San Juan Basin Groundwater and Facilities Management Plan

Final Report

Prepared for

San Juan Basin Authority

November 2013

Prepared by

WILDERMUTH™ ENVIRONMENTAL INC.

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Acronyms, Abbreviations, and Initialisms

acre-ft/yr	acre-feet per year
acre-ft	acre feet
ADA	American with Disabilities Act
ADT	Average daily traffic
AGR	Agricultural Supply
AWT	advanced water treatment
Basin Plan	Water Quality Control Plan for the San Diego Basin
Caltrans	The California Department of Transportation
Camp Pendleton	City of San Clemente and Marine Corps Base
CASGEM	California Statewide Groundwater Elevation
CBC	California Building Code
CDC	California Department of Conservation
CDFG	California Department of Fish and Game
CDFM	cumulative departure from mean
CDPH	California Department of Public Health
CGS	California Geological Survey
CMIP3	Coupled Model Intercomparison Project Phase 3
CNDDB	Natural Diversity Data Base
CNPS	California Native Plant Society
CNPSEI	California Native Plant Society's Electronic Inventory
COLD	Cold Freshwater Habitat
CPT	cone penetration tests
CRA	Colorado River Aqueduct
CSC	California Species of Special Concern
CSJC	City of San Juan Capistrano
DOT	U.S. Department of Transportation
DWR	Department of Water Resources
EC	electrical conductivity
EIR	environmental impact report
FHWA	Federal Highway Administration
FMMP	Farmland Mapping and Monitoring Program
FSC	Federal Species of Concern
ft-amsl	Feet above mean sea level
ft-bgs	feet below ground surface
FY	fiscal year

Acronyms, Abbreviations, and Initialisms

GCM	global circulation models
GFDL	Geophysical Fluid Dynamic Lab Model
gpm	gallons per minute
HA	Hydrologic Area
HSA	Hydrologic Sub-Area
IND	Industrial Service Supply
IPCC	Intergovernmental Panel on Climate Change
JPA	Joint Powers Authority
JRTP	Joint Regional Treatment Plant
LNAPL	Light Nonaqueous Phase Liquids
MCL	maximum contamination level
meq/L	milliequivalents per liter
mg/L	Milligrams per liter
mgd	millions gallons per day
MNWD	Moulton Niguel Water District
MPAH	The Orange County Master Plan of Arterial Highways
MSL	mean sea level
MTBE	methyl-tert-butyl-ether
MUN	Municipal and Domestic Supply
MWDOC	Water District of Orange County
MWDSC	Metropolitan Water District of Southern California
NCEP	National Centers for Environmental Predictions
NO3-N	nitrate as nitrogen
Ntu	Nephelometric Turbidity Units
OCTA	Orange County Transportation Authority
PCM	Parallel Climate Model
PERI	programmatic environmental impact report
QA/QC	quality assurance/quality control
REC1	Contact Water Recreation (REC1)
REC2	Non-contact Water Recreation
RMAP	Radar Mean Areal Precipitation
RMV	Rancho Mission Viejo
RO	reverse osmosis
SCAG	Southern California Association of Governments
SCRRA	Southern California Regional Rail Authority
SCWD	South Coast Water District

Acronyms, Abbreviations, and Initialisms

SJBA	San Juan Basin Authority
SJBGFMP	San Juan Basin Groundwater and Facilities Management Plan
SJHGC	San Juan Hills Golf Course
SMWD	Santa Margarita Water District
SOB	state of the basin
SOCOD	South Orange County Ocean Desalter
SR-1	Pacific Coast Highway
SR-241	Foothill Transportation Corridor.
SR-241	State Route 241
SR-73	State Route 73
SR-74	Ortega Highway
SRES	special report emissions scenarios
SWP	State Water Project
SWRCB	State Water Resources Control Board
SY	specific yield
TAC	Technical Advisory Committee
TBA	tert-butyl-alcohol
TCWD	Trabuco Canyon Water District
TDS	total dissolved solids
TUa	acute toxic units
ug/L	micrograms per liter
UNEP	United Nations Environment Programme
USFWS	U.S. Fish and Wildlife Service
UST	underground storage tanks
VMT	vehicle miles traveled
VOC	volatile organic chemicals
WARM	Warm Freshwater Habitat
WAS	waster activated sludge
WCRP	World Climate Research Programme
WEI	Wildermuth Environmental, Inc.
WILD	Wildlife Habitat
WMO	World Meteorological Organization
WRP	water reclamation plant

ES-1 Introduction

In 2010 the San Juan Basin Authority (SJBA) engaged Wildermuth Environmental, Inc. (WEI) to update their San Juan Basin Groundwater Management and Facilities Plan (SJBGMFP). WEI teamed with Carollo Engineers and Michael Bradman and Associates to complete this work. This administrative draft report documents the efforts of the stakeholders and our team to update the SJBGMFP. Specifically, this report documents the current state of the basin (SOB), the conceptual model of the hydrologic system, the environmental and infrastructure resources in the investigation area, management goals and impediments to the goals, management alternatives, recommended management plan(s), and a monitoring and reporting plan.

The investigation considered all the water resources of the San Juan Creek watershed but limited the application of management activities to the surface and ground waters of the lower part of the watershed between the Pacific Ocean at the most downstream end of the watershed to the Ortega Highway bridge on San Juan Creek and to near the confluence of the Arroyo Trabuco and Oso Creeks on the Arroyo Trabuco. The investigation area is s referred to as the active management area or the active storage area later in this document. The active management area was developed in Task 4 and was approved by the SJBA TAC during the 2013 SJBGFMP development process.

ES-2 Planning Area and Its Resources

This section characterizes the major resources in the planning area for use in the development of the SJBGFMP and subsequent environmental documentation. The following topics are described in detail for the planning area: land use, aesthetics, biological and ecological resources, geologic hazards, hydrology, and transportation infrastructure. Approximately half of the land area within the SJBA service area is urbanized, while the remaining is undeveloped and mostly unincorporated. Most of the developed land within the basin is designated residential and commercial. Information was provided by the Southern California Association of Governments (SCAG), for land use designations within the SJBA service area.

Many of the maps contained in this planning section refer to the SJBA service area as the union of the SJBA member agencies service area. For clarity, the SJBGFMP contains management activities for surface and ground waters within the San Juan Creek watershed exclusively in the lower part of the watershed. The SJBGFMP management activities provide direct benefits to the SJBA member agencies. The service area boundaries of the SJBA member agencies extend beyond the boundaries of the watershed. This means that while the management activities of SJBGFMP occur within the San Juan Creek watershed (and exclusively in the lower part of the watershed), that the direct benefits of the management program can reach beyond the watershed, principally the service areas of the SJBA member agencies and the State.

The Rancho Mission Viejo (RMV) is a large land owner and riparian water user located in the San Juan Creek watershed whose lands and water use are upstream and not included in the SJBGFMP except through the recognition of the RMV upstream water uses. The management activities included in the SJBGFMP occur completely downstream of the RMV and they do not interfere with the water rights and management activities of the RMV.

ES-3 Existing Water Resources

San Juan Creek Watershed

The San Juan Creek watershed is located in Southern Orange County on the western flank of the Santa Ana Mountains. The headwaters originate in the Cleveland National Forest near the Orange/Riverside County border at an elevation of approximately 3,300 feet above sea level and flow approximately 29 miles south-southwest to the Pacific Ocean at Doheny State Beach in Dana Point. The total watershed drainage area covers approximately 175 square miles and consists of two major tributaries to San Juan Creek, known as the Arroyo Trabuco and Oso Creek. The upper third of the watershed is extremely rugged with steep slopes and deep cutting narrow canyons with minor tributaries from these areas flowing out from sharp canyons. The center third is dominated by rolling hills, and the downstream third is a highly developed floodplain. As the streams come out of the canyon mouth, they widen out into several alluvial floodplains (Pace 2008). These floodplains comprise the alluvial sediments from which groundwater is extracted. Land rises from sea level, where San Juan Creek discharges to the Pacific Ocean, to 5,687 ft at the peak of Santiago Mountain. There are three principal streams that drain the watershed: Oso Creek, the Arroyo Trabuco and San Juan Creek. There are numerous other small streams that feed into these principal streams including Horno Creek, Oso Creek, Chiquita Canyon, Canada Gobernadora and Bell Canyon.

Groundwater Basins

Groundwater within the San Juan Creek watershed primarily occurs in the relatively thin alluvial deposits along the valley floors and within the major stream channels. The State Water Resources Control Board (SWRCB) has characterized this groundwater, from a water rights perspective, as flow of an underground stream. The Basin is bound to the north by the Santa Ana Mountains, composed of impermeable granitic and metamorphic bedrock, and to the south by the Pacific Ocean. Sedimentary bedrock formations form the sides of the water bearing canyons of the Upper Basin and Arroyo Trabuco (i.e. Cañada Chiquita, Cañada Gobernadora, and Bell Canyon).

Four principal groundwater basins have been identified in the San Juan Creek watershed: (1) Lower Basin, (2) Middle Basin, (3) Upper Basin, and (4) Arroyo Trabuco. These basins were first delineated by the DWR in 1972, based on water quality differences. CDM (1987), NBS Lowery/PSOMAS (1994, annual reports), and others, have modified the DWR delineations to suit the needs of their respective studies. The Upper Basin, which underlies the Canada Chiquita, Canada Gobernadora, Bell Canyon, Dove Canyon and Upper San Juan Creek watersheds, was excluded because a majority of the land overlying the basin is privately owned and managed by the RMV, who would not make their data available to the SJBA, regardless; the groundwater resource is small and negligible to this study. For purposes of this investigation, The Arroyo Trabuco basin, at approximately Crown Valley Parkway, was divided into a lower and upper portion. The lower portion of Arroyo Trabuco, herein referred to as Lower Arroyo Trabuco, is included in this study. The Lower Trabuco, Middle, and Lower Basins contain approximately 5.9 square miles of water bearing alluvium.

The active management area is delineated in several map figures in Section 3 and is the surface and ground waters of the lower part of the watershed between the Pacific Ocean at the most downstream end of the watershed to the Ortega Highway bridge on San Juan Creek and to near the confluence of the Arroyo Trabuco and Oso Creeks on the Arroyo Trabuco.

Groundwater Recharge and Discharge

The predominant sources of recharge to the San Juan Basin include:

- Streambed infiltration in San Juan Creek, Horno Creek, Oso Creek, and the Arroyo Trabuco
- Subsurface boundary inflows at the head of the tributaries upstream boundaries and other minor subsurface inflows along the other boundaries
- Deep infiltration of precipitation and applied water
- Flow from fractures and springs

Groundwater discharge from the San Juan Basin occurs as:

- Groundwater production from wells
- Rising groundwater
- Evapotranspiration
- Subsurface outflow to the Pacific Ocean

In general, groundwater flow within the study area follows the surface topography: from areas of recharge in the surrounding highlands towards the central axis of the basin and then southwesterly along the axis of the basin before exiting into the Pacific Ocean.

Effective Base of the Freshwater Aquifer

Underlying this shallow alluvial aquifer system is what is commonly referred to in well completion reports as a green or blue clay/shale (believed to represent the Capistrano Formation), which likely acts as an aquitard preventing the downward movement of groundwater (Psomas, 2009). The effective base of the freshwater aquifer contours honored sixty borings that penetrated the alluvial aquifer with depths that range from 30 to 50 feet below ground surface (ft-bgs) near the bedrock outcrops to about 150 to 160 ft-bgs near the confluence of Arroyo Trabuco Creek and San Juan Creek.

Aquifer Storage Properties

Younger alluvial deposits comprise the aquifer material within the study area and consist of a heterogeneous mixture of sand, silts, and gravel.

Specific yield or effective porosity is a property of rocks that describes the ability of the rock to store water that can be recovered. A commonly used definition of specific yield is the quantity of water which a unit volume of aquifer, after being saturated, will yield by gravity, expressed either as a ratio or as a percentage of the volume of the aquifer. In other words, specific yield is a measure of the water available to wells. The specific yield of the aquifer-system sediments in the San Juan Basin study area was estimated through the analysis of lithologic descriptions from well driller's reports. WEI maintains a library of well driller's reports of all known boreholes that have been drilled in the San Juan Basin. The lithologic descriptions from the well driller's reports were input into a relational database along with corresponding estimates of specific yield by sediment description. The volume of groundwater in storage as of fall 2010 was 20,400 acre-ft in the active management area. Section 3 also contains an analysis of storage changes based on recent groundwater modeling investigation conducted by Municipal Water District of Orange County (MWDOC) for its South Orange County Ocean Desalter (SOCOD) project.

Water Rights

Several water rights permits and agreements exist to allocate groundwater production from the San Juan Basin. A list of the existing and pending water rights permits is shown in the table below[1].

Applicant	Application Number	Permit Number	Diversion Amount Eligible Under Current Permit and Agreements (acre-ft/yr)	Diversion Amount Potentially Eligible to be Permitted and Agreement (acre-ft/yr)	Purpose of Use
South Coast Water District (SCWD)	A30337	21138	1,300	1,300	Municipal
SJBA	A30123	21074	8,026	10,702	Municipal
Santa Margarita Water District (SMWD)	A25557	17489	611 (Nov to Apr)	611 (Nov to Apr)	Irrigation
SMWD	A25733	17692	32 (Nov to Apr)	32 (Nov to Apr)	Irrigation
San Juan Hills Golf Course (SJHGC)	A30171	21142	450	450	Irrigation
City of San Juan Capistrano (CSJC)	A30696	N/A	3,325	3,325	Municipal
Totals			13,520	16,520	

[1] Note that the discussion of water rights contained herein is for illustrative purposes only and should not be construed as restricting, granting, or otherwise endorsing any particular claim of right. Rather, the discussion of water rights is for the purpose of explaining the amount of water rights that have been approved or applied for, and the agreements made by and amongst the parties to protect their existing or potential future rights. Any future projects proposed or implemented by the SJBA or other parties will need to address water rights, and the impacts the projects have on these rights, in more thorough detail.

Pursuant to SJHGC's current water rights permit, the State Board has only authorized the diversion of up to 450 acre-ft/yr. However, per the 1997 agreement between SJBA and SJHGC, the SJBA has agreed not to protest any increase to the SJHGC right up to a total right of 550 acre-ft/yr, subject to the terms of the agreement.

Water Supply and Distribution

Due to limited groundwater supplies, the SJBA members obtain most of its water supply (about 92 percent of potable and 78 percent of total demands) from imported water sources. The table below lists the estimated total water demand for each agency and the amount of water supplied from imported, recycled and native sources for fiscal 2010 (Section 4 presents a more rigorous discussion of water demands and supplies for the recent past and for the future through 2035).

Water Demand and Supply within the SJBA Service Area in 2010[2]

Water Agency	Total Water Demand (acre-ft/yr)	Water Supply (acre-ft/yr)		
		Native Potable Water	Recycled/ Non-Potable Water	Imported Water
Moulton Niguel Water District (MNWD)	36,593	-	6,858	29,735
CSJC	8,783	1,980	434	6,379
SMWD	34,169	65	6,027	28,077
SCWD	6,909	634	826	5,449
Total	86,454	2,679	14,145	69,640

ES-4 Historical and Projected Water Demands

The SJBA agencies currently[3] (2010) have a combined service area population of about 406,200 and a total water demand of about 86,400 acre-feet per year (acre-ft/yr). Of this, 84 percent (about 72,300 acre-ft/yr) is potable water demand, and 16 percent (about 14,100 acre-ft/yr) is non-potable demand. Imported water satisfies the majority of the study area's potable water demand at about 69,600 acre-ft/yr, compared to the 3,000 acre-ft/yr produced from the San Juan Groundwater Basin. Non-potable demands of about 14,100 acre-ft/yr are met with recycled water (about 11,700 acre-ft/yr), local surface water diversions (about 2,000 acre-ft/yr), and San Juan Basin Groundwater (400 acre-ft/yr).

By 2035, the SJBA service area population is projected to increase to about 486,500 with a total water demand of about 106,400 acre- ft/yr. Compared to current conditions, the ratio of potable to non-potable water demands is expected to decrease, primarily due to the planned increase in recycled water reuse by the SJBA member agencies: potable demands will account

[2] Sources include SJBA members agencies and MWDOC. See Section 4 and more specifically Table 4-1.

[3] The use of the modifier word "current" means 2010.

for about 76 percent (81,100 acre-ft/yr) of the total demand and will be met with a mix of imported water (about 72,200 acre-ft/yr) and groundwater from the San Juan Basin (8,900 acre-ft/yr), and non-potable demands will account for about 24 percent (25,300 acre-ft/yr) of the total demand and will be met with a mix of recycled water reuse (20,600 acre-ft/yr), local surface water diversions (2,700 acre-ft/yr) and untreated groundwater (2,700 acre-ft/yr).

ES-5 Management Goals and Impediments

During the period of September 2010 through November 2010, the SJBA Technical Advisory Committee (TAC) met four times to develop the scope of the SJBGFMP. These meetings were held at the SMWD on September 21st, October 5th, November 2nd, and November 16th. As part of this SJBGFMP scoping process, issues, needs, and interests were solicited from SJBA member agencies. These "issues, needs, and interests" are summarized in a tabular form in Tables ES-1 through ES-7. Each table refers to a class of issues, needs, and interests, including:

- safe yield
- native and imported water recharge
- quality and quantity
- reclaimed water
- conjunctive-use storage
- costs
- human resources and administration

Attribution for the source of each issue, need, and interest is listed in these tables. In some cases, a specific issue (need and interest) may show up in more than one class. These issues, needs, and interests were used to focus problem identification, SJBGFMP goals, and the resulting SJBGFMP update.

The goal setting process involved the proposal of an initial set of goals, followed by group and individual discussions and group editing of the goals at those meetings. The TAC member's also articulated impediments to achieving the goals and the action items required to remove impediments. At the November 16, 2010 meeting, the TAC member's achieved consensus on goals, impediments to those goals, and the action items required to remove the impediments. The goals of the SJBGFMP are listed below.

- Goal No. 1 – Enhance Basin Water Supplies. In addition to local groundwater, this goal applies to all sources of water available for the enhancement of the San Juan Basin (Basin). The intent is to maximize the use of all available water in the Basin. This goal will be accomplished by increasing the recharge of all available waters, including storm water discharge, dry-weather discharge, and recycled water.
- Goal No. 2 – Protect and Enhance Water Quality. The intent of this goal is to improve surface and groundwater quality to ensure the maximum use and reuse of

available supplies and to minimize the cost of groundwater treatment. This goal will be accomplished by implementing activities that capture and treat contaminated groundwater for direct high-priority beneficial uses, implementing the recharge of storm water discharge, and encouraging better management of waste discharges that impact groundwater.

- Goal No. 3 – Maximize the Use of Unused Storage Space. The intent of this goal is to maximize the use of the Basin's storage capacity to improve water supply availability. This goal will be accomplished by determining the temporal and spatial availability of unused storage space in the Basin and subsequently determining how best to use that space to increase operational flexibility and water supply reliability.
- Goal No. 4 – Satisfy State Requirements for a Groundwater Management Program. The intent of this goal is to integrate the SJBGFMP into the South Orange County regional water management plan and to improve the opportunity of obtaining outside funding for SJBGFMP implementation. This goal will be accomplished by ensuring that the SJBGFMP contains the minimum elements required for a groundwater management plan and by inclusion of the SJBGFMP in the MWDOC Integrated Regional Water Management Plan.
- Goal No. 5 – Establish Equitable Share of the Funding, Benefits, and Costs of the SJBGFMP. The intent of this goal is to align the benefits of the SJBGFMP with individual SJBA member agencies and SJBGFMP implementation costs. This goal will be accomplished by clearly articulating the benefits of the SJBGFMP to each SJBA member agency and subsequently allocating the funding and costs in an equitable manner.

These goals, impediments to the goals, and the action items required to remove the impediments are discusses in Section 5.

ES-6 Groundwater Management Alternatives

This section describes the groundwater management plan elements that can be applied to remove the impediments to achieving the management program goals discussed in Section 5 and to meet the water demands discussed in Section 4, using the resources described in Sections 2 and 3.

Management Alternatives for the Update of the San Juan Basin Groundwater Management and Facilities Plan

Four meetings were held with the SJBA TAC to review the impediments to the goals and the groundwater management plans that could be implemented to remove those impediments. The basic intent of the management alternatives is to manage production to the available yield. Yield will vary from year to year based on hydrology, production will be managed consistent with the existing diversion permits and interagency agreements, modification to the diversion permits and interagency agreements will be made to maximize yield, and additional permits and interagency agreements will be required to incorporate novel groundwater management schemes. Furthermore, it has not been determined if the MWDOC SOCOD project will be implemented within the next few years or at all. Thus, management alternatives need to consider whether or not SOCOD will exist in the future. The SJBA TAC asked that the alternatives be structured for incremental expansion from the least resource intensive to the most resource intensive. This would allow the implementation of more resource intensive management elements as more information on their feasibility can be obtained and as future funding becomes available.

The alternatives that the SJBA TAC is considering are described below. The first set of alternatives assumes that the SOCOD project will either not be implemented or will be deferred by ten or more years. The second set of alternatives assumes that the SOCOD project will be implemented within the next ten years.

Alternative 1 – Adaptive Production Management within Existing Recharge and Production Facilities (the current plan or baseline alternative)

Alternative 1 is an attempt to refine the current status quo management plan to comply with the diversion permits held by the SJBA and SCWD and the interagency agreements. It involves the management of groundwater production by the CSJC and the SCWD to prevent or at least minimize seawater intrusion and to what is otherwise available on an annual basis. Alternative 1 is the future baseline. The average annual production or yield that can be developed from the basin is estimated to be about 9,200 acre-ft/yr, ranging from about 7,100 acre-ft/yr to 10,900 acre-ft/yr. About 71 percent of the time, the yield will be less than 11,000 acre-ft/yr, and about 14 percent of the time, production will meet the desired goal of 11,200 acre-ft/yr. Finally there exists in certain reaches of San Juan Creek and tributaries an invasive high water-consuming phreatophyte called arundo dornax. This plant species degrades habitat and reduces the amount of water available for useful habitat and human purposes. Eliminating this plant will improve habitat and water supplies. Arundo is immune to herbicides and must be mechanically removed in a systematic way so to manage its reemergence.

Alternative 2 – Adaptive Production Management within Existing Recharge and Production Facilities with a Seawater Injection Barrier

Alternative 2 is identical to Alternative 1 except a seawater injection barrier would be constructed to prevent seawater intrusion and groundwater production would be reduced to what is otherwise available on an annual basis. The goals of Alternative 2 are to increase the yield of the basin during non-wet periods over the yield that would otherwise be developed in Alternative 1 and to prevent seawater intrusion as required in the SJBA and SCWD diversion permits. The minimum injection rate required to just replace the estimated seawater intrusion during dry periods is about 500 acre-ft/yr. The injection barrier is assumed herein to have an injection capacity of 1,000 acre-ft/yr, and the yield of the basin is expected to increase by the amount injected. The average yield of the Basin would be increased from about 9,200 acre-ft/yr to about 10,000 acre-ft/yr.

Alternative 3 – Adaptive Production Management within Existing Recharge and Production Facilities with a Seawater Extraction Barrier

Alternative 3 is identical to Alternative 2 except a seawater extraction barrier would be constructed to prevent seawater intrusion. The goals of Alternative 3 are identical to those of

Alternative 2: to increase the yield of the basin during non-wet periods over the yield that would otherwise be developed in Alternative 1 and to prevent seawater intrusion as required in the SJBA and SCWD diversion permits. The yield developed by this alternative would be greater than that developed by the seawater injection barrier in Alternative 2 because the extraction barrier can function independent of the amount of storage in the basin landward of the SCWD desalter wells; whereas, the injection barrier approach will have variable injection rates with lesser injection during high storage periods and more injection during dry periods when storage in the basin is low. The average yield of the Basin would be increased from about 9,200 acre-ft/yr to about 12,200 acre-ft/yr.

Alternative 4 – Adaptive Production Management with Seawater Barrier and Construction of Ranney-Style Collector Well(s)

Alternatives 4A and 4B are identical to Alternatives 2 and 3, respectively, except that one or two Ranney-style collector wells would be constructed to increase production capacity during dry periods. The goals of Alternative 4 are to increase the production capacity of the basin during non-wet periods, to prevent seawater intrusion, and to increase the yield of the Basin through the inducement of more stormwater recharge. Replacement supplies would be provided to non-SJBA overlying groundwater producers, as necessary, to replace lost groundwater production at their wells when the basin is operated at lower groundwater levels. The average yield of the Basin would be increased from about 9,200 acre-ft/yr to about 11,200 acre-ft/yr and 13,400 acre-ft/yr for Alternatives 4a and 4b, respectively.

Alternative 5 – Adaptive Production Management, with Seawater Barrier, Construction of Ranney-Style Collector Wells, and In-stream Recharge

Alternatives 5A and 5B are identical to Alternatives 4A and 4B, respectively, except that a reach of San Juan Creek and the Arroyo Trabuco would be operated as stormwater recharge facilities. These recharge facilities would increase stormwater recharge and thus the yield of the basin. The goals of Alternative 5 are to increase the production capacity of the basin during non-wet periods, to improve water quality (principally reduce salt and nutrient concentrations in groundwater), to prevent seawater intrusion, and to increase the yield of the Basin through the inducement of more stormwater recharge. The average yield of the Basin would be increased from about 9,200 acre-ft/yr to about 12,000 acre-ft/yr and 14,200 acre-ft/yr for Alternatives 5a and 5b, respectively.

Alternative 6 – Adaptive Production Management, Creation of a Seawater Barrier, In-stream Recharge and Recycled Water Recharge

The goals of Alternative 6 are to increase the production capacity of the basin during non-wet periods, to prevent seawater intrusion, to increase the yield of the Basin through the inducement of more stormwater recharge, and to increase the yield through the recharge of large amounts of recycled water. The in-stream recharge facilities used for stormwater recharge in Alternative 5 would be modified to create a corridor for small summer storms to pass through the basin and most of the channel would be bermed-off into discrete cells to receive and recharge recycled water. Recycled water would be recharged from May through September. Approximately 27 acres of streambed would be used for recharge. This would provide the SJBA with about 10,000 acre-ft/yr of supplemental water recharge capacity. Groundwater production and treatment would be increased to recover this recharge. The yield of the Basin would be increased from about 9,200 acre-ft/yr to about 21,400 acre-ft/yr—an increase of about 12,000 acre-ft/yr.

Alternative 7– Adaptive Production Management within Existing Recharge and Production Facilities (Alternative 1 with SOCOD)

This alternative is identical to Alternative 1 with SOCOD with the expectation that the average yield of the basin will be lowered by about 1,600 to 2,000 acre-ft/yr with greater losses in yield occurring in dry years. There will be no need for a seawater intrusion barrier as the SOCOD project will eliminate seawater intrusion.

Alternative 8– Adaptive Production Management, Existing Recharge and Production Facilities (Alternative 1 with SOCOD), Construction of Ranney-Style Collector Wells

This alternative is identical to Alternative 7 with the addition of one or more Ranney-style collector wells (as described by Alternative 4). The average yield of the Basin would be increased from about 7,500 acre-ft/yr to about 8,700 acre-ft/yr.

Alternative 9– Adaptive Production Management, Existing Recharge and Production Facilities (Alternative 1 with SOCOD), Construction of Ranney-Style Collector Wells, and In-stream Recharge

This alternative is identical to Alternative 8 with the addition of in-stream recharge facilities (as described in Alternative 5). The average yield of the Basin would be increased from about 7,500 acre-ft/yr to about 9,500 acre-ft/yr.

Alternative 10– Adaptive Production Management, Existing Recharge and Production Facilities (Alternative 1 with SOCOD), In-stream Recharge and Recycled Water Recharge

This alternative is identical to Alternative 9 with the utilization in-stream recycled water recharge (as described in Alternative 6). The average yield of the Basin would be increased from about 7,500 acre-ft/yr to about 16,700 acre-ft/yr.

Stormwater Recharge in Off-stream Facilities

During the review of the draft SJBGFMP report many stakeholders commented that there were no recommendations for diversion of stormwater to new off stream recharge facilities included in the SJBGFMP. Early in the investigation the concept of off stream recharge was discussed with the TAC committee and it concluded in those discussions that there were few suitable sites for off stream recharge and for off stream recharge to work there would be a need for significant storage for which it was concluded that there no suitable storage sites. These conclusions should be revisited prior to or during the next SJBGFMP update.

ES-7 Evaluation of Groundwater Management Alternatives

Consistency with SJBGMFP Goals

The management goals of the SJBGMFP were developed by the SJBA TAC along with the impediments to achieving these goals and a list of actions that could be implemented to overcome the impediments. These goals include:

- Goal No. 1 – Enhance Basin Water Supplies.
- Goal No. 2 – Protect and Enhance Water Quality.
- Goal No. 3 – Maximize the Use of Unused Storage Space.
- Goal No. 4 – Satisfy State Requirements for a Groundwater Management Program.
- Goal No. 5 – Establish Equitable Share of the Funding, Benefits, and Costs of the SJBGFMP.

The alternatives were reviewed and evaluated by the SJBA TAC members using the following evaluation criteria, described in more detail in Section 7, and considerations of their individual agencies.

- Yield and Costs of the Management Alternatives
- Implementation Difficulty
- Adaptive Production
- Seawater Injection Barrier
- Seawater Extraction Barrier
- Ranney Collector Wells
- Enhanced Stormwater Recharge and Recycled Water Recharge
- Recommended Alternative

The features of the alternatives were described at two SJBA Board meetings in late 2012. Based on the management goals of the SJBGMFP articulated in Section 5 and the ability of these alternatives to attain these goals, the SJBA TAC has recommended the phased implementation of Alternative 6. If MWDOC proceeds with the SOCOD project then the SJBA TAC recommends the phased implementation of Alternative 10. The implementation plan for Alternatives 6 and 10 are discussed in Section 8.

ES-8 Implementation and Monitoring Plans

Implementation of the Recommended SJBGFMP

Table ES-8 lists the implementation steps for the recommended alternatives, a proposed ten-year implementation plan, and a reconnaissance-level cost estimate up to and excluding construction cost. The intent of Table ES-8 is to characterize the schedule, scope, and cost of activities required to implement the recommended alternatives. This characterization is provided below.

Adaptive Production Management

Adaptive production management will refine the current status quo management plan to comply with the diversion permits held by the CSJC, the SJBA, and the SCWD, and related interagency agreements. It involves the management of groundwater production by the CSJC and the SCWD to prevent or at least minimize seawater intrusion and to what is otherwise available on an annual basis. The SJBA, in its role as the Basin Manager, will set an Annual Safe Yield based on groundwater in storage in the spring of each year and the spring assessment of seawater intrusion. The SJBA will depend on groundwater level and chemistry monitoring and the interpretation of the monitoring data to make its determination. The implementation time frame illustrated in Table ES-8 shows the monitoring occurring each year and the SJBA, acting as the Basin Manager, setting the Annual Safe Yield each year. The time frame also shows the occurrence of a triennial update of the criteria that the SJBA will use to set the Annual Safe Yield. The annual cost, shown in Table ES-8, would be about $140,000 (current cost of monitoring and reporting) for two out of three years and about $160,000 in years when the Annual Safe Yield assessment criteria are reviewed and updated (current cost of monitoring and reporting plus cost to review and update tool used by the SJBA to set the Annual Safe Yield).

In the implementation of the recommended alternative it is proposed to include the groundwater substitution program element within the adaptive production management program element. By replacing the water supplied by private wells with an alternative supply, the SJBA and SCWD will have greater flexibility in complying with their diversion permits in the near term and when the more aggressive program elements are implemented. The implementation steps include:

- Preliminary engineering to identify all the private wells and the water demands placed on those wells
- Determine the facilities and operations required to provide those water users a substitute supply
- Assess feasibility
- Complete CEQA documentation
- Finalize agreements with private well owners
- Obtain permits
- Prepare final designs
- Construct conveyance facilities to enable substitute supplies

The implementation of the groundwater substitution program element is proposed to start in year 1 (2013-14) and be completed in year 3 (2015-16). The implementation cost, excluding construction, is estimated to be about $190,000.

Planning and CEQA Process for the Recommended Alternative

The recommend alternatives contain very complex water management program elements that will require additional investigations to determine their feasibility, their integration into the existing water resource management plans, and their impacts on the environment. This information will evolve in the early engineering and feasibility investigations required for implementation. Some of the program elements in the recommended plan may end up not being feasible as described herein. For planning purposes it was assumed that a programmatic environmental impact report (PEIR) will be completed. The implementation steps include:

- Conduct CEQA process through the preparation of a draft PEIR for the SJBGFMP
- Prepare application/change petitions for new points of diversions, revised diversion amounts, surface water diversion for recharge, storage and subsequent recovery
- Conduct engineering investigations to develop alternative preliminary designs, determine feasibility, and to identify fatal flaws for:
  - Groundwater extraction barrier
  - In-stream stormwater recharge
  - In-stream recycled water recharge and groundwater recycled water reuse
- Finalize and certify programmatic EIR
- Finalize SWRCB application/change petitions

The planning and CEQA process are proposed to occur in years 2 (2014-15) to 4 (2016-17). This phase of the work is estimated to cost about $1,800,000.

Complete Agreements for SJBA Members Participation, Construction and Operation

The prior implementation efforts will provide detailed estimates of new yield and its associated costs. Agreements will be drafted to define participation by individual SJBA members, their responsibilities in the construction and operations of facilities, their yield allocations, financing arrangements, their cost share and other arrangements as required to implement the SJBGFMP. The effort to prepare implementation agreements is proposed to occur in years 3 (2015-16) to 4 (2016-17). The cost to negotiate and prepare these agreements is projected to be about $200,000.

Design and Construction

By the end of year 4 (2016-17), all the planning for the program elements and implementation agreements will have been completed. The time frames and cost (through design) for each program element is summarized below:

- Groundwater extraction barrier

- The design will take about two years to complete and is assumed to start in year 5 (2017-18)
- Design and permit acquisition costs are projected to be about $4,000,000
- Construction will take about two years

- In-stream stormwater recharge
  - The design will take about a year to complete and is assumed to start in year 5 (2017-18)
  - Design and permit acquisition costs are projected to be about $150,000
  - Operation of the temporary in-stream recharge facilities will start in year 6 (2018-19)
- In-stream recycled water recharge and groundwater recycled reuse
  - The design will take about two years to complete and is assumed to start in year 5 (2017-18)
  - Design and permit acquisition costs are projected to be about $4,000,000
  - Construction will take about three years

The permits referred in this implementation step include all the permits related to construction and operation exclusive of the SWRCB and the Regional Board. The cost to implement Alternative 6 up to and excluding construction is about $12 million. The cost to implement Alternative 10 through and excluding construction is about $8 million.

Minimum Monitoring Program Required for Implementation of the SJBGFMP

The scope of work is designed to rely on groundwater and surface water data collected by others in the basin to the extent possible, and supplements this data with data collected in a field-monitoring program to fill in data gaps. The Basin Management Monitoring and Reporting Program is divided into three tasks: Field Monitoring Program, Data Acquisition and Management, and Reporting. The scope of work that follows is paraphrased from the current monitoring contract issued to WEI for 2013 that includes the monitoring required for implementation of the SJBGFMP. The objectives, sub-tasks, schedule of implementation, and deliverables for each task are described below.

- Task 1 –Field Monitoring Program.
  - Task 1.1 Quarterly Groundwater Level Monitoring.
  - Task 1.2 – Quarterly Groundwater Quality Monitoring.
  - Task 1.3 – Surface Water Quality Monitoring.
  - Task 1.4 – Vegetation Monitoring.

- Task 2 – Data Acquisition and Management.
  - Task 2.1 – Data Acquisition from Collecting Agencies.
  - Task 2.2 – Data QA/QC, Processing, and Upload to Relational Database.
- Task 3 – Reporting.
  - Task 3.1 – Water Rights Permit Reporting.
  - Task 3.2 – CASGEM Reporting.
  - Task 3.3 – Spring and Fall Storage Estimate and Annual Safe Yield Reports.
  - Task 3.4 – Seawater Intrusion Monitoring Report.
  - Task 3.5 – Presentations to the SJBA Board of Directors.

Table ES-1
Safe Yield Issues, Needs and Wants

	San Juan Basin Authority				Other Interested Parties			
	SJC	MNWD	SMWD	SCWD	MWDOC	TCWD	RMV	SJHGC
Ability to continue to divert foreign developed water for irrigation purposes			●					
Increase the District's reliability	●	●	●	●				
Identify project(s) to obtain water from SJBA			●					
Future level of participation in SJBA			●					
Maximize interconnections between agencies			●					
Identify the safe yield of the basin			●					
Identify and propose mitigation for impacts from proposed ocean desalination			●					
Confirm the modeling efforts are developing safe yields			●					
Review and recommend any proposed changes to the monitoring efforts			●					
Develop a uniform reporting methodology for monitoring			●					
Coordinate water harvesting with private entities			●					
Identify short and long term goals for the basin			●					
Flexible supply/Transfer/Over-Production Methodology	●							
Increase Safe Yield Based on Past Engineering Studies	●							
Dedicate Increases in Safe Yield to Agencies for Specific Basin Management Projects	●							
Need to continue to rely on stable safe yield	●							
Monitor fluctuations in basin and changes in production patterns to ID basin issues	●							
explore impacts to safe yield from basin development	●							
allow parties to use basin in their best interest and mitigate impacts	●							
Determine and assess storage losses in the basin	●							
Increase safe yield by installing wells	●							
coordinate/reduce/relocate production to reduce subsidence	●							
Evaluate impacts of desalter operations on safe yield	●							
Support sole and/or cooperative efforts to develop a	●							
Vet the GSSI groundwater model		●						
Verify impacts of Desalination project and develop mitigation measures		●						
Confirm basin safe yield		●						
Define management objectives to maintain basin safe yield		●						
Identify project(s) to optimize water from SJBA				●				
That the Basin Plan provides safe yields for current and future needs				●				
Identify the safe yield of the basin without projects versus with projects				●				

Table ES-2
Native and Imported Water Recharge Issues, Needs and Wants

	San Juan Basin Authority				Other Interested Parties			
	SJC	MNWD	SMWD	SCWD	MWDOC	TCWD	RMV	SJHGC
Support sole and/or cooperative efforts to develop additional economically feasible recharge facilities for both native and imported water	•		•					
Develop program to increase recharge of native runoff and create a mechanism to pledge the value of the increase in safe yield from these "new water" sources to help pay for the construction of these facilities	•		•					
Recharge high quality runoff and reclaimed water as hydrologically high as possible in the basin	•		•					
Determine availability of imported water for recharge		•						
Ability to utilize recycled water for recharge			•	•				
Ability to utilize stormwater for recharge			•	•				
Identify potential projects for economical recharge			•	•				

Table ES-3
Quality and Quantity Issues, Needs and Wants

	San Juan Basin Authority				Other Interested Parties			
	SJC	MNWD	SMWD	SCWD	MWDOC	TCWD	RMV	SJHGC
Develop sellable and/or exportable water insurance rights to replenish overproduction during drought and/or encourage basin clean-up	•							
Identify and regulate sources of contamination	•							
Develop "credit type" program to encourage development and implementation of water quality improving and conservation programs	•							
Assess the impacts of groundwater production and recharge on water quality of down gradient producers	•							
Incorporate existing remediation projects in basin water quality management program	•							
Increase conservation and develop new sources of water	•							
Manage basin to maintain/improve water quality of water supply sources to meet discharge standards	•							
Re-examine basin water quality objectives and establish naturally-occurring limits	•							
Produce maps showing problem areas and projected problem areas	•							
Identify projects to develop locate water supply source		•						
Increase the District's reliability through ground water supply				•				
Identify and propose mitigation for impacts from proposed ocean desalination				•				
Identify sources of contaminants				•				
Comprehensive groundwater quality monitoring plan				•				
Identify components required to develop and implement a Salt and Nutrient Plan				•				
Determine impacts of naturally occurring minerals on Salt and Nutrient Plan				•				
Determine impacts of naturally occurring minerals on Salt and Nutrient Plan			•					
Identify sources of contaminants			•					
Identify components required to develop and implement a Salt and Nutrient Plan			•					
Modify Basin Plan as appropriate			•	•				
Support economical programs that mitigate water quality issues	•							

Table ES-4
Recycled Water Issues, Needs and Wants

	San Juan Basin Authority				Other Interested Parties			
	SJC	MNWD	SMWD	SCWD	MWDOC	TCWD	RMV	SJHGC
Develop reuse and recharge projects to maximize use	●							
Establish agreement with RWQCB on mitigation credits for pumping in bottom and recharge in top	●							
Modify basin water quality objectives to increase levels of water recycling	●							
Coordinate basin water quality plans to permit increased levels of recycling	●							
Use reclaimed water to flush lower basin								
Confirm availability of recycled water for recharge		●						
Determine if recycled water is best used for recharge		●						
Identify recycled water recharge opportunities		●						
Coordinated review and impact of the Salt and Nutrient Plans		●						
Coordinate recycled water recharge with regulatory agencies		●						
Determine water quality impacts from MS4 permits and City enforcement		●						
Identify regional availability of recycled water				●				
Ability to utilize recycled water for recharge				●				
Ability to continue to utilize recycled water			●					
Identify regional availability of recycled water			●					
Maximize the use of reclaimed water	●							
Recharge high quality runoff and reclaimed water as hydrologically high as possible in the basin	●							

Table ES-5
Conjunctive Use Storage Issues, Needs and Wants

	San Juan Basin Authority				Other Interested Parties			
	SJC	MNWD	SMWD	SCWD	MWDOC	TCWD	RMV	SJHGC
Develop ability to market basin losses	•							
Provide transfer mechanisms between pools to ensure beneficial use of water	•							
Determine and assess storage losses	•							
Develop programs to construct facilities and deliver water between agencies	•			•				
Develop pumping regimes to optimize basin production				•				
Analyze benefit of water harvesting with private entities, agencies or the SJBA				•				
Coordinate facilities with the Orange County Southern Sub region Habitat Conservation Plan				•				
Characterize unused storage space within the basin		•						

Table ES-6
Cost Issues, Needs and Wants

	San Juan Basin Authority				Other Interested Parties			
	SJC	MNWD	SMWD	SCWD	MWDOC	TCWD	RMV	SJHGC
Seek financial aid to meet management goals, including grants and loans	•	•	•	•				
Develop five year capital improvement program, identify projects out 20 years			•	•				
Identify realistic and economically feasible long-term goals	•							
Develop incentives to encourage basin management objectives	•							
Develop equity and the perception of equity in the operation of the basin	•							
Estimate costs and benefits for water supply and recharge projects (recycled, storm and imported)		•						

Table ES-7
Human Resources and Administration Issues, Needs and Wants

	San Juan Basin Authority				Other Interested Parties			
	SJC	MNWD	SMWD	SCWD	MWDOC	TCWD	RMV	SJHGC
Develop and maintain centralized database for the San Juan Basin	•	•	•	•				
Develop comprehensive groundwater and surface water monitoring program for basin management	•			•				
Prepare regular "State of the Basin" reports with recommendations for monitoring plan modifications	•			•				
Develop rules intended to prevent agency impacts and avoid litigious situations	•							
Coordinate efforts with other appropriate entities (SOCWA, MWDOC)		•						
Staffing requirements for alternatives of governance				•				
Accounting for cyclic and local losses				•				
Clearly define water rights				•				
Verify to what extent previous hydraulic models are still valid				•				
Utilization of “Paper Swaps”				•				
Identify short and long term goals for the basin				•				
Authority proactive in legislation and regulations				•				
Coordinate facilities with the Orange County Southern Sub region Habitat Conservation Plan			•					

Table ES-8
Major Implementation Steps for the Recommended SJBGMFP Alternatives 6 and 10[1]

Program Element / Feature	Implementation Steps	Ten-Year Implementation Schedule 1	2	3	4	5	6	7	8	9	10	Annual Implementation Cost by Year Excluding Construction[2] ($1,000) 1	2	3	4	5	6	7	8	9	10	Total
Adaptive Production Management												**$260**	**$230**	**$140**	**$160**	**$140**	**$140**	**$160**	**$140**	**$140**	**$160**	**$1,670**
	Groundwater level monitoring and the development of groundwater level maps and storage estimates; and groundwater chemistry monitoring to assess state of seawater intrusion and determine if SJBGMFP is contributing to degradation																					
	Currently being implemented by the SJBA[3]											*$140*	*$140*	*$140*	*$140*	*$140*	*$140*	*$140*	*$140*	*$140*	$140	*$1,400*
	The SJBA, in its role as "Basin Manager" will establish an annual production amount for the CSJC and the SCWD as required to not interfere with private pumpers, and to ensure sustainable production																					
	The SJBA establishes the Basin Management Committee which is empowered by the March 1998 settlement agreement to set an annual Available Safe Yield																					*$0*
	The SJBA will need to develop and periodically revise a relationship between Available Safe Yield and Spring groundwater storage; the relationship will depend on the then existing production and conveyance facilities											*$20*			*$20*			*$20*			*$20*	*$80*
	Groundwater substitution																					
	Conduct preliminary design and assess feasibility											*$50*										*$50*
	Complete CEQA process											*$30*										*$30*
	Finalize agreements with private well owners											*$20*	*$20*									*$40*
	Obtain permits												*$20*									*$20*
	Prepare final design												*$50*									*$50*
	Construct conveyance facilities to enable substitute supply																					
Planning and CEQA Process												**$0**	**$875**	**$600**	**$325**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$1,800**
	Conduct CEQA process through the preparation of a draft PEIR												*$125*	*$125*								*$250*
	Prepare application/petition to SWRCB for new points of diversion, new pumping, to divert surface water, store and subsequently recover																					
	Prepare initial application/petition, review with SWRCB staff until application/petition is accepted												*$50*	*$50*								*$100*
	Coordinate with SWRCB to complete process and acquire diversion permits													*$25*	*$25*							*$50*
	Conduct engineering investigations to develop alternative preliminary designs, determine feasibility and to identify fatal flaws																					
	Groundwater extraction barrier												*$200*	*$200*								*$400*
	In-stream stormwater recharge												*$100*									*$100*
	In-stream recycled water recharge and groundwater recycled water reuse												*$400*	*$200*	*$200*							*$800*

Table ES-8
Major Implementation Steps for the Recommended SJBGMFP Alternatives 6 and 10[1]

Program Element / Feature — Implementation Steps	Ten-Year Implementation Schedule										Annual Implementation Cost by Year Excluding Construction[2] ($1,000)										
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	Total
Finalize and certify PEIR for the SJBGFMP														*$50*							*$50*
Finalize SWRCB application/petition														*$50*							*$50*
Complete Agreements for SJBA Member Participation, Construction and Operation													**$100**	**$100**							**$200**
Design and Construction											**$0**	**$0**	**$0**	**$0**	**$4,150**	**$4,000**	**$0**	**$0**	**$0**	**$0**	**$8,150**
Groundwater Extraction Barrier																					
Obtain permits															*$50*	*$50*					*$100*
Complete design															*$1,900*	*$1,900*					*$3,800*
Construct extraction barrier																					
In-stream Stormwater Recharge																					
Obtain permits															*$50*						*$50*
Complete design															*$100*						*$100*
Operate in-stream stormwater recharge																					
In-stream Recycled Water Recharge and Groundwater Recycled Reuse (Indirect Potable Reuse)																					
Obtain permits															*$50*	*$50*					*$100*
Complete design															*$2,000*	*$2,000*					*$4,000*
Construct recycled water conveyance, recovery wells and treatment system																					
Totals for Alternative 6											**$260**	**$1,105**	**$840**	**$585**	**$4,290**	**$4,140**	**$160**	**$140**	**$140**	**$160**	**$11,820**
Totals for Alternative 10[4]											**$260**	**$905**	**$640**	**$585**	**$2,340**	**$2,190**	**$160**	**$140**	**$140**	**$160**	**$7,520**

[1] Alternative 10 contains all the program elements of Alternative 6 except the extraction barrier

[2] Costs shown in italics total to the cost shown above in the grey bar highlighting the program element.

[3] Costs of current program and recommended program for this part of the recommended SJBGFMP. Significant additional cost will be incurred with recycled water recharge.

[4] There could be additional reduced cost in the processing of SWRCB applications and in the CEQA process if the extraction barrier is excluded.

In 2010 the San Juan Basin Authority (SJBA) engaged Wildermuth Environmental, Inc. (WEI) to update their San Juan Basin Groundwater Management and Facilities Plan (SJBGMFP). WEI teamed with Carollo Engineers and Michael Bradman and Associates to complete this work. This administrative draft report documents the efforts of the stakeholders and our team to update the SJBGMFP. Specifically, this report documents the current state of the basin (SOB), the conceptual model of the hydrologic system, the environmental and infrastructure resources in the investigation area, management goals and impediments to the goals, management alternatives, recommended management plan(s), and a monitoring and reporting plan.

1.1 Scope of Work

The SJBA member agencies include: the City of San Juan Capistrano (CSJC), the Moulton Niguel Water District (MNWD), the Santa Margarita Water District (SMWD), and the South Coast Water District (SCWD). All member agencies of the SJBA are highly dependent on imported water from the Metropolitan Water District of Southern California (MWDSC). MWDSC supplies consist primarily of State Water Project (SWP) water and Colorado River Aqueduct (CRA) water, both of which have been permanently reduced and are now less reliable. MWDSC's water rates to retail agencies have increased dramatically in the last several years and are projected to continue to increase into the future. The SJBA member agencies need to develop more local supplies and local storage to improve supply reliability, reduce their demands on MWDSC, mitigate temporary interruptions of supply from MWDSC, and minimize their exposure to penalties in the drought allocation plan.

The range in groundwater management plans includes the following:

- Preserve the status quo. Complete existing planned projects and rely on MWDSC to serve all water above and beyond existing local supplies. In this alternative the SJBA member agencies will purchase the maximum amount of MWDSC water relative to other alternatives and be subject to MWDSC's rate structure and drought penalties.

- Maximize the use of local water. Complete existing planned projects and then maximize the use of all local water including storm water, native groundwater, and recycled water. In this alternative, the SJBA members will use all their recycled water, the full yield of the groundwater basins and will maximize the recharge of storm water pursuant to the MS4 permit and other opportunistic storm water recharge projects. Existing infrastructure would be leveraged to the maximum extent possible and new infrastructure would be added as required.

- Maximize the use of local water and recycled water. This alternative is identical to the above alternative except that it recharges supplemental water as necessary to maintain or increase supply and supply reliability.

We investigated how to best manage the San Juan groundwater basin under these types of planning concepts, how each SJBA member and other stakeholders would be impacted, mitigation measures and costs. Some of the management concepts considered herein push the regulatory envelope and may require changes in the current Basin Plan and in the indirect recycled water reuse paradigm. We have identified how the current regulatory paradigm limits the management plan and developed reasonable changes in the regulatory paradigm to improve management plan performance and presented both types of plans to the SJBA for their consideration.

The investigation considered all the water resources of the San Juan Creek watershed but limited the application of management activities to the surface and ground waters of the lower part of the watershed between the Pacific Ocean at the most downstream end of the watershed to the Ortega Highway bridge on San Juan Creek and to near the confluence of the Arroyo Trabuco and Oso Creeks on the Arroyo Trabuco. The investigation area is s referred to as the active management area or the active storage area later in this document. The active management area was developed in Task 4 and was approved by the SJBA TAC during the 2013 SJBGFMP development process.

The scope of work included the following tasks:

- Task 1 Define Water Management Objectives
- Task 2 Describe Planning Area and its Resources
- Task 3 Describe Historical and Future Water Requirements
- Task 4 Describe Existing Resources
- Task 5 Describe Water Management Issues and Strategies
- Task 6 Define Alternative Management Plans
- Task 7 Evaluate Alternative Management Plans
- Task 8 Describe Recommended Management Plan.
- Task 9 Develop Monitoring and Reporting Protocols
- Task 10 Prepare Groundwater Management Plan Report
- Task 11 Project Meetings and Coordination Activities
- Task 12 Preliminary CEQA Analysis
- Task 13 Project Management

1.2 Organization of this Report

Section	Title	Description
1	Introduction	
2	Planning Area and its Resources	Describes planning area and the resources to be evaluated in a CEQA checklist
3	Existing Water Resources	Describes the surface and groundwater resources, water rights, groundwater response to continuing the current management plan, and water facilities infrastructure
4	Historical and Projected Water Demand	Describes the historical water use and sources and future water demands and supply plans
5	Management Goals and Impediments	Describes the management goals and impediments to the goals and other "issues needs and wants" of the SJBA member agencies
6	Strategies and Actions to Achieve Management Objectives	Describes strategies and actions that will overcome the impediments to the management goals and management plan alternatives
7	Alternative Management Plans	Describes the evaluation of the management plans based on ability to meet management plan goals, cost and ability to implement
8	Implementation and Monitoring Plans	Describes the SJBGFMP implementation and monitoring plans
9	References	Contains the list of reference documents consulted in the preparation of the SJBGFMP
A	Appendix – Comments and Responses to Comments	Contains verbatim comments and responses on the draft SJBGMFP report.

This section describes the planning area, the various jurisdictions, and the environmental resources within the SJBA service area. The environmental resources are identified to provide a baseline of potential opportunities and constraints during the preparation of alternative management plan activities.

Many of the maps contained in this planning document refer to the SJBA service area as the union of the SJBA member agencies service area. For clarity, the SJBGFMP contains management activities for surface and ground waters within the San Juan Creek watershed exclusively in the lower part of the watershed. The SJBGFMP management activities provide direct benefits to the SJBA member agencies. The service area boundaries of the SJBA member agencies extend beyond the boundaries of the watershed. This means that while the management activities of SJBGFMP occur within the San Juan Creek watershed (and exclusively in the lower part of the watershed), that the direct benefits of the management program can reach beyond the watershed, principally the service areas of the SJBA member agencies and the State.

The Rancho Mission Viejo (RMV) is a large land owner and riparian water user located in the San Juan Creek watershed whose lands and water use are upstream and not included in the SJBGFMP except through the recognition of the RMV upstream water uses. The management activities included in the SJBGFMP occur completely downstream of the RMV and they do not interfere with the water rights and management activities of the RMV.

2.1 Regional Setting

2.1.1 Location

The SJBA is located in southern Orange County and encompasses approximately 100,110 acres or 156 square miles of land. Figures 2-1 and 2-2 show the boundaries of the SJBA in a regional context and in relation to the San Juan Creek Watershed, respectively. The SJBA is bordered by Cleveland National Forest to the east, the City of San Clemente and Marine Corps Base (Camp Pendleton) to the south, the Pacific Ocean to the west, and mostly urbanized Orange County to the north.

2.1.2 Setting

The SJBA is located within the coastal plains and foothills of southern Orange County (Figure 2-3). Elevations range from sea level to approximately 4,500 feet in the Santa Ana Mountains. Approximately half of the land within the basin is open space, park land, or designated agricultural land; the other half is primarily urbanized with residential, commercial, and industrial uses. There are five major roadways that traverse and/or terminate within the basin area, including Interstate 5 (I-5), State Route 73 (SR-73), Pacific Coast Highway (SR-1), SR-241, and Ortega Highway (SR-74). SR-241 currently terminates at Oso Parkway in the City of Mission Viejo. SR-73 merges with Interstate 5 just south of Crown Valley Parkway. The Ortega Highway begins at Interstate 5 in the CSJC and continues east outside the boundary of the SJBA through Cleveland National Forest into Riverside County. The Pacific

Coast Highway runs along the coast through the basin until it merges with Interstate 5 near Doheny State Beach.

There are nine cities located within or that have land area within the SJBA service area. These cities include Aliso Viejo, Dana Point, Laguna Beach, Laguna Hills, Laguna Niguel, Mission Viejo, Rancho Santa Margarita, San Clemente, and San Juan Capistrano. Two of these cities, San Clemente and Laguna Beach, have small amounts of land within the Authority's boundary. Figure 2-4 shows these cities within and adjacent to the SJBA. The land use discussion below includes further detail regarding the amount of land these cities have within the boundary.

There are four water districts within the SJBA service area boundary. These four water districts include the MNWD, the SCWD, the CSJC, and the SMWD (Figure 2-5). The sizes and specific locations of these districts are discussed below in Section 2.7 – Land Use. The Trabuco Canyon Water District overlies parts of the Arroyo Trabuco and Bell Canyon watersheds north of the SMWD. TCWD is not a member of the SJBA and like the RMV their groundwater and surface water management activities were considered in the development of the SJBGFMP.

2.2 Aesthetics

The SJBA service area consists of urbanized flatlands and hills, sandy beaches, rocky coastal points, and mountain ridges, reaching elevations of nearly 4,500 feet above sea level. Broad sandy beaches extending into shallow offshore waters, coastal bluffs, uplifted marine terraces, and marshes characterize the Pacific shoreline. Views are characterized by the Santa Ana Mountains to the northeast, the Santa Margarita Mountains to the southeast, the San Joaquin Hills to the northwest, and the Pacific Ocean, which can be seen from many of the ridgelines within the SJBA's boundary. Scenic resources within the basin are characterized by the rise of coastal hills and ridges from the west to east, which provide rugged canyons with flowing creeks and streams.

Approximately half of the land located within the SJBA service area is urbanized and man-made, while the other half consists of designated parks, open space, and agriculture. Features of the built environment that influence the visual setting include residential, commercial, industrial, and utility-related structures; linear features such as highways, roads, transmission lines, walls, fences, and ditches; agricultural fields, orchards, parks, and golf courses; and dispersed ornamental landscaping that has replaced natural vegetative patterns and colors with row or field crops, fields of grass, and nonnative ornamental vegetation.

2.2.1 Location

There are no County-designated scenic highways that are within or run through the SJBA's boundary. The Pacific Coast Highway through Orange County, including through the SJBA area, has been proposed as a potential scenic highway but has not been officially designated.

2.2.2 Viewscape Corridors

According to the Orange County General Plan, there are roadway segments within the SJBA's boundary that are designated viewscape corridors. A viewscape corridor is a "[…] route which traverses a corridor within which unique or unusual scenic resources and aesthetic values are found" (OCGP, 2004). This designation is intended to minimize the impact the highway and land development has upon significant scenic resources along the route. The following is a list of designated viewscape corridors throughout the SJBA boundary.

2.2.2.1 Santa Margarita Parkway

This roadway is designated a viewscape corridor from Melinda Road to Avenida Empresa.

2.2.2.2 Oso Parkway

This roadway is designated a viewscape corridor from the intersection of Oso Parkway and SR-241 east until Oso Parkway ends.

2.2.2.3 Ortega Highway (SR-74)

This roadway is designated a viewscape corridor from the southern portion of Caspers Regional Park to the northeast where it meets the Orange County border.

2.2.2.4 Pacific Coast Highway

This roadway is designated a viewscape corridor from where it enters the SJBA boundary in the City of Laguna Beach to the southeast where it extends to the San Diego Freeway (I-5) in the City of Dana Point.

2.2.2.5 Interstate-5

A short portion of I-5 is designated a viewscape corridor from where it merges with Pacific Coast Highway to where it leaves the SJBA boundary in the western portion of the City of San Clemente.

2.2.3 Landscape Corridors

According to the Orange County General Plan, there are roadway segments within the SJBA service area that are designated landscape corridors. A landscape corridor is a roadway that "[…] traverses developed or developing areas and has been designated for special treatment to provide a pleasant driving environment as well as community enhancement" (OCGP, 2004). Development within the corridor should serve to complement the scenic highway. The following is a list of landscape corridors throughout the SJBA boundary.

2.2.3.1 Santa Margarita Parkway

This roadway is designated a landscape corridor from Avenida Empresa to Plano Trabuco Road.

2.2.3.2 Antonio Parkway

This roadway is designated a landscape corridor from Avenida Empresa to Oso Parkway.

2.2.3.3 Oso Parkway

This roadway is designated a landscape corridor from Alicia Parkway to the interchange of SR-241 and Oso Parkway.

2.2.3.4 Alicia Parkway

This roadway is designated a landscape corridor from Paseo De Valencia south to Aliso Creek Road.

2.2.3.5 La Paz Road

This roadway is designated a landscape corridor from Paseo De Valencia south to Crown Valley Parkway.

2.2.3.6 Crown Valley Parkway

This roadway is designated a landscape corridor from I-5 south to its termination at Pacific Coast Highway.

2.2.3.7 Ortega Highway

This roadway is designated a landscape corridor from I-5 northeast to the southern portion of Caspers Regional Park.

2.2.3.8 Niguel Road

This roadway is designated a landscape corridor from Crown Valley Parkway south to its termination at Pacific Coast Highway.

2.2.3.9 Camino Del Avion

This roadway is designated a landscape corridor from Crown Valley Parkway to Del Obispo Street.

2.2.3.10 Del Obispo Street

This roadway is designated a landscape corridor from Camino Del Avion to its termination at Pacific Coast Highway.

2.3 Agriculture

A little more than one-third of the land located within the boundary of the SJBA is designated agricultural land. This land is primarily located in the center to southeast part of the SJBA's boundary. The remaining approximate two-thirds of the project area are urbanized with residential, commercial, and light industrial land uses. The Cleveland National Forest is located in the eastern portion of the SJBA service area and is the County's largest single open space feature. Open space is also provided by County and City local parks within suburban and urban settings.

2.3.1 California Department of Conservation Farmland Classification

The California Department of Conservation (CDC) Farmland Mapping and Monitoring Program (FMMP) combines technical ratings of the soils and current land use information to determine the appropriate mapping land category as it relates to potential agricultural production. Agricultural land classifications for the proposed project area included mainly Grazing Land (approximately 28,379 acres in 2008), Prime Farmland (approximately 299 acres in 2008), Unique Farmland (approximately 770 acres in 2008), and Farmland of Statewide Importance (approximately 59.4 acres in 2008), totaling 29,507 acres of agricultural land out of approximately 100,110 acres of land within the SJBA service area (CDC, 2008). The locations of these lands and their classification are shown in Figure 2-6 and are further described below. Please note that the information regarding farmland was updated by the CDC in 2008. See below, under Williamson Act Contract, for further information about agricultural land that is planned for development and is to be rezoned from agricultural use.

2.3.1.1 Prime Farmland

Land with the best combination of physical and chemical features for the long-term production of agricultural crops is termed Prime Farmland by the CDC. This land can economically produce sustained high yields when treated and managed according to accepted modern farming methods. The land must have been used for the production of irrigated crops at some time during the two updated cycles prior to the current mapping date. Prime Farmland within SJBA is mostly concentrated south of Ladera Ranch and east of Antonio Parkway along Ortega Highway. There is Prime Farmland located along and west of I-5. This farmland is off Camino Del Avion and Camino Capistrano in the City of San Juan Capistrano. Lastly, a small piece of Prime Farmland is located in north Coto De Caza off Coto De Caza Drive. Refer to Figure 2-6 for the locations of this farmland.

2.3.1.2 Farmland of Statewide Importance

This is land with a good combination of physical and chemical features but with minor shortcomings, such as greater slopes, or with less ability to hold and store moisture. The land must have been cropped at some time prior to the mapping date. Farmland of Statewide Importance within the SJBA service area is located east of Antonio Parkway along Ortega Highway. There is also Farmland of Statewide Importance located along and west of I-5. This farmland is off Camino Del Avion and south of La Novia Avenue in the City of San Juan Capistrano. Lastly, two small pieces of Farmland of Statewide Importance are located to the north and south of Ortega Highway. Refer to Figure 2-6 for the locations of this farmland.

2.3.1.3 Grazing Land

Grazing land is land on which the existing vegetation, whether grown naturally or through management, is suitable for the grazing or browsing of livestock. This classification of farmland is located in the north central and eastern parts of the basin boundary. Grazing Land comprises most of the farmland designated within the basin. This is located north and south of Ortega Highway. Refer to Figure 2-6 for the locations of this farmland. Most of the grazing land is located within The Ranch Plan, which as discussed above, has already been approved.

2.3.1.4 Farmland of Local Importance

This is land of importance to the local agricultural economy and is determined by each county's Board of Supervisors and local advisory committees. Examples of this type of land could include dairies, dry land farming, aquaculture, and uncultivated areas with soils qualifying for Prime Farmland and Farmland of Statewide Importance. There is no land within the SJBA service area that is classified as Farmland of Local Importance.

2.3.1.5 Urban and Developed Land

This land is used for residential, industrial, commercial, construction, institutional, and public administrative purposes; railroad yards; cemeteries; airports; gold courses; sanitary landfills; sewage treatment plants; water control structures; and other development purposes. Approximately half of the land within the basin boundary is developed land.

2.3.2 Williamson Act Contracts

The CDC provides an ftp site containing maps by county of lands under Williamson Act contracts. As mentioned above, the agricultural land classifications shown in Figure 2-6 were obtained from the CDC and was updated in 2008. This is the most recent information available. Taking this into consideration, there was land that was classified as agricultural land in 2008 that is now no longer under Williamson Act contracts. According to the Ranch Plan, of the total 22,282 acres of designated agricultural land in 2008

2.4 Biological/Ecological Resources

2.4.1 Introduction

Approximately half of the land within the SJBA service area is urban and developed, leaving the remaining land zoned agricultural, recreational, and open-space. The basin is bound by the Santa Ana Mountains to the northeast and the San Joaquin Hills to the southwest and contains a series of canyons and creeks throughout. Below is a detailed account of endangered, threatened, and special-status species (plants and wildlife) that exist within the project area.

2.4.1.1 Literature and Data Review

Information regarding the occurrences of special-status species in the vicinity of the San Juan Basin boundary was obtained from searching the California Department of Fish and Game's (CDFG) Natural Diversity Data Base (CNDDB, February 2011) and the California Native Plant Society's Electronic Inventory (CNPSEI, February 2011). These databases contain records of reported occurrences of federal- or State-listed endangered or threatened and proposed endangered or threatened species, former Federal Species of Concern (FSC), California Species of Special Concern (CSC), or otherwise sensitive species or habitat that may occur within or in the immediate vicinity of the basin. Lists from the U.S. Fish and Wildlife Service (USFWS) and the CDFG were also reviewed, and lists of sensitive wildlife and plant species potentially occurring within the vicinity of the basin boundaries were developed. The search range encompasses a sufficient distance to accommodate for regional habitat diversity and to overcome the limitations of the CNDDB; the CNDDB is based on reports of actual occurrences and does not constitute an exhaustive inventory of every resource.

2.4.1.2 Biological Differences

There are 27 sensitive wildlife species identified within the SJBA service area. Figure 2-7 shows where these species occur within the basin. Of the 27 sensitive wildlife species, seven are considered federally endangered and one is considered federally threatened. Two species are considered endangered by the State, and 22 species are considered “California Species of Concern,” according to the CDFG. Table 2-1 lists these species by their common and scientific names and shows their federal and state statuses.

There are 15 sensitive plant species identified within the SJBA boundary. Figure 2-8 is a map showing where these species occur within the SJBA service area. Of the 15 species, three are considered to be federally threatened and According to the State of California, two are considered to be threatened and one endangered. All of the species listed in Table 2-2 have a California Native Plant Society (CNPS) rating of 1B.1 or 1B.2. These ratings are defined as plants being rare, threatened, or endangered by the CNPS rating system Table 2-2 lists these plant species by their common and scientific names.

2.4.1.3 Critical Habitat

According to the USFWS, there are five critical habitats that occur within SJBA service area. These habitats and their areas are listed in Table 2-3 and their locations are shown in Figure 2-9. Steelhead, San Diego fairy shrimp, Arroyo toad, thread-leaved brodiaea, and Coastal California gnatcatcher all have critical habitat with in the basin.

2.4.2 Habitat Descriptions

2.4.2.1 Arroyo Toad

Arroyo toads can be found in washes, streams, and arroyos. They can also be found on sandy banks in riparian woodlands and along rivers that have shallow gravelly pools adjacent to sandy terraces.

2.4.2.2 Coastal California Gnatcatcher

The Coastal California gnatcatcher typically occurs in or near coastal sage scrub habitat. This species is found within coastal Southern California from Ventura County down to the northern coastal parts of Mexico.

2.4.2.3 San Diego Fairy Shrimp

The San Diego fairy shrimp is a small aquatic crustacean, which is generally restricted to vernal pools and other ephemeral basins in coastal Orange and San Diego Counties. Vernal pools in Southern California typically contain water in the winter and are dry in the summer. The San Diego fairy shrimp can be found in pools that are 2 to 12 inches deep.

2.4.2.4 Thread-leaved Brodiaea

Thread-leaved brodiaea typically occurs on gentle hillsides, valleys, and floodplains. It grows in southern needlegrass grassland and alkali grassland plant communities that are associated with clay, loamy sand, or alkaline silty-clay soils.

2.4.2.5 Steelhead

Steelhead typically occur in coastal rivers. Steelhead critical habitat, as shown in Figure 2-9, occurs within San Juan Creek. This critical habitat extends from the mouth of San Juan Creek at the Pacific Ocean to approximately 2.6 miles upstream, where San Juan Creek meets the I-5. Steelhead critical habitat is also identified from the Arroyo Trabuco and San Juan Creek confluence to approximately 2.5 miles upstream within the Arroyo Trabuco.

2.5 Geological Hazards

2.5.1 Seismicity and Faulting

2.5.1.1 Groundshaking

According to the 2001 California Building Code (CBC), the SJBA boundary is in Seismic Zone 4. Seismic Zone 4 includes those areas that lie in a zone of major historic earthquakes (i.e. Mw magnitude greater than 7.0) and recent high levels of seismicity. Major damage, corresponding to intensities VIII or higher on the Modified Mercalli Intensity Scale, should be expected within this zone. The amount of earthquake shaking at a site is a function of earthquake magnitude, the type of earthquake source (i.e. type of fault), the distance between the site and the earthquake source; the geology of the site, and how the earthquake waves subside (attenuate) as they travel from their source to a given location. Larger, nearer quakes will increase the degree of groundshaking at a given location. Soil and rock type may act to amplify or attenuate seismic waves and consequent groundshaking. Generally, areas that are underlain by bedrock tend to experience less groundshaking than those underlain by unconsolidated sediments such as artificial fill.

There are two major fault zones that occur within the SJBA service area: the Cristianitos fault zone and the Mission Viejo fault zone. The Cristianitos fault zone passes through the central portion of the SJBA service area, from north to south, while the Mission Viejo fault zone passes through the eastern portion of the SJBA service area, from north to south. There are other unnamed faults located in the southwestern, north-central, and northeastern part of the SJBA boundary. Figure 2-10 shows the locations of these faults within and around the basin.

2.5.2 Soil Constraints

2.5.2.1 Liquefaction

Liquefaction is a phenomenon in which saturated soils lose strength and cohesion when subjected to dynamic forces, such as shaking during an earthquake. Liquefaction can occur in unsaturated soils with low cohesion, such as uniformly fine sand. Liquefaction potential is greatest in areas with shallow groundwater and saturated soils. Soil type, climate, topography, slope geometry, and excavations influence the potential for slope failures and landslides.

Liquefaction and related phenomena have been responsible for a tremendous amount of damage during earthquakes, as soil cohesion is lost along with the support that it normally supplies to building foundations. Ground failure resulting from liquefaction can include sand boils, ground settlement, ground cracking, lateral spreading, slope toe failure, and ground warping. Liquefaction within the SJBA service area is generally confined to the creeks and stream areas. Figure 2-11 shows this in detail for liquefaction throughout the basin.

2.5.2.2 Landslides

Landslides, rock falls, and debris flows are all forms of mass wasting—the movement of soils and rock under the influence of gravity. A landslide may occur if the source material on a slope is triggered by some mechanism. Source materials include fractured and weathered bedrock and loose soils. Triggering mechanisms include earthquakes, saturation from rainfall, and erosion.

Shaking during an earthquake may lead to seismically induced landslides, especially in areas that have previously experienced landslides or slumps, in areas of steep slopes, or in saturated hillsides. The California Geological Survey (CGS) has identified areas subject to landslides within the SJBA service area. These areas are shown in Figure 2-12. Potential areas where seismically induced landslides could occur are in the foothill portions of the SJBA service area.

2.5.2.3 Tsunami and Seiche

A tsunami (Japanese word meaning "harbor wave") or "seismic sea wave" is a water wave or a series of waves generated by a sudden displacement of the surface of the ocean or other deep body of water. Tsunamis can travel across oceanic basins and cause damage thousands of miles from their sources. Most tsunamis are caused by a rapid vertical movement along a break in the Earth's crust (i.e. a tectonic fault rupture on the bottom of the ocean resulting in the displacement of the column of water directly above it). Earthquake ruptures along subduction zones trigger the majority of tsunamis.

A seiche is a periodic oscillation or "sloshing" of water in an enclosed basin caused by an earthquake. The period of oscillation is dependent upon the size and configuration of the water body and may range from minutes to hours. A seiche may occur in a lake, bay, or other enclosed body of water.

Any unprotected coastal area may have some degree of risk from tsunamis. The presence of active offshore faults would indicate an additional tsunami risk to low-lying areas near the Orange County coast. The risk from a seismic seiche in lakes and reservoirs in the County also exists to some degree and would be related to the size and depth of the water body and its proximity to the epicenter of a major quake.

2.5.3 Soil Types

Soils in the area are characteristic of the Southern California coastal plain, consisting of alluvial deposits and floodplain soils. The major soil series, permeability, and degree of limitation for development at shallow excavations are identified in Table 2-4. Much of the alluvial and fluvial soils underlying SJBA boundary were deposited from runoff of the Santa Ana

Mountains. Such deposits are composed of variable amounts of sand, silt, and clay. The SJBA area consists of 28 different soil series that make up the basins ground composition.

A soil's permeability is defined in three categories; Slow, Moderate, and Rapid. These are the general rates at which water and air are absorbed into the soils. Figure 2-13 shows the categories of permeability throughout the basin. The degree of limitation defines the development constraints—slight, moderate, and severe—for structures being installed. The United States Department of Agriculture "building site development" classification of shallow excavations was chosen due to the likelihood of water facilities, such as pipelines being constructed at a depth of 3 to 6 feet. The constraints of slight, moderate, and severe are defined as follows:

- Slight means that the soil properties are generally favorable and that the limitations are minor and easily overcome.
- Moderate means that the limitations can be overcome or alleviated by planning, design, or special maintenance.
- Severe means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or a combination of these measures.

Figure 2-14 shows the degrees of limitation throughout the basin.

2.6 Hydrology

2.6.1 Water Courses

The major watercourse that feeds the San Juan Creek Watershed is San Juan Creek. The San Juan Creek watershed is located in southern Orange County, California. The watershed encompasses a drainage area of approximately 176 square miles, and extends from the Cleveland National Forest in the Santa Ana Mountains to the Pacific Ocean at Doheny State Beach near Dana Point Harbor. The upstream tributaries of the watershed flow out of steep canyons. As the streams flow, they coalesce and widen out into several alluvial floodplains. The major streams in the watershed include San Juan Creek, Bell Canyon Creek, Canada Chiquita, Canada Gobernadora, Verdugo Canyon Creek, Oso Creek, Trabuco Creek, and Lucas Canyon Creek (Figure 2-15). Elevations range from 5,687 feet at Santiago Peak to sea level at the mouth of San Juan Creek. The San Juan Creek watershed is bounded on the north by the Aliso Creek watershed and on the south by the San Mateo Creek watershed. The Lake Elsinore watershed, which is a tributary of the Santa Ana River watershed, is adjacent to the eastern edge of the San Juan Creek watershed. A brief description of the major streams that feed into San Juan Creek is provided below.

2.6.1.1 Bell Canyon Creek

Bell Canyon is a large sixth order sub-basin in the central San Juan Creek watershed (Figure 2-15). The Bell Canyon and San Juan confluence is 12.62 miles upstream of the coast. Bell Canyon represents about 28.4 percent of the San Juan Creek watershed area upstream of the Bell Canyon and San Juan Creek confluence. The mouth of Bell Canyon enters San Juan

Creek immediately upstream of Verdugo Canyon, about 1.5 miles downstream of Lucas Canyon. Bell Canyon's longest continuous stream length is approximately 15 miles.

2.6.1.2 Cañada Chiquita

Cañada Chiquita is an elongated north-south oriented sub-basin. Cañada Chiquita and Chiquita creek are located between Cañada Gobernadora to the southeast and Arroyo Trabuco Canyon to the northwest. Cañada Chiquita and Chiquita creek begin close to where SR-241 ends near Oso Parkway. The longest continuous stream length is approximately 6.5 miles, extending from the mouth of the stream near the Santa Ana Mountains its confluence with San Juan Creek, approximately 3 miles east of the Ortega Highway and I-5 interchange.

2.6.1.3 Cañada Gobernadora

Cañada Gobernadora is an elongated north-south oriented sub-basin that is similar in drainage form to Cañada Chiquita to the west and Bell Canyon to the east. The longest watercourse in the sub-basin is approximately 9.7 miles. Cañada Gobernadora's area represents about 11.6 percent of the San Juan Creek watershed area, upstream of the Cañada Gobernadora and San Juan Creek confluence. Cañada Gobernadora's confluence with San Juan Creek is approximately 1 mile upstream of the Cañada Chiquita confluence.

2.6.1.4 Verdugo Canyon

The Verdugo Canyon sub-basin is located in the eastern central portion of the San Juan Basin, just south of the Lucas Canyon sub-basin (Figure 2-15). Similar to Lucas Canyon, the Verdugo Canyon watershed has roughly an east-west orientation with several tributary channels entering the main valley stream from the north and south. The longest continuous watercourse is approximately 8 miles. Verdugo Canyon's area represents about 6.2 percent of the San Juan Creek watershed area, upstream of the Verdugo Canyon and San Juan Creek confluence. It is roughly 14.5 miles downstream to the Pacific Ocean along the route of San Juan Creek.

2.6.1.5 Lucas Canyon

The Lucas Canyon sub-basin is located in the eastern central portion of the San Juan Creek watershed (Figure 2-15). The central valley and main stream course of this sub-basin is oriented along an east-west axis while most tributary channels enter Lucas Canyon from the north or south. The longest continuous watercourse of the sub-basin is approximately 6 miles. The Lucas Canyon and San Juan Creek confluence occurs roughly 1.5 miles upstream of the Bell Canyon and Verdugo Canyon outlets. Lucas Canyon's area represents about 14.3 percent of the San Juan Creek watershed area, upstream of the Lucas Canyon and San Juan Creek confluence.

2.6.1.6 Arroyo Trabuco

The Arroyo Trabuco Creek sub-basin is located in the central western portion of the San Juan Creek watershed (Figure 2-15). The central valley and main stream course of this sub-basin is oriented along a north-south axis within the SJBA service area. As the stream leaves the basin boundary, though still within the watershed, it takes an eastward turn and becomes oriented on an east-west axis. The longest continuous stream course for Arroyo Trabuco is 17 miles. The Arroyo Trabuco and Oso Creek confluence is approximately 1.3 miles north of the SR-74 and I-5 interchange. These two creeks converge with San Juan Creek approximately 1 mile south of the Ortega Highway and I-5 interchange or approximately 2.2 miles south of the Arroyo Trabuco and Oso Creek confluence.

2.6.1.7 Oso Creek

The Oso Creek sub-basin is located just west of the Arroyo Trabuco sub-basin, on the western border of the San Juan Creek watershed. The main stream course is oriented on a north-south axis with most tributaries entering the main stream course from the east and west. The longest continuous stream course for Oso Creek is approximately 12.8 miles in length. Oso Creek does not directly flow into San Juan Creek; however, it does have a confluence with Arroyo Trabuco approximately 2.2 miles upstream of the San Juan Creek and Arroyo Trabuco confluence.

2.6.2 FEMA Hazards

Hazards due to floods within the San Juan Basin area are generally confined to the canyon and creek areas. Figure 2-16 shows which areas are subject to flooding during a major storm event. As Figure 2-16 shows, the areas identified in Zone A are most prone to flooding. Zone A is the only FEMA flood designation area that appears within the SJBA boundary. Zone A is defined by having a 1 percent yearly chance of flooding and a 26 percent chance of flooding over the time of a 30-year mortgage. The areas most prone to flooding within the San Juan Basin area are San Juan Creek, Bell Canyon, Canada Goberadora, Canada Chiquita, Arroyo Trabuco, Oso Creek, and Aliso Creek. Approximately 4,602 acres of land within the basin is located in a flood hazard area or Zone A. Although these areas are located within Zone A according to FEMA, these areas are self-contained and would not result in any damage or inundation to surrounding land uses. Other areas within the basin are designated flood Zone X or X500. Zone X areas are defined as being the area between the limits of the 100-year and 500-year floods.

2.7 Land Use

2.7.1 Setting

The SJBA's boundary encompasses approximately 100,110 acres of land, most of southern Orange County, south of the City of Lake Forest. This includes all and portions of nine cities and four water district areas. Approximately half of the SJBA area is urbanized developed land that contains residential, commercial, industrial, and other uses. The areas that remain undeveloped are concentrated in the central and southern portions of the SJBA service area and are designated mostly agricultural, open-space, and recreational wilderness.

2.7.2 Cities and Agencies

2.7.2.1 Cities

As previously mentioned, there are nine cities that have land area within the SJBA service area (refer to Figure 2-4). Table 2-5 lists these cities and their acreages within the SJBA service area.

The SJBA boundary completely encompasses some of these cities and only partly encompasses others. As seen in Figure 2-4, the cities of San Clemente, Laguna Beach, and Rancho Santa Margarita have only portions of land area within the boundary.

2.7.2.2 Water Districts

As previously mentioned, there are four water districts that serve the area within the SJBA service area (refer to Figure 2-5 for locations and boundaries). Table 2-6 lists these water districts and their acreages. All four water districts are contained within the SJBA service area. The SMWD has the largest land area, followed by MNWD, CSJC, and SCWD.

2.7.3 Land Uses within Basin

As previously mentioned, approximately half of the land area within the SJBA service area is urbanized, while the remaining is undeveloped and mostly unincorporated. Most of the developed land within the basin is designated residential and commercial. Table 2-7 provides the approximate acreages, according to information provided by the Southern California Association of Governments (SCAG), for land use designations within the SJBA service area. Figure 2-17 shows these land uses.

Note that the information provided by SCAG for land use designations did not cover the entire basin, and small portions on the fringes of unincorporated land were left out; this is why the land use acreages in Table 2-7 do not add up to the approximate 100,110 acres within the SJBA service area. As Table 2-7 shows, Single Family Residential encompasses approximately 19,000 acres of land area, a large portion of developed land within the basin. Single Family Residential is shown as yellow in Figure 2-17 and can be seen scattered throughout the western portion of the SJBA. Recreation and Open Space encompasses a large portion of land area within the basin as well, approximately 22,300 acres. This can be seen more clearly in Figure 2-18.

Vacant land comprises approximately 35,400 acres of land within the basin. Note that SCAG defines this as land in a natural state, containing tree, brush/shrub, and/or grassland vegetation. Also, parts of undeveloped parks could be included in this category as well as rangeland. Therefore, it is not uncommon to expect land designated by the CDC as grazing land—seen in Figure 2-6, within the Agricultural discussion above—to be included in this "Vacant" designation.

2.8 Transportation Infrastructure

2.8.1 Streets and Highway System

Residents of Orange County depend on automobiles and trucks for the majority of their local and regional transportation requirements. As a result, a variety of interstate and state routes, as well as local arteries, exist for vehicles to travel through Orange County to other locations. The freeway system is the backbone of the transportation network, with interstates and state routes supplemented by conventional highways and toll roads. A network of arterial highways serves as a feeder system to the freeway system and also provides local travel corridors for drivers and transit-users within Orange County.

2.8.1.1 Freeways and Tollways

Figure 2-19 displays the freeways, toll roads, and arterial road systems in the planning area. The major interstate route running through the basin is I-5, which is a major regional north-south route leading to adjacent Los Angeles and San Diego Counties. Major state routes running within and through the basin include SR-73, SR-1, and SR-74. In addition, the SJBA boundary includes privately franchised toll roads, including SR-73 (San Joaquin Hills Transportation Corridor [southern portion of SR-73]) and SR-241 (Foothill Transportation Corridor). The California Department of Transportation (Caltrans) is responsible for the design, construction, maintenance, and operation of the California State Highway System as well as the portion of the Interstate Highway System within the state's boundaries. Caltrans District 12 is responsible for the design, construction, maintenance, and operation of the California State Highway System in Orange County and vicinity, while the U.S. Department of Transportation (DOT), Federal Highway Administration (FHWA) provides oversight on road projects in Orange County that involve federal highways and federal funding.

While Caltrans constructs and maintains the freeways in Orange County, the Orange County Transportation Authority (OCTA) assists with planning and funding for all freeway improvements. In addition, OCTA administers regional street and road improvement projects in Orange County as well as a variety of funding programs for cities to widen streets, improve intersections, coordinate signals, build Smart Streets, and rehabilitate pavement.

2.8.1.2 Master Plan of Arterial Highways

The importance of the arterial street system in Orange County can be illustrated by the fact that it carries slightly over half the vehicle miles traveled (VMT) in the county. The Orange County Master Plan of Arterial Highways (MPAH) ensures consistent standards and coordinated planning of the arterial streets in Orange County. The MPAH consists of a network of major thoroughfares composed of freeways, transportation corridors, and five main arterial highway classifications: principal, major, primary, secondary, and collector. In addition, one other arterial highway subcategory—Smart Streets—is part of the MPAH system. Figure 2-19 displays the entire MPAH at buildout. Table 2-8 presents average daily traffic (ADT) for the various roadway classes based on the criteria given in the Orange County CMP as well as ADT for local residential (neighborhood-serving) streets.

2.8.2 Public and Rapid Transportation

Orange County has a variety of public transportation systems available to its residents and visitors. Most of the rapid transportation system is located within the northern and central areas of Orange County.

2.8.2.1 Orange County Bus System

OCTA is the primary provider of bus service in Orange County. The Long Beach Transit, the Riverside Transit Agency, the Los Angeles County Metropolitan Transportation Authority, and the North San Diego County Transit District also offer limited service. Additionally, a number of Orange County cities operate local community bus routes or specialized transit services.

OCTA provides local fixed route, express, and rail connector (Station Link) bus services throughout Orange County with a fleet of more than 600 vehicles, ranging in size from 60-foot articulated buses—used on high density corridors in the central county—to 25-foot mini buses—used for lightly traveled routes. During fiscal year (FY) 2008/09, approximately 1,800,000 vehicle service hours were operated on 87 routes. Annual boarding's (passengers carried) are over 57 million (OCTA 2009). Figure 2-20 displays Orange County's fixed route bus system within the SJBA service area.

In addition to fixed route bus services, OCTA also provides paratransit services (i.e. "curb to curb" on-demand transit and shared ride services) designed to meet the needs of persons with disabilities and senior citizens. This includes ACCESS service designed to meet the requirements of the *Americans with Disabilities Act* (ADA) and "Special Agency" service which provides service to nutrition centers for the Office on Aging.

2.8.2.2 Passenger/Commuter Rail

Metrolink commuter rail service uses existing freight rail corridors to provide passenger services between residential and employment centers in Orange, Los Angeles, Riverside, San Bernardino, and Ventura Counties. In 1991, these counties formed the Southern California Regional Rail Authority (SCRRA)—a Joint Powers Authority (JPA)—to administer, operate, and market the Metrolink regional commuter rail service. Figure 2-20 displays the Metrolink commuter rail system operating within and through the basin.

2.8.2.2.1 Orange County Line

Metrolink service in Orange County was launched in 1994 with service between Oceanside in northern San Diego County with Orange County and Los Angeles Union Station along the Orange County Line. OCTA owns 42 miles of railroad right-of-way along this route (the Orange Subdivision) from the San Diego County line to the Fullerton Transportation Center. The Orange County Line currently provides 19 daily trips between Orange and Los Angeles Counties. There are two stations within the basin where Metrolink and Amtrak's Pacific Surfliner stop for passengers: the Laguna Niguel/Mission Viejo Station and the San Juan Capistrano Station.

Amtrak passenger rail service also operates along the Orange County Line in central and southern Orange County, providing service between San Diego and Orange Counties.

Table 2-1
CNDDB List of Sensitive Wildlife Species

	Common Name	*Scientific Name*	Federal Status	State Status
1	Least Bell's vireo	*Vireo belliipusillus*	Endangered	Endangered
2	Southwestern willow flycatcher	*Empidonaxtraillliiextimus*	Endangered	Endangered
3	Pacific pocket mouse	*Perognathuslongimembrispacificus*	Endangered	CSC
4	Arroyo toad	*Anaxyruscalifornicus*	Endangered	CSC
5	Riverside fairy shrimp	*Streptocephaluswoottoni*	Endangered	
6	San Diego fairy shrimp	*Branchinectasandiegonensis*	Endangered	
7	Tidewater goby	*Eucyclogobiusnewberryi*	Endangered	
8	Coastal California gnatcatcher	*Polioptilacalifornicacalifornica*	Threatened	CSC
9	American badger	*Taxideataxus*		CSC
10	Coast Range newt	*Tarichatorosa*		CSC
11	Dulzura pocket mouse	*Chaetodipuscalifornicusfemoralis*		CSC
12	San Diego desert woodrat	*Neotomalepidaintermedia*		CSC
13	Arroyo chub	*Gila orcuttii*		CSC
14	Burrowing owl	*Athenecunicularia*		CSC
15	Coast horned lizard	*Phrynosomablainvillii*		CSC
16	Coastal cactus wren	*Campylorhynchusbrunneicapillus-sandiegensis*		CSC
17	Long-eared owl	*Asiootus*		CSC
18	Northern harrier	*Circus cyaneus*		CSC
19	Orange throat whiptail	*Aspidoscelishyperythra*		CSC
20	Pallid bat	*Antrozouspallidus*		CSC
21	Red-diamond rattlesnake	*Crotalusruber*		CSC
22	Tricolored blackbird	*Agelaius tricolor*		CSC
23	Two-striped garter snake	*Thamnophishammondii*		CSC
24	Western mastiff bat	*Eumopsperotiscalifornicus*		CSC
25	Western pond turtle	*Emysmarmorata*		CSC
26	Western red bat	*Lasiurusblossevillii*		CSC
27	Western spadefoot	*Speahammondii*		CSC

Notes:

CSC = California Species of Special Concern

Source: California Department of Fish and Game, Natural Diversity Database, February 2011.

Table 2-2
CNDDB Special-Status Species

	Common Name	*Scientific Name*	Federal Status	State Status	CNPS
1	Thread-leaved brodiaea	*Brodiaeafilifolia*	Threatened	Endangered	1B.1
2	Laguna Beachdudleya	*Dudleyastolonifera*	Threatened	Threatened	1B.1
3	Big-leaved crownbeard	*Verbesinadissita*	Threatened	Threatened	1B.1
4	Allen's pentachaeta	*Pentachaetaaurea* ssp.*allenii*			1B.1
5	Blochman's dudleya	*Dudleyablochmaniae* ssp.*blochmaniae*			1B.1
6	Nuttall's scrub oak	*Quercusdumosa*			1B.1
7	Orcutt's pincushion	*Chaenactisglabriuscula* var.*orcuttiana*			1B.1
8	Southern tarplant	*Centromadiaparryi* ssp.*australis*			1B.1
9	Coulter's saltbush	*Atriplexcoulteri*			1B.2
10	Peninsular nolina	*Nolina cismontane*			1B.2
11	Aphanisma	*Aphanismablitoides*			1B.2
12	Intermediate mariposa-lily	*Calochortusweedii* var.*intermedius*			1B.2
13	Many-stemmed dudleya	*Dudleyamulticaulis*			1B.2
14	Sticky dudleya	*Dudleyaviscida*			1B.2
15	Summer holly	*Comarostaphylisdiversifolia* ssp.*diversifolia*			1B.2

Notes:

CNPS = California Native Plant Society

1B.1 = Seriously Endangered in California

1B.2 = Fairly Endangered in California

Source: California Department of Fish and Game, Natural Diversity Database, February 2011.

Table 2-3
Critical Habitat in Acres

Species		Acres of Critical Habitat
1	Arroyo Toad	3,532
2	Coastal California Gnatcatcher	50,007
3	San Diego Fairy Shrimp	140
4	Steelhead[1]	—
5	Thread-leaved Brodiaea	1,039

Notes:

[1] Refer to Exhibit 2-9 for occurrences.

Source: USFWS Critical Habitat Data.

Table 2-4
Soil Types within San Juan Basin Authority

Soil Series	Permeability	Degree of Limitation - Shallow Excavation Depth
Alo	Slow	Severe
Anaheim	Slow	Severe
Balcom	Slow	Severe
Blasingame	Slow	Severe
Bolsa	Slow	Moderate
Bosanko	Slow	Severe
Botella	Slow	Slight
Calleguas	Moderate	Moderate
Capistrano	Moderate	Slight
Chesterton	Slow	Severe
Chino	Slow	Moderate
Cieneba	Moderate	Severe
Corralitos	Rapid	Severe
Cropley	Slow	Severe
Exchequer	Moderate	Severe
Gabino	Slow	Severe
Hanford	Moderate	Slight
Marina	Moderate	Severe
Metz	Moderate	Severe
Mocho	Moderate	Slight
Modjeska	Moderate	Severe
Myford	Slow	Moderate
Ramona	Slow	Slight
San Andreas	Moderate	Severe
Soboba	Rapid	Severe
Soper	Slow	Severe
Sorrento	Moderate	Moderate
Yorba	Slow	Severe

Source: USDA, Soil Survey of Orange County and Western Part of Riverside County, California, September 1978.

Table 2-5
Cities within San Juan Basin Authority

	Cities	Area within SJBA [acres]
1	Aliso Viejo	6,377
2	Dana Point	4,475
3	Laguna Beach	1,213
4	Laguna Hills	2,923
5	Laguna Niguel	9,381
6	Mission Viejo	11,577
7	Rancho Santa Margarita	5,665
8	San Clemente	2,057
9	San Juan Capistrano	9,381
10	Unincorporated	47,154

Source: Orange County Data, February 2011.

Table 2-6

Water Districts within
San Juan Basin Authority

Water District		Acreages
1	Moulton Niguel	23,361
2	South Coast	3,828
3	San Juan Capistrano	9,031
4	Santa Margarita	62,515

Source: San Juan Basin Authority, 2011.

Table 2-7

Land Use Acreages

Land Use		Acres
1	Single Family Residential	19,000
2	Multi-Family Residential	3,800
3	Commercial	5,300
4	Industrial	1,200
5	Educational Facilities	1,400
6	Agricultural	324
7	Recreation and Open Space	22,300
8	Transportation, Communication, and Utilities	3,600
9	Vacant	35,400

Source: SCAG, 2008.

Table 2-8

Arterial Highway Daily Carrying Capacities

MPAH Classification	Number of Lanes	ADT**	Right-of-Way/ Roadway Width***
Principal	8 Lanes Divided	60,000	144 ft/126 ft
Major	6 Lanes Divided	45,000	120 ft/102 ft
Primary	4 Lanes Divided	30,000	100 ft/84 ft
Secondary	4 Lanes Undivided	20,000	80 ft/64 ft
Collector	2 Lanes Undivided	10,000	56 ft/40 ft
N/A	Residential Street*	1,200	varies

Notes:

MPAH = Master Plan of Arterial Highways

ADT = Average Daily Traffic

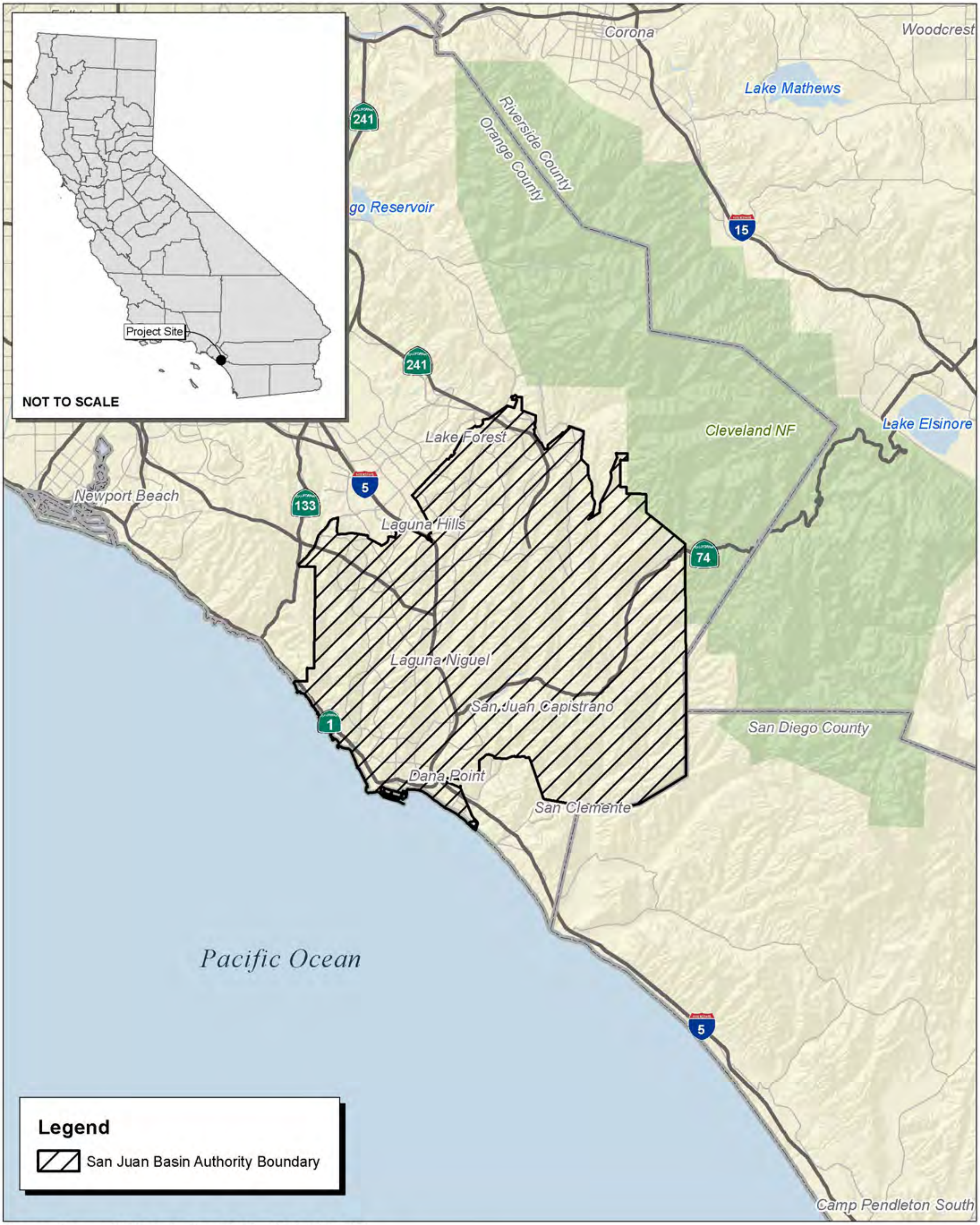
ft = feet

* Residential roadway ADT based upon ITE data.

** Maximum recommended number of average daily trips at level of service (LOS) "C."

*** Typical widths

Source: Orange County General Plan, April 2004.



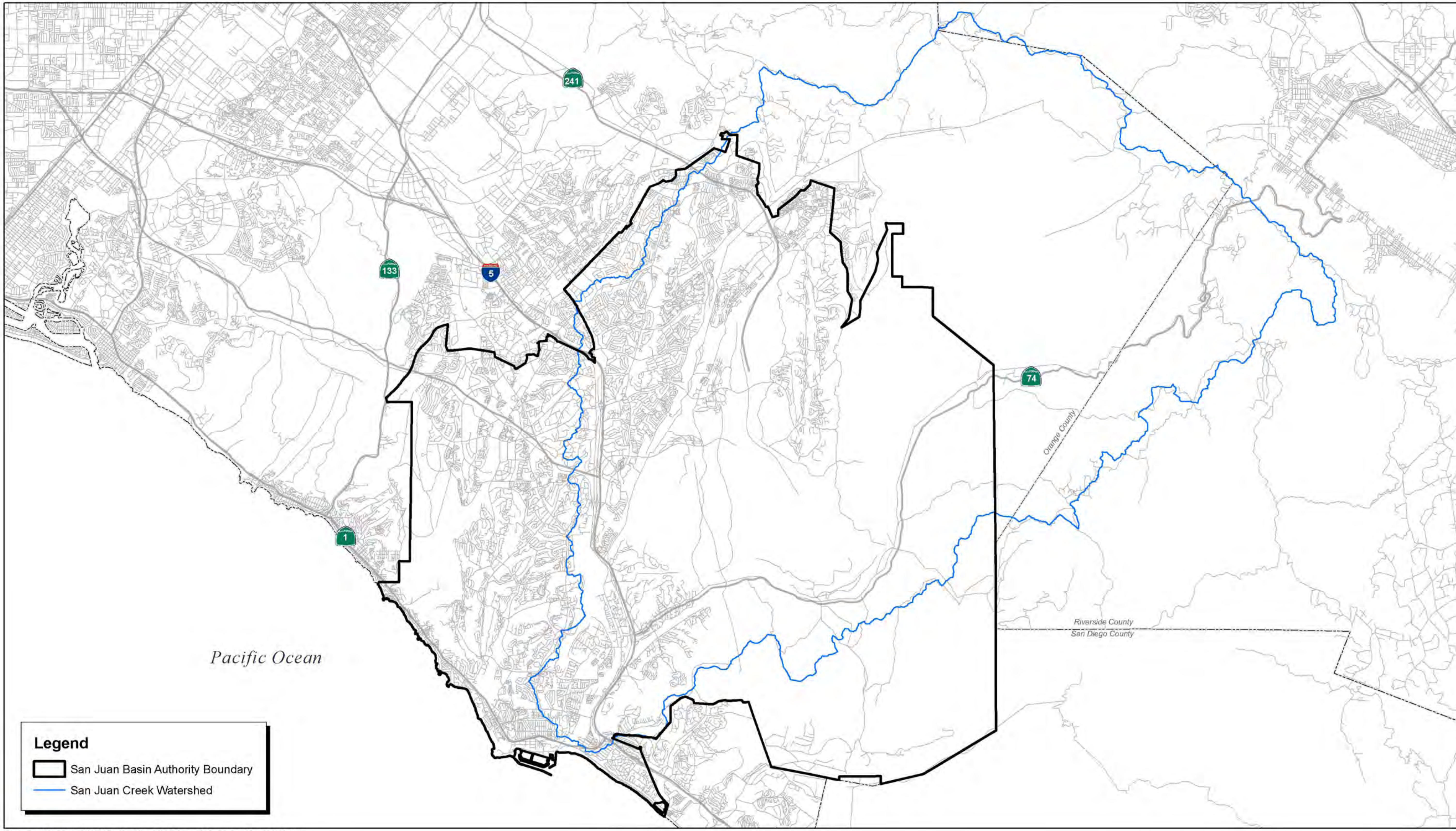
Source: Census 2000 Data, The CaSIL, MBA GIS 2011.

Michael Brandman Associates

NORTH

5 2.5 0 5 Miles

Figure 2-1
Regional Location Map



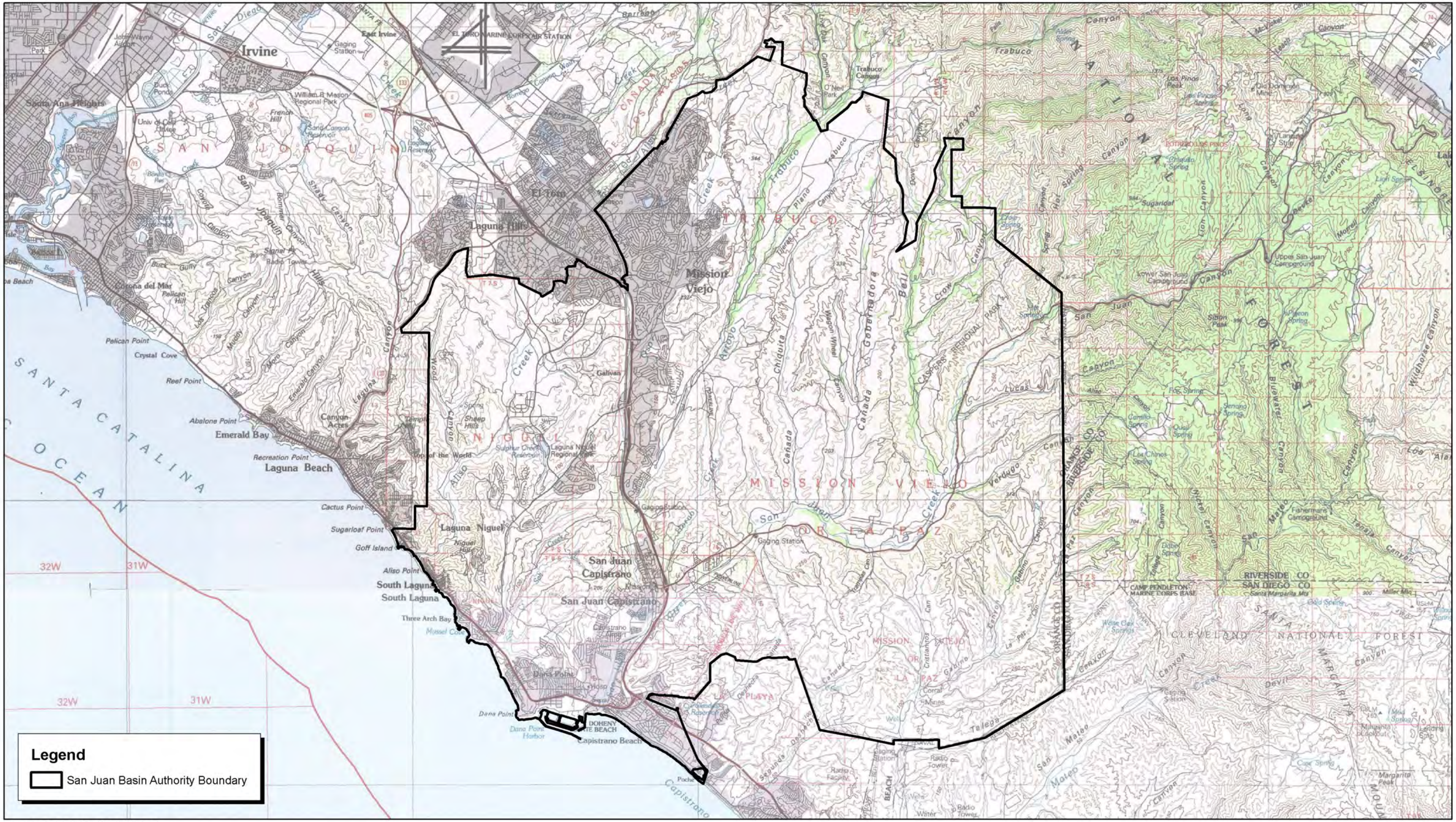
Source: Census 2000 Data, The CaSIL and Orange County Data.

Michael Brandman Associates

NORTH

2.2 1.1 0 2.2 Miles

Figure 2-2
Local Vicinty Map



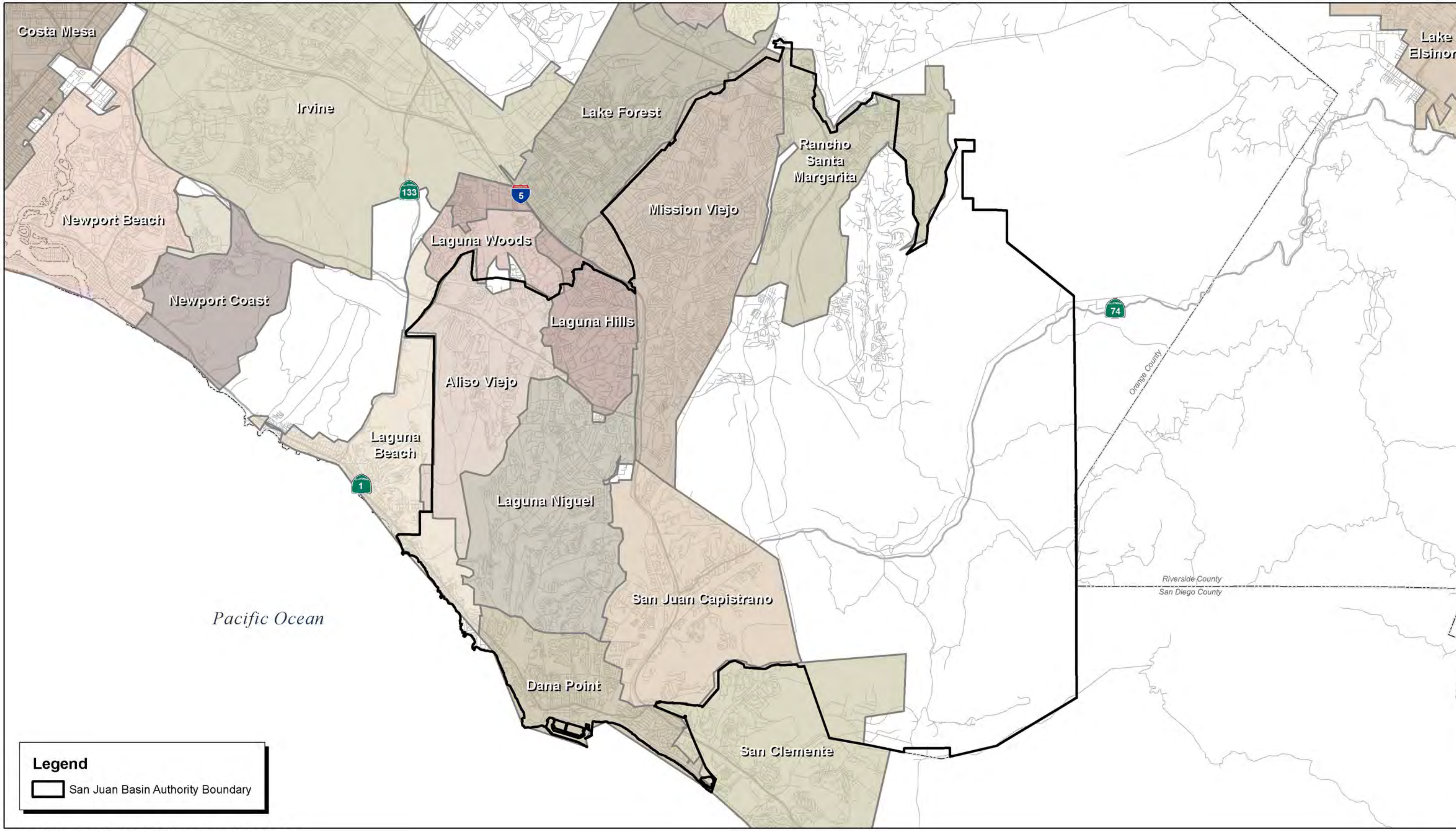
Source: TOPO! USGS 100K DRG.

Michael Brandman Associates

NORTH

2 1 0 2 Miles

Figure 2-3
Topographic Map



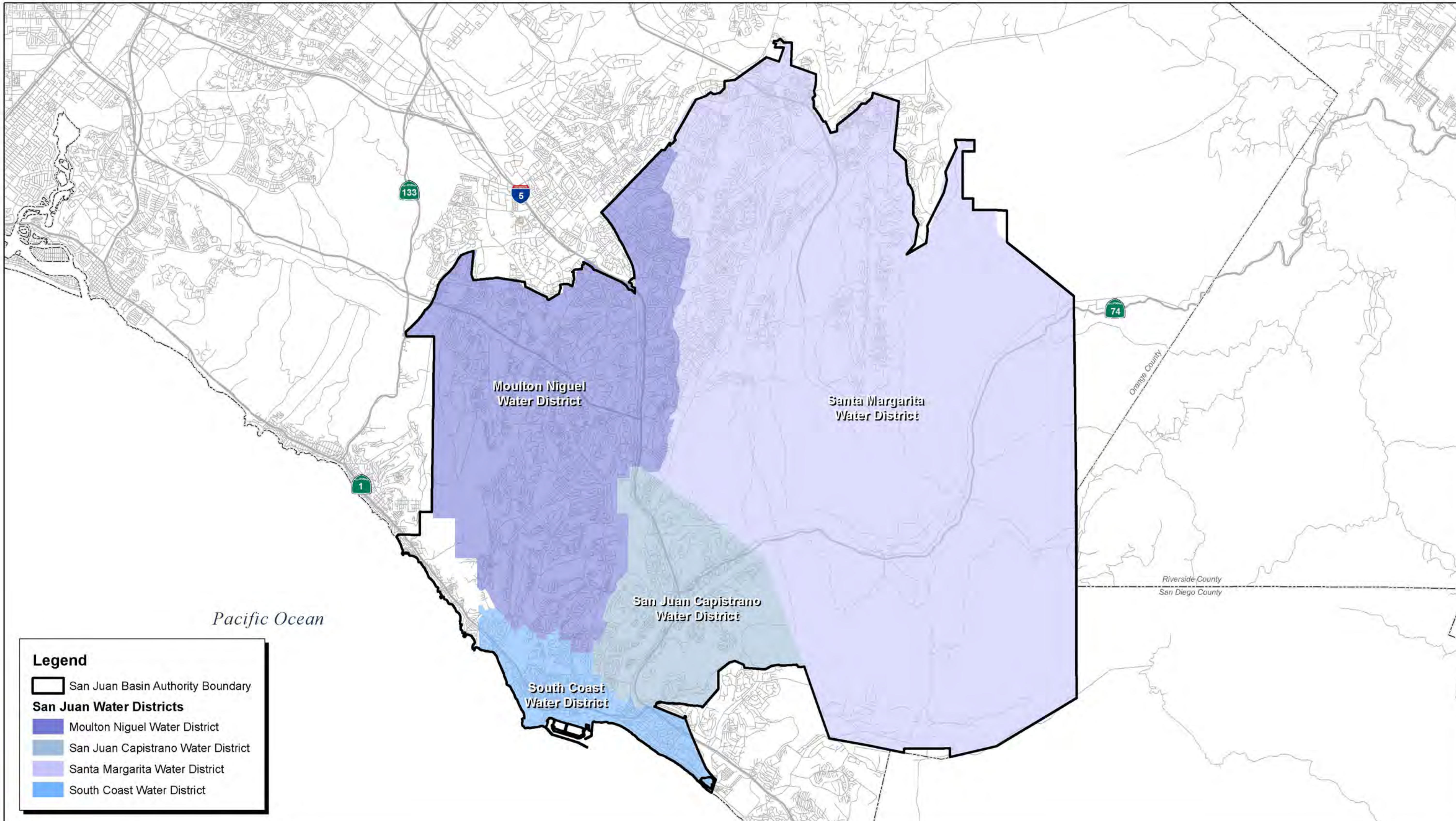
Source: Census 2000 Data, The CaSIL and Orange County Data.

Michael Brandman Associates

NORTH

2 1 0 2 Miles

Figure 2-4
City Boundaries



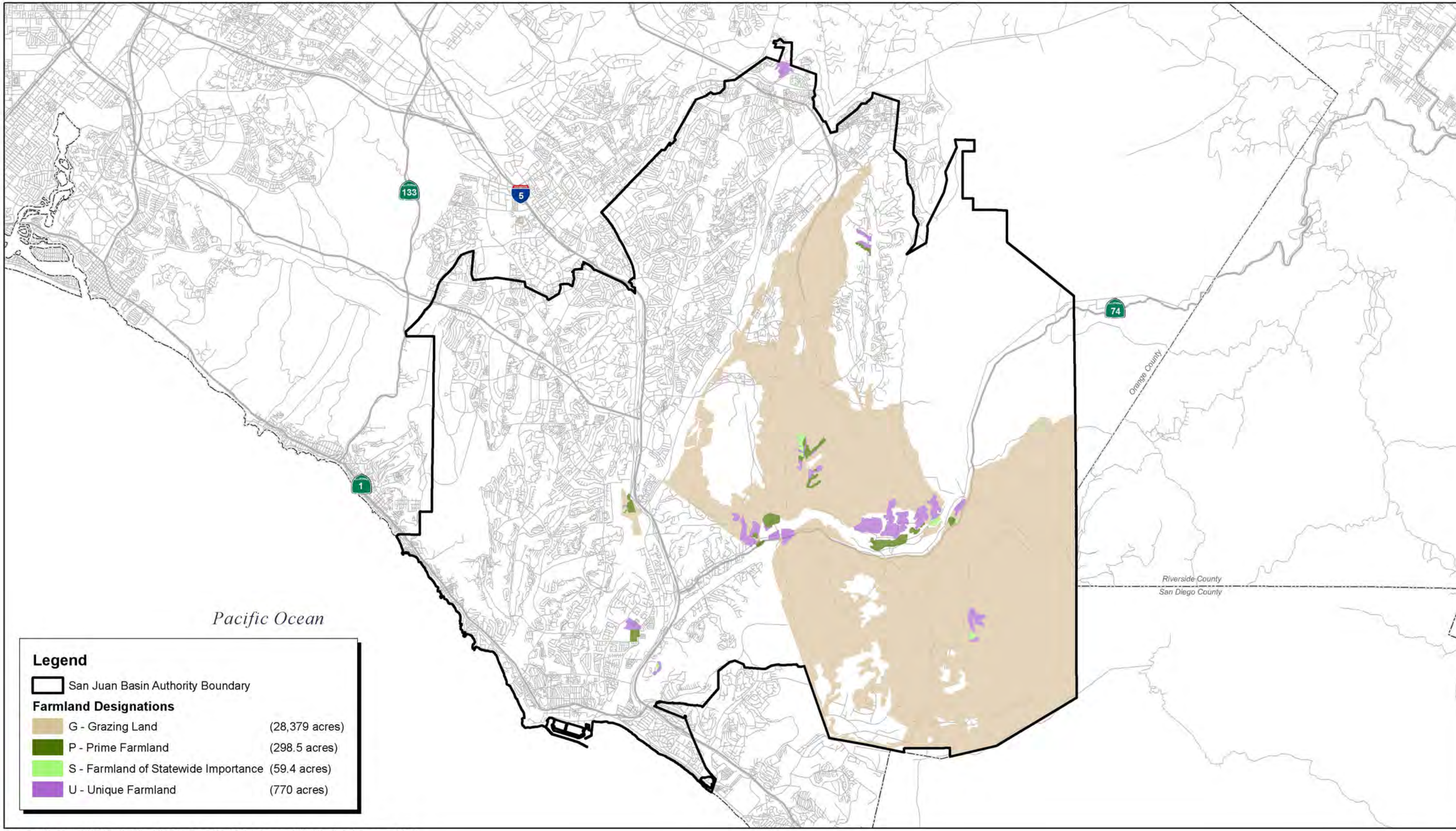
Source: Census 2000 Data, The CaSIL and Orange County Data.

Michael Brandman Associates

NORTH

2 1 0 2 Miles

Figure 2-5
San Juan Water Districts



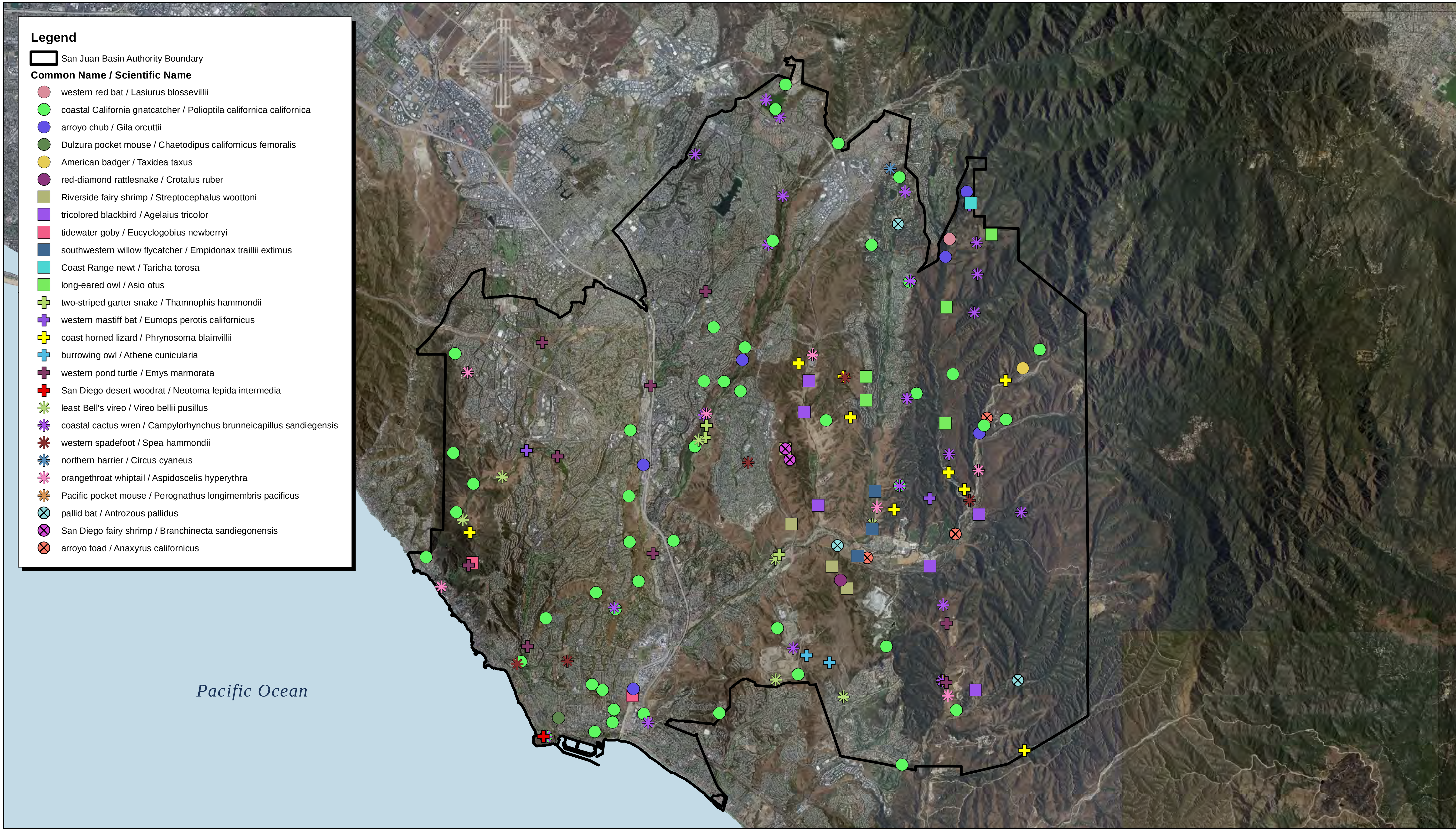
Source: Census 2000 Data, The CaSIL. Farmland Mapping and Monitoring Program, 2008.

Michael Brandman Associates

NORTH

2 1 0 2 Miles

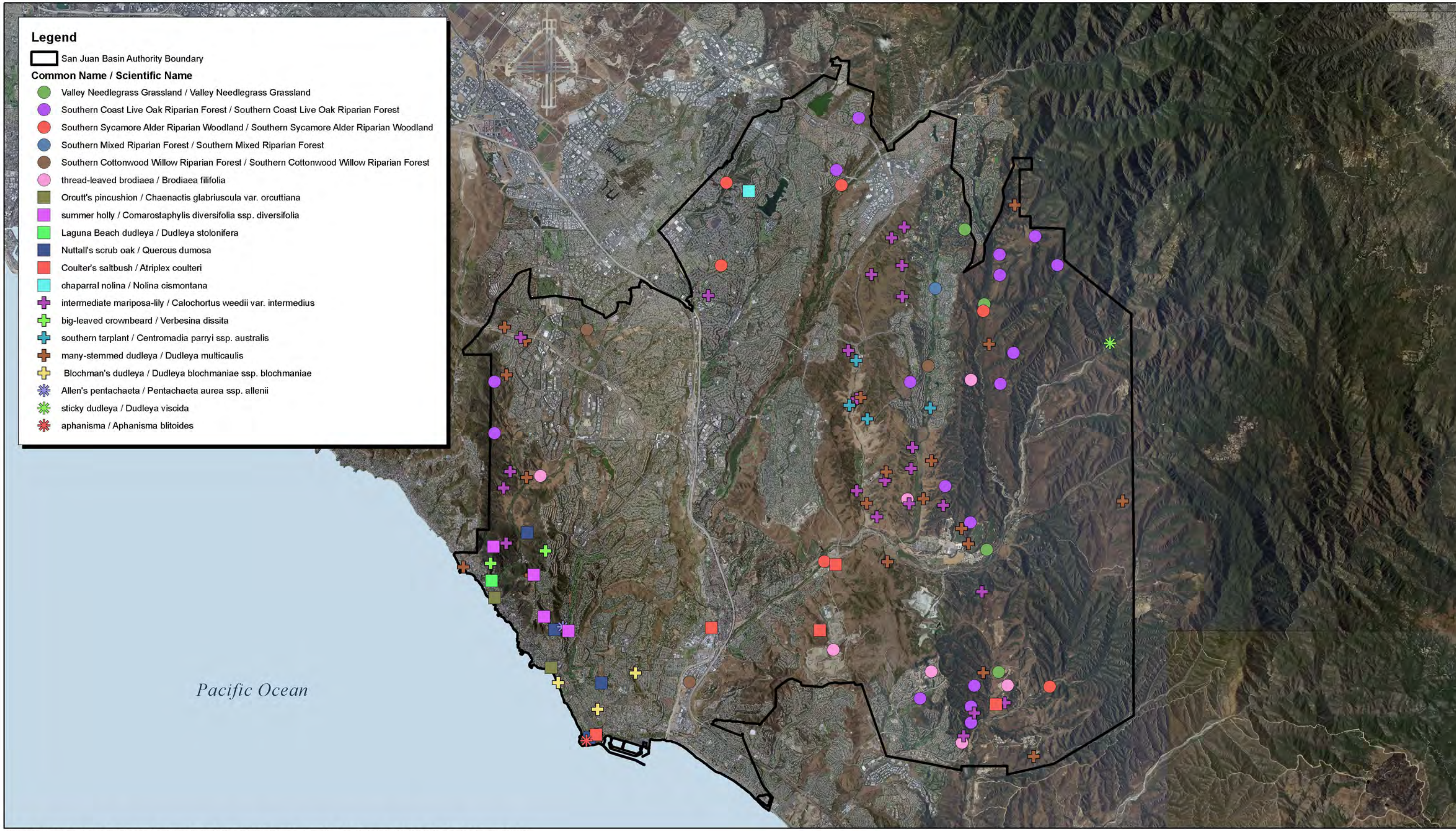
Figure 2-6
Agricultural Resources Map



Source: Orange County, Riverside County and San Diego Diego County NAIP, 2009. CNDDB Data, February 2011.

Michael Brandman Associates

Figure 2-7
CNDDB Recorded Occurrences of
Special-Status Wildlife Species within San Juan Basin Boundary



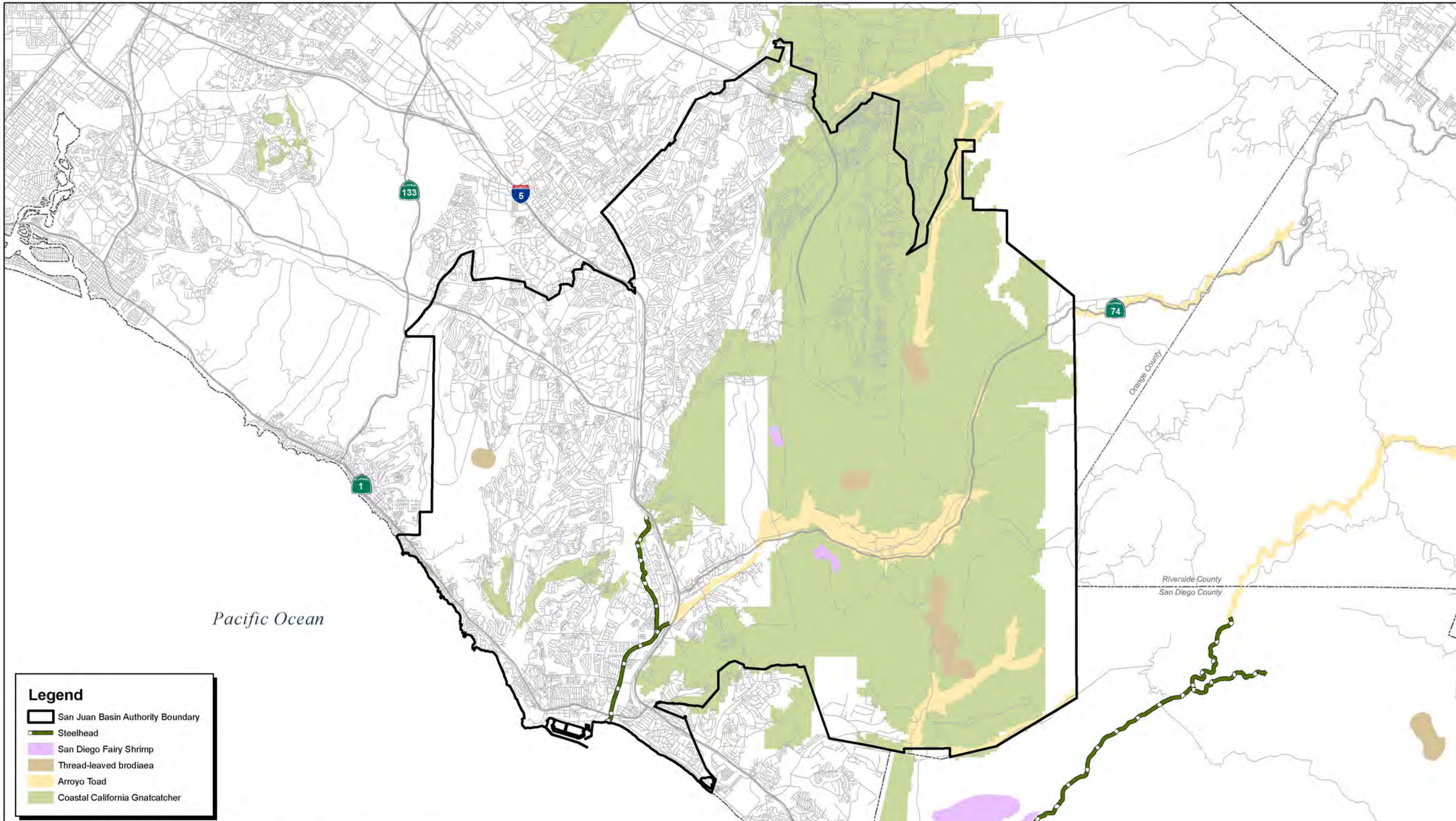
Source: Orange County, Riverside County and San Diego Diego County NAIP, 2009. CNDDB Data, February 2011.

Michael Brandman Associates

NORTH

2 1 0 2 Miles

Figure 2-8
CNDDB Recorded Occurences of
Special-Status Plant Species within the San Juan Basin Boundary



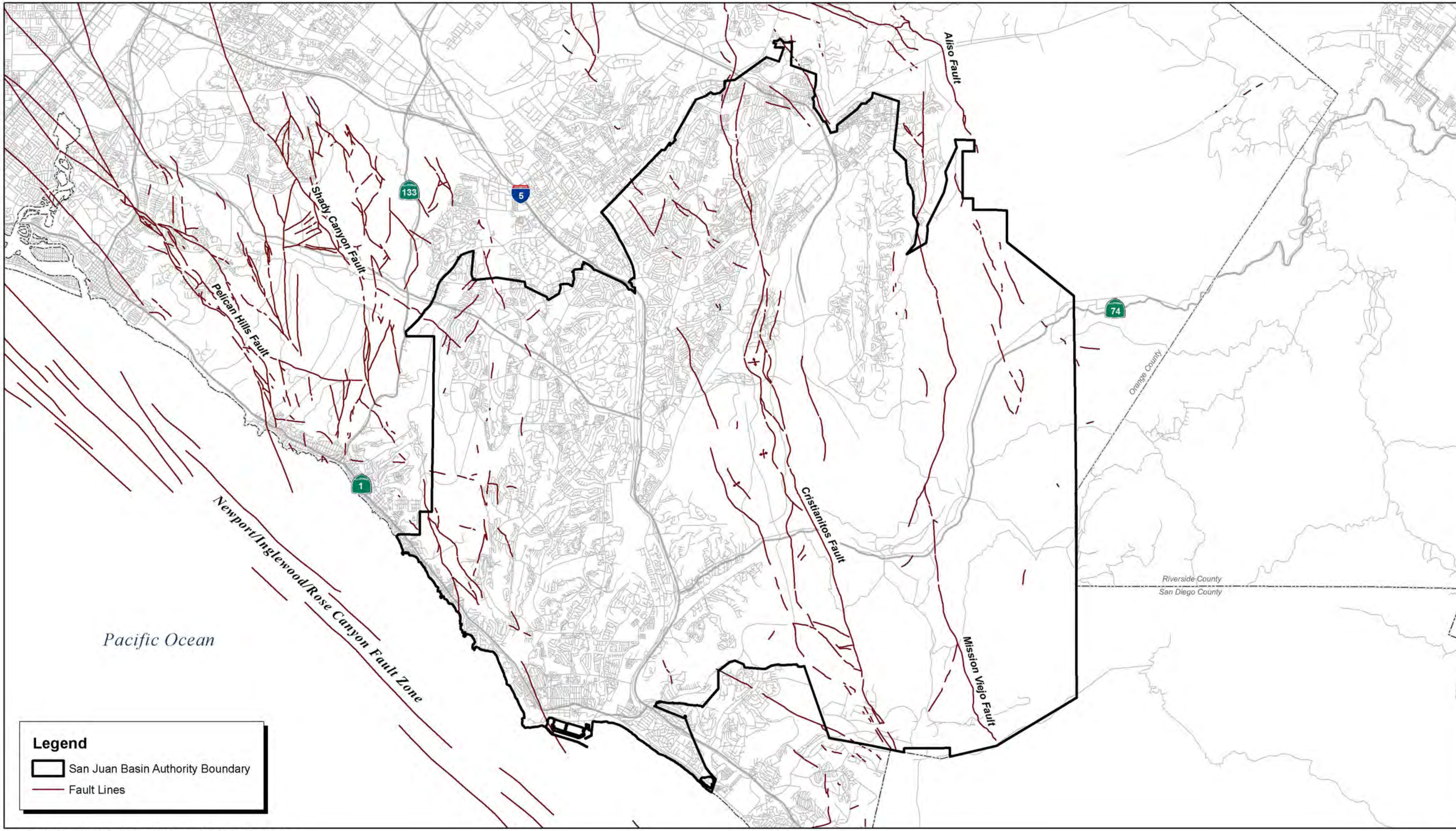
Source: Census 2000 Data, The CaSIL and Orange County Data. USFWS Critical Habitat Data.

Michael Brandman Associates

NORTH

2 1 0 2
Miles

Figure 2-9
Critical Habitat Areas



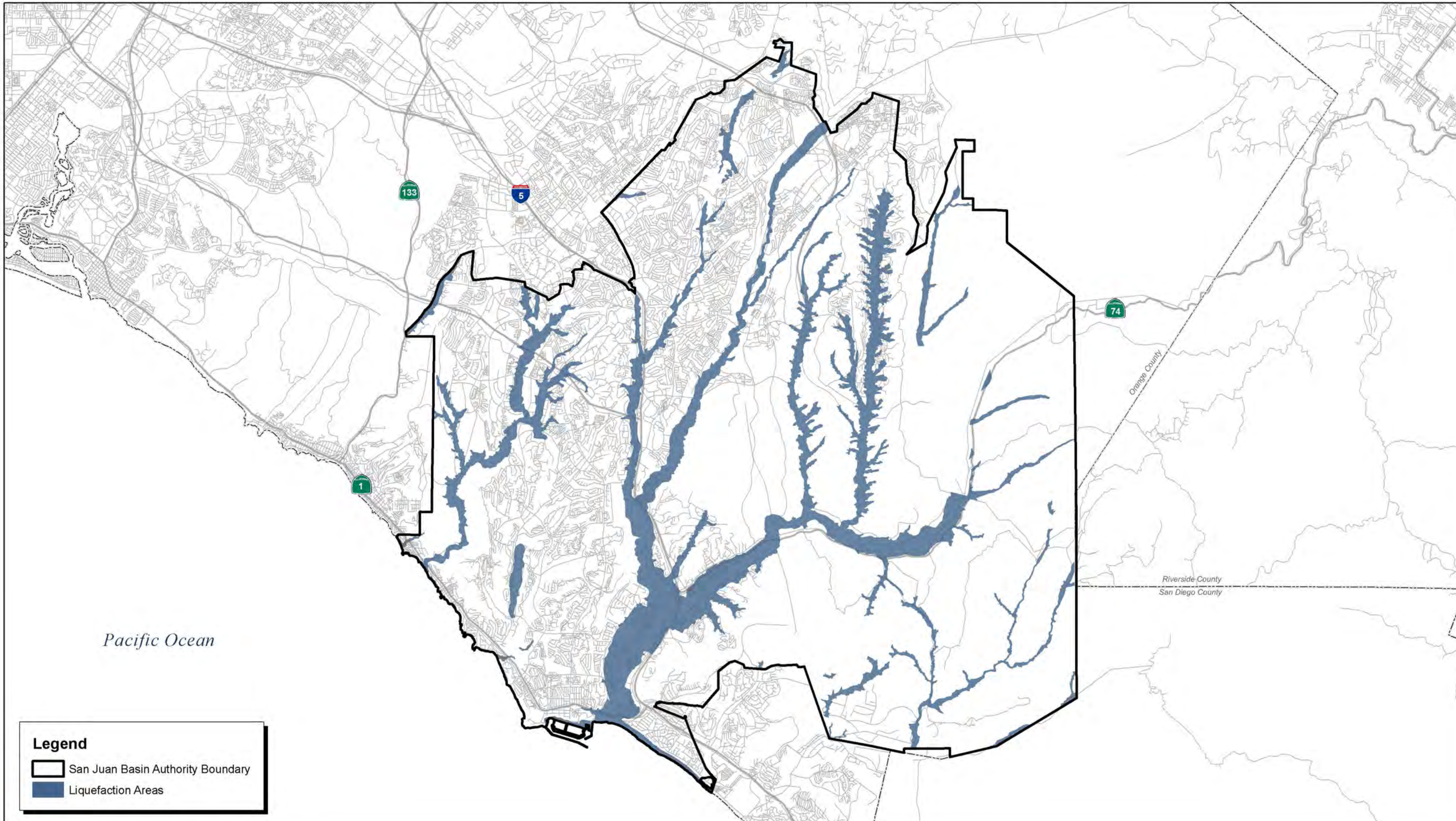
Source: Census 2000 Data, The CaSIL and Orange County Data.

Michael Brandman Associates

NORTH

2 1 0 2 Miles

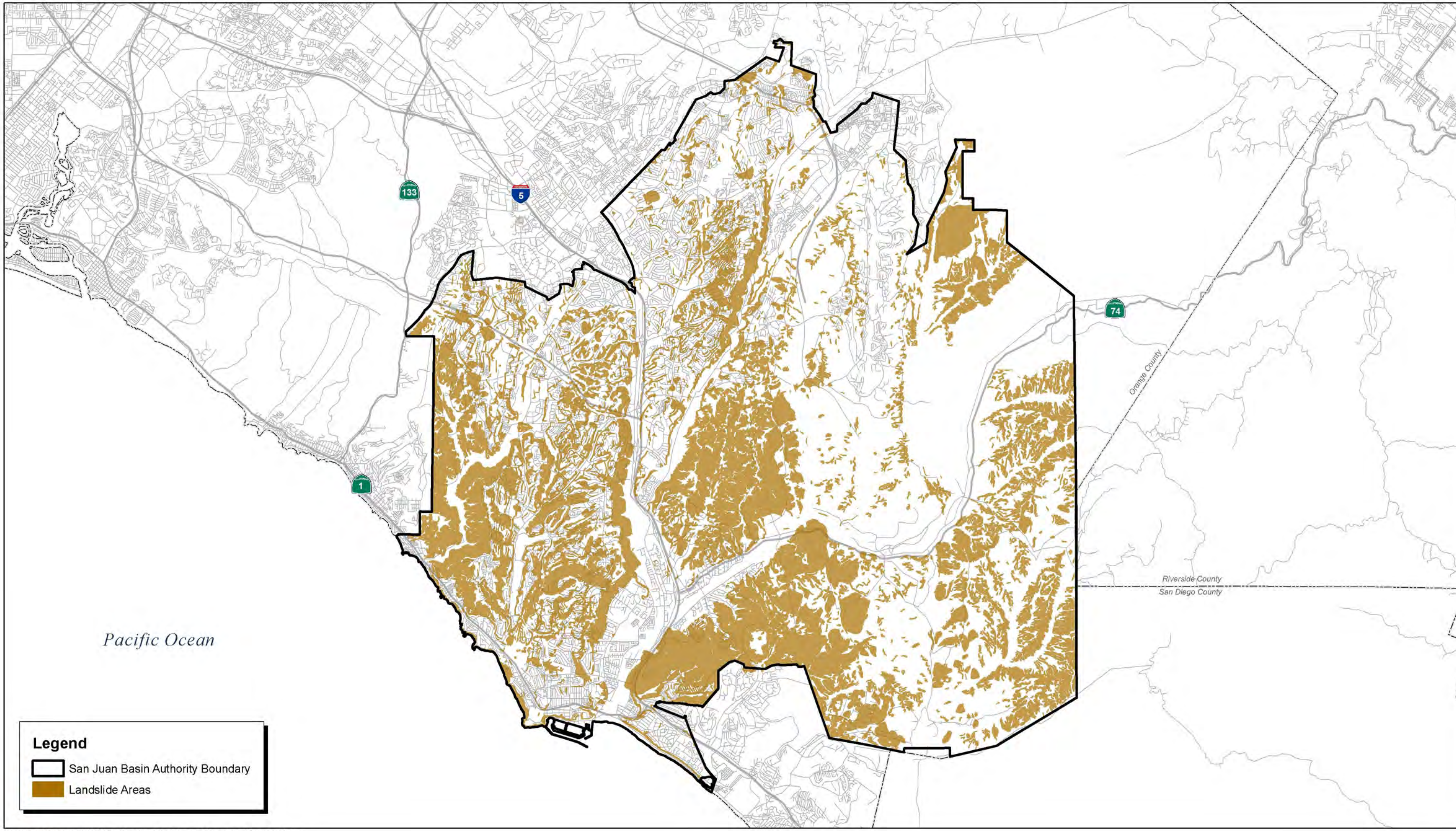
Figure 2-10
Fault Lines



Source: Census 2000 Data, The CaSIL and Orange County Data.

Michael Brandman Associates

Figure 2-11
Liquefaction Areas



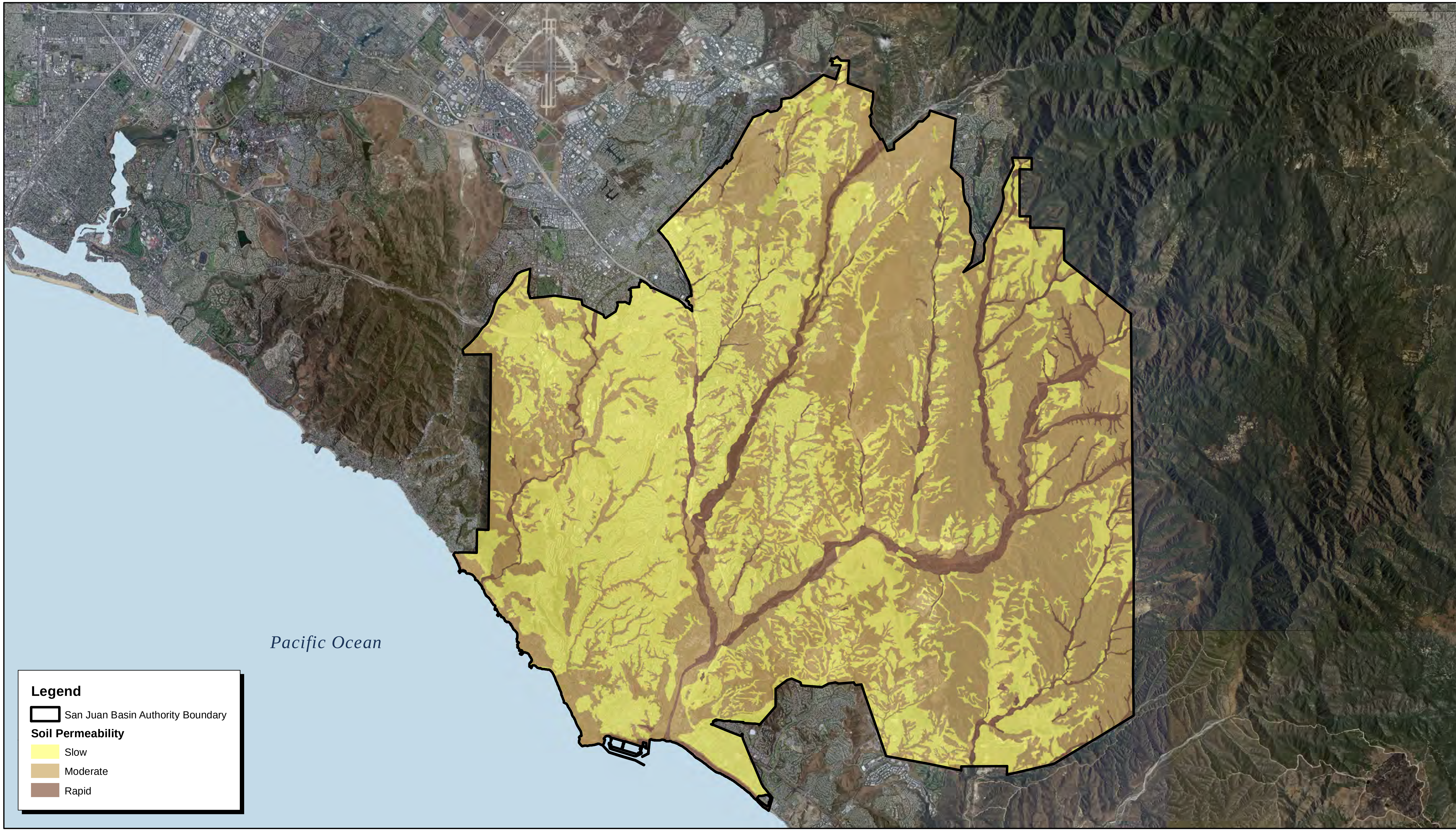
Source: Census 2000 Data, The CaSIL and Orange County Data.

Michael Brandman Associates

NORTH

2 1 0 2 Miles

Figure 2-12
Landslide Areas



Source: Orange County, Riverside County and San Diego Diego County NAIP, 2009. USDA Soils Data.

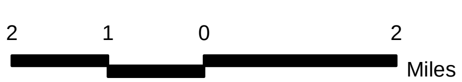
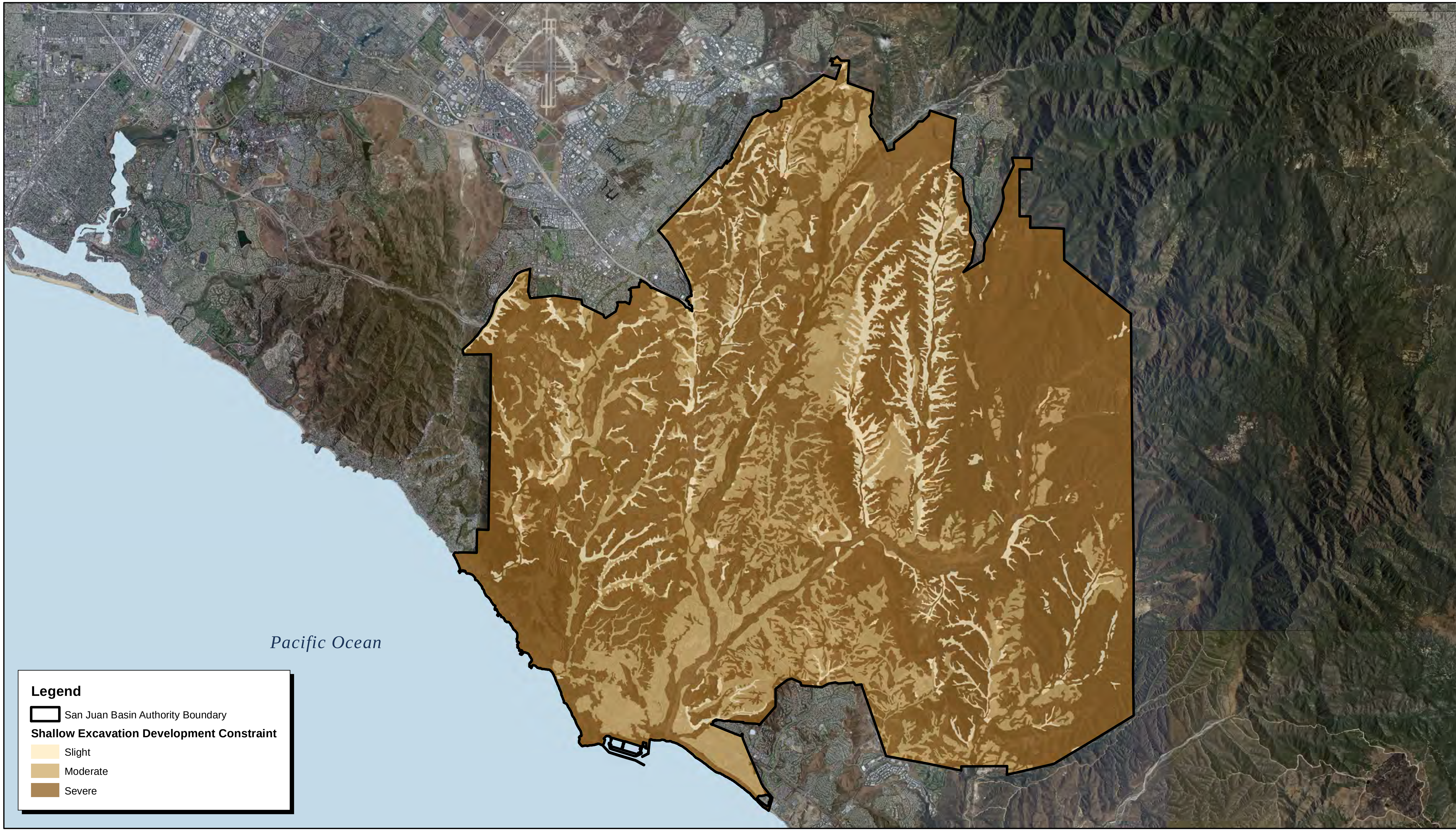
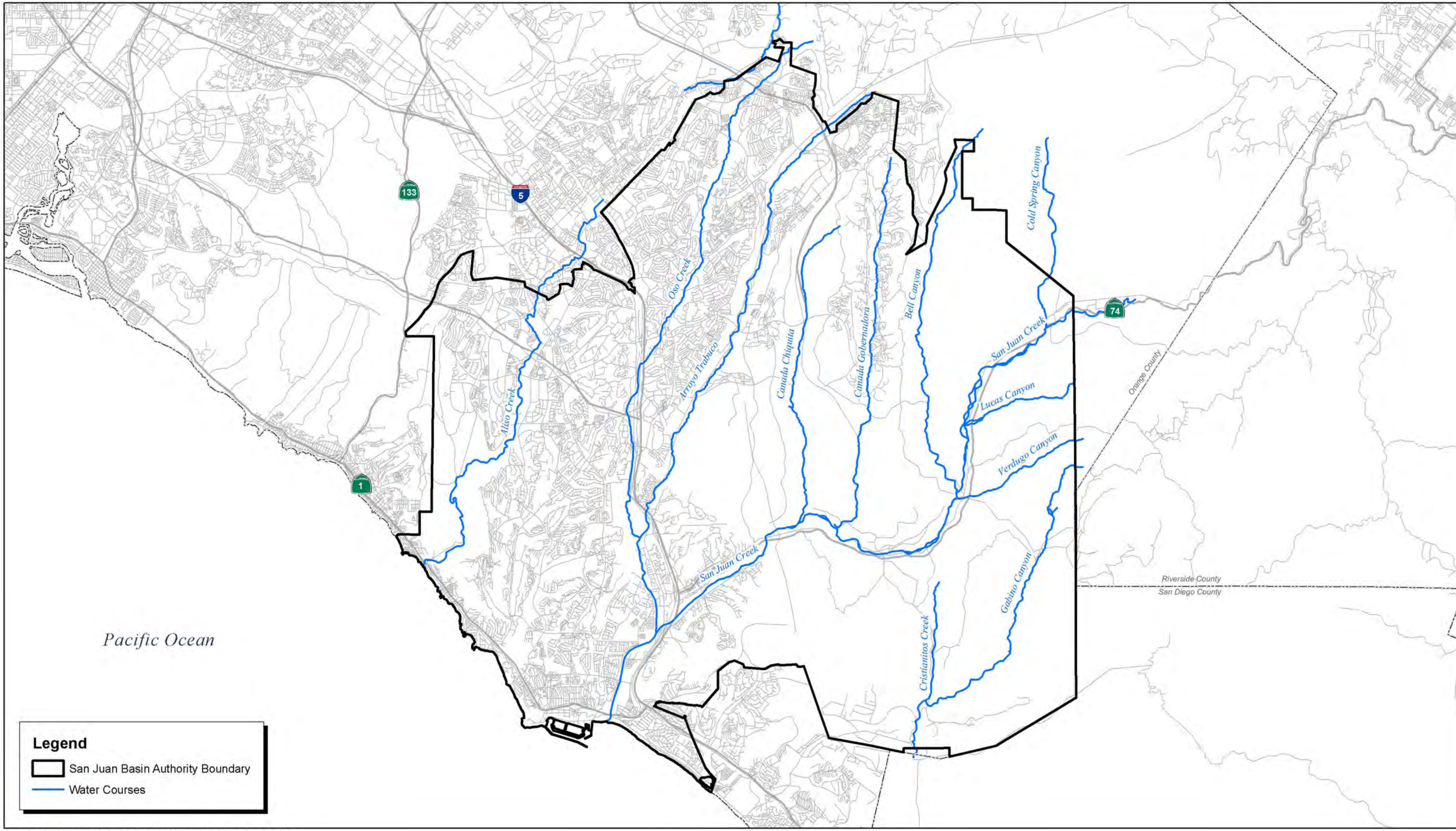


Figure 2-13
Soil Permeability



Source: Orange County, Riverside County and San Diego Diego County NAIP, 2009. USDA Soils Data.

Figure 2-14
Shallow Excavation Development Constraint



Source: Census 2000 Data, The CaSIL and Orange County Data.

Michael Brandman Associates

NORTH

2 1 0 2 Miles

Figure 2-15
Water Courses

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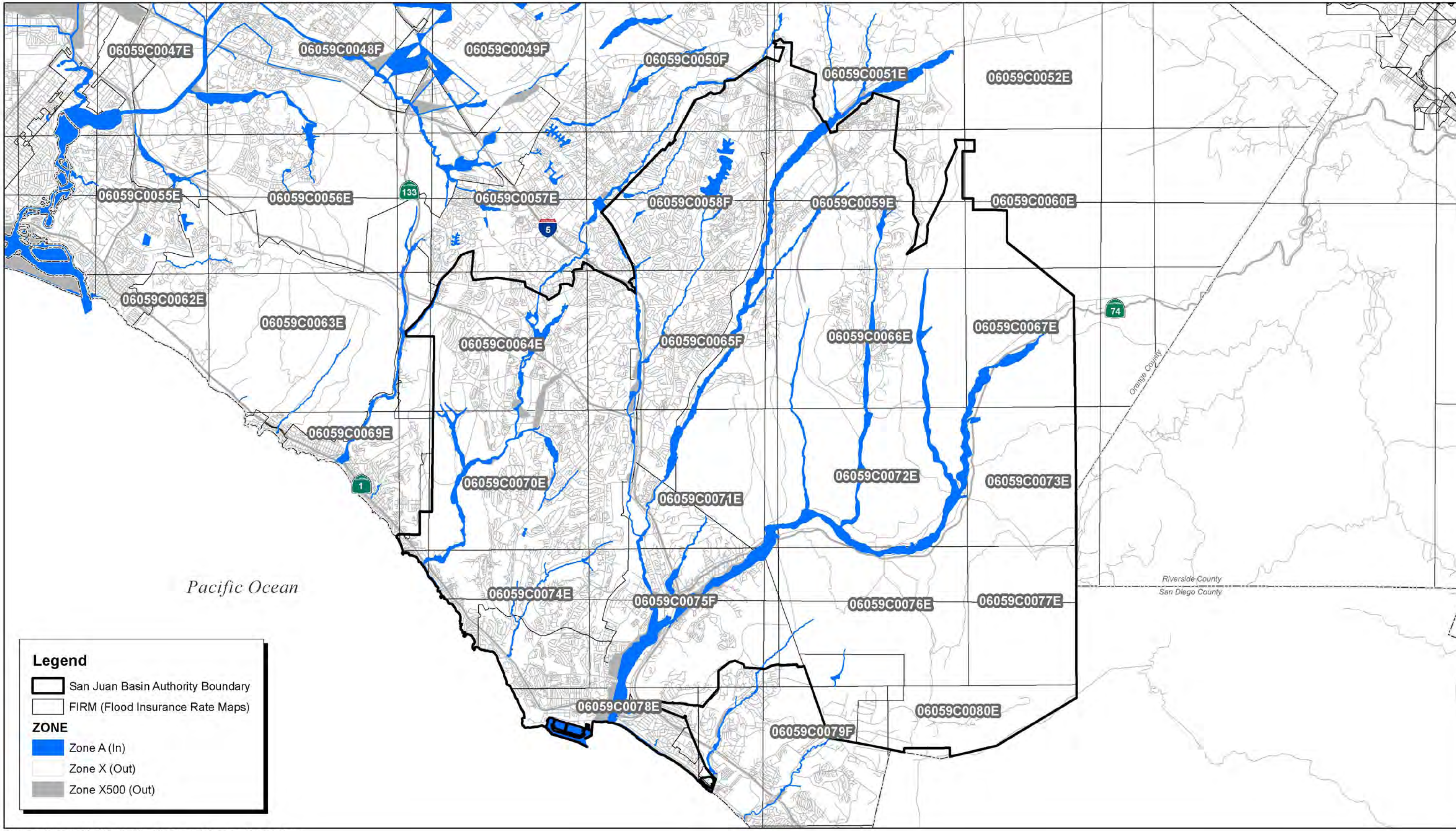


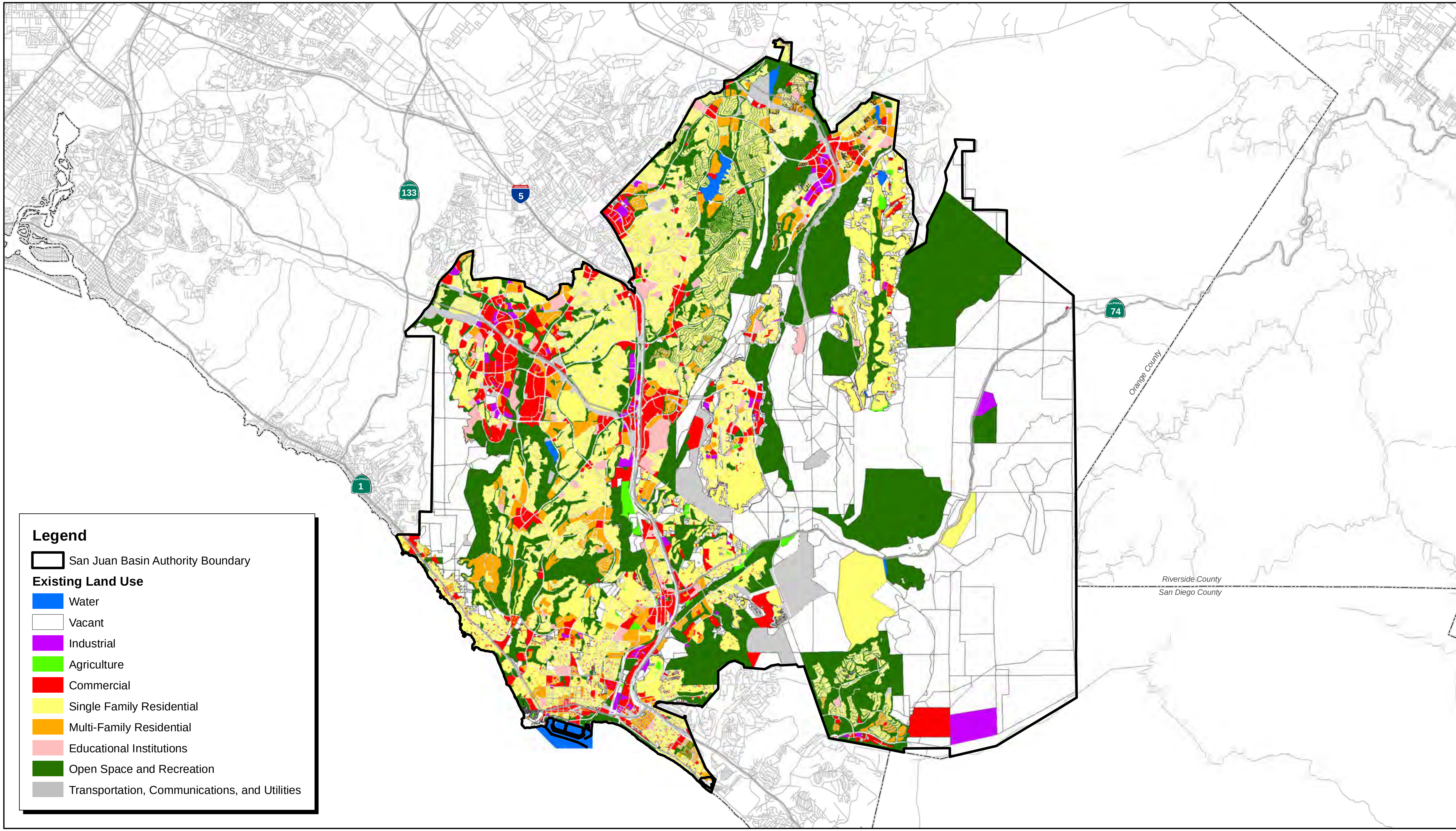
Source: Census 2000 Data, The CaSIL and Orange County Data.

Michael Brandman Associates

NORTH

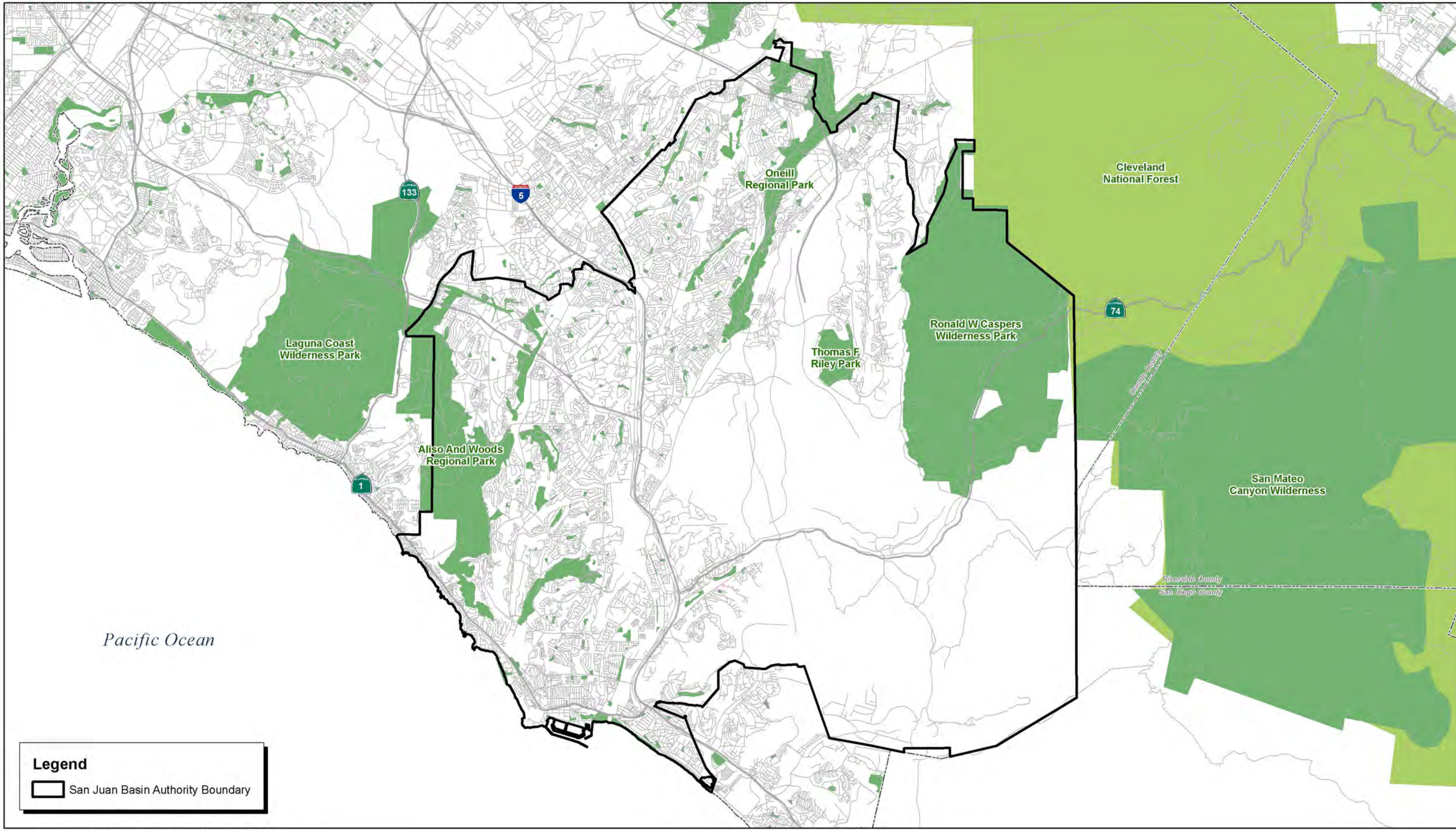
2 1 0 2
Miles

Figure 2-16
FEMA Flood Zone Map



Source: Census 2000 Data, The CaSIL and Orange County Data.

Figure 2-17
Existing Land Use



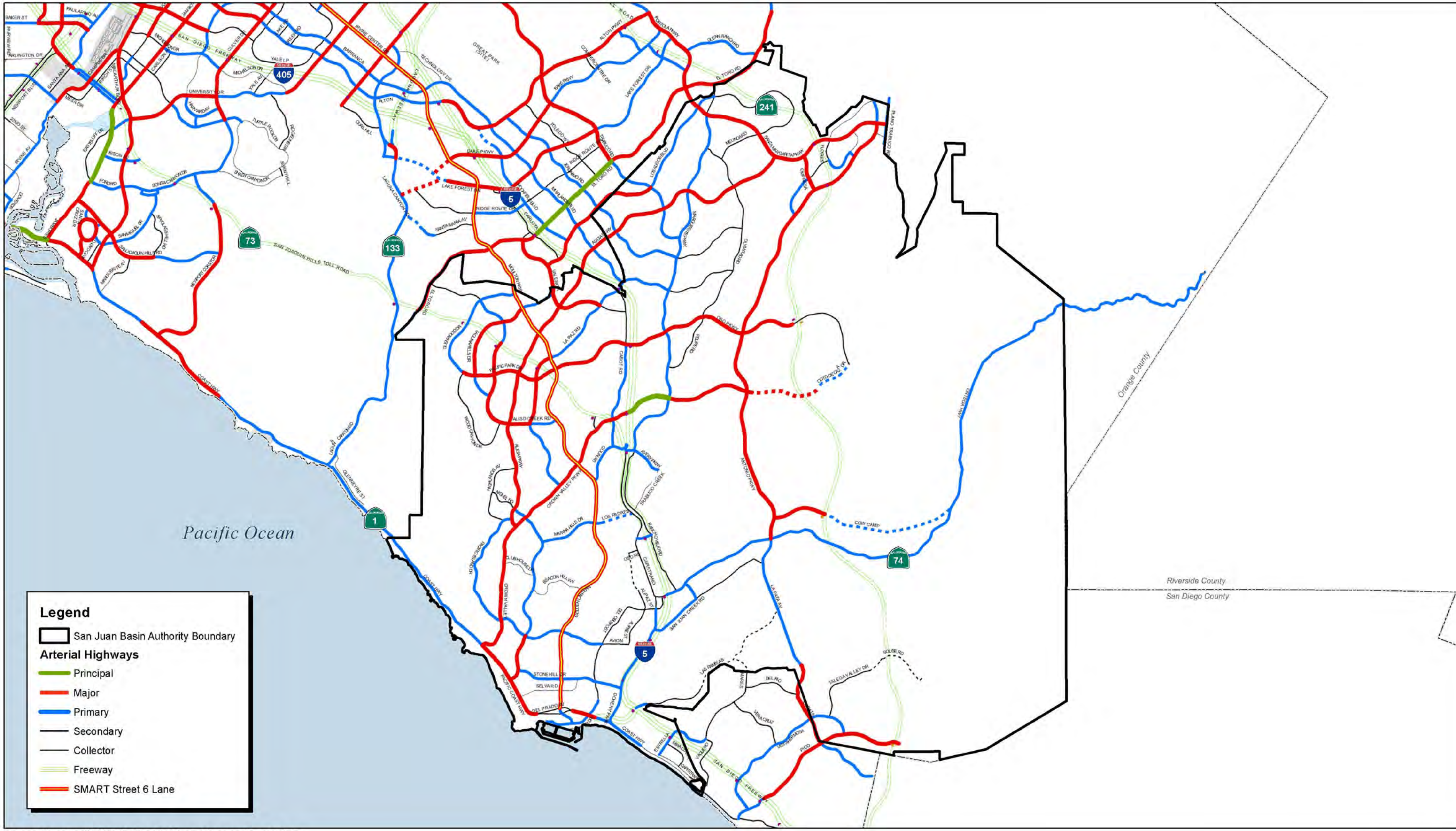
Source: Census 2000 Data, The CaSIL and Orange County Data.

Michael Brandman Associates

NORTH

2 1 0 2 Miles

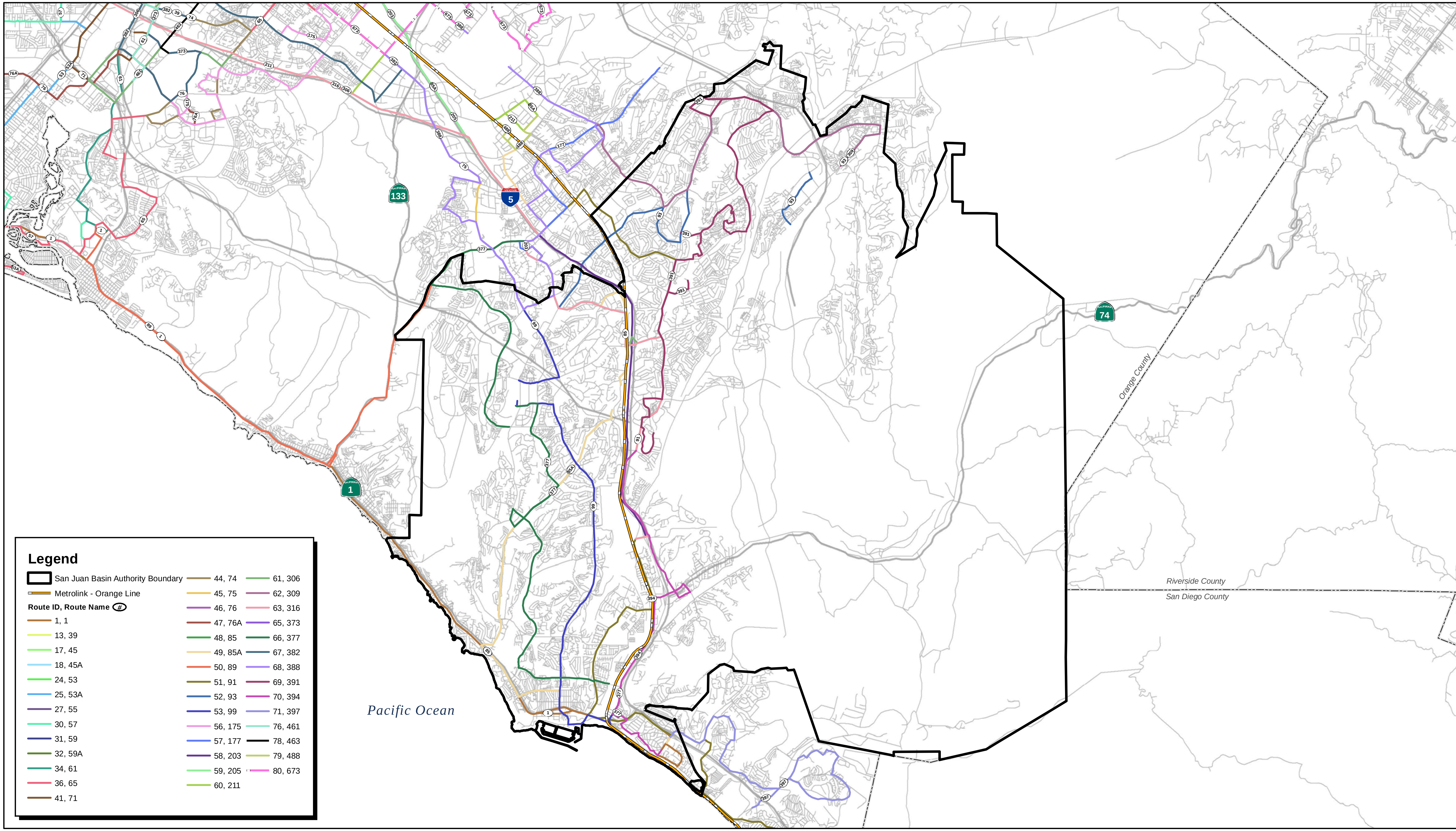
Figure 2-18
Parks and Recreation



Source: Census 2000 Data, The CaSIL and Orange County Data.

Michael Brandman Associates NORTH 2 1 0 2 Miles

Figure 2-19
Master Plan of Arterial Highways



Source: Census 2000 Data, The CaSIL and Orange County Data.

2 1 0 2
Miles

Michael Brandman Associates

Figure 2-20
Fixed Bus Routes & Rail Systems

3.1 Introduction

This section of the report describes the existing water resources in the San Juan Basin area with an emphasis on the surface and groundwater resources in the investigation area which includes the basin area bounded by the Ortega Highway on San Juan Creek, the confluence of Arroyo Trabuco and Oso Creek and the Pacific Ocean. What follows is an inventory of the surface and groundwater hydrology, geologic conditions and storage, water quality, water infrastructure and interpretation of groundwater modeling work conducted by the Municipal Water District of Orange County (MWDOC) in support of the South Orange County Ocean Desalter (SOCOD) project.

3.2 Surface Water Hydrology

This section of the report characterizes the surface water hydrology of the watershed tributary and overlying the groundwater resources of the investigation area.

3.2.1 Topographic and General Setting

The San Juan Creek watershed is located in Southern Orange County on the western flank of the Santa Ana Mountains, as shown in Figure 3-1. The headwaters originate in the Cleveland National Forest near the Orange/Riverside County border at an elevation of approximately 3,300 feet above sea level and flow about 29 miles south-southwest to the Pacific Ocean at Doheny State Beach in Dana Point. The total watershed drainage area covers approximately 175 square miles and consists of two major tributaries to San Juan Creek, known as the Arroyo Trabuco and Oso Creek. The upper third of the watershed is extremely rugged with steep slopes and deep cutting narrow canyons with minor tributaries from these areas flowing out from sharp canyons. The center third is dominated by rolling hills, and the downstream third is a highly developed floodplain. As the streams come out of the canyon mouth, they widen out into several alluvial floodplains (Pace 2008). These floodplains comprise the alluvial sediments from which groundwater is extracted. Land rises from sea level the where San Juan Creek discharges to the Pacific Ocean to 5,687 ft at the peak of Santiago Mountain. There are three principal streams that drain the watershed: Oso Creek, the Arroyo Trabuco and San Juan Creek. There are numerous other small streams that feed into the principal streams. Figure 3-2 shows the locations of the principal streams and some other tributaries in the lower part of the San Juan Basin where these streams traverse the underlying groundwater resources of interest in the groundwater management plan.

About 30 percent of the watershed is incorporated into 10 cities and unincorporated area. The larger cities and communities in the watershed include the Cities of Laguna Niguel, Laguna Hills, Mission Viejo, Rancho Santa Margarita, and San Juan Capistrano; and the unincorporated areas of Coto de Gaza, Dove Canyon and Trabuco Canyon.

The area has experienced continuous urban development since the 1970s. Some of this growth has been documented by SCAG in their periodic compilations of land use data. Since 1990, SCAG has developed GIS coverages of land use in its service area based on a four-level Anderson landuse coding system to characterize landuse. The latest land use coverage available from SCAG is from 2008. Residential landuse of all types has increased from about 9,400 acres in 1990 to about 13,500 acres in 2008, an increase of about 46 percent in 18 years; and relative to the watershed itself, the residential landuse has increased from about 8 percent of the watershed in 1990 to about 11 percent in 2008. Other urban land uses have also grown over time including institutional, commercial and industrial uses. Urban development significantly modifies the land surface and the hydrologic process in the watershed.

3.2.2 Precipitation

Table 3-1 lists major precipitation gauges in and around San Juan Basin. There are six active gauges with long history of records in or adjacent to the San Juan Creek Watershed the locations of which are shown in Figure 3-1. The annual average precipitation is about 12 to 13 inches per year at the coast (Laguna Beach, station number 100, period of record 1929 through 2010; Palisades Reservoir San Clemente, station number 186 period of record 1965 through 2010) and increases going inland with increasing elevation, to about 33 inches at Santiago Peak (Santiago Peak, station number 208, period of record 1949 through 2010).

Figure 3-3 shows the annual precipitation time history recorded at the Laguna Beach station for the period 1929 to 2010. The Laguna Beach station has the longest active precipitation history in the investigation area. Also shown in Figure 3-3 is the cumulative departure from mean (CDFM) precipitation. When the slope of the CDFM curve trends downward from left to right, the annual precipitation is less than the average precipitation: if the slope continues downward for more than one year then the CDFM is indicating a dry period. When the slope of the CDFM curve trends upward from left to right, the annual precipitation is greater than the average precipitation: if the slope continues upward for more than one year then the CDFM is indicating a wet period. The CDFM curve in Figure 3-3 suggests that the area experienced

- A long dry period from 1946 to 1977 that was punctuated with two very wet years in 1958 and 1969,
- a wet period from 1978 through 1983,
- a dry period from 1984 through 1992,
- a wet period from 1993 through 1998,
- a dry period from 1999 through 2010 punctuated with a very wet year in 2005

Figure 3-4 illustrates the monthly variation of precipitation at the Laguna Beach station, including the maximum, minimum , and median precipitation for the each month, and the 25th and 75th percentiles. Most of the precipitation occurs in the November through April period. The months of October through March have the greatest extremes as characterized by the maximum monthly precipitation relative to its median precipitation.

3.2.2.1 Doppler Radar Precipitation Estimates

As is evident in Figure 3-1, there are too few precipitation stations in the San Juan Creek watershed to accurately estimate areal variation in precipitation in the watershed. This situation has improved recently with newer spatially resolved datasets. In late 2001, the National Centers for Environmental Predictions (NCEP) began generating "Stage IV" radar-based precipitation estimates. These data are compiled from regional multi-sensor data (Stage III) produced by the 12 Regional Forecast Centers that cover the contiguous United States. In January 2002, archived spatial-temporal, high-resolution gridded precipitation estimates (Stage IV) became available for download from the National Center for Atmospheric Research (http://data.eol.ucar.edu/codiac/dss/id=21.093). Daily Radar Mean Areal Precipitation (RMAP) data for the San Juan watershed were downloaded and processed to obtain daily average precipitation estimates over the San Juan Creek watershed on approximately 2.5 by 2.5-mile grid. These daily precipitation estimates were aggregated to estimate annual precipitation for each year for the 2001 through 2009 period.

Figures 3-5 and 3-6 show radar-generated precipitation for 2007 (July 1, 2006 through June 30, 2007, a dry year) and 2005 (July 1, 2004 through June 30, 2005, a wet year), respectively. These maps show the spatial distribution of precipitation over the watershed and the annual total precipitation for precipitation stations in and around the watershed. This type of characterization is not possible with the data from the precipitation stations alone. The amount of precipitation falling in the watershed increases from the southwest on the coast to the northeast going inland following a classic orographic precipitation pattern – precipitation increases with altitude as moisture laden air from the sea flows up and over the Santa Ana Mountains. This effect can be observed in both the precipitation stations and the gridded precipitation estimates.

The difference between the annual precipitation estimates at the precipitation gauges and the annual value for each corresponding grid cell suggests there is significant spatial variability in the vicinity of the gauges. For example, the annual precipitation measured at the Santiago Peak station is substantially different than the precipitation estimate in the corresponding grid cell. In 2007 (Figure 3-5), the grid estimate is 2.69 inches and the station estimate is 8.04 inches. This suggests that the gauge estimate is not a good indicator of precipitation in the area of gauge and that highly localized intense precipitation occurs at the gauge due to its elevation and exposure. This same anomaly is observed for 2005, as shown in Figure 3-6. Another interesting observation is that during dry years the Doppler radar precipitation estimates suggest that the variability of precipitation across the watershed is substantially less than the variability in a wet year. For example, precipitation over the watershed in 2007 ranged from about1.9 inches near the coast to about 3.0 inches inland, an increase of about 2.1 inches, or 58 percent, relative to precipitation at the coast. In contrast, precipitation over the watershed in 2005, a wet year, ranged from about 23.1 inches near the coast to about 43.0 inches inland, an increase of about 19.9 inches, or 86 percent, relative to the precipitation at the coast. The implication of the areal variability of precipitation shown in Figures 3-5 and 3-6 are that the spatial variability increases with increasing precipitation, and that the use of an average value or a constant areal precipitation pattern computed from observed gauge estimates will likely not yield accurate estimates of watershed precipitation and runoff.

3.2.2.2 Climate Change

The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 by two United Nations Organizations, the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) to assess "the scientific, technical and socioeconomic information relevant for the understanding of the risk of human-induced climate change." IPCC produced a series of assessment reports on climate change in 1990 1995, 2001 and 2007. In 1992, the IPCC released its initial carbon dioxide emissions scenarios to be used for driving global circulation models (GCM's) to develop climate change scenarios, so-called IS92 scenarios. The IPCC revised the emissions scenarios in 1996 for its third assessment report. The emissions scenarios are based on four different narrative storylines, A1, A2, B1, and B2 that describe consistently the relationships between emission driving forces and their evolution and add context for the scenario quantification. Each storyline represents different demographic, social, economic, technological and environmental developments. For each storyline, several scenarios were developed using various modeling approaches to examine the range of outcomes that arise from the various models that use similar assumptions about driving forces. This resulted in a total of 40 special report emissions scenarios (SRES). After evaluating all SRES, the IPCC picked six scenarios to consider further: A1F1, A1T, A1B, A2, B1, and B2. A detailed discussion can be found in the third assessment report (IPCC, 2001) or in the summary report (IPCC, 2000).

3.2.2.2.1 Climate Change Approach Adopted by the California Department of Water Resources

The California Department of Water Resources (DWR) has incorporated climate change into its planning process[4]. DWR evaluated possible future impacts on California's water supply, and specifically the SWP, using its CalSIM II model and the results of climate changes models. DWR constructed four planning alternatives that were based on two IPCC greenhouse gas emission scenarios, A2 and B1, and two GCM's, the Geophysical Fluid Dynamic Lab Model (GFDL) and the Parallel Climate Model (PCM). These four planning alternatives were used in the 2007 State Water Project Delivery Reliability Report (DWR, 2008). This work was updated and reported in the 2009 State Water Project Delivery Reliability Report (DWR, 2009). In this update the DWR used its CALSIM II to evaluate the SWP delivery reliability with the precipitation, temperature estimates from the MPI-ECHAM5 for the A2 greenhouse gas emissions scenarios.

3.2.2.2.2 Projected Climate Change for the San Juan Basin

In order to conduct water resources impact analyses for climate change scenarios, the coarse spatial representation of global climate model data must be refined in a process called downscaling. Such data can be obtained from the World Climate Research Programme's (WCRP's) Coupled Model Intercomparison Project Phase 3 (CMIP3) multi-model dataset (Maurer et al, 2007)[5]. This data archive consists of bias-corrected and spatially downscaled climate projections derived from CMIP3 data. The data is available for 1/8th degree latitude/longitude resolution.

Figure 3-7 shows monthly average temperature predicted for the MPI-ECHAM5 A2 scenario for the 1950 through 2100 period. The 1950 through 2000 period was used to calibrate the models and the 2000 through 2100 period are model projections for the A2 scenario. The best-fit linear regression lines are also plotted in Figure 3-7 to emphasize the trend. In this

[4] This discussion is based on the 2009 SWP Delivery Reliability Report
http://www.water.ca.gov/news/.../2010/01262010reliabilitysummary.pdf

[5] http://gdo-dcp.ucllnl.org /downscaled_cmip3_projections/

scenario, the average temperature will rise about 3oC, or about 5oF, in winter months, and about 5oC, or about 9oF, in summer months, over the 150-year period. The significance of the historical and projected temperature increases is the corresponding increase in the evapotranspiration of vegetation.

Figure 3-8 shows the annual precipitation estimated under MPI-ECHAM5 A2 scenario for the 1950 through 2100 period. The chart shows the 50-year average precipitation for three sequential 50-year periods, 1950-1999, 2000-2049, and 2050-2099, and the 75-year average precipitation for two sequential 75-year periods, 1950-2024 and 2025-2988. The table below compares the basic statistics of the annual precipitation estimates for these periods.

Annual Precipitation Estimates

Period	Average	Standard Deviation	Coefficient of Variation	Minimum	Maximum
50-Year Interval					
1950-1999	13.66	4.67	34%	6.12	22.20
2000-2049	12.69	4.63	36%	4.95	24.92
2050-2099	13.72	6.14	45%	2.96	30.99
75-Year Interval					
1950-2024	13.13	4.57	35%	4.95	24.03
2025-2099	13.58	5.74	42%	2.96	30.99

Figure 3-8 and the above table suggests that the future will have: wetter wet years (a higher period maximum precipitation value), drier dry years (a lower period minimum precipitation value) and greater variability (greater standard deviations and coefficients of variation for the period). Interestingly, the mean precipitation is not significantly different among the periods. The projected increase in variability means that more storage for surface and groundwater than is currently used will be required to achieve the same native water supply utilized in the past.

Figure 3-9 shows the projected annual precipitation projection from the GCM for the area that includes the Laguna Beach precipitation station and the CDFM for that projection. Comparison of the annual measured precipitation at the Laguna Beach precipitation station and its associated CDFM shown in Figure 3-3 to the projection in Figure 3-9 for the overlapping record indicates that the GCM projection does not match the measured data very well (the wet periods and dry periods do not correlate well). The implication of this finding is that the reliability of the GCM precipitation projections for the San Juan Creek watershed is unknown.

3.2.3 Surface Water Hydrology

The USGS maintains several stream gauging stations that can be used to characterize the surface water hydrology in the San Juan Basin, the locations of which are shown in Figure 3-2. Table 3-2 lists these stations, their location and period of record. The most important gauging station is located on San Juan Creek at the Ortega Highway bridge crossing. The location of this gauging station has varied in the past and the record represents discharge time histories for slightly different drainage areas. The drainage area for the three gauges varies from 106 square miles to 117 square miles. Figure 3-10 shows the cumulative discharge curve (mass curve) of surface water discharge in San Juan Creek from the combined records of these three surface water discharge gaging stations for the 1928 to 2011 period. The average slope of the mass curve for the three distinct records shows the effect of the drainage area size on discharge. These slopes were used to normalize the historical record for the 11046500 and 11046550 gaging stations to be roughly equivalent to the record at the 11046530 gauging station. The result is the annual discharge record shown in Figure 3-11 and its associated CDFM annual discharge. The wet and dry periods suggested by the CDFM plot in Figure 3-11 are identical to the wet and dry periods observed for precipitation at the Laguna Beach precipitation station. That said, the variability in annual discharge is greater than the variability in precipitation.

Figure 3-12 illustrates the monthly variation of San Juan Creek discharge at the 11046530 gauging station including the maximum, minimum, and median precipitation for the each month, and the 25th and 75th percentiles. Most of the discharge occurs in the December through May period. The months of January through March have the greatest extremes as characterized by the maximum monthly discharge relative to its median discharge. This is a non-stationary time series due to urban development in watershed. The discharge record indicates that the discharge in San Juan Creek is highly variable and difficult to regulate for water development purposes without surface water storage.

3.3 Groundwater Hydrology

Four principal groundwater basins have been identified in the San Juan watershed: (1) Lower Basin, (2) Middle Basin, (3) Upper Basin, and (4) Arroyo Trabuco. These basins were first delineated by the DWR in 1972, based on water quality differences. These groundwater basins are shown in Figure 3-13. CDM (1987), NBS Lowery/PSOMAS (1994, annual reports), and others have modified the DWR delineations to suit the needs of their respective studies. Figure 3-13 shows the limits of the basins included this investigation. The Upper Basin was excluded because a majority of the land overlying the basin is privately owned, the groundwater resource is small and is managed by the RMV, and the RMV would not make their data available to the SJBA. The Arroyo Trabuco basin was divided into a lower and upper portion, with the Lower Arroyo Trabuco included in this investigation. The Lower Trabuco, Middle, and Lower Basins contain approximately 5.9 square miles of water bearing alluvium.

3.3.1 Geologic Setting

The San Juan Creek watershed is located on the western flank of the Santa Ana Mountains. The Santa Ana Mountains are part of a northwest-southeast trending fault block that has been tilted at a shallow angle in a westerly direction by the Elsinore fault system. The San Juan Creek watershed is underlain by plutonic, volcanic, metamorphic, and sedimentary rocks (Morton, 2004). The two major faults in the San Juan Creek watershed are the northwest/southeast trending Mission Viejo and Cristianitos Faults. The Cristianitos Fault displaces Tertiary sedimentary rocks and the Mission Viejo Fault bounds the Cretaceous sedimentary rocks on the west (Taylor, 2006).

3.3.2 Stratigraphy

In this report, the stratigraphy of the San Juan Creek watershed is divided into three divisions: (1) Mesozoic and older bedrock units, (2) Tertiary bedrock units, and (3) late Holocene to Early Pleistocene surficial deposits, as shown in Figure 3-13. The Mesozoic and older bedrock units are further differentiated as (a) Cretaceous Age Formations of Sedimentary Origin, (b) Pre-Cretaceous Metamorphic Formations of Sedimentary and Volcanic Origins, and (c) Granitic and other intrusive crystalline rocks. The tertiary bedrock units are further differentiated as (a) fine-grained formations and (b) coarse-grained formations. The Late Holocene to Early Pleistocene Surficial Deposits are further differentiated as (a) younger alluvial deposits, (b) landslide deposits, and (c) older alluvial deposits. The main water bearing unit in the watershed consists of the younger alluvial deposits. Below, these geologic formations are generally described in stratigraphic order, starting with the oldest formations first.

3.3.2.1 Mesozoic and Older Bedrock Units

The Mesozoic crystalline igneous rocks, the Pre-Cretaceous metasedimentary rocks of the Bedford Canyon Formation, and the metamorphic rocks of the Menifee Valley Formation are exposed in the northeastern portion of the San Juan Creek watershed and are considered non-water bearing. Overlying the igneous and metamorphic basement units are the Cretaceous sandstone and conglomerate sandstone of the Williams Formation and the non-marine conglomerate and sandstone of the Trabuco Formation.

3.3.2.2 Tertiary Bedrock Units

The tertiary bedrock units are divided into fine-grained and coarse-grained formations, as grouped in the California Geological Survey CGS Special Report 217. The fine-grained formations include the Capistrano and Monterey Formations and the coarse-grained formations include the Santiago, Sespe, and Niguel Formations.

3.3.2.2.1 Coarse-Grained Formations

The Santiago and Sespe Formations are bounded to the east by the Mission Viejo Fault and to the west by the Cristianitos Fault, as shown in Figure 3-13. The DWR (1971) identified both the Santiago and Sespe Formations as potential aquifers. The Santiago Formation is a chiefly marine conglomerate with interbedded very fine to coarse grained sandstones and is estimated to be about 3,000 feet thick (DWR, 1971). The Sespe Formation consists of non-marine conglomeratic sandstone, sandstone, and silty sandstone, and is estimated to be about 1,500 feet thick.

In Bulletin No. 104-7, the DWR reported that a test hole was drilled into the Santiago Formation and yielded groundwater at 48 gallons per minute (gpm) with a drawdown of 257 feet and a specific capacity of about 5 gpm/ft. In the same report, the DWR collected several outcrop samples from the Sespe Formation and determined the porosity to range between 20 and 25 percent.

The Pliocene Niguel Formation is younger than the Santiago and Sespe, but they are grouped together because the Pliocene Niguel Formation is coarse-grained. The Niguel Formation is about 350 feet thick and is comprised of sandstone interbedded with sandy siltstone that is exposed in the southwest portion of the watershed where it overlies the Capistrano and Monterey Formations (DWR, 1971).

3.3.2.2.2 Fine-Grained Formations

The Capistrano and Monterey Formations outcrop in the southeast portion of the watershed. The Capistrano Formation is about 2,400 feet thick and consists of white to pale gray, massive to crudely bedded siltstone and mudstone (DWR 1971). The Monterey Formation is a brown to yellow grey silty shale. Both the Capistrano and Monterey Formations are very prone to landslides in the surrounding hills.

The Capistrano Formation forms the bottom of the alluvial aquifer in the basins south of the Cristianitos Fault. The Capistrano Formation has been described in driller's logs as greenish black siltstone, grey siltstone, blue shale, and green shale. About sixty wells in the study area encountered the Capistrano Formation at depths ranging from about 30 feet to 160 feet below ground surface (ft-bgs). A more detailed discussion of the bottom of aquifer can be found in *Section 3.3.3 Geologic Cross Sections and Section 3.3.5 Effective Base of the Alluvial Aquifer*.

3.3.2.3 Late Holocene to Early Pleistocene Surficial Deposits

The late Holocene to Early Pleistocene deposits are divided into three groups: (1) older alluvial deposits, (2) landslide deposits, and (3) younger alluvial deposits.

3.3.2.3.1 Older Alluvial Deposits

The very old and older alluvial deposits are stream terraces ranging in age from the Early to Late Pleistocene. These terrace deposits are composed of clays, silts, sands, and gravels, and range in thickness from about 13 to 98 feet (Taylor, 2006). These terrace deposits are normally above the water table; however, they may overlie stream channel deposits (DWR, 1971).

3.3.2.3.2 Landslide Deposits

The landslides in the study area typically occur in the Capistrano and Monterey Formations. Like the stream terraces, they may overlie the water bearing stream channel deposits.

3.3.2.3.3 Younger Alluvial Deposits

The main water bearing sediments of the San Juan Creek watershed are the Younger Alluvial Deposits of the Late Pleistocene to the Holocene. The younger alluvium occupies streambeds, washes, floodplains, and other areas of recent sedimentation. The alluvial deposits' average thickness is about 90 feet throughout the study area, and they consist of a heterogeneous mixture of sand, silt, and gravel. The sediment is derived from the erosion of the more resistant bedrock formations that make up most of the watershed.

3.3.3 Geologic Cross Sections

Figure 3-14 shows the geology in greater detail in the management plan investigation area and the location of three cross sections developed for this investigation. These cross sections are shown in Figures 3-15 through 3-17. Plotted on these cross-sections are well and borehole data, including, where available, graphical borehole lithology, well casing perforations, geophysical data, and recent water levels.

Cross section A-A', which is orientated northeast-southwest and bisects the Middle and Lower Basins along San Juan Creek is shown in Figure 3-15. The northeast section terminates in terrace deposits that overly the coarse-grained Tertiary Capistrano Formation and the southeastern section terminates in the Pacific Ocean. A-A' traverses the two deepest portions of the San Juan Basin: (1) the CSJC desalter well field (CVWD-1) at about 160 ft-bgs and (2) Doheny State Beach where MWDOC MW-2 was drilled to 188 ft-bgs without penetrating the Capistrano Formation. The alluvial thickness through this section averages approximately 100 feet. The aquifer material is generally composed of coarse-grained materials (gravel and sand layers) with few interbedded silt and clay layers. A 5 to 10-foot thick basal gravel bed occurs in the wells that penetrate the Capistrano Formation. A 6 to 10-foot thick aquitard was observed in SCWD wells MW-1 and MW-4 (Geoscience, 2010). The average thickness-weighted specific yield of the wells on this cross section is about 16.5 percent.

Cross section B-B', which is oriented north-south and bisects the lower portion of Arroyo Trabuco, is shown in Figure 3-16. This cross section crosses the Arroyo Trabuco and San Juan Creek. The north section terminates in very old alluvial deposits that overlie the Capistrano Formation, and the southern end terminates in landslide deposits that also overly the Capistrano Formation. The aquifer is about 130 feet thick where the CSJC's northern production well field is located (North Open Space and Rosenbaum wells) and about 113 feet thick at the City's Dance Hall well. The aquifer material is generally composed of coarse-grained materials (gravel and sand layers) with few interbedded silt and clay layers. As in Cross section A-A', a 5 to 10-foot thick basal gravel bed occurs in the wells that penetrate the Capistrano Formation. The average thickness-weighted specific yield of the wells on this cross section is about 15 percent.

Cross section C-C', which is aligned east-west along the southern boundaries of both the Arroyo Trabuco and the Middle Basins, is shown in Figure 3-17. This cross section bisects Arroyo Trabuco, Horno, and San Juan Creeks. Both the east and west sides terminate into terrace deposits that overlie the Capistrano Formation. The aquifer thickness is about 130 feet in the vicinity the Hollywood 2A production well, thins in east to about 25 feet near Interstate 5 in the Arroyo Trabuco portion, and is about 80 feet thick near San Juan Creek. The aquifer material is generally composed of coarse-grained materials (gravel and sand layers) with few interbedded silt and clay layers. The basal gravel that overlies the Capistrano Formation is about 15 to 20 feet thick in the channel cut by Arroyo Trabuco. The average thickness weighted specific yield of the wells on this cross section is about 16 percent.

3.3.4 Groundwater Occurrence and Movement

Groundwater within the San Juan Creek watershed primarily occurs in the relatively thin alluvial deposits along the valley floors and within the major stream channels. The State Water Resources Control Board (SWRCB) has characterized this groundwater, from a water rights perspective, as flow of an underground stream. The physical nature of the San Juan Basin groundwater reservoir is described below with regard to basin boundaries, recharge, groundwater flow, and discharge.

3.3.4.1 San Juan Basin Boundaries

The physical boundaries of the San Juan Basin are shown in Figure 3-13 and include:

- Santa Ana Mountains. The Santa Ana Mountains are composed of impermeable granitic and metamorphic bedrock and form the northern boundary of the watershed.
- Sedimentary bedrock formations. Sedimentary bedrock formations form the sides of the water bearing canyons of the Upper Basin and Arroyo Trabuco (i.e. Cañada Chiquita, Cañada Gobernadora, and Bell Canyon).
- Pacific Ocean. The entire watershed drains south-southwest and into the Pacific Ocean, which forms the southern boundary of the basin.

3.3.4.2 Groundwater Recharge and Discharge

The predominant sources of recharge to the San Juan Basin include:

- Streambed infiltration in San Juan Creek, Horno Creek, Oso Creek, and the Arroyo Trabuco
- Subsurface boundary inflows at the head of these creeks on the upstream boundaries to the management plan investigation area and other minor subsurface inflows along the other boundaries
- Deep infiltration of precipitation and applied water
- Flow from fractures and springs

Groundwater discharge from the San Juan Basin occurs as:

- Groundwater production from wells
- Rising groundwater
- Evapotranspiration
- Subsurface outflow to the Pacific Ocean

In general, groundwater flow within the study area follows the surface topography: from areas of recharge in the surrounding highlands towards the central axis of the basin and then southwesterly along the axis of the basin before exiting into the Pacific Ocean. Figures 3-18 and 3-19 show groundwater elevation contours for the spring of 1987 and the fall of 2010, respectively. The direction of groundwater flow is perpendicular to the groundwater elevation contours. These maps show similar groundwater gradients and flow directions for the two time periods. A groundwater pumping depression, resulting from desalter production, is evident in the lower basin in the fall 2010 map.

3.3.5 Effective Base of the Freshwater Aquifer

Figure 3-20 depicts the effective base of the freshwater aquifer by equal depth contour lines. The geographic extent of the delineation of the effective base of the freshwater aquifer is the active storage management area with a slight extension above the active management area. Underlying this shallow alluvial aquifer system is what is commonly referred to in well completion reports as a green or blue clay/shale (believed to represent the Capistrano Formation), which likely acts as an aquitard preventing the downward movement of groundwater (Psomas, 2009). The effective base of the freshwater aquifer contours honored sixty borings that penetrated the alluvial aquifer with depths that range from 30 to 50 ft-bgs near the bedrock outcrops to about 150 to 160 ft-bgs near the confluence of Arroyo Trabuco and San Juan Creek.

3.3.6 Aquifer Storage Properties

Younger alluvial deposits comprise the aquifer material within the study area and consist of a heterogeneous mixture of sand, silts, and gravel.

Specific yield or effective porosity is a property of rocks that describes the ability of the rock to store water that can be recovered. A commonly used definition of specific yield is the quantity of water which a unit volume of aquifer, after being saturated, will yield by gravity, expressed either as a ratio or as a percentage of the volume of the aquifer. In other words, specific yield is a measure of the water available to wells. The specific yield of the aquifer-system sediments in the San Juan Basin study area was estimated through the analysis of lithologic descriptions from well driller's reports. WEI maintains a library of well driller's reports of all known boreholes that have been drilled in the San Juan Basin. The lithologic descriptions from the well driller's reports were input into a relational database along with corresponding estimates of specific yield by sediment description. A thickness-weighted, average specific yield was calculated at each borehole in the San Juan Basin, and these point values were imported to ArcGIS. Using a Kriging interpolation method within the Geostatistical Analyst extension of ArcGIS, a specific yield raster was created to interpolate specific yield of aquifer sediments between wells. Figure 3-21 shows the wells labeled by thickness-weighted, average specific yield. Specific yield values in the San Juan Basin average about 15 percent and range between 4 and 25 percent.

3.3.7 Historical Groundwater Level Monitoring

Groundwater level data has been collected from wells in the San Juan Basin since the late 1940s and early 1950s. These data have been collected by well owners, water district staff, and various consultants. In 2004, the SJBA installed nine monitoring wells with pressure transducers/data loggers that collect water level readings every 15 minutes. All of the groundwater level data collected in this investigation were carefully checked and uploaded into a relational database through WEI's HydroDaVESM system.

Figures 3-22 through 3-24 show groundwater level time histories at selected wells for the Lower and Middle San Juan Basins and for the lower portion of the Arroyo Trabuco Basin, respectively, for the 1979 through 2010 period. Figures 3-22 through 3-24 were constructed to compare groundwater level time histories to common drivers of groundwater level change: climate and production. The wells featured in the time-history plot are located on the map inset on the right hand side of each figure. On each chart, groundwater level time histories are plotted with the CDFM precipitation curve from the Laguna Beach precipitation station. Positive sloping lines on the CDFM curve indicate wet years or wet periods. Negatively sloping lines indicate dry years or dry periods. For example, the periods between 1978 to 1983, 1990 to 1998, and 2004 to 2005 are wet periods, and are represented as positively sloping lines. The periods 1983 through 1989 and 1998 through 2010 are drought periods and are represented as negatively sloping lines. Each chart also contains the time history of groundwater pumping in each basin as a stacked bar chart illustrating the magnitude of production by well in each basin. Thus, the groundwater level, climate and production time histories can be viewed together to explore how climate and production drive groundwater level changes.

Figure 3-22 illustrates the groundwater level time history for select wells in the Lower Basin. Groundwater levels in the Lower Basin ranged between 10 and 20 ft-bgs prior to the startup of the CSJC's desalter operations in 2005. After the commencement of desalter production, groundwater levels fluctuated between 20 and 40 ft-bgs. Groundwater levels at the two shallow screened monitoring wells MW-2 (perforated 14-74 ft) and MW-7 (perforated 10-90 ft) do not appear to respond to desalter production but fluctuate between 15 and 25 ft-bgs in response to climatic variations. During the wet period in the mid-1990s, groundwater levels at SJBA-2 reacted more like MW-2 and MW-7 and only fluctuated between 15 and 20 ft-bgs.

Figure 3-23 illustrates the groundwater level time history for select wells in the Middle Basin. Groundwater levels in the shallow SJBA monitoring wells (MW-4, MW-5, and MW-6) located along San Juan Creek fluctuate in response to climatic variations. As is shown in Figure 3-15, the groundwater-level and streambed of the San Juan Creek are essentially at the same elevation in this section of the study area. In other words, the Middle Basin was full of water in the spring of 2010.

Figure 3-24 illustrates the groundwater level time history for select wells in the lower Arroyo Trabuco Basin. Groundwater levels at several wells have declined from about 60 to 90 ft-bgs since the mid-1990s. Groundwater levels at MW-8 and Hollywood 2A have not undergone the same decline and fluctuate in response to climatic variations due to their close proximity to Arroyo Trabuco Creek. The lower Arroyo Trabuco Basin appears to be the only basin that may be suitable for artificial recharge due to the approximate 60 to 80 feet of unsaturated alluvium.

3.3.8 Groundwater Production Time Histories

Historical groundwater production data have been kept by private well owners and water agencies. Production data from 1978 through 2008 were compiled by MWDOC as part of their groundwater investigations for SOCOD, and the remaining data were collected from the CSJC and the SCWD. Table 3-3 shows production wells by owner and annual production for the 1978 to 2010 period. Figures 3-22 through 3-23 show the time series of annualized groundwater production at wells for the Lower, Middle, and the lower Arroyo Trabuco sub-basins, respectively. Prior to 2005, production was greatest in the lower Arroyo Trabuco Basin with average production at about 1,600 acre-ft/yr. On average, about 500 acre-ft/yr was pumped from the Middle Basin during the 1978-2010 period. Since the installation of the CSJC's desalter well field in 2005 and the SCWD's desalter in 2007, groundwater production has averaged about 3,500 acre-ft/yr.

3.3.9 Groundwater Storage Time History

The storage capacity of the alluvial areas in the San Juan Watershed was first calculated by DWR in 1972 (DWR, 1972). DWR simplified the storage calculation by dividing the alluvial aquifer into segments with similar hydrogeologic characteristics. Estimates of specific yield, area, and average alluvial thickness were made for each segment, which were, in turn, used to calculate the storage capacity of each segment. In the 1994 San Juan Basin Groundwater Management and Facility Plan, NBS Lowry calculated a combined storage capacity of about 41,600 acre-feet for the Lower San Juan, Middle San Juan and lower Arroyo from the ground surface to the base of the aquifer. In their Annual Integrated Environmental Monitoring Reports (Psomas, 2004 through 2010), Psomas created six polygons that approximately correspond to the alluvial aquifer segments delineated by the DWR in 1972 in order to make storage change calculations on an annual basis. The total storage capacity of the basins was calculated to be about 26,924 acre-ft by multiplying the area of each segment by the DWR's estimates of average thickness and specific yield. This is a difference of about 14,000 acre-ft, or 34 percent, from the DWR's estimate.

This study attempted to refine the estimates of storage capacity, groundwater currently in storage, and storage change within the study area. A GIS-based storage model was developed, and the following steps were taken: 1) develop a fine rectangular grid (i.e. GIS polygon layer) over the area, 2) compute the amount of groundwater storage in 2010, and 3) compute the total storage capacity in the each cell. These steps are described in more detail below.

1. *Develop a fine rectangular grid.* The grid cell size used in the calculation was 100x100 meters (see Figure 3-21). Where a grid cell is split by a storage segment, it is assigned parameters based on the apportionment of the grid cell in each segment (determined by area).
2. *Compute the volume of groundwater in storage in each grid cell based on the current condition.* Groundwater elevation contours for fall 2010 groundwater conditions (Figure 3-19), bottom of the aquifer elevation contours (Figure 3-20), and specific yield estimates (Figure 3-21) were used to calculate the total storage volume of each grid cell. The groundwater elevations and the bottom of aquifer elevations for each grid cell were estimated with an automated gridding program that interpolates between contours. The volume of groundwater in a grid cell for a single-layer aquifer is computed as:

$$V_i = A_i * (WL_i - B_i) * SY$$

Where V_i = volume of groundwater in the i^{th} grid cell

A_i = grid cell area (10,000 square meters for a square grid cell)

WL_i = average elevation of groundwater in the i^{th} grid cell (feet above mean sea level [ft-amsl])

B_i = average elevation of the effective base of aquifer in the i^{th} grid cell (ft-amsl)

SY = specific yield

3. *Compute the total storage capacity from the ground surface to the base of the aquifer.* The CSJC's 2-ft ground surface elevation contours, bottom of aquifer contours, and specific yield estimates were used to calculate the total storage capacity of the alluvium within the study area. The total storage capacity[6] in a grid cell for the alluvial aquifer is computed as:

$$SC_i = A_i * (GS_i - B_i) * SY$$

Where SC_i = storage capacity in the i^{th} grid cell (acre-ft)

A_i = grid cell area (10,000 square meters for a square grid cell)

GS_i = average streambed elevation in i^{th} grid cell (ft-amsl)

B_i = average elevation of the effective base of the aquifer in the i^{th} grid cell (ft-amsl)

SY = specific yield

The total storage capacity of the San Juan Basin was calculated to be about 26,500 acre-ft, and the amount of groundwater in storage in 2010 was calculated to be about 20,400 acre-ft. The amount of unused storage in the San Juan Basin is about 6,150 acre-ft. Table 3-4 compares the total storage capacity estimates made by DWR, Psomas, and WEI.

3.4 Water Rights

Several water rights permits and agreements exist to allocate groundwater production from the lower San Juan Basin.[7] A list of the existing water rights permits and pending water rights applications are shown in the table below.

[7] Note that the discussion of water rights contained herein is for illustrative purposes only and should not be construed as restricting, granting, or otherwise endorsing any particular claim of right. Rather, the discussion of water rights is for the purpose of explaining the amount of water rights that have been approved or applied for, and the agreements made by and amongst the parties to protect their existing or potential future rights. Any future projects proposed or implemented by the SJBA or other parties will need to address water rights, and the impacts the projects have on these rights, in more thorough detail.

Applicant	Application Number	Permit Number	Diversion Amount Eligible Under Current Permit and Agreements (acre-ft/yr)	Diversion Amount Potentially Eligible to be Permitted and Agreement (acre-ft/yr)	Purpose of Use
SCWD	A30337	21138	1,300	1,300	Municipal
SJBA	A30123	21074	8,026	10,702	Municipal
SMWD	A25557	17489	611 (Nov to Apr)	611 (Nov to Apr)	Irrigation
SMWD	A25733	17692	32 (Nov to Apr)	32 (Nov to Apr)	Irrigation
San Juan Hills Golf Course (SJHGC)	A30171	21142	450	450	Irrigation
CSJC	A30696[8]	N/A	3,325	3,325	Municipal
Totals			13,520	16,520	

Pursuant to SJHGC's current water rights permit, the State Board has only authorized the diversion of up to 450 acre-ft/yr. However, per the 1997 agreement between SJBA and SJHGC, the SJBA has agreed not to protest any increase to the SJHGC right up to a total right of 550 acre-ft/yr, subject to the terms of the agreement.

The key provisions of the SJBA and SCWD Water Rights Permits are:

- SJBA rights can be pumped out of the desalter project.
- SJBA right can be increased by 2,676 acre-ft/yr upon showing the availability of un-appropriated water and approval by the SWRCB Chief, Division of Water Rights.
- Allocation of water between SCWD and the SJBA is recognized as governed by agreements of Nov 21, 1995, Mar 1, 1998 and joint letter of Mar 13, 1998.
- Monitoring wells shall be used to measure groundwater levels on a minimum quarterly basis.
- The project shall not cause injury to the reasonable and beneficial uses of water recognized in the Basin Plan.

[8] The application remains pending, and CSJC is currently evaluating options for the future disposition of its application. In the meantime, all or most of the water pumped and treated under SJBA's Permit 20174 is beneficially used in the CSJC's service area.

- Downstream TDS and chloride concentration in groundwater shall be monitored when SJBA extractions exceed 4,800 acre-ft/yr (Phase 2). Extractions shall not cause Basin Plan Objectives to be exceeded or further degradation to occur.
- Mitigation monitoring of stresses to native vegetation is required when SJBA extractions exceed 4,800 acre-ft/yr), and if groundwater pumping has caused significant stresses to the vegetation then the SJBA will be required to cease pumping until the stress has been reduced to acceptable levels.
- Extractions by all pumpers shall not exceed the total recharge and the condition is satisfied as long as groundwater storage does not fall below 50 percent of the storage capacity of the basin.
- The SJBA pumping right is subject to the prior riparian right of San Juan Hills Golf Course (SJHGC) and shall not cause significant impact on water quality.

The groundwater rights and other conditions were agreed to by the parties in four agreements.

- Nov 1995 SJBA/CSJC Agreement.
  - By this Agreement, SJBA recognized and agreed that it would not challenge the CSJC extractions up to 3,325 acre-ft/yr
  - SJBA agreed to not operate its Groundwater Recovery Project in a manner that would infringe upon the City's extraction of water.
- 1997 SJBA/SJHGC Agreement
  - The SJHGC can continue to take up to 550 acre-ft/yr of water from the Basin under any water right (riparian or appropriative), and that water will be used for "irrigation and other proper riparian purposes only."
  - The SJHGC will request that the State Board include the riparian use limitation in the appropriative rights permit (as is show in the table above).
  - The SJBA will not oppose the SJHGC's application to appropriate water, and will not "interfere with" the SJHGC's take of 550 acre-ft/yr from the basin.
  - The SJBA will not take water from the Basin in a manner that causes significant injury to the quality of water necessary for use by the Golf Course or any other use recognized for the San Juan Creek watershed in the San Diego Basin Plan.
- Mar 1, 1998 SCWD/SJBA Settlement Agreement
  - SJBA to establish a Project Committee 10 "Basin Management Committee" which would serve as the "Basin Manager". The Basin Manager is responsible for determining on an annual basis the amounts of Available Safe Yield (ASY) which can be diverted by SCWD and SJBA from their water rights.

   - SCWD Base Allocation was set at 20 percent of the ASY up to a maximum of 1,300 acre-ft/yr.
   - SJBA Base Allocation was set at 80 percent of ASY, up to a maximum of 12,500 acre-ft/yr.
   - Either party can use the other parties unused allocation.
   - SCWD is responsible for artificial replenishment when necessary to achieve the SCWD's annual diversion but both parties agree to work to avoid diversions that will result in the need for artificial replenishment.
   - SCWD to become a member of SJBA.
   - SCWD agreed to not interfere with City water rights in total of 3,325 acre-ft/yr.
   - SCWD expressed that it had no interest in the SJBA water right or desalter project.
- Oct 2002 Project Implementation Agreement San Juan Basin Desalter Project
   - CSJC's allocated interest in the SJBA water rights were set at 5,800 acre-ft/yr from the desalter project.
   - SJBA has no obligation to provide make-up water to the CSJC as the allocation exceeds CSJC's base right of 3,325 acre-ft/yr.

The active management area of the SJBGFMP excludes the RMV whose lands and water use are upstream and not included in the SJBGFMP except through the recognition of the RMV upstream water uses and water rights. The management activities included in the SJBGFMP occur completely downstream of the RMV and they do not interfere with the water rights and management activities of the RMV.

3.5 Recent Results of MWDOC Groundwater Model Application to the San Juan Basin

The MWDOC and five agencies – Laguna Beach County Water District, MNWD, City of San Clemente, CSJC, and SCWD – have been investigating the feasibility of improving local water reliability in south Orange County through the development of SOCOD. This project would decrease the area's dependence upon imported drinking water supplies. Currently, South Orange County depends on water imported from northern California and the Colorado River to meet approximately 95 percent of its local demand[9].

The proposed ocean desalination facility would be located north of Doheny State Beach in Dana Point, adjacent to San Juan Creek on the inland side of Pacific Coast Highway. It would produce approximately 15 million gallons of drought-proof water per day (16,000 acre-ft/yr),

[9] http://www.mwdoc.com/pages.php?id_pge=68

which is approximately 25 percent of the area's potable water demand. This new, local water supply would also benefit the area during emergencies and outages of the regional imported water delivery system. The projected SOCOD project construction cost is estimated at about $182 million to $241 Million (estimated 2012 dollars, without and with Fe/Mn treatment, respectively), and the unit cost of water could range from about $1,500 to $1,700 per acre-ft[10] without incentives from MWDSC.

The project would divert seawater into the treatment plant through slant wells drilled into the near and offshore parts of the San Juan groundwater basin. These wells will induce seawater into the aquifer as well as draw groundwater from the landward side of the well field. The use of this forced seawater intrusion into the slant wells will greatly reduce the cost of pre filtration and eliminate the environmental challenges caused by direct intake of seawater.

Two phases of project feasibility testing have been conducted successfully at Doheny Beach since 2005. The project entered Phase 3: Extended Pumping & Pilot Plant Testing in early 2010 and was completed in May 2012. If pumping results are favorable, efforts would be initiated to move forward with development of a full-scale project description and environmental impact report (EIR). Successful adoption of the EIR and the receipt of all necessary permits from all appropriate regulatory agencies would be the next steps prior to project implementation and the initiation of construction. As planned, the project would be constructed and operational within two years, and water deliveries could begin as early as fall 2019..

The implementation of the SOCOD project will have significant impacts on the San Juan groundwater basin and include a reduction in the yield of the basin by diversion of groundwater from the landward side of the slant well intake system, and by the likely creation of a seawater intrusion barrier caused by the slant wells system. As to the latter, the regional groundwater level depression caused by the SOCOD intake could virtually eliminate future seawater intrusion regardless of how the San Juan groundwater basin is managed. Therefore if implemented, the natural yield of the San Juan groundwater basin would likely decline and the basin could be operated at lower levels during drought periods without the fear of seawater intrusion. These findings are preliminary and based on preliminary groundwater modeling conducted by MWDOC and its consultants. Additional surface and groundwater modeling and other investigations will be required to validate and refine these findings.

3.5.1 Summary Description of MWDOC's Groundwater Model of the San Juan Basin

Prior to the completion of this draft report, there was no written documentation of MWDOC's Groundwater Model other than pdf's of PowerPoint presentations located on MWDOC's website. Since the release of this report, the MWDOC model report was completed and is available for review at http://www.mwdoc.com/services/dohenydesal. Below is a summary of the model's limitations.

[10] MWDOC planning documents in early 2013 suggests that the unit cost could range between $1,800 and $2,000 per acre-ft in 2019 when the SOCOD project could become operational.

There are always limitations in the application of models. The specific limitations that were identified from the review of presentation materials and supplementary materials provided by MWDOC and the final report[11] include the following[12]:

- There is very little data that can be used to calibrate the model under high pumping stresses. This reduces confidence (or requires greater faith) in the models ability to predict future groundwater levels during dry periods and higher than historical production. This challenge can be addressed in the future through monitoring. Also, MWDOC should consider conducting sensitivity analysis to explore the how their model would predict groundwater level changes with alternative but plausible data sets.

- The subsurface boundary inflows are purported to average 2,700 acre-ft/yr, with this value being tied to other upstream surface modeling work. There is insufficient data to support the plausibility of this assumption given the limited size of the aquifers upstream of the model boundaries and the great variability in the hydrology upstream of these boundaries. As will be seen below, a constant subsurface inflow of 2,700 acre-ft/yr is a substantial part of the production yield of the basin during wet and dry periods. The implication to producers in the San Juan groundwater basin is that the model will likely over-estimate the ability to produce groundwater during dry periods.

- Seawater intrusion in the vicinity of the SCWD wells was estimated with a model that is not capable of simulating groundwater flow with variable density fluids. This may or may not be a limitation – presumably the appropriateness of the present model application will be demonstrated.

- The model projections do not include a provision in the water rights agreement limiting groundwater production when groundwater storage falls below half of the basin's storage capacity. The implication is that the model may project greater groundwater pumping during dry periods than may be allowed per the SWRCB permits. In fairness the permit is not clear on how production would be reduced when storage falls below half the basins storage capacity. This is explored in the section below.

3.5.2 MWDOC 2013 Groundwater Model Results for the SJBGFMP Baseline and Implications for the SJBGFMP

As mentioned above, the MWDOC model documentation is in preparation and was not available at the time this document was being prepared. WEI did request and obtain certain

[11] South Orange Coastal Ocean Desalination Project, Phase 3 Extended Pumping and Pilot Plant Testing, Volume 3 – San Juan Basin Regional Watershed and Groundwater Models, prepared by Geoscience Support Services, 2013.

[12] MWDOC's consultant provided WEI with supplementary information including certain water budget, model parameters and other hydrologic data and these comments are based on MWDOC power point presentations and supplementary information.

information to enable us to characterize the basin response to baseline stresses. This characterization is described herein.

Table 3-5 shows the baseline water budget for the San Juan basin model area for a constant 2014 groundwater production projection and the hydrologic period 1947 through 2010. The water budget shown in Table 3-5 represents how the basin would respond under 2014 production if that production were held constant for a long representative hydrologic period. The hydrologic period shown in Table 3-5 includes statistical summaries for a wet period (1978-1983), a dry period (1947-1976), the so called "average" period (1963-1992) and the entire simulation period. The simulation period 1947 through 2010 period contains very similar statistics to the average period and therefore the average period is not included in the subsequent discussion. Table 3-5 shows the hydrologic year, the recharge components, discharge components, the change in storage (sum of recharge components minus the sum of discharge components), end of period storage, deviation from minimum storage to maintain maximum production, and the unmet production demand.

The recharge components include underflow from upgradient groundwater resources in San Juan Creek, Horno Creek, Arroyo Trabuco and Oso Creek (column 1); streambed infiltration in the model area including natural flows and dry-weather flows (column 2); the deep infiltration of return flows (column 3); subsurface boundary inflows from adjacent non water bearing areas (column 4); and subsurface (underflow) from the ocean (column 5). The total inflow is shown in column 6 and ranges from low of about 4,300 acre-ft/yr to a high of about 24,000 acre-ft/yr, averages about 10,200 acre-ft/yr – about 1,000 acre-ft/yr less than the amount requested by all the groundwater producers in the basin, and the median is about 8,400 acre-ft/yr which is about 2,800 acre-ft/yr less than the amount requested by all the groundwater producers in the basin. The total recharge is dominated by the streambed infiltration that ranges from 1,400 to 19,100 acre-ft/yr, averages about 6,700 acre-ft/yr and has a median value of about 5,000 acre-ft/yr. The underflow from the ocean shown in column 5 is seawater intrusion and ranges from 0 in the first year to about 600 acre-ft/yr, averages about 300 acre-ft/yr and has a median value of 400 acre-ft/yr. This seawater intrusion is predicted to impact the SCWD desalter wells in the early 2020s. Both the SJBA and the SCWD diversion permits, contain language that prohibits water quality degradation due the exercise of rights conferred by the permits. Review of Table 3-5 indicates that the underflow from the ocean is essentially positive for all years meaning that seawater intrusion is projected to occur even for groundwater production levels less than the planned amounts. Seawater intrusion, if it occurs as suggested by the model, will degrade the basin water quality and thus the production allowed for within the permits will have to be reduced to the point that no seawater intrusion occurs[13].

The discharge components include groundwater production (column 7), evapotranspiration (column 8), rising groundwater discharge to streamflow (column 9), and underflow to the ocean (column 10). The total discharge is shown in column 11 and ranges from low of about 7,900 acre-ft/yr to a high of about 12,900 acre-ft/yr, averages about 10,300 acre-ft/yr, and the

[13] Model predictions of seawater intrusion are not conclusive. The SJBA is conducting groundwater monitoring to determine if and when seawater intrusion occurs and will take appropriate measures if and when seawater intrusion is detected.

median is also about 10,300 acre-ft/yr which is about 900 acre-ft/yr less than the planned groundwater production. The total discharge is dominated by the model-predicted groundwater production that ranges from 7,400 to 11,200 acre-ft/yr, averages about 9,600 acre-ft/yr and has a median value also of about 9,600 acre-ft/yr. The 2014 groundwater production was estimated initially by the SJBA TAC members and represents the potential maximum groundwater production for the basin for 2014. The SJBA TAC members supplied individual well production estimates and drawdown constraints that limit groundwater production at wells when the groundwater production falls below the drawdown constraint. The 2014 production was estimated as follows:

- 7,758 acre-ft/yr – CSJC desalter wells
- 1,023 acre-ft/yr – CSJC other wells
- 1,585 acre-ft/yr – SCWD desalter wells
- 850 acre-ft/yr – Other private wells
- 11,216 acre-ft/yr – Total "requested" production

In practice when the groundwater model predicts a groundwater level at or below water level constraint[14] at a well, the model ceased production at the well to try to maintain groundwater levels at or about the constraint. The annual production totals listed in Table 3-5 show that production was limited by groundwater levels falling below drawdown constraints in 56 of 63 years of the simulation period or about 90 percent of simulation period.

The other discharge components are relatively minor and in aggregate range from about 500 to 1,600 acre-ft/yr, average about 700 acre-ft/yr and have a median value of about 600 acre-ft/yr.

The end of period storage is equal to the storage at the beginning of the year (the end of period storage for the prior year, column 13) and the change in storage for the current year (column 12). For example the end of period storage for 1948 is equal to the end of period storage for 1947 (17,637 acre-ft) plus the change in storage for 1948 of -5,781 acre-ft and equals 11,857 acre-ft. The end of period storage ranges from 7,500 acre-ft to 43,900 acre-ft, average about 18,400 acre-ft and has a median value of about 17,200 acre-ft.

Figure 3-25 shows the relationship of end of period storage to model predicted groundwater production. The chart shows that requested or planned groundwater production is usually achievable if the end of period storage is greater than 27,000 acre-ft, and that the predicted production is highly variable and sometimes substantially less when the end of period storage is less than 27,000 acre-ft. The variability in predicted production is due to the variability in stream infiltration when the prior year end of period storage is less than 27,000 acre-ft.

Figure 3-26a shows the frequency of end of period storage based on the end of period time series shown in column 13 in Table 3-5. Review of Figure 3-26a indicates that the end of

[14] Production at a well is assumed to cease when the groundwater elevation at a well is projected to fall below an elevation corresponding to two feet above the top of screens

period storage will be less than half of the basin capacity at least 71 percent of the time, or seven out ten years.

Figure 3-26b is a similar figure that shows the frequency of model-predicted annual production for the hydrologic period and existing cultural conditions. Combining Figures 3-25, 3-26a and 3-26b reveals that:

- The basin producers will produce less than the desired 11,200 acre-ft/yr 85 percent of the time or about nine out of ten years. Restated, the basin producers will be able to meet their desired production one out of ten years.

- The basin producers will produce less than 11,000 acre-ft/yr 71 percent of the time or about seven out of ten years; production of 11,000 acre-ft/yr corresponds to storage of about 22,900 acre-ft or close to half the estimated basin storage capacity of 43,900 acre-ft. Restated, the basin producers will be able to product more than 11,000 acre-ft/yr in three out of ten years when the groundwater in storage is greater than half of the basin storage capacity.

- The basin producers will be produce less than the average achievable production of 9,600 acre-ft/yr about 49 percent of the time or about five out of ten years; this will occur when the groundwater in storage is less than 16,000 acre-ft and is less than half full. Restated the basin producers will produce the average achievable production of 9,600 acre-ft/yr at least five out of ten years when the groundwater in storage is greater than 16,000 acre-ft.

The take-away from this baseline simulation is that planned production by the CSJC and SCWD along with private producers seems to exceed the production capabilities of the basin and will result in production levels less than planned and potentially seawater intrusion. The average production from the basin under the baseline plan appears to be about 9,600 acre-ft/yr and ranges from about 7,400 acre-ft/yr to about 11,200 acre-ft/yr. The firm yield of the basin appears to be less than 7,000 acre-ft/yr. The limiting factors on yield are storage and the ability to capture and recharge surface water during and after storms. The management plan moving forward will need to include increased recharge, decreased production or some combination of the two to meet the water needs of those dependent on the basin.

3.5.3 The Impacts of SOCOD on San Juan Basin Production

At the March 21, 2013 SOCOD Technical Advisory Committee meeting, MWDOC presented the results of its most recent model investigations of the projected impacts of the SOCOD project on producers in the San Juan Basin. The average decline in yield over the dry period of 1947 through 1976 is projected to be about 1,500 acre-ft/yr – no information was presented to characterize the SOCOD impacts on production during the driest years (no annual minimum). MWDOC estimated that implementation of the SOCOD project would result in an average decline of 1,800 acre-ft/yr of production among basin producers during the "average" climate period of 1963 through 1992.[15]

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[15] Handouts from the March 21, 2013 SOCOD TAC meeting, Agenda item 2.

3.6 Yield Concepts for the SJBGFMP

3.6.1 Definition of Safe Yield

Water managers, civil engineers, hydrogeologist have wrestled with the term "safe yield" since the turn of the last century. The goal was to scientifically define and estimate a term for how much groundwater can extracted from a groundwater basin in a reliable manner.

Lee (1915) defined safe yield as the limit to the quantity of water which can be withdrawn regularly and permanently without dangerous depletion of the storage reserve. He noted that water permanently extracted from an underground reservoir reduces by an equal quantity the volume of water passing from the basin by way of natural channels, i.e., the natural discharge.

Theis (1940) recognized that all groundwater of economic importance is in constant movement through a porous rock stratum, from a place of recharge to a place of discharge. He reasoned that under pristine conditions, aquifers are in a state of approximate dynamic equilibrium. Discharge by pumping is a new discharge superimposed on a previously stable system; consequently, it must be balanced by: an increase in natural recharge; a decrease in natural discharge; a loss of storage in the aquifer; or a combination thereof. Significantly, Theis (1940) distinguished between natural recharge and available recharge.

The most common definition of safe yield is attributed to Todd (1959): the rate at which groundwater can be withdrawn perennially under specified operating conditions without producing an undesirable result. Most modern groundwater adjudications use some form of this definition. The definition also ties the safe yield to the cultural conditions of a specific year—presumably a near current year if cultural conditions are changing. Undesirable results commonly listed in literature include the depletion of groundwater reserves, intrusion of water of undesirable quality, contravention of existing water rights, excessive increases in production costs, stream flow depletion, and subsidence (Freeze & Cherry, 1979; Todd, 1959).

Safe yield is incorporated in the physical solution of adjudicated groundwater basins. Most of these physical solutions use different definitions of safe yield but they are all directed to enable a groundwater basin to be managed in a sustainable way.

3.6.2 Alternative Yield Concepts for the SJBGFMP

The concept of safe yield does not strictly apply to the San Juan Basin as the storage in the groundwater basin is small relative to recharge and production. The SWRCB has found that the San Juan basin is "flow of an underground stream" which means that they consider the groundwater in the basin a surface water.

A more appropriate yield term for the San Juan basin is "firm yield" a term used by the U.S. Bureau of Reclamation to describe the maximum quantity of water that can be guaranteed with some specified degree of confidence during a specific critical period. The critical period is that period in a sequential record that requires the largest volume from storage to provide a specified yield[16].

[16] www.usbr.gov/projects/glossary.jsp

More water can be produced from the basin most of time. What's needed is an articulation of how much can be produced given a specific amount of storage going into each production season and a statistical characterization of that production – an adaptive yield that's large enough to meet local demands with the potential to be augmented through various management schemes including artificial recharge. Given what has been learned in this investigation it appears that the minimum yield (firm yield) of the San Juan basin is slightly less than 7,000 acre-ft/yr; and that the basin could be managed to produce, with current production facilities and additional facilities that could constructed in the near term, between 7,000 and 11,000 acre-ft/yr. This would require intensive monitoring and facilities to protect the basin from seawater intrusion. The adaptive yield could also be augmented through aggressive means including the recharge of supplemental water.

The SJBA should consider adopting the term "adaptive yield" which in magnitude is bracketed by firm yield on the low end and a maximum yield consisting of natural and artificial recharge, and where the yield for a given year is established in the spring based on the groundwater levels in the spring and planned artificial recharge during the spring, summer and fall.

3.7 Water Quality

3.7.1 Data Sources

3.7.1.1 Surface Water Data Sources

All available surface water quality data in the San Juan Basin were collected for surface water sites along the San Juan Creek and its tributaries from a number of different data sources. Table 3-6 summarizes the different data sources and surface water stations from which water quality data were collected. The most continuous surface water quality monitoring program in the San Juan Basin is the County of Orange's storm water monitoring program. Grab and composite surface water quality samples for the County of Orange's Bioassesment and Mass Emissions storm water monitoring programs were collected for six sites in the study area with data from 2000 to 2009, and four sites with data from 1993 to 2009. Surface water quality data were collected from the San Diego Regional Water Quality Control Board, with data from 2002 to 2003 and 2009 to 2010 for their Surface Water Ambient Monitoring program. Surface water quality data were collected for the five SJBA monitoring sites along San Juan Creek, and for two SMWD monitoring sites at the Oso and Horno Creek Barriers. Additional surface water quality data were collected for project-specific monitoring programs for studies performed by Wildermuth Environmental (WEI, 1999) and CDM (1987). Figure 3-27 shows the locations of all the surface water quality monitoring sites in the San Juan Basin along the San Juan Creek and its tributaries.

3.7.1.2 Groundwater Data Sources

All available groundwater quality data for wells in the San Juan Basin were collected from a variety of resources for the period from 1952 to 2010. Table 3-7 summarizes the different sources from which water quality data were collected. Previous studies by DWR (1972), WEI (1999), CDM (1987), NBS Lowery (1994), and GeoTechnical Consultants, Inc. (GTC, 2001) provided sporadic historical groundwater quality data for various private and public wells the San Juan Basin. Groundwater quality data from production wells were extracted from the State of California Department of Public Health (CDPH) database for wells owned by the City, SCWD, RMV (Well 7), and SJBA. Additional production well data was provided by the City and SMWD. Monitoring well data from the California SWRQB GeoTracker website were collected for point-source contamination sites. Monitoring well water quality was provided by the SJBA for their nine San Juan Basin monitoring wells. Figure 3-28 shows the location of wells were water quality data were collected in the San Juan Basin.

3.7.1.3 Information Management

All groundwater and surface water quality data were uploaded into HydroDaVE. These data are readily accessed through the HydroDaVE Explorer interface where the user can perform spatial and temporal queries. All data collected for this project will be delivered in a HydroDaVE project file. Maintaining water resources data in HydroDaVE will make these data available for future projects and will save money.

3.7.2 Beneficial Uses

The Water Quality Control Plan for the San Diego Basin, or the Basin Plan, (SDRWQCB, 1995) identifies the beneficial uses for surface waters in the study area as AGR, REC1, REC2, WARM, COLD, and WILD. Surface waters in the San Juan Watershed have "been exempted by the Regional Board from the municipal use designation [MUN] under the terms and conditions of State Board Resolution No. 88-63, Sources of Drinking Water Policy." The Basin Plan identifies the beneficial uses for groundwater as MUN, AGR, and IND. Because of the interaction of surface water and groundwater in the watershed, this technical memorandum also compares surface water constituent concentrations with drinking water standards. The beneficial uses designations are defined as follows:

- Agricultural Supply (AGR) – Includes uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.
- Contact Water Recreation (REC1) – Includes uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and SCUBA diving, surfing, white water activities, fishing, or use of natural hot springs.
- Non-contact Water Recreation (REC2) – Includes the uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.
- Warm Freshwater Habitat (WARM) – Includes uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.

- Cold Freshwater Habitat (COLD) – Includes uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.

- Wildlife Habitat (WILD) – Includes uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

- Municipal and Domestic Supply (MUN) – Includes uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.

- Industrial Service Supply (IND) – Includes uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressurization.

3.7.3 General Surface Water Quality Characterization

Figure 3-27 shows all surface water stations with water quality monitoring data. Constituents in surface water were compared with both water quality objectives in the Basin Plan and California water quality standards (primary and secondary maximum contamination levels (MCLs) and notification levels (NLs)) enforced by DPH. California drinking water MCLs were used because they are the same or more stringent than federal drinking water standards.

Basin Plan water quality objectives "must protect the most sensitive of the beneficial uses which have been designated for a water body. Water quality objectives may be numerical values for water quality constituents or narrative descriptions. Water quality objectives must be based upon sound scientific water quality criteria needed to protect the most sensitive of the beneficial uses which have been designated for a water body. Water quality objectives must be as stringent as or more stringent than water quality criteria [developed under the Clean Water Act]. " Tables 3-2 and 3-3 in the Basin Plan list water quality objectives for inland surface waters and for groundwater. Other constituents are prospectively incorporated by reference in the following tables in the Basin Plan:

- Table 3-4: Inorganic Chemicals

- Table 3-5: Organic Chemicals

- Table 3-6: Secondary MCLs for Consumer Acceptance Limits

The Basin Plan also includes narrative objectives, including the following calculation for percent sodium:

$$\% Na = \frac{100 \cdot Na}{(Na + Ca + Mg + K)}$$

where Na, Ca, Mg, and K are expressed as milliequivalents per liter (meq/L) concentrations. To the extent data were available, environmental concentrations were compared with these narrative objectives.

Drinking water quality standards are promulgated by federal and state agencies. Primary MCLs are enforceable criteria that are set due to health effects. They are developed by the USEPA from MCL Goals and by CDP from Public Health Goals or from one-in-a-million incremental cancer risk estimates for carcinogens and threshold toxicity levels for non-carcinogens. Secondary standards are related to the aesthetic qualities of the water, such as taste and odor. For some chemicals, there are "Notification Level" (NL) criteria that are set by the CDPH. These are health-based advisory levels established by CDPH for chemicals that lack MCLs. When notification levels are exceeded, the CDPH recommends that the utility inform its customers and consumers about the presence of the contaminant and any health concerns associated with exposure. The level at which the CDPH recommends the drinking water system remove the affected drinking water source from service is the "Response Level." These levels range from 10 to 100 times the notification level, depending on the chemical.

Table 3-8 in this report list all the constituents for which Primary or Secondary Drinking Water MCLs or State NLs were exceeded at surface water sites in the San Juan Basin. The first portion of the table lists the Primary and Secondary MCLs, and State NLs for those constituents, and is primarily California State MCLs unless otherwise noted. The remaining portion of the table shows statistics for the occurrence of an MCL or NL exceedance for two time periods; the last five years (2006 to 2010) and the historical record prior to the last five years (1987 to 2005). The two time periods are shown because data for the last five years is not representative of all of the surface water data collected in the San Juan Basin at the various sites, as shown in Table 3-8. The exceedance statistics summarize the count and percentage of sites and samples exceeding an MCL or NL, and the count and percentage of sites and samples not exceeding an MCL or NL. As an example, in the period 1987 through 2005, there were 19 surface water stations where TDS exceeded the secondary MCL of 500 milligrams per liter (mg/L) and 10 stations where the MCL was not exceeded. In this period, 192 samples (88 percent) were greater than the MCL and 27 samples (12 percent) were less than the MCL.

Table 3-9 in this report summarizes compliance with the Basin Plan surface water objectives for the constituents shown in Table 3-2 of the San Diego Basin Plan for all surface water monitoring sites on the San Juan Creek and its tributaries. The basin plan compliance metric requires that the concentration of these constituents shall not exceed its respective objective more than 10 percent of the time during any one-year period. Table 3-8 contains demonstrations as to whether or not measured surface water quality at each site has exceeded the Basin Plan objectives more than 10% of the time in any given year. In Table 3-9, the surface water sites are organized by surface water body from upstream to downstream, and the status of compliance with each objective is shown for the entire period of record where data are available. As an example, the surface water station San Juan Creek at La Novia (SJC @ La Novia in Table 3-9) has a discontinuous record for TDS concentration spanning 1987 through 2009, a period of 23 years. The TDS concentration was sampled in 5 of the 23 years. For the five years with TDS concentration data, the TDS concentration was above the objective more than 10 percent of the time.

3.7.4 General Groundwater Quality Characterization

Figure 3-28 shows all wells in the San Juan Basin for which groundwater quality data were available. Inorganic and organic constituents detected in groundwater samples from wells in the San Juan Basin through June 2010 were analyzed synoptically and temporally. This analysis included all available data from production and monitoring wells. Hence, the data do not represent a programmatic investigation of potential sources nor do they represent a randomized study that was designed to ascertain the water quality status of San Juan Basin. These data do, however, represent the most comprehensive information available to date. Monitoring wells targeted at potential sources tend to have greater concentrations than municipal or agricultural production wells. Wells with constituent concentrations greater than one-half of the MCL represent areas that warrant concern and inclusion in a long-term monitoring program. In addition, groundwater in the vicinity of wells with samples greater than the MCL may be impaired from a beneficial use standpoint, which for the study area are MUN, AGR, and IND.

Table 3-10 in this report list all the constituents for which Primary or Secondary Drinking Water MCLs or State NLs were exceeded at wells in the San Juan Groundwater Basin. The first portion of the table lists the Primary and Secondary MCLs, and State NLs for those constituents, and is primarily California State MCLs unless otherwise noted. The remaining portion of the table shows statistics for the occurrence of a MCL or NL exceedance for the last five years (2006 to 2010). The exceedance statistics summarize the count and percentage of sites and samples exceeding a MCL or NL, and the count and percentage of sites and samples not exceeding an MCL or NL. As an example, during 2006 to 2010 there were 22 wells where TDS exceeded the secondary MCL of 500 mg/L and no wells stations where the MCL was not exceeded. During this period, 424 samples (100 percent) were greater than the MCL and no samples (0%) were less than the MCL.

Table 3-11 in this report summarizes compliance determination of the San Diego RWQCB groundwater quality objectives for constituents shown in Table 3-3 of the Basin Plan for all wells in San Juan Groundwater Basin study area where groundwater quality data was collected. Table 3-11 shows the constituents with the corresponding groundwater quality objectives. As stated in the Basin Plan, the concentrations of these constituents are not to exceed the objective more than 10 percent of the time during any one year period. This table shows groundwater quality objective compliance by evaluating data per calendar year for the time period of 2006 to 2010. Wells are group by groundwater basin hydrologic Sub Area, and compliance of objectives for each well is summarized by the constituent, the number of years the constituent was sampled for during the five year period, and the number of years the concentration was above and below the objective based on the 10 percent metric.

3.7.5 Surface Water and Groundwater Quality Areal and Temporal Distribution

Figures were developed to depict the areal distribution of surface and groundwater quality in the study area. For each of the groundwater maps, time-history plots of constituent concentrations are also shown for four key wells: Rosenbaum Well 1, Hollywood Well 2A, San Juan Hills Golf Course Well, and SJBA #2. These wells were chosen because of their relatively long time history of water quality data. For each of the groundwater maps, the well symbols denote the maximum concentration of a given constituent for the last five years: 2006 through 2010. Because of the paucity of surface water quality data, the surface water maps depict the maximum concentration over the entire record of data.

Groundwater and surface water quality maps were prepared for following constituents where the MCL was exceeded at 10 percent or more of the groundwater sample during 2006 to 2010: total dissolved solids (TDS); manganese; iron; sulfate; and chloride. Groundwater quality maps only were prepared for methyl-tert-butyl-ether (MTBE), tert-butyl-alcohol (TBA), benezene, and arsenic where the MCL was exceeded in 10 percent or more of samples which were predominantly at wells associated with the known point source contamination monitoring; these maps are discussed in a later section. A nitrate as nitrogen (NO3-N) groundwater map was also prepared because nitrate is a constituent generally used to characterize the overall water quality of a basin and often used in compliance determination.

For the figures that depict water quality distributions in the San Juan Basin, the following convention is followed in setting class intervals in the legend (where WQS is the applicable water quality standard [see table below]).

Water Quality Class Interval Symbology

Symbol	Class Interval
○	Not Detected
🔵	<0.5x WQS, but detected
🟢	0.5x WQS to WQS
🟡	WQS to 2x WQS
🟠	2x WQS to 4x WQS
🔴	> 4x WQS

3.7.5.1 Total Dissolved Solids

TDS comprise inorganic salts dissolved in water; the major ions are sodium, potassium, calcium, magnesium, bicarbonates, chlorides, and sulfates Under Title 22, TDS is regulated as a secondary contaminant; high concentrations of TDS may be objectionable to consumers from an aesthetic standpoint. Secondary MCLs are established as guidelines to assist public water supply agencies in managing drinking water supplies for taste, odor, and color. The California secondary drinking water MCL for TDS is 500 mg/L. The following table lists the drinking water standard, and the surface water and groundwater objectives for TDS:

TDS Concentration Objectives in the Basin Plan

Drinking Water Standard	Hydrologic Area (HA) or Hydrologic Sub Area (HSA)	TDS Objective or MCL (mg/L)
California Secondary MCL		500
	Surface Water	
	Mission Viejo HA	500
	Groundwater	
	Oso HSA	1,200
	Upper Trabuco HSA	500
	Middle Trabuco HSA	750
	Gobernadora HSA	1,200
	Upper San Juan HSA	500
	Middle San Juan HSA	750
	Lower San Juan HSA	1,200
	Ortega HSA	1,100

Figure 3-29 shows the distribution of the maximum TDS concentrations in groundwater in the San Juan Basin from 2006 through 2010 as well as time history plots of the four key wells. All wells exceeded the secondary MCL for TDS, and several wells exceeded the Basin Plan objective for their respective sub areas. Note that there are numerous wells in the study area that do not have recent data (last five years).

Figure 3-30 shows the TDS concentrations in surface water in the San Juan Watershed. With the exception of the upper reaches of Arroyo Trabuco and San Juan Creek, TDS is generally greater than the MCL and the objective for the Mission Viejo HA. TDS is highest in the Oso and the Lower San Juan hydrologic sub areas (HSAs).

The relatively higher TDS in the lower portions of the basin can be attributed to irrigation return flows (agricultural and domestic landscape irrigation), fertilizer use, consumptive use, and the dissolution of ions from weathered rock surfaces and evaporate salts. As water percolates through soil, it dissolves ionic and non-ionic particles from mineral surfaces and exchange sites.

3.7.5.2 Nitrate Nitrogen

Nitrate can be naturally-occurring and it can also be associated with agriculture, septic systems, POTW discharges. Nitrate can be converted into nitrite, especially in the gastrointestinal system of infants; nitrite is a concern because it can interfere with the ability of red blood cells to transmit oxygen, potentially leading to a condition called methemoglobinemia, or "blue-baby syndrome."

The primary MCL for NO3-N in drinking water is 10 mg/L . The following table lists the drinking water standard, and the surface water and groundwater objectives for NO3-N:

Nitrate-Nitrogen Concentration Objectives in the Basin Plan

Drinking Water Standard	Hydrologic Area (HA) or Hydrologic Sub Area (HAS)	Objective or MCL (mg/L)
California Primary MCL		10
	Surface Water	
	Mission Viejo HA	footnote[17]
	Groundwater	
	Oso HSA	10
	Upper Trabuco HSA	10
	Middle Trabuco HSA	10
	Gobernadora HSA	10
	Upper San Juan HSA	10
	Middle San Juan HSA	10
	Lower San Juan HSA	10
	Ortega HSA	10

Figure 3-31 shows the distribution of the maximum nitrate-nitrogen concentrations in groundwater in the San Juan Basin from 2006 through 2010 as well as time history plots of the four key wells. Nitrate is typically below the MCL for wells in the study area with data. The only two wells that exceeded the MCL were the Stonehill well and MW-20A (associated with

[17] "Concentrations of nitrogen and phosphorus, by themselves or in combination with other nutrients, shall be maintained at levels below those which stimulate algae and emergent plant growth." *Ibid.* p. 3-14

Chevron Service Station #9-3417) in the Lower San Juan HSA. The MCL for nitrate was not exceeded at surface water stations in the study area based on the available data.

3.7.5.3 Sulfate

Sulfate is an inorganic compound dissolved in water. Under Title 22, sulfate is regulated as a secondary contaminant; high concentrations of sulfate may be objectionable to consumers from an aesthetic standpoint and may cause diarrhea. The California secondary drinking water MCL for sulfate is 250 mg/L. The following table lists the drinking water standard, and the surface water and groundwater objectives:

Sulfate Concentration Objectives in the Basin Plan

Drinking Water Standard	Hydrologic Area (HA) or Hydrologic Sub Area (HAS)	Objective or MCL (mg/L)
California Secondary MCL		250
	Surface Water	
	Mission Viejo HA	250
	Groundwater	
	Oso HSA	500
	Upper Trabuco HSA	250
	Middle Trabuco HSA	375
	Gobernadora HSA	500
	Upper San Juan HSA	250
	Middle San Juan HSA	375
	Lower San Juan HSA	500
	Ortega HSA	450

Figure 3-32 shows the distribution of the maximum sulfate concentrations in groundwater in the San Juan Basin from 2006 through 2010 as well as time history plots of the four key wells. Most of the wells exceeded the secondary MCL for TDS, and many wells exceeded the Basin Plan objective for their respective sub areas. Note that there are numerous wells in the study area that do not have recent data (last five years).

Figure 3-33 shows the sulfate concentrations in surface water in the San Juan Watershed. With the exception of the upper reaches of Arroyo Trabuco sulfate is generally greater than the MCL and the objective for the Mission Viejo HA. Sulfate is generally highest in the Oso and the Lower San Juan HSAs.

3.7.5.4 Chloride

Chloride is an inorganic constituent dissolved in water and is naturally occurring. Higher concentrations can be associated with consumptive use, marine sediments, and sea water intrusion. Under Title 22, chloride is regulated as a secondary contaminant; high concentrations of chloride may make drinking water taste salty (especially if sodium concentrations are high, there is less of an effect with calcium or magnesium). The California secondary drinking water MCL for sulfate is 250 mg/L. The following table lists the drinking water standard, and the surface water and groundwater objectives for chloride:

Chloride Concentration Objectives in the Basin Plan

Drinking Water Standard	Hydrologic Area (HA) or Hydrologic Sub Area (HAS)	Objective or MCL (mg/L)
California Secondary MCL		250
	Surface Water	
	Mission Viejo HA	250
	Groundwater	
	Oso HSA	400
	Upper Trabuco HSA	250
	Middle Trabuco HSA	375
	Gobernadora HSA	400
	Upper San Juan HSA	250
	Middle San Juan HSA	375
	Lower San Juan HSA	400
	Ortega HSA	375

Figure 3-34 shows the distribution of the maximum chloride concentrations in groundwater in the San Juan Basin from 2006 through 2010 as well as time history plots of the four key wells. Most of the wells exceeded the secondary MCL for TDS, and several wells exceeded the Basin Plan objective for their respective sub areas. Chloride is higher in the Lower San Juan HSA.

Figure 3-35 shows the chloride concentrations in surface water in the San Juan Watershed. Surface water stations along Arroyo Trabuco, Canada Chiquita, Canada Gobernadora, the middle to upper reaches of San Juan Creek all reported samples with chloride concentrations generally below the MCL and basin plan objective. Surface water stations along Oso Creek, Horno Creek, and the lower reaches of San Juan Creek all reported concentrations that were generally greater than the MCL and basin plan objective.

3.7.5.5 Manganese

Manganese is an inorganic constituent dissolved in water and is naturally occurring through the dissolution of manganese-bearing minerals. At low concentrations, manganese is an essential micronutrient. Higher concentrations can be associated with industrial effluent, acid-mine drainage, sewage and landfill leachate. Under Title 22, manganese is regulated as a secondary contaminant; high concentrations of manganese may give drinking water a bitter and metallic taste and may cause staining of clothes. The California secondary drinking water

MCL for manganese is 0.05 mg/L. The following table lists the drinking water standard, and the surface water and groundwater objectives:

Manganese Concentration Objectives in the Basin Plan

Drinking Water Standard	Hydrologic Area (HA) or Hydrologic Sub Area (HAS)	Objective or MCL (mg/L)
California Secondary MCL		0.05
	Surface Water	
	Mission Viejo HA	0.05
	Groundwater	
	Oso HSA	0.05
	Upper Trabuco HSA	0.05
	Middle Trabuco HSA	0.05
	Gobernadora HSA	0.05
	Upper San Juan HSA	0.05
	Middle San Juan HSA	0.05
	Lower San Juan HSA	0.05
	Ortega HSA	0.05

Figure 3-36 shows the distribution of the maximum manganese concentrations in groundwater in the San Juan Basin from 2006 through 2010 as well as time history plots of the four key wells. With the exception of two wells in the Oso and Lower Trabuco HSA, all of the wells exceeded the secondary MCL for manganese by as much as 40 times.

Figure 3-37 shows the manganese concentrations in surface water in the San Juan Watershed. With the exception of the upper reaches of Arroyo Trabuco, Bell Canyon, Canada Chiquita, Canada Gobernadora, and San Juan Creek, manganese is generally greater than the MCL and the objective for the Mission Viejo HA. The surface water station, SN-1A, in the upper reach of Arroyo Trabuco is on a mine adit from a former tin mine that discharges into Arroyo Trabuco.

3.7.5.6 Iron

Iron is an inorganic constituent dissolved in water and is naturally occurring through the dissolution of iron-bearing minerals. At low concentrations, iron is an essential micronutrient. Higher concentrations can be associated with industrial effluent, acid-mine drainage, sewage and landfill leachate. Under Title 22, iron is regulated as a secondary contaminant; high concentrations of iron may give drinking water a bitter and metallic taste and may cause staining of clothes. The California secondary drinking water MCL for iron is 0.3 mg/L. The following table lists the drinking water standard, and the surface water and groundwater objectives:

Iron Concentration Objectives in the Basin Plan

Drinking Water Standard	Hydrologic Area (HA) or Hydrologic Sub Area (HAS)	Objective or MCL (mg/L)
California Secondary MCL		0.3
	Surface Water	
	Mission Viejo HA	0.3
	Groundwater	
	Oso HSA	0.3
	Upper Trabuco HSA	0.3
	Middle Trabuco HSA	0.3
	Gobernadora HSA	0.3
	Upper San Juan HSA	0.3
	Middle San Juan HSA	0.3
	Lower San Juan HSA	0.3
	Ortega HSA	0.3

Figure 3-38 shows the distribution of the maximum iron concentrations in groundwater in the San Juan Basin from 2006 through 2010 as well as time history plots of the four key wells. With the exception of Rosenbaum Well 1 in the Oso HSA, all of the wells exceeded the secondary MCL for manganese by as much as 60 times.

Figure 3-39 shows the iron concentrations in surface water in the San Juan Watershed. With the exception of Arroyo Trabuco, and the upper reaches of San Juan Creek, iron is generally greater than the MCL and the objective for the Mission Viejo HA. The surface water station, SN-1A, in the upper reach of Arroyo Trabuco is on a mine adit from a former tin mine that discharges into Arroyo Trabuco.

3.7.6 Point Sources of Concern/Geo Tracker

The SWRCQ's GeoTracker database was queried interactively using the HydroDaVE Explorer interface to determine if there are any current open cases/sites in the study area. GeoTracker "is the Water Boards' data management system for managing sites that impact groundwater, especially those that require groundwater cleanup (Underground Storage Tanks [USTs], Department of Defense, Site Cleanup Program) as well as permitted facilities such as operating USTs and land disposal sites." Ten point-source contaminant sites were identified within the study area as potentially impacting the groundwater basin in the vicinity of active production wells (Figure 3-40).

3.7.6.1 Ultramar/San Juan Service (GeoTracker Global ID T0605902555)

The Ultramar/San Juan Service site is located at 26572 Junipero Serra Road in San Juan Capistrano. The site is on the southern side of Junipero Serra Road just east of the 5 Freeway. Junipero Serra High School is located south and west of the site. In 1998, five, single-walled USTs were removed, along with the associated fuel dispensers and product piping (Frey, 2005):

- Three 8000-gallon gasoline USTs
- One 12,000-gallon diesel UST
- One 280-galling waste oil UST

TPH, benzene, MTBE, and TBA have been detected in groundwater at concentrations up to 23,000 micrograms per liter (ug/L), 150 ug/L, 34,000 ug/L, and 62,000 ug/L, respectively. In the most recent sampling event reported (August 4, 2010), these constituents were still detected above their MCLs or NLs: 1,000 ug/L, 9.2 ug/L, 14 ug/L and 17,000 ug/L. Figures 3-41, 3-42, and 3-43 show the maximum concentrations of MTBE, TBA, and benzene, respectively, over the past 5 years (2006 to 2010) in the San Juan Basin study area.

3.7.6.2 Former Shell Station (GeoTracker Global ID T0605902592)

The former Shell Station site is located at 27101 Ortega Highway in San Juan Capistrano, CA. In May of 1986 a petroleum hydrocarbon leak was discovered. Several soil investigations occurred between 1987 and 2005. These investigations included installation and sampling of several monitoring wells and soil borings (OCHCA, 2006; MBE, 2006). Significant concentrations of MTBE and TBA were detected in the soils onsite, and in groundwater beneath the site and at offsite wells. Remedial activities at the site included excavation of USTs and surrounding soil, vapor extraction system, and a pump and treat program. TBA and MTBE concentrations decreased over this time. During 2004 and 2005 a mathematical model and HydroPunch groundwater samples collected on the downgradient side of the 5 Freeway concluded that plume would not move more than 450 feet offsite. A submittal for site closure was approved on March 6, 2006 (OCHCA, 2006).

The contaminant plume is characterized by elevated concentrations of MTBE, TBA, and benzene. Concentrations of ethylbenzene and naphthalene were detected above the California or Federal, Primary or Secondary MCLs for drinking water. Figures 3-41, 3-42, and 3-43 show maximum concentrations of MTBE, TBA, and benzene, respectively, over the past 5 years (2006 to 2010) in the San Juan Basin study area. The last groundwater quality monitoring event at the sites monitoring wells was conducted in January 2006. At the cessation of monitoring in 2006 MTBE concentrations ranged from non-detect (<0.5 ug/L) to 59 ug/L, TBA concentrations ranged from non-detect (2 ug/L) to 34,000 ug/L, and benzene concentrations ranged from non-detect (0.5 ug/L) to 1 ug/L.

3.7.6.3 76 Station 5425 (GeoTracker Global ID T0605902561)

The 76 Station 5425 site is located on the south side of the Ortega Highway, east of Interstate 5 in San Juan Capistrano, CA. In 1985, during a UST removal, hydrocarbons were detected in the soil surrounding the UST excavation. Between 1985 and 1994 soil removal and a vapor extraction system were used to remediate the soil and groundwater beneath the site. Several site investigations were conducted from 1986 to 1994. Data from borings drilled in late 1994 within the affected areas resulted in closure of the OCHCA case in late 1995 (TRC, 2006).

In 1998, during a product piping and dispenser island upgrade, hydrocarbons were detected in the soil surrounding the UST excavation. TPH as gasoline and MTBE were detected in the soil under three of the four dispenser sites (TRC, 2006). Between 1998 and 2008 contaminated soil was removed and several soil borings and monitoring wells were drilled to assess soil and groundwater contamination onsite and offsite (TRC, 2006; Delta Consultants, 2010). Groundwater quality monitoring is conducted quarterly at the monitoring wells

The contaminant plume is characterized by elevated concentrations of MTBE, and TBA. Concentrations of ethylbenzene, benzene, toluene, and total xylene were detected above the California or Federal, Primary or Secondary MCLs for drinking water. These constituents have been primarily non-detect since December 2004 with the exception of the sample from September 2009 when all of these constituents were detected in almost all monitoring wells, and one sample of total xylene in late 2005. Maximum concentrations of TPH were reached in 2004 (24,000 ug/L) and have been declining since to primarily non-detect. MTBE concentrations have decreased from a maximum of 8,600 ug/L at one well in 2000 to concentrations of less than 8 ug/L at all sites in late 2010. Figure 3-41 through Figure 3-43 show maximum concentrations of MTBE, TBA, and benzene over the past 5 years (2006 to 2010) in the San Juan Basin study area. MTBE concentrations have ranged from non-detect (<0.5 ug/L) to 1200 ug/L at the sites monitoring wells during 2006 to 2010. TBA concentrations have ranged from non-detect (<10 ug/L) to 6,900 ug/L at the sites monitoring wells during 2006 to 2010. Benzene concentrations have ranges from non-detect (<0.5 ug/L) to 20 ug/L in the sites monitoring wells during 2006 to 2010.

3.7.6.4 Chevron Service Station #9-8719 (GeoTracker Global ID T0605902510)

The Chevron Service Station #9-8719 site is located at 26988 Ortega Highway in San Juan Capistrano, CA. The station began operating in 1967, and is currently still in operation. During UST system upgrades in 1987, TPH as gasoline was detected in the soils beneath the site, resulting in the Orange County Local Oversight Program (OCLOP) opening of case #87UT233. During 1998 to 1993 contaminated soil was removed, and four monitoring wells were constructed and monitored for petroleum hydrocarbons, but not analyzed for MTBE or other oxygenates which were not of concern at the time (HFA, 2011b). The OCLOP case #87UT233 was closed in 1993. During additional facility upgrades in 1995, elevated concentrations of TPH and benezene were detected in soils resulting in the opening of OCLOP case # 95UT002, which was transfer to the San Diego RWQCB in 2009. Between 1995 and 2010, 43 soil borings, 18 groundwater monitoring wells, and 3 soil vapor wells were installed to assess the contamination on and off the site. Results of soil and groundwater sampling indicate that benzene, MTBE, and other constituents are present in soil below the site, and groundwater onsite and offsite to the south. Groundwater monitoring has been conducted quarterly since November 1995.

The contaminant plume is characterized by elevated concentrations of TPH as gasoline, MTBE, TBA, and benzene. Concentrations of 1,2-DCA, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, ethylbenzene, naphthalene, styrene, total xylenes, and toluene above the California or Federal, Primary or Secondary MCLs for drinking water. TPH as gasoline concentrations ranged from non-detect (<22 ug/L) to 25,000 ug/L between 2006 and 2010. MTBE concentrations have been declining since a maximum of 1660 ug/L was reached in 2001 at an onsite well. Figure 3-41 through Figure 3-44 show maximum concentration of MTBE, TBA, benezene, and 1,2-DCA for the past 5 years (2006 to 2010) in the San Juan Basin study area During 2006 to 2010, concentrations of MTBE ranged from non-detect (<0.5 ug/L) to 420 ug/L at the sites monitoring wells; During 2006 to 2010 TBA ranged from non-detect (<2 ug/L) and 4,500 ug/L at the sites monitoring wells. Benzene concentrations ranged from non-detect (<0.5 ug/L) to 1100 ug/L during 2006 to 2010 at the sites monitoring wells. 1,2-DCA concentrations ranged from non-detect (<0.5 ug/L) to 62 ug/L during 2006 to 2010 at the sites monitoring wells.

3.7.6.5 Chevron Service Station #9-3417 (GeoTracker Global ID T0605902379)

The Chevron Service Station #9-3417 site is located at 32001 Camino Capistrano, on the southwest corner of the intersection of Del Obispo Street and Camino Capistrano in San Juan Capistrano, CA. The station began operating in 1972, and is still in operation. Investigation of onsite contamination began in 1988 following a gasoline release from onsite underground storage tanks (USTs). Between 1988 and 1993, four UST were removed, several soil borings were drilled, and cone penetration tests (CPTs) were performed to assess the extent of contamination onsite. (Converse Environmental West, 1993). Between 1988 and 2010 over forty monitoring wells were drilled onsite and offsite to assess the extent of the groundwater contamination. Quarterly monitoring is performed at selected monitoring wells. From 1990 to 1996 soil excavations and soil vapor extractions were used to remove contamination from soils beneath the site. In 2010, an air sparging/soil vapor extraction system was used to remove constituents of concern from soil and groundwater in the source area (HFA, 2011a).

The contaminant plume is characterized by elevated concentrations of MTBE, TBA, benzene, and total petroleum hydrocarbon concentrations (TPH) including gasoline and diesel range organics. Concentrations of 1,2-dicloroethane (1,2-DCA), dibromo-3-chloropropane (DBCP), ethylbenzene, naphthalene, tetrachloroethane (PCE), toluene, and total xylenes were detected above the California or Federal, Primary or Secondary MCLs for drinking water. TPH ranged from 73,000 to 25,000 ug/L in 2010. At the sites monitoring wells MTBE concentrations have ranged from non-detect (<0.5 ug/L) to 370 ug/L, and TBA concentrations ranged from none-detect (<2 ug/L) to 170 ug/L during this time period. Benzene concentrations were as high as 6200 ug/L in 2003 and 2004, but have since declined, ranging from non-detect (<0.5 ug/L) to 890 ug/L between 2006 and 2010.

3.7.6.6 Mobil Station 18372 (GeoTracker Global ID T0605902502)

The Mobil Station 18372 site is located at 33571 Del Obispo Street in Dana Point, at the southwestern corner of Del Obispo Street and Stonehill Drive. There is one 15,000-gallon and one 20,000-gallon USTs, two dispenser islands and associated product piping. The site is located about 2100 feet northwest of SCWD's Stonehill well.

Thirty-two wells for monitoring, soil vapor extraction, air sparging, and nested fluid/vapor recovery. Light Nonaqueous Phase Liquids (LNAPLs) have been observed in on- and off-site monitoring wells from November 1991 through January 2004 (ERI, 2009).

TPH, benzene, MTBE, and TBA have been detected in groundwater at concentrations up to 170,000 ug/L, 4,100 ug/L, 50,000 ug/L, and 13,200 ug/L, respectively. In the most recent sampling event reported (December 14, 2009), these constituents were still detected at the following concentrations: 1,200 ug/L, <1.0 ug/L, 3.1 ug/L and 3.9J ug/L. Figures 3-41, 3-42, and 3-43 show the maximum concentrations of MTBE, TBA, and benzene, respectively, over the past 5 years (2006 to 2010) in the San Juan Basin study area.

3.7.6.7 Former Exxon Station 74816 (GeoTracker Global ID T0605902575)

The Former Exxon Station 74816 site is located at 34295 Doheny Park Road in Capistrano Beach, at the intersection of Las Vegas Avenue and Doheny Park Road. The site is now used as a U-Haul rental facility.

USTs and fuel dispensers from the Former Exxon Station were removed in 1972. Thirteen monitoring wells have been installed along with six triple nested extraction wells. Air sparging and soil vapor extraction to remove hydrocarbons has been conducted. LNAPLs were observed in a monitoring well (off-site monitoring well MW8) for the first time on November 22, 2010 (Cardno ERI, 2011a). Bailing of the NAPL has commenced since February 2011 (Cardno ERI, 2011b).

TPH, benzene, MTBE, and TBA have been detected in groundwater at concentrations up to 19,200 ug/L, 1,480 ug/L, 50,000 ug/L, and 2,000 ug/L, respectively. In the most recent sampling events reported (November 30, 2010), these constituents were still detected at the following concentrations: 3400 ug/L, 93 ug/L, 7.5 ug/L, and 470 ug/L. Figures 3-41, 3-42, and 3-43 show the maximum concentrations of MTBE, TBA, and benzene, respectively, over the past 5 years (2006 to 2010) in the San Juan Basin study area.

3.7.6.8 76 Station #255385 (GeoTracker Global ID T0605902362)

The 76 Station #255385 site is located at 34131 Doheny Park Road in Capistrano Beach, on the northwest corner of the intersection of Doheny Park Road and Victoria Boulevard. The site is currently an active gasoline station.

USTs and fuel dispensers from the 76 station were removed in 1990. Twenty-three monitoring wells have been installed. Soil vapor extraction to remove hydrocarbons was begun in July 1995, but ceased in August 1996 due to low influent concentrations. In 1998, an oxygen releasing compound (ORC) was injected around monitoring well MW-14 to promote bioremediation of petroleum compounds.

In the most recent sampling events reported (August 23, 2010 and November 22, 2010), TPH, benzene, MTBE, and TBA were detected at the following concentrations: 15,000 ug/L, 7.5 ug/L, and 25 ug/L (Antea Group, 2011). Figures 3-41, 3-42, and 3-43 show the maximum concentrations of MTBE, TBA, and benzene, respectively, over the past 5 years (2006 to 2010) in the San Juan Basin study area.

3.7.6.9 76 Station 7329 (GeoTracker Global ID T0605902573)

The 76 Station 7329 site is located at 34306 Pacific Coast Highway in Dana Point, at the northern corner of Del Obispo Street and Pacific Coast Highway. The site is an active service station with two 15,000-gallon gasoline USTs and one 12,000-gallon diesel UST, along with associated product piping and dispensing equipment.

Twenty-eight monitoring wells have been installed to date, along with five double nested sets of wells. Remedial activities have included dual phase extraction, oxygen and ozone injection pilot testing.

In 2009, OCHCA requested an Interim Remedial Action Plan because of the possibility of the dissolved-phase petroleum compounds impacting the desalinization pump test proposed by MWDOC. In May and June of 2010 URS installed 20 dual-nested ozone injection points to form a "reactive barrier" and to prevent dissolved-phase petroleum compounds from reaching the desalination well.

URS (2011) reports the current maximum concentrations of TPH, benzene, MTBE, and TBA to be: 29,000 ug/L, 1,600 ug/L, 4,400 ug/L, and 52,000 ug/L. Figures 3-41, 3-42, and 3-43 show the maximum concentrations of MTBE, TBA, and benzene, respectively, over the past 5 years (2006 to 2010) in the San Juan Basin study area.

3.7.6.10 ARCO Facility #0447 (GeoTracker Global ID T0605902526)

The ARCO Facility #0447 site is located at 34342 Pacific Coast Highway in Dana Point. The site is an active service station with three 12,000-gallon gasoline USTs (replacing the previous three 12,000-gallon singled-walled fiberglass USTs) along with associated product piping and dispensing equipment.

Twenty single completion monitoring wells have been installed to date, along with five double nested sets of wells. Remedial activities have included dual phase extraction, oxygen and ozone injection pilot testing.

In 2009, OCHCA requested an Interim Remedial Action Plan because of the possibility of the dissolved-phase petroleum compounds impacting the desalinization pump test proposed by MWDOC. In May and June of 2010 URS installed 20 dual-nested ozone injection points to form a "reactive barrier" and to prevent dissolved-phase petroleum compounds from reaching the desalination well.

Arcadis (2011) reports the current maximum concentrations of Gasoline Range Organics (GRO), benzene, MTBE, and TBA to be: < 50 ug/L, <0.5 ug/L, 4.8 ug/L, and <25 ug/L. Figures 3-41, 3-42, and 3-43 show the maximum concentrations of MTBE, TBA, and benzene, respectively, over the past 5 years (2006 to 2010) in the San Juan Basin study area.

3.8 Water Supply and Distribution

Due to limited groundwater supplies, the SJBA members obtain most of its water supply (about 92 percent of potable and 78 percent of total demands) from imported water sources. The table below lists the estimated total water demand for each agency and the amount of water supplied from imported, recycled and native sources for fiscal 2010 (Section 4 presents a more rigorous discussion of water demands and supplies for the recent past and for the future through 2035).

Water Demand and Supply within the SJBA Service Area in 2010[18]

Water Agency	Total Water Demand (acre-ft/yr)	Water Supply (acre-ft/yr)		
		Native Potable Water	Recycled/ Non-Potable Water	Imported Water
MNWD	36,593	-	6,858	29,735
CSJC	8,783	1,980	434	6,379
SMWD	34,169	65	6,027	28,077
SCWD	6,909	634	826	5,449
Total	86,454	2,679	14,145	69,640

3.8.1 Native Water Supply

The native groundwater supply in the SJBA service area is limited by availability and production capacity in the upper reaches of the basin, and by availability and water quality in the lower portions of the basin. SJBA member agencies produce potable native groundwater from two potable groundwater wells and two desalting facilities. Figure 3-45[19] shows the potable water infrastructure in the San Juan Basin Area. A summary of native water supply sources and their capacity is shown the table below.

Potable Native Groundwater Supply in the SJBA Service Area

Source	Water Agency	Production Capacity		Estimated Future Capacity	
		mgd	acre-ft/yr	mgd	acre-ft/yr
Potable Wells					
Rosenbaum No. 1	CSJC	0.58	650	0.58	650
North Open Space	CSJC	0.47	526	0.47	526
Desalters					
San Juan Basin Desalter	CSJC	5.1	5,713	5.1	5,713

[18] Sources include SJBA members agencies and MWDOC. See Section 4 and more specifically Table 4-1.

[19] Many of the maps contained in this planning document refer to the SJBA service area as the union of the SJBA member agencies service area. For clarity, the SJBGFMP contains management activities for surface and ground waters within the San Juan Creek watershed exclusively in the lower part of the watershed. The SJBGFMP management activities provide direct benefits to the SJBA member agencies. The service area boundaries of the SJBA member agencies extend beyond the boundaries of the watershed. This means that while the management activities of SJBGFMP occur within the San Juan Creek watershed (and exclusively in the lower part of the watershed), that the direct benefits of the management program can reach beyond the watershed, principally the service areas of the SJBA member agencies and the State.

Source	Water Agency	Production Capacity		Estimated Future Capacity	
		mgd	acre-ft/yr	mgd	acre-ft/yr
Capistrano Beach Desalter	SCWD	0.80	900	1.6	1,776
Total Capacity		6.95	7,789	7.75	8,665

3.8.1.1 Potable Groundwater Wells

The CSJC operates two potable groundwater wells, Rosenbaum Well No. 1 and the North Open Space Well. Several other groundwater wells were operated by CSJC in the past, but they have abandoned or converted to non-potable supply wells.

Rosenbaum Well No. 1. The Rosenbaum Well No. 1 was constructed in 1957 and is located in the upper reaches of the Lower Trabuco subbasin. It has a production capacity of 400 gpm (0.58 million gallons per day (mgd). The water is chlorinated at the wellhead and pumped directly into the distribution system.

North Open Space Well. The North Open Space Well was constructed in 2000 and is also located in the upper reaches of the Lower Trabuco subbasin. It has a maximum production capacity of 325 gpm (0.47 mgd) with actual capacity dependent on groundwater levels. The well is equipped with a variable frequency drive that allows the well to vary production based on the availability of groundwater. The water is chlorinated at the wellhead and pumped directly into the distribution system.

Additional Wells. The CSJC owns several other wells, as mentioned above, that have been abandoned or converted to non-potable wells due to declining production and water quality. These wells included Rosenbaum Well No. 2, Hollywood Well 2A, and the Mission Street Well.

3.8.1.2 Groundwater Desalting Facilities

A portion of the potable water delivered is produced from local desalters that were constructed and operated by the CSJC and SCWD.

San Juan Basin Groundwater Recovery Plant. The San Juan Basin Groundwater Recovery Plant was constructed in 2005 and is operated by CSJC. The facility is located in the Lower San Juan subbasin and is fed by several groundwater wells surrounding the plant. The plant consists of iron and manganese removal followed by two reverse osmosis (RO) trains capable of producing 5.1 mgd of potable water. The facility provides half of the CSJC water needs in the summer and almost all of the demand in the winter.

Capistrano Beach Groundwater Recovery Facility. The Ground Water Recovery Facility was constructed in 2007 and is operated by the SCWD. The treatment facility is fed by a single groundwater well and consists of RO treatment and Iron and Manganese Removal. A portion of the influent groundwater is sent to RO treatment process to remove dissolved solids.

Another portion bypasses the RO and is treated to remove iron and manganese. The RO permeate and bypass are recombined to produce 0.71 mgd of potable water.

3.8.2 Water Distribution

Each of the SJBA member agencies operate their own water distributions systems. The distributions systems consist of pipelines, pump stations, and reservoirs.

Moulton Niguel Water District. The MNWD operates and maintains over 700 miles of distribution piping, 28 potable water reservoirs with a total capacity of 69.7 MG, and 27 booster pump stations. These separate systems are interconnected and can be used to exchange water among the agencies.

City of San Juan Capistrano. The CSJC operates approximately 180 miles of pipelines, 10 reservoirs ranging in size from 0.21 million gallons to 10.11 million gallons, and twelve booster pump stations.

Santa Margarita Water District. The SMWD operates and maintains over 1,200 miles of water and sewer lines, 29 potable water reservoirs, and 20 booster pump stations.

South Coast Water District. The SCWD operates approximately 150 miles of watermains, 14 potable water reservoirs with a total capacity of 21.9 million gallons, and 9 booster pump stations

3.8.2.1 Bradt Reservoir

The Bradt Reservoir is a large regulating and terminal reservoir, located at the end of the JTM. The reservoir serves several water agencies, including SCWD, MNWD, and CSJC.

3.8.2.2 Upper Chiquita Reservoir

The Upper Chiquita Reservoir was recently constructed and came on line in 2012. The Upper Chiquita Reservoir has the capacity to store 244 million gallons (750 acre-ft) of domestic water. The reservoir is designed to supply drinking water in the event of an emergency or service disruption and will provide water to approximately 500,000 residents for one week.

3.9 Wastewater Collection, Treatment and Disposal

Each of the individual agencies operate their own wastewater collection systems, but many of the treatment facilities are jointly owned. There are a total of seven wastewater treatment facilities within the SJBA service area and four of them are managed and operated by SOCWA. A few of these facilities treat water to Title 22 standards for irrigation water. The water that is not recycled is discharged to the ocean through two ocean outfalls operated by the SOCWA.

3.9.1 Wastewater Collection

Each of the SJBA member agencies operate their own wastewater collection systems. The collection systems consist of gravity sewer, forcemains, and lift stations.

Moulton Niguel Water District. The MNWD maintains approximately 530 miles of sewers ranging in size from 8 inches to 33 inches and nineteen lift stations.

City of San Juan Capistrano. The CSJC maintains 120 miles of collection piping ranging up to 27 inches in diameter and two lift stations.

Santa Margarita Water District. The SMWD maintains over 1,200 miles of water and sewer lines and nineteen lift stations.

South Coast Water District. The SCWD maintains 140 miles of sewer ranging in size from 6 – 24 inches, three miles of force mains, and fourteen lift stations. The SCWD's lift station #2 is designed for a capacity of 2,200 gpm and is used to pump wastewater to the Coastal Treatment Plant.

3.9.2 Wastewater Treatment

There are seven wastewater treatment facilities within the SJBA service area. A summary of wastewater treatment plants and their liquid and solids capacities are shown in the table below, and their locations are shown on Figure 3-46[20].

Wastewater Treatment Facilities within the SJBA

Treatment Facility	Water Agency	Operated By	Capacity (mgd)	
			Liquid	Solid
Jay B. Latham Regional Treatment Plant	MNWD, CSJC, SMWD, SCWD	SOCWA	13	18.5
Joint Regional Treatment Plant	MNWD	SOCWA	12	24
Coastal Treatment Plant	MNWD, SCWD	SOCWA	6.7	-[21]
Plant 3A Water Reclamation Plant	MNWD, SMWD	SOCWA	8.0	8.0
Oso Creek Water Reclamation Plant	SMWD	SMWD	3.0	-[22]

[20] Many of the maps contained in this planning document refer to the SJBA service area as the union of the SJBA member agencies service area. For clarity, the SJBGFMP contains management activities for surface and ground waters within the San Juan Creek watershed exclusively in the lower part of the watershed. The SJBGFMP management activities provide direct benefits to the SJBA member agencies. The service area boundaries of the SJBA member agencies extend beyond the boundaries of the watershed. This means that while the management activities of SJBGFMP occur within the San Juan Creek watershed (and exclusively in the lower part of the watershed), that the direct benefits of the management program can reach beyond the watershed, principally the service areas of the SJBA member agencies and the State.

[21] Solids are sent to the Joint Regional Treatment Plant for Processing.

[22] Waste solids and filter backwash are sent to the Jay B. Latham Regional Treatment Plant for treatment.

Treatment Facility	Water Agency	Operated By	Capacity (mgd)	
			Liquid	Solid
Chiquita Water Reclamation Plant	SMWD	SMWD	9.0	9.0
Nichols Institute Water Reclamation Plant	SMWD	SMWD	0.086	-[23]
Total Capacity			51.8	59.5

3.9.2.1 Jay B. Latham Regional Treatment Plant

The Jay B. Latham Regional Treatment Plant is a conventional activated sludge secondary treatment facility managed by SOCWA. The plant has a liquid treatment capacity of 13 mgd and a solids handling capacity of 18.5 mgd. The treatment plant processes include screening, grit removal, primary clarification, and activated sludge secondary treatment. The plant also has chlorination facilities that are used to manage microbial growth. All four SJBA member agencies own capacity in the Jay B. Latham Regional Treatment Plant. Currently, all treated effluent is discharged to the ocean through the San Juan Creek Outfall.

3.9.2.2 Joint Regional Treatment Plant

The Joint Regional Treatment Plant (JRTP) is located in Laguna Niguel and is designed for a liquid treatment capacity of 12.0 mgd and a solids handling capacity of 24.0 mgd. MNWD owns 12.0 mgd of liquid capacity and 14 mgd of solids capacity. The JRTP is a conventional activated sludge secondary treatment plant that include screening, aerated grit removal, primary sedimentation, and activated sludge secondary treatment and is managed by SOCWA. A portion of the secondary effluent is sent to an advanced water treatment facility where it is treated to Title 22 standards for irrigation water. The treated secondary effluent not used for irrigation is discharged to the Aliso Creek Ocean Outfall.

3.9.2.3 Coastal Treatment Plant

The Coastal Treatment Plant is a conventional activated sludge secondary treatment facility managed by SOCWA. The plant has a liquid treatment capacity of 6.7 mgd and pumps its solids to the JRTP through a force main for processing. The treatment plant processes include screening, aerated grit removal, primary sedimentation, and activated sludge secondary treatment. Secondary effluent can be sent to an advanced water treatment plant to be treated to Title 22 standards for irrigation or discharged to the ocean through the Aliso Creek Ocean Outfall.

3.9.2.4 Plant 3A Water Reclamation Plant

The Plant 3A Water Reclamation Plant is a conventional activated sludge secondary treatment facility managed by SOCWA. The plant has a liquid treatment capacity of 8.0 mgd and a solids treatment capacity of 8.0 mgd. Capacity in this plant is owned by the MNWD and SMWD and

[23] Solids are trucked to the Chiquita Water Reclamation Plant for treatment and disposal.

is located in Mission Viejo. The treatment plant processes include screening, aerated grit removal, primary sedimentation, and activated sludge secondary treatment. Secondary effluent can be sent to an advanced water treatment plant to be treated to Title 22 standards for irrigation or discharged to the ocean through the San Juan Creek Ocean Outfall

3.9.2.5 Oso Creek Water Reclamation Plant

The Oso Creek Water Reclamation Plant is located in Mission Viejo and is an activated sludge treatment facility. The treatment plant processes include microscreening and activated sludge secondary treatment.. The plant is owned and operated by SMWD. Secondary effluent can be sent to an advanced water treatment plant to be treated to Title 22 standards or to the Jay B. Latham Regional Treatment Plant for further treatment and discharge to the ocean. Waste solids and filter backwash are discharged to the sewer and transported to the Jay B. Latham Regional Treatment Plant for treatment.

3.9.2.6 Chiquita Water Reclamation Plant

The Chiquita Water Reclamation Plant is located east of San Juan Capistrano and treats 7.5 million gallons per day. The plant is owned and operated by SMWD and has a liquid treatment capacity of 9.0 mgd and a solids handling capacity of 9.0 mgd. The treatment plant processes include screening, grit removal, primary sedimentation, and conventional activated sludge secondary treatment. Of the 7.5 mgd treated, 5.0 mgd is sent to an advanced water treatment plant to be treated to Title 22 standards for irrigation. The treated secondary effluent not used for irrigation is discharged to the ocean through the San Juan Creek Ocean Outfall.

3.9.2.7 Nichols Institute Water Reclamation Plant

The SMWD owns and operates the Water Reclamation Plant (WRP) at the Nichols Institute. The existing plant has a design capacity of 86,000 gpd. The treatment plant processes include conventional activated sludge secondary treatment, tertiary filtration, and disinfection. Waste activated sludge (WAS) is trucked to the Chiquita Water Reclamation Plant for digestion and disposal. Disinfected effluent is stored in a holding pond and used for irrigation.

3.9.3 Effluent Disposal

Treated secondary effluent from the treatment plants within the SJBA service area is disposed of through two ocean outfalls: the Aliso Creek Ocean Outfall and the San Juan Creek Ocean Outfall. Both outfalls are owned and operated by the SOCWA.

3.9.3.1 NPDES Permits

Treated secondary effluent from the treatment plants within the SJBA service area are regulated by two NPDES permits, one for each outfall. The effluent limitations for major constituents and properties of wastewater are shown in in the table below.

Effluent Limitations for Major Constituents of Wastewater

Outfall	NPDES Permit No.	CBOD (mg/L)[24]	TSS (mg/L)	Oil & Grease (mg/L)	Settleable Solids (ml/L)	Turbidity (ntu)	pH	Acute Toxicity (TUa)
		Weekly Average (7 day)						
		40	45	40	1.5	100	6.0-9.0	2.0
		Maximum at Any Time						
		45	50	75	3.0	225	6.0-9.0	2.5

3.9.3.2 San Juan Creek Ocean Outfall

San Juan Creek Ocean Outfall. The San Juan Creek Ocean Outfall discharges effluent from the Jay B. Latham Regional Treatment Plant, Chiquita Reclamation Plant, Oso Creek Water Reclamation Plant, and the Plant 3A Water Reclamation Plant. The outfall was constructed in 1978 and extends 10,550 feet southwesterly from Doheny State Beach. The first 216 feet of the diffuser are collinear with the outfall then the remaining 1,272 feet of diffuser extends northwesterly. The depth of the diffuser is approximately 100 ft. The San Juan Creek Outfall has a design capacity of 36.8 mgd.

3.10 Non-Potable Water Supplies and Demand

The member agencies of the SJBA have been developing recycled water and non-potable water infrastructure to provide irrigation water and reduce their dependence on imported water. Irrigation water comes from three different sources within the SJBA: wastewater, non-potable groundwater, and runoff. The non-potable groundwater and runoff are considered to be native sources of irrigation water, while the tertiary treated wastewater is considered to be a supplemental source.

3.10.1 Recycled Water Supplies

Six of the seven wastewater treatment plants have advanced water treatment (AWT) facilities that are capable of producing tertiary Title 22 effluent suitable for irrigation. A summary of the advanced water treatment plants and their Title 22 irrigation water capacities is shown in table below.

[24] For the JBLRTP the ratio of CBOD to BOD is approximately 0.6.

Advanced Water Treatment Facilities within the SJBA

Treatment Facility	Water Agency	Capacity	
		mgd	acre-ft/yr
Joint Regional Treatment Plant	MNWD	11.4	12,770
Coastal Treatment Plant	SCWD	2.6	2,912
Plant 3A Water Reclamation Plant	MNWD	2.4	2,688
Oso Creek Water Reclamation Plant	SMWD	3.0	3,360
Chiquita Water Reclamation Plant	SMWD	5.0	5,600
Nichols Institute Water Reclamation Plant	SMWD	0.086	96
Total Capacity		24.5	27,426

Title 22 irrigation water capacities within the San Juan Basin are about twice the current demand (14,145 acre-ft/yr) for non-potable demands. Some of this excess Title 22 capacity will be used to satisfy future increased non-potable demands and some could be used for indirect potable reuse thereby replacing imported water.

AWT Facility at the Joint Regional Treatment Plant. The AWT facility at the Joint Regional Treatment Plant is designed for a capacity of 11.4 mgd. The plant consists of chemical addition, coagulation, filtration, and chlorine disinfection and supplies Title 22 irrigation water to the MNWD service area.

AWT Facility at the Coastal Treatment Plant. The AWT facility at the Coastal Treatment Plant has a capacity of 2.6 mgd and supplies Title 22 irrigation water to the SCWD. The SCWD can also supply 1.4 mgd of reclaimed water to the MNWD from the AWT facility. The plant consists of chemical addition, coagulation, filtration, and chlorine disinfection.

AWT Facility at Plant 3A. The AWT facility at Plant 3A has a design capacity of 2.4 mgd and supplies Title 22 irrigation water to the MNWD. The plant consists of tertiary filtration and chlorine disinfection.

Oso Creek Water Reclamation Plant. The Oso Creek Water Reclamation Plant has the capacity to produce 3.0 mgd of Title 22 irrigation water for the SMWD. The plant consists of tertiary filtration and chlorine disinfection. The reclamation plant was designed to treat water needed for irrigation and does not have a direct connection to either of the ocean outfalls. Treated irrigation water is pumped to the Upper Oso Reservoir for storage and reuse.

Chiquita Water Reclamation Plant. The Chiquita Water Reclamation Plant currently treats 7.5 mgd of wastewater, of that, 5 mgd is treated to Title 22 standards for irrigation water and distributed throughout the SMWD. The plant consists of tertiary filtration and chlorine disinfection.

Nichols Institute Water Reclamation Plant. The Nichols Institute Water Reclamation Plant is a small plant designed to serve the Nichols Institute. All wastewater is treated to Title 22 standard for irrigation and pumped to a storage pond for use as irrigation water.

3.10.2 Native Irrigation Water Supplies

Within the SJBA, native irrigation water is delivered from non-potable groundwater wells and urban runoff barriers. A summary of native groundwater sources and their capacities is shown in the table below.

Native Irrigation Water Sources within the SJBA

Source	Water Agency	Capacity	
		mgd	acre-ft/yr
Non-Potable Wells			
Mission Street Well	CSJC	0.29[25]	325
Hollywood Well No. 2A	CSJC	0.43	482
Urban Runoff Barriers			
Oso Creek Barrier	SMWD	1.0	1,120
Dove Canyon Barrier	SMWD	0.18	200
Horno Creek Barrier	SMWD	0.29	322
Total		3.27	3,659

3.10.2.1 Non-Potable Wells

The CSJC operates three non-potable wells to supply irrigation water to fifteen customers: the Mission Street Well, Hollywood Well No. 2A, and Well 5. Currently, Well 5 is not used due to high iron and manganese levels.

3.10.2.2 Urban Runoff Barriers

There are currently three urban runoff barriers in operation and one under development within the SJBA service area. The barriers are designed to intercept and reuse urban runoff before entering and polluting sensitive environmental areas.

Oso Creek Barrier. The Oso Creek Barrier was constructed in the late 1970s and is designed to collect dry-weather urban-runoff within Oso Creek. The barrier consists of a water diversion structure, pump station, pressure discharge pipeline, and a gravity pipeline.

Dove Canyon Barrier. The Dove Canyon Barrier is designed to collect urban runoff from the Dove Canyon community before entering the environmentally sensitive Starr Ranch

[25] The Mission Street Well can only produce 50 gpm when operating at the same time as Hollywood Well No. 2A.

Sanctuary. The collected runoff is used for irrigation of nearby golf courses and parks. The Trabuco Canyon Water District (TCWD) owns and operates the barrier and the reclaimed water is shared by TCWD and SMWD.

Horno Creek Barrier. Horno Creek Barrier treats urban runoff from the Ladera Ranch community in a constructed wetland. The barrier provides reclaimed water to the SMWD.

3.10.3 Non-Potable Water Storage and Distribution

Each agency in the SJBA owns and maintains its own recycled water distribution system. The distribution systems consist of pipeline, pump stations, and reservoirs. Figure 3-47[26] shows the location of major storage reservoirs and back bone irrigation infrastructure.

Moulton Niguel Water District. The MNWD has constructed approximately 140 miles of recycled water distribution pipeline, 11 reservoirs with a total capacity of 18.7 million gallons, and 12 recycled water pump stations.

City of San Juan Capistrano. The CSJC maintains 54,000 ft of recycled water pipeline and one 500,000-gallon reservoir.

Santa Margarita Water District. The SMWD has over 2,500 irrigation water connections and operates 7 irrigation water reservoirs. The SMWD owns the Upper Oso Reservoir, which is one of the largest recycled water reservoirs in Orange County. The reservoir has the capacity to hold 1.3 billion gallons (4,000 acre-ft) of non-potable water and helps to conserve over a billion gallons (3,100 acre-ft) of drinking water each year.

South Coast Water District. The SCWD maintains fifteen miles of recycled water pipeline, three pump stations, and three recycled water reservoirs with a total capacity of 7.0 million gallons.

[26] Many of the maps contained in this planning document refer to the SJBA service area as the union of the SJBA member agencies service area. For clarity, the SJBGFMP contains management activities for surface and ground waters within the San Juan Creek watershed exclusively in the lower part of the watershed. The SJBGFMP management activities provide direct benefits to the SJBA member agencies. The service area boundaries of the SJBA member agencies extend beyond the boundaries of the watershed. This means that while the management activities of SJBGFMP occur within the San Juan Creek watershed (and exclusively in the lower part of the watershed), that the direct benefits of the management program can reach beyond the watershed, principally the service areas of the SJBA member agencies and the State.

Table 3-1 Precipitation Gauging Stations In and Around the San Juan Creek Basin

Station Number	Station Name	Location				Period of Record		Operator	Annual Precipitation (inches/yr)		
		Latitude (dms)	Longitude (dms)	Elevation (feet)	San Juan Basin	Start Year	End Year		Minimum	Maximum	Average
Inactive Precipitation Stations											
50	El Toro - Moulton Ranch	33-36-26	117-42-08	375	Outside	1877	1972	Private Observer			
56	Irvine - Baudino Ranch	33-38-56	117-42-35	355	Outside	1911	1975	The Irvine Co.			
81	Trabuco Canyon - Robinson	33-39-12	117-34-14	1,150	Inside	1926	1967	Private Observer			
82	Bell Canyon - Hare and Starr Ranch	33-38-00	117-34-00	1,250	Inside	1930	1946	Private Observer			
86	San Juan Capistrano - Hankey	33-30-45	117-38-16	150	Inside	1905	1977	Private Observer			
92	San Juan Substation	33-30-44	117-39-56	160	Inside	1923	1976	Private Observer			
104	Trabuco Canyon - Refractory	33-40-24	117-34-48	1,500	Inside	1932	1941	Private Observer			
130	El Toro - Alios Ranch	33-39-50	117-40-05	640	Outside	1929	1977	Private Observer			
133	Trabuco Canyon (Trabuco Canyon)	33-39-26	117-36-00	970	Inside	1939		NWS/OCRDMD			
134	San Juan Guard Station	33-35-30	117-30-47	728	Inside	1939		NWS/OCRDMD			
151	Aliso Canyon - Cook's Corner	33-40-59	117-37-12	1,080	Outside	1945	1975	Private Observer			
164	Capistrano Beach	33-28-03	117-41-02	20	Inside	1955	1988	OCRDMD			
181	Modjeska Canyon - McArthur	33-42-28	117-37-39	1,300	Outside	1963	1993	Private Observer			
182	Hincky Canyon - Joplin Boys Ranch	33-40-43	117-34-23	1,720	Inside	1963	1974	Private Observer			
192	El Cariso Guard Station	33-39-00	117-24-43	2,660	Inside	1965	1997	NSFS/RCFCWCD			
201	Mission Viejo Cow Camp	33-31-21	117-35-31	300	Inside	1969	1989	Private Observer			
203	Moulton Niguel Water District	33-34-41	117-40-23	300	Inside	1969	1985	Water District Personnel			
207	Coto de Caza	33-35-14	117-35-05	970	Inside	1971	1988	Private Observer			
211	Laguna Niguel-South County Garage	33-31-29	117-42-58	350	Outside	1973	1988	O.C. Garage Personnel			
221	San Juan Capistrano - Lacouague	33-30-33	117-37-55	140	Inside	1979	1988	OCRDMD/Priv Observer			
Active Precipitation Stations											
100	Laguna Beach Treatment Plant (Laguna)	33-32-49	117-46-53	50	Outside	1928	Present	NWS/City of Laguna Beach	4.05	35.11	12.42
206	Trabuco Forestry (Trabuco Canyon)	33-39-15	117-35-34	970	Inside	1971	Present	O.C. Fire Authority	4.87	43.58	19.61
216	Sulphur Creek Dam (Laguna Niguel)	33-32-59	117-42-20	200	Outside	1974	Present	OCRDMD	3.54	35.32	14.21
176	El Toro (Lake Forest)	33-37-39	117-41-26	445	Outside	1964	Present	OCRDMD	2.58	38.58	14.79
208	Santiago Peak	33-42-06	117-32-01	5,638	Inside	1949	Present	OCPW	8.04	106.15	33.37
186	Palisades Reservoir (San Clemente)	33-27-46	117-39-02	360	Outside	1965	Present	Private Observer	4.13	28.70	12.99

Source: County of Orange, Resources and Development Management Department

Table 3-2 USGS Stream Flow Gauges in the San Juan Basin

Site Number	Site Name	Location					Record	
		Latitide (dms)	Longigude (dms)	Altitude (ft)	Dranage (sq mile)	San Juan Basin	Begin	End
11046400	SAN JUAN C A CASPER REG PRK NR SAN JUAN CAPISTRANO	33-34-25	117-32-29	515	42.1	Inside	10/6/00	9/25/01
11046500	SAN JUAN C NR SAN JUAN CAPISTRANO CA	33-31-08	117-37-30	150	106	Inside	10/1/28	9/30/69
11046501	SAN JUAN C AND CWC CANAL NR SAN JUAN CAPISTRANO CA	33-29-30	117-39-47		117	Inside	10/1/54	9/30/69
11046530	SAN JUAN C AT LA NOVIA ST BR AT SAN JUAN CAPIS CA	33-30-09	117-38-53		109	Inside	10/1/85	Present
11046550	SAN JUAN C AT SAN JUAN CAPISTRANO CA	33-29-30	117-39-47		117	Inside	10/1/69	9/30/85
11047000	ARROYO TRABUCO NR SAN JUAN CAPISTRANO CA	33-31-36	117-40-11	180	35.7	Inside	10/1/30	9/30/81
11047200	OSO C A CROWN VALLEY PKWY NR MISSION VIEJO CA	33-33-29	117-40-36		14	Inside	12/1/69	9/30/81
11047300	ARROYO TRABUCO A SAN JUAN CAPISTRANO CA	33-29-54	117-39-57	80	54.1	Inside	10/1/72	Present
11047350	SAN JUAN C A STONEHILL DRIVE NR DANA POINT CA	33-28-26	117-40-43	20	174	Inside	10/6/98	9/26/03
11047500	ALISO C A EL TORO CA	33-37-34	117-41-06	440	7.91	Outside	10/1/30	9/30/80
11047700	ALISO C A SOUTH LAGUNA CA	33-30-43	117-44-52		34.4	Outside	10/1/82	9/30/87
11046310	SAN MATEO C NR SAN ONOFRE CA	33-25-10	117-31-53		91.9	Outside	10/1/50	9/30/52
11046350	CRISTIANITOS C NR SAN CLEMENTE CA	33-26-57	117-34-16	165	29	Outside	10/1/50	9/30/67
11046358	S CH CRISTIANITOS C AB SAN MATEO C NR SN CLMNTE CA	33-25-35	117-34-13	90		Outside	10/1/93	2/6/98
11046359	N CH CRISTIANITOS C AB SAN MATEO C NR SN CLMNTE CA	33-25-35	117-34-13	90		Outside	10/1/93	2/24/98
11046360	CRISTIANITOS C AB SAN MATEO C NR SAN CLEMENTE CA	33-25-35	117-34-13	90	31.6	Outside	10/1/93	Present
11046370	SAN MATEO C A SAN ONOFRE CA	33-23-28	117-35-26	20	132	Outside	10/1/46	6/6/02

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Table 3-3 Annual Groundwater Production within San Juan Basin Authority

Well Name	Kinoshita	Tirador	SJBA-4	SJBA-2	CVWD-1	Dance Hall	Stonehill	CVWD # 5	SJHGC-Small	SJHGC-Large	The Oaks	La Couague	Arroyo Trabucco Golf Course	Schuller	Sycamore Stables	Egan Tract-3	Rosenbaum 1	Rosenbaum 2	North Open Space(NOS)	Hollywood 2A	Mission Street	Total Groundwater Production [acre-ft]		
Basin	Lower Basin [acre-ft]							Middle Basin [acre-ft]					Arroyo Trabuco Basin [acre-ft]									Lower Basin	Middle Basin	Arroyo Trabuco Basin
1979	0	0	0	0	0	0	0	0	19	29	54	81	0	55	54	41	292	310	0	0	0	0	183	752
1980	0	0	0	0	0	0	0	0	78	116	81	122	0	83	81	62	506	660	0	0	0	0	397	1,393
1981	0	0	0	0	0	0	0	0	78	116	81	122	0	83	81	62	364	584	0	0	0	0	397	1,174
1982	0	0	0	0	0	0	0	0	80	121	81	122	0	83	81	62	550	550	0	0	0	0	404	1,325
1983	0	0	0	0	0	0	0	0	78	116	81	122	0	83	81	62	517	546	0	136	0	0	397	1,425
1984	0	0	0	0	0	0	0	0	80	121	81	122	0	83	81	62	377	549	0	377	0	0	404	1,528
1985	0	0	0	0	0	0	0	0	78	116	81	122	0	83	81	62	499	476	0	447	0	0	397	1,648
1986	0	0	0	0	0	0	0	0	79	118	81	122	0	83	81	62	637	699	0	418	0	0	400	1,980
1987	0	0	0	25	0	0	0	0	78	116	81	122	0	83	81	62	586	435	0	133	0	25	397	1,379
1988	0	0	0	163	0	0	0	0	122	184	81	122	0	83	81	62	583	384	0	657	0	163	509	1,850
1989	0	0	0	383	0	0	0	0	122	184	81	122	0	83	81	62	539	327	0	470	0	383	509	1,562
1990	0	0	0	292	0	0	0	0	122	184	81	122	0	83	81	62	501	339	0	429	0	292	509	1,495
1991	0	0	0	251	0	0	0	87	122	184	81	122	0	83	81	62	591	469	0	332	0	251	596	1,619
1992	0	0	0	144	0	0	0	159	122	184	81	122	0	83	81	62	593	633	0	312	0	144	668	1,763
1993	0	0	0	94	0	0	0	105	122	184	81	122	0	83	81	62	577	717	0	266	0	94	615	1,786
1994	0	0	0	70	0	0	0	76	122	184	81	122	0	83	81	62	588	312	0	324	0	70	585	1,449
1995	0	0	0	50	0	0	0	0	122	184	81	122	0	83	81	62	706	336	0	331	7	50	509	1,606
1996	0	0	0	55	0	0	0	0	122	184	81	122	0	83	81	62	697	27	0	379	236	55	509	1,566
1997	0	0	0	84	0	0	0	0	122	184	81	122	0	83	81	62	686	31	0	459	289	84	509	1,691
1998	0	0	0	12	0	0	0	0	122	184	81	122	0	83	81	62	375	226	0	88	118	12	509	1,033
1999	0	0	0	58	0	0	0	0	122	184	81	122	0	83	81	62	612	0	263	364	117	58	509	1,581
2000	0	0	0	58	0	0	0	0	122	184	81	122	0	83	81	62	612	0	263	364	117	58	509	1,581
2001	0	0	0	3	0	0	0	0	122	184	81	122	0	83	81	62	677	0	136	304	0	3	509	1,343
2002	0	0	0	4	0	0	0	0	122	184	81	122	405	83	81	62	223	0	0	342	0	4	509	790
2003	0	0	0	4	0	0	0	0	122	184	81	122	405	83	81	62	416	0	384	123	4	4	509	1,153
2004	12	17	66	6	62	3	0	0	122	182	81	122	405	83	81	62	1,323	0	978	1,263	0	166	507	3,789
2005	261	617	1,005	1,179	1,242	505	0	0	135	203	81	122	405	83	81	62	555	0	446	329	0	4,809	541	1,556
2006	81	796	924	1,082	1,102	860	0	0	142	113	81	122	405	83	81	62	417	0	323	260	0	4,846	458	1,227
2007	466	407	616	666	41	552	132	0	108	308	81	122	405	83	81	62	366	0	207	79	0	2,880	619	877
2008	57	71	479	424	390	29	822	0	79	268	68	102	338	69	68	52	377	0	344	291	0	2,271	516	1,199
2009	57	258	695	780	797	40	961	0	79	265							21	0	266	190	0	3,589	345	477
2010	1	24	748	717	261	1	854															2,606	0	0

Table 3-4
Comparison of Storage Capacity Estimates

Segment Number	Surface Area	Storage Capacity Estimates[a]					Groundwater in Storage Fall 2010	Unused Storage in Fall 2010
	Psomas[1]	DWR 1972[2]	PSOMAS		WEI		WEI	
	acres	acre-ft	Specific Yield (%)[3]	acre-ft[4]	Specific Yield (%)[5]	acre-ft[6]	acre-ft[7]	acre-ft[8]
San Juan Creek								
1	346.7	3,860	0.075	3,510	0.178	5,789	5,058	730
2	439.2	5,140	0.070	3,843	0.153	2,028	1,523	505
3	564	5,120	0.040	2,594	0.146	5,305	4,372	933
4	338	10,220	0.075	2,535	0.181	4,139	3,359	781
5	492	8,330	0.173	7,247	0.182	5,416	4,438	978
Arroyo Trabuco								
3[b]								
6	502	8,180	0.143	7,194	0.164	3,862	1,637	2,225
Total	2,682	40,850		26,924		26,539	20,387	6,152

a. Storage Capacity=Area x Aquifer Thickness x Specific Yield.

b. The lowermost 6,000 feet from the outlet of Arroyo Trabuco is included with segment 3 in San Juan Creek

(1) Psomas (2004) adopted the DWR (1972) methodology within the lower basins and created six polygons that represent the alluvial areas in each segment as shown in Figure 3-24.

(2) After Table 8 San Juan Groundwater Basin Storage Capacity in DWR Bulletin No. 104-7.

(3) DWR (1972) reported specific yield values for attitude segments in the basin. These values were assigned based on correlation to the average altitude for that segment. (PSOMAS, 2010)

(4) Calculated using the DWR (1972)/Psomas(Annual Reports) specific yield estimates and the average thickness of each segment from DWR (1972).

(5) Calculated using a thickness weighted specific yield value as shown in Figure 3-24.

(6) Calculated using a kriged surface from thickness weighted specific yield values, kriged bottom of aquifer surface and was adjusted by the average difference in elevation of the stream channel and the ground surface elevation wells adjacent to the creeks.

(7) Calculated using a kriged surface from thickness weighted specific yield values, kriged bottom of aquifer surface and a kriged water level surface from Fall 2010 groundwater elevation contours and points as shown in Figure 3-26.

(8) Calculated by subtracting the Groundwater in Storage Fall 2010 column from the WEI storage capacity estimate column.

Table 3-5

Annual Groundwater Water Budget for San Juan Basin Model Area with Analytics - Model Scenario 2h[1,2]

(acre-ft)

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]
						=[1]+[2]+[3]+[4]+[5]					=[7]+[8]+[9]+[10]	=[6]-[11]		=If(S_{min}>[13], S_{min}-[13],0), 0)	=P_{req}-[7]
	Recharge Components						Discharge Components								
Hydrologic Year	Underflow Inflow from Up-Gradient of San Juan, Horno, Trabuco and Oso Creeks	Streambed Infiltration Including Natural Water and Return Flow	Deep Infiltration of Return Flow	Areal Recharge and Mountain Front Runoff Recharge	Underflow Inflow from Ocean	Total Recharge	Groundwater Production	Evapotrans-piration	Rising Water Discharge to Streamflow	Underflow to Ocean	Total Discharge	Change in Groundwater Storage	End of Period Storage	Deviation from Minimum Storage to Maintain Production	Unmet Production Demand
	[acre-ft]	[acre-ft]	[acre-ft]	[acre-ft]	[acre-ft]	[acre-ft]	[acre-ft]	[acre-ft]	[acre-ft]	[acre-ft]	[acre-ft]	[acre-ft]	25,000	27,000	11,214
1947	2,700	1,436	134	7	0	4,277	10,919	520	38	163	11,640	-7,363	17,637	-9,363	295
1948	2,700	2,392	134	21	93	5,340	10,589	520	3	8	11,121	-5,781	11,857	-15,143	625
1949	2,700	3,908	134	65	266	7,074	9,237	520	17	2	9,777	-2,703	9,154	-17,846	1,977
1950	2,700	3,542	134	154	452	6,982	8,036	520	6	0	8,562	-1,580	7,574	-19,426	3,178
1951	2,700	4,325	134	149	527	7,836	7,355	520	16	0	7,891	-55	7,519	-19,481	3,859
1952	2,700	11,097	134	891	280	15,102	9,123	520	278	5	9,926	5,177	12,695	-14,305	2,091
1953	2,700	2,740	134	52	474	6,101	8,250	520	1	0	8,771	-2,671	10,025	-16,975	2,964
1954	2,700	5,021	134	233	484	8,572	7,988	520	33	0	8,541	31	10,056	-16,944	3,226
1955	2,700	3,461	134	83	511	6,889	7,724	520	7	0	8,252	-1,362	8,693	-18,307	3,490
1956	2,700	5,435	134	320	470	9,060	8,009	520	63	0	8,593	467	9,160	-17,840	3,205
1957	2,700	5,559	134	118	470	8,982	7,760	520	13	0	8,293	688	9,849	-17,151	3,454
1958	2,700	10,928	134	835	274	14,871	9,707	520	326	7	10,560	4,311	14,160	-12,840	1,507
1959	2,700	3,255	134	95	508	6,693	8,507	520	8	0	9,034	-2,341	11,819	-15,181	2,707
1960	2,700	3,896	134	54	489	7,273	8,000	520	10	0	8,530	-1,257	10,561	-16,439	3,214
1961	2,700	2,052	134	24	608	5,518	7,405	520	0	0	7,925	-2,407	8,155	-18,845	3,809
1962	2,700	8,033	134	479	399	11,744	8,561	520	222	2	9,306	2,439	10,593	-16,407	2,653
1963	2,700	3,996	134	140	498	7,468	7,809	520	1	0	8,330	-862	9,731	-17,269	3,405
1964	2,700	2,983	134	55	557	6,429	7,553	520	0	0	8,073	-1,645	8,086	-18,914	3,661
1965	2,700	9,435	134	735	456	13,460	7,775	520	210	2	8,506	4,954	13,040	-13,960	3,439
1966	2,700	7,435	134	284	362	10,915	8,851	520	160	3	9,534	1,381	14,421	-12,579	2,363
1967	2,700	7,347	134	383	280	10,843	10,078	520	79	3	10,681	163	14,583	-12,417	1,136
1968	2,700	2,977	134	49	496	6,356	8,605	520	0	0	9,125	-2,769	11,814	-15,186	2,609
1969	2,700	13,718	134	1,200	199	17,951	10,863	520	504	17	11,904	6,048	17,862	-9,138	351
1970	2,700	4,661	134	86	385	7,967	9,873	520	16	0	10,410	-2,443	15,419	-11,581	1,341
1971	2,700	3,312	134	49	508	6,703	8,544	520	7	0	9,070	-2,367	13,052	-13,948	2,670
1972	2,700	2,463	134	18	570	5,884	7,819	520	0	0	8,339	-2,454	10,597	-16,403	3,395
1973	2,700	4,508	134	138	472	7,952	8,046	520	32	0	8,599	-647	9,950	-17,050	3,168
1974	2,700	4,702	134	144	495	8,175	7,883	520	16	0	8,419	-244	9,707	-17,293	3,331
1975	2,700	5,346	134	164	455	8,799	8,068	520	53	1	8,642	157	9,864	-17,136	3,146
1976	2,700	4,640	134	104	487	8,065	7,862	520	8	0	8,390	-325	9,539	-17,461	3,352
1977	2,700	4,261	134	88	486	7,670	7,723	520	2	0	8,245	-575	8,963	-18,037	3,491
1978	2,700	16,862	134	1,121	158	20,975	10,308	520	592	19	11,438	9,536	18,500	-8,500	906
1979	2,700	10,897	134	523	150	14,405	10,969	520	347	22	11,858	2,547	21,047	-5,953	245
1980	2,700	14,742	134	1,279	98	18,954	11,228	520	643	48	12,439	6,514	27,561	0	-14
1981	2,700	3,763	134	103	263	6,962	11,056	520	12	1	11,590	-4,627	22,934	-4,066	158
1982	2,700	8,434	134	286	244	11,798	10,934	520	115	3	11,572	226	23,160	-3,840	280
1983	2,700	15,983	134	916	74	19,807	11,139	520	489	32	12,180	7,628	30,787	0	75
1984	2,700	4,495	134	102	257	7,689	11,008	520	55	3	11,587	-3,898	26,890	-110	206
1985	2,700	4,917	134	103	314	8,168	10,772	520	26	2	11,320	-3,151	23,738	-3,262	442
1986	2,700	6,866	134	221	331	10,252	10,496	520	88	2	11,106	-854	22,885	-4,115	718
1987	2,700	4,561	134	82	431	7,908	9,664	520	10	0	10,194	-2,285	20,599	-6,401	1,550
1988	2,700	5,034	134	165	480	8,512	9,072	520	25	0	9,617	-1,105	19,494	-7,506	2,142
1989	2,700	3,707	134	82	478	7,101	9,047	520	7	0	9,573	-2,472	17,022	-9,978	2,167
1990	2,700	3,684	134	85	512	7,115	8,631	520	14	0	9,165	-2,051	14,972	-12,028	2,583
1991	2,700	7,251	134	289	430	10,804	9,314	520	152	1	9,988	816	15,788	-11,212	1,900
1992	2,700	10,638	134	768	289	14,530	10,443	520	299	5	11,267	3,263	19,050	-7,950	771
1993	2,700	15,578	134	1,719	97	20,228	11,208	520	697	47	12,472	7,756	26,806	-194	6
1994	2,700	4,208	134	104	283	7,429	11,049	520	31	2	11,602	-4,173	22,634	-4,366	165
1995	2,700	15,353	134	1,143	93	19,423	11,214	520	578	42	12,354	7,070	29,703	0	0
1996	2,700	10,018	134	536	152	13,541	11,232	520	256	12	12,020	1,520	31,224	0	-18
1997	2,700	10,340	134	782	98	14,053	11,214	520	373	37	12,145	1,909	33,132	0	0
1998	2,700	19,130	134	1,617	2	23,584	11,214	520	922	188	12,845	10,739	43,871	0	0
1999	2,700	2,422	134	33	62	5,351	11,214	520	16	41	11,791	-6,440	37,431	0	0
2000	2,700	5,982	134	159	108	9,083	11,232	520	100	14	11,866	-2,783	34,648	0	-18
2001	2,700	6,793	134	167	137	9,932	11,214	520	112	12	11,858	-1,926	32,722	0	0
2002	2,700	2,462	134	29	340	5,665	11,084	520	0	0	11,605	-5,940	26,782	-218	130
2003	2,700	7,411	134	264	269	10,778	10,981	520	122	3	11,627	-849	25,933	-1,067	233
2004	2,700	7,648	134	237	305	11,025	10,657	520	102	2	11,281	-256	25,677	-1,323	557
2005	2,700	13,104	134	955	125	17,019	11,206	520	509	31	12,266	4,753	30,430	0	8
2006	2,700	3,989	134	123	277	7,223	11,010	520	29	1	11,560	-4,337	26,093	-907	204
2007	2,700	1,413	134	4	518	4,769	10,014	520	0	0	10,534	-5,765	20,328	-6,672	1,200
2008	2,700	5,251	134	244	507	8,835	9,304	520	36	0	9,860	-1,024	19,304	-7,696	1,910
2009	2,700	4,736	134	203	465	8,238	9,518	520	87	1	10,125	-1,887	17,417	-9,583	1,696
2010	2,700	12,002	134	1,007	341	16,184	10,247	520	341	3	11,112	5,072	22,489	-4,511	967
Entire Investigation Period (1947-2010)															
Average	2,700	6,696	134	354	339	10,223	9,585	520	146	12	10,263	-39	18,394	-9,568	1,629
Median	2,700	4,969	134	156	352	8,375	9,686	520	34	2	10,302	-851	17,220	-9,780	1,528
Standard Deviation	0	4,270	0	421	165	4,575	1,369	0	210	32	1,501	3,944	8,699	6,987	1,369
Coef of Variation	0%	64%	0%	119%	49%	45%	14%	0%	145%	262%	15%	-10054%	47%	-73%	84%
Max	2,700	19,130	134	1,719	608	23,584	11,232	520	922	188	12,845	10,739	43,871	0	3,859
Min	2,700	1,413	134	4	0	4,277	7,355	520	0	0	7,891	-7,363	7,519	-19,481	-18
Dry Period Hydrology (1947-1976)															
Average	2,700	5,153	134	238	417	8,643	8,560	520	71	7	9,158	-515	11,239	-15,761	2,654
Median	2,700	4,416	134	128	473	7,894	8,041	520	14	0	8,596	-611	10,040	-16,960	3,173
Standard Deviation	0	3,512	0	334	112	3,744	919	0	154	5	1,038	3,028	2,860	2,860	919
Coef of Variation	0%	68%	0%	141%	27%	43%	11%	0%	216%	64%	11%	-587%	25%	-18%	35%
Max	2,700	16,862	134	1,279	608	20,975	11,228	520	643	48	12,439	9,536	27,561	0	3,859
Min	2,700	2,052	134	18	98	5,518	7,405	520	0	0	7,925	-4,627	8,086	-18,914	-14
Average Period Hydrology (1963-1992)															
Average	2,700	6,787	134	325	374	10,321	9,381	520	132	5	10,039	282	16,702	-10,443	1,833
Median	2,700	4,975	134	154	407	8,344	9,489	520	43	1	10,091	-450	16,405	-10,595	1,725
Standard Deviation	0	4,298	0	449	145	4,605	1,283	0	216	14	1,421	3,865	6,159	5,885	1,283
Coef of Variation	0%	63%	0%	138%	39%	45%	14%	0%	163%	247%	14%	1371%	37%	-56%	70%
Max	2,700	16,862	134	1,719	570	20,975	11,232	520	697	48	12,472	9,536	31,224	0	3,491
Min	2,700	2,463	134	18	74	5,884	7,723	520	0	0	8,245	-4,627	8,963	-18,037	-18
Wet Period Hydrology (1978-1983)															
Average	2,700	11,780	134	705	164	15,484	10,939	520	366	21	11,846	3,637	23,998	-3,727	275
Median	2,700	12,820	134	720	154	16,679	11,013	520	418	21	11,724	4,531	23,047	-3,953	201
Standard Deviation	0	5,070	0	473	76	5,445	328	0	257	18	392	5,294	4,462	3,336	328
Coef of Variation	0%	43%	0%	67%	46%	35%	3%	0%	70%	86%	3%	146%	19%	-90%	119%
Max	2,700	16,862	134	1,279	263	20,975	11,228	520	643	48	12,439	9,536	30,787	0	906
Min	2,700	3,763	134	103	74	6,962	10,308	520	12	1	11,438	-4,627	18,500	-8,500	-14

Notes

[1] Water budget as shown in columns 1 through 12 based on unpublished modeling results provided MWDOC January 2013 representing 2014 requested pumping and 2014 landuse and water management conditions.

[2] Minimum storage (S_{min}) assumed to be 27,000 acre-ft; Pumping request in 2014 (P_{req}) is 11,216; Initial sotrage is 25,000 acre-ft.

Table 3-6
Surface Water Quality Sampling Sites in the San Juan Basin Watershed

Monitoring Entity	Surface Water Body	Station Name	Station Abbreviation	Station Alias	Monitoring Program	Sampling Time Period	Analytes
County	Bell Creek	Bell Creek	Bell Creek	REF-BC	Bioassessment Program	2003 - 2009	General Physical, Metals, Pesticides
County	San Juan Creek	San Juan Creek at Cold Spring	SJC @ Cold Spring	REF-CS	Bioassessment Program	2002 - 2009	General Physical, Metals, Pesticides
County	San Juan Creek	San Juan Creek at Ortega Highway	SJC @ Ortega	SJC-74	Bioassessment Program	2003 - 2009	General Physical, Metals, Pesticides
County	San Juan Creek	San Juan Creek at Caspers Park	SJC @ Caspers Park	SJOL01	Mass Emissions Monitoring Program	1993 - 2001	General Physical, Metals, Pesticides
County	San Juan Creek	San Juan Creek at Camino Capistrano	SJC @ Camino Capistrano	SJC-CC	Bioassessment Program	2002 - 2009	General Physical, Metals, Pesticides
County	Trabuco Creek	Trabuco Creek alder Spring	TC @ Alder Spring	REF-TCAS	Bioassessment Program	2003 - 2009	General Physical, Metals, Pesticides
County	Trabuco Creek	Trabuco Creek at Avery Parkway	TC @ Avery	TC-AP	Bioassessment Program	2002 - 2008	General Physical, Metals, Pesticides
County/CDM	Oso Creek	Oso Creek at Crown Valley Parkway	OC @ Crown Valley	OSOLO3/CDM-SW-9	Bioassessment Program	1986 - 1999	General Physical, Metals, Pesticides
County/CDM/RWQCB	San Juan Creek	San Juan Creek at La Novia	SJC @ La Novia	SJNL01/CDM-SW-4	Mass Emissions Monitoring Program	1987 - 2009	General Physical, Metals, Pesticides
County/CDM	Trabuco Creek	Trabuco Creek at Del Obispo	TC @ Del Obispo	TCOL02/CDM-SW-6	Mass Emissions Monitoring Program	1986 - 2009	General Physical, Metals, Pesticides
CDM	Oso Creek	CDM-SW-8	CDM-8	CDM-8	Monitoring Program	1986 - 1987	General Physical, Fe, Mn
CDM	San Juan Creek	San Juan Creek at Treatment Plant	SJC @ Treatment Plant	CDM-1	Monitoring Program	1986 - 1987	General Physical, Fe, Mn
CDM	San Juan Creek	CDM_SW-10 (Tributary to San Juan Creek)	CDM-10	CDM-10	Monitoring Program	1986 - 1987	General Physical, Fe, Mn
CDM	San Juan Creek	CDM_SW-11	CDM-11	CDM-11	Monitoring Program	1986 - 1987	General Physical, Fe, Mn
CDM	San Juan Creek	CDM_SW-11A (Tributary to San Juan Creek)	CDM-11A	CDM-11A	Monitoring Program	1986 - 1987	General Physical, Fe, Mn
CDM	San Juan Creek	CDM_SW-16	CDM-16	CDM-16	Monitoring Program	1986 - 1987	General Physical, Fe, Mn
CDM	San Juan Creek	San Juan Creek below Trabuco Creek	SJC below Trabuco	CDM-2	Monitoring Program	1986 - 1987	General Physical, Fe, Mn
CDM	San Juan Creek	San Juan Creek at Oda Nursery	CDM-5	CDM-5	Monitoring Program	1986 - 1987	General Physical, Fe, Mn
CDM	Trabuco Creek	Trabuco Creek At Camino Capistrano	CDM-7	TC @ Camino Cap	Monitoring Program	1986 - 1987	General Physical, Fe, Mn
RWCQB	San Juan Creek	San Juan Creek ~1mi above Lion Cyn. Cr.	SJC above Lion Cyn	901S00313	Ambient SW Monitoring Program	2009 - 2010	General Physical, Metals, Pesticides
RWCQB	San Juan Creek	San Juan Creek above Arroyo Trabuco	SJC above Trabuco	901S39498	Ambient SW Monitoring Program	2009 - 2010	General Physical, Metals, Pesticides
RWCQB	San Juan Creek	San Juan Creek ~0.3mi below Hwy 74	SJC below Ortega	901S45253	Ambient SW Monitoring Program	2009 - 2010	General Physical, Metals, Pesticides
RWCQB	Trabuco Creek	Trabuco Creek 2	TC -2	901SJATC2	Ambient SW Monitoring Program	2002 - 2003	General Physical, Metals, Pesticides
RWCQB	Trabuco Creek	Trabuco Creek 5	TC - 5	901SJATC5	Ambient SW Monitoring Program	2002 - 2003	General Physical, Metals, Pesticides
RWCQB	Bell Creek	Bell Canyon Creek 2	Bell Canyon Creek 2	901SJBEL2	Ambient SW Monitoring Program	2002 - 2003	General Physical, Metals, Pesticides
RWCQB	Oso Creek	Oso Creek 3	OC - 3	901SJOSO3	Ambient SW Monitoring Program	2002 - 2003	General Physical, Metals, Pesticides
RWCQB	San Juan Creek	San Juan Creek 5	SJC - 5	901SJSJC5	Ambient SW Monitoring Program	2002 - 2003	General Physical, Metals, Pesticides
RWCQB	San Juan Creek	San Juan Creek 9	SJC - 9	901SJSJC9	Ambient SW Monitoring Program	2002 - 2003	General Physical, Metals, Pesticides
SJBA	San Juan Creek	PMS-Control	PMS-Control	PMS-Control	Integrated Environmental Sampling	2009 - 2010	General Mineral, Physical, and Metals
SJBA	San Juan Creek	PMS-01	PMS-01	PMS-01	Integrated Environmental Sampling	2009 - 2010	General Mineral, Physical, and Metals
SJBA	San Juan Creek	PMS-02	PMS-02	PMS-02	Integrated Environmental Sampling	2009 - 2010	General Mineral, Physical, and Metals
SJBA	San Juan Creek	PMS-03	PMS-03	PMS-03	Integrated Environmental Sampling	2009 - 2010	General Mineral, Physical, and Metals
SJBA	San Juan Creek	PMS-04	PMS-04	PMS-04	Integrated Environmental Sampling	2009 - 2010	General Mineral, Physical, and Metals
SMWD	Oso Creek	Oso Creek at Oso Barrier	OC @ Barrier	Oso Barrier	Surface Water Diversion Monitoring	2009 - 2010	General Mineral, Physical, and Metals
SMWD	Horno Creek	Horno Creek at Horno Barrier	Horno Creek @ Barrier	Horno Barrier	Surface Water Diversion Monitoring	2009 - 2010	General Mineral, Physical, and Metals
WEI	Trabuco Creek	Trabuco Creek-8	TC - 8	TC-8	Arroyo Trabuco Study	1998	General Mineral, Physical, Metals, Trace Constituents
WEI	Trabuco Creek	Drainage Tributary from RSM Development	TC @ RSMD	D-SM	Arroyo Trabuco Study	1998	General Mineral, Physical, Metals, Trace Constituents
WEI	Trabuco Creek	Trabuco Creek at Rising Groundwater	TC @ Rising Groundwater	TC-RG	Arroyo Trabuco Study	1998	General Mineral, Physical, Metals, Trace Constituents
WEI	Trabuco Creek	Trabuco Creek-7	TC-7	TC-7	Arroyo Trabuco Study	1998	General Mineral, Physical, Metals, Trace Constituents
WEI	Trabuco Creek	Tin Mine Adit (SN-1A)	TC @ Mine Adit	SN-1A	Arroyo Trabuco Study	1998	General Mineral, Physical, Metals, Trace Constituents
WEI	Trabuco Creek	Trabuco Creek Below Tin Mine Adit (SN-1)	TC below Mine Adit	SN-1	Arroyo Trabuco Study	1998	General Mineral, Physical, Metals, Trace Constituents
WEI	Trabuco Creek	Holy Jim Creek-1	Holy Jim	HJC-1	Arroyo Trabuco Study	1998	General Mineral, Physical, Metals, Trace Constituents
WEI	Trabuco Creek	Trabuco Creek-2A	TC-2A	TC-2A	Arroyo Trabuco Study	1998	General Mineral, Physical, Metals, Trace Constituents
WEI	Trabuco Creek	Trabuco Creek at Oso Parkway	TC @ Oso	TC-OSO	Arroyo Trabuco Study	1998	General Mineral, Physical, Metals, Trace Constituents
WEI	Trabuco Creek	Trabuco Creek-3	TC-3	TC-3	Arroyo Trabuco Study	1998	General Mineral, Physical, Metals, Trace Constituents
WEI	Trabuco Creek	Trabuco Creek at Crown Valley Parkway	TC @ Crown Valley	TC-CV	Arroyo Trabuco Study	1998	General Mineral, Physical, Metals, Trace Constituents

Table 3-7
Groundwater Quality Data Sources for Wells in the San Juan Basin

WQ Data Source	Time Period	# of Wells	Description
DWR, 1972	1952 - 1969	19	Private and Public Wells in San Juan Basin
NBS Lowry, 1994	1970 - 1992	10	Private and Public Wells in San Juan Basin
CDM, 1987	1986 - 1987	15	Private and Public Wells in San Juan Basin
CA DPH Database - RMV	1986 - 1999	1	Non Private RMV Wells (RMV 7)
GTC, 2001	1988 - 2001	15	Private and Public Wells in San Juan Basin
CA DPH Database - City of San Juan	1991 - 2010	10	City of San Juan Production Wells
CA State GeoTracker Website	2001 - 2010	272	Monitoring Wells for 10 Point Source Contamination Sites
SJBA	2003 - 2010	9	SJBA Monitoring Wells
City of San Juan Capistrano	2005 - 2008	6	City of San Juan Desalter Production Wells
CA DPH Database - SJBA	2005 - 2010	6	City of San Juan Desalter Production Wells
CA DPH Database - SCWD	2006 - 2010	1	Stonehill Well
Santa Margarita Water District	2006 - 2010	1	Nichols Well

Table 3-8
Surface Water Quality Data in Exceedance of Drinking Water Maximum Contaminant Levels

Analyte Group/ Constituent	Maximum Contaminant Levels[1]					1987 - 2005								Last Five Years (2006-2010)							
						Exceedance				Non-Exceedance				Exceedance				Non-Exceedance			
	Primary	Secondary	Notification Level	Units	Notes	# of Sites	% of Sites Exceeding MCLs	Count	% of Samples Exceeding MCLs	# of Sites	% of Sites Not Exceeding MCLs	Count	% of Samples Not Exceeding MCLs	# of Sites	% of Sites Exceeding MCLs	Count	% of Samples Exceeding MCLs	# of Sites	% of Sites Not Exceeding MCLs	Count	% of Samples Not Exceeding MCLs
Inorganic Constituents																					
Total Dissolved Solids		500		mg/L		19	66%	192	88%	10	34%	27	12%	10	91%	90	99%	1	9%	1	1%
Sulfate		250		mg/L		16	38%	143	62%	26	62%	88	38%	9	82%	89	98%	2	18%	2	2%
Chloride		250		mg/L		6	20%	115	53%	24	80%	102	47%	6	38%	57	66%	10	63%	30	34%
Manganese		0.05	0.5	mg/L		15	38%	67	44%	24	62%	87	56%	8	50%	40	62%	8	50%	25	38%
Iron		300		mg/L		10	31%	26	19%	22	69%	109	81%	7	41%	30	46%	10	59%	35	54%
Aluminum	1	0.2		mg/L	2	1	6%	1	2%	17	94%	51	98%	1	14%	1	2%	6	86%	46	98%
Arsenic	10			ug/L		0	0%	0	0%	17	100%	51	100%	2	25%	22	45%	6	75%	27	55%
Boron			1000	ug/L		0	0%	0	0%	12	100%	115	100%	1	33%	7	10%	2	67%	60	90%
Cadmium	5			ug/L		4	13%	26	5%	27	87%	537	95%	4	24%	12	5%	13	76%	233	95%
Lead	15			ug/L		4	20%	34	6%	16	80%	498	94%	3	19%	5	2%	13	81%	240	98%
Chromium	50			ug/L	3	2	7%	7	1%	27	93%	556	99%	2	13%	2	1%	13	87%	243	99%
Nickel	100			ug/L		3	10%	6	1%	26	90%	557	99%	1	8%	1	0%	11	92%	203	100%
Nitrate-N	10			mg/L		10	25%	32	16%	30	75%	165	84%	0	0%	0	0%	6	100%	60	100%
General Physical																					
Specific Conductance		900		umhos/cm		8	26%	86	19%	23	74%	367	81%	11	52%	68	49%	10	48%	71	51%
Turbidity	1			NTU		8	44%	262	66%	10	56%	138	35%	8	35%	60	39%	15	65%	92	61%
Color		15		Units		0	NA	0	NA	0	NA	0	NA	5	83%	13	81%	1	17%	3	19%
Odor		3		Threshold Units		0	NA	0	NA	0	NA	0	NA	5	50%	7	44%	5	50%	9	56%
pH		6.5<pH<8.5		Units		3	12%	13	3%	23	88%	442	97%	0	0%	0	0%	13	100%	111	100%

1 The California MCL was used for exceedance analysis unless otherwise noted.
2 The Primary California MCL is used for this analysis because the lower Secondary limit of 0.2 mg/L is the same as the US EPA Threshold 2 limit.
3 MCL is for total chromium.

Table 3-9
Surface Water Quality Data in Exceedance of San Diego Regional Water Quality Control Board Basin Plan Surface Water Quality Objectives

Station	Analyte	Unit	Objective	Time Period in which Data is Available	# of Years with Sample Results During Time Period	# of Years in which Compliance Metric is Violated	# of Years in which Compliance Metric is Not Violated
Bell Creek - Upstream to Downstream							
Bell Creek	Turbidity	NTU	20	2003-2009	7	0	7
Bell Canyon Creek 2	SO4	mg/L	250	2003-2003	1	0	1
Bell Canyon Creek 2	Mn	mg/L	0.05	2003-2003	1	0	1
San Juan Creek - Upstream to Downstream							
SJC above Lion Cyn.	TDS	mg/L	500	2009-2009	1	0	1
SJC above Lion Cyn.	SO4	mg/L	250	2009-2009	1	1	0
SJC above Lion Cyn.	Cl	mg/L	250	2009-2009	1	0	1
SJC above Lion Cyn.	Fe	mg/L	0.3	2009-2009	1	0	1
SJC above Lion Cyn.	Mn	mg/L	0.05	2009-2009	1	0	1
SJC above Lion Cyn.	%Na	%	60	2009-2009	0	0	0
SJC - 5	SO4	mg/L	250	2002-2003	2	0	2
SJC - 5	Mn	mg/L	0.05	2002-2003	2	0	2
SJC @ Cold Spring	Turbidity	NTU	20	2002-2009	8	1	7
SJC @ Caspers Park	Turbidity	NTU	20	1993-2001	9	4	5
CDM-16	TDS	mg/L	500	1987-1987	1	0	1
CDM-16	SO4	mg/L	250	1987-1987	1	0	1
CDM-16	Cl	mg/L	250	1987-1987	1	0	1
CDM-16	Fe	mg/L	0.3	1987-1987	1	0	1
CDM-16	Mn	mg/L	0.05	1987-1987	1	1	0
CDM-11A	TDS	mg/L	500	1987-1987	1	1	0
CDM-11A	SO4	mg/L	250	1987-1987	1	1	0
CDM-11A	Cl	mg/L	250	1987-1987	1	0	1
CDM-11A	Fe	mg/L	0.3	1987-1987	1	0	1
CDM-11A	Mn	mg/L	0.05	1987-1987	1	0	1
CDM-11	TDS	mg/L	500	1986-1987	2	2	0
CDM-11	SO4	mg/L	250	1986-1987	2	0	2
CDM-11	Cl	mg/L	250	1986-1987	2	0	2
CDM-11	Fe	mg/L	0.3	1986-1987	2	2	0
CDM-11	Mn	mg/L	0.05	1986-1987	2	1	1
CDM-10	TDS	mg/L	500	1986-1987	2	2	0
CDM-10	SO4	mg/L	250	1986-1987	2	0	2
CDM-10	Cl	mg/L	250	1986-1987	2	0	2
CDM-10	Fe	mg/L	0.3	1986-1987	2	1	1
CDM-10	Mn	mg/L	0.05	1986-1987	2	0	2
SJC @ Oda Nursery	TDS	mg/L	500	1986-1987	2	2	0
SJC @ Oda Nursery	SO4	mg/L	250	1986-1987	2	1	1
SJC @ Oda Nursery	Cl	mg/L	250	1986-1987	2	0	2
SJC @ Oda Nursery	Fe	mg/L	0.3	1986-1987	2	0	2
SJC @ Oda Nursery	Mn	mg/L	0.05	1986-1987	2	1	1
PMS-Control	TDS	mg/L	500	2009-2011	3	3	0
PMS-Control	SO4	mg/L	250	2009-2011	3	2	1
PMS-Control	Cl	mg/L	250	2009-2011	3	1	2
PMS-Control	Fe	mg/L	0.3	2009-2011	3	2	1
PMS-Control	Mn	mg/L	0.05	2009-2011	3	2	1
PMS-Control	Turbidity	NTU	20	2009-2011	3	0	3
PMS-Control	Color	units	20	2009-2011	3	0	3
PMS-Control	MBAS	mg/L	0.5	2009-2011	3	0	3
PMS-Control	%Na	%	60	2009-2011	3	0	3
SJC @ Ortega	Turbidity	NTU	20	2003-2009	7	1	6

Table 3-9
Surface Water Quality Data in Exceedance of San Diego Regional Water Quality Control Board Basin Plan Surface Water Quality Objectives

Station	Analyte	Unit	Objective	Time Period in which Data is Available	# of Years with Sample Results During Time Period	# of Years in which Compliance Metric is Violated	# of Years in which Compliance Metric is Not Violated
SJC Below Ortega	TDS	mg/L	500	2010-2010	1	1	0
SJC Below Ortega	SO4	mg/L	250	2010-2010	1	0	1
SJC Below Ortega	Cl	mg/L	250	2010-2010	1	0	1
SJC Below Ortega	Fe	mg/L	0.3	2010-2010	1	0	1
SJC Below Ortega	Mn	mg/L	0.05	2010-2010	1	0	1
SJC Below Ortega	%Na	%	60	2010-2010	0	0	0
PMS-04	TDS	mg/L	500	2010-2011	2	2	0
PMS-04	SO4	mg/L	250	2010-2011	2	1	1
PMS-04	Cl	mg/L	250	2010-2011	2	0	2
PMS-04	Fe	mg/L	0.3	2010-2011	2	0	2
PMS-04	Mn	mg/L	0.05	2010-2011	2	1	1
PMS-04	Turbidity	NTU	20	2010-2011	2	0	2
PMS-04	Color	units	20	2010-2011	2	1	1
PMS-04	MBAS	mg/L	0.5	2010-2011	2	0	2
PMS-04	%Na	%	60	2010-2011	2	0	2
PMS-03	TDS	mg/L	500	2010-2011	2	2	0
PMS-03	SO4	mg/L	250	2010-2011	2	1	1
PMS-03	Cl	mg/L	250	2010-2011	2	0	2
PMS-03	Fe	mg/L	0.3	2010-2011	2	0	2
PMS-03	Mn	mg/L	0.05	2010-2011	2	1	1
PMS-03	Turbidity	NTU	20	2010-2011	2	0	2
PMS-03	Color	units	20	2010-2011	2	0	2
PMS-03	MBAS	mg/L	0.5	2010-2011	2	0	2
PMS-03	%Na	%	60	2010-2011	2	0	2
SJC @ La Novia	TDS	mg/L	500	1987-2009	5	5	0
SJC @ La Novia	SO4	mg/L	250	1987-1992	4	4	0
SJC @ La Novia	Cl	mg/L	250	1987-2009	4	0	4
SJC @ La Novia	Fe	mg/L	0.3	1987-2009	5	2	3
SJC @ La Novia	Mn	mg/L	0.05	1987-2009	5	3	2
SJC @ La Novia	Turbidity	NTU	20	1992-2009	18	15	3
SJC @ La Novia	%Na	%	60	2009-2009	0	0	0
PMS-02	TDS	mg/L	500	2009-2011	3	3	0
PMS-02	SO4	mg/L	250	2009-2011	3	2	1
PMS-02	Cl	mg/L	250	2009-2011	3	2	1
PMS-02	Fe	mg/L	0.3	2009-2011	3	1	2
PMS-02	Mn	mg/L	0.05	2009-2011	3	1	2
PMS-02	Turbidity	NTU	20	2009-2011	3	0	3
PMS-02	Color	units	20	2009-2011	3	2	1
PMS-02	MBAS	mg/L	0.5	2009-2011	3	0	3
PMS-02	%Na	%	60	2009-2011	3	0	3
PMS-01	TDS	mg/L	500	2009-2011	3	3	0
PMS-01	SO4	mg/L	250	2009-2011	3	3	0
PMS-01	Cl	mg/L	250	2009-2011	3	2	1
PMS-01	Fe	mg/L	0.3	2009-2011	3	1	2
PMS-01	Mn	mg/L	0.05	2009-2011	3	2	1
PMS-01	Turbidity	NTU	20	2009-2011	3	1	2
PMS-01	Color	units	20	2009-2011	3	2	1
PMS-01	MBAS	mg/L	0.5	2009-2011	3	0	3
PMS-01	%Na	%	60	2009-2011	3	0	3

Table 3-9
Surface Water Quality Data in Exceedance of San Diego Regional Water Quality Control Board Basin Plan Surface Water Quality Objectives

Station	Analyte	Unit	Objective	Time Period in which Data is Available	# of Years with Sample Results During Time Period	# of Years in which Compliance Metric is Violated	# of Years in which Compliance Metric is Not Violated
SJC above Trabuco Creek	TDS	mg/L	500	2010-2010	1	1	0
SJC above Trabuco Creek	SO4	mg/L	250	2010-2010	1	0	1
SJC above Trabuco Creek	Cl	mg/L	250	2010-2010	1	1	0
SJC above Trabuco Creek	Fe	mg/L	0.3	2010-2010	1	1	0
SJC above Trabuco Creek	Mn	mg/L	0.05	2010-2010	1	0	1
SJC above Trabuco Creek	%Na	%	60	2010-2010	0	0	0
SJC below Trabuco Creek	TDS	mg/L	500	1986-1987	2	2	0
SJC below Trabuco Creek	SO4	mg/L	250	1986-1987	2	2	0
SJC below Trabuco Creek	Cl	mg/L	250	1986-1987	2	2	0
SJC below Trabuco Creek	Fe	mg/L	0.3	1986-1987	2	0	2
SJC below Trabuco Creek	Mn		0.05	1986-1987	2	2	0
SJC - 9	SO4	mg/L	250	2002-2008	3	3	0
SJC - 9	Mn	mg/L	0.05	2002-2003	2	1	1
SJC @ Treatment Plant	TDS	mg/L	500	1986-1987	2	2	0
SJC @ Treatment Plant	SO4	mg/L	250	1986-1987	2	2	0
SJC @ Treatment Plant	Cl	mg/L	250	1986-1987	2	2	0
SJC @ Treatment Plant	Fe	mg/L	0.3	1986-1987	2	1	1
SJC @ Treatment Plant	Mn	mg/L	0.05	1986-1987	2	2	0
SJC @ Camino Capistrano	Turbidity	NTU	20	2002-2009	7	1	6
Horno Creek - Upstream to Downstream							
Horno Creek @ Barrier	TDS	mg/L	500	1997-2010	14	14	0
Horno Creek @ Barrier	SO4	mg/L	250	1997-2010	14	14	0
Horno Creek @ Barrier	Cl	mg/L	250	1997-2010	14	14	0
Horno Creek @ Barrier	Fe	mg/L	0.3	2009-2010	2	2	0
Horno Creek @ Barrier	Mn	mg/L	0.05	2009-2010	2	1	1
Horno Creek @ Barrier	B	mg/L	0.75	1997-2010	14	0	14
Horno Creek @ Barrier	F	mg/L	1	1997-2010	14	1	13
Horno Creek @ Barrier	Turbidity	NTU	20	2009-2010	2	0	2
Horno Creek @ Barrier	MBAS	mg/L	0.5	2009-2010	2	0	2
Horno Creek @ Barrier	%Na	%	60	1997-2010	0	0	0
Trabuco Creek - Upstream to Downstream							
TC - 8	TDS	mg/L	500	1998-1998	1	0	1
TC - 8	SO4	mg/L	250	1998-1998	1	0	1
TC - 8	Cl	mg/L	250	1998-1998	1	0	1
TC - 8	Fe	mg/L	0.3	1998-1998	1	0	1
TC - 8	Mn	mg/L	0.05	1998-1998	1	0	1
TC - 8	B	mg/L	0.75	1998-1998	1	0	1
TC - 8	F	mg/L	1	1998-1998	1	0	1
TC - 8	%Na	%	60	1998-1998	1	0	1
Holy Jim	TDS	mg/L	500	1998-1998	1	0	1
Holy Jim	SO4	mg/L	250	1998-1998	1	0	1
Holy Jim	Cl	mg/L	250	1998-1998	1	0	1
Holy Jim	Fe	mg/L	0.3	1998-1998	1	0	1
Holy Jim	Mn	mg/L	0.05	1998-1998	1	0	1
Holy Jim	B	mg/L	0.75	1998-1998	1	0	1
Holy Jim	F	mg/L	1	1998-1998	1	0	1
Holy Jim	%Na	%	60	1998-1998	1	0	1

Table 3-9
Surface Water Quality Data in Exceedance of San Diego Regional Water Quality Control Board Basin Plan Surface Water Quality Objectives

Station	Analyte	Unit	Objective	Time Period in which Data is Available	# of Years with Sample Results During Time Period	# of Years in which Compliance Metric is Violated	# of Years in which Compliance Metric is Not Violated
TC - 7	TDS	mg/L	500	1998-1998	1	0	1
TC - 7	SO4	mg/L	250	1998-1998	1	0	1
TC - 7	Cl	mg/L	250	1998-1998	1	0	1
TC - 7	Fe	mg/L	0.3	1998-1998	1	0	1
TC - 7	Mn	mg/L	0.05	1998-1998	1	0	1
TC - 7	B	mg/L	0.75	1998-1998	1	0	1
TC - 7	F	mg/L	1	1998-1998	1	0	1
TC - 7	%Na	%	60	1998-1998	1	0	1
TC @ Mine Adit	TDS	mg/L	500	1998-1998	1	1	0
TC @ Mine Adit	SO4	mg/L	250	1998-1998	1	1	0
TC @ Mine Adit	Cl	mg/L	250	1998-1998	1	0	1
TC @ Mine Adit	Fe	mg/L	0.3	1998-1998	1	1	0
TC @ Mine Adit	Mn	mg/L	0.05	1998-1998	1	1	0
TC @ Mine Adit	B	mg/L	0.75	1998-1998	1	0	1
TC @ Mine Adit	F	mg/L	1	1998-1998	1	1	0
TC @ Mine Adit	%Na	%	60	1998-1998	1	0	1
TC Below Mine Adit	TDS	mg/L	500	1998-1998	1	0	1
TC Below Mine Adit	SO4	mg/L	250	1998-1998	1	0	1
TC Below Mine Adit	Cl	mg/L	250	1998-1998	1	0	1
TC Below Mine Adit	Fe	mg/L	0.3	1998-1998	1	0	1
TC Below Mine Adit	Mn	mg/L	0.05	1998-1998	1	0	1
TC Below Mine Adit	B	mg/L	0.75	1998-1998	1	0	1
TC Below Mine Adit	F	mg/L	1	1998-1998	1	0	1
TC Below Mine Adit	%Na	%	60	1998-1998	1	0	1
TC @ Alder Spring	Turbidity	NTU	20	2003-2009	7	0	7
TC - 2	SO4	mg/L	250	2003-2003	1	0	1
TC - 2	Mn	mg/L	0.05	2003-2003	1	0	1
TC @ RSMD	TDS	mg/L	500	1998-1998	1	1	0
TC @ RSMD	SO4	mg/L	250	1998-1998	1	1	0
TC @ RSMD	Cl	mg/L	250	1998-1998	1	0	1
TC @ RSMD	Fe	mg/L	0.3	1998-1998	1	0	1
TC @ RSMD	Mn	mg/L	0.05	1998-1998	1	1	0
TC @ RSMD	B	mg/L	0.75	1998-1998	1	0	1
TC @ RSMD	F	mg/L	1	1998-1998	1	0	1
TC @ RSMD	%Na	%	60	1998-1998	1	0	1
TC @ Rising Groundwater	TDS	mg/L	500	1998-1998	1	1	0
TC @ Rising Groundwater	SO4	mg/L	250	1998-1998	1	1	0
TC @ Rising Groundwater	Cl	mg/L	250	1998-1998	1	0	1
TC @ Rising Groundwater	Fe	mg/L	0.3	1998-1998	1	0	1
TC @ Rising Groundwater	Mn	mg/L	0.05	1998-1998	1	0	1
TC @ Rising Groundwater	B	mg/L	0.75	1998-1998	1	0	1
TC @ Rising Groundwater	F	mg/L	1	1998-1998	1	1	0
TC @ Rising Groundwater	%Na	%	60	1998-1998	1	0	1
TC - 3	TDS	mg/L	500	1998-1998	1	1	0
TC - 3	SO4	mg/L	250	1998-1998	1	1	0
TC - 3	Cl	mg/L	250	1998-1998	1	0	1
TC - 3	Fe	mg/L	0.3	1998-1998	1	0	1
TC - 3	Mn	mg/L	0.05	1998-1998	1	0	1
TC - 3	B	mg/L	0.75	1998-1998	1	0	1
TC - 3	F	mg/L	1	1998-1998	1	0	1
TC - 3	%Na	%	60	1998-1998	1	0	1

Table 3-9
Surface Water Quality Data in Exceedance of San Diego Regional Water Quality Control Board Basin Plan Surface Water Quality Objectives

Station	Analyte	Unit	Objective	Time Period in which Data is Available	# of Years with Sample Results During Time Period	# of Years in which Compliance Metric is Violated	# of Years in which Compliance Metric is Not Violated
TC @ Oso	TDS	mg/L	500	1998-1998	1	1	0
TC @ Oso	SO4	mg/L	250	1998-1998	1	0	1
TC @ Oso	Cl	mg/L	250	1998-1998	1	0	1
TC @ Oso	Fe	mg/L	0.3	1998-1998	1	0	1
TC @ Oso	Mn	mg/L	0.05	1998-1998	1	0	1
TC @ Oso	B	mg/L	0.75	1998-1998	1	0	1
TC @ Oso	F	mg/L	1	1998-1998	1	0	1
TC @ Oso	%Na	%	60	1998-1998	1	0	1
TC @ Crown Valley	TDS	mg/L	500	1998-1998	1	1	0
TC @ Crown Valley	SO4	mg/L	250	1998-1998	1	0	1
TC @ Crown Valley	Cl	mg/L	250	1998-1998	1	0	1
TC @ Crown Valley	Fe	mg/L	0.3	1998-1998	1	0	1
TC @ Crown Valley	Mn	mg/L	0.05	1998-1998	1	0	1
TC @ Crown Valley	B	mg/L	0.75	1998-1998	1	0	1
TC @ Crown Valley	F	mg/L	1	1998-1998	1	0	1
TC @ Crown Valley	%Na	%	60	1998-1998	1	0	1
TC @ Avery	Turbidity	NTU	20	2002-2008	7	0	7
TC - 2A	TDS	mg/L	500	1998-1998	1	1	0
TC - 2A	SO4	mg/L	250	1998-1998	1	0	1
TC - 2A	Cl	mg/L	250	1998-1998	1	0	1
TC - 2A	Fe	mg/L	0.3	1998-1998	1	0	1
TC - 2A	Mn	mg/L	0.05	1998-1998	1	1	0
TC - 2A	B	mg/L	0.75	1998-1998	1	0	1
TC - 2A	F	mg/L	1	1998-1998	1	0	1
TC - 2A	%Na	%	60	1998-1998	1	0	1
TC @ Camino Cap	TDS	mg/L	500	1986-1992	5	3	2
TC @ Camino Cap	SO4	mg/L	250	1986-1992	5	1	4
TC @ Camino Cap	Cl	mg/L	250	1986-1992	5	0	5
TC @ Camino Cap	Fe	mg/L	0.3	1986-1992	5	4	1
TC @ Camino Cap	Mn	mg/L	0.05	1986-1992	5	5	0
TC - 5	SO4	mg/L	250	2002-2003	2	0	2
TC - 5	Mn	mg/L	0.05	2002-2003	2	0	2
TC @ Del Obispo	TDS	mg/L	500	1986-1991	4	4	0
TC @ Del Obispo	SO4	mg/L	250	1986-1991	4	4	0
TC @ Del Obispo	Cl	mg/L	250	1986-1991	4	3	1
TC @ Del Obispo	Fe	mg/L	0.3	1986-1991	4	2	2
TC @ Del Obispo	Mn	mg/L	0.05	1986-1991	4	2	2
TC @ Del Obispo	Turbidity	NTU	20	1994-2009	11	10	1
Oso Creek - Upstream to Downstream							
OC @ Barrier	TDS	mg/L	500	1997-2010	14	14	0
OC @ Barrier	SO4	mg/L	250	1997-2010	14	14	0
OC @ Barrier	Cl	mg/L	250	1997-2010	14	14	0
OC @ Barrier	Fe	mg/L	0.3	2009-2010	2	2	0
OC @ Barrier	Mn	mg/L	0.05	2009-2010	2	2	0
OC @ Barrier	B	mg/L	0.75	1997-2010	14	0	14
OC @ Barrier	F	mg/L	1	1997-2010	14	1	13
OC @ Barrier	Turbidity	NTU	20	2009-2010	2	0	2
OC @ Barrier	MBAS	mg/L	0.5	2009-2010	2	0	2
OC @ Barrier	%Na	%	60	1997-2010	0	0	0

Table 3-9
Surface Water Quality Data in Exceedance of San Diego Regional Water Quality Control Board Basin Plan Surface Water Quality Objectives

Station	Analyte	Unit	Objective	Time Period in which Data is Available	# of Years with Sample Results During Time Period	# of Years in which Compliance Metric is Violated	# of Years in which Compliance Metric is Not Violated
OC @ Crown Valley	TDS	mg/L	500	1986-1987	2	2	0
OC @ Crown Valley	SO4	mg/L	250	1986-1987	2	2	0
OC @ Crown Valley	Cl	mg/L	250	1986-1987	2	2	0
OC @ Crown Valley	Fe	mg/L	0.3	1986-1987	2	1	1
OC @ Crown Valley	Mn	mg/L	0.05	1986-1987	2	2	0
OC @ Crown Valley	Turbidity	NTU	20	1991-1999	8	7	1
CDM-8	TDS	mg/L	500	1986-1992	5	5	0
CDM-8	SO4	mg/L	250	1986-1992	5	5	0
CDM-8	Cl	mg/L	250	1986-1992	5	5	0
CDM-8	Fe	mg/L	0.3	1986-1992	5	3	2
CDM-8	Mn	mg/L	0.05	1986-1992	5	4	1
OC - 3	SO4	mg/L	250	2002-2003	2	2	0
OC - 3	Mn	mg/L	0.05	2002-2003	2	2	0

Table 3-10
Groundwater Quality Data in Exceedance of Drinking Water Maximum Contaminant Levels
2006 to 2010

Analyte Group/Constituent	Maximum Contaminant Levels[1]					Exceedance				Non-Exceedance			
	Primary	Secondary	Notification Level	Units	Notes	# of Wells	% of Wells Exceeding MCL	Count	% of Samples Exceeding MCL	# of Wells	% of Wells Not Exceeding MCL	Count	% of Samples Not Exceeding MCL
Inorganic Constituents													
Total Dissolved Solids		500		mg/L		22	100%	424	100%	0	0%	0	0%
Manganese		0.05	0.5	mg/L		20	77%	422	95%	6	23%	21	5%
Iron		300		mg/L		28	51%	398	73%	27	49%	144	27%
Sulfate		250		mg/L		98	89%	375	88%	12	11%	52	12%
Chloride		250		mg/L		64	75%	162	55%	21	25%	132	45%
Arsenic	10			ug/L		35	40%	64	20%	52	60%	249	80%
Chromium	50			ug/L	2	8	13%	14	6%	54	87%	223	94%
Aluminum		0.05		mg/L	3,4	1	8%	1	2%	11	92%	48	98%
Nitrate-Nitrogen	10			mg/L		3	3%	5	1%	86	97%	439	99%
Lead	0.015			mg/L		2	10%	2	7%	19	90%	26	93%
Vanadium			0.05	mg/L		2	9%	2	8%	20	91%	24	92%
Barium	1			mg/L		1	4%	1	2%	26	96%	63	98%
Cadmium	5			ug/L		1	2%	1	1%	46	98%	167	99%
Copper	1.3	1		mg/L		1	2%	1	0%	55	98%	349	100%
Foaming Agents		0.5		mg/L		1	5%	1	1%	20	95%	183	99%
Mercury	0.002			mg/L		1	4%	1	2%	26	96%	63	98%
Nitrite-Nitrogen	1			mg/L		1	2%	1	1%	65	98%	82	99%
Silver		0.1		mg/L		1	1%	1	4%	72	99%	26	96%
Mercury	0.002			mg/L		1	4%	1	2%	26	96%	63	98%
Nickel	0.1			mg/L		1	2%	1	1%	45	98%	167	99%
Zinc		5		mg/L		1	2%	1	0.3%	55	98%	348	99.7%
General Physical													
Specific Conductance		900		umhos/cm		18	58%	344	87%	13	42%	52	13%
Turbidity		5		NTU		15	52%	145	59%	14	48%	100	41%
Color		15		Units		13	41%	73	29%	19	59%	178	71%
Odor		3		Threshold Units		11	35%	38	18%	20	65%	179	82%
pH		6.5<pH<8.5		Units		2	8%	2	1%	22	92%	342	99%
Chlorinated VOCs													
Methyl Tert-Butyl Ether	13	5		ug/L		106	29%	632	21%	260	71%	2349	79%
Tert-Butyl Alcohol			12	ug/L		111	30%	567	20%	256	70%	2263	80%
Benzene	1			ug/L		59	17%	386	13%	283	83%	2495	87%
Ethylbenzene	300			ug/L		15	5%	121	4.2%	290	95%	2760	96%
Naphthalene			17	ug/L		16	6%	96	6%	241	94%	1426	94%
1,2-Dichloroethane	0.5			ug/L		27	10%	85	6%	238	90%	1456	94%
Toluene	150			ug/L		12	4%	82	3%	292	96%	2798	97%
1,2,4-Trimethylbenzene	5			ug/L		12	5%	66	4%	245	95%	1465	96%
Total Xylene	1750			ug/L		12	4%	61	2%	267	96%	2573	98%
1,3,5-Trimethylbenzene			330	ug/L		9	4%	32	2%	247	96%	1499	98%
n-Propylbenzene			260	ug/L		6	2%	24	2%	247	98%	1507	98%

Table 3-10
Groundwater Quality Data in Exceedance of Drinking Water Maximum Contaminant Levels
2006 to 2010

Analyte Group/Constituent	Maximum Contaminant Levels[1]					Exceedance				Non-Exceedance			
	Primary	Secondary	Notification Level	Units	Notes	# of Wells	% of Wells Exceeding MCL	Count	% of Samples Exceeding MCL	# of Wells	% of Wells Not Exceeding MCL	Count	% of Samples Not Exceeding MCL
1,2-Dibromo-3-chloropropane	0.2			ug/L		16	6%	23	2%	246	94%	1488	98%
Chlorinated VOCs - continued													
Ethylene Dibromide	0.05			ug/L		13	5%	21	1%	246	95%	1491	99%
1,2,3-Trichloropropane			0.005	ug/L		13	5%	20	1%	248	95%	1508	99%
Dichloromethane	5			ug/L		13	5%	20	1%	248	95%	1520	99%
Tetrachloroethene	5			ug/L		6	2%	14	1%	247	98%	1522	99%
1,2-Dichloropropane	5			ug/L		4	2%	10	1%	248	98%	1530	99%
Methyl Isobutyl Ketone			120	ug/L		4	2%	10	1%	225	98%	1045	99%
Trichloroethene	5			ug/L		3	1%	10	1%	248	99%	1530	99%
1,1,2,2-Tetrachloroethane	1			ug/L		3	1%	6	0%	248	99%	1534	100%
1,1,2-Trichloroethane	5			ug/L		4	2%	6	0%	248	98%	1534	100%
Carbon Tetrachloride	0.5			ug/L		3	1%	6	0%	248	99%	1534	100%
Vinyl Chloride				ug/L		3	1%	6	0%	248	99%	1534	100%
1,1-Dichloroethane	5			ug/L		3	1%	5	0%	248	99%	1535	100%
1,1-Dichloroethene	6			ug/L		3	1%	5	0%	248	99%	1535	100%
1,2,4-Trichlorobenzene	5			ug/L		3	1%	5	0%	248	99%	1535	100%
1,4-Dichlorobenzene	5			ug/L		3	1%	5	0%	248	99%	1535	100%
Cis-1,2-Dichloroethene	6			ug/L		3	1%	5	0%	248	99%	1535	100%
Styrene	100			ug/L		3	1%	3	0%	248	99%	1537	100%
Trans-1,2-Dichloroethene	10			ug/L		2	1%	3	0%	248	99%	1537	100%
Trichlorofluoromethane	150			ug/L		2	1%	3	0%	248	99%	1537	100%
Chlorobenzene	70			ug/L		2	1%	2	0%	248	99%	1538	100%
n-Butylbenzene			260	ug/L		1	0%	1	0%	247	100%	1530	100%
Sec-Butylbenzene			260	ug/L		1	0%	1	0%	248	100%	1530	100%
Tert-Butylbenzene			260	ug/L		1	0%	1	0%	248	100%	1530	100%

1 The California MCL was used for exceedance analysis unless otherwise noted.
2 MCL is for total chromium
3 US EPA Secondary MCL Threshold 1
4 The US EPA Secondary MCL was used to compute counts and percentages of exceedances because it is a lower than the California MCL. The counts and percentages of exceedances were calculated for the US EPA Secondary MCL Threshold 2 (0.2 mg/L),California Secondary MCL (0.2 mg/L), and California Primary MCL (1 mg/L) and were determined to be zero.

Table 3-11
Groundwater Quality Data in Exceedance of San Diego Regional Water Quality Control Board Basin Plan Groundwater Quality Objectives - 2006 to 2010

Lower San Juan Sub Area	**TDS**			**Cl**			**SO4**			**%Na**			**NO3-N**			**Fe**		
Objective:	1,200 mg/L			400 mg/L			500 mg/L			60%			10 mg/L			0.3 mg/L		
	# of Years			# of Years			# of Years			# of Years			# of Years			# of Years		
Well Name	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below
08S08W01F001	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S08W01K003	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S08W01Q005	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S08W01Q01	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S08W12A001	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S08W12B002	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S08W12C002	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S08W14H003	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S08W14Q001 (Rancho SJ)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S08W23A007	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S08W23A05	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
AMW-01(T0605902379)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0
Capistrano Beach CWD-4	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-7(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-7-1 (T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-7-1R(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-7-2(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-7-3(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-7-4(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-7-5(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-8(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-8-1(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-8-2(t0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-8-3(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-8-4(t0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-8-5(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-8-6(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-9(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-9-1(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-9-2(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-9-3(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-9-4(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-9-5(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-9-6(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-9-7	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-9-7(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMW-09(T0605902379)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0
CMW-11(T0605902379)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0
Crean Well	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CVWD #2	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CVWD-1	1	4	0	2	0	3	2	3	0	2	0	3	1	0	4	1	1	3
Dance Hall	0	5	0	1	0	4	1	4	0	1	0	4	0	0	5	0	5	0
Hollywood 2A	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
Kinoshita	0	5	0	1	0	4	1	3	1	1	0	4	0	0	5	0	5	0
Mission Street	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-01(T0605902510)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0
MW-02(T0605902379)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0
MW-02A(T0605902510)	5	0	0	4	0	1	4	0	1	4	0	1	4	0	1	5	0	0
MW-02B(T0605902510)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-03(T0605902379)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0

Lower San Juan Sub Area	**Mn**			**MBAS**			**B**			**Turbidity**			**Color**			**F**		
Objective:	0.05 mg/L			0.5 mg/L			0.75 mg/L			5 NTU			15 units			1 mg/L		
	# of Years			# of Years			# of Years			# of Years			# of Years			# of Years		
Well Name	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below
08S08W01F001	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S08W01K003	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S08W01Q005	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S08W01Q01	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S08W12A001	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S08W12B002	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S08W12C002	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S08W14H003	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S08W14Q001 (Rancho SJ)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S08W23A007	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S08W23A05	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
AMW-01(T0605902379)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
Capistrano Beach CWD-4	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-7(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-7-1 (T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-7-1R(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-7-2(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-7-3(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-7-4(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-7-5(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-8(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-8-1(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-8-2(t0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-8-3(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-8-4(t0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-8-5(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-8-6(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-9(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-9-1(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-9-2(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-9-3(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-9-4(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-9-5(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-9-6(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-9-7	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMT-9-7(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CMW-09(T0605902379)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
CMW-11(T0605902379)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
Crean Well	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CVWD #2	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CVWD-1	1	4	0	3	0	2	3	0	2	1	0	4	1	0	4	2	0	3
Dance Hall	0	5	0	3	0	3	4	0	1	0	5	0	0	3	2	1	0	4
Hollywood 2A	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
Kinoshita	0	5	0	3	0	2	4	0	1	1	4	0	1	2	2	1	0	4
Mission Street	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-01(T0605902510)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-02(T0605902379)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-02A(T0605902510)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-02B(T0605902510)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-03(T0605902379)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1

Table 3-11
Groundwater Quality Data in Exceedance of San Diego Regional Water Quality Control Board Basin Plan Groundwater Quality Objectives - 2006 to 2010

Lower San Juan Sub Area	**TDS**			**Cl**			**SO4**			**%Na**			**NO3-N**			**Fe**			**Mn**			**MBAS**			**B**			**Turbidity**			**Color**			**F**		
Objective:	1,200 mg/L			400 mg/L			500 mg/L			60%			10 mg/L			0.3 mg/L			0.05 mg/L			0.5 mg/L			0.75 mg/L			5 NTU			15 units			1 mg/L		
	# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years		
Well Name	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below
MW-03(T0605902510)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-03R(T0605902510)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-04(T0605902379)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-04(T0605902510)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-05(T0605902379)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-05(T0605902510)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-06(T0605902510)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW07 (T0605902573)	5	0	0	5	0	0	3	0	2	5	0	0	3	0	2	3	1	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-07(T0605902510)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW08 (T0605902573)	5	0	0	5	0	0	4	1	0	5	0	0	4	0	1	3	0	2	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-08(T0605902379)	5	0	0	4	0	1	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-08A(T0605902510)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-08B(T0605902510)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW09 (T0605902573)	5	0	0	5	0	0	3	2	0	5	0	0	3	0	2	3	0	2	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-09A(T0605902510)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-09B(T0605902510)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW1 (T0605902575)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-1(T0605902362)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-1(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-1(T0605902524)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW10 (T0605902575)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-10(T0605902362)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-10(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-10(T0605902573)	5	0	0	5	0	0	3	0	2	5	0	0	4	0	1	3	0	2	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-10A(T0605902510)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-10B(T0605902510)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW11 (T0605902573)	5	0	0	5	0	0	4	1	0	5	0	0	4	0	1	3	2	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-11(T0605902362)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-11(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-11A(T0605902510)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-11B(T0605902510)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-12(T0605902362)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-12A(T0605902379)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-12A(T0605902510)	5	0	0	4	1	0	4	1	0	4	0	1	4	1	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-12B(T0605902379)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-12B(T0605902510)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-12C(T0605902379)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-12D(T0605902379)	5	0	0	4	0	1	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-13(T0605902362)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-13A(T0605902379)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-13A(T0605902510)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-13B(T0605902379)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-13B(T0605902510)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-13C(T0605902379)	5	0	0	4	0	1	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-14(T0605902362)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-14A(T0605902379)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-14A(T0605902510)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-14B(T0605902379)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-14B(T0605902510)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-14C(T0605902379)	5	0	0	4	0	1	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1

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Groundwater Quality Data in Exceedance of San Diego Regional Water Quality Control Board Basin Plan Groundwater Quality Objectives - 2006 to 2010

Lower San Juan Sub Area	**TDS**			**Cl**			**SO4**			**%Na**			**NO3-N**			**Fe**			**Mn**			**MBAS**			**B**			**Turbidity**			**Color**			**F**		
Objective:	1,200 mg/L			400 mg/L			500 mg/L			60%			10 mg/L			0.3 mg/L			0.05 mg/L			0.5 mg/L			0.75 mg/L			5 NTU			15 units			1 mg/L		
	# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years		
Well Name	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below
MW-15(T0605902362)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-15A(T0605902379)	5	0	0	4	0	1	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-15A(T0605902510)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-15B(T0605902379)	5	0	0	4	0	1	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-15B(T0605902510)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-15C(T0605902379)	5	0	0	4	0	1	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-15D(T0605902379)	5	0	0	4	0	1	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-16(T0605902362)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-16(T0605902510)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-16A(T0605902379)	5	0	0	4	0	1	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-16B(T0605902379)	5	0	0	4	0	1	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-16C(T0605902379)	5	0	0	4	0	1	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-16D(T0605902379)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-17(T0605902362)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-18(T0605902362)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-19A(T0605902379)	5	0	0	4	0	1	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-19B(T0605902379)	5	0	0	4	0	1	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-19C(T0605902379)	5	0	0	4	0	1	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW2 (T0605902575)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-2(T0605902362)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-2(T0605902524)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-20A(T0605902379)	5	0	0	4	1	0	4	1	0	4	0	1	4	1	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	1	0
MW-20B(T0605902379)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	1	0
MW-20C(T0605902379)	5	0	0	4	1	0	4	1	0	4	1	0	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	1	0
MW-20D(T0605902379)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	1	0
MW-21(T0605902379)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-21A(T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-21B(T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-22A(T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-22B(T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-23A(T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-23B(T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-24(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-24A(T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-24B(T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-25(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-25A(T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-25B(T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-26(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-27(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-28(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW3 (T0605902575)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-3(T0605902362)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-3(T0605902524)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-30(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-31(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-32(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-34(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-35(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-36(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0

WILDERMUTH ENVIRONMENTAL INC.

Table 3-11
Groundwater Quality Data in Exceedance of San Diego Regional Water Quality Control Board Basin Plan Groundwater Quality Objectives - 2006 to 2010

Lower San Juan Sub Area	**TDS**			**Cl**			**SO4**			**%Na**			**NO3-N**			**Fe**			**Mn**			**MBAS**			**B**			**Turbidity**			**Color**			**F**		
Objective:	1,200 mg/L			400 mg/L			500 mg/L			60%			10 mg/L			0.3 mg/L			0.05 mg/L			0.5 mg/L			0.75 mg/L			5 NTU			15 units			1 mg/L		
	# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years		
Well Name	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below
MW37(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW38(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW4 (T0605902575)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-4(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-4(T0605902524)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-4(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW5 (T0605902575)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-5(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-5(T0605902524)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-5(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW6 (T0605902575)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-6(T0605902362)	5	0	0	5	0	0	4	1	0	5	0	0	5	0	0	5	0	0	4	1	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-6(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-6(T0605902524)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-6(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW7 (T0605902575)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-7(T0605902362)	5	0	0	5	0	0	4	1	0	5	0	0	5	0	0	5	0	0	4	1	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-7(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-7A(T0605902379)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-7B(T0605902379)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-7C(T0605902379)	5	0	0	4	1	0	4	1	0	4	0	1	4	0	1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW8 (T0605902575)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-8(T0605902362)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-8(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-8(T0605902524)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-8(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW9 (T0605902575)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-9(T0605902362)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-9(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-9(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-12(T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-13(T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-14(T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-15(T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-22/A (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-22/B (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-23/A (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-23/B (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-24/A (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-24/B (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-25/A (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-25/B (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-26/A (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-26/B (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-27/A (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-27/B (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-28/A (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-28/B (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-29/A (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-29/B (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0

Groundwater Quality Data in Exceedance of San Diego Regional Water Quality Control Board Basin Plan Groundwater Quality Objectives - 2006 to 2010

Lower San Juan Sub Area	**TDS**			**Cl**			**SO4**			**%Na**			**NO3-N**			**Fe**			**Mn**			**MBAS**			**B**			**Turbidity**			**Color**			**F**		
Objective:	1,200 mg/L			400 mg/L			500 mg/L			60%			10 mg/L			0.3 mg/L			0.05 mg/L			0.5 mg/L			0.75 mg/L			5 NTU			15 units			1 mg/L		
	# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years		
Well Name	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below
OZ-30/A (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-30/B (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-31/A (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-31/B (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-32/A (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-32/B (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-33/A (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-33/B (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-34/A (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-34/B (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-35/A (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-35/B (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-36/A (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-36/B (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-37/A (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-37/B (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-38/A (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-38/B (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-39/A (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-39/B (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-40/A (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-40/B (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-41/A (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
OZ-41/B (T0605902573)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
Rosan Ranch-1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
Rosan Ranch-2	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
RP-1(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
RP-2(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
RP-3(T0605902526)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
RW-15(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
RW-16(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
RW-2(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
RW-3(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
Schuller	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
SJBA #1	5	0	0	5	0	0	5	0	0	5	0	2	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
SJBA MW-01N	0	2	3	0	0	5	0	2	3	0	4	1	5	0	0	0	5	0	0	5	0	0	0	5	5	0	0	0	4	1	0	1	4	5	0	0
SJBA MW-01S	0	2	3	0	0	5	0	1	4	0	0	5	5	0	0	0	5	0	0	5	0	0	0	5	5	0	0	0	5	0	0	3	2	5	0	0
SJBA MW-02	0	5	0	0	0	5	0	5	0	0	0	5	5	0	0	0	5	0	0	5	0	0	1	4	5	0	0	0	5	0	0	3	2	5	0	0
SJBA MW-03	0	2	3	0	1	4	0	2	3	0	0	5	5	0	0	0	5	0	0	5	0	0	0	5	5	0	0	0	5	0	0	4	1	5	0	0
SJBA MW-07	0	5	0	0	0	5	0	5	0	0	0	5	5	0	0	0	5	0	0	5	0	0	0	5	5	0	0	0	5	0	0	3	2	5	0	0
SJBA MW-08	0	5	0	0	0	5	0	5	0	0	0	5	5	0	0	0	5	0	0	4	1	0	0	5	5	0	0	0	5	0	0	2	3	5	0	0
SJBA-2	0	5	0	1	0	4	1	4	0	1	0	4	0	0	5	0	5	0	0	5	0	3	0	2	4	0	1	0	0	5	0	0	5	1	0	4
SJBA-4	0	5	0	1	0	4	1	4	0	1	0	4	0	0	5	0	5	0	0	5	0	3	0	2	4	0	1	0	4	1	0	0	5	1	0	4
SP-1(T0605902362)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
SP-2(T0605902362)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
SP-3(T0605902362)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
SP-4(T0605902362)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
SP-5(T0605902362)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
SP-6(T0605902362)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
SP-7(T0605902362)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0

Table 3-11
Groundwater Quality Data in Exceedance of San Diego Regional Water Quality Control Board Basin Plan Groundwater Quality Objectives - 2006 to 2010

Lower San Juan Sub Area	TDS			Cl			SO4			%Na			NO3-N			Fe			Mn			MBAS			B			Turbidity			Color			F		
Objective:	1,200 mg/L			400 mg/L			500 mg/L			60%			10 mg/L			0.3 mg/L			0.05 mg/L			0.5 mg/L			0.75 mg/L			5 NTU			15 units			1 mg/L		
	# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years		
Well Name	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below
Stonehill	1	4	0	2	3	0	2	3	0	2	0	3	1	3	1	1	4	0	1	4	0	2	0	3	3	0	2	4	1	0	2	3	0	4	0	1
SW-16A(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
Sycamore Stables	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
TCW-1(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
TCW-2(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
TW-1 (SJC)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
Vermulean Well	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
VEW-12(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
VEW-13(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
VEW-14(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
VEW-15(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
VEW-16(T0605902502)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
VW-2(T0605902524)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
VW-3(T0605902524)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0

Middle San Juan Sub Area	TDS			Cl			SO4			%Na			NO3-N			Fe			Mn			MBAS			B			Turbidity			Color			F		
Objective:	750 mg/L			375 mg/L			375 mg/L			60%			10 mg/L			0.3 mg/L			0.05 mg/L			0.5 mg/L			0.75 mg/L			5 NTU			15 units			1 mg/L		
	# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years		
Well Name	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below
RMV 7	4	0	1	4	0	1	4	0	1	4	0	1	0	0	5	4	0	1	4	0	1	4	0	1	5	0	0	4	0	1	4	0	1	4	0	1

Middle Trabuco Sub Area	TDS			Cl			SO4			%Na			NO3-N			Fe			Mn			MBAS			B			Turbidity			Color			F		
Objective:	750 mg/L			375 mg/L			375 mg/L			60%			10 mg/L			0.3 mg/L			0.05 mg/L			0.5 mg/L			0.75 mg/L			5 NTU			15 units			1 mg/L		
	# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years		
Well Name	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below
07S08W25B004	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
07S08W25K002	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
07S08W25L001	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
07S08W36L01	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
Christmas Tree Farm 1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
Egan Tract-2	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
IW-1	0	5	0	5	0	0	0	0	5	5	0	0	0	0	5	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-01(T0605933373)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-02(T0605933373)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-04(T0605933373)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-05(T0605933373)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-06(T0605933373)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-07(T0605933373)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-08(T0605933373)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-09(T0605933373)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-1(T0605902366)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW1(T0605902555)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-1(T0605952809)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW10(T0605902555)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-10(T0605933373)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-10(T0605952809)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW11(T0605902555)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-11(T0605933373)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0

Table 3-11
Groundwater Quality Data in Exceedance of San Diego Regional Water Quality Control Board Basin Plan Groundwater Quality Objectives - 2006 to 2010

Middle Trabuco Sub Area	TDS			Cl			SO4			%Na			NO3-N			Fe			Mn			MBAS			B			Turbidity			Color			F		
Objective:	750 mg/L			375 mg/L			375 mg/L			60%			10 mg/L			0.3 mg/L			0.05 mg/L			0.5 mg/L			0.75 mg/L			5 NTU			15 units			1 mg/L		
	# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years		
Well Name	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below
MW12(T0605902555)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-12(T0605933373)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW13(T0605902555)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW14(T0605902555)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-15(T0605933373)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-2(T0605902366)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW2(T0605902555)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-2(T0605952809)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW2U(T0605902555)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-3(T0605902366)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW3(T0605902555)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-3(T0605933373)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-3(T0605952809)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW3U(T0605902555)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-4(T0605902366)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW4(T0605902555)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-4(T0605952809)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW4U(T0605902555)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-5(T0605902366)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW5(T0605902555)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-5(T0605952809)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW5U(T0605902555)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW6(T0605902555)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-6(T0605952809)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW7(T0605902555)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-7(T0605952809)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW8(T0605902555)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-8(T0605952809)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW9(T0605902555)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-9(T0605952809)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
North Open Space(NOS)	2	3	0	2	0	3	2	2	1	2	0	3	2	0	3	2	0	3	2	0	3	2	0	3	4	0	1	2	1	2	2	0	3	2	0	3
P-6	0	5	0	5	0	0	0	0	5	5	0	0	0	0	5	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1	5	0	0	5	0	0
Rosenbaum 2	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0

Ortega Sub Area	TDS			Cl			SO4			%Na			NO3-N			Fe			Mn			MBAS			B			Turbidity			Color			F		
Objective:	1,100 mg/L			375 mg/L			450 mg/L			60%			10 mg/L			0.3 mg/L			0.05 mg/L			0.5 mg/L			0.75 mg/L			5 NTU			15 units			1 mg/L		
	# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years		
Well Name	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below
07S07W33B01	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S07W06K001	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S07W06K03	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S07W06P001	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
08S07W07C03	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
Cerritos Ranch 3	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CVWD # 5	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CVWD #4	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
CVWD #5A	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
La Couague	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-03R(T0605902510)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0

Table 3-11
Groundwater Quality Data in Exceedance of San Diego Regional Water Quality Control Board Basin Plan Groundwater Quality Objectives - 2006 to 2010

Ortega Sub Area	**TDS**			**Cl**			**SO4**			**%Na**			**NO3-N**			**Fe**			**Mn**			**MBAS**			**B**			**Turbidity**			**Color**			**F**		
Objective:	1,100 mg/L			375 mg/L			450 mg/L			60%			10 mg/L			0.3 mg/L			0.05 mg/L			0.5 mg/L			0.75 mg/L			5 NTU			15 units			1 mg/L		
	# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years		
Well Name	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below
MW-1(T0605902561)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-10(T0605902561)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-10(T0605902592)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-11(T0605902592)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-12(T0605902592)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-13(T0605902592)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-14(T0605902592)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-15(T0605902592)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-16(T0605902510)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-16(T0605902592)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-2(T0605902561)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-2(T0605902592)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-3(T0605902561)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-4(T0605902561)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-4(T0605902592)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-5(T0605902561)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-5(T0605902592)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-6(T0605902561)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-6(T0605902592)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-7(T0605902561)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-8(T0605902561)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-8(T0605902592)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-9(T0605902561)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-9(T0605902592)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
Orange County Water Works #4	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
SJBA MW-04	0	5	0	0	0	5	0	3	2	0	0	5	5	0	0	0	5	0	0	5	0	0	0	5	5	0	0	0	5	0	0	3	2	5	0	0
SJBA MW-05	0	5	0	0	0	5	0	5	0	0	0	5	5	0	0	0	5	0	0	4	1	0	0	5	5	0	0	0	5	0	0	3	2	5	0	0
SJBA MW-06	0	2	3	0	0	5	0	1	4	0	0	5	5	0	0	0	5	0	0	5	0	0	0	5	5	0	0	0	5	0	0	3	2	5	0	0
SJHGC-Large	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
SJHGC-Small	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
South Cooks	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
The Oaks	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
Tirador	0	5	0	1	0	4	1	4	0	1	0	4	0	0	5	0	5	0	0	5	0	3	0	3	4	0	1	0	5	0	0	5	0	1	2	2
TW-2 (SJC)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
W-2(T0605902592)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0

Oso Sub Area	**TDS**			**Cl**			**SO4**			**%Na**			**NO3-N**			**Fe**			**Mn**			**MBAS**			**B**			**Turbidity**			**Color**			**F**		
Objective:	1,200 mg/L			400 mg/L			500 mg/L			60%			10 mg/L			0.3 mg/L			0.05 mg/L			0.5 mg/L			0.75 mg/L			5 NTU			15 units			1 mg/L		
	# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years		
Well Name	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below
07S08W25L001	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	0	0	5	0	0	5	0	0	5
B-11(T0605902455)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
B-12(T0605902620)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
B-13(T0605902455)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
B-13(T0605902620)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
B-14(T0605902455)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	2	1	2	2	0	3	2	0	3
B-15(T0605902455)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
B-16(T0605902455)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
B-17(T0605902455)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0

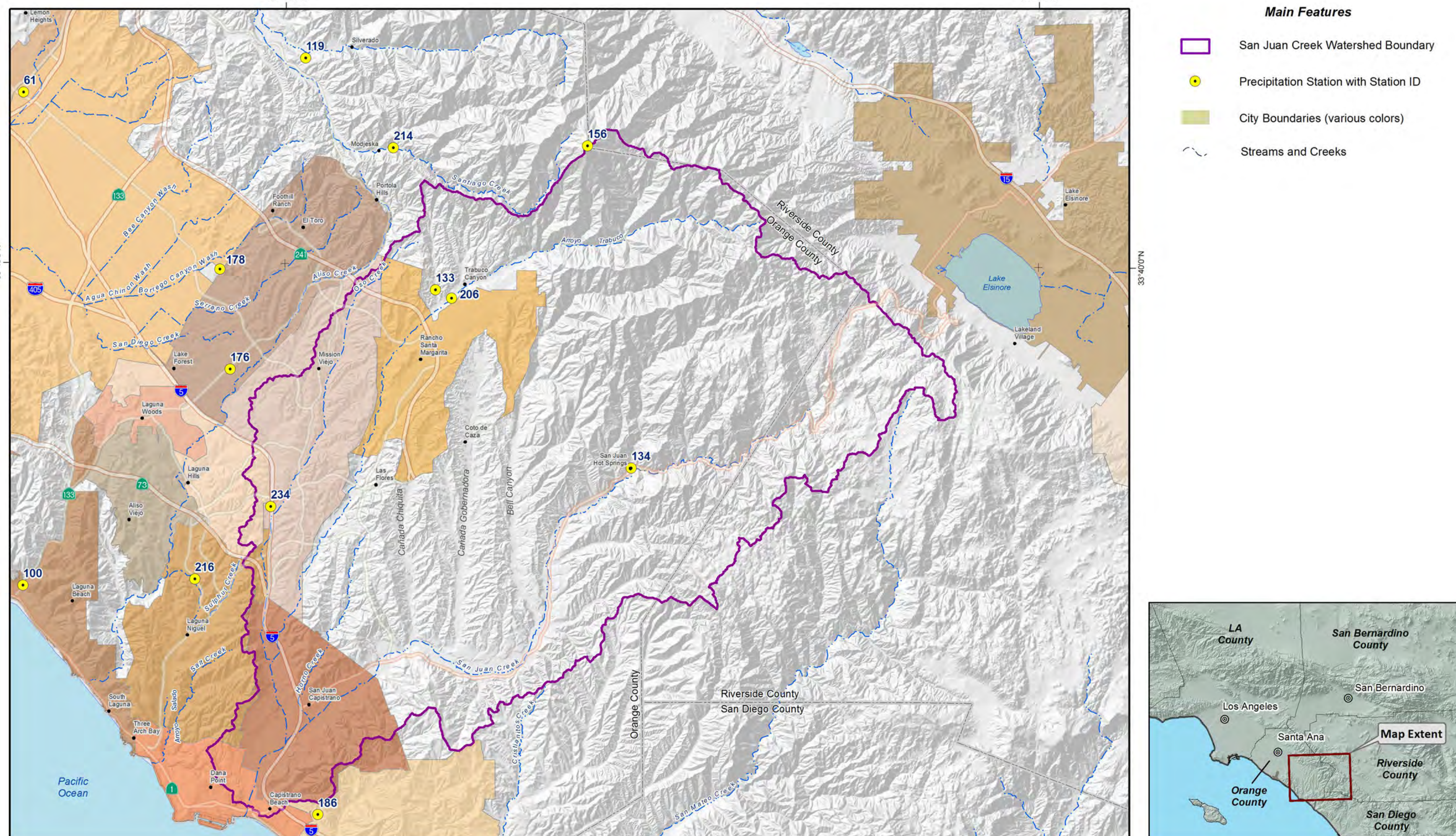
WILDERMUTH ENVIRONMENTAL INC.

Groundwater Quality Data in Exceedance of San Diego Regional Water Quality Control Board Basin Plan Groundwater Quality Objectives - 2006 to 2010

Oso Sub Area	TDS			Cl			SO4			%Na			NO3-N			Fe			Mn			MBAS			B			Turbidity			Color			F		
Objective:	1,200 mg/L			400 mg/L			500 mg/L			60%			10 mg/L			0.3 mg/L			0.05 mg/L			0.5 mg/L			0.75 mg/L			5 NTU			15 units			1 mg/L		
	# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years		
Well Name	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below
B-20(T0605902620)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
B-28(T0605902620)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
B-30(T0605902620)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
B-31(T0605902620)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
B-36(T0605902620)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
B-37(T0605902620)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
Christmas Tree Farm 1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
Christmas Tree Farm 2	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
E-1(T0605902475)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
E-11(T0605902475)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
E-13(T0605902475)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
E-14(T0605902475)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
E-16(T0605902475)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
E-17(T0605902475)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
E-18(T0605902475)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
E-19(T0605902475)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
E-20(T0605902475)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
E-21(T0605902475)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
E-22(T0605902475)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
E-4(T0605902475)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
E-5(T0605902475)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
E-7(T0605902475)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
Egan Tract-1	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
Egan Tract-3	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
GW-1(T0605902381)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-1(T0605902381)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-1(T0605902472)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-1(T0605902475)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-1(T0605902574)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-1(T0605940201)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW1(T0605991301)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-10(T0605902381)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-10(T0605902472)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-10(T0605902568)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-10(T0605902574)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-11(T0605902381)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-11(T0605902568)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-12(T0605902568)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-1A(T0605902472)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW1C(T0605902580)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-2(T0605902381)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-2(T0605902574)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-2(T0605902580)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-2(T0605940201)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW2(T0605991301)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-24(T0605902454)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-25(T0605902454)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-26(T0605902454)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-27(T0605902454)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-28(T0605902454)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0

Table 3-11
Groundwater Quality Data in Exceedance of San Diego Regional Water Quality Control Board Basin Plan Groundwater Quality Objectives - 2006 to 2010

Oso Sub Area	**TDS**			**Cl**			**SO4**			**%Na**			**NO3-N**			**Fe**			**Mn**			**MBAS**			**B**			**Turbidity**			**Color**			**F**		
Objective:	1,200 mg/L			400 mg/L			500 mg/L			60%			10 mg/L			0.3 mg/L			0.05 mg/L			0.5 mg/L			0.75 mg/L			5 NTU			15 units			1 mg/L		
	# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years			# of Years		
Well Name	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below	Not Samp	Above	Below
MW-3(T0605902381)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-3(T0605902472)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-3(T0605902574)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-3(T0605902580)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-3(T0605940201)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW3(T0605991301)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-4(T0605902381)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-4(T0605902472)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-4(T0605902574)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-4(T0605902580)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-5(T0605902381)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-5(T0605902472)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-5(T0605902574)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-5(T0605902580)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-6(T0605902381)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-6(T0605902472)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-6(T0605902574)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-6(T0605902580)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-7(T0605902381)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-7(T0605902472)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-7(T0605902574)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW7A(T0605902580)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW7B(T0605902580)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-8(T0605902381)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-8(T0605902472)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-8(T0605902574)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW8A(T0605902580)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW8B(T0605902580)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-9(T0605902381)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-9(T0605902472)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-9(T0605902568)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
MW-9(T0605902574)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
Rosenbaum 1	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	1	0	4	5	0	0	5	0	0	5	0	0	5	0	0
Shaw	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
TCW(T0605902580)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
VEW-1(T0605902455)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
VEW-2(T0605902455)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
VEW-3(T0605902455)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
VEW-4(T0605902455)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
VEW-5(T0605902455)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
VEW-6(T0605902455)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0
VEW-7(T0605902455)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0



Main Features

- San Juan Creek Watershed Boundary
- Precipitation Station with Station ID
- City Boundaries (various colors)
- Streams and Creeks

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0 1 2 3 4 Miles
0 2 4 6 KM

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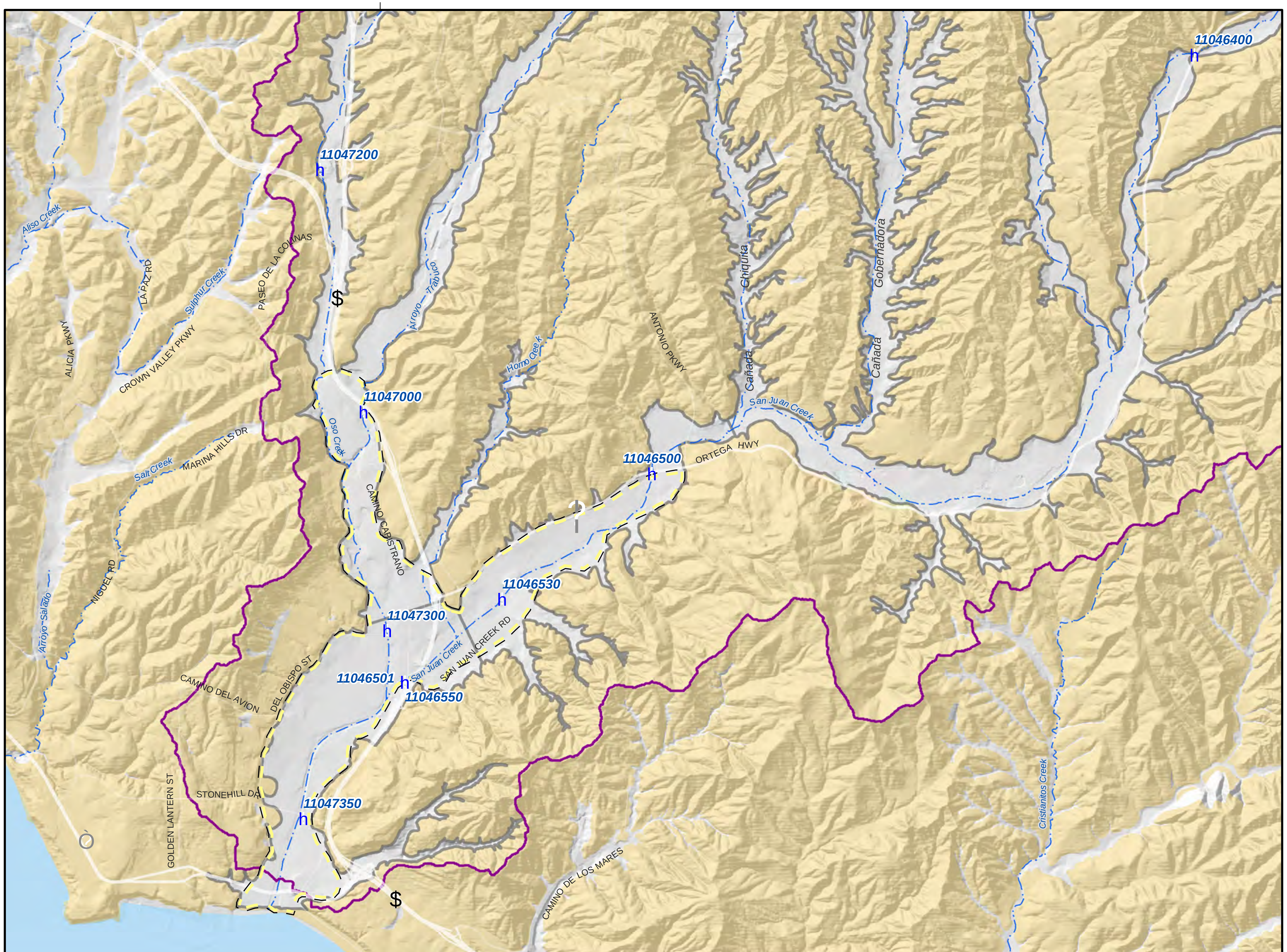
The San Juan Creek Watershed

City Boundaries and Precipitation Station Locations

Figure 3-1



Main Features

San Juan Creek Watershed Boundary

USGS Stream Gauge Station with Station ID

San Juan Basin

Streams and Creeks

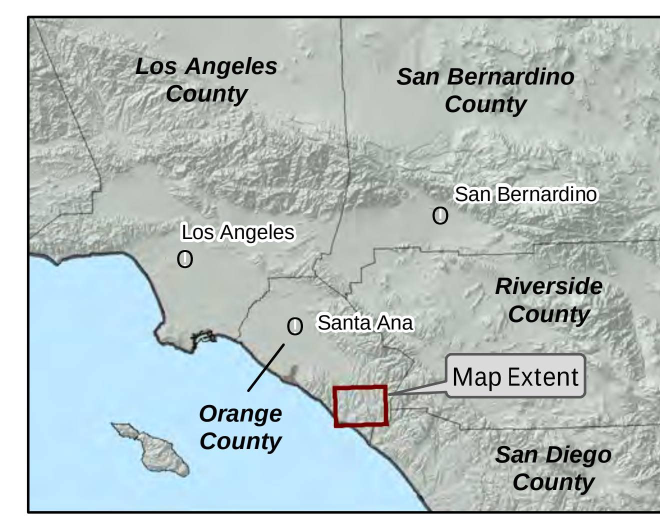
Active Managment Area

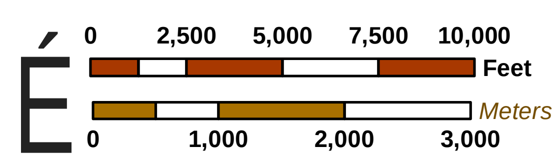
Geologic Features

Younger Alluvial Deposits

Older Alluvial Deposits, Landslides, and Tertiary Sedimentary bedrock

Source: CGS Special Report 217.





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Location of USGS Stream Gauging Stations

Figure 3-2

Figure 3-3 Cumulative Departure from Mean (CDFM)
Laguna Beach Station

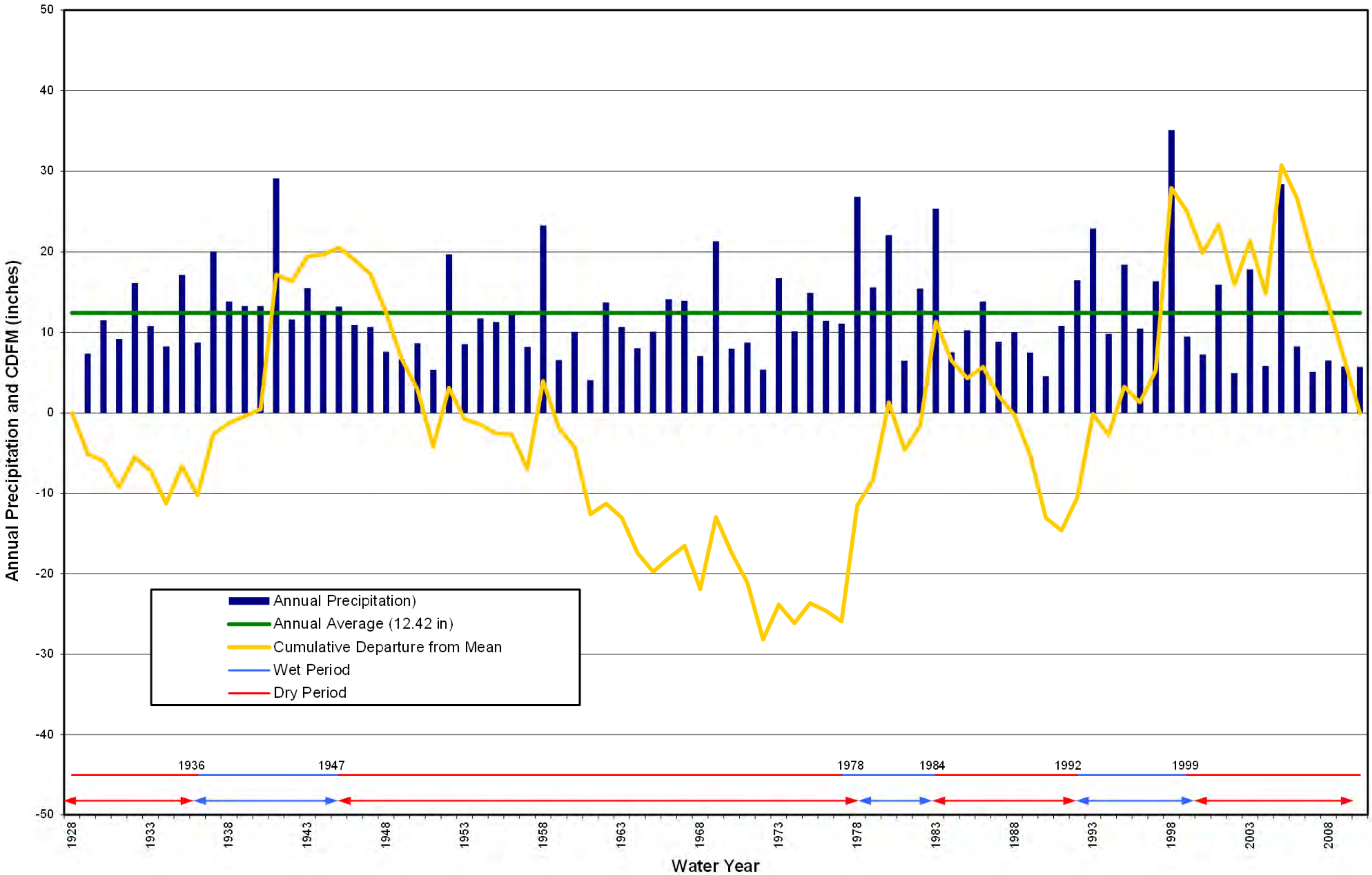

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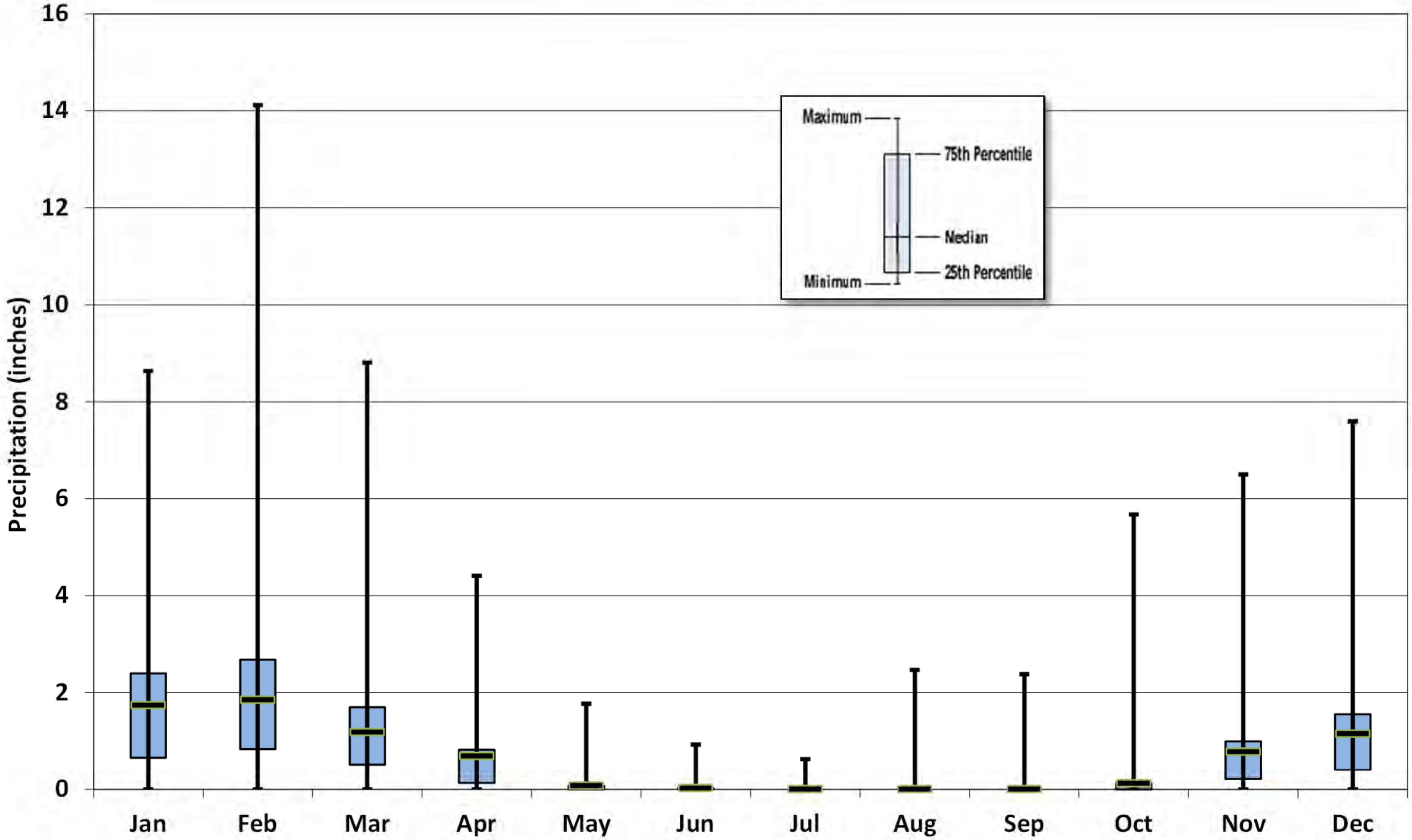
Figure 3-4 Monthly Precipitation Variability in Laguna Beach Station from 1928 to 2010



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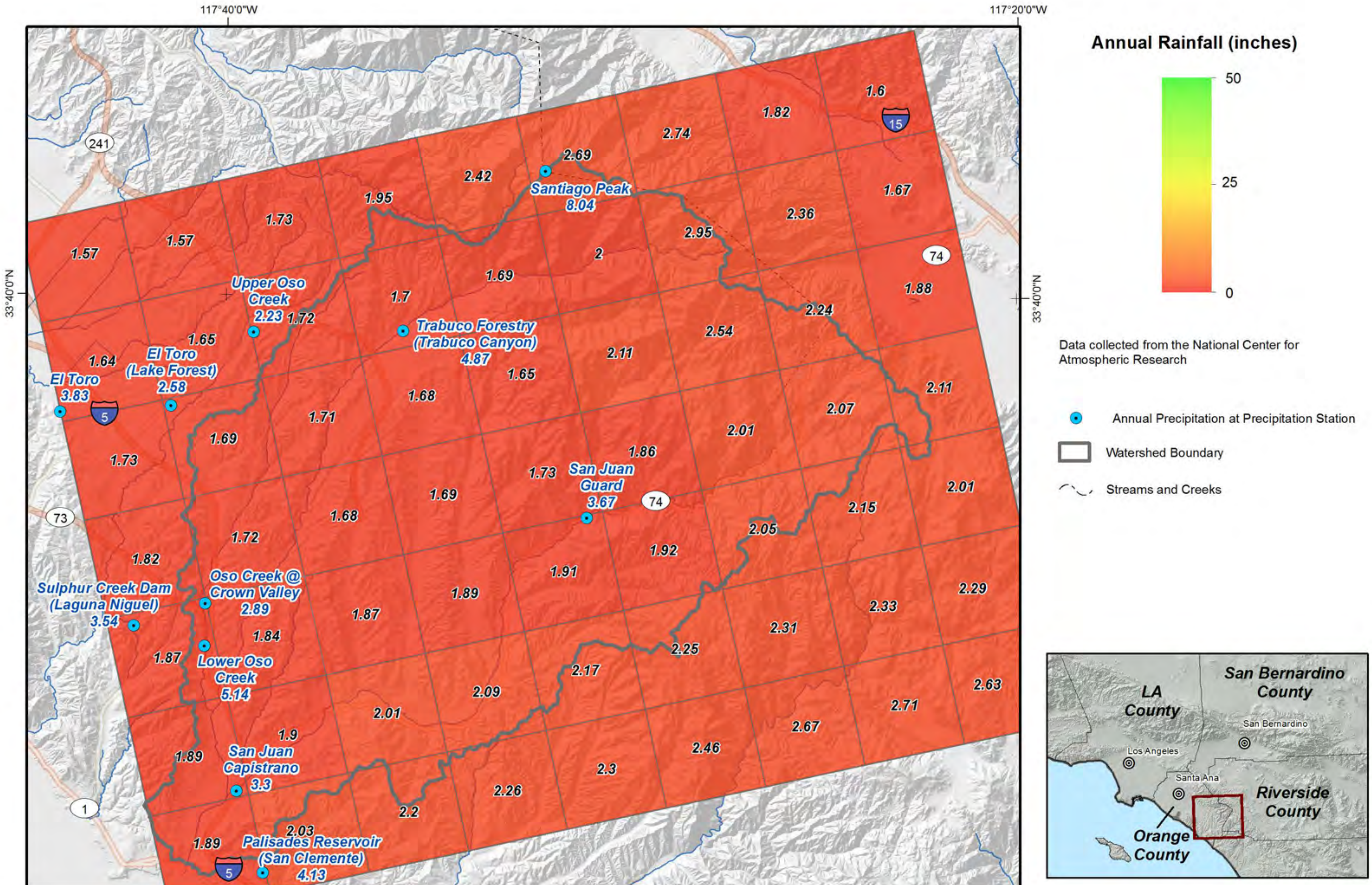

Annual Precipitation on San Juan Basin in Fiscal Year 2007

Figure 3-5

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0 2 Miles

0 2 4 6 Kilometers

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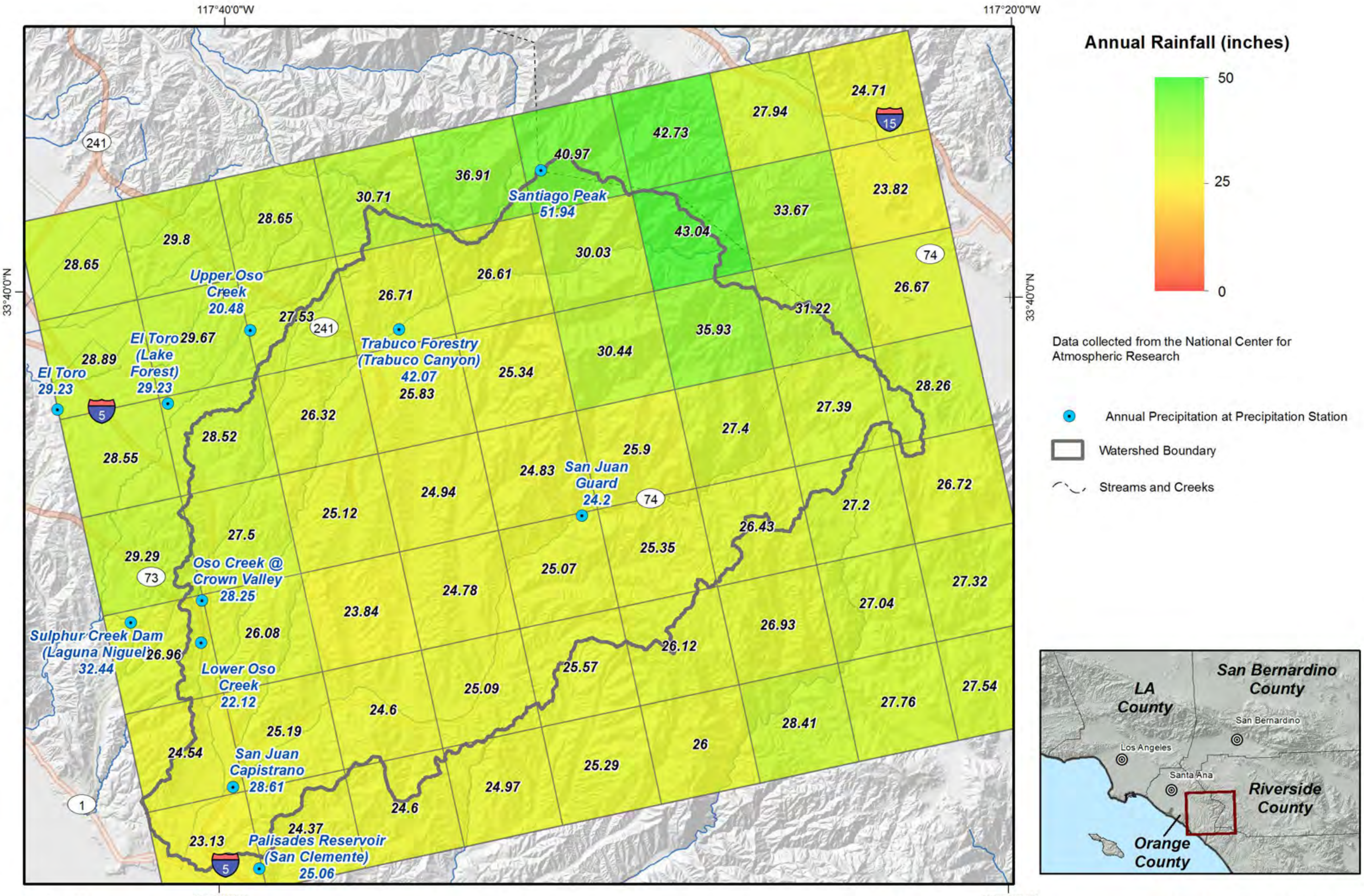

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0 2 Miles
0 2 4 6 Kilometers

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Annual Precipitation on San Juan Basin in Fiscal Year 2005

Figure 3-6

Figure 3-7 Projected Average Monthly Temperature for the San Juan Creek Watershed
Based on the IPCC A2 Emission Scenario and the MPI-ECHAM5 Model

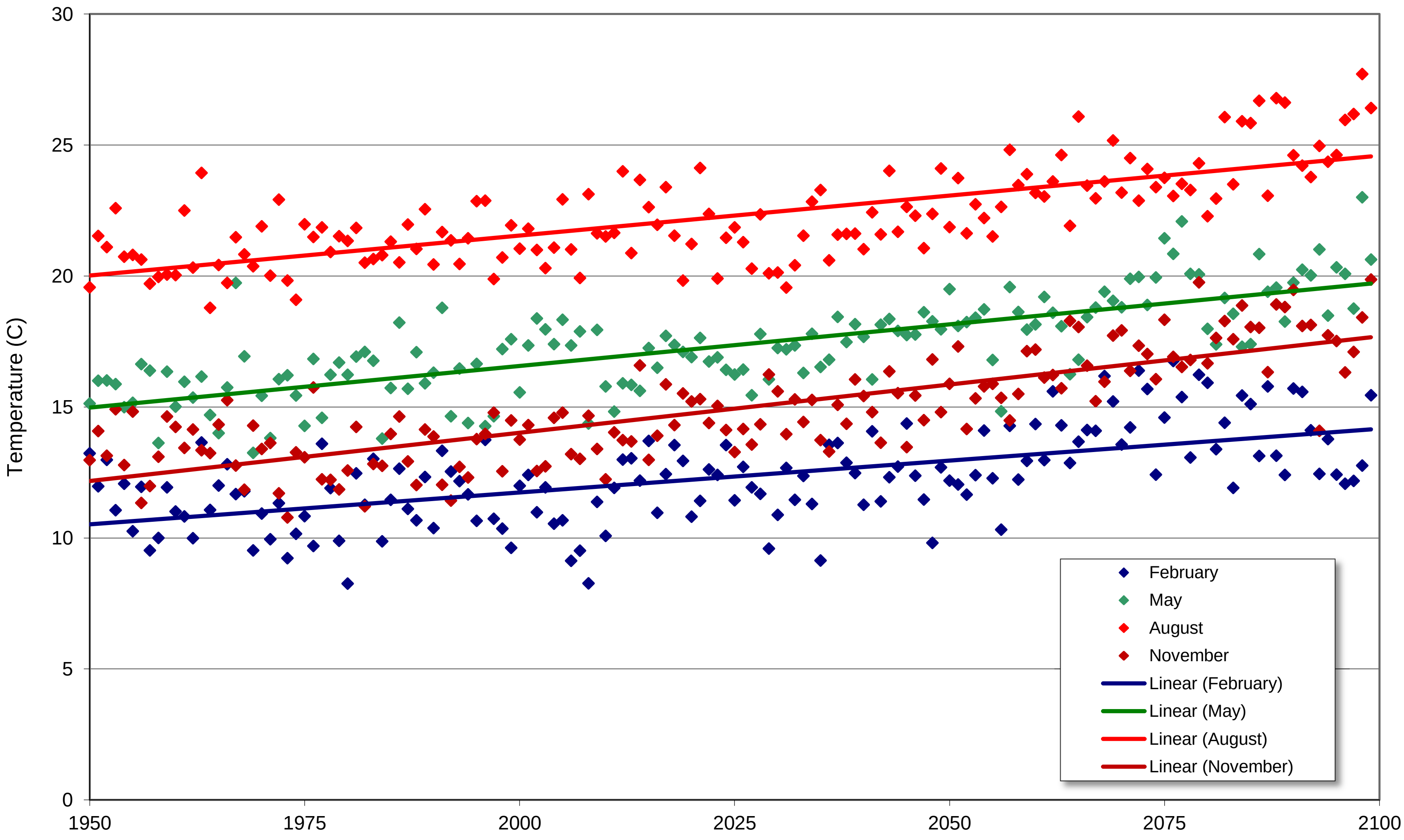

Figure 3-8 Projected Precipitation on the San Juan Creek Watershed
MPI-ECHAM 5.1 Model - A2 Emissions Scenario

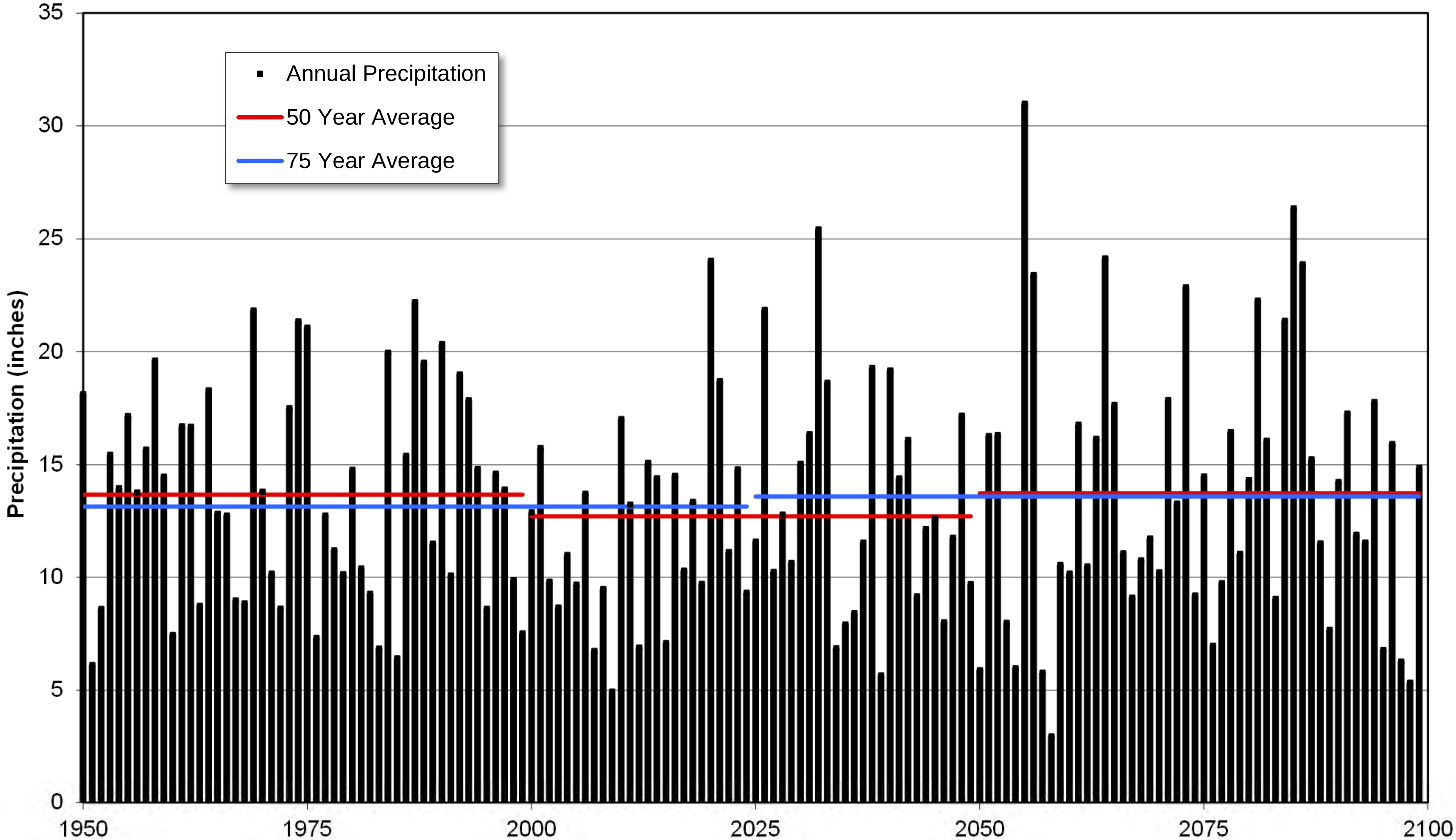

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Figure 3-9 Projected Annual Precipitation on the San Juan Watershed 1950 through 2100 Based on the IPCC A2 Emission Scenario and the MPI-ECHAM5 Model

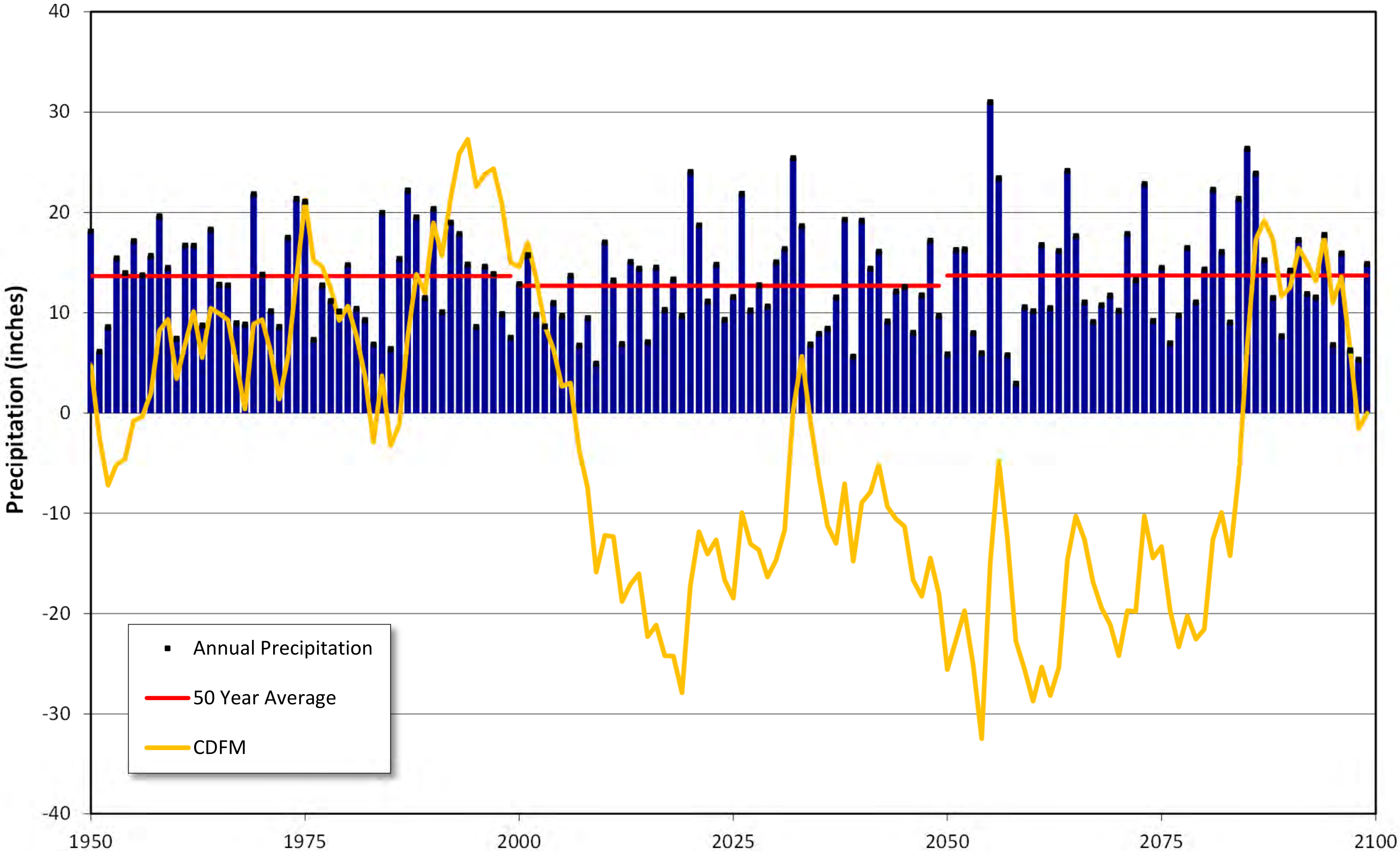

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Figure 3-10 Mass Curve of Stream Flow
San Juan Creek (1928 - 2010)

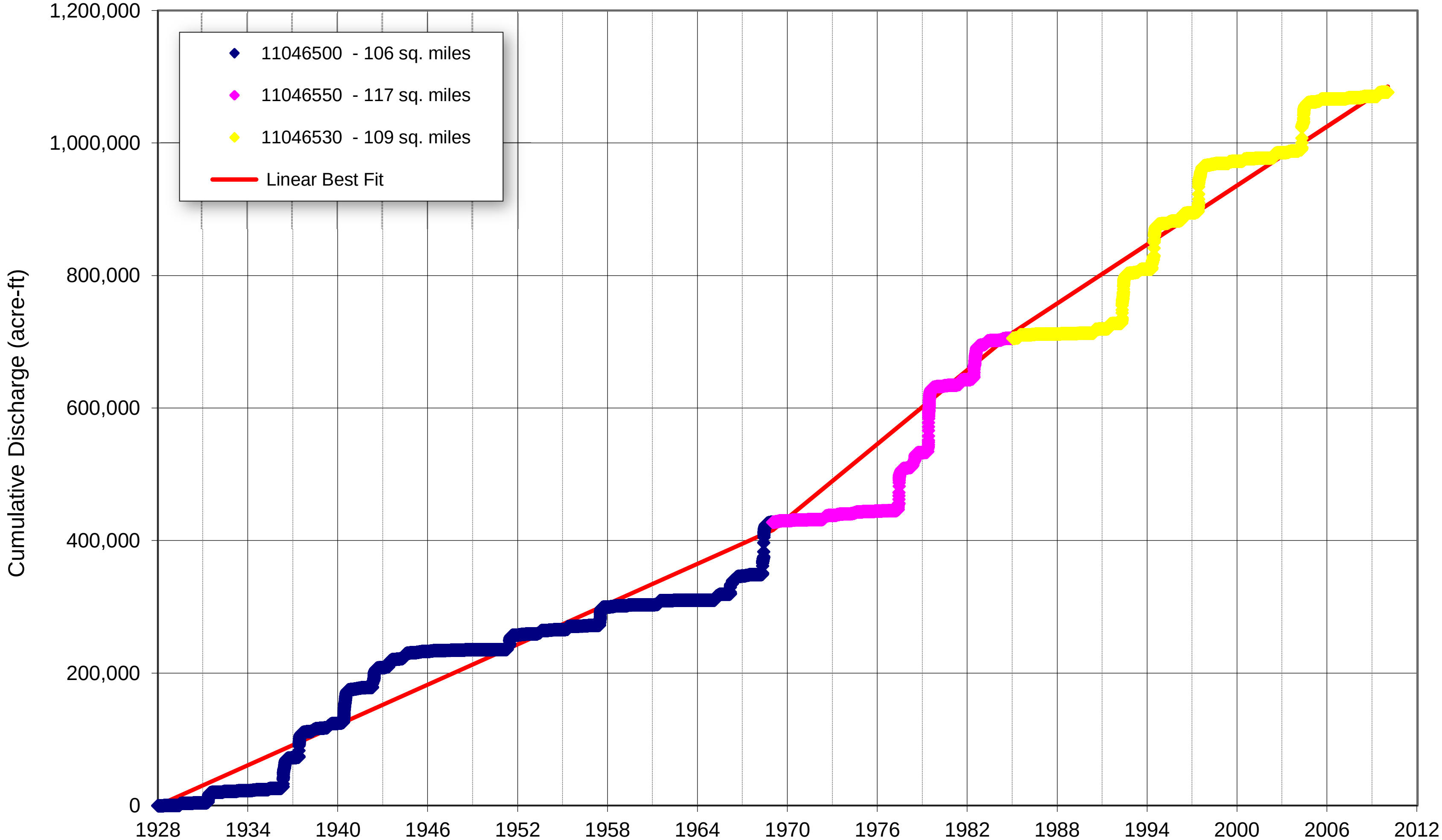

Fig 3-10 3-11 and 3-12-- Fig 3-10

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Figure 3-11 Annual Stream Discharge with CDFM
San Juan Creek Composite Gage

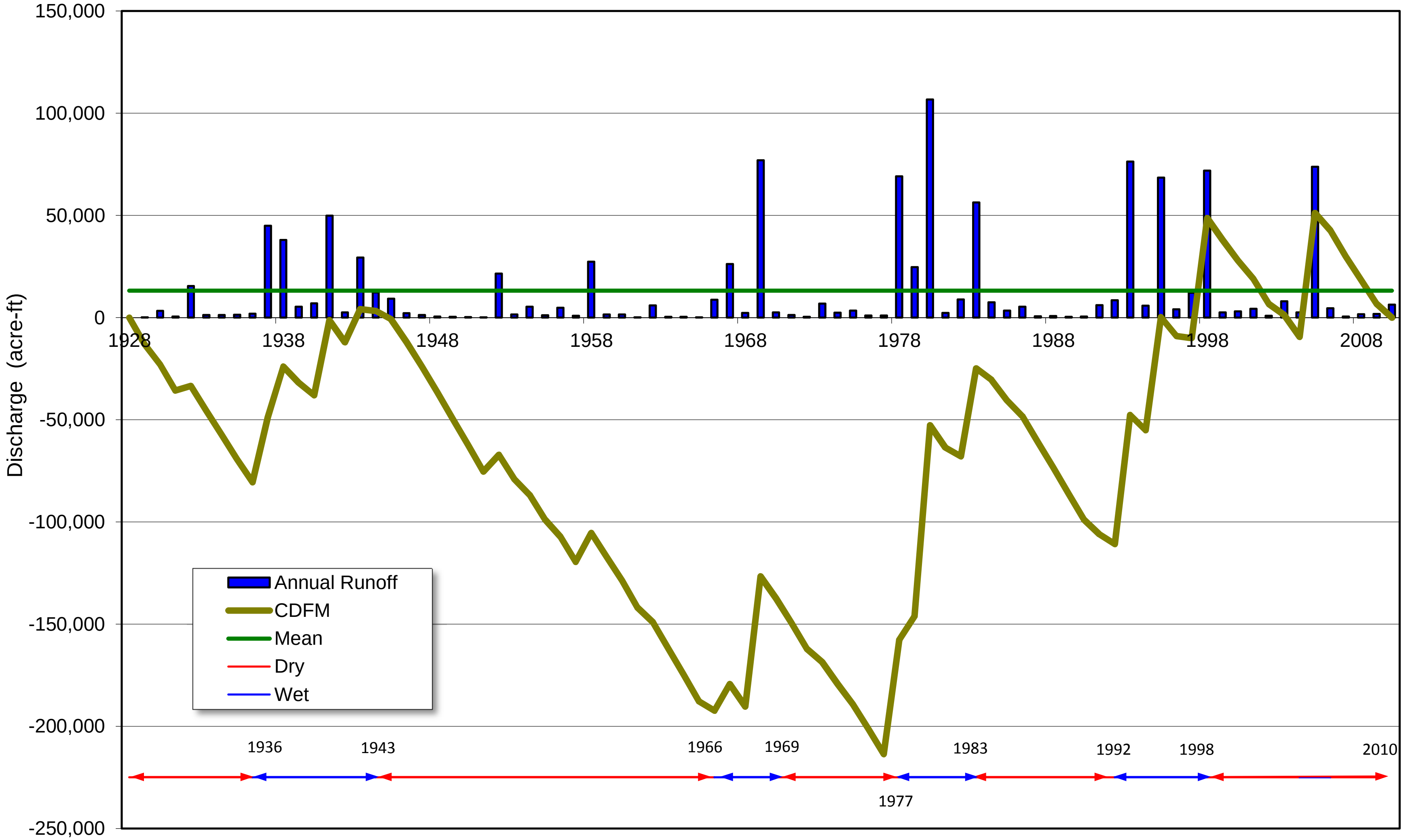

Fig 3-10 3-11 and 3-12-- Fig 3-11

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Figure 3-12 Monthly Discharge Variability Plot
San Juan Creek, from 1930 to 2010

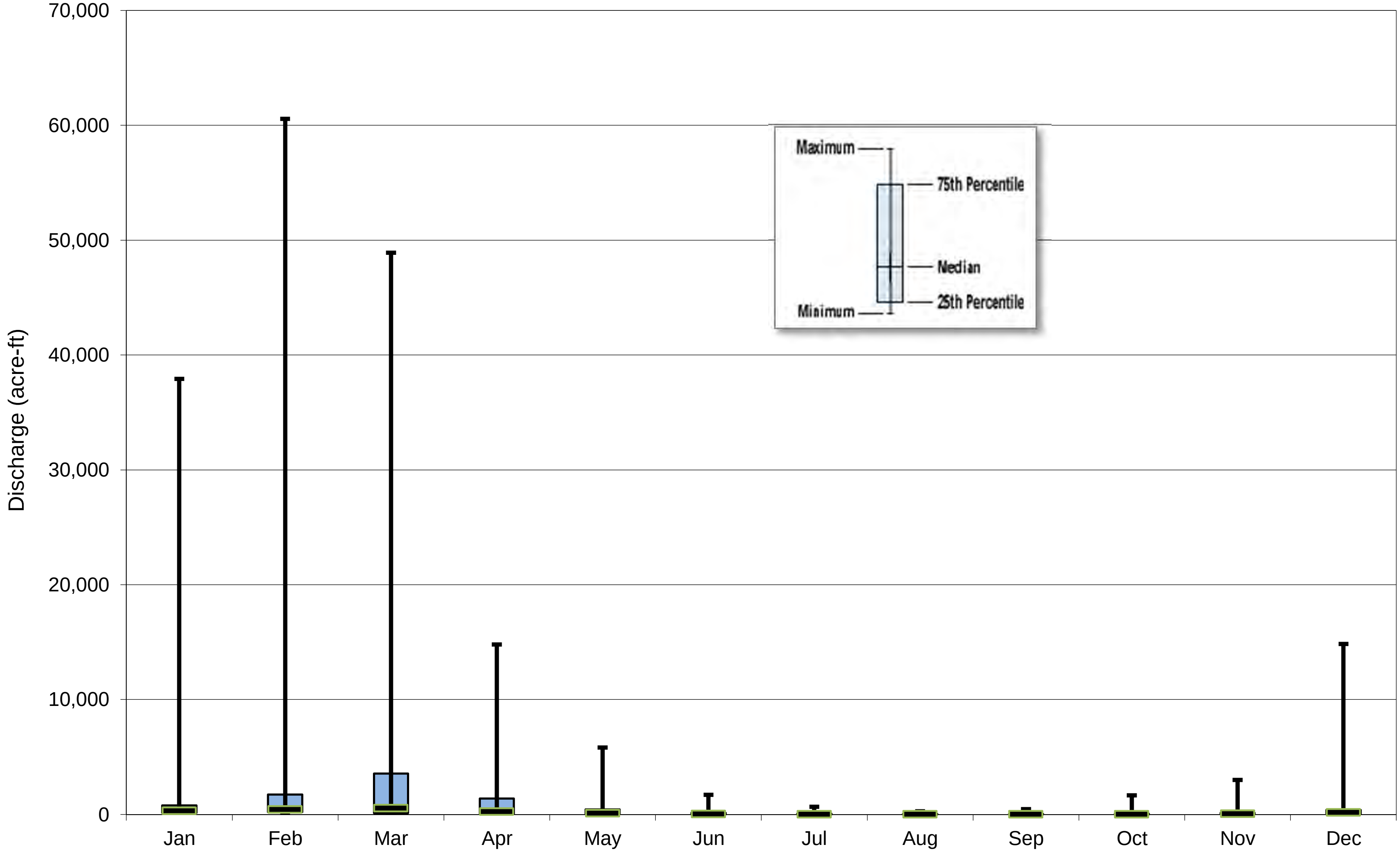

Fig 3-10 3-11 and 3-12-- Fig 3-12

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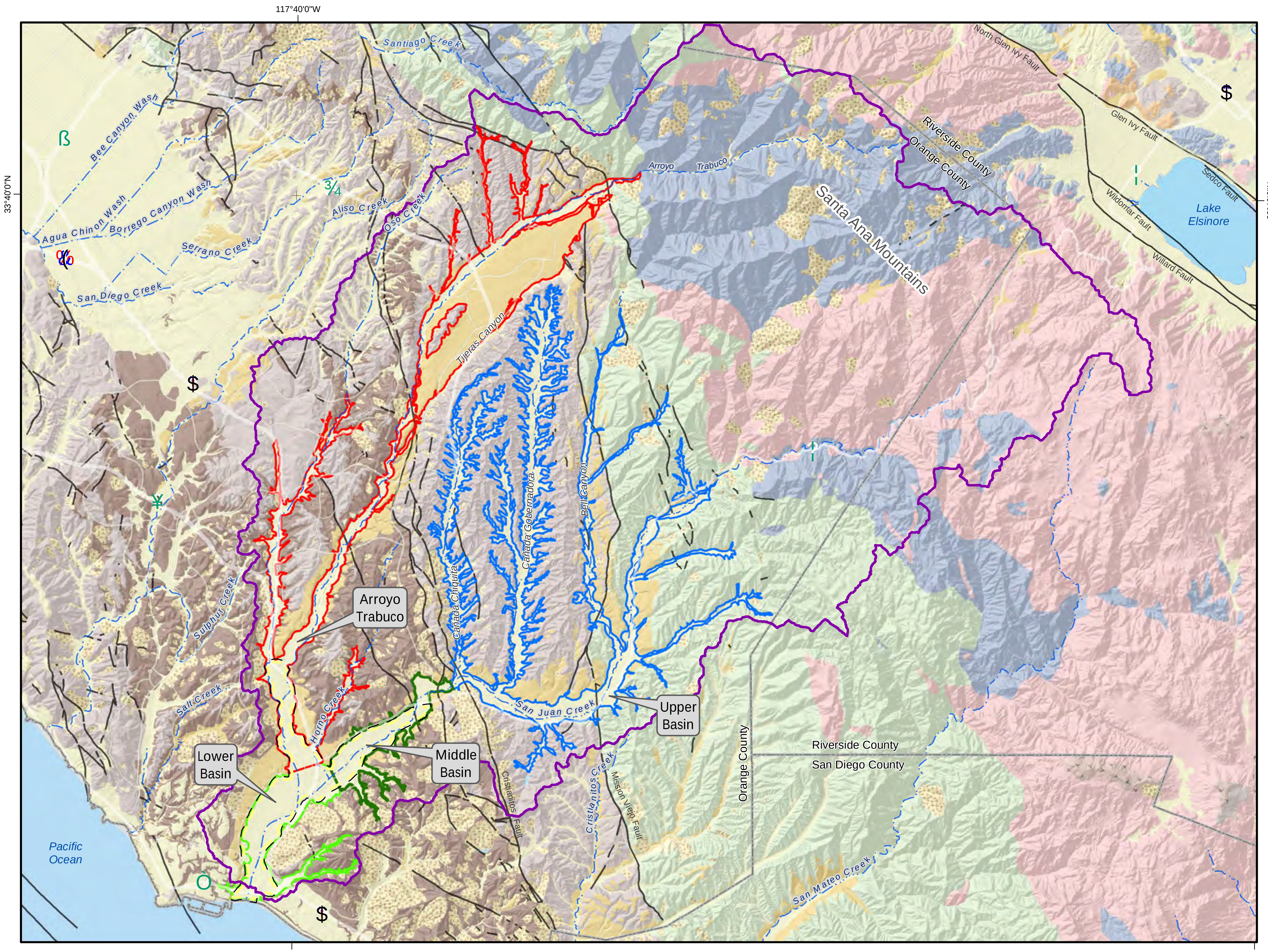


Hydrologic Features

- San Juan Creek Watershed Boundary

San Juan Sub-Basins

- Arroyo Trabuco
- Lower Basin
- Middle Basin
- Upper Basin
- Active Managment Area

Geologic Features

Late Holocene to Early Pleistocene Surficial Deposits

- Younger Alluvial Deposits
- Landslide Deposits
- Older Alluvial Deposits

Tertiary Bedrock Units

- Fine-grained Formations (Capistrano and Monterey Formations)
- Coarse-grained Formations (Santiago,Sespe, and Niguel Formations)

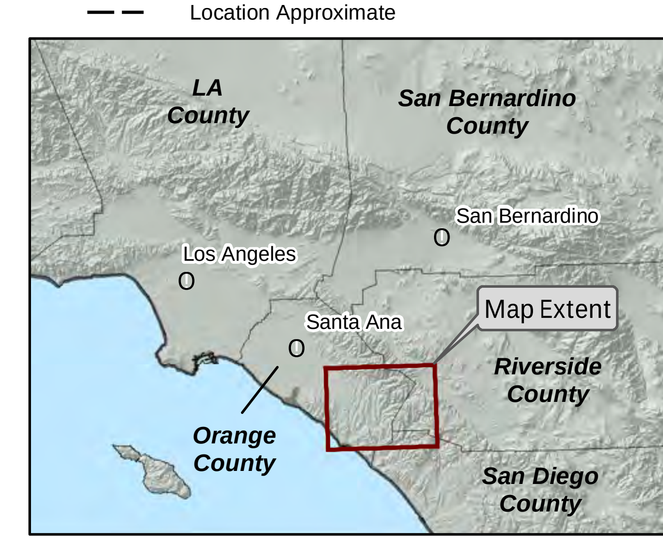
Mesozoic and Older Bedrock Units

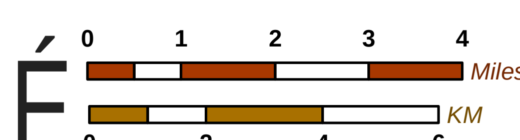
- Cretaceous Age Formations of Sedimentary Origin (Williams and Trabuco Formations)
- Pre-Cretaceous Metamorphic Formations of Sedimentary and Volcanic Origins (Menifee Valley and Bedford Canyon Formations)
- Granitic and other intrusive crystalline rocks

Source: CGS Special Report 217.

Faults

- Location Certain
- Location Approximate





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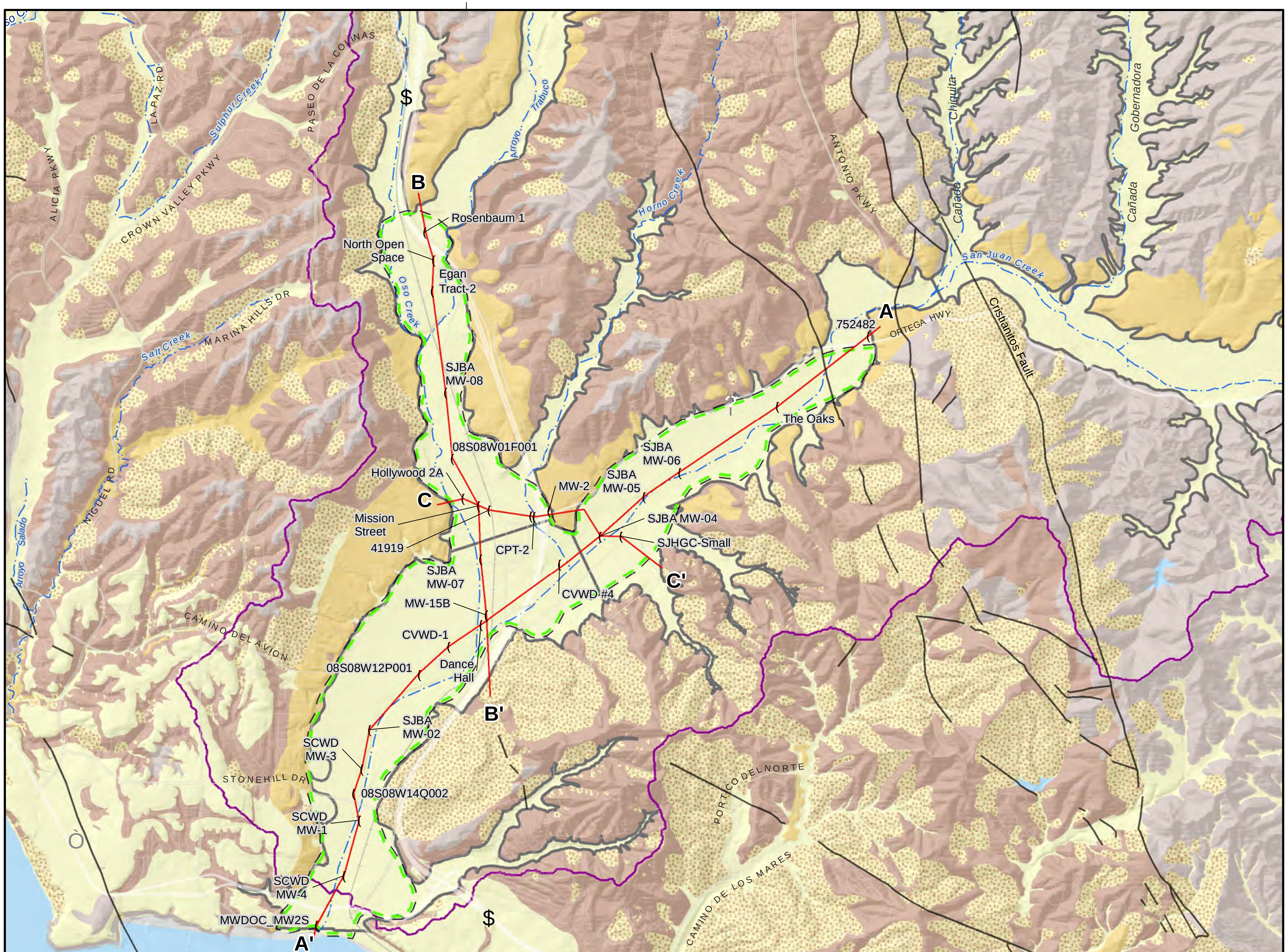
Generalized Geology and Locations of Groundwater Sub-Basins

Figure 3-13



Main Features

Line of Geologic Cross Section *(shown in Figures 3-15 thru 3-17)*

Well Used in Cross Section

Hydrologic Features

Groundwater Sub-basin

San Juan Creek Watershed Boundary

Active Managment Area

Geologic Features

Late Holocene to Early Pleistocene Surficial Deposits

Younger Alluvial Deposits

Landslide Deposits

Older Alluvial Deposits

Tertiary Bedrock Units

Fine-grained Formations (Capistrano and Monterey Formations)

Coarse-grained Formations (Santiago,Sespe, and Niguel Formations)

Source: CGS Special Report 217.

Faults

Location Certain

Location Approximate

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0 2,500 5,000 7,500 10,000 Feet

0 1,000 2,000 3,000 Meters

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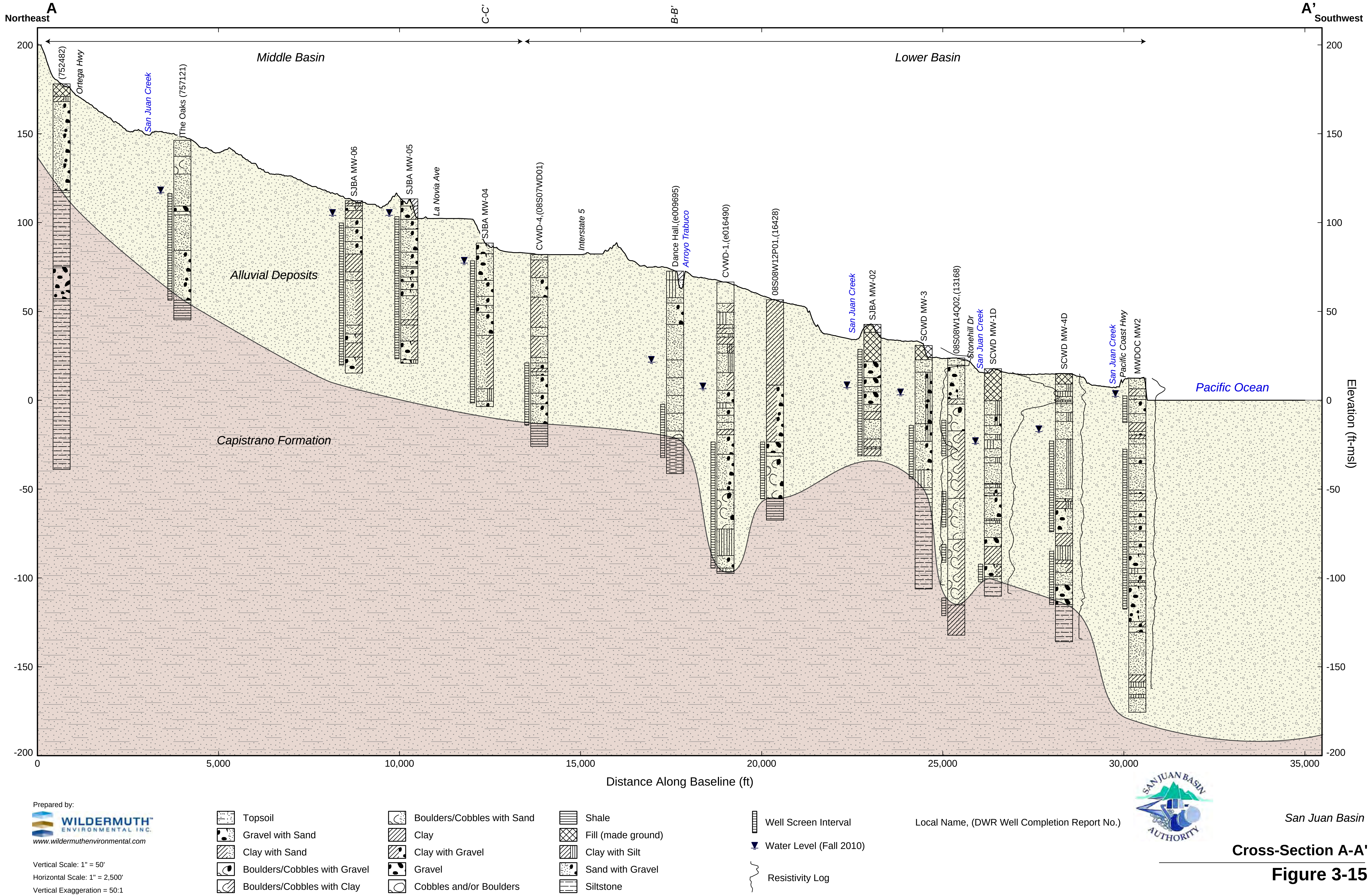
Plan View of Geologic Cross Sections

Figure 3-14

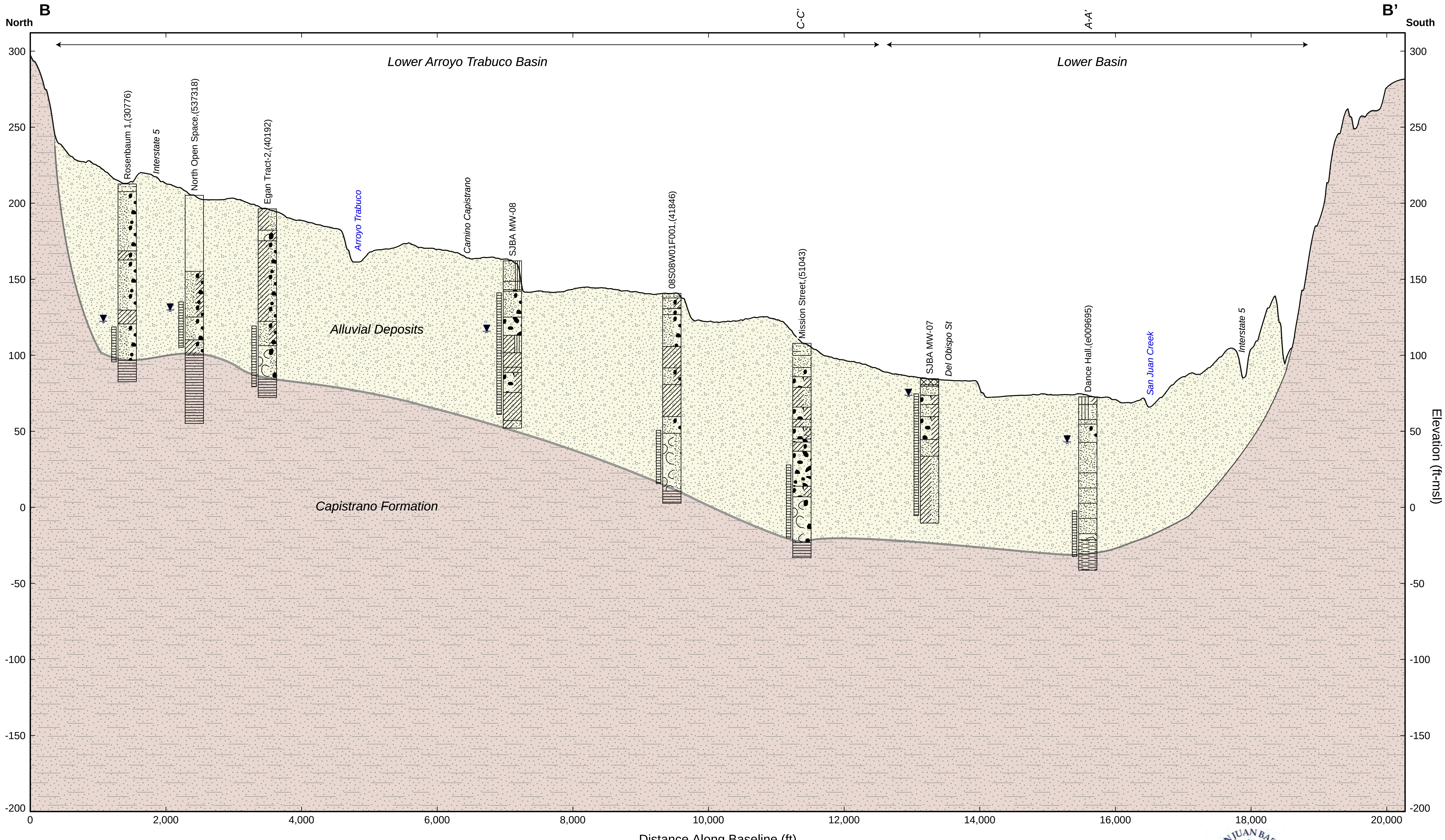


Report: STRAT+GEOPHYSICAL_11X17; File: XSECTIONS.GPJ; 4/6/2011

San Juan Basin

Cross-Section A-A'

Figure 3-15



Report: STRAT+GEOPHYSICAL_11X17; File: XSECTIONS.GPJ; 4/6/2011

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Vertical Scale: 1" = 27'

Horizontal Scale: 1" = 1,350'

Vertical Exaggeration = 50:1

Topsoil

Sand with Gravel

Clay with Gravel and Sand

Clay

Shale

Clay with Sand

Boulders/Cobbles with Gravel and Clay

Sand with Gravel and Clay

Boulders/Cobbles with Gravel and Sand

Boulders/Cobbles with Sand

Sand

Gravel with Clay

Gravel with Sand and Clay

Gravel

Clay with Gravel

Well Screen Interval

Water Level (Fall 2010)

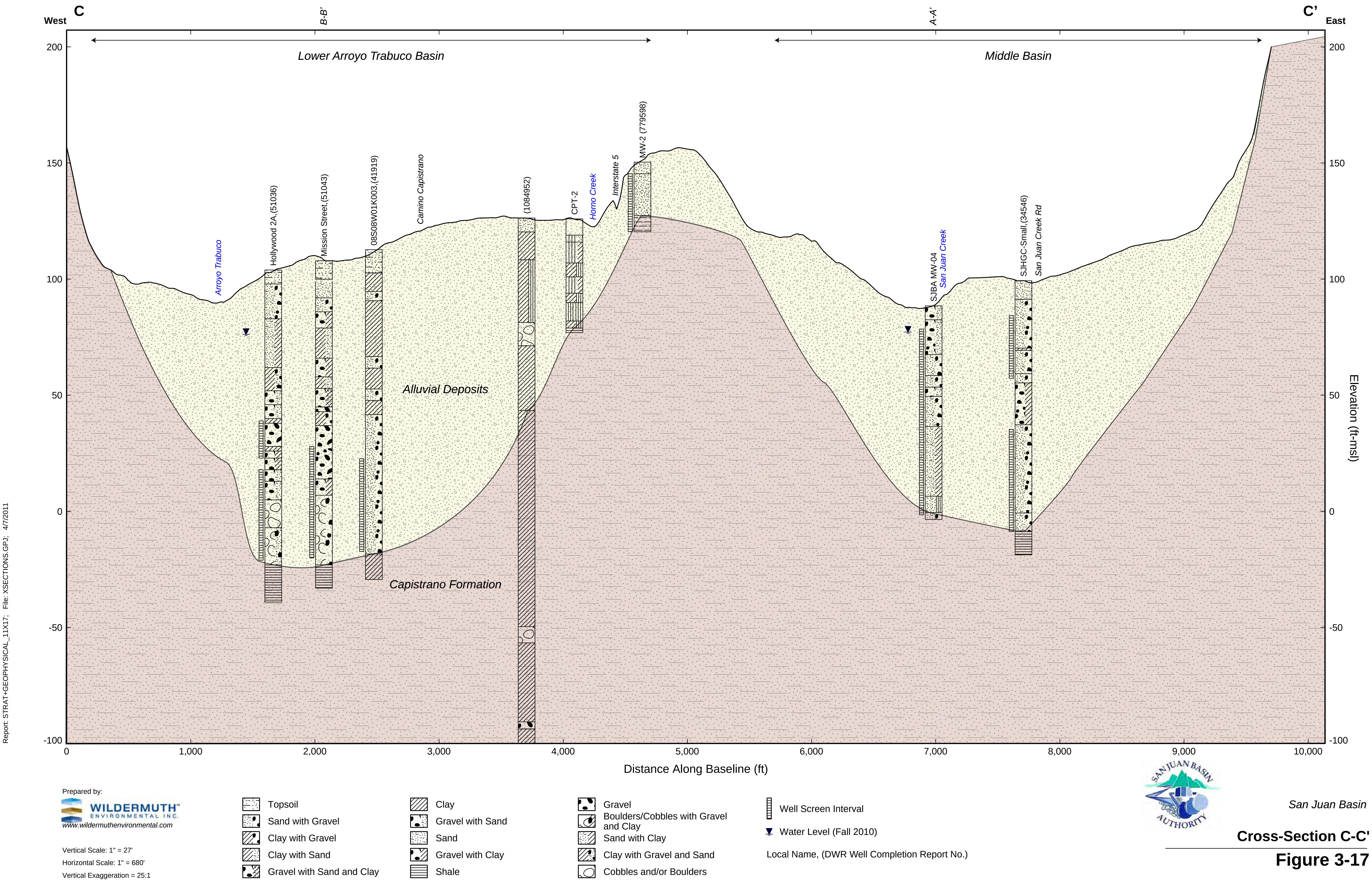
Local Name, (DWR Well Completion Report No.)

San Juan Basin Authority

San Juan Basin

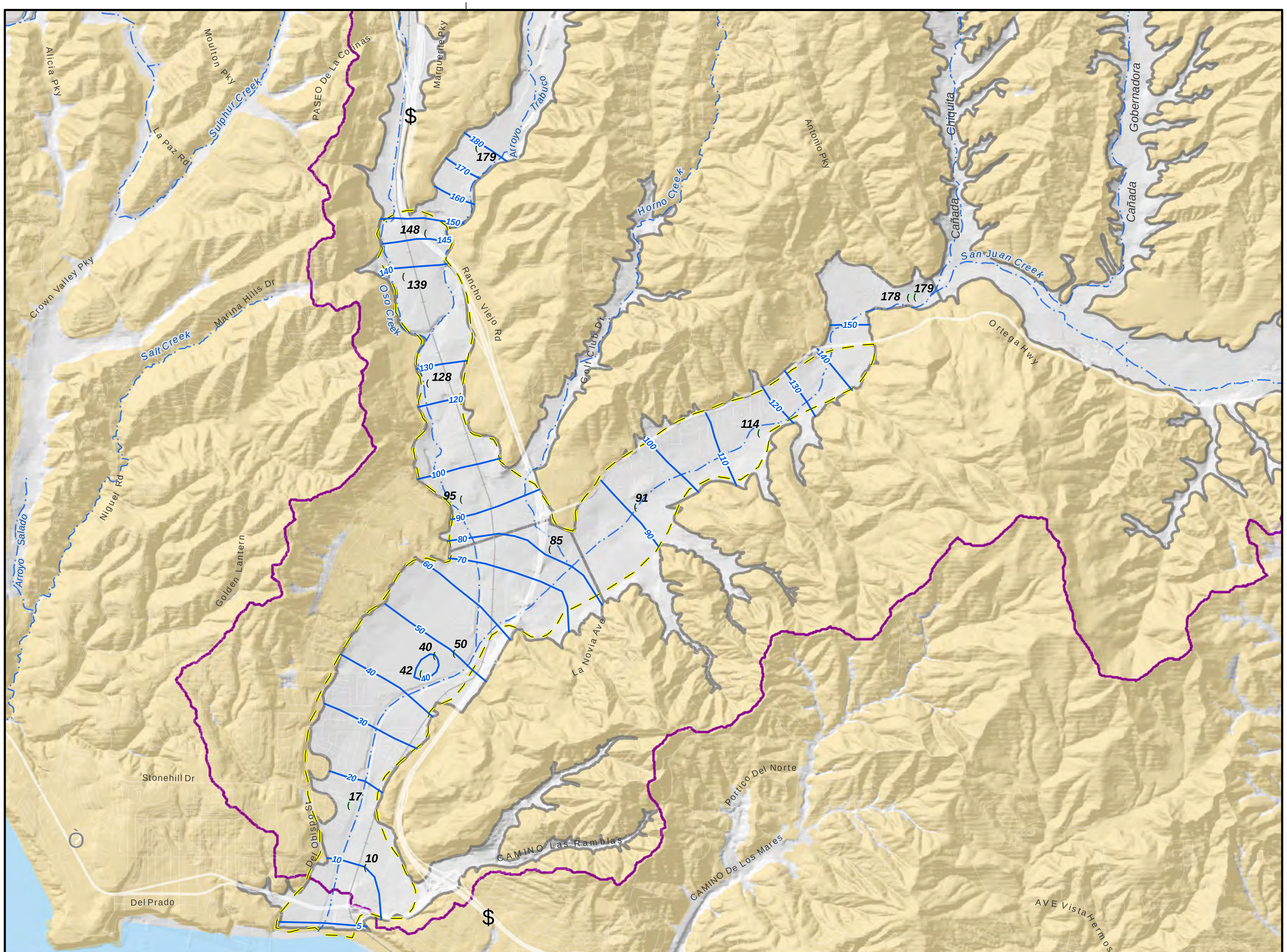
Cross-Section B-B'

Figure 3-16



Cross-Section C-C'

Figure 3-17



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0 2,500 5,000 7,500 10,000 Feet

0 1,000 2,000 3,000 Meters

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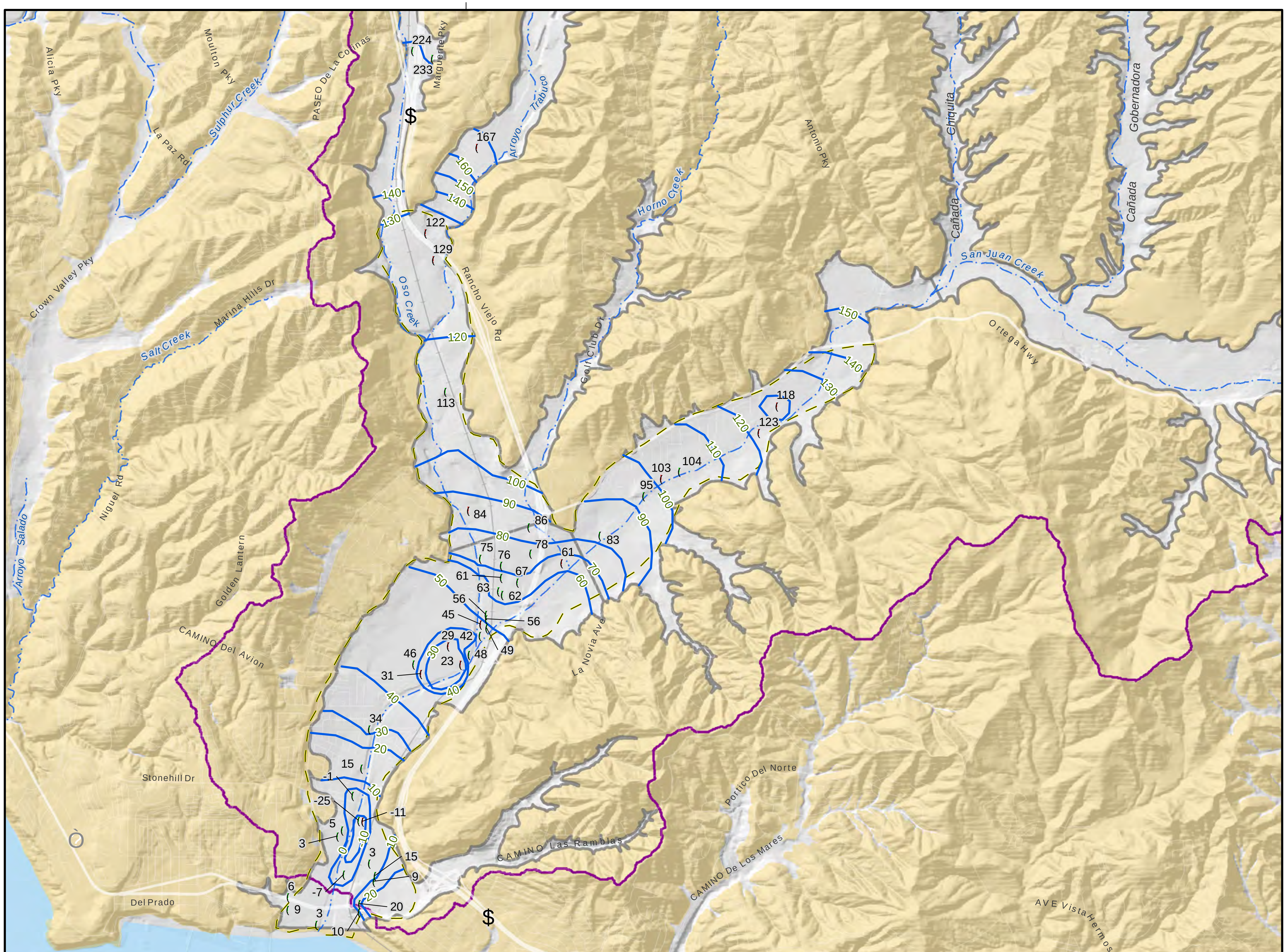
Groundwater Level Elevation

Spring 1987

Figure 3-18



Main Features

Groundwater Elevation Contours (ft-above msl)

Monitoring Well with Groundwater Elevation (ft amsl)

Production Well with Groundwater Elevation (ft amsl)

Active Management Area

San Juan Creek Watershed Boundary

San Juan Basin

Streams and Creeks

Geologic Features

Younger Alluvial Deposits

Older Alluvial Deposits, Landslides, and Tertiary Sedimentary bedrock

Source: CGS Special Report 217.

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0 2,500 5,000 7,500 10,000 Feet

0 1,000 2,000 3,000 Meters

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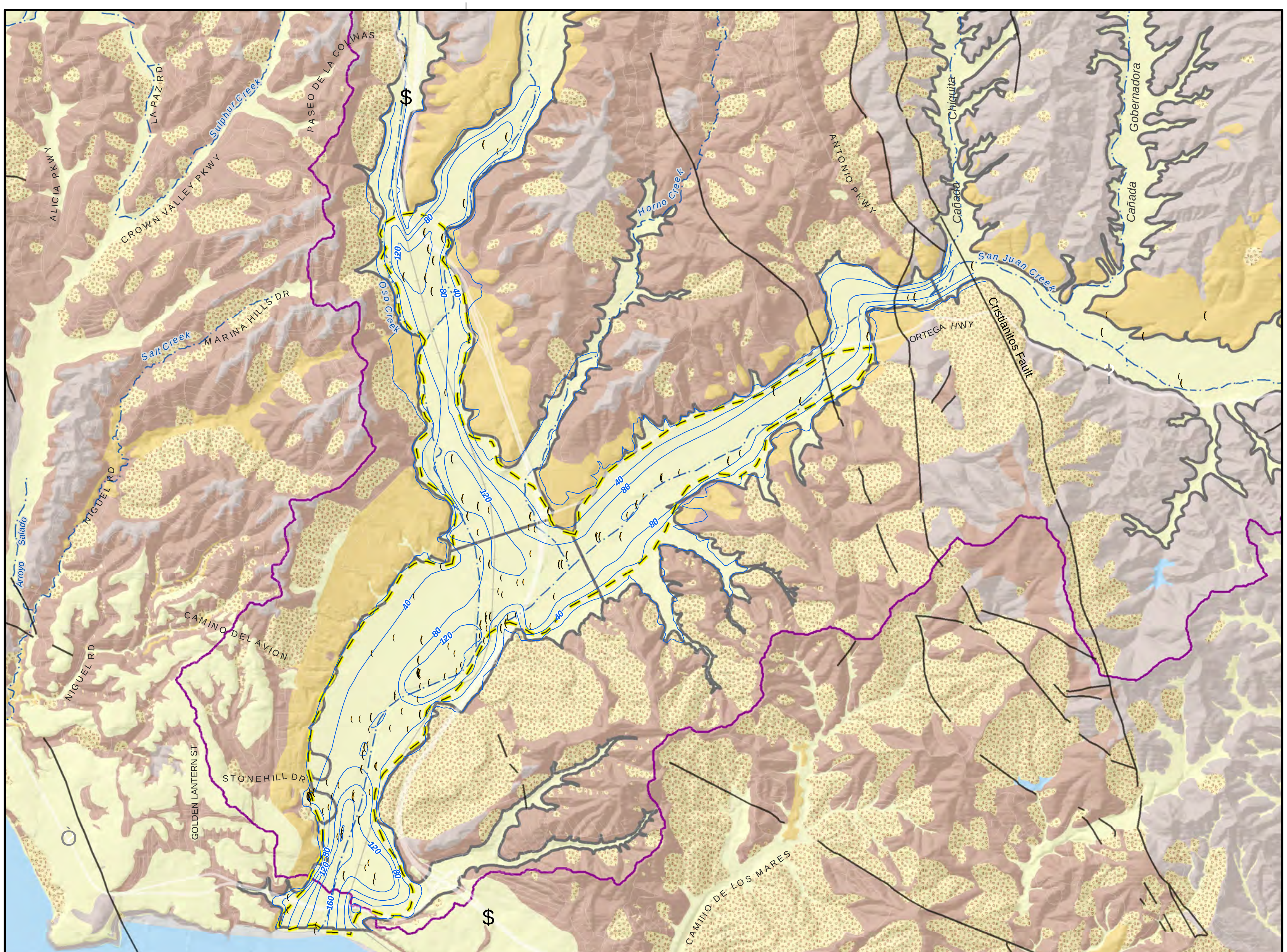
Groundwater Level Elevation

Fall 2010

Figure 3-19



Hydrologic Features

Contour of Depth to Effective Base of the Alluvial Aquifer (feet-amsl)

Well/Boring which fully penetrated the alluvial aquifer

Well/Boring with lithology information

Groundwater Sub-basin

Active Management Area

San Juan Creek Watershed Boundary

Geologic Features

Late Holocene to Early Pleistocene Surficial Deposits

Younger Alluvial Deposits

Landslide Deposits

Older Alluvial Deposits

Tertiary Bedrock Units

Fine-grained Formations (Capistrano and Monterey Formations)

Coarse-grained Formations (Santiago,Sespe, and Niguel Formations)

Source: CGS Special Report 217.

Faults

Location Certain

Location Approximate

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0 2,500 5,000 7,500 10,000 Feet

0 1,000 2,000 3,000 Meters

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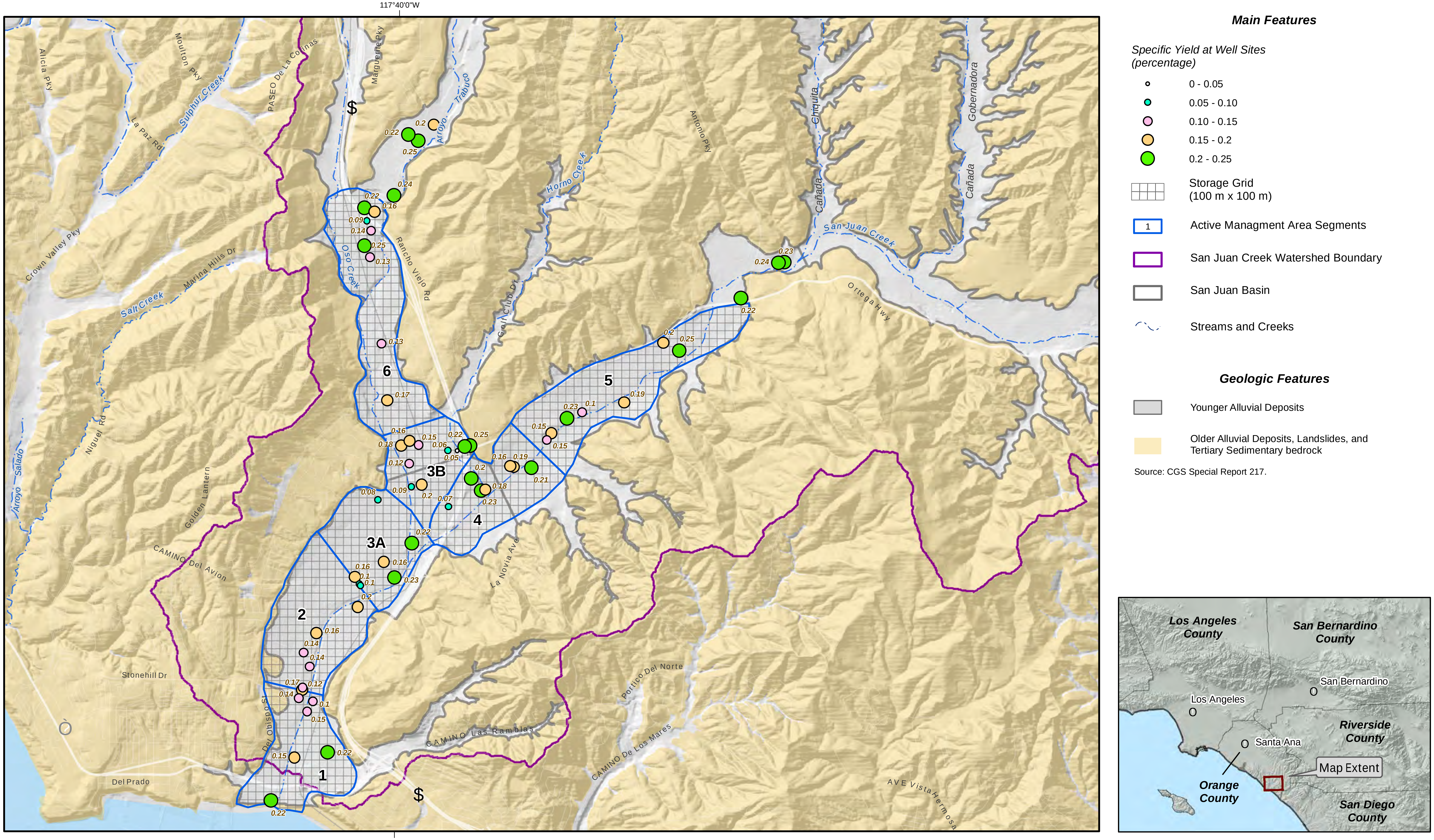
Effective Base of Alluvial Aquifer

Figure 3-20



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0 2,500 5,000 7,500 10,000 Feet
0 1,000 2,000 3,000 Meters

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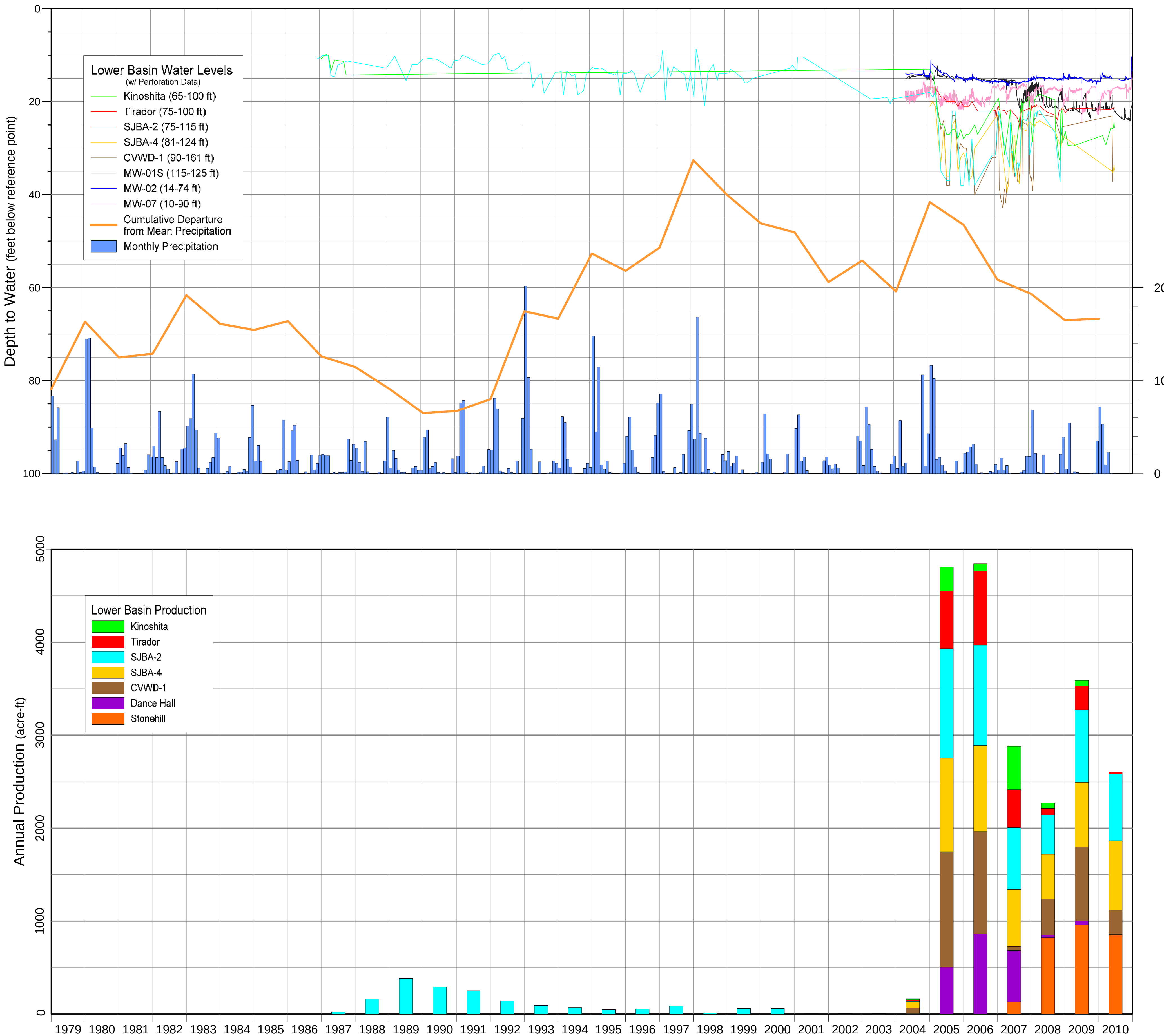
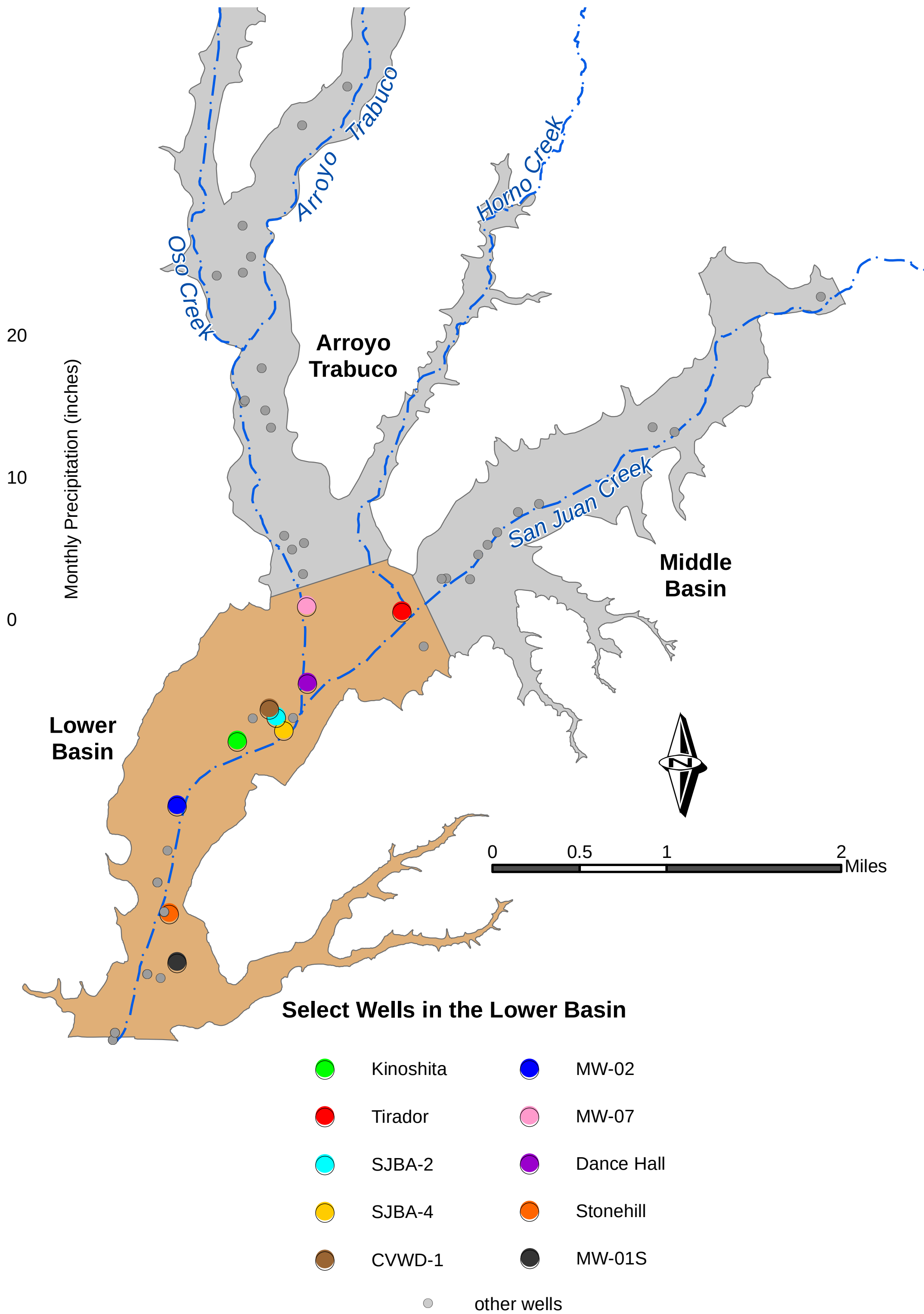
Storage Capacity Grid and Estimated Specific Yield

Figure 3-21





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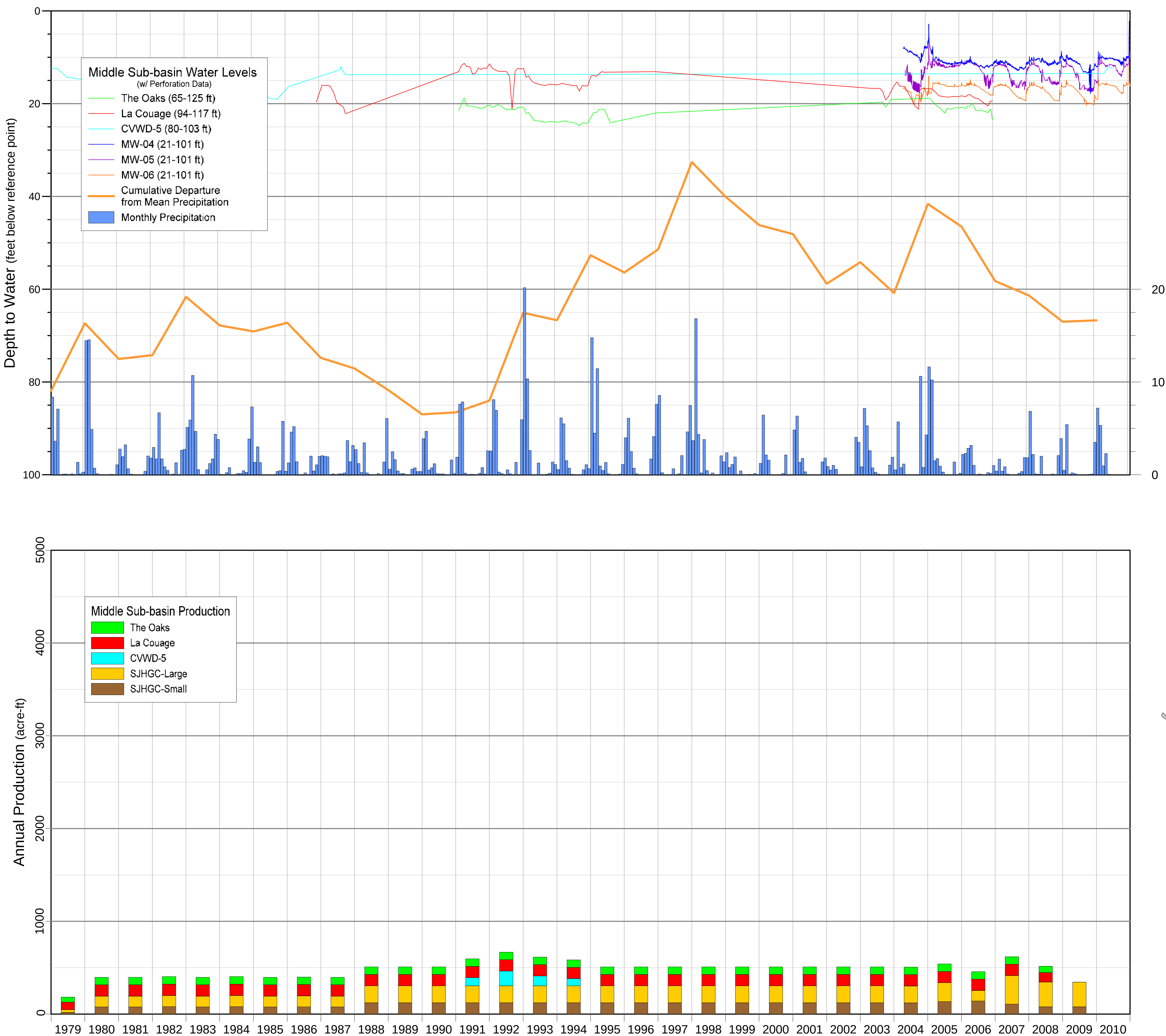
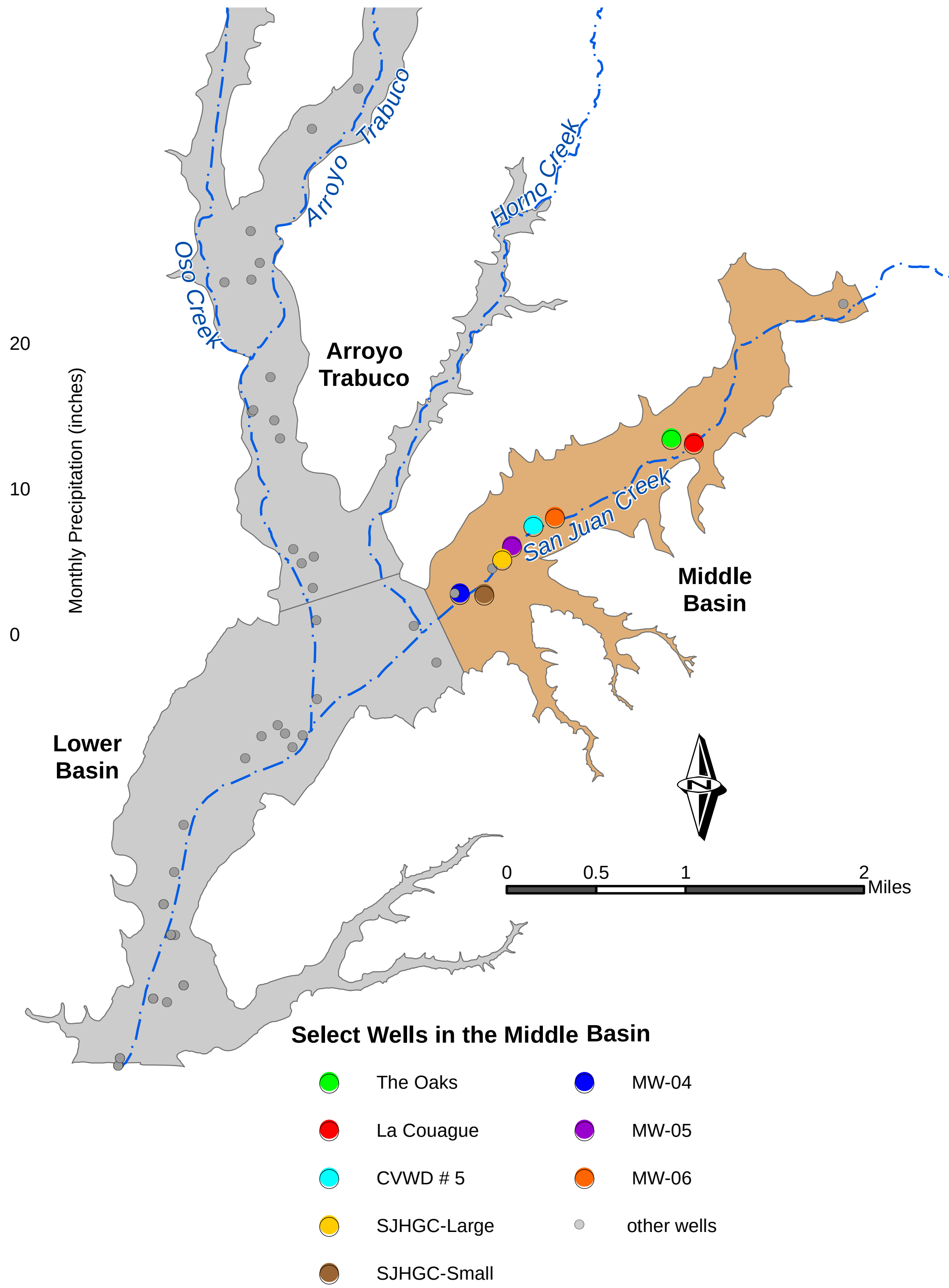
Time History of Production and Groundwater Levels in the Lower Basin

Figure 3-22





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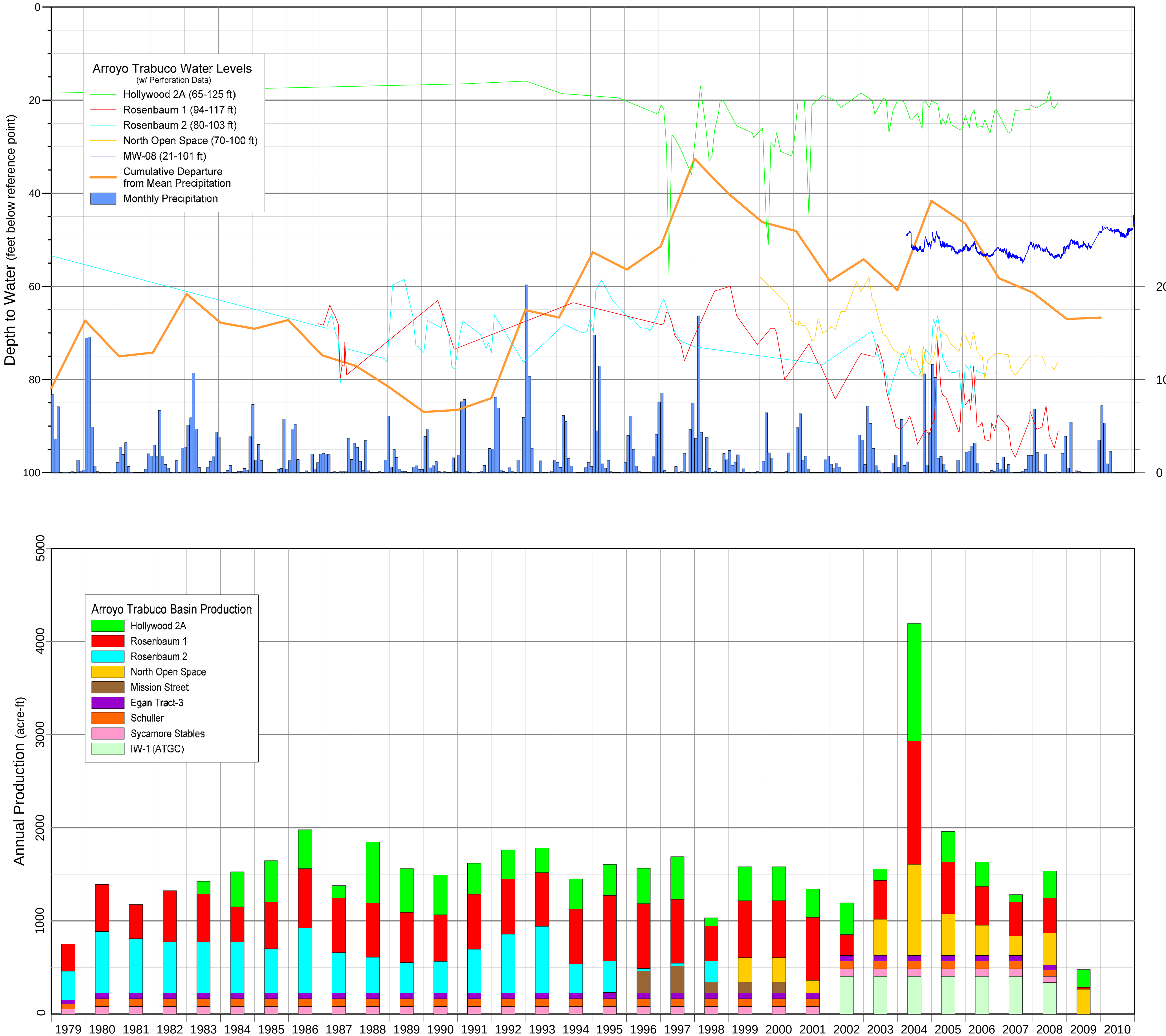
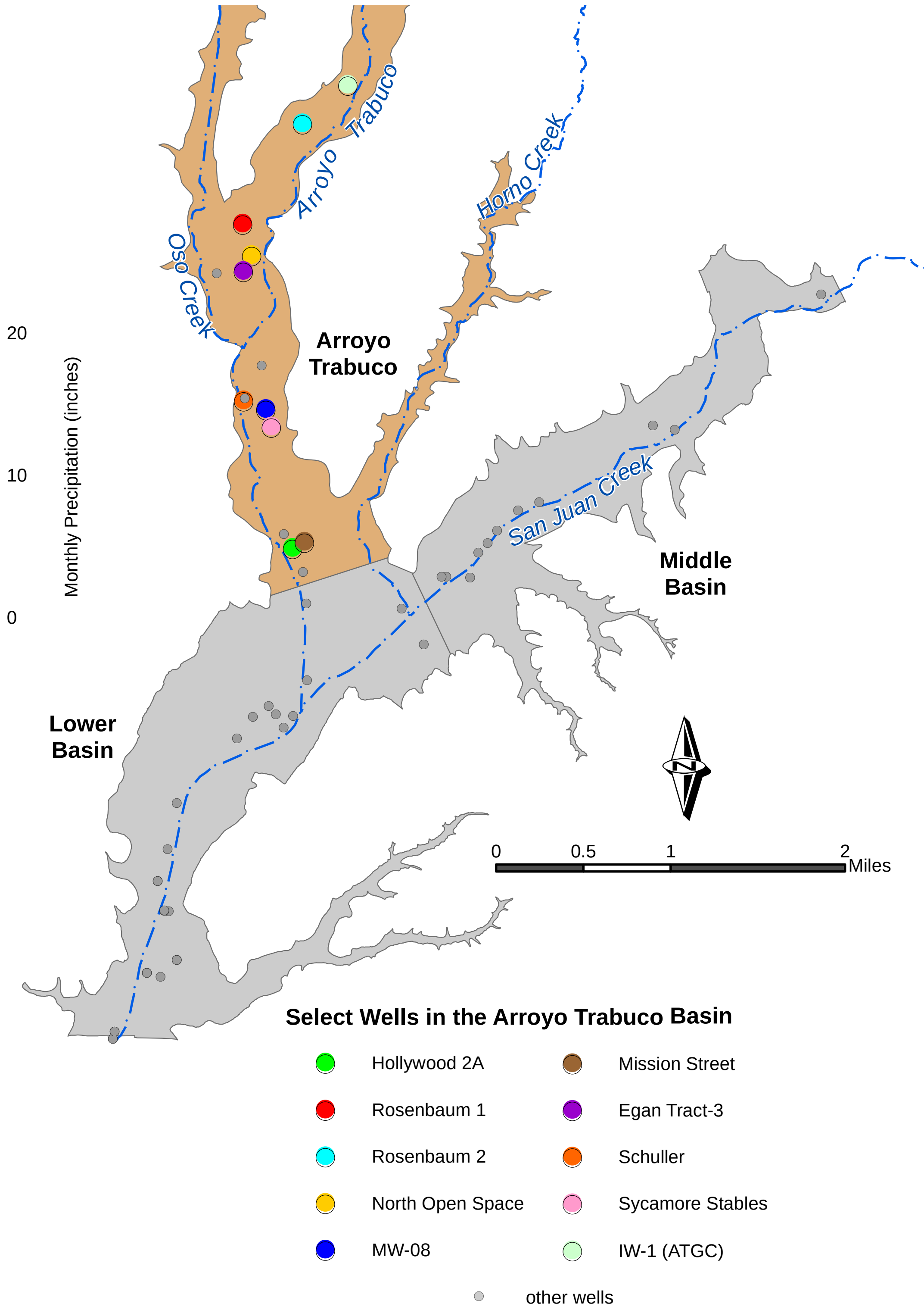
Time History of Production
and Groundwater Levels
in the Middle Basin

Figure 3-23





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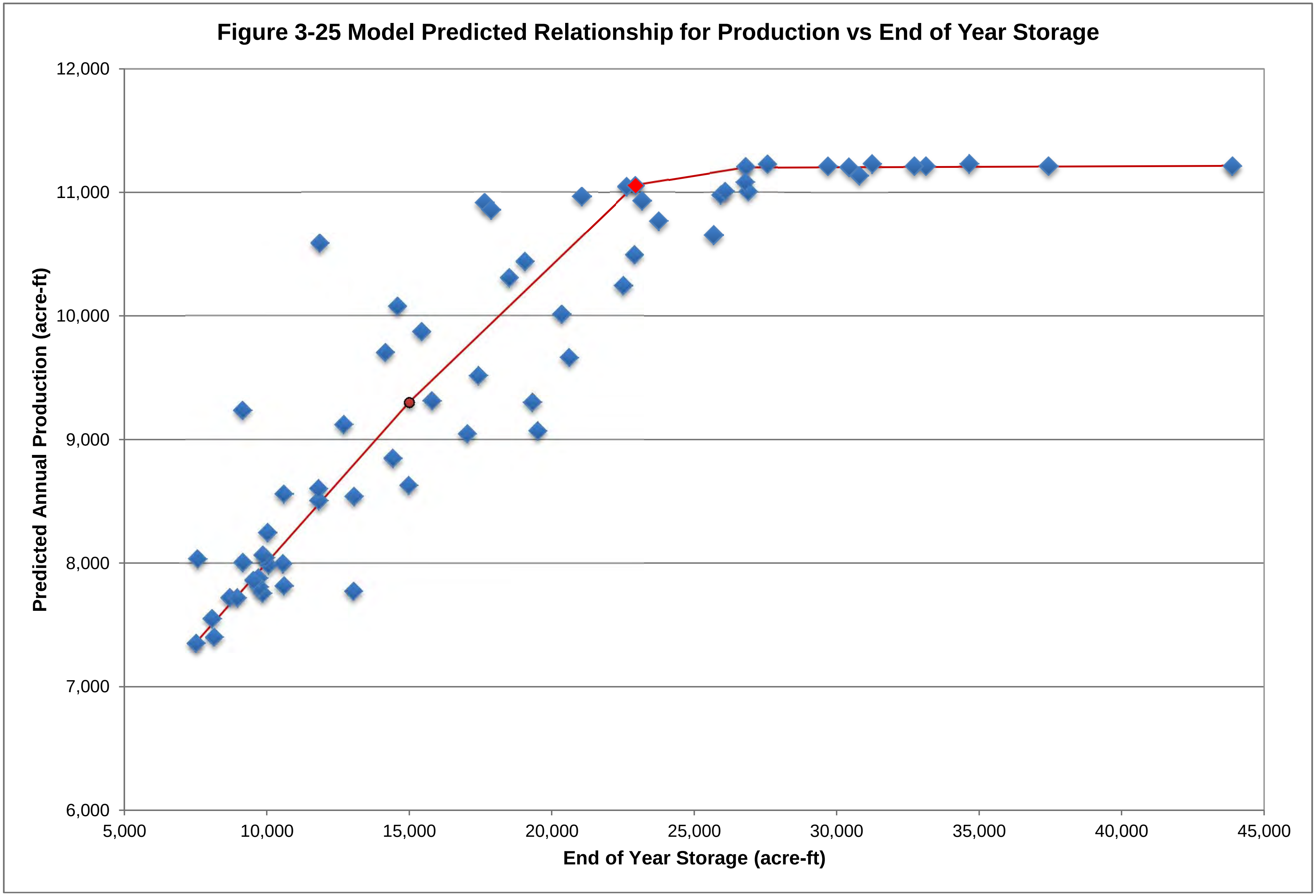
Filename: Figure_3.grf

Time History of Production
and Groundwater Levels
in the Arroyo Trabuco Basin

Figure 3-24



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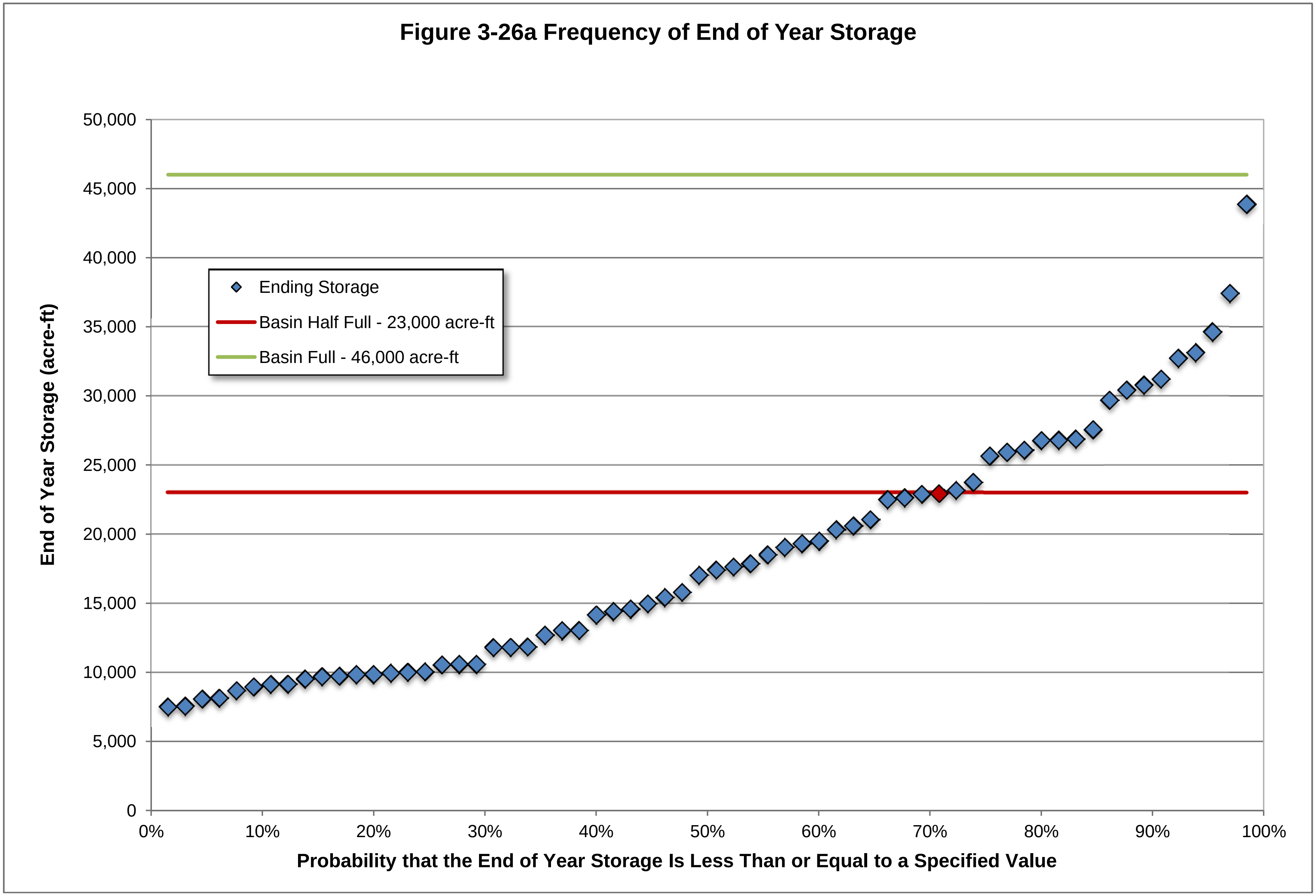
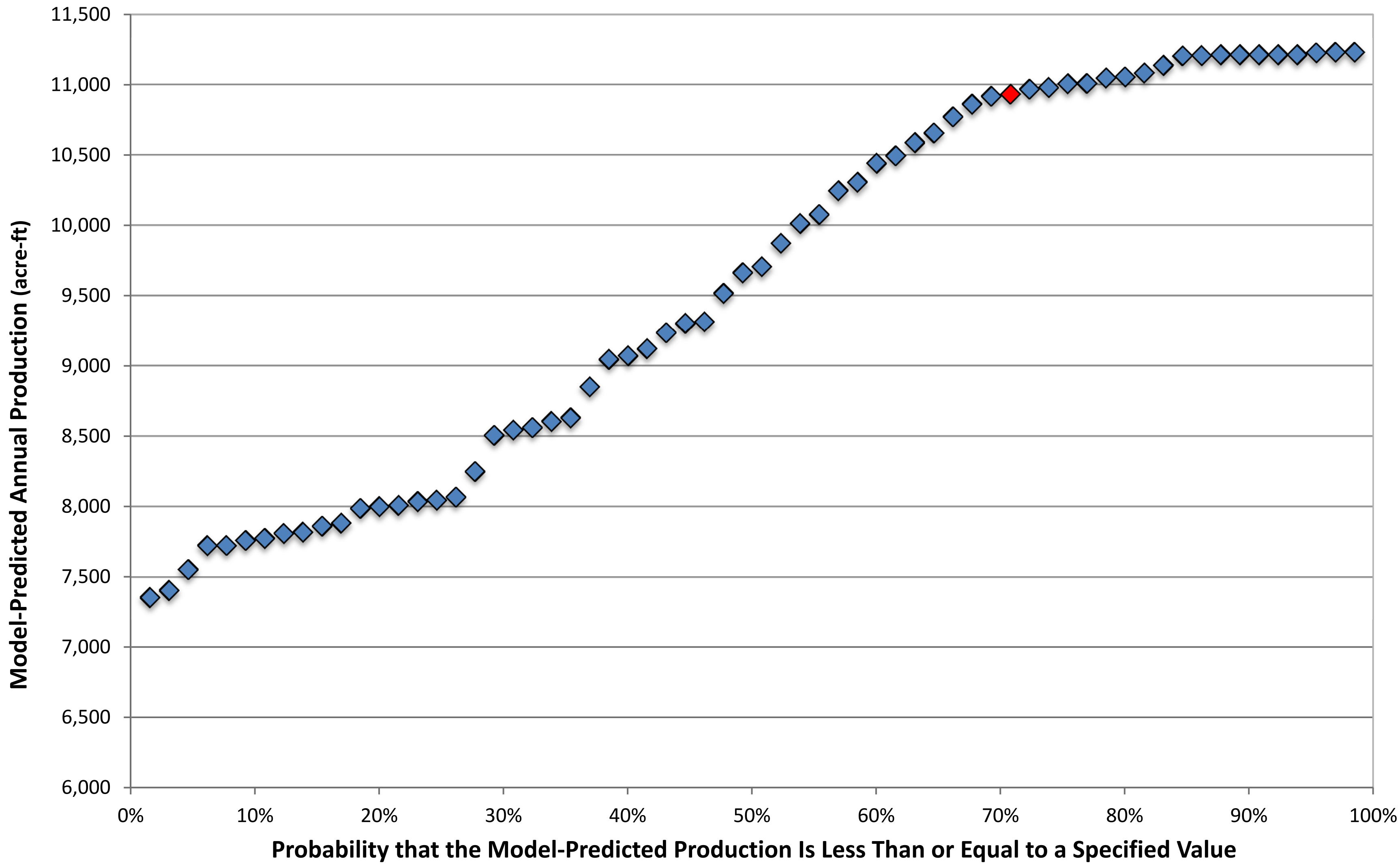
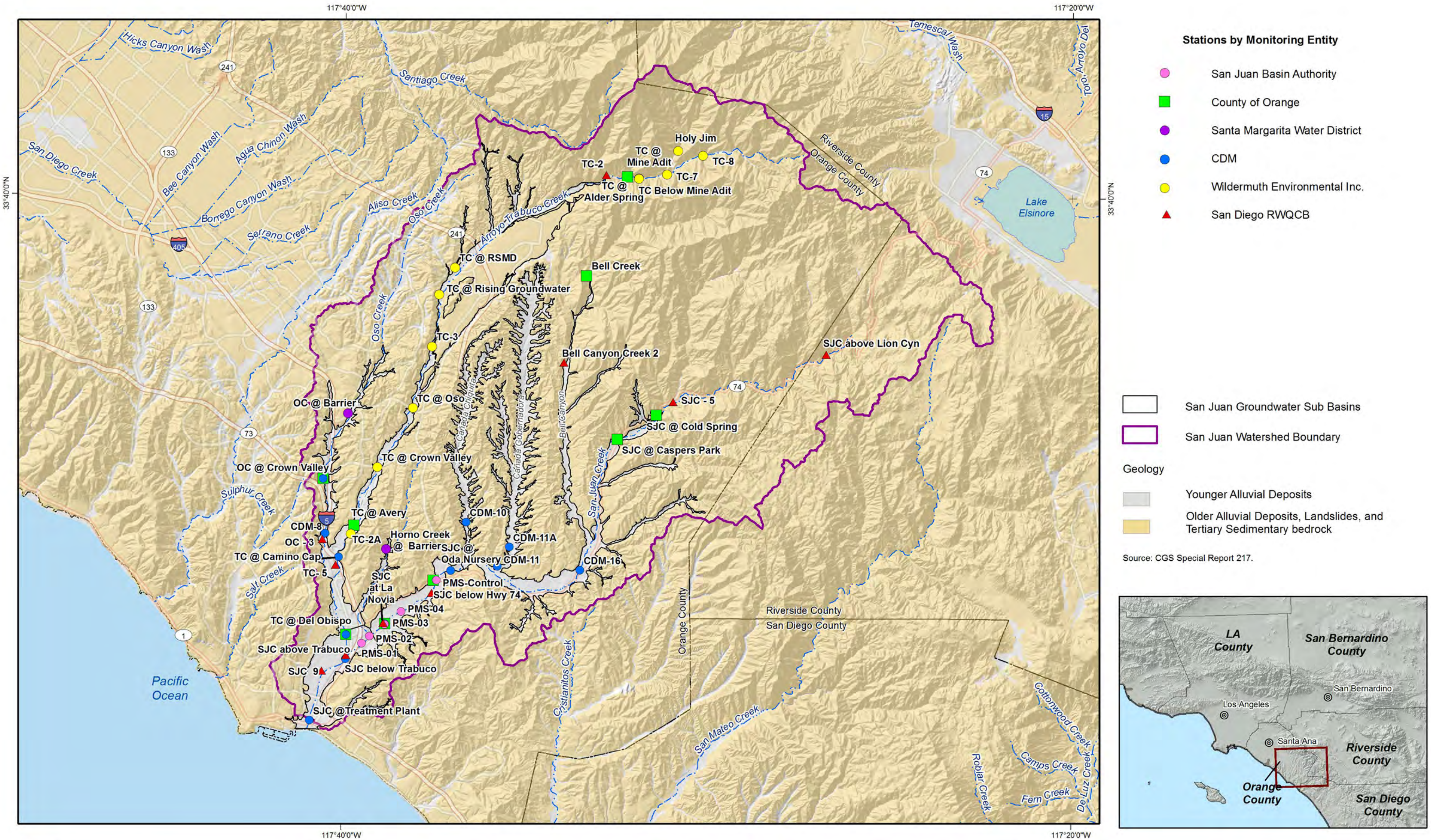


Figure 3-26a Frequency of End of Year Storage
Ending Storage
Basin Half Full - 23,000 acre-ft
Basin Full - 46,000 acre-ft
End of Year Storage (acre-ft)
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability that the End of Year Storage Is Less Than or Equal to a Specified Value

Figure 3-26b Frequency of Model-Predicted Annual Production





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075-003
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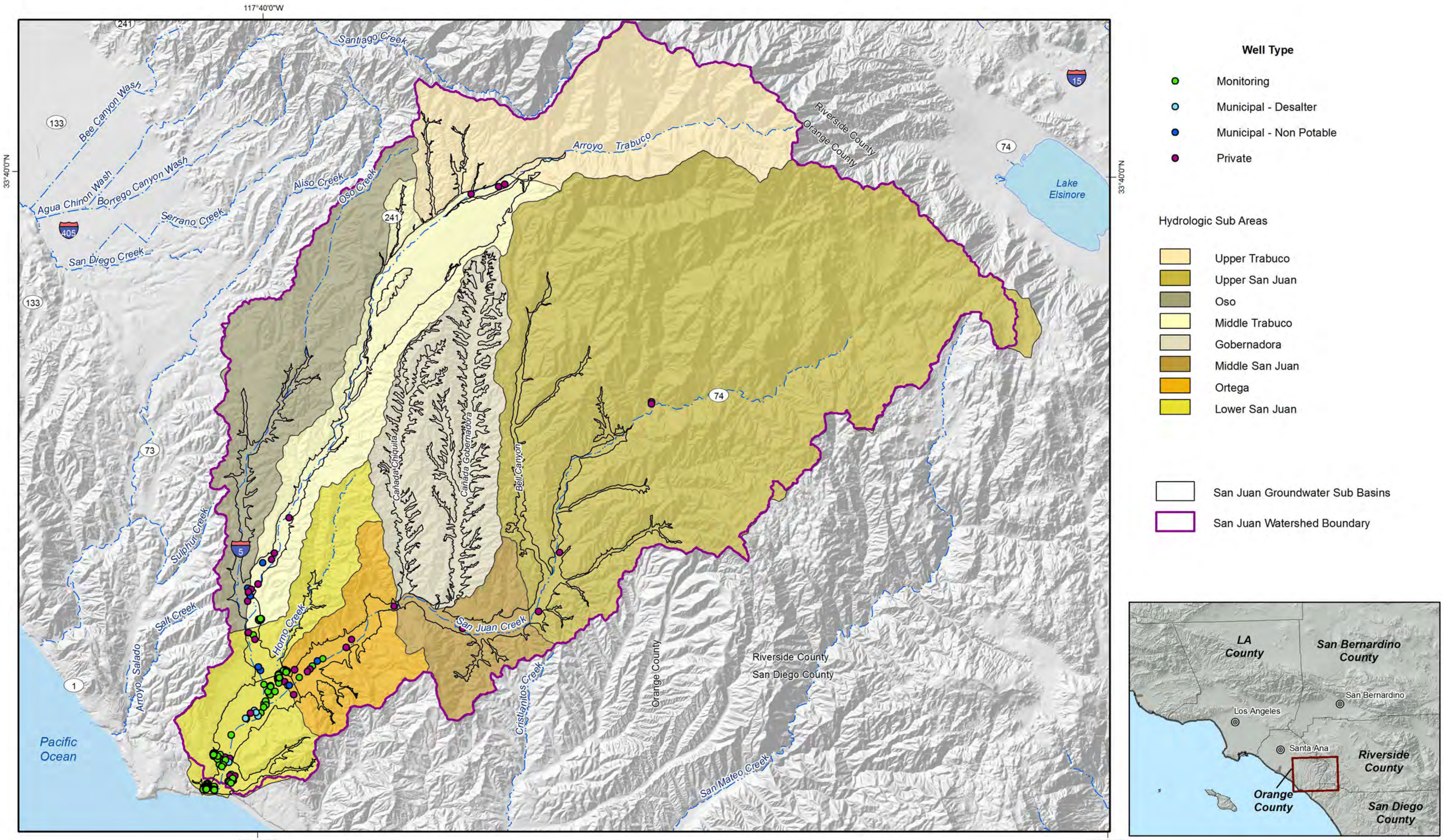
San Juan Watershed
Surface Water Quality Monitoring Stations

Figure 3-27



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0 1 2 3 4 Miles

0 2 4 6 KM

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075-003
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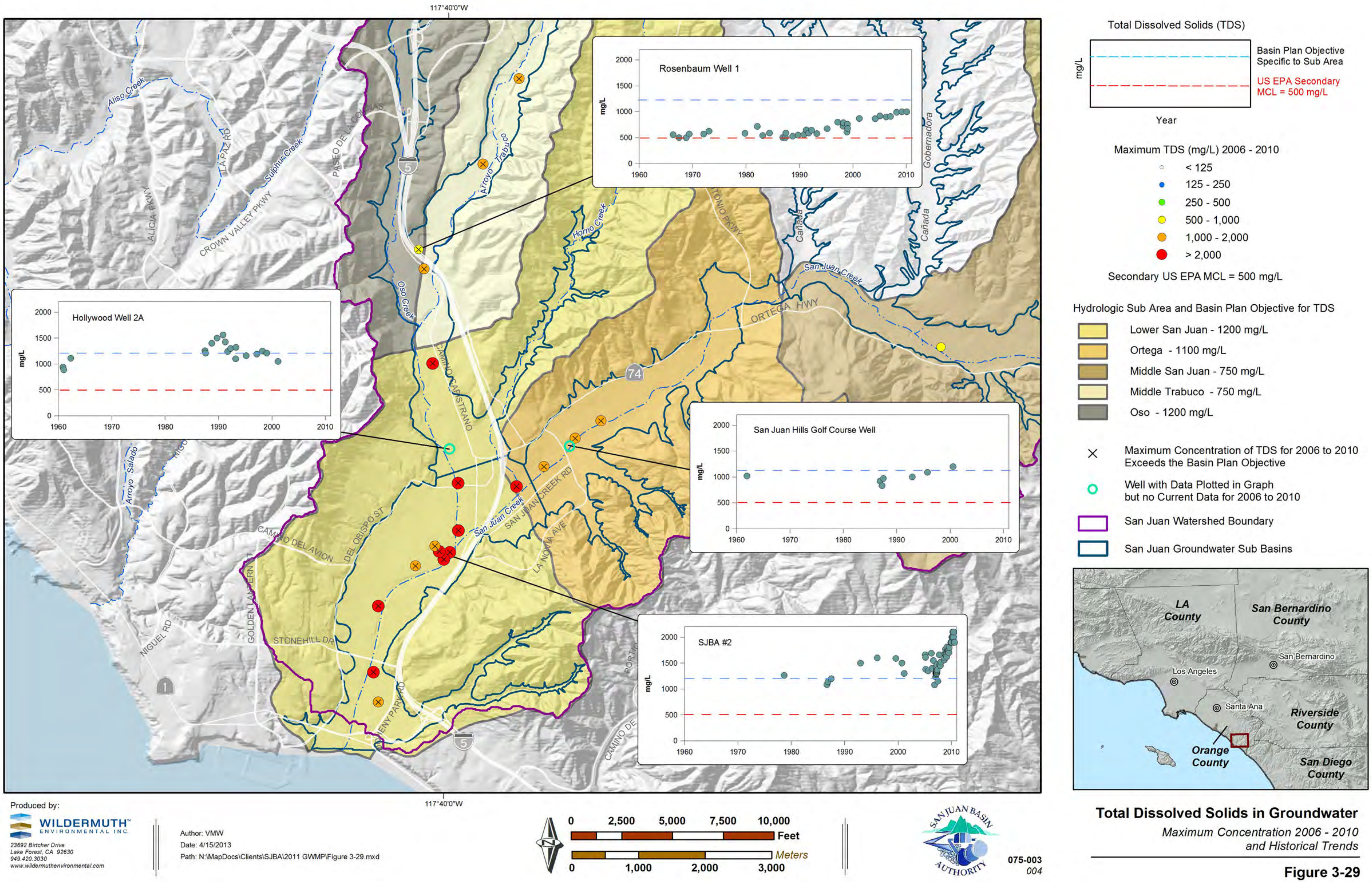
San Juan Watershed
Wells with Water Quality Data

Figure 3-28



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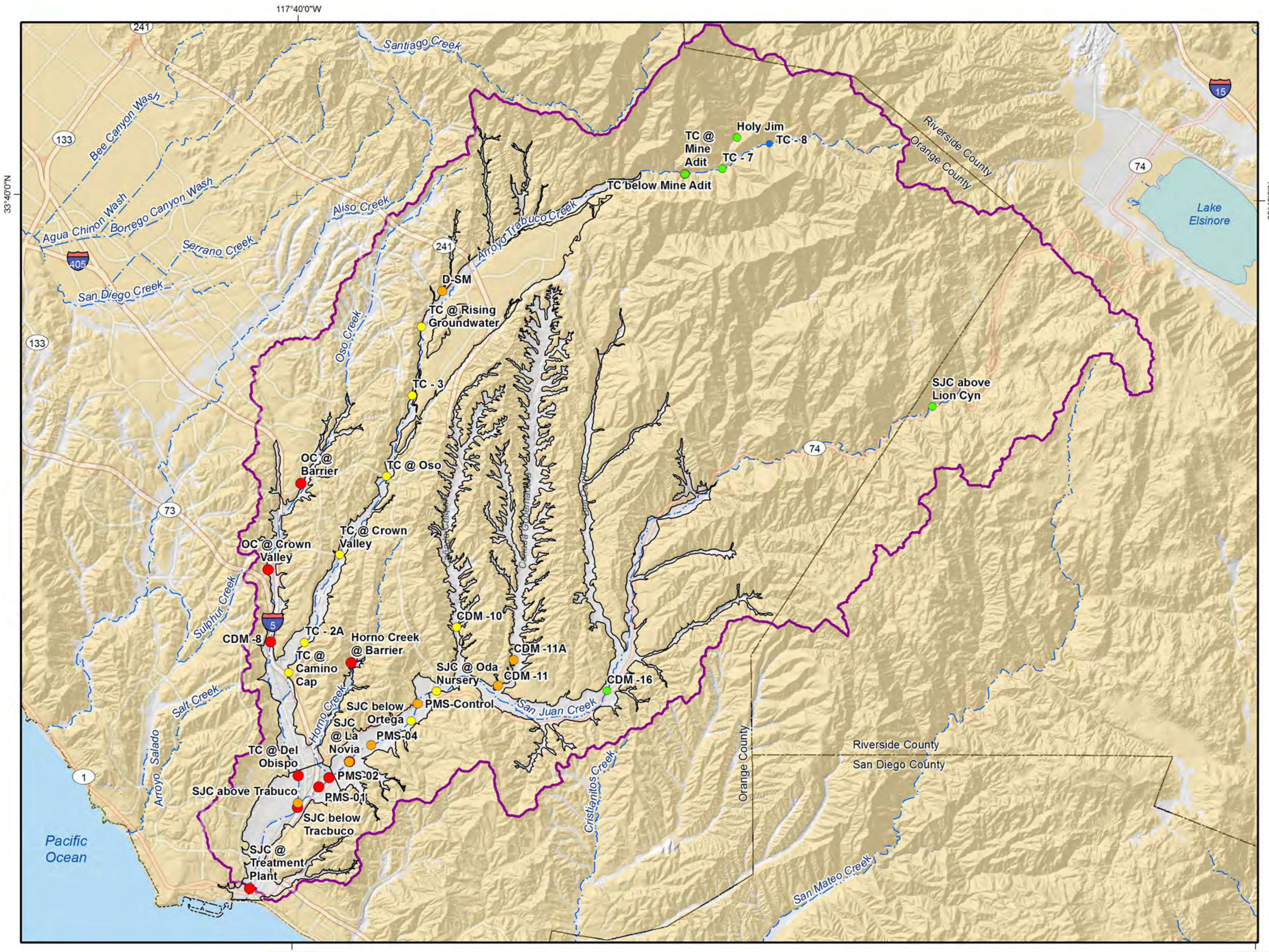
075-003
004

Total Dissolved Solids in Groundwater

Maximum Concentration 2006 - 2010 and Historical Trends

Figure 3-29



Maximum TDS (mg/L)

- < 125
- 125 - 250
- 250 - 500
- 500 - 1,000
- 1,000 - 2,000
- > 2,000

Secondary US EPA MCL = 500 mg/L

Basin Plan Surface Water Objective = 500 mg/L

** Maximum concentration is based on all available data from the historical record. All surface water sites are monitored at different time periods and for different analytes. Refer to Table 3-5 in this report for a summary of the monitoring at the surface water stations.*

San Juan Groundwater Sub Basins

San Juan Watershed Boundary

Geology

Younger Alluvial Deposits

Older Alluvial Deposits, Landslides, and Tertiary Sedimentary bedrock

Source: CGS Special Report 217.

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0 1 2 3 4 Miles

0 2 4 6 KM

SAN JUAN BASIN AUTHORITY

075-003
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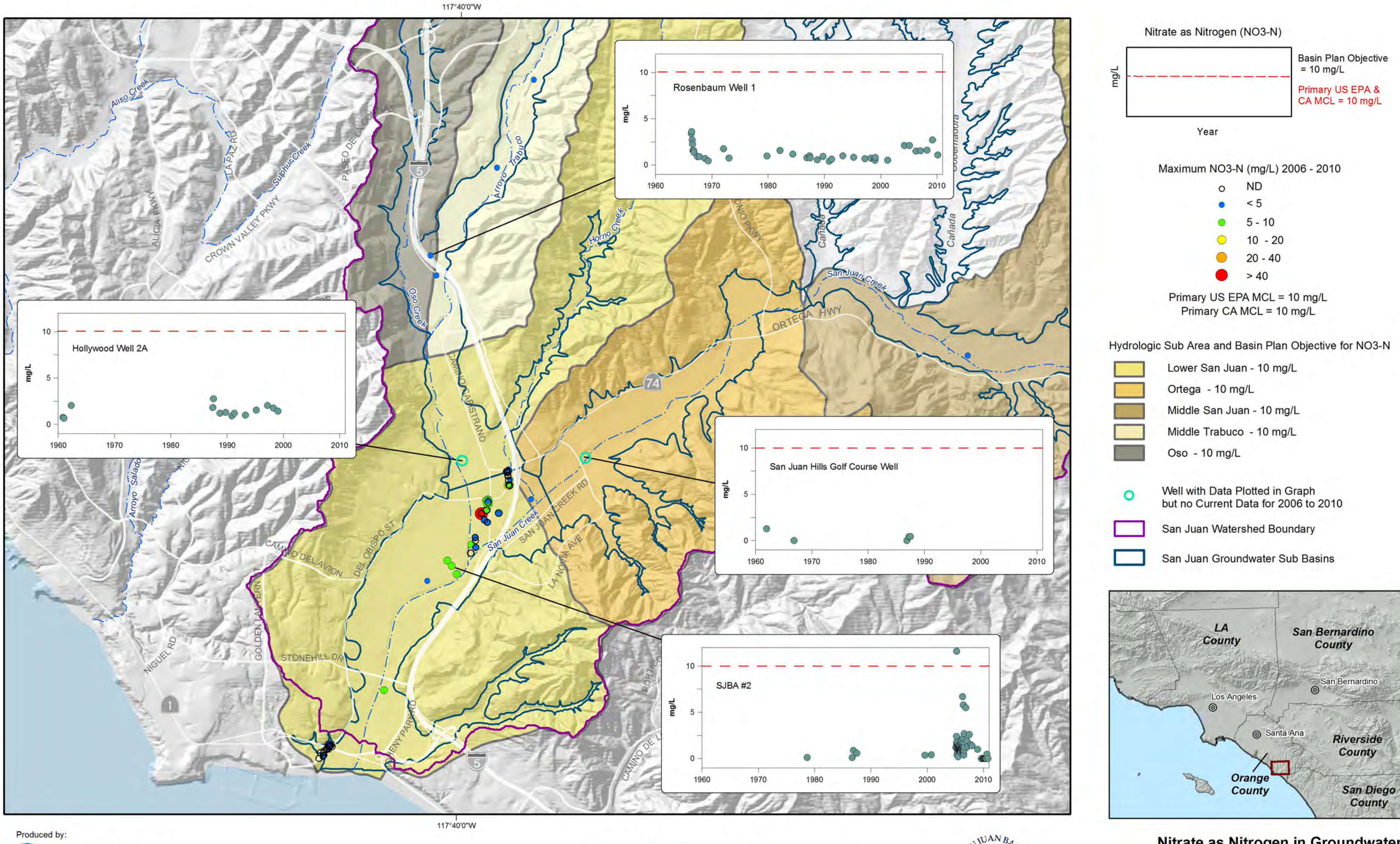
Total Dissolved Solids in Surface Water

Maximum Concentration for Historical Record

Figure 3-30



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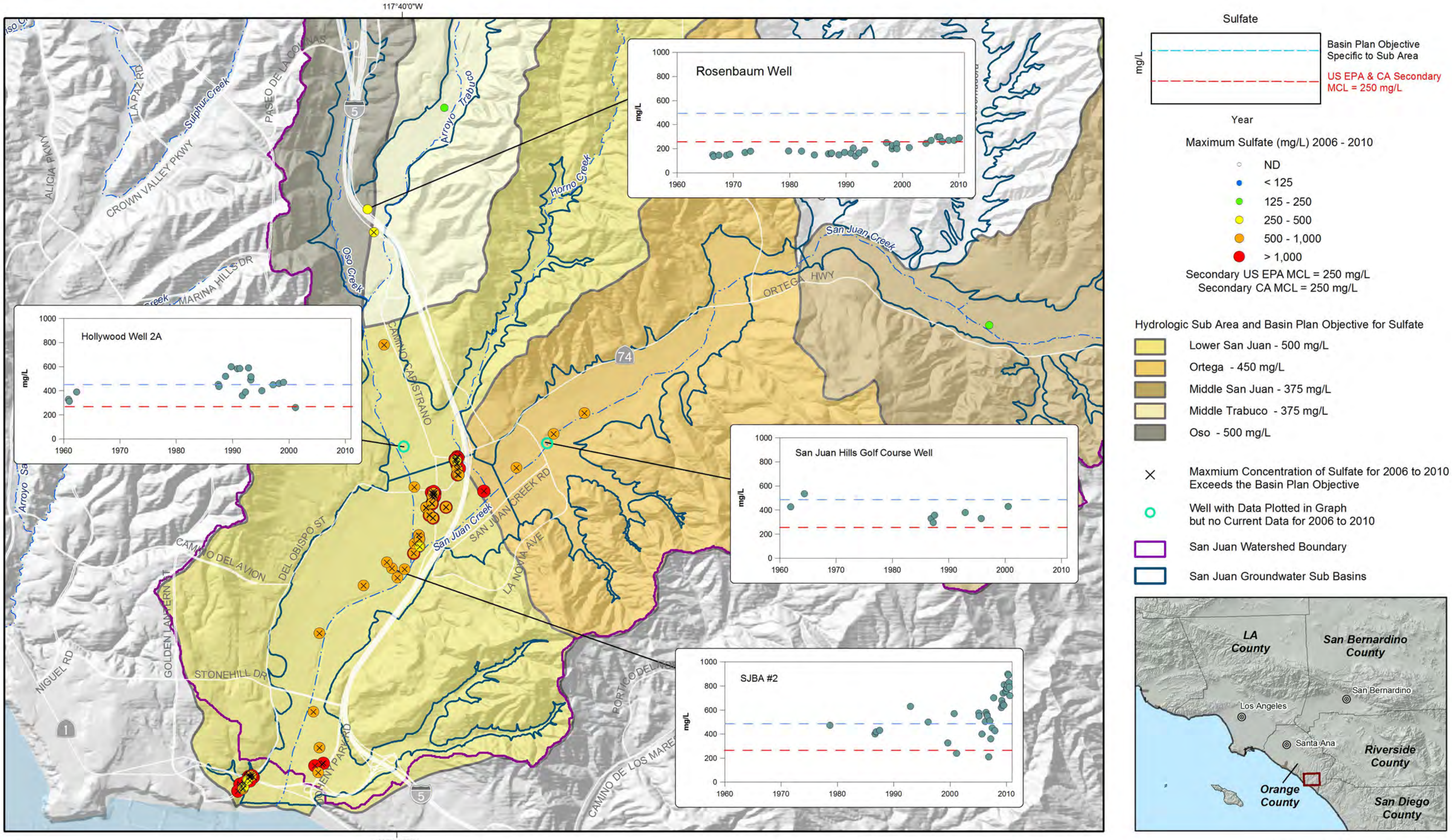
Nitrate as Nitrogen in Groundwater

Maximum Concentration 2006 - 2010 and Historical Trends

Figure 3-31



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SAN JUAN BASIN AUTHORITY

075-003
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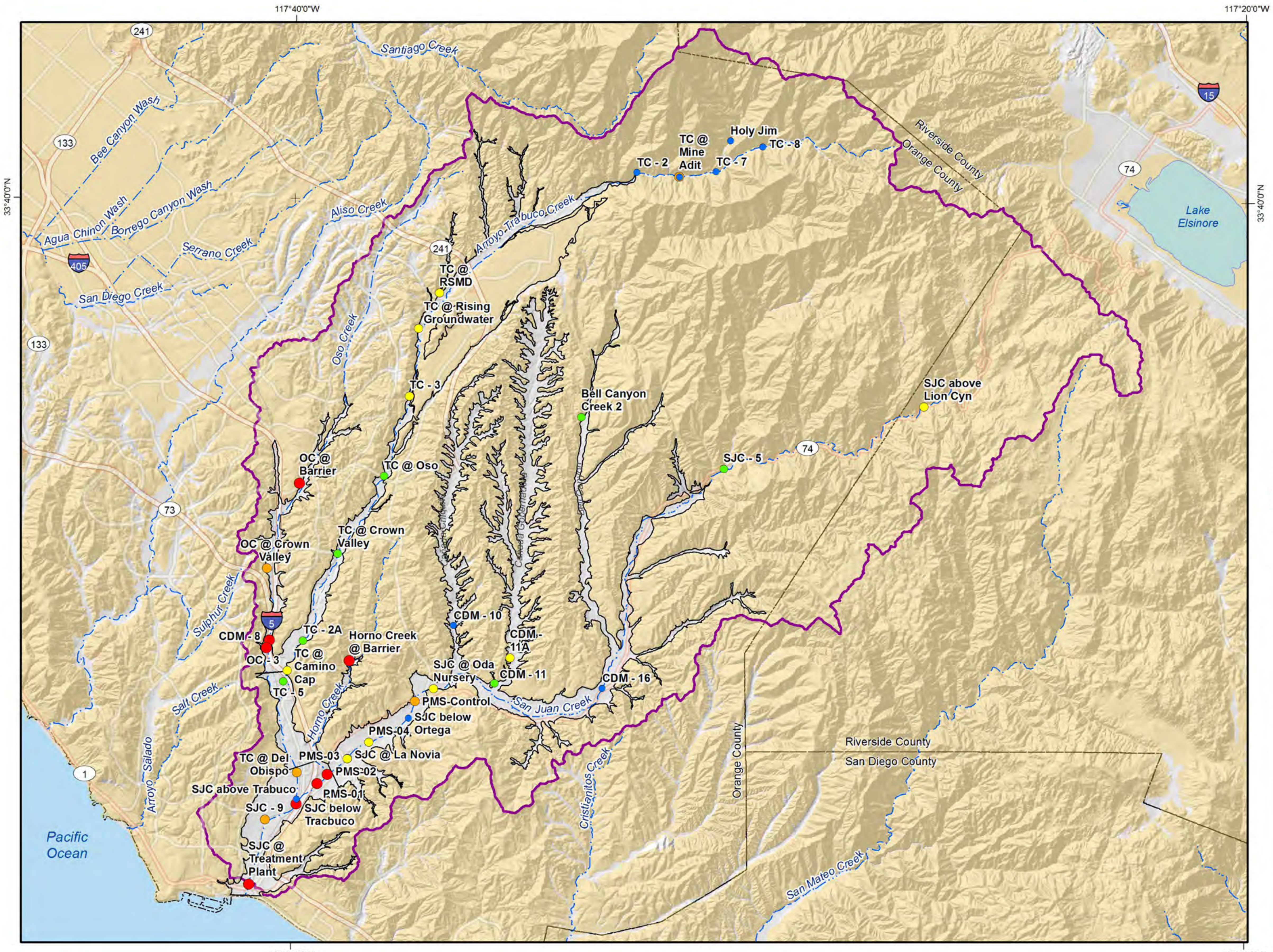
Sulfate in Groundwater

Maximum Concentration 2006 - 2010 and Historical Trends

Figure 3-32



Maximum Sulfate (mg/L)

- ND
- < 125
- 125 - 250
- 250 - 500
- 500 - 1,000
- > 1,000

Secondary US EPA MCL = 250 mg/L
Secondary CA MCL = 250 mg/L

Basin Plan Basin Plan Surface Water Objective = 250 mg/L

** Maximum concentration is based on all available data from the historical record. All surface water sites are monitored at different time periods and for different analytes. Refer to Table 3-5 in this report for a summary of the monitoring at the surface water stations.*

San Juan Groundwater Sub Basins

San Juan Watershed Boundary

Geology

Younger Alluvial Deposits

Older Alluvial Deposits, Landslides, and Tertiary Sedimentary bedrock

Source: CGS Special Report 217.

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0 1 2 3 4 Miles
0 2 4 6 KM

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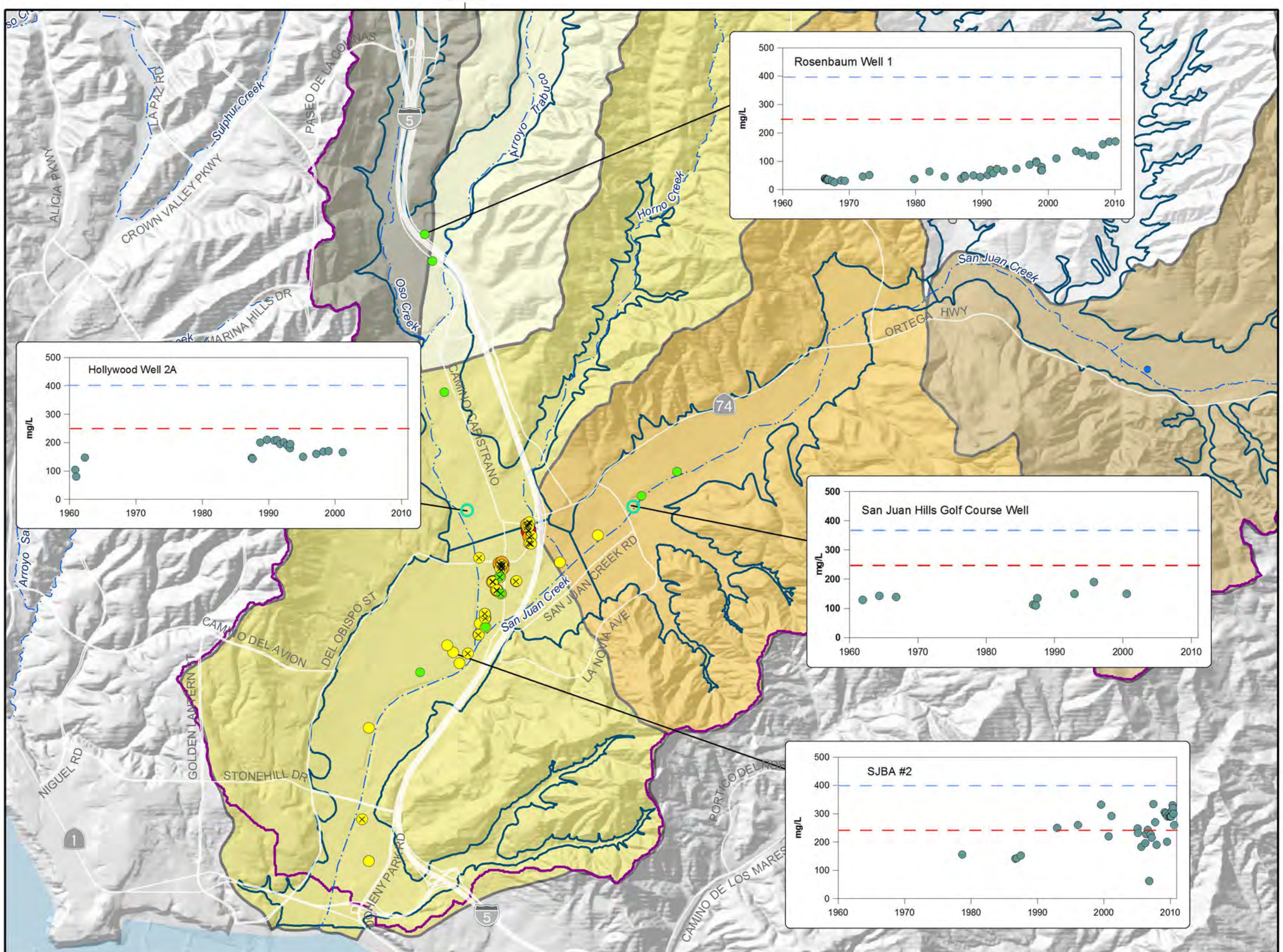
075-003
004

Sulfate in Surface Water

Maximum Concentration for Historical Record

Figure 3-33



Chloride

Basin Plan Objective Specific to Sub Area

US EPA & CA Secondary MCL = 250 mg/L

mg/L

Year

Maximum Chloride (mg/L) 2006 - 2010

- ND
- < 125
- 125 - 250
- 250 - 500
- 500 - 1,000
- > 1,000

Secondary US EPA MCL = 250 mg/L
Secondary CA MCL = 250 mg/L

Hydrologic Sub Area and Basin Plan Objective for Chloride

- Lower San Juan - 400 mg/L
- Ortega - 375 mg/L
- Middle San Juan - 375 mg/L
- Middle Trabuco - 375 mg/L
- Oso - 400 mg/L

- Maximum Concentration of Chloride for 2006 to 2010 Exceeds the Basin Plan Objective
- Well with Data Plotted in Graph but no Current Data for 2006 to 2010
- San Juan Watershed Boundary
- San Juan Groundwater Sub Basins

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0 2,500 5,000 7,500 10,000 Feet

0 1,000 2,000 3,000 Meters

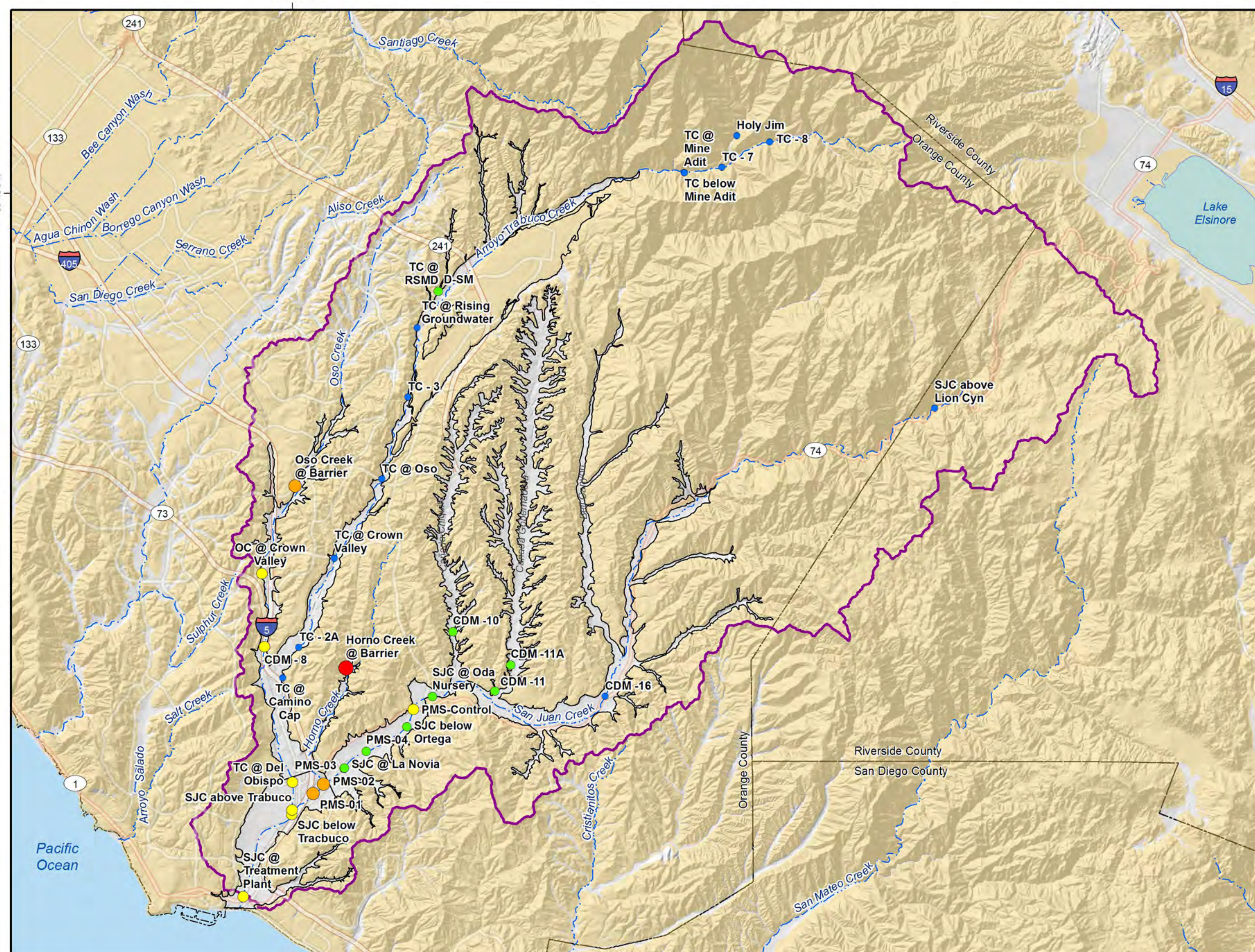
SAN JUAN BASIN AUTHORITY

075-003
004

Chloride in Groundwater

Maximum Concentration 2006 - 2010 and Historical Trends

Figure 3-34



Maximum Chloride (mg/L)

- ND
- < 125
- 125 - 250
- 250 - 500
- 500 - 1,000
- > 1,000

Secondary US EPA MCL = 250 mg/L
Secondary CA MCL = 250 mg/L

Basin Plan Surface Water Objective = 250 mg/L

** Maximum concentration is based on all available data from the historical record. All surface water sites are monitored at different time periods and for different analytes. Refer to Table 3-5 in this report for a summary of the monitoring at the surface water stations.*

San Juan Groundwater Sub Basins

San Juan Watershed Boundary

Geology

Younger Alluvial Deposits

Older Alluvial Deposits, Landslides, and Tertiary Sedimentary bedrock

Source: CGS Special Report 217.

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0 1 2 3 4 Miles
0 2 4 6 KM

SAN JUAN BASIN AUTHORITY

075-003
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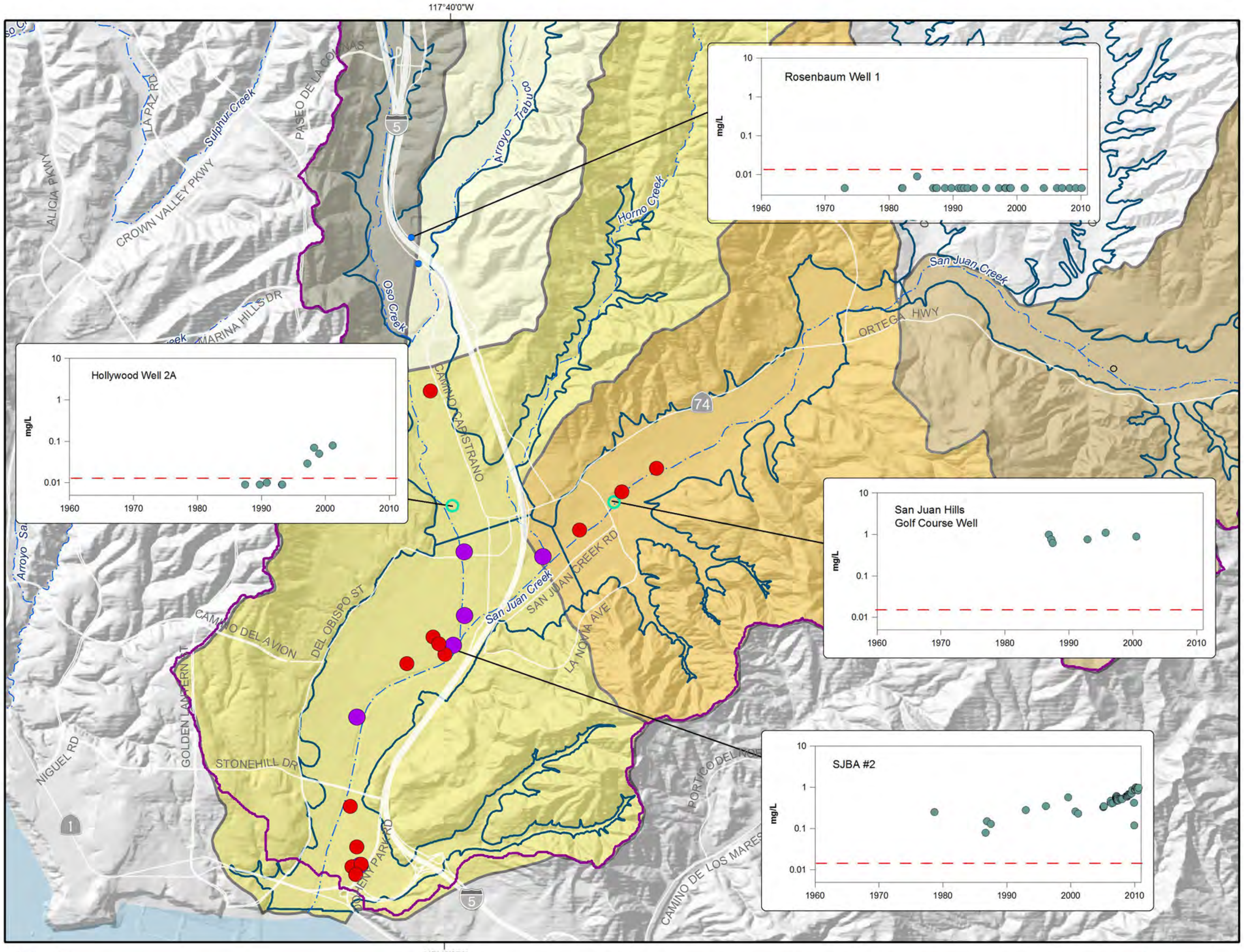
Chloride in Surface Water

Maximum Concentration for Historical Record

Figure 3-35



Manganese

mg/L

Year

Basin Plan Objective
= 0.05 mg/L

US EPA & CA Secondary
MCL = 0.05 mg/L

Maximum Manganese (mg/L) 2006 - 2010

- ND
- < .025
- .025 - .05
- .05 - .1
- .1 - .2
- .2 - 2.0
- > 2.0

Secondary US EPA MCL = 0.05 mg/L
Secondary CA MCL = 0.05 mg/L

Hydrologic Sub Area and Basin Plan Objective for Manganese

- Lower San Juan - 0.05 mg/L
- Ortega - 0.05 mg/L
- Middle San Juan - 0.05 mg/L
- Middle Trabuco - 0.05 mg/L
- Oso - 0.05 mg/L

Well with Data Plotted in Time-History
but no Current Data for 2006 to 2010

San Juan Watershed Boundary

San Juan Groundwater Sub Basins

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0 2,500 5,000 7,500 10,000 Feet

0 1,000 2,000 3,000 Meters

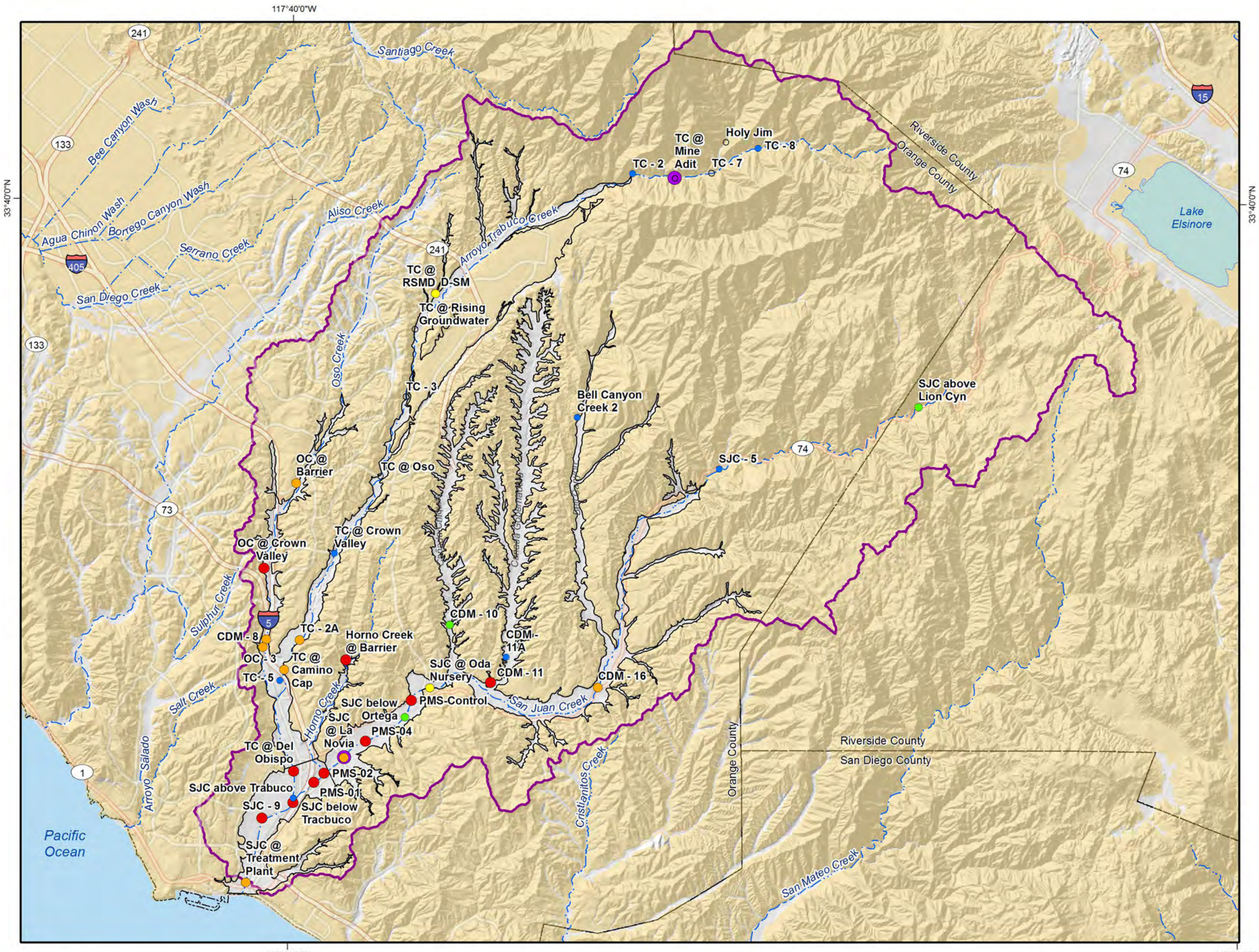
SAN JUAN BASIN AUTHORITY

075-003
004

Manganese in Groundwater

Maximum Concentration 2006 - 2010
and Historical Trends

Figure 3-36



Maximum Manganese (mg/L)

- ND
- < .025
- .025 - .05
- .05 - .1
- .1 - .2
- .2 - 2.0
- > 2.0

Secondary US EPA MCL = 0.05 mg/L
Secondary CA MCL = 0.05 mg/L

Basin Plan Surface Water Objective = 0.05 mg/L

** Maximum concentration is based on all available data from the historical record. All surface water sites are monitored at different time periods and for different analytes. Refer to Table 3-5 in this report for a summary of the monitoring at the surface water stations.*

- San Juan Groundwater Sub Basins
- San Juan Watershed Boundary

Geology

- Younger Alluvial Deposits
- Older Alluvial Deposits, Landslides, and Tertiary Sedimentary bedrock

Source: CGS Special Report 217.

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0 1 2 3 4 Miles
0 2 4 6 KM

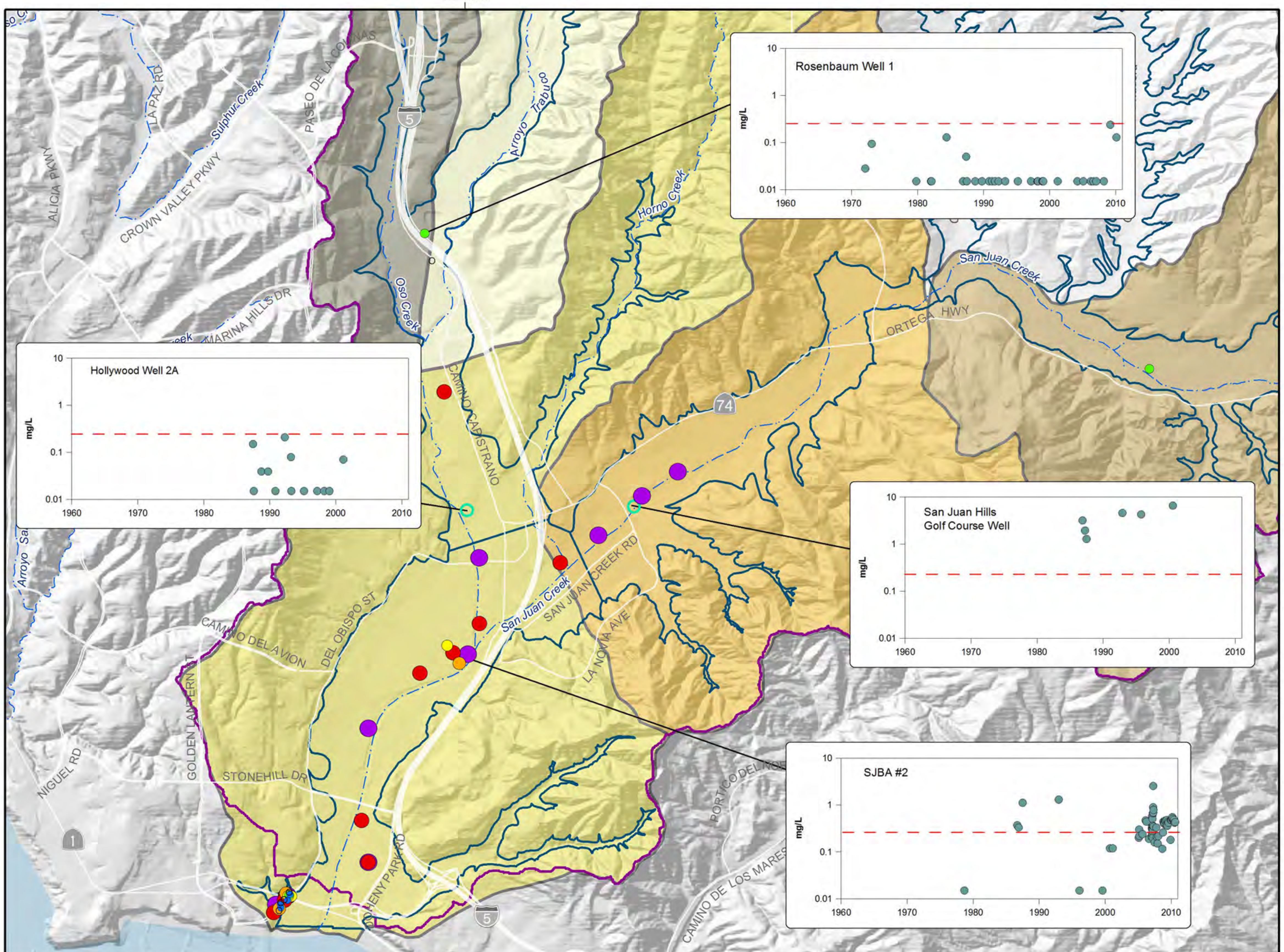
SAN JUAN BASIN AUTHORITY

075-003
004

Manganese in Surface Water

Maximum Concentration for Historical Record

Figure 3-37



Iron

Basin Plan Objective = 0.3 mg/L

US EPA & CA Secondary MCL = 0.3 mg/L

mg/L

Year

Maximum Iron (mg/L) 2006 - 2010

- ND
- < .15
- .15 - .3
- .3 - .6
- .6 - 1.2
- 1.2 - 20
- > 20

Secondary US EPA MCL = 0.3 mg/L
Secondary CA MCL = 0.3 mg/L

Hydrologic Sub Area and Basin Plan Objective for Iron

- Lower San Juan - 0.3 mg/L
- Ortega - 0.3 mg/L
- Middle San Juan - 0.3 mg/L
- Middle Trabuco - 0.3 mg/L
- Oso - 0.3 mg/L

- Well with Data Plotted in Graph but no Current Data for 2006 to 2010
- San Juan Watershed Boundary
- San Juan Groundwater Sub Basins

117°40'0"W

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0 2,500 5,000 7,500 10,000 Feet

0 1,000 2,000 3,000 Meters

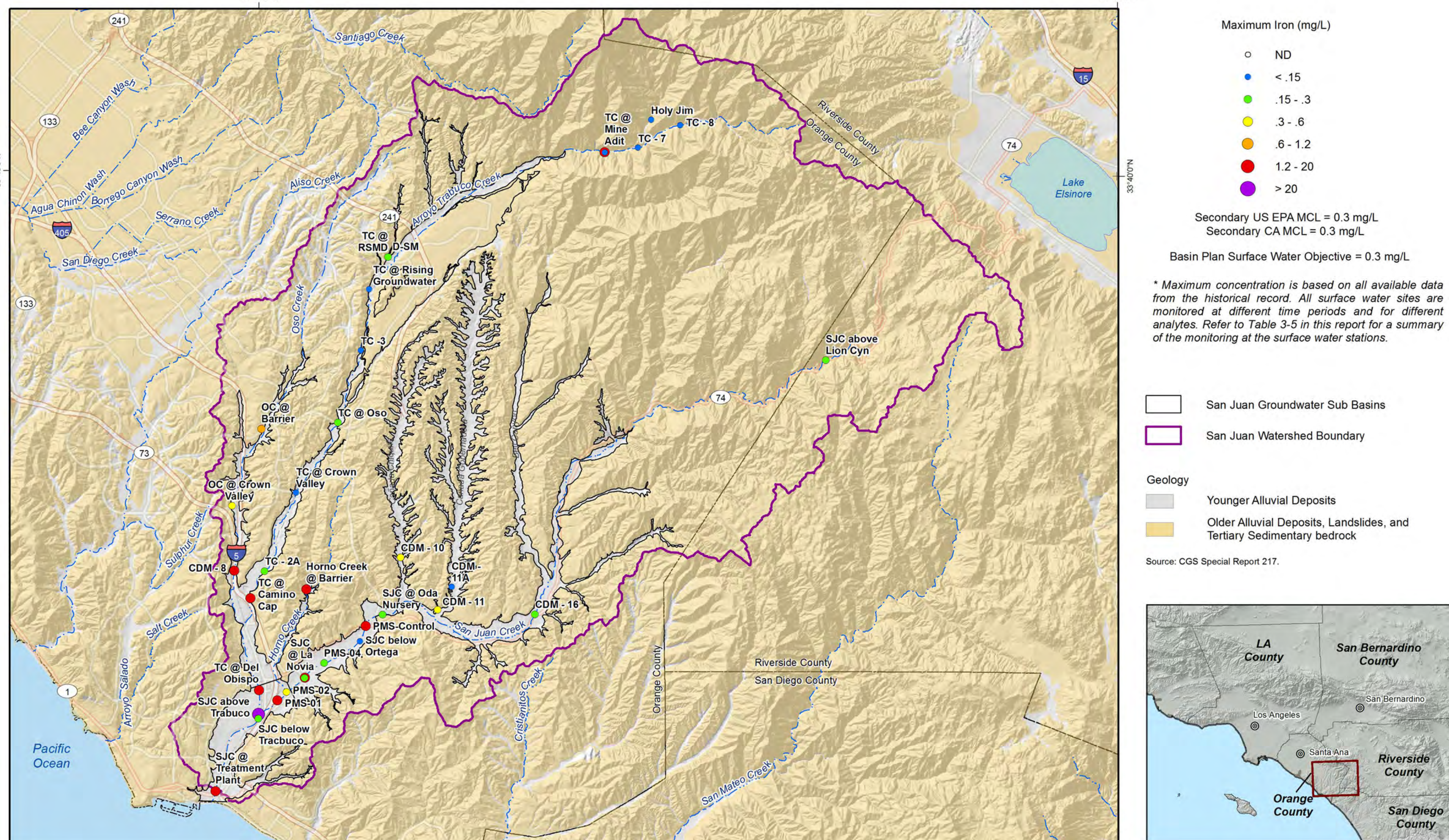
SAN JUAN BASIN AUTHORITY

075-003
004

Iron in Groundwater

Maximum Concentration 2006 - 2010 and Historical Trends

Figure 3-38



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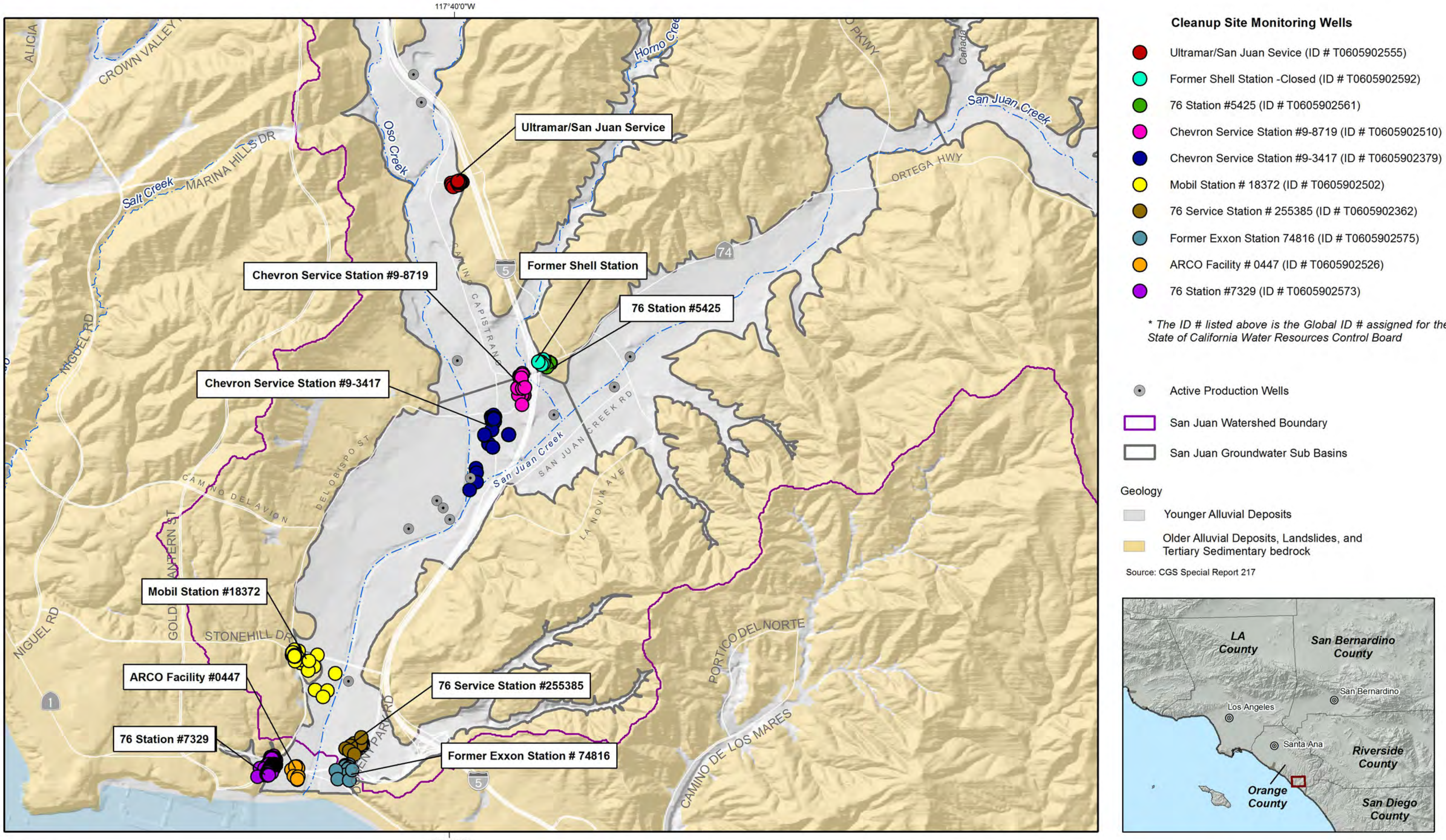
SAN JUAN BASIN AUTHORITY

075-003
004

Iron in Surface Water

Maximum Concentration for Historical Record

Figure 3-39



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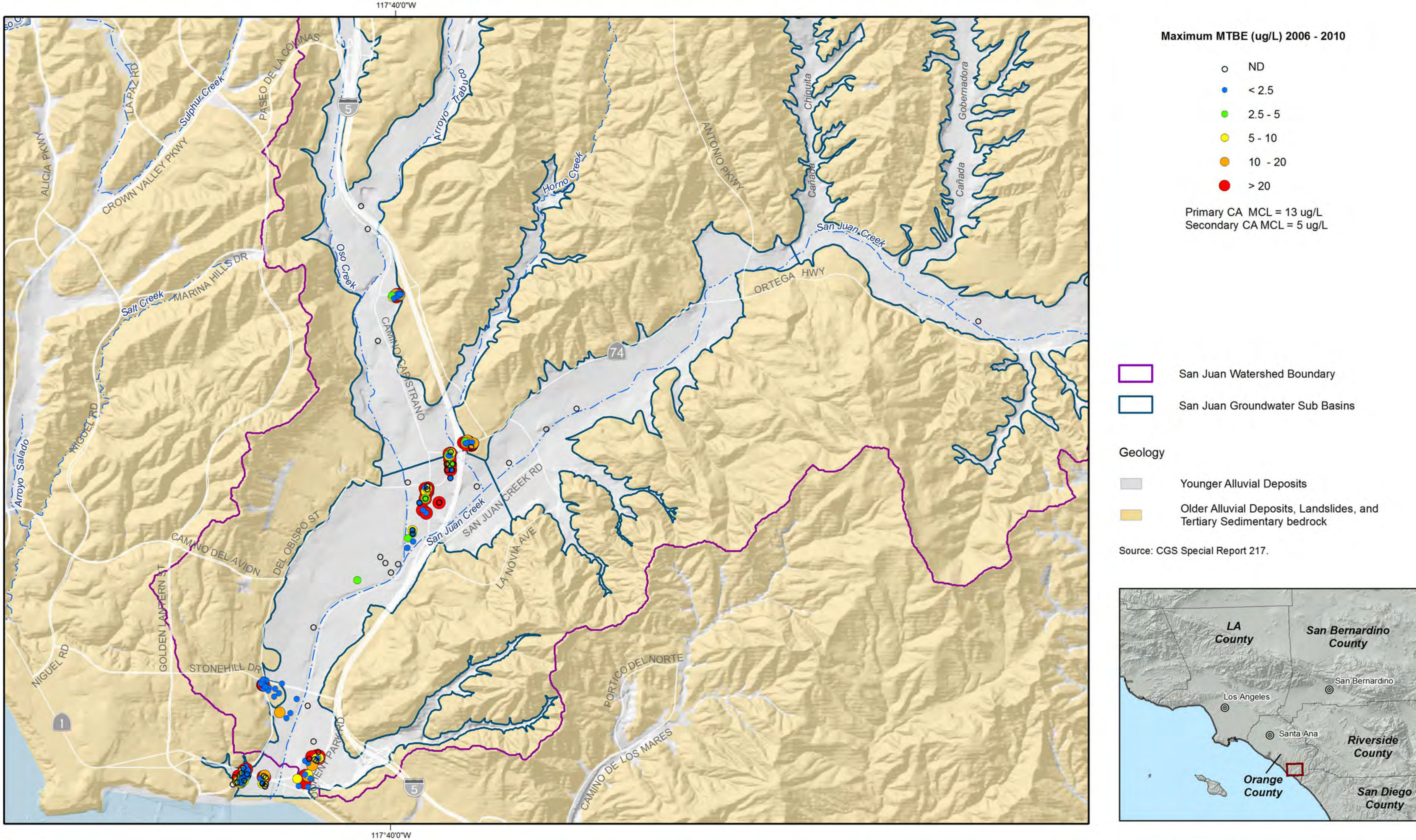
0 2,500 5,000 7,500 10,000 Feet
0 1,000 2,000 3,000 Meters

SAN JUAN BASIN AUTHORITY

075-003
004

San Juan Basin Point Source Contamination Cleanup Sites and Monitoring Wells

Figure 3-40



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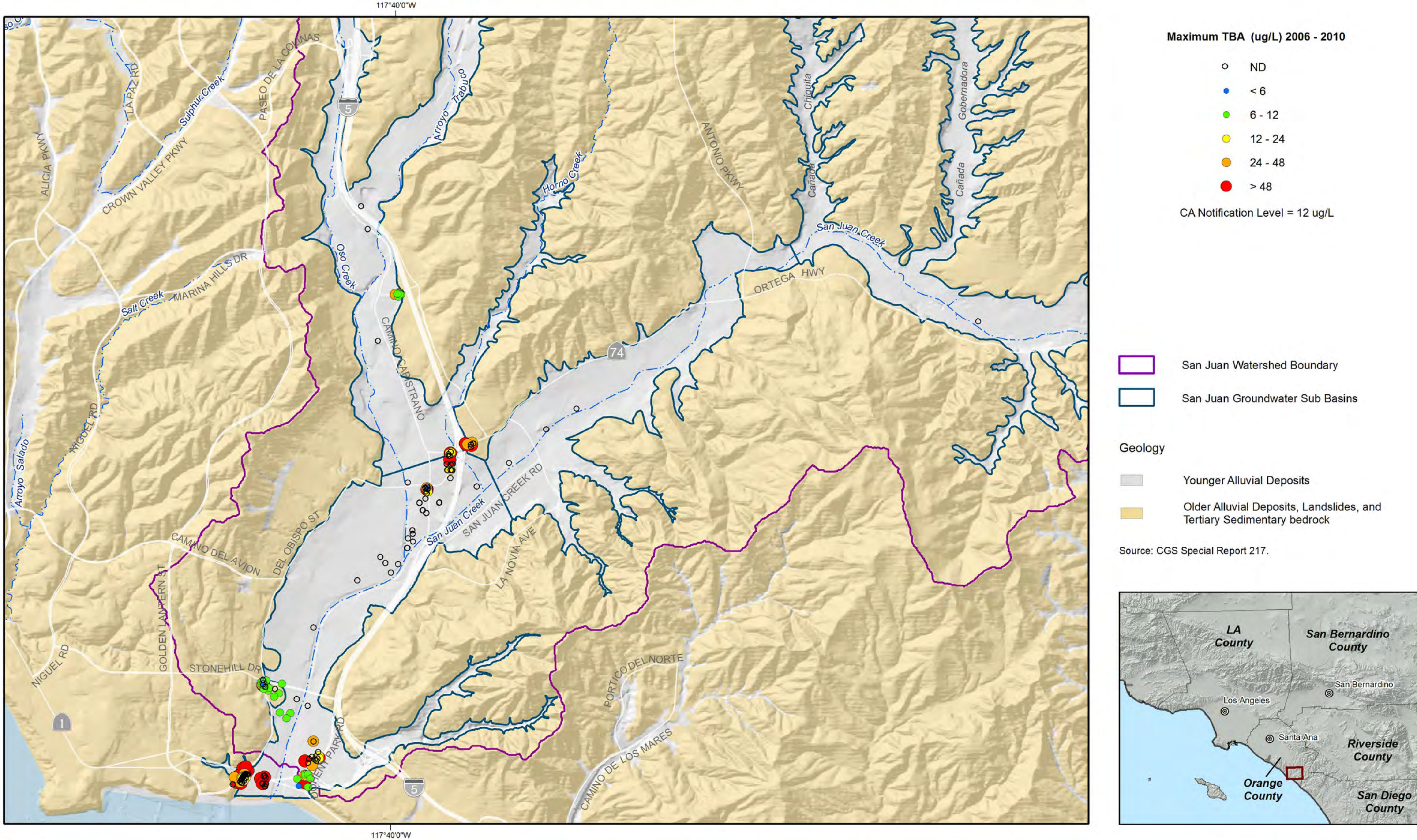
SAN JUAN BASIN AUTHORITY

075-003
004

Methyl Tert-Butyl Ether in Groundwater
Maximum Concentration 2006 to 2010

Figure 3-41



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075-003
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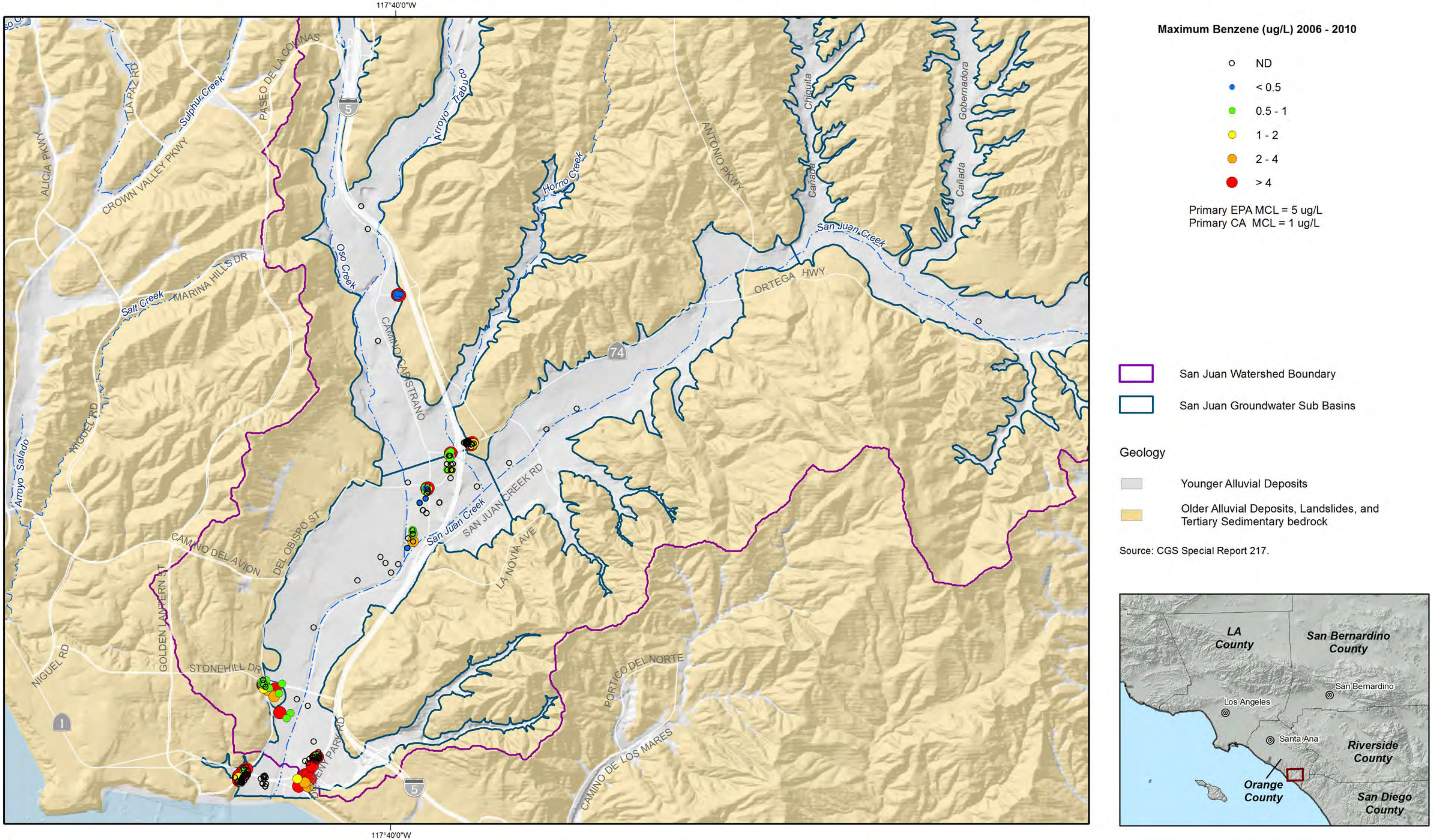
Tert-Butyl Alcohol in Groundwater
Maximum Concentration 2006 to 2010

Figure 3-42



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SAN JUAN BASIN AUTHORITY

075-003
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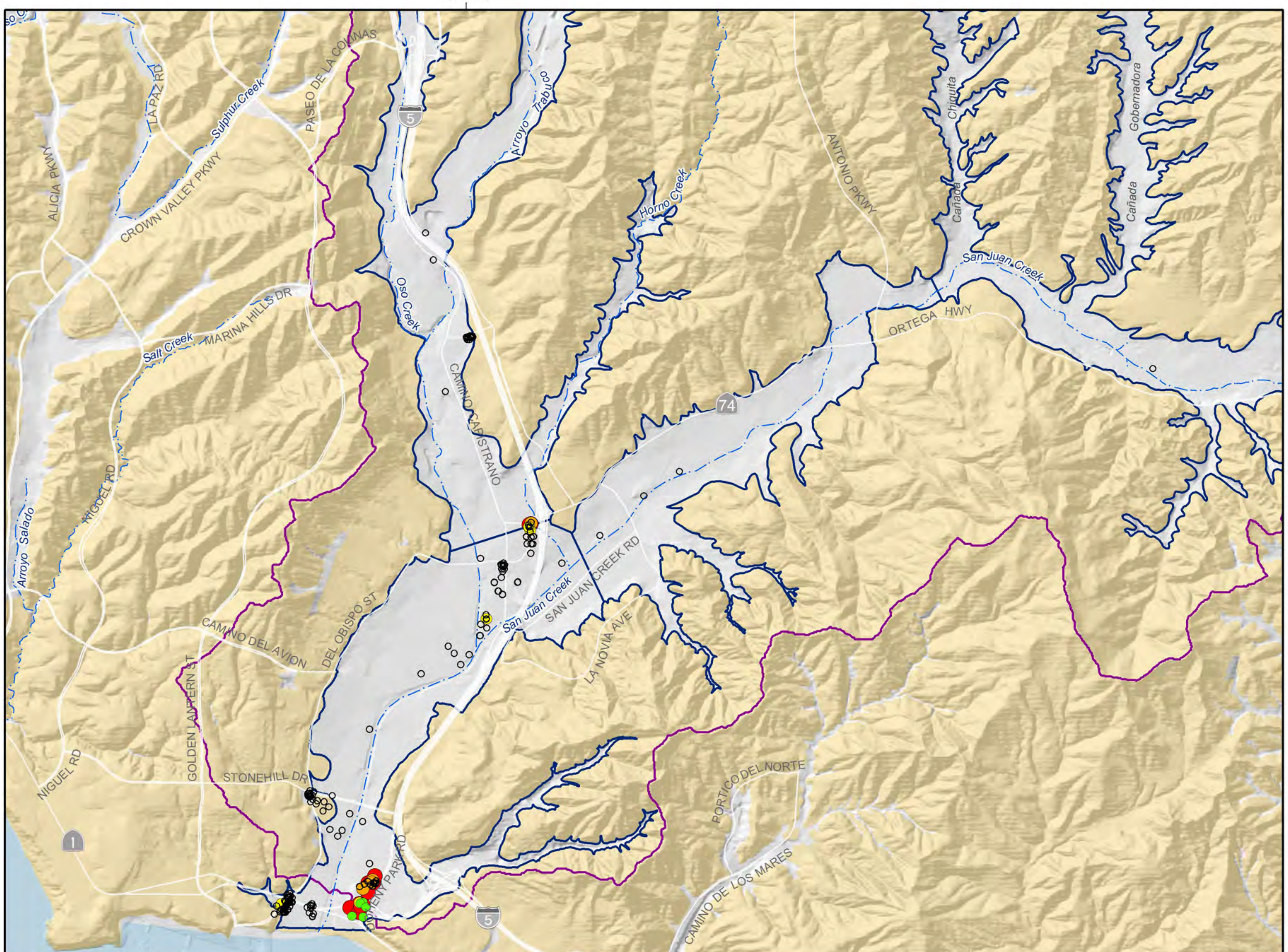
Benzene in Groundwater

Maximum Concentration 2006 to 2010

Figure 3-43



Maximum 1,2 DCA (ug/L) 2006 -2010

- ND
- < 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 2
- > 2

Primary EPA MCL = 5 ug/L
Primary CA MCL = 0.5 ug/L

San Juan Watershed Boundary

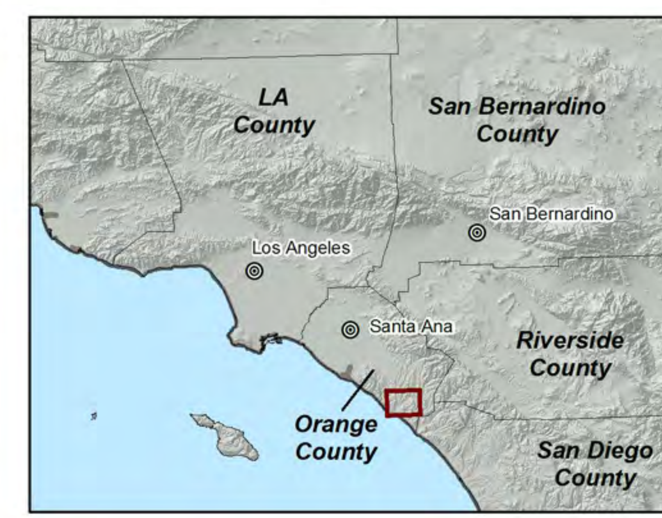
San Juan Groundwater Sub Basins

Geology

Younger Alluvial Deposits

Older Alluvial Deposits, Landslides, and Tertiary Sedimentary bedrock

Source: CGS Special Report 217.



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0 2,500 5,000 7,500 10,000 Feet

0 1,000 2,000 3,000 Meters

SAN JUAN BASIN AUTHORITY

075-003
004

1,2 - Dichloroethane in Groundwater

Maximum Concentration 2006 to 2010

Figure 3-44

Figure 3-45
Native and Supplemental Potable Water Infrastructure
San Juan Basin Authority

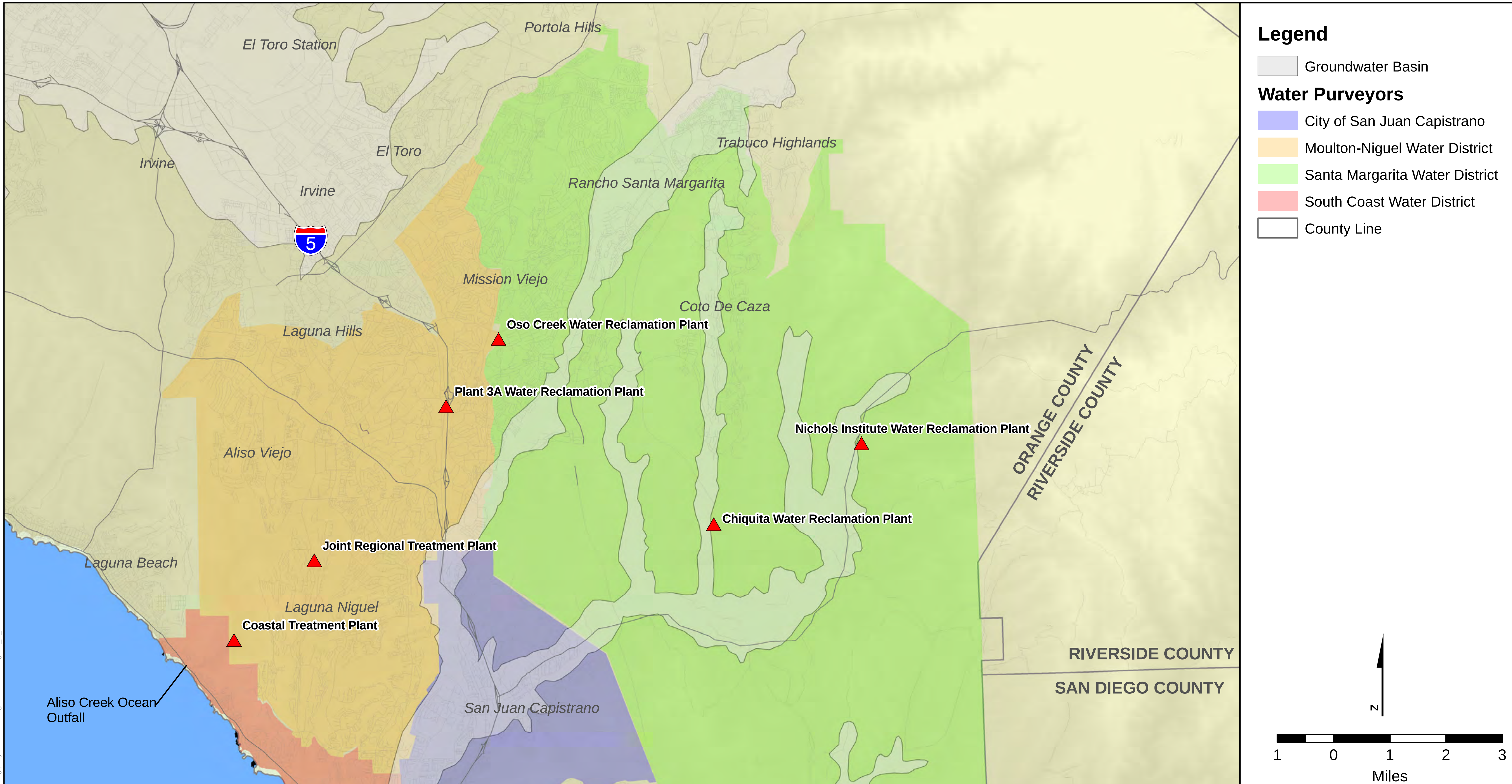

Figure 3-46
Wasterwater Infrastructure
Within the SJBA
San Juan Basin Authority

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DATE: 2/9/2011

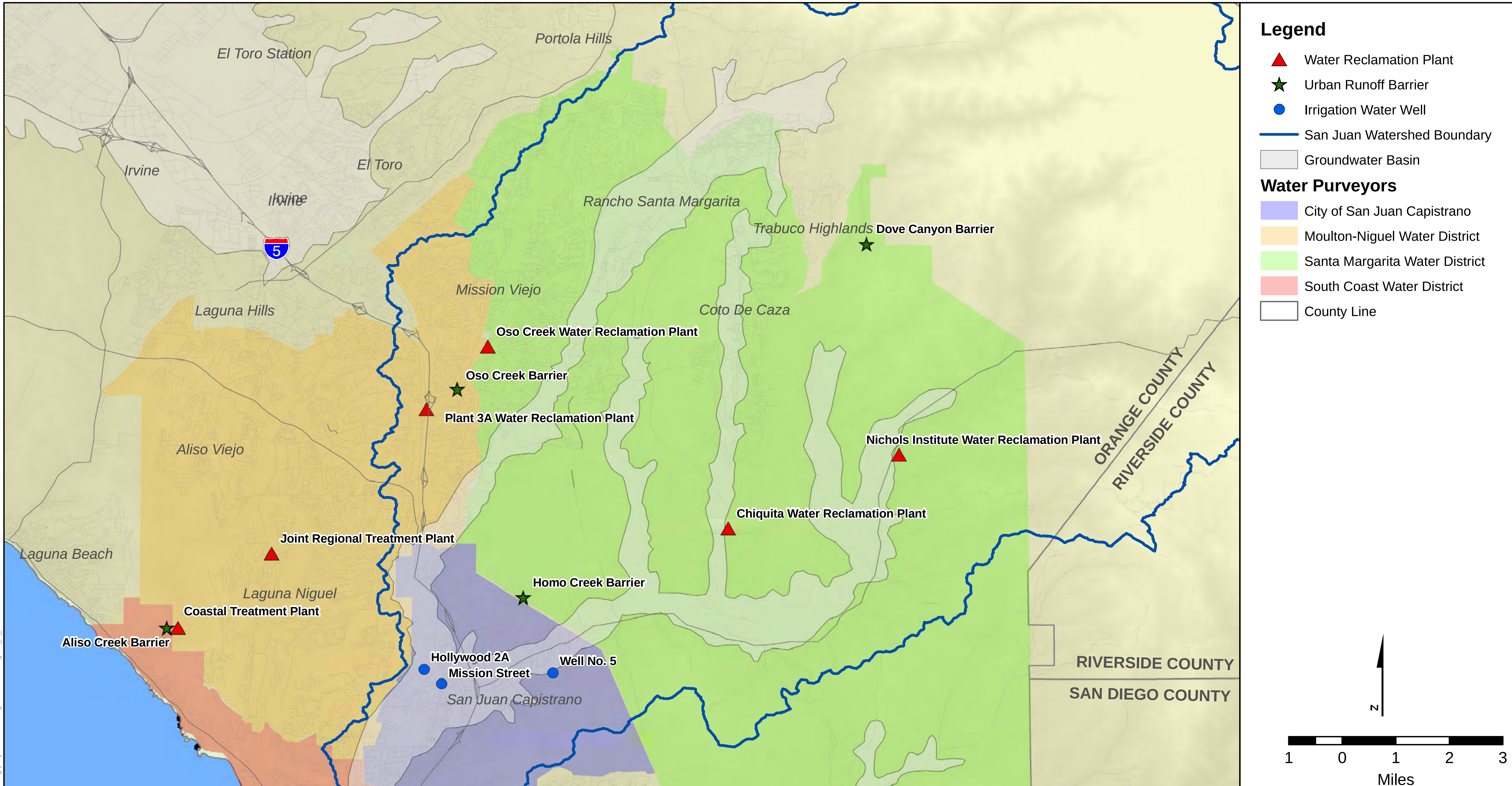

Figure 3-47
Irrigation Water Infrastructure
Within the SJBA
San Juan Basin Authority

This section describes the historical and projected water demands of SJBA member agencies. As described in Section 3.6, the primary water supply sources include imported water from MWDSC, groundwater from the San Juan Basin, local surface water, and recycled water.

Table 4-1 summarizes the recent (2005 through 2010) and projected (2015 through 2035) water demands[27] of the four SJBA member agencies. The SJBA agencies currently[28] (2010) have a combined service area population of about 406,200 and a total water demand of about 86,400 acre-feet per year (acre-ft/yr). Of this, 84 percent (about 72,300 acre-ft/yr) is potable water demand, and 16 percent (about 14,100 acre-ft/yr) is non-potable demand. Imported water satisfies the majority of the study area's potable water demand at about 69,600 acre-ft/yr, compared to the 3,000 acre-ft/yr produced from the San Juan Groundwater Basin. Non-potable demands of about 14,000 acre-ft/yr are met with recycled water (, local surface water diversions, and San Juan Basin Groundwater.

By 2035, the SJBA service area population is projected to increase to about 486,500 with a total water demand of about 106,400 acre- ft/yr. Compared to current conditions, the ratio of potable to non-potable water demands is expected to decrease, primarily due to the planned increase in recycled water reuse by the SJBA member agencies: potable demands will account for about 76 percent (81,100acre-ft/yr) of the total demand and will be met with a mix of imported water (about 72,200 acre-ft/yr) and groundwater from the San Juan Basin (8,900 acre-ft/yr), and non-potable demands will account for about 24 percent (26,000 acre-ft/yr) of the total demand and will be met with a mix of recycled water (20,600 acre-ft/yr), untreated San Juan Basin groundwater (2,700 acre-ft/yr), and local surface water diversions (2,700 acre-ft/yr).

Table 4-2 shows the projected amount of wastewater that will be generated within the service areas of the SJBA member agencies from 2015 through 2035 and the existing capacity to generate Title 22 recycled water. In 2015, the demand for recycled water is projected to be about 14,700 acre-ft/yr, which is about 56 percent of the existing capacity for Title 22 recycled water or 33 percent of total wastewater generated (44,800 acre-ft/yr). As indicated above, by 2035, the demand for recycled water is projected to increase to about 20,600 acre-ft/yr, which is about 80 percent of the existing capacity for Title 22 recycled water or 41 percent of the total wastewater generated (50,200 acre-ft/yr). The surplus recycled water provides an opportunity for indirect potable reuse in the San Juan Basin.

The following is a brief summary of the historical and projected demands of each of the SJBA member agencies.

City of San Juan Capistrano. The CSJC currently has a service area population of about 40,200 people that is expected to increase to about 44,100 by 2035. The CSJC's current water demand

[27] Note that the demands in Table 4-1 reflect the total amount of water that has to be produced to meet consumptive demands. In the case of the CSJC and the SCWD, there are losses of water associated with the desalination process. For example, in order to produce 5,450 acre-ft of treated groundwater from the Groundwater Recovery Plant, the City must pump about 6,800 acre-ft of groundwater.

[28] The use of the modifier word "current" means 2010.

is about 8,800 acre-ft/yr: 8,400 acre-ft/yr of potable and 400 acre-ft/yr of non-potable water demands. The completion of the Groundwater Recovery Plant in December 2004 made up to 4,800 acre-ft of untreated groundwater available for use. The CSJC has not been able to take full advantage of this capacity in recent years due to MTBE contamination in groundwater near several of the City's major production wells. The installation of MTBE treatment facilities and an increase in groundwater production capacity to the Groundwater Recovery Plant will allow up to about 6,800 acre-ft/yr of San Juan Basin groundwater to be treated for future potable use. This will satisfy just over 50 percent of the City's total demands, which are expected to increase to 11,800 acre-ft/yr by 2035[29]. The increase of non-potable water use to about 1,950 acre-ft/yr, will also reduce the City's demand for imported water.

Moulton Niguel Water District. The MNWD currently has a service area population of about 172,000 people that is expected to increase to about 183,400 by 2035. The MNWD's current water demand is about 36,600 acre-ft/yr: 29,700 acre-ft/yr of potable and 6,900 acre-ft/yr of non-potable water demands. The MNWD relies solely on imported water to meet potable water demands and recycled water to meet non-potable demands. The MNWD experienced a pre-drought demand high of about 41,700 acre-ft in fiscal year 2007, but conservation measures due to drought conditions brought total demand down to the current level. Demands are projected to rebound to about 40,600 acre-ft by 2015 as emergency conservation measures are lifted, but the introduction of additional demand management practices required by SBx7-7 will reduce overall demand to about 39,500 acre-ft/yr by 2035, despite the increase in population. By 2035, recycled water use will increase to about 9,100 acre-ft/yr.

Santa Margarita Water District. The SMWD currently has a service area population of about 155,000 people that is expected to increase to about 217,000 by 2035. The SMWD's current water demand is about 34,200 acre-ft/yr: 28,200 acre-ft/yr of potable and 6,000 acre-ft/yr of non-potable water demands. Potable demand is met almost entirely through the purchase of imported water from the MWDOC, with only a minimal amount of San Juan Basin groundwater produced each year (<100 acre-ft/yr). Currently, non-potable demands are met through the use of recycled water , the diversion of urban run-off from Horno Creek, Oso Creek, and the Arroyo Trabuco, and in the near future, surface water diversions from the Canada Gobernadora. SMWD recycled water use will reach about 5,200 acre-ft/yr by 2015 and will increase to about 10,100 acre-ft/yr by 2030. SMWD will divert about 2,300 acre-ft/yr of surface water in 2015 and this will increase to about 2,700 acre-ft/yr by 2020. Total water demand is projected to increase to about 46,400 acre-ft/yr by 2030, of which 33,500 acre-ft/yr will be potable demands met with imported water and 12,900 acre-ft/yr will be non-potable demands met with recycled water (10,140 acre-ft/yr) and local surface water (2,700 acre-ft/yr).

South Coast Water District. The SCWD currently has a service area population of about 38,600 people that is expected to increase to about 41,500 by 2035. The SCWD's current water demand is about 6,900 acre-ft/yr: 6,100 acre-ft/yr of potable and 800 acre-ft/yr of non-potable water demands. Historically, imported water was the only source of potable water for the SCWD, but the demand for imported water has decreased in the last three years since the startup of the SCWD Groundwater Recovery Facility. Planned potable water production from the SCWD Groundwater Recovery Facility will reach about 1,300 acre-ft/yr by 2015 and

[29] See footnote 28.

2,000 acre-ft/yr by 2020. The total water demand is projected to increase to about 8,700 acre-ft/yr by 2035[30], of which 7,300 acre-ft/yr will be potable demand and 1,400 acre-ft/yr will be non-potable demand met with recycled water.

[30] See footnote 28.

Table 4-1
Historical and Projected (Normal Year) Water Demands and Supplies for Agencies in the San Juan Basin Authority
(acre-ft/yr)

Agency Water Supply and Demand	Historical (Fiscal Years- July 1 through June 30)					Projection				
	05-06	06-07	07-08	08-09	09-10	2015	2020	2025	2030	2035
City of San Juan Capistrano[1]										
Service Area Population	38,909	39,136	39,580	39,835	40,262	41,039	41,816	42,593	43,370	44,147
Total Water Demand	8,856	9,974	9,887	9,852	8,783	10,763	11,013	11,263	11,513	11,763
Potable	8,521	9,818	9,720	9,589	8,359	8,813	9,063	9,313	9,563	9,813
Non-Potable	335	156	167	263	424	1,950	1,950	1,950	1,950	1,950
Total Potable Supplies	8,877	9,297	9,347	9,698	8,676	8,813	9,063	9,313	9,563	9,813
San Juan Basin Groundwater	5,966	3,267	1,616	2,756	2,297	6,813	6,813	6,813	6,813	6,813
Imported	2,912	6,029	7,731	6,942	6,379	2,000	2,250	2,500	2,750	3,000
Non-Potable Supplies	335	156	167	263	424	1,950	1,950	1,950	1,950	1,950
Recycled Water	0	0	0	0	0	0	0	0	0	0
San Juan Basin Groundwater	335	156	167	263	424	1,950	1,950	1,950	1,950	1,950
Surface Water Diversions	0	0	0	0	0	0	0	0	0	0
Moulton Niguel Water District[2]										
Service Area Population	168,172	168,327	169,361	170,675	172,068	174,342	176,616	178,891	181,165	183,439
Total Water Demand	39,819	44,730	42,670	40,941	36,593	40,600	38,000	38,500	39,000	39,500
Potable	33,438	36,679	35,083	33,744	29,735	32,100	29,300	29,600	30,000	30,400
Non-Potable	6,381	8,050	7,587	7,197	6,858	8,500	8,700	8,900	9,000	9,100
Total Potable Supplies	33,438	36,679	35,083	33,744	29,735	32,100	29,300	29,600	30,000	30,400
San Juan Basin Groundwater	0	0	0	0	0	0	0	0	0	0
Imported from MWDOC	33,438	36,679	35,083	33,744	29,735	32,100	29,300	29,600	30,000	30,400
Non-Potable Supplies	6,381	8,050	7,587	7,197	6,858	8,500	8,700	8,900	9,000	9,100
Recycled Water	6,381	8,050	7,587	7,197	6,858	8,500	8,700	8,900	9,000	9,100
San Juan Basin Groundwater	0	0	0	0	0	0	0	0	0	0
Surface Water Diversions	0	0	0	0	0	0	0	0	0	0
Santa Margarita Water District[3]										
Service Area Population	149,107	151,847	153,264	154,174	155,229	167,663	180,097	192,531	204,965	217,399
Total Water Demand	36,562	41,362	38,642	36,866	34,169	36,006	39,599	44,987	46,409	46,409
Potable	32,942	34,845	32,868	30,952	28,142	28,567	29,996	32,637	33,549	33,549
Non-Potable	3,620	6,517	5,774	5,914	6,027	7,439	9,603	12,350	12,860	12,860
Potable Supplies	32,942	34,845	32,868	30,952	28,142	28,567	29,996	32,637	33,549	33,549
San Juan Basin Groundwater	71	78	65	73	65	100	116	116	116	116
Imported	32,871	34,767	32,803	30,879	28,077	28,467	29,880	32,521	33,433	33,433
Non-Potable Supplies	3,620	6,517	5,774	5,914	6,027	7,439	9,603	12,350	12,860	12,860
Recycled Water	3,620	6,517	5,774	5,914	6,027	5,154	6,883	9,630	10,140	10,140
San Juan Basin Groundwater						0	0	0	0	0
Surface Water Diversions						2,285	2,720	2,720	2,720	2,720
South Coast Water District[4]										
Service Area Population	37,893	37,925	38,078	38,335	38,641	39,219	39,798	40,376	40,955	41,533
Total Water Demand	7,755	8,678	8,369	7,982	6,909	8,208	8,495	8,605	8,736	8,736
Potable	7,005	7,773	7,520	7,037	6,083	7,108	7,295	7,305	7,336	7,336
Non-Potable	750	905	849	945	826	1,100	1,200	1,300	1,400	1,400
Potable Supplies	7,005	7,773	7,520	7,037	6,083	7,108	7,295	7,305	7,336	7,336
San Juan Basin Groundwater	0	0	258	748	634	1,300	2,000	2,000	2,000	2,000
Imported	7,005	7,773	7,263	6,290	5,449	5,808	5,295	5,305	5,336	5,336
Non-Potable Supplies	750	905	849	945	826	1,100	1,200	1,300	1,400	1,400
Recycled Water	750	905	849	945	826	1,100	1,200	1,300	1,400	1,400
San Juan Basin Groundwater	0	0	0	0	0	0	0	0	0	0
Surface Water Diversions	0	0	0	0	0	0	0	0	0	0
Private Entities										
Non-Potable Supplies										
San Juan Basin Groundwater	660	821	752	750	653	727	727	727	727	727
Total SJBA Planning Area										
Service Area Population	394,081	397,235	400,283	403,019	406,200	422,263	438,327	454,391	470,455	486,518
Total Water Demand	92,992	104,743	99,569	95,641	86,454	95,577	97,107	103,355	105,658	106,408
Potable	81,906	89,115	85,191	81,323	72,319	76,588	75,654	78,855	80,448	81,098
Non-Potable	11,085	15,629	14,377	14,319	14,134	18,989	21,453	24,500	25,210	25,310
Potable Supplies	82,263	88,593	84,818	81,431	72,636	76,588	75,654	78,855	80,448	81,098
San Juan Basin Groundwater	6,037	3,345	1,938	3,577	2,996	8,213	8,929	8,929	8,929	8,929
Imported	76,226	85,248	82,879	77,854	69,641	68,375	66,725	69,926	71,519	72,169
Non-Potable Supplies	11,746	16,449	15,129	15,068	14,787	19,716	22,180	25,227	25,937	26,037
Recycled Water	10,751	15,472	14,210	14,056	13,710	14,754	16,783	19,830	20,540	20,640
San Juan Basin Groundwater	995	977	919	1,012	1,077	2,677	2,677	2,677	2,677	2,677
Surface Water Diversions						2,285	2,720	2,720	2,720	2,720

Notes:

1--Historical data for the City of San Juan Capistrano provided by San Juan Basin Authority Records. Projected data is derived from the City's 2010 UWMP. Note that the demands reflect the total amount of water that has to be produced to meet consumptive demands. There are losses of water associated with the desalination process. Thus, the demands may appear overstated relative to the consumptive demands reported in the UWMP.

2--Historical and projected data for the Moulton Niguel Water District provided by the Municipal Water District of Orange County.

4--Historical and projected data for the Santa Margarita Water District provided by Santa Margarita Water District. Historical data on the relative contributions of recycled water and surface water diversions used to meet non-potable demands not provided.

5--Historical data for the South Coast Water District provided by the Municipal Water District of Orange County. Projected Data obtained from SCWD's 2010 UWMP. Note that the demands reflect the total amount of water that has to be produced to meet consumptive demands. There are losses of water associated with the desalination process.

Table 4-2
Projected Wastewater Generation for Treatment Facilities in the San Juan Basin Authority Planning Area
(acre-ft)

Wastewater Treatment Plant	Operator	Agencies Discharging to Treatment Plant	Title 22 Recycled Water Capacity	Projected Wastewater Generation				
				2015	2020	2025	2030	2035
Jay B. Latham Regional Treatment Plant	SOCWA	CSJC, MNWD, SCWD, SMWD	0	11,200	11,200	11,200	11,200	11,200
Joint Regional Treatment Plant	SOCWA	MNWD	12,770	10,900	11,476	11,476	11,476	11,476
Coastal Treatment Plant	SOCWA	MNWD, SCWD	2,912	5,000	5,500	5,934	5,934	5,934
Plant 3A Water Reclamation Plant	SOCWA	MNWD, SCWD	2,688	3,360	3,360	3,639	3,639	3,639
Oso Creek Water Reclamation Plant	SMWD	SMWD	2,240	2,240	2,240	2,240	2,240	2,240
Chiquita Water Reclamation Plant	SMWD	SMWD	5,601	12,096	14,224	15,680	15,680	15,680
Total			**26,211**	**44,796**	**48,000**	**50,169**	**50,169**	**50,169**
Demand for Recycled Water *(from table 4-1)*				14,754	16,783	19,830	20,540	20,640
Remaining Unused Title 22 Recycled Water				11,457	9,428	6,381	5,671	5,571
Total Unused Wastewater *(Total Generation - Total Demand)*				30,042	31,217	30,339	29,629	29,529

Notes
1--All SOCWA plant data provided by the Municipal Water District of Orange County. All SMWD plant data provided by SMWD.

Section 5 Management Goals and Impediments

During the period of September 2010 through November 2010, the SJBA TAC met four times to develop the scope of the SJBGFMP. These meetings were held at the SMWD on September 21st, October 5th, November 2nd, and November 16th. As part of this SJBGFMP scoping process, issues, needs, and interests were solicited from SJBA member agencies. These "issues, needs, and interests" are summarized in a tabular form in Tables 5-1 through 5-7. Each table refers to a class of issues, needs, and interests, including:

- safe yield
- native and imported water recharge
- quality and quantity
- reclaimed water
- conjunctive-use storage
- costs
- human resources and administration

Attribution for the source of each issue, need, and interest is listed in these tables. In some cases, a specific issue (need and interest) may show up in more than one class. These issues, needs, and interests were used to focus problem identification, SJBGFMP goals, and the resulting SJBGFMP update.

The goal setting process involved the proposal of an initial set of goals, followed by group and individual discussions and group editing of the goals at those meetings. The TAC member's also articulated impediments to achieving the goals and the action items required to remove impediments. At the November 16, 2010 meeting, the TAC member's achieved consensus on goals, impediments to those goals, and the action items required to remove the impediments. The goals of the SJBGFMP are listed below.

- Goal No. 1 – Enhance Basin Water Supplies. In addition to local groundwater, this goal applies to all sources of water available for the enhancement of the San Juan Basin (Basin). The intent is to maximize the use of all available water in the Basin. This goal will be accomplished by increasing the recharge of all available waters, including storm water discharge, dry-weather discharge, and recycled water.
- Goal No. 2 – Protect and Enhance Water Quality. The intent of this goal is to improve surface and groundwater quality to ensure the maximum use and reuse of available supplies and to minimize the cost of groundwater treatment. This goal will be accomplished by implementing activities that capture and treat contaminated groundwater for direct high-priority beneficial uses, implementing the recharge of storm water discharge, and encouraging better management of waste discharges that impact groundwater.

- Goal No. 3 – Maximize the Use of Unused Storage Space. The intent of this goal is to maximize the use of the Basin's storage capacity to improve water supply availability. This goal will be accomplished by determining the temporal and spatial availability of unused storage space in the Basin and subsequently determining how best to use that space to increase operational flexibility and water supply reliability.

- Goal No. 4 – Satisfy State Requirements for a Groundwater Management Program. The intent of this goal is to integrate the SJBGFMP into the South Orange County regional water management plan and to improve the opportunity of obtaining outside funding for SJBGFMP implementation. This goal will be accomplished by ensuring that the SJBGFMP contains the minimum elements required for a groundwater management plan and by inclusion of the SJBGFMP in the County's Integrated Regional Water Management Plan.

- Goal No. 5 – Establish Equitable Share of the Funding, Benefits, and Costs of the SJBGFMP. The intent of this goal is to align the benefits of the SJBGFMP with individual SJBA member agencies and SJBGFMP implementation costs. This goal will be accomplished by clearly articulating the benefits of the SJBGFMP to each SJBA member agency and subsequently allocating the funding and costs in an equitable manner.

Table 5-8 lists these goals, impediments to the goals, and the action items required to remove the impediments. Some of the impediments listed in Table 5-8 were developed after the TAC completed its lists goals and impediments; these additional items were identified during the technical work documented in Sections 3 and 4.

The next section of this report expands on the action items listed in Table 5-8 specifically in the context of *Section 2 Planning Area and its Resources, Section 3 Existing Water Resources, and Section 4 Historical and Projected Water Demands*, and describes management strategies that can be employed to remove impediments to the SJBGFMP goals.

Table 5-1
Safe Yield Issues, Needs and Wants

	San Juan Basin Authority				Other Interested Parties			
	SJC	MNWD	SMWD	SCWD	MWDOC	TCWD	RMV	SJHGC
Ability to continue to divert foreign developed water for irrigation purposes			•					
Increase the District’s reliability	•	•	•	•				
Identify project(s) to obtain water from SJBA			•					
Future level of participation in SJBA			•					
Maximize interconnections between agencies			•					
Identify the safe yield of the basin			•					
Identify and propose mitigation for impacts from proposed ocean desalination			•					
Confirm the modeling efforts are developing safe yields			•					
Review and recommend any proposed changes to the monitoring efforts			•					
Develop a uniform reporting methodology for monitoring			•					
Coordinate water harvesting with private entities			•					
Identify short and long term goals for the basin			•					
Flexible supply/Transfer/Over-Production Methodology	•							
Increase Safe Yield Based on Past Engineering Studies	•							
Dedicate Increases in Safe Yield to Agencies for Specific Basin Management Projects	•							
Need to continue to rely on stable safe yield	•							
Monitor fluctuations in basin and changes in production patterns to ID basin issues	•							
explore impacts to safe yield from basin development	•							
allow parties to use basin in their best interest and mitigate impacts	•							
Determine and assess storage losses in the basin	•							
Increase safe yield by installing wells	•							
coordinate/reduce/relocate production to reduce subsidence	•							
Evaluate impacts of desalter operations on safe yield	•							
Support sole and/or cooperative efforts to develop a	•							
Vet the GSSI groundwater model		•						
Verify impacts of Desalination project and develop mitigation measures		•						
Confirm basin safe yield		•						
Define management objectives to maintain basin safe yield		•						
Identify project(s) to optimize water from SJBA				•				
That the Basin Plan provides safe yields for current and future needs				•				
Identify the safe yield of the basin without projects versus with projects				•				

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Table 5-2
Native and Imported Water Recharge Issues, Needs and Wants

	San Juan Basin Authority				Other Interested Parties			
	SJC	MNWD	SMWD	SCWD	MWDOC	TCWD	RMV	SJHGC
Support sole and/or cooperative efforts to develop additional economically feasible recharge facilities for both native and imported water	•		•					
Develop program to increase recharge of native runoff and create a mechanism to pledge the value of the increase in safe yield from these "new water" sources to help pay for the construction of these facilities	•		•					
Recharge high quality runoff and reclaimed water as hydrologically high as possible in the basin	•		•					
Determine availability of imported water for recharge		•						
Ability to utilize recycled water for recharge			•	•				
Ability to utilize stormwater for recharge			•	•				
Identify potential projects for economical recharge			•	•				

Table 5-3
Quality and Quantity Issues, Needs and Wants

	San Juan Basin Authority				Other Interested Parties			
	SJC	MNWD	SMWD	SCWD	MWDOC	TCWD	RMV	SJHGC
Develop sellable and/or exportable water insurance rights to replenish overproduction during drought and/or encourage basin clean-up	•							
Identify and regulate sources of contamination	•							
Develop "credit type" program to encourage development and implementation of water quality improving and conservation programs	•							
Assess the impacts of groundwater production and recharge on water quality of down gradient producers	•							
Incorporate existing remediation projects in basin water quality management program	•							
Increase conservation and develop new sources of water	•							
Manage basin to maintain/improve water quality of water supply sources to meet discharge standards	•							
Re-examine basin water quality objectives and establish naturally-occurring limits	•							
Produce maps showing problem areas and projected problem areas	•							
Identify projects to develop locate water supply source		•						
Increase the District's reliability through ground water supply				•				
Identify and propose mitigation for impacts from proposed ocean desalination				•				
Identify sources of contaminants				•				
Comprehensive groundwater quality monitoring plan				•				
Identify components required to develop and implement a Salt and Nutrient Plan				•				
Determine impacts of naturally occurring minerals on Salt and Nutrient Plan				•				
Determine impacts of naturally occurring minerals on Salt and Nutrient Plan			•					
Identify sources of contaminants			•					
Identify components required to develop and implement a Salt and Nutrient Plan			•					
Modify Basin Plan as appropriate			•	•				
Support economical programs that mitigate water quality issues	•							

Table 5-4
Recycled Water Issues, Needs and Wants

	San Juan Basin Authority				Other Interested Parties			
	SJC	MNWD	SMWD	SCWD	MWDOC	TCWD	RMV	SJHGC
Develop reuse and recharge projects to maximize use	•							
Establish agreement with RWQCB on mitigation credits for pumping in bottom and recharge in top	•							
Modify basin water quality objectives to increase levels of water recycling	•							
Coordinate basin water quality plans to permit increased levels of recycling	•							
Use reclaimed water to flush lower basin								
Confirm availability of recycled water for recharge		•						
Determine if recycled water is best used for recharge		•						
Identify recycled water recharge opportunities		•						
Coordinated review and impact of the Salt and Nutrient Plans		•						
Coordinate recycled water recharge with regulatory agencies		•						
Determine water quality impacts from MS4 permits and City enforcement		•						
Identify regional availability of recycled water				•				
Ability to utilize recycled water for recharge				•				
Ability to continue to utilize recycled water			•					
Identify regional availability of recycled water			•					
Maximize the use of reclaimed water	•							
Recharge high quality runoff and reclaimed water as hydrologically high as possible in the basin	•							

Table 5-5
Conjunctive Use Storage Issues, Needs and Wants

	San Juan Basin Authority				Other Interested Parties			
	SJC	MNWD	SMWD	SCWD	MWDOC	TCWD	RMV	SJHGC
Develop ability to market basin losses	●							
Provide transfer mechanisms between pools to ensure beneficial use of water	●							
Determine and assess storage losses	●							
Develop programs to construct facilities and deliver water between agencies	●			●				
Develop pumping regimes to optimize basin production				●				
Analyze benefit of water harvesting with private entities, agencies or the SJBA				●				
Coordinate facilities with the Orange County Southern Sub region Habitat Conservation Plan				●				
Characterize unused storage space within the basin		●						

Table 5-6
Cost Issues, Needs and Wants

	San Juan Basin Authority				Other Interested Parties			
	SJC	MNWD	SMWD	SCWD	MWDOC	TCWD	RMV	SJHGC
Seek financial aid to meet management goals, including grants and loans	●	●	●	●				
Develop five year capital improvement program, identify projects out 20 years			●	●				
Identify realistic and economically feasible long-term goals	●							
Develop incentives to encourage basin management objectives	●							
Develop equity and the perception of equity in the operation of the basin	●							
Estimate costs and benefits for water supply and recharge projects (recycled, storm and imported)		●						

Table 5-7
Human Resources and Administration Issues, Needs and Wants

	San Juan Basin Authority				Other Interested Parties			
	SJC	MNWD	SMWD	SCWD	MWDOC	TCWD	RMV	SJHGC
Develop and maintain centralized database for the San Juan Basin	•	•	•	•				
Develop comprehensive groundwater and surface water monitoring program for basin management	•			•				
Prepare regular "State of the Basin" reports with recommendations for monitoring plan modifications	•			•				
Develop rules intended to prevent agency impacts and avoid litigious situations	•							
Coordinate efforts with other appropriate entities (SOCWA, MWDOC)		•						
Staffing requirements for alternatives of governance				•				
Accounting for cyclic and local losses				•				
Clearly define water rights				•				
Verify to what extent previous hydraulic models are still valid				•				
Utilization of “Paper Swaps”				•				
Identify short and long term goals for the basin				•				
Authority proactive in legislation and regulations				•				
Coordinate facilities with the Orange County Southern Sub region Habitat Conservation Plan			•					

Table 5-8

Summary Matrix of SJBGFMP Goals, Impediments and Action Items

Impediments to the Goal	Action Items to Implement Goal	Implications
Goal 1 -- Enhance Basin Water Supplies		
1 Regulatory concerns regarding the diversion and use of storm water discharge and dry-weather discharge.		
1a Water quality	Characterize by water type the magnitude, temporal occurrence and ranges of diversion at locations of interest. Determine locations for diversion, storage and use. Describe conceptual diversion locations, storage, use types, use areas, new recharge to the basin, and changes in discharge after diversion. Characterize water quality and the issues from naturally occurring contamination anthropogenic impacts. Determine the changes in water quality that occur in groundwater through soil aquifer treatment and surface water after diversion.	Collectively these actions will define the resource, storage and use schemes for conceptual projects, and characterize the expected quantity and quality impacts to surface and groundwater.

Created on 11/01/2010
Printed on 11/26/2013

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Table 5-8

Summary Matrix of SJBGFMP Goals, Impediments and Action Items

Impediments to the Goal	Action Items to Implement Goal	Implications
1b Regulatory uncertainty as to how the diversions of dry-weather discharge and recycled water reuse will be regulated. This leads to confusion as to how compliance with the MS4 permit can be achieved and the facilities and strategies to obtain and comply with permits	Develop a regulatory compliance strategy for the use of all waters available to the SJBA members.	This action will create certainty in how to comply with the Basin Plan and DPH requirements
1c Impacts on habitat and species	Define and characterize the existing riparian habitat, the species dependent on the habitat and the relationship of groundwater and surface water discharge to the habitat. Characterize by water type the magnitude, temporal occurrence and ranges of diversion at locations of interest. Determine locations for diversion, storage and use. Describe conceptual diversion locations, storage, use types use areas, new recharge to the basin, changes in discharge after diversion consistent with minimum requirements for habitat maintenance.	Collectively these actions will define the resource, storage and use schemes for conceptual projects, and characterize the expected impacts to riparian habitat and dependent species. (These action items are almost identical to the action items for impediment 1a.

Table 5-8

Summary Matrix of SJBGFMP Goals, Impediments and Action Items

Impediments to the Goal	Action Items to Implement Goal	Implications
1d There is uncertainty as to the right to divert native runoff, and to use or claim credit for the new diverted water.	Characterize by water type the magnitude, temporal occurrence and ranges of diversion at locations of interest. Determine locations for diversion, storage and use. Describe conceptual diversion locations, diversions for beneficial use for each party, and changes in downstream discharge and recharge.	These actions will create certainty regarding the impacts of diversions of native runoff, the impacts of these diversions on downstream water users and allow the SJBA members to develop agreements related to the equitable beneficial use of these diversions.
2 High cost of developing and operating facilities to divert, store, recharge and use storm water and dry-weather discharge.	Develop facility plan concepts and cost to show the cost of developing new reliable yield.	This action will provide information to the SJBA member agencies that can be used to make decisions regarding the feasibility of creating new yield
3 The safe yield of the groundwater basin is uncertain and varies based on recharge and production schemes.	Develop a definition for safe yield consistent with the basin recharge hydrology, storage capabilities and range of production plans. Develop safe yield estimates for various recharge, storage management and groundwater production alternatives.	These actions will result in estimates of safe yield for various expected groundwater management plans that can be used to identify unused safe yield for exploitation, groundwater storage opportunities for improving water supply reliability, and the associated facilities and operational requirements.

Table 5-8

Summary Matrix of SJBGFMP Goals, Impediments and Action Items

Impediments to the Goal	Action Items to Implement Goal	Implications
4 High cost of developing and operating groundwater well fields and conveyance facilities for some SJBA members.	Develop facility plan concepts and cost to show the cost of developing new reliable yield.	This action will provide information to the SJBA member agencies that can be used to make decisions regarding the feasibility of creating new yield
5 Constraints on recycled water reuse		
5a Uncertainty in the results of the forthcoming salt and nutrient management programs. 5b Regulatory perception/constraint that the use of recycled water in the SJB will degrade surface and groundwater.	Develop maximum benefit water quality objectives based on EO 68-16, WC 13241 and other criteria that will maximize the use of all available waters in the SJB and protect the beneficial use of waters in the SJB.	This action will maximize the use of recycled water in the SJB and will include a series of commitments by SJBA and the SJBA member agencies to guarantee maximum benefit to the State.
5c There is uncertainty as to the optimum use of recycled water in the SJBA service area -- what is the best combination of reuse among direct use and groundwater recharge?	Review the existing recycled water reuse strategies and water management strategies and determine the potential projects and need for indirect potable reuse of recycled water and the tradeoffs of direct use versus indirect potable reuse.	This action will produce a list of indirect potable reuse projects and their potential benefits and costs for comparison with planned direct reuse projects.

Table 5-8

Summary Matrix of SJBGFMP Goals, Impediments and Action Items

Impediments to the Goal	Action Items to Implement Goal	Implications
6 Existing production patterns are not balanced with recharge and result in reduced safe yield.	Develop and implement a comprehensive groundwater level and quality monitoring program. Store data in a relational database for real-time use by all SJBA members. Develop and calibrate a groundwater flow model to evaluate how the groundwater system works and how to maximize the yield and the use of unused storage space for supplemental water storage.	These actions will provide information that can be used to calibrate groundwater models and subsequently study the balance of recharge and discharge and maximize safe yield.
7 There is a possibility that groundwater production by overliers could reduce the amount of groundwater available for the SJBA members.	Estimate production by existing overliers and future groundwater production by existing and other overliers, Develop plans to identify and serve alternative water supplies to existing and future overliers or to retire their demands.	These actions will provide certainty to the SJBA members as to their access to the safe yield of the SJB.

Table 5-8

Summary Matrix of SJBGFMP Goals, Impediments and Action Items

Impediments to the Goal	Action Items to Implement Goal	Implications
Goal 2 -- Protect and Enhance Water Quality		
1 Existing water quality problems		
1a The sources and extent of water quality degradation are not well characterized in the SJB.	Develop and implement a groundwater quality assessment program consisting of: an assessment of historical groundwater quality data, comprehensive monitoring of all wells in the basin, analysis of new and historical water quality data and the implementation of a long-term focused water quality monitoring program. Monitoring will based on existing monitoring programs supplemented by the new monitoring required to characterize important water quality issues.	These actions will result in the most complete understanding of the existing water quality conditions in the basin and provide the monitoring for continuing assessment of water quality conditions. The actions are designed to leverage existing data sources and to limit new monitoring to fill in important gaps and to characterize all constituents of concern. This water quality characterization will also be required to some extent to meet the requirements of maximum benefit based water quality objectives.
1b There are natural occurring sources of mineral degradation.	Characterize the contribution of naturally occurring minerals as to location and hydrologic conditions that exacerbate this degradation and develop tools to reduce the loading of naturally occurring minerals and to maximize the beneficial use of these degraded waters.	

Table 5-8

Summary Matrix of SJBGFMP Goals, Impediments and Action Items

Impediments to the Goal	Action Items to Implement Goal	Implications
2 There is lack of coordinated response to water quality threats. The RWQCB does not have adequate resources to address water quality issues in the SJB in a timely manner.	Coordinate with regulatory agencies to share monitoring and other information to detect and define water quality problems. Take coordinated action regarding SJB priorities of mutual interest.	This action will result in more efficient use of SJBA, SJBA member agencies, and regulatory resources.
4 Poor ambient groundwater quality limits the direct use of groundwater and can lead to loss of basin yield.	Expand groundwater treatment capacity to recover all groundwater in the basin for beneficial use; no losses to the ocean.	This action will contribute to maximizing the basin safe yield.
5 The lack of storm water recharge facilities limits the amount of high quality storm water recharge in the SJB	Develop and implement a comprehensive storm water recharge plan.	This action will result in a list of recharge projects that when implemented will maintain/increase basin yield, and improve surface water and groundwater quality.

Table 5-8

Summary Matrix of SJBGFMP Goals, Impediments and Action Items

Impediments to the Goal	Action Items to Implement Goal	Implications
Goal 3 -- Maximize the use of unused storage space		
1 The unused storage available for storage of new storm water recharge and supplemental water is undefined. The unused storage available for these waters is a function of groundwater management and there is no formal groundwater management program that maximizes yield and the storage of supplemental water.	Conduct an investigation of unused storage to determine the range of operating storage for supplemental water based on long-term historical hydrology, groundwater production and supplemental recharge strategies.	This action will result in a series of groundwater production and supplemental water storage alternatives that will maximize safe yield and improve the reliability of supplemental water supplies
2 Existing production patterns are not balanced with recharge and result in reduced safe yield.	Develop and implement a comprehensive groundwater level and quality monitoring program. Store data in a relational database for real-time use by all SJBA Develop and calibrate a groundwater flow model to evaluate how the groundwater system works and how to maximize the yield and the use of unused storage space for supplemental water storage.	These actions will provide information that can be used to calibrate groundwater models and subsequently study the balance of recharge and discharge, maximize safe yield and optimize the use of unused storage.

Table 5-8

Summary Matrix of SJBGFMP Goals, Impediments and Action Items

Impediments to the Goal	Action Items to Implement Goal	Implications
3 Equitably sharing the unused storage capacity	Develop an equitable formula for sharing in the benefits of storage of native and supplemental waters.	This action will allocate storage to participating SJBA members and provide certainty and predictability to these members allowing them to develop storage and recovery projects
Goal 4 -- Satisfy the State requirements for a groundwater management program		
1 Obtaining appropriate and acceptable input from non SJBA entities involved in the County IRWMP for inclusion into the SJBGMP. The intent here is to ensure that the SJBGMP is included in the County IRWMP.	Demonstrate the value of the SJBGMP to the region. Consider County staff input in the development of the SJBGMP update and coordinate with County to ensure that the SJBGMP is included in its IRWMP.	SJBGMP is included in the County IRWMP

Table 5-8

Summary Matrix of SJBGFMP Goals, Impediments and Action Items

Impediments to the Goal	Action Items to Implement Goal	Implications
Goal 5 -- Establish equitable share of the funding, benefits and costs of the SJBGMP		
1 Not all SJBA member agency service areas overlie the exploitable parts of the SJB and the development of projects to exploit the SJB for some member agencies is not economically attractive given their location and/or the current way of allocating benefits of the SJBGMP.	Develop new ways to allocate the benefits of the existing and future SJBGMP projects to all SJBA members in an equitable way.	The yield of all SJBA projects will be allocated to all members of the SJBA in an equitable manner although the physical delivery of the water produced by the projects will be distributed in such a way as to minimize the cost and impacts to the environment.

Section 6 Groundwater Management Alternatives

This section describes the groundwater management plan elements that can be applied to remove the impediments to achieving the management program goals discussed in Section 5 and to meet the water demands discussed in Section 4, using the resources described in Sections 2 and 3.

6.1 Management Alternatives for the Update of the San Juan Basin Groundwater Management and Facilities Plan

Four meetings were held with the SJBA TAC to review the impediments to the goals and the groundwater management plans that could be implemented to remove those impediments. The basic intent of the management alternatives is to manage production to the available yield: yield will vary from year to year based on hydrology, production will be managed consistent with the existing diversion permits and interagency agreements, modification to the diversion permits and interagency agreements will be made to maximize yield, and additional permits and interagency agreements will be required to incorporate novel groundwater management schemes. Furthermore, it has not been determined if the MWDOC SOCOD project will be implemented within the next few years or at all. Thus, management alternatives need to consider whether or not SOCOD will exist in the future. The SJBA TAC asked that the alternatives be structured for incremental expansion from the least resource intensive to the most resource intensive. This would allow the implementation of more resource intensive management elements as more information on their feasibility can be obtained and as future funding becomes available.

The alternatives that the SJBA TAC is considering are described below. The first six alternatives assume that the SOCOD project will either not be implemented or will be deferred by ten or more years. Alternatives 7 through 10 assume that the SOCOD project will be implemented within the next ten years.

6.1.1 SJBGFMP Alternatives Assuming SOCOD Is Not Implemented or that SOCOD Implementation Is Deferred for Ten or More Years

6.1.1.1 Alternative 1 – Adaptive Production Management within Existing Recharge and Production Facilities (the current plan or baseline alternative)

Alternative 1 is an attempt to refine the current status quo management plan to comply with the diversion permits held by the SJBA and SCWD and the interagency agreements. It involves the management of groundwater production by the CSJC and the SCWD to prevent or at least minimize seawater intrusion and to what is otherwise available on an annual basis. Alternative 1 is the future baseline. The average annual production or yield that can be developed from the basin is estimated to be about 9,200 acre-ft/yr, ranging from about 7,400 acre-ft/yr to 10,600 acre-ft/yr[31]. About 71 percent of the time, the production will be less

[31] These values correspond to the model period average, min and maximum model predicted production minus seawater intrusion.

than 11,000 acre-ft/yr, and about 15 percent of the time, production will meet or exceed the desired goal of 11,200 acre-ft/yr.

6.1.1.1.1 Summary of Features[32]

1a. Set groundwater level based production thresholds and use monitoring to adjust production.

1b. Implement water exchanges and possibly an interconnection among SJBA members to ensure equitable sharing of groundwater when groundwater production is reduced per 1a above.

1.c Implement a groundwater level, quality, and production monitoring program to determine water in storage in the spring of each year, to assess ambient quality, to manage seawater intrusion, and to comply with specific recharge permit conditions.

1.d Implement an aggressive program to eliminate the invasive water-consuming phreatophyte called Arundo Dornax.

6.1.1.1.2 Detailed Description

Alternative 1 is an attempt to refine the current status quo groundwater management and facilities plan to comply with the diversion permits held by the SJBA and SCWD and the interagency agreements. In Alternative 1, the SJBA would set annual groundwater production limits in the spring of each year, based on groundwater levels measured that spring and an estimate of groundwater storage that spring. These production limits would hold until the following spring. A storage-production relationship would be initially constructed based on groundwater model simulations and subsequently refined based on experience and future groundwater simulations. Figure 3-25 shows an example of such a relationship. This mode of operation is consistent with a provision in the SJBA and SCWD diversion permits issued from the State Board that limits production (diversion) when groundwater storage falls to less than half of the storage capacity (a provision included to protect other groundwater producers), which is predicted to occur about 71 percent of the time (see Figure 3-26a). Groundwater monitoring would be done by the SJBA, and the SJBA would determine production limits related to basin storage.

This mode of operation will reduce the rate of seawater intrusion but not eliminate it. Groundwater monitoring is required seaward of the SCWD desalter wells to monitor the progress of seawater intrusion and to guide future production limitations at the SCWD wells. Groundwater monitoring would be done by the SJBA, and the SJBA would determine production limits related to seawater intrusion.

The existing interagency agreements require an equitable adjustment of production among the CSJC and SCWD based on the water available for production. This can be achieved through existing interconnections or exchange agreements and should not require the construction of new interconnections. The SJBA would determine when and how the adjustment of

[32] The number labels associated with the features indicate that they are common to other alternatives.

production would occur and how to equitably distribute production and exchange among the SJBA members.

Finally there exists in certain reaches of San Juan Creek and tributaries an invasive high water-consuming phreatophyte called arundo dornax. This plant species degrades habitat and reduces the amount of water available for useful habitat and human purposes. Eliminating this plant will improve habitat and water supplies. Arundo is immune to herbicides and must be mechanically removed in a systematic way so to manage its reemergence.

6.1.1.2 Alternative 2 – Adaptive Production Management within Existing Recharge and Production Facilities with a Seawater Injection Barrier

Alternative 2 is identical to Alternative 1 except a seawater injection barrier would be constructed to prevent seawater intrusion, and groundwater production would be reduced to what is otherwise available on an annual basis. The goals of Alternative 2 are to increase the yield of the basin during non-wet periods over the yield that would otherwise be developed in Alternative 1 and to prevent seawater intrusion as required in the SJBA and SCWD diversion permits. The minimum injection rate required to just replace the estimated seawater intrusion during dry periods is about 500 acre-ft/yr. The injection barrier is assumed herein to have an injection capacity of 1,000 acre-ft/yr, and the yield of the basin is expected to increase by the amount injected. The average yield of the Basin would be increased from about 9,200 acre-ft/yr to about 10,000 acre-ft/yr.

6.1.1.2.1 Summary of Features

1a. Set groundwater level based production thresholds and use monitoring to adjust production.

1b. May require water exchanges and possibly an interconnection among SJBA members to ensure equitable sharing of groundwater.

1.c Implement a groundwater level, quality, and production monitoring program to determine water in storage in the spring of each year, to assess ambient quality, to manage seawater intrusion, and to comply with specific recharge permit conditions.

1.d Implement an aggressive program to eliminate the invasive water-consuming phreatophyte called Arundo Dornax.

2a. Construct injection wells seaward of the SCWD wells. Modulate injection rate to maintain barrier without surface discharge of groundwater or loss seaward of the barrier. Increase annual production from the San Juan Basin by the amount injected to recover the injected water. The source water for the injection barrier is based on least cost—assumed initially to come from MWDOC but could eventually be recycled water.

2b. Revise existing diversion permits, if necessary, to increase production rights at existing wells to ensure that injected water can be produced.

6.1.1.2.2 Detailed Description

Alternative 2 is an attempt to increase the yield of the basin during non-wet periods through the injection of supplemental water into the basin just seaward of the SCWD desalter wells. The supplemental water for injection would initially come from MWDOC but could be replaced in subsequent years by recycled water. Supplemental water would be injected at a rate to establish a pressure mound seaward of the SCWD extraction wells and would supplement the water available for production by SCWD and the CSJC on a one-for-one basis. None of the injected water would be lost. This will allow for the operation of the basin at slightly lower levels inland of the barrier and allow greater production during dry periods relative to Alternative 1. Figure 6-1 shows the conceptual location of up to four injection wells located seaward of the SCWD desalter wells. Two of these wells would be constructed initially, and up to two additional wells would be added later if necessary. The precise number of wells would be determined after the first two wells are constructed and operational.

The cost and yield of the injection project would be allocated to SJBA members under a cost sharing agreement based on their financial participation and benefit. There could be adjustments in the cost allocation to account for reductions in treatment costs experienced by the SCWD due to the SCWD desalter wells intercepting higher quality injected water. If the CSJC and SCWD are the only SJBA members producing groundwater from the San Juan Basin, the cost of the seawater injection project could be allocated on their annual production or a similar scheme that distributes costs based on benefit or potential benefit.

6.1.1.3 Alternative 3 – Adaptive Production Management within Existing Recharge and Production Facilities with a Seawater Extraction Barrier

Alternative 3 is identical to Alternative 2 except a seawater extraction barrier would be constructed to prevent seawater intrusion in lieu of an injection barrier. The goals of Alternative 3 are identical to those of Alternative 2: to increase the yield of the basin during non-wet periods over the yield that would otherwise be developed in Alternative 1 and to prevent seawater intrusion as required in the SJBA and SCWD diversion permits. The yield developed by this alternative would be greater than that developed by the seawater injection barrier in Alternative 2 because the extraction barrier can function independent of the amount of storage in the basin landward of the SCWD desalter wells; whereas, the injection barrier approach will have variable injection rates with lesser injection during high storage periods and more injection during dry periods when storage in the basin is low. The average yield of the Basin would be increased from about 9,200 acre-ft/yr to about 12,200 acre-ft/yr.

6.1.1.3.1 Summary of Features

1a. Set groundwater level based production thresholds and use monitoring to adjust production.

1b. May require water exchanges and possibly an interconnection among SJBA members to ensure equitable sharing of groundwater.

1c. Implement a groundwater level, quality, and production monitoring program to determine water in storage in the spring of each year, to assess ambient quality, to manage seawater intrusion, and to comply with specific recharge permit conditions.

1.d Implement an aggressive program to eliminate the invasive water-consuming phreatophyte called Arundo Dornax.

3a. Revise existing diversion permits to include new expanded production at the new extraction barrier wells.

3b. Construct and operate a seawater extraction barrier.

6.1.1.3.2 Detailed Description

Alternative 3 is an attempt to increase the yield of the basin throughout the year and to eliminate seawater intrusion into the basin landward of the seawater extraction barrier. This can be done through the creation of an extraction barrier seaward of the SCWD desalter wells and could include the SCWD wells. Figure 6-1 shows the potential extraction barrier well field area and its spatial relationship to the SCWD and CSJC wells. The source of water to the extraction barrier would initially be brackish groundwater and would eventually be seawater induced to flow inland due to production at the extraction barrier wells. The extraction barrier wells would be located between the Pacific Coast highway and the SCWD desalter wells and, unlike the proposed SOCOD wells, would be conventional vertically aligned wells. The treatment facilities for this project would be collocated with the SCWD desalter facility. The ultimate capacity of this project is unclear at this time, but it initially appears that about 2,000 to 3,000 acre-ft/yr of new supply could be developed long term through the production of 4,000 to 6,000 acre-ft/yr, respectively, of groundwater seaward of the SCWD desalter wells. The initial yield would be greater as the groundwater salinity will be significantly less than the salinity of seawater for a substantial period of time.

In contrast to Alternative 2, which uses a seawater injection barrier to inject imported water into the basin, the extraction barrier described herein will generate a new supply of water and reduce the use imported water.

The cost and yield of the extraction barrier project would be allocated to the SJBA members under a cost sharing agreement based on their financial participation and benefit.

6.1.1.4 Alternative 4 – Adaptive Production Management with Seawater Barrier and Construction of Ranney-Style Collector Well(s)

Alternatives 4A and 4B are identical to Alternatives 2 and 3, respectively, except that one or two Ranney-style collector wells would be constructed to increase production capacity during dry periods. The goals of Alternative 4 are to increase the production capacity of the basin during non-wet periods, to prevent seawater intrusion, and to increase the yield of the Basin through the inducement of more stormwater recharge. Replacement supplies would be provided to non-SJBA overlying groundwater producers, as necessary, to replace lost groundwater production at their wells when the basin is operated at lower groundwater levels. The average yield of the Basin would be increased from about 9,200 acre-ft/yr to about 11,200 acre-ft/yr and 13,400 acre-ft/yr for Alternatives 4a and 4b, respectively.

6.1.1.4.1 Summary of Features

1a. Set groundwater level-based production thresholds and use monitoring to adjust production.

1b. May require water exchanges and possibly an interconnection among SJBA members to ensure equitable sharing of groundwater.

1c. Implement a groundwater level, quality, and production monitoring program to determine water in storage in the spring of each year, to assess ambient quality, to manage seawater intrusion, and to comply with specific recharge permit conditions.

1.d Implement an aggressive program to eliminate the invasive water-consuming phreatophyte called Arundo Dornax.

2a or 3b. Construct injection wells seaward of the SCWD wells (2a) or construct an extraction barrier seaward of the CVWD wells (3b). In either case, revise existing diversion permits, as necessary, to include new additional production at the injection or extraction wells.

4a. Revise existing diversion permits to include new additional production at the Ranney wells, the approval to provide alternative water supplies to existing overlier producers in lieu of them producing groundwater, and potentially to increase production rights to recover new stormwater recharge created by operating the basin at lower levels.

4b. Construct and operate Ranney-style collector well(s).

4c. Construct and operate interconnections with overlying water right holders to provide them with replacement water when groundwater levels are too low for them to operate their wells.

6.1.1.4.2 Detailed Description

Alternative 4 is an attempt to increase the production capacity of the basin during non-wet periods through the construction of one or two Ranney-style collector wells and potentially to increase the yield of the basin. Figure 6-2 is a schematic of a typical Ranney-style collector well. These collector wells would allow for increased groundwater production during non-wet periods, allow the production to be maintained at lower basin storage levels, and increase stormwater recharge by generally maintaining lower levels in the basin. Moreover, an increase in stormwater recharge would occur because the basin could be operated at lower storage levels and minimize the lost recharge during wet years. It is unclear as to how much additional stormwater recharge could be induced due to operating the basin at lower groundwater storage. Additional surface water and groundwater modeling work will be required to assess the expected increase in stormwater recharge. For planning purposes, 1,000 acre-ft/yr of new stormwater recharge was assumed.

The capacity of each Ranney-style collector well would range from about 2,900 to 5,800 acre-ft/yr, depending on groundwater levels. The benefit achieved by inducing more stormwater recharge is not currently knowable. Groundwater modeling will be required to estimate new induced recharge.

The cost of the Ranney-style collector wells and the additional yield would be allocated the SJBA members under a cost sharing agreement based on their financial participation and benefit.

6.1.1.5 Alternative 5 – Adaptive Production Management, with Seawater Barrier, Construction of Ranney-Style Collector Wells, and In-Stream Recharge

Alternatives 5A and 5B are identical to Alternatives 4A and 4B, respectively, except that a reach of San Juan Creek and the Arroyo Trabuco would be operated as stormwater recharge facilities. These recharge facilities would increase stormwater recharge and thus the yield of the basin. The goals of Alternative 5 are to increase the production capacity of the basin during non-wet periods, to improve water quality (principally reduce salt and nutrient concentrations in groundwater), to prevent seawater intrusion, and to increase the yield of the Basin through the inducement of more stormwater recharge. The average yield of the Basin would be increased from about 9,200 acre-ft/yr to about 12,000 acre-ft/yr and 14,200 acre-ft/yr for Alternatives 5a and 5b, respectively.

6.1.1.5.1 Summary of Features

1a. Set groundwater level based production thresholds and use monitoring to adjust production.

1b. May require water exchanges and possibly an interconnection among SJBA members to ensure equitable sharing of groundwater.

1c. Implement a groundwater level, quality, and production monitoring program to determine water in storage in the spring of each year, to assess ambient quality, to manage seawater intrusion, and to comply with specific recharge permit conditions.

1.d Implement an aggressive program to eliminate the invasive water-consuming phreatophyte called Arundo Dornax.

2a or 3b. Construct injection wells seaward of the SCWD wells (2a) or construct an extraction barrier seaward of the CVWD wells (3b). In either case, revise existing diversion permits, as necessary, to include new additional production at the injection or extraction wells.

4a. Revise existing diversion permits to include new additional production at the Ranney wells, the approval to provide alternative water supplies to existing overlier producers in lieu of them producing groundwater, and potentially to increase production rights to recover new stormwater recharge created by operating the basin at lower levels.

4b. Construct and operate Ranney-style collector wells.

5a. Revise diversion permit to include the right to divert, recharge, and store new stormwater recharge, and subsequently recover this water.

5b. Construct and operate in-stream recharge facilities.

6.1.1.5.2 Detailed Description

Alternative 5 is an attempt to increase the yield of the basin through the recharge of stormwater. In-stream recharge is the only viable large-scale recharge method for the San Juan Basin due to the lack of suitable off-stream sites for stormwater storage and recharge, and the inability of the basin to accept large amounts of recharge at a specific site. Off-stream sites are not practical either because they do not overly the San Juan Basin proper and will not provide enough regulatory storage to divert and store a significant amount of stormwater for subsequent infiltration into the basin. There is also a limitation in the ability of the basin to take in significant amounts of stormwater at conventional recharge basins located over the San Juan Basin. Offstream recharge sites will readily clog with fine grain sediments in the stormwater. The in-stream facilities proposed herein would provide for a significant amount of diffuse stormwater recharge with the recharge distributed over a large area, similar to what happens currently with stormwater recharge in the Arroyo Trabuco and San Juan Creek. The proposed in-stream recharge facilities would increase the magnitude of stormwater recharge.

Figure 6-1 shows the potential location of the stream reaches where this recharge could be accomplished. Temporary berms would be constructed in these reaches, making discharge in the channel flow "bank to bank" whenever stormwater is available and thereby maximizing the wetted area and recharge. The OCWD has been successfully conducting this type of recharge in the Santa Ana River since the mid-1900s. Figure 6-3 illustrates the berm configurations used by the OCWD. These berms would be damaged or washed out during some storms and would need to be reconstructed periodically throughout the year with the number of reconstructions dependent on the number and magnitude of storms during the year. Temporary "T" and "L" berms would be constructed in the reach illustrated in Figure 6-3 that would make the discharge in the channel flow "bank to bank" for smaller stormwater events, thereby maximizing the wetted area and recharge. The berms would washout completely during the onset of significant flood events and would not interfere with the flood control function of the channel. Alternatively rubber dams could also be constructed along the streams and used to intercept and store stormwater. All the dry-weather discharge that currently reaches the ocean could be intercepted and recharged providing water quality benefits at Doheny Beach. Detailed hydraulic modeling would have to be done to precisely estimate the expected new recharge from these proposed in-stream recharge facilities. For planning purposes, it is reasonable to assume that the annual increase in stormwater recharge could range from 500 to 2,000 acre-ft/yr and that to achieve this recharge, the basin would have to be operated such that there is always storage space available to accept recharge.

The cost and yield from the implementation of in-stream recharge would be allocated to the SJBA members under a cost sharing agreement based on their financial participation and benefit.

6.1.1.6 Alternative 6 – Adaptive Production Management, Creation of a Seawater Barrier, In-stream Recharge, and Recycled Water Recharge

The goals of Alternative 6 are to increase the production capacity of the basin during non-wet periods, to prevent seawater intrusion, to increase the yield of the Basin through the inducement of more stormwater recharge, and to increase the yield through the recharge of large amounts of recycled water. The in-stream recharge facilities used for stormwater recharge in Alternative 5 would be modified to create a corridor for small summer storms to pass through the basin, and most of the channel would be bermed-off into discrete cells to receive and recharge recycled water. Recycled water would be recharged from May through September. Approximately 27 acres of streambed would be used for recharge. This would provide the SJBA with about 10,000 acre-ft/yr of supplemental water recharge capacity. Groundwater production and treatment would be increased to recover this recharge. The yield of the Basin would be increased from about 9,200 acre-ft/yr to about 21,400 acre-ft/yr—an increase of about 12,000 acre-ft/yr.

6.1.1.6.1 Summary of Features

1a. Set groundwater level based production thresholds, based on spring groundwater levels, and use monitoring to adjust production.

1b. May require water exchanges and possibly an interconnection among SJBA members to ensure equitable sharing of groundwater..

1c. Implement a groundwater level, quality, and production monitoring program to determine water in storage in the spring of each year, to assess ambient quality, to manage seawater intrusion, and to comply with specific recharge permit conditions.

1.d Implement an aggressive program to eliminate the invasive water-consuming phreatophyte called Arundo Dornax.

3a. Construct extraction barrier seaward of the SCWD wells to increase basin yield by 4,000 acre-ft/yr and eliminate seawater intrusion.

4a. Revise existing diversion permits to include the approval to provide alternative water supplies to existing overlying producers in lieu of them producing groundwater.

4b. Site[33] and construct new wells to increase production capacity.

5a. Revise the existing diversion permit to include the right to divert, recharge, and store new stormwater recharge; subsequently recover this water; and allow production in the seawater extraction barrier.

5b. Construct and operate in-stream recharge facilities to enhance the recharge of stormwater from October through April. Reconstruct as necessary during the year. Yield increase will be about 2,000 acre-ft/yr.

6a. Complete Title 22 Engineering Report for a recycled water recharge project (Groundwater Recharge Reuse Project or GRRP in Title 22 vernacular) and subsequent permitting process with the Regional Board and DPH to obtain a recharge permit.

6b. Revise diversion permit to include the right to recharge and store recycled water recharge and subsequently recover this water.[34]

6c. Construct and operate recycled water recharge facilities. Yield increase will be 10,000 acre-ft/yr.

6d. Expand existing or construct new desalting facilities to enable the recovery of recycled water recharge.

[33] At higher levels of recycled water recharge, the Ranney collector wells may not be necessary.

[34] This is done to protect the recycled water recharge from other producers and to update the permit to include monitoring for the same.

6.1.1.6.2 Detailed Description

Alternative 6 is an attempt to increase the sustainable yield of the basin through the recharge of storm and recycled waters, the creation of a seawater extraction barrier that will desalt seawater and generate a new supply of water, the recharge of large amounts of recycled water, and the recovery of the new recharge by expanding groundwater production facilities and treatment. Figure 6-1 shows the potential location of the stream reaches where storm and recycled water recharge could be accomplished. Temporary "T" and "L" berms would be constructed in the reaches illustrated in Figure 6-1, making discharge in the channel flow "bank to bank" for smaller stormwater events, thereby maximizing the wetted area and recharge. During the dry-weather period of May through September (a period of 123 days), the SBJA would modify the berms to create a corridor along the north side of the channel for passage of small storm discharge and a series of cascading recharge cells along the southeast side of the channel for use in the recharge of recycled water. Inundation depths in the recycled water recharge cells would be one foot or less to ensure that the ponds can be dewatered by infiltration in advance of storms. Approximately 27 acres of ponds could be created providing the SJBA with up to 10,000 acre-ft of recycled water recharge capacity. Tertiary-treated Title 22 effluent from SOCWA would be used for recharge. The amount of recycled water recharged each year would be based on spring groundwater levels and storage. New groundwater wells will be required to recover the increased recharge, and the existing desalters would have to either be expanded or new desalters would have to be built.

In implementation, the recycled water recharge part of Alternative 6 would be ramped up slowly, allowing the SJBA to conduct monitoring to develop data on soil-aquifer treatment and recycled water contribution at each production well. These data and their interpretations would be reported to the Regional Board and the State DPH in compliance with a recharge permit and to demonstrate to the regulatory agencies that the project can be operated pursuant to the recharge permit. The amount of recycled water recharge would be ratcheted up each year based on these demonstrations to the ultimate design recharge capacity. Production would also have to ratchet up to recover the recycled water. The recycled water sources for this project could include the J. B. Latham plant, the 3A plant, the Chiquita plant, and recycled water from storage.

The cost and yield from the implementation of recharge would be allocated to the SJBA members under a cost sharing agreement based on their financial participation and benefit.

6.1.2 SJBGFMP Alternatives Assuming SOCOD Is Implemented in the Next Ten Years

6.1.2.1 Alternative 7– Adaptive Production Management within Existing Recharge and Production Facilities (Alternative 1 with SOCOD)

This alternative is identical to Alternative 1 with SOCOD and with the expectation that the average yield of the basin will be lowered by about 1,600 to 2,000 acre-ft/yr with greater losses in yield occurring in dry years. There will be no need for a seawater intrusion barrier as the SOCOD project will eliminate seawater intrusion.

6.1.2.2 Alternative 8 – Adaptive Production Management, Existing Recharge and Production Facilities (Alternative 1 with SOCOD), Construction of Ranney-Style Collector Wells

This alternative is identical to Alternative 7 with the addition of one or more Ranney-style collector wells (as described in Alternative 4). The average yield of the Basin would be increased from about 7,500 acre-ft/yr to about 8,700 acre-ft/yr.

6.1.2.3 Alternative 9 – Adaptive Production Management, Existing Recharge and Production Facilities (Alternative 1 with SOCOD), Construction of Ranney-Style Collector Wells, and In-stream Recharge

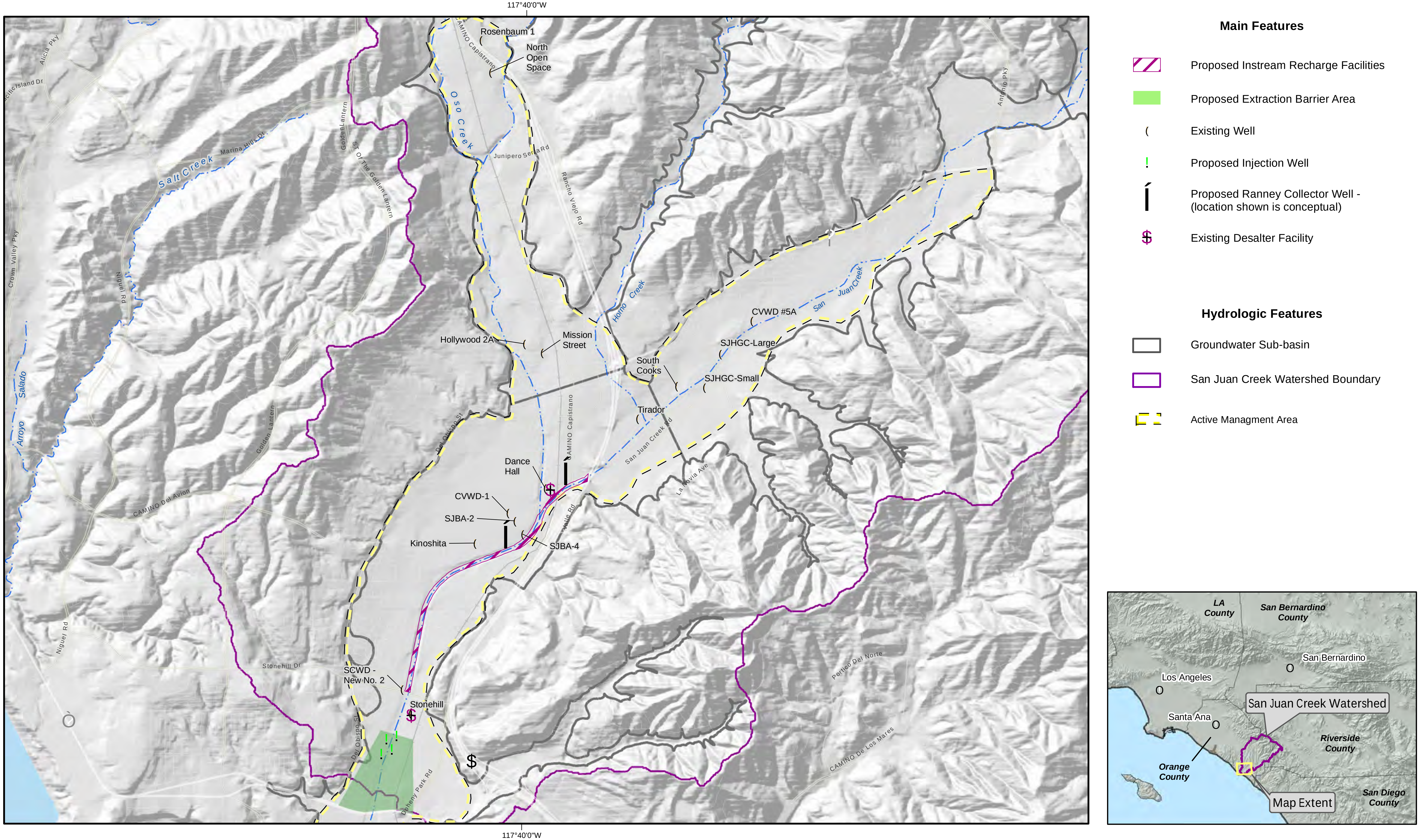
This alternative is identical to Alternative 8 with the addition of in-stream recharge facilities (as described in Alternative 5). The average yield of the Basin would be increased from about 7,500 acre-ft/yr to about 9,500 acre-ft/yr.

6.1.2.4 Alternative 10 – Adaptive Production Management, Existing Recharge and Production Facilities (Alternative 1 with SOCOD), In-stream Recharge, and Recycled Water Recharge

This alternative is identical to Alternative 9 with the utilization in-stream recycled water recharge (as described in Alternative 6). The average yield of the Basin would be increased from about 7,500 acre-ft/yr to about 16,700 acre-ft/yr.

6.2 Stormwater Recharge in Off Stream Facilities

Many stakeholders commented that there were no recommendations for diversion of stormwater to off stream recharge facilities included in the SJBGFMP. Early in the investigation the concept of off stream recharge was discussed with the TAC committee and it concluded in those discussions that there were few suitable sites for off stream recharge and for off stream recharge to work there would be a need for significant storage for which it was concluded that there no suitable storage sites. These conclusions should be revisited prior to or during the next SJBGFMP update.



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SAN JUAN BASIN AUTHORITY

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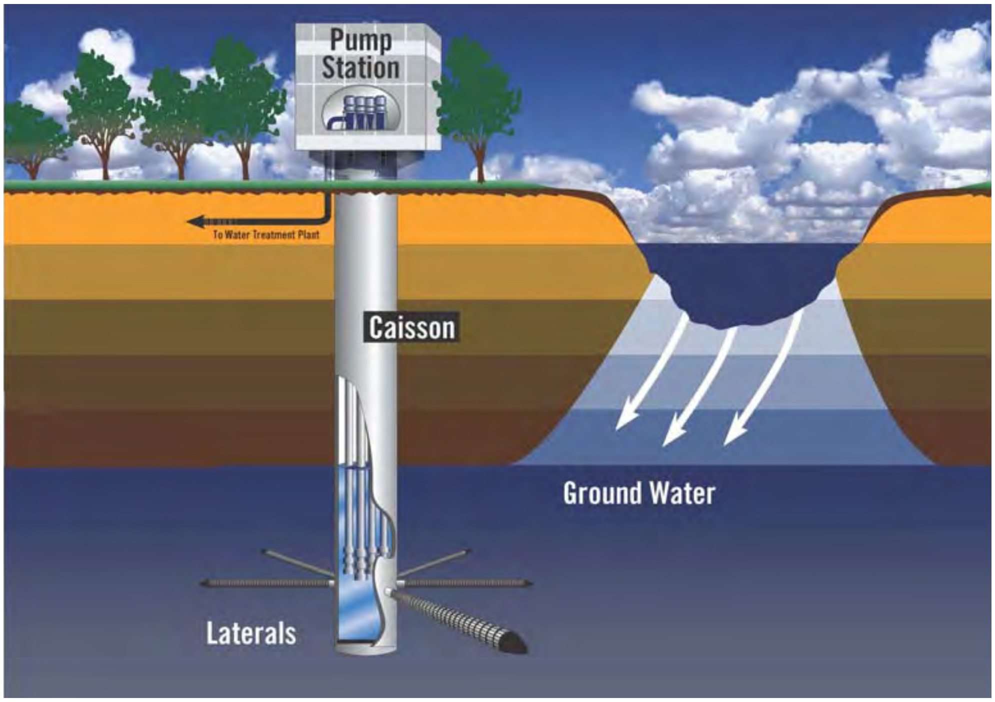
Management Components

Figure 6-1

Figure 6-2 - Schematic Illustration of a Ranney Collector Well



Source: Layne Christensen, 2013

Figure 6-3 - "T" Levees in the Santa Ana River

Section 7 Evaluation of Groundwater Management Alternatives

This section documents the reconnaissance-level evaluation of the groundwater management alternatives described in the previous section. The evaluation criteria include consistency with the goals described in Section 5, reliability of supply, cost, and implementation difficulty.

7.1 Consistency with SJBGMFP Goals

The management goals of the SJBGMFP were developed by the SJBA TAC, and impediments to achieving those goals and a list of actions that could be implemented to overcome the impediments were identified. The goals, impediments, and action items are listed in detail in Table 5-8. The goals include:

- Goal No. 1 – Enhance Basin Water Supplies. In addition to local groundwater, this goal applies to all sources of water available for the enhancement of the San Juan Basin (Basin). The intent is to maximize the use of all available water in the Basin. This goal will be accomplished by increasing the recharge of all available waters, including storm water discharge, dry-weather discharge, and recycled water.

- Goal No. 2 – Protect and Enhance Water Quality. The intent of this goal is to improve surface and groundwater quality to ensure the maximum use and reuse of available supplies and to minimize the cost of groundwater treatment. This goal will be accomplished by implementing activities that capture and treat contaminated groundwater for direct high-priority beneficial uses, implementing the recharge of storm water discharge, and encouraging better management of waste discharges that impact groundwater.

- Goal No. 3 – Maximize the Use of Unused Storage Space. The intent of this goal is to maximize the use of the Basin's storage capacity to improve water supply availability. This goal will be accomplished by determining the temporal and spatial availability of unused storage space in the Basin and subsequently determining how best to use that space to increase operational flexibility and water supply reliability.

- Goal No. 4 – Satisfy State Requirements for a Groundwater Management Program. The intent of this goal is to integrate the SJBGFMP into the South Orange County regional water management plan and to improve the opportunity of obtaining outside funding for SJBGFMP implementation. This goal will be accomplished by ensuring that the SJBGFMP contains the minimum elements required for a groundwater management plan and by inclusion of the SJBGFMP in the County's Integrated Regional Water Management Plan.

- Goal No. 5 – Establish Equitable Share of the Funding, Benefits, and Costs of the SJBGFMP. The intent of this goal is to align the benefits of the SJBGFMP with individual SJBA member agencies and SJBGFMP implementation costs. This goal will be accomplished by clearly articulating the benefits of the SJBGFMP to each

SJBA member agency and subsequently allocating the funding and costs in an equitable manner.

Table 7-1 shows the alignment of the alternatives to the management goals. The management alternatives were crafted to remove impediments to the goals and to exploit available resources. Thus, all but the baseline alternatives (Alternatives 1 and 7) have some or complete consistency with the goals. Alternative 1 is a refined version of the current status quo, and Alternative 7 is identical to Alternative 1 except it includes the SOCOD project. In these two alternatives, current producers do the best they can, given available resources and management, with the CSJC and SCWD managing their production pursuant to existing diversion permits and the interagency agreements. The other alternatives have varying amounts of new resources and management overlays that increase the yield overall and improve the reliability of the groundwater supply.

7.2 Yield and Costs of the Management Alternatives

Yield as used herein refers to the maximum production that can be developed from the basin in a year, given the location of wells, the hydrology, and management activities. Because the basin is small, the yield will be variable and highly responsive to stormwater recharge, activities that increase recharge, and pumping. Table 7-2 summarizes the yield of each alternative and the increments of new yield by management component. Tables 7-3a, b and c describe the cost opinions for a seawater injection barrier, a seawater extraction barrier, and a Ranney collector well, respectively. The cost to construct in-stream recharge facilities for storm and recycled water are $400,000 per year and $500,000 per year, respectively, based on information provided by OCWD.[35] The cost of recovering any water recharged in the basin was assumed to be $900 per acre-ft, based on the unit cost (all in capital and operations and maintenance costs, reduced by grant funding) projected for the Chino Basin desalter expansion.[36] An economic analysis of the recycled water recharge project was not completed in this SJBGMFP update as it was created late in the planning process and will require a substantial effort to complete. Table 7-4 summarizes the new yield and the volume weighted unit cost of new yield.

The average yield developed from the basin under Alternatives 1 and 7 (baseline alternatives) are about 9,200 acre-ft/yr and 7,500 acre-ft/yr, respectively; the decrease in Alternative 7 is attributable to the SOCOD project. The various management components added in the other alternatives increase yield during primarily dry periods, and some increase yield irrespective of the hydrology.

Alternatives 2 and 3 were designed to prevent seawater intrusion (Goals 2 and 4 and a requirement of the SJBA and SCWD diversion permits) and enhance yield (Goal 1). Alternative 2 does this through strategically located injection wells using supplemental water, and Alternative 3 accomplishes this through a seawater extraction barrier. Alternative 3 will produce a new supply that can benefit all members of the SJBA, in particular those SJBA members that are considering participation in the SOCOD project. The new yield from Alternative 3 will range from 2,000 to 4,000 acre-ft/yr—3,000 acre-ft/yr was assumed in

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[35] Personal communication with Adam Hutchinson of OCWD, January 2013.

[36] Personal communication with Jack Safely of Western Municipal Water District, May 2013.

Tables 7-2 and 7-4. Alternative 2 will require supplemental water that could otherwise be put to use without treatment and will produce a relatively small increment to the groundwater yield compared to Alternative 3. 800 acre-ft/yr[37] was assumed in Tables 7-2 and 7-4. The final groundwater management plan must contain either an injection or extraction barrier to ensure that the SJBA member agencies can fully develop their diversion permits. The cost to construct four injection wells capable of injecting up to 1,000 acre-ft yr and connect them to the imported water system is about $3.0 million with an annual cost of about $1.2 million.[38] The unit cost to inject and recover water in Alternative 2 would be about $2,439 per acre-ft. The cost to construct the extraction barrier, treatment plant, and conveyance facilities capable of producing 3,000 acre-ft/yr long-term would be about $42 million with an annual cost of about $4.0 million. The unit cost to produce water would be about $1,326 per acre-ft.

Alternative 4 incorporates one or two Ranney-style collector wells that will enable the SJBA members to produce groundwater when levels are low due to drought and will increase the yield by creating space for new stormwater recharge (consistent with Goals 1, 2, and 3). Also included in Alternative 4 are adaptive production management and a seawater intrusion barrier. Recall from Section 3 that groundwater yield is predicted to be less than hoped for due to the small basin storage and relatively large production. Operating the basin at lower groundwater levels will increase storm water recharge. However, operating at lower levels may make it difficult or impossible for overlying producers to produce groundwater pursuant to their water rights. The SJBA and SCWD diversion permits currently limit the producers from lowering storage and impacting the overlying producers. Therefore, the SJBA would have to provide an alternative water supply for overlying producers if Ranney-style collector wells were used. The increase in groundwater production due to the construction of a Ranney-style collector well and the replacement of the overlying producers' groundwater supply are about 1,000 acre-ft/yr and 500 acre-ft/yr, respectively. It is anticipated that this new yield will be recovered within the existing capacity of the CSJC and SCWD treatment plants with a net yield of 1,200 acre-ft/yr.[39] The total yield for Alternatives 4a and 4b, with all components in, will be about 11,100 or 13,400 acre-ft/yr, respectively. The cost to construct a Ranney collector well is estimated to be about $5.5 million with an annual cost of about $651,000. The new yield is estimated to be about 2,000 acre-ft/yr at $1,841 per acre-ft for Alternative 4a and about 4,200 acre-ft at $1,445 per acre-ft for Alternative 4b.

Alternative 5 incorporates in-stream storm and dry-weather flow recharge facilities identical to what the OCWD does in the Santa Ana River (consistent with Goals 1, 2, and 3). Also included in Alternative 5 are adaptive production management, a seawater intrusion barrier, and Ranney-style collector wells. The increase in recharge for this alternative is estimated to range from 500 to 2,000 acre-ft/yr and was assumed to be 1,000 acre-ft/yr. It is anticipated that this new yield will be recovered within the existing capacity of the CSJC and SCWD treatment plants with a net yield of 800 acre-ft/yr. The total yield for Alternatives 5a and 5b with all components in will be 12,000 or 14,200 acre-ft/yr, respectively. There is no capital

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[37] 1,000 acre-ft/yr would be injected. About 800 acre-ft/yr of the water would be recovered at the SCWD desalter, and the remaining 200 acre-ft/yr would discharged as brine to the SOCWA ocean outfall.

[38] Annualized capital cost (5 percent and 30 years) plus other operations and maintenance costs. These assumptions apply for all annualized costs.

[39] 20 percent of the new yield was assumed to be discharged as brine to the SOCWA ocean outfall.

cost assumed herein with the in-stream recharge facilities. The new yield is estimated to be about 2,800 acre-ft/yr at $1,715 per acre-ft for Alternative 5a and about 5,000 acre-ft at $1,438 per acre-ft for Alternative 5b.

Alternative 6 incorporates large-scale recycled water recharge and subsequent indirect potable reuse to develop a new source of potable water for the SJBA area. Also included in Alternative 6 are adaptive production management, a seawater intrusion barrier, and in-stream stormwater recharge facilities. In this alternative, natural and recycled water recharge would comingle in the groundwater basin, be recovered at wells, and be treated prior to use. This type of reuse project has been recently developed and successfully implemented in the Chino Basin by the Inland Empire Utilities Agency. Up to 10,000 acre-ft/yr of recycled water could be recharged in this alternative, starting at 1,000 acre-ft/yr and gradually increasing to full capacity. The additional stormwater recharge from in-stream recharge facilities will dilute and partially offset the salt load from the recycled water. The existing groundwater treatment facilities will have to be expanded or new facilities built to treat the additional 10,000 acre-ft/yr of new recharge created in this alternative. The type of treatment anticipated in this alternative is a combination of iron and manganese removal and reverse osmosis with an overall recovery of 80 percent. Therefore, the yield will be about 8,000 acre-ft/yr. The total yield for Alternative 6 with all components in will be about 21,400 acre-ft/yr, an increase of 12,200 acre-ft/yr over baseline conditions. There is no capital cost assumed herein with the in-stream recharge facilities. There will be a construction cost associated with the recycled water conveyance system required to distribute recycled water to in-stream recharge facilities and an annual cost for the treatment of recycled water—these costs have been excluded herein. The new yield is estimated to be about 12,200 acre-ft/yr at $1,042 per acre-ft.

Alternatives 8, 9, and 10 are identical to Alternatives 4, 5, and 6, respectively, except they do not include a seawater barrier component—the seawater barrier component is provided by the operation of SOCOD. The differences in yield are caused by SOCOD (-1,700 acre-ft/yr) and the seawater barrier projects. The new yield and unit cost estimates are listed in Table 7-4.

7.3 Implementation Difficulty

Implementation difficulty is best characterized by the features of the individual management components and then by Alternative. Table 7-5 summarizes the implementation difficulty by management component and management alternative.

7.3.1 Adaptive Production

Adaptive production is featured in all management alternatives. The implementation difficulty is not significant.

Adaptive production is required to comply with the diversion permits held by the SJBA and SCWD and with the interagency agreements. The SJBA would set annual groundwater production limits in the spring of each year based on groundwater levels measured that spring and an estimate of the groundwater storage that spring. These production limits would hold until the following spring. Since the permits and agreements are in place, the only obstacle to implementing adaptive production is the SJBA's decision to implement it.

7.3.2 Seawater Injection Barrier

The construction and operation of a seawater injection barrier is featured in Alternatives 2, 4a, and 5a. The implementation difficulty is not significant.

Environmental impacts will be insignificant if wells and conveyance facilities are sited properly. Imported water lines are close and future access to recycled water is also close. The injection wells will protect water quality in the San Juan Basin.

7.3.3 Seawater Extraction Barrier

The construction and operation of a seawater extraction barrier is featured in Alternatives 3, 4b, and 5b. The implementation difficulty is potentially significant.

There may be significant environmental impacts from the construction of wells, conveyance facilities, and treatment facilities. Some wells will be located close to the coast and have a greater level of regulatory scrutiny. There may be concerns regarding hydraulic impacts on the near shore lagoon from the operation of the barrier wells. These concerns can be technically addressed through careful siting of the facilities.

7.3.4 Ranney Collector Wells

The construction and operation of one or two Ranney collector wells is featured in Alternatives 4, 5, 8, and 9. The implementation difficulty is potentially significant.

Environmental impacts will be insignificant if wells and conveyance facilities are sited properly. There may be potentially significant environmental impacts from the cumulative drawdown caused by these and other wells that could limit the ability of overlying producers, such as the San Juan Hills golf course. This concern can be technically addressed by providing the overlying producers with alternative water supplies.

7.3.5 Enhanced Stormwater Recharge and Recycled Water Recharge

The construction of in-stream recharge facilities for stormwater recharge is featured in Alternatives 5, 6, 9, and 10, and for the recharge of recycled water in Alternatives 6 and 10.

The construction and reconstruction of berms in San Juan Creek may be problematic. Berms used for stormwater recharge would be constructed in October each year and reconstructed during the October through April period as necessary to maximize recharge. The upper reaches of San Juan Creek and the Arroyo Trabuco are Steelhead Trout habitat, and the berm construction and reconstruction process would have to include consideration of fish passage. There may be other sensitive habitat in San Juan Creek that would need to considered and mitigated. It is not clear at this time that these concerns can be addressed.

The process to obtain a permit to recharge recycled water is complex and time-consuming. The locations of recharge and recovery need to be thoroughly studied, and some wells may have to be relocated. These concerns can be technically addressed.

7.4 Recommended Alternative

The alternatives were reviewed and evaluated by the SJBA TAC members using the evaluation criteria described above and considerations of their individual agencies. The features of the alternatives were described at two SJBA Board meetings in late 2012. Based on the management goals of the SJBGMFP articulated in Section 5 and the ability of these alternatives to attain these goals, the SJBA TAC has recommended the phased implementation of Alternative 6. If MWDOC proceeds with the SOCOD project then the SJBA TAC recommends the phased implementation of Alternative 10. The implementation plan for Alternatives 6 and 10 are discussed in Section 8.

7.5 SJBGFMP Consistency with SB 1938

SB 1938, signed into law in 2002, requires any public agency seeking State funds administered through DWR for the construction of groundwater projects or groundwater quality projects to prepare and implement a groundwater management plan with certain specified components. Requirements include establishing basin management objectives, preparing a plan to involve other local agencies in a cooperative planning effort, and adopting monitoring protocols that promote efficient and effective groundwater management. The requirements applies to both agencies that have already adopted groundwater management plans as well as agencies that do not overlie groundwater basins identified in Bulletin 118 and its updates. The California Budget Act of 1999 directed DWR to complete several tasks including the development of criteria for evaluating groundwater management plans. In response to this mandate, DWR developed a set of recommended components for groundwater management plans with the intent of providing a framework by which local agencies can proactively plan for and implement effective management programs.

These components are listed in Appendix C of Bulletin 118 and are listed below along with the demonstration of compliance with these components in the 2013 SJBGFMP Update and subsequent SJBA actions.

1. Include documentation that a written statement was provided to the public *"describing the manner in which interested parties may participate in developing the groundwater management plan,"* which may include appointing a technical advisory committee (Water Code § 10753.4 (b)).

2013 SJBGFMP Update and Subsequent SJBA Actions – The SJBA conducted two formal workshops where the public was invited to attend through posted public notices and provide comments. Various deliverables of the development process were presented orally at regularly scheduled SJBA Board meetings and the public was informed of these meetings through public notices. A draft report was published on the SJBA website and the public comment was solicited and obtained. Each comment was responded to directly and the comment and responses are included in Appendix A to the SJBGFMP.

2. Include a plan by the managing entity to *"involve other agencies that enables the local agency to work cooperatively with other public entities whose service area or boundary overlies the groundwater basin."* (Water Code § 10753.7 (a)(2)). A local agency includes *"any local public agency that provides water service to all or a portion of its service area"* (Water Code § 10752 (g)).

2013 SJBGFMP Update and Subsequent SJBA Actions – All agencies serving water in the SJBGFMP active management area were involved with the development of the SJBGFMP and include the CSJC, MNWD, SCWD and SMWD.

3. Provide a map showing the area of the groundwater basin, as defined by DWR Bulletin 118, with the area of the local agency subject to the plan as well as the boundaries of other local agencies that overlie the basin in which the agency is developing a groundwater management plan (Water Code § 10753.7 (a)(3)).

2013 SJBGFMP Update and Subsequent SJBA Actions – The 2012 SJBGFMP Update report (this report) contains several maps that define the groundwater management area as wells as the service area boundaries of the interested water management agencies including the CSJC, MNWD, SMWD and the SCWD.

4. Establish an advisory committee of stakeholders (interested parties) within the plan area that will help guide the development and implementation of the plan and provide a forum for resolution of controversial issues.

2013 SJBGFMP Update and Subsequent SJBA Actions – A technical advisory committee was established that consisted of representatives of the CSJC, MNWD, SMWD and the SCWD. The TAC met periodically during the preparation of the SJBGFMP Update.

5. Describe the area to be managed under the plan, including:
   a. The physical structure and characteristics of the aquifer system underlying the plan area in the context of the overall basin.
   b. A summary of the availability of historical data including, but not limited to, the components in Section 7 below.
   c. Issues of concern including, but not limited to, issues related to the components in Section 7 below.
   d. A general discussion of historical and projected water demands and supplies.

2013 SJBGFMP Update and Subsequent SJBA Actions – The 2012 SJBGFMP Update report (this report) contains all the information described above. Specifically: the contents of items "a", "b" and "c" above can be found in Section 3; and the contents of item "d" above can be found in in Section 4.

6. Establish management objectives for the groundwater basin that is subject to the plan. (Water Code § 10753.7 (a)(1)).

2013 SJBGFMP Update and Subsequent SJBA Actions – The 2012 SJBGFMP Update report (this report) contains the management objectives in Section 5.

7. Include components relating to the monitoring and management of groundwater levels, groundwater quality, inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater pumping. (Water Code § 10753.7 (a)(1)). Consider additional components listed in Water Code § 10753.8 (a) through (l). These water code citations are listed below.

"10753.7. (a) For the purposes of qualifying as a groundwater management plan under this part, a

plan shall contain the components that are set forth in this section. In addition to the requirements of a specific funding program, any local agency seeking state funds administered by the department for the construction of groundwater projects or groundwater quality projects, excluding programs that are funded under Part 2.78 (commencing with Section 10795), shall do all of the following:

(1) Prepare and implement a groundwater management plan that includes basin management objectives for the groundwater basin that is subject to the plan. The plan shall include components relating to the monitoring and management of groundwater levels within the groundwater basin, groundwater quality degradation, inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater pumping in the basin."

"10753.8. A groundwater management plan may include components relating to all of the following:

a. *The control of saline water intrusion.*
b. *Identification and management of wellhead protection areas and recharge areas.*
c. *Regulation of the migration of contaminated groundwater.*
d. *The administration of a well abandonment and well destruction program.*
e. *Mitigation of conditions of overdraft.*
f. *Replenishment of groundwater extracted by water producers.*
g. *Monitoring of groundwater levels and storage.*
h. *Facilitating conjunctive use operations.*
i. *Identification of well construction policies.*
j. *The construction and operation by the local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects.*
k. *The development of relationships with state and federal regulatory agencies.*
l. *The review of land use plans and coordination with land use planning agencies to assess activities which create a reasonable risk of groundwater contamination."*

2013 SJBGFMP Update and Subsequent SJBA Actions – As to Water Code § 10753.7 (a)(1)), the SJBA already has an extensive groundwater monitoring plan in place that characterizes groundwater levels and quality and which is being used to manage groundwater production. The adaptive groundwater production element of the recommended alternative has already been implemented and is based on the data produced by the SJBA monitoring plan. The implementation plan of the 2013 SJBGFMP Update includes a description of this monitoring plan in Section 8. As to Water Code § 10753.8 (a) through (l), the 2013 SJBGFMP Update contains management components "a", "c," "e", "f", "g", and "j".

8. For each management objective, describe how meeting the management objective will contribute to a more reliable supply for long-term beneficial uses of groundwater in the plan area, and describe existing or planned management actions to achieve management objectives.

2013 SJBGFMP Update and Subsequent SJBA Actions – Consistency with management objectives is described in Sections 7 and 8 of the 2013 SJBGFMP Update report.

9. Adopt monitoring protocols for the components in Section 7 (Water Code § 10753.7

(a)(4)). Monitoring protocols are not defined in the Water Code, but the section is interpreted to mean developing a monitoring program capable of tracking changes in conditions for the purpose of meeting management objectives.

2013 SJBGFMP Update and Subsequent SJBA Actions – The nexus between the information developed through the SJBA groundwater monitoring program and the tracking of the performance of the management program in meeting the objectives stated in Section 5 is discussed in Section 8 of the 2013 SJBGFMP Update report.

10. Describe the monitoring program, including:
    a. A map indicating the general locations of any applicable monitoring sites for groundwater levels, groundwater quality, subsidence stations, or stream gages.
    b. A summary of monitoring sites indicating the type (groundwater level, groundwater quality, subsidence, stream gage) and frequency of monitoring. For groundwater level and groundwater quality wells, indicate the depth interval(s) or aquifer zone monitored and the type of well (public, irrigation, domestic, industrial, monitoring).

2013 SJBGFMP Update and Subsequent SJBA Actions – A monitoring and reporting program was developed for the SJBGFMP to specifically produce information to manage production and recharge pursuant to the management objectives contained in Section 5 of the 2013 SJBGFMP Update report, to make this information available in near real time to each of the SJBA members and to the public through the SJBA member agencies and to produce a semiannual report on the state of the basin and management activities. The monitoring program is described in detail in Appendix B.

11. Describe any current or planned actions by the local managing entity to coordinate with other land use, zoning, or water management planning agencies or activities (Water Code § 10753.8 (k), (l)).

2013 SJBGFMP Update and Subsequent SJBA Actions – The SJBA continuously coordinates its SJBGFMP with its member agencies, MWDOC (as the wholesale entity for imported water and the SOCOD project), Metropolitan (as the importation agency and provider of incentive funding), the County of Orange (land use, flood control and IRWMP) and the SOCWA (JPA responsible for treatment and disposal of wastewater and provider of recycled water) .

12. Provide for periodic report(s) summarizing groundwater basin conditions and groundwater management activities. The report(s), prepared annually or at other frequencies as determined by the local management agency, should include:
    a. Summary of monitoring results, including a discussion of historical trends.
    b. Summary of management actions during the period covered by the report.
    c. A discussion, supported by monitoring results, of whether management actions are achieving progress in meeting management objectives.
    d. Summary of proposed management actions for the future.
    e. Summary of any plan component changes, including addition or modification of management objectives, during the period covered by the report.
    f. Summary of actions taken to coordinate with other water management and land use agencies, and other government agencies.

2013 SJBGFMP Update and Subsequent SJBA Actions – Same response to item 10 above.

13. Provide for the periodic re-evaluation of the entire plan by the managing entity.

2013 SJBGFMP Update and Subsequent SJBA Actions – The SJBA has committed to review and update the SJBGFMP every five years.

14. For local agencies not overlying groundwater basins, plans should be prepared including the above listed components and using geologic and hydrologic principles appropriate to those areas (Water Code § 10753.7 (a)(5)). Water Code § 10753.7 (a)(5) reads:

> *"Local agencies that are located in areas outside the groundwater basins delineated on the latest edition of the department's groundwater basin and subbasin map shall prepare groundwater management plans incorporating the components in this subdivision, and shall use geologic and hydrologic principles appropriate to those areas."*

2013 SJBGFMP Update and Subsequent SJBA Actions – Not applicable.

Table 7-1
Consistency of Groundwater Management Plan Alternatives to Goals

Alternative	Goals				
	Goal 1 -- Enhance Basin Water Supplies	Goal 2 -- Protect and Enhance Water Quality	Goal 3 -- Maximize the use of Unused Storage Space	Goal 4 -- Satisfy the State Requirements for a Groundwater Management Program	Goal 5 -- Establish Equitable Share of the Funding, Benefits and Costs of the SJBGMP[1]
Alternative 1 – Adaptive Production Management within Existing Recharge and Production Facilities					
Alternative 2 – Adaptive Production Management within Existing Recharge and Production Facilities with a Seawater Injection Barrier	✔	✔		✔	tbd
Alternative 3 – Adaptive Production Management within Existing Recharge and Production Facilities with a Seawater Extraction Barrier	✔	✔		✔	tbd
Alternative 4a – Adaptive Production Management with Seawater Injection Barrier and Construction of Ranney-Style Collector Well(s)	✔	✔	✔	✔	tbd
Alternative 4b – Adaptive Production Management with Seawater Extraction Barrier and Construction of Ranney-Style Collector Well(s)	✔	✔	✔	✔	tbd
Alternative 5a – Adaptive Production Management, with Seawater Injection Barrier, Construction of Ranney-Style Collector Wells, and In-stream Recharge	✔	✔	✔	✔	tbd
Alternative 5b – Adaptive Production Management, with Seawater Extraction Barrier, Construction of Ranney-Style Collector Wells, and In-stream Recharge	✔	✔	✔	✔	tbd
Alternative 6 – Adaptive Production Management, Creation of a Seawater Extraction Barrier, Construction of Ranney-Style Collector Wells, In-stream Recharge and Recycled Water Recharge	✔	✔	✔	✔	tbd
Alternative 7– Adaptive Production Management within Existing Recharge and Production Facilities (Alternative 1 with SOCOD).					
Alternative 8– Adaptive Production Management, Existing Recharge and Production Facilities (Alternative 1 with SOCOD), Construction of Ranney-Style Collector Wells	✔	✔	✔	✔	tbd
Alternative 9– Adaptive Production Management, Existing Recharge and Production Facilities, Construction of Ranney-Style Collector Wells, and In-stream Recharge	✔	✔	✔	✔	tbd
Alternative 10– Adaptive Production Management, Existing Recharge and Production Facilities, Construction of Ranney-Style Collector Wells, In-stream Recharge and Recycled Water Recharge	✔	✔	✔	✔	tbd

[1] tbd -- to be determined in the final implementation plan.

Table 7-2
Estimated Yield of the SJBGMFP Alternatives

Alternative	Yield from Key Features (acre-ft/yr)							
	Adaptive Production	Seawater Injection Barrier	Seawater Extraction Barrier	Ranney Collector Wells	Enhanced Stormwater Recharge	Recycled Water Recharge	Alternative Water Supply for Overlying Water Right Holders	Total
Alternative 1 – Adaptive Production Management within Existing Recharge and Production Facilities	9,200							9,200
Alternative 2 – Adaptive Production Management within Existing Recharge and Production Facilities with a Seawater Injection Barrier	9,200	800						10,000
Alternative 3 – Adaptive Production Management within Existing Recharge and Production Facilities with a Seawater Extraction Barrier	9,200		3,000					12,200
Alternative 4a – Adaptive Production Management with Seawater Injection Barrier and Construction of Ranney-Style Collector Well(s)	9,200	800		800			400	11,200
Alternative 4b – Adaptive Production Management with Seawater Extraction Barrier and Construction of Ranney-Style Collector Well(s)	9,200		3,000	800			400	13,400
Alternative 5a – Adaptive Production Management, with Seawater Injection Barrier, Construction of Ranney-Style Collector Wells, and In-stream Recharge	9,200	800		800	800		400	12,000
Alternative 5b – Adaptive Production Management, with Seawater Extraction Barrier, Construction of Ranney-Style Collector Wells, and In-stream Recharge	9,200		3,000	800	800		400	14,200
Alternative 6 – Adaptive Production Management, Creation of a Seawater Extraction Barrier, Construction of Ranney-Style Collector Wells, In-stream Recharge and Recycled Water Recharge	9,200		3,000		800	8,000	400	21,400
Alternative 7– Adaptive Production Management within Existing Recharge and Production Facilities (Alternative 1 with SOCOD).	7,500							7,500
Alternative 8– Adaptive Production Management, Existing Recharge and Production Facilities (Alternative 1 with SOCOD), Construction of Ranney-Style Collector Wells	7,500			800			400	8,700
Alternative 9– Adaptive Production Management, Existing Recharge and Production Facilities, Construction of Ranney-Style Collector Wells, and In-stream Recharge	7,500			800	800		400	9,500
Alternative 10– Adaptive Production Management, Existing Recharge and Production Facilities, Construction of Ranney-Style Collector Wells, In-stream Recharge and Recycled Water Recharge	7,500				800	8,000	400	16,700

Table 7-3a
Construction Cost and Annual and Unit Cost Opinions for the Proposed 1,000 Acre-ft/yr Seawater Injection Barrier

Item	Description	Unit Type	Units	Cost per Unit	Cost
	Capital Cost				
C1	Injection Well Construction and Development	LS	4	$184,500	$738,000
C2	Injection Wellhead Completion and Equipping	LS	4	$70,500	$282,000
C3	Piping to Connect Injection Wells to the Imported Water Pipeline	LS	1	$1,000,000	$1,000,000
C4	Misc Fittings[4]	LS	1		$100,000
	Subtotal Construction Cost				$2,120,000
C5	Contingency[1]				$424,000
	Total Construction Cost				$2,544,000
	Planning, Engineering and Legal[2]				$381,600
	Total Capital Cost				$2,925,600
	Annual and Unit Costs				
A1	Annualized Cost of Construction[3]				$190,314
A2	Injection Water	AF	1,000	$953	$953,000
A3	Fixed O&M	LS	1	$71,000	$88,000
	Total Annual Cost				$1,231,314
	Unit Cost				$1,539.14

[1]Contingency estimated to be 20% of subtotal construction cost
[2]Planning, Engineering and Legal estimated to be 15% of total construction cost
[3]Annual amortization cost based on 30-yr bond at 5.00%
[4]Misc Fitting estimated at 10% of pipeline construction cost

Table 7-3b
Construction Cost and Annual and Unit Cost Opinions for the Proposed Extraction Well Barrier Well Field and Water Supply Project

Derivation of 2013 Construction Cost Opinion for the Proposed Extraction Barrier Well Field and Water Supply Project

16	mgd product water capacity of the proposed SOCOD project				
$125,577,000	MWDOC 2011 Level 4 Estimate of the construction cost of the SOCOD project				
$44,759,000	MWDOC estimate of slant wells construction cost				
$80,818,000	Subtotal 2011 SOCOD construction cost for treatment and product water conveyance system to end users				
5%	Escalator to 2013				
$84,858,900	Subtotal 2013 SOCOD construction cost for treatment and product water conveyance system to end users				
$5,303,681.25	Subtotal 2013 SOCOD construction cost for treatment and product water conveyance system to end users per mgd				
3.00	mgd product water capacity for proposed extraction barrier project				
$15,911,044	Subtotal 2013 construction cost for proposed extraction barrier treatment and product water conveyance system to end users				
6,000	Raw water pumping rate of extraction barrier wells in acre-ft/yr				
6.00	No. of wells required to pump 8,000 acre-ft/yr at	800	gpm and	90%	utilization
2.00	No. of back up wells				
5.95	mgd raw water production rate				
$10,400,000	Subtotal 2013 construction cost of new equipped extraction barrier wells at			$1,300,000	ea.
$4,000,000	2013 construction cost estimate for raw water conveyance				
$30,311,044	Subtotal 2013 extraction barrier system construction cost				
$7,577,761	Contingency at	25%			
$4,546,657	Engineering at	15%			
$42,435,461	Total Construction Cost				

Derivation of 2013 Unit Cost Opinion for the Proposed Extraction Barrier Well Field and Water Supply Project

$2,760,488	Annualized capital cost at	30	years and	5%
362	2011 per acre-ft for O&M, all cost in per MWDOC			
5%	Escalator to 2013			
$380	2013 O&M cost for the extraction barrier			
$1,277,304	2013 total O&M costs			
$3,976,968	2013" All-in" Annual Cost			
$1,326	per acre-ft unit cost			

Source of 2011 proposed SOCOD project costs were obtained from the MWDOC presentation entitled "SOCOD Project Decision Making: Spring 2013" prepared in December 2012, and the handout from the SOCOD March 21, 2013 TAC meeting.

Table 7-3c

Construction Cost and Annual and Unit Cost Opinions for the Proposed 4,300 Acre-ft/yr Ranney Collector Well

Line Item	Description	Unit Type	Units	Cost per Unit	Cost
	Capital Cost				
C1	16-ft OD, 13-ft ID RC Caisson	LF	100	$8,000	$800,000
C2	12-in Stainless Steel Wire-wrapped Screens	LF	1,200	$1,000	$1,200,000
C3	Motor, Pump, Motor Control Panels and SCADA	LS	1	$1,500,000	$1,500,000
C4	Piping to Connect to SJBA Desalter	LF	1	$500,000	$500,000
C5	Misc Fittings[4]	LS	1		$50,000
	Subtotal Construction Cost				$4,000,000
C6	Contingency[1]				$800,000
	Total Construction Cost				$4,800,000
	Planning, Engineering and Legal[2]				$720,000
	Total Capital Cost				$5,520,000
	Annual and Unit Costs				
A1	Annualized Construction Cost[3]				$359,084
A2	Energy at 4,300 acre-ft/yr	kwh	628,842	$0.20	$125,768
A3	Fixed O&M	LS	1	$166,000	$166,000
	Total Annual Cost				$650,852
	Additional Cost per Acre-ft of Desalter Production				$151

[1]Contingency estimated to be 20% of subtotal construction cost
[2]Planning, Engineering and Legal estimated to be 15% of total construction cost
[3]Annual amortization cost based on 30-yr bond at 5.00%
[4]Misc Fitting estimated at 10% of pipeline construction cost

Table 7-4
Unit Cost Comparisons of SJBGMFP Alternatives

Alternative	New Yield [acre-ft]	Annual Cost [dollars]	Unit Cost [dollars per acre-ft]
Alternative 1 – Adaptive Production Management within Existing Recharge and Production Facilities	0	$0	na
Alternative 2 – Adaptive Production Management within Existing Recharge and Production Facilities with a Seawater Injection Barrier	800	$1,951,314	$2,439
Alternative 3 – Adaptive Production Management within Existing Recharge and Production Facilities with a Seawater Extraction Barrier	3,000	$3,976,968	$1,326
Alternative 4a – Adaptive Production Management with Seawater Injection Barrier and Construction of Ranney-Style Collector Well(s)	2,000	$3,682,167	$1,841
Alternative 4b – Adaptive Production Management with Seawater Extraction Barrier and Construction of Ranney-Style Collector Well(s)	4,200	$6,067,820	$1,445
Alternative 5a – Adaptive Production Management, with Seawater Injection Barrier, Construction of Ranney-Style Collector Wells, and In-stream Recharge	2,800	$4,802,167	$1,715
Alternative 5b – Adaptive Production Management, with Seawater Extraction Barrier, Construction of Ranney-Style Collector Wells, and In-stream Recharge	5,000	$7,187,820	$1,438
Alternative 6 – Adaptive Production Management, Creation of a Seawater Extraction Barrier, In-stream Recharge and Recycled Water Recharge	12,200	--	$1,042
Alternative 7– Adaptive Production Management within Existing Recharge and Production Facilities (Alternative 1 with SOCOD).	0	$0	na
Alternative 8– Adaptive Production Management, Existing Recharge and Production Facilities (Alternative 1 with SOCOD), Construction of Ranney-Style Collector Well	1,200	$1,730,852	$1,442
Alternative 9– Adaptive Production Management, Existing Recharge and Production Facilities, Construction of Ranney-Style Collector Well, and In-stream Recharge	2,000	$2,130,852	$1,065
Alternative 10– Adaptive Production Management, Existing Recharge and Production Facilities, In-stream Recharge and Recycled Water Recharge	9,200	--	$949

Table 7-5
Implementation Difficulty

Alternative	Adaptive Production	Seawater Injection Barrier	Seawater Extraction Barrier	Ranney Collector Wells	Enhanced Stormwater Recharge	Recycled Water Recharge	Alternative Water Supply for Overlying Water Right Holders
Alternative 1 – Adaptive Production Management within Existing Recharge and Production Facilities	not significant						
Alternative 2 – Adaptive Production Management within Existing Recharge and Production Facilities with a Seawater Injection Barrier	not significant	not significant					
Alternative 3 – Adaptive Production Management within Existing Recharge and Production Facilities with a Seawater Extraction Barrier	not significant		potentially significant				
Alternative 4a – Adaptive Production Management with Seawater Injection Barrier and Construction of Ranney-Style Collector Well(s)	not significant	not significant		potentially significant			potentially significant
Alternative 4b – Adaptive Production Management with Seawater Extraction Barrier and Construction of Ranney-Style Collector Well(s)	not significant		potentially significant	potentially significant			potentially significant
Alternative 5a – Adaptive Production Management, with Seawater Injection Barrier, Construction of Ranney-Style Collector Wells, and In-stream Recharge	not significant	not significant		potentially significant	potentially significant		potentially significant
Alternative 5b – Adaptive Production Management, with Seawater Extraction Barrier, Construction of Ranney-Style Collector Wells, and In-stream Recharge	not significant		potentially significant	potentially significant	potentially significant		potentially significant
Alternative 6 – Adaptive Production Management, Creation of a Seawater Extraction Barrier, Construction of Ranney-Style Collector Wells, In-stream Recharge and Recycled Water Recharge	not significant		3,000		potentially significant	significant	potentially significant
Alternative 7– Adaptive Production Management within Existing Recharge and Production Facilities (Alternative 1 with SOCOD).	not significant						
Alternative 8– Adaptive Production Management, Existing Recharge and Production Facilities (Alternative 1 with SOCOD), Construction of Ranney-Style Collector Wells	not significant			potentially significant			potentially significant
Alternative 9– Adaptive Production Management, Existing Recharge and Production Facilities, Construction of Ranney-Style Collector Wells, and In-stream Recharge	not significant				potentially significant		potentially significant
Alternative 10– Adaptive Production Management, Existing Recharge and Production Facilities, Construction of Ranney-Style Collector Wells, In-stream Recharge and Recycled Water Recharge	not significant				potentially significant	significant	potentially significant

This section describes the proposed implementation plan, the monitoring required under the continuation of the existing SJBGFMP, and the implementation of the recommended alternative—either Alternative 6 or Alternative 10. These alternatives are identical except that Alternative 6 contains an extraction barrier to control seawater intrusion and to generate a new water supply and assumes the SOCOD project is not constructed. Alternative 10 assumes the SOCOD project is built and excludes the extraction barrier.

8.1 Implementation of the Recommended San Juan Basin Groundwater Management and Facilities Plan

Table 8-1 lists the implementation steps for the recommended alternatives, a proposed ten-year implementation plan, and a reconnaissance-level cost estimate up to and excluding construction cost. The intent of Table 8-1 is to characterize the schedule, scope, and cost of activities required to implement the recommended alternatives. This characterization is provided below.

8.1.1 Adaptive Production Management

Adaptive production management will refine the current status quo management plan to comply with the diversion permits held by the CSJC, the SJBA, and the SCWD, and related interagency agreements. It involves the management of groundwater production by the CSJC and the SCWD to prevent or at least minimize seawater intrusion and to what is otherwise available on an annual basis. The SJBA, in its role as the Basin Manager[40], will set an Annual Safe Yield[41] based on groundwater in storage in the spring of each year and the spring assessment of seawater intrusion. The SJBA will depend on groundwater level and chemistry monitoring and the interpretation of the monitoring data to make its determination. The implementation time frame illustrated in Table 8-1 shows the monitoring occurring each year and the SJBA, acting as the Basin Manager, setting the Annual Safe Yield each year. The time frame also shows the occurrence of a triennial update of the criteria that the SJBA will use to set the Annual Safe Yield. The annual cost, shown in Table 8-1, would be about $140,000 (current cost of monitoring and reporting) for two out of three years and about $160,000 in years when the Annual Safe Yield assessment criteria are reviewed and updated (current cost of monitoring and reporting plus cost to review and update tool used by the SJBA to set the Annual Safe Yield).

In the implementation of the recommended alternative, it is proposed to include the groundwater substitution program element within the adaptive production management program element. By replacing the water supplied by private wells with an alternative supply, the SJBA and SCWD will have greater flexibility in complying with their diversion permits in

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[40] Mar 1, 1998 SCWD/SJBA Settlement Agreement provides that the SJBA will establish a Project Committee 10 "Basin Management Committee" which would serve as the "Basin Manager". The Basin Manager is responsible for determining on an annual basis the amounts of Available Safe Yield (ASY) which can be diverted by SCWD and SJBA from their water rights.

[41] The method to determine ASY is described in Appendix B and is currently implemented by the SJBA.

the near term and when the more aggressive program elements are implemented. The implementation steps include:

- Preliminary engineering to identify all of the private wells and the water demands placed on those wells
- Determine the facilities and operations required to provide those water users a substitute supply
- Assess feasibility
- Complete CEQA documentation
- Finalize agreements with private well owners
- Obtain permits
- Prepare final designs
- Construct conveyance facilities to enable substitute supplies

The implementation of the groundwater substitution program element is proposed to start in year 1 (2013-14) and be completed in year 3 (2015-16). The implementation cost, excluding construction, is estimated to be about $190,000.

8.1.2 Planning and CEQA Process for the Recommended Alternative

The recommend alternatives contain very complex water management program elements that will require additional investigations to determine their feasibility, their integration into the existing water resource management plans, and their impacts on the environment. This information will evolve in the early engineering and feasibility investigations required for implementation. Some of the program elements in the recommended plan may end up not being feasible as described herein. For planning purposes, it was assumed that a programmatic environmental impact report (PEIR) will be completed. The implementation steps include:

- Conduct CEQA process through the preparation of a draft PEIR for the SJBGFMP
- Prepare application/change petitions for new points of diversion, revised diversion amounts, surface water diversion for recharge, storage and subsequent recovery
- Conduct engineering investigations to develop alternative preliminary designs, determine feasibility, and identify fatal flaws for:
    - Groundwater extraction barrier
    - In-stream stormwater recharge
    - In-stream recycled water recharge and groundwater recycled water reuse

- Finalize and certify programmatic EIR
- Finalize SWRCB application/change petitions

The planning and CEQA process are proposed to occur in years 2 (2014-15) to 4 (2016-17). This phase of the work is estimated to cost about $1,800,000.

8.1.3 Complete Agreements for SJBA Members Participation, Construction, and Operation

The prior implementation efforts will provide detailed estimates of new yield and associated costs. Agreements will be drafted to define participation by individual SJBA members, their responsibilities in the construction and operations of facilities, their yield allocations, financing arrangements, their cost share, and other arrangements as required to implement the SJBGFMP. The effort to prepare implementation agreements is proposed to occur in years 3 (2015-16) to 4 (2016-17). The cost to negotiate and prepare these agreements is projected to be about $200,000.

8.1.4 Design and Construction

By the end of year 4 (2016-17), all of the planning for the program elements and implementation agreements will have been completed. The time frames and costs (through design) for each program element are summarized below:

- Groundwater extraction barrier
  - The design will take about two years to complete and is assumed to start in year 5 (2017-18)
  - Design and permit acquisition costs are projected to be about $4,000,000
  - Construction will take about two years
- In-stream stormwater recharge
  - The design will take about a year to complete and is assumed to start in year 5 (2017-18)
  - Design and permit acquisition costs are projected to be about $150,000
  - Operation of the temporary in-stream recharge facilities will start in year 6 (2018-19)
- In-stream recycled water recharge and groundwater recycled reuse
  - The design will take about two years to complete and is assumed to start in year 5 (2017-18)
  - Design and permit acquisition costs are projected to be about $4,000,000
  - Construction will take about three years

The permits referred to in this implementation step include all of the permits related to construction and operation exclusive of the SWRCB and the Regional Board. The cost to implement Alternative 6 up to and excluding construction is about $12 million. The cost to implement Alternative 10 through and excluding construction is about $8 million.

8.2 Minimum Monitoring Program Required for Implementation of the Recommended SJBGFMP

8.2.1 Background

In early 2003, the SJBA implemented a groundwater, surface water, and vegetation field monitoring program to comply with the conditions outlined in its Permit for Diversion and Use of Water, No. 21074 (Permit 21074), issued by the SWRCB Division of Water Rights in October 2000. The original monitoring program, which was developed in 2001, focused primarily on collecting the data needed to satisfy the monitoring requirements enumerated in Permit 21074. In October 2011, the SWRCB amended Permit 21074 to reflect the results of monitoring performed by the SJBA.

In 2012, WEI was retained to prepare an updated Basin Management Monitoring and Reporting Program to comply with the amended conditions of Permit 21074 and to develop the SJBGFMP. In developing the 2013 SJBGFMP, WEI identified basin management issues requiring specific monitoring activities to be included in 2013 Basin Management Monitoring and Reporting Program in addition to the explicit requirements of Permit 21074. These additional activities required to implement the 2013 SJBGFMP include monitoring and interpretation activities to investigate (1) groundwater storage and net recharge, (2) seawater intrusion, and (3) point-source groundwater contamination from LUSTs. Additional monitoring components can be added to the monitoring plan in subsequent years to address any management issues that arise as the SJBGFMP is implemented and potentially from the Salt and Nutrient Management Plan that is currently being prepared by SOCWA, which will be complete by 2014. The SJBA should anticipate a significant, but as yet undefined, increase in monitoring associated with the recharge of recycled water when that program element is implemented.

The following is a description of each regulatory and basin management issue that should be addressed as part of the Basin Management Monitoring and Reporting Program.

8.2.1.1 Permit 21074 Monitoring and Reporting

Amended Permit 21074 describes, among other things, the groundwater and vegetation monitoring requirements that must be satisfied to evaluate the impacts to groundwater-level elevation, groundwater quality, and riparian vegetation that result from groundwater extractions related to the operation of the SJBA desalter facility at two levels of production: groundwater extractions less than 4,800 acre-ft/yr and groundwater extractions in excess of 4,800 acre-ft/yr. The SJBA anticipates groundwater extractions will exceed 4,800 acre-ft/yr in 2013 and after. Thus, the monitoring program for extractions in excess of 4,800 acre-ft/yr is assumed herein. The explicit monitoring requirements include: (1) quarterly groundwater level monitoring at eight monitoring wells to comply with the DWR California Statewide Groundwater Elevation (CASGEM) program, (2) quarterly groundwater quality monitoring for Electrical Conductivity (EC) at eight monitoring wells, and (3) monthly monitoring of riparian vegetation health at five monitoring sites along San Juan Creek.

In addition to the explicit monitoring requirements listed in the permit, additional data is needed to satisfy other permit conditions, such as reporting total groundwater extractions from the basin and computing water in storage. The additional data needed to address the permit conditions include groundwater production, total water use, precipitation, groundwater elevation data across the basin, groundwater storage, and TDS and chloride concentrations at wells. A GIS-based storage model was built for the SJBGFMP, and it will be used to estimate groundwater in storage. An annual progress report documenting permit compliance must be submitted each year to the SWRCB by June 30th.

8.2.1.2 Groundwater Storage and Production Management

Through the work performed for the 2013 SJBGFMP, WEI determined that the storage capacity and groundwater in storage were significantly less than has long been reported by the DWR and others studying the basin. The groundwater "yield" estimates developed from the most recent groundwater model developed by the MWDOC for the SOCOD planning work is of limited value because it is based on limited useful groundwater production and groundwater level data. Additional high quality groundwater production and groundwater level data are necessary to calibrate a groundwater model in the near future to improve groundwater yield estimates and thereby improve decision making.

The recommended SJBGFMP includes a program element called Adaptive Production Management. This program element requires an estimate of groundwater storage in the spring of each year. Each year, the SJBA, in its role as the Basin Manager, will use the spring storage estimate and spring groundwater level data to establish an "Available Safe Yield" (ASY) from which the CSJC and SCWD will be allocated an annual production allocation for that year until next spring.[42]

The SJBA will conduct a regional, comprehensive groundwater-level survey and analysis of the San Juan Basin in the spring and the fall of each year to compute the volume of water in storage and the change in storage between each period (spring to fall, fall to spring, and so on). The spring levels and storage change calculations can be used by the SJBA to determine an appropriate level of pumping until the next spring storage determination. Additionally, the period change in storage and period pumping can be used to estimate the net period inflow to the San Juan Basin. The net period inflow can then be correlated to precipitation and stream discharge measurements to characterize near-term and long-term recharge[43]. This would be invaluable for future groundwater model calibration.

[42] An annual Available Safe Yield must be established pursuant to the March 1, 1998 SCWD/SJBA Settlement Agreement.

[43] It is anticipated that surface discharge and water quality data at the boundaries of the basin will be available from the monitoring conducted for the SOCWA SNMP.

8.2.1.3 Seawater Intrusion

Preliminary planning simulations done by the MWDOC for the proposed SOCOD project suggest that seawater intrusion is an imminent threat to the basin with the projected groundwater production plans of the SJBA member agencies. To track seawater intrusion into the San Juan Basin, it is critical to begin collecting groundwater level and specific groundwater chemistry data that will help the SJBA to understand the current extent of seawater intrusion.

This monitoring includes sampling groundwater and surface water in the Basin, from the coast to the forebay areas, for intrinsic seawater tracers, including boron, bromide, iodide, and strontium. The CSJC and the SCWD will need to sample their production wells for the same intrinsic seawater tracers. These, or other tracers, will need to be monitored in the future until it is determined from both groundwater level and chemistry data that seawater intrusion will likely not occur or the seawater extraction barrier is implemented and working as designed.

The intrinsic tracers will be monitored across the basin to initially characterize the spatial baseline distribution of these constituents and to identify the most promising set of constituents. This initial period will last two years after which the sampling for intrinsic constituents will be limited to monitoring and production wells from the SCWD Desalter to the coast, unless the data indicate that additional monitoring upgradient of the SCWD Desalter is necessary.

8.2.1.4 Point-Source Groundwater Contamination

Seven point-sources of groundwater contamination from LUST sites have been identified in the San Juan Basin. Contamination by MTBE, has already required the CSJC to incorporate high-cost treatment systems into their municipal water system. As the pumpers in the San Juan Basin continue to increase production over time, there is a concern that the contaminants associated with the various LUST sites could be mobilized and further impact municipal water supplies. We recommend that the SJBA include an annual groundwater-sampling event for volatile organic compounds (VOCs), including MTBE, as part of the monitoring program.

8.2.2 Scope of Work

The following is the scope of work required to implement the recommended monitoring and reporting program described above. The scope of work is designed to rely on groundwater and surface water data collected by others in the basin to the extent possible, supplementing that data with data collected in a field-monitoring program to fill in data gaps. The Basin Management Monitoring and Reporting Program is divided into three tasks: Field Monitoring Program, Data Acquisition and Management, and Reporting. The scope of work that follows is paraphrased from the current monitoring contract issued to WEI for 2013 (see Appendix B) and includes the monitoring required for the implementation of the SJBGFMP over the next year or two. The scope of work for the monitoring program should be reviewed and updated annually, or more frequently if necessary. The objectives, sub-tasks, schedule of implementation, and deliverables for each task are described below.

8.2.2.1 Task 1 –Field Monitoring Program

The objective of the field-monitoring program is to collect data in the field that is not available from the other agencies that monitor the Basin. This task is broken down into four subtasks based on data type and monitoring frequency.

8.2.2.1.1 Task 1.1 Quarterly Groundwater Level Monitoring

Currently, the SJBA has pressure transducers and data loggers installed in eight monitoring wells across the San Juan Basin to continuously record groundwater-level elevations. The data loggers are also equipped to record electrical conductivity (EC). Groundwater elevation and EC data collected from these wells are used for water rights permit compliance reporting, CASGEM reporting, storage management, and seawater intrusion monitoring. Each quarter, the groundwater-level elevation and EC data will be downloaded from the data loggers, manual measurements of depth to groundwater will be made to calibrate the pressure transducers, EC probes will be calibrated, and routine transducer maintenance will be performed. The field data will be processed, checked for quality assurance/quality control (QA/QC) and loaded into a relational database.

8.2.2.1.2 Task 1.2 – Quarterly Groundwater Quality Monitoring

To establish the baseline condition for monitoring seawater intrusion into the Basin, 14 monitoring wells in the San Juan Basin will be sampled on a quarterly basis for a two year period. The quarterly groundwater quality sampling events consist of purging each well, measuring field water quality parameters (e.g. temperature, pH, and EC), and collecting groundwater quality samples for laboratory analysis. Note that groundwater samples will only be tested for VOCs during one of the four quarterly sampling events. Data collected for this task can also be used for the analysis and reporting required by Permit 21074. All field and laboratory data will be processed, checked for QA/QC, and loaded into a relational database.

8.2.2.1.3 Task 1.3 – Surface Water Quality Monitoring

To establish the baseline condition for monitoring seawater intrusion, five surface water sites in the Basin will be sampled twice a year during dry-weather conditions over a two-year period. The field and laboratory data will be processed, checked for QA/QC, and loaded into a relational database.

8.2.2.1.4 Task 1.4 – Vegetation Monitoring

The SJBA's water rights permit requires monthly vegetation monitoring at five sites along San Juan Creek. Monthly vegetation monitoring consists of a biologist visiting five monitoring stations to collect written and photographic records of vegetation health and current climate conditions. The field data will be checked for QA/QC and the photographs will be stored in a project file.

8.2.2.2 Task 2 – Data Acquisition and Management

The objective of this task is to coordinate with and collect data from all public and private entities that collect groundwater, surface water, or climate data in the San Juan Basin. This data will supplement the data generated by the SJBA to satisfy the regulatory reporting requirements and basin management issues identified herein. At the end of this task, the SJBA will have an updated database through the end of the calendar year.

8.2.2.2.1 Task 2.1 – Data Acquisition from Collecting Agencies

Each public and private entity that participates in the monitoring plan will be contacted on a quarterly basis to collect the relevant data sets (April, July, October, and January). The SCWD, CSJC, and MWDOC will be sent a request, asking that they sample their wells for the intrinsic seawater tracers that are not included as part of their standard analytical testing programs.

8.2.2.2.2 Task 2.2 – Data QA/QC, Processing, and Upload to Relational Database

After each quarterly data collection event, all groundwater, surface water, and climate data will be processed, checked for QA/QC, and loaded into a relational database.

8.2.2.3 Task 3 – Reporting

The objective of this task is to prepare reports and presentations that summarize the data collected in the San Juan Basin during each year.

8.2.2.3.1 Task 3.1 – Water Rights Permit Reporting

A letter report will be prepared and submitted to the SWRCB, summarizing the status of compliance with the requirements of Permit No. 21074. This report will be formatted as a letter report that directly answers the questions posed in the permit.

8.2.2.3.2 Task 3.2 – CASGEM Reporting

The quarterly groundwater level data collected in Task 1.1 will be uploaded to the DWR through the CASGEM online reporting system. Data will be uploaded in April, July, October, and January.

8.2.2.3.3 Task 3.3 – Spring and Fall Storage Estimate and Annual Safe Yield Reports

Two letter reports will be prepared and submitted to the SJBA, summarizing the analysis of storage change, the estimation of net inflow to the San Juan Basin, and a preliminary estimate of the ASY. The first letter report will document the change in storage in the San Juan Basin from fall to spring and will be submitted to the SJBA by May 31. This report will contain an estimate of the ASY, based on the estimated storage in the spring of the current year. The second letter report will document the change in storage in the San Juan Basin from spring to fall and will be submitted to the SJBA by December 30. Both reports will contain an estimate of the net inflow in the prior period.

8.2.2.3.4 Task 3.4 – Seawater Intrusion Monitoring Report

A seawater intrusion monitoring summary report will be prepared at the conclusion of each year of groundwater quality sampling. The report will describe the monitoring program, analyze historical and current year data to establish the baseline condition of the basin as it relates to seawater intrusion, and describe the questions, analytical methods, and ongoing monitoring needed to track seawater intrusion in subsequent years. The first draft monitoring report will be submitted to the SJBA for review and comment by January 2014, and a final report incorporating comments on the draft will be submitted by February 2014.

8.2.2.3.5 Task 3.5 – Presentations to the SJBA Board of Directors

Oral status reports will be presented to the SJBA Board at regular Board meetings.

Table 8-1
Major Implementation Steps for the Recommended SJBGMFP Alternatives 6 and 10[1]

Program Element / Feature	Implementation Steps	Ten-Year Implementation Schedule 1	2	3	4	5	6	7	8	9	10	Annual Implementation Cost by Year Excluding Construction[2] ($1,000) 1	2	3	4	5	6	7	8	9	10	Total
Adaptive Production Management												**$260**	**$230**	**$140**	**$160**	**$140**	**$140**	**$160**	**$140**	**$140**	**$160**	**$1,670**
	Groundwater level monitoring and the development of groundwater level maps and storage estimates; and groundwater chemistry monitoring to assess state of seawater intrusion and determine if SJBGMFP is contributing to degradation																					
	Currently being implemented by the SJBA[3]	■	■	■	■	■	■	■	■	■	■	*$140*	*$140*	*$140*	*$140*	*$140*	*$140*	*$140*	*$140*	*$140*	$140	*$1,400*
	The SJBA, in its role as "Basin Manager" will establish an annual production amount for the CSJC and the SCWD as required to not interfere with private pumpers, and to ensure sustainable production																					
	The SJBA establishes the Basin Management Committee which is empowered by the March 1998 settlement agreement to set an annual Available Safe Yield	■	■	■	■	■	■	■	■	■	■											*$0*
	The SJBA will need to develop and periodically revise a relationship between Available Safe Yield and Spring groundwater storage; the relationship will depend on the then existing production and conveyance facilities	■			■			■			■	*$20*			*$20*			*$20*			*$20*	*$80*
	Groundwater substitution																					
	Conduct preliminary design and assess feasibility	■										*$50*										*$50*
	Complete CEQA process	■										*$30*										*$30*
	Finalize agreements with private well owners	■	■									*$20*	*$20*									*$40*
	Obtain permits		■										*$20*									*$20*
	Prepare final design		■										*$50*									*$50*
	Construct conveyance facilities to enable substitute supply			■																		
Planning and CEQA Process												**$0**	**$875**	**$600**	**$325**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$1,800**
	Conduct CEQA process through the preparation of a draft PEIR		■	■									*$125*	*$125*								*$250*
	Prepare application/petition to SWRCB for new points of diversion, new pumping, to divert surface water, store and subsequently recover																					
	Prepare initial application/petition, review with SWRCB staff until application/petition is accepted		■	■									*$50*	*$50*								*$100*
	Coordinate with SWRCB to complete process and acquire diversion permits			■	■									*$25*	*$25*							*$50*
	Conduct engineering investigations to develop alternative preliminary designs, determine feasibility and to identify fatal flaws																					
	Groundwater extraction barrier		■	■									*$200*	*$200*								*$400*
	In-stream stormwater recharge		■										*$100*									*$100*
	In-stream recycled water recharge and groundwater recycled water reuse		■	■	■								*$400*	*$200*	*$200*							*$800*

Table 8-1
Major Implementation Steps for the Recommended SJBGMFP Alternatives 6 and 10[1]

Program Element / Feature	Implementation Steps	Ten-Year Implementation Schedule 1	2	3	4	5	6	7	8	9	10	Annual Implementation Cost by Year Excluding Construction[2] ($1,000) 1	2	3	4	5	6	7	8	9	10	Total
	Finalize and certify PEIR for the SJBGFMP														*$50*							*$50*
	Finalize SWRCB application/petition														*$50*							*$50*
Complete Agreements for SJBA Member Participation, Construction and Operation														**$100**	**$100**							**$200**
Design and Construction												**$0**	**$0**	**$0**	**$0**	**$4,150**	**$4,000**	**$0**	**$0**	**$0**	**$0**	**$8,150**
	Groundwater Extraction Barrier																					
	Obtain permits															*$50*	*$50*					*$100*
	Complete design															*$1,900*	*$1,900*					*$3,800*
	Construct extraction barrier																					
	In-stream Stormwater Recharge																					
	Obtain permits															*$50*						*$50*
	Complete design															*$100*						*$100*
	Operate in-stream stormwater recharge																					
	In-stream Recycled Water Recharge and Groundwater Recycled Reuse (Indirect Potable Reuse)																					
	Obtain permits															*$50*	*$50*					*$100*
	Complete design															*$2,000*	*$2,000*					*$4,000*
	Construct recycled water conveyance, recovery wells and treatment system																					
Totals for Alternative 6												**$260**	**$1,105**	**$840**	**$585**	**$4,290**	**$4,140**	**$160**	**$140**	**$140**	**$160**	**$11,820**
Totals for Alternative 10[4]												**$260**	**$905**	**$640**	**$585**	**$2,340**	**$2,190**	**$160**	**$140**	**$140**	**$160**	**$7,520**

[1] Alternative 10 contains all the program elements of Alternative 6 except the extraction barrier

[2] Costs shown in italics total to the cost shown above in the grey bar highlighting the program element.

[3] Costs of current program and recommended program for this part of the recommended SJBGFMP. Significant additional cost will be incurred with recycled water recharge.

[4] There could be additional reduced cost in the processing of SWRCB applications and in the CEQA process if the extraction barrier is excluded.

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Appendix A

Comments and Responses to Comments

Agency Providing Comment	Appendix Number
Santa Margarita Water District	A.1
San Juan Hills Golf Course – The Burnett Firm	A.2
Moulton Niguel Water District	A.3
City of San Juan Capistrano	A.4
Municipal Water District of Orange County	A.5
South Coast Water District	A.6
Capistrano Taxpayers Association	A.7
Rancho Mission Viejo	A.8

A.1 SANTA MARGARITA WATER DISTRICT

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
1 As provided	Section 3.5, page 3-17 second paragraph	*The text says: "The projected SOCOD project construction cost is estimated at about &175 million (estimated 2015 dollars), and the unit cost of water would be about $1,300/acre-ft – with the cost being reduced to $1,050/acre-ft with incentives from Metropolitan."* This is way too low.	Text has been updated to read as follows: "*The projected SOCOD project construction cost is estimated at about $182 million to $241 Million (estimated 2012 dollars, without and with Fe/Mn treatment, respectively), and the unit cost of water could range from about $1,500 to $1,700 per acre-ft*[1] *without incentives from Metropolitan*."
2 As provided	Section 3.5.2, page 3-21 first paragraph	The text says: *"The end of period storage ranges from 7500 acre-ft to 43,900 acre-ft…"* How? Basin is 26K	The difference is explained by (1) the difference in the aquifer area described in Section 3.3.9 and the area used by MWDOC's consultant in their groundwater model which is larger, and (2) the elevation control on the WEI estimate in Section 3.3.9 is the channel bottom whereas there is no such control in the groundwater model.
3 As provided	Section 3.5.2, page 3-21 fourth paragraph	The text says: *"The take-aways from this baseline simulation is that planned production be the CSJC and SMWD along with private producers seems to exceed the production capabilities…"* SCWD?	Thank you. The text was changed to replace SMWD with SCWD.

[1] MWDOC planning documents in early 2013 suggests that the unit cost could range between $1,800 and $2,000 per acre-ft in 2019 when the SOCOD project could become operational.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
4 As provided	Section 3.9.3.2, page 3-46 second paragraph	The text says: *"The San Juan Creek Outfall has a design capacity of 107 mgd."* Update design capacity.	Thank you. The text has been updated to read as follows: "*The San Juan Creek Outfall has a design capacity of 36.8 mgd.*"
5 As provided	Section 3.10.1, page 3-46 last paragraph	The text says: *"Six of the seven wastewater treatment plants have advanced water treatment facilities that are capable of producing Title 22 water for irrigation."* Tertiary?	Text has been updated to read as follows: "*Six of the seven wastewater treatment plants have advanced water treatment (AWT) facilities that are capable of producing tertiary Title 22 effluent suitable for irrigation.*"
6 As provided	Section 4.0, page 4-1 second paragraph	The text says: *"The SJBA agencies currently (2010) have a combined service area population of…"* Couldn't this be updated? This is 3 years old.	It could be. 2010 was "current" when the investigation was commenced. The investigation to develop the plan has taken much longer than intended due to challenges beyond WEI's control.
7 As provided	Section 4.0, page 4-1 last paragraph	The text says: *"Imported water has been the primary source of potable water for the past five years."* Longer than that.	The sentence has been deleted.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
8 As provided	Section 4.0, page 4-2 third paragraph	The text says: *"Potable demand is met almost entirely through the purchase of imported water from the MWDOC, with only minimal amount of San Juan Basin groundwater produced each year…"* Where is this?	Source is the SMWD 2010 UWMP prepared jointly by SMWD and MWDOC. This was the source document provided to WEI for developing the supply plan.
9 As provided	Section 4.0, page 4-2 third paragraph	The text says: *"… the diversion of urban runoff flows in … Canada Gobernadora…"* Not yet.	Text has been updated to read as follows: "*Currently, non-potable demands are met through the use of recycled water , the diversion of urban run-off from Horno Creek, Oso Creek, and the Arroyo Trabuco, and in the near future, surface water diversions from the Canada Gobernadora. SMWD recycled water use will reach about 5,200 acre-ft/yr by 2015 and will increase to about 10,100 acre-ft/yr by 2030. SMWD will divert about 2,300 acre-ft/yr of surface water in 2015 and this will increase to about 2,700 acre-ft/yr by 2020.*"
10 As provided	Section 4.0, page 4-2 third paragraph	The text says: *"Total water demand is projected to increase to about 46,400 acre-ft…*" Higher than I remember.	Source is the SMWD 2010 UWMP prepared jointly by SMWD and MWDOC. This was the source document provided to WEI for developing the supply plan.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
11 As provided	Section 4.0, page 4-2 last paragraph	The text says: *"Since the startup of the SCWD Groundwater Recovery Facility, which now produces about 1,000 acre-ft/yr…"* This doesn't add up.	Thank you. Text has been updated to read as follows: "*Historically, imported water was the only source of potable water for the SCWD, but the demand for imported water has decreased in the last three years since the startup of the SCWD Groundwater Recovery Facility. Planned potable water production from the SCWD Groundwater Recovery Facility will reach about 1,300 acre-ft/yr by 2015 and 2,000 acre-ft/yr by 2020*."
12 As provided	Section 4.0, page 4-2 last	The text says: *"The total water demand is projected to increase to about 8,700 acre-ft by 2035…"* Why a 1,800 acre-ft increase for 2,900 people?	Source is 2010 UWMP prepared jointly by SCWD and MWDOC. This was the source document provided to WEI for developing the supply plan.
13 As provided	Table 4-2	The values for Chiquita Water Reclamation Plant 2015 and 2020 projections – This is different I think.	This was the information provided to WEI and Carollo when the data was being collected in 2011.
14 As provided	Table 4-2	*The row "Total Recycled Water"* – Not Recycled, this is wastewater.	Table has been modified replacing row titled "Total Recycled Water" with Total Wastewater"
15 As provided	Table 5-1	This table doesn't make much sense for where the bullets show up.	This table was prepared by the SJBA members themselves and has been reviewed by them at least three times prior to publishing them in the draft report.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
16 As provided	Table 5-2	Add bullets to items 1,2,3,5 and 6 for SMWD.	Table has been updated.
17 As provided	Table 5-4	Add bullet to item 17 for SMWD.	Table has been updated.
18 As provided	Table 5-8	What does grey highlight indicate?	The grey was included to help group content.
19 As provided	Table 5-8 Page 3 of 3	The text says: *"Goal 4 implications – SJBGWMFP is included in the MWDOC IWRMP"* MWDOC or County?	County. Table has been revised.
20 As provided	Section 6, page 6-1, second paragraph	The text says: *"The first set of alternatives…"* What numbers are the first set and which are the second?	Text has been updated to read as follows: "*The first six alternatives assume that the SOCOD project will either not be implemented or will be deferred by ten or more years. Alternatives 7 through 10 assume that the SOCOD project will be implemented within the next ten years.*"

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
21 As provided	Section 6, page 6-1, last paragraph	The text says: *“About 71 percent of the time, the yield will be less than 11,000 acre-ft/yr, and about 14 percent of the time…”* What about the other 15%?	The text in Section 3.5.2 and figures 3-25 and 3-26 were modified to more clearly characterize production limitations and their relationship to storage. This text was carried over to commented text. See text and figures for changes.
22 As provided	Section 6.1.1.5.2, page 6-7, first paragraph	The text says: *“In-stream recharge is the only viable large-scale recharge method for the San Juan Basin due to the lack of suitable off-stream sites for recharge and the inability of the basin to accept large amounts of recharge at a specific site.”* Not sure I agree with this.	The text in this part of the document contains slight revisions to state that surface water storage is also a limiting factor for stormwater recharge.
23 As provided	Section 6.1.1.6, page 6-8	The text says: *“The yield of the Basin would be increased from about 9,200 acre-ft/yr to about 21,400 acre-ft/yr—an increase of about 12,000 acre-ft/yr.”* Should be 16,000 for total project	As the Report is written it’s about 12,000 acre-ft/yr. See Table 7-2.

A.2 SAN JUAN HILLS GOLF CLUB - THE BURNETT FIRM [2]

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
1 Para-phrased	Section 3.4	The Draft Plan understates the volume and nature of San Juan Golf's water rights. The San Juan Golf retains a 550 acre foot per year riparian water right.	Thank you. The text was updated to reflect the potential use of up to 550 AFY assuming compliance with pertinent agreements and San Juan Golf's SWRCB Permit.
2 Para-phrased	Section 3.4, Pages 3-14 to 3-16	The Draft Plan overstates the City of San Juan Capistrano's water rights. The City of San Juan does not have their own water rights but shares water rights with SJBA (3,325 acre-ft). It is imperative that the final quantification of water rights reflect the sharing of facilities and the original water rights held by participating agencies.	Under the settlement agreements associated with the SJBA's water rights permit, the Authority and the State Water Resources Control Board recognized the City has the right to secure its own water rights outside the water rights of the Authority in an amount up to 3,325 acre-ft of additional appropriative use.

[2] Paraphrased comments can be viewed as submitted within this appendix following the Appendix A tables.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
3 Para-phrased		The Draft Plan does not account for all of the extractions in the Basin. The plan does not include riparian rights holders such as Rancho Mission Viejo.	The active management boundary of the SJBGFM excludes the RMV. The Rancho Mission Viejo production occurs in the same watershed, but in different basin per se (in the upper basin). The production activities of the RMV impact the amount of inflow into the San Juan Basin, but the activities in the SJBA management area do not impact the RMV. Production by the RMV has been accounted for through the modeling of inflow to the lower basin and assumes that RMVs production will not significantly change relative to their current operations.
4 Para-phrased		In an effort to understand land subsidence it is requested to include past and present land surface elevations be included in the plan.	Given the geology of the basin, subsidence is not a concern for the management of this basin and thus no groundwater level monitoring will be required to monitor for it.
5 Para-phrased	Section 3.6.1, pages 3-21 to 3-22	The Draft Plan relies on a "firm yield" figure that is not the industry standard for determining the availability of supplies in a groundwater basin. The Draft Plan disavows safe yield as an appropriate measure for the Basin and instead uses "firm yield". The risk of relying on this figure rather than traditional notions of safe yield is that it could result in overdraft conditions when expected recharge does not occur. Use of "firm yield" therefore calls into question the "sustainable" nature of the Draft Plan and its compliance with AB3030 requirements.	We respectfully disagree. From a regulatory perspective the San Juan Basin is considered surface water. Firm yield refers to yield of a surface water system regulated by storage. Safe yield, as used in groundwater adjudications, is not an appropriate management tool for the San Juan Basin as it would result in large losses of groundwater to the ocean.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
6 Para-phrased	Section 3.6.2, pages 3-22 to 3-23	The Basin is over-subscribed. The Draft Plan and model demonstrate that there is not enough water on a year to year basis in the Basin to support all the existing and proposed uses described in the Draft Plan. The lower than estimated firm yield is corroborated by major drawdown of water levels in the Basin which appears to coincide with increased production at the Groundwater Recovery Facility. The SJBA needs to consider a change in operations that potentially include reducing the volume of water taken by the facility, including water taken by the City of San Juan Capistrano.	The intent of the SJBGFMP is to maximize the beneficial use of the basin and to protect those that depend on the basin for water supply. One of the key features of the plan is an adaptive management element that would limit production by the CSJC, SJBA and SCWD based on groundwater in storage and consistent with the requirements of the SJBA and SCWD permits (e.g limit production or change production operations in years when the storage volume is low).
7 Para-phrased		The Basin Authority and the City need to consider changing operations at the City's Groundwater Recovery Facility to prevent impacts to other pumpers.	See response to your comment 6 above.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
8 Para-phrased		Adopting the Draft Plan is a discretionary action requiring compliance with the California Environmental Quality Act. The impacts caused by the management practices and alternatives will need to be studied in an associate environmental document produced to support the draft Plan in compliance with CEQA.	Based on our review of the draft SJBA Groundwater Management Plan (the "Plan"), we think the Authority's adoption of this Plan is statutorily exempt from CEQA under State CEQA Guidelines, section 15262. Specifically, State CEQA Guidelines Section 15262 exempts from the EIR/negative declaration requirements a "project involving only feasibility or planning studies for possible future actions which the agency . . . has not approved, adopted or funded". The agency has considered environmental factors when approving the planning/feasibility study. Also, the planning/feasibility study does not have a legally binding effect on later activities. Additional work is required for development of any projects to a level that CEQA can be prepared.

A.3 MOULTON NIGUEL WATER DISTRICT

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
1 As provided	Section 3.5.2, page 3-21	Last paragraph, first sentence (Page 3-21) - Change reference of SMWD to SCWD	Thank you. The text has been modified.
2 As provided	Section 3.6.2, page 3-22	Page 3-22- last paragraph, first sentence - Change 'form' to 'from'	Thank you. The text has been modified.
3 As provided	Section 3.7.3	The last paragraph in Section 3.7.3 is confusing	Thank you. The text has been modified.
4 As provided	Section 3.10.4	Is this section missing?	Thank you. The text has been modified.
5 As provided	Section 6.1.1.6	This section identifies recycled water recharge from May through September. Is the additional yield based on available recycled water production to meet those recharge values or will that require additional storage to maximize the recycled water production from the plants?	Based on existing and planned recycled water available during that period.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
6 As provided	General	The wastewater treatment plant capacity is good information, but it should be supplemented with the annual average inflow to the plant. Excluding those numbers may overstate the availability of recycled water. Also, I assume the numbers were confirmed by SOCWA. With the information provided in Section 4, maybe change 'will be generated' to 'could be generated'.	Table 4-2 represents the projected volume of wastewater that will be generated during the planning period (not the treatment plant capacity). These data were provided by MWDOC, as directed by the Authority. Table 4-2 was modified to compare the future recycled water demands with the capacity for producing Title 22 recycled water to ensure that the availability of recycled water is not overstated relative to the existing capacity to produce Title 22 recycled water.
7 As provided	General	Does the publication of the groundwater modeling report change or lend more significant information to this report where the modeling results are left uncertain or undefined?	As we understand this question, the recently developed groundwater model could be used to analyze some of the program elements in the SJBGFMP. This effort should be deferred until the model has been peer reviewed. There are certain model features that need to be tested and potentially updated (e.g. subsurface boundary inflow) prior to using the new model to evaluate the SJBGFMP.

A.4 CITY OF SAN JUAN CAPISTRANO

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
1 As provided	Section 6.1.1	Add somewhere in article 6.1.1 preferably 6.1.1.1 to have an aggressive arundo removal program since arundo absorbs a tremendous amount of water that otherwise would replenish the basin.	Thank you. The text has been modified.
2 As provided		Add as a plan to study and then implement a plan for retention of water in the Oso/Creek/Trabuco Creek area of the basin.	Thank you. The text has been modified. See the new section 6.2.
3 As provided		Additional monitoring along Oso and Trabuco Creeks to determine more accurately the amount of water from run-off occurring all year round.	It is anticipated that surface discharge and water quality data at the boundaries of the basin will be available from the monitoring conducted for the SOCWA SNMP. A footnote has been added to Section 8.2.1.2 to indicate this.
4 As provided	Section 3.5, page 3-17	Article 3.5 on Page 3-17 states that the use of slant wells to extract sea water greatly reduces the cost of pre-filtration. I have not seen a comparison cost ad I believe that assumes that the manganese and iron levels will levels will eventually be reduced. I have seen no proof of that occurring.	Comment noted. The statement in the report is based on information provided by MWDOC.
5	Section 3.5, page 3-17	Article 3.5 on Page 3-17 states that SOCOD could be operating by 2016. That is not realistic.	Thank you. The text has been modified replacing 2016 with 2019.

A.5 MUNICIPAL WATER DISTRICT OF ORANGE COUNTY[3]

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
1 Para-phrased		The yield was determined through the use of a watershed model that calculated daily streamflow and recharge based on a production well water level constraints that ceased production when the pumping water levels fell below 2-feet above the top of the screen, this constraint should be noted in the GWM&F Plan.	Thank you the report has been revised.

[3] Paraphrased comments can be viewed as submitted within this appendix following the Appendix A tables.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
2 Para-phrased		The model runs constrain production only on pumping water levels and not on seawater intrusion, The yield generated by the model includes the 300-400 afy of seawater intrusion. Basin production should be reduced by 300 to 400 afy to maintain a net positive outflow to the ocean to prevent seawater intrusion.	Current groundwater production is below the target production that was analyzed with the new MWDOC model. It is also presumptuous to assume, based on the MWDOC model that seawater intrusion is occurring at the rate predicted by the model. The model is approximate and based on a short calibration period. At this point in time the model results are "suggestive" and not "deterministic". Monitoring is required to make a finding of seawater intrusion. The SJBA is conducting groundwater monitoring to detect seawater intrusion and will coordinate and manage future production to ensure it doesn't occur, consistent with the SJBA and SCWD permits.
3 Para-phrased		The GWM&F Plan should note the yield for both dry and average periods.	The characterization of "dry" and "average" periods as discussed with the MWDOC model are arbitrary and not actionable in the management of the basin. The adaptive management plan coupled with monitoring provides SJBA the tools needed to manage production and control seawater intrusion.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
4 Para-phrased		Ranney Wells were estimated to increase the basin yield by 800 afy. We are not sure how that estimate was derived. We believe it could be from mining storage.	The Ranney wells were evaluated as a tool to enable groundwater production at storage levels enabling the generation of yield from water that would otherwise remain in storage during low storage periods. This storage would be refilled during wet years.
5 Para-phrased		The Doheny Desal Project will need to mitigate its impact on the basin in one of three ways: 1) Provide in-lieu of pumping make-up water from the desal project yield to the impacted users 2) Install a coastal injection barrier using recycled water to reduce or eliminate the draw on the basin and to maintain higher water levels in the coastal area 3) Invest in basin yield enhancement projects	Additional analysis is warranted to determine the impacts to the Basin from potential pumping by the Doheny Desal Project. The identified mitigation alternatives are recognized as potential solutions to impacts.
6 Para-phrased		The GWM&F Plan should extend the decision making process to cover the full extent of the basin past just the groundwater basin and ocean interface.	Comment noted. The current level of planning is in the groundwater basin above the ocean interface. The Authority will continue to cooperate with the Doheny Desal planning process

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
7 Para-phrased		The GWM&F Plan should include the Doheny Ocean Desalination Project in its plan. It should also be noted that the Doheny Desal Project would also provide seawater intrusion control for the benefit of the basin, also that the extraction wells can be converted to injection wells when the Doheney Desal Project is implemented.	There are two sets of alternatives. One includes and the other excludes the Doheny Desal Project (referred to as SOCOD project in the draft and final reports), respectively. It was also stated in the report that the Doheny Desal Project would function as a seawater intrusion barrier. The Authority will continue to cooperate with the Doheny Desal planning process,
8 Para-phrased	Section 7-2	The cost estimate for the extraction barrier desalination project uses the Doheny Desal Project costs. We estimate that a 3 mgd plant would have a higher unit cost of about 10% above a 15mgd plant.	Comment noted.

A.6 SOUTH COAST WATER DISTRICT

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
1 As Provided	Figure 2-1, 2-2	SJBA boundary differs from watershed?	Yes.
2 As Provided	Figure 2-11	Aliso Creek watershed is within SJBA boundary?	No.
3 As Provided	Section 3.4, page 3-14	Why is Aliso Creek permit listed in San Juan Basin water rights Section 3.4? The jurisdiction of the SJBA is the management of the San Juan Creek Basin only. The report appears to imply that there is an extension of management into the service areas of each of the member agencies for the scope of the geographic area of the basin authority members and this is inaccurate. The scope of the SJBA activities is stated in the 1971 Basin Authority Agreement as "management" of the basin and that basin is clearly stated to be the "San Juan Creek Basin" only. Permit 21256 should not be mention in this report. That Permit is held by SCWD and the referenced amount in the first table in Section 3.4 is wrong. The purpose of use is also inaccurate. Further, in the Table on Page 3-14 (all tables should be identified with a Table number), the water rights of the SCWD for the GRF Permit number 21138 has recently revised from 976 to 1300 acre' per year.	Thank you. The text has been revised pursuant to your comment.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
4 As Provided	Section 3.4, page 3-14	Permit 21138 has been amended to 1,300 afy already.	Thank you. The text has been revised pursuant to your comment.
5 As Provided	Page 3-46	Aliso Creek Ocean Outfall within SJBA?	Thank you. The text has been revised pursuant to your comment.
6 As Provided	Section 6.1.1.1, page 5-1	Says it will reduce the rate of seawater intrusion, Is this simply theoretical based on the model or is there observed intrusion? Is there a rate of extraction for which there is no seawater intrusion?	The model is suggestive of seawater intrusion as is historically limited groundwater monitoring data. The present SJBA monitoring program has been recently modified to detect seawater intrusion if present. The adaptive management program being pursued by the SJBA will result in an annual estimate of extraction that will result in no seawater intrusion.
7 As Provided	Section 6.1.1.5, page 6-6	Alts 5a and 5b layout additional storm water recharge of 2,000 to 5,000 afy. How was this estimated?	Your observation is incorrect. The correct increase in storm water recharge is 800 acre-ft/yr.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
8 As Provided	Alternatives 5 and 6	T & L levees are discussed to detain the stream flow. There are some differing opinions on the effectiveness. For Santiago Creek, OCWD enters once a year (and pulls permits) due to the sensitive habitat. That creek bottom is disturbed with heavy equipment and level to spread the water. T & L levees required more maintenance. Raceways along the river are also used. The correct configuration will have to consider the velocity in the creek and the amount of maintenance that will be provided.	We concur. OCWD recharges storm and Santa Ana River baseflow, the latter of which is perennial and often greater than stormwater and therefore their maintenance issues are different. If implemented the SJBA will have to experiment with various channel bottom configurations and operational practices as did OCWD. It may be more efficient to construct and operate rubber dams than the “T” and “L” levees.
9 As Provided	Alternative 6	Rather than basins, it appears to be stream discharge in the San Juan Creek. Are there some issues with this use? NDMA?	The concept is to create temporary basins in the stream bottom and to recharge recycled water in those basins. The basins would be flooded to shallow depths enabling them infiltrate completely prior to a storm event. There are significant environmental issues that would need to be worked out. Providing that the habitat issues can be worked out, the efficacy of the groundwater quality issues will be resolved through a Title 22 Engineering Report process for a GRRP.
10 As Provided	Alternative 6	Recharge appears to be adjacent to proposed extraction and in some cases downstream, this would appear to provide little to no retention time, any estimation?	To be determined in a subsequent investigation.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
11 As Provided	Alternative 6	The reach of the creek identified for recharge is not maintained to a condition that would recharge effectively. Is SJBA going to take over the maintenance of the channel?	To be determined in a subsequent investigation.
12 As Provided	Alternative 6	Water depth at one foot or less will develop biological growth particularly when using tertiary treated water, which will decrease permeability. Is there a plan to address?	To be determined in a subsequent investigation.
13 As Provided	Alternative 6	Will use of the OC flood facilities be possible in storm season?	To be determined in a subsequent investigation.
14 As Provided	Alternative 6	Are there any existing permits in place for maintenance of the channel?	To be determined in a subsequent investigation.
15 As Provided	Alternative 6	It appears that an assumption regarding permeability was made at an overall average of 1 ft/day? Any basis for this number? How long to develop a fouling layer? How often a year would clean be necessary?	It was assumed that the seasonal average infiltration rate was 1 f/d. It would likely be more at the onset of recharge operations and deteriorate during the season. The thought was that the basin would be operated in an “on and off” pattern throughout the recharge season to main infiltration rates in excess of 1 f/d. All this will be resolved in a subsequent investigation and ultimately after the project is implemented.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
16 As Provided	General	What is the difference between Alternative 6 and Alternative 10? There appears to be a large production difference. Although adding SOCOD should be similar to creating a seawater barrier?	The major difference is that the seawater extraction barrier that is included in Alternative 6 is not included in Alternative 10 – and this explains the difference in yield.
17 As Provided	General	There are two sections called "Recommended Alternatives…" then at the end of Chapter 7 there is one recommended alternative. This is a little confusing. Perhaps the sections in Ch 6 should just say "Alternatives…"?	Thank you. The text has been modified.
18 As Provided	General	Shouldn't improving stormwater recharge be the highest priority of the proposed projects?	A new short Section 6.2 is included in the final report and it says: "*Many stakeholders commented that there were no recommendations for diversion of stormwater to off stream recharge facilities included in the SJBGFMP. Early in the investigation the concept of off stream recharge was discussed with the TAC committee and it concluded in those discussions that there were few suitable sites for off stream recharge and for off stream recharge to work there would be a need for significant storage for which it was concluded that there no suitable storage sites. These conclusions should be revisited prior to or during the next SJBGFMP update.*"

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
19 As Provided	Section 7-2	In the yield costs section it states that costs associated with the treatment and conveyance are not included. Aren't those significant (RO, UV?)when considering the recommendation? Can the unit costs be fairly compared with no cost put to the treatment of the recycled water?	To be determined in a subsequent investigation.
20 As Provided	Table 7-5	In the Implementation Difficulty Section, could we break up stormwater and recycled water separately? It seems one may be easier to do than the other.	To be determined in a subsequent investigation.
21 As Provided	Table 7-3c	Is the 13ft ID big enough for directional drilling? How will it be installed? Are dewatering costs included in the unit cost?	Facility sizes and cost were provided by Layne Christiansen.
22 As Provided	Section 8.1.2	Strike "additional" or "extensive".	Thank you. The text has been modified.
23 As Provided		Costs exclude construction?	The costs shown in Table 8-1 do not include construction costs.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
24 As Provided	Section 3.4, page 3-15	Regarding water rights, at footnote 4 a reference is made to a withdrawal of the CSJC Rights Application, information should be obtained from the State Water Board to confirm the status of the application and the City should provide information as to the status as well.	Thank you. The CSJC has stated that it has not "withdrawn" its 1998 application for an appropriative water rights permit for extraction/diversion of 3,325 acre feet per year ("AFY") of water from the San Juan Basin with the State Water Resources Control Board ("SWRCB"). The application remains pending, and CSJC is currently evaluating options for the future disposition of its application.
25 As Provided	Section 3.4, page 3-14;3-16	At footnote 6, reference is made to the Richard Bell memo, however the agreements in question are numerous, were signed by differing parties over a series of years and the overall intent and basis of historical use for each of the members of the basin is hard to readily discern. Accordingly, Richard Bell's observations may not be accurate and/or may be incomplete. There is no foundation indicating that Richard Bell's memo was intended to be relied upon as a conclusive statement of water rights. There is no foundation that Richard Bell has a particular expertise in water rights or that his memo was ever finalized or distributed for comment or discussion. As an example, the March 13, 1998 correspondence to the SWRCB from the SJBA, the CBWD and the CSJC notes that the parties' agreements were intended to reserve 3,325 acre-ft/yr to CSJC as water no longer available for	Comment noted.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
		appropriation. However, later agreements appear to intend that the Desalter Project extractions are representative of and include this reserved water (Project Implementation Agreement of October 15, 2002); therefore, while it is informative to introduce the topic of water rights into the GWBMP the report should indicate that the relationship of the rights and claims to the past or the future use of the basin is somewhat inconclusive. As a further example, the Project Implementation Agreement of October 15, 2002 refers to the initiation of negotiations should diversions of water in addition to the production water from the Desalter Project occur. The text discussion of the parties rights or obligations may not be complete or accurate in light of the whole of the various agreements and the history, and this should be noted if the text at 3-16 if a water rights discussion is to be included at all. Further, the three documents referenced at 3-16 are not the whole of the record on the water rights, the issued permits and their history. SCWD would reserve the right to look further into the accuracy of the references outlined and to agree or disagree with the references.	

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
26 As Provided	Section 3.8.1, page 3-40	Native water supply: Production capacity for the desalter the well capacity or the product water? If it is native water supply it should be revised to 1089 acre feet per year replacing 795. If it is product water revise the number to 900 (?) replacing 795 (note to David, please check this number with Joe Sovella, he is confirming the table in the Tetra Tech GRF Expansion Report dated June 2012 with Steve Dishon on Monday).	Thank you. The text has been modified.
27 As Provided	Section 3.8.1, page 3-40	Please revise the estimated future capacity on the Capo Beach Desalter from 1465 to 1776 acre ' per year. The design and construction of the GRF allows for expansion of the treatment system in two future stages, Stage 1 would go from present production to 1776 acre ' yr of product water. Stage 2 would increase production from 1776 acre ' yr to 2622 acre ' per year. Of course, to achieve such expansion of production there will be an additional raw water source, and the existing facility is capable of growth in the use of groundwater supply from 1300 acre ' of drawn well water to Stage 1 at 2163 acre feet a year and Stage 2 (or ultimate) at 3194 acre ' per year. Please see the Tetra Tech GRF Expansion Report dated June 2012.	Thank you. The text has been modified.
28 As Provided	General	Alternatives do not include analysis on environmental impacts. It's unlikely that CA Dept of Fish and Game and US Fish and Wildlife will allow a live stream discharge during the steelhead migration period.	To be determined in a subsequent investigation.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
29 As Provided	Alternative 3	Expanding the existing diversion permits will be difficult and may result in a determination that the Creek is over-appropriated. This will also require CEQA analysis.	To be determined in a subsequent investigation.
30 As Provided	Alternative 4	How will Ranney well affect surface flows? Surface flows will likely be required by Resource Agencies to meet habitat requirements for arroyo toad and steelhead. There will be impacts to the lagoon that need analysis.	To be determined in a subsequent investigation.
31 As Provided	Alternative 5	Don't need to revise water supply rights permit to recharge storm water.	Comment noted.
32 As Provided	Alternative 6	Extensive effort for permitting and may require field studies to determine travel times, dilution rates, chemical interactions. Will require Basin Plan amendments along with CEQA.	To be determined in a subsequent investigation.
33 As Provided	General	Goals do not include environmental goals such as maintaining and protecting wildlife habitat. A schedule for the alternatives should be supplied. Costs should include CEQA/NEPA, permitting and mitigation.	The goals were established by the SJBA TAC. Table 8-1 includes a schedule and has a preliminary budget of about $1.8 million for CEQA and permitting.
34 As Provided	General	There should be an objective ranking of alternatives based on cost/benefits and considering environmental impacts. The ranking and how it was done should be discussed in detail.	To be determined in a subsequent investigation.

A.7 JOHN PERRY (CAPISTRANO TAXPAYERS ASSOCIATION)[4]

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
1 As Provided	Page 1-1, Section 1.1, first bullet point	Of all the management options presented in this report this option makes the most sense to me. The attached chart from the Urban Water Management Report shows that MWD can support all its current customer needs for water through 2035 with current sources. Why should we spend hundreds of millions on improving the basin yields when a less expensive source of water is available?	There are two reasons: (1) the MWD forecast is based on the hydrology of 1922 to 2004 which is representative of that period and not representative of what is possible. Historical records indicate there are more severe dry-periods than included in this period. The MWD report makes assumptions regarding facilities, droughts and other water supply shortages and disaster recovery all of which may not be true. (2) Diversification of supply and local control may enhance an agency's water supply portfolio to ensure reliability during droughts or other supply shortages and system outages. Local water supplies under the control of the local retail water agency enhance the reliability of the imported supplemental water supplies. And the local supplies often cost more.

[4] Paraphrased comments can be viewed as submitted within this appendix following the Appendix A tables.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
2 As Provided	Section 3.4, page 3-16, first paragraph	The State water permit does not allow the basin to be pumped to below 50% of total storage of to impair any other water user with water rights. If the estimates of water storage are accurate we may now be approaching the 50% level.	One of the key features of the SJBGFMP is an adaptive management element that would limit production by the CSJC, SJBA and SCWD based on groundwater in storage consistent with the requirements of the SJBA and SCWD permits. This was done to ensure that all private pumpers would be able to produce their rights and to manage storage.
3 As Provided	Section 3.5, page 3-17	The SOCOD facility with an output of 16,000 acre feet at a cost of $1050 would be a bargain if the cost estimates are anywhere close. Also, the SODOD will provide a salt water barrier that will protest the basin from seawater intrusion. We should seriously consider this option instead of spending hundreds of millions on basin enhancement.	Comment noted. Also the draft report contained a typo regarding the cost of SOCOD water. The correct estimate of SOCOD unit cost was abstracted from MWDOC planning documents produced in early 2013 that suggest that the unit cost could range between $1,800 and $2,000 per acre-ft in 2019 when the SOCOD project could become operational.
4 As Provided	Section 3.5.1, page 3-18	Is it true that our model of the basin model is unable to predict effects of high levels of pumping?	No.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
5 As Provided	Section 3.5.2, page 3-19	The recharge of the basin depends on rain. If this drought thing is long term, how can we plan on high levels of pumping? Sea water intrusion may occur at any time in dry years.	Given the existing facilities, recharge depends on rain. The SJBGFMP, when implemented, will increase the recharge from rain and recycled water, allow the basin to operate at lower pumping levels during dry periods and protect the basin from seawater intrusion. Your last comment is not accurate as to "may occur at any time in dry years". Dry years do not cause seawater intrusion. Depressed groundwater levels near the coast may cause sea water intrusion if not managed. As of this moment there is no management of groundwater levels near the coast. The SJBGFMP, when implemented will protect the basin from seawater intrusion.
6 As Provided	Page 3-20, Table 3-11	The long term predictions show production totals cause groundwater levels falling below state requirements 90% of the time. Will reduced production be the answer?	No. Aggressive groundwater management as provided for in the SJBGFMP is the answer.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
7 As Provided	Page 3-21, fourth paragraph	The prediction that planned production levels will cause sea water intrusion without extensive and costly measures to recharge and block the sea water? I return to item 1on my comments as the only way to manage the basin without causing the consumer water rates to drastically increase.	Increasing local supplies and improving their reliability may be more costly in the short run than depending on imported water. Water supply costs include reliability and the value placed on reliability by an agency recognizes the being able to continue to use water during droughts, water supply emergencies; and it's the benefit to community in sustaining the local economy during shortages.
8 As Provided	Section 3.8.1.1, Page 3-41, second paragraph	I am surprised that SJC has potable wells that produce almost 1million gallons of drinking water per day without treatment. What can't we drill more wells in this area of the lower Trabuco?	The supply is limited by water quality. If these wells produce water, they have to be blended with other sources lower concentrations of TDS, iron, and manganese. To produce more water would require treatment.
9 As Provided	Section 4.0, page 4-1 last paragraph	The demand for potable water for SJC seems to be overstated. The 2012/13 budget document shows the demand to be 7423 af. Why is the figure of 8400 af used?	The demands reported in Section 4 represent the total water that needs to be produced to meet consumptive demands. In the case of the CSJC and SCWD, there are water losses associated with the groundwater desalination process and thus more water needs to be produced than is consumed. The text and Table 4-1 has been modified to clarify this distinction.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
10 As Provided	Section 5.0, page 5-2, third paragraph	Does goal 5 mean that only SCWD and CSJC will be the only water departments to pay for all of the proposed basin management alternatives? This will mean the SJC taxpayers will foot the majority of the costs?	No. SMWD and MNWD are interested in the implementation of the SJBGFMP and obtaining some of the new supplies consistent with their participation in the SJBGFMP. The Plan does not attempt to allocate water or costs among the Authority Member Agencies at this time, but rather identifies the amount of estimated supply.
11 As Provided	Page 6-1, Alternative 2	Alternate 2 proposes to create a seawater injection barrier using MWD water as a source. Won't the cost of production increase if we buy water to inject it into the basin then pump it out in a contaminated condition and have to clean it up before we can use it? It seems like the cost per acre foot would nearly double? I go back to my comments on number 1.	Yes and yes. It's not effective and is not being pursued in the SJBGFMP As to your comment No. 1 please see the response to that comment.
12 As Provided	Alternative 3	Alternate 3 would be a seawater extraction barrier sort of like the SODOC but using new facilities at SCWD to process seawater. This alternate is extremely costly and drive the water rates for SCWD and CSJC through the roof.	The SJBGFMP as proposed herein will not be implemented by the CSJC and SCWD only – if implemented the increased yield will be allocated among the participating agencies, which may include the SMWD and MNWD. At this time, the Plan does not attempt to allocate water or costs.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
13 As Provided	Alternative 4	Alternate 4 would do everything above in Alternates 2-3 but drill one or two Ranney wells to take water from the bottom of the basin that turbine pumps can't reach. The wells are extremely expensive to drill and to maintain. Again, all of this would be paid by CSJC and SCWD?	The SJBGFMP as proposed does not attempt to allocate water or costs. If implemented, CSJC, SCWD, SMWD, and MNWD may participate and share both the benefits and the costs.
14 As Provided	Alternative 5	Alternate 5 would add in stream recharge using storm water. This is a relatively inexpensive approach but is full of environmental concerns to regulators. Is it doable?	To be determined in a subsequent investigation.
15 As Provided	Alternative 6	Alternative 6 is the TEC committee recommended alternative. This do everything approach and is the most expensive. I don't know how the TEC committee can recommend this alternative when they have no idea of the total cost. Somehow we must get the "water empire" folks to recognize that it is the consumer water rates that pay the bills. Under the plan only the CSJC and SCWD would pay all of the construction and annual costs because they are the only agencies to benefit from the basin improvements. If the basin was the only water source available we would be forced to do most of the things they have recommended. But MWD water is available at significantly lower cost than any of the various combinations of alternatives.	Additional work needs to be done to determine the yield and improve the cost estimates. The cost of implementing the SJBGFMP cannot be directly compared to MWD water as their reliabilities are different. The SJBGFMP will produce more reliable water. See response to your comment No. 1. The SJBGFMP as proposed herein does not attempt to allocate water or costs. If implemented the increased yield benefits and costs will be allocated among the participating agencies, which may include the SMWD and MNWD.

A.8 RANCHO MISSION VIEJO[5]

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
1 As Provided	Section 3.3	Report Approach: Please confirm the boundary of the Middle and Lower Basins. In the event that the upstream boundary is upstream of Ortega Highway, the study should address the RMV Mutual Water Company and address the riparian water rights. Section 3.3 indicates that the Upper Basin is not a part of the study and should be clarified that it is because it operates independent from the Lower and Middle Basin.	The intent of the report is to address the water resources management downstream of the RMV and its new mutual water company.
2 As Provided	General	Ortega/Trampas Lake Reservoir: While the study reinforces a strategy for recharge of the groundwater, it should recognize ongoing efforts to implement a potential 5,000 acft recycled/non-potable water facility. Also, this project has received support from the County Board of Supervisors for contributing storm runoff water as well as recycled water from the SMWD CWRP. This project would be the largest storage facility in the region of this type and should maintain a high priority for implementation.	This project was discussed during the SJBGFMP development was considered to more of recycled or non-potable management tool than a SJBGFMP element. This decision was made early in the SJBGFMP update process. It will be considered again during the next SJBGFMP update.

[5] Paraphrased comments can be viewed as submitted within this appendix following the Appendix A tables.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
3 As Provided	Figure 2-1 through 2-4 and 3-45 through 3-47	The San Juan Basin Authority boundary appears to follow the cumulative external boundaries of the San Juan Basin Authority (SJBA) agency member. In some cases the boundary exceeds the boundary of the San Juan Watershed. In cases where this occurs, please clarify if there be some delineation between the boundary corresponding to a service area of a SJBA member and the actual boundary of SJBA.	The text has been modified as followed: "*Many of the maps contained in this planning document refer to the SJBA service area as the union of the SJBA member agencies service area. For clarity, the SJBGFMP contains management activities for surface and ground waters within the San Juan Creek watershed exclusively in the lower part of the watershed. The SJBGFMP management activities provide direct benefits to the SJBA member agencies. The service area boundaries of the SJBA member agencies extend beyond the boundaries of the watershed. This means that while the management activities of SJBGFMP occur within the San Juan Creek watershed (and exclusively in the lower part of the watershed), that the direct benefits of the management program can reach beyond the watershed, principally the service areas of the SJBA member agencies and the State.* *The Rancho Mission Viejo (RMV) is a large land owner and riparian water user located in the San Juan Creek watershed whose lands and water use are upstream and not included in the SJBGFMP except through the recognition of the RMV upstream water uses. The management activities included in the SJBGFMP occur completely downstream of the RMV and they do not interfere with the water rights*

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
			and management activities of the RMV." Also the first paragraph in the new text is included as a footnote to text references of the figures in Section 3 where the SJBA boundary is shown.
4 As Provided	Figure 3-1:	Clarify the Lower and Middle Basin study area boundary on this or an appropriate exhibit. Figure 3-14 and 6-1 appears to reference a portion of the boundary however it is not clear.	The subbasin delineation for the Lower, Middle and Upper Basins originated with the DWR in its Bulletin 104-7. This delineation was subsequently adapted by the SJBA in its 1994 SJBGFMP. We were aware of the bedrock elevation at the Ortega Highway bridge and located the "active storage management area" for the 2013 SJBGFMP update downstream of the Ortega Highway Bridge. We are using the DWR basin designations as tools to describe water levels and water quality but not as the active management area of the SJBGFMP. The text was updated in to reflect this.
5 As Provided	Figure 3-3	The Laguna Beach Station is used to summarize Annual Precipitation and Cumulative Departure from Mean. It seems that there would be better stations to represent runoff tributary to the San Juan Creek, either the mountainous or coastal area.	The Laguna Beach station has a relatively long record and was used to characterize wet and dry periods. From Table 3-1 it can be seen that the period of record is the longest of all active precipitation stations in the area. Its elevation and location make it a logical choice for this purpose. It was not used to represent runoff in the watershed other than to indicate which year or period of years would likely have produce high or low runoff.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
6 As Provided	Figure 3-15:	The determination of the boundary for the Middle Basin appears to be upstream of the crossing at Ortega Highway. However, prior construction information for the bridges at Ortega Highway and Antonio Parkway indicate that bedrock is 10' and 75' (+/-)below the thalweg of the Creek. Please confirm the boundary location. In the event that the boundary is upstream of Ortega Highway, the study should address the RMV Mutual Water Company and address the riparian water rights.	See response to RMV comment number 4.
7 As Provided	Figure 3-27	Address the interdependence of the Upper Basin since this is designated in this exhibit.	See response to RMV comment number 8.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
8 As Provided	Section 1.1	Clarify the intent of the study boundary. In the event that the boundary is upstream of Ortega Highway, the study should address the RMV Mutual Water Company (MWC) and address the riparian water rights.	Thank you. The text was modified as described in response to comment No. 6 and Section 1.1 contains a new short paragraph that reads: "*The investigation considered all the water resources of the San Juan Creek watershed but limited the application of management activities to the surface and ground waters of the lower part of the watershed between the Pacific Ocean at the most downstream end of the watershed to the Ortega Highway bridge on San Juan Creek and to near the confluence of the Arroyo Trabuco and Oso Creeks on the Arroyo Trabuco. The investigation area is sometimes referred to as the active management area or the active storage area later in this document. This investigation area was developed in Task 4 and was approved by the SJBA TAC during the 2013 SJBGFMP development process.*"
9 As Provided	Section 2.1.2	The report references 4 water districts, yet there appears to be an area not designated under a water district. Clarify if this is for another water district or if it is within the sphere of influence of such.	Thank you. The text was modified with the following added to the last paragraph of this section: *"The Trabuco Canyon Water District overlies parts of the Arroyo Trabuco and Bell Canyon watersheds north of the SMWD. TCWD is not a member of the SJBA and like the RMV their groundwater and surface water management activities were considered in the development of the SJBGFMP."*

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
10 As Provided	Section 2.3.1	The report indicates that the Ranch Plan has not yet been developed, however P A-1 has been graded with lots currently for sale. Also, clarify the boundary area and the relationship with area outside of the San Juan Watershed as it seems the study should not include areas outside of the watershed.	Thank you. The text regarding the Ranch Plan in this section was deleted
11 As Provided	Section 2.3.2	Clarify the acreages in the Ranch Plan. The Ranch Plan includes 22,282 acres yet 29,507 are referenced. Also, lands pending developed are removed from the Williamson Act contract (the report indicates them as "not renewed" which is incorrect administration of the process).	Thank you. The text was updated.
12 As Provided	Section 2.6.1.8	The report indicates that Aliso Creek watershed is included in the analysis since this is tributary to San Juan Creek. However, San Mateo watershed, not tributary to San Juan Creek, appears to be included in the analysis for which there is no explanation.	Thank you. The text was updated.
13 As Provided	Section 3.3.5	Clarify that the aquifer is for the Middle and Lower Basins.	Thank you. The text was updated.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
14 As Provided	Section 3.4	Similar to comments above, confirm that the boundary of the analysis does not include the RMV MWC; otherwise the numeric information in this section will need to be adjusted appropriately. Also, clarify the eligible diversion amount of 3,325 acft. (in the table) is that which the City of San Juan Capistrano has as a part of the Desalter Project; also confirm the amounts that the City has been including in current operations.	Thank you. The text was updated to include the following paragraph at the end of the section: *"The active management area of the SJBGFMP excludes the RMV whose lands and water use are upstream and not included in the SJBGFMP except through the recognition of the RMV upstream water uses and water rights. The management activities included in the SJBGFMP occur completely downstream of the RMV and they do not interfere with the water rights and management activities of the RMV."*
15 As Provided	Section 3.5.2 and 3.6.2	The study indicates that the firm yield of the basin appears to be less than 7,000 acft./yr., yet 13,508 acft./yr. is permitted. Clarify the impact of this variance.	The permitted diversions can sum to be larger than the firm yield. When there is not enough water to meet all the permitted diversions then diversions are reduced to the available supply.
16 As Provided	Section 3.7.1.2	Rancho Mission Viejo (Well 7) is included in the study yet this well is upstream of the Middle Basin. Please clarify why this is included in the study if it is outside the boundary.	The chemistry of RMV Well 7 was included to characterize the water quality of groundwater that may flow into the active management area.
17 As Provided	Section 3.8 and 4	Confirm the Water Demand and Supply volumes for SMWD as these appear to be higher than current operations.	The water demands in Section 4 are based on planning data provided by the SMWD to MWDOC for the 2010 UWMP. The water demands in Section 3.8 were also provided by the SMWD.

Comment Number	Page Reference in April 2013 DRAFT	Comment	Response
18 As Provided	Section 3.9.2.6	The report indicates that 5.0 mgd is sent to advanced water treatment. However, SMWD recently increased the capacity at the plant to 5.5 or 5.75 mgd. Please clarify.	SMWD is in the process of expanding the capability; the current permit is for 5.0 MGD through the Regional Board.
19 As Provided	Section 6:	Provide a summary table of each alternatives with advantages, disadvantages, capacity, costs, and time for implementation. Provide clarification for where there is overlap or where one alternative supersedes another.	This is covered in Section 7 of the report.

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MICHAEL W. BURNETT

September 6, 2013

Mr. Larry McKenney
Board Chair
San Juan Basin Authority
C/O Santa Margarita Water District
P.O. Box 7005
Mission Viejo, CA 92690-7005

RE: Comments on Draft AB 3030 Groundwater Management Plan for the San Juan Creek Groundwater Basin

Dear Mr. McKenney:

This letter provides comments from San Juan Hills Golf Club LP ("San Juan Golf") on the draft Groundwater Management Plan ("Draft Plan") for the San Juan Creek Groundwater Basin ("Basin")[1] circulated for public comment by the San Juan Basin Authority ("Basin Authority") on July 17, 2013.

As you may be aware, San Juan Golf owns and operates the San Juan Hills Golf Course and Country Club ("Golf Course"). The Golf Course is located adjacent to San Juan Creek in the City of San Juan Capistrano. Incident to its ownership of the Golf Course, San Juan Golf holds riparian water rights to the surface and underflow of San Juan Creek, and the associated San Juan Groundwater Basin. San Juan Golf additionally holds appropriative rights permit number 21142 allowing diversion and use water from San Juan Creek and its underlying groundwater basin for irrigation uses on the Golf Course. San Juan Golf therefore has a substantial interest in the management and use of the Basin.

The Draft Plan includes estimates of the sustainable yield of the Basin, and a summary of the existing and potential future groundwater extraction projects that will

[1] The California State Water Resources Control Board has investigated the San Juan Basin and determined that it is underflow of San Juan Creek and the other creeks that converge with San Juan Creek downstream of the San Juan Hills Golf Club. California law gives the State Board jurisdiction over surface water, and groundwater that is part of the flow of a surface water body.

rely on the Basin as a water supply. It also includes a model of the Basin and projections of available water supplies in the Basin produced by the Metropolitan Water District of Southern California (the "Basin Model"), and a description of several management options for the Basin. San Juan Golf has significant concerns about aspects of the Draft Plan, including the potential that implementation of any of the proposed alternatives will result in long term overdraft conditions and/or seawater intrusion that will degrade the quality of water presently available in the Basin.

Basin Authority Staff have taken the time to meet with San Juan Golf representatives and discuss some of San Juan Golf's concerns. San Juan Golf is hopeful that its concerns regarding the Draft Plan and more importantly the long term management of the Basin can be addressed through coordinated action with the Basin Authority. Nonetheless, San Juan Golf cannot support any Basin-wide management plan until the Basin Authority makes firm commitments to San Juan Golf that its activities in the Basin will not hinder San Juan Golf's long term access to water of a quality sufficient to support the Golf Course.

Lastly, it is unclear from the notice provided on the Basin Authority's website whether the meeting planned for September 10, 2013 is the hearing anticipated by Water Code section 10753.5. If so, please consider these comments San Juan Golf's official protest to adoption of the Draft Plan in its current form. Our comments follow.

COMMENTS ON DRAFT PLAN

1. THE DRAFT PLAN UNDERSTATES THE VOLUME AND NATURE OF SAN JUAN GOLF'S WATER RIGHTS.

The Golf Course property is riparian to both San Juan Creek and the underlying groundwater basin. As a result of this location (*Lux v. Haggin* (1886) 69 Cal. 255, 390-391.), and separate agreements with the Basin Authority, San Juan Golf holds a riparian water right to take up to 550 acre feet of water from the Basin annually.

Use of water pursuant to a riparian right is limited to the riparian property, but allows the owner to use as much water as necessary for reasonable and beneficial use of their property. The right to take water is not dependent on how much the owner, or any other riparian has used in the past, or when that use began. (*See Peabody v. City of Vallejo* (1935) 2 Cal.2d 351; *United States v. State Water Resources Control Board* (1986) 182 Cal.App.3d 82, 104.) Additionally, all riparian owners have an equal, or correlative, right to use the water, and a new or expanded riparian use is entitled to share equally with all other riparian users, so long as the use is reasonable and beneficial. (*In re Waters of Long Valley Creek Stream System* (1979) 25 Cal. 3d 339, 359.)

San Juan Golf's riparian water rights are superior to and take priority over the rights of all appropriative users in the Basin including the Basin Authority and the City of San Juan Capistrano. (*City of Barstow v. Mojave Water Agency* (2000) 23 Cal.4th 1224, 1241; *Allen v. California Water & Tel. Co.* (1946) 29 Cal.2d 466, 481.)

In addition to riparian rights, San Juan Golf holds appropriative rights to the Basin. On August 19, 1992, San Juan Golf's predecessor in interest in the Golf Course filed an application to appropriate water from the Basin. The State Board granted the Golf Course's application for 450 acre feet per year in 2003. San Juan Golf's application to appropriate was filed immediately after and in response to the Basin Authority's application to appropriate water from the Basin.

In 1997, San Juan Golf's predecessor in interest in the Golf Course and the Basin Authority entered in a settlement agreement regarding water rights in the Basin. The 1997 settlement agreement removed mutual opposition to the applications to appropriate, and included the following notable terms:

- The Golf Course can continue to take up to 550 acre feet of year of water from the Basin under any water right (riparian or appropriative), and that water will be used for "irrigation and other proper riparian purposes only."
- The Golf Course will request that the State Board include the riparian use limitation in the Golf Course's appropriative rights permit.
- The Basin Authority will not oppose the Golf Course's application to appropriate water, and will not "interfere with" the Golf Course's take of 550 acre feet per year from the Basin.
- The Basin Authority will not take water from the Basin in a manner that causes significant injury to the quality of water necessary for use by the Golf Course or any other use recognized for the San Juan Creek watershed in the Water Quality Control Plan for the San Diego Basin.

Thus San Juan Golf retains a 550 acre foot per year riparian water right and the Basin Authority cannot operate or otherwise manage the Basin in a manner that causes degradation to the quality of water available to the Golf Course. This full right is not noted in the Draft Plan. Instead, the Draft Plan uses the 450 acre-foot figure from San Juan Golf's appropriative rights permit. (Draft Plan pp. 3-15.)

The Draft Plan needs to be revised to reflect the Golf Course's full water right. Moreover, as explained more fully below, the Draft Plan needs to include alternatives that will ensure that the Basin Authority complies with its obligations under the 1997 settlement agreement and applicable California law.

2. THE DRAFT PLAN OVERSTATES THE CITY OF SAN JUAN CAPISTRANO'S WATER RIGHTS.

The City of San Juan Capistrano ("City") currently operates a groundwater recovery facility in the Basin under contract with the Basin Authority. Notably, the City does not hold a valid water rights permit from the State Water Resources Control Board. Nor does it hold other recognized water rights to the Basin.

The City filed an application to appropriate water from the Basin in April, 1998, approximately six years after the Basin Authority and the Golf Course. The City's application is still pending, and the State Board has made no indication that it will issue a permit any time soon. Moreover, during the permit application process, the City opposed the Golf Course's application on the grounds that the City holds pueblo water rights to the Basin.

The State Board rejected the City's argument on the grounds that there is no historical evidence that San Juan Capistrano was a pueblo, and the Mission San Juan Capistrano is located upstream on Oso Creek, a different tributary to the San Juan Creek system. (*See* Feb 17, 1993, Memorandum from Edward Anton, Chief Division of Water Rights, to Susan Trager regarding protests to Applications 30123 (San Juan Basin Authority) and 30171 (Torson Pacific Investments) filed by the Capistrano Valley Water District claiming interference with pueblo water rights; and March 23, 1995 from Marci Williams to Barbara Katz regarding same; *see also* State Water Resources Control Board Order No. WR-95-7 [citing *id.*].) As a result, the City lacks an independent right to draw water from the Basin unless it can prove the water it is drawing is water that it originally imported into the Basin.[2]

Despite the fact that the City lacks its own water rights permit, it operates a groundwater recovery project under contract with the Basin Authority. The Basin Authority reports the City's water take as part of its own when filing reports with the State Board.

Leasing and sharing water production facilities where more than one entity needs access to the same supply is not an uncommon practice among water purveyors. It saves resources and can protect the sustainability of a given supply. However, it is imperative that the final quantification of water rights reflect the sharing of facilities, and the original water rights held by participating agencies. The Draft Plan does not do that and appears to over allocate water rights to the City. Water rights that the City does not hold.

Pages 3-14 through 3-16 of the Draft Plan include totals of quantified water rights in the Basin. The Draft Plan allocates 3,325 acre-feet per year to the City. Page 3-16 includes a statement that the City's take is pursuant to a 1995 agreement with the Basin Authority under which the Basin Authority "recognized and agreed that it would not challenge the City extractions up to 3,325 acre-ft/yr." An agreement not to challenge is not equivalent to a right to take. Moreover, the Draft Plan appears to account for the City's acre-foot take as a right in addition to that allowed for the Basin Authority under its permits from the State Water Resources Control Board. (Draft Plan, pp. 3-15, 3-16.)

The Draft Plan needs to be revised to clearly state that the 3,325 acre-feet that the City draws comes from the Basin Authority's allocation under State Water Resources Control Board Water Rights Permit No 021074 (application No 30123). Any

[2] Pursuant to the California Supreme Court's decisions in *City of Los Angeles v. Glendale* (1943) 23 Cal.2d 68 and *City of Los Angeles v San Fernando* (1975) 14 Cal. 3d 199, a water purveyor has a prior and preferential right to reclaim all of the water it imports into a watershed or groundwater basin, including water that it serves to customers that then infiltrates into an underlying groundwater basin.

calculations done to support the Draft Plan or the Basin Model that rely on the City's allocation as an additional take must also be revised to reflect the same limitation.

3. THE DRAFT PLAN DOES NOT ACCOUNT FOR ALL OF THE EXTRACTORS IN THE BASIN.

The Draft Plan does not appear to include pumping by numerous other operators in the Basin including riparian rights holders such as the Rancho Mission Viejo. Leaving these operators out of the analysis in the Draft Plan leaves a huge data-gap that could severely hinder the Draft Plan's use as a planning tool or informational document.

The Legislature passed AB 3030 (California Water Code sections 10750-10756) in 1992 to "ensure the safe production, quality, and proper storage of groundwater in this state." (Cal Water Code § 10750(b).) The primary purpose of a groundwater management plan adopted pursuant to AB 3030 is to develop monitoring and management objectives to ensure the sustainable use of the subject basin. (Cal Water Code §§ 10750(a); 10752(e); 10753.7(a)(1); 10753.8.) Specifically, a groundwater management plan adopted pursuant to AB 3030 must include components to manage the following:

- groundwater levels,
- groundwater quality,
- land surface subsidence, and
- changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater pumping in the basin.

(Cal Water Code § 10753.7(a)(1).)

The plan should also include components relating to seawater intrusion and overdraft mitigation among other things. (Cal Water Code § 10753.8.)

Without accurate information about the characteristics of a groundwater basin, including total extractions and the number and locations of users, a groundwater management plan cannot adequately meet the above listed requirements. In the case of the Draft Plan, in order to accurately assess the sustainable yield, and the amount of pumping that can take place moving forward, an accurate accounting of all of the extractions from the Basin is required. This information is necessary before the Basin Authority can formulate appropriate management practices for the Basin, and without it, the Draft Plan is useless as a planning or management tool.

4. THE DRAFT PLAN RELIES ON A "FIRM YIELD" FIGURE THAT IS NOT THE INDUSTRY STANDARD FOR DETERMINING THE AVAILABILITY OF SUPPLIES IN A GROUNDWATER BASIN.

The Draft Plan deviates from the industry standard use of "safe yield" as the determining factor for management practices in the Basin. (*See* Draft Plan pp. 3-21, 3-22.) The industry standard for expressing the volume of water that can be safely removed from an aquifer is the "safe yield." The Draft Plan disavows safe yield as an appropriate measure for the Basin and instead uses "firm yield." (*Id.*) Perhaps more concerning is the Draft Plan's statement that the use of the "firm yield" figure is an effort to avoid the storage requirements traditionally associated with safe yield. (Draft Plan pp. 3-21 ["the concept of safe yield does not strictly apply to the San Juan Basin as the storage in the groundwater basin is small relative to recharge and production"].)

Safe yield is generally defined as the maximum quantity of water that can be withdrawn from a groundwater basin over a long period of time without resulting in adverse conditions. Safe yield is typically determined by technical professionals based upon a defined hydrology, water levels or groundwater models. (Metropolitan Water District of Southern California, Groundwater Assessment Study, Report Number 1308 (Sep., 2007) III-3.)

Use of safe yield as a measure of aquifer sustainability is the industry standard. It is used by the California Department of Water Resources and the Metropolitan Water District of Southern California ("MET") to describe groundwater basins throughout the State. MET describes safe yield as follows:

> The determination of safe yield may include quantitative measures to evaluate when adverse conditions occur. . . . This is particularly important in basins in which seawater intrusion is a factor. For example, the Ventura County Basins operate under a safe yield that is based upon maintaining water levels to prevent seawater intrusion or migration of contaminants among aquifers. This safe yield is significantly lower than the safe yield determined based on a hydrologic water balance alone.
>
> (Metropolitan Water District of Southern California, Groundwater Assessment Study, Report Number 1308 (Sep., 2007) III-3.)

In contrast, the Draft Plan is relying on the "firm yield" term to emphasize the higher rates of recharge that the Basin periodically experiences. The risk of relying on this figure rather than traditional notions of safe yield is that it could result in overdraft conditions when expected recharge does not occur. For businesses dependent on groundwater for continued operations this could be highly detrimental.

Use of the firm yield figure therefore calls into question the "sustainable" nature of the Draft Plan and its compliance with the requirements of AB 3030. AB 3030's stated goal is to "ensure the safe production, quality, and proper storage of groundwater in this state." (Cal Water Code § 10750(b).) Use of the firm yield figure could violate that requirement. For that reason, the Draft Plan should be revised to assess and rely on the safe yield of the Basin.

5. **THE BASIN IS OVER-SUBSCRIBED.**

The Draft Plan and the Basin Model demonstrate that there is not enough water on a year-to-year basis in the Basin to support all of the existing and proposed uses described in the Draft Plan. (Draft Plan pp. 3-22, 3-23.)

The Basin Model indicates that the firm yield of the Basin is potentially as low as 7,000 to 11,000 acre-feet per year. (Draft Plan pp. 3-23.) Pumping the Basin at this level would "require intensive monitoring and facilities to protect the basin from seawater intrusion." (*Id.*) This figure is substantially lower than previous estimations of the Basin's safe yield. For example, in 1998, Boyle Engineering estimated that the safe yield of the Basin was 14,100 acre feet per year. (Availability of Unappropriated Water San Juan Creek Basin, Boyle Engineering, 1998.)

The lower than estimated firm yield is corroborated by a major drawdown in water levels in the Basin that has occurred since 2007. According to the Draft Plan and the Basin Model, drawdown has increased since 2010, and appears to coincide with increased production at the City of San Juan Capistrano's groundwater recovery facility. To protect the health of the Basin, the Basin Authority will need to consider a change to operations that potentially includes a reduction in the volume of water taken under its permit – including water taken by the City.

The Basin Authority's permit allows the Basin Authority to initially draw a maximum of 8,026 acre feet per year. This amount can be increased by an additional 2,676 acre feet per year upon showing by the Basin Authority that there is additional unappropriated water available for a total of 10,702 acre feet per year. (California State Water Resources Control Board, Water Rights Permit No. 21074, Condition 5.) Given the projections in the Draft Plan it appears unlikely that the Basin Authority will ever be able to exercise the full allocation allowed under its permit. Indeed, the State Board may need to revise the Basin Authority's permit as well as others to reflect the lower amount of water available.

As stated above, the purpose of AB 3030 is to develop monitoring and management objectives to ensure the sustainable use of the subject basin. (Cal Water Code §§ 10750(a); 10752(e); 10753.7(a)(1); 10753.8.) Where a Basin is already oversubscribed, the management objectives should reflect the need to maintain the long term sustainable use of the Basin and management practices that achieve that goal. The Draft Plan does not accomplish that goal. It needs to be revised to include specific steps the Basin Authority and other major groundwater users will take to preserve the viability of the resource for all other lawful users.

6. **THE BASIN AUTHORITY AND THE CITY NEED TO CONSIDER CHANGING OPERATIONS AT THE CITY'S GROUNDWATER RECOVERY FACILITY TO PREVENT IMPACTS TO OTHER PUMPERS IN THE BASIN.**

The Draft Plan includes a range of alternatives that the Basin Authority can pursue to manage the Basin. Alternative 1, (Draft Plan, pp. 6-1) purports to preserve the 2013 status quo. No other reduced pumping alternative is presented in the Draft Plan.

As described above (and in the Draft Plan) major drawdown in water levels in the Basin that has occurred since 2007, and has increased since 2010. The increase in drawdown appears to coincide with increased production at the City of San Juan Capistrano's groundwater recovery facility. To alleviate pressure on other existing pumpers such as San Juan Golf, the Basin Authority needs to consider a reduced production alternative operation plan that returns the Basin to the pre-City groundwater recovery project status quo.

Because the City lacks its own water rights permit, it operates the groundwater recovery project under contract with the Basin Authority. The Basin Authority therefore has direct control over the volume of water produced by the facility and the ability to reduce extraction activity. These measures should at a minimum be included in the Draft Plan as an alternative.

7. **ADOPTING THE DRAFT PLAN IS A DISCRETIONARY ACTION REQUIRING COMPLIANCE WITH THE CALIFORNIA ENVIRONMENTAL QUALITY ACT.**

Because the Basin is already oversubscribed and the Draft Plan includes no alternatives that would reduce current pumping rates, proceeding with any of the management goals described in the Draft Plan will result in significant draw-down of the Basin. These impacts will need to be studied in an associated environmental document produced to support the Draft Plan in compliance with the California Environmental Quality Act ("CEQA").

CEQA applies to "discretionary projects proposed to be carried out or approved by public agencies." (Cal Pub Res Code §21080.) Adoption of an AB 3030 groundwater management plan is a discretionary decision of the Basin Authority. We are unaware of any exemptions from CEQA that would excuse the Basin Authority from conducting environmental review of the environmental impacts that will be caused by implementation of the Draft Plan. The Draft Plan is more than a mere planning study. It includes management plans that will direct future activities in the Basin. As such its adoption will tie the Basin Authority to a course of action that could have negative impacts on the environment.

While it is true that the impacts associated with some of the projects described in the Draft Plan were studied in past CEQA documents, the Basin Model represents new information not available at the time of those previous studies. As a result, the previous CEQA determinations are not relevant (Cal Pub Res Code § 21166) and a new review that takes into account the Basin Model is required.

Similarly, the Draft Plan discusses the proposed Dana Point desalination project that may be constructed in the future. The Draft Plan indicates that the proposed desalination project could cause significant seawater intrusion into the Basin and that this will need to be managed as part of the project. (Draft Plan pp. 3-19.) The desalination project will have other environmental impacts (and impacts to the Basin) that need to be considered and mitigated before it moves forward. The Basin Authority should include reference to the future studies that will be required for this project in the Draft Plan.

CONCLUSION

The Draft Plan includes a comprehensive analysis of water supplies in the San Juan Basin. The Draft Plan provides the Basin Authority's options for managing groundwater supplies in the Basin, and a description of efforts for coordinating (to the extent possible) the actions of its member agencies. The written comments above represent our comments after an initial review of the Draft Plan. We appreciate the Basin Authority's attention to our comments and efforts to meet with San Juan Golf representatives to hear our concerns. We look forward to working with Basin Authority staff to preserve the long term viability of the Basin.

Thank you for your attention to this matter. If you have any questions regarding the comments in this letter or San Juan Golf's position on the Draft Plan please do not hesitate to contact me.

Very truly yours,

THE BURNETT FIRM

Michael W. Burnett

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September 10, 2013

Mr. Daniel R. Ferons, Administrator
San Juan Basin Authority
26111 Antonio Parkway
Rancho Santa Margarita, CA 92688

Subject: Comments on Draft Groundwater Management and Facilities Plan

Dear ~~Dan~~ Da,

We appreciate the opportunity to provide comments on the subject draft Groundwater Management and Facilities Plan for the San Juan Basin. It is our opinion that the plan provides an excellent overall framework for managing the small alluvial basin associated with San Juan Creek, augmenting its supply and providing protection from potential seawater intrusion under higher production levels. We will be providing technical comments in a separate memorandum in the next few days.

Over the course of the development of the plan, through the work of the Doheny Ocean Desalination Project, a refined regional watershed and groundwater model was developed to help in understanding the basin yield under dry, average and wet periods without the Doheny Desal Project and then by imposing the project on the basin to determine its potential direct drawdown impacts and draw of brackish water from the basin.

Over the nearly three years of effort, we very much appreciate the assistance provided by San Juan Basin Authority and its consultant, Wildermuth Environmental, Inc. This collaborative effort has led to a robust modeling tool that can used in evaluation of alternative management and facility plans to evaluate drawdowns at individual wells, estimate basin yields, and determine potential seawater intrusion effects and controls.

With the recent award of funding through the MET Foundational Action Program, additional groundwater modeling and study will be undertaken by SJBA and the Doheny Desal Project over the next year or two. MWDOC looks forward to continued coordination and collaboration with SJBA and the Doheny Desal Project participants in the subsequent investigations. Areas of further coordination include environmental baseline studies, offshore geotechnical investigations, and groundwater level and water quality sampling from our two monitoring wells located in Doheny State Beach.

It is understood that the Doheny Desal Project will need to mitigate its impact on basin and further work is necessary to evaluate cost-effective approaches. The SJBA plan should also recognize that the basin extends out under the ocean and the Doheny Desal Project should be considered as a component of its recommended plan.

If you should have any questions, please do not hesitate to contact the undersigned.

Sincerely,

Richard B. Bell, PE
Principal Engineer

MEMORANDUM

September 10, 2013

TO: Dan Ferons, SJBA
FROM: Richard Bell, MWDOC
SUBJECT: Technical Comments on the SJBA Draft GW Management and Facilities Plan

Supplementing the general comments provided in our letter of today, are the following technical comments on the Draft Groundwater Management and Facilities Plan.

Basin Yield. The groundwater modeling work conducted by the Doheny Desal Project by Geoscience estimated the yield of the basin over a 64-year baseline period that included a 31-year dry period. The yield was determined through the use of a watershed model that calculated daily streamflow and recharge based on a production well water level constraints that ceased production when the pumping water levels fell below 2-feet above the top of the screens. This constraint should be noted in the Draft GWM&F Plan.

The basin yield without the Doheny Desal Project was determined to average 9,150 afy over a 31-year period of average precipitation and over a repeat of the 31-year dry period the supply would decrease to 8,040 afy. Since the model runs constrained pumping only on pumping water levels and not on seawater intrusion, these yields include ocean water intrusion that over the 64-year period average are thought to be about 300 to 400 afy. These quantities have not yet been confirmed. Under these runs when ocean water intrusion occurred and salinity reached 2,600 mg/l at the the South Coast wells, they were turned off. This occurred after 9 and 12 years for the dry and average periods, respectively with the starting point being the beginning of the the 64-year period (1947). The results from these runs are shown below.

Groundwater Modeling Production Analysis – Base Case (2i/2j)
Pumping Water Level Constraint with Salinity Constraint

Producer	Groundwater Pumping Yield (afy) Dry	Average
City's GWRP Wells	5,808	6,690
City's Other Wells	823	942
Subtotal City	6,631	7,632
SCWD	559	664
Private Wells	850	850
Total (1)	8,040 afy	9,146 afy

(1) Includes a low level of seawater intrusion of approximately 300 to 400 afy (needs confirmation)

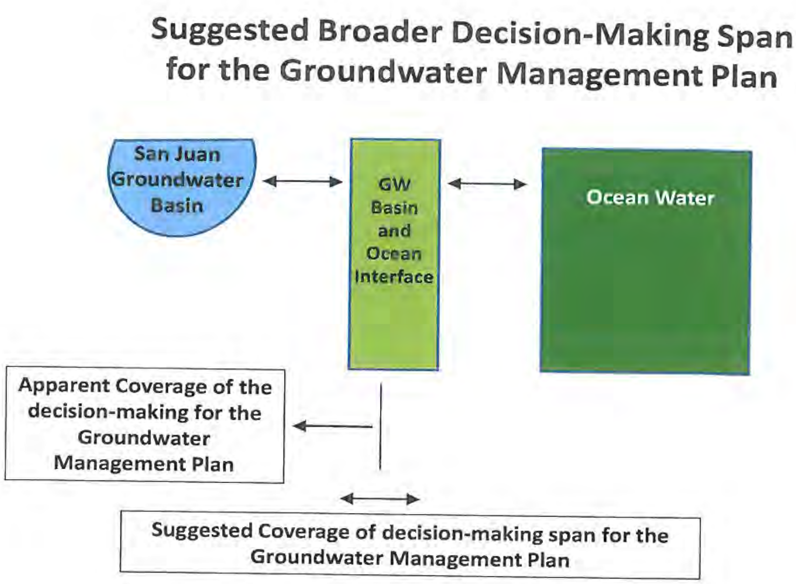
The draft Groundwater Management and Facilities Plan indicates an impact on the basin by the Doheny Desal Project at 1,700 afy. Based on the modeling work, the average impact over the 64-year base period was found to be 1,660 afy. However, as noted above, the base case runs induced seawater intrusion. To control seawater intrusion, basin production would have to be reduced by about 300 to 400 afy to maintain a net positive outflow to the ocean in order to prevent seawater intrusion. Using these numbers would reduce the Doheny Desal Project impact to about 1,300 afy over the 64-year period. These runs will need to be completed in the next phase of work. The Draft GWM&F Plan should note the yield for both the dry and average periods.

Ranney Well Evaluation. We noted that the Draft GWM&F Plan indicates that the use of Ranney Wells will increase the basin yield by 800 afy. We are not sure how that estimate was derived. The groundwater model yields used all the available streamflow that naturally recharged the basin. We believe this new yield could be from mining storage. Ranney Wells provide the advantage in shallow river/stream basins of having their intakes near the bottom of the alluvial channel. They are not constrained by pumping water levels below screened intervals that can lead to the introduction of aerated water and downhole oxidation of dissolved iron present in the groundwater. They also allow a greater amount the basin storage to be utilized and would also allow the desalter plants to run more continuously without having to be shutdown as often due to the pumping water level constraint.

Doheny Desal Mitigation. The Doheny Desal Project will need to mitigate its impact on the basin in one of three ways: (1) provide in-lieu of pumping make-up water from the desal project yield to the impacted users, (2) install a coastal injection barrier using recycled water to reduce or eliminate the draw on the basin and to maintain higher water levels in the coastal area, and/or (3) invest in basin yield enhancement projects.

Further work is required to determine the cost-effectiveness of the second and third approaches. This work is planned to be undertaken over the next year or two as part of the MET Foundational Action Program work.

San Juan Basin – Planning Extent and Integration with the Doheny Desal Project. The alluvial basin underlying San Juan Creek extends out under the ocean within the continental shelf.



The current Draft GWM&F Plan seems to end at the interface between the basin and the Ocean. It is important that the decision making process cover the full extent of the basin as the source of intrusion is the ocean and marine groundwater and the proposed Doheny Desal Project would utilize slant wells constructed from the beach out under the ocean.

The plan should include in its recommended plan the Doheny Ocean Desalination Project. The use of the vertical extraction wells as both a seawater intrusion control barrier and a feedwater supply for an ocean desalination project may inadvertently constrain the planned Doheny Desal Project. It should also be noted in the preferred plan that the Doheny Desal Project would also provide seawater intrusion control for the benefit of the basin. Also, the proposed extraction wells along the coast can be converted to injection wells using recycled water when the Doheny Desal Project is implemented. The conversion to injection wells will help to mitigate the Doheny Desal Project impacts on both the draw of brackish water from the basin and the drawdown impacts. The injection wells will also help to mitigate any project impacts on drawdowns of water levels in the seasonal coastal lagoon.

Desalination Cost Estimates Utilized in the Draft GWM&F Plan. The plan utilized the Doheny Desal Project costs to estimate the costs for the extraction barrier desalination project. There is an economy of scale effect with desalination projects that should be factored into the cost estimate. We estimate that a 3 mgd plant would have a higher unit cost of about 10% above a 15 mgd plant.

San Juan Basin Authority
Attn: Dan Ferons General Manager

COMMENTS ON SJBA BASIN GROUNDWATER MANAGEMENT REPORT

Page 1-1 "Preserve the status quo. Complete existing planned projects and rely on Metropolitan to serve all water above and beyond existing local supplies. In this alternative the SJBA agencies will purchase the maximum amount of Metropolitan water relative to other alternatives and be subject to Metropolitan's rate structure and drought penalties."

1. Of all the management options presented in this report this option makes the most sense to me. The attached chart from the Urban Water Management Report shows that MWD can support all its current customer needs for water through 2035 with current sources. Why should we spend hundreds of millions on improving the basin yields when a less expensive source of water is available?

Page3-16 " Exactions by all pumpers shall not exceed the total recharge and the condition is satisfied as long as the groundwater storage does not fall below 50 percent of the storage capacity of the basin. The SJBA right is subject to the prior riparian right of the San Juan Hills golf course and shall not cause significant impact on water quality"

2. The State water permit does not allow the basin to be pumped to below 50% of total storage of to impair any other water user with water rights. If the estimates of water storage are accurate we may now be approaching the 50% level.

Page3-17 MWDOC Groundwater model and development of SOCOD

3. The SOCOD facility with an output of 16,000 acre feet at a cost of $1050 would be a bargain if the cost estimates are anywhere close. Also, the SODOD will provide a salt water barrier that will protest the basin from seawater intrusion. We should seriously consider this option instead of spending hundreds of millions on basin enhancement.

Page 3-18 MWDOC Groundwater model

4. Is it true that our model of the basin model is unable to predict effects of high levels of pumping?

Page 3-19 MODOC groundwater model

5. The recharge of the basin depends on rain. If this drought thing is long term, how can we plan on high levels of pumping? Sea water intrusion may occur at any time in dry years.

Page 3-20 " The annual production totals listed in Table 3-11show that production was limited by groundwater levels falling below drawdown constraints in 56 of 63 years of the simulation period or about 90% of the simulation period."

6. The long term predictions show production totals cause groundwater levels falling below state requirements 90% of the time. Will reduced production be the answer?

Page3-21 " the take-always from the baseline simulation is that planned production by CSJC and SCWD along with private producers seems to exceed the production capabilities of the basin and will result in production levels less than planned and potentially seawater intrusion.

7. The prediction that planned production levels will cause sea water intrusion without extensive and costly measures to recharge and block the sea water? I return to item 1 on my comments as the only way to manage the basin without causing the consumer water rates to drastically increase.

Page 3-41 "The Rosenbaum Well No. 1 produces .58 million gallons per day and North Open Space Well produces .47 mgd."

8. I am surprised that SJC has potable wells that produce almost 1 million gallons of drinking water per day without treatment. What can't we drill more wells in this area of the lower Trabuco?

Page 4-1 The City of San Juan Capistrano current potable water demand is 8,400 acre-ft/yr.

9. The demand for potable water for SJC seems to be overstated. The 2012/13 budget document shows the demand to be 7423 af. Why is the figure of 8400 af used?

Page5-2 "Goal No. 5 "Establish Equitable Share for the funding and costs of the SJBAMP. The intent of this goal is to align the benefits of the SJBAMP with individual SJBA member's agencies and the SJBAMP implementation costs. This goal will be accomplished by clearly articulating the benefits of the SJBAMP to each SJBA member agency and subsequently allocating the funding and costs in an equitable manner

10. Does goal 5 mean that only SCWD and CSJC will be the only water departments to pay for all of the proposed basin management alternatives? This will mean the SJC taxpayers will foot the majority of the costs?

Page 6-1 "Recommended alternatives assuming SOCOD is not implemented"

Alternate 1. The SJBA would set annual production limits in the spring of each year based upon based upon the levels measured that spring and an estimate of groundwater storage that spring. The productions levels would hold until the next spring.

Construction cost	**$0**
Annual cost	**$0**

Alternate 2. This alternate is an attempt to increase the yield of the basin during non-wet periods through injection of supplemental water into the basin just seaward of the SCWD desalter walls. The initial water for injection would come from MWDOC but could be replaced in subsequent years by recycled water.

Construction cost	**$2,925,600**
Annual cost	**$1,231,314**

Alternate 2 proposes to create a seawater injection barrier using MWD water as a source. Won't the cost of production increase if we buy water to inject it into the basin then pump it our in a contaminated condition and have to clean it up before we can use it? It seems like the cost per acre foot would nearly double? I go back to my comments on number 1.

Alternate 3. This alternate is designed to eliminate seawater intrusion into the basin by creating an extraction barrier by inducing seawater to flow inland due to production at the extraction barrier wells. The water would initially be brackish and would eventually be seawater. New treatment facilities would be constructed and collocated with the SCWD desalter facility.

Construction cost	**$42,435,461**
Annual cost	**$3,976,968**

Alternate 3 would be a seawater extraction barrier sort of like the SODOC but using new facilities at SCWD to process seawater. This alternate is extremely costly and drive the water rates for SCWD and CSJC through the roof.

Alternate 4. This alternate includes alternates 2 and 3 but would drill one or two Ranney-style wells to produce basin yield capacity during dry periods and to prevent seawater intrusion of sea water.

Construction cost	**$5,520,000 each or $11,040,000 for 2**
Annual cost	**$650,852 each or $1,301,704 for 2**

Alternate 4 would do everything above in Alternates 2-3 but drill one or two Ranney wells to take water from the bottom of the basin that turbine pumps can't reach. The wells are extremely expensive to drill and to maintain. Again, all of this would be paid by CSJC and SCWD?

Alternate 5. This alternate would include alternate 2-3-4 but would build T and L levies on a reach of the San Juan Creek as a storm water recharge facility from runoff from Arroyo and San Juan creeks. The storm water would percolate through the strata to recharge the basin.

Construction cost	**$?**

Annual cost	**$?**

Alternate 5 would add in stream recharge using storm water. This is a relatively inexpensive approach but is full of environmental concerns to regulators. Is it doable?

Alternate 6 This alternate would include alternates 2-3-4-5 and would use recycled water to recharge the basin during the months of May through September. The recycled water would come from existing sources but plans are to obtain water that meets Title 22 effluent from SOCWA for recharge. The SOCWA facility would be modified to produce Tertiary-treated water in quantities for annual recharge based upon spring time measurements.

Construction cost	**Not stated but could be over $75 million**
Annual cost	**Not stated but could be over $ 2 million per year**

Alternative 6 is the TEC committee recommended alternative. This do everything approach and is the most expensive. I don't know how the TEC committee can recommend this alternative when they have no idea of the total cost. Somehow we must get the "water empire" folks to recognize that it is the consumer water rates that pay the bills. Under the plan only the CSJC and SCWD would pay all of the construction and annual costs because they are the only agencies to benefit from the basin improvements. If the basin was the only water source available we would be forced to do most of the things they have recommended. But MWD water is available at significantly lower cost than any of the various combinations of alternatives.

John Perry
Capistrano Taxpayers Association

RANCHO MISSION VIEJO

September 9, 2013

Mr. Don Bunts
Santa Margarita Water District
26111 Antonio Parkway
Rancho Santa Margarita, CA 92688

Reference: San Juan Basin Groundwater Management Plan, Draft Dated April 2013

Subject: Rancho Mission Viejo Comments

Dear Don:

Thank you for the opportunity to review and comment on the referenced report. Rancho Mission Viejo (RMV) has reviewed the document and offers the following comments for your consideration:

General

1. **Pages ES-1 through ES 10**: These pages represent the Executive Summary, which appears to be missing from the document; please provide when available.

2. **Report Approach**: Please confirm the boundary of the Middle and Lower Basins. In the event that the upstream boundary is upstream of Ortega Highway, the study should address the RMV Mutual Water Company and address the riparian water rights. Section 3.3 indicates that the Upper Basin is not a part of the study and should be clarified that it is because it operates independent from the Lower and Middle Basin.

3. **Ortega/Trampas Lake Reservoir**: While the study reinforces a strategy for recharge of the groundwater, it should recognize ongoing efforts to implement a potential 5,000 acft recycled/non-potable water facility. Also, this project has received support from the County Board of Supervisors for contributing storm runoff water as well as recycled water from the SMWD CWRP. This project would be the largest storage facility in the region of this type and should maintain a high priority for implementation.

Exhibits & Figures

4. **Figure 2-1** through 2-4 and 3-45 through 3-47: The San Juan Basin Authority boundary appears to follow the cumulative external boundaries of the San Juan Basin Authority (SJBA) agency member. In some cases the boundary exceeds the boundary of the San Juan Watershed. In cases where this occurs, please clarify if there be some delineation

between the boundary corresponding to a service area of a SJBA member and the actual boundary of SJBA.

5. **Figure 3-1**: Clarify the Lower and Middle Basin study area boundary on this or an appropriate exhibit. Figure 3-14 and 6-1 appears to reference a portion of the boundary however it is not clear.

6. **Figure 3-3**: The Laguna Beach Station is used to summarize Annual Precipitation and Cumulative Departure from Mean. It seems that there would be better stations to represent runoff tributary to the San Juan Creek, either the mountainous or coastal area.

7. **Figure 3-15**: The determination of the boundary for the Middle Basin appears to be upstream of the crossing at Ortega Highway. However, prior construction information for the bridges at Ortega Highway and Antonio Parkway indicate that bedrock is 10' and 75' (+/-) below the thalweg of the Creek. Please confirm the boundary location. In the event that the boundary is upstream of Ortega Highway, the study should address the RMV Mutual Water Company and address the riparian water rights.

8. **Figure 3-27**: Address the interdependence of the Upper Basin since this is designated in this exhibit.

9.

<u>Report</u>

10. Section 1.1: Clarify the intent of the study boundary. In the event that the boundary is upstream of Ortega Highway, the study should address the RMV Mutual Water Company (MWC) and address the riparian water rights.

11. Section 2.1.2: The report references 4 water districts, yet there appears to be an area not designated under a water district. Clarify if this is for another water district or if it is within the sphere of influence of such.

12. Section 2.3.1: The report indicates that the Ranch Plan has not yet been developed, however PA-1 has been graded with lots currently for sale. Also, clarify the boundary area and the relationship with area outside of the San Juan Watershed as it seems the study should not include areas outside of the watershed.

13. Section 2.3.2: Clarify the acreages in the Ranch Plan. The Ranch Plan includes 22,282 acres yet 29,507 are referenced. Also, lands pending developed are removed from the Williamson Act contract (the report indicates them as "not renewed" which is incorrect administration of the process).

14. Section 2.6.1.8: The report indicates that Aliso Creek watershed is included in the analysis since this is tributary to San Juan Creek. However, San Mateo watershed, not tributary to San Juan Creek, appears to be included in the analysis for which there is no explanation.

15. Section 3.3.5: Clarify that the aquifer is for the Middle and Lower Basins.

16. Section 3.4: Similar to comments above, confirm that the boundary of the analysis does not include the RMV MWC; otherwise the numeric information in this section will need to be adjusted appropriately. Also, clarify the eligible diversion amount of 3,325 acft. (in the table) is that which the City of San Juan Capistrano has as a part of the Desalter Project; also confirm the amounts that the City has been including in current operations.

17. Section 3.5.2 and 3.6.2: The study indicates that the firm yield of the basin appears to be less than 7,000 acft./yr., yet 13,508 acft./yr. is permitted. Clarify the impact of this variance.

18. Section 3.7.1.2: Rancho Mission Viejo (Well 7) is included in the study yet this well is upstream of the Middle Basin. Please clarify why this is included in the study if it is outside the boundary.

19. Section 3.8 and 4: Confirm the Water Demand and Supply volumes for SMWD as these appear to be higher than current operations.

20. Section 3.9.2.6: The report indicates that 5.0 mgd is sent to advanced water treatment. However, SMWD recently increased the capacity at the plant to 5.5 or 5.75 mgd. Please clarify.

21. Section 6: Provide a summary table of each alternatives with advantages, disadvantages, capacity, costs, and time for implementation. Provide clarification for where there is overlap or where one alternative supersedes another.

Should you have any questions regarding these comments, please feel free to contact me at (949) 240-3363.

Sincerely,

Jeff R. Thompson

Jeff R. Thompson
Vice President, Development Engineering

Bcc: Laura Eisenberg, RMV
Jeff Brinton, PBMB
Richard Broming, RMV
Sam Couch, RMV

Appendix B

SJBA Monitoring Plan

SAN JUAN BASIN AUTHORITY

26111 Antonio Parkway • Rancho Santa Margarita, CA 92688 (949) 459-6400 FAX (949) 459-6463

TO: Board of Directors **DATE:** January 8, 2013

FROM: Dan Ferons

SUBJECT: Authorization of 2013 San Juan Basin Management Monitoring and Reporting Program

SUMMARY

Issue: The Authority authorized soliciting a proposal from Wildermuth Environmental at the December Board meetings for monitoring under its Permit for Diversion and Use of Water from the State Water Resources Control Board as well as under the California Statewide Groundwater Elevation Monitoring (CASGEM) Program. The Authority is proposing additional monitoring during 2013 to identify the amount of water in storage and establish a baseline for seawater intrusion.

Recommendation: Authorize professional service contract in the amount of $139,119 with Wildermuth Environmental for monitoring services in Calendar Year 2013.

Fiscal Impact: Monitoring costs are included in the annual budget; the proposed additional services can be accommodated in the current administration budget.

Previously Related Action: The Authority has an annual contract for monitoring services. The current contract was through December 2012 with Wildermuth Environmental in the amount of $96,381.

DISCUSSION

Attached is a detailed proposal from Wildermuth Environmental Inc. (WEI) to provide expanded monitoring services in 2013. WEI provides ongoing monitoring services for the Authority for 2012 at a reduced level in comparison to 2011 and 2010. The Authority selected WEI based on competitive proposals in 2010 and the Board extended the contract in 2011 and currently through December 2012. The Authority's monitoring requirements are based on the amount of water diverted through pumping. The current requirements are based on a projected pumping over 4,800 acre feet per year.

The recommendation to continue with WEI is based on the following:

- The annual reports prepared by WEI are detailed and well-received by the member agencies and the State Water Resources Control Board.
- WEI is developing an on-line database for the monitoring information that also incorporates other water quality data from the member agencies.
- WEI efforts have been cost-effective and under budget.

Funding:

The proposed contract is divided between two fiscal years as noted below:

Account Description	Budget FY 12/13	Notes
Monitoring services budget	$ 100,000.00	
Current authorization	$ 74,114.74	2012 monitoring
Proposed authorization	$ 43,436.00	2013 monitoring in Fiscal 2012-13
Shortfall reallocated from Administration	$ (17,550.74)	Contingency was included in the administration budget for development of a database and library that has started.
Proposed authorization for Fiscal 2013/14	$ 95,683.00	Portion of the contract in next fiscal year

P:\SJBA\Authorization of 2013 Groundwater Monitoring Program 1-8-13docx.cl

January 4, 2013

San Juan Basin Authority
Attn: Dan Ferons and West Curry
C/o Santa Margarita Water District
P.O. Box 7005
Mission Viejo, CA 92690-7005

Subject: *2013 San Juan Basin Management Monitoring and Reporting Program*

Dear Messrs. Ferons and Curry:

Pursuant to our professional services agreement (PSA) with the San Juan Basin Authority (SJBA) dated February 14, 2012, Wildermuth Environmental Inc. (WEI) prepared this letter proposal to present the recommended San Juan Basin Management Monitoring and Reporting program for 2013 and the scope-of-work and cost estimate for WEI to implement the recommended program.

Background

Since early 2003, the SJBA has implemented a groundwater, surface water, and vegetation field monitoring program to comply with the conditions outlined in the SJBA's Permit for Diversion and Use of Water, No. 21074 (Permit 21074), issued by the State Water Resources Control Board (SWRCB) Division of Water Rights in October 2000. The monitoring program, which was developed in 2001, has focused primarily on collecting the data needed to satisfy the monitoring requirements enumerated in Permit 21074. WEI has implemented the SJBA's field monitoring and reporting program since calendar year 2010. In October 2011, the SWRCB amended Permit 21074 to reflect the results of monitoring performed by the SJBA to date. Program Task III of WEI's 2012 PSA, is to prepare an updated Basin Management Monitoring and Reporting Program, in part to comply with the amended conditions of Permit 21074.

In 2011, the SJBA hired WEI to prepare an updated Groundwater Management Plan for the long-term, sustainable management of the San Juan Basin's water resources. The final task of the Groundwater Management Plan is to recommend a monitoring program to collect the data needed to effectively manage the basin (e.g. assess the impact to groundwater levels and groundwater quality as a result of implementing the Groundwater Management Plan).

The secondary goal of Program Task III is to design the Basin Management Monitoring and Reporting Program such that it addresses the SJBA's regulatory compliance requirements, the recommended monitoring program from the Groundwater Management Plan, and that it identifies and eliminates any redundant data collection efforts of the SJBA and other local agencies collecting data in the San Juan Basin.

As of December 2012, the Groundwater Management Plan is still being developed, and thus the monitoring program to support the plan has not been identified. However, through the process of developing the Groundwater Management Plan, WEI has identified several basin management issues that should be addressed as part of the 2013 Basin Management Monitoring and Reporting

Program in addition to the requirements of Permit 21074: (1) groundwater storage, (2) seawater intrusion, and (3) point-source groundwater contamination from leaking underground storage tanks (LUSTs). Additional monitoring components can be added to the monitoring plan in subsequent years to address any additional management issues that arise as the Groundwater Management Plan is completed in 2013.

Recommended 2013 Basin Management Monitoring and Reporting Program

The following is a description of each regulatory or basin management issue that should be addressed as part of the 2013 Basin Management Monitoring and Reporting Program.

Permit 21074 Monitoring and Reporting

Amended Permit 21074 describes, among other things, the groundwater, surface water, and vegetation monitoring requirements that must be satisfied to evaluate the impacts to groundwater-level elevation, groundwater quality, and riparian vegetation that result from groundwater extractions related to the operation of the SJBA desalter facility at two levels of production: groundwater extractions less than 4,800 acre-feet per year (acre-ft/yr) and groundwater extractions in excess of 4,800 acre-ft/yr. In 2013, the San Juan Basin Authority anticipates groundwater extractions will exceed 4,800 acre-ft/yr. Thus, the monitoring program for extractions in excess of 4,800 acre-ft/yr will be implemented in 2013. The explicit monitoring requirements include (1) quarterly groundwater level monitoring at eight monitoring wells to comply with the Department of Water Resources' (DWR) California Statewide Groundwater Elevation (CASGEM) program, (2) quarterly groundwater quality monitoring for Electrical Conductivity (EC) at eight monitoring wells, and (3) monthly monitoring of riparian vegetation health at five monitoring sites along the San Juan Creek. In addition to the explicit monitoring requirements listed in the permit, additional data is needed satisfy other permit conditions, such as reporting total groundwater extractions from the basin and computing water in storage. The additional data needed address the permit conditions includes groundwater production, total water use, precipitation, groundwater elevation data across the basin, and total dissolved solids (TDS) and chloride concentrations at wells. An annual progress report documenting permit compliance must be submitted to the SWRCB by June 2014.

Groundwater Storage Management

Through the work performed for the Groundwater Management Plan, WEI identified that the amount of groundwater storage in the San Juan Basin is far less than has long been reported by the DWR and others studying the basin. Furthermore, the water budget of the San Juan Basin is not well understood, particularly as it relates to net inflow to and outflow from to the basin. While a groundwater model of the San Juan Basin has been developed to simulate changes in storage, inflow, and outflow based on the pumping plans of the agencies operating in the Basin, real-time data needs to be collected to validate the model results and to assist in the future update and calibration of the model.

We recommend that the SJBA conduct a regional, comprehensive groundwater-level survey and analysis of the San Juan Basin in the spring and the fall of each year to compute the volume of water in storage and the change in storage between each period (spring to fall and fall to spring). The spring levels and storage change calculations can be used by the SJBA to determine an appropriate level of pumping for the following summer. Additionally, the period change in storage and period pumping can be used to estimate the net period inflow to the San Juan Basin. The net period inflow can then be correlated to precipitation and stream discharge measurements to characterize near-term and long-term recharge. After each groundwater-level survey (spring and fall), WEI will prepare a letter reports to the SJBA summarizing the analysis of storage change, the estimation of net inflow to the San Juan Basin, and recommending pumping plans for the subsequent period.

Seawater Intrusion

Preliminary results of the groundwater modeling performed by Geoscience Support Services (GSS) in support of the Municipal Water District of Orange County's (MWDOC) seawater desalination project predicts that seawater intrusion is an imminent threat to the basin under the groundwater production plans of the SJBA member agencies.

To track seawater intrusion into the San Juan Basin, it is critical to begin collecting baseline data that will help the SJBA to understand the current extent of seawater intrusion. We recommend that this baseline dataset be collected in 2013. This effort would include sampling groundwater and surface water in the Basin, from the coast to the forebay areas, for intrinsic seawater tracers, including boron, bromide, iodide, and strontium. In addition, we recommend that the SJBA coordinate with the South Coast Water District (SCWD) and the City of San Juan Capistrano (CSJC) to request that they sample their production wells for the same intrinsic seawater tracers.

At the conclusion of the baseline data collection effort, a report will be prepared that describes the 2013 monitoring program, analyzes historical and 2013 data to establish the baseline condition of the San Juan Basin as it relates to seawater intrusion, and describe the questions, analytical methods, and ongoing monitoring program to track the future rate of seawater intrusion.

Point-Source Groundwater Contamination

Seven point-sources of groundwater contamination from LUST sites have been identified in the San Juan Basin. Contamination by methyl-tert-butyl-ether, or MTBE, has already required the CSJC to incorporate high-cost treatment systems into their municipal water system. As the pumpers in the San Juan Basin continue to increase production over time, there is a concern that the contaminants associated with the various LUST sites could be mobilized and further impact municipal water supplies. We recommend that the SJBA include an annual groundwater sampling event for volatile organic compounds (VOCs), including MTBE, as part of the monitoring program.

Scope of Work

The following is the scope of work required to implement the recommended monitoring and reporting program described above. The scope of work is designed to rely on groundwater and surface water data collected by others in the basin to the extent possible, and supplements this data with a field monitoring program to fill in data gaps. The Basin Management Monitoring and Reporting Program is divided into three tasks: Field Monitoring Program, Data Acquisition and Management, and Reporting. The objectives, sub-tasks, schedule of implementation, and deliverables for each task are described below.

Task 1 –Field Monitoring Program

The objective of the field monitoring program is to collect data in the field that is not available from other agencies that monitor the Basin. This task is broken down into four subtasks based on the data type and monitoring frequency. The duration of the field monitoring program is from January 2013 through December 2013.

Subtask 1.1 Quarterly Groundwater Level Monitoring. Currently, the SJBA has pressure transducers and data loggers installed in eight monitoring wells across the San Juan Basin to continuously record groundwater-level elevations. The data loggers are also equipped to record electrical conductivity (EC). Groundwater elevation and EC data collected from these wells are used for water rights permit compliance reporting, CASGEM reporting, storage management, and seawater intrusion monitoring. Each quarter, WEI will download the groundwater elevation and EC data from the loggers, manually measure groundwater level elevation to calibrate the pressure transducers, calibrate the EC probes, and perform routine transducer maintenance. The field data will be processed, checked for quality assurance/quality control (QA/QC) and loaded into HydroDaVE.

Subtask 1.2 – Quarterly Groundwater Quality Monitoring. To establish the baseline condition for monitoring seawater intrusion into the Basin, WEI will sample 14 monitoring wells in the San Juan Basin on a quarterly basis in 2013. The quarterly groundwater quality sampling events consist of purging each well, measuring field water quality parameters (e.g. temperature, pH, and EC), and collecting a groundwater quality sample for laboratory analysis. Groundwater samples will be delivered to Eurofins—Eaton Analytical Laboratory and analyzed for the constituents listed in Table 1. Note that groundwater samples will only be tested for VOCs during one of the four quarterly sampling events. Data collected for this task can also be used for the analysis and reporting required by Permit 21074. All field and laboratory data will be processed, checked for QA/QC and loaded into HydroDaVE.

Subtask 1.3 – Surface Water Quality Monitoring. To establish the baseline condition for monitoring seawater intrusion into the Basin, WEI will sample up to 5 surface water sites in the Basin. The sites will be sampled twice in 2013 during dry-weather conditions for the constituents listed in Table 1 (excluding VOCs). The field and laboratory data will be processed, checked for =QA/QC and loaded into HydroDaVE.

Subtask 1.4 – Vegetation Monitoring. The SJBA's water rights permit requires monthly vegetation monitoring at five sites along San Juan Creek. Monthly vegetation monitoring consists of a biologist visiting five monitoring stations to collect written and photographic records of vegetation health and current climate conditions. The field data will be checked for QA/QC and the photographs stored in a project file. Vegetation monitoring is performed by WEI's sub-consultant, Glenn Lukos Associates.

Task 2 – Data Acquisition and Management

The objective of this task is to coordinate with and collect data from all public and private entities that are collecting groundwater, surface water, or climate data in the San Juan Basin. This data will supplement the database of field data generated by the SJBA to satisfy the regulatory reporting requirements and basin management issues identified herein. At the end of this task, the SJBA will have an updated database through December 2013. The duration of this task is from April 2013 through February 2014.

Subtask 2.1 – Data Acquisition from Collecting Agencies. WEI staff will coordinate with each public and private entity on a quarterly basis to collect the relevant data sets (April 2013, July 2013, October 2013, and January 2014). Additionally, in early 2013, WEI staff will coordinate with the SCWD, the CSJC, and the MWDOC, to request that these agencies sample their wells for the intrinsic seawater tracers that are not included as part of their standard analytical testing programs.

Subtask 2.2 – Data QA/QC, Processing, and Upload to HydroDaVE. After each quarterly data collection event, all groundwater, surface water, and climate data will be processed, checked for QA/QC, and loaded in to HydroDaVE.

Task 3 – Reporting

The objective of this task is to prepare reports and presentations summarizing the data collected in the San Juan Basin during 2013.

Subtask 3.1 – Water Rights Permit Reporting. WEI will prepare a letter report to the SWRCB summarizing the status of compliance with the requirements of Permit No. 21074. This report will be formatted as a letter report that directly answers the questions posed in the permit. A draft letter report will be submitted to the SJBA for review and comment by March 31, 2014. A final letter report, which incorporates the comments on the draft, will be submitted to the SWRCB by May 31, 2014.

Subtask 3.2 – CASGEM Reporting. WEI will upload the quarterly groundwater sampling data collected in Task 1.1 to the DWR through the CASGEM online reporting system. Data will be uploaded in April 2013, July 2013, October 2013, and January 2014.

Subtask 3.3 – Biannual Storage Change Reports. WEI will prepare two letter reports to the SJBA summarizing the analysis of storage change, the estimation of net inflow to the San Juan Basin, and recommending pumping plans for the subsequent six month period. The first letter report will document the change in storage in the San Juan Basin from fall 2012 to spring 2013 and will be submitted to the SJBA by May 31, 2013. The second letter report will document the change in storage in the San Juan Basin from spring 2013 to fall 2013 and will be submitted to the SJBA by November 30, 2013.

Subtask 3.4 – Seawater Intrusion Monitoring Report. WEI will prepare a seawater intrusion monitoring report at the conclusion of the four quarterly groundwater quality sampling events in 2013. The report will describe the 2013 monitoring program, analyze historical and 2013 data to establish the baseline condition of the basin as it relates to seawater intrusion, and describe the questions, analytical methods, and ongoing monitoring needed to track seawater intrusion in subsequent years. A draft monitoring report will be submitted to the SJBA for review and comment by December 31, 2013. A final report incorporating comments on the draft will be submitted by February 28, 2014.

Subtask 3.5 – Presentations to the SJBA Board of Directors. WEI staff will attend four SJBA Board meetings during 2013 to update the Board on the progress and deliverables produced for the various monitoring and reporting tasks.

Subtask 3.6 – Miscellaneous Data Requests and Meetings. Typically during the year, WEI staff are asked to prepare data deliverables or attend meetings relevant to the work of the SJBA. This subtask assumes WEI will be asked to prepare one data deliverable and attend one meeting per quarter in 2013.

Professional Services Fee

The total cost to complete the scope of work for the 2013 San Juan Basin Monitoring and Reporting Program presented herein is $139,119. A line-item work breakdown structure is provided in Table 2. We recommend the SJBA budget $153,031, which includes a contingency budget equal to ten percent of the professional services fee ($13,912) to cover unanticipated costs that may arise throughout the year. WEI will not utilize the contingency budget without prior consent from the SJBA.

We look forward to continuing to work with the SJBA on this important and timely work. Should you have any questions about the recommendations and scope of work presented herein, please contact us at (949) 420-3030.

Very truly yours,

Wildermuth Environmental, Inc.

Samantha S. Adams
Supervising Scientist

Mark J. Wildermuth, PE
President, Principal Engineer

Enclosures:

Table 1 – Groundwater Quality Sampling Program – List of Chemical Analyses

Table 2 – Work Breakdown Structure and Fee Estimate for Professional Services

Table 1
2013 Quarterly Groundwater Quality Sampling Program
List of Chemical Analyses

Analytes
Alkalinity (Including Bicarbonate, Carbonate, and Hydroxide)
Boron
Bromide
Calcium
Chloride
Fluoride
Hardness
Iodide
Iron
Magnesium
Manganese
Nitrate-nitrogen
pH
Potassium
Sodium
Specific Conductance at 25C
Strontium
Sulfate
Total Dissolved Solids
VOCs (groundwater only, annual sample only)

Table 2
Work Breakdown Structure and Fee Estimate for Professional Services
2013 San Juan Basin Monitoring and Reporting

Description	Notes	Labor			Other Direct Charges								Total Program Costs	
		Person Hours	Cost		Travel	Equipment		Subs	Lab	Repro-duction	Total ODCs			
			Sub-task	Task		New	Rental				Sub-task	Task	Sub-Task	Task
Task 1 - Field Monitoring Program	a			**$23,935**								**$29,507**		**$53,442**
1.1 Quarterly Groundwater-Level Monitoring		88	$9,800		$456	$520	$128				$1,104		$10,904	
1.2 Quarterly Groundwater Quality Monitoring	b	128	$10,960		$456		$500	$1,300	$13,500		$15,756		$26,716	
1.3 Bi-annual Dry-weather Surface Water Monitoring	c	15	$1,420		$228		$100		$2,070		$2,398		$3,818	
1.4 Monthly Vegetation Monitoring	d	12	$1,755					$10,250			$10,250		$12,005	
Task 2 - Data Acquisition and Management	e			**$21,560**								**$0**		**$21,560**
2.1 Data Acquisition from Collecting Agencies		32	$4,680										$4,680	
2.2 Data QA/QC, Processing, and Upload to HydroDaVE		120	$16,880										$16,880	
Task 3 - Reporting				**$61,005**								**$3,112**		**$64,117**
3.1 Water Rights Permit Reporting to the State Board	f	86	$12,300					$2,000		$750	$2,750		$15,050	
3.2 Quarterly CASGEM Reporting to DWR		12	$1,620										$1,620	
3.3 Biannual Storage Change Reports to the SJBA Board	g													
3.3.1 Spring 2013 Storage Change Letter Report		77	$11,870										$11,870	
3.3.2 Fall 2013 Storage Change Letter Report		46	$6,845										$6,845	
3.4 Seawater Intrusion Monitoring Plan	h	114	$19,010							$250	$250		$19,260	
3.5 Presentations to SJBA Board of Directors	i	24	$4,320		$56						$56		$4,376	
3.6 Miscellaneous Meetings and Data Requests	j	32	$5,040		$56						$56		$5,096	
Sub-total		**786**		**$106,500**	**$1,251**	**$520**	**$728**	**$13,550**	**$15,570**	**$1,000**		**$32,619**		**$139,119**
Contingency @ 10%	k													**$13,912**
Total														**$153,031**

Notes:

a Field data collection tasks include review, post-processing, QA/QC, and upload of data to HydroDaVE.

b Assumes 14 wells will be sampled by WEI staff (7 SCWD monitoring wells and 6 SJBA monitoring wells), and assumes that municipal production wells that need to be tested for seawater intrinsic tracers will be sampled by the well owners (CSJC anc SCWD).

c Assumes 5 surface water sites will be sampled during dry-weather flow.

d Field work performed by our sub-consultant Glenn Lukos Associates. Labor hours includes coordination with sub-consultant and review of results

e Includes collection of groundwater production, groundwater level, groundwater quality, surface water quality, surface water flow, and precipitation data collected in the field by cooperating agencies (e.g. SCWD, City of San Juan Capistrano, County of Orange, etc.).

f A portion of the report is produced by our sub-consultant Glenn Lukos Associates.

g The initial storage change letter report will require more staff hours than subsequent reports because it is the first time the report is being produced. Also, the initial reporting effort will require water level elevation contouring for multiple time periods (Fall 2012 and Spring 2013). Subsequent reports will only require water level elevation contouring for one time period (Fall 2013) and will rely on figure and text templates developed during the initial reporting effort.

h After analysis of the water quality data collected in 2013, an ongoing seawater intrusion monitoring program will be recommended. The analysis and recommended monitoring program will be documented in a letter repor

i Assumes a total of four quarterly presentations to the SJBA Board of Directors.

j Assumes a total of one meeting and one data request per quarter.

k WEI recommends a contingency budget of $10,000 to cover unanticipated work. The contingency will not be spent without prior approval from the San Juan Basin Authority

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