APPENDIX A

UWMP Water Code Checklist

Water Code Requirements Checklist

Water Code Section	Summary as Applies to UWMP	Subject	2020 Guidebook Location	2020 UWMP Location
10615	A plan shall describe and evaluate sources of supply, reasonable and practical efficient uses, reclamation and demand management activities.	Introduction and Overview	Chapter 1	Section 1.2
10630.5	Each plan shall include a simple description of the supplier's plan including water availability, future requirements, a strategy for meeting needs, and other pertinent information. Additionally, a supplier may also choose to include a simple description at the beginning of each chapter.	Summary	Chapter 1	Executive Summary
10620(b)	Every person that becomes an urban water supplier shall adopt an urban water management plan within one year after it has become an urban water supplier.	Plan Preparation	Section 2.2	Sections 1 and 2.1
10620(d)(2)	Coordinate the preparation of its plan with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practicable.	Plan Preparation	Section 2.6	Sections 2.2.1 and 10.2
10642	Provide supporting documentation that the water supplier has encouraged active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of the plan and contingency plan.	Plan Preparation	Section 2.6.2	Sections 2.2.3, 10.1 and 10.3, Appendix L
10631(h)	Retail suppliers will include documentation that they have provided their wholesale supplier(s) - if any - with water use projections from that source.	System Supplies	Section 2.6, Section 6.1	N/A for Wholesale

10631(h)	Wholesale suppliers will include documentation that they have provided their urban water suppliers with identification and quantification of the existing and planned sources of water available from the wholesale to the urban supplier during various water year types.	System Supplies	Section 2.6	Sections 2.2.2 and 4.3
10631(a)	Describe the water supplier service area.	System Description	Section 3.1	Section 3.2
10631(a)	Describe the climate of the service area of the supplier.	System Description	Section 3.3	Section 3.3
10631(a)	Provide population projections for 2025, 2030, 2035, 2040 and optionally 2045.	System Description	Section 3.4	Section 3.4.1
10631(a)	Describe other social, economic, and demographic factors affecting the supplier's water management planning.	System Description	Section 3.4.2	Section 3.4.2
10631(a)	Indicate the current population of the service area.	System Description and Baselines and Targets	Sections 3.4 and 5.4	Section 3.4.1
10631(a)	Describe the land uses within the service area.	System Description	Section 3.5	Section 3.5
10631(d)(1)	Quantify past, current, and projected water use, identifying the uses among water use sectors.	System Water Use	Section 4.2	Section 4.2 and 4.3
10631(d)(3)(C)	Retail suppliers shall provide data to show the distribution loss standards were met.	System Water Use	Section 4.2.4	Section 4.4
10631(d)(4)(A)	In projected water use, include estimates of water savings from adopted codes, plans and other policies or laws.	System Water Use	Section 4.2.6	Section 4.3
10631(d)(4)(B)	Provide citations of codes, standards, ordinances, or plans used to make water use projections.	System Water Use	Section 4.2.6	Section 4.3
10631(d)(3)(A)	Report the distribution system water loss for each of the 5 years preceding the plan update.	System Water Use	Section 4.3.2.4	Optional for Wholesale; MWDOC does not own or operate a

				transmission or distribution system and therefore did not need to conduct a water loss audit.
10631.1(a)	Include projected water use needed for lower income housing projected in the service area of the supplier.	System Water Use	Section 4.4	Optional for Wholesale
10635(b)	Demands under climate change considerations must be included as part of the drought risk assessment.	System Water Use	Section 4.5	Section 4.3.1.1, 7.2
10608.20(e)	Retail suppliers shall provide baseline daily per capita water use, urban water use target, interim urban water use target, and compliance daily per capita water use, along with the bases for determining those estimates, including references to supporting data.	Baselines and Targets	Chapter 5	N/A for Wholesale
10608.24(a)	Retail suppliers shall meet their water use target by December 31, 2020.	Baselines and Targets	Chapter 5	N/A for Wholesale
10608.36	Wholesale suppliers shall include an assessment of present and proposed future measures, programs, and policies to help their retail water suppliers achieve targeted water use reductions.	Baselines and Targets	Section 5.1	Sections 4.3, 5.2, 9.2, 9.3, 9.4 and Appendix J and K
10608.24(d)(2)	If the retail supplier adjusts its compliance GPCD using weather normalization, economic adjustment, or extraordinary events, it shall provide the basis for, and data supporting the adjustment.	Baselines and Targets	Section 5.2	N/A for Wholesale

10608.22	Retail suppliers' per capita daily water use reduction shall be no less than 5 percent of base daily per capita water use of the 5 year baseline. This does not apply if the suppliers base GPCD is at or below 100.	Baselines and Targets	Section 5.5	N/A for Wholesale
10608.4	Retail suppliers shall report on their compliance in meeting their water use targets. The data shall be reported using a standardized form in the SBX7-7 2020 Compliance Form.	Baselines and Targets	Section 5.5 and Appendix E	N/A for Wholesale
10631(b)(1)	Provide a discussion of anticipated supply availability under a normal, single dry year, and a drought lasting five years, as well as more frequent and severe periods of drought.	System Supplies	Sections 6.1 and 6.2	Sections 7.1, 7.3, 7.5
10631(b)(1)	Provide a discussion of anticipated supply availability under a normal, single dry year, and a drought lasting five years, as well as more frequent and severe periods of drought, *including changes in supply due to climate change.*	System Supplies	Sections 6.1	Sections 7.1, 7.2, 7.3, 7.5
10631(b)(2)	When multiple sources of water supply are identified, describe the management of each supply in relationship to other identified supplies.	System Supplies	Section 6.1	Sections 6.1, 6.2, 6.3, 6.4, 6.6, 6.8
10631(b)(3)	Describe measures taken to acquire and develop planned sources of water.	System Supplies	Section 6.1.1	Sections 6.7, 6.8, 6.9
10631(b)	Identify and quantify the existing and planned sources of water available for 2020, 2025, 2030, 2035, 2040 and optionally 2045.	System Supplies	Section 6.2.8	Section 6.1
10631(b)	Indicate whether groundwater is an existing or planned source of water available to the supplier.	System Supplies	Section 6.2	Sections 6.1 and 6.3

10631(b)(4)(A)	Indicate whether a groundwater sustainability plan or groundwater management plan has been adopted by the water supplier or if there is any other specific authorization for groundwater management. Include a copy of the plan or authorization.	System Supplies	Section 6.2.2	Sections 6.3.1, 6.3.2, and Appendices D, E, F, G
10631(b)(4)(B)	Describe the groundwater basin.	System Supplies	Section 6.2.2	Sections 6.3.1.1 and 6.3.2
10631(b)(4)(B)	Indicate if the basin has been adjudicated and include a copy of the court order or decree and a description of the amount of water the supplier has the legal right to pump.	System Supplies	Section 6.2.2	Sections 6.3.1.2, 6.3.1.3 and 6.3.2
10631(b)(4)(B)	For unadjudicated basins, indicate whether or not the department has identified the basin as a high or medium priority. Describe efforts by the supplier to coordinate with sustainability or groundwater agencies to achieve sustainable groundwater conditions.	System Supplies	Section 6.2.2.1	Sections 6.3.1 and 6.3.2
10631(b)(4)(C)	Provide a detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years	System Supplies	Section 6.2.2.4	Section 6.3
10631(b)(4)(D)	Provide a detailed description and analysis of the amount and location of groundwater that is projected to be pumped.	System Supplies	Section 6.2.2	Sections 6.1, 6.3
10631(c)	Describe the opportunities for exchanges or transfers of water on a short-term or long- term basis.	System Supplies	Section 6.2.7	Section 6.8
10633(b)	Describe the quantity of treated wastewater that meets recycled water standards, is being discharged, and is otherwise available for use in a recycled water project.	System Supplies (Recycled Water)	Section 6.2.5	Section 6.6
10633(c)	Describe the recycled water currently being used in the supplier's service area.	System Supplies	Section 6.2.5	Section 6.6.2

		(Recycled Water)		
10633(d)	Describe and quantify the potential uses of recycled water and provide a determination of the technical and economic feasibility of those uses.	System Supplies (Recycled Water)	Section 6.2.5	Section 6.6.3
10633(e)	Describe the projected use of recycled water within the supplier's service area at the end of 5, 10, 15, and 20 years, and a description of the actual use of recycled water in comparison to uses previously projected.	System Supplies (Recycled Water)	Section 6.2.5	Section 6.6.4
10633(f)	Describe the actions which may be taken to encourage the use of recycled water and the projected results of these actions in terms of acre-feet of recycled water used per year.	System Supplies (Recycled Water)	Section 6.2.5	Section 6.6.4
10633(g)	Provide a plan for optimizing the use of recycled water in the supplier's service area.	System Supplies (Recycled Water)	Section 6.2.5	Section 6.6.4
10631(g)	Describe desalinated water project opportunities for long-term supply.	System Supplies	Section 6.2.6	Section 6.7
10633(a)	Describe the wastewater collection and treatment systems in the supplier’s service area with quantified amount of collection and treatment and the disposal methods.	System Supplies (Recycled Water)	Section 6.2.5	N/A for Wholesale
10631(f)	Describe the expected future water supply projects and programs that may be undertaken by the water supplier to address water supply reliability in average, single-dry, and for a period of drought lasting 5 consecutive water years.	System Supplies	Section 6.2.8, Section 6.3.7	Sections 6.2.3, 6.3.3, 6.5.2, 6.6.3, 6.8.2, 6.9
10631.2(a)	The UWMP must include energy information, as stated in the code, that a supplier can readily obtain.	System Suppliers, Energy Intensity	Section 6.4 and Appendix O	Section 6.10

10634	Provide information on the quality of existing sources of water available to the supplier and the manner in which water quality affects water management strategies and supply reliability	Water Supply Reliability Assessment	Section 7.2	Sections 6.3.1, 6.3.2, 7.2.3
10620(f)	Describe water management tools and options to maximize resources and minimize the need to import water from other regions.	Water Supply Reliability Assessment	Section 7.2.4	Section 7.4
10635(a)	Service Reliability Assessment: Assess the water supply reliability during normal, dry, and a drought lasting five consecutive water years by comparing the total water supply sources available to the water supplier with the total projected water use over the next 20 years.	Water Supply Reliability Assessment	Section 7.3	Section 7.3
10635(b)	Provide a drought risk assessment as part of information considered in developing the demand management measures and water supply projects.	Water Supply Reliability Assessment	Section 7.3	Section 7.5
10635(b)(1)	Include a description of the data, methodology, and basis for one or more supply shortage conditions that are necessary to conduct a drought risk assessment for a drought period that lasts 5 consecutive years.	Water Supply Reliability Assessment	Section 7.3	Section 7.5.1
10635(b)(2)	Include a determination of the reliability of each source of supply under a variety of water shortage conditions.	Water Supply Reliability Assessment	Section 7.3	Sections 7.3, 7.5.2 and 7.5.3
10635(b)(3)	Include a comparison of the total water supply sources available to the water supplier with the total projected water use for the drought period.	Water Supply Reliability Assessment	Section 7.3	Section 7.5.2
10635(b)(4)	Include considerations of the historical drought hydrology, plausible changes on projected supplies and demands under climate change conditions,	Water Supply Reliability Assessment	Section 7.3	Sections 7.2 and 7.5.1

	anticipated regulatory changes, and other locally applicable criteria.			
10632(a)	Provide a water shortage contingency plan (WSCP) with specified elements below.	Water Shortage Contingency Planning	Chapter 8	Appendix I
10632(a)(1)	Provide the analysis of water supply reliability (from Chapter 7 of Guidebook) in the WSCP	Water Shortage Contingency Planning	Chapter 8	Appendix I (Section 3.1)
10632(a)(10)	Describe reevaluation and improvement procedures for monitoring and evaluation the water shortage contingency plan to ensure risk tolerance is adequate and appropriate water shortage mitigation strategies are implemented.	Water Shortage Contingency Planning	Section 8.10	Appendix I (Section 3.10)
10632(a)(2)(A)	Provide the written decision-making process and other methods that the supplier will use each year to determine its water reliability.	Water Shortage Contingency Planning	Section 8.2	Appendix I (Section 3.1 and 3.2)
10632(a)(2)(B)	Provide data and methodology to evaluate the supplier's water reliability for the current year and one dry year pursuant to factors in the code.	Water Shortage Contingency Planning	Section 8.2	Appendix I (Section 3.2)
10632(a)(3)(A)	Define six standard water shortage levels of 10, 20, 30, 40, 50 percent shortage and greater than 50 percent shortage. These levels shall be based on supply conditions, including percent reductions in supply, changes in groundwater levels, changes in surface elevation, or other conditions. The shortage levels shall also apply to a catastrophic interruption of supply.	Water Shortage Contingency Planning	Section 8.3	Appendix I (Section 3.3)
10632(a)(3)(B)	Suppliers with an existing water shortage contingency plan that uses different water shortage levels must cross reference their	Water Shortage Contingency Planning	Section 8.3	N/A for Wholesale

	categories with the six standard categories.			
10632(a)(4)(A)	Suppliers with water shortage contingency plans that align with the defined shortage levels must specify locally appropriate supply augmentation actions.	Water Shortage Contingency Planning	Section 8.4	Appendix I (Section 3.4)
10632(a)(4)(B)	Specify locally appropriate demand reduction actions to adequately respond to shortages.	Water Shortage Contingency Planning	Section 8.4	Appendix I (Section 3.4)
10632(a)(4)(C)	Specify locally appropriate operational changes.	Water Shortage Contingency Planning	Section 8.4	Appendix I (Section 3.4)
10632(a)(4)(D)	Specify additional mandatory prohibitions against specific water use practices that are in addition to state-mandated prohibitions are appropriate to local conditions.	Water Shortage Contingency Planning	Section 8.4	Appendix I (Section 3.4)
10632(a)(4)(E)	Estimate the extent to which the gap between supplies and demand will be reduced by implementation of the action.	Water Shortage Contingency Planning	Section 8.4	Appendix I (Section 3.4)
10632.5	The plan shall include a seismic risk assessment and mitigation plan.	Water Shortage Contingency Plan	Section 8.4.6	Appendix I (Section 3.4.6)
10632(a)(5)(A)	Suppliers must describe that they will inform customers, the public and others regarding any current or predicted water shortages.	Water Shortage Contingency Planning	Section 8.5	Appendix I (Section 3.5)
10632(a)(5)(B) 10632(a)(5)(C)	Suppliers must describe that they will inform customers, the public and others regarding any shortage response actions triggered or anticipated to be triggered and other relevant communications.	Water Shortage Contingency Planning	Section 8.5 and 8.6	Appendix I (Section 3.5)
10632(a)(6)	Retail supplier must describe how it will ensure compliance with and enforce provisions of the WSCP.	Water Shortage Contingency Planning	Section 8.6	N/A for Wholesale

10632(a)(7)(A)	Describe the legal authority that empowers the supplier to enforce shortage response actions.	Water Shortage Contingency Planning	Section 8.7	Appendix I (Section 3.7)
10632(a)(7)(B)	Provide a statement that the supplier will declare a water shortage emergency Water Code Chapter 3.	Water Shortage Contingency Planning	Section 8.7	Appendix I (Section 3.7)
10632(a)(7)(C)	Provide a statement that the supplier will coordinate with any city or county within which it provides water for the possible proclamation of a local emergency.	Water Shortage Contingency Planning	Section 8.7	Appendix I (Section 3.7)
10632(a)(8)(A)	Describe the potential revenue reductions and expense increases associated with activated shortage response actions.	Water Shortage Contingency Planning	Section 8.8	Appendix I (Section 3.8)
10632(a)(8)(B)	Provide a description of mitigation actions needed to address revenue reductions and expense increases associated with activated shortage response actions.	Water Shortage Contingency Planning	Section 8.8	Appendix I (Section 3.8)
10632(a)(8)(C)	Retail suppliers must describe the cost of compliance with Water Code Chapter 3.3: Excessive Residential Water Use During Drought	Water Shortage Contingency Planning	Section 8.8	N/A for Wholesale
10632(a)(9)	Retail suppliers must describe the monitoring and reporting requirements and procedures that ensure appropriate data is collected, tracked, and analyzed for purposes of monitoring customer compliance.	Water Shortage Contingency Planning	Section 8.9	N/A for Wholesale
10632(b)	Analyze and define water features that are artificially supplied with water, including ponds, lakes, waterfalls, and fountains, separately from swimming pools and spas.	Water Shortage Contingency Planning	Section 8.11	N/A for Wholesale
10635(c)	Provide supporting documentation that Water Shortage Contingency Plan has been, or will be, provided to any city or county within which it provides water, no later than	Plan Adoption, Submittal, and Implementation	Sections 8.12 and 10.4	Sections 10.1 and 10.4, Appendix L

	30 days after the submission of the plan to DWR.			
10632(c)	Make available the Water Shortage Contingency Plan to customers and any city or county where it provides water within 30 after adopted the plan.	Water Shortage Contingency Planning	Section 8.12	Appendix I (Section 3.12)
10631(e)(2)	Wholesale suppliers shall describe specific demand management measures listed in code, their distribution system asset management program, and supplier assistance program.	Demand Management Measures	Sections 9.1 and 9.3	Section 9.2 and 9.3 and Appendix K
10631(e)(1)	Retail suppliers shall provide a description of the nature and extent of each demand management measure implemented over the past five years. The description will address specific measures listed in code.	Demand Management Measures	Sections 9.2 and 9.3	N/A for Wholesale
10608.26(a)	Retail suppliers shall conduct a public hearing to discuss adoption, implementation, and economic impact of water use targets (recommended to discuss compliance).	Plan Adoption, Submittal, and Implementation	Chapter 10	N/A for Wholesale
10621(b)	Notify, at least 60 days prior to the public hearing, any city or county within which the supplier provides water that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan. Reported in Table 10-1.	Plan Adoption, Submittal, and Implementation	Section 10.2.1	Sections 10.1 and 10.2, Appendix L
10621(f)	Each urban water supplier shall update and submit its 2020 plan to the department by July 1, 2021.	Plan Adoption, Submittal, and Implementation	Section 10.4	Sections 10.1 and 10.4
10642	Provide supporting documentation that the urban water supplier made the plan and contingency plan available for public inspection, published notice of the public hearing, and held a public hearing	Plan Adoption, Submittal, and Implementation	Sections 10.2.2, 10.3, and 10.5	Sections 2.2.3, 10.1 and 10.3, Appendix L

	about the plan and contingency plan.			
10642	The water supplier is to provide the time and place of the hearing to any city or county within which the supplier provides water.	Plan Adoption, Submittal, and Implementation	Section 10.2.2	Appendix L
10642	Provide supporting documentation that the plan and contingency plan has been adopted as prepared or modified.	Plan Adoption, Submittal, and Implementation	Section 10.3.2	Appendix M
10644(a)	Provide supporting documentation that the urban water supplier has submitted this UWMP to the California State Library.	Plan Adoption, Submittal, and Implementation	Section 10.4	Sections 10.1 and 10.4
10644(a)(1)	Provide supporting documentation that the urban water supplier has submitted this UWMP to any city or county within which the supplier provides water no later than 30 days after adoption.	Plan Adoption, Submittal, and Implementation	Section 10.4	Sections 10.1 and 10.4
10644(a)(2)	The plan, or amendments to the plan, submitted to the department shall be submitted electronically.	Plan Adoption, Submittal, and Implementation	Sections 10.4.1 and 10.4.2	Sections 10.4 and 10.5
10645(a)	Provide supporting documentation that, not later than 30 days after filing a copy of its plan with the department, the supplier has or will make the plan available for public review during normal business hours.	Plan Adoption, Submittal, and Implementation	Section 10.5	Sections 10.1 and 10.4
10645(b)	Provide supporting documentation that, not later than 30 days after filing a copy of its water shortage contingency plan with the department, the supplier has or will make the plan available for public review during normal business hours.	Plan Adoption, Submittal, and Implementation	Section 10.5	Sections 10.1 and 10.4
10621(c)	If supplier is regulated by the Public Utilities Commission, include its plan and contingency plan as part of its general rate case filings.	Plan Adoption, Submittal, and Implementation	Section 10.6	N/A - MWDOC is not regulated by Public

				Utilities Commission
10644(b)	If revised, submit a copy of the water shortage contingency plan to DWR within 30 days of adoption.	Plan Adoption, Submittal, and Implementation	Section 10.7.2	Section 10.5 of UWMP and Section 3.12 of WSCP

APPENDIX B

DWR Standardized Tables

B1. UWMP Submittal Tables
B2. SBx7-7 Verification and Compliance Forms

Submittal Table 2 2: Plan Identification			
Select Only One	Type of Plan		Name of RUWMP or Regional Alliance *if applicable* (select from drop down list)
☑	**Individual UWMP**		
	☐	Water Supplier is also a member of a RUWMP	
	☑	Water Supplier is also a member of a Regional Alliance	Orange County 20x2020 Regional Alliance
☐	**Regional Urban Water Management Plan (RUWMP)**		
NOTES:			

Submittal Table 2 3: Supplier Identification	
Type of Supplier (select one or both)	
☑	Supplier is a wholesaler
☐	Supplier is a retailer
Fiscal or Calendar Year (select one)	
☐	UWMP Tables are in calendar years
☑	UWMP Tables are in fiscal years
If using fiscal years provide month and date that the fiscal year begins (mm/dd)	
7/1	
Units of measure used in UWMP * (select from drop down)	
Unit	AF
**** Units of measure (AF, CCF, MG)*** *must remain consistent throughout the UWMP as reported in Table 2-3.*	
NOTES: The energy intensity data is reported in calendar year consistent with the Greenhouse Gas Protocol.	

Submittal Table 2 4 Wholesale: Water Supplier Information Exchange (select one)	
☑	Supplier has informed more than 10 other water suppliers of water supplies available in accordance with Water Code Section 10631. Completion of the table below is optional. If not completed, include a list of the water suppliers that were informed.
Section 3-2 (Page 3-5)	**Provide page number for location of the list.**
☐	Supplier has informed 10 or fewer other water suppliers of water supplies available in accordance with Water Code Section 10631. **Complete the table below.**
Water Supplier Name	
Add additional rows as needed	
NOTES:	

Submittal Table 3 1 Wholesale: Population Current and Projected						
Population Served	2020	2025	2030	2035	2040	2045*(opt)*
	2,342,740	2,411,727	2,473,392	2,518,117	2,532,393	2,530,621

NOTES:
Source - Center for Demographic Research at California State University, Fullerton, 2020

Submittal Table 4-1 Wholesale: Demands for Potable and Non-Potable[1] Water - Actual

Use Type	2020 Actual		
Drop down list May select each use multiple times These are the only use types that will be recognized by the WUE data online submittal tool	Additional Description (as needed)	Level of Treatment When Delivered Drop down list	Volume[2]
Add additional rows as needed			
Sales to other agencies	MWD Treated and Untreated Imported Water	Drinking Water	142,879
Groundwater recharge	Untreated Import Water for Groundwater Recharge + Sea Water Barrier	Raw Water	18,027
Other Potable	Untreated Import Water for Surface Storage	Raw Water	649
		TOTAL	161,555

[1] *Recycled water demands are NOT reported in this table. Recycled water demands are reported in Table 6-4.* [2] *Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES:

Submittal Table 4 2 Wholesale: Use for Potable and Raw Water [1] Projected						
Use Type	Additional Description (as needed)	Projected Water Use [2] Report To the Extent that Records are Available				
Drop down list May select each use multiple times These are the only Use Types that will be recognized by the WUEdata online submittal tool.		2025	2030	2035	2040	2045 (opt)
Add additional rows as needed						
Sales to other agencies	MWD (Retail M&I)	119,743	120,573	123,502	123,107	122,819
Groundwater recharge	MWD GW Replenishment (Non-M&I)	51,600	51,600	51,600	51,600	51,600
Other Potable	MWD Irvine Lake Fill (Non-M&I)	4,017	4,017	4,017	4,017	4,017
	TOTAL	175,360	176,190	179,119	178,724	178,436

[1] Recycled water demands are NOT reported in this table. Recycled water demands are reported in Table 6-4. *[2]*
Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Table 2-3.

NOTES:

Submittal Table 4 3 Wholesale: Total Water Use (Potable and Non Potable)						
	2020	2025	2030	2035	2040	2045 (opt)
Potable and Raw Water From Tables 4-1W and 4-2W	161,555	175,360	176,190	179,119	178,724	178,436
Recycled Water Demand* From Table 6-4W	0	0	0	0	0	0
TOTAL WATER DEMAND	161,555	175,360	176,190	179,119	178,724	178,436
**Recycled water demand fields will be blank until Table 6 4 is complete.*						
NOTES: Volumes in AF.						

Submittal Table 6 1 Wholesale: Groundwater Volume Pumped						
☑	Supplier does not pump groundwater. The supplier will not complete the table below.					
☐	All or part of the groundwater described below is desalinated.					
Groundwater Type ***Drop Down List*** *May use each category multiple*	Location or Basin Name	2016*	2017*	2018*	2019*	2020*
Add additional rows as needed						
	TOTAL	0	0	0	0	0
**** Units of measure (AF, CCF, MG)*** *must remain consistent throughout the UWMP as reported in Table 2-3.*						
NOTES:						

Submittal Table 6-3 Wholesale: Wastewater Treatment and Discharge Within Service Area in 2020											
☑	Wholesale Supplier neither distributes nor provides supplemental treatment to recycled water. The Supplier will not complete the table below.										
Wastewater Treatment Plant Name	Discharge Location Name or Identifier	Discharge Location Description	Wastewater Discharge ID Number *(optional)* [2]	Method of Disposal *Drop down list*	Does This Plant Treat Wastewater Generated Outside the Service Area? *Drop down list*	Treatment Level *Drop down list*	2020 volumes [1]				
							Wastewater Treated	Discharged Treated Wastewater	Recycled Within Service Area	Recycled Outside of Service Area	Instream Flow Permit Requirement
Add additional rows as needed											
						Total	0	0	0	0	0

[1] **Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3. [2] If the **Wastewater Discharge ID Number** is not available to the UWMP preparer, access the SWRCB CIWQS regulated facility website at https://ciwqs.waterboards.ca.gov/ciwqs/readOnly/CiwqsReportServlet?inCommand=reset&reportName=RegulatedFacility

NOTES:

Submittal Table 6-4 Wholesale: Current and Projected Retailers Provided Recycled Water Within Service Area							
☑	Recycled water is not directly treated or distributed by the Supplier. The Supplier will not complete the table below.						
Name of Receiving Supplier or Direct Use by Wholesaler	Level of Treatment *Drop down list*	2020*	2025*	2030*	2035*	2040*	2045* *(opt)*
Add additional rows as needed							
Total		0	0	0	0	0	0
*** Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.							
NOTES:							

Submittal Table 6 5 Wholesale: 2015 UWMP Recycled Water Use Projection Compared to 2020 Actual		
☑	Recycled water was not used or distributed by the supplier in 2015, nor projected for use or distribution in 2020. The wholesale supplier will not complete the table below.	
Name of Receiving Supplier or Direct Use by Wholesaler	2015 Projection for 2020*	2020 Actual Use*
Add additional rows as needed		
Total	0	0
****Units of measure (AF, CCF, MG)*** *must remain consistent throughout the UWMP as reported in Table 2-3.*		
NOTES:		

Submittal Table 6-7 Wholesale: Expected Future Water Supply Projects or Programs						
☑	No expected future water supply projects or programs that provide a quantifiable increase to the agency's water supply. Supplier will not complete the table below.					
☐	Some or all of the supplier's future water supply projects or programs are not compatible with this table and are described in a narrative format.					
	Provide page location of narrative in the UWMP					
Name of Future Projects or Programs	Joint Project with other suppliers?		Description *(if needed)*	Planned Implementation Year	Planned for Use in Year Type *Drop Down list*	Expected Increase in Water Supply to Supplier*
	Drop Down Menu	*If Yes, Supplier Name*				
Add additional rows as needed						
****Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.*						
NOTES:						

Submittal Table 6 8 Wholesale: Water Supplies Actual			
Water Supply	Additional Detail on Water Supply	2020	
Drop down list May use each category multiple times.These are the only water supply categories that will be recognized by the WUEdata online submittal tool		Actual Volume*	Water Quality Drop Down List
Add additional rows as needed			
Purchased or Imported Water	From MET for Municipal & Industrial	142,879	Drinking Water
Purchased or Imported Water	From MET for Groundwater Recharge	18,027	Other Non-Potable Water
Purchased or Imported Water	From MET for Surface Storage	649	Other Non-Potable Water
	Total	161,555	

****Units of measure (AF, CCF, MG)*** *must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES:
Source: MWDOC UWMP Supply Projections, 2021

Submittal Table 6 9 Wholesale: Water Supplies Projected						
Water Supply	Additional Detail on Water Supply	Projected Water Supply* Report To the Extent Practicable				
		2025	**2030**	**2035**	**2040**	**2045** (opt)
Drop down list May use each category multiple times. These are the only water supply categories that will be recognized by the WUEdata online submittal tool		Reasonably Available Volume	Reasonably Available Volume	Reasonably Available Volume	Reasonably Available Volume	Reasonably Available Volume
Add additional rows as needed						
Purchased or Imported Water	From MET for Municipal & Industrial	119,743	120,573	123,502	123,107	122,819
From MET for Municipal & Industrial	From MET for Groundwater Recharge	51,600	51,600	51,600	51,600	51,600
From MET for Groundwater Recharge	From MET for Surface Storage	4,017	4,017	4,017	4,017	4,017
	Total	175,360	176,190	179,119	178,724	178,436

Units of measure (AF, CCF, MG) *must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES:
Source: MWDOC UWMP Supply Projections and OCWD, 2021

DWR Submittal Table 7 1 Wholesale: Basis of Water Year Data (Reliability Assessment)			
Year Type	**Base Year** If not using a calendar year, type in the last year of the fiscal, water year, or range of years, for example, water year 1999-2000, use 2000	**Available Supplies if Year Type Repeats**	
		☐ Quantification of available supplies is not compatible with this table and is provided elsewhere in the UWMP. Location ___________________________	
		☑ Quantification of available supplies is provided in this table as either volume only, percent only, or both.	
		Volume Available *	**% of Average Supply**
Average Year	2018-2019	-	100%
Single-Dry Year	2014	-	106%
Consecutive Dry Years 1st Year	2012	-	106%
Consecutive Dry Years 2nd Year	2013	-	106%
Consecutive Dry Years 3rd Year	2014	-	106%
Consecutive Dry Years 4th Year	2015	-	106%
Consecutive Dry Years 5th Year	2016	-	106%

Supplier may use multiple versions of Table 7-1 if different water sources have different base years and the supplier chooses to report the base years for each water source separately. If a supplier uses multiple versions of Table 7-1, in the "Note" section of each table, state that multiple versions of Table 7-1 are being used and identify the particular water source that is being reported in each table. Suppliers may create an additional worksheet for the additional tables.

***Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES:
Assumes an increase of six percent above average year demands in dry and multiple dry years based on the Demand Forecast TM (CDM Smith, 2021). 106% represents the percent of average supply needed to meet demands of a single-dry and multiple-dry years. Since all of MWDOC’s supply comes from MET, the percent of average supply value reported is equivalent to the percent of average demand under the corresponding hydrologic condition.

DWR Submittal Table 7 2 Wholesale: Normal Year Supply and Demand Comparison					
	2025	2030	2035	2040	2045 *(Opt)*
Supply totals *(autofill from Table 6-9)*	175,360	176,190	179,119	178,724	178,436
Demand totals *(autofill fm Table 4-3)*	175,360	176,190	179,119	178,724	178,436
Difference	0	0	0	0	0

NOTES:
Includes treated and untreated water from MET for M&I and non-M&I demands.

DWR Submittal Table 7 3 Wholesale: Single Dry Year Supply and Demand Comparison					
	2025	2030	2035	2040	2045 (Opt)
Supply totals*	182,545	183,425	186,530	186,110	185,806
Demand totals*	182,545	183,425	186,530	186,110	185,806
Difference	0	0	0	0	0
***Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.*					
NOTES: Includes treated and untreated water from MET for M&I and non-M&I demands. The single dry year projections estimate a 6% increase on imported M&I demand. Non-M&I demand (Irvine Lake and groundwater storage and replenishment) remain constant at 55,617 AFY for all years because these demands are not affected by changes in hydrological conditions.					

Submittal Table 7 4 Wholesale: Multiple Dry Years Supply and Demand Comparison						
		2025*	2030*	2035*	2040*	2045* (Opt)
First year	Supply totals	172,611	176,121	177,446	179,846	179,449
	Demand totals	172,611	176,121	177,446	179,846	179,449
	Difference	0	0	0	0	0
Second year	Supply totals	175,094	176,297	178,067	179,762	179,389
	Demand totals	175,094	176,297	178,067	179,762	179,389
	Difference	0	0	0	0	0
Third year	Supply totals	177,578	176,473	178,688	179,678	179,328
	Demand totals	177,578	176,473	178,688	179,678	179,328
	Difference	0	0	0	0	0
Fourth year	Supply totals	180,061	176,649	179,309	179,594	179,267
	Demand totals	180,061	176,649	179,309	179,594	179,267
	Difference	0	0	0	0	0
Fifth year	Supply totals	182,545	183,425	186,530	186,110	185,806
	Demand totals	182,545	183,425	186,530	186,110	185,806
	Difference	0	0	0	0	0

***Units of measure (AF, CCF, MG) m** ust remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES:
Includes treated and untreated water from MET for M&I and non-M&I demands. The multiple dry-year projections estimate a six percent increase on imported M&I demand. Non-M&I demand (Irvine Lake and groundwater storage and replenishment) remain constant at 55,617 AFY because these demands are not affected by changes in hydrological conditions. The 2025 column assesses supply and demand for FY 2020-21 through FY 2024-25; the 2030 column assesses FY 2025-26 through FY 2029-30 and so forth, in order to end the water service reliability assessment in FY 2044-45.

Submittal Table 7-5: Five Year Drought Risk Assessment Tables to address Water Code Section 10635(b)

2021	Total
Total Water Use	172,611
Total Supplies	172,611
Surplus/Shortfall w/o WSCP Action	0
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	0
WSCP - use reduction savings benefit	0
Revised Surplus/(shortfall)	0
Resulting % Use Reduction from WSCP action	0%

2022	Total
Total Water Use	175,094
Total Supplies	175,094
Surplus/Shortfall w/o WSCP Action	0
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	0
WSCP - use reduction savings benefit	0
Revised Surplus/(shortfall)	0
Resulting % Use Reduction from WSCP action	0%

2023	Total
Total Water Use	177,578
Total Supplies	177,578
Surplus/Shortfall w/o WSCP Action	0
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	0
WSCP - use reduction savings benefit	0
Revised Surplus/(shortfall)	0
Resulting % Use Reduction from WSCP action	0%

2024	Total
Total Water Use	180,061
Total Supplies	180,061
Surplus/Shortfall w/o WSCP Action	0
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	0
WSCP - use reduction savings benefit	0
Revised Surplus/(shortfall)	0
Resulting % Use Reduction from WSCP action	0%

2025	Total
Total Water Use	182,545
Total Supplies	182,545
Surplus/Shortfall w/o WSCP Action	0
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	0
WSCP - use reduction savings benefit	0
Revised Surplus/(shortfall)	0
Resulting % Use Reduction from WSCP action	0%

DWR Submittal Table 8 1
Water Shortage Contingency Plan Levels

Shortage Level	Percent Shortage Range	Shortage Response Actions (*Narrative description)*
0	0% (Normal)	A Level 0 Water Supply Shortage – Condition exists when MWDOC notifies its water users that no supply reductions are anticipated in this year. MWDOC proceeds with planned water efficiency best practices to support consumer demand reduction in line with state mandated requirements and local MWDOC goals for water supply reliability.
1	Up to 10%	A Level 1 Water Supply Shortage – Condition exists when no supply reductions are anticipated, a consumer imported demand reduction of up to 10% is recommended to make more efficient use of water and respond to existing water conditions. Upon the declaration of a Water Aware condition, MWDOC shall implement the mandatory Level 1 conservation measures identified in this WSCP. The type of event that may prompt MWDOC to declare a Level 1 Water Supply Shortage may include, among other factors, a finding that its wholesale water provider (MET) calls for extraordinary water conservation efforts.
2	Up to 20%	A Level 2 Water Supply Shortage – Condition exists when MWDOC notifies its member agencies that due to drought or other supply reductions, a consumer imported demand reduction of up to 20% is necessary to make more efficient use of water and respond to existing water conditions. Upon declaration of a Level 2 Water Supply Shortage condition, MWDOC shall implement the mandatory Level 2 conservation measures identified in this WSCP.
3	Up to 30%	A Level 3 Water Supply Shortage – Condition exists when MWDOC declares a water shortage emergency condition pursuant to California Water Code section 350 and notifies its member agencies that up to 30% consumer imported demand reduction is required to ensure sufficient supplies for human consumption, sanitation and fire protection. MWDOC must declare a Water Supply Shortage Emergency in the manner and on the grounds provided in California Water Code section 350.
4	Up to 40%	A Level 4 Water Supply Shortage - Condition exists when MWDOC declares a water shortage emergency condition pursuant to California Water Code section 350 and notifies its member agencies that up to 40% consumer imported demand reduction is required to ensure sufficient supplies for human consumption, sanitation and fire protection. MWDOC must declare a Water Supply Shortage Emergency in the manner and on the grounds provided in California Water Code section 350.
5	Up to 50%	A Level 5 Water Supply Shortage - Condition exists when MWDOC declares a water shortage emergency condition pursuant to California Water Code section 350 and notifies its member agencies that up to 50% or more consumer imported demand reduction is required to ensure sufficient supplies for human consumption, sanitation and fire protection. MWDOC must declare a Water Supply Shortage Emergency in the manner and on the grounds provided in California Water Code section 350.
6	>50%	A Level 6 Water Supply Shortage – Condition exists when MWDOC declares a water shortage emergency condition pursuant to California Water Code section 350 and notifies its member agencies that greater than 50% or more consumer imported demand reduction is required to ensure sufficient supplies for human consumption, sanitation and fire protection. MWDOC must declare a Water Supply Shortage Emergency in the manner and on the grounds provided in California Water Code section 350.

NOTES:

DWR Submittal Table 8 2: Demand Reduction Actions

Shortage Level	Demand Reduction Actions *Drop down list* *These are the only categories that will be accepted by the WUEdata online submittal tool. Select those that apply.*	How much is this going to reduce the shortage gap? *Include units used (volume type or percentage)*	Additional Explanation or Reference *(optional)*	Penalty, Charge, or Other Enforcement? *For Retail Suppliers Only* *Drop Down List*
0	Provide Rebates for Landscape Irrigation Efficiency	On-going Long Term-Conservation Savings Measure. Not applicable to Water Shortage Contingency Plan quantifiable savings.	Base level of support to retail agencies and their customers through Landscape Irrigation Efficency rebates.	No
0	Provide Rebates on Plumbing Fixtures and Devices	On-going Long Term-Conservation Savings Measure. Not applicable to Water Shortage Contingency Plan quantifiable savings.	Base level of support to retail agencies and their customers through water saving device rebates.	No
0	Provide Rebates for Turf Replacement	On-going Long Term-Conservation Savings Measure. Not applicable to Water Shortage Contingency Plan quantifiable savings.	Base level of support to retail agecies and their customers through MWDOC's Turf Removal Program.	No
0	Reduce System Water Loss	On-going Long Term-Conservation Savings Measure. Not applicable to Water Shortage Contingency Plan quantifiable savings.	Base level of programatic support to retail agencies through MWDOC's Water Loss Program.	No
1	Expand Public Information Campaign	0 to 5% of total imported water use met by voluntary Demand Reduction	Expand Public Awareness to encourage residents and industries to reduce their usage of water.	No
1	Other	0 to 10% of total imported water use met by voluntary Demand Reduction	Implement Voluntary Demand Reduction	No
1	Other	0 to 10% of total imported base demand met by WSAP supply allocation	Implement Water Supply Allocation Plan	Yes
2	Expand Public Information Campaign	0 to 20% of total imported water use met by voluntary Demand Reduction	Increase Public Awareness efforts to encourage residents and industries to reduce their usage of water.	No
2	Other	0 to 20% of total imported water use met by voluntary Demand Reduction	Implement Voluntary Recommended Demand Reduction	No
2	Other	0 to 20% of total imported base demand met by WSAP supply allocation	Implement Water Supply Allocation Plan	Yes
3	Expand Public Information Campaign	0 to 30% of total imported water use met by voluntary Demand Reduction	Pursue an aggressive Public Awareness Campaign to encourage residents and industries to reduce their usage of	No
3	Other	0 to 30% of total imported water use met by voluntary Demand Reduction	Work with retail agencies to review and update as needed water waste prohibitions and ordinances to discourage unnecessary water usage.	No
3	Other	0 to 30% of total imported water use met by voluntary Demand Reduction	Implement Voluntary Demand Reduction	No
3	Other	0 to 30% of total base demand met by WSAP supply allocation	Implement Water Supply Allocation Plan	Yes
4	Expand Public Information Campaign	0 to 40% of total imported water use met by voluntary Demand Reduction	Pursue an aggressive Public Awareness Campaign to encourage residents and industries to reduce their usage of water.	No
4	Other	0 to 40% of total imported water use met by voluntary Demand Reduction	Implement Voluntary Demand Reduction	No
4	Other	0 to 40% of total base demand met by WSAP supply allocation	Implement Water Supply Allocation Plan	Yes
5	Expand Public Information Campaign	0 to 50% of total imported water use met by voluntary Demand Reduction	Pursue an aggressive Public Awareness Campaign to encourage residents and industries to reduce their usage of water.	No
5	Other	0 to 50% of total imported water use met by voluntary Demand Reduction	Implement Voluntary Demand Reduction	No
5	Other	0 to 50% of total base demand met by WSAP supply allocation	Implement Water Supply Allocation Plan	Yes
6	Other	0 to 50% of total imported water use met by voluntary Demand Reduction	Implement Voluntary Demand Reduction	No
6	Other	>50% of total base demand met by WSAP supply allocation	Implement Water Supply Allocation Plan	Yes

NOTES:
Coordination with WEROC is anticipated to begin at Level 4 or greater. In the event of a short or long-term emergency MWDOC will utilize the WEROC Emergency Operations Plan and follow the detailed steps and process as specified.

DWR Submittal Table 8-3: Supply Augmentation and Other Actions			
Shortage Level	Supply Augmentation Methods and Other Actions by Water Supplier ***Drop down list*** *These are the only categories that will be accepted by the WUEdata online submittal tool*	How much is this going to reduce the shortage gap? *Include units used (volume type or percentage)*	Additional Explanation or Reference *(optional)*
0 through 6	Other Actions (describe)	TBD	MWDOC will work in close coordination with MET on their supply augmentation projects during this time to ensure reliability for the service area.
NOTES:			

Submittal Table 10 1 Wholesale: Notification to Cities and Counties (select one)		
☑	Supplier has notified more than 10 cities or counties in accordance with Water Code Sections 10621 (b) and 10642. **Completion of the table below is not required. Provide a separate list of the cities and counties that were notified.**	
Appendix L	Provide the page or location of this list in the UWMP.	
☐	Supplier has notified 10 or fewer cities or counties. **Complete the table below.**	
City Name	60 Day Notice	Notice of Public Hearing
Add additional rows as needed		
County Name *Drop Down List*	60 Day Notice	Notice of Public Hearing
Add additional rows as needed		
NOTES:		

SB X7-7 RA1 - Weighted Baseline

Participating Member Agency Name *Add rows as needed*	10-15 year Baseline GPCD*	Average Population During 10-15 Year Baseline Period	(Baseline GPCD) X (Population)	Regional Alliance Weighted Average 10-15 Year Baseline GPCD
Brea	276	36,045	9,946,499	
Buena Park	198	78,916	15,611,799	
East Orange CWD RZ	291	3,549	1,031,047	
El Toro WD	204	48,813	9,942,446	
Fountain Valley	172	55,472	9,528,507	
Garden Grove	163	165,319	26,986,073	
Golden State WC	173	156,342	27,023,326	
Huntington Beach	161	191,181	30,813,300	
Irvine Ranch WD	213	256,763	54,807,546	
La Habra	161	58,614	9,413,542	
La Palma	152	15,340	2,331,631	
Laguna Beach CWD	204	20,465	4,167,224	
Mesa Water	179	104,051	18,606,494	
Moulton Niguel WD	216	152,639	32,951,572	
Newport Beach	258	62,565	16,160,133	
Orange	226	130,790	29,513,093	
San Clemente	191	50,800	9,686,872	
San Juan Capistrano	232	36,619	8,497,227	
Santa Margarita WD	211	100,219	21,128,578	
Seal Beach	156	23,877	3,724,838	
Serrano WD	482	6,271	3,022,528	
South Coast WD	187	34,972	6,541,275	
Trabuco Canyon WD	267	11,048	2,946,733	
Tustin	189	64,151	12,124,522	
Westminster	143	88,721	12,713,415	
Yorba Linda WD	296	69,441	20,542,295	
Anaheim	203	328,563	66,668,537	
Fullerton	223	126,794	28,296,430	
Santa Ana	130	331,732	43,112,605	
Regional Alliance Total	6,155	2,810,069	537,840,085	**191**

**All participating agencies must submit individual SB X7-7 Tables, as applicable, showing the individual agency's calculations. These tables are: SB X7-7 Tables 0 through 6 , Table 7, any required supporting tables (as stated in SB X7-7 Table 7), and SB X7-7 Table 9, as applicable.These individual agency tables will be submitted with the individual or Regional Urban Water Management Plan.*

NOTES

SB X7-7 RA1 - Weighted 2020 Target

Participating Member Agency Name *Add rows as needed*	2020 Target GPCD*	2020 Population	(2020 Target) X (Population)	Regional Alliance Weighted Average 2020 Target
Brea	221	45,317	10,003,978	
Buena Park	158	82,023	12,980,878	
East Orange CWD RZ	232	3,210	746,002	
El Toro WD	163	47,911	7,807,042	
Fountain Valley	142	56,747	8,032,538	
Garden Grove	142	176,635	25,002,684	
Golden State WC	142	168,108	23,795,687	
Huntington Beach	142	201,327	28,497,837	
Irvine Ranch WD	170	418,163	71,249,163	
La Habra	150	61,923	9,304,086	
La Palma	140	15,567	2,179,079	
Laguna Beach CWD	163	19,468	3,171,382	
Mesa Water	145	111,051	16,053,433	
Moulton Niguel WD	173	170,236	29,395,029	
Newport Beach	203	61,916	12,540,480	
Orange	181	138,995	25,091,226	
San Clemente	153	51,065	7,804,701	
San Juan Capistrano	183	38,301	7,020,098	
Santa Margarita WD	169	161,264	27,198,793	
Seal Beach	142	24,000	3,397,200	
Serrano WD	386	6,263	2,415,057	
South Coast WD	150	34,232	5,145,021	
Trabuco Canyon WD	200	12,921	2,581,514	
Tustin	151	66,421	10,042,788	
Westminster	130	94,068	12,232,790	
Yorba Linda WD	237	75,608	17,893,214	
Anaheim	162	365,987	59,408,797	
Fullerton	179	141,648	25,288,490	
Santa Ana	116	335,086	38,731,637	
Regional Alliance Total	5,021	3,185,461	505,010,624	**159**

**All participating agencies must submit individual SB X7-7 Tables, as applicable, showing the individual agency's calculations. These tables are: SB X7-7 Tables 0 through 6 , Table 7, any required supporting tables (as stated in SB X7-7 Table 7), and SB X7-7 Table 9, as applicable.These individual agency tables will be submitted with the individual or Regional Urban Water Management Plan.*

NOTES

SB X7-7 Regional Alliance - 2020 GPCD (Actual)				
Participating Member Agency Name *Add rows as needed*	**2020 Actual GPCD[1]**	**2020 Population**	**(2020 GPCD) X (2020 Population)**	**Regional Alliance 2020 GPCD (Actual)**
Brea	180	45,317	8,157,060	
Buena Park	106	82,023	8,694,438	
East Orange CWD RZ	218	3,210	699,780	
El Toro WD	135	47,911	6,467,985	
Fountain Valley	91	56,747	5,163,977	
Garden Grove	93	176,635	16,427,055	
Golden State WC	90	168,108	15,129,720	
Huntington Beach	102	201,327	20,535,354	
Irvine Ranch WD	108	418,163	45,161,604	
La Habra	124	61,923	7,678,452	
La Palma	75	15,567	1,167,525	
Laguna Beach CWD	130	19,468	2,530,840	
Mesa Water	86	111,051	9,550,386	
Moulton Niguel WD	120	170,236	20,428,320	
Newport Beach	160	61,916	9,906,560	
Orange	129	138,995	17,930,355	
San Clemente	123	51,065	6,280,995	
San Juan Capistrano	161	38,301	6,166,461	
Santa Margarita WD	128	161,264	20,641,792	
Seal Beach	95	24,000	2,280,000	
Serrano WD	301	6,263	1,885,163	
South Coast WD	140	34,232	4,792,480	
Trabuco Canyon WD	173	12,921	2,235,333	
Tustin	95	66,421	6,309,995	
Westminster	75	94,068	7,055,100	
Yorba Linda WD	188	75,608	14,214,304	
Anaheim	114	365,987	41,722,518	
Fullerton	111	141,648	15,722,928	
Santa Ana	66	335,086	22,115,676	
Regional Alliance Totals	3,717	3,185,461	347,052,156	**109**

[*] *All participating agencies must submit individual SB X7-7 Tables, as applicable, showing the individual agency's calculations. These tables are: SB X7-7 Tables 0 through 6 , Table 7, any required supporting tables (as stated in SB X7-7 Table 7), and SB X7-7 Table 9, as applicable.These individual agency tables will be submitted with the individual or Regional Urban Water Management Plan.*

NOTES

SB X7-7 Regional Alliance - 2020 Compliance

2020 Actual GPCD	Optional Adjustment for Economic Growth[1]	Adjusted **2020 Actual GPCD**	**2020 Target GPCD** [2]	**Did Alliance Achieve Targeted Reduction for 2020?**
109	-	109	159	YES

[1] Adjustments for economic growth can be applied to either the individual supplier's data or to the aggregate regional alliance data (but not both), depending upon availability of suitable data and methods. *[2] 2020 Target GPCD will be taken from the Regional Alliance's SB X7-7 Verification Form, Option 1 Weighted Target Table, Option 2 SB X7-7 Table 7-F.*

NOTES

APPENDIX C

MWDOC's Reduced Delta Reliance Reporting

MWDOC's
REDUCED DELTA RELIANCE REPORTING

C.1 Background

Under the Sacramento-San Joaquin Delta Reform Act of 2009, state and local public agencies proposing a covered action in the Delta, prior to initiating the implementation of that action, must prepare a written certification of consistency with detailed findings as to whether the covered action is consistent with applicable Delta Plan policies and submit that certification to the Delta Stewardship Council. Anyone may appeal a certification of consistency, and if the Delta Stewardship Council grants the appeal, the covered action may not be implemented until the agency proposing the covered action submits a revised certification of consistency, and either no appeal is filed, or the Delta Stewardship Council denies the subsequent appeal.

An urban water supplier that anticipates participating in or receiving water from a proposed covered action such as a multi-year water transfer, conveyance facility, or new diversion that involves transferring water through, exporting water from, or using water in the Delta should provide information in their 2015 and 2020 Urban Water Management Plans (UWMPs) that can then be used in the covered action process to demonstrate consistency with Delta Plan Policy WR P1, Reduce Reliance on the Delta Through Improved Regional Water Self-Reliance (WR P1).

WR P1 details what is needed for a covered action to demonstrate consistency with reduced reliance on the Delta and improved regional self-reliance. WR P1 subsection (a) states that:

(a) Water shall not be exported from, transferred through, or used in the Delta if all of the following apply:

> *(1) One or more water suppliers that would receive water as a result of the export, transfer, or use have failed to adequately contribute to reduced reliance on the Delta and improved regional self-reliance consistent with all of the requirements listed inparagraph*
> *(1) of subsection (c);*
>
> *(2) That failure has significantly caused the need for the export, transfer, or use; and*
>
> *(3) The export, transfer, or use would have a significant adverse environmental impact in the Delta.*

WR P1 subsection (c)(1) further defines what adequately contributing to reduced reliance on the Delta means in terms of (a)(1) above.

(c)(1) Water suppliers that have done all the following are contributing to reduced reliance on the Delta and improved regional self-reliance and are therefore consistent with this policy:

> *(A) Completed a current Urban or Agricultural Water Management Plan (Plan) which has been reviewed by the California Department of Water Resources for compliance with the applicable requirements of Water Code Division 6, Parts 2.55, 2.6, and 2.8;*
>
> *(B) Identified, evaluated, and commenced implementation, consistent with the implementation schedule set forth in the Plan, of all programs and projects included in the Plan that are locally cost effective and technically feasible which reduce reliance on the Delta; and*
>
> *(C) Included in the Plan, commencing in 2015, the expected outcome for measurable reduction in Delta reliance and improvement in regional self-reliance. The expected outcome for measurable reduction in Delta reliance and improvement in regional self- reliance shall be reported in the Plan as the reduction in the amount of water used, or in the percentage of water used, from the Delta watershed. For the purposes of reporting, water efficiency is considered a new source of water supply, consistent with Water Code section 1011(a).*

The analysis and documentation provided below include all of the elements described in WR P1(c)(1) that need to be included in a water supplier's UWMP to support a certification of consistency for a future covered action.

C.2 Summary of Expected Outcomes for Reduced Reliance on the Delta

As stated in WR P1 (c)(1)(C), the policy requires that, commencing in 2015, UWMPs include expected outcomes for measurable reduction in Delta reliance and improved regional self- reliance. WR P1 further states that those outcomes shall be reported in the UWMP as the reduction in the amount of water used, or in the percentage of water used, from the Delta.

The expected outcomes for MWDOC's regional self-reliance were developed using the approach and guidance described in Appendix C of DWR's Urban Water Management Plan Guidebook 2020 – Final Draft (Guidebook Appendix C) issued in March 2021. The data used in this analysis represent the total regional efforts of Metropolitan, MWDOC, and its member agencies and were developed in conjunction with Metropolitan as part of the UWMP coordination process.

The following provides a summary of the near-term (2025) and long-term (2045) expected outcomes for MWDOC's Delta reliance and regional self-reliance. The results show that as a region, MWDOC, Metropolitan, and its member agencies are measurably reducing reliance on the Delta and improving regional self-reliance, both as an amount of water used and as a percentage of water used.

Expected Outcomes for Regional Self-Reliance for MWDOC

- Near-term (2025) – Normal water year regional self-reliance is expected to increase by 243 TAF from the 2010 baseline; this represents an increase of about 37 percent of 2025 normal water year retail demands (Table C-2).
- Long-term (2040) – Normal water year regional self-reliance is expected to increase by nearly 265 TAF from the 2010 baseline, this represents an increase of about 38 percent of 2045 normal water year retail demands (Table C-2).

C.3 Demonstration of Reduced Reliance on the Delta

The methodology used to determine MWDOC's reduced Delta reliance and improved regional self-reliance is consistent with the approach detailed in DWR's UWMP Guidebook Appendix C, including the use of narrative justifications for the accounting of supplies and the documentation of specific data sources. Some of the key assumptions underlying MWDOC's demonstration of reduced reliance include:

- All data were obtained from the current 2020 UWMP or previously adopted UWMPs and represent average or normal water year conditions.
- All analyses were conducted at the service area level, and all data reflect the total contributions of MWDOC and its member agencies in conjunction with information provided by Metropolitan.
- No projects or programs that are described in the UWMPs as "Projects Under Development" were included in the accounting of supplies.

Baseline and Expected Outcomes

In order to calculate the expected outcomes for measurable reduction in Delta reliance and improved regional self-reliance, a baseline is needed to compare against. This analysis uses a normal water year representation of 2010 as the baseline, which is consistent with the approach described in the Guidebook Appendix C. Data for the 2010 baseline were taken from MWDOC's 2005 UWMP as the UWMPs generally do not provide normal water year data for the year that they are adopted (i.e., 2005 UWMP forecasts begin in 2010, 2010 UWMP forecasts begin in 2015, and so on).

Consistent with the 2010 baseline data approach, the expected outcomes for reduced Delta reliance and improved regional self-reliance for 2015 and 2020 were taken from MWDOC's 2010 and 2015 UWMPs respectively. Expected outcomes for 2025-2040 are from the current 2020 UWMP. Documentation of the specific data sources and assumptions are included in the discussions below.

Service Area Demands without Water Use Efficiency

In alignment with the Guidebook Appendix C, this analysis uses normal water year demands, rather than normal water year supplies to calculate expected outcomes in terms of the percentage of water used. Using normal water year demands serves as a proxy for the amount of supplies that would be used in a normal water year, which helps alleviate issues associated with how supply capability is presented to fulfill requirements of the UWMP Act versus how supplies might be accounted for to demonstrate consistency with WR P1.

Because WR P1 considers water use efficiency savings a source of water supply, water suppliers such as MWDOC needs to explicitly calculate and report water use efficiency savings separate from service area demands to properly reflect normal water year demands in the calculation of reduced reliance. As explained in the Guidebook Appendix C, water use efficiency savings must be added back to the normal year demands to represent demands without water use efficiency savings accounted for; otherwise the effect of water use efficiency savings on regional self-reliance would be overestimated. Table C-1 shows the results of this adjustment for MWDOC. Supporting narratives and documentation for the all of the data shown in Table C-1 are provided below.

Table C -1

Service Area Water Use Efficiency Demands	2010	2015	2020	2025	2030	2035	2040
Service Area Water Demands with Water Use Efficiency	616,714	552,487	482,879	486,747	495,958	502,014	501,487
Non-Potable Water Demands	124,590	122,568	121,721	107,634	109,508	51,600	51,600
Potable Service Area Demands with Water Use Efficiency	492,124	429,919	361,158	379,113	386,450	450,414	449,887

Total Service Area Population	2010	2015	2020	2025	2030	2035	2040
Service Area Population	2,197,120	2,295,946	2,342,740	2,411,727	2,473,392	2,518,117	2,532,393

Water Use Efficiency Since Baseline	2010	2015	2020	2025	2030	2035	2040
Per Capita Water Use (GPCD)	200	167	138	140	139	160	159
Change in Per Capita Water Use from Baseline (GPCD)		(33)	(62)	(60)	(60)	(40)	(41)
Estimated Water Use Efficiency Since Baseline		84,341	163,583	161,080	167,555	113,609	117,333

Total Service Area Water Demands	2010	2015	2020	2025	2030	2035	2040
Service Area Water Demands with Water Use Efficiency	616,714	552,487	482,879	486,747	495,958	502,014	501,487
Estimated Water Use Efficiency Since Baseline	-	84,341	163,583	161,080	167,555	113,609	117,333
Service Area Water Demands without Water Use Efficiency	616,714	636,828	646,462	647,827	663,513	615,623	618,820

Service Area Demands with Water Use Efficiency

The service area demands shown in Table C-1 represent the total retail water demands for MWDOC's service area and include municipal and industrial demands, agricultural demands, recycled, seawater barrier demands, and storage replenishment demands. These demand types and the modeling methodologies used to calculate them are described in 4.3 of MWDOC's 2020 UWMP.

Non-Potable Water Demands

The non-potable water demands shown in Table C-1 represent demands for non-potable recycled water, water used for surface reservoir storage, and replenishment water for groundwater basin recharge and sweater barrier demands. In accordance with section C.3.6 of the UWMP Guidebook, MWDOC characterizes demands for groundwater basin recharge and seawater barrier demands as indirect uses of water. In order to avoid double counting of water use these supplies are generally excluded from demand projections, since they are already captures as part of MWDOC's retail water demand. Additionally, non-potable supplies have a demand hardening effect due to the inability to shift non-potable supplies to meet potable water demands. When water use efficiency or conservation measures are implemented, they fall solely on the potable water users. This is consistent with the approach for water conservation reporting used by the State Water Resources Control Board.

Total Service Area Population

MWDOC's total service area population as shown in Table C-1 come from the Center for Demographic Research, with actuals and projections further described in Section 3.4 of the 2020 MWDOC UWMP.

Water Use Efficiency Since Baseline

The water use efficiency numbers shown in Table C-1 represent the formulation that MWDOC utilized, consistent with Appendix C of the UWMP Guidebook approach.

Service area demands, excluding non-potable demands, are divided by the service area population to get per capita water use in the service area in gallons per capita per day (GPCD) for each five-year period. The change in per capita water use from the baseline is the comparative GPCD from that five-year period compared to the 2010 baseline. Changes in per capita water use over time are then applied back to the MWDOC service area population to calculate the estimated WUE Supply. This estimated WUE Supply is considered an additional supply that may be used to show reduced reliance on Delta water supplies.

The demand and water use efficiency data shown in Table C-1 were collected from the following sources:

- Baseline (2010) values – MWDOC's 2005 UWMP, Table 2-2-1-A and Table 2-2-1-A
- 2015 values – MWDOC's 2010 UWMP, Table 2-10
- 2020 values – MWDOC's 2015 UWMP, Table 2-3
- 2025-2040 values – MWDOC's 2020 UWMP, Table 4-1

It should be noted that the results of this calculation differ from what MWDOC calculated under MWDOC's 2020 UWMP Section 5.2 pertaining to the Water Conservation Act of 2009 (SB X7-7) due to differing formulas.

C.4 Supplies Contributing to Regional Self-Reliance

For a covered action to demonstrate consistency with the Delta Plan, WR P1 subsection (c)(1)(C) states that water suppliers must report the expected outcomes for measurable improvement in regional self-reliance. Table C-2 shows expected outcomes for supplies contributing to regional self-reliance both in amount and as a percentage. The numbers shown in Table C-2 represent efforts to improve regional self-reliance for MWDOC's entire service area and include the total contributions of MWDOC and its member agencies. Supporting narratives and documentation for the all of the data shown in Table C-2 are provided below.

The results shown in Table C-2 demonstrate that MWDOC's service area is measurably improving its regional self-reliance. In the near-term (2025), the expected outcome for normal water year regional self-reliance increases by 126 TAF from the 2010 baseline; this represents an increase of about 19.3 percent of 2025 normal water year retail demands. In the long-term (2040), normal water year regional self-reliance is expected to increase by more than 265 TAF from the 2010 baseline; this represents an increase of about 38 percent of 2040 normal water year retail demands.

Table C-2 – Supplies Contributing to Regional Self Reliance

Water Supplies Contributing to Regional Self-Reliance (Acre-Feet)	2010	2015	2020	2025	2030	2035	2040
Water Use Efficiency	-	84,341	163,583	161,080	167,555	174,551	178,410
Water Recycling	34,393	41,690	42,330	52,017	53,891	59,926	57,043
Stormwater Capture and Use	-	-	-	-	-	-	-
Advanced Water Technologies	66,083	100,347	94,235	130,000	130,000	130,000	130,000
Conjunctive Use Projects	-	-	-	-	-	-	-
Local and Regional Water Supply and Storage Projects	-	-	-	-	-	-	-
Other Programs and Projects the Contribute to Regional Self-Reliance	-	-	-	-	-	-	-
Water Supplies Contributing to Regional Self-Reliance	100,476	226,377	300,148	343,097	351,446	364,477	365,453

Service Area Water Demands without Water Use Efficiency	2010	2015	2020	2025	2030	2035	2040
Service Area Water Demands without Water Use Efficiency	616,714	636,828	646,462	647,827	663,513	676,566	679,880

Change in Regional Self Reliance (Acre-Feet)	2010	2015	2020	2025	2030	2035	2040
Water Supplies Contributing to Regional Self-Reliance	100,476	226,377	300,148	343,097	351,446	364,477	365,453
Change in Water Supplies Contributing to Regional Self-Reliance		125,901	199,672	242,621	250,970	264,001	264,977

Change in Regional Self Reliance (As a Percent of Water Demand w/out WUE)	2010	2015	2020	2025	2030	2035	2040
Water Supplies Contributing to Regional Self-Reliance	16.3%	35.5%	46.4%	53.0%	53.0%	53.9%	53.8%
Change in Water Supplies Contributing to Regional Self-Reliance		19.3%	30.1%	36.7%	36.7%	37.6%	37.5%

Water Use Efficiency

The water use efficiency information shown in Table C-2 is taken directly from Table C-1 above.

Water Recycling

The water recycling values shown in Table C-2 reflect the total recycled water production in MWDOC's service area as described in Section 6.6 of MWDOC's UWMP.

Advanced Water Technologies

The advanced water technologies data shown in Table C-2 include total indirect potable reuse for the Orange County Groundwater Replenishment System (GWRS) production in MWDOC's service area as described in more detail in Section 6.6 of MWDOC's UWMP.

C.5 Reliance on Water Supplies from the Delta Watershed

Metropolitan's service area as a whole, reduces reliance on the Delta through investments in non-Delta water supplies, local water supplies and demand management measures. Quantifying MWDOC's and its member agencies investments in self-reliance, locally, regionally, and throughout Southern California is infeasible for the reasons as noted in Section C.6. Due to the regional nature of these investments, MWDOC is relying on Metropolitan's regional accounting of measurable reductions in supplies from the Delta Watershed.

The results shown in Table A.11-3 demonstrate that Metropolitan's service area, including MWDOC, is measurably reducing its Delta reliance. In the near-term (2025), the expected outcome for normal water year reliance on supplies from the Delta watershed decreased by 301 TAF from the 2010 baseline; this represents a decrease of 3 percent of 2025 normal water year retail demands. In the long- term (2045), normal water year reliance on supplies from the Delta watershed decreased by 314 TAF from the 2010 baseline; this represents a decrease of just over 5 percent of 2045 normal water year retail demands.

Table C-2
Metropolitan Reliance on Water Supplies from the Delta Watershed

Water Supplies from the Delta Watershed (Acre Feet)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045
CVP/SWP Contract Supplies	1,472,000	1,029,000	984,000	1,133,000	1,130,000	1,128,000	1,126,000	1,126,000
Delta/Delta Tributary Diversions	-	-	-	-	-	-	-	-
Transfers and Exchanges of Supplies from the Delta Watershed	20,000	44,000	91,000	58,000	52,000	52,000	52,000	52,000
Other Water Supplies from the Delta Watershed	-	-	-	-	-	-	-	-
Total Water Supplies from the Delta Watershed	**1,492,000**	**1,073,000**	**1,075,000**	**1,191,000**	**1,182,000**	**1,180,000**	**1,178,000**	**1,178,000**

Service Area Demands without Water Use Efficiency (Acre Feet)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045
Service Area Demands without Water Use Efficiency Accounted For	5,493,000	5,499,000	5,219,000	4,925,000	5,032,000	5,156,000	5,261,000	5,374,000

Change in Supplies from the Delta Watershed (Acre Feet)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045
Water Supplies from the Delta Watershed	1,492,000	1,073,000	1,075,000	1,191,000	1,182,000	1,180,000	1,178,000	1,178,000
Change in Supplies from the Delta Watershed	**NA**	**(419,000)**	**(417,000)**	**(301,000)**	**(310,000)**	**(312,000)**	**(314,000)**	**(314,000)**
Percent Change in Supplies from the Delta Watershed (As a Percent of Demand w/out WUE)	**Baseline (2010)**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
Percent of Supplies from the Delta Watershed	27.2%	19.5%	20.6%	24.2%	23.5%	22.9%	22.4%	21.9%
Change in Percent of Supplies from the Delta Watershed	**NA**	**-7.6%**	**-6.6%**	**-3.0%**	**-3.7%**	**-4.3%**	**-4.8%**	**-5.2%**

C.6 Metropolitan Member and Sub-Member Agency Infeasibility of Accounting Supplies from the Delta Watershed

Metropolitan's member agencies and retail subagencies individually contribute to reduced reliance on the Delta in two ways. First, through the development of local projects and demand management measures in their own service areas, and second through their investments in regional projects and programs through Metropolitan. Regional investments are funded through revenues from water purchases from Metropolitan or one or more of its member agencies. Metropolitan uses a portion of revenues from those purchases to fund projects and programs that contribute to the region's reduced reliance on Delta water supplies. Because some or all of these regional investments may not be constructed or implemented directly in a particular water supplier's service area, a water supplier's demands on Metropolitan or one or more of its member agencies will not accurately reflect that water supplier's total contributions to reduced reliance on supplies from the Delta watershed. It infeasible for a water supplier that makes investments in regional projects and programs to quantify its individual contributions to reduced reliance and reflect them properly in its demands on Metropolitan or one or more of Metropolitan's member agencies.

The following discussions outline how regional funding is provided through Metropolitan's local resources and conservation incentive programs and how funding for those programs is collected through Metropolitan's water rates. The history and participation of Metropolitan's member agencies and the local agencies that purchase water from Metropolitan's members in local resource and demand management in the region has spanned more than four decades, and thus makes accounting of these contributions at the individual agency level infeasible for those agencies to calculate.

Local Resources Programs

In 1982, Metropolitan began providing financial incentives to its member agencies to develop new local supplies to assist in meeting the region's water needs. Because of Metropolitan's regional distribution system these programs benefit all member agencies regardless of project location because they help to increase regional water supply reliability, reduce demands for imported water supplies, decrease the burden on Metropolitan's infrastructure, reduce system costs and free up conveyance capacity to the benefit of all the agencies that rely on water from Metropolitan. For example, the Groundwater Replenishment System (GWRS) operated by the Orange County Water District, is the world's largest water purification system for indirect potable reuse and was funded, in part, by Metropolitan's local resource program and its Member Agencies. Annually, GWRS produces approximately 103,000 acre-feet of reliable, locally controlled, drought-proof supply of high-quality water to recharge the Orange County Groundwater Basin and protect it from seawater intrusion. GWRS is a premier example of a regional project that significantly reduced the need to utilize imported water for groundwater replenishment in the Metropolitan Service area, increasing regional and local supply reliability and reducing the region's reliance on imported supplies, including supplies from the State Water Project.

Metropolitan's local resource programs have evolved through the years to better assist Metropolitan's member agencies in increasing local supply production. The following is a description and history of the local supply incentive programs.

Local Projects Program

In 1982, Metropolitan initiated the Local Projects Program (LPP), which provided funding to member agencies to facilitate the development of recycled water projects. Under this approach, Metropolitan contributed a negotiated up-front funding amount to help finance project capital costs. Participating member agencies were obligated to reimburse Metropolitan over time. In 1986, the LPP was revised. Changing the up-front funding approach to an incentive-based approach. Metropolitan contributed an amount equal to the avoided State Water Project pumping costs for each acre-foot of recycled water delivered to end-use consumers. This funding incentive was based on the assumption that local projects resulted in the reduction of water imported from the Delta and the associated pumping cost. The incentive amount varied from year to year depending on the actual variable power cost paid for State Water Project imports. In 1990, Metropolitan's Board increased the LPP contribution to a fixed rate of $154 per acre-foot, which was calculated based on Metropolitan's avoided capital and operational costs to convey, treat, and distribute water, and included considerations of reliability and service area demands.

Groundwater Recovery Program

The drought of the early 1990s sparked the need to develop additional local water resources, aside from recycled water, to meet regional demand and increase regional water supply reliability. In 1991, Metropolitan conducted the Brackish Groundwater Reclamation Study which determined that large amounts of degraded groundwater in the region were not being utilized. Subsequently, the Groundwater Recovery Program (GRP) was established to assist the recovery of otherwise unusable groundwater degraded by minerals and other contaminants, provide access to the storage assets of the degraded groundwater, and maintain the quality of groundwater resources by reducing the spread of degraded plumes.

Local Resources Program

In 1995, Metropolitan's Board adopted the Local Resources Program (LRP), which combined the LPP and GRP into one program. The Board allowed for existing LPP agreements with a fixed incentive rate to convert to the sliding scale up to $250 per acre-foot, similar to GRP incentive terms. Those agreements that were converted to LRP are known as "LRP Conversions."

Competitive Local Projects Program

In 1998, the Competitive Local Resources Program was established. The competitive program encouraged development of recycled water and recovered groundwater through a process that emphasized cost-efficiency to Metropolitan, timing new production according to regional need while minimizing program administration cost. Under the competitive program, agencies requested an incentive rate up to $250 per acre-foot of production over 25 years under a Request for Proposals (RFP) for the development of up to 53,000 acre-feet per year of new water recycling and groundwater recovery projects. In 2003, a second RFP was issued for the development of an additional 65,000 acre-feet of new recycled water and recovered groundwater projects through the LRP.

Seawater Desalination Program

Metropolitan established the Seawater Desalination Program (SDP) in 2001 to provide financial incentives to member agencies for the development of seawater desalination projects. In 2014, seawater desalination projects became eligible for funding under the LRP and the SDP was ended.

2007 Local Resources Program

In 2006, a task force comprising member agency representatives was formed to identify and recommend program improvements to the LRP. As a result of the task force process the 2007 LRP was established with a goal of 174,000 acre-feet per year of additional local water resource development. The new program allowed for an open application process and eliminated the previous competitive process. This program offered sliding scale incentives of up to $250 per acre-foot, calculated annually based on a member agency's actual local resource project costs exceeding Metropolitan's prevailing water rate.

2014 Local Resources Program

A series of workgroup meetings with member agencies was held to identify the reasons why there was a lack of new LRP applications coming into the program. The main constraint identified by the member agencies was that the $250 per acre-foot was not providing enough of an incentive for developing new projects due to higher construction costs to meet water quality requirements and to develop the infrastructure to reach end-use consumers located further from treatment plants. As a result, in 2014, the Board authorized an increase to the maximum incentive amount, provided alternative payment structures, included onsite retrofit costs and reimbursable services as part of the LRP and added eligibility for seawater desalination projects. The current LRP incentive payment options are structured as follows:

- Option 1 – Sliding scale incentive up to $340/AF for a 25-year agreement term
- Option 2 – Sliding scale incentive up to $475/AF for a 15-year agreement term
- Option 3 – Fixed incentive up to $305/AF for a 25-year agreement term

On-site Retrofit Programs

In 2014, Metropolitan's Board also approved the On-site Retrofit Pilot Program which provided financial incentives to public or private entities toward the cost of small-scale improvements to their existing irrigation and industrial systems to allow connection to existing recycled water pipelines. The On-site Retrofit Pilot Program helped reduce recycled water retrofit costs to the end-use consumer which is a key constraint that limited recycled water LRP projects from reaching full production capacity. The program incentive was equal to the actual eligible costs of the on-site retrofit, or $975 per acre-foot of up-front cost which equates to $195 per acre-foot for an estimated five years of water savings ($195/AF x 5 years) multiplied by the average annual water use in previous three years, whichever is less. The Pilot Program lasted two years and was successful in meeting its goal of accelerating the use of recycled water.

In 2016 Metropolitan's Board authorized the On-site Retrofit Program (ORP), with an additional budget of $10 million. This program encompassed lessons learned from the Pilot Program and feedback from member agencies to make the program more streamlined and improve its efficiency. As of fiscal year 2019/20, the ORP has successfully converted 440 sites increasing the use of recycled water by 12,691 acre-feet per year.

Stormwater Pilot Programs

In 2019, Metropolitan's Board authorized both the Stormwater for Direct Use Pilot Program and a Stormwater for Recharge Pilot Program to better understand stormwater in Southern California. These pilot programs are intended to encourage the development, monitoring, and study of new and existing stormwater projects by providing financial incentives for their construction/ retrofit and monitoring/reporting costs. These pilot programs will help evaluate the potential water supply benefits delivered by stormwater capture projects and provide a basis for potential future funding approaches. Metropolitan's Board authorized a total of $12.5 million for the stormwater pilot programs ($5 million for the District Use Pilot and $7.5 million for the Recharge Pilot).

Current Status

Today, nearly one-half of the total recycled water and groundwater recovery production in the region is developed with an LRP incentive by Metropolitan. During fiscal year 2019/20, Metropolitan provided about $13 million for production of 71,000 acre-feet of recycled water for non-potable and indirect potable uses. Metropolitan provided about $4 million to support projects that produced about 50,000 acre-feet of recovered groundwater for municipal use. Since 1982, Metropolitan has invested $680 million to fund 85 recycled water projects and 27 groundwater recovery projects that have produced a cumulative total of about 4 million acre-feet.

Conservation Programs

Metropolitan's regional conservation programs and approaches have a long history. Decades ago, it was recognized that demand management would be an important part of balancing regional supplies and demands. By reducing the demand for water, water conservation efforts were seen as a way to reduce the need of imported supplies and offset the need to transport or store additional water into or within the Metropolitan service area. The actual conservation of water takes place at the retail consumer level. Regional conservation approaches have proven to be effective at reaching retail consumers throughout the service area and successfully implementing water saving devices, programs, and practices. Regional investments in demand management programs, of which conservation is a key part along with local supply programs, benefit all member agencies regardless of project location. These programs help to increase regional water supply reliability, reduce demands for imported water supplies, decrease the burden on the district's infrastructure and reduce system costs, and free up conveyance capacity to the benefit of all system users.

Incentive-Based Conservation Programs

Conservation Credits Program

In 1988, Metropolitan's Board approved the Water Conservation Credits Program (Credits Program). The Credits Program is similar in concept to the Local Projects Program (LPP). The purpose of the Credits Program is to encourage local water agencies to implement effective water conservation projects through the use of financial incentives. The Credits Program provides financial assistance for water conservation projects that reduce demands on Metropolitan's imported water supplies and require Metropolitan's assistance to be financially feasible.

Initially, the Credits Program provided 50 percent of a member agency's program cost, up to a maximum of $75 per acre-foot of estimated water savings. The $75 Base Conservation Rate was established based Metropolitan's avoided cost of pumping SWP supplies. The Base Conservation Rate has been revisited by Metropolitan's Board and revised twice since 1988, from $75 to $154 per acre-foot in 1990 and from $154 to $195 per acre-foot in 2005.
In fiscal year 2019/20 Metropolitan processed more than 30,400 rebate applications totaling $18.9 million.

Member Agency Administered Program

Some agencies also have unique programs within their service areas that provide local rebates that may differ from Metropolitan's regional program. Metropolitan continues to support these local efforts through a member agency administered funding program that adheres to the same funding guidelines as the Credits Program. The Member Agency Administered Program allows member agencies to receive funding for local conservation efforts that supplement, but do not duplicate, the rebates offered through Metropolitan's regional rebate program.

Water Savings Incentive Program

There are numerous commercial entities and industries within Metropolitan's service area that pursue unique savings opportunities that do not fall within the general rebate programs that Metropolitan provides. In 2012, Metropolitan designed the Water Savings Incentive Program (WSIP) to target these unique commercial and industrial projects. In addition to rebates for devices, under this program, Metropolitan provides financial incentives to businesses and industries that created their own custom water efficiency projects. Qualifying custom projects can receive funding for permanent water efficiency changes that result in reduced potable demand.

Non-Incentive Conservation Programs

In addition to its incentive-based conservation programs, Metropolitan also undertakes additional efforts throughout its service area that help achieve water savings without the use of rebates. Metropolitan's non-incentive conservation efforts include:

- residential and professional water efficient landscape training classes
- water audits for large landscapes
- research, development and studies of new water saving technologies
- advertising and outreach campaigns
- community outreach and education programs
- advocacy for legislation, codes, and standards that lead to increased water savings

Current Status

Since 1990, Metropolitan has invested $824 million in conservation rebates that have resulted in a cumulative savings of 3.27 million acre-feet of water. These investments include $450 million in turf removal and other rebates during the last drought which resulted in 175 million square feet of lawn turf removed. During fiscal year 2019/20, 1.06 million acre-feet of water is estimated to have been conserved. This annual total includes Metropolitan's Conservation Credits Program, code-based conservation achieved through Metropolitan-sponsored legislation; building plumbing codes and ordinances; reduced consumption resulting from changes in water pricing; and pre-1990 device retrofits.

Rate Structure

Metropolitan's regional demand management programs and approaches have a long history. Decades ago, it was recognized that demand management would be an important part of balancing regional supplies and demands. Developing new local projects and increasing water conservation efforts were seen as ways to reduce the need of increased imported supplies and offset the need to transport or store additional water into or within the Metropolitan service area, reducing infrastructure costs.

The actual production and use of local resources and conservation of water under Metropolitan's demand management programs takes place at the member agency or end-user level, meaning they produce or conserve water for their own use, and the water is not Metropolitan's. Metropolitan determined decades ago that regional investments in demand management—both conservation and local resource development—benefit all member agencies regardless of project location. These programs help to increase regional water supply reliability, reduce demands for imported water supplies, decrease the burden on Metropolitan's infrastructure and reduce system costs, and free up conveyance capacity to the benefit of all system users.

Infeasibility of Accounting

The accounting of the regional investments that contribute to reducing Metropolitan's reliance on the Delta is straightforward to calculate and report at the regional aggregate level. However, any similar accounting is infeasible at the individual member or sub-member agency level. As described above, the region (through Metropolitan) makes significant investments in resources and programs that reduce reliance on the Delta. In fact, all of Metropolitan's investments in Colorado River supplies, groundwater and surface storage, local resources development and demand management measures that reduce reliance on the Delta are collectively funded by revenues generated from the member agencies (and their subagencies) through rates and charges. The relative contributions for a member agency may be able to be approximately quantified or estimated by proxy through relative water purchases, however making an estimate of any quantifiable savings in gallons or acre-feet is not feasible. Water purchases cannot, with any accuracy or precision, be tied to the actual projects or programs that deliver water to the collective member agencies and their subagencies. Additionally, using water purchases as a proxy for member agency and subagencies would result in projects and programs done outside of the Metropolitan incentive programs to be omitted and discounted. Accounting at the regional level allows for the incorporation of these local supplies and water use efficiency programs done by member agencies and subagencies in both the regional programs and their own specific local programs. Projects and programs each have different online dates, useful lives, production, incentive rates and contributions that cannot be matched to the demands or supply production history of an individual agency, or consistently across the agencies within Metropolitan's service area. As shown above, despite that infeasibility, Metropolitan's members and their subagencies have together made substantial contributions to the region's reduced reliance.

C.7 2015 UWMP Appendix

The information contained in this Appendix C is also intended to be a new Appendix H attached to MWDOC's 2015 UWMP consistent with WR P1 subsection (c)(1)(C) (Cal. Code Regs. tit. 23, § 5003). MWDOC provided notice of the availability of the draft 2020 UWMP (including this Appendix C which will also be a new Appendix H to its 2015 UWMP) and 2020 WSCP and the public hearing to consider adoption of both plans in accordance with CWC Sections 10621(b) and 10642, and Government Code Section 6066, and Chapter 17.5 (starting with Section 7290) of Division 7 of Title 1 of the Government Code. The public review drafts of the 2020 UWMP, Appendix H to the 2015 UWMP, and the 2020 WSCP were posted prominently on MWDOC's website, mwdoc.com. The notice of availability of the documents was sent to MWDOC's member agencies, as well as cities and counties in MWDOC's service area. In addition, a public notice advertising the public hearing was published in the OC Register on May 3 and 10, 2021. Copies of: (1) the notification letter sent to the member agencies, cities, and county in MWDOC's service area, and (2) the notice published in the newspapers are included in the 2020 UWMP Appendix L. Thus, this Appendix C to MWDOC's 2020 UWMP, which will be adopted with MWDOC's 2020 UWMP, will also be recognized and treated as Appendix H to MWDOC's 2015 UWMP.

C.8 References

http://www.mwdh2o.com/WhoWeAre/Board/Board-Meeting/Board%20Archives/2017/12-Dec/Reports/064863458.pdf

http://www.mwdh2o.com/PDF_About_Your_Water/Annual_Achievement_Report.pdf

http://www.mwdh2o.com/WhoWeAre/Board/Board-Meeting/Board%20Archives/2016/12-Dec/Reports/064845868.pdf

http://www.mwdh2o.com/WhoWeAre/Board/Board-Meeting/Board%20Archives/2012/05%20-%20May/Letters/064774100.pdf

http://www.mwdh2o.com/WhoWeAre/Board/Board-Meeting/Board%20Archives/2020/10%20-%20Oct/Letters/10132020%20BOD%209-3%20B-L.pdf

http://www.mwdh2o.com/WhoWeAre/Board/Board-Meeting/Board%20Archives/2001/10-October/Letters/003909849.pdf

APPENDIX D

2017 Basin 8-1 Alternative

Basin 8-1 Alternative

Submitted by: Orange County Water District
City of La Habra
Irvine Ranch Water District

Submitted to: California Department of Water Resources

January 1, 2017

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VI. Santa Ana Canyon Management Area

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BASIN 8-1 ALTERNATIVE OVERVIEW

The Sustainable Groundwater Management Act (SGMA) requires all high- and medium-priority basins, as designated by the Department of Water Resources (DWR), be sustainably managed. DWR designated the Coastal Plain of Orange County Groundwater Basin ("Basin 8-1" or "Basin") as a medium-priority basin, primarily due to heavy reliance on the Basin's groundwater as a source of water supply.

Compliance with SGMA can be achieved in one of two ways:

1) A Groundwater Sustainability Agency (GSA) is formed and a Groundwater Sustainability Plan (GSP) is adopted, or
2) Special Act Districts created by statute, such as OCWD, and other agencies may prepare and submit an Alternative to a GSP.

The agencies within Basin 8-1 have agreed to collaborate together in order to submit an Alternative to a GSP. Within this document, this Alternative to a GSP will be referred to herein as the "Basin 8-1 Alternative" or "Alternative". In accordance with Water Code §10733.6(b)(3), this Alternative presents an analysis of basin conditions that demonstrates that the Basin has operated within its sustainable yield over a period of at least 10 years. In addition, the Alternative establishes objectives and criteria for management that would be addressed in a GSP and is designed to be "functionally equivalent" to a GSP. As will be shown in the Basin 8-1 Alternative, Basin 8-1 has been operated within its sustainable yield for more than 10 years without experiencing significant and unreasonable (1) lowering of groundwater levels, (2) reduction in storage, (3) water quality degradation, (4) seawater intrusion, (5) inelastic land subsidence, or (6) depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water. Please note that the boundaries of Basin 8-1 described in this document are based on the scientific boundary modifications as accepted by DWR in 2016 as part of the Basin Boundary Modification Process.

The Basin 8-1 Alternative has been jointly prepared by the Orange County Water District (OCWD), Irvine Ranch Water District (IRWD); and the City of La Habra (collectively the "Submitting Agencies"); pursuant to this Alternative, the Submitting Agencies will ensure the entire Basin 8-1 continues to be sustainably managed and data reported as required by SGMA. Other agencies within Basin 8-1 and at least partially outside of OCWD's boundaries support submission of the Basin 8-1 Alternative and either have participated in preparing the Alternative and/or reviewed the Alternative. These agencies include the cities of Brea, Corona, and Chino Hills; the Counties of Orange, Riverside, and San Bernardino; Yorba Linda Water District; and El Toro Water District. Pursuant to Water Code §10733.6(b)(3), the Basin 8-1 Alternative has been prepared by or under the direction of a professional geologist or professional engineer.

For the purpose of compliance with the SGMA requirement that the entire basin be covered by this Basin 8-1 Alternative, Submitting Agencies have divided Basin 8-1 into four management areas: La Habra-Brea, OCWD, South East, and Santa Ana Canyon Management Areas, shown in Figure 1-1.

Historically, the majority of Basin 8-1 (90% of the land area) has been managed by OCWD, which includes the land area within the OCWD Management Area and a small portion of the land area within the Santa Ana Canyon Management Area. The percentage of the land area within Basin 8-1 in each of the management areas is shown in Figure 1-2.

Although the land areas outside of OCWD's jurisdiction in the Santa Ana Canyon and South East Management Areas have not been formally "managed" by OCWD, the hydrogeological conditions in these areas are essentially an extension of the managed basin. OCWD has incorporated data, when available, from these areas into the OCWD data base. For example, precipitation runoff from the mountains along the eastern border (in the South East Management Area) is estimated and incorporated into OCWD's basin water budget. The Santa Ana Canyon Management Area, created in this report in order to include land within and outside of OCWD's service area, is upstream of OCWD recharge operations. While OCWD does not have jurisdiction over all the land in this area, OCWD does have the rights to all the water in the Santa Ana River released from Prado Dam. In this respect, OCWD is actively engaged in managing the flow of surface water within the Santa Ana Canyon irrespective of land ownership.

While the four management areas are described separately in this report, it is important to understand that actual "management" is not as distinct, and existing collaborative efforts between agencies in managing groundwater resources will continue. In the case of the La Habra-Brea Management Area, the City of La Habra has already been deemed the exclusive GSA for the La Habra/Brea area and intends to prepare a Groundwater Sustainability Plan (GSP). When La Habra submits a GSP, this Basin 8-1 Alternative will no longer include the La Habra/Brea area within the area designated by the GSP.

As authorized by 23 CCR § 354.20, this Basin 8-1 Alternative describes four management areas as shown in Figure 1. The rationale for designating these management areas within Basin 8-1 is explained as follows:

- La Habra-Brea Management Area includes the northern portion of Basin 8-1 that is located outside of the OCWD service area and is within the cities of La Habra and Brea. The City of La Habra currently manages this portion of Basin 8-1. Although this management area is hydrologically distinct from the OCWD Management Area there is an estimated 1,000 afy of subsurface groundwater flow from the La Habra-Brea Management Area to the OCWD Management Area. Surface water that recharges the OCWD portion of Basin 8-1 does not replenish the La Habra-Brea Management Area.

- The OCWD Management Area includes approximately 89 percent of the land area of Basin 8-1. Ninety-eight percent of all groundwater production within 8-1 occurs in this management area. This area includes the portion of Basin 8-1 that is within OCWD's service area, except for an approximately 7-square mile portion of OCWD's service area that is in the Santa Ana Canyon Management Area. OCWD has been managing the majority of Basin 8-1 since its formation in 1933.

- The South East Management Area includes the southern and southeastern portion of Basin 8-1 that is hydrogeologically connected to the OCWD Management Area but is outside of OCWD's service area. This area consists of several, disconnected, small fringe areas that are within the DWR designated boundary of Basin 8-1. This management area includes areas under the jurisdiction of the IRWD, the El Toro Water District and the City of Orange. The groundwater basin in this area is thin and contains more clay and silt deposits than aquifers in the OCWD Management Area. Groundwater historically has flowed out of this area into the OCWD Management Area. Production has been minimal in this area due to hydrogeological conditions with little potential for significant future increases.

- The Santa Ana Canyon Management Area includes the easternmost section of Basin 8-1. This area includes land under the jurisdiction of several cities, two counties, and two water districts, including a portion that is within the OCWD service area. Groundwater production is relatively minor compared to groundwater production in the OCWD Management Area.   The western boundary of this management area is located at Imperial Highway in the city of Anaheim where the basin thickness begins to increase. Imperial Highway crosses the Santa Ana River where OCWD begins to divert river water into the recharge facilities for percolation into the groundwater basin.

The Basin 8-1 Alternative is organized as follows:

- Overview: Provides a map and description of Basin 8-1 and a brief description of the basin management areas.

- Hydrogeology of Basin 8-1: Provides a description of the hydrogeology of Basin 8-1 including a description of the basin, the aquifer systems, fault zones, total basin volume, basin cross-sections, basin characteristics, and general groundwater quality.

- La Habra-Brea Management Area: Provides a description of sustainable management of the La Habra-Brea Management Area

- OCWD Management Area: Provides a description of sustainable management of the OCWD Management Area

- South East Management Area: Provides a description of sustainable management of the South East Management Area

- Santa Ana Canyon Management Area: Provides a description of sustainable management of the Santa Ana Canyon Management Area

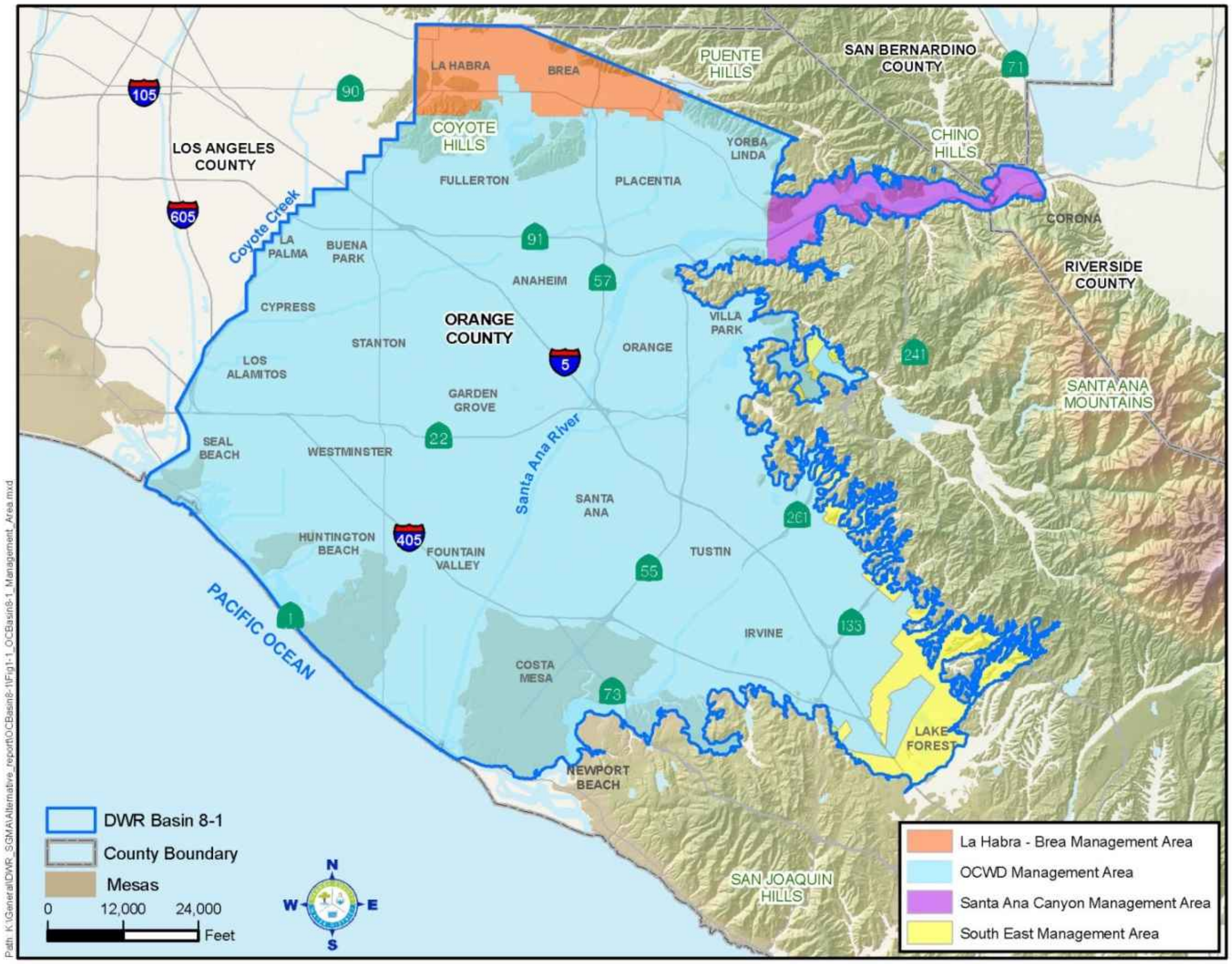

Figure 1-1: Basin 8-1 Management Area Boundaries

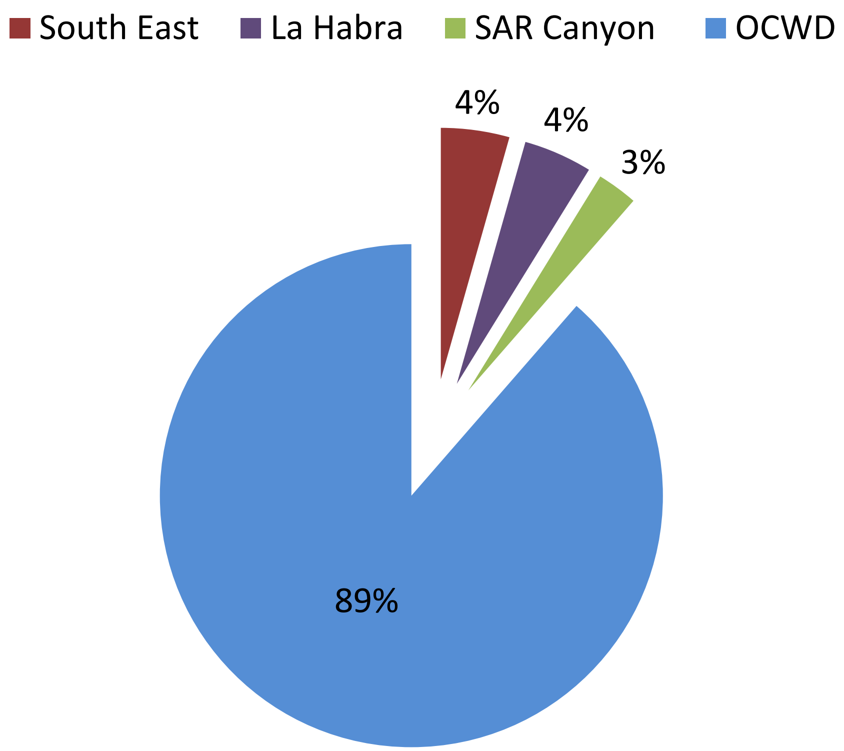

Figure 1-2: Percentage of Land Area in Basin 8-1 within Management Areas

1. LA HABRA-BREA MANAGEMENT AREA

The La Habra-Brea Management area covers the northern portion of Basin 8-1. The City of La Habra has been deemed the exclusive GSA under SGMA for this management area. This management area is part of Basin 8-1, but is hydrogeologically distinct from the OCWD Management Area and is not under the jurisdiction of OCWD. The City adopted a resolution to establish the La Habra Basin as a separate basin from Basin 8-1. OCWD adopted a resolution to support the City's request to DWR for an internal jurisdictional boundary modification in the OC Basin that follows the city limits of La Habra and Brea as is outside of the Orange County Water District's jurisdictional boundary.

The La Habra-Brea Management Area is included with this Alternative to facilitate collaboration among groundwater agencies within Basin 8-1 as required by SGMA. The City of La Habra and portions of the City of Brea comprise the La Habra-Brea Management Area. This area overlies the extents of the proposed La Habra Groundwater Basin, referenced herein.

The La Habra-Brea Management Area is currently monitored for groundwater elevations and for groundwater quality through productions wells and historical data from monitoring wells within the La Habra-Brea Management Area and surrounding area.

As the City of La Habra currently depends on local groundwater to meet approximately 40 percent of its water consumption; preserving the sustainability of the La Habra-Brea Management Area is essential. Currently (and historically), the City of La Habra manages (and has managed) the La Habra-Brea Management Area through management plans and programs for groundwater levels, basin storage, and water quality. By January 2020, the City will manage the La Habra-Brea Management Area through a Groundwater Sustainability Plan under SGMA, which will describe the monitoring program and ensure that no undesirable results occur in the future.

2. OCWD MANAGEMENT AREA

The OCWD Management Area covers an area of approximately 260 square miles within Basin 8-1, which represents approximately 89 percent of the land area of Basin 8-1. Ninety-eight percent of the groundwater production within Basin 8-1 occurs in the OCWD Management Area. Groundwater produced within the OCWD Management Area provides approximately 70 percent of the total water supply for a population of around 2.4 million residents.

Since its formation by the California Legislature in 1933, OCWD has been the managing agency for the majority of Basin 8-1, also referred to as the Coastal Plain of Orange County Groundwater Basin. As a special act district listed in Water Code § 1072(c)(1), OCWD is the exclusive local agency within its jurisdictional boundaries with powers to comply with SGMA.

Water demands within the OCWD Management Area have grown from approximately 150,000 acre-feet per year (afy) in the mid-1950s to a high of approximately 366,000 afy in water year 2007-08. OCWD operates an extensive network of recharge basins to increase recharge of surface water into the groundwater basin to support groundwater production. OCWD monitors the basin by collecting groundwater elevation and quality data from nearly 700 wells, including over 400 OCWD-owned monitoring wells, manages an electronic database that stores water elevation, water quality, production, recharge and other data on over 2,000 wells and facilities within and outside OCWD boundaries.

An OCWD-operated water recycling plant provides up to 100 million gallons per day of advanced tertiary-treated wastewater that supplies recharge operations and a seawater intrusion barrier operated to protect the basin’s water quality. OCWD manages groundwater storage and water levels within an established operating range which has resulted in sustainable conditions with no unreasonable and significant undesirable results.

The Sustainability Goal for the OCWD Management Area is to continue to sustainably manage the groundwater basin to prevent conditions that would lead to significant and unreasonable (1) lowering of groundwater levels, (2) reduction in storage, (3) water quality degradation, (4) seawater intrusion, (5) inelastic land subsidence and (6) adverse impacts on hydrologically connected surface water.

3. SOUTH EAST MANAGEMENT AREA

The South East Management Area contains portions of Irvine Ranch Water District (IRWD), El Toro Water District (ETWD), and the City of Orange. The area covered this management area is essentially an extension of the main basin and was formed to comply with the requirement that the entirety of Basin 8-1 be covered by a responsible agency.

There is relatively little existing, or potential, groundwater development within the South East Management Area. What pumping does occur is less than 200 acre-feet-per-year (afy), which is much less than the total recharge to the area. Water levels and storage levels are steady.

The Sustainability Goal for the South East Management Area is to recognize it is a small part of the larger groundwater basin that is managed by OCWD. Nevertheless, groundwater levels and water quality will be monitored to assure that conditions do not lead to significant and unreasonable (1) lowering of groundwater levels, (2) reduction in storage, (3) water quality degradation, (4) inelastic land subsidence, (5) unreasonable adverse effect on surface water resources, and (6) adverse impacts on hydrologically connected surface water.

4. SANTA ANA CANYON MANAGEMENT AREA

The Santa Ana Canyon Management Area covers the easternmost extent of Basin 8-1. The water resources in the Santa Ana Canyon Management Area include the Santa Ana River and groundwater. Groundwater is primarily located in a thin alluvial aquifer that is 90 to 100 feet thick and is a combination of infiltrated surface water and groundwater inflow from the adjacent foothills.

Groundwater pumping in this management area is primarily used for irrigation with a minimal amount used for potable purposes. The amount of groundwater pumping is small relative to the large volumes of flow in the canyon provided by the Santa Ana River and monitoring indicates there are no depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water. There are no groundwater withdrawals within the areas covered by the Cities of Anaheim, Chino Hills, and Yorba Linda; Riverside County; and Yorba Linda Water District.

OCWD has water rights to all Santa Ana River flows released through Prado Dam. For the area within its boundary, OCWD has the legal authority through the OCWD Act to require reporting of groundwater production and to charge groundwater pumping assessments for groundwater production. OCWD also monitors surface water flow and quality as well as groundwater levels and quality throughout the Santa Ana Canyon Management Area.

The Sustainability Goal for the Santa Ana Canyon Management Area is to continue monitoring sustainable conditions and monitor to ensure that no significant and unreasonable results occur in the future.

ABBREVIATIONS AND ACRONYMS

afy	acre-feet per year
AWPF	Advanced Water Purification Facility
basin	Orange County groundwater basin
Basin Model	OCWD groundwater model
BEA	Basin Equity Assessment
BPP	Basin Production Percentage
CDPH	California Department of Public Health
cfs	cubic feet per second
DATS	Deep Aquifer Treatment System
DOC	dissolved organic compound
DWR	Department of Water Resources
DWSAP	Drinking Water Source Assessment and Protection
EDCs	Endocrine Disrupting Compounds
EIR	Environmental Impact Report
EPA	U.S. Environmental Protection Agency
FY	fiscal year
GAC	granular activated carbon
GIS	geographic information system
GWRS	Groundwater Replenishment System
IAP	Independent Advisory Panel
IRWD	Irvine Ranch Water District
LACDWP	Los Angeles County Department of Public Works
maf	million acre feet
MCAS	Marine Corps Air Station
MCL	maximum contaminant level
MF	microfiltration
MODFLOW	Computer modeling program developed by USGS
mgd	million gallons per day
mg/L	milligrams per liter
MTBE	methyl tertiary-butyl ether
MWD	Metropolitan Water District of Southern California
MWDOC	Municipal Water District of Orange County
NDMA	n-Nitrosodimethylamine
NF	nanofiltration
ng/L	nanograms per liter
NBGPP	North Basin Groundwater Protection Program
NO_2	nitrite
NO_3^-	nitrate
NPDES	National Pollution Discharge Elimination System
NWRI	National Water Research Institute

ABBREVIATIONS AND ACRONYMS

O&M	operations and maintenance
OCHCA	Orange County Health Care Agency
OCSD	Orange County Sanitation District
OC Survey	Orange County Survey
OCWD	Orange County Water District
PCE	perchloroethylene
PPCPs	pharmaceuticals and personal care products
Producers	Orange County groundwater producers
RA	replenishment assessment
RO	reverse osmosis
Regional Water Board	Regional Water Quality Control Board
SARI	Santa Ana River Interceptor
SARMON	Santa Ana River Monitoring Program
SARWQH	Santa Ana River Water Quality and Health
SAWPA	Santa Ana Watershed Project Authority
SBGPP	South Basin Groundwater Protection Program
SDWA	Safe Drinking Water Act
SOCs	synthetic organic chemicals
SWP	State Water Project
SWRCB	State Water Resources Control Board
TCE	trichloroethylene
TDS	total dissolved solids
TIN	total inorganic nitrogen
µg/L	micrograms per liter
USFWS	U.S. Fish & Wildlife Service
USGS	U.S. Geological Survey
UV	ultraviolet light
VOCs	volatile organic compounds
WACO	Water Advisory Committee of Orange County
WEI	Wildermuth Environmental Inc.
WF-21	Water Factory 21
WLAM	Waste Load Allocation Model
WRD	Water Replenishment District of Southern California
WRMS	Water Resources Management System

Hydrogeology of Basin 8-1

January 1, 2017

ORANGE COUNTY WATER DISTRICT

SINCE 1933

Basin 8-1 Alternative

Hydrogeology of Basin 8-1

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January 1, 2017

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SECTION 1 INTRODUCTION

The Coastal Plain of Orange County Groundwater Basin (Basin 8-1) underlies a coastal alluvial plain in the northwestern portion of Orange County with a small portion in Riverside and San Bernardino counties at the easternmost edge. The basin is designated as Basin 8-1 in the Department of Water Resources Bulletin 118. The basin is bounded by consolidated sedimentary rocks exposed on the north in the Puente Hills and Chino Hills, on the east in the Santa Ana Mountains, and on the south in the San Joaquin Hills. The basin is bounded by the Pacific Ocean on the southwest and by a low topographic divide approximated by the Orange County-Los Angeles County line on the northwest. The basin underlies the lower Santa Ana River watershed and a portion of the Coyote Creek Watershed (Coyote Creek is a tributary to the San Gabriel River).

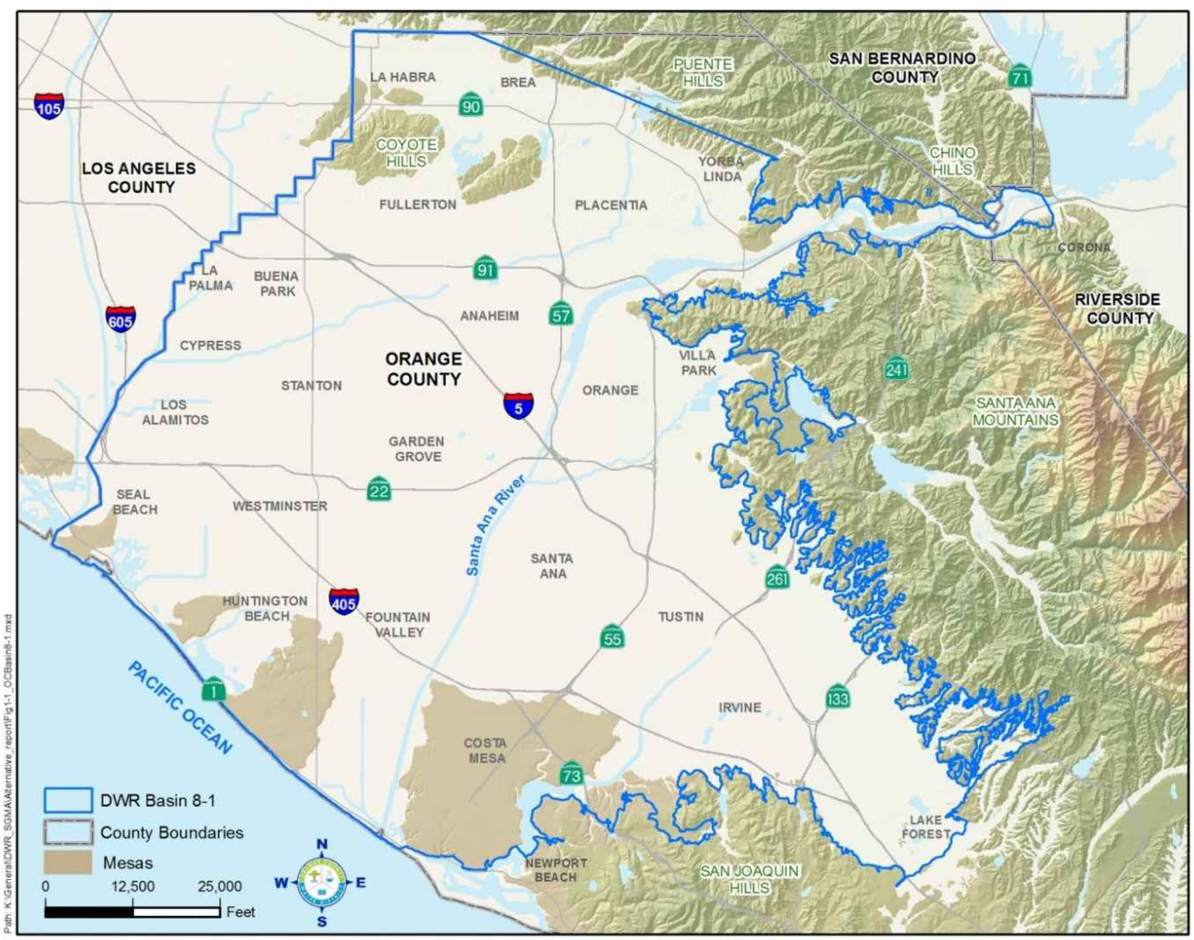


Figure 1-1: Coastal Plain of Orange County Groundwater Basin, Basin 8-1

SECTION 2 BASIN HYDROGEOLOGY

2.1 BASIN DESCRIPTION

Basin 8-1 underlies north and central Orange County beneath broad lowlands known as the Tustin and Downey plains. The basin covers an area of approximately 350 square miles, bordered by the Puente Hills and Chino Hills to the north, the Santa Ana Mountains to the northeast, and the Pacific Ocean to the southwest. The basin boundary extends to the Orange-Los Angeles county line to the northwest, where groundwater flow between Basin 8-1 and the Central Basin (Basin 4-11.04) is unrestricted. The Newport-Inglewood fault zone forms the southwestern boundary of all fresh water-bearing zones but the Shallow Aquifer, which extends to the ocean in coastal erosional gaps between the mesas.

The groundwater basin formed in a synclinal, northwest-trending trough that deepens as it continues beyond the Orange-Los Angeles county line. The Newport-Inglewood fault zone, San Joaquin Hills, Puente Hills, and Santa Ana Mountains form the uplifted margins of the syncline. The total thickness of sedimentary rocks in the basin surpasses 20,000 feet, of which only the upper 2,000 to 4,000 feet contain fresh water. In the southeastern area underlying the city of Irvine and along the basin margins, the thickness of fresh water-bearing sediments is less than 1,000 feet (Herndon and Bonsangue, 2006).

Basin 8-1 includes the La Habra Groundwater Basin which is separated from the rest of Basin 8-1 by the Coyote Hills. The La Habra Groundwater Basin lies in the synclinal trough between the Puente Hills and the Santa Fe Springs - Coyote Hills uplift. The Whittier fault, located in the Puente Hills, forms the northern limit of the La Habra syncline.

Structural folding and faulting along the basin margins, together with down warping and deposition within the basin, have occurred since Oligocene time (last 23 million years). The Newport-Inglewood fault zone, comprising the most significant structural feature in the basin from a hydrogeologic standpoint, consists of a series of faulted blocks which are generally up thrown on the southwest side. Folding and faulting along the Newport-Inglewood fault zone have created a natural restriction to seawater intrusion into the groundwater basin (Herndon and Bonsangue, 2006).

Formations of Miocene or older age constitute the base of water-bearing strata, as they are consolidated units with minimal water transmissive capacity. The tops of Miocene-aged units, including the non-marine Sespe formation, marine Vaqueros formation, and Monterey shale, form the base of water bearing sediments in the coastal and Irvine areas of the basin, whereas the tops of the Miocene-aged marine Puente and Topanga formations and El Modeno volcanics define the base of permeable sediments along inland boundary of the basin from the city of La Habra to the city of Villa Park.

Fresh water-bearing formations within the groundwater basin are comprised of Pliocene or younger (last 5 million years), semi-consolidated to unconsolidated sedimentary units. The upper Pliocene-aged Pico formation is reportedly present throughout much of the basin, and is significant in that the base of its upper unit is reported to form the base of the fresh water aquifer system where it exists. Other Pliocene-aged sediments, including the Fernando and Repetto formations, are believed to contain producible quantities of fresh water; however, they are relatively untapped in the center of the basin, as they fall below economically viable depths to which to construct water wells (>2,000 feet).

Unconsolidated sands and gravels of the Pleistocene-aged San Pedro, Lakewood, and La Habra formations, and to a lesser extent, the Coyote Hills formation and Palos Verdes sand, constitute the primary production aquifers within the groundwater basin. The non-marine Coyote Hills and La Habra formations underlie the Fullerton and Anaheim areas, whereas the marine Lakewood and San Pedro formations underlie the majority of the central and coastal portions of the basin. The Coyote Hills and La Habra formations are present in the La Habra Basin portion of Basin 8-1 and are underlain by the San Pedro formation. These marine and non-marine formations are time correlative and are thought to interfinger throughout the basin. Total depths of the base of these formations range from approximately 500 to 2,000 feet.

Overlying the Pleistocene deposits are younger, Recent-aged alluvial sediments that range from less than 50 feet to approximately 300 feet thick. These sediments include coarse-grained channel deposits laid down by the Santa Ana River, which has flowed into the Pacific Ocean as far north as the present-day San Gabriel River mouth and as far south as Newport Bay. It is these channel deposits, which have not been substantially offset by the Newport-Inglewood fault zone, that provide the conduits for seawater to migrate inland toward groundwater pumping depressions.

Pleistocene or younger aquifers within the basin form a complex series of interconnected sand and gravel deposits. In coastal and central portions of the basin, these deposits are extensively separated by lower-permeability clay and silt deposits or aquitards. In the inland areas, the clay and silt deposits become thinner and more discontinuous, allowing larger quantities of groundwater to flow more easily between shallow and deeper aquifers (DWR, 1967).

2.2 AQUIFER SYSTEMS

The current “conceptual model’ of the basin is based on studies by the DWR in the mid-1960s which described the existence of three major aquifer systems. In OCWD’s management of the groundwater basin, these aquifer systems are referred to as the Shallow, Principal, and Deep Aquifers (see Figure 2-1).

Because of the groundwater basin’s synclinal and faulted structure, the Shallow Aquifer system extends over a larger area than the underlying Principal and Deep aquifer systems. Potentiometric head differences measured in over 60 multi-depth, discretely-screened monitoring wells have been the primary means by which the vertical delineation of these aquifer systems has been interpreted. These head differences range from negligible to several tens of feet depending on the degree of hydraulic continuity and local pumping and recharge. Generally, aquifers in the “Forebay area” have a higher degree of vertical hydraulic continuity than aquifers in the “Pressure area” (see Section 2.4). This is due to thinner and less laterally extensive low-permeability sediments in the Forebay area as compared to the Pressure area.

The Shallow Aquifer system overlies the entire basin and includes the transmissive Talbert Aquifer, which covers an approximate three-mile wide swath along today's Santa Ana River. It generally occurs from the surface to approximately 200 feet below ground surface. The majority of groundwater from the Shallow Aquifer is pumped by small water systems for industrial and agricultural use, although the cities of Garden Grove and Newport Beach, and the Yorba Linda Water District, operate wells that pump from the Shallow Aquifer for municipal use.

Over 90 percent of groundwater production occurs from wells that are screened within the Principal Aquifer system at depths between 200 and 1,300 feet, which underlies the Shallow Aquifer system and is up to 2,000 feet deep in the center of the basin. Underlying the Principal Aquifer System is the Deep Aquifer system, which reaches depths of up to 4,000 feet. The depth and presence of amber colored groundwater in some coastal areas hinders production from the Deep Aquifer system.

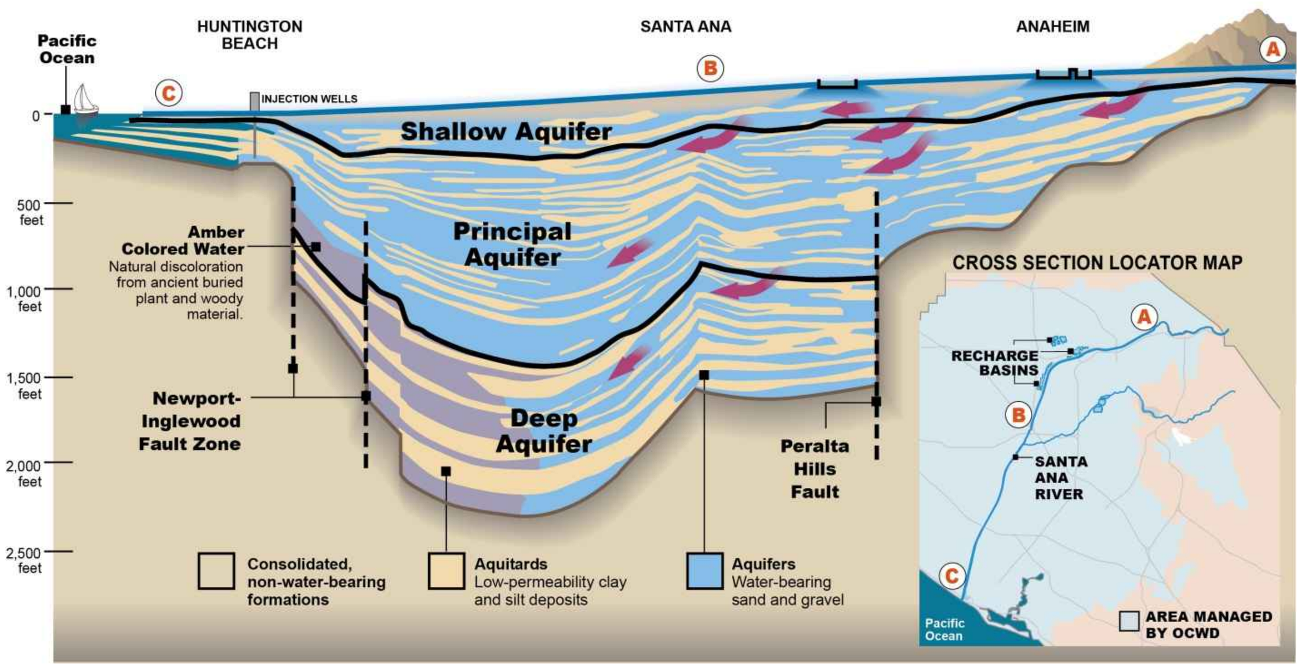


Figure 2-1: Basin 8-1 Aquifer Systems

The La Habra Groundwater Basin was studied by the DWR in the mid-1930s (DWR, 1934) and mid-1940s (DWR, 1947). It has been characterized as a layered aquifer system consisting of the near-surface alluvium, the La Habra Aquifer, and the San Pedro Aquifer (Montgomery, 1977; Geoscience, 2009).

The alluvial aquifer is typically about 100 feet thick. The older alluvium covers most of the surface of the eastern La Habra Groundwater Basin with younger alluvium deposited in Coyote Creek and Brea Creek stream channels. The La Habra aquifer is composed of nonmarine pebbly sandstones within the La Habra formation and underlying the Coyote Hills formation. This aquifer can reach a thickness of 1,200 feet near the center of the basin. Underlying the Coyote Hills formation is the San Pedro formation which contains the San Pedro aquifer, representing the most productive aquifer in the La Habra Groundwater Basin. This confined aquifer is thickest along the axis of the syncline in the basin.

2.3 FAULT ZONES AND GROUNDWATER FLOW

The following is a description of the fault zones in Basin 8-1 from Bulletin 118 (DWR, 2003):

> There are three fault zones within this basin that impede groundwater flow (DWR 1967). The most prominent is the Newport-Inglewood fault zone, which trends northwest and is responsible for formation of the Newport Inglewood uplift. This fault zone forms a barrier to groundwater flow to the southwest and marks the southwest edge of the thick aquifer materials important for groundwater production in the basin (DWR 1967). This barrier is breached by erosional channels filled with alluvium at the Alamitos and Talbert Gaps. Another northwest-trending system is the Whittier fault zone which forms the northeastern boundary of the basin along the Puente Hills. This fault forms a groundwater barrier except where it is breached by recent alluvial channels (DWR 1967). The Norwalk fault trends eastward along the southern edge of the Coyote Hills and is responsible for a lower groundwater level to the south (DWR 1967).

Figure 2-2 shows the major fault zones in Basin 8-1. Because of its variable stratigraphy, large thickness, and annual recharge and production volume, Basin 8-1 possesses a complex subsurface flow regime. Groundwater generally flows in a southwesterly direction from the Forebay recharge areas toward coastal pumping depressions.

The Peralta Hills fault follows a northwest trend crossing the Santa Ana River just north of Lincoln Avenue in the city of Anaheim. This fault has been mapped along the southern flank of the Peralta Hills, and its extension across the Santa Ana River has been inferred from a perennial steep potentiometric gradient in the vicinity of Lincoln Avenue. The fault is believed to partially restrict groundwater flow in this area (OCWD, 1991).

OCWD prepares a groundwater elevation contour map for each of the Shallow, Principal and Deep aquifers within the basin on an annual basis. These maps are useful in assessing the direction of lateral groundwater flow and annual change in groundwater storage in the basin. Data from over 60 depth-specific monitoring wells throughout the basin are used to determine the vertical hydraulic gradients between aquifers as well as temporal changes in groundwater elevation within each of the three major aquifers.

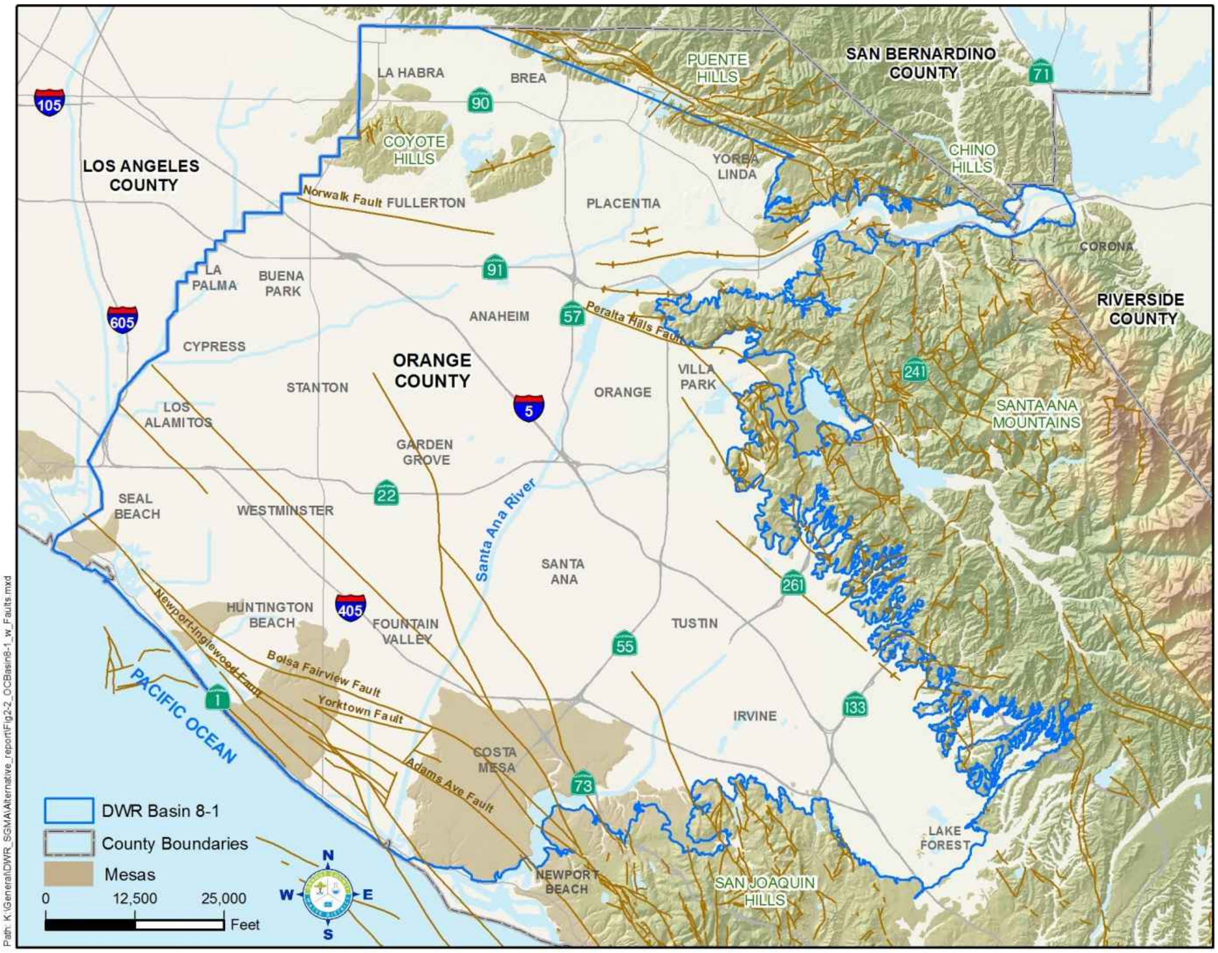


Figure 2-2: Fault Zones

2.4 FOREBAY AND PRESSURE AREAS

The Department of Water Resources (DWR, 1934) divided the basin into two primary hydrologic divisions, the Forebay and Pressure areas, as shown in Figure 2-3. The Forebay/Pressure area boundary generally delineates the areas where surface water or shallow groundwater can or cannot move downward to the first producible aquifer in quantities significant from a water supply perspective. From a water quality perspective, the amount of vertical flow to deeper aquifers from surface water or shallow groundwater may be significant in terms of impacts of past agricultural or industrial land uses (e.g., fertilizer application and leaky underground storage tanks).

The Forebay refers to the area of intake or recharge where the major basin aquifers are replenished by either direct percolation from surface water or downward groundwater flow from overlying, hydraulically-connected aquifers. The area is characterized by a stratigraphic sequence of relatively coarse-grained deposits of sands and gravels with occasional lenses of clay and silt. These clay and silt lenses do not generally impede groundwater flow from one aquifer to another. In fact, it is the lack of continuous aquitards which make aquifer delineation and correlation in the Forebay extremely difficult. Aquifers within the Forebay typically exhibit unconfined to semiconfined conditions. The Forebay area encompasses most of the cities of Anaheim, Fullerton, and Villa Park and portions of the cities of Orange and Yorba Linda.

The Pressure Area is generally defined as the area of the basin where large quantities of surface water and near-surface groundwater are impeded from percolating into the major producible aquifers by clay and silt layers at shallow depths (upper 50 feet). This area is characterized by semi-perched groundwater at depths of less than 50 feet, with substantially clayey or silty sediments in the shallow subsurface. Piezometric head differentials of 50 to 100 feet are common between the shallow-most aquifers and underlying production aquifers in the Pressure Area. The main production aquifers in the Pressure Area, generally at depths between 300 and 1,500 feet, behave as confined or "pressure" aquifers, with seasonal piezometric level fluctuations of several tens of feet between pumping and non-pumping conditions. Most of the central and coastal portions of the basin fall within the Pressure Area.

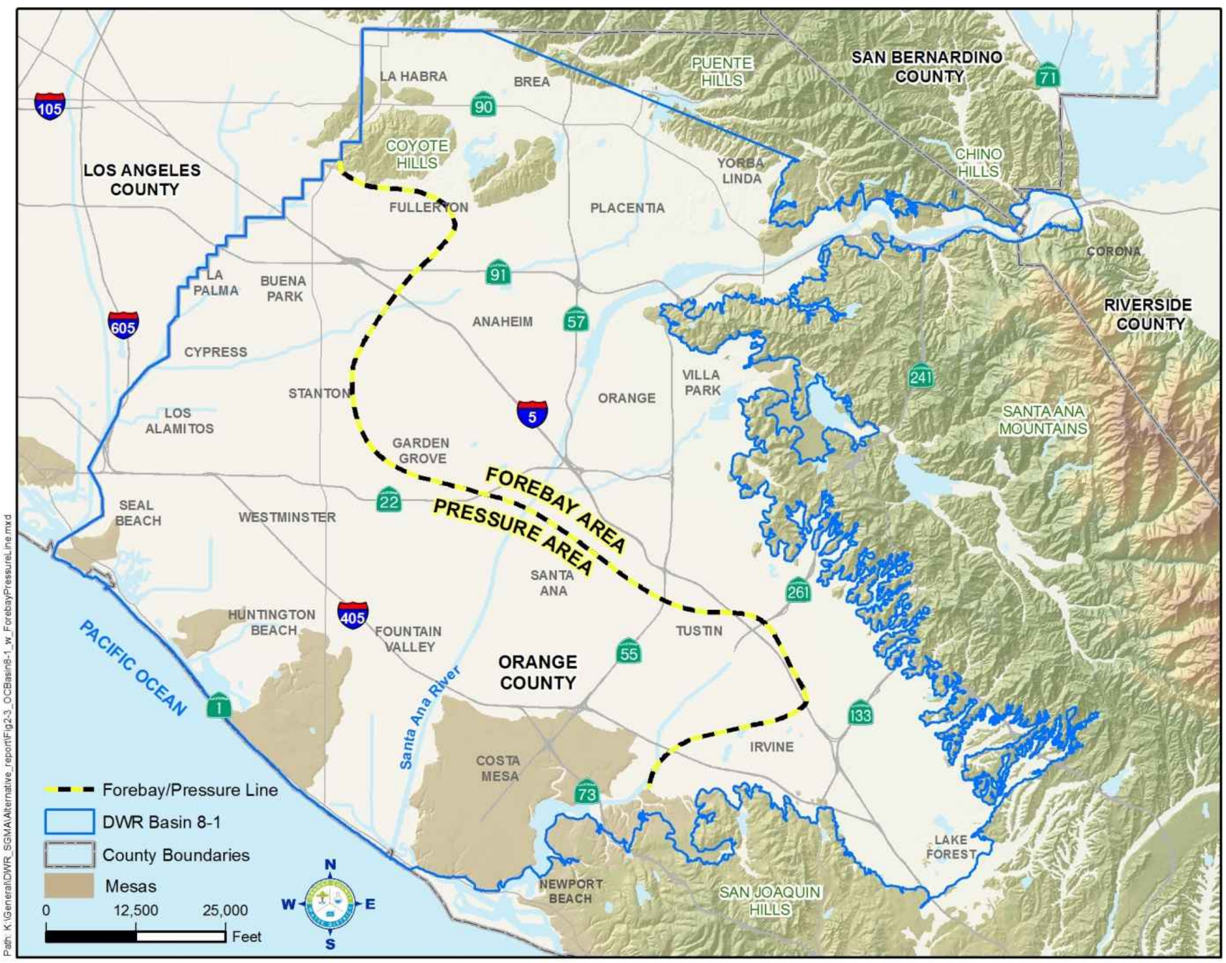


Figure 2-3: Basin 8-1 Forebay and Pressure Areas and Mesas

2.5 COASTAL AREAS

Four relatively flat elevated areas, known as mesas, occur along the coastal boundary of the basin. These mesas, shown in Figure 2-3, were formed by ground surface uplift along the Newport Inglewood Fault Zone. Concurrent with the coastal uplift, alternating courses of the ancient Santa Ana River carved notches through the uplifted area and left behind sand- and gravel-filled deposits beneath the lowland areas between the mesas, known as gaps (Poland et al., 1956).

2.6 TOTAL BASIN VOLUME

A vast amount of fresh water is stored within the basin, although only a fraction of this water can be removed practically using pumping wells and without causing physical damage such as seawater intrusion or the potential for land subsidence. Nonetheless, it is important to note the total volume of groundwater that is within the active flow system, i.e., within the influence of pumping and recharge operations.

OCWD used its geographic information system and the aquifer system boundaries to calculate the total volume of each of the three major aquifer systems as well as the intervening aquitards. The total volume was calculated by multiplying the area and thickness of each hydrogeologic unit. Because groundwater fills the pore spaces that represent typically between 20 and 30 percent of the total volume, the total volume was multiplied by this porosity percentage to arrive at a total groundwater volume. Assuming the basin is completely full, based on District estimates, the total amount of fresh groundwater stored in the basin is approximately 66 million acre-feet, as shown in Table 2-1.

For comparison, DWR (1967) estimated that about 38 million acre-feet of fresh water is stored in the groundwater basin when full. DWR used a factor known as the specific yield to calculate this volume. The specific yield (typically between 10 and 20 percent) is the amount of water that can be drained by gravity from a certain volume of aquifer and reflects the soil's ability to retain and hold a significant volume of water due to capillary effects. Thus, DWR's *drainable* groundwater volume can be considered consistent with OCWD's estimate of *total* groundwater volume in the basin.

2.7 BASIN CROSS SECTIONS

Figure 2-1 shows a schematic basin cross-section prepared by OCWD that shows a representation of the aquifer zones, bottom of basin, and general configuration of aquifers and aquitards. OCWD has developed a series of cross-sections depicting major stratigraphic and structural features in the basin. The twenty-six cross-section profile lines are shown in Figure 2-4. Three representative cross-sections are shown in Figures 2-5 to 2-7.

Table 2-1: Estimated Basin Groundwater Storage by Hydrogeologic Unit
(Volumes in Acre-feet)

HYDROGEOLOGIC UNIT	PRESSURE AREA	FOREBAY	TOTAL
Shallow Aquifer System	3,800,000	1,200,000	5,000,000
Aquitard	900,000	200,000	1,100,000
Principal Aquifer System	24,300,000	8,600,000	32,900,000
Aquitard	1,600,000	300,000	1,900,000
Deep Aquifer System	18,800,000	6,300,000	25,100,000
TOTAL	49,400,000	16,600,000	66,000,000

Notes: (1) Volumes calculated using the 3-layer basin model surfaces with ArcInfo Workstation GRID. (2) A porosity of 0.25 was assumed for aquifer systems. (3) A porosity of 0.30 was assumed for aquitards.

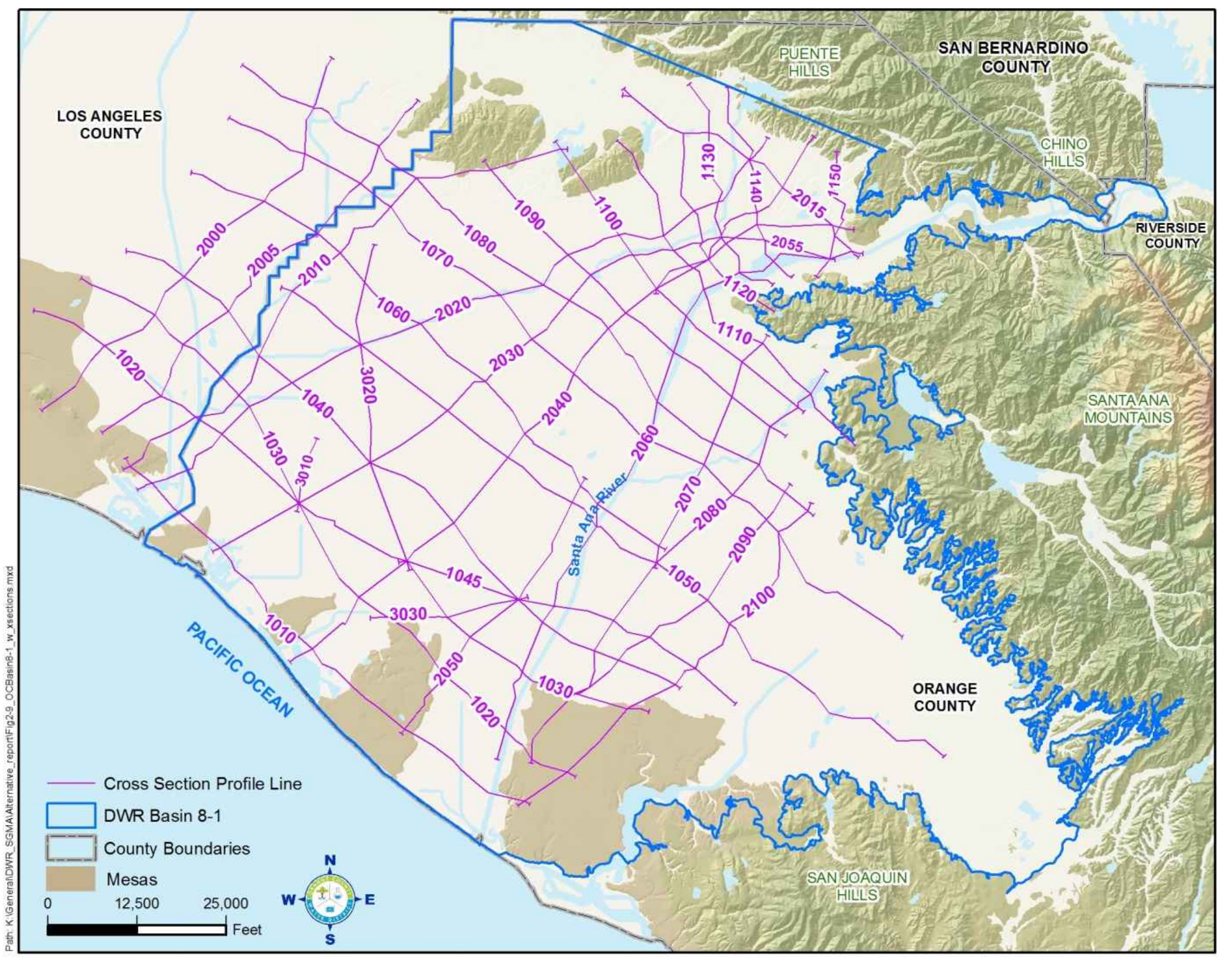


Figure 2-4: Groundwater Basin Cross-Sections

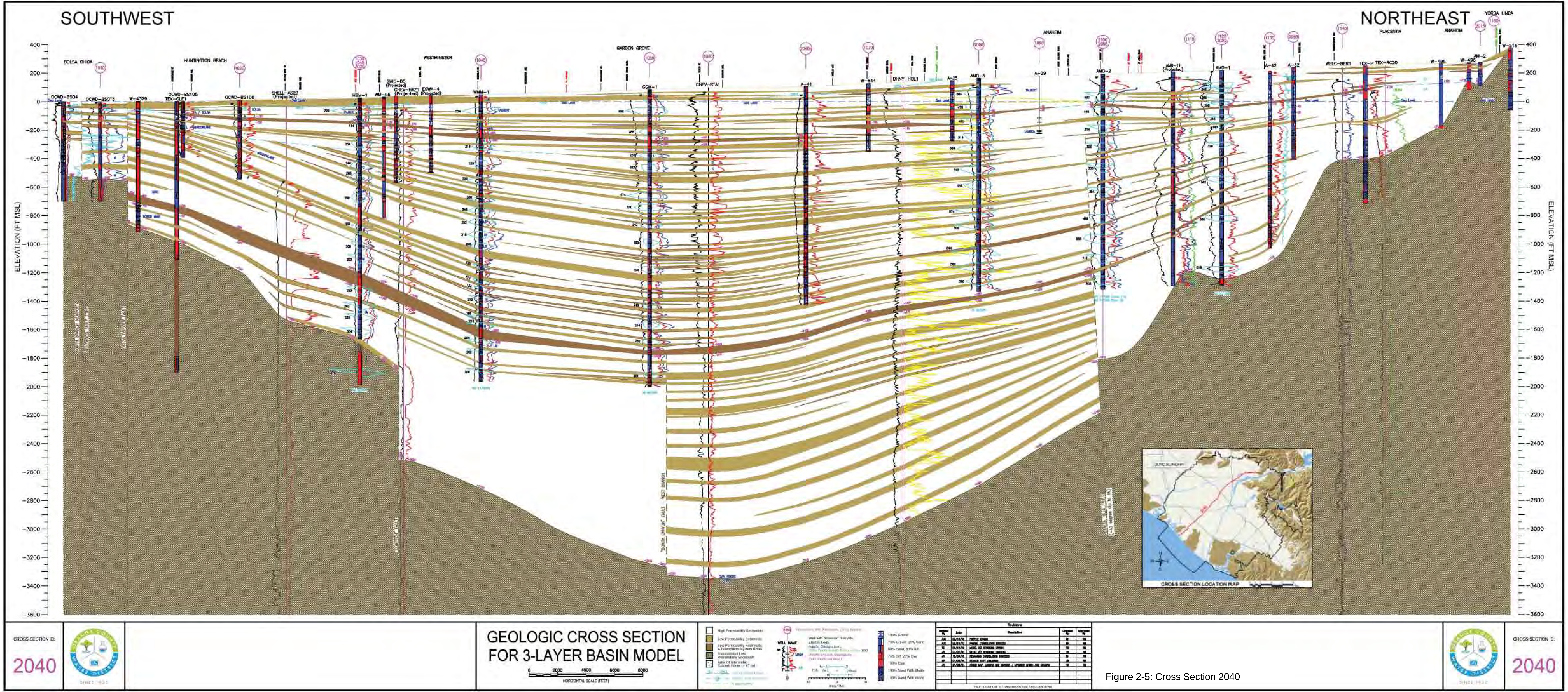


Figure 2-5: Cross Section 2040

CROSS SECTION ID:

1050

GEOLOGIC CROSS SECTION FOR 3-LAYER BASIN MODEL

0 2000 4000 6000 8000

HORIZONTAL SCALE (FEET)

High Permeability Sediments

Low Permeability Sediments

Low Permeability Sediments & Paleosols

Consolidated Low Permeability Sediments

Area Of Interpreted Colored Water

100% Gravel

75% Gravel, 25% Sand

50% Sand, 50% Silt

75% Silt, 25% Clay

100% Clay

100% Sand With Shells

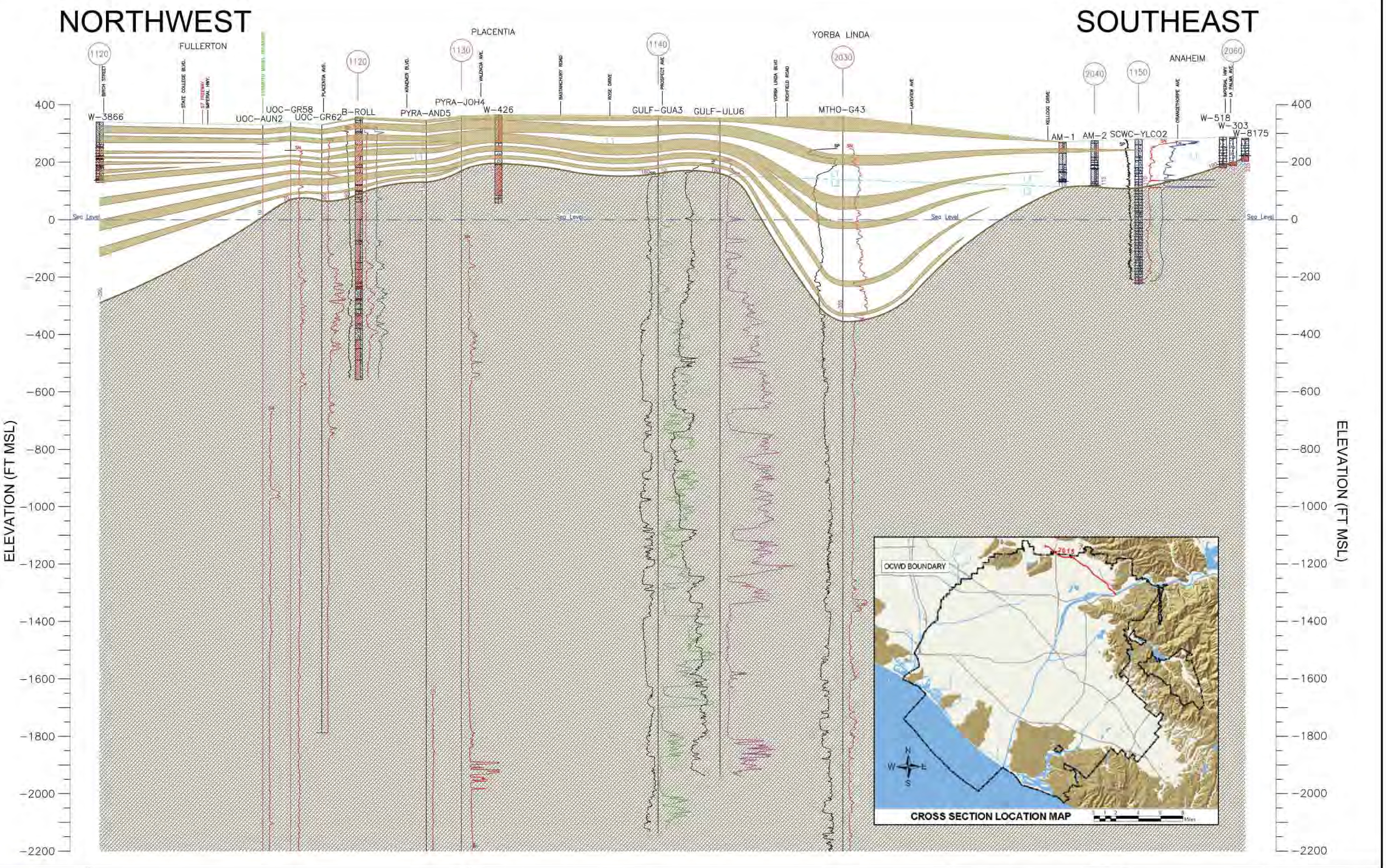
100% Sand With Wood

Revisions

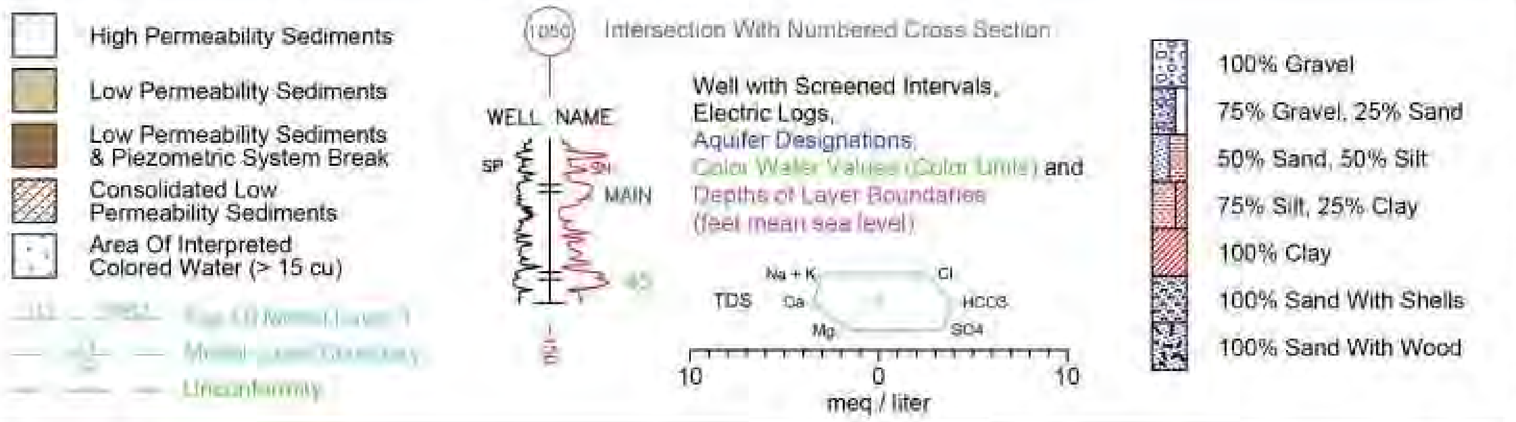
CROSS SECTION ID:

1050

Figure 2-6: Cross Section 1050



GEOLOGIC CROSS SECTION FOR 3-LAYER BASIN MODEL



Revisions				
Revised By	Date	Description	Checked By	Approved By
AJC	10/28/94	PROFILE DRAWN	TS	RH
JR	05/30/97	BOTTOM OF 3D MODEL DRAWN	TS	RH
JR	10/23/03	CORRELATION DIGITIZED	TS	RH
JR	02/26/04	ADDED MAP, LEGEND AND BORDER / UPDATED HATCH AND COLORS	TS	RH

FILE LOCATION: S:/ BASINMOD / XSC / XSC-2015.DWG

Figure 2-7: Cross Section 2015

CROSS SECTION ID:

2015

2.8 BASIN CHARACTERISTICS

Physiographic characteristics of Basin 8-1 are shown in Figures 2-8 to 2-11. These figures show the USGS topographic information, surface soil characteristics, recharge areas and surface water bodies that are significant to the management of the basin, and surficial geology.

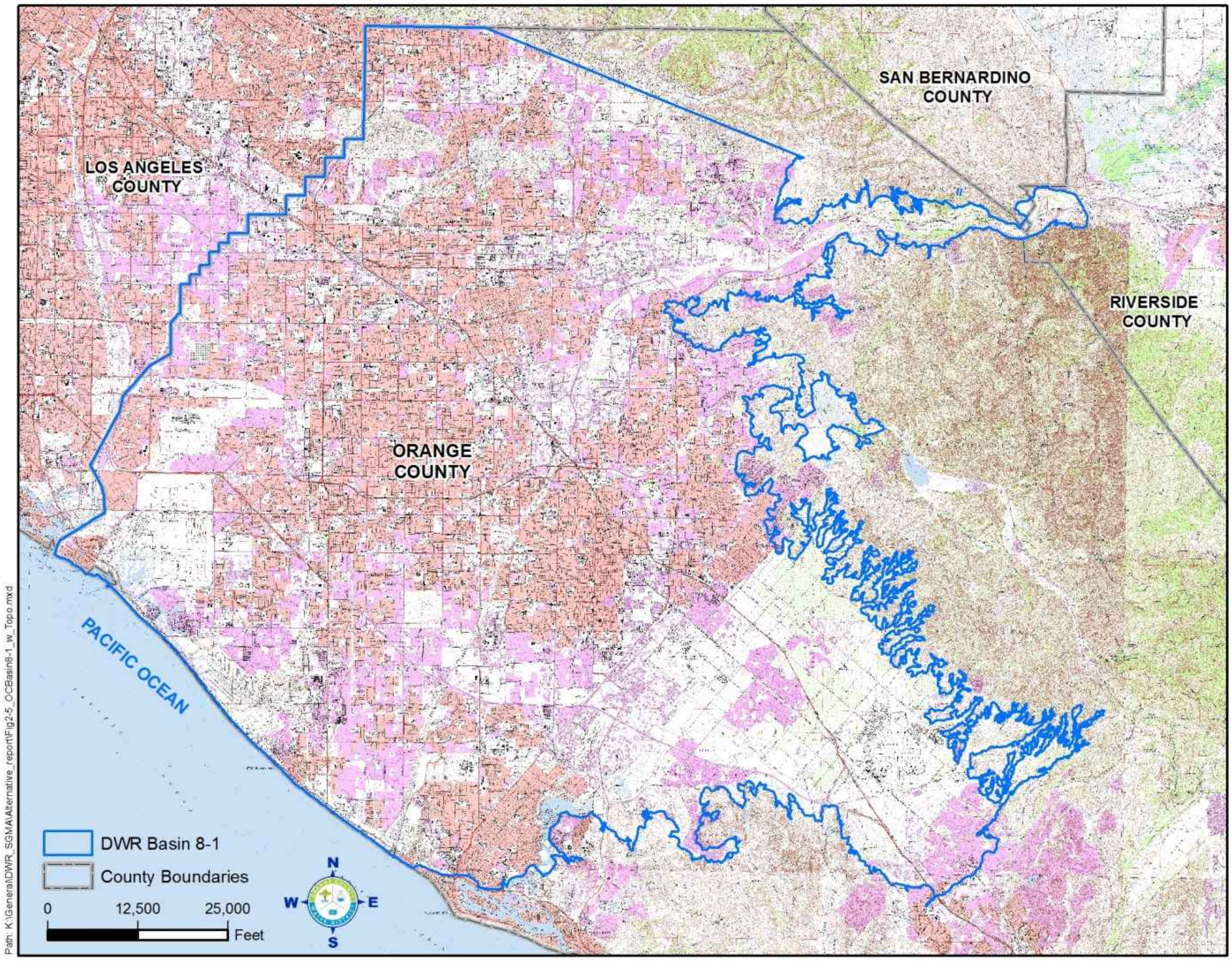


Figure 2-8: United States Geological Survey Topographic Map

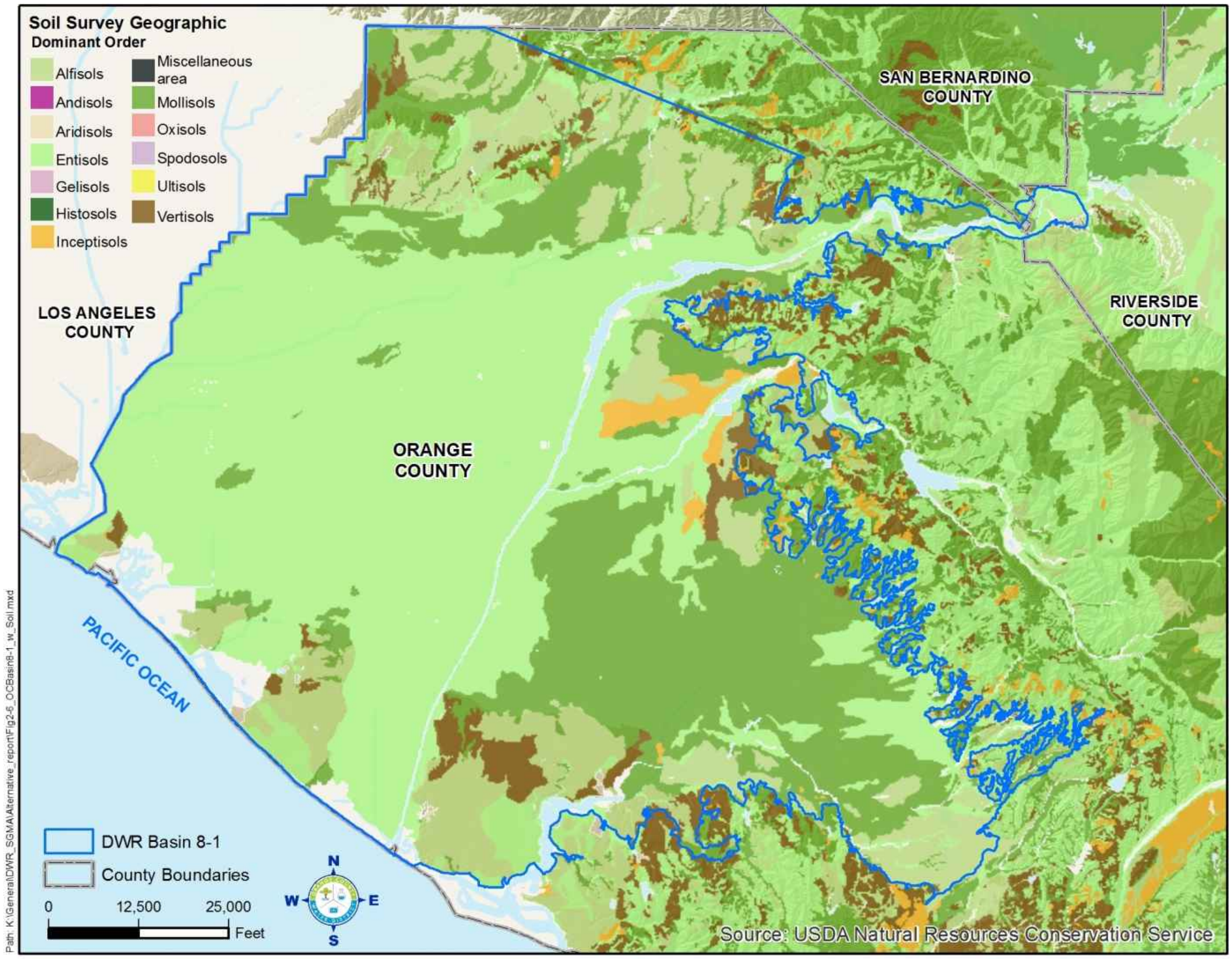


Figure 2-9**:** Surficial Soil Characteristics

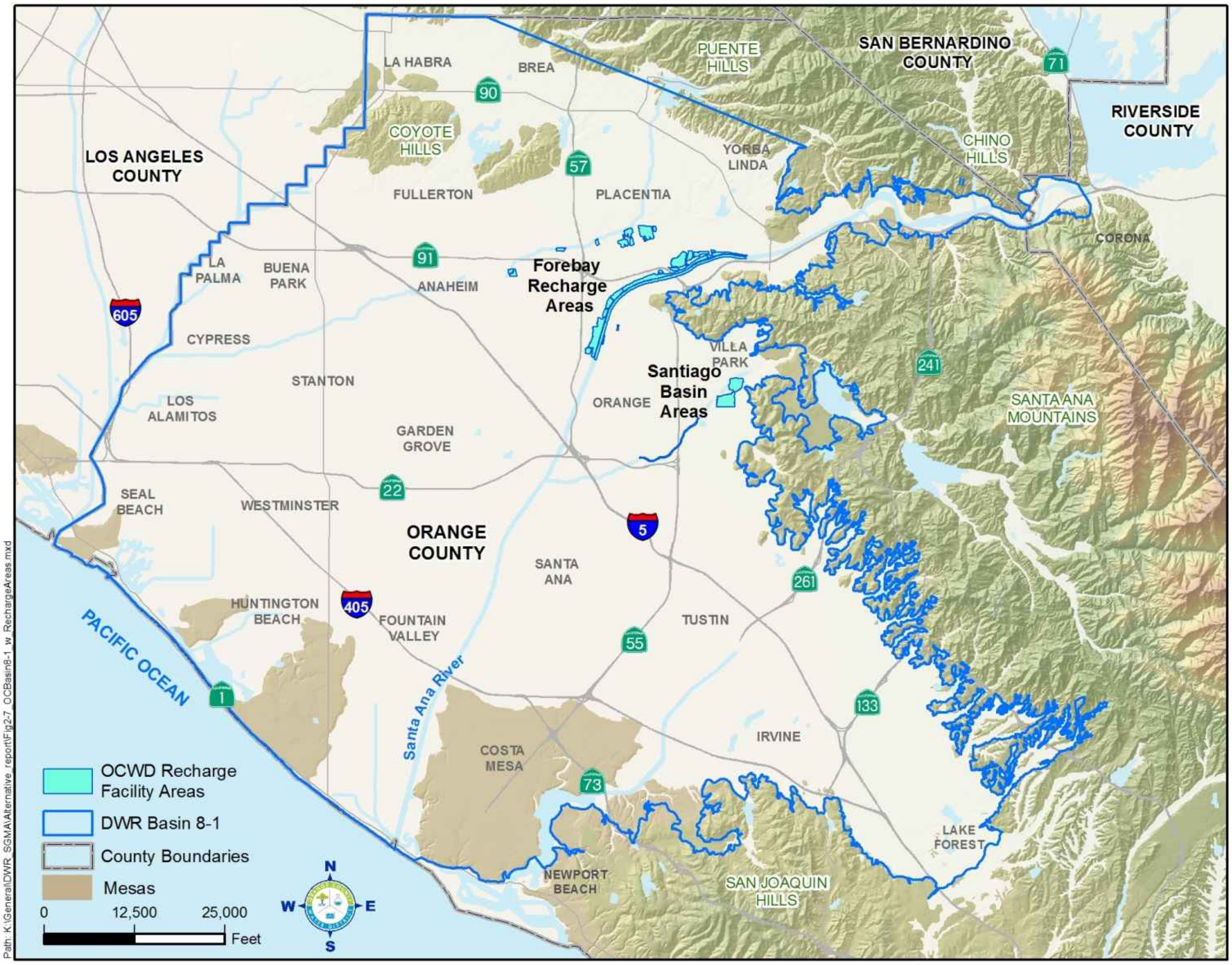


Figure 2-10: Recharge Areas

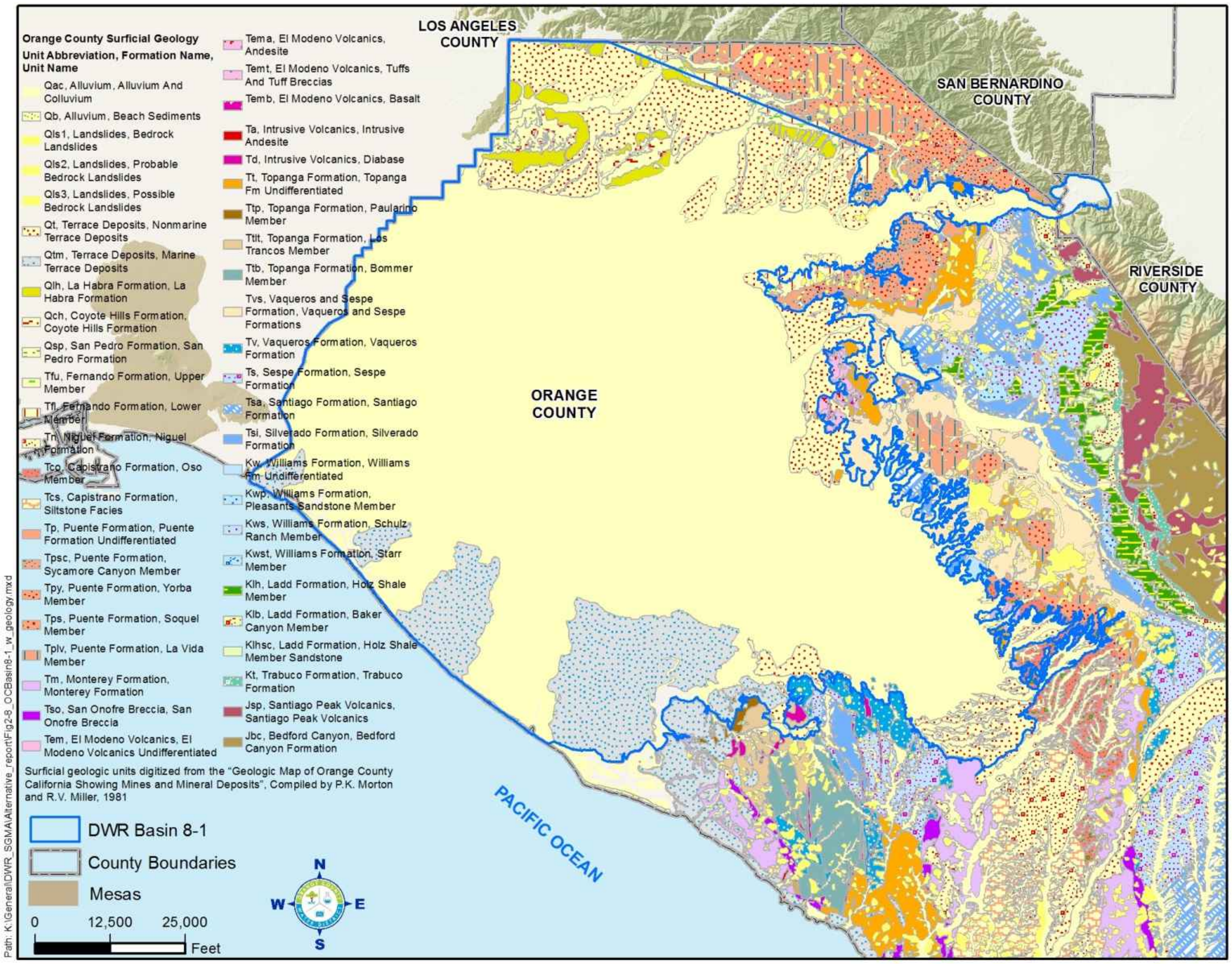


Figure 2-11: Surficial Geology

SECTION 3 BENEFICIAL USES AND BASIN WATER QUALITY

3.1 BASIN PLAN

The State Water Resources Control Board (State Board) and nine Regional Water Quality Control Boards have responsibility to protect the quality of California's waters. Basin 8-1 is under the jurisdiction of the Santa Ana Regional Board (Regional Water Board). The Regional Water Board first adopted, in 1975, the Water Quality Control Plan (Basin Plan) for the Santa Ana Region. The Santa Ana Region, shown in Figure 3-1, includes the area drained by the Santa Ana River and a portion of the Coyote Creek Watershed drained by the San Gabriel River.

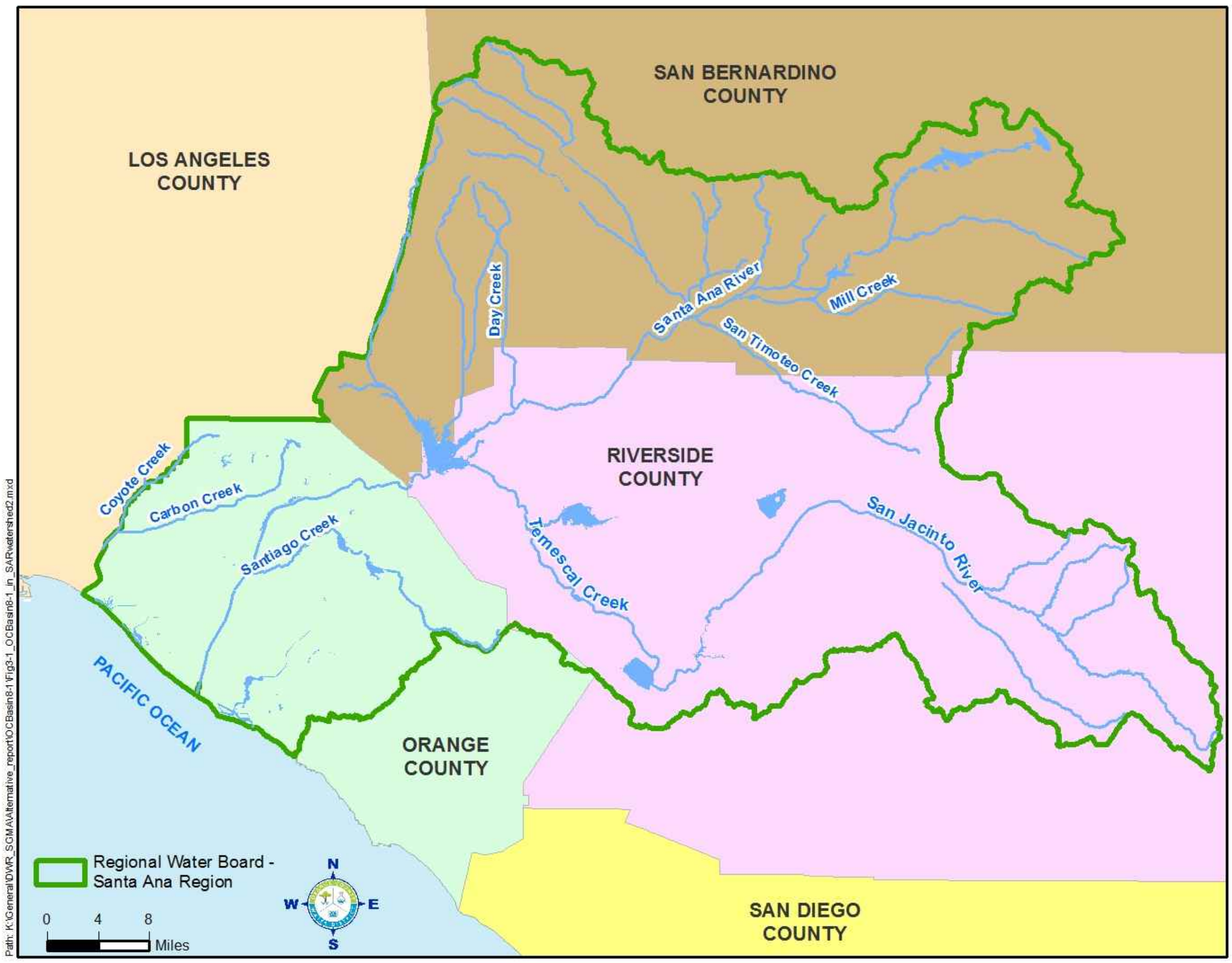


Figure 3-1: Regional Water Quality Control Board, Santa Ana Region

The Santa Ana River begins in the San Bernardino Mountains, flows through parts of Riverside and San Bernardino Counties and discharges to the Pacific Ocean in Orange County. Since the initial adoption of the Basin Plan, it has been periodically updated. The Basin Plan is the basis for the Regional Water Board's regulatory programs and salt and nutrient management programs. It establishes beneficial uses and water quality standards for surface water and groundwater in the region and a wasteload allocation for discharges to the Santa Ana River and its tributaries for total dissolved solids and nitrate.

3.2 BENEFICIAL USE DESIGNATIONS

Groundwater Management Zones established by the Regional Board in Basin 8-1 are shown in Figure 3-2. Beneficial uses designated for Groundwater Management Zones within Basin 8-1 are shown in Table 3-1.

Figures 3-3 and 3-4 show the surface water body designations for water bodies within the Santa Ana Region. Beneficial Uses designated for surface water bodies that may influence the quality of groundwater in Basin 8-1 are shown in Table 3-4.

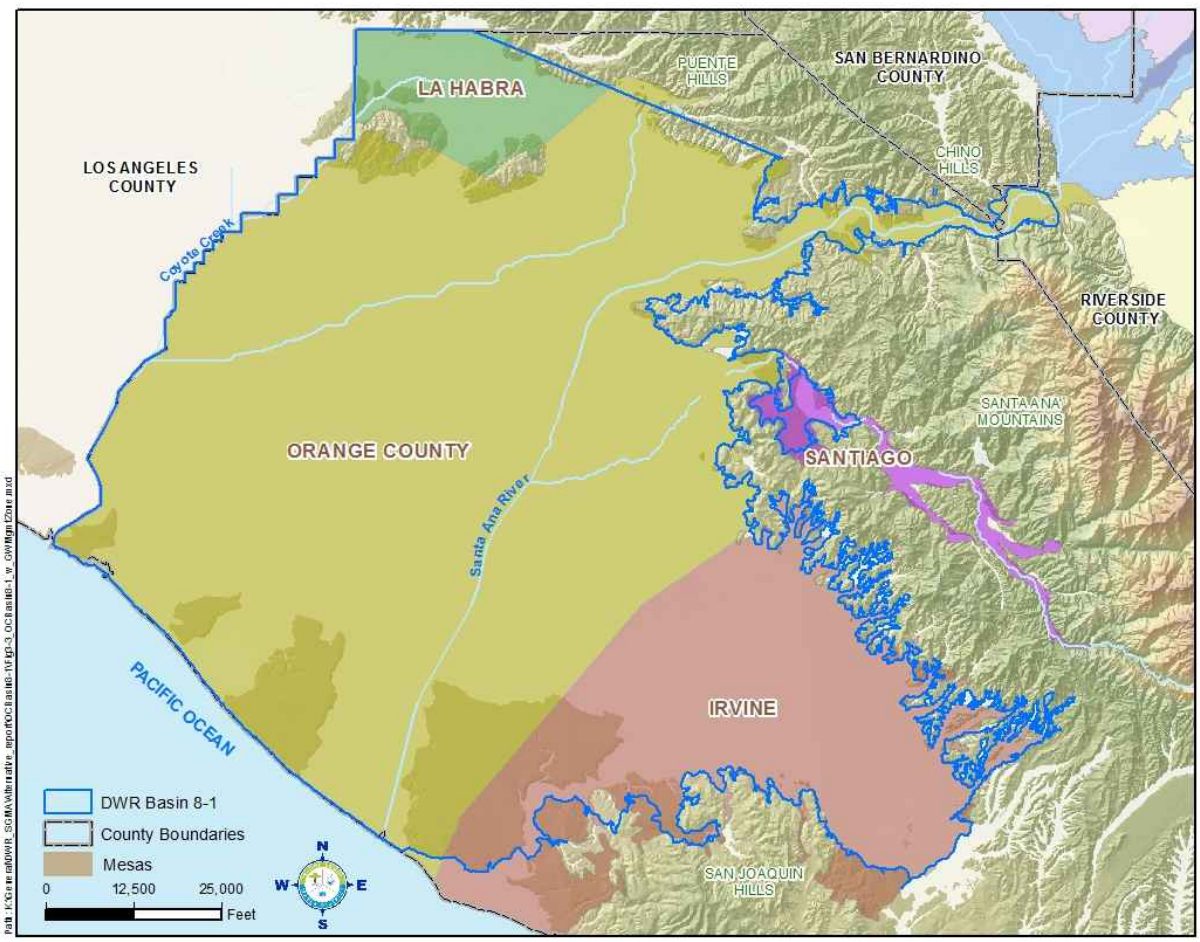


Figure 3-2: Basin 8-1 Groundwater Management Zones

Table 3-1: Beneficial Use Designations for Groundwater Management Zones

Groundwater Management Zone	Existing or Potential Beneficial Use			
	Municipal and Domestic Supply	Agricultural Supply	Industrial Service Supply	Industrial Process Supply
La Habra	X	X		
Santiago	X	X		
Orange	X	X	X	X
Irvine	X	X	X	X

Source: Santa Ana Basin Plan X= existing or potential Beneficial Use

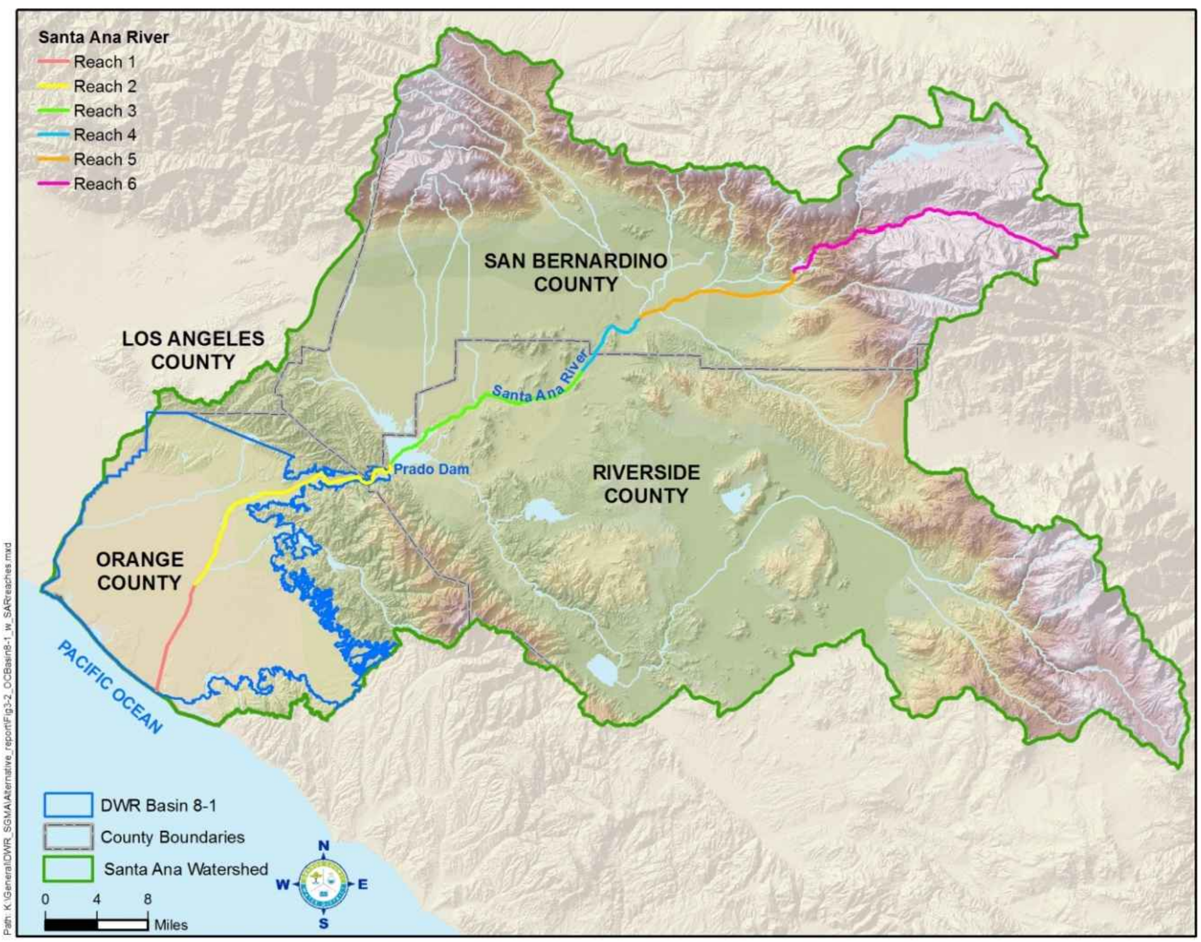


Figure 3-3: Santa Ana River Reaches

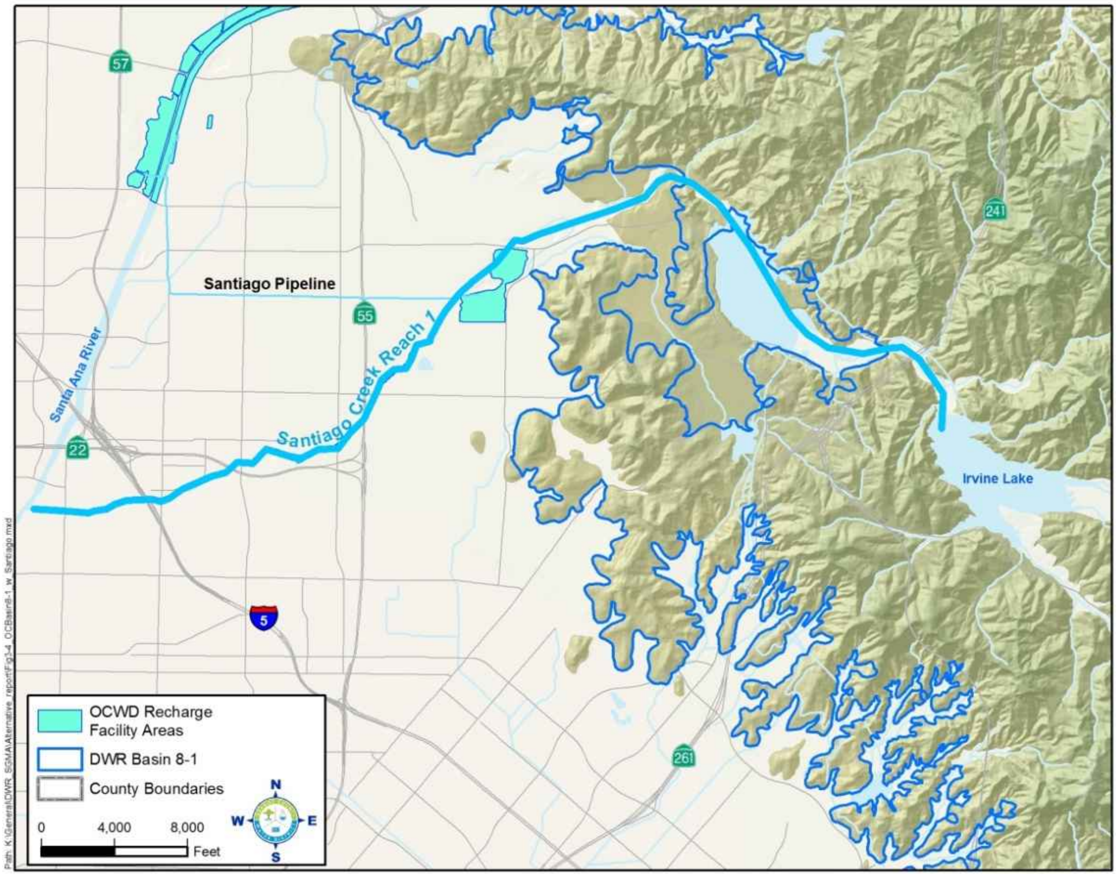


Figure 3-4: Santiago Creek and Santiago Basins

Table 3-2: Beneficial Use Designations for Surface Water Bodies

Surface Water Body	Existing or Potential Beneficial Use*							
	MUN	AGR	GWR	REC 1	REC 2	WARM	WILD	RARE
Santa Ana River, Reach 2- 17th Street in Santa Ana to Prado Dam		X	X	X	X	X	X	X
Santiago Creek, Reach 1- below Irvine Lake	X		X	X	X	X	X	
Coyote Creek (within Santa Ana Regional Boundary)	X			X	X	X	X	

*MUN- municipal and domestic supply; AGR-agricultural supply; GWR-groundwater recharge; REC 1-water contact recreation; REC 2-non-contact water recreation; WARM-warm freshwater habitat; WILD-wildlife habitat; RARE-rare, threatened, or endangered species

Source: Santa Ana Basin Plan X= Existing or Potential Beneficial Use

3.3 WATER QUALITY OBJECTIVES

3.3.1 Regulation of Groundwater Quality

The 1975 Basin Plan established groundwater subbasin boundaries in the Santa Ana Region for the purpose of designating water quality objectives for specified geographic areas. These subbasin boundaries were revised with the creation of Management Zones by amendments to the Basin Plan in 2004. The new Management Zones were defined on the basis of separation by impervious rock formations or other groundwater barriers, distinct flow systems defined by consistent hydraulic gradients that prevent widespread intermixing, and distinct differences in water quality.

Along with the creation of Management Zones, the Regional Water Board adopted water quality objectives for total dissolved solids (TDS) and nitrate-nitrogen for a majority of the management zones. The water quality objectives were based on historical concentrations of TDS and nitrate-nitrogen from 1954 to 1973. In Basin 8-1, the Regional Board established four management zones: La Habra, Santiago, Orange County, and Irvine (see Figure 3-2). For La Habra and Santiago Management Zones, the Regional Water Board did not established numeric objectives. For these two management zones, water quality is regulated by narrative objectives in the Basin Plan. For Orange County and Irvine Management Zones, numeric water quality objectives were adopted for TDS and nitrate-nitrogen (as N), as shown in Table 3-3.

Table 3-3: Groundwater Water Quality Objectives

MANAGEMENT ZONE	WATER QUALITY OBJECTIVE	
	Total Dissolved Solids (TDS)	Nitrate-nitrogen (as N)
La Habra*	---	---
Santiago*	---	---
Orange County	580 mg/L	3.4 mg/L
Irvine	910 mg/L	5.9 mg/L

* Numeric objectives not established; narrative objectives apply
Source: Regional Board, 2008

3.3.2 Regulation of Surface Water Quality

Water quality objectives for the Santa Ana River are a significant part of the Basin Plan, in part because the river water is a major source of groundwater recharge for Basin 8-1.

The Regional Water Board divides the Santa Ana River into five reaches (see Figure 3-3). The dividing line between Reaches 2 and 3 of the river, and between the upper and lower Santa Ana Basins, is Prado Dam, a flood control facility built and operated by the U.S. Army Corps of Engineers. The dam includes a subsurface groundwater barrier, and as a result all ground and surface waters from the upper basin are forced to pass through the dam (or over the spillway).

The quality of the Santa Ana River is a function of the quantity and quality of the base flows and storm flows. The base flow is primarily comprised of wastewater discharges. OCWD captures and recharges nearly all of the base flow and a portion of the storm flow in the river that is released through Prado Dam.

OCWD also recharges surface water within the Santiago Creek bed and in recharge basins located adjacent to the creek. Santiago Creek is the primary drainage for the northwest portion of the Santa Ana Mountains and ultimately drains into the Santa Ana River. Water from Santiago Creek is impounded by Santiago Dam, creating Irvine Lake, which is owned by the Irvine Ranch Water District and Serrano Water District. Downstream of Santiago Dam is Villa Park Dam, which is a flood-control facility owned and operated by the Orange County Flood Control District. OCWD owns and operates recharge basins downstream of Villa Park Dam.

The water quality objectives established in the Basin Plan for Santa Ana River, Reach 2 and Santiago Creek, Reach 1, are shown in Table 3-4. The Regional Board has not established numeric objectives for the portion of Coyote Creek within the Santa Ana Basin boundary.

Table 3-4: Surface Water Quality Objectives

SURFACE WATER BODY	WATER QUALITY OBJECTIVES Total Dissolved Solids (mg/L)
Santa Ana River, Reach 2	650 (5-year moving average)
Santiago Creek, Reach 1- below Irvine Lake	600
Coyote Creek (within Santa Ana Regional Boundary)	*

*Numeric objectives not established; narrative objectives apply

3.4 GENERAL WATER QUALITY OF THE PRINCIPAL AQUIFER

TDS concentrations in the Principal Aquifer in the OCWD Management Zone of Basin 8-1 generally range from 300 to 400 mg/L in the Pressure Area and from 500 to 700 mg/L in the Forebay Area. In the Irvine Management Zone, TDS concentrations range from approximately 400 mg/L west of Culver Drive to 1,000 mg/L in the area northeast of Interstate 5.

Nitrate (as N) concentrations in the OCWD Management Zone of Basin 8-1 generally range from less than 1 to 4 mg/L in the Pressure Area and from 4 to 7 mg/L in the Forebay Area. In the Irvine Management Zone, nitrate (as N) concentrations are generally less than 1 mg/L in the area west of Culver Drive and increase to 10 to 25 mg/L in the area northeast of Interstate 5.

The Regional Water Board requires that the ambient quality of groundwater in each of the Management Zones be recomputed every three years for TDS and nitrate. The most recent re-computation was completed in 2014 for the period ending in 2012. Ambient water quality concentrations for the Basin 8-1 Management Zones are shown in Table 3-5

Table 3-5: Ambient Water Quality

MANAGEMENT ZONE	AMBIENT WATER QUALITY	
	Total Dissolved Solids (TDS)	Nitrate-nitrogen (as N)
Orange County	610 mg/L	2.9 mg/L
Irvine	940 mg/L	6.7 mg/L
La Habra	963 mg/L	2 mg/L

Source: Wildermuth Environmental, Inc. 2014; City of La Habra

SECTION 4 REFERENCES

California Department of Public Works, Division of Water Resources, 1934, *South Coastal Basin Investigation, Geology and Ground Water Storage Capacity of Valley Fill*, Bulletin No. 45.

California Department of Water Resources, 1934. Bulletin No. 45 South Coastal Basin Investigation; Geology and Ground Water Storage Capacity of Valley Fill. State of California, Department of Public Works, Division of Water Resources.

***** 1947. Bulletin No. 53 South Coastal Basin Investigation; Overdraft on Ground Water Basins. State of California, Department of Public Works, Division of Water Resources.

***** 1967, *Progress Report on the Ground Water Geology of the Coastal Plain of Orange County*.

***** 1989, Southern District, *Analysis of Aquifer-System Compaction in the Orange County Ground Water Basin*, prepared for Orange County Water District.

***** 2003, *California's Groundwater* Bulletin No. 118

California Regional Water Quality Control Board, Santa Ana Region, 2008, Water Quality Control Plan, Santa Ana River Basin (8)

Geoscience, 2009. Draft Preliminary Geohydrologic Evaluation of the La Habra Basin. Prepared for City of La Habra, April 2, 2009.

Herndon, R. L., and J. D. Bonsangue, 2006, *Hydrology of the Orange County Groundwater Basin – An Updated Overview, Annual Field Trip Guide No. 33*, South Coast Geological Society, Inc.

Montgomery, 1977. La Habra Basin Ground Water Study. Prepared for City of La Habra, November 1977. James M. Montgomery Consulting Engineers, Inc.

Orange County Water District, 1991. *Santiago Creek Recharge Project, Phase 1 Hydrogeologic Investigation.*

***** 1994, *Hydrogeology and Groundwater Production Potential in the Vicinity of Brea Creek at Bastanchury Road, Fullerton, California*.

Poland, J.F. et al., 1956. Ground Water Geology of the Coastal Zone Long Beach-Santa Ana Area, California, USGS Water Supply Paper 1109.

Yerkes, R.F. 1972. Geology and Oil Resources of the Western Puente Hills Area, Southern California. Geological Survey Professional Paper 420-C.

Wildermuth Environmental, Inc., 2014, *Recomputation of Ambient Water Quality in the Santa Ana Watershed for the Period 1993 to 2012, Technical Memorandum,* Prepared for Santa Ana Watershed Project Authority Basin Monitoring Program Task Force.

Basin 8-1 Alternative

La Habra-Brea Management Area

Submitted by: City of La Habra

On behalf of: City of La Habra

City of Brea

January 1, 2017

Basin 8-1 Alternative

La Habra-Brea Management Area

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Prepared for the Department of Water Resources, pursuant to Water Code §10733.6(b)(3)

January 1, 2017

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SECTION 1. EXECUTIVE SUMMARY

The La Habra-Brea Management area covers the northern corner of the Department of Water Resources (DWR) Basin 8-1, Coastal Plain of Orange County Groundwater Basin. The City of La Habra is established as the GSA under SGMA for the La Habra-Brea Management Area. This management area is part of Basin 8-1, but is hydrogeologically distinct from the OCWD Management Area and is not under the jurisdiction of OCWD. The City of La Habra adopted a resolution to establish the La Habra Groundwater Basin as a separate basin from Basin 8-1. OCWD adopted a resolution to support the City's request to DWR for an internal jurisdictional boundary modification in the OC Basin that follows the city limits of La Habra and Brea and is outside of the Orange County Water District's jurisdictional boundary. .

The La Habra-Brea Management Area is included with this Basin 8-1 Alternative to facilitate collaboration among groundwater agencies within Basin 8-1 as required by SGMA. The City of La Habra and portions of the City of Brea comprise the La Habra-Brea Management Area. This management area overlies the extents of the proposed La Habra Groundwater Basin, referenced herein. Figure 1-1 shows the extent of the La Habra Groundwater Basin and the cities (La Habra and Brea) with jurisdiction in the La Habra-Brea Management Area.

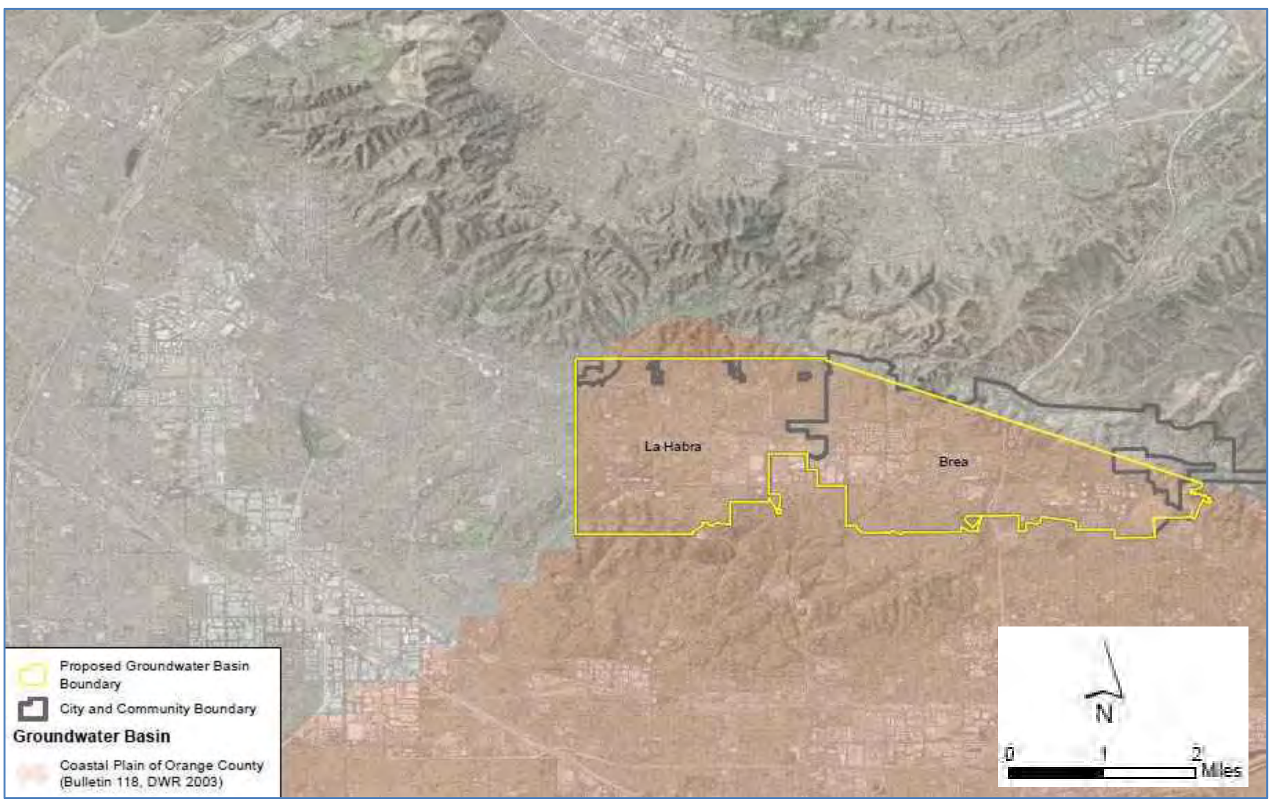

Figure 1-1: La Habra Groundwater Basin

The geologic structure of the La Habra Groundwater Basin is dominated by the La Habra Syncline, a northwest trending, U-shaped down-fold. The syncline is deepest in the Brea area and becomes increasingly shallower towards the City of Whittier and is bounded by the Whittier Fault within the Puente Hills to the north and the Coyote Hills to the south (Montgomery, 1977). The La Habra Syncline produces the La Habra Valley, a naturally-occurring valley, where significant amounts of groundwater have accumulated over the past 150,000 years (Malcolm Pirnie, 2011a).

Groundwater within the La Habra Groundwater Basin generally flows from the Puente Hills in a south or southwesterly direction. A groundwater level hydrograph for a well completed in the Alluvium shows water levels declining to their lowest level in the 1950s, and recovering during the 1970s. More recent data from a nearby well shows a leveling off of water levels through the 1990s. Wells completed in the San Pedro Formation show rising groundwater levels. The lowest groundwater levels in this aquifer were observed during the 1930s and 1940s, with water levels recovering about 60 feet through 1972. More recent data show an overall rising trend of 50 to 60 feet in groundwater levels from 1970 through 2007 and a slight decline during the last three years of data.

The City of La Habra pumps local groundwater from the La Habra Groundwater Basin from three production wells: the Idaho Street Well, the La Bonita Well, and the Portola Well. The City of Brea owns and operates one non-potable groundwater well used for irrigation at Brea Creek Golf Course.

The La Habra Groundwater Basin is currently monitored for groundwater elevations and for groundwater quality through productions wells and historical data from monitoring wells within the La Habra Groundwater Basin and surrounding area.

Groundwater resources protection is considered a critical component for safeguarding the long-term sustainability of the La Habra Groundwater Basin. Groundwater resources protection includes water resources planning as well as groundwater protection programs including well construction, abandonment, and destruction policies, wellhead protection, and the control of the migration and remediation of contaminated, poor quality, or saline water.

As the City of La Habra currently depends on local groundwater to meet approximately 40 percent of its water consumption, preserving the sustainability of the La Habra Groundwater Basin is essential for the well-being of the City. Currently (and historically), the City of La Habra manages (and has managed) the La Habra Groundwater Basin through management plans and programs for groundwater levels, basin storage, and water quality. By January 2020, the City will manage the La Habra Groundwater Basin through a Groundwater Sustainability Plan (“GSP”) under SGMA, which will describe the City’s monitoring program and ensure that no undesirable results occur in the future.

SECTION 2. AGENCY INFORMATION

2.1 HISTORY OF AGENCIES IN LA HABRA GROUNDWATER BASIN

Two cities overly the La Habra Groundwater Basin within Basin 8-1: the City of La Habra and the City of Brea, which are the only groundwater producers in the La Habra Groundwater Basin. See Figure 2-1.

The City of La Habra is located in the northwestern corner of Orange County. The City of La Habra serves a population of approximately 63,000 throughout its 7.3 square-mile service area. Los Angeles County borders the City of La Habra on the north and west, the City of Brea on the east, and the City of Fullerton on the south and southeast.

The City of Brea is located in the northwestern corner of Orange County. The City of Brea serves a population of approximately 40,377 throughout its 10.7 square-mile service area. Los Angeles County borders the City of La Habra on the north and west, the City of Brea on the east, and the City of Fullerton on the south and southeast.

Historically, the Cities of La Habra and Brea have managed the groundwater resources in the La Habra Groundwater Basin.

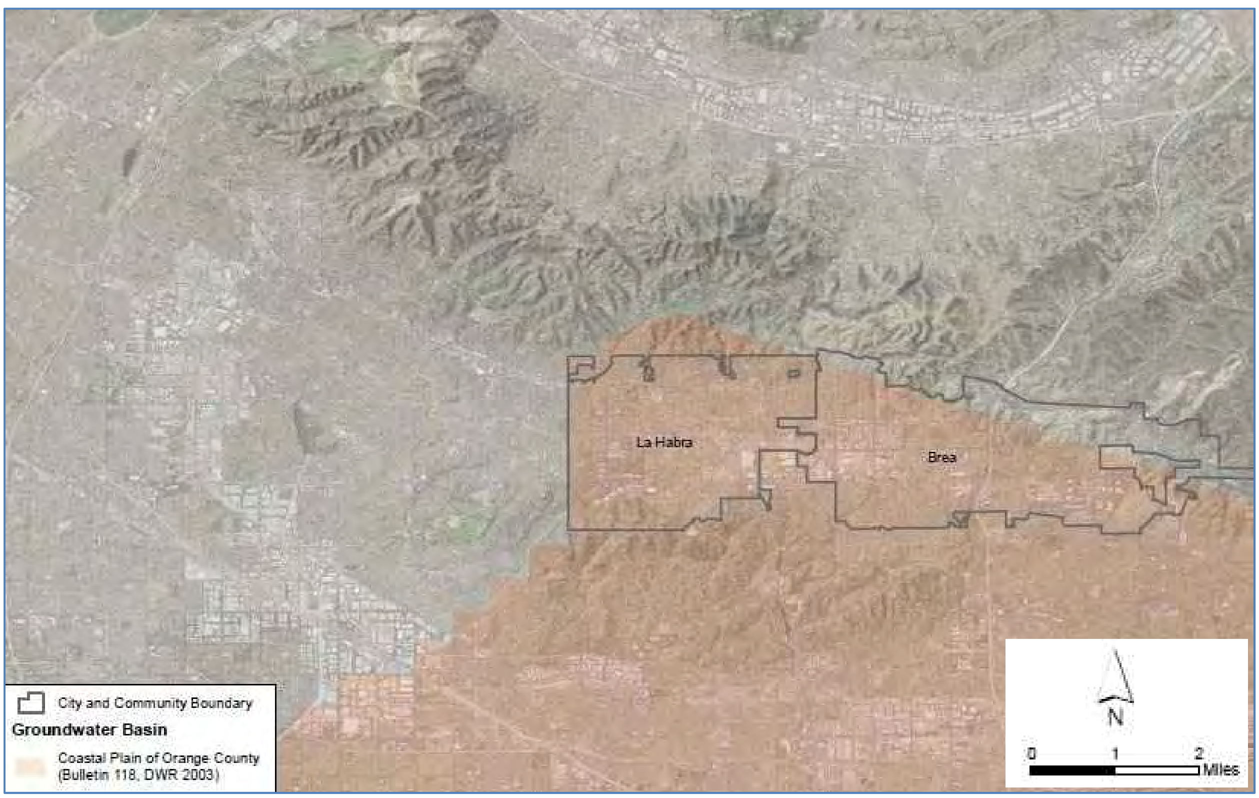

Figure 2-1: Cities of La Habra and Brea within Basin 8-1

2.2 GOVERNANCE AND MANAGEMENT STRUCTURE

Pursuant to California Water Code 10723 of the Sustainable Groundwater Management Act (SGMA), the City of La Habra, under a memorandum of agreement with the City of Brea, has been established as the Groundwater Sustainability Agency (GSA) for the La Habra Groundwater Basin. On December 21, 2015, the La Habra City Council adopted Resolution No. 5714 to establish La Habra as a GSA and formally notified the Department of Water Resources on May 11, 2016. The Department of Water Resources has listed the La Habra GSA as an "exclusive" GSA within the areas of the Basin identified in La Habra's GSA notification, meaning the 90 day notice period has expired and La Habra is the exclusive GSA for that portion of the basin, i.e. the La Habra-Brea Management Area.

2.3 LEGAL AUTHORITY

Apart from SGMA, the Cities of La Habra and Brea have the legal authority to make and enforce ordinances and regulations not in conflict with general laws within their jurisdictions, pursuant to California Constitution Article XI Section 7; and to establish ordinances not in conflict with the Constitution and State and Federal laws, pursuant to Government Code Title 4 Division 3 Part 2 Chapter 3 Section 37100. Pursuant to both Article XI, Section 7 and Article X, Section 2, the City of La Habra adopted Ordinance No. 1767 to prohibit extraction and exportation of groundwater underlying the City for use outside of the City.

As local government, the Cities can establish, purchase, and operate public works, including water services, pursuant to California Constitution Article XI Section 9. Likewise, Government Code Title 4 Division 3 Part 2 Chapter 10 Article 5 Section 38730 grants cities legal authority to acquire water, water rights, and all suitable water infrastructure to supply water to the City and its inhabitants.

As discussed in Section 2.2, the City of La Habra has been established as the GSA for the portions of the Cities of La Habra and Brea within a portion of Basin 8-1 that is outside of OCWD's jurisdiction, i.e. the La Habra-Brea Management Area.

Therefore, the Cities of La Habra and Brea have the authority independently, as Cities, and through the memorandum of agreement and establishment of the GSA, to manage the groundwater resources in the La Habra-Brea Management Area.

2.4 BUDGET

The costs for managing groundwater within the La Habra-Brea Management Area are for data collection and reporting. The budget for costs required to comply with this plan have not been estimated due to the minimal nature of the effort to collect and report groundwater production, level and water quality data.

The following funding sources are available to the La Habra GSA to finance groundwater projects. These sources are briefly described below.

- Grants and Loans from State and Federal Agencies: La Habra GSA has the option to pursue funding opportunities from DWR and other governmental agencies.
- Local Groundwater Assistance Program: Under AB 303 (the Local Groundwater Assistance Program), grants are awarded to public agencies with up to $250,000 to conduct groundwater studies or carry out groundwater monitoring and management programs.
- Capital Improvement Fees: La Habra GSA has the authority to collect repayment charges from beneficial parties of capital improvement projects such as a groundwater recharge or banking project.
- Water User Fees and Assessments: La Habra GSA has the authority to fund groundwater projects through water use fees and assessments collected regularly from City residents and businesses.

SECTION 3. MANAGEMENT AREA DESCRIPTION

3.1 LA HABRA GROUNDWATER BASIN SERVICE AREA

The La Habra-Brea Management Area refers to the northwestern portion of Basin 8-1, as defined by DWR Bulletin 118, overlying the La Habra Groundwater Basin. This management area is outside of the jurisdiction of OCWD. As discussed in Section 2.2, the City of La Habra adopted a resolution establishing it as a GSA, under a memorandum of agreement with the City of Brea, for management of the La Habra Groundwater Basin underlying the two cities. The City adopted a second resolution to establish the La Habra Basin as a separate basin from Basin 8-1. OCWD adopted a resolution to support the City's establishment of the La Habra Basin.

3.1.1 Jurisdictional Boundaries

The historical La Habra Groundwater Basin as described in DWR Bulletin 45 (1934) and Bulletin 53 (1947) is located in both Los Angeles (western basin) and Orange Counties (eastern basin) (see Figure 3-1). The majority of the historical La Habra Basin located in Los Angeles County is within Basin 4-11, the Coastal Plain of Los Angeles, as depicted in DWR Bulletin 118 (2003 update); the entirety of the La Habra Basin located in Los Angeles County is within the area subject to the terms of the Central Basin Adjudication. The majority of the historical La Habra Basin located in Orange County is within Basin 8-1, the Coastal Plain of Orange County as depicted in DWR Bulletin 118. Only a small portion of the historical La Habra Basin in Orange County is within the boundaries of the Orange County Water District.

The Cities of La Habra and Brea overlie a portion of the La Habra Groundwater Basin that is not within the area subject to the terms of the Central Basin Adjudication, nor within the boundaries of the Orange County Water District. The La Habra Groundwater Basin referred to herein, includes all of the City of La Habra and the portion of the City of Brea within Basin 8-1 but not within the jurisdiction of Orange County Water District, overlying the historical La Habra Groundwater Basin (see Figure 3-2).

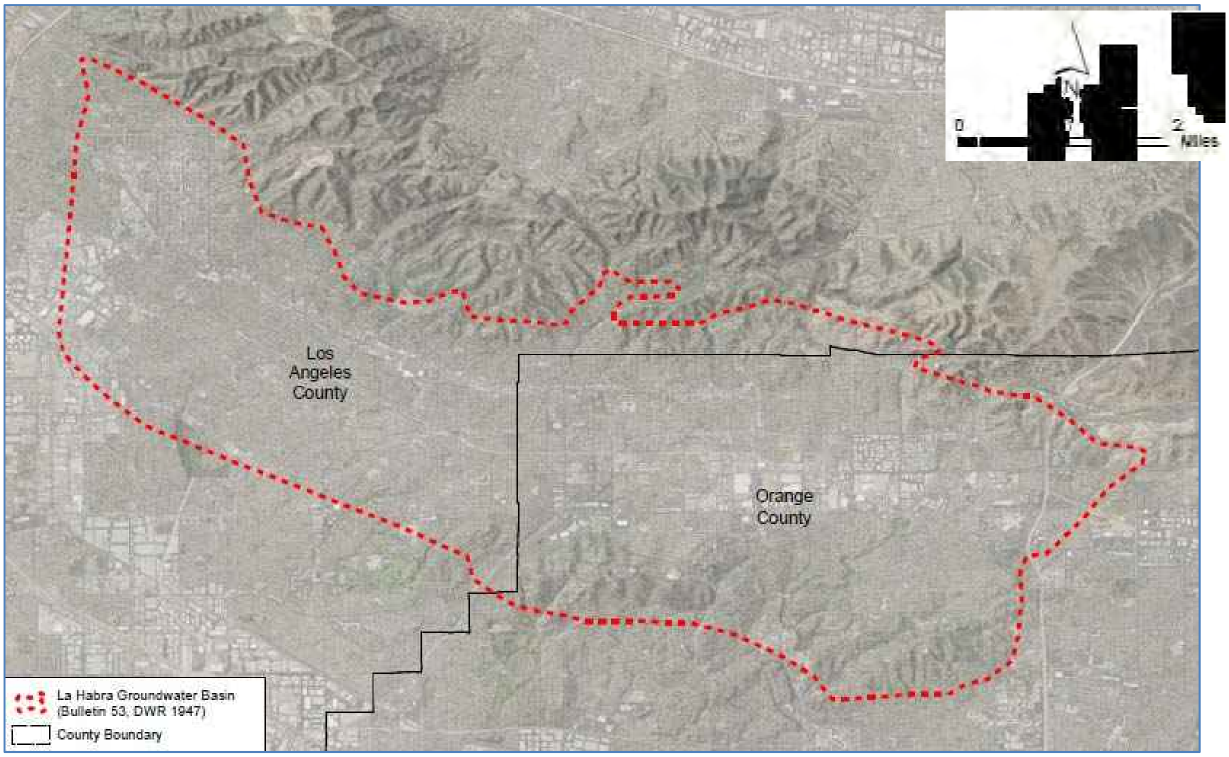

Figure 3-1: Historical La Habra Groundwater Basin (DWR, 1934. DWR, 1937)

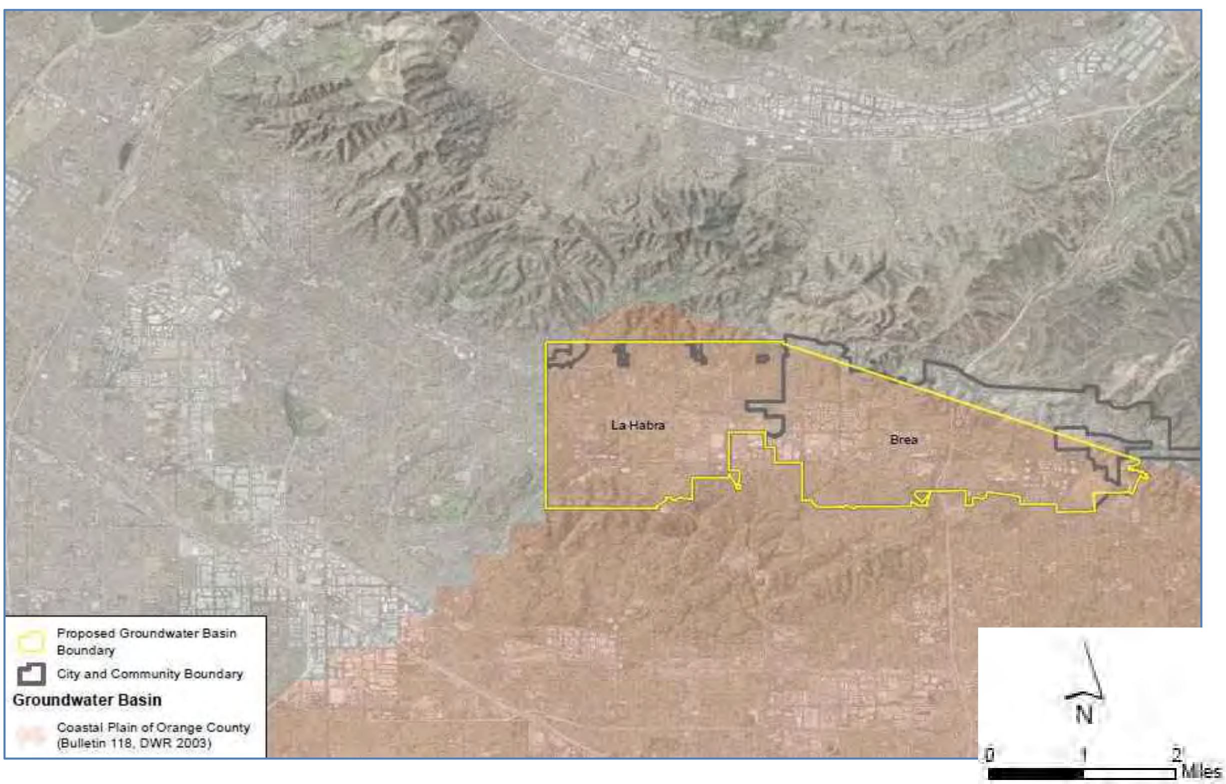

Figure 3-2 La Habra Groundwater Basin

3.1.2 Existing Land Use Designations

The major land use within the City of La Habra is low-density residential with pockets of medium-density residential areas. Portions of La Habra consist of commercial and light industrial land uses. Likewise, land use within the City of Brea is primarily residential with sections of commercial and industrial facilities.

3.2 GROUNDWATER CONDITIONS

The geologic structure of the La Habra Groundwater Basin is dominated by the La Habra Syncline, a northwest trending, U-shaped down-fold. The syncline is deepest in the Brea area and becomes increasingly shallower the west and is bounded by the Whittier Fault within the Puente Hills to the north and the Coyote Hills to the south (Montgomery, 1977). The La Habra Syncline produces the La Habra Valley, a naturally-occurring valley, where significant amounts of groundwater have accumulated over the past 150,000 years (Malcolm Pirnie, 2011a).

3.2.1 Groundwater Elevation

Groundwater within the La Habra Groundwater Basin generally flows from the Puente Hills in a south or southwesterly direction. Subsurface flow out of the basin occurs near Coyote and La Mirada Creeks into the Coastal Plain of Los Angeles and at the gap between the East and West Coyote Hills into the Coastal Plain of Orange County (Stetson, 2014).

A groundwater level hydrograph for a well completed in the Alluvium shows water levels declining to their lowest level in the 1950s, and recovering during the 1970s. More recent data from a nearby well shows a leveling off of water levels through the 1990s. Two other wells completed in the alluvium also show relatively flat water levels from the 1970s through the 1990s (Stetson, 2014).

Wells completed in the San Pedro Formation show rising groundwater levels. The lowest groundwater levels in this aquifer were observed during the 1930s and 1940s, with water levels recovering about 60 feet through 1972. This corresponds to DWR Bulletin No. 53 (1947) stating that the La Habra Groundwater Basin was in overdraft.   More recent data show an overall rising trend of 50 to 60 feet in groundwater levels from 1970 through 2007 and a slight decline during the last three years of data. There were no water levels available for the La Habra Formation. See Section 3.2.3 for more information.

3.2.2 Regional Pumping Patterns

The transmissivity of a groundwater basin is the rate at which groundwater flows horizontally through the aquifer. Based on Montgomery (1977), the following are the estimated transmissivities in gallons per day per foot (gpd/ft) for each of the water-bearing zones of the La Habra Groundwater Basin.

- Alluvium: 200 gpd/ft to 10,000 gpd/ft

- La Habra Formation: 25,000 gpd/ft
- San Pedro Formation: 60,000 gpd/ft

Historically, all three water-bearing zones of the La Habra Groundwater Basin were developed for domestic and irrigation purposes, with most wells drilled between 1916 and 1940. The City of La Habra originally drilled three production wells in the deeper aquifers. Groundwater production in these wells ceased in 1968 (Montgomery, 1977). Based on Montgomery (1979), the Alluvium and La Habra Formations are not considered to have groundwater development potential for the following reasons: the Alluvium is limited in thickness and extent, has low permeability characteristics, and is of poor water quality while the La Habra Formation's permeable sand and gravel zones are thin and discontinuous. Groundwater production in the San Pedro Formation continues to this day. Based on Montgomery (1977), the following are expected well yields for each of the water-bearing zones of the La Habra Groundwater Basin.

- Alluvium: 200 gpm
- La Habra Formation: 100 gpm to 400 gpm
- San Pedro Formation: 300 gpm to 800 gpm

The City of La Habra pumps local groundwater from the La Habra Groundwater Basin from three production wells: the Idaho Street Well, the La Bonita Well, and the Portola Well. The Idaho Street Well has a capacity of 2,000 gpm but is regulated at 1,500 gpm. Water pumped from the Idaho Street Well requires treatment before entering into the distribution system. This treatment consists of chlorination, air-stripping to remove ammonia and hydrogen sulfide, and the addition of sodium hexametaphosphate to sequester iron and manganese (Malcolm Pirnie, 2011a). The capacity of La Bonita Well and Portola Well is 850 gpm and 1,200 gpm, respectively.

The City of Brea owns and operates one non-potable groundwater well used for irrigation at Brea Creek Golf Course (Brea, Water Master Plan Update, November 2009). The maximum capacity of this well is 450 gpm.

Table 3-1: Groundwater Production in La Habra Groundwater Basin (afy)

City	2011	2012	2013	2014	2015
City of La Habra	1,849	1,865	3,073	4,094	3,630
City of Brea	76	86	82	121	50
TOTAL	1,925	1,951	3,155	4,215	3,680

Source: 2015 Urban Water Management Plans (Arcadis, 2016).

Table 3-2: La Habra Groundwater Basin Wells

Well Owner	Well Name	Well Use	Well Depth (ft)	Well Capacity (gpm)
City of La Habra	Idaho Street	Potable	970	2,000
City of La Habra	La Bonita	Potable	890	850
City of La Habra	Portola	Potable	1,010	1,200
City of Brea	Irrigation Well	Irrigation	--	450

3.2.3 Long-Term Groundwater Elevation Hydrograph

Groundwater level data were compiled from DWR's Water Data Library for eight wells with sufficient data to analyze trends within the La Habra Groundwater Basin. The DWR groundwater data were available for 1970 through 2010. Montgomery's hydrographs from 1922 through 1975 are also included to capture earlier groundwater trends when there was more agricultural groundwater pumping for crop irrigation. Five of the ten monitoring wells had accompanying well logs to determine which aquifer was represented by the data. Figure 3-3 shows the location of these wells and the inferred direction of groundwater flow based on the groundwater level data (Stetson, 2014).

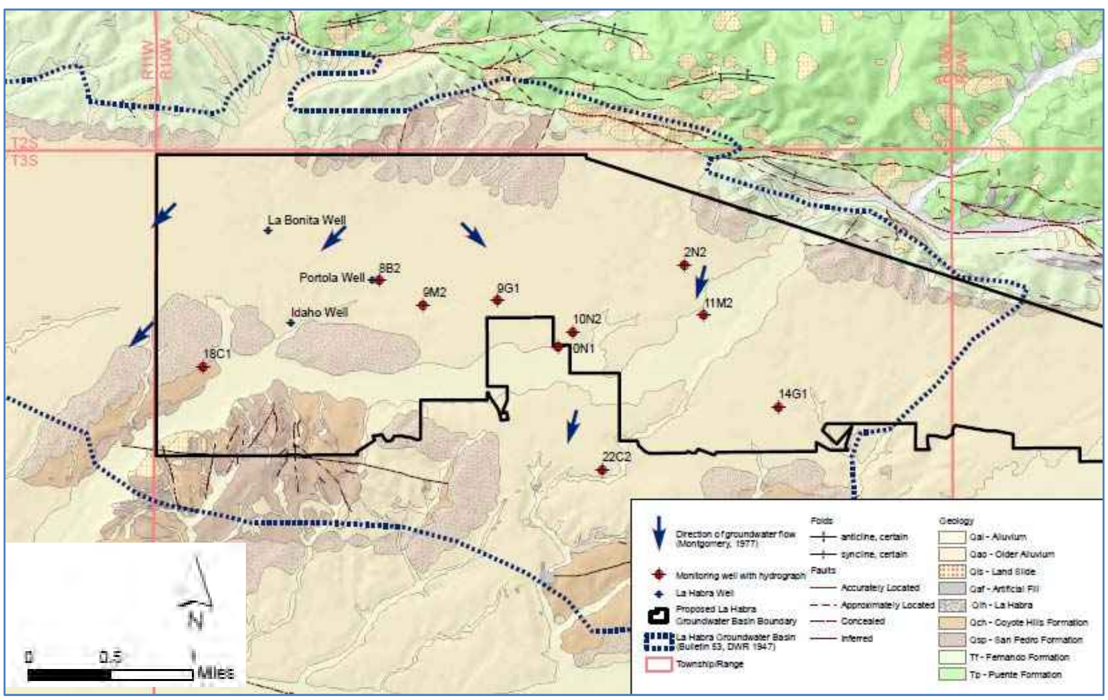

Figure 3-3: Groundwater Elevation Monitoring Wells

The groundwater level hydrograph for a well completed in the alluvial aquifer (Figure 3-4; T3/R10-10N1) shows water levels declining to their lowest level in the 1950s, and recovering during the 1970s. More recent data from a nearby well (Figure 3-5; T3/R10-10N2) shows a leveling off of water levels through the 1990s. Two other wells completed in the alluvium (T3/R10-2N2 and -9M2) also show relatively flat water levels from the 1970s through the 1990s, (Stetson, 2014).

Wells completed in the San Pedro aquifer show rising groundwater levels. The lowest groundwater levels in this aquifer were observed during the 1930s and 1940s, with water levels recovering about 60 feet through 1972 at well T3/R10-14G1. This corresponds to DWR Bulletin No. 53 (1947) stating that the La Habra Groundwater Basin was in overdraft.   More recent data from well T3/R10-18C1 show an overall rising trend of 50 to 60 feet in groundwater levels from 1970 through 2007 and a slight decline during the last three years of data. There were no water levels available for the La Habra aquifer (Stetson, 2014).

Recent data showing the depth to groundwater are presented in Figure 3-6. Wells T3/R10-9G1 and -8B2 show a similar pattern of rising groundwater levels through 2007 as seen at well T3/R10-18C1 completed in the San Pedro aquifer. The alluvial aquifer well data present a relatively flat groundwater level from 10 to 40 feet below land surface. The depth to groundwater graph shows groundwater levels in the San Pedro Aquifer recovering to levels observed in the alluvial aquifer (Stetson, 2014).

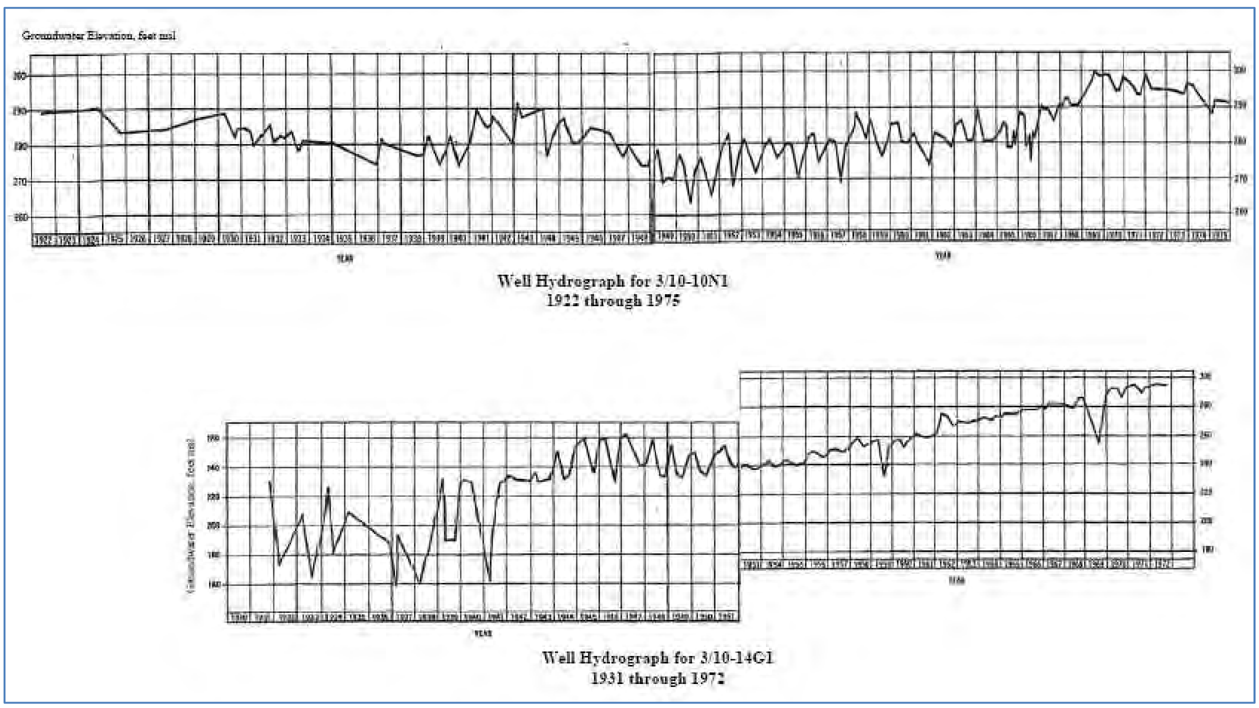

Figure 3-4: Early Well Hydrograph (1922-1975)

Source: Montgomery, 1977.

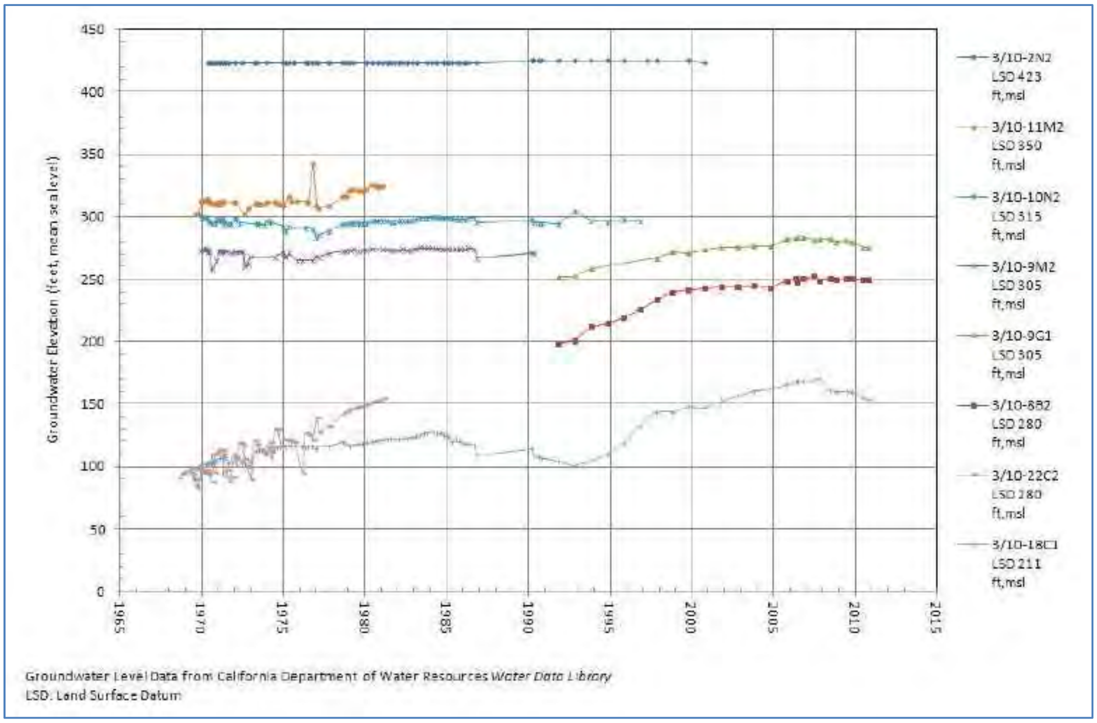

Figure 3-5: Groundwater Level Hydrographs

Source: Stetson, 2014.

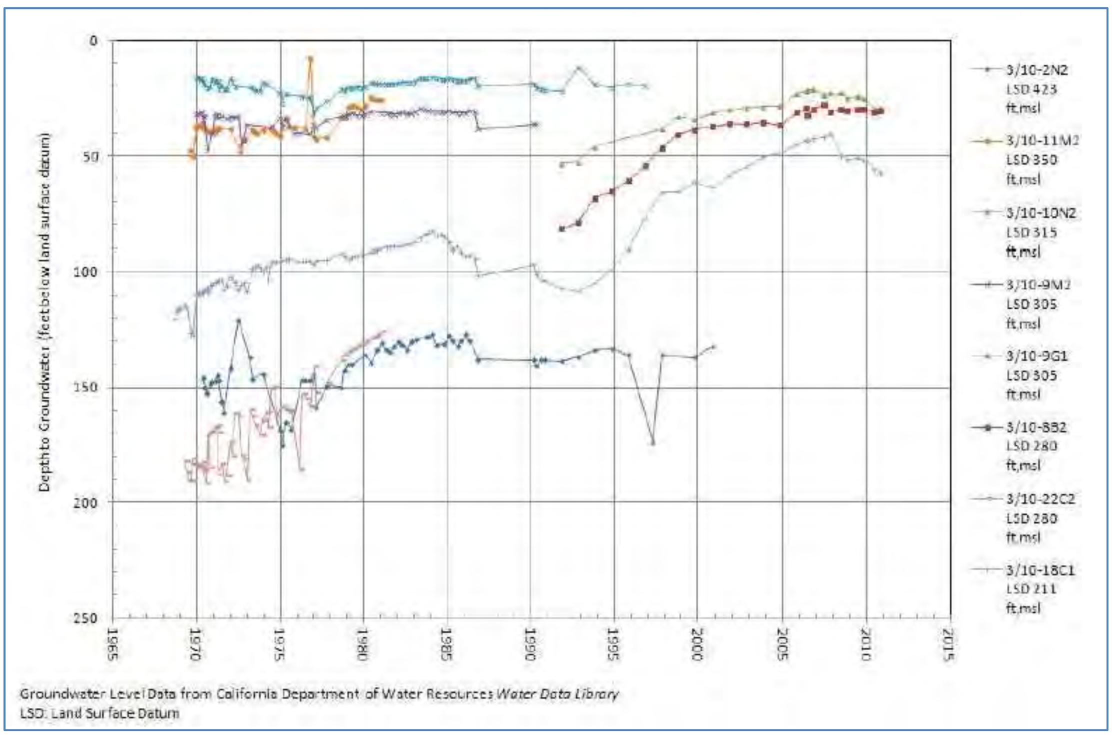

Figure 3-6: Depth to Groundwater

Source: Stetson, 2014.

3.2.4 Groundwater Storage Data

According to the DWR Bulletin 45 (1934), the storage capacity of the historical La Habra Groundwater Basin is approximately 153,000 acre-feet. Approximately 57 percent of the historical La Habra Groundwater Basin is in the eastern portion of the basin which is now designated within Basin 8-1. The Cities of La Habra and Brea overlie approximately 60 percent of the eastern portion of the historical La Habra Groundwater Basin (Stetson, 2014). Accordingly, the storage capacity of the current La Habra Groundwater Basin is approximately 55,000 acre-feet.

3.2.5 Groundwater Quality Conditions

Previous investigations of water quality within the La Habra Basin determined that the quality is extremely variable. It was shown that shallow regions within the central portion of the basin as well as areas recharged by surface water along the basin boundary are of a bicarbonate and chloride character. Sulfate concentration increased with depth in the La Habra and San Pedro water-bearing zones. The historical data also shows that total dissolved solids (TDS) concentrations have remained relatively stable (Montgomery, 1977). The current TDS concentration in La Habra wells is approximately 960 mg/L. Overall, groundwater from the San Pedro Aquifer is considered to be of fair to good quality (Montgomery, 1979).

Water from the La Bonita and Portola Wells is chlorinated and then blended with water purchased from the California Domestic Water Company in a 250,000-gallon forebay to reduce the concentration of minerals prior to entering the City of La Habra's distribution system (La Habra, 2014).

The City of Brea's non-potable well is strictly used for irrigation purposes as the groundwater beneath the city has poor water quality and would require extensive treatment and blending with higher quality water to meet public health standards (Malcolm Pirnie, 2011).

Table 3-3: Historical Constituent Concentrations (1927-1977)

Constituent	Minimum	Maximum	Average
Specific Conductance	255	2,235	1,324
Total Dissolved Solids	269	1,696	943
Sulfate	0	672	174
Chloride	18	460	161
Nitrate	0	185	44
Fluoride	0	1.6	0.44
Total Hardness	75	931	489

Source: Montgomery, 1977.

3.2.6 Land Subsidence

Based on Orange County Water District's 2015 Update to its Groundwater Management Plan, there is no evidence that the observed minimal land surface changes in portions of Orange County has caused, or are likely to cause, any structural damage within the area (OCWD, 2015). As long as groundwater elevations and storage within the basin are maintained within their historical operating ranges, the potential for problematic land subsidence is reduced.

Additionally, the United States Geological Survey (USGS) does not show the La Habra Groundwater Basin as an area where there have been historical or current subsidence recorded due to either groundwater pumping, loss of peat, or oil extraction (USGS, 2016).

3.2.7 Groundwater and Surface Water Interactions and Groundwater Dependent Ecosystems

The La Habra Groundwater Basin lies entirely within the Coyote Creek Watershed (see Figure 3-7). The Coyote Creek Watershed drains approximately 165 square miles of densely populated areas of residential, commercial, and industrial areas as well as areas of open space (Atkins, 2012). Coyote Creek is a tributary to the San Gabriel River. Major Creeks within the watershed are: Coyote Creek, Brea Creek, Fullerton Creek, Carbon Creek, Moody Creek, and Los Alamitos Channel.

Coyote Creek, Brea Creek, and La Mirada Creek (a non-major creek) all flow into and drain out of the La Habra Valley. The total drainage area of these three creeks within the valley is approximately 12,950 acres (Stetson, 2013). Coyote Creek and La Mirada Creek are surface waters flowing through the boundaries of the City of La Habra. Montgomery (1977) determined that about 30% of the runoff available in an average rainfall year percolates to the aquifers underlying the La Habra Valley.

Within the La Habra Valley, direct percolation of precipitation also occurs. The 40-year average rainfall (14 inches) results in a water supply from precipitation within the 10,160-acre drainage area of approximately 11,870 AFY (Stetson, 2013).

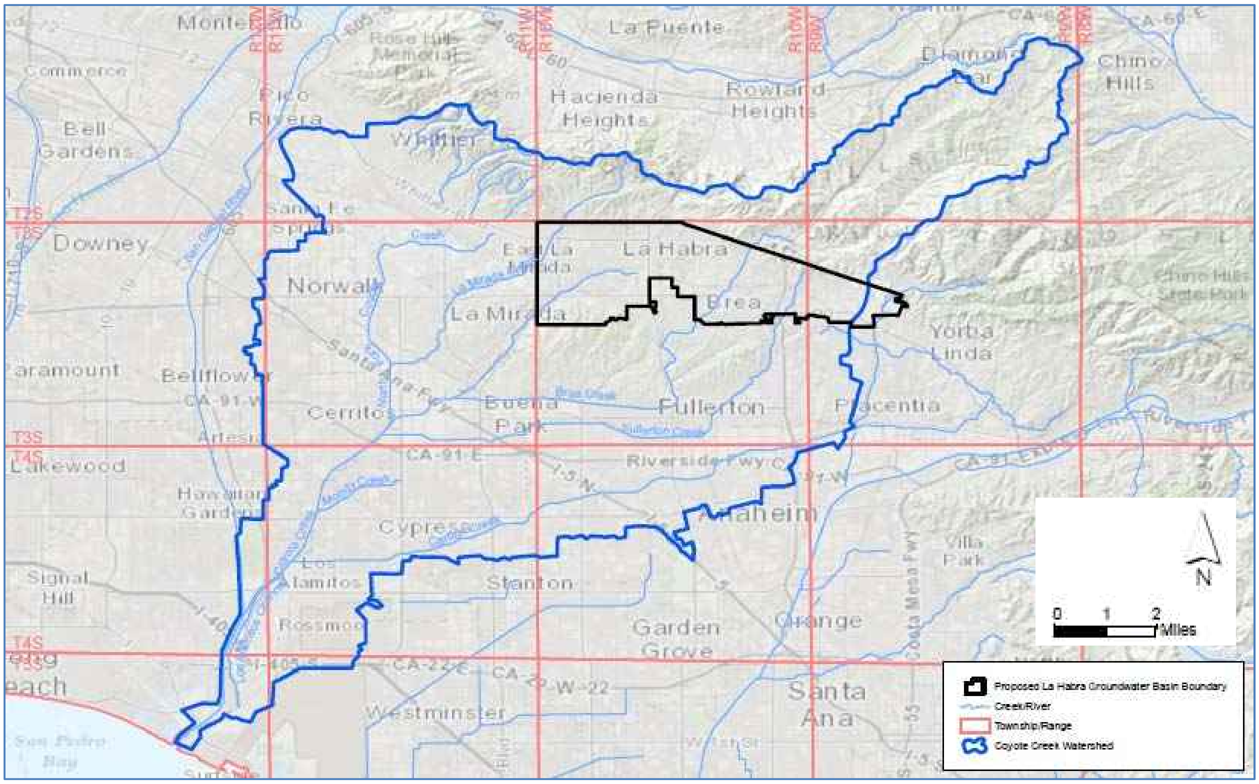

Figure 3-7: Coyote Creek Watershed

SECTION 4. WATER BUDGET

4.1 BUDGET COMPONENTS

The components of the water budget generally include recharge from precipitation and runoff, recharge from subsurface inflow, subsurface outflow, and groundwater production.

Groundwater production in the La Habra Groundwater Basin has ranged from approximately 2,000 AFY to 4,200 AFY in recent years (See Table 3-1). Subsurface flow out of the groundwater basin occurs near Coyote and La Mirada Creeks into the Coastal Plain of Los Angeles, and at the gap between the East and West Coyote Hills into the Coastal Plain of Orange County (Stetson, 2014). The remaining breakdown of the water budget components in the La Habra Groundwater Basin is not well known; therefore, a formal water budget has not been established but will be established in accordance with DWR regulations as part of the GSP development that is anticipated to occur within the La Habra-Brea Management Area before 2020.

As discussed in the section below, based on water level measurements the water budget appears to be in balance over the past ten years. Changes in groundwater storage are monitored through the monitoring of groundwater elevations and have shown rising trends since the 1970s.

4.2 ESTIMATE OF SUSTAINABLE YIELD

In 1977, Montgomery Engineers completed a groundwater study for the City of La Habra and estimated the "probable long-term groundwater basin yield" of the La Habra Groundwater Basin. Stetson conducted a re-evaluation of Montgomery's 1977 safe yield analysis in 2013. The average of these two methods results in an approximate safe yield of 4,500 AFY.

The City of La Habra has been producing groundwater since the late 1990s and monitoring non-pumping and pumping groundwater elevations since 2008. Previous investigations into groundwater levels and the safe yield have been used to manage the La Habra Groundwater Basin for over 10 years.

Groundwater production within the La Habra-Brea Management Area will be managed by the establishment of the safe yield so that the groundwater levels and storage capacity in the La Habra Groundwater Basin will be maintained.

SECTION 5. WATER RESOURCE MONITORING PROGRAMS

5.1 OVERVIEW

The La Habra Groundwater Basin is currently monitored for groundwater elevations and for groundwater quality through productions wells and monitoring wells within the City of La Habra. Surface water is currently not monitored in the Cities of La Habra and Brea overlying the La Habra Groundwater Basin. Recycled water is not used within the La Habra-Brea Management Area. Imported surface water and groundwater are used within the La Habra-Brea Management Area for potable supply. These potable water sources are monitored prior to delivery and not directly monitored by the Cities of La Habra and Brea.

5.2 GROUNDWATER MONITORING PROGRAMS

Groundwater Elevations

Since 2008, the City of La Habra has measured non-pumping and pumping groundwater elevations at its production wells to review general trends in groundwater elevations in the Basin.

The City of La Habra will supplement its existing groundwater elevation monitoring program by including water level measurements reported by DWR for three monitoring wells in the La Habra Basin. Groundwater elevations are reported by DWR for wells 3/10-9G1, 3/10-8B2, and 3/10-18C1. By January 2020, the City's monitoring program will be governed by its GSP under SGMA.

Groundwater Quality

Currently, the City samples for constituents at its production wells pursuant to Title 22 of the California Code of Regulations (Title 22). Under Title 22, the City monitors and reports groundwater quality for constituents that are regulated by the State Water Resources Control Board Division of Drinking Water pertaining to maximum contaminant levels (MCLs). The City of La Habra also monitors areas of contamination, as described in its Drinking Water Source Assessments provided to the Division of Drinking Water for its production wells. The City of La Habra plans to continue to review and comment on documents regarding these areas within the City limits as well as be aware of any areas outside of its jurisdiction that may affect the water quality of the Basin through surface or subsurface flow.

The City of La Habra plans to continue its existing groundwater water quality monitoring program and will evaluate the need for additional monitoring above its current program in accordance with DWR GSP regulations.

5.3 OTHER MONITORING PROGRAMS

Currently the City of La Habra does not perform any surface water quality monitoring; however, the City of La Habra will investigate any existing programs for the Coyote Creek Watershed including monitoring programs being developed in response to regulations set forth for the watershed by the local Regional Water Quality Control Board (Coyote Creek is shown on the Clean Water Act's 303(d) list of impaired waters). The City of La Habra will consider developing and implementing its own surface and subsurface inflow quality monitoring programs for the local watershed in accordance with DWR GSP regulations.

Likewise, the City of La Habra does not monitor land subsidence within the La Habra-Brea Management Area. However, the City may develop a program to monitor and measure the rate of land surface subsidence in accordance with DWR GSP regulations.

SECTION 6. WATER RESOURCE MANAGEMENT PROGRAMS

Groundwater resources protection is considered a critical component for safeguarding the long-term sustainability of the La Habra Groundwater Basin. Groundwater resources protection includes water resources planning and an ordinance to prohibit the extraction and exportation of groundwater underlying the City for use outside the City as well as groundwater protection programs including well construction, abandonment, and destruction policies, wellhead protection, and the control of the migration and remediation of contaminated, poor quality, or saline water.

6.1 LAND USE ELEMENTS RELATED TO BASIN MANAGEMENT

The Cities of Brea and La Habra participate in two water resources management planning documents: the Integrated Regional Water Management Plan, and the Urban Water Management Plan.

Integrated Regional Water Management Plan

Integrated Regional Water Management (IRWM) is a collaborative approach of implementing water management solutions on a regional scale in order to address water resources needs. The Greater Los County Region has been designated as an IRWM region and is comprised of the following subregions: North Santa Monica Bay, South Bay, Upper Los Angeles River, Upper San Gabriel and Rio Hondo Rivers, and Lower San Gabriel and Los Angeles Rivers. The Coyote Creek watershed, which overlies the La Habra Groundwater Basin, is within the Lower San Gabriel and Los Angeles Rivers IRWM subregion. The La Habra Groundwater Basin contributes a small portion of the groundwater produced within the subregion.

Urban Water Management Plan

Water Code Sections 10610 through 10656 of the Urban Water Management Planning Act require every urban water supplier providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre-feet (AF) of water annually to prepare, adopt, and file an Urban Water Management Plan (UWMP) with the California Department of Water Resources (DWR). The Cities of Brea and La Habra both are required to file an UWMP every five years with DWR. The UWMP is a management tool that provides water planning and identifies water supplies needed to meet existing and future water demands.

6.2 GROUNDWATER WATER QUALITY PROTECTION AND MANAGEMENT

Well Construction, Abandonment, and Destruction Policies

The policies that govern well construction, abandonment, and destruction are designed specifically to protect groundwater quality. The administration of these policies has been delegated to individual counties by California legislature. As stated in Orange County Ordinance No. 2607, all well activity within Orange County will comply with the standards set in DWR Bulletin 74, Chapter 2. These standards are enforced by the Orange County Health Care Agency. The Cities of La Habra and Brea properly construct and abandon wells pursuant to Orange County Ordnance No. 2607.

Wellhead Protection Measures

Wellhead protection is a way to prevent drinking water from being contaminated by managing sources of potential contamination within the vicinity of a production well. Surface contaminants can enter a well through the outside edge of the well casing or directly through opening in the well head. These contaminants can travel in two directions: to the groundwater aquifer or to the distribution system. As defined in the Safe Drinking Water Act Amendments of 1986, a wellhead protection area is “the surface and subsurface area surrounding a water well or well field supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or well field.”

The Cities of La Habra and Brea design and construct wells in accordance with the measures described in DWR Bulletin 74 so that the wellhead is protected from contamination. Important wellhead protection measures described in Bulletin 74 include: methods for sealing the well from intrusion from surface contaminants, site grading to assure drainage is away from the wellhead, and set-back requirements from known pollution sources.

Control of Migration and Remediation of Contaminated Groundwater

Groundwater can become contaminated naturally or through human activity. Based on a 2010 drinking water assessment performed by the City of La Habra, sources of potential groundwater contamination to the La Habra Basin include: car repair and bodywork shops, gas stations, machine and metalwork shops, and sewer collection systems (La Habra, 2013).

The City of La Habra has previously taken the position that oil and gas mining operations in or up gradient of the basin have the potential to release chemicals that could contaminate groundwater, particularly during fracking activities.

The Cities of La Habra and Brea will monitor the migration of contaminants through its water quality monitoring program and will also monitor nearby oil and gas mining operations. This will allow the point and non-point pollution sources to be identified. If contamination becomes a concern in the future, an approach to address the problem will be developed.

Control of Saline Water Intrusion

Raised salinity is a significant water quality problem in many parts of the southwestern United States and southern California, including Orange County. Elevated salinity is of concern as it can limit the implementation of recycling water projects and potentially require water purveyors to perform additional treatment on their water supplies.

The level of salinity is sometimes measured based on Total Dissolved Solids (TDS) concentrations. The TDS concentrations in the La Habra Basin are naturally occurring and it is not believed that current activities in the basin significantly contribute to the TDS loading in the basin. The TDS concentrations are not a result of saline water intrusion. The TDS concentrations in the City of La Habra’s wells are below the secondary Maximum Contaminant Level (MCL) of 1,000 mg/L. TDS is listed as a secondary constituent as it does not directly cause harm to consumers but can affect the aesthetic quality of the water, including taste.

6.3 GROUNDWATER EXPORT PROHIBITION

The protection of the health, welfare, and safety of the residents and economy of the City of La Habra require that the groundwater resources of the City be protected for present and future municipal, industrial, and domestic beneficial uses within the City. The sustainable yield of the portion of the La Habra Basin underlying the City is not sufficient to serve beneficial uses in addition to the beneficial municipal, industrial and domestic uses currently served through the City municipal water system. The best interest of the present and future inhabitants of the City is served by the prohibition against the extraction and exportation of groundwater produced from within the City's jurisdictional boundaries. Accordingly, on December 21, 2015, the City of La Habra adopted Ordinance No. 1767 to prohibit the extraction and exportation of groundwater underlying the City for use outside of the City.

SECTION 7. NOTICE AND COMMUNICATION

7.1 INTRODUCTION

The Cities of La Habra and Brea overlie the La Habra Groundwater Basin and are the only producers of groundwater within the basin. Potential agencies that may additionally have a stake in the successful management of the basin include:

- Central Basin Watermaster (DWR): adjudicated Central Basin (Los Angeles)
- OCWD: actively manages Orange County portion
- City of Fullerton: included in OCWD's service area

7.2 GROUNDWATER PRODUCERS

As the City of Brea is a direct stakeholder in the Orange County portion of the La Habra Basin outside of OCWD's service area, Brea was included in the preparation of this plan.

While the Central Basin Watermaster, OCWD, and the City of Fullerton do not have a direct stake in the Orange County portion of the La Habra Basin outside of OCWD's service area that is the focus of this Plan, the portions of the historical La Habra Basin underlying these entities are hydrologically connected to the portion of the basin that is the subject of this Plan. As such these entities were informed that OCWD was preparing this Plan and the planned management of the basin was discussed with them.

7.3 PUBLIC PARTICIPATION

The City of La Habra has invited the public to participate in City Council meetings where management of the La Habra Basin and future actions have been discussed and presented. On December 21, 2015, La Habra held a public hearing to establish La Habra as a GSA for the La Habra Basin and to establish the La Habra Basin as a separate basin from Basin 8-1. Notice for the public hearing was posted in the Orange County Register in accordance with Government Code Section 6066. The City Council also approved the readings of an ordinance to prohibit the extraction and exportation of groundwater underlying La Habra for use outside of the city on December 21, 2015 and January 19, 2016. This ordinance took effect on February 18, 2016.

The La Habra GSA will strive to involve the public in groundwater management decisions regarding the La Habra-Brea Management Area. In the future, the La Habra GSA plans to provide copies of the periodic groundwater reports that will be prepared to the public at their request and publish information on groundwater management accomplishments on the City's website. The La Habra GSA will also comply with the public participation requirements under SGMA.

7.4 COMMUNICATION PLAN

The La Habra GSA plans to prepare a summary report of the current conditions of the La Habra Groundwater Basin ideally every two to five years using the results from the monitoring program (see Section 5.0). These informative reports will be used to plan future groundwater projects, develop new groundwater policies, and identify any new concerns with the basin.

SECTION 8. SUSTAINABLE MANAGEMENT APPROACH

As the City of La Habra currently depends on local groundwater to meet approximately 40 percent of its water consumption and the City of Brea uses groundwater to meet irrigation needs, preserving the sustainability of the La Habra Groundwater Basin is essential for the well-being of the two cities. Currently (and historically), the City of La Habra manages (and has managed) the La Habra Groundwater Basin through management plans and programs for groundwater levels, basin storage, water quality, groundwater export prohibition, and groundwater-surface water interactions, discussed below in Sections 9, 10, 11, and 14, respectively. Seawater intrusion and land subsidence are not occurring in the La Habra-Brea Management Area and therefore are not actively managed at this time, but will be monitored under the La Habra GSP. By January 2020, the La Habra GSA will manage the La Habra- Brea Management Area through its GSP, which will describe the City's monitoring program and ensure that no undesirable results occur in the future.

As a key component of sustainable management, the Cities of La Habra and Brea strongly promote conservation as a means to preserve water supplies. Both cities have sections on their websites dedicated to water conservation in addition to including conservation guidance in their annual Consumer Confidence Reports distributed to residents.

SECTION 9. SUSTAINABLE MANAGEMENT RELATED TO GROUNDWATER LEVELS

A solid understanding of groundwater elevations, seasonal fluctuations and response to pumping, existing basin yield, and how groundwater is stored and transmitted through the basin is critical for sustainably managing the La Habra-Brea Management Area.

9.1 HISTORY OF BASIN CONDITIONS AND MANAGEMENT ACTIONS

As shown on Figures 3-4, 3-5, and 3-6, groundwater levels in the La Habra-Brea Management Area have recovered from lows in the 1930 to 1950s and have experienced a general rising trend and leveling off since the 1970s. Given consistent groundwater production within the estimated safe yield of the basin, groundwater levels are expected to remain steady in the future.

9.2 MONITORING OF GROUNDWATER LEVELS

As discussed in Section 5.2, the La Habra GSA has measured non-pumping and pumping groundwater elevations at its production wells since 2008. In addition, DWR reports water level measurements for some monitoring wells in the La Habra Groundwater Basin. Groundwater levels reported by DWR for wells 3/10-9G1, 3/10-8B2, and 3/10-18C1 will be included in the periodic reviews of the condition of the basin.

In accordance with DWR GSP regulations, the City of La Habra will evaluate the need for additional monitoring above its current groundwater elevation monitoring program. The need for standard and multi-level monitoring wells to monitor the three aquifers of the basin will be investigated. Characterization of the conditions of the basin using the City's existing groundwater elevation data from its production wells may not reflect steady state conditions because the wells pump frequently and groundwater within the well does not have enough time to fully recover to obtain a static elevation before the well is put into production once more. Static elevations may be recorded through the use of monitoring wells where no pumping is performed and the well is constantly in a static condition.

If the City constructs a monitoring or production well in the future, the City will perform aquifer tests to determine the hydrologic properties of each aquifer.

9.3 DEFINITION OF SIGNIFICANT AND UNREASONABLE LOWERING OF GROUNDWATER LEVELS

The definition of significant and unreasonable lowering of groundwater levels in the La Habra Management Area is a lowering of groundwater levels such that a significant loss of well production capacity or a significant degradation of water quality occurs which would impact the intended use of the groundwater.

9.4 DETERMINATION OF MINIMUM THRESHOLDS

There are no minimum thresholds established for groundwater levels in the La Habra Groundwater Basin because the basin is currently not in overdraft and is managed within the safe yield of the basin. If chronic or significant lowering of groundwater levels are observed through groundwater level monitoring, the La Habra GSA will evaluate its operations, re-evaluate the safe yield and establish minimum thresholds, where appropriate, and in accordance with SGMA.

SECTION 10. SUSTAINABLE MANAGEMENT RELATED TO BASIN STORAGE

10.1 HISTORY

As discussed in Section 9.1, groundwater levels in the La Habra Groundwater Basin have recovered from lows in the 1930 to 1950s and have experienced a general rising trend and leveling off since the 1970s. Given steady groundwater production within the estimated safe yield of the basin, groundwater levels are expected to remain steady in the future.

10.2 MONITORING STORAGE LEVELS

The monitoring of storage levels is indirectly monitored through the groundwater level monitoring program described in Section 9.2.

10.3 MANAGEMENT PROGRAMS

10.3.1 Establishment of Safe Yield

A "safe yield" is used for ongoing management and future planning of a groundwater basin for sustained beneficial use. It is generally defined as the volume of groundwater that can be pumped annually without depleting the aquifer beyond its ability to recover through natural recharge over a reasonable hydrologic period. In 1977, Montgomery Engineers completed a groundwater study for the City of La Habra and estimated the "probable long-term groundwater basin yield" of the La Habra Groundwater Basin. Stetson conducted a re-evaluation of Montgomery's 1977 safe yield analysis in 2013. The average of these two methods results in an approximate safe yield of 4,500 AFY.

Based on a review of groundwater elevations performed in January 2014, groundwater elevations in the San Pedro aquifer of the La Habra Basin appear to have risen about 100 feet from the 1940s to the present with an overall rising trend of 50 to 60 feet between 1970 and 2007 (Stetson, 2014). Therefore, it appears that the basin is not currently in an overdraft condition.

The City of La Habra can maintain sustainable groundwater production by maintaining and coordinating groundwater production within the estimated safe yield of the La Habra Groundwater Basin.

10.3.2 Review and Evaluation of Groundwater Levels

The condition of the basin can be verified through a periodic review of groundwater elevations within the basin. The City can utilize and supplement its existing groundwater elevation monitoring program to review general trends in groundwater elevations in the Basin.

In accordance with DWR GSP regulations, the City will evaluate the need for additional monitoring above its current groundwater elevation program. If the City of La Habra chooses to expand its groundwater monitoring program in the future, the City will prepare basin management reports on a periodic basis (every two to five years) using the results of the monitoring program. These informative reports will be used to review whether groundwater production is within the safe yield of the basin, plan future groundwater projects, develop new groundwater policies, and identify any new concerns within the La Habra-Brea Management Area.

10.3.3 Groundwater Recharge of Storage Projects

The City of La Habra currently does not operate any groundwater recharge or storage projects. In the future, the City may perform a basin replenishment study that identifies potential recharge areas and measures to protect these areas. Two areas where a groundwater recharge project could be studied for implementation are shown in Figure 10-1 The San Pedro Formation is naturally recharged directly through aquifer outcrops (exposed formation sediments) in the Los Coyote Hills (south of the intersection of Beach Boulevard and Imperial Highway) and in the Puente Hills (along the foothills north of Whittier Boulevard) [Montgomery, 1977]. The San Pedro Formation could also be indirectly recharged through the uplifted and exposed San Pedro beds that lie just below a thin layer of alluvium along the Coyote Creek valley (Montgomery, 1977).

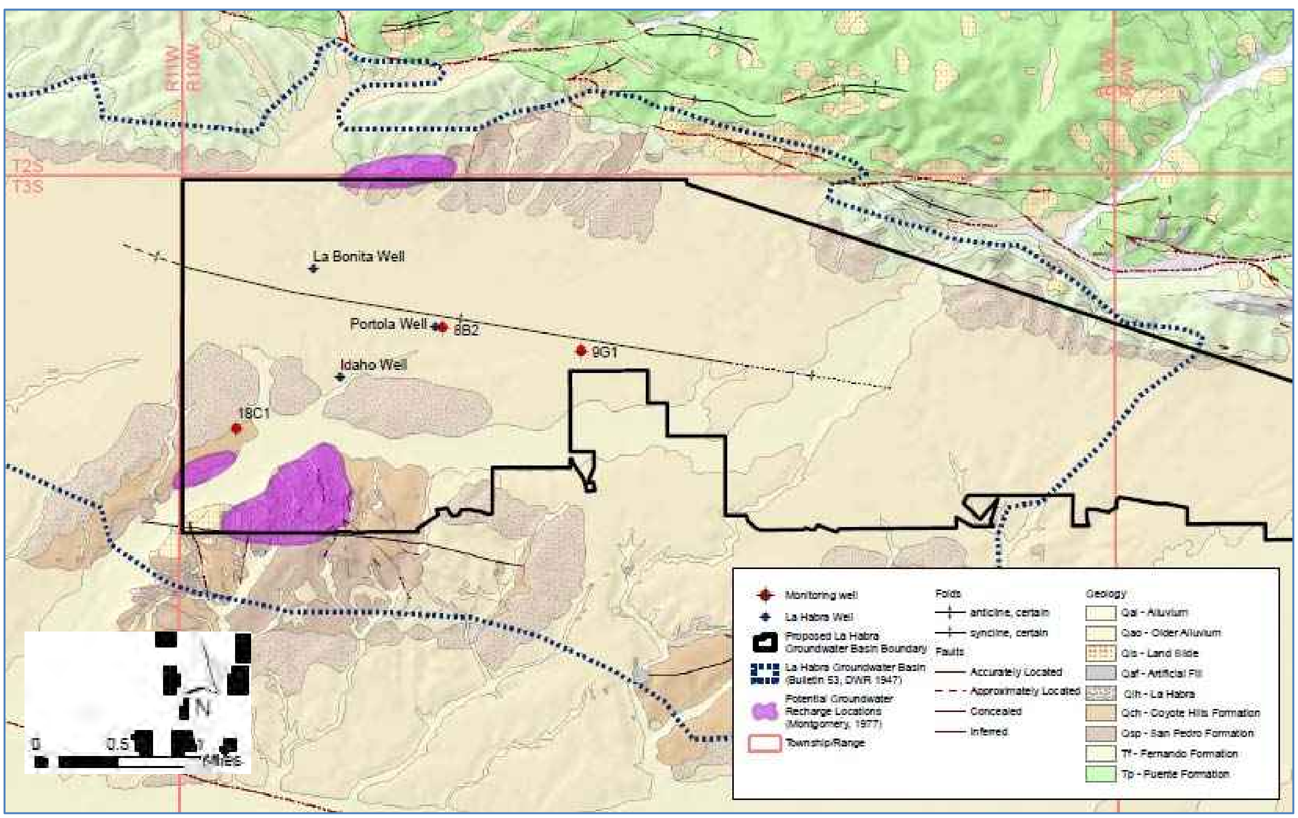

Figure 10-1: Potential Groundwater Recharge Locations

As discussed in Section 2.2, the City of La Habra is located in the Coyote Creek Watershed. The Coyote Creek Watershed is included in the Municipal Separate Storm Sewer System (MS4) Permit for the Orange County Santa Ana Region. The City is implementing new water quality control programs to meet the requirements of the MS4 permit for discharges from storm drains. The programs include Low Impact Development measures to address water quality on residential and commercial properties, new inspection activities, and potential retention and recharge of stormwater runoff. Recharge activities associated with MS4 compliance are anticipated to occur outside of the City of La Habra.

The City of La Habra currently does not operate any conjunctive use projects. The City may study the feasibility of conjunctive use projects in the future.

10.3.4 Potential Management Programs

No known desktop flow model exists for the La Habra Basin. As such, the La Habra GSA will consider developing a desktop flow model for the La Habra-Brea Management Area in the future once a sufficient amount of data are collected (as additional monitoring wells are constructed and monitored, for example). Groundwater models are used to represent natural flow conditions of an aquifer and can predict the effects of hydrological changes (such as pumping and replenishment) on the behavior of the aquifer.

10.4 DEFINITION OF SIGNIFICANT AND UNREASONABLE REDUCTION IN STORAGE

As with groundwater levels, the definition of significant and unreasonable reduction in groundwater storage in the La Habra-Brea Management Area is a lowering of groundwater levels such that a significant loss of well production capacity or a significant degradation of water quality occurs which would impact the intended use of the groundwater.

10.5 DETERMINATION OF MINIMUM THRESHOLDS

As with groundwater levels, minimum thresholds have not been established for changes in groundwater storage. If chronic or significant lowering of groundwater levels is observed through groundwater level monitoring, the La Habra GSA will evaluate its operations, re-evaluate the safe yield and establish minimum thresholds, where appropriate, and in accordance with SGMA.

SECTION 11. SUSTAINABLE MANAGEMENT RELATED TO WATER QUALITY

It is the intent of the La Habra GSA to protect and enhance the groundwater quality in the La Habra-Brea Management Area. This can be achieved through groundwater quality programs, understanding the quality of surface waters and subsurface water that naturally recharge the basin, and implementing measures to protect potential recharge areas.

11.1 HISTORY

Previous investigations of water quality within the La Habra Groundwater Basin determined that the quality is extremely variable. Overall, groundwater from the San Pedro Aquifer is considered to be of fair to good quality (Montgomery, 1979).

11.2 SUMMARY OF GROUNDWATER QUALITY ISSUES

As discussed in Section 3.2.5, Water from the La Bonita and Portola Wells is chlorinated and then blended with water purchased from the California Domestic Water Company in a 250,000-gallon forebay to reduce the concentration of minerals prior to entering the City of La Habra's distribution system (La Habra, 2014).

The City of Brea's non-potable well is strictly used for irrigation purposes as the groundwater beneath the city has poor water quality and would require extensive treatment and blending with higher quality water to meet public health standards (Malcolm Pirnie, 2011).

11.3 MONITORING OF GROUNDWATER QUALITY

The La Habra GSA will continue the City of La Habra's existing water quality monitoring program, described in Section 5.2, and supplement the program as required by SGMA. If the La Habra GSA were to choose to construct monitoring wells for groundwater elevations, these wells can also be sampled for water quality.

The La Habra Basin is recharged through surface runoff and streamflow recharge as well as mountain front recharge (Stetson, 2013). Understanding the quality of the surface and subsurface water that recharges the La Habra Basin is important in protecting and enhancing the water quality of the groundwater basin as the groundwater within the basin originates from these waters. Although the City currently does not have a surface water quality monitoring program for the Coyote Creek Watershed, the La Habra GSA will investigate any existing programs for the watershed including regulations set forth for the watershed by the local Regional Water Quality Control Board (Coyote Creek is shown on the Clean Water Act's 303(d) list of impaired waters). The La Habra GSA will consider developing and implementing its own surface and subsurface inflow quality monitoring programs for the local watershed in the future.

To protect the water quality of the Basin, the La Habra GSA will continue to monitor and review areas of contamination within the La Habra-Brea Management Area, as described in its Drinking Water Source Assessments provided to the California Department of Public Health (CDPH) for its production wells. The La Habra GSA will continue to review and comment on documents within the La Habra-Brea Management Area as well as be aware of any areas outside of its jurisdiction that may affect the water quality of the La Habra-Brea Management Area through surface or subsurface flow.

11.4 DESCRIPTION OF MANAGEMENT PROGRAMS

The management programs intended to protect the water quality of the La Habra-Brea Management Area include well construction, abandonment, and destruction policies, wellhead protection measures, control of migration and remediation of contaminated water, and control of saline water. See Section 6.

11.5 DEFINITION OF SIGNIFICANT AND UNREASONABLE DEGRADATION OF WATER QUALITY

The definition of significant and unreasonable degradation of water quality is a reduction of water quality in the La Habra-Brea Management Area such that the groundwater can no longer be used for the intended purposes even with the implementation of reasonable mitigation measures. Currently, the City of Brea only uses groundwater produced from the La Habra Groundwater Basin for irrigation; however, the City of La Habra uses groundwater for its potable supply, thus requiring a higher level of quality.

11.6 DETERMINATION OF MINIMUM THREHOLDS

Because groundwater from the La Habra Groundwater Basin is used as a potable source, the minimum thresholds for groundwater quality are exceedances of Maximum Contaminant Levels (MCLs) or other applicable regulatory limits that are directly attributable to groundwater management actions in the La Habra-Brea Management Area that prevents the use of groundwater for its intended purpose.

SECTION 12. SUSTAINABLE MANAGEMENT RELATED TO SEAWATER INTRUSION

The La Habra Groundwater Basin is not located near the ocean. Accordingly, there is no need to manage or consider the potential impact of seawater intrusion in the La Habra-Brea Management Area.

SECTION 13. SUSTAINABLE MANAGEMENT RELATED TO LAND SUBSIDENCE

As discussed in Section 3.2.6, there is no evidence that land subsidence is, or will likely become, problematic within the La Habra-Brea Management Area. However, the City of La Habra may develop a program to monitor and measure the rate of land surface subsidence within the La Habra-Brea Management Area in accordance with DWR GSP regulations. The need for land surface subsidence monitoring will be considered on an annual basis.

SECTION 14. SUSTAINABLE MANAGEMENT RELATED TO GROUNDWATER DEPLETIONS IMPACTING SURFACE WATER

As discussed in Section 3.2.7, the La Habra Groundwater Basin lies within the Coyote Creek Watershed with the major creeks in the watershed being Coyote Creek, Brea Creek, Fullerton Creek, Carbon Creek, Moody Creek, and Los Alamitos Channel. The watershed is highly urbanized with densely populated areas of residential, commercial, and industrial areas, as well as open space. Montgomery (1977) determined that about 30% of the runoff available in an average rainfall year percolates to the aquifers underlying the La Habra Valley.

In recent years, the depth to groundwater from the ground surface is approximately 30 feet (see Figure 3-6. However, groundwater production occurs within the confined San Pedro aquifer which is significantly deeper than the perched alluvial aquifer with a depth to groundwater of approximately 140 feet in the year 2000 (see Figure 3-6). Thus, groundwater production is not anticipated impact surface waters and local habitats.

SECTION 15. PROTOCOLS FOR MODIFYING MONITORING PROGRAMS

A Groundwater Advisory Committee will be established by the La Habra GSA which will be responsible for monitoring the progress in implementing the sustainable management strategies and programs of this plan. The Committee will meet once every five years to evaluate and discuss the current conditions of the La Habra-Brea Management Area and the effectiveness of the current programs. This plan will be amended to reflect any new policies or practices relevant to the management of the La Habra-Brea Management Area. It will also be updated to reflect changes in groundwater conditions as necessary.

Monitoring protocols are necessary to ensure consistency and accuracy in monitoring efforts and are required for monitoring assessments to be valid. Consistency should be reflected in factors such as the locations of the sampling points, frequency and seasonality of measurements, sampling procedures, and testing procedures. Accordingly, the La Habra GSA will undertake uniform data gathering procedures to ensure comparable measurements of groundwater are taken.

15.1 ESTABLISHMENT OF PROTOCOLS FOR WATER QUALITY

The following protocols will be followed for future groundwater elevation measurements:

- Annual sampling should be performed at the same time each year.
- Sampling should be performed during periods of both low and high groundwater production from the basin.
- Pump the well for an adequate period of time prior to sampling and document the stabilized parameters.
- Use proper containers, preservatives, and holding times.
- Use proper handling procedures (gloves, ice coolers, etc.).
- Document the time, date, location, and name of the technician on each sample container.
- Document any field notes regarding the condition of the well, sample, etc. if necessary.
- Use secure chain-of-custody procedures.
- Use the same laboratory for all testing, when possible. Select a laboratory that is accredited and state-certified that use proper quality control and quality assurance procedures.
- Include spiked, duplicates, and field-blank samples for comparison to genuine samples.

15.2 ESTABLISHMENT OF PROTOCOLS FOR GROUNDWATER ELEVATION/STORAGE

The following protocols will be followed for future groundwater elevation measurements:

- Document the time, date, location, and name of the technician for each measurement.
- Document the reference point, measuring device, and calibration date for the measuring device for each measurement.
- Annual measurements should be performed at the same time each year.
- When taking measurements for multiple wells, measurements should be taken in as short a period as possible.
- Measure the groundwater elevation twice, or more if necessary, until consistent results are obtained.
- If groundwater contamination is suspected, decontaminate the measuring equipment. In general, measurements should be performed from the least contaminated to most contaminated wells.

SECTION 16. PROCESS TO EVALUATE NEW PROJECTS

The La Habra GSA will evaluate any proposed actions for the La Habra-Brea Management Area pursuant to this Basin 8-1 Alternative in cooperation with the City of Brea. However, if there is a conflict between this Alternative and La Habra GSA's GSP, the GSP will control. Additionally, new projects would be evaluated through the CEQA process (i.e. by reviewing and commenting on draft CEQA documents). Likewise, OCWD would have an opportunity to comment on projects proposed within the La Habra-Brea Management Area, but OCWD has no authority under this Plan to obstruct any action taken by the La Habra GSA regarding the La Habra-Brea Management Area.

SECTION 17. LIST OF REFERENCES AND TECHNICAL STUDIES

Arcadis. 2016. 2015 Urban Water Management Plan, City of La Habra.

Arcadis. 2016. Draft 2015 Urban Water Management Plan, City of Brea.

Atkins, 2012. City of La Habra General Plan Update. Technical Background Report.

California Department of Water Resources (DWR). 1934. South Coastal Basin Investigation: Geology and Ground Water Storage Capacity of Valley Fill. Bulletin No. 45. Written while DWR was the California Department of Public Works.

DWR. 1947. South Coastal Basin Investigation: Overdraft on Ground Water Basins. Bulletin No. 53. Written while DWR was the California Division of Water Resources.

Geoscience. 2009. Draft Preliminary Geohydrologic Evaluation of the La Habra Basin. Prepared for City of La Habra, April 2, 2009.

Malcolm Pirnie, 2011. Final 2010 Urban Water Management Plan. City of La Habra.

Montgomery, Consulting Engineers Inc. (Montgomery). 1977, November. La Habra Basin Groundwater Study.

Montgomery, 1979, July. Exploratory Drilling in the La Habra Groundwater Basin, Summary Report and Evaluation.

Orange County Water District (OCWD). 2015. Groundwater Management Plan 2105 Update, Orange County Water District. .

Stetson Engineers Inc. August, 2013. Draft Technical Report: Task 1 Re-Evaluation of Basin Safe Yield.

Stetson Engineers, Inc. 2014. Task 3 Hydrogeologic Investigation of the La Habra Groundwater Basin. Technical Memorandum.

United States Geological Survey (USGS). Areas of Land Subsidence in California. Accessed October 5, 2016. http://ca.water.usgs.gov/land_subsidence/california-subsidence-areas.html

Yerkes, R.F. 1972. Geology and Oil Resources of the Western Puente Hills Area, Southern California. Geology of the Eastern Los Angeles Basins, Southern California. Geological Survey Professional Paper 420-C; A study of the stratigraphy, structure, and oil resources of the La Habra and Whittier quadrangles.

Basin 8-1 Alternative

OCWD Management Area

Prepared by: Orange County Water District

January 1, 2017

Basin 8-1 Alternative

OCWD Management Area

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Prepared for the Department of Water Resources, pursuant to Water Code §10733.6(b)(3)

January 1, 2017

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Appendices

APPENDIX A: List of Wells in OCWD Monitoring Programs

SECTION 1 EXECUTIVE SUMMARY

The Orange County Water District (OCWD) is a special district formed in 1933 by an act of the California Legislature, the “OCWD Act”. OCWD manages the groundwater basin that underlies north and central Orange County pursuant to the OCWD Act. Water produced from the basin is the primary water supply for approximately 2.4 million residents living within the service area boundaries. The mission of OCWD includes sustainably managing the Orange County Groundwater Basin, Basin 8-1, over the long-term. Additionally, as a special act district listed in Water Code § 10723 (c)(1), OCWD is the exclusive local agency within its jurisdictional boundaries with powers to comply with SGMA via a groundwater sustainability plan (“GSP”) or via an Alternative prepared in accordance with Water Code § 10733.6.

The OCWD Management Area includes 89 percent of the area designated by the Department of Water Resources (DWR) as Basin 8-1, the “Coastal Plain of Orange County Groundwater Basin” in Bulletin 118 (DWR, 2003). The OCWD Management Area includes the same land area as the OCWD service area within Basin 8-1 except for a small 6.7-square mile area in the northeast corner of the basin that is part of the Santa Ana Canyon Management Area. The boundaries of Basin 8-1, the OCWD service area and the OCWD Management Area are shown in Figure 1-1.

1.1 GROUNDWATER BASIN CONDITIONS

GROUNDWATER ELEVATIONS

OCWD prepares groundwater elevation contour maps for each of the three major aquifer systems (Shallow, Principal, and Deep) annually. In addition to illustrating regional groundwater gradients, the maps are used to prepare water level change maps and to calculate the amount of groundwater in storage and the annual storage change. OCWD’s basin-wide network of monitoring wells is used to monitor groundwater levels and quality, assess effects of pumping and recharge, estimate groundwater storage, characterize basin hydrogeology, and develop and calibrate a numerical flow model of the basin. Groundwater elevation contours in the Principal Aquifer as of June 2016 are shown in Figure 1-2.

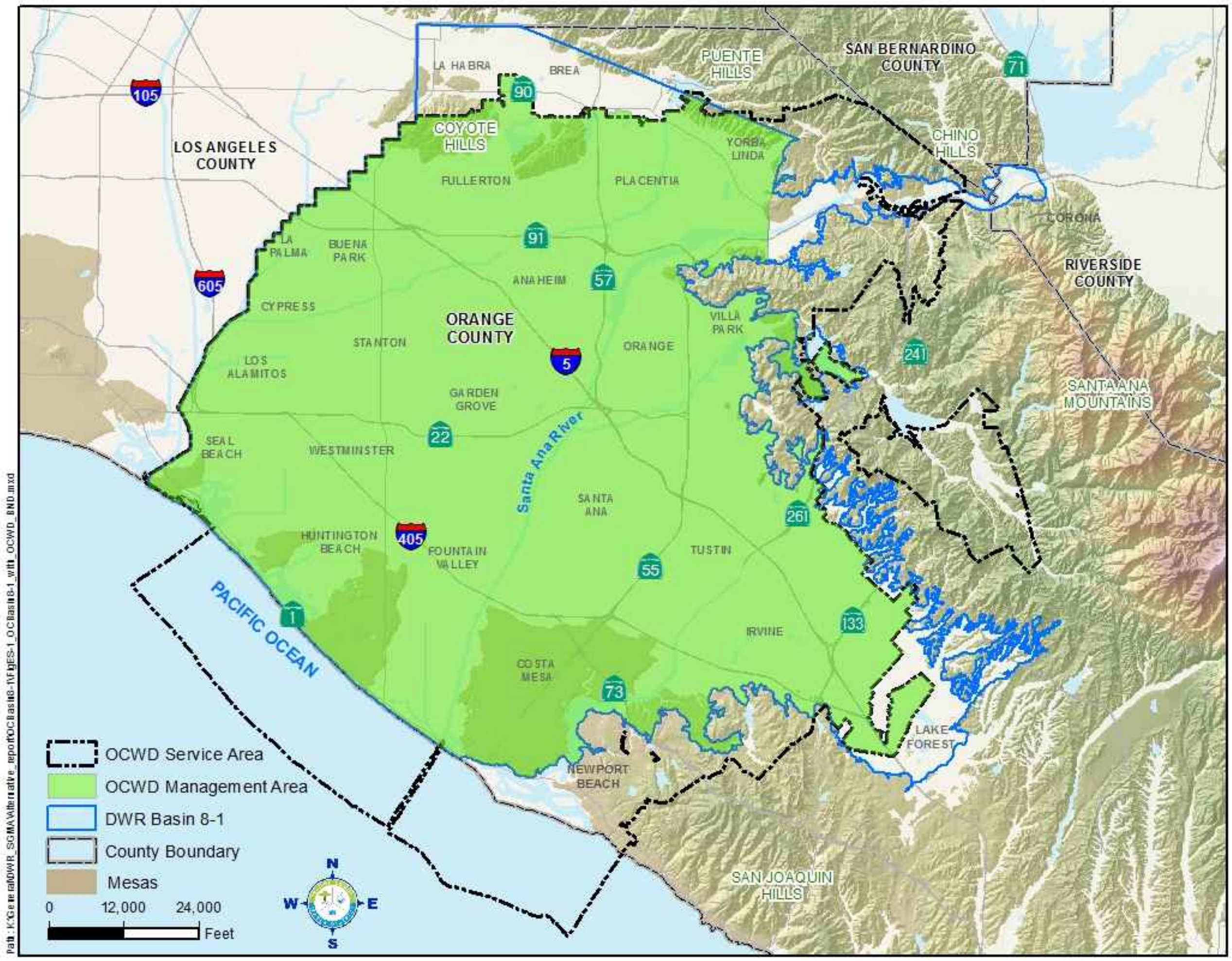


Figure 1-1: Basin 8-1, OCWD Service Area and OCWD Management Area

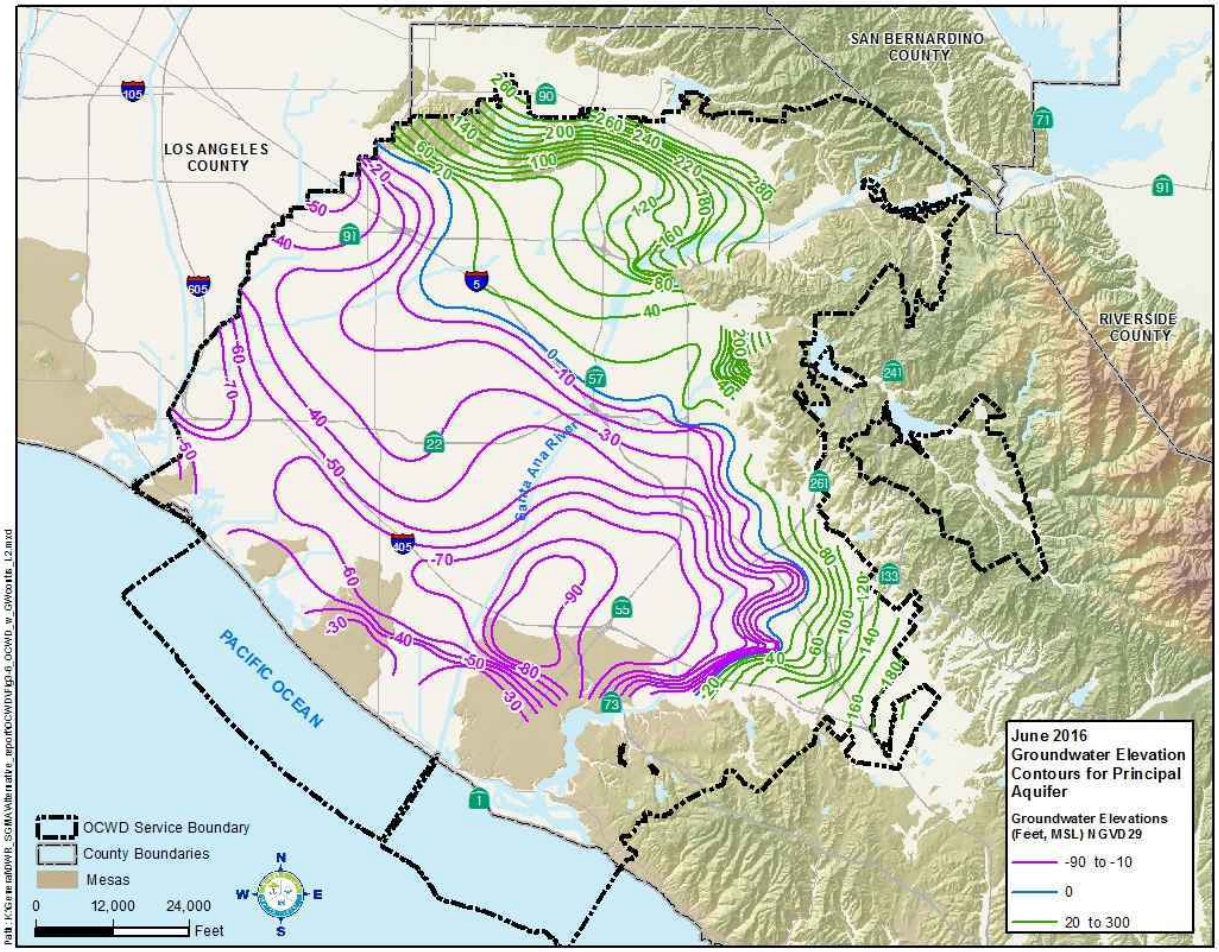


Figure 1-2: Groundwater Elevation Contours for the Principal Aquifer, June 2016

GROUNDWATER STORAGE

The groundwater basin contains an estimated 66 million acre-feet when full. However, OCWD manages the basin within an established operating range of up to 500,000 acre-feet below full condition. This operating range was established to designate the levels of groundwater storage within which the basin that can be maintained without causing adverse impacts. In order to manage the basin within this operating range, OCWD calculates the amount of groundwater in storage on an annual basis. Long-term groundwater storage levels based on OCWD's water year (July 1 to June 30) are shown in Figure 1-3.

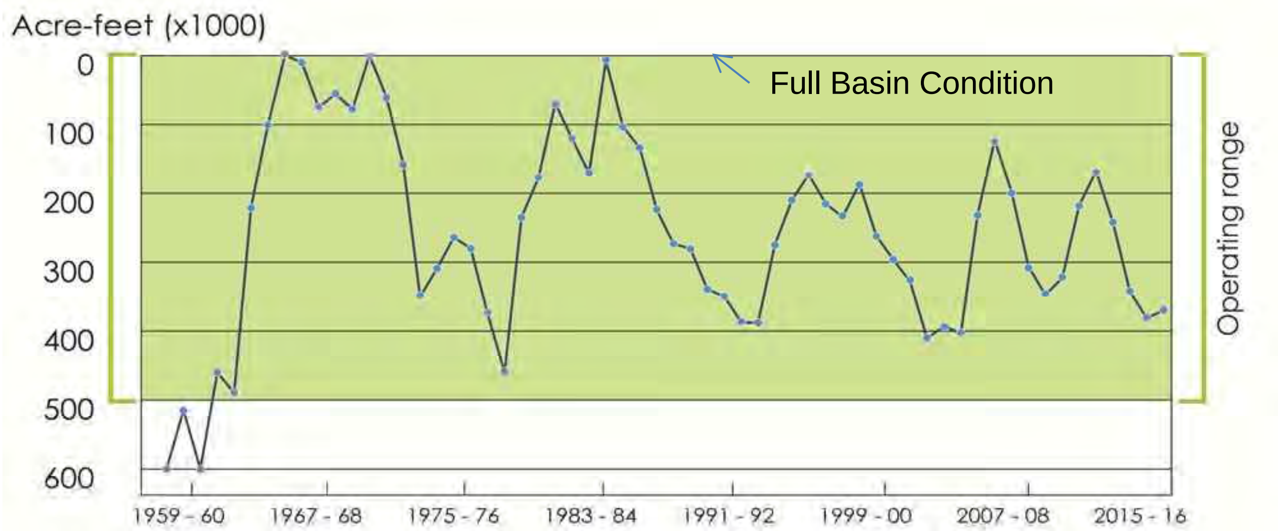


Figure 1-3: Available Basin Storage WY 1958-59 to WY 2015-16

WATER QUALITY

The California Regional Water Quality Control Board, Santa Ana Region (Regional Water Board) is responsible for protection and enhancement of the quality of waters in the watershed, which includes surface water and groundwater in the OCWD Management Area. The watershed's salinity management program, overseen by the Regional Water Board, is managed by the Basin Monitoring Program Task Force. Water quality objectives for total dissolved solids (TDS) and nitrate-nitrogen in groundwater management zones were adopted by the Regional Water Board based on historical water quality data. Every three years the Task Force calculates the current ambient water quality for each groundwater management zone. The most recent recalculation for the groundwater basin was completed in 2014.

There are several regional groundwater contamination plumes within the OCWD Management Area, all of which are under active remediation. The U.S. EPA is the lead agency in remediation of the plume in the North Basin area. Remediation for individual sites within the South Basin area is within the jurisdiction of either the California Department of Toxic Substances Control or the Regional Water Board. The U.S. Navy is taking the lead in remediation of plumes from the former El Toro and Tustin Marine Corps Air Stations and the Naval Weapons Station Seal Beach.

LAND SUBSIDENCE

Land subsidence due to changes in groundwater conditions in the OCWD Management Area is variable and does not show a pattern of widespread, permanent lowering of the ground surface. There is no evidence of permanent, inelastic land subsidence within the OCWD Management Area.

1.2 WATER BUDGET

OCWD developed a hydrologic budget for the purpose of constructing a basin-wide numerical groundwater flow model and for evaluating basin production capacity and recharge requirements. The key components of the budget include measured and unmeasured (estimated) recharge, groundwater production and subsurface outflows.

The groundwater basin is not operated on an annual safe-yield basis. The net change in storage in any given year may be positive or negative; however, over a period of several years, the basin is maintained in an approximate balance. Amounts of total basin production and total water recharged from water year 1999-2000 to 2015-16 are shown in Figure 1-4.

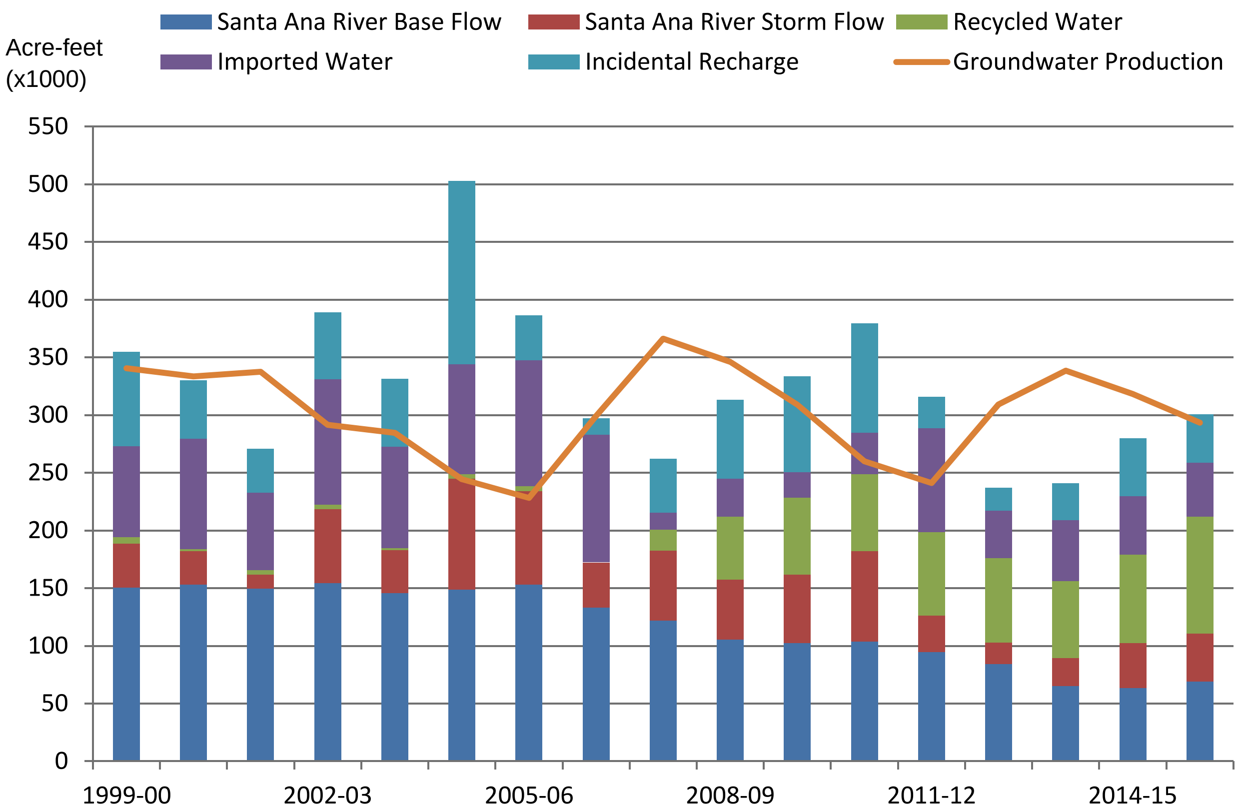


Figure 1-4: Basin Production and Recharge Sources, WY 1999-2000 to WY 2015-16

1.3 WATER RESOURCE MONITORING PROGRAMS

Water resource monitoring programs for groundwater, surface water, recycled water, and imported water are summarized in Table 1-1.

Table 1-1: OCWD Monitoring Programs

MONITORING PROGRAM	PURPOSE
Groundwater Production	Manage basin storage; collect revenues based on production
Groundwater Elevation	Manage basin storage; prepare groundwater level contour maps; manage seawater intrusion barrier injection rates
CA Statewide Groundwater Elevation Monitoring (CASGEM) Program	Compliance with state CASGEM program
Title 22 Water Quality Program	Compliance with CA SWRCB Division of Drinking Water, Title 22 Monitoring for more than 100 regulated and unregulated chemicals at approximately 200 large- and small-system drinking water wells
Groundwater Contamination Plumes	Monitor location of contamination plumes and levels of contamination to protect drinking water wells and basin water quality
Seawater Intrusion	Monitor effectiveness of existing seawater intrusion barriers
Santa Ana River Monitoring Program	Annual review to affirm that OCWD recharge practices are protective of public health
Basin Monitoring Program Task Force	Annual report prepared to comply with Regional Water Board Basin Plan
Santa Ana River Watermaster Monitoring	Determine annual Santa Ana River baseflow and stormflow and TDS at two locations to comply with the 1969 judgment on Santa Ana River water rights
Prado Wetlands	Evaluate changes in water quality and effectiveness of wetlands treatment of surface water used for groundwater recharge
Emerging Constituents	Compliance with federal and state regulations
Recycled Water	Monitor quality of water produced by GWRS
Imported Water	Monitor water quality of supply used for groundwater recharge

1.4 GROUNDWATER MANAGEMENT PROGRAMS

LAND USE

The OCWD Management Area is highly urbanized. As such, OCWD monitors, reviews and comments on local land use plans, environmental documents, and proposed regulatory agency permits to provide input to land use planning agencies regarding proposed projects and programs that could cause short- or long-term water quality impacts to the groundwater basin.

DEMAND MANAGEMENT

Water demands within the OCWD Management Area for water year (WY) 2015-16 totaled approximately 364,000 acre-feet. It is noted that water demands in WY 2015-16 reflect mandatory demand reductions imposed by the State Water Board in response to an extended drought. Between WY1996-97 to present, water demands have ranged between 413,000 afy to 515,000 afy but have generally decreased, as shown in Figure 1-5. OCWD strives to sustainably maximize both production from the basin and recharge of the groundwater basin. Total water demands in the management area are met by a combination of groundwater and imported water.

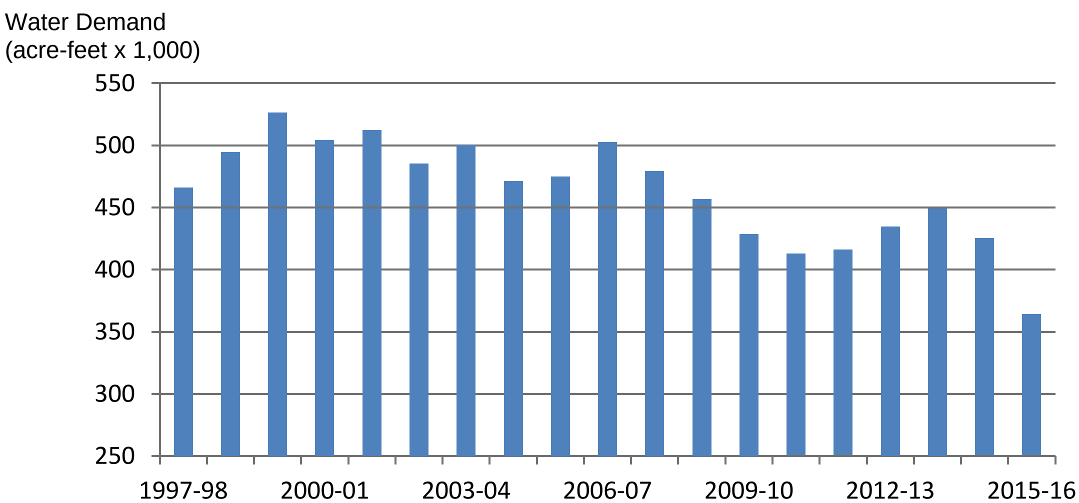


Figure 1-5: Total Water Demands within OCWD, WY 1997-98 to WY 2015-16

GROUNDWATER QUALITY PROTECTION AND MANAGEMENT

OCWD adopted a Groundwater Quality Protection Policy in 1987 and updated it in 2014. This policy guides the actions of OCWD to maintain groundwater quality suitable for all existing and potential beneficial uses; prevent degradation of groundwater quality and protect groundwater from contamination; maintain surface water and groundwater quality monitoring programs, a monitoring well network and data management system; and assist regulatory agencies in remediating contaminated sites.

Salinity Management Programs within the OCWD Management Area include:

- Operation of two seawater intrusion barriers along the coast;
- The Coastal Pumping Transfer Program, a voluntary program that shifts pumping from coastal to inland areas to lessen the potential for seawater intrusion;
- Production of recycled water at OCWD's Groundwater Replenishment System (GWRS) that is used for groundwater recharge and operation of the seawater intrusion barrier;
- Operation of groundwater desalters in Orange, Riverside and San Bernardino Counties to reduce salt buildup in groundwater basins as well as surface water that is used to recharge the Orange County groundwater basin;
- The salt and nutrient management program managed by the Regional Water Board; and
- Removal of nitrates through operation of the city of Tustin's Main Street and 17th Street treatment plants, IRWD's Irvine Desalter and Well 21/22 projects and OCWD's 465-acre Prado Constructed Wetlands.

RECYCLED WATER PRODUCTION

The GWRS produces up to 100 million gallons per day (mgd) of highly treated recycled water. Plans are underway to expand the plant to 130 mgd. GWRS product water is recharged into the groundwater basin and is the primary source of water for the Talbert Seawater Barrier. OCWD also operates the Green Acres Project, a non-potable recycled water supply for irrigation and industrial water users.

CONJUNCTIVE USE PROGRAMS

Recharge water sources include water from the Santa Ana River and tributaries, imported water, and recycled water supplied by the GWRS as well as incidental recharge from precipitation and subsurface inflow. OCWD's conjunctive use program includes over 1,500 acres of land on which there are 1,067 wetted acres of recharge facilities. This network of 25 facilities recharges an average of over 250,000 afy.

MANAGEMENT OF SEAWATER INTRUSION

The Alamitos and Talbert Seawater Intrusion Barriers control seawater intrusion through the Alamitos and Talbert Gaps by injecting fresh water into susceptible aquifers through a series of injection wells to create a hydraulic barrier.

1.5 NOTICE AND COMMUNICATION

The local agencies that produce the majority of the groundwater from the basin include 19 cities, water districts, and water companies. OCWD staff holds monthly meetings with this group to provide information and seek input on issues related to groundwater management. OCWD has a proactive community outreach program that includes conducting an annual Children's Water Education Festival attended by over 7,000 elementary school students and a monthly electronic newsletter with approximately 5,700 subscribers.

1.6 SUSTAINABLE BASIN MANAGEMENT

The sustainability goal for the OCWD Management Area is to:

> Continue to manage the groundwater basin to prevent basin conditions that would lead to significant and unreasonable (1) lowering of groundwater levels, (2) reduction in storage, (3) water quality degradation, (4) seawater intrusion, (5) land subsidence and (6) depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

Existing monitoring and management programs in place today enable OCWD to sustainably manage the groundwater basin. Since its founding in 1933, OCWD has developed a managed aquifer recharge program, constructed hundreds of monitoring wells, developed an extensive water quality monitoring program, installed seawater intrusion barriers, and doubled the volume of groundwater production while protecting the long-term sustainability of the groundwater resource. OCWD's management of the OCWD Management Area will continue to provide long-term sustainable basin management that is able to adapt to changing conditions affecting the groundwater basin.

1.6.1 Sustainable Management: Water Levels

OCWD manages the basin for long-term sustainability by maximizing groundwater recharge and managing basin production within sustainable levels. Long-term data trends demonstrate that groundwater elevations in the basin have not been in the condition of chronic lowering. The undesirable result of "chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply" is not present and is not anticipated to occur in the future in the OCWD Management Area due to OCWD's management programs. Hydrographs representative of long-term water levels in the basin are shown in Figure 1-6. These hydrographs demonstrate that groundwater levels in the OCWD Management Area are being managed at long-term sustainable levels.

1.6.2 Sustainable Management: Basin Storage

OCWD manages the basin within an established operating range of groundwater in storage of up to 500,000 acre-feet below full condition. Maintaining basin storage within this range protects the basin from detrimental impacts such as land subsidence, chronic lowering of groundwater levels and chronic reduction in storage. OCWD manages groundwater pumping such that it is sustainable over the long-term; however, in any given year pumping may exceed recharge or vice versa. Thus, the amount of groundwater stored in or withdrawn from the basin varies from year to year and often goes through multi-year cycles of emptying and filling, which typically correlates with state-wide and/or local precipitation patterns and other factors.

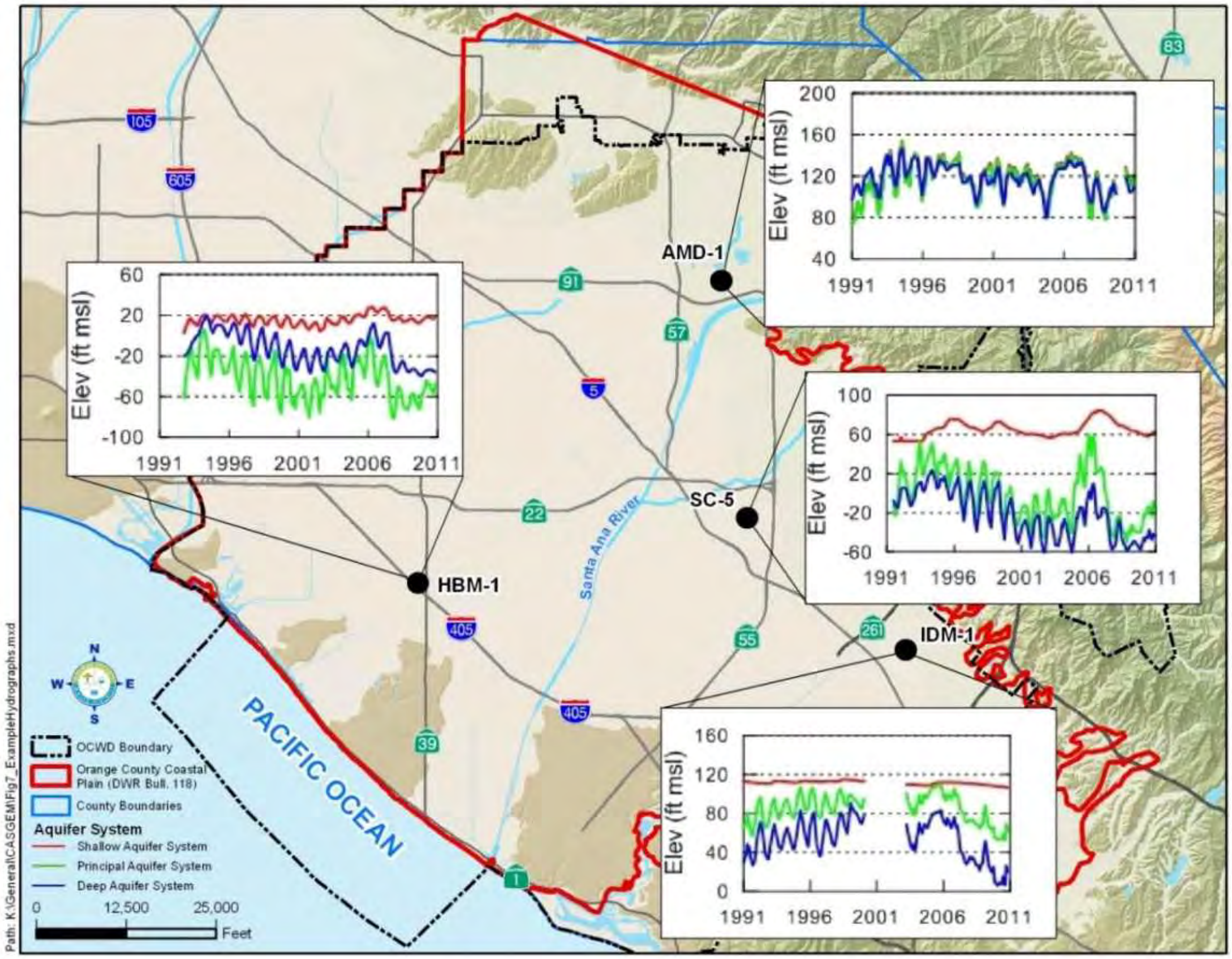


Figure 1-6: Example Hydrographs

Each year OCWD calculates the volume of groundwater storage change from a theoretical "full" benchmark condition based on a calculation using changes in groundwater elevations in each of the three major aquifer systems and aquifer storage coefficients. This calculation is checked against an annual water budget that accounts for all production, measured recharge and estimated unmeasured recharge. The amount of available or unfilled storage from the theoretical full condition is graphed on Figure 1-3. Maintaining the basin storage condition on a long-term basis within the established operating range allows for long-term sustainable management of the basin without experiencing undesirable effects. Therefore, the undesirable result of "significant and unreasonable reduction of groundwater storage" is not present and is not anticipated to occur in the OCWD Management Area in the future due to OCWD's management programs.

1.6.3 Sustainable Management: Water Quality

OCWD has extensive monitoring and management programs in place to monitor and protect the water quality of the groundwater basin. OCWD's network of approximately 400 monitoring wells is generally distributed throughout the basin. Water quality in these wells is tested on a regular basis for a large number of parameters. OCWD also conducts groundwater quality sampling of approximately 200 production wells on behalf of groundwater producers to comply with Title 22 requirements. An additional approximately 200 private, domestic, and irrigation production wells area also sampled periodically.

OCWD has a sampling protocol in place that includes standards for increased monitoring of individual wells. In cases where there is a detection of an organic compound for the first time, for example, OCWD will resample that well and if the detection is confirmed will increase the sampling frequency of that well. Another example is an increased frequency for monitoring when there is a detection of nitrate at 50% of the MCL. These sampling protocols are designed to detect water quality problems at the earliest possible stage. The undesirable result of "significant and unreasonable degradation of water quality including migration of contaminant plumes that impair water supplies" is not present and is not anticipated to occur in the future in the OCWD Management Area due to OCWD's management programs.

1.6.4 Sustainable Management: Seawater Intrusion

OCWD's management of seawater intrusion is implemented through a comprehensive program that includes operating seawater intrusion barriers, monitoring and evaluating barrier performance, monitoring and evaluating susceptible coastal areas, and coastal groundwater management. These programs enable OCWD to sustainably manage groundwater conditions in the basin by preventing significant and unreasonable seawater intrusion.

The Alamitos Seawater Intrusion Barrier manages seawater intrusion in the Alamitos Gap. The Talbert Seawater Intrusion Barrier manages seawater intrusion in the Talbert Gap. The Alamitos Barrier groundwater model is being used to evaluate seawater intrusion in the area of the Sunset Gap.

Monitoring and evaluating barrier performance and potential seawater intrusion consists of sampling monitoring wells semi-annually, measuring water levels at least quarterly, installing monitoring wells when needed to fill data gaps, and conducting other management activities to reduce potential for seawater intrusion, such as construction of additional injection wells and the Coastal Pumping Transfer Program.

The undesirable result of "significant and unreasonable seawater intrusion" is not present and is not anticipated to occur in the future in the OCWD Management Area due to OCWD's management programs.

1.6.5 Sustainable Management: Land Subsidence

Management of the groundwater basin by maintaining storage levels within the established operating range has prevented the undesirable result in the OCWD Management Area of significant and unreasonable land subsidence that substantially interferes with surface uses. Within the OCWD Management Area there is no evidence of long-term inelastic land subsidence, nor any land subsidence that has interfered with surface uses. Therefore, the undesirable result of "significant and unreasonable land subsidence that substantially interferes with surface uses" is not present and is not anticipated to occur in the OCWD Management Area in the future due to OCWD's management programs.

1.6.6 Sustainable Management: Depletion of Interconnected Surface Waters

There are no surface water bodies within the OCWD Management Area that are interconnected with groundwater in which the groundwater connection to the surface water provides surface water flow to sustain beneficial uses in a surface water body. Therefore, the undesirable result of "depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water due to groundwater conditions occurring throughout the basin" is not present and in the future is not anticipated to occur in the OCWD Management Area due to OCWD's management programs.

1.7 PROTOCOLS FOR MODIFYING MONITORING PROGRAMS

Protocols that trigger a change in a monitoring program include a change in regulations, a first time detection of a constituent in a water sample, an increase in a constituent in a water sample that approaches or exceeds a regulatory limit or Maximum Contaminant Level, an indication of an adverse water quality trend or water level, a special study, or a recommendation from OCWD's Independent Expert Panel.

1.8 EVALUATION OF POTENTIAL PROJECTS

OCWD regularly evaluates potential projects and conducts studies to improve existing operations. This may include:

- Increasing the capacity of existing recharge basins;
- Constructing new recharge facilities;
- Constructing new production wells
- Improving seawater intrusion barriers; and
- Constructing water quality improvement projects.

1.9 CONCLUSION

OCWD has been managing the OCWD Management Area since formation of OCWD by the State Legislature in 1933. Monitoring and management programs described in this Alternative, submitted in compliance with CA Code of Regulations (Title 23, Division 2, Chapter 1.5, Subchapter 2) demonstrate that the groundwater basin has been and will continue to be sustainably managed. This report demonstrates that the OCWD Management Area has operated within its sustainable yield over a period of at least 10 years, as required by CCR Title 23, Division 2, Chapter 1.5, Subchapter 2, Article 9, Section 358.2 (c)(3).

SECTION 2 AGENCY INFORMATION

2.1 HISTORY OF OCWD

The Orange County Water District (OCWD) is a special district formed in 1933 by an act of the California Legislature, the OCWD Act. Additionally, as a special act district listed in Water Code § 10723 (c)(1), OCWD is the exclusive local agency within its jurisdictional boundaries with powers to comply with SGMA via a groundwater sustainability plan ("GSP") or via an Alternative prepared in accordance with Water Code § 10733.6.

OCWD manages the groundwater basin that underlies north and central Orange County. Water produced from the basin is the primary water supply for approximately 2.4 million residents living within OCWD's boundaries. With passage of the Sustainable Groundwater Management Act (SGMA) (Water Code §10723(c)) in 2014, OCWD was designated the exclusive local agency within its jurisdictional boundaries with powers to comply with SGMA.

Nineteen major groundwater producers, including cities, water districts, and a private water company, pump groundwater from about 200 large-capacity wells for retail water use. There are also approximately 200 small-capacity wells that pump water from the basin. OCWD protects and manages the groundwater resource for long-term sustainability, while meeting approximately 70 to 75 percent of the water demand within its service area.

Since its founding, OCWD has grown in area from 162,676 to 243,968 acres and has experienced an increase in population from approximately 120,000 to 2.4 million people. OCWD has employed groundwater management techniques to increase the annual yield from the basin including operating over 1,500 acres of recharge basins in the cities of Anaheim, Orange, and unincorporated areas of Orange County. Annual water production increased from approximately 150,000 acre-feet per year (afy) in the mid-1950s to a high of over 366,000 afy in water year 2007-08.

OCWD has managed the basin to provide a reliable supply of relatively low-cost water, accommodating rapid population growth while at the same time avoiding the costly and time-consuming adjudication of water rights experienced in many other major groundwater basins in Southern California. Facing the challenge of increasing demand for water has fostered a history of innovation and creativity that has enabled OCWD to increase available groundwater supply while ensuring the long-term sustainability of the groundwater basin.

A brief history of OCWD is provided in the following timeline:

June 14, 1933: California Legislature creates the Orange County Water District by special act to protect surface water rights and manage the groundwater basin. The new district joins the Irvine Company's lawsuit.

1930s: Groundwater pumping in Orange County exceeds the rate of recharge resulting in groundwater levels dropping. OCWD begins actively recharging the groundwater basin by infiltrating Santa Ana River flows and looking for additional water supplies.

1936: OCWD begins purchasing portions of the Santa Ana River channel with the first purchase of 26 acres.

1941: U.S. Army Corps of Engineers completes construction of Prado Dam.

1949: OCWD begins purchasing imported water from the Colorado River Aqueduct for groundwater recharge.

1951: OCWD initiates legal action against cities upstream of Orange County to protect rights to Santa Ana River flow. Settlement of the suit in 1957 limits use of river water to the amount used in 1946.

1954: The District Act is amended giving OCWD authority to collect groundwater production records and a Replenishment Assessment (RA) from groundwater pumpers to purchase imported water for groundwater recharge. The amendments also enlarged OCWD boundaries, and required the publication of an annual engineer's report on groundwater production and basin conditions.

1956: Groundwater levels drop as much as 40 feet below sea level and seawater intrudes 3½ miles inland. Plans begin to construct seawater intrusion barriers in two areas – Alamitos Gap at the mouth of the San Gabriel River at the Orange County/Los Angeles County border and the Talbert Gap at the mouth of the Santa Ana River in Fountain Valley.

1957: OCWD purchases land and constructs Anaheim Lake, OCWD's first off-river recharge basin.

1963: OCWD files a lawsuit against all upper watershed entities above Prado Dam to ensure a minimum amount of Santa Ana River water for Orange County.

1965: OCWD partners with the Los Angeles County Flood Control District to begin injecting fresh water into the Alamitos Gap to prevent saltwater intrusion.

1968: OCWD purchases land and water rights owned by Anaheim Union Water Company and the Santa Ana Valley Irrigation Company, which includes land upstream of Prado Dam that was acquired to protect Orange County's interest in Santa Ana River water.

1969: The lawsuit against upper watershed entities is settled. (Orange County Water District v. City of Chino, et al., Case no. 117628 – County of Orange). Large water districts agree to deliver at least 42,000 acre-feet of Santa Ana River baseflow to Orange County, and OCWD gains the rights to all stormflows reaching Prado Dam. Parties to the judgment include Western Municipal Water District, San Bernardino Valley Municipal Water District and the Inland Empire Utilities Agency.

1969: The Basin Production Percentage and the Basin Equity Assessment are established.

1973: First water quality laboratory is constructed to analyze samples from the Santa Ana River and to begin analysis of demonstration injection wells for the planned construction of Water Factory 21.

1975: Talbert Seawater Intrusion Barrier begins operation. Control of seawater intrusion in the Talbert Gap requires six times the amount of water needed for the Alamitos Gap. Water Factory 21 is built to supply recycled water to the Talbert Seawater Intrusion Barrier. Secondary-treated wastewater from the Orange County Sanitation District receives advanced treatment and is blended with potable water to produce a safe, reliable supply for barrier operations – the first project of its kind permitted in the United States.

1991: Santiago Creek recharge project is completed, including purchase and development of Santiago Basins along Santiago Creek, a pump station at Burris Basin, and a pipeline to convey water back and forth from recharge basins along the Santa Ana River and Santiago Basins. Two rubber dams are installed on the Santa Ana River, allowing for more efficient diversion of river water to the downstream recharge facilities.

2008: The Groundwater Replenishment System (GWRS) begins operation, replacing Water Factory 21. The largest of its kind in the world, the GWRS is capable of producing up to 72 mgd of purified recycled water for use in Talbert Barrier operations and for groundwater recharge.

2009: New Advanced Water Quality Assurance Laboratory opens to handle over 400,000 analyses of nearly 20,000 water samples each year.

2015: GWRS Initial Expansion is completed, expanding plant capacity from 72 mgd to 100 mgd of product water.

2.2 GOVERNANCE AND MANAGEMENT STRUCTURE

The Orange County Water District was created by the OCWD Act for the purpose of:

> "providing for the importation of water into said district and preventing waste of water in or exportation of water from said district and providing for reclamation of drainage, storm, flood and other water for beneficial use in said district and for the conservation and control of storm and flood water flowing into said district; providing for the organization and management of said district and establishing the boundaries and divisions thereof and defining the powers of the district, including the right of the district to sue and be sued, and the powers and duties of the officers thereof; providing for the construction of works and acquisition of property by the district to carry out the purposes of this act; authorizing the incurring of indebtedness and the voting, issuing and selling of bonds and the levying and collecting of assessments by said district; and providing for the inclusion of additional lands therein and exclusion of lands therefrom."
> (Stats.1933, c. 924, p. 2400)

OCWD is divided into 10 divisions as specified in the District Act. One director is elected or appointed from each division. The cities of Anaheim, Fullerton, and Santa Ana appoint one member each to serve on the Board. The other seven Board members are elected by voters in the respective divisions. Boundaries of the 10 divisions are shown in Figure 2-1. Appointed members of the Board serve a four-year term and may be removed at any time by a majority vote of the appointing governing body. Elected members of the board serve four-year terms and may be re-elected without limits.

The full Board of Directors meets twice a month, normally on the first and third Wednesdays of the month. Board committees also meet on a monthly basis. These committees include the Water Issues, Communication/Legislation, Administration/Finance, Property Management and Retirement.

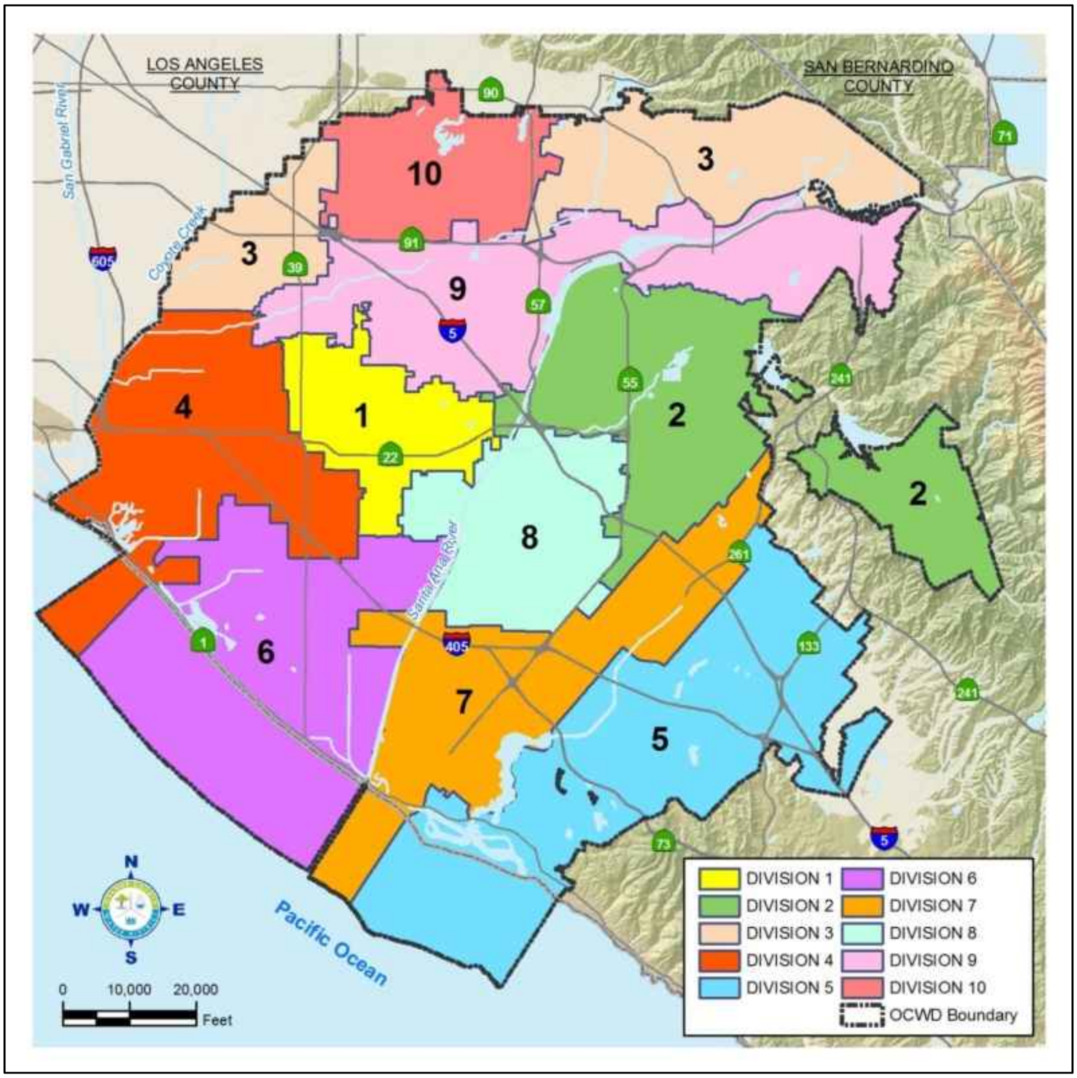


Figure 2-1: Orange County Water District Divisions

The ten divisions are comprised of the following areas:

Division One:	Garden Grove, Stanton, Westminster
Division Two:	Orange, Villa Park, and parts of Tustin
Division Three:	Buena Park, La Palma, Placentia, Yorba Linda, and parts of Cypress

Division Four:	Los Alamitos, Seal Beach, and parts of Buena Park, Cypress, Garden Grove, Huntington Beach, Stanton, and Westminster
Division Five:	Parts of Irvine and Newport Beach
Division Six:	Parts of Fountain Valley and Huntington Beach
Division Seven:	Costa Mesa and parts of Fountain Valley, Irvine, Newport Beach and Tustin
Division Eight:	Santa Ana
Division Nine:	Anaheim
Division Ten:	Fullerton

The nineteen major groundwater producers meet on a monthly basis with OCWD staff to consult with and provide advice on basin management issues. This group is described in more detail in Section 7.1

2.3 LEGAL AUTHORITY

Section 2 of the District Act grants powers to OCWD including, but not limited to:

- To construct, purchase, lease, or otherwise acquire, and to operate and maintain necessary waterworks, water rights, spreading grounds, lands, and rights necessary to replenish the groundwater basin and augment and protect the water quality of the common water supplies of the District;
- Provide for the conjunctive use of groundwater and surface water resources within the district area;
- Store and replenish water in underground basins or reservoirs within or outside the District;
- Regulate and control the storage of water and the use of groundwater basin storage space in the basin;
- Purchase and import water into the District;
- Transport, reclaim, purify, treat, inject, extract, or otherwise manage and control water for the beneficial use of persons or property within the District and to improve and protect the quality of the groundwater supplies;
- Determine the operational range in which groundwater levels may decline or recover during a given water year within the District's boundaries by determining the amount and percentage of water that may be produced by pumpers from the Groundwater Basin within the district in proportion to the total amount of water used within the District (from all sources) by all persons and operators, e.g., setting of a Basin Production Percentage, or "BPP";
- Require groundwater producers who produce more of their total water needs from the groundwater within the District than the basin production percentage ("BPP") determined

annually by the District Board of Directors permits to pay a surcharge, the "Basin Equity Assessment" or "BEA", that removes any financial incentive for over-production from the Basin beyond that set by the OCWD Board each year;

- Provide for the protection and enhancement of the environment within and outside the District in connection with the water activities of the District; and
- To commence, maintain, intervene in, defend, and compromise, and assume the costs and expenses of all actions to prevent interference with water or water rights used within the District or diminution of the quality or pollution or contamination of the water supply of the District.

A copy of the OCWD Act, which has been the basis for OCWD's sustainable management of its portion of the Basin over many years, can be found at:

http://www.ocwd.com/media/2681/ocwddistrictact_201501.pdf

2.4 BUDGET

The mission of OCWD is to provide a reliable, high quality water supply in a cost-effective and environmentally responsible manner and to manage the Orange County groundwater basin in a sustainable manner over the long-term. For the purposes of this report, the District's entire budget is the cost to sustainably manage the basin.

OCWD's fiscal year (FY) begins on July 1 and ends on June 30. The annual operating budget and expected revenues for 2016-17 totaled approximately $158.2 million.

2.4.1 Operating Expenses

OCWD's budgeted operating expenses for FY 2016-17 are summarized in Table 2-1 and described as follows.

Table 2-1: FY 2016-17 Budget Operating Expenses

EXPENSES	Total (in millions)
General Fund	$64.4
Total Debt Service	36.6
Water Purchases	34.7
Capital Projects	6.6
Retiree Health Trust	1.3
Refurbishment and Replacement Transfer	14.6
Total	$158.2

General Fund

The general fund account primarily allows OCWD to operate the recharge facilities in the cities of Anaheim and Orange, GWRS, the Talbert and Alamitos Seawater Intrusion Barriers, the Green Acres Project, and the Prado Wetlands. In addition, the Advanced Water Quality Assurance Laboratory, groundwater monitoring programs, watershed management, planning, and other basin management activities are funded by this account.

Debt Service

The debt service budget provides for repayment of OCWD's debt from issues of previous bonds. OCWD has a comprehensive long-range debt program, which provides for the funding of projects necessary to increase basin production and protect water quality, while providing predictable impacts to the RA. OCWD holds very high credit ratings of AAA from Standard & Poor's, AAA from Fitch, along with an Aa1 rating from Moody's. Because of these excellent credit ratings, OCWD is able to borrow money at a substantially reduced cost.

Water Purchases

The District Act authorizes OCWD to purchase imported water for groundwater recharge to sustain groundwater pumping levels and refill the basin. Imported water is purchased from MWD for basin replenishment. This fund provides the flexibility to purchase water when such supplies are available. The Board of Directors can allocate funds to the Water Reserve Fund so that funds may accumulate in reserve in preparation for water purchases in future years.

New Capital Equipment

This category includes equipment items such as laboratory equipment, vehicles, heavy equipment, tools, computers, and software. These items are expensed and funded using current revenues.

Refurbishment and Replacement Fund

OCWD has over $908 million invested in existing plant and fixed assets. These facilities were constructed to provide a safe and reliable water supply. The Replacement and Refurbishment Fund was established to ensure that sufficient funds are available to repair and replace existing infrastructure, such as pumps, heavy equipment, injection and monitoring wells and water recycling facilities.

2.4.2 Operating Revenues

Expected operating revenues for FY 2016-17 are shown in Table 2-2 and described below.

Table 2-2: FY 2016-17 Operating Revenues

REVENUES	Total (in millions)
Replenishment Assessments	$117.8
Basin Equity Assessments	1.8
Property Taxes	22.9
Investment Revenues	1.6
Gap Sales and LRP Revenues	9.6
Miscellaneous Revenue	4.5
Total	$158.2

Replenishment Assessments

The Replenishment Assessment (RA) is paid for water pumped out of the basin. OCWD invoices Groundwater Producers for their production in July and January. The amount of revenue generated by the RA is directly related to the amount of groundwater production.

Basin Equity Assessment

The Basin Equity Assessment (BEA), as previously referenced, is paid by Producers for groundwater production above the BPP and is one of the primary tools OCWD uses to ensure groundwater levels remain within the pre-established operational range set by the District. This charge is assessed annually in September. The BPP is a percentage of each Producer's water supply that comes from groundwater pumped from the basin (see Section 10.3).

Property Taxes

OCWD receives a small percentage of property taxes, also referred to as ad valorem taxes, collected in the service area. The County of Orange assesses and collects these taxes and transmits them to OCWD at various times during the year. This revenue source has been dedicated to the annual debt service expense.

Investment Revenue

Investment Revenue is generated from OCWD's cash reserves.

GAP Sales and LRP Revenues

OCWD operates the Green Acres Project (GAP), which provides recycled water to customers who purchase the water for landscape irrigation. OCWD receives a subsidy for operation of the Groundwater Replenishment System and the GAP from the Metropolitan Water District of Southern California (MWD) through the Local Resources Program (LRP).

Miscellaneous Revenues

Miscellaneous revenues include annexation fees, producer well loan repayments, and rents and leases.

2.4.3 Reserves

OCWD maintains cash reserves to ensure its financial integrity so that the basin can be successfully managed and protected. Cash reserves ensure that:

- OCWD has sufficient funds for cash flow purposes;
- Funds are available for unexpected events such as contamination issues;
- Funds are available to make necessary replacements and repairs to infrastructure;
- OCWD has access to debt programs with low interest cost;
- A financial hedge is available to manage variable rate debt; and
- Funds are available to purchase MWD water when available.

Reserve Policies

OCWD has reserve policies, which establish reserves in the following categories:

- Operating reserves
- The Replacement and Refurbishment Program
- The Toxic Cleanup Reserve
- Contingencies required by the District Act
- Bond reserve covenants

Operating Reserves

This reserve category helps maintain sufficient funds for cash flow purposes and helps sustain the District's excellent credit rating. Maintaining this reserve, which is set at 15 percent of the operating budget, is particularly important because the principal source of revenue, the RA, is only collected twice a year. Payments for significant activities, such as replenishment water purchases, are typically required on a monthly basis. The reserve provides the financial "bridge" to meet the District's financial obligations on a monthly basis.

Replacement and Refurbishment Program

OCWD maintains a Replacement and Refurbishment Fund to provide the financial resources for replacement and/or repair of the District capital assets. These assets include treatment facilities, monitoring and injection wells, and treatment facilities.

Toxic Cleanup Reserve

Funds are reserved in this account to be used in the event that a portion of the basin becomes threatened by contamination. Over two million residents rely on the basin as their primary source of water. This reserve fund allows OCWD to respond, immediately, to contamination threats in the basin.

General Contingencies

Section 17.1 of the District Act requires the allocation of funds to cover annual expenditures that have not been provided for or that have been insufficiently provided for and for unappropriated requirements.

Debt Service Account

Restricted funds in this account have been set aside by the bonding institutions as a requirement to ensure financial solvency and to help guarantee repayment of any debt issuances. These funds cannot be used for any other purpose. The requirement varies from year to year depending on the OCWD's debt issuance and outstanding state loans.

Capital Improvement Projects

OCWD prepares a Capital Improvements Project budget to support basin production by increasing recharge capacity and operational flexibility, protecting the coastal portion of the basin, and providing water quality improvement.

SECTION 3 MANAGEMENT AREA DESCRIPTION

3.1 OCWD MANAGEMENT AREA

OCWD's service area covers approximately 430 square miles and is co-extensive with the OCWD Management Area for purposes of this Basin 8-1 Alternative, except as identified below. The OCWD service area includes 76 percent of the area designated by the Department of Water Resources (DWR) as Basin 8-1, the "Coastal Plain of Orange County Groundwater Basin" in Bulletin 118 (DWR, 2003). For the purposes of this Basin 8-1 Alternative, the OCWD Management Area contains the same geographical area as the portion of the OCWD service area within Basin 8-1 except for a small 6.7-square mile area in the northeast corner of the basin that is part of the Santa Ana Canyon Management Area. The boundaries of Basin 8-1, the OCWD service area and the OCWD Management Area are shown in Figure 3-1.

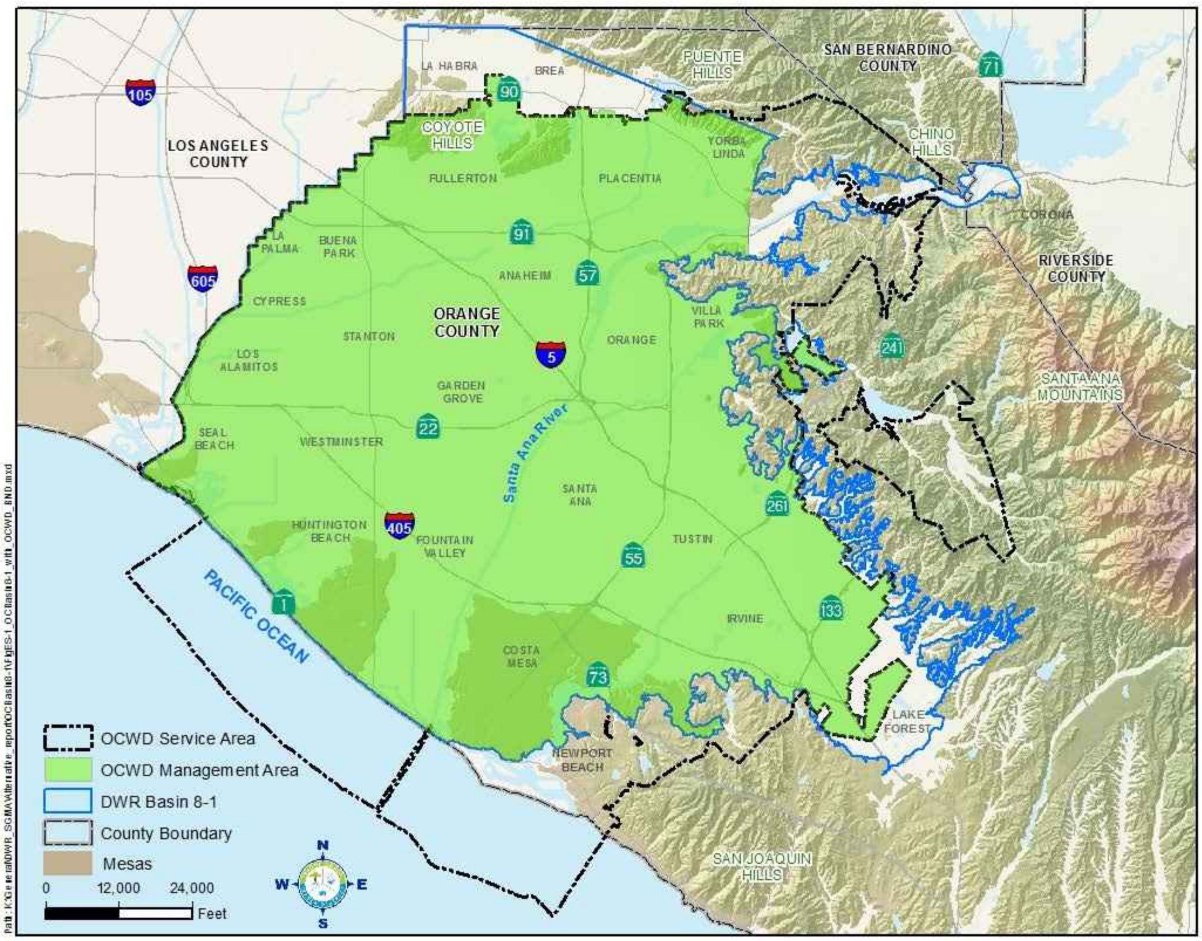


Figure 3-1: Basin 8-1, OCWD Service Area and OCWD Management Area

Jurisdictional Areas within OCWD Management Area

Federal and state lands within the OCWD Management Area as well as city boundaries are shown in Figure 3-2. Retail water providers within OCWD's service area are shown in Figure 3-3. The OCWD Management Area with a population of approximately 2.4 million is highly urbanized, as shown in Figure 3-4. Each of the 22 cities within OCWD's jurisdiction has an adopted general plan. There are no federally recognized tribes with land and there are no adjudicated areas within the OCWD Management Area. The unincorporated areas are managed by the County of Orange. Groundwater supplies are managed as a single, shared resource with no separate water use sectors.

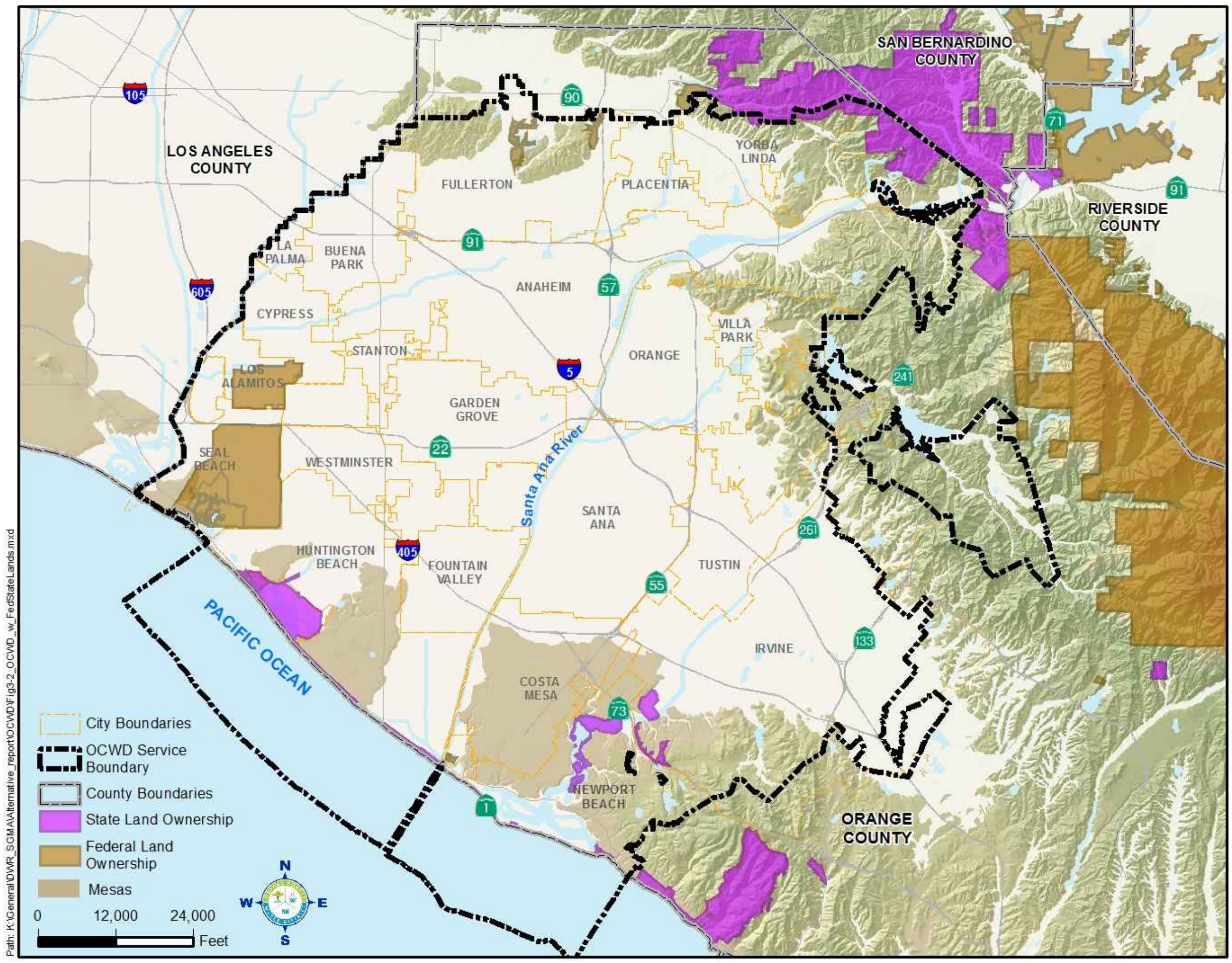


Figure 3-2: Federal and State Lands

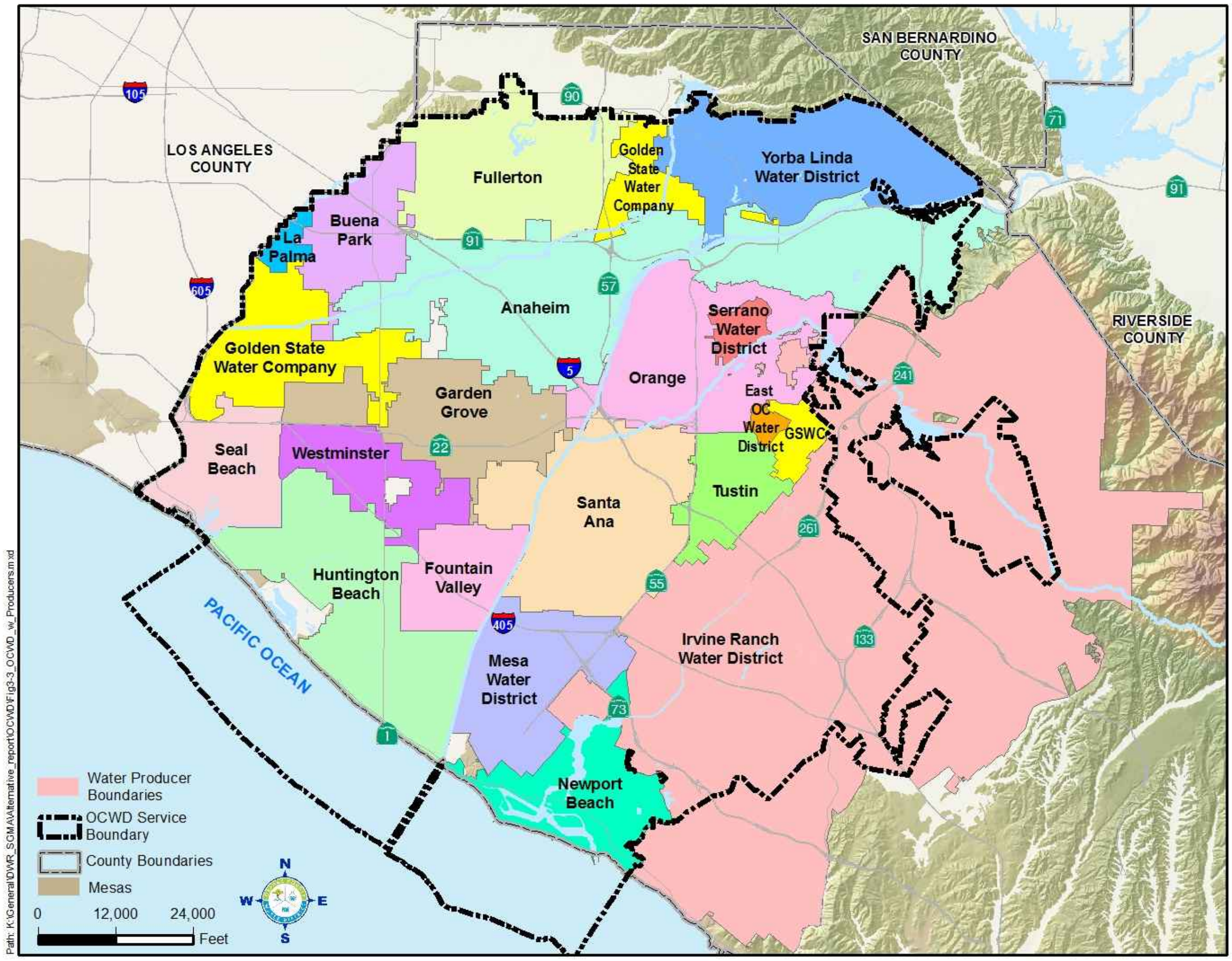


Figure 3-3: Retail Water Supply Agencies

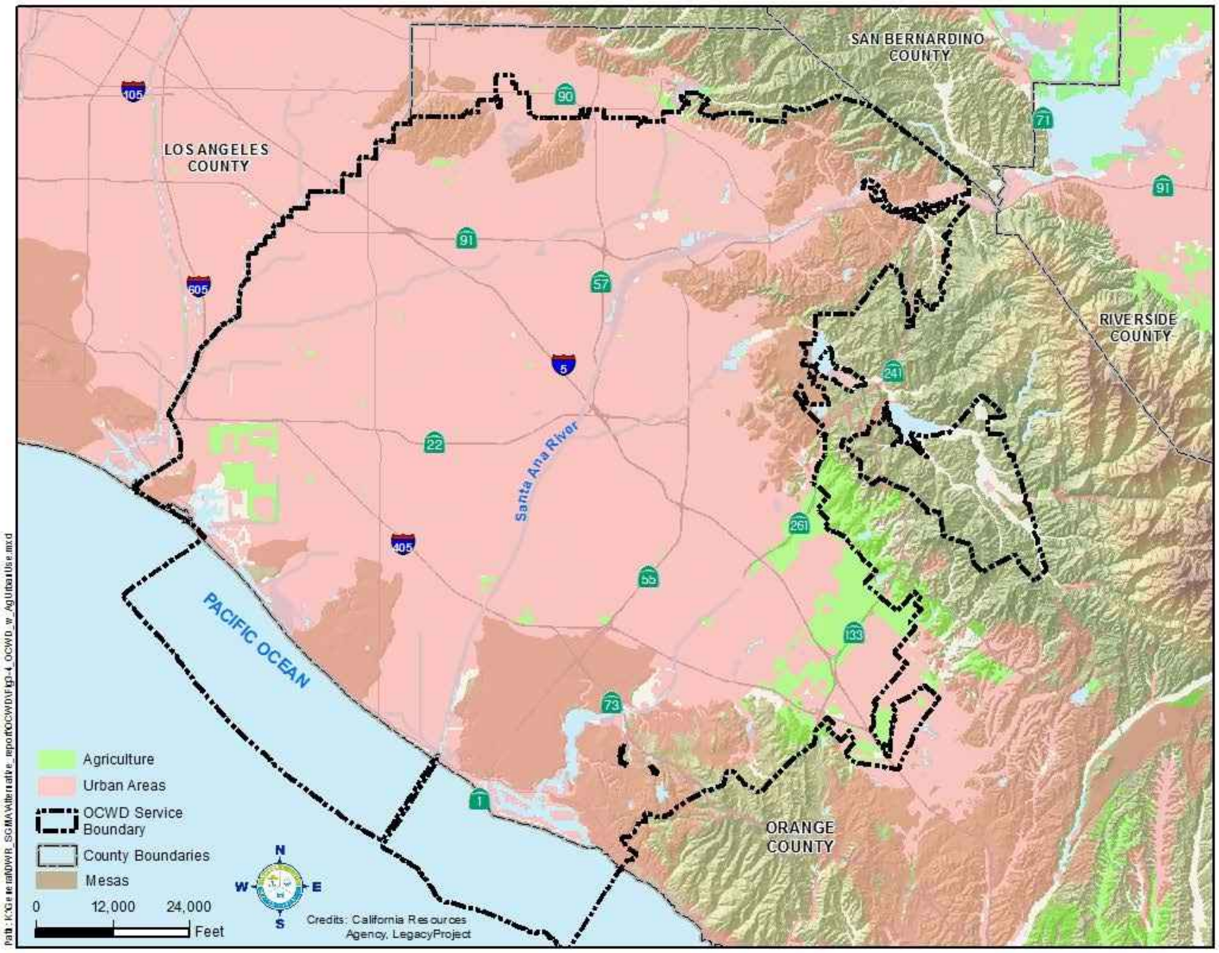


Figure 3-4: Land Uses

3.2 GROUNDWATER CONDITIONS

This section describes the groundwater conditions within the OCWD Management Area. The description includes current and historic groundwater elevation, pumping patterns, storage levels, groundwater quality, historical information concerning land subsidence, seawater intrusion, and interactions between surface water and groundwater. All elevations in this report are in units of feet above mean sea level referenced to vertical datum NGVD29, which can be converted to NAVD88. Geographic locations are reported in GPS State Plane coordinates referenced to NAD83.

3.2.1 Groundwater Elevation Contours

Figures 3-5, 3-6 and 3-7 show the contoured water levels for the Shallow, Principal and Deep Aquifers in June 2016. The contour maps for each of the three aquifer systems are prepared annually. The maps area used to prepare water level change maps for the three major aquifer systems and to calculate the amount of groundwater in storage and the annual storage change.

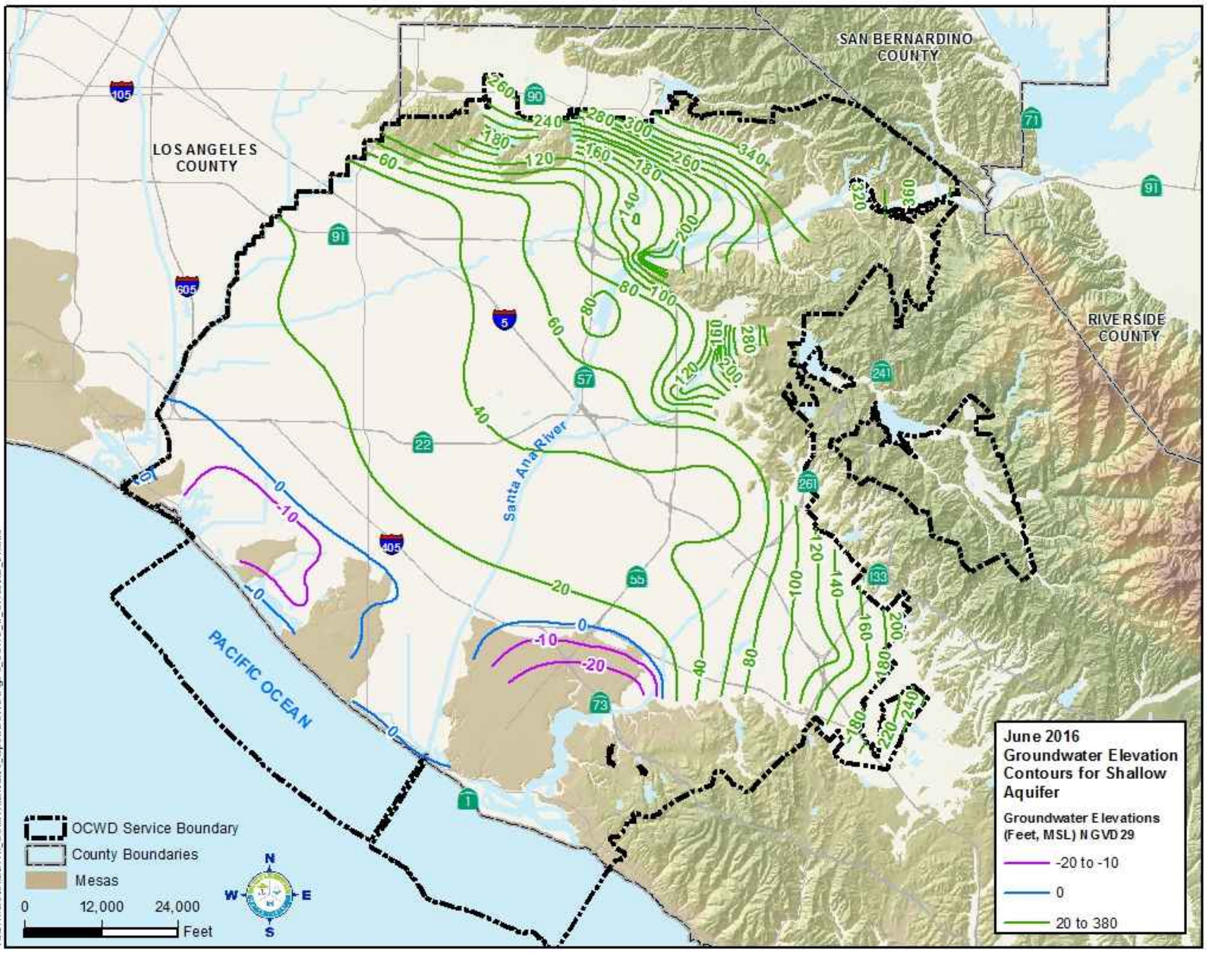


Figure 3-5: Groundwater Elevation Contours for the Shallow Aquifer June 2016

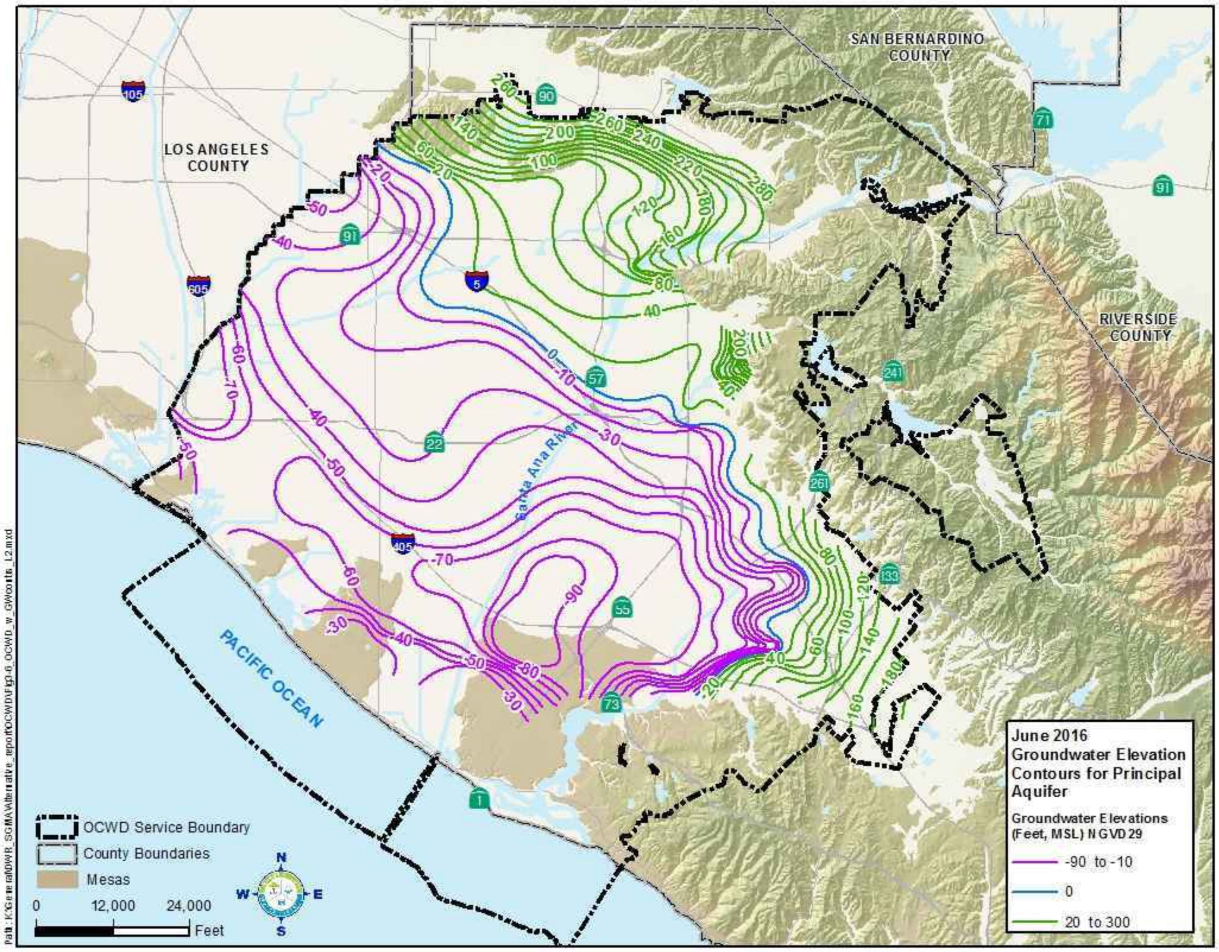


Figure 3-6: Groundwater Elevation Contours for the Principal Aquifer June 2016

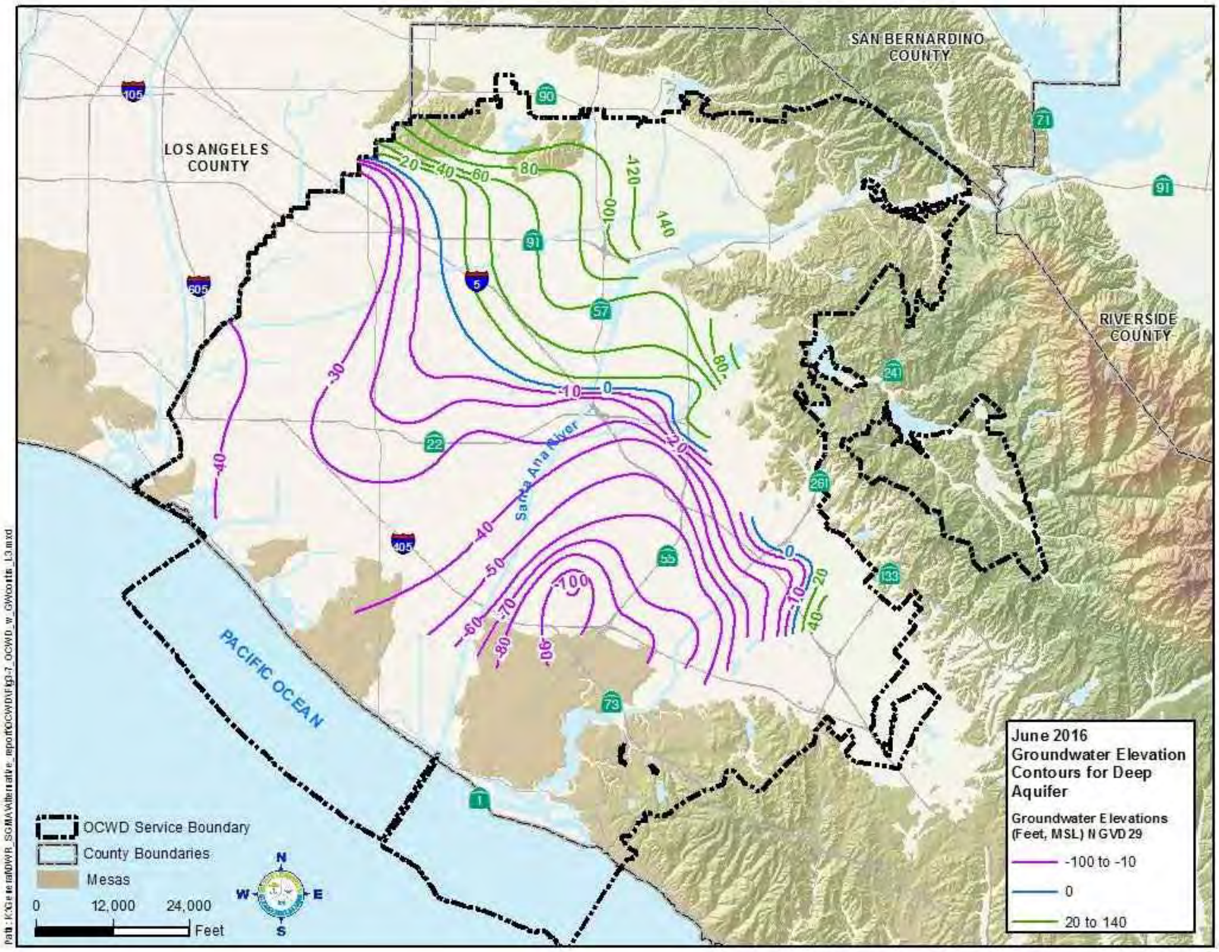


Figure 3-7: Groundwater Elevation Contours for the Deep Aquifer June 2016

3.2.2 Regional Pumping Patterns

Active wells pumping water from the basin are shown in Figure 3-8. The approximately 200 large-system wells account for an estimated 97 percent of the total basin production. The remaining three percent of total basin production includes agricultural and industrial producers, small mutual water companies, domestic well producers, and production from privately-owned wells. As can be seen in Figure 3-8, groundwater production is distributed throughout the productive areas of the basin.

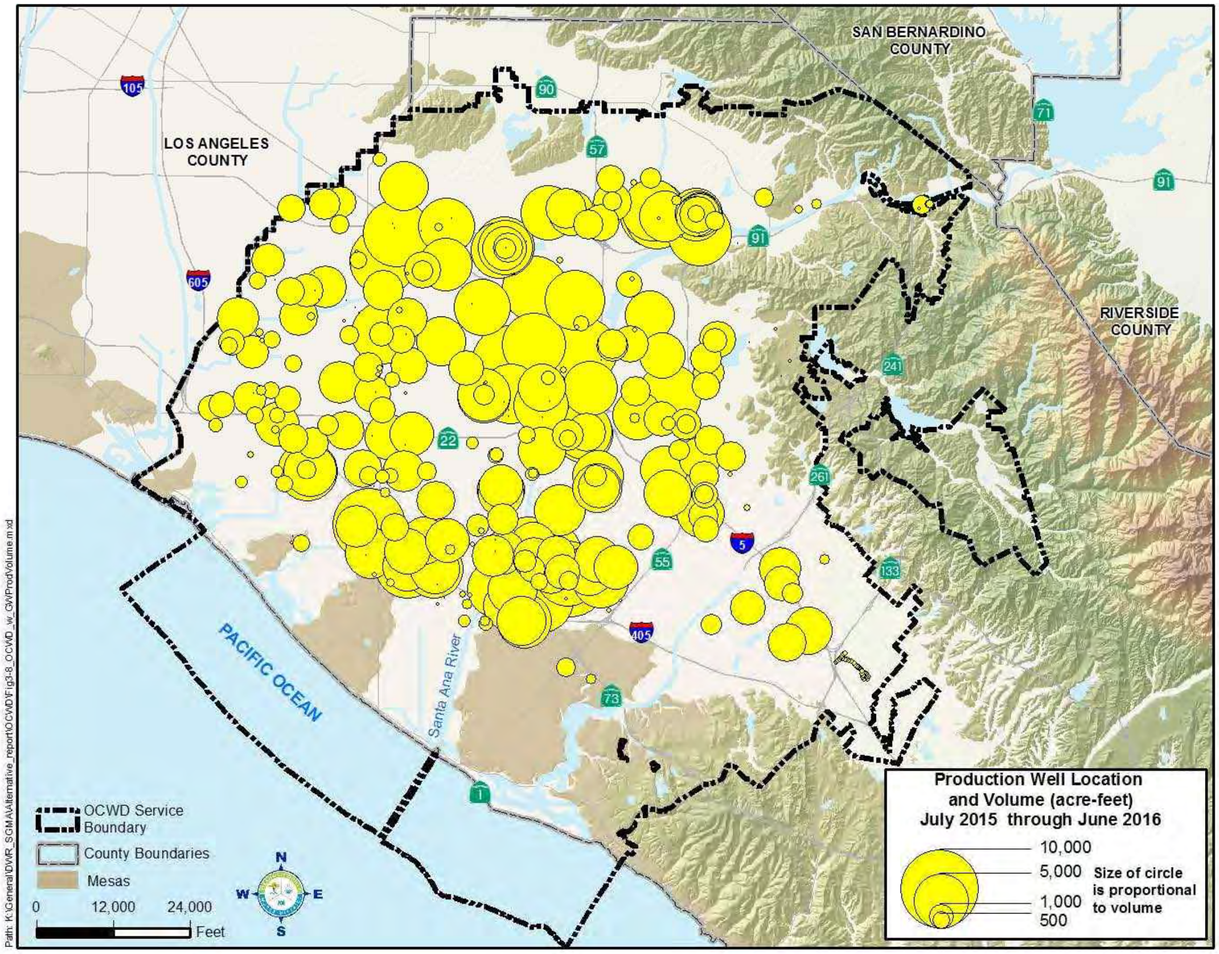


Figure 3-8: Groundwater Production, July 2015 to June 2016

3.2.3 Long-Term Groundwater Elevation Hydrograph

Historical groundwater elevation data within the Orange County groundwater basin dates to the turn of the 20th century and, until the 1980s, is largely derived from measurements of long-screened agricultural and municipal production wells. In the 1950s and 1960s, the United States Geological Survey and DWR conducted focused investigations of seawater intrusion along the coast. These investigations included construction of monitoring wells, some of which are still used today. In 1988, OCWD initiated construction of a basin-wide network of multi-depth monitoring wells which are used to monitor groundwater levels and quality, assess effects of pumping and recharge, estimate groundwater storage, characterize basin hydrogeology, and develop and calibrate a numerical flow model of the basin.

Groundwater elevation trends exhibit both short-term (seasonal) and long-term fluctuations. Seasonal elevation changes reflect short-term variations in pumping and recharge, while multi-year trends reflect the effects of extended periods of above- or below-average precipitation and/or availability of imported water.

OCWD measures elevations in three principal aquifer systems. In general, groundwater elevations in the Shallow Aquifer system show less amplitude than those in the underlying Principal and Deep Aquifer systems due to the higher degree of pumping and confinement of the Principal and Deep Aquifer systems. Because approximately 95 percent of all production occurs from wells screened within the Principal Aquifer system, groundwater elevations within this system are typically lower than those in the overlying Shallow Aquifer system and, in some areas, the underlying Deep Aquifer system. As a result, vertical gradients created by pumping and recharge drive groundwater into the Principal Aquifer system from the overlying Shallow aquifer system and, to a lesser extent, from the Deep Aquifer system.

The groundwater elevation profile for the Principal Aquifer following the Santa Ana River from the ocean to the Forebay in Anaheim, for 1969, 2013, and the theoretical full basin condition are shown in Figure 3-9. A comparison of these profiles shows that groundwater elevations in the Forebay recharge area for all three conditions are similar while in the central and coastal areas of the basin elevations in 2013 are significantly lower. The lowering of coastal area groundwater levels relative to groundwater levels further inland in the Forebay reflects the changes in basin pumping and storage between 1969 and 2013. It also translates into a steeper hydraulic gradient, which drives greater flow from the Forebay to the coastal areas.

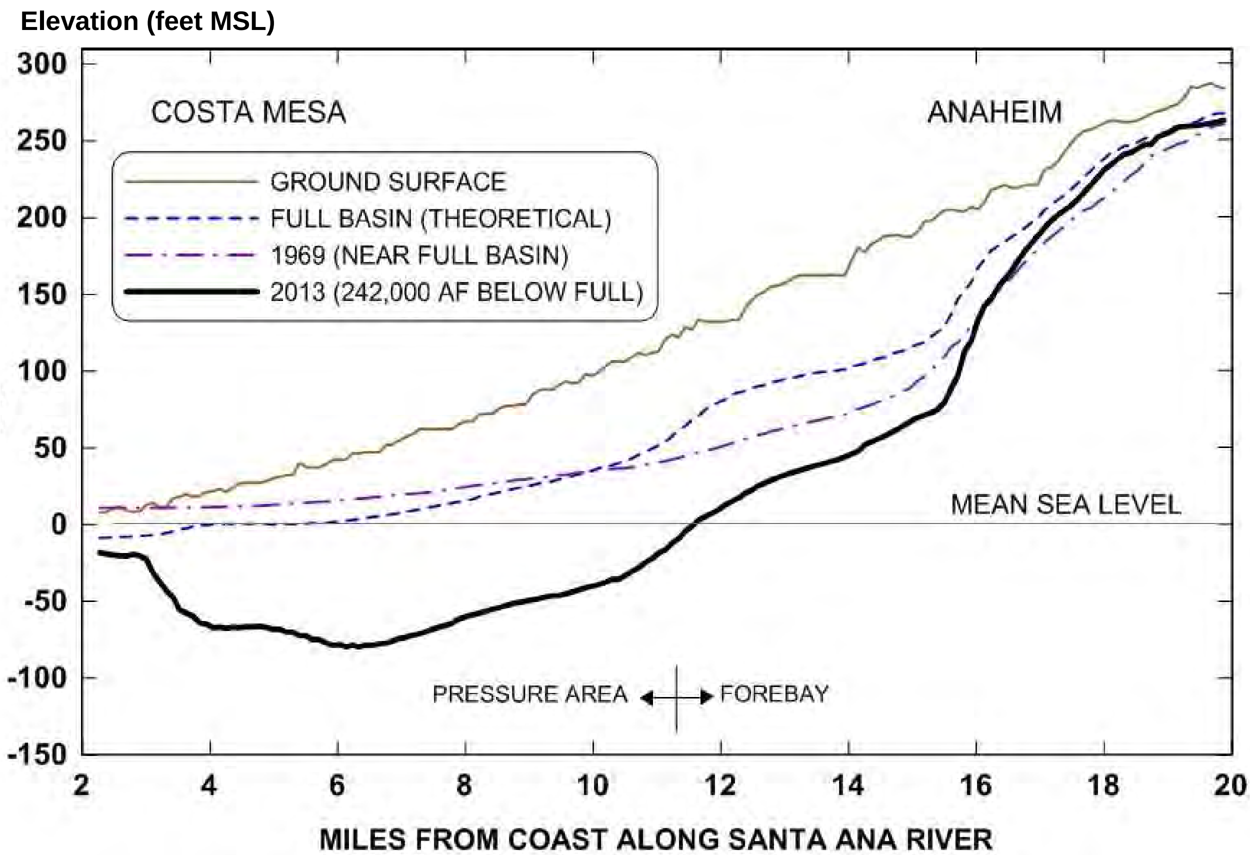


Figure 3-9: Principal Aquifer Groundwater Elevation Profiles, 1969 and 2013

Groundwater elevation trends can be examined using seven wells with long-term groundwater level data, the locations of which are shown in Figure 3-10. Figures 3-11 and 3-12 show water level hydrographs for wells SA-21 and GG-16 representing historical conditions in the Pressure area and well A-27 representing historical conditions in the Forebay. Water level data for well A-27 near Anaheim Lake dates back to 1932 and indicate that the historic low water level in this area occurred in 1951-52. The subsequent replenishment of Colorado River water essentially refilled the basin by 1965. Water levels in this well reached a historic high in 1994 and have generally remained high as recharge has been nearly continuous at Anaheim Lake since the late 1950s.

The hydrograph for well SA-21 indicates that water levels in this area have decreased since 1970. Also noteworthy is the large range of water level fluctuations from the early 1990s to early 2000s. The increased water level fluctuations during this period were due to a combination seasonal water demand-driven pumping and participation in the MWD Short-Term Seasonal Storage Program by local Producers (Boyle Engineering and OCWD, 1997), which encouraged increased pumping from the groundwater basin during summer months when MWD was experiencing high demand for imported water. Although this program did not increase the amount of pumping from the basin on an annual basis, it did result in greater water level declines during the summer during the period of 1989 to 2002 when the program was active.

Figure 3-13 presents water level hydrographs of two OCWD multi-depth monitoring wells, SAR-1 and OCWD-CTG1, showing the relationship between water level elevations in aquifer zones at different depths. The hydrograph of well SAR-1 in the Forebay exhibits a similarity in water levels between shallow and deep aquifers, which indicates the high degree of hydraulic interconnection between aquifers characteristic of much of the Forebay.

The hydrograph of well OCWD-CTG1 is typical of the Pressure Area in that there are large differences in water levels in different aquifers, indicating a reduced level of hydraulic interconnectivity between shallow and deep aquifers caused by fine-grained layers that restrict vertical groundwater flow. Water levels in the deepest aquifer zone at well OCWD-CTG1 are higher than overlying aquifers, in part, because few wells directly produce water from these zones. The lack of production from the deepest aquifers is due to the presences of amber-colored water, the cost to construct very deep wells, and the fact that sufficient high-quality groundwater is readily available within the overlying Principal aquifer.

Two additional hydrographs for wells HBM-1 and IDM-1 show multi-depth water levels representative of the coastal area and the southwestern portion of the management area. The downward trend in water levels at well IDM-1 shows the effects of a water quality improvement project known as the Irvine Desalter Project. This joint project between OCWD and IRWD, in collaboration with the U.S. Department of Navy, went on line in 2006 and consists of production wells, pipelines, and treatment facilities to remove, treat, and put to beneficial use groundwater that contains elevated TDS, nitrate, and/or trichloroethylene. To provide the intended hydraulic containment of this impacted groundwater, lowered groundwater levels in the Irvine area were necessary and expected based on model projections.

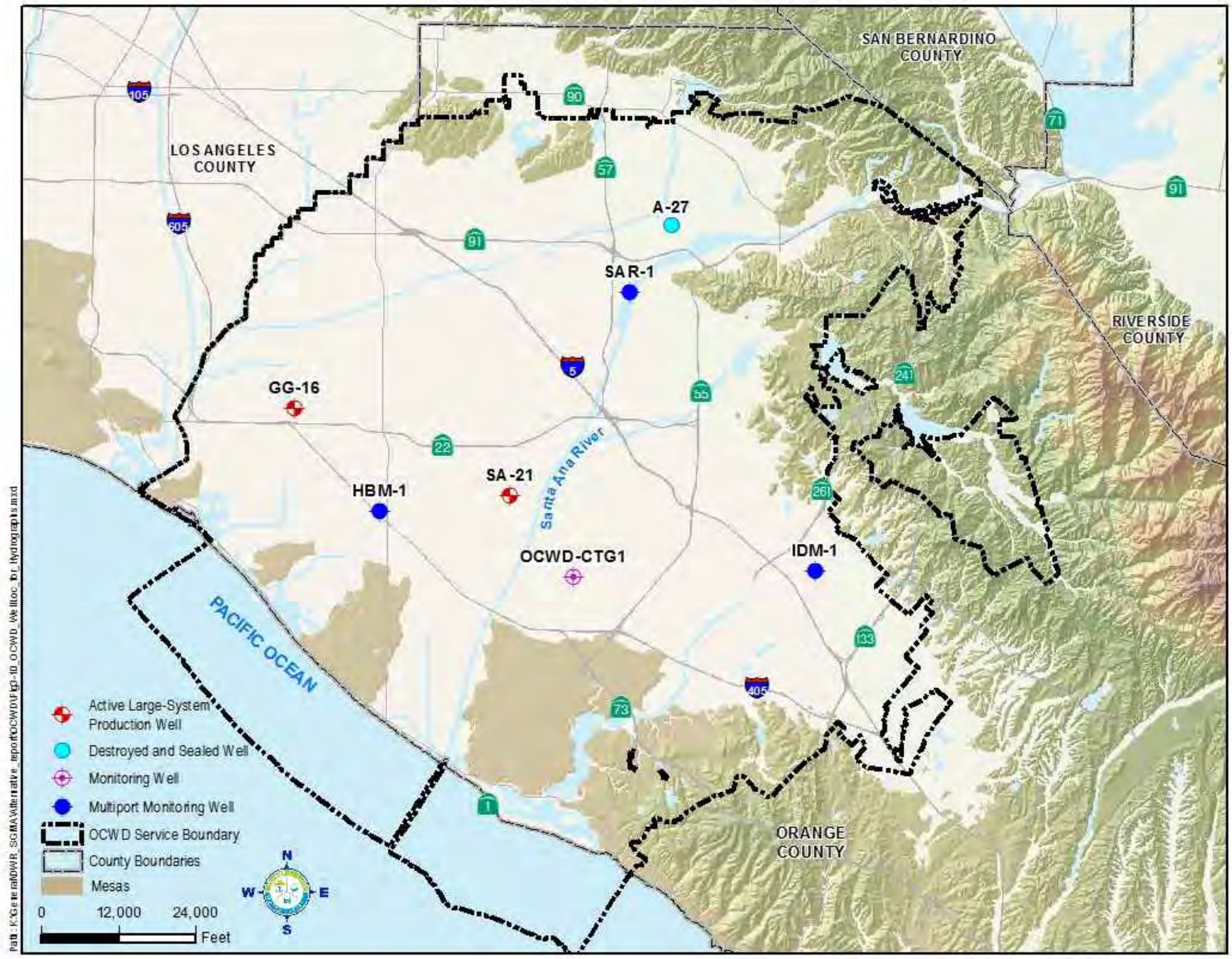
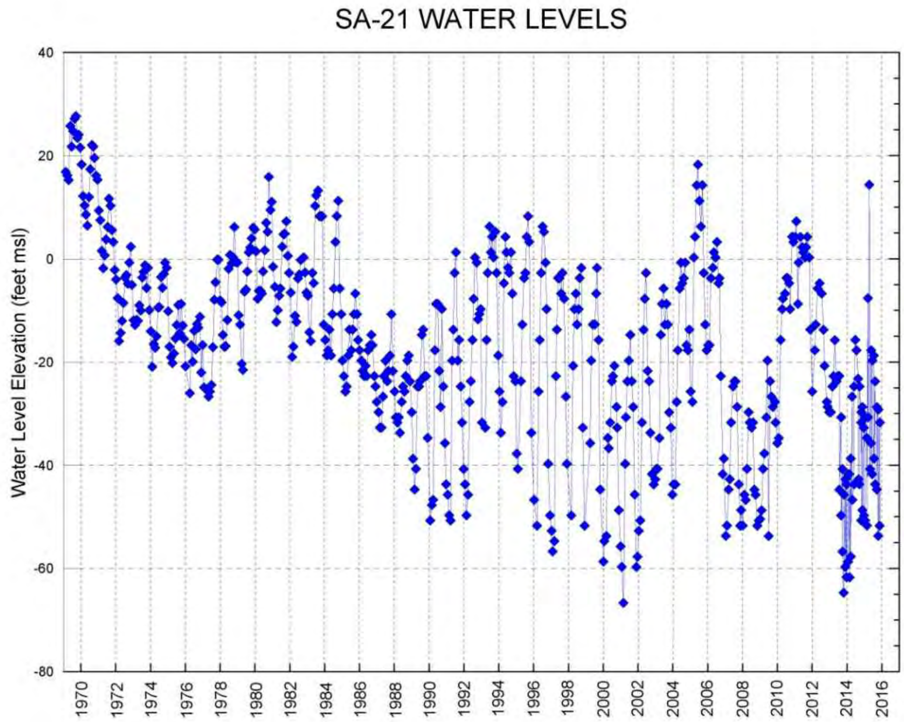


Figure 3-10: Location of Long-Term Groundwater Elevation Hydrographs



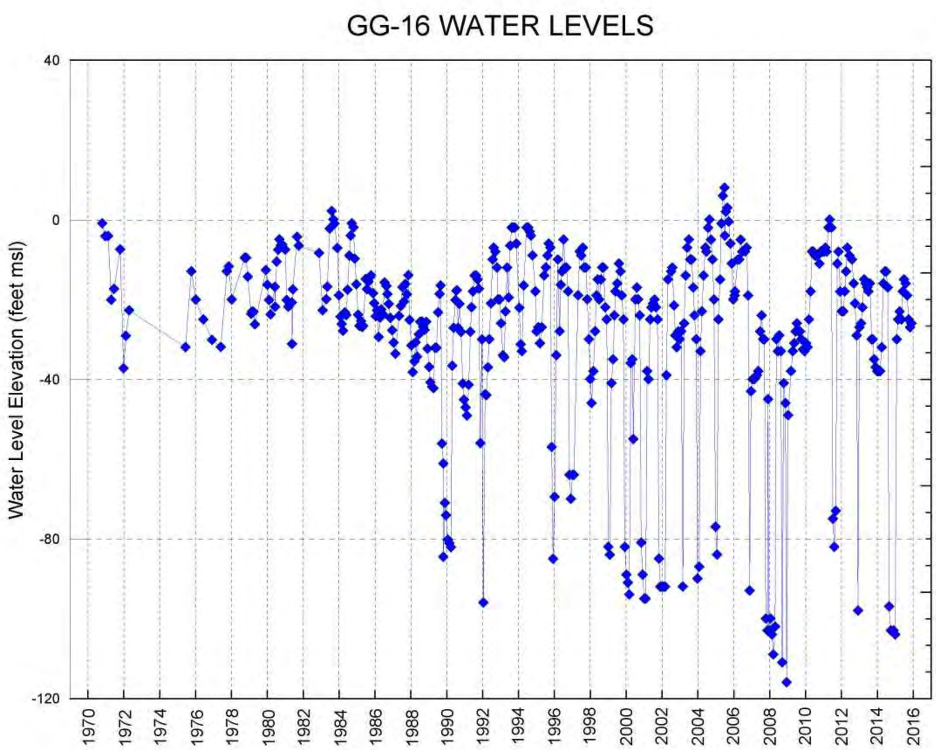


Figure 3-11: Water Level Hydrographs of Wells SA-21 and GG-16 in Pressure Area

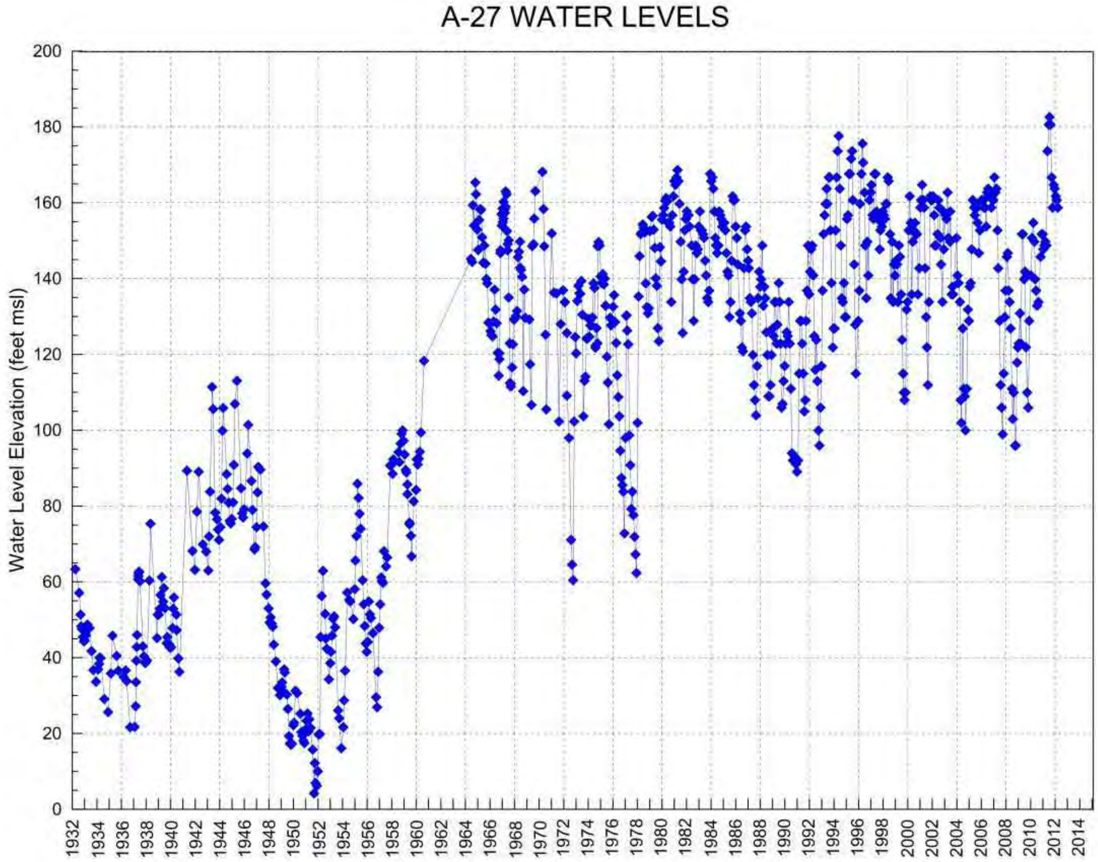
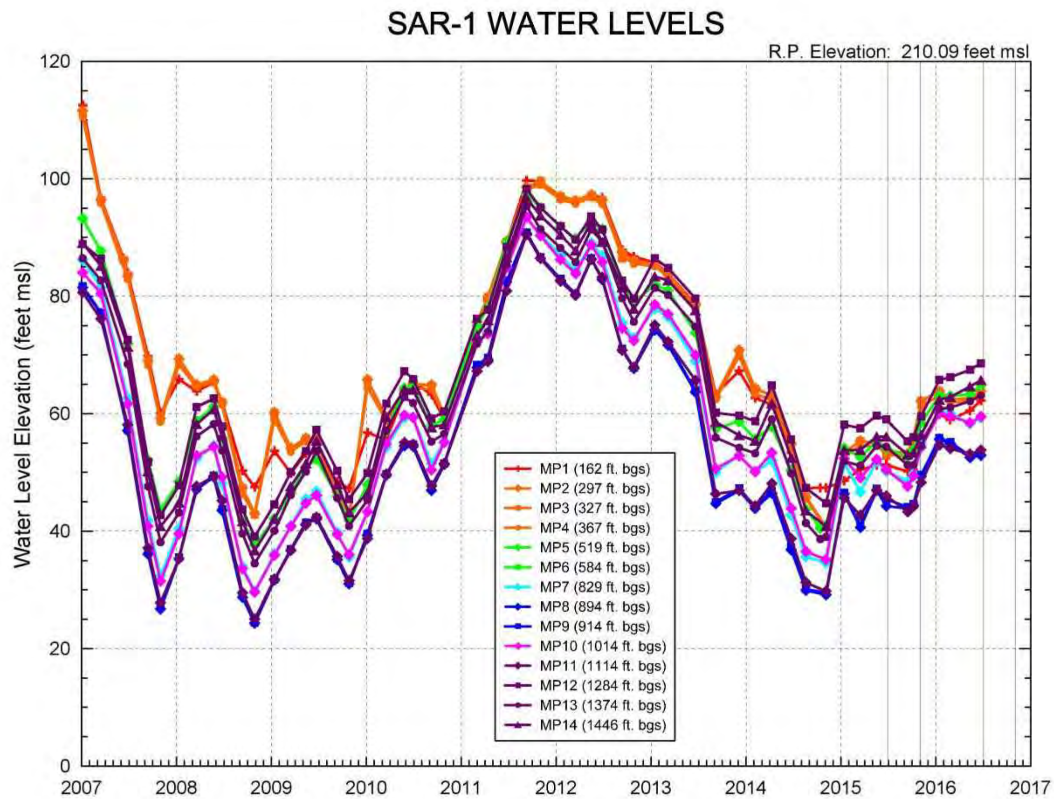


Figure 3-12: Water Level Hydrograph of Well A-27 in Forebay Area



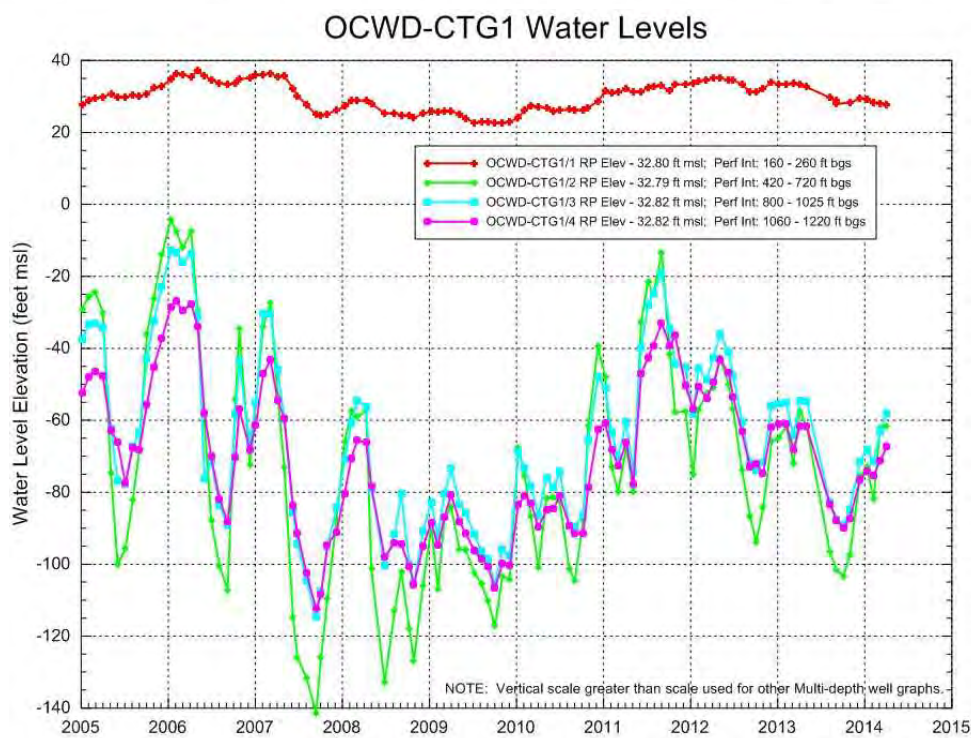


Figure 3-13: Water Level Hydrographs of Wells SAR-1 and OCWD-CTG1

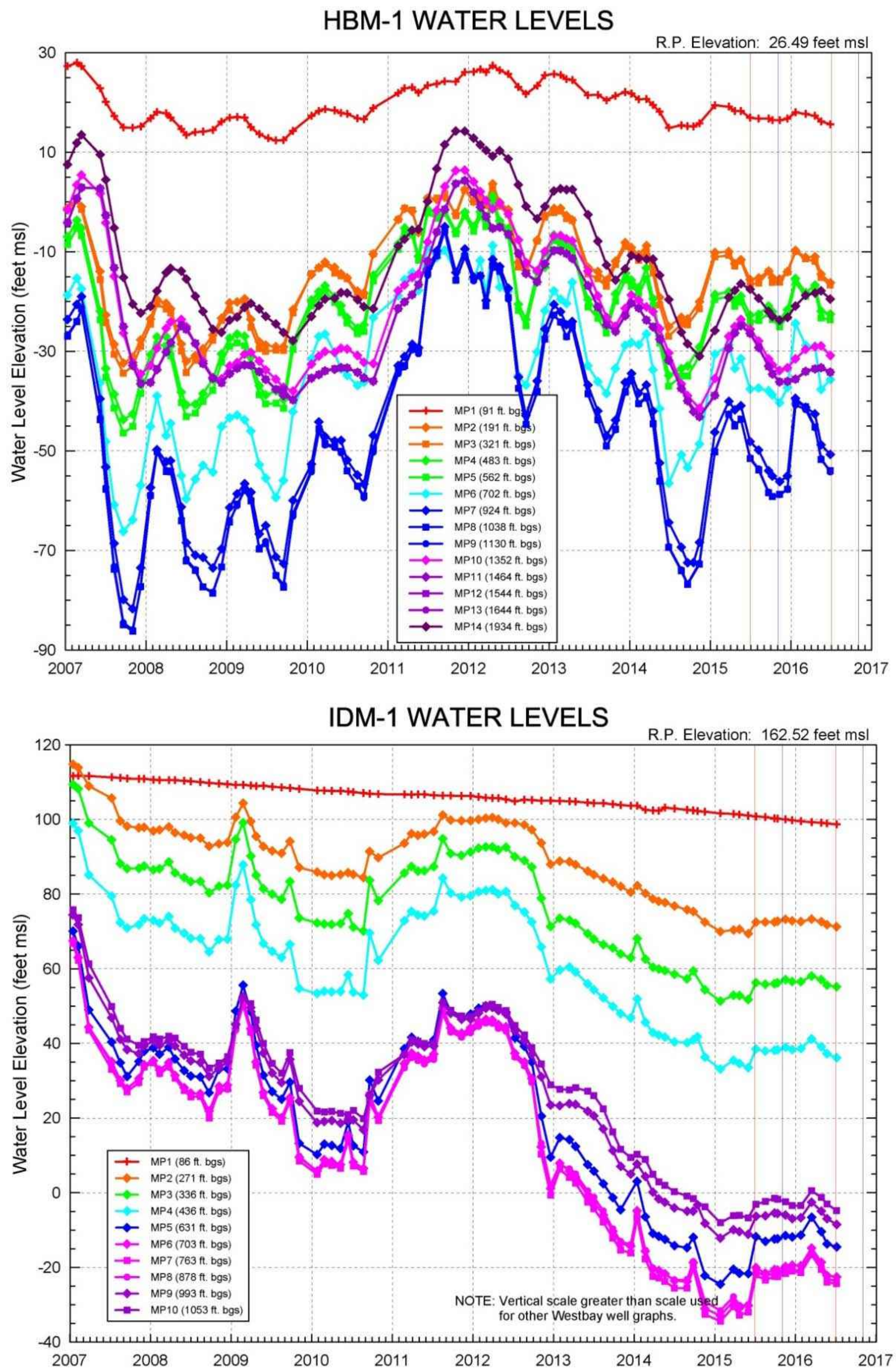


Figure 3-14: Water Level Hydrographs of Wells HBM-1 and IDM-1

3.2.4 Groundwater Storage Data

OCWD operates the basin within an operating range from a full condition to approximately 500,000 acre-feet below full to protect against seawater intrusion, inelastic land subsidence, and other potential undesirable results. On a short-term basis, the basin can be operated at an even lower storage level in an emergency.

In order to manage the basin within this operating range, OCWD calculates the change in storage relative to a full basin condition on an annual basis for the three aquifer layers, an example of which is shown in Figure 3-15. This figure indicates an increase in groundwater in storage from 381,000 acre-feet below full condition in June 2015 to 379,000 acre-feet below full condition in June 2016. In essence, basin storage in June 2015 and June 2016 was almost unchanged, indicating inflows and outflows during that period were virtually balanced, which is not often the case nor necessarily OCWD's goal in any particular year. It is noteworthy that the increase in storage of 2,000 acre-feet is not evenly divided between aquifer layers.

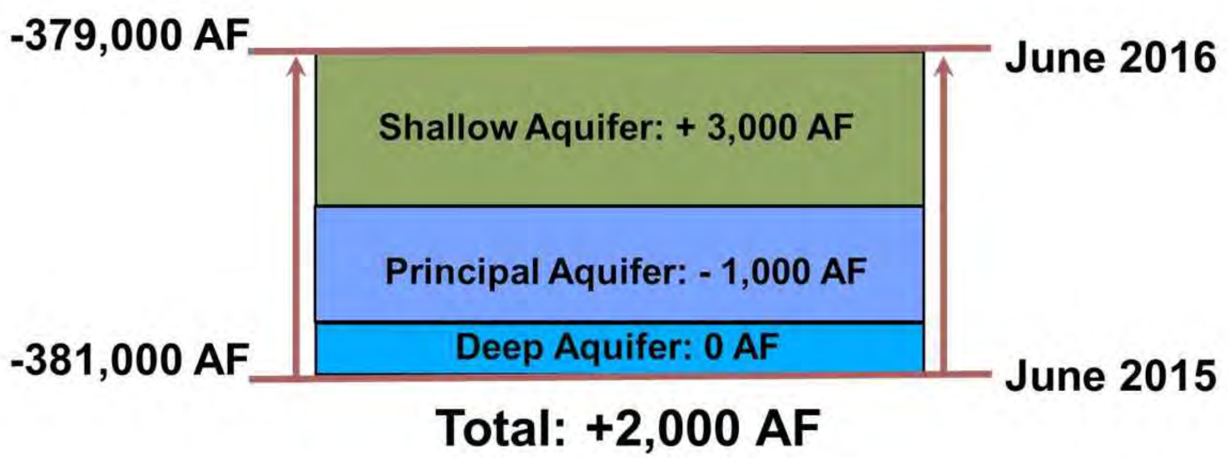


Figure 3-15: Groundwater Storage Level Change, June 2015 to June 2016

3.3 BASIN MODEL

OCWD's basin model encompasses most of Basin 8-1 and extends approximately three miles into the Central Basin in Los Angeles County to provide for more accurate model results than if the model boundary stopped at the county line (see Figure 3-16). The county line is not a hydrogeologic boundary, and groundwater freely flows through aquifers that have been correlated across the county line. The model provides a tool to supplement the storage change calculations that are done each year with actual groundwater elevation data. The model also provides a tool to conduct a wide range of evaluations of proposed projects and operating scenarios.

Coverage of the modeled area is accomplished with grid cells having horizontal dimensions of 500 feet by 500 feet (approximately 5.7 acres) and vertical dimensions ranging from approximately 50 to 1,800 feet, depending on the thickness of each model layer at that grid cell location. Basin aquifers and aquitards are grouped into three composite model layers thought sufficient to describe the three distinguishable flow systems corresponding to the Shallow, Principal, and Deep Aquifers. The three model layers comprise a network of over 90,000 grid cells.

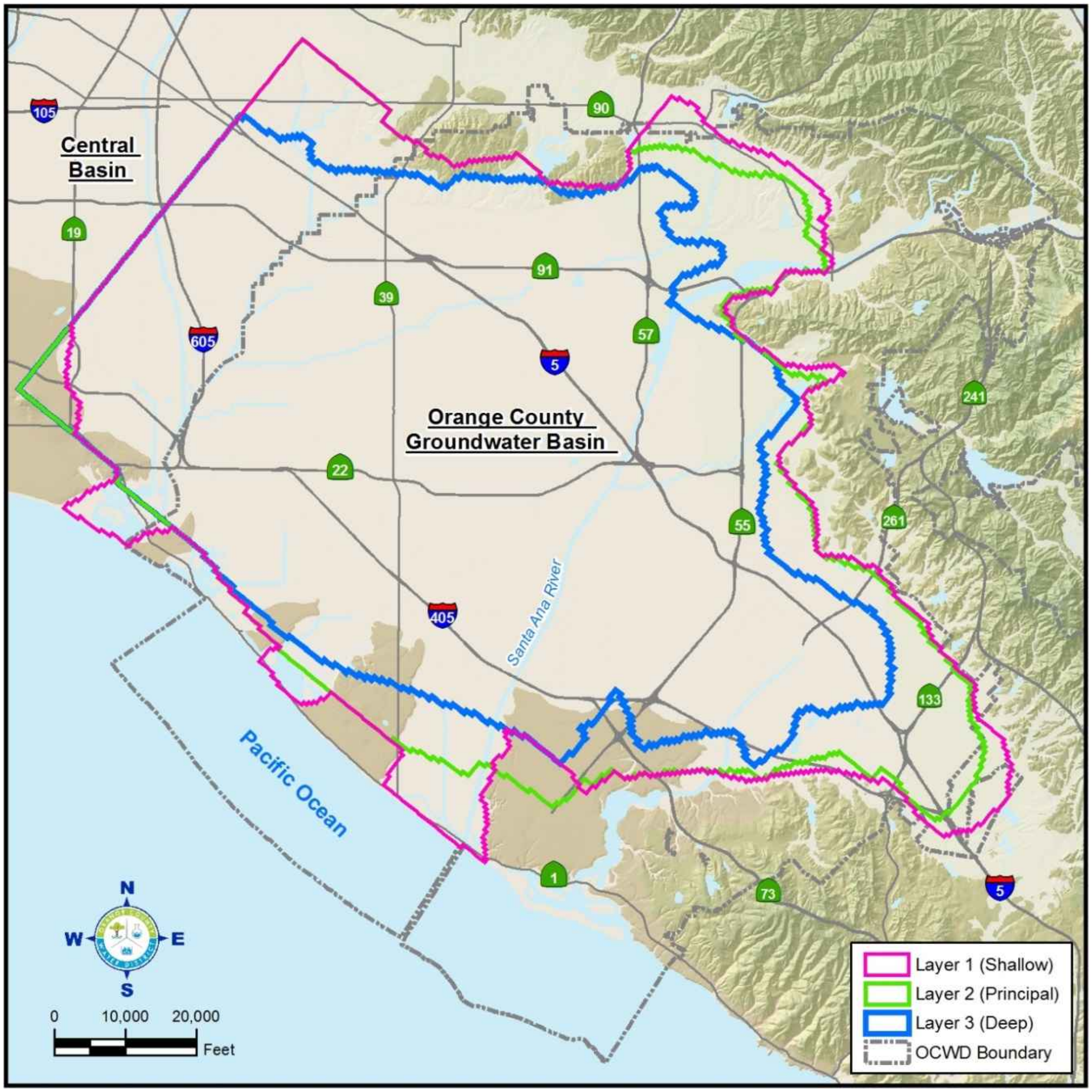


Figure 3-16: Basin Model

The widely-accepted computer program, "MODFLOW," developed by the USGS, was used as the base modeling code for the mathematical model (McDonald and Harbaugh, 1988). Analogous to an off-the-shelf spreadsheet program needing data to be functional, MODFLOW requires vast amounts of input data to define the hydrogeologic conditions in the conceptual model. The types of information that must be input in digital format (data files) for each grid cell in each model layer include the following:

- Aquifer top and bottom elevations
- Aquifer lateral boundary conditions (ocean, faults, mountains)
- Aquifer hydraulic conductivity and storage coefficient/specific yield
- Initial groundwater surface elevation
- Natural and artificial recharge rates (runoff, precipitation, percolation, injection)
- Groundwater production rates for approximately 200 large system and 200 small system wells

These data originate from hand-drawn contour maps, spreadsheets, and the OCWD Water Resources Management System (WRMS) historical database. Because MODFLOW requires the input of data files in a specific format, staff developed a customized database and GIS program to automate data compilation and formatting functions. These data pre-processing tasks constituted one of the key activities in the model development process.

Before a groundwater model can be reliably used as a predictive tool for simulating future conditions, the model must be calibrated to reach an acceptable match between simulated and actual observed conditions. The basin model was first calibrated to steady-state conditions to numerically stabilize the simulations, to make rough adjustments to the water budget terms, and to generally match regional groundwater flow patterns. Also, the steady-state calibration helped to determine the sensitivity of simulated groundwater levels to changes in incidental recharge and aquifer parameters such as hydraulic conductivity. Steady-state calibration of the basin model is documented in more detail in the *OCWD Master Plan Report* (OCWD, 1999).

Typical transient model output consists of water level elevations at each grid cell that can be plotted as a contour map for one point in time or as a time-series graph at a single location. Post-processing of model results into usable graphics is performed using a combination of semi-automated GIS and database program applications. Figure 3-17 presents a simplified schematic of the modeling process.

Model construction, calibration, and operation were built upon 12 years of effort by OCWD staff to collect, compile, digitize, and interpret hundreds of borehole geologic and geophysical logs, water level hydrographs, and water quality analyses. The process was composed of 10 main tasks comprising over 120 subtasks. The major tasks are summarized as follows:

- Finalize conceptual hydrogeologic model layers and program GIS/database applications to create properly formatted MODFLOW input data files. Over 40 geologic cross sections were used to form the basis of the vertical and lateral aquifer boundaries.
- Define model layer boundaries. The top and bottom elevations of the three aquifer system layers and intervening aquitards were hand-contoured, digitized, and overlain on the model grid to populate the model input arrays with a top and bottom elevation for each layer at every grid cell location. Model layer thickness values were then calculated using GIS.

- Develop model layer hydraulic conductivity (K) grids. Estimates of K for each layer were based on (in order of importance): available aquifer test data, well-specific capacity data, and lithologic data. In the absence of reliable aquifer test or specific capacity data for areas in Layers 1 and 3, lithology-based K estimates were calculated by assigning literature values of K to each lithology type (e.g., sand, gravel, clay) within a model layer and then calculating an effective K value for the entire layer at that well location. Layer 2 had the most available aquifer test and specific capacity data. Therefore, a Layer 2 transmissivity contour map was prepared and digitized, and GIS was used to calculate a K surface by dividing the transmissivity grid by the aquifer thickness grid. Initial values of K were adjusted during model calibration to achieve a better match of model results with known groundwater elevations.
- Develop layer production factors for active production wells simulated in the model. Many production wells had long screened intervals that spanned at least two of the three model layers. Therefore, groundwater production for each of these wells had to be divided among each layer screened by use of layer production factors. These factors were calculated using both the relative length of screen within each model layer and the hydraulic conductivity of each layer. Well production was then multiplied by the layer factors for each individual well. For example, if a well had a screened interval equally divided across Layers 1 and 2, but the hydraulic conductivity of Layer 1 was twice that of Layer 2, then the calculated Layer 1 and 2 production factors for that well would have been one-third and two-thirds, respectively, such that when multiplied by the total production for this well, the production assigned to Layer 1 would have been twice that of Layer 2. For the current three-layer model, approximately 25 percent of the production wells in the model were screened across more than one model layer. In this context, further vertical refinement of the model (more model layers) may better represent the aquifer architecture in certain areas but may also increase the uncertainty and potential error involved in the amount of production assigned to each model layer.
- Develop basin model water budget input parameters, including groundwater production, artificial recharge, and unmeasured recharge. Groundwater production and artificial recharge volumes were applied to grid cells in which production wells or recharge facilities were located. The most uncertain component of the water budget – unmeasured or incidental recharge – was applied to the model as an average monthly volume based on estimates calculated annually for the OCWD *Engineer's Report*. Unmeasured recharge was distributed to cells throughout the model, but was mostly applied to cells along margins of the basin at the base of the hills and mountains. The underflow component of the incidental recharge represents the amount of groundwater flowing into and out of the model along open boundaries. Prescribed groundwater elevations were assigned to open boundaries along the northwest model boundary in Los Angeles County; the ocean at the Alamitos, Bolsa, and Talbert Gaps; the mouth of the Santa Ana Canyon; and the mouth of Santiago Creek Canyon. Groundwater elevations for the boundaries other than the ocean boundaries were based on historical groundwater elevation data from nearby wells. The model automatically calculated the dynamic flow across these open boundaries as part of the overall water budget.
- Develop model layer storage coefficients. Storage coefficient values for portions of model layers representing confined aquifer conditions were prepared based on available aquifer test data and were adjusted within reasonable limits based on calibration results.
- Develop vertical leakage parameters between model layers. Vertical groundwater flow between aquifer systems in the basin is generally not directly measured, yet it is one of the critically-important factors in the model's ability to represent actual basin hydraulic processes. Using geologic cross-sections and

depth-specific water level and water quality data from the OCWD multi-depth monitoring well network, staff identified areas where vertical groundwater flow between the modeled aquifer systems is either likely to occur or be significantly impeded, depending on the relative abundance and continuity of lower-permeability aquitards between model layers. During model calibration, the initial parameter estimates for vertical leakage were adjusted to achieve closer matches to known vertical groundwater gradients.

- Develop groundwater contour maps for each model layer to be used for starting conditions and for visual comparison of water level patterns during calibration. Staff used observed water level data from multi-depth and other wells to prepare contour maps of each layer for November 1990 as a starting point for the calibration period. Care was taken to use wells screened within the appropriate vertical interval representing each model layer. The hand-drawn contour maps were then digitized and used as model input to represent starting conditions.
- Perform transient calibration runs. The nine-year period of November 1990 to November 1999 was selected for transient calibration, as it represented the period corresponding to the most detailed set of groundwater elevation, production, and recharge data. The transient calibration process and results are described in the next section.
- Perform various basin production and recharge scenarios using the calibrated model. Criteria for pumping and recharge, including facility locations and quantities, were developed for each scenario and input for each model run.

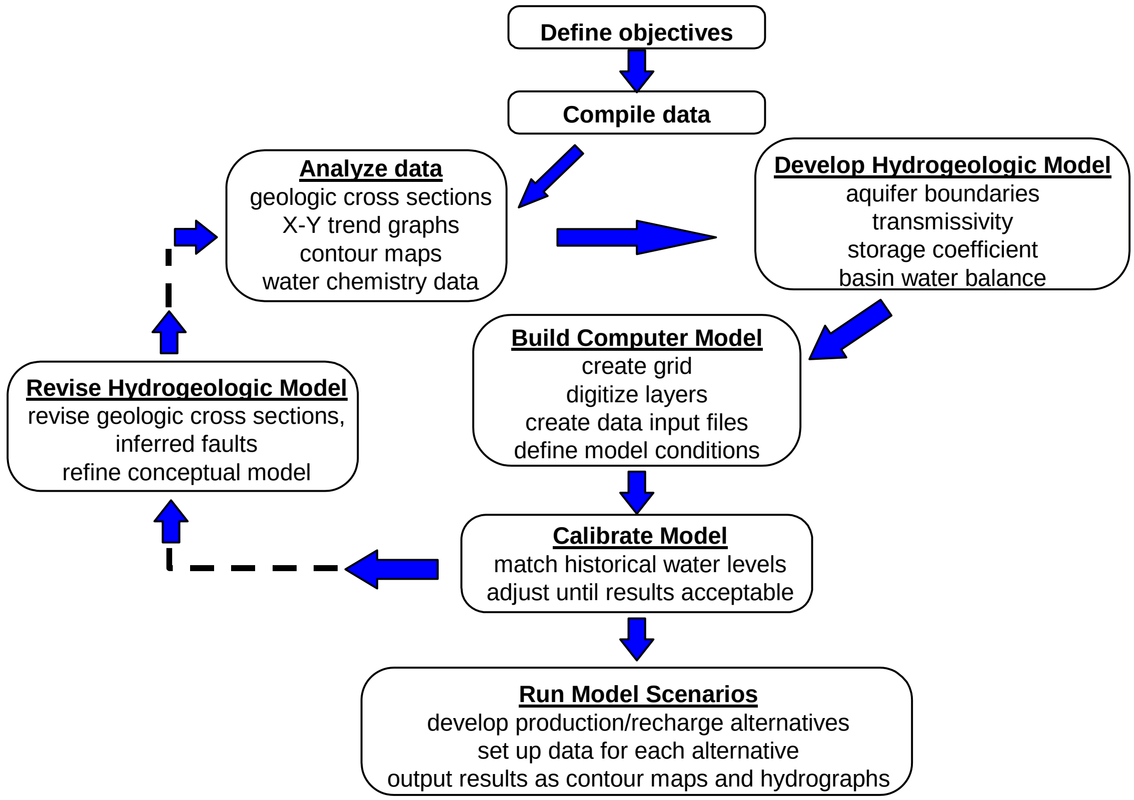


Figure 3-17: Model Development Flowchart

Model Calibration

Calibration of the transient basin model involved a series of simulations of the period 1990 to 1999, using monthly flow and water level data. The time period selected for calibration represents a period during which basic data required for monthly transient calibration were essentially complete (compared to pre-1990 historical records). The calibration period spans at least one “wet/dry” rainfall cycle. Monthly water level data from almost 250 target locations were used to determine if the simulated water levels adequately matched observed water levels. As shown in Figure 3-18, the calibration target points were densely distributed throughout the basin and also covered all three model layers.

After each model run, a hydrograph of observed versus simulated water levels was created and reviewed for each calibration target point. In addition, a groundwater elevation contour map for each layer was also generated from the simulated data. The simulated groundwater contours for all three layers were compared to interpreted contours of observed data (November 1997) to assess closeness of fit and to qualitatively evaluate whether the simulated gradients and overall flow patterns were consistent with the conceptual hydrogeologic model. November 1997 was chosen for the observed versus simulated contour map comparison since these hand-drawn contour maps had already been created for the prior steady state calibration step. Although

November 1997 observed data were contoured for all three layers, the contour maps for Layers 1 and 3 were somewhat more generalized than for Layer 2 due to a lower density of data points (wells) in these two layers.

Depending on the results of each calibration run, model input parameters were adjusted, including hydraulic conductivity, storage coefficient, boundary conditions, and recharge distribution. Time-varying head boundaries along the Orange County/Los Angeles County line were found to be extremely useful in obtaining a close fit with observed historical water levels in the northwestern portion of the model.

Fifty calibration runs were required to reach an acceptable level of calibration in which model-generated water levels were within reasonable limits of observed water level elevations during the calibration period. Figures 3-19 through 3-21 show examples of hydrographs of observed versus simulated water levels for three wells used as calibration targets.

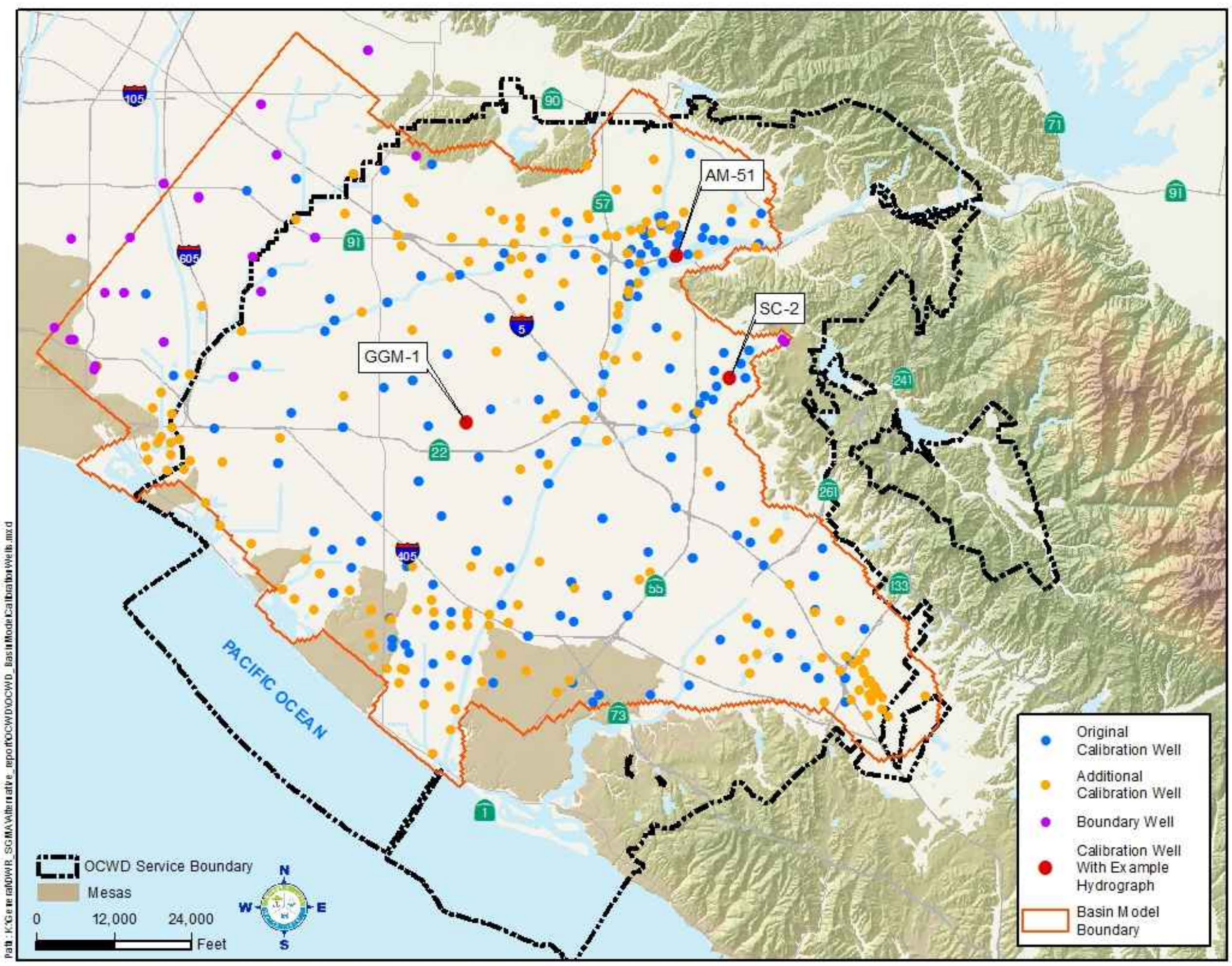


Figure 3-18: Basin Model Calibration Wells

Noteworthy findings of the model calibration process are summarized below:

- The model was most sensitive to adjustments to hydraulic conductivity and recharge distribution. In other words, minor variations in these input parameters caused significant changes in the model water level output.
- The model was less sensitive to changes in storage coefficient, requiring order-of-magnitude changes in this parameter to cause significant changes in simulated water levels, primarily affecting the amplitude of seasonal water level variations.
- The vast amount of observed historical water level data made it readily evident when the model was closely matching observed conditions.
- Incidental (unmeasured) recharge averaging approximately 70,000 afy during the 1990-1999 period appeared to be reasonable, as the model was fairly sensitive to variations in this recharge amount.
- Groundwater outflow to Los Angeles County was estimated to range between 5,000 and 12,000 afy between 1990 and 1999, most of this occurring in Layers 1 and 3.
- Groundwater flow at the Talbert Gap was inland during the entire model calibration period, indicating moderate seawater intrusion conditions. Model-derived seawater inflow ranged from 500 to 2,700 afy in the Talbert Gap and is consistent with chloride concentration trends during the calibration period that indicated inland movement of saline groundwater in these areas.
- Model-derived groundwater inflow from the ocean at Bolsa Gap was only 100-200 afy due to the Newport-Inglewood Fault zone, which offsets the Bolsa aquifer and significantly restricts the inland migration of saline water across the fault.
- Model adjustments (mainly hydraulic conductivity and recharge) in the Santiago Basins area in Orange significantly affected simulated water levels in the coastal areas.
- Model reductions to the hydraulic conductivity of Layer 2 (Principal Aquifer) along the Peralta Hills Fault in Anaheim/Orange had the desired effect of steepening the gradient and restricting groundwater flow across the fault into the Orange area. These simulation results were consistent with observed hydrogeologic data indicating that the Peralta Hills Fault acts as a partial groundwater barrier.
- Potential unmapped faults immediately downgradient from the Santiago Basins appear to restrict groundwater flow in the Principal Aquifer, as evidenced by observed steep gradients in that area, which were reproduced by the model. As with the Peralta Hills Fault, an approximate order-of-magnitude reduction in hydraulic conductivity along these suspected faults achieved the desired effect of reproducing observed water levels with the model.

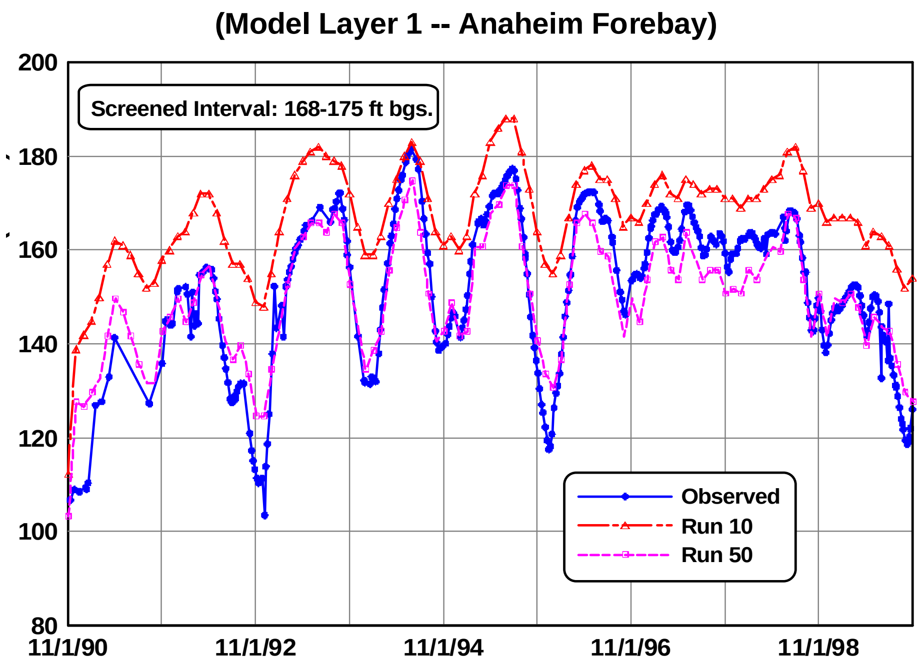


Figure 3-19: Calibration Hydrograph of Monitoring Well AM-5A

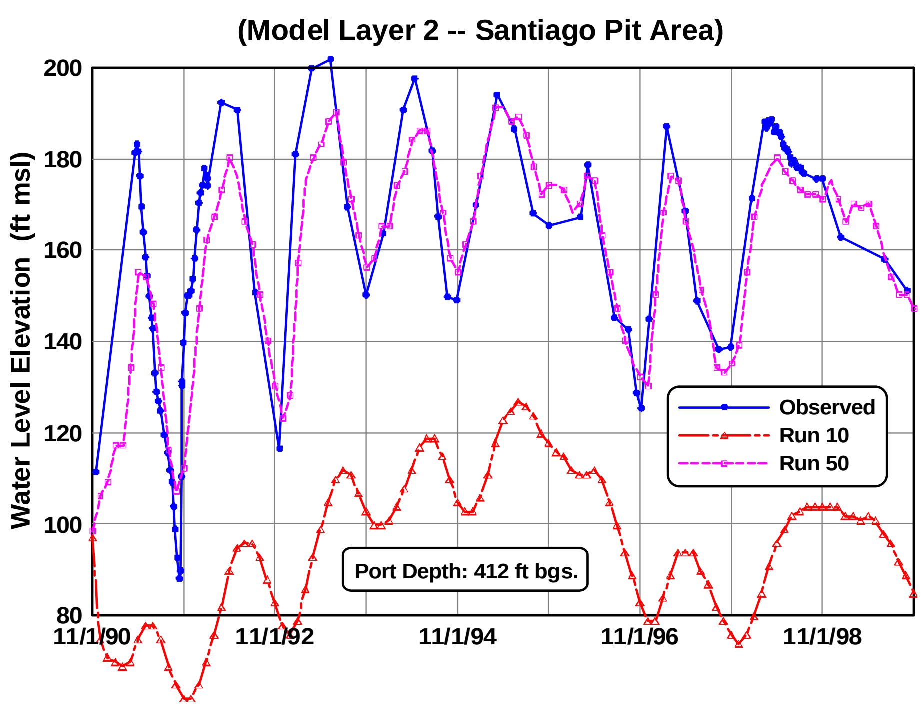


Figure 3-20: Calibration Hydrograph for Monitoring Well SC-2

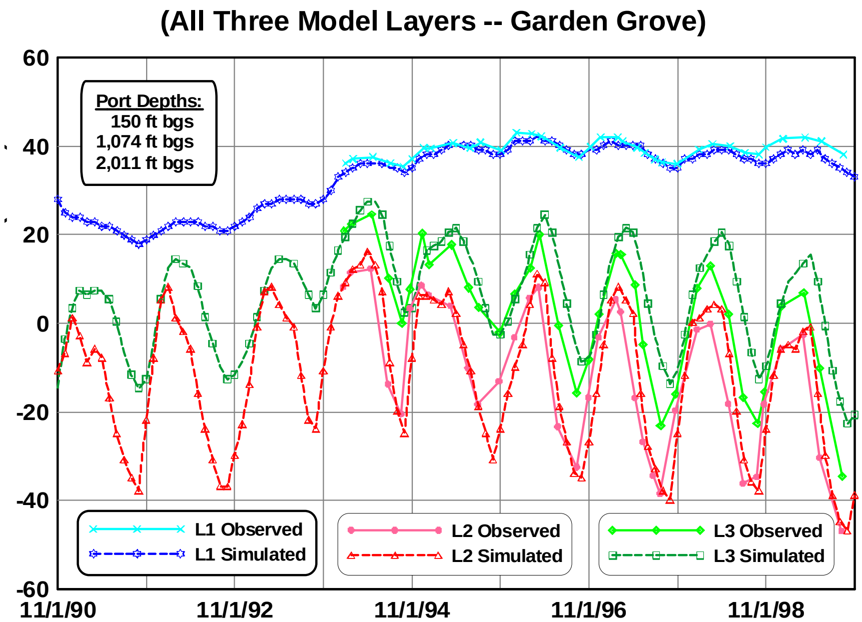


Figure 3-21: Calibration Hydrograph for Monitoring Well GGM-1

Groundwater Model Update and Applications

OCWD staff update the basin groundwater model approximately every three to five years, guided by new information, e.g. new wells in critical areas, warranting the effort or by needed model evaluations using the most recent years, e.g., estimating the groundwater outflow to Los Angeles County. Major changes and improvements over the past five years include:

1. Model conversion from UNIX to PC using the Groundwater Vistas as the Graphical User Interface.
2. Extension of the model transient calibration through WY 2010-11. The new calibration period is November 1990 to June 2011 which includes a wide range of basin storage conditions as well as a wide range of hydrologic conditions.
3. Addition of several new Talbert Barrier injection wells and the addition of two new recharge basins, La Jolla and Miraloma Basins.

Typical applications of the Basin Model include estimating the effects of potential future pumping and recharge projects on groundwater levels, storage, and the water budget. The storage coefficients determined during the original Basin Model calibration are also used to estimate annual change in groundwater storage.

Other applications of the Basin Model were related to operation of the Talbert Seawater Barrier. The first was to guide the planning, location and hydraulic effectiveness of supplemental injection wells for the Talbert Barrier. The second was to estimate the general flow paths and subsurface residence time of barrier injection water to delineate the Talbert Barrier's recycled water retention buffer area.

3.3.1 Groundwater Quality Conditions

Salinity

At the state level, the State Water Resources Control Board (SWRCB) and Regional Water Quality Control Boards have authority to manage TDS in water supplies. The salinity management program for the Santa Ana River Watershed is implemented by the Basin Monitoring Program Task Force (Task Force), a group comprised of water districts, wastewater treatment agencies and the Regional Water Board. OCWD is a member of the Task Force.

Historical ambient or baseline conditions were calculated for levels of total dissolved solids (TDS) and nitrate-nitrogen in each of the 39 groundwater management zones in the watershed. Management Zones within the OCWD Management Area are shown in Figure 3-22. The water quality objectives for TDS and ambient water quality levels for the two zones within the OCWD Management Area are shown in Table 3-1.

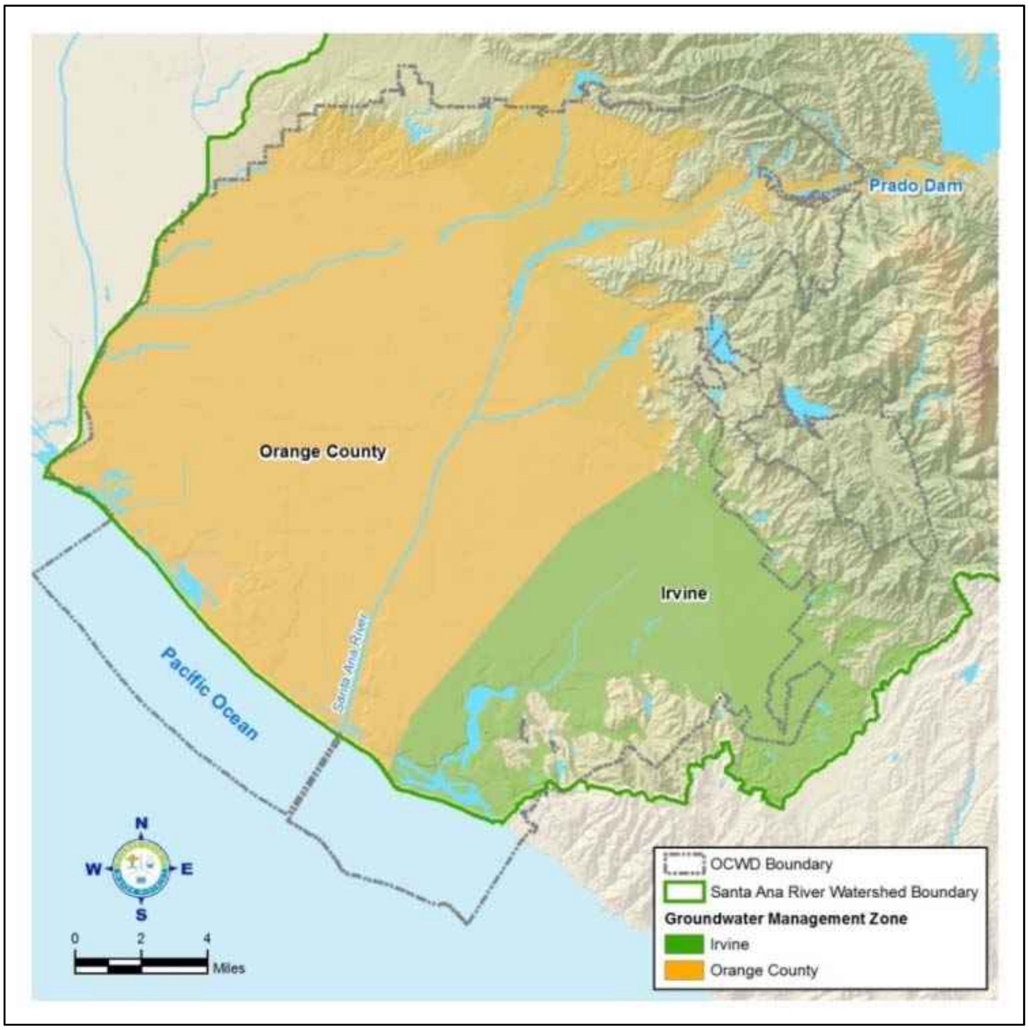


Figure 3-22: Groundwater Management Zones

Table 3-1: TDS Water Quality Objectives for Lower Santa Ana River Basin Management Zones

Management Zone	Water Quality Objective	2012 Ambient Quality
Orange County	580 mg/L	610 mg/L
Irvine	910 mg/L	940 mg/L

(Wildermuth, 2014)

Figure 3-23 shows the average TDS at production wells in the basin for calendar years 2011 to 2015 as well as data available in early 2016. In general, the portions of the basin with the highest TDS levels are located in Irvine, Tustin, Yorba Linda, Anaheim, and Fullerton. There is a broad area in the middle portion of the basin where the TDS generally ranges from 500 to 700 mg/L.

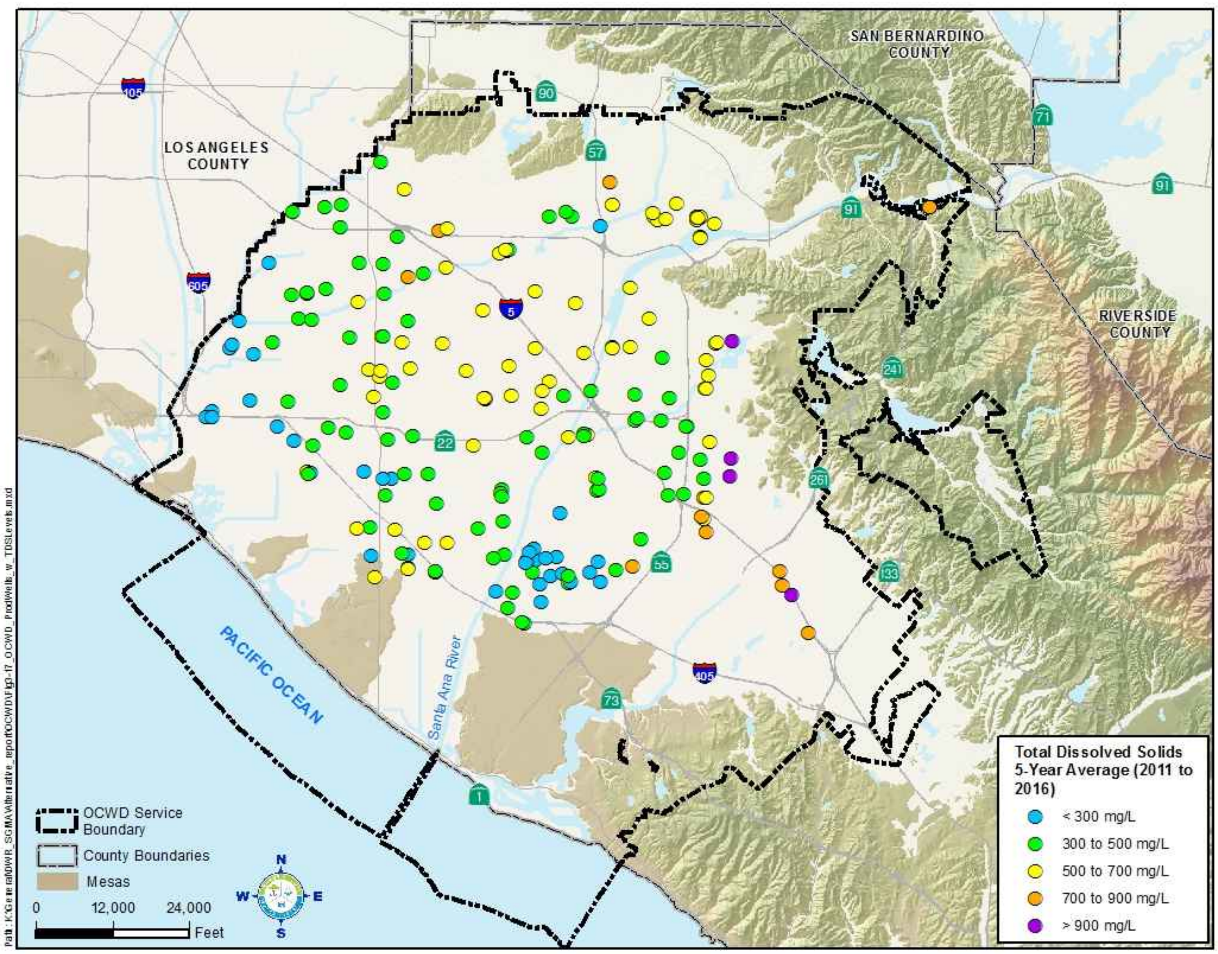


Figure 3-23: TDS in Groundwater Production Wells, 5-year average

Nitrate

Management of nitrate is a component of the salinity management program in the Santa Ana River Watershed. Along with TDS objectives, water quality objectives for nitrate-nitrogen are established for each of the 39 groundwater management zones in the watershed. Water quality objectives and ambient quality levels for the zones within the OCWD Management Area are shown in Table 3-2.

Figure 3-24 shows the 5-year average nitrate-nitrogen levels in production wells for calendar years 2011 to 2015, as well as data available in early 2016. This figure displays data for 306 production wells. Of these 306 wells, twelve exceeded the primary MCL for nitrate-nitrogen of 10 mg/L at least once during the five year period. In cases where pumped groundwater exceeds the MCL, the groundwater producer treats the water to reduce nitrate-nitrogen levels prior to being served to customers.

Table 3-2: Nitrate-nitrogen Water Quality Objective for
Lower Santa Ana River Basin Management Zones

Management Zone	Water Quality Objective	Ambient Quality
Orange County	3.4 mg/L	2.9 mg/L
Irvine	5.9 mg/L	6.7 mg/L

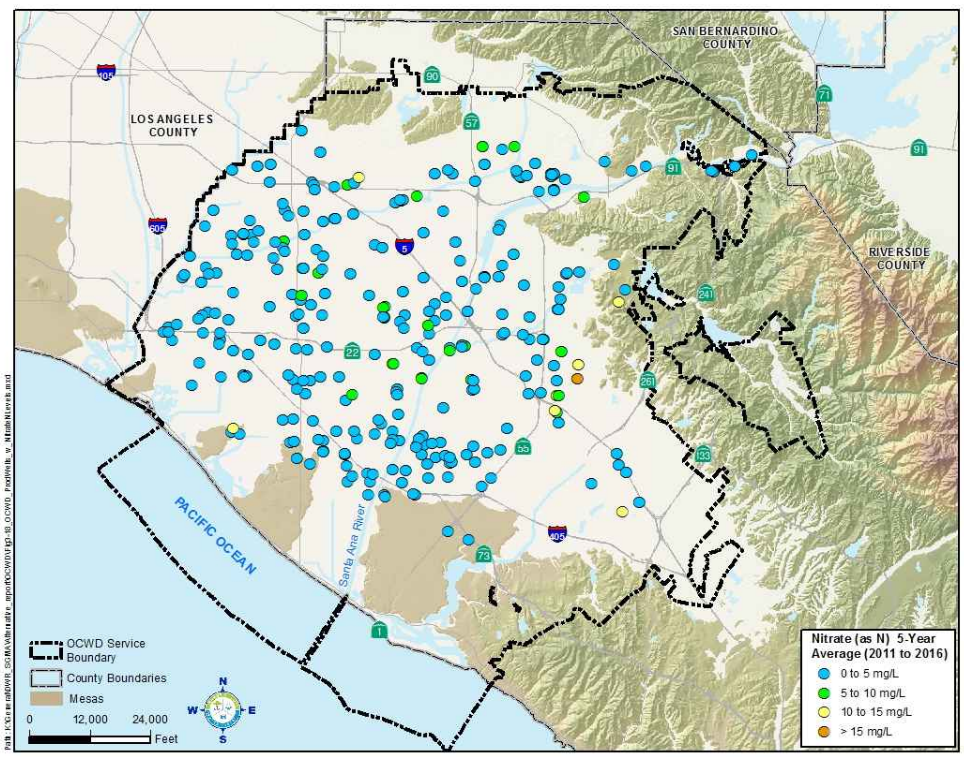


Figure 3-24: Nitrate (as N) Levels in Groundwater Production Wells, 5-year average

Contamination Plumes

Major groundwater contamination sites within the OCWD Management Area include areas where contamination has migrated significantly beyond the contamination sources and threaten the water quality of the underlying groundwater. These plumes, shown in Figure 3-25 are in the process of being remediated.

The North Basin VOC plume area contains contaminated groundwater primarily in the Shallow Aquifer, which is generally less than 200 feet deep with some migration downward into the Principal Aquifer. OCWD is performing a remedial investigation/feasibility study (RI/FS) under the oversight of the U.S. EPA and working with regulatory agencies and stakeholders to evaluate and develop effective remedies to address the contamination under the National Contingency Plan process. The U.S. EPA is the lead agency for this North Basin Groundwater Protection Project (NBGPP).

The South Basin plume area contains VOCs and perchlorate. OCWD has collected data to assist with delineating the plumes. OCWD is performing an RI/FS in consultation with the Regional Water Board, Department of Toxic Substances Control, and stakeholders to evaluate and develop effective remedies to address the contamination under the National Contingency Plan process, designated as the South Basin Groundwater Protection Project (SBGPP).

The U.S. Navy is taking the lead in remediation of three groundwater contamination plumes of VOCs in the vicinity of the former El Toro Marine Corps Air Station (MCAS), former Tustin MCAS, and the Naval Weapons Station Seal Beach.

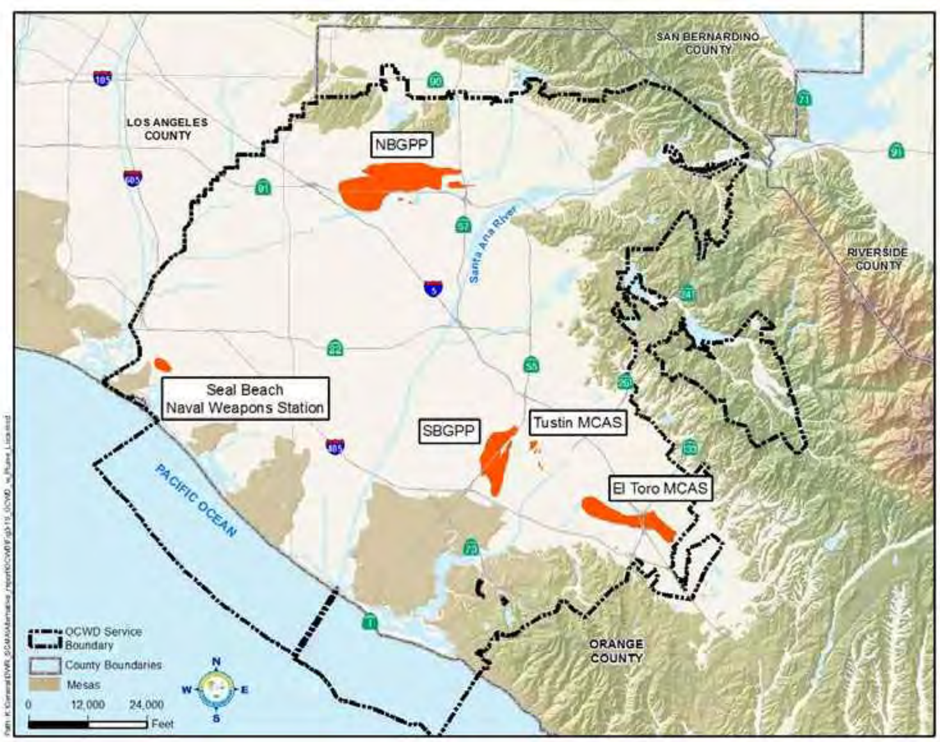


Figure 3-25: Groundwater Contamination Plume Locations

3.3.2 Coastal Gaps

In the coastal area of Orange County, the primary source of saline groundwater is seawater intrusion into the basin through permeable aquifer sediments underlying topographic lowlands or gaps between the erosional remnants or mesas of the Newport-Inglewood Uplift. The susceptible locations from north to south are the Alamitos, Sunset, Bolsa, and Talbert gaps as shown in Figure 3-26.

Alamitos Gap was formed primarily from the ancestral San Gabriel River which carved its way to the ocean as the surrounding hills were contemporaneously being uplifted. Similarly, Bolsa Gap and Talbert Gap were carved by two different paths of the ancestral Santa Ana River as the surrounding mesas were being uplifted by the Newport-Inglewood Fault.

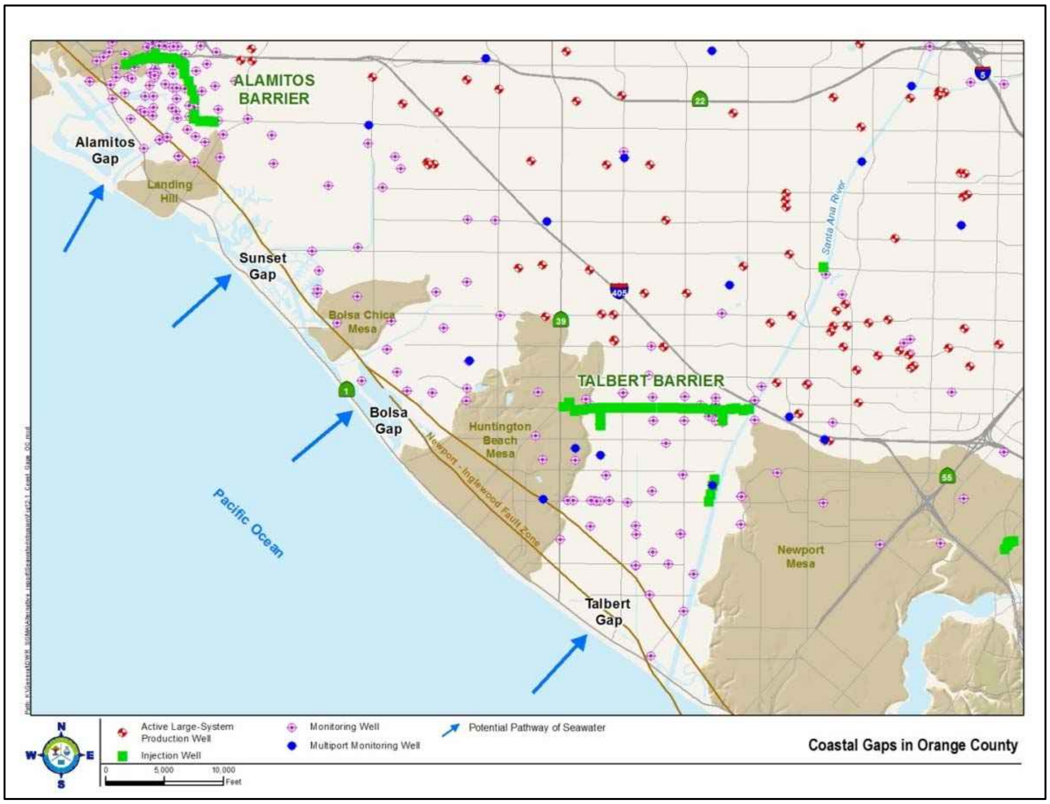


Figure 3-26: Orange County Coastal Gaps

Over Recent geologic time (within the last 12,000 years), the Santa Ana River meandered its way across what is now coastal Orange County reaching as far west as the San Gabriel River. These rivers deposited relatively coarse sands and gravels in their paths and were then subsequently buried with less permeable sediments as sea levels rose coming out of the last ice age. Therefore, in these three gaps, these relatively young river deposits formed permeable aquifers connecting to the Pacific Ocean and thus are the primary conduits for inland migration of seawater, namely the recent aquifer in Alamitos Gap, the Bolsa aquifer in Bolsa Gap, and the Talbert aquifer in Talbert Gap.

In the Alamitos and Talbert gaps, the permeable Recent and Talbert aquifers, respectively, have not been appreciably folded or offset by the Newport-Inglewood Fault Zone due to their geologically young age. Therefore, these shallow aquifers are relatively horizontal, continuous, and in direct hydraulic connection with the Pacific Ocean.

As compared to the Alamitos and Talbert gaps, the permeable Recent deposits forming the Bolsa aquifer in the Bolsa Gap are slightly older and thus are thought to be more offset by the Newport-Inglewood Fault Zone as evidenced by well logs and groundwater level and quality data. Groundwater quality trends (primarily chloride concentrations) from monitoring wells in Bolsa Gap indicate that the Newport-Inglewood Fault Zone restricts groundwater flow and thus impedes the inland migration of seawater.

In the Alamitos, Bolsa, and Talbert gaps, the shallow river-deposited aquifers are locally merged with deeper Upper Pleistocene aquifers, thus providing an avenue for seawater intrusion within the shallow aquifers to migrate vertically downward via these mergence zones into deeper aquifers tapped by production wells further inland.

Sunset Gap is not considered to be an erosional gap carved by a river but rather is a wider and more gradual topographic lowland resulting from a mild dip in the underlying strata. Therefore, Sunset Gap lacks a laterally extensive permeable shallow aquifer comprised of river deposits continuous to the ocean as in the other three gaps discussed above.

OCWD regularly reviews hydrogeologic data, including water quality data, to evaluate the extent of seawater intrusion. In 2016, OCWD documented an updated comprehensive evaluation of the extent of seawater intrusion along the Orange County coast within the OCWD Management Area. The Technical Memorandum, *Summary of Seawater Intrusion in Orange County* (OCWD, 2016a). This report contains detailed descriptions of coastal aquifers, monitoring networks and programs, operation of seawater intrusion barriers, barrier groundwater models, an evaluation of the current extent of seawater intrusion, and descriptions of future plans to protect the water quality of the groundwater basin.

3.3.3 Land Subsidence

In Orange County, subsidence in swampy low-lying coastal areas underlain by shallow organic peat deposits started as early as 1898 when development of these areas for agriculture resulted in excavation of unlined drainage ditches. The ditches drained the swamps and intercepted the shallow water table which was lowered sufficiently to allow the land to drain adequately for irrigated agriculture. When the shallow water table was lowered, it exposed the formerly-saturated peat deposits to oxygen that caused depletion and shrinkage of the peat due to oxidation (Fairchild and Wiebe, 1976).

Subsidence related to shallow peat deposits was associated with land development practices that occurred in Orange County in the late 1800s and early 1900s and, as such, is not something associated with or controlled by groundwater withdrawals in the basin. Another documented cause of subsidence in Orange County unrelated to groundwater basin utilization is oil extraction along the coast, particularly in Huntington Beach (Morton et al., 1976).

Subsidence due to changes in groundwater conditions in the Orange County groundwater basin is variable and does not show a pattern of widespread irreversible permanent lowering of the ground surface. Storage conditions in the groundwater basin were at historical lows in the mid-1950s, but since this time OCWD has operated the groundwater basin within a storage range above this historical low. There are reports that some subsidence may have occurred before OCWD began refilling the groundwater basin in the late 1950s (Morton, et al., 1976); however, the magnitude and scope of this subsidence is uncertain, and it is not clear if this subsidence was permanent. As such, there is no evidence of permanent, inelastic land subsidence in the OCWD Management Area (see Section 13) and future subsidence is not expected as long as OCWD continues to manage basin storage above the historic low observed in the late 1950s.

3.3.4 Groundwater/Surface Water Interactions and Groundwater Dependent Ecosystems

Frequent and destructive flooding of the Santa Ana River in Orange County was the impetus for construction of the Prado Dam in 1941. Prior to the construction of flood control facilities, the banks of the Santa Ana River naturally overflowed periodically and flooded broad areas of Orange County as seen in Figure 3-27. Coastal marshes were inundated during winter storms, and the mouth of the river moved both northward and southward of its present location. In the days before flood control, surface water naturally percolated into the groundwater basin, replenishing groundwater supplies.

Subsequent flood protection efforts included construction of levees along the river and concrete-lined bottoms along portions of the river. Flood risk was reduced, increased pumping of groundwater lowered water levels, and low-lying areas were filled in and/or equipped with drains, pumps and other flood control measures to allow for urban development. Since at least the 1950s, groundwater levels throughout the OCWD Management Area have been low enough that the rising and lowering of groundwater levels do not impact surface water flows or ecosystems.

Although it is outside the OCWD Management Area (within the Santa Ana Canyon Management Area described later), it is noted that from Prado Dam to Imperial Highway, the wide soft-bottomed Santa Ana River channel supports riparian habitats. Riparian habitat is dependent on river water released through Prado Dam, which is predominantly treated wastewater discharged in the upper watershed when storm flow is not present. In aggregate, this stretch is generally considered to be in equilibrium between surface water and groundwater based on available stream gage and groundwater level data, although some infiltration may occur due to minor groundwater pumping in the Santa Ana Canyon Management Area.

As the Santa Ana River enters the OCWD Management Area, from Imperial Highway to 17th Street in Santa Ana, there is minimal riparian habitat, and the river is a losing reach with engineered facilities to infiltrate surface water into groundwater basin. OCWD conducts recharge operations within the soft-bottomed river channel except for a portion of the river where the Riverview Golf Course occupies the river channel. The river levees are constructed of either rip-rap or concrete.

From 17th Street to near Adams Avenue in Costa Mesa, the river channel is concrete-lined for flood control with vertical to sloping concrete side walls and a concrete bottom as shown in Figure 3-38. From Adams Avenue to the coast, the channel has vertical concrete side walls or rip-rap for flood control and a soft bottom. Estuary conditions within the concrete channel exist at the mouth of the river where the ocean encroaches at high tide. The tidal prism extends from the ocean approximately three miles inland to the Adams Avenue Bridge.

There are no surface water bodies within the boundaries of the OCWD Management Area that are dependent on groundwater. Therefore, there are no groundwater-dependent ecosystems issues in the OCWD Management Area.

Some areas in the basin experience relatively high groundwater levels due to perched groundwater where shallow groundwater is impeded from flowing into deeper groundwater by a layer of low-permeable clay or silt, known as an aquitard. Except in very low-lying areas near sea level, the high groundwater is not close enough to the surface to support hydrophilic vegetation. OCWD carefully monitors water levels in the vicinity of the Talbert Seawater Barrier in order to maintain injection well rates to assure that groundwater levels do not rise to levels that could threaten urban infrastructure.

Figure 3-27: Santa Ana River in Orange County,1938
Courtesy of the Anaheim Public Library

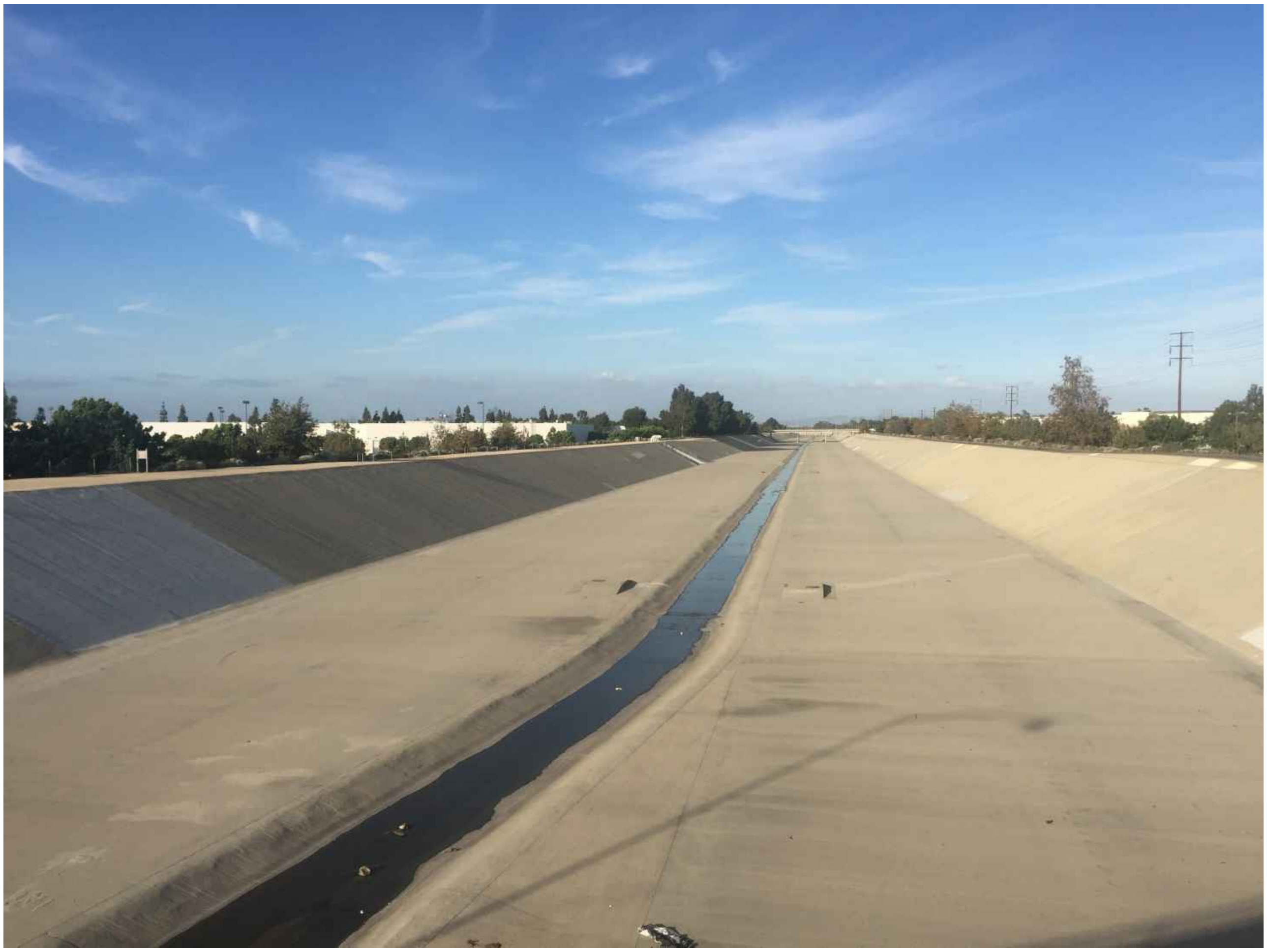


Figure 3-28: Santa Ana River
View upstream from Talbert Avenue Bridge in Fountain Valley. The portion of the river here has both concrete levees and bottom.

SECTION 4 WATER BUDGET

OCWD developed a hydrologic budget (inflows and outflows) for the purpose of constructing a basin-wide groundwater flow model, (Basin Model) and for evaluating basin production capacity and recharge requirements. The key components of the budget include measured and unmeasured (estimated) recharge, groundwater production, and subsurface flows along the coast and across the Orange County/Los Angeles County line. Because the basin is not operated on an annual safe-yield basis, the net change in storage in any given year may be positive or negative; however, over the long-term, the basin is operated within the established operating range. The components of the water budget are described below. OCWD's water year (WY) begins on July 1 and ends on June 30.

4.1 WATER BUDGET COMPONENTS

4.1.1 Measured Recharge

Measured recharge consists of all water artificially recharged at OCWD's surface water recharge facilities and water injected in the Talbert and Alamitos Barriers. The majority of measured recharge occurs in the District's surface water system, which receives Santa Ana River baseflow and storm flow, GWRS recycled water, and imported water.

4.1.2 Unmeasured Recharge

Unmeasured recharge also referred to as "incidental recharge" accounts for a significant amount of the basin's recharge, particularly in wet periods. This includes recharge from precipitation, irrigation return flows, urban runoff, seawater inflow through the gaps as well as subsurface inflow at the basin margins along the Chino, Coyote, and San Joaquin hills and the Santa Ana Mountains, and beneath the Santa Ana River and Santiago Creek. Subsurface inflow beneath the Santa Ana River and Santiago Creek refers to groundwater that enters the basin at the mouth of Santa Ana Canyon and in the Santiago Creek drainage below Villa Park Dam. Estimated average subsurface inflow to the basin is shown in Figure 4-1.

OCWD has estimated total unmeasured recharge between 20,000 and 160,000 afy. Net unmeasured or incidental recharge is the amount of incidental recharge remaining in the basin after accounting for underflow losses to Los Angeles County. Under average hydrologic conditions, net incidental recharge averages 62,000 acre-feet per year. This average was substantiated during calibration of the Basin Model and is also consistent with the estimate of 58,000 afy reported by Hardt and Cordes (1971) as part of a USGS modeling study of the basin. Because unmeasured recharge is one of the least understood components of the basin's water budget, the error margin for any given year is likely in the range of 10,000 to 20,000 acre-feet. Since unmeasured recharge is well distributed throughout the basin, the physical significance (e.g., water level drawdown or mounding in any given area) of overestimating or underestimating the total recharge volume within this error margin is considered to be minor.

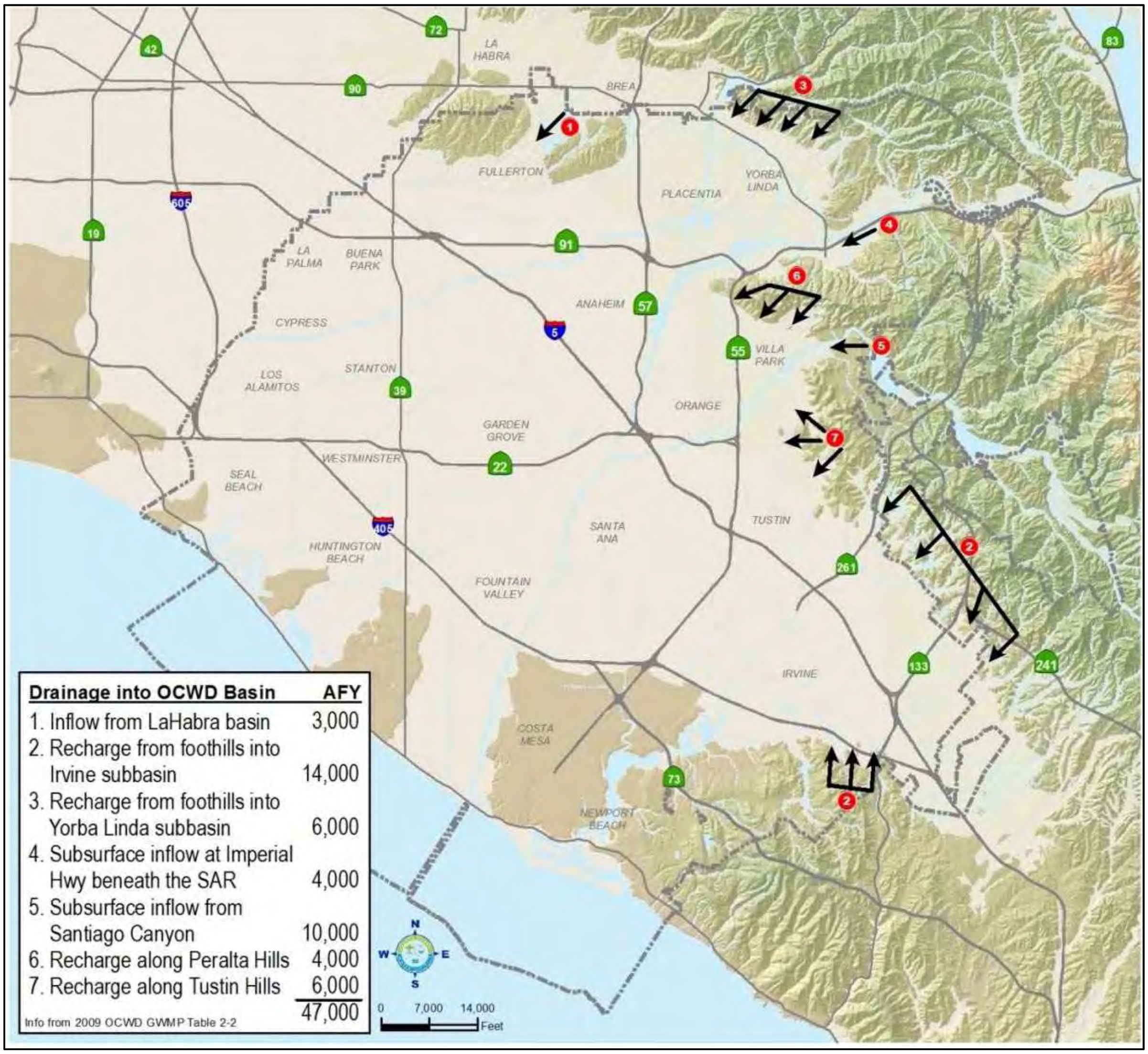


Figure 4-1: Estimated Subsurface Inflow

4.1.3 Groundwater Production

Entities that produce groundwater within the OCWD Management Area include major groundwater producers and small groundwater producers. Ninety-eight percent of groundwater production within Basin 8-1 occurs within the OCWD Management Area. The major groundwater producers include cities, water districts and water companies that account for approximately 97 percent of the total basin production. These 19 major producers operate approximately 200 large-system wells. Small groundwater producers include entities that typically produce less than 500 afy. These include small mutual water companies, industrial users, agricultural companies, golf courses, cemeteries, and private-well owners. Groundwater pumping for agricultural irrigation use accounts for less than one percent of total basin production.

4.1.4 Subsurface Outflow

Groundwater outflow from the basin across the Los Angeles County/Orange County line has been estimated to range from approximately 1,000 to 14,000 afy based on groundwater elevation gradients and aquifer transmissivity (DWR, 1967; McGillicuddy, 1989). The Water Replenishment District of Southern California also has estimated underflow from Orange County to Los Angeles County within the aforementioned range. Groundwater outflow cannot be directly measured and is accounted for in the basin water budget within the net unmeasured recharge described above.

Modeling by OCWD indicates that underflow to Los Angeles County increases by approximately 7,500 afy for every 100,000 acre-feet of increased groundwater in storage in Orange County, given the assumption that groundwater elevations in Los Angeles County remain constant (see Figure 4-2). With the exception of unknown amounts of semi-perched (near-surface) groundwater being intercepted and drained by submerged sewer trunk lines and unlined flood control channels along coastal portions of the basin, no other significant basin outflows are known to occur.

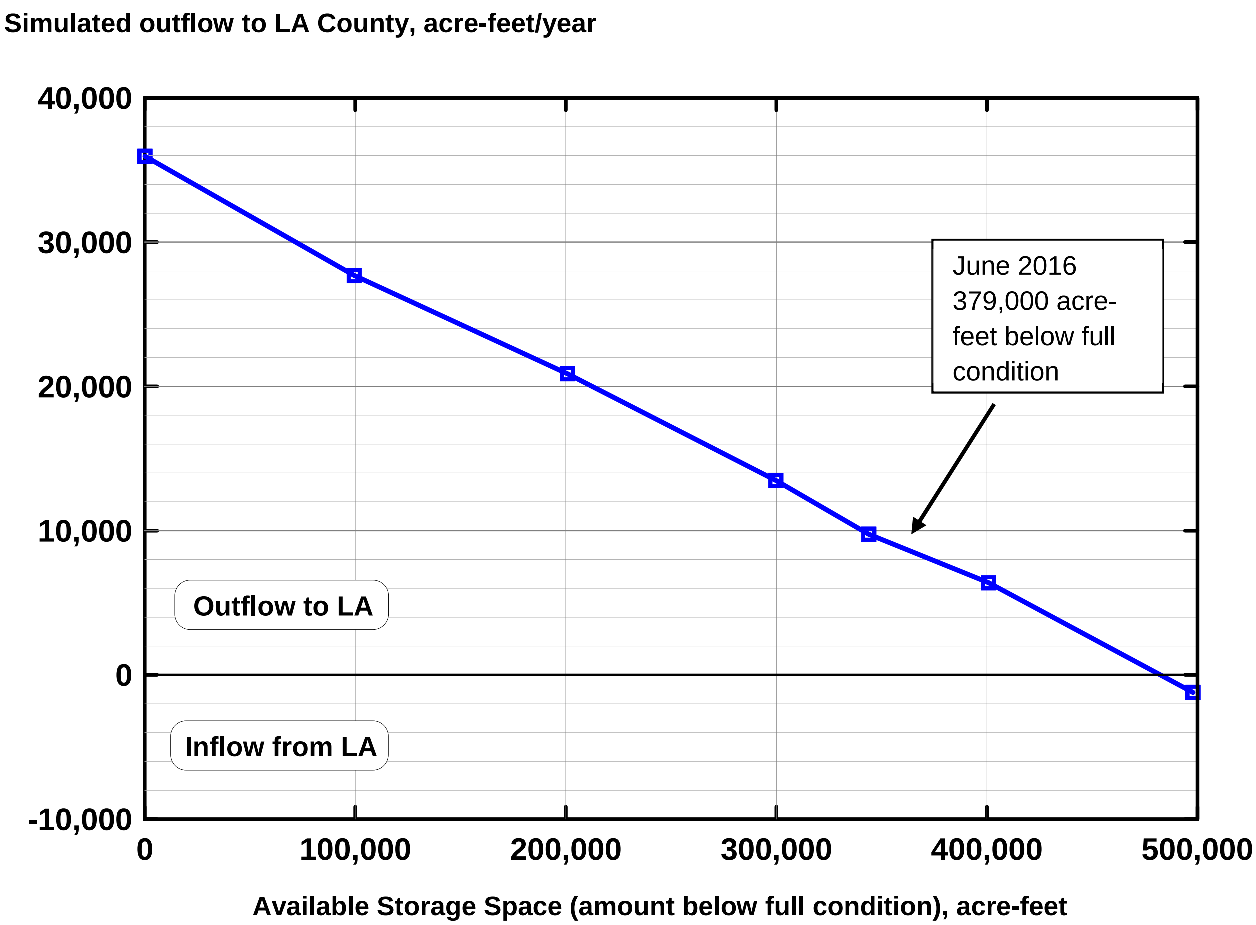


Figure 4-2: Relationship between Basin Storage and Estimated Outflow to Los Angeles County

4.1.5 Evaporation

The total wetted area of the District's recharge system is over 1,000 acres. OCWD estimates the evaporation from this system on a monthly basis. Generally, total evaporation is on the order of 2,000 acre-feet per year which is approximately one percent of the total volume recharged annually. The relatively minor impact of evaporation reflects moderate temperatures in the region and high percolation rates (1 to 10 feet per day).

4.2 WATER YEAR TYPE

As explained previously, OCWD manages groundwater pumping and basin storage over the long-term. Basin storage levels in comparison to wet and dry years from 1957 to present are shown in Figure 10-1. Typically, basin storage levels increase during wet periods and decrease during dry periods. Operating the basin within the operating range provides for maximum basin production while preventing significant and unreasonable undesirable results.

4.3 ESTIMATE OF SUSTAINABLE YIELD

Even though the groundwater basin contains an estimated 66 million acre-feet when full, OCWD operates the basin within an operating range of up to 500,000 acre-feet below full condition to protect against seawater intrusion, inelastic land subsidence, and other potential undesirable results. On a short-term basis, the basin can be operated at an even lower storage level in an emergency.

OCWD manages groundwater production and recharge to maintain groundwater storage levels within the established operating range. In this sense, the basin's sustainable yield can be defined as the volume of groundwater production that can be sustained while maintaining groundwater in storage within the operating range. Basin storage is determined on an annual basis by calculating the difference between groundwater production and recharge based on water year (July 1 to June 30).

In recent years (WY 2002-03 to 2014-15), annual groundwater production has ranged from 270,300 to 366,200 afy (shown in Figure 4-3). The average annual production for the past ten years (WY 2006-07 to 2015-16) was 310,000 afy. The long-term average annual production between WY 1965-666 and 2015-16 was 283,000 afy.

The sustainable yield of the basin is a function of the amount of groundwater recharge from OCWD's managed aquifer recharge program and natural recharge as a result of precipitation and percolation of irrigation flows.

OCWD seeks to maximize recharge in order to support the maximum levels of groundwater production. The increase in sustainable yield as a result of OCWD groundwater management can be illustrated by looking at long-term historical production data. Figure 4-3 shows the increase in annual groundwater production from approximately 150,000 afy in the mid-1950s to a high of 366,000 afy in WY 2007-08.

The process that determines a sustainable level of pumping on an annual basis considers the basin's operating range, basin storage conditions and the amount of available recharge water supplies.

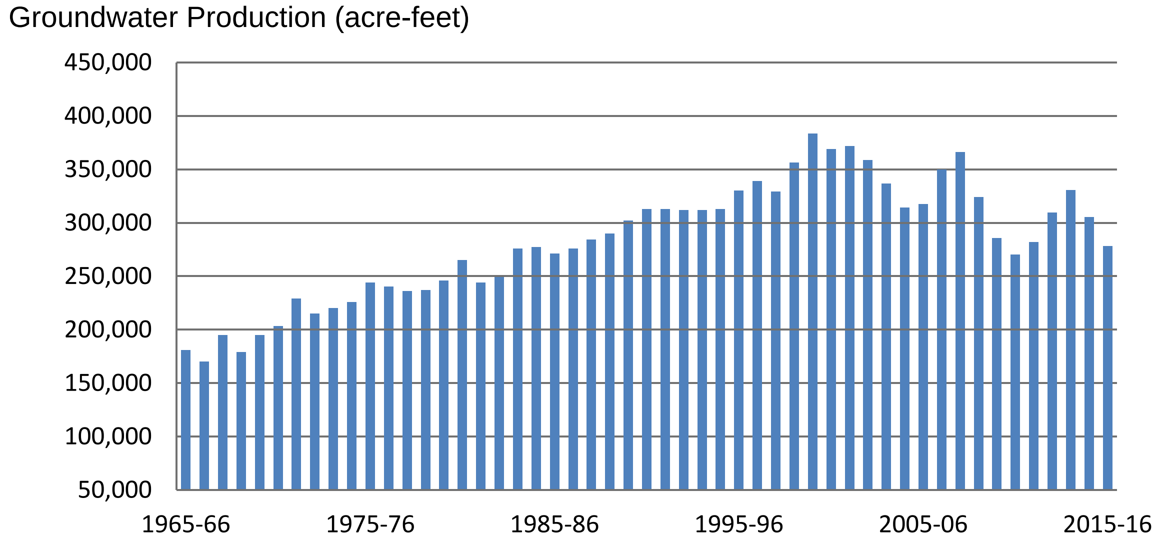


Figure 4-3: Groundwater Production, WY 1965-66 to WY 2015-16

4.4 WATER BUDGETS

Typical water budgets for dry years, average years and wet years as well as a future projected budget are presented in Tables 4-1 to 4-4. For the typical average year, total inflow and outflow are similar, indicating nearly balanced inflow and outflow, as shown in Table 4-1. During a dry year, measured and unmeasured recharge is lower compared with the average year. On the other hand, in a dry year water demands (including groundwater production) are usually higher due to outdoor irrigation. As shown in Table 4-2, the net result is a negative storage change, demonstrating how the groundwater basin serves as a storage reservoir to help meet demands during dry periods. During a wet year, measured and unmeasured recharge is greater compared to average year conditions. Water demands (hence, groundwater production) are often lower in a wet year due to decreased irrigation demands, and the resulting positive change in storage indicates how the basin reservoir is replenished, as shown in Table 4-3.

The average annual stormwater capture volume for the past ten years (WY 2006-07 to 2015-16) was approximately 44,000 acre-feet; however, this period's rainfall was 17% below the long-term average using San Bernardino precipitation data. The average year water budget (Table 4-1) assumed a stormwater capture volume of 52,000 acre-feet, which was based on a longer period (1989-2015) of rainfall and captured stormwater records.

The net estimated unmeasured or incidental recharge for the OCWD Management Area shown in Tables 4-1 through 4-4 include subsurface inflow from the South East, La Habra, and Santa Ana Canyon Management Areas.

Estimates of GWRS recharge volumes and Talbert Barrier injection volumes are based on actual GWRS production and recharge. These volumes do not fluctuate based on the average, dry and wet years. Alamitos Barrier injection volumes were based on long-term records and do not fluctuate significantly between average, wet, or dry years.

Table 4-4 is the projected future water budget under average hydrologic conditions. This projection considers several possible new sources of water supply: the final expansion of GWRS, recharging recycled water produced by a proposed MWD Regional Recycled Water Supply Program, and desalinated ocean water. The future projection accounts for these new water supplies as an increase in total inflow to the basin. The projected amount of groundwater production is increased in order to balance total inflow and outflow. In the case where one or more of the new water supplies is not available in the future, the amount of groundwater production would be reduced in order to create a balanced water budget.

Over the long-term, the basin must be maintained in an approximate balance to ensure the long-term viability of basin water supplies and to prevent the occurrence of undesirable results. In any particular year, water withdrawals may exceed water recharged as long as this is balanced by years when water recharged exceeds withdrawals. OCWD manages groundwater production and recharge to maintain groundwater storage levels within the established operating range as explained in detail in Section 10.

Table 4-1: Water Budget – Average Year

FLOW COMPONENT	Acre-feet
INFLOW	
Measured Recharge	
Santa Ana River baseflow	52,000
Santa Ana River stormflow	52,000
GWRS recharge in Forebay	73,000
Imported Water	65,000
Talbert Barrier injection	30,000
Alamitos Barrier injection in Orange County	2,000
Net Estimated Unmeasured or Incidental Recharge*	62,000
TOTAL INFLOW:	336,000
OUTFLOW	
Groundwater Production	320,000
TOTAL OUTFLOW:	320,000
CHANGE IN STORAGE:	+16,000

*subsurface outflow is included within net unmeasured recharge

Table 4-2: Water Budget – Dry Year

FLOW COMPONENT	Acre-feet
INFLOW	
Measured Recharge	
Santa Ana River baseflow	44,000
Santa Ana River stormflow	35,000
GWRS recharge in Forebay	73,000
Imported Water	50,000
Talbert Barrier injection	30,000
Alamitos Barrier injection in Orange County	2,000
Net Estimated Unmeasured or Incidental Recharge*	40,000
TOTAL INFLOW:	274,000
OUTFLOW	
Groundwater Production	330,000
TOTAL OUTFLOW:	330,000
CHANGE IN STORAGE:	-56,000

*subsurface outflow is included within net unmeasured recharge

Table 4-3: Water Budget – Wet Year

FLOW COMPONENT	Acre-feet
INFLOW	
Measured Recharge	
Santa Ana River baseflow	60,000
Santa Ana River stormflow	80,000
GWRS recharge in Forebay	73,000
Imported Water	65,000
Talbert Barrier injection	30,000
Alamitos Barrier injection in Orange County	2,000
Net Estimated Unmeasured or Incidental Recharge*	80,000
TOTAL INFLOW:	390,000
OUTFLOW	
Groundwater Production	305,000
TOTAL OUTFLOW:	305,000
CHANGE IN STORAGE:	+ 85,000

*subsurface outflow is included within net unmeasured recharge

Table 4-4: Water Budget – Future Projection (Average Rainfall)

FLOW COMPONENT	Acre-feet
INFLOW	
Measured Recharge	
Santa Ana River baseflow	52,000
Santa Ana River stormflow	52,000
GWRS recharge in Forebay	104,000
Imported Water/MWD IPR	65,000
Desalinated Ocean Water	53,000
Talbert Barrier injection	30,000
Alamitos Barrier injection in Orange County	2,000
Net Estimated Unmeasured or Incidental Recharge*	62,000
TOTAL INFLOW:	420,000
OUTFLOW	
Groundwater Production	420,000
TOTAL OUTFLOW:	420,000
CHANGE IN STORAGE:	0

*subsurface outflow is included within net unmeasured recharge

SECTION 5 WATER RESOURCE MONITORING PROGRAMS

5.1 OVERVIEW

Water resource monitoring programs can be categorized into groundwater, surface water, and recycled and imported water programs. These programs are summarized in Table 5-1 and described below.

Table 5-1: Summary of Monitoring Programs

MONITORING PROGRAM	PURPOSE	SCALE	FREQUENCY OF MONITORING
GROUNDWATER			
Groundwater Production	Manage basin storage; collect revenues based on production	All entities that pump groundwater	Producers (approx. 200 large capacity wells producing 97% of total production) track daily production rates and volumes; report totals to OCWD monthly. Others report semi-annually
Groundwater Elevation	Manage basin storage; prepare groundwater level contour maps; manage seawater intrusion barrier injection rates	1,000 individual measuring points	OCWD monitoring wells: all once a year (typically monthly); some measured by-weekly with some equipped with continuous monitoring equipment. Varying frequency for production wells, depending on local protocols
CA Statewide Groundwater Elevation Monitoring (CASGEM) Program	Compliance with state CASGEM program	96 key wells	Quarterly
Title 22 Water Quality Program	Compliance with CA SWRCB Division of Drinking Water, Title 22	All production wells regulated by Title 22	See schedule in Table 5-2

MONITORING PROGRAM	PURPOSE	SCALE	FREQUENCY OF MONITORING
	Monitoring for more than 100 regulated and unregulated chemicals at drinking water wells		
Groundwater Contamination Plumes	Monitor location of contamination plumes and levels of contamination	As needed	Depending on site-specific conditions
Seawater Intrusion	Monitor effectiveness of existing seawater intrusion barriers	425 monitoring and production wells	Semi-annually for all; selected wells monthly; some equipped with pressure transducers and data loggers for twice daily measurements Key parameters include chloride, TDS, electrical conductivity and bromide
SURFACE WATER			
Santa Ana River Monitoring Program	Annual review to affirm that OCWD recharge practices are protective of public health	22 surface water sites	Varying frequencies for general minerals, nutrients, metals, microbial, volatile and semi-volatile organic compounds, total organic halides, radioactivity, perchlorate, chlorate, NDMA, and chemicals of emerging concern.
Basin Monitoring Program Task Force program	Annual report preparation for compliance with Regional Water Board Basin Plan	Compilation of data from all monitoring programs	Collection of data on annual basis
Santa Ana River Watermaster Monitoring	Determine annual baseflow and stormflow and water quality at two locations to comply with judgment on Santa Ana River water rights	Basin-wide data collected by Watermaster parties in the watershed	Monitoring programs in watershed vary depending on individual agencies schedules
Prado Wetlands	Evaluate changes in	Daily flow in	Field parameters

MONITORING PROGRAM	PURPOSE	SCALE	FREQUENCY OF MONITORING
	water quality and effectiveness of wetlands treatment of surface water used for groundwater recharge	and out of wetlands	Biological, inorganic, and organic constituents
Emerging Constituents	Compliance with federal and state regulations	Watershed - wide	Federal or state programs; frequency determined by regulatory requirements
RECYCLED AND IMPORTED WATER			
Recycled Water	Monitor quality of water produced by GWRS	35 monitoring wells	GWRS monitoring wells: Quarterly for general minerals, metals, organics, and microbiological constituents; GWRS final product water: daily & weekly for specific parameters
Recycled Water	Monitor GWRS final product water		Daily or weekly for specific parameters
Imported Water	Monitor water quality of supply used to recharge groundwater basin		General minerals, nutrients, other selected constituents

5.2 GROUNDWATER MONITORING PROGRAMS

OCWD collects samples and analyzes water elevation and water quality data from approximately 400 District-owned monitoring wells (shown in Figure 5-1) and at over 250 privately-owned and publically-owned large and small system drinking water wells that are part of OCWD's Title 22 program, shown in Figure 5-2. OCWD also has access agreements to sample a number of non-District-owned monitoring wells and privately-owned irrigation, domestic and industrial wells, shown in Figure 5-3. Inactive wells are included in District monitoring programs when feasible. An inactive well is defined as a well that is not currently being routinely operated. The number and location of wells that are sampled change regularly as new wells come online and old ones are abandoned and destroyed.

The District collects, stores, and uses data from wells owned and sampled by other agencies. For example, data collected by the Water Replenishment District of Southern California from wells in Los Angeles County along the Orange County boundary are part of the network of wells evaluated to determine annual groundwater elevations and are used for basin modeling. Also included in OCWD's monitoring network are wells that are owned and operated by the U.S.

Navy for remediation of contamination plumes in the cities of Irvine, Seal Beach and Tustin, and wells that are related to operation of the Alamitos Barrier that are located in Los Angeles County. Los Angeles County wells are also used to model the Orange County groundwater basin as groundwater flow is unrestricted across the county line.

Wells sampled under various monitoring programs change in response to fluctuations in the number of available wells, basin conditions, observed water quality, and regulatory and non-regulatory requirements. A comprehensive list of all wells in OCWD's database can be found in Appendix A. This list includes well name, owner, type of well, casing sequence number, depth, screened interval, and aquifer zone monitored, when known.

In some cases well depth and screened intervals are listed on the database as unknown. OCWD maintains data on these wells when water quality or elevation data continues to be collected by the owner or operator. OCWD is able to use data from these wells in monitoring programs, for groundwater modeling, or for other basin programs. Wells on the list also include inactive wells when water quality or water elevation data continues to be collected or the data is utilized in one or more current basin programs. Groundwater elevation and monthly production data are used to quantify total basin pumping, evaluate seasonal groundwater level fluctuations and assess basin storage conditions.

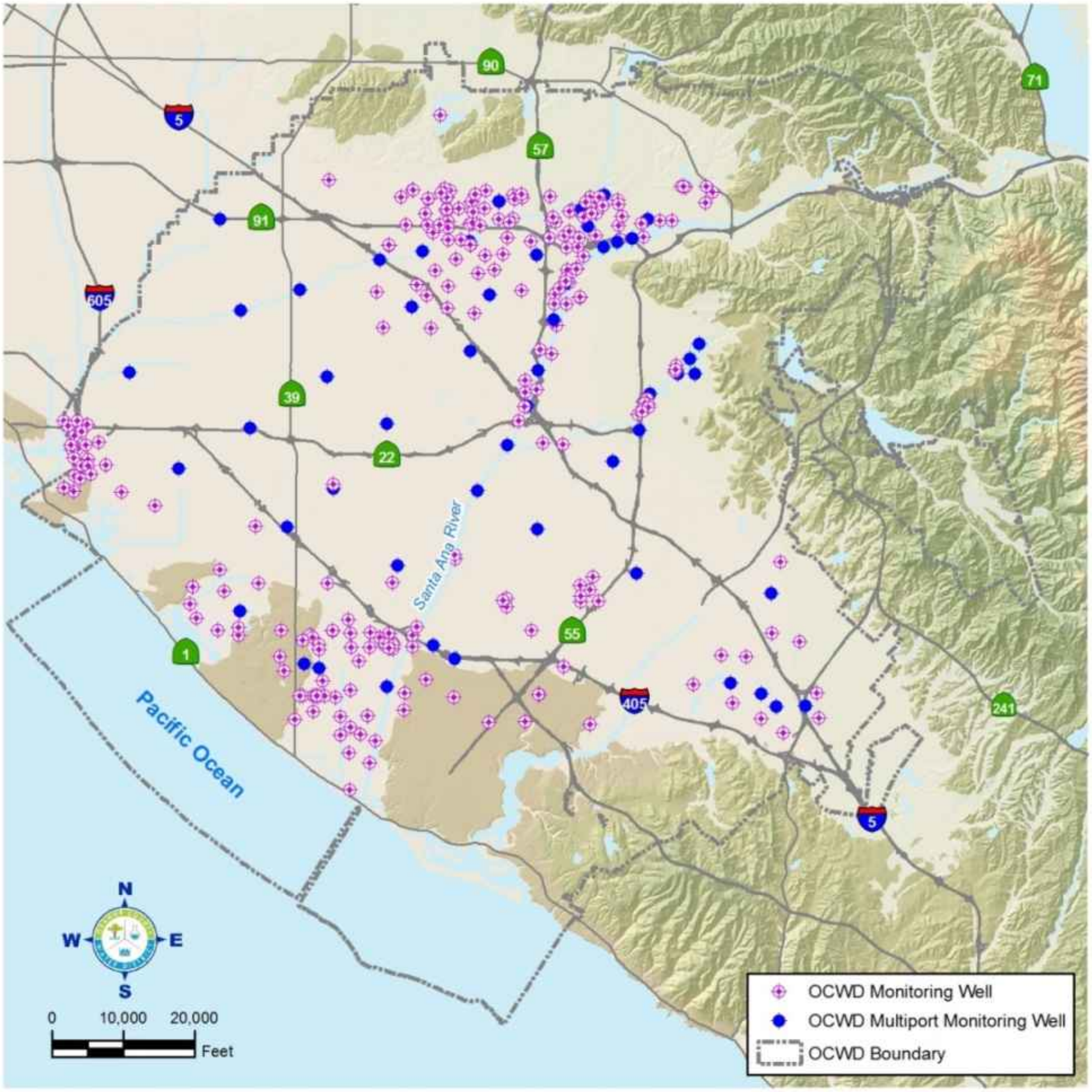


Figure 5-1: OCWD Monitoring Wells

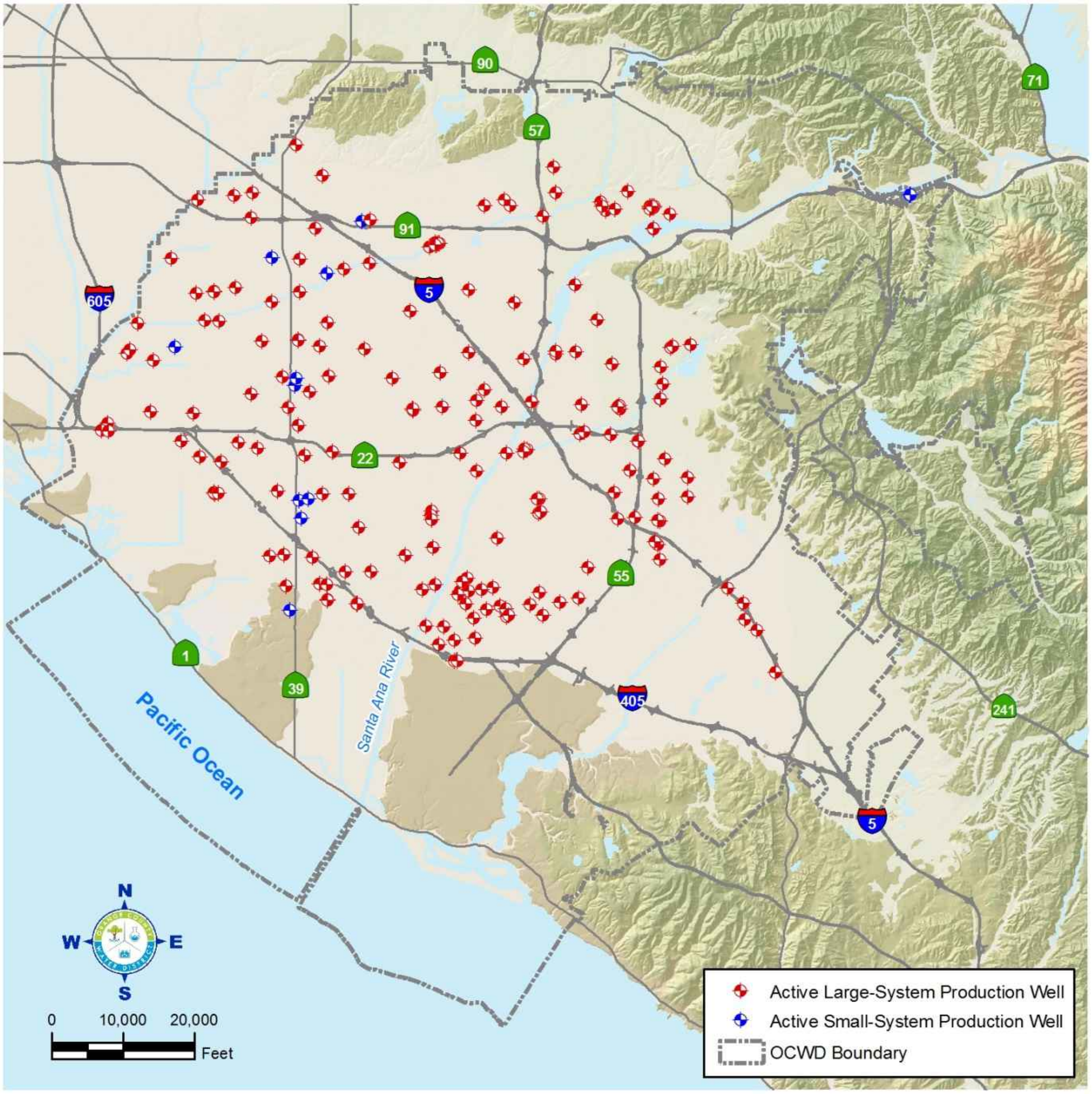


Figure 5-2: Large and Small System Drinking Water Wells in Title 22 Monitoring Program

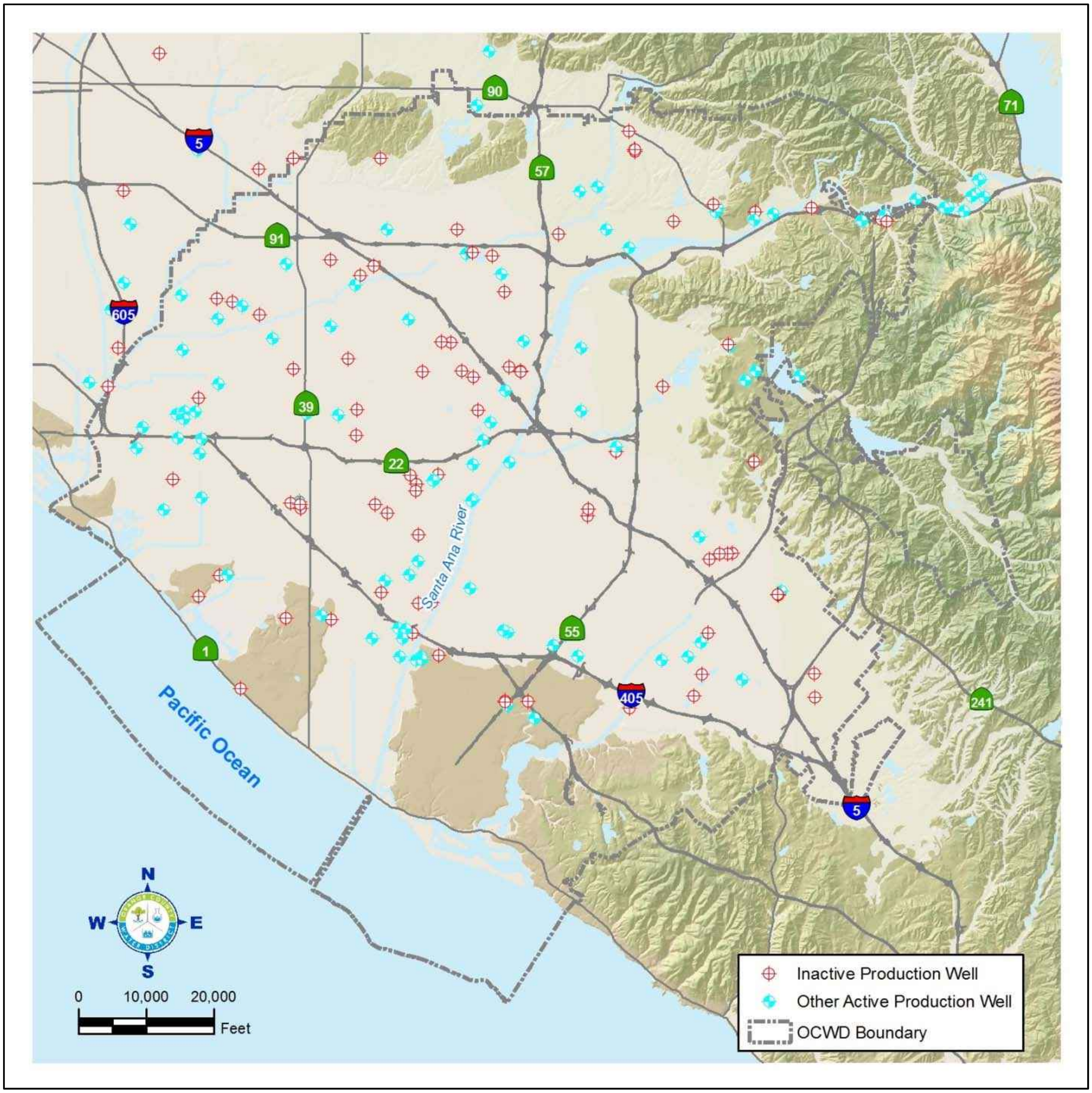


Figure 5-3: Private Domestic, Irrigation and Industrial Wells in OCWD Monitoring Program

5.2.1 Groundwater Production Monitoring

All entities that pump groundwater from the basin are required by the OCWD District Act to report production every six months and pay a Replenishment Assessment. Owners or operators of wells with discharge outlets of two inches in diameter or less and supply an area of no more than one acre pay an annual flat fee instead of the Replenishment Assessment and do not have to report their production.

Approximately 200 large-capacity production wells owned by 19 major water retail agencies account for ninety-seven percent of production. Large-capacity well owners report monthly groundwater production for each of their wells. The production volumes are verified by OCWD field staff. Production data are used to evaluate basin conditions, calculate and manage basin storage, run groundwater model scenarios, and collect revenues. Agricultural production accounts for a small amount of basin pumping. In 2015, irrigation production (including agriculture and nurseries) accounted for less than 2,000 acre-feet.

5.2.2 Groundwater Elevation Monitoring

Production and monitoring wells in the basin are measured for groundwater elevation at varying intervals, as explained below:

- Water elevation measurements are collected for every OCWD monitoring well at least once a year with most wells measured at least monthly;
- Monitoring of production wells is typically monthly but may vary depending on operational status, well maintenance, abandonment, new well construction, and related factors;
- Over 1,000 individual measuring points are monitored for water levels on a monthly or bi-monthly basis to evaluate short-term effects of pumping, recharge or injection operations; and
- Additional monitoring is done as needed in the vicinity of OCWD's recharge facilities, seawater barriers, and areas of special investigation where drawdown, water quality impacts or contamination are of concern.

Beginning in 2011, OCWD began reporting seasonal groundwater elevation measurements to DWR as part of the California Statewide Groundwater Elevation Monitoring (CASGEM) program. OCWD has been designated as the Monitoring Entity for the Orange County Groundwater Basin. Wells monitored under the CASGEM program are listed in Appendix A.

The monitoring well network developed for the CASGEM program and historical and proposed future groundwater elevation monitoring frequency provide a detailed and representative data set, both spatially and temporally. The initial network established in 2011 consisted of a total of 77 monitoring stations distributed laterally and vertically throughout the groundwater basin. Most of the wells are owned by OCWD and have detailed borehole geologic logs and downhole geophysical logs. Figures 5-4 to 5-6 present the monitoring well locations for each of the three aquifer systems. The CASGEM network includes wells within the La Habra-Brea and Santa Ana Canyon Management Areas.

Nearly all of the stations are discretely-screened monitoring wells, with the exceptions being inactive production wells. Many of the monitoring wells are of the "Westbay" or "multi-point" type whereby a single casing with multiple screened intervals is installed in a single borehole. Each screened interval (typically 10 feet long) is hydraulically isolated by permanently installed hydraulic packers inside the blank casing and annular seals outside the blank casing. With few unavoidable exceptions, the wells have known screened intervals, geologic logs, and typically more than 15 years of historical groundwater elevation data. The few wells with unknown screened intervals are the only known wells in their areas and are believed to provide representative groundwater elevation data based on historical measurements and their hydrogeologic setting. Wells in the network are sampled quarterly in order to monitor seasonal trends and amplitude. The quarterly measurements are typically completed within a one- to two-week period. Historical data from the wells within the La Habra-Brea and Santa Ana Canyon Management Areas indicate little seasonal variation in groundwater elevations. Measurements in these areas can be on a reduced scheduled as long as the levels show little variation.

Each monitoring station has been assigned a unique identification name. Most stations have also been assigned a State Well Number, but these are not recommended to be used for the purposes of CASGEM, because State Well Numbers were not assigned to each multi-depth station (or screened interval) and, therefore, are not unique.

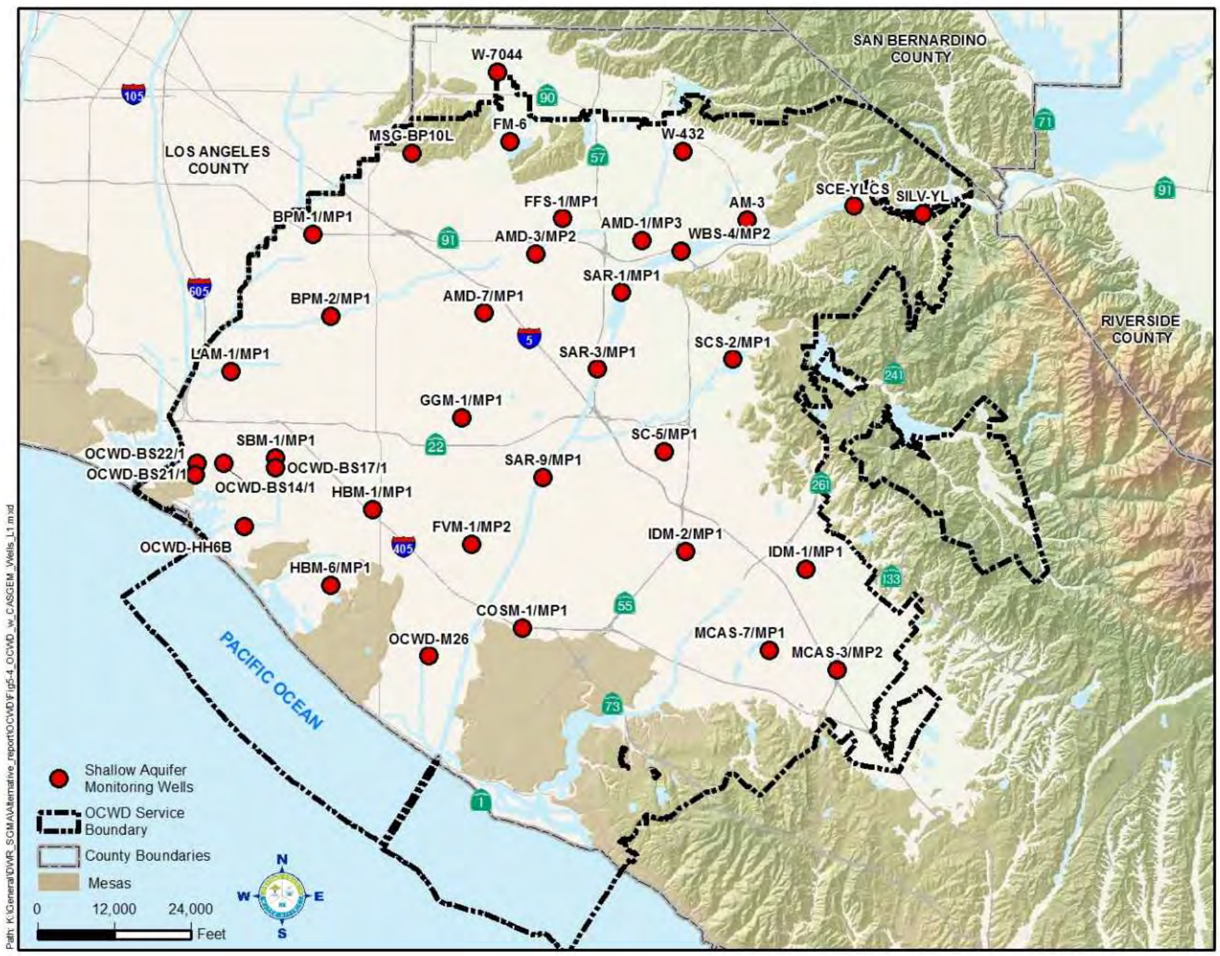


Figure 5-4: CASGEM Shallow Aquifer System Monitoring Well Network

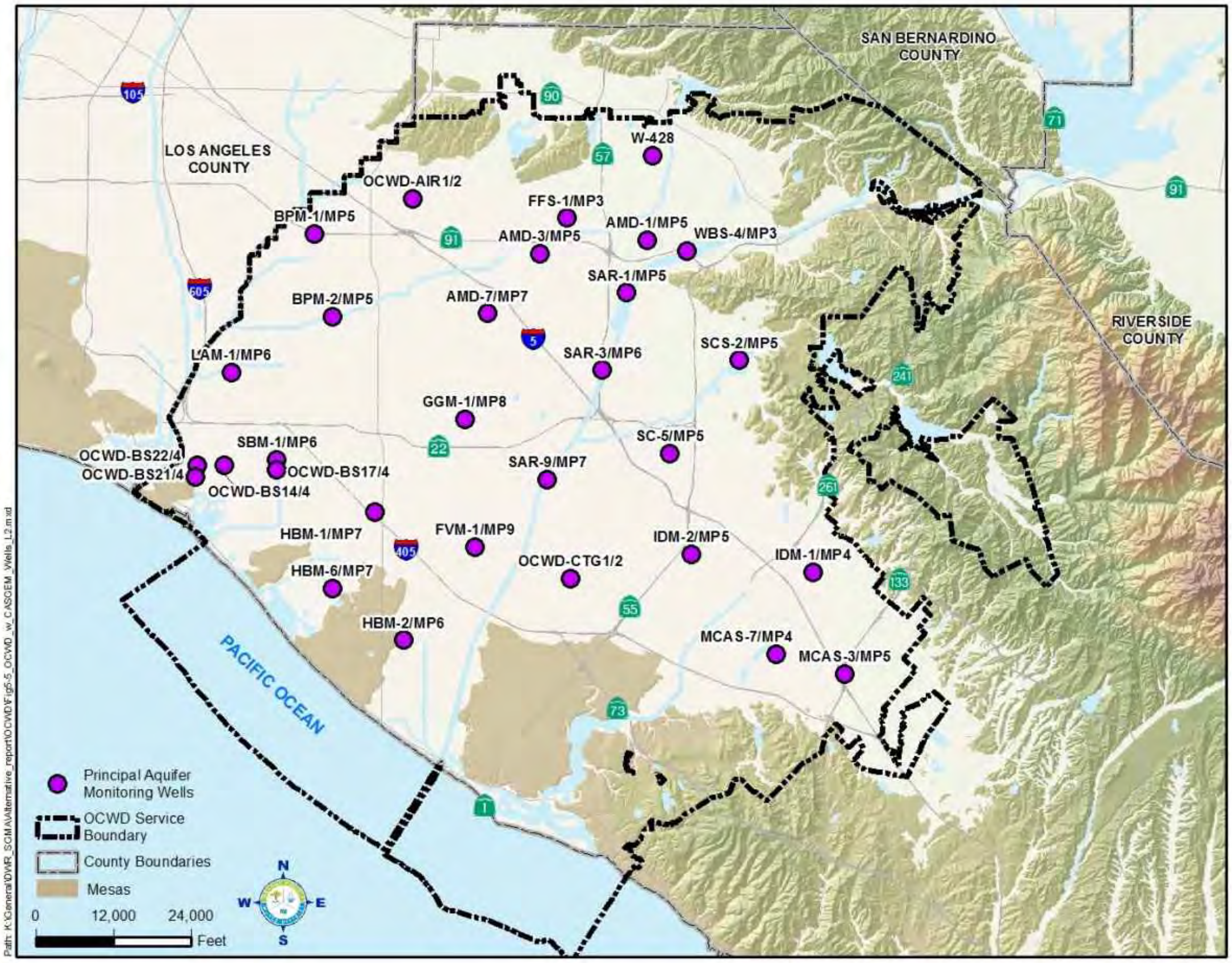


Figure 5-5: CASGEM Principal Aquifer System Monitoring Well Network

The locations of all of the monitoring network wells have been established through a global positioning system with a horizontal accuracy of ±3 feet after data post-processing. The location data are stored in the WRMS database using the projection of State Plane NAD83 California Zone 6, with latitude and longitude available to be reported in either decimal degrees or feet equivalent units.

Each monitoring station has an established reference point description and elevation referenced to the NAVD88 vertical datum. The reference point and ground surface elevations for most of the monitoring stations have been established to the nearest 0.01 foot by licensed surveyors, with elevations for the remaining stations estimated from topographic maps to the nearest foot (±10 feet estimated accuracy). The method of elevation determination for each station reference point is stored and reportable from the database. In the event a reference point elevation changes over time, e.g., a top of casing is raised or lowered, the WRMS database is designed to store historical reference point elevations such that reference point to water level measurements can be converted to an accurate, normalized groundwater elevation over time.

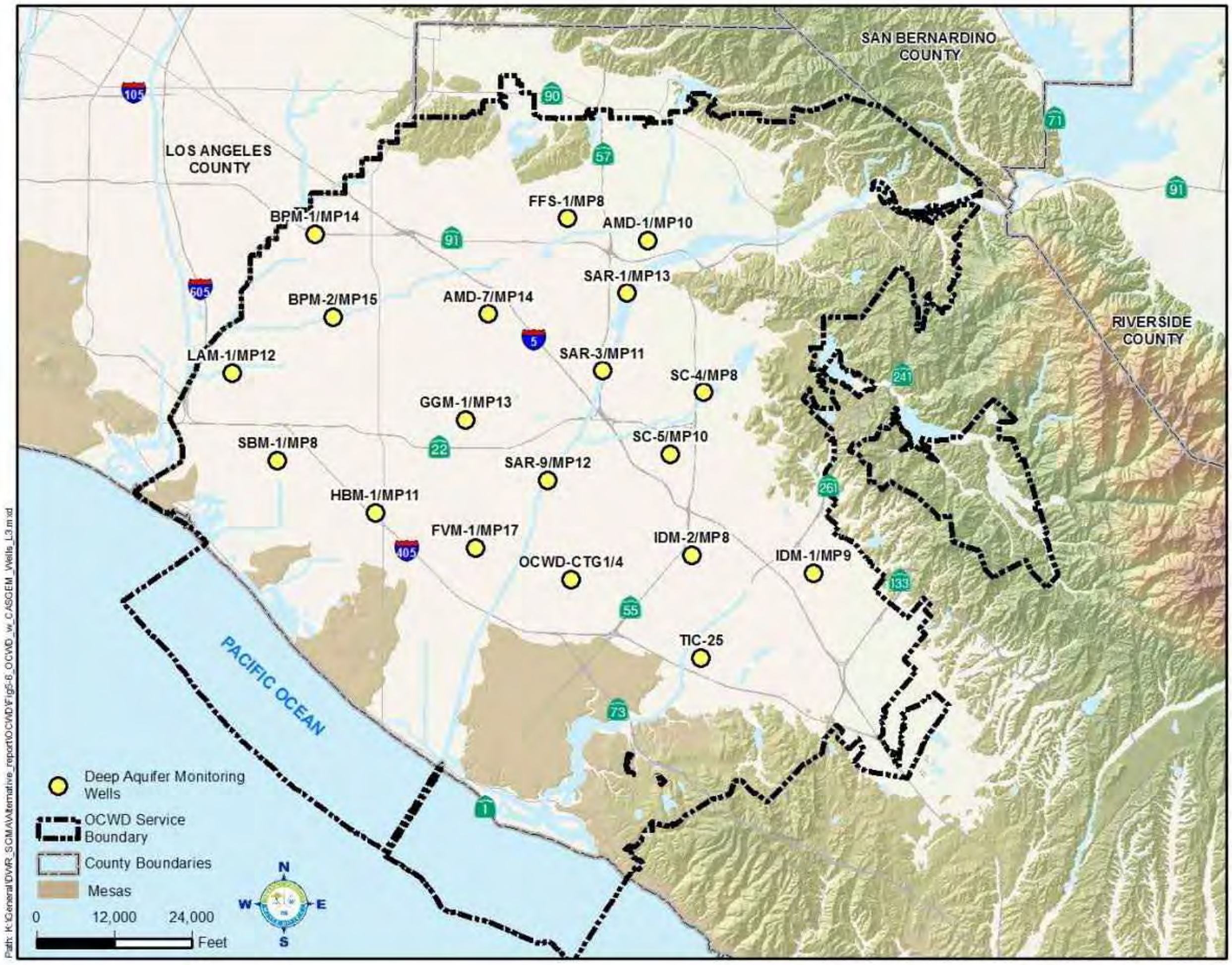


Figure 5-6: CASGEM Deep Aquifer System Monitoring Well Network

5.2.3 Groundwater Quality Monitoring

OCWD monitors water quality in production wells on behalf of the Groundwater Producers for compliance with state and federal drinking water regulations. Samples are analyzed for more than 100 regulated and unregulated chemicals at frequencies established by regulation as shown in Table 5-2. Over 425 monitoring and production wells are sampled semi-annually to assess water quality conditions during periods of lowest (winter) and peak production (summer).

The total number of water samples analyzed varies year-to-year due to regulatory requirements, conditions in the basin and applied research and/or special study demands. In 2015, over 15,000 samples were collected by the Water Quality Department and analyzed at OCWD's state-certified Water Quality Assurance Laboratory, of which 20% were for drinking water. OCWD developed specific programs to monitor the North Basin and South Basin plumes, shown in Figures 5-7 and 5-8.

Continual monitoring of groundwater near the coast is done to assess the effectiveness of the Alamitos and Talbert Barriers and track salinity levels in the Bolsa and Sunset Gaps. Key groundwater monitoring parameters used to determine the effectiveness of the barriers include water level elevations, chloride, TDS, electrical conductivity, and bromide. Groundwater elevation contour maps for the aquifers most susceptible to seawater intrusion are prepared to evaluate whether or not the freshwater mound developed by the barrier injection wells is sufficient to prevent the inland movement of saline water.

OCWD's extensive network of monitoring wells within the groundwater basin includes concentrated monitoring along the seawater barrier and near the recharge basins. GWRS-related monitoring wells in the vicinity of Kraemer, Miller, and Miraloma basins are used to measure water levels and to collect water quality samples. In addition to ensuring the protection of water quality, these wells have been used to determine travel times from recharge basins to production wells.

Permits regulating operation of GWRS require adherence to rigorous product water quality specifications, extensive groundwater monitoring, buffer zones near recharge operations, reporting requirements, and a detailed treatment plant operation, maintenance and monitoring program. GWRS product water is monitored daily, weekly, and quarterly for general minerals, metals, organics, and microbiological constituents. Focused research-type testing has been conducted on organic contaminants and selected microbial species.

Table 5-2: Monitoring of Regulated and Unregulated Chemicals in Production Wells

<table>
<tr><th colspan="3">CA SWRCB Division of Drinking Water (DDW)
Title 22 Drinking Water: Groundwater Source Monitoring Frequency - Regulated Chemicals</th></tr>
<tr><th>Chemical Class</th><th>Frequency</th><th>Monitoring Notes</th></tr>
<tr><td>Inorganic - General Minerals</td><td>Once every 3 years</td><td></td></tr>
<tr><td>Inorganic - Trace Metals</td><td>Once every 3 years</td><td></td></tr>
<tr><td>Nitrate and nitrite</td><td>Annually</td><td>New wells sampled quarterly for 1st year</td></tr>
<tr><td>Detected ≥ 50% MCL</td><td>Quarterly</td><td></td></tr>
<tr><td>Perchlorate</td><td></td><td>New wells sampled quarterly for 1st year</td></tr>
<tr><td>Detected ≥ DLR</td><td>Quarterly</td><td>State Detection limit = 4 ppb; OCWD RDL = 2.5 ppb</td></tr>
<tr><td>Non-detect at < DLR</td><td>Once every 3 years</td><td></td></tr>
<tr><td>Volatile organic chemicals (VOC)</td><td>Annually</td><td>New wells sampled quarterly for 1st year</td></tr>
<tr><td>Detected VOC</td><td>Quarterly</td><td></td></tr>
<tr><td>Synthetic organic chemicals (SOC)</td><td></td><td>New wells sampled quarterly for 1st year; if non-detect, susceptibility waiver for 3 years</td></tr>
<tr><td>Simazine</td><td>Once every 3 years</td><td>Must sample 2 consecutive quarters once every 3 years</td></tr>
<tr><td>Radiological</td><td></td><td>New wells sampled quarterly for 1st year (initial screening) to determine reduced monitoring frequency for each radionuclide</td></tr>
<tr><td>Detected at > 1/2 MCL to MCL</td><td>Once every 3 years</td><td>Per radionuclide</td></tr>
<tr><td>Detected at ≥ DLR ≤ 1/2 MCL</td><td>Once every 6 years</td><td>Per radionuclide</td></tr>
<tr><td>Non-detect at < DLR</td><td>Once every 9 years</td><td>Per radionuclide</td></tr>
<tr><th colspan="3">EPA and DDW Unregulated Chemicals</th></tr>
<tr><td>DDW : 4-Inorganic and 5-Organic chemicals</td><td rowspan="7"><u>Two required GW samples:</u>
(1) Vulnerable period: May-Jun-Jul-Aug-Sep
(2) 5 to 7 months before or after the sample collected in the vulnerable period. No further testing after completing the two required sampling events</td><td>Monitoring completed for existing wells in 2001-2003; new wells tested during 1st year of operation</td></tr>
<tr><td>EPA UCMR1 - List 1: 1-Inorganic and 10-Organic chemicals</td><td rowspan="2">UCMR1 program completed Jan 2001 - Dec 2003</td></tr>
<tr><td>EPA UCMR1 - List 2: 13-Organic chemicals</td></tr>
<tr><td>EPA UCMR2 - List 1: 10 Organic chemicals</td><td rowspan="2">UCMR2 program completed Jan 2008 - Dec 2010</td></tr>
<tr><td>EPA UCMR2 - List 2: 15 Organic chemicals</td></tr>
<tr><td>EPA UCMR3 List 1: 7-Inorganic and 14-Organic chemicals</td><td>All water utilities serving >10,000 people. Monitoring period: Jan 2013 - Dec 2015</td></tr>
<tr><td>EPA UCMR3 List 2: 7-Organic chemicals (Hormones)</td><td>All water utilities serving population >100,000 and EPA selected systems serving <100,000 population. Monitoring period: Jan 2013 - Dec 2015</td></tr>
</table>

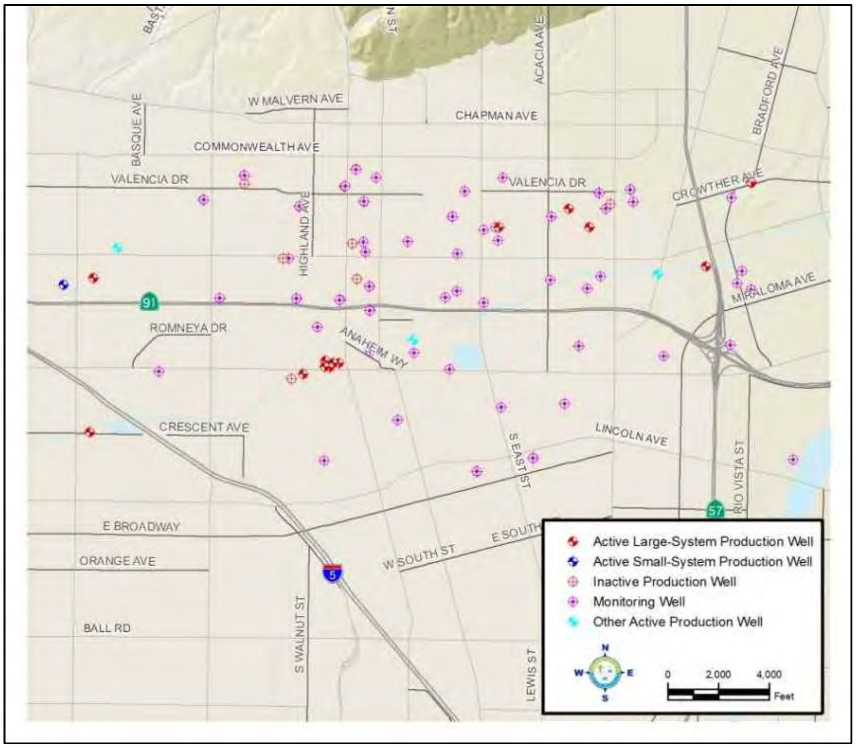


Figure 5-7: North Basin Monitoring Wells

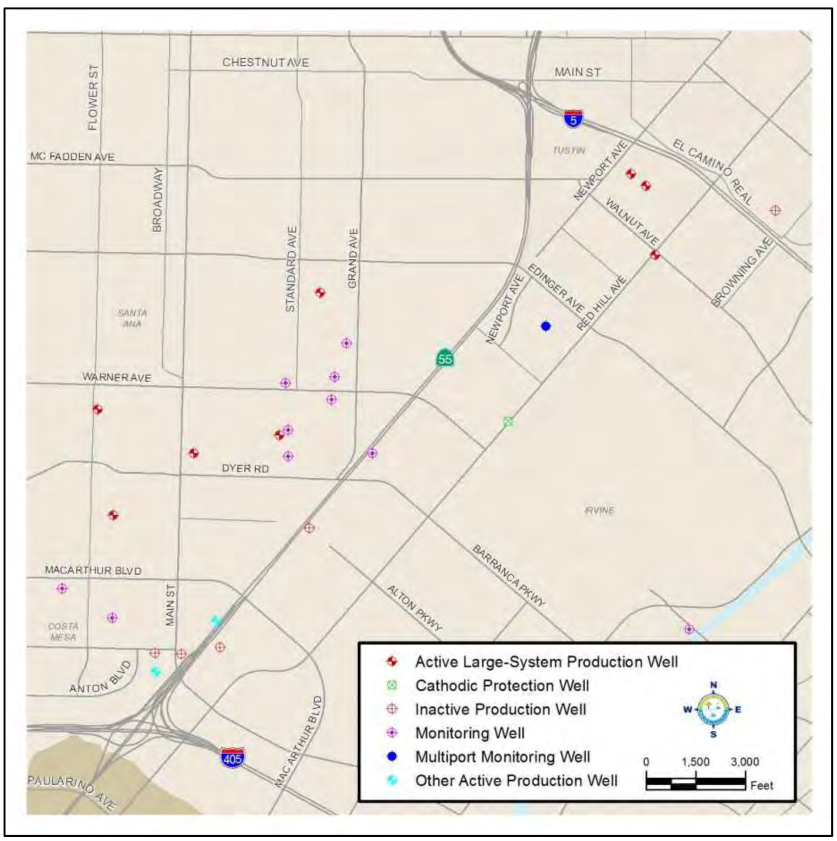


Figure 5-8: South Basin Monitoring Wells

5.2.4 Coastal Area Monitoring

OCWD operates and maintains a network of coastal area monitoring wells that provide water level and water quality data that allow staff to evaluate the performance of seawater intrusion barriers and to identify potential intrusion in coastal areas. The monitoring well network has been expanded and improved over time based on new information and a greater understanding of the basin hydrogeology.

In addition to obtaining groundwater level and quality data from the coastal monitoring well network, valuable geologic information is gained whenever a new well is drilled. Analysis of lithologic logs and geophysical logs produced during well drilling helps fill in data gaps and better define the structure of the underlying strata, such as the depth, thickness, and composition of the various aquifer zones susceptible to seawater intrusion. This geologic information, coupled with groundwater level and quality data, has led to an improved and refined conceptual model of Orange County coastal stratigraphy and characterization of seawater intrusion in the area.

Approximately 200 monitoring and production well sites are monitored for groundwater levels and quality within a 4- to 5- mile area from the coast, generally seaward or south of the 405 freeway, as shown in Figure 5-9. The monitoring wells are largely located in the coastal gaps as well as on the coastal mesas. The mesas are not impermeable features; rather, the marine deposition Pleistocene aquifers extend beneath the mesas to the basin production wells and provide potential avenues for seawater intrusion.

OCWD conducts the groundwater monitoring for the majority of the monitoring wells with the exception of the Alamitos Barrier monitoring wells. The Alamitos Seawater Intrusion Barrier is located along the border of Los Angeles and Orange counties and is jointly owned by OCWD and LACDPW. LACDPW operates, maintains, and samples Alamitos Barrier monitoring and injection wells, including those owned by OCWD located within Orange County. Through an interagency cooperative agreement dating to 1964, operational costs and data are shared between the two agencies with a joint report on the status of the barrier prepared on an annual basis.

Most of the monitoring wells shown in Figure 5-9 are owned by OCWD and are either single-point or nested. Single-point monitoring wells have one screened interval in one targeted aquifer zone, while nested wells have multiple (2 to 6) casings within the same borehole, with each casing screened in a separate aquifer zone at a discrete depth. A handful of OCWD monitoring wells in the coastal area are Westbay multi-port type, having only one well casing but with multiple monitoring ports each separated by inflatable packers. Therefore, although there are approximately 200 monitoring and production well sites in the coastal groundwater monitoring program, there are as many as 436 individual sampling points.

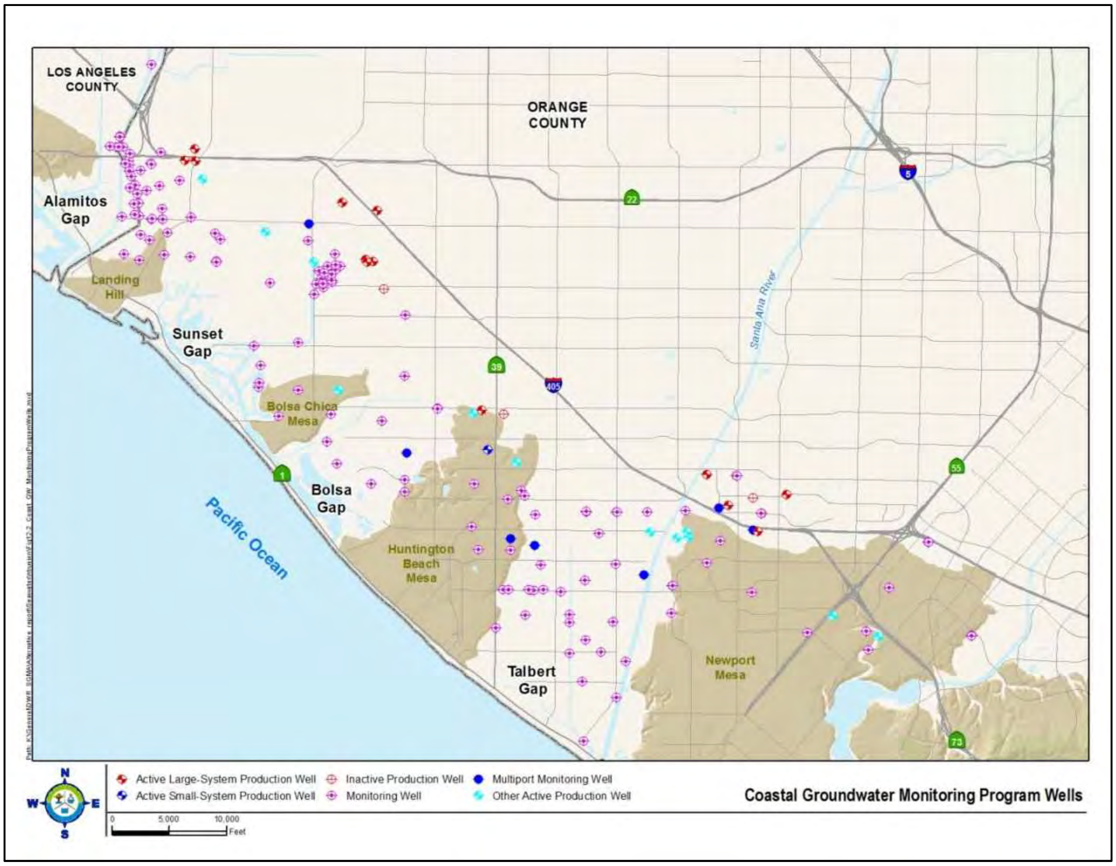


Figure 5-9: Seawater Intrusion Monitoring Wells

In addition to OCWD monitoring wells, there are a few privately owned monitoring wells and active municipal production wells included in OCWD's coastal monitoring program. For example, in Sunset Gap there are a few monitoring wells owned by The Boeing Company (Boeing) related to a shallow VOC plume in the area; Boeing monitors these wells twice a year (groundwater levels and VOCs), and OCWD obtains split samples with Boeing for seawater intrusion monitoring. The retail water agency production wells in the coastal monitoring program include three wells inland of the Alamitos Barrier (City of Seal Beach and Golden State Water Company) and three wells just inland of Sunset Gap (City of Huntington Beach). A complete list of all wells in the coastal groundwater monitoring program, along with their screened interval depths, can be found in Appendix A.

Groundwater levels are measured bi-monthly (every 2 months) at the majority of coastal monitoring wells, with many wells done monthly where seasonally changing gradients and protective elevations must be evaluated throughout the year to evaluate the potential for intrusion and the effectiveness of injection barrier operations at the Alamitos and Talbert barriers. In addition, several key coastal wells are also equipped with pressure transducers connected to automated data loggers that are downloaded regularly and record twice-daily groundwater level readings.

Nearly all of the coastal monitoring wells are sampled semi-annually (March and September) for key groundwater quality parameters to assess seawater intrusion and barrier operations. Some wells in the immediate vicinity of the injection barriers are sampled more frequently (e.g., quarterly) to track injection water pathways and travel times, per the permit requirements for the direct injection of purified recycled water. Key groundwater quality parameters analyzed for the coastal monitoring program include chloride, bromide, and electrical conductivity (EC), which is a surrogate for TDS. The EC is typically measured both in the field at the time of sampling and in the laboratory.

Dissolved chloride concentrations and EC are used both to track seawater intrusion and to trace the injection of purified recycled water at the barriers, especially the Talbert Barrier in which the injection supply consists of 100 percent recycled water having a much lower salinity signal than native fresh groundwater. Chloride is considered to be a good conservative intrinsic tracer since it is relatively unaffected by sorption- and chemical-, or biological reactions in the subsurface. Bromide concentrations in brackish groundwater samples are valuable to help determine the origin or source of intrusion by evaluating the chloride to bromide ratio. Chloride to bromide ratios in the range of 280-300 in brackish coastal samples suggest relatively young active intrusion from the ocean or water body connected to the ocean, whereas lower ratios may indicate intrusion from past oil brine disposal or an influence of very old connate water from the original marine depositional process when these coastal aquifers were first formed.

5.3 SURFACE WATER AND RECYCLED WATER MONITORING

Surface water from the Santa Ana River is a major source of recharge supply for the groundwater basin. As a result, the quality of the surface water has a significant influence on groundwater quality. Therefore, characterizing the quality of the river and its effect on the basin is necessary to verify the sustainability of continued use of river water for recharge and to safeguard a high-quality drinking water supply for Orange County. Several on-going programs monitor the condition of Santa Ana River water. OCWD monitoring sites along the river and its tributaries are shown in Figure 5-10.

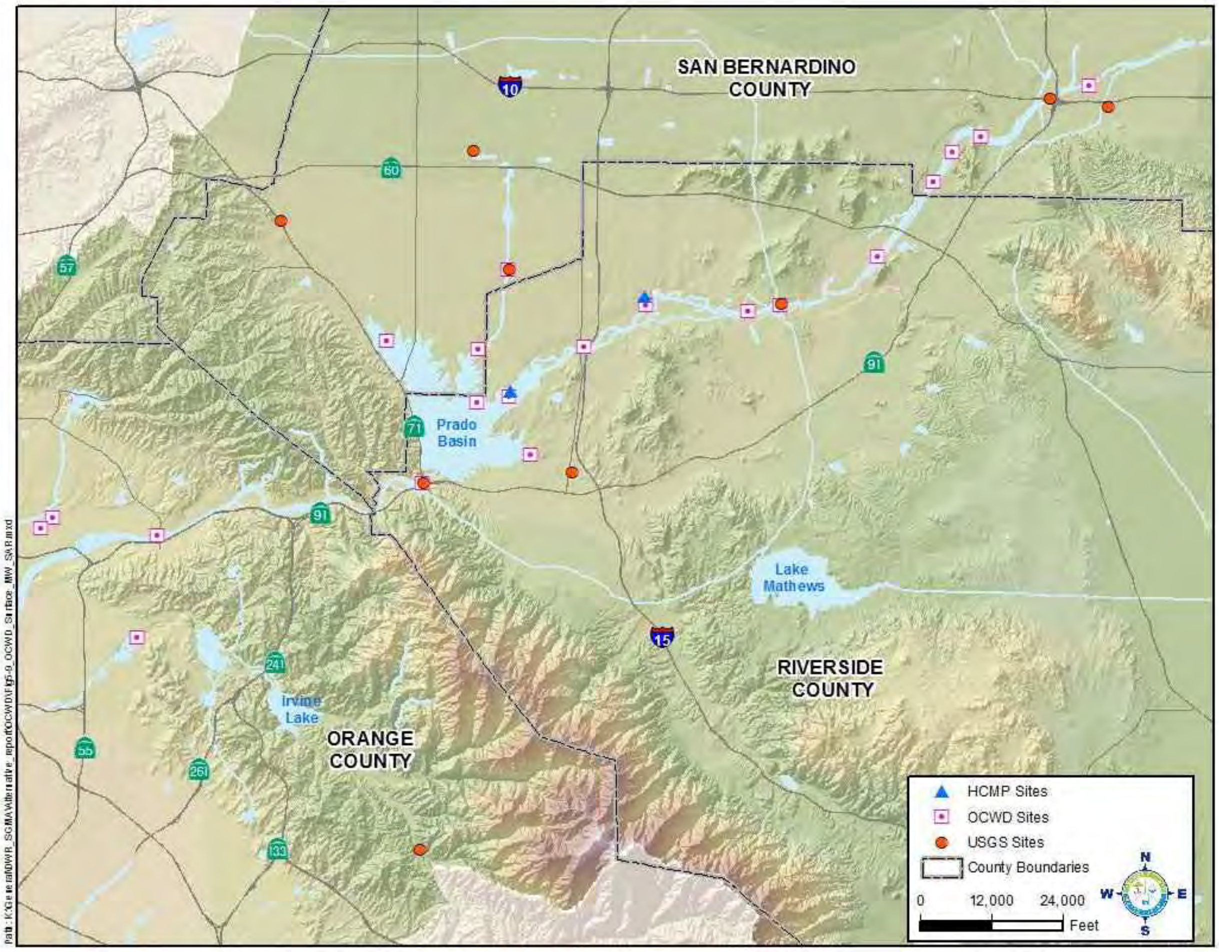


Figure 5-10: Surface Water Monitoring Locations

5.3.1 Surface Water Monitoring Programs

SARMON Monitoring

OCWD implements a comprehensive surface water and groundwater monitoring program, referred to as the Santa Ana River Monitoring (SARMON) Program. Monitoring activities include sites on the Santa Ana River, Anaheim Lake, Miraloma Basin, and Santiago Basin, as well as selected monitoring wells downgradient from the recharge basins to provide data on travel time, to assess water quality changes and ensure the continued safety of recharging Santa Ana River water into the groundwater basin.

On-going monthly surface water monitoring of the Santa Ana River is conducted at Imperial Highway near the diversion of the river to the off-river recharge basins and at a site below Prado Dam. Sampling frequencies for selected river sites and recharge basins are shown in Table 5-3.

Table 5-3: Surface Water Quality Sampling Frequency within Orange County
(A= annual, S= semi-annual, M = monthly, Q = quarterly)

CATEGORY	SAR Below Dam	SAR Imperial Hwy	Anaheim Lake	Miraloma Basin	Santiago Basins
General Minerals	M	M	Q	Q	M
Nutrients	M	M	Q	Q	M
Metals	Q	Q	Q	Q	Q
Microbial	M	M	Q	M	M
Volatile Organic Compounds (VOC)	Q	M	Q	Q	M
Semi-Volatile Organic Compounds	Q	Q	Q	Q	Q
Total Organic Halides (TOX)	M	M	Q	--	M
Radioactivity	Q	Q	Q	--	Q
Perchlorate	M	M	Q	Q	M
Chlorate	Q	M	Q	Q	M
NDMA Formation Potential (NDMA-FP)	--	S	--	--	--
Chemicals of Emerging Concern (CEC)*	Q	Q	Q	Q	Q

*Imperial Highway samples are tested for a full suite of CECs. The other sites are tested for a reduced list of analytes.

Basin Monitoring Program Annual Report of Santa Ana Water Quality

The Basin Monitoring Program Task Force (Task Force) monitors levels of Total Inorganic Nitrogen (TIN) and Total Dissolved Solids (TDS) in groundwater basins in the Santa Ana River Watershed. The Task Force is a group of 22 water and wastewater agencies in the watershed that conducts this work under the direction of the Regional Water Board. The Board requires that the Task Force prepare an annual report of the Santa Ana River water quality. Sampling locations used for this program include sites, shown in Figure 5-10, sampled by OCWD, USGS, and the Chino Basin Watermaster/Inland Empire Utilities Agency for the Hydrologic Control Monitoring Program (HCMP).

Santa Ana River Watermaster Monitoring

The Santa Ana River Watermaster produces an annual report in fulfillment of requirements of the Stipulated Judgment in the case of Orange County Water District v. City of Chino, et al., Case No. 117628-County of Orange, entered by the court on April 17, 1969. The Judgment settled water rights between entities in the Lower Area of the Santa Ana River Basin downstream of Prado Dam against those in the Upper Area tributary to Prado Dam. The court-appointed Watermaster Committee consists of representatives of the Orange County Water District representing the Lower Area and San Bernardino Municipal Water District, Western Municipal Water District, and the Inland Empire Utilities Agency, representing the Upper Area.

The Watermaster annually compiles the basin hydrologic and water quality data necessary to determine compliance with the provisions of the Judgment. The data include records of stream discharge (flow) and quality for the Santa Ana River at Prado Dam and at Riverside Narrows as well as discharges for most tributaries; flow and quality of non-tributary water entering the river; rainfall records at locations in or adjacent to the watershed; and other data that may be used to support the determinations of the Watermaster.

Data collected by the USGS at two gaging stations, “Santa Ana River below Prado” and “Santa Ana River at Metropolitan Water District Crossing” are used. Discharge data at both stations consists of computed daily mean discharges based on continuous recordings and daily maximum and minimum and mean values for EC measured as specific conductance and monthly measured values for total dissolved solids.

Stream gage data collected by the USGS at the following gaging stations are also used: Santa Ana River at E Street in San Bernardino, Chino Creek at Schaefer Avenue, Cucamonga Creek near Mira Loma, and Temescal Creek in the City of Corona. Precipitation data is collected at the USGS Gilbert Street Gage in San Bernardino and by OCWD in Orange County.

Emerging Constituents

OCWD participated in a watershed-wide Emerging Constituents Monitoring Program administered by the Santa Ana Watershed Project Authority. This group was formed in 2010 to characterize emerging constituents in 1) municipal wastewater effluents, 2) the Santa Ana River at various locations, and 3) imported water. Three years of testing (2011-2013) were completed as directed by the Regional Water Quality Control Board (R8-2009-0071). OCWD monitored two sites twice a year on the Santa Ana River for this program. Watershed-wide testing may be conducted in the future.

OCWD monitors two surface water sites monthly on the Santa Ana River and at groundwater monitoring wells downgradient of the recharge area. In addition, OCWD sampled for emerging constituents at the diversion into the Prado Wetlands once during the winter and fall and monthly from spring through summer as part of a focused research study.

For the GWRS, OCWD performs the emerging constituents monitoring required by its Regional Water Board permit and by the Amended Recycled Water Policy adopted by the State Water Resources Control Board in 2013. Samples are analyzed for pharmaceuticals, endocrine disruptors and other emerging constituents such as personal care products, food additives, pesticides and industrial chemicals.

Metropolitan Water District of Southern California Imported Water

Imported water purchased by OCWD from the Metropolitan Water District of Southern California (MWD) is monitored for general minerals, nutrients and other selected constituents. OCWD may also monitor metals, volatile organics and select semi-volatile organics (e.g., pesticides and herbicides). MWD performs its own comprehensive monitoring and provides data to the District upon request.

5.3.2 Recycled Water Monitoring

Performance of the GWRS is monitored on a routine basis. Annual GWRS reports are prepared by a diplomate of the American Academy of Environmental Engineering and an Independent Advisory Panel (IAP) to document ongoing scientific peer review. The IAP analyzes data in OCWD's Annual GWRS Report as well as water quality data collected throughout the groundwater basin. The IAP is appointed and administered by the National Water Research Institute to provide credible, objective review of all aspects of GWRS by scientific and engineering experts. In addition to formal written reports, the IAP also offers suggestions for enhancing monitoring of water quality, improving the efficiency of current GWRS technologies and evaluating future projects associated with the GWRS.

Use of GWRS water is regulated by the Regional Water Board and the Division of Drinking Water. Monitoring is performed at the WRD-owned Leo J. Vander Lans Advanced Water Treatment Facility that supplies recycled water to the Alamitos Seawater Barrier for injection.

To comply with the permit to operate the GWRS, groundwater samples are taken from 35 monitoring wells at nine sites to monitor GWRS water after percolation or injection. Samples are also taken from wells downgradient and along the groundwater flow path to collect data for long-term analysis of the effect of using GWRS supply for groundwater recharge. The location of these wells is shown in Figure 5-11. Monitoring frequencies are shown in Table 5-4.

Because of the low concentration of salts in GWRS water, OCWD initiated a Metals Mobilization Study to analyze for trace metals in selected wells near and downgradient of basins used for recharge of GWRS water. The GWRS Independent Advisory Panel recommended this study to evaluate the potential of GWRS water to alter existing groundwater geochemical equilibria, such as causing metals currently bound to aquifer sediments to be released when GWRS water mixes with an aquifer matrix that is in equilibrium with the ambient groundwater.

OCWD is investigating the feasibility of injecting 100 percent GWRS water directly into the Principal Aquifer in the central part of the basin. The Mid-Basin Injection Demonstration Project consists of a test injection well (MBI-1) along with seven nearby monitoring wells (SAR-10/1-4 and SAR-11/1-3) located approximately three miles north of the Talbert Barrier, along the GWRS pipeline at the Santa Ana River and Edinger Avenue in Santa Ana.

Ambient water quality conditions are monitored in the vicinity of the demonstration project to establish a water quality baseline to evaluate the potential of metals mobilization upon injection of GWRS water and to access any other water quality changes should they occur once injection of GWRS water at the site commences. Samples are analyzed for microbial, general minerals, trace metals, semi-volatile organic compounds, and radiological constituents. Data from this Mid-Basin Injection Demonstration Project will support the design and permitting of future additional wells in the basin.

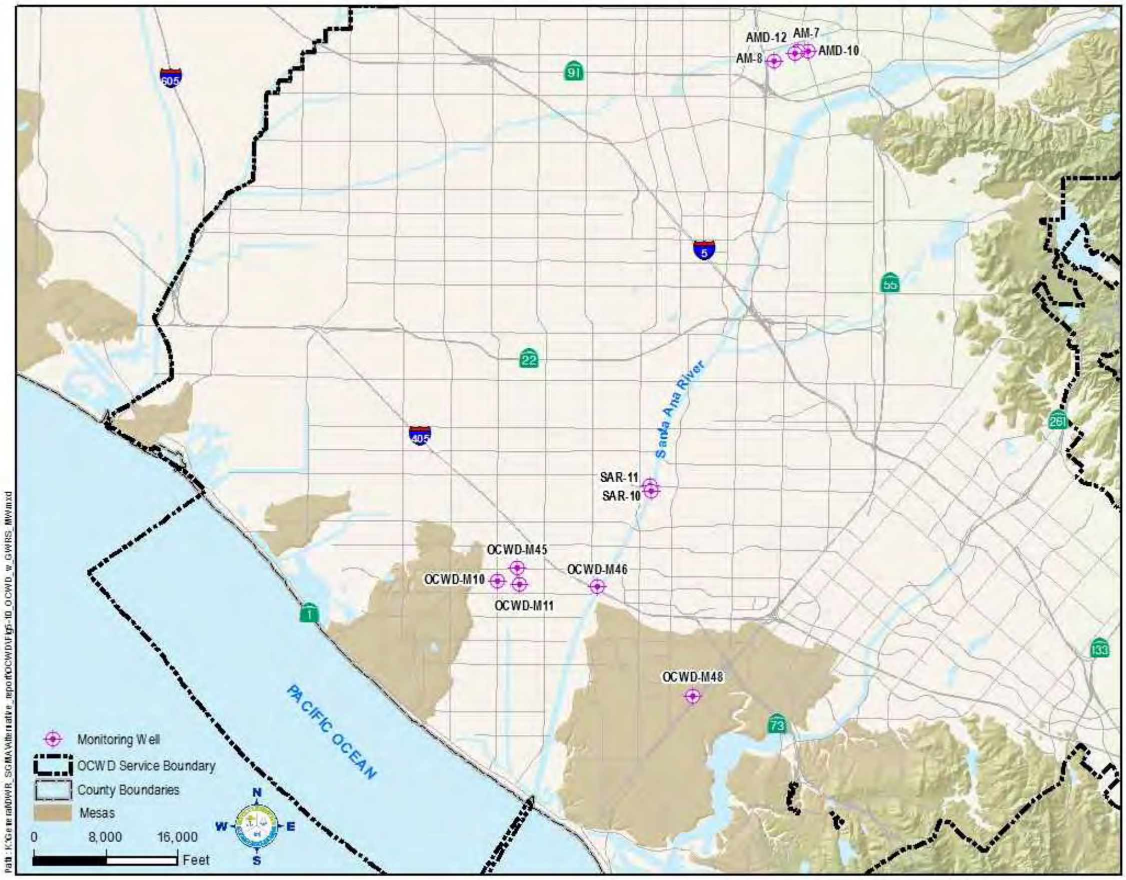


Figure 5-11: Recycled Water Monitoring Wells

Table 5-4: Groundwater Replenishment System Product Water Quality Monitoring

CATEGORY	TESTING FREQUENCY
General Minerals	monthly
Nitrogen Species (NO3, NO2, NH3, Org-N)	twice weekly
TDS	weekly
Metals	quarterly
Inorganic Chemicals	quarterly
Microbial	daily
Total Organic Carbon (TOC)	daily
Non-volatile Synthetic Organic Compounds (SOCs)	quarterly
Disinfection Byproducts	quarterly
Radioactivity	quarterly
Emerging Constituents	quarterly

SECTION 6 WATER RESOURCE MANAGEMENT PROGRAMS

6.1 LAND USE ELEMENTS RELATED TO BASIN MANAGEMENT

The OCWD Management Area is highly urbanized. Monitoring potential impacts from proposed new land uses and planning for future development are key management activities essential for sustainable management of the groundwater basin.

OCWD monitors, reviews and comments on local land use plans and environmental documents such as Environmental Impact Reports, Notices of Preparation, amendments to local General Plans and Specific Plans, proposed zoning changes, draft Water Quality Management Plans, and other land development plans. District staff also review draft National Pollution Discharge Elimination System and waste discharge permits issued by the Regional Water Board. The proposed projects and programs may have elements that could cause short- or long-term water quality impacts to source water used for groundwater replenishment or have the potential to degrade groundwater resources. Monitoring and reviewing waste discharge permits provides OCWD with insight on activities in the watershed that could affect water quality.

The majority of the basin's land area is located in a highly urbanized setting and requires tailored water supply protection strategies. Reviewing and commenting on stormwater permits and waste discharge permits adopted by the Regional Water Board for the portions of Orange, Riverside and San Bernardino counties that are within the Santa Ana River watershed are conducted by OCWD on a routine basis. These permits can affect the quality of water in the Santa Ana River and other water bodies, thereby impacting groundwater quality in the basin.

OCWD works with local agencies having oversight responsibilities on the handling, use and storage of hazardous materials; underground tank permitting; well abandonment programs; septic tank upgrades; and drainage issues. Participating in basin planning activities of the Regional Water Board and serving on technical advisory committees and task forces related to water quality are also valuable activities to protect water quality.

6.1.1 Summary of Plans Related to Basin Management

Municipal Stormwater Permit

The municipal separate storm sewer systems (MS4) permit (Order R-8-2009-0030) was adopted by the Regional Water Board with specific requirements for new development and significant redevelopment to manage stormwater on-site. Low impact development (LID) is a stormwater management strategy that emphasizes conservation and use of existing site features integrated with distributed stormwater controls. The strategy is designed to mimic natural hydrologic patterns of undeveloped sites as opposed to traditional stormwater management controls. LID includes both site design and structural measures used to manage stormwater on a particular development site.

The MS4 permit requires that any new development or significant re-development project consider groundwater conditions as part of the preparation of a Project Water Quality Management Plan (WQMP). The County of Orange prepared a Model WQMP to explain the requirements and types of analyses that are required in preparing a Conceptual/Preliminary or Project WQMP in compliance with the permit. A Technical Guidance Document (TGD) was prepared as a technical resource companion to the Model WQMP.

To assist municipalities in implementing the stormwater program, the county prepared detailed maps showing areas where infiltration potentially is feasible and areas where infiltration is likely to be infeasible due to soil conditions, high groundwater, potential for landslides, and groundwater contamination. These maps are included as Figure XVI.2 in Appendix XVI of the Technical Guidance Document that can be found at: http://cms.ocgov.com/gov/pw/watersheds/documents/wqmp/default.asp

A permit condition requires that municipalities consult with the applicable groundwater management agency in reviewing on-site project plans that propose to infiltrate storm water on-site. As such, OCWD reviews these plans within OCWD boundaries to evaluate potential impacts to groundwater quality due to infiltration of stormwater at particular sites.

The TGD contains specific criteria to protect groundwater quality as part of local efforts to manage stormwater infiltration. The depth to seasonal high groundwater table beneath the project may preclude on-site infiltration of stormwater. In areas with known groundwater and soil contamination, infiltration may need to be avoided if it could contribute to the movement or dispersion of soil or groundwater contamination or adversely affect ongoing cleanup efforts. Potential for contamination due to infiltration is dependent on a number of factors including local hydrogeology and the chemical characteristics of the pollutants of concern. If infiltration is under consideration in areas where soil or groundwater pollutant mobilization is a concern, a site-specific analysis must be conducted to determine where infiltration-based BMPs can be used without adverse impacts.

Criteria for infiltration related to protection of groundwater quality include:

- Minimum separation between the ground surface and groundwater including guidance for calculating mounding potential
- Categorization of infiltration BMPs by relative risk of groundwater contamination
- Pollutant sources in the tributary watershed and pretreatment requirements
- Setbacks from known plumes and contaminated sites
- Guidelines for review by applicable groundwater management agencies

North Orange County Integrated Regional Water Management Plan

This plan was prepared by the County of Orange with the participation of a diverse group of stakeholders. The North Orange County planning area encompasses the Santa Ana River Watershed, the Lower San Gabriel River, Coyote Creek Watershed, and the Anaheim Bay-Huntington Harbour Watershed. The North Orange County Integrated Regional Watershed Management Plan was prepared in 2011 to maximize use of local water resources, to increase collaboration and to apply multiple water management strategies by implementing multi-purpose projects in the region. The plan was designed to help agencies, governments and community groups manage their water, wastewater and ecological resources and to identify potential projects to improve water quality, engage in long range water planning and obtain funding. OCWD participated in the preparation of this plan and submitted proposed projects to be considered as regional projects to augment local water supplies, protect groundwater quality and increase water supply reliability.

Central Orange County Integrated Regional and Coastal Watershed Management Plan

The Central Orange County plan was prepared in 2011 by the County of Orange and local stakeholders, including OCWD, to serve as a planning tool to effectively manage the region's water resources. The central area encompasses the entire Newport Bay Watershed and the northern portion of the adjacent Newport Coast Watershed that lies within the jurisdiction of the Santa Ana Regional Water Quality Control Board. The plan sets goals and objectives, identifies water resource projects, and discusses ways to integrate a proposed project with other projects.

One Water One Watershed (OWOW) 2.0

The Integrated Regional Watershed Management Plan for the Santa Ana Watershed is referred to as the OWOW 2.0 plan. Drafted by watershed stakeholders, including OCWD, under the direction of the Santa Ana Watershed Project Authority (SAWPA), this updated plan was adopted by the SAWPA Commission in 2014. The plan details the water resource related opportunities and constraints with the aim of developing proposed projects that provide a regional benefit, are integrated, and are proposed by more than one agency.

Municipal Water District of Orange County

Urban Water Management Plan

The Municipal Water District of Orange County (MWDOC) is a water wholesaler and regional planning agency serving 26 cities and water districts throughout Orange County, which includes OCWD's service area. MWDOC prepared its 2015 Regional Urban Water Management Plan to provide a comprehensive assessment of the region's water services, sources and supplies, including imported water, groundwater, surface water, recycled water, and wastewater. Findings and projections in the plan are used by OCWD and water retailers.

Orange County Reliability Study

The Orange County Reliability Study was prepared in 2016 to comprehensively evaluate current and future water supply and system reliability for Orange County. Water demands and supplies were evaluated for current and future conditions with a planning horizon from 2015 to 2040 using a simulation model developed for this study.

6.1.2 Land Use Development and Water Demands and Supply

Water demands within the OCWD Management Area for water year (WY) 2015-16 totaled approximately 364,000 acre-feet, which reflects the state-mandated water use reductions in response to the extended drought. Total demands include the use of groundwater, surface water from Santiago Creek and Irvine Lake, recycled water, and imported water. As shown in Figure 6-1, water demands between WY1989-90 and 2014-15 have fluctuated between approximately 413,000 afy to 515,000 afy.

Since its founding, OCWD has grown in area from 162,676 to 243,968 acres and has experienced an increase in population from approximately 120,000 to 2.4 million people. OCWD has employed groundwater management techniques to increase the annual yield from the basin including operating over 1,500 acres of infiltration basins. Annual groundwater production increased from approximately 150,000 acre-feet in the mid-1950s to a high of over 360,000 acre-feet in WY 2007-08. OCWD strives to maximize production from the basin through maximizing recharge of the groundwater basin. The groundwater basin is managed within the established operating range independently of total regional water demands as total water demands are met by a combination of groundwater and imported water.

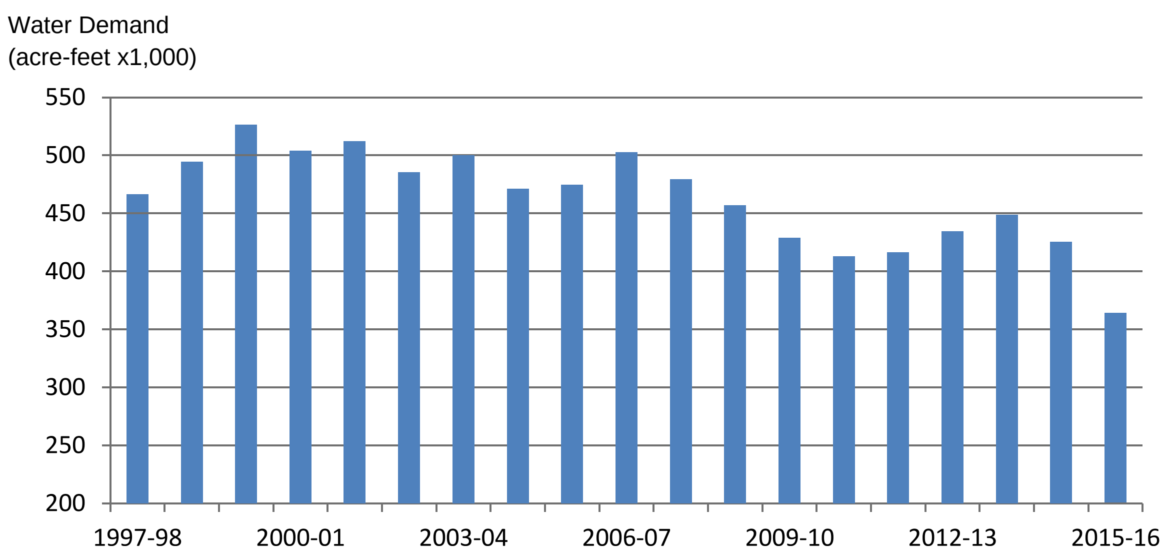


Figure 6-1: Historic Total Water Demands

6.1.3 Well Development, Management, and Closure

To comply with federal Safe Drinking Water Act requirements regarding the protection of drinking water sources, the California Department of Public Health (now the Division of Drinking Water) created the Drinking Water Source Assessment and Protection (DWSAP) program. Water suppliers must submit a DWSAP report as part of the drinking water well permitting process and have it approved before providing a new source of water from a new well. OCWD provides technical support to groundwater producers in the preparation of these reports.

This program requires all well owners to prepare a drinking water source assessment and establish a source water protection program for all new wells. The source water program must include: (1) a delineation of the land area to be protected, (2) the identification of all potential sources of contamination to the well, and (3) a description of management strategies aimed at preventing groundwater contamination.

Developing management strategies to prevent, reduce, or eliminate risks of groundwater contamination is one component of the multiple barrier protection of source water. Contingency planning is an essential component of a complete DWSAP and includes developing alternate water supplies for unexpected loss of each drinking water source, by man-made or catastrophic events.

Wells constructed by OCWD are built to prevent the migration of surface contamination into the subsurface. This is achieved through the placement of annular well seals and surface seals during construction. Also, seals are placed within the borehole annulus between aquifers to minimize the potential for flow between aquifers.

Well construction ordinances adopted and implemented by the Orange County Health Care Agency (OCHCA) and municipalities follow state well construction standards established to protect water quality under California Water Code Section 231. Cities within OCWD boundaries that have local well construction ordinances and manage well construction within their local jurisdictions include the cities of Anaheim, Fountain Valley, Buena Park, and Orange. To provide guidance and policy recommendations on these ordinances, the County of Orange established the Well Standards Advisory Board in the early 1970s. The five-member appointed Board includes OCWD’s Chief Hydrogeologist. Recommendations of the Board are used by the OCHCA and municipalities to enforce well construction ordinances within their jurisdictions.

A well is considered abandoned when the owner has permanently discontinued its use or it is in such a condition that it can no longer be used for its intended purpose. This often occurs when wells have been forgotten by the owner, were not disclosed to a new property owner, or when the owner is unknown.

A properly destroyed and sealed well has been filled so that it cannot produce water or act as a vertical conduit for the movement of groundwater. In cases where a well is paved over or under a structure and can no longer be accessed it is considered destroyed but not properly sealed. Many of these wells may not be able to be properly closed due to overlying structures, landscaping or pavement. Some of them may pose a threat to water quality because they can be conduits for contaminant movement as well as physical hazards to humans and/or animals.

Information on the status of wells is kept within OCWD's Water Resource Management System data base. Records in this data base show 606 wells that have been destroyed and properly sealed, 217 destroyed wells with inadequate information to determine if properly sealed and 948 abandoned wells most of which have inadequate information to determine if the well is accessible or covered over.

OCWD supports and encourages efforts to properly destroy abandoned wells. As part of routine monitoring of the groundwater basin, OCWD will investigate on a case-by-case basis any location where data suggests that an abandoned well may be present and may be threatening water quality. When an abandoned well is found to be a significant threat to the quality of groundwater, OCWD will work with OCHCA and the well owner, when appropriate, to properly destroy the well.

The City of Anaheim has a well destruction policy and has an annual budget to destroy one or two wells per year. The funds are used when an abandoned well is determined to be a public nuisance or needs to be destroyed to allow development of the site. The city's well permit program requires all well owners to destroy their wells when they are no longer needed. When grant funding becomes available, the city uses the funds to destroy wells where a responsible party has not been determined and where the well was previously owned by a defunct water consortium.

6.2 GROUNDWATER QUALITY PROTECTION AND MANAGEMENT

6.2.1 OCWD Groundwater Quality Protection Policy

OCWD adopted the first Groundwater Quality Protection Policy in 1987 under statutory authority granted under Section 2 of the OCWD Act. A revised policy was adopted by the Board of Directors in 2014. The policy guides the actions of OCWD to:

- Maintain groundwater quality suitable for all existing and potential beneficial uses;
- Prevent degradation of groundwater quality and protect groundwater from contamination;
- Assist regulatory agencies in identifying sources of contamination to assure cleanup by the responsible parties;
- Support regulatory enforcement of investigation and cleanup requirements on responsible parties in accordance with law;
- Undertake investigation and cleanup projects as necessary to protect groundwater from contamination;
- Maintain consistency with the National Contingency Plan when seeking recovery of investigation and response costs;
- Negotiate with and engage in mediation with parties responsible for contamination when possible to resolve issues related to cleanup and abatement of contamination;

- Establish a Groundwater Contamination Cleanup Fund to hold proceeds received from settlement of lawsuits for each groundwater contamination case for which the District received moneys;
- Maintain surface water and groundwater quality monitoring programs and monitoring well network;
- Maintain the database system, geographic information system, and computer models to support water quality programs;
- Maintain an Emergency Response Fund to ensure adequate funds are available to contain and clean up catastrophic releases of chemicals or other substances that may contaminate surface water or groundwater;
- Coordinate with groundwater producer(s) impacted or threatened by any groundwater contamination and work to develop appropriate monitoring and remediation if necessary; and
- Encourage the beneficial use and appropriate treatment of poor-quality groundwater where the use of such groundwater will reduce the risk of impact to additional production wells, increase the operational yield of the basin and/or provide additional water quality improvements to the basin.

6.2.2 Salinity Management Programs

Increasing salinity in water supplies is a significant water quality problem in many parts of the southwestern United States and southern California. Programs to manage salinity within the OCWD Management Area are described in this section. These programs include both programs within the management area as well as those related to management of surface water in the upper watershed that affect the quality of water used by OCWD for groundwater replenishment. Seawater intrusion barrier programs are described in Section 6.5.

Coastal Pumping Transfer Program

The Coastal Pumping Transfer Program (CPTP) allows OCWD to manage salinity levels in the groundwater basin by encouraging the shifting of groundwater production from the coastal area to inland areas. The purpose of the CPTP is to encourage inland producers to pump more groundwater and coastal producers to pump less in order to raise coastal groundwater levels, which lessens the potential for seawater intrusion. Inland producers participate in this cooperative program to increase pumping and both inland and coastal producers are compensated so that it is a cost-neutral program for the groundwater producers.

Groundwater Replenishment System

The GWRS plant produces highly-treated recycled water to be used for groundwater recharge and to operate the Talbert Seawater Intrusion Barrier. The TDS of water produced by GWRS is approximately 50 mg/L. Recharging the groundwater basin with this water supply significantly improves the water quality of the basin.

Septic Systems

Another source of salinity in the basin originates from onsite wastewater treatment systems, commonly known as septic systems. There are an estimated 2,500 septic systems in operation within the OCWD Management Area. Septic systems operate by collecting wastewater in a holding tank and then allowing the liquid fraction to leach out into the underlying sediments where it becomes filtered and eventually becomes part of the groundwater supply. A properly maintained system can be effective at removing many contaminants from the wastewater but salts remain in the leachate. Septic systems are typically in older communities that were developed prior to the construction of sewer systems or located in an area some distance from existing sewers. The State Water Board and Regional Water Board regulate the siting of new septic systems to reduce the possibility of groundwater contamination. Within Orange County, water districts and local officials work to expand sewer systems in order to reduce the use of septic systems to the extent feasible and economical.

Nitrogen and Selenium Management Program

Selenium is a naturally-occurring micronutrient found in soils and groundwater in the Newport Bay watershed. Selenium is essential for reproductive health and immune system function in humans, fish and wildlife. However, selenium bio-accumulates in the food chain and can result in deformities, stunted growth, reduced hatching success, and suppression of immune systems in fish and wildlife.

Prior to urban development, in the western portion of the Irvine Subbasin was an area of shallow groundwater that contained an area known as the Swamp of the Frogs (Cienega de Las Ranas). Runoff from local foothills over several thousands of years accumulated selenium-rich deposits in the swamp. To make this region suitable for farming, drains and channels were constructed in the early 1900s. This mobilized selenium from sediments into the shallow groundwater drained by the channels that eventually discharge to Newport Bay.

The Nitrogen and Selenium Management Program was formed to develop and implement a work plan to address selenium and nitrate in the watershed. This stakeholder working group that includes the County of Orange, affected cities, environmental organizations, Irvine Ranch Water District, the Irvine Company and the Regional Water Board are implementing a long-term work plan. Management of selenium is difficult as there is no off-the-shelf treatment technology available.

Groundwater Desalters and the Inland Empire Brineline and Non-Reclaimable Waste Line

Several water treatment plants that are designed to remove salts from groundwater, commonly referred to as desalters, have been built in Orange, Riverside, and San Bernardino counties. These plants are effectively reducing the amount of salt buildup in the watershed. Managing salinity in the upper watershed is important to OCWD as this protects the water quality in the Santa Ana River that is used in Orange County for groundwater recharge. The Inland Empire Brine Line, formerly called the Santa Ana Regional Interceptor (SARI), built by SAWPA, has operated since 1975 to remove salt from the watershed by transporting industrial wastewater and brine produced by desalter operations directly to OCSD for treatment.

The other brine line in the upper watershed, the Non-Reclaimable Waste Line in the Chino Basin operated by the Inland Empire Utilities Agency (IEUA), segregates high TDS industrial wastewater and conveys this flow to Los Angeles County for treatment and disposal.

In Orange County, salinity management projects include groundwater desalters located in the cities of Tustin and Irvine that are pumping and treating high salinity groundwater. The saline groundwater in Tustin and Irvine is a combination of naturally occurring salts and impacts from past agricultural activities.

Basin Monitoring Program Task Force

In 1995, a task force of over 20 water and wastewater resource agencies and local governments, including OCWD, initiated a study to evaluate the impacts to groundwater quality of elevated levels of total inorganic nitrogen (TIN) and total dissolved solids (TDS) in the watershed. This study was completed and resulted in adoption in 2004 of amendments to the Water Quality Control Plan for the Santa Ana River Basin (Basin Plan). This nearly 10-year effort involved collecting and analyzing data in 25 newly defined groundwater management zones in the watershed to recalculate nitrogen and TDS levels and to establish new water quality objectives.

One major challenge of this effort was developing the tools and collecting data to assess and monitor surface water and groundwater interactions. Although typically regulated and managed separately, stakeholders recognized that surface water and groundwater in the watershed are interconnected and as such protection of these resources would require a comprehensive program. Models were developed and data collected to enable an evaluation of the potential short-term and long-term impacts on water resources due to changes in land use, the quantity and quality of runoff, and point source discharges.

The Basin Plan charges the Task Force with implementing a watershed-wide TDS/Nitrogen management program. Task Force members agreed to fund and participate in a process to recalculate ambient water quality every three years in each of the 25 groundwater management zones and to compare water quality to the water quality objectives in order to measure compliance with the Basin Plan. The latest recalculation, the third since adoption of the amendment, was completed in 2014 (Wildermuth, 2014).

Salinity Management and Imported Water Recharge Workgroup

The Salinity Management and Imported Water Recharge Workgroup, in cooperation with the Regional Water Board, implements a cooperative agreement signed in 2008 by water agencies that use imported water for groundwater recharge. The objective of this effort is to evaluate and monitor the long-term impacts of recharging groundwater basins with imported water. The workgroup analyzes water quality data and estimates future conditions to evaluate the potential impact of recharging imported water. TDS and nitrate data are collected and analyzed to determine whether the intentional recharge of imported water may have adverse impacts on compliance with salinity objectives in the region.

Management of Nitrates

OCWD regularly monitors nitrate levels in groundwater and works with Groundwater Producers to treat individual wells when nitrate concentrations exceed safe levels. Construction of the Tustin Main Street Treatment Plant is an example of such an effort.

Within Orange County, nitrate (as N) levels in groundwater generally range from 4 to 7 mg/L in the Forebay area and from 1 to 4 mg/L in the Pressure area. One of OCWD's programs to reduce nitrate concentrations in groundwater is managing the nitrate concentration of water recharged in OCWD facilities. This includes managing the quality of surface water flowing to Orange County through Prado Dam. To reduce nitrate concentrations in Santa Ana River water, OCWD owns and operates an extensive system of wetlands in the Prado Basin.

The 465-acre Prado Constructed Wetlands, shown in Figure 6-2 are designed to remove nitrogen and other contaminants from the Santa Ana River before the water is diverted from the river in Orange County for recharge through OCWD's surface water recharge system. The majority of the baseflow (non-stormwater flow) in the Santa Ana River is comprised of treated wastewater. On an annual basis, about 50 percent of the SAR flow entering the Prado Basin is treated wastewater, but during summer months, treated wastewater can comprise more than 90 percent of the baseflow. OCWD diverts approximately half of the base flow of the Santa Ana River through the wetland ponds, which remove an estimated 15 to 40 tons of nitrate a month depending on the time of year. The wetlands are more effective from May through October when the water temperatures are warmer and daylight hours are longer. During summer months the wetlands reduce nitrate from nearly 10 mg/L to 1 to 2 mg/L.

Figure 6-2: OCWD Prado Wetlands

6.2.3 Regulation and Management of Contaminants

A variety of federal, state, county and local agencies have jurisdiction over the regulation and management of hazardous substances and the remediation of contaminated groundwater supplies. OCWD does not have regulatory authority to require responsible parties to clean up pollutants that have contaminated groundwater. In some cases, OCWD has pursued legal action against entities that have contaminated the groundwater basin to recover OCWD's remediation costs or to compel those entities to implement remedies. OCWD also coordinates and cooperates with regulatory oversight agencies that investigate sources of contamination. OCWD efforts to assess the potential threat to public health and the environment from contamination in the Santa Ana River Watershed and within the County of Orange include:

- Reviewing ongoing groundwater cleanup site investigations and commenting on the findings, conclusions, and technical merits of progress reports;
- Providing knowledge and expertise to assess contaminated sites and evaluating the merits of proposed remedial activities; and
- Conducting third-party groundwater split samples at contaminated sites to assist regulatory agencies in evaluating progress of groundwater cleanup and/or providing confirmation data of the areal extent of contamination.

The following is a summary of the potential contaminants of greatest concern for basin water quality management.

Methyl Tertiary Butyl Ether (MTBE)

Methyl tertiary butyl ether (MTBE) is a synthetic, organic chemical that was added to gasoline to increase octane ratings during the phase-out of leaded gasoline. In the mid-1990s, the percentage of MTBE added to gasoline increased significantly to reduce air emissions. MTBE is a serious threat to groundwater quality as it sorbs weakly to soil and does not readily biodegrade. The greatest source of MTBE contamination comes from underground fuel tank releases. The State of California banned the use of the additive in 2004 in response to its widespread detection in groundwater throughout the state.

In 2003, OCWD filed suit against numerous oil and petroleum-related companies that produce, refine, distribute, market, and sell MTBE and other oxygenates. The suit seeks funding from these responsible parties to pay for the investigation, monitoring and removal of oxygenates from the basin.

Volatile Organic Compounds

Volatile organic compounds (VOCs) in groundwater come from a number of sources. From the late 1950s through early 1980s, VOCs were used for industrial degreasing in metals and electronics manufacturing. Other common sources include paint thinners and dry cleaning solvents. OCWD's comprehensive water quality monitoring programs include testing for a wide-range of potential VOC contaminants in order to discover incidents of groundwater contamination at the earliest possible stage.

N-Nitrosodimethylamine (NDMA)

N-Nitrosodimethylamine (NDMA) is a low molecular weight compound that can occur in wastewater after disinfection of water or wastewater via chlorination and/or chloramination. It is also found in food products such as cured meat, fish, beer, milk, and tobacco smoke. OCWD routinely monitors for NDMA in the groundwater and in water supplies used for recharge.

Dioxane

A suspected human carcinogen, 1,4-dioxane, is used as a solvent in various industrial processes such as the manufacture of adhesive products and membranes and may be present in consumer products such as detergents, cosmetics, pharmaceuticals, and food products.

Constituents of Emerging Concern

Constituents of emerging concern (CECs) are synthetic or naturally occurring substances that are not formally regulated in water supplies or wastewater discharges but can now be detected using very sensitive analytical techniques. One of the newest groups of constituents of emerging concern includes pharmaceuticals, personal care products and endocrine disruptors. Due to the potential impact of EDCs on water reclamation projects, OCWD prioritizes monitoring of these chemicals.

OCWD's state-certified laboratory is one of a few in the state that has a program to continuously develop capabilities to analyze for new compounds and works on developing low detection levels for chemicals likely to be targeted for future regulation or monitoring.

OCWD advocates the following general principles as water suppliers and regulators develop programs to protect public health and the environment from adverse effects of CECs:

- Monitoring should focus on constituents that pose the greatest risk.
- Constituents that are prevalent, persistent in the environment, and may occur in unsafe concentrations should be prioritized.
- Analytical methods to detect these constituents should be approved by the state or federal government.
- Studies to evaluate the potential risk to human health and the environment should be funded by the state or federal government.
- The state and federal government should encourage programs to educate the public on waste minimization and proper disposal of unused pharmaceuticals.

OCWD is committed to (1) track new compounds of concern; (2) research chemical occurrence and treatment; (3) communicate closely with the Division of Drinking Water on prioritizing investigation and guidance; (4) coordinate with Orange County Sanitation District, upper watershed wastewater dischargers and regulatory agencies to identify sources and reduce contaminant releases; and (5) inform the Groundwater Producers on emerging issues.

6.3 RECYCLED WATER PRODUCTION

6.3.1 Overview

The Groundwater Replenishment System (GWRS) is a joint project built by OCWD and the Orange County Sanitation District that began operating in 2008. Wastewater that otherwise would be discharged to the Pacific Ocean is purified using a three-step advanced process to produce high-quality water used to control seawater intrusion and recharge the groundwater basin. The GWRS produces up to 100 million gallons per day (mgd) of highly-treated recycled water. Plans are underway for expansion of GWRS to increase total capacity to 130 mgd. The system includes three major components (1) the Advanced Water Purification Facility (AWPF), (2) the Talbert Seawater Intrusion Barrier, and (3) recharge basins where GWRS water is percolated into the groundwater basin, schematically illustrated in Figure 6-3.

Secondary-treated wastewater is conveyed to OCWD from OCSD Plant No.1, located adjacent to OCWD's facilities in Fountain Valley. The water undergoes an advanced treatment process that includes microfiltration, reverse osmosis and advanced oxidation/disinfection with hydrogen peroxide and ultraviolet light exposure followed by de-carbonation and lime stabilization. The Full Advanced Treated water is used for groundwater recharge, to supply the Talbert Seawater Barrier and provide recycled water for three industrial/commercial users. On average, 34 percent of the water is injected in the Talbert Barrier and 66 percent is percolated in the recharge basins. Industrial and commercial uses include cooling water for the City of Anaheim's Canyon Power Plant, recycled water for the Anaheim Regional Transportation Intermodal Center, and hydrostatic testing of new secondary treatment basins at OCSD Plant No.1.

GWRS water is recharged in Kraemer, Miller and Miraloma basins, located in the city of Anaheim. Water is conveyed to these basins through a 13-mile pipeline in the west levee of the Santa Ana River through the cities of Fountain Valley, Santa Ana, Orange, and Anaheim and along the Carbon Canyon Diversion Channel. Five feet in diameter at its end point, this pipeline is capable of delivering over 80 million gallons of highly-treated recycled water to the basins each day.

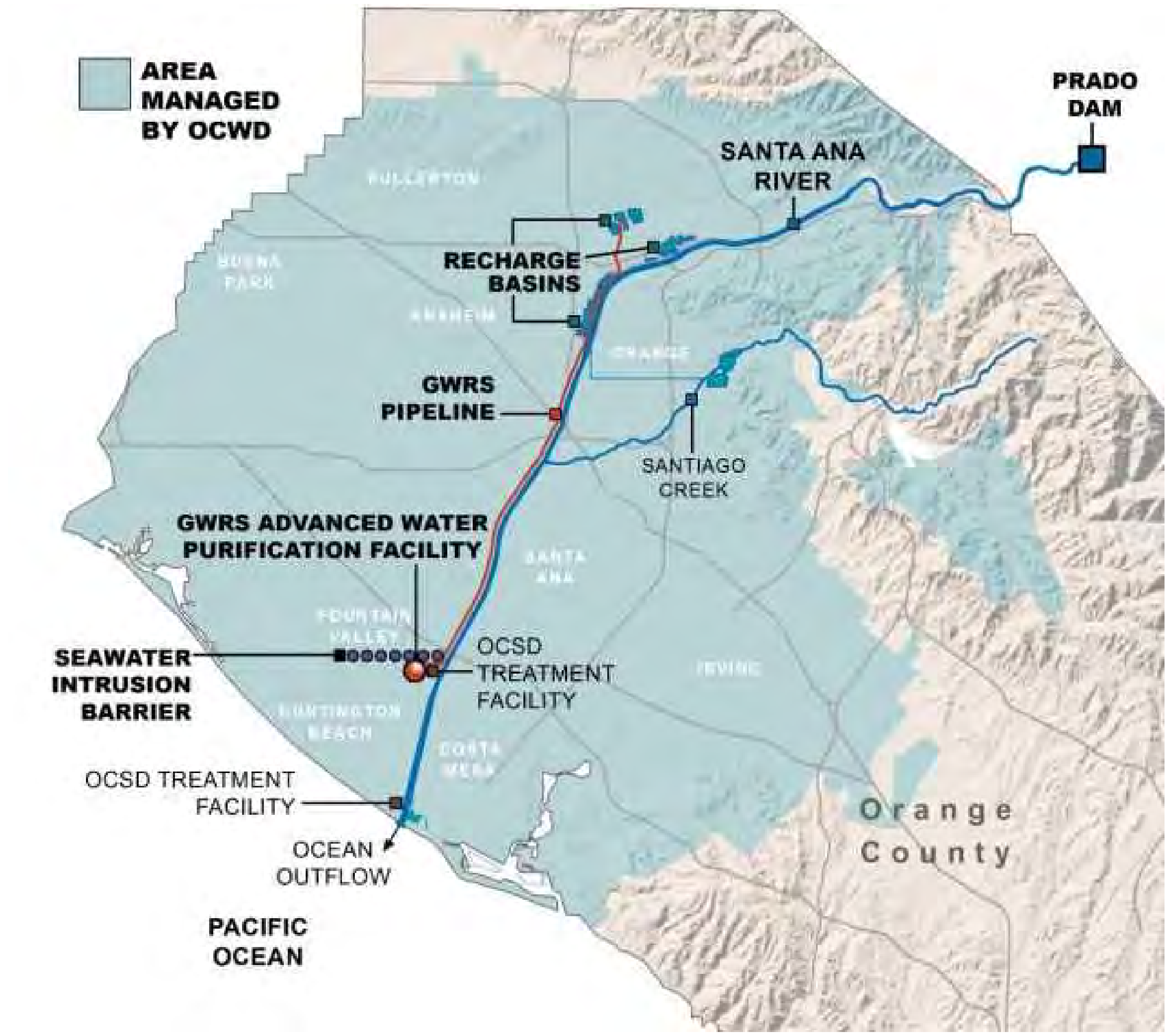


Figure 6-3: Groundwater Replenishment System

6.4 CONJUNCTIVE USE PROGRAMS

Recharge water sources include water from the Santa Ana River and tributaries, imported water, and recycled water supplied by the GWRS as well as incidental recharge from precipitation and subsurface inflow. OCWD owns over 1,500 acres of land on which there are 1,067 wetted acres of recharge facilities. These facilities are located in the Forebay of the groundwater basin adjacent to the Santa Ana River and Santiago Creek.

Managed aquifer recharge began in the 1930s, in response to declining water levels in the basin. OCWD began purchasing portions of the river channel, eventually acquiring six miles of the channel in Orange County, in order to maximize the recharge of Santa Ana River water to the basin.

Recharge of imported water began in 1949 when OCWD began purchasing Colorado River water from MWD. In 1958, OCWD purchased and excavated a 64-acre site one mile north of the Santa Ana River to create Anaheim Lake, OCWD's first recharge basin. Today OCWD operates a network of 25 facilities that recharge an average of over 230,000 afy.

6.4.1 Sources of Recharge Water Supplies

Water supplies used to recharge the groundwater basin are listed in Table 6-1. Figure 6-4 shows the historical recharge by source from 1936 to 2016. Table 6-2 shows the average annual recharge by source between WY 2006-07 and 2015-16.

Santa Ana River

Water from the Santa Ana River is a primary source of water used to recharge the groundwater basin. OCWD diverts river water into recharge facilities where the water percolates into the groundwater basin. Recharge facilities are capable of recharging all of the baseflow. Both the Santa Ana River baseflow and storm flow vary from year to year as shown in Figure 6-5. Recent trends show a decline in baseflow, which may be a result of increased recycling, drought conditions, and declining per capita water use in the upper watershed. The volume of storm water that can be recharged into the basin is highlight dependent on the amount and timing of precipitation in the upper watershed, which is highly variable, as shown in Figure 6-6. OCWD has water rights to all storm flows that reach Prado Dam. When storm flows exceed the capacity of the diversion facilities, river water reaches the ocean and this portion is lost as a water supply.

Santiago Creek

Santiago Creek is the primary drainage for the northwest portion of the Santa Ana Mountains and ultimately drains into the Santa Ana River. OCWD captures and recharges water in Santiago Creek that flows into the Santiago Recharge Basins. During dry periods, the Santiago basins are used to recharge Santa Ana River flows which are pumped to the basins.

Table 6-1: Sources of Recharge Water Supplies

SUPPLY SOURCES AND DESCRIPTION			RECHARGE LOCATION
Santa Ana River	Base Flow	Perennial flows from the upper watershed in Santa Ana River; predominately treated wastewater discharges	Santa Ana River, recharge basins, and Santiago Creek
	Storm Flow	Precipitation from upper watershed flowing in Santa Ana River through Prado Dam	Santa Ana River, recharge basins, and Santiago Creek
Santiago Creek	Storm Flow / Santa Ana River	Storm flows in Santiago Creek and Santa Ana River water pumped from Burris Basin via Santiago Pipeline	Santiago Creek, Santa Ana River, recharge basins
Incidental Recharge	Precipitation and subsurface inflow	Precipitation and runoff from Orange County foothills, subsurface inflow from basin boundaries	Basin-wide
Recycled Water	Groundwater Replenishment System	Advanced treated wastewater produced at GWRS plant in Fountain Valley	Injected into Talbert Barrier; recharged in Kraemer, Miller, and Miraloma basins
	Water Replenishment District of Southern CA	Water purified at the Leo J. Vander Lans Treatment Facility in Long Beach	Injected into Alamitos Barrier
Imported Water	Untreated	State Water Project and Colorado River Aqueduct	Various recharge basins
	Treated	State Water Project and Colorado River Aqueduct treated at MWD Diemer Water Treatment Plant	Injected into Talbert and Alamitos Barriers

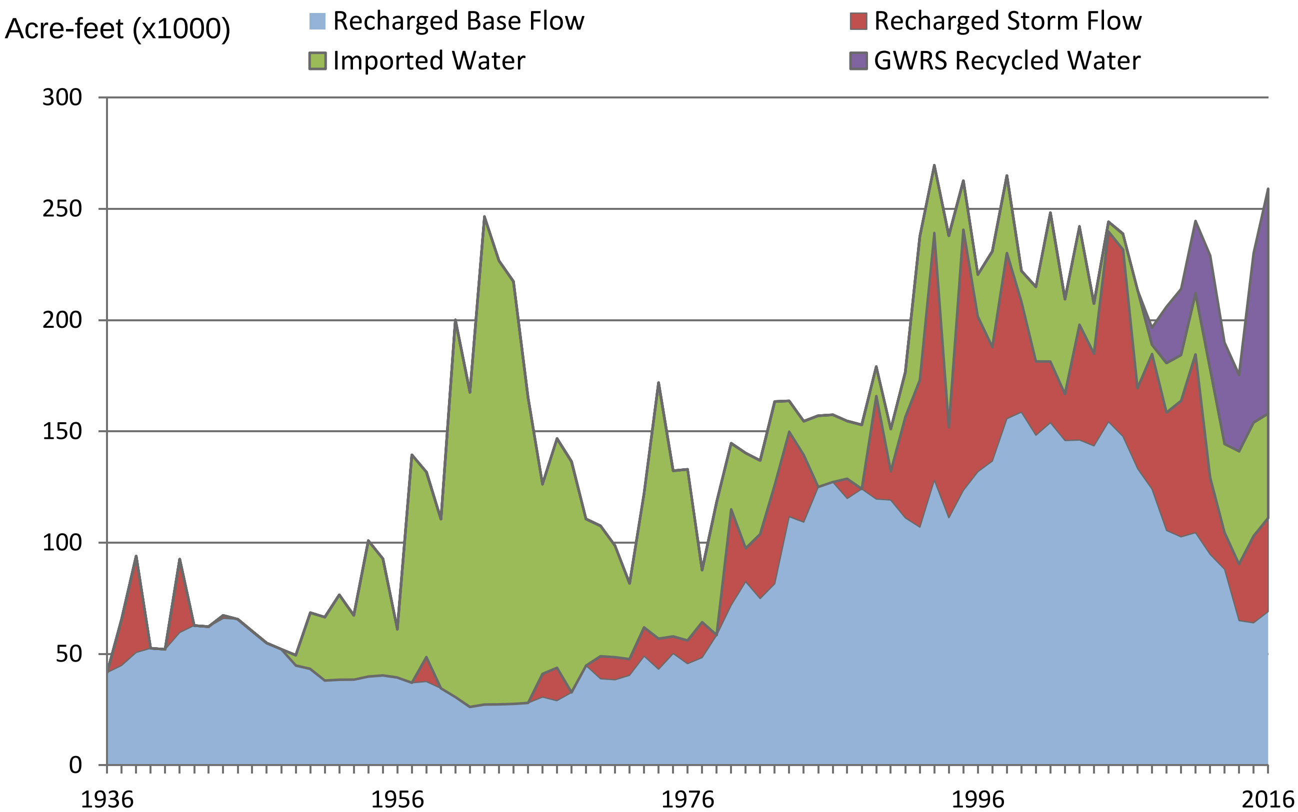


Figure 6-4**:** Historical Recharge in Surface Water Recharge System

Table 6-2: Annual Recharge by Source, Water Year 2006-07 to 2015-16 (acre-feet)

Water year	Santa Ana River Base Flow	Santa Ana River Storm Flow	Recycled Water	Imported Water	In-Lieu	Incidental Recharge	Total
2006-07	133,000	39,000	400	111,000	37,000	14,000	334,400
2007-08	122,000	61,000	18,000	15,000	0	46,000	262,000
2008-09	106,000	52,000	55,000	33,000	0	68,000	334,000
2009-10	103,000	59,000	67,000	22,000	0	83,000	332,000
2010-11	104,000	78,000	67,000	36,000	10,000	94,000	389,000
2011-12	95,000	32,000	72,000	90,000	31,000	27,000	347,000
2012-13	85,000	18,000	73,000	41,000	0	20,000	237,000

Water year	Santa Ana River Base Flow	Santa Ana River Storm Flow	Recycled Water	Imported Water	In-Lieu	Incidental Recharge	Total
2013-14	65,000	25,000	66,000	53,000	0	32,000	241,000
2014-15	63,000	39,000	76,000	51,000	0	50,000	279,000
2015-16	69,000	42,000	101,000	47,000	0	42,000	259,000
Average	95,000	45,000	60,000	50,000	8,000	48,000	304,000
Average %	31%	15%	19%	16%	3%	16%	100%

Notes: (1) "Storm Water" includes total storm flow recharged in both the Santa Ana River and Santiago Creek, a tributary of the Santa Ana River (2) "Imported water" includes water used for Alamitos and Talbert Barriers, water purchased by and recharged by OCWD, MWD CUP supply and MWD CUP in lieu supply recharged in the Forebay.

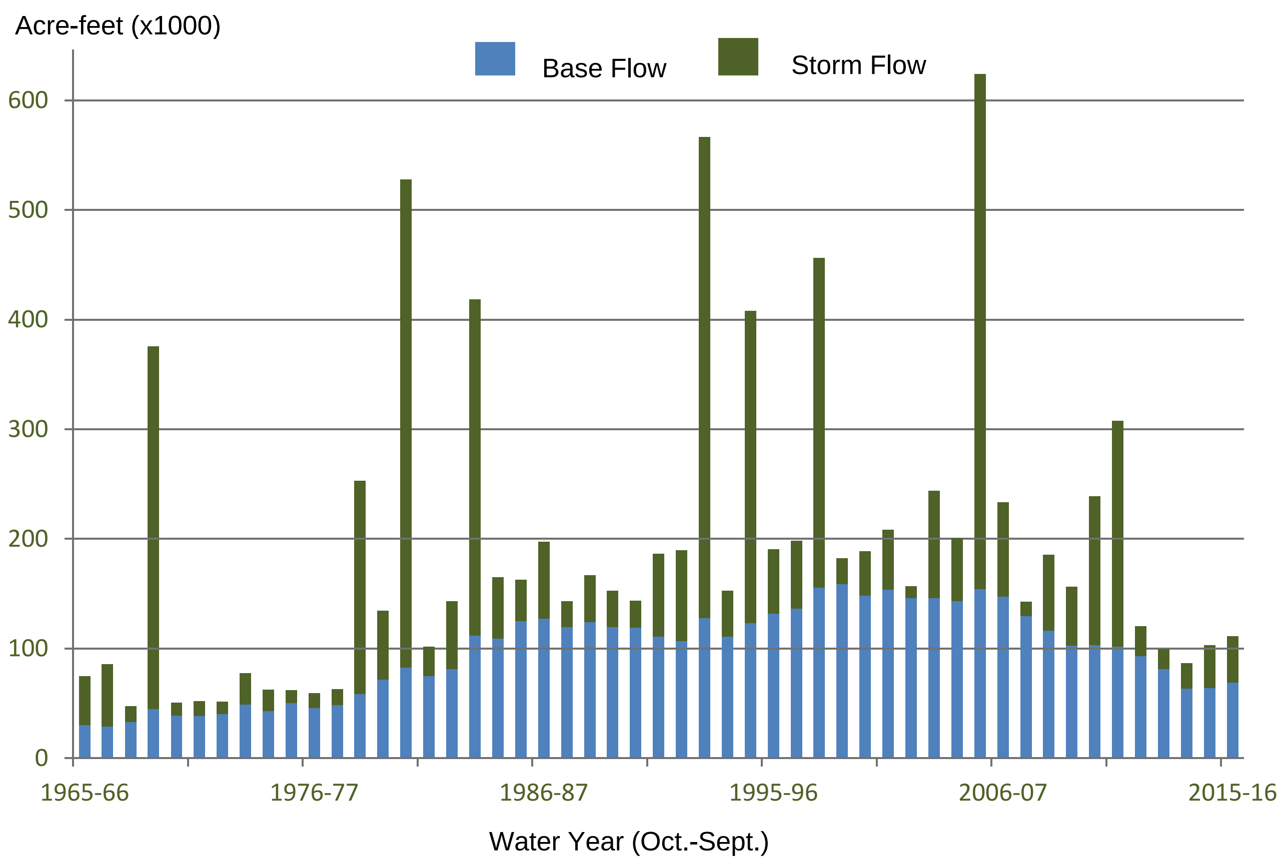


Figure 6-5: Annual Base and Storm Flow in the Santa Ana River at Prado Dam
Source: Santa Ana River Watermaster, 2014

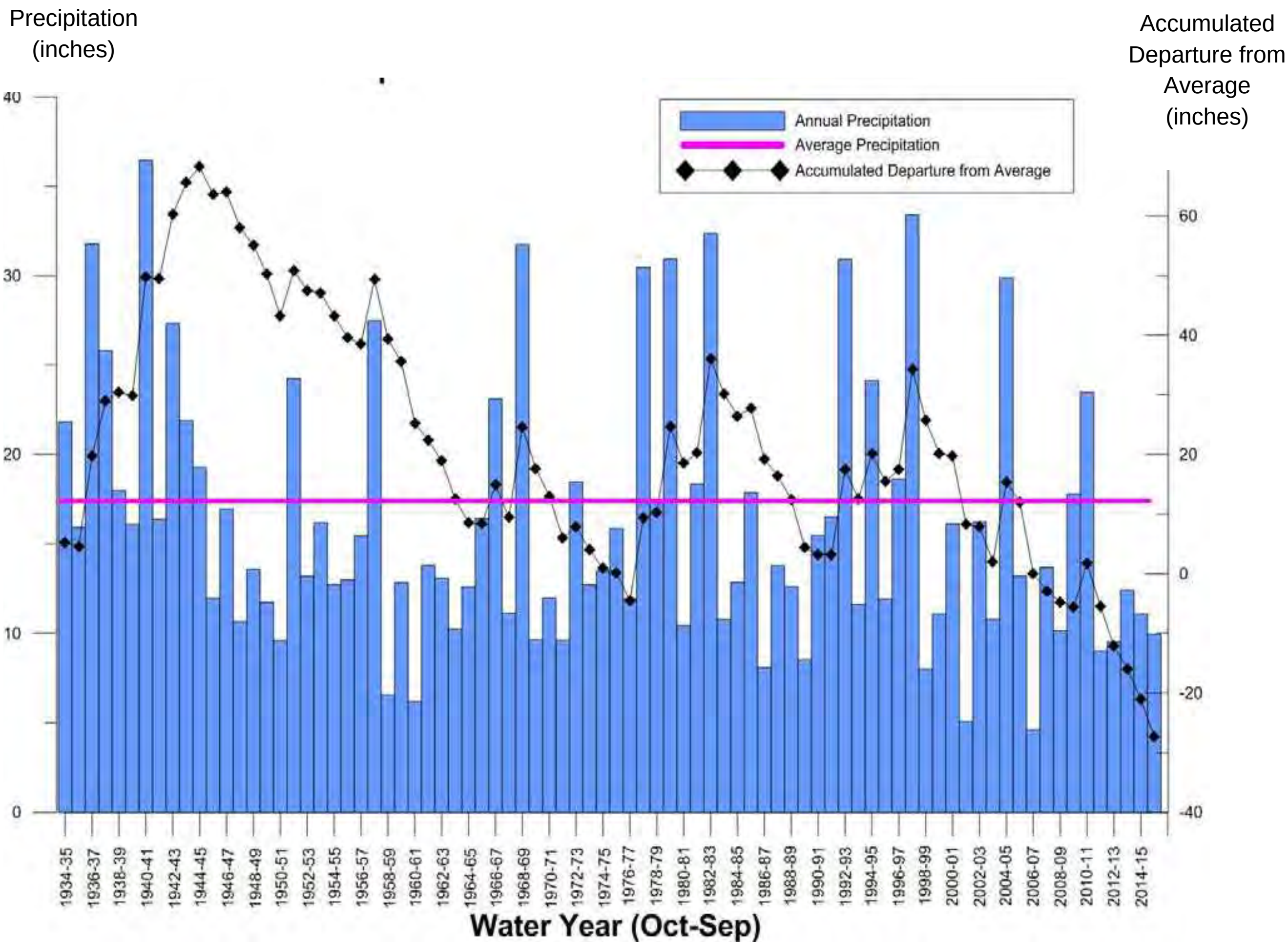


Figure 6-6: Precipitation at San Bernardino, Water Year (Oct.-Sept.) 1934-35 to 2015-16

Incidental Recharge

Also discussed in Section 4.1, l incidental recharge is comprised of subsurface inflow from the local hills and mountains, infiltration of precipitation and irrigation water, recharge in small flood control channels, and groundwater underflow to and from Los Angeles County and the ocean. Since the amount of incidental recharge cannot be directly measured, it is also referred to as unmeasured recharge. Each year, an estimate is made of the amount of net incidental recharge based on OCWD's annual groundwater storage calculation. In general, since the Central Basin in Los Angeles County is usually operated at a lower level than the Orange County basin, there is usually a net flow of water out of the Orange County basin to the Central Basin. This outflow is subtracted from the total incidental recharge to get the net incidental recharge to the basin, which is the value reported in this document. Figure 6-7 shows the amount of net incidental recharge from WY 2000-01 to 2013-14. Note the correlation between amount of precipitation and net incidental recharge.

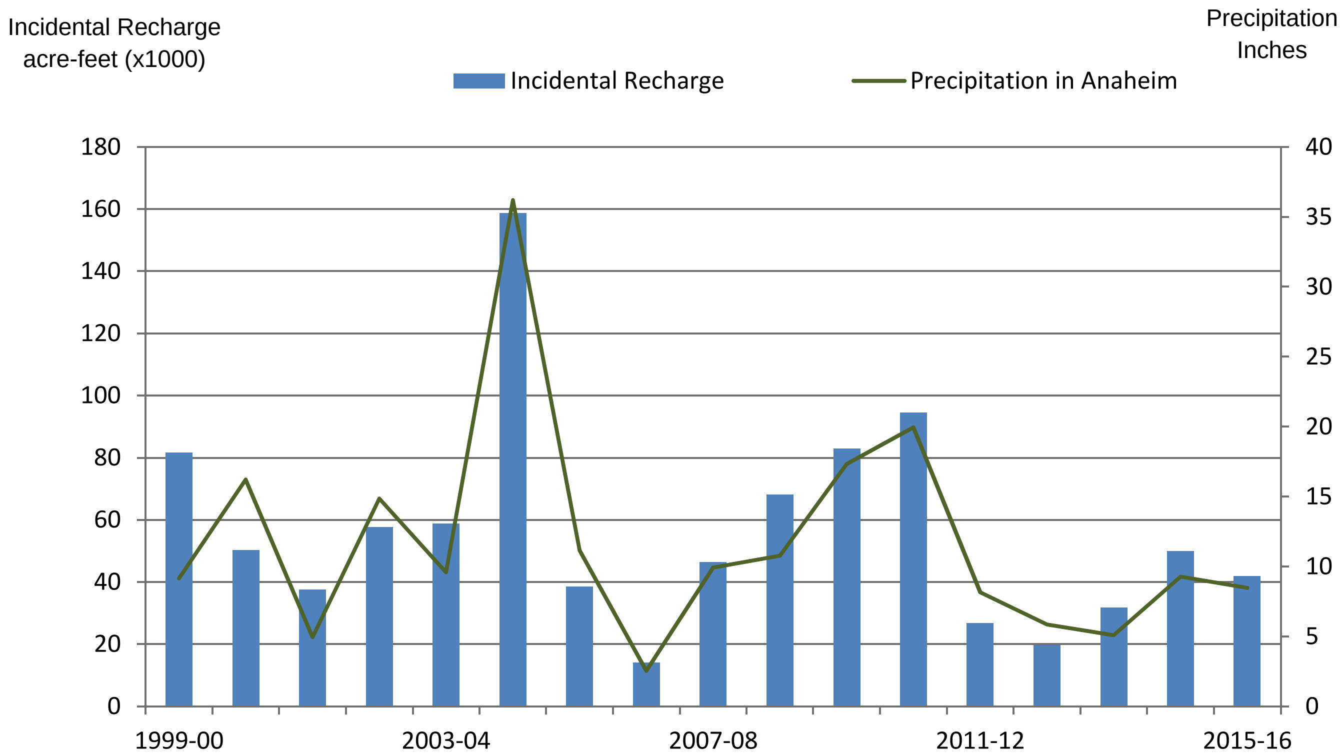


Figure 6-7: Net Incidental Recharge and Precipitation, WY 1999-00 to WY 2015-16

Recycled Water

The basin receives two sources of recycled water for recharge, the GWRS and the Leo J. Vander Lans Treatment Facility that supplies water to the Alamitos Seawater Barrier. Only a portion of the water recharged in the Alamitos Barrier recharges the Orange County Groundwater Basin with the remainder recharging the Central Basin in Los Angeles County.

Imported Water

OCWD purchases imported water for recharge from the Municipal Water District of Orange County (MWDOC), which is a member agency of MWD. Untreated imported water can be delivered to the surface water recharge system in multiple locations, including Anaheim Lake (OC-28/28A), Santa Ana River (OC-11), Irvine Lake (OC-13A), and San Antonio Creek near the City of Upland (OC-59). These locations are shown in Figure 6-8. Connections OC-28, OC-11 and OC-13 supply OCWD with Colorado River Aqueduct water. Connection OC-59 supplies OCWD with State Water Project water, and OC-28A supplies OCWD with a variable blend of water from these two sources.

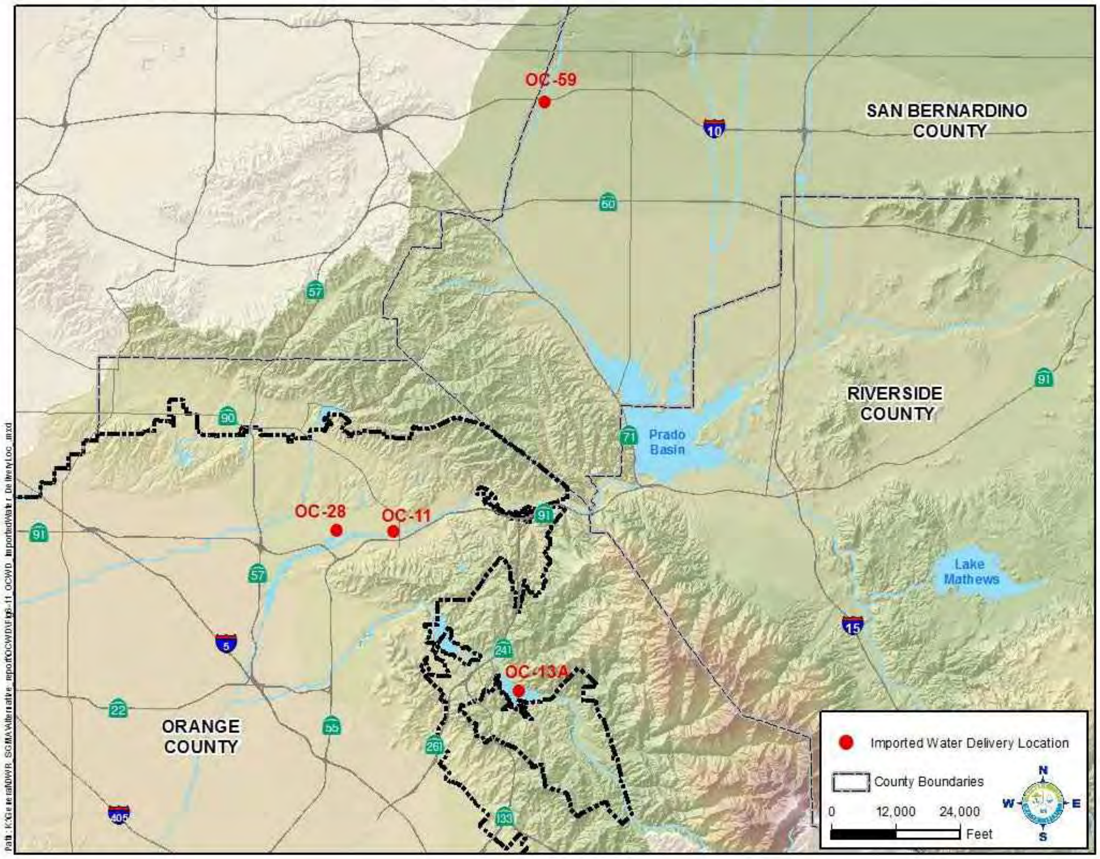


Figure 6-8: Locations of Imported Water Deliveries

6.4.2 Surface Water Recharge Facilities

OCWD's surface water recharge system is comprised of 24 facilities covering over 1,000 wetted acres and a total storage capacity of approximately 26,000 acre-feet. The locations of these facilities are shown in Figure 6-9. OCWD carefully tracks the amount of water being recharged in each facility on a daily basis.

Three full-time hydrographers control and monitor the recharge system. These hydrographers and other OCWD staff prepare a monthly *Water Resources Summary Report*, which lists the source and volume for each recharge water supply, provides an estimate of the amount of water percolated in each recharge basin, documents total groundwater production from the basin, and estimates the change in groundwater storage. The report also estimates the amount of incidental recharge, evaporation and losses to the ocean – essentially a monthly water budget accounting. The monthly figures are compiled to determine yearly recharge and production totals and used in the year-end determination of groundwater storage change.

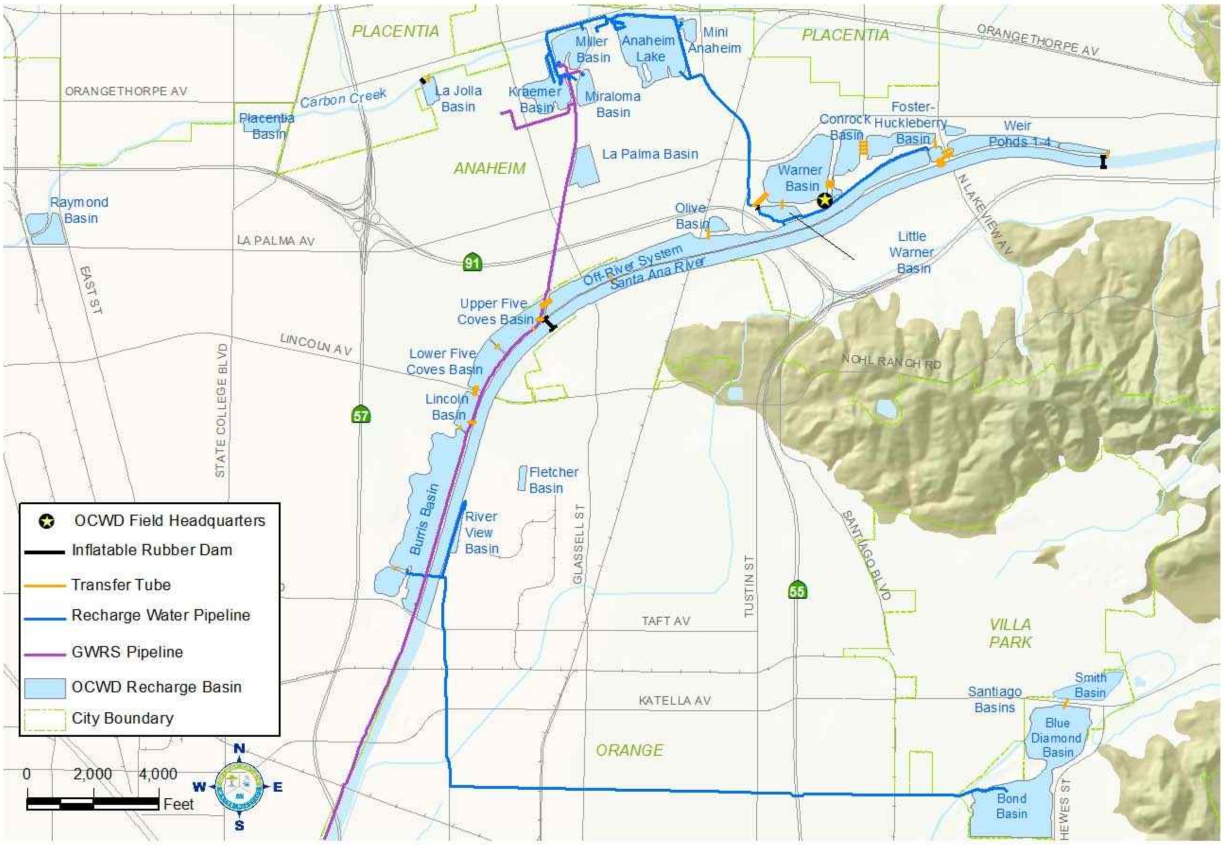


Figure 6-9: OCWD Surface Water Recharge Facilities

6.5 MANAGEMENT OF SEAWATER INTRUSION

In the coastal area of Orange County, the primary source of saline groundwater is seawater intrusion into the groundwater basin through permeable sediments underlying topographic lowlands or gaps between the erosional remnants or mesas of the Newport-Inglewood Uplift. The susceptible locations are the Talbert, Bolsa, Sunset, and Alamitos gaps as shown previously in Figure 3-26.

Seawater intrusion in the Talbert Gap area began as early as the 1920s as the previously flowing artesian conditions within the shallow Talbert aquifer were gradually lowered until groundwater levels declined below sea level due to unrestricted agricultural pumping. By the 1930s and 1940s, seawater had advanced more than one mile inland within the Talbert Gap, forcing the closure of municipal supply wells owned and operated by the cities of Newport Beach and Laguna Beach due to elevated salinity.

Seawater intrusion became a critical problem in the 1950s. Overdraft of the basin caused water levels to drop as much as 40 feet below sea level. By the mid-1960s seawater had intruded nearly four miles inland within the Talbert Gap. Intrusion was also observed in the Alamitos Gap area along the Orange County/Los Angeles County border. During the 1950s and 1960s seawater intrusion investigations in coastal Orange County were conducted by the USGS, DWR and OCWD to define the nature and extent of the problem. During this time, OCWD slowed seawater intrusion by filling the basin with imported Colorado River water in the Anaheim Forebay area, thus reducing the overdraft throughout the basin and raising coastal groundwater levels (DWR, 1966).

Largely based on the 1966 DWR study, OCWD constructed the initial Talbert Seawater Intrusion Barrier in 1975 with 23 injection well sites. In 1965, a line of injection wells was constructed across the Alamitos Gap to form a subsurface freshwater hydraulic barrier. The Alamitos and Talbert barriers control seawater intrusion in their respective gaps by injecting fresh water into a series of multi-depth wells targeting each individual aquifer zone that is susceptible to seawater intrusion. The pressure mound resulting from this injection minimizes seawater intrusion through these gaps into the basin.

Both the Alamitos and Talbert barriers have been expanded and improved periodically and have allowed the basin to be operated more flexibly as a storage reservoir with an operating range of 500,000 acre-feet below full condition.

In July 2014, the OCWD Board of Directors adopted a Seawater Intrusion Prevention Policy that contained the following tenets:

- Prevent degradation of the quality of the groundwater basin from seawater intrusion.
- Effectively operate and evaluate the performance of the seawater barrier facilities.
- Adequately identify and track trends in seawater intrusion in susceptible coastal areas and evaluate and act upon this information, as needed, to protect the groundwater basin.

6.5.1 Talbert Seawater Intrusion Barrier

The Talbert Barrier consists of 36 injection well sites, shown in Figure 3-26, with the primary alignment along Ellis Avenue approximately four miles inland from the ocean. Barrier injection raises groundwater levels in the immediate vicinity and thus creates a groundwater mound that acts as a hydraulic barrier to seawater that would otherwise migrate inland toward areas of groundwater production.

From 1975 until 2008, a blend of deep well water, imported water and recycled water from the former Water Factory 21 was injected into the barrier. In 2008, GWRS recycled water became the primary supply used for the injection wells, with a small and intermittent portion of the supply from potable imported water delivered via the City of Huntington Beach at the OC-44 turnout and potable water delivered by the City of Fountain Valley (a blend of groundwater and imported water). Since approval by the Regional Water Board in 2009, OCWD uses recycled water for all of the injection well supply at the Talbert Barrier.

Prior to GWRS, barrier capacity averaged approximately 15 MGD but now averages approximately 30 MGD with a typical seasonal range of 20 to nearly 40 MGD. The approximately doubled injection capacity was necessary to prevent seawater intrusion as groundwater production increased and was made possible by construction of additional injection wells and pipelines, superior water quality (100% purified recycled water), and improved barrier operations, such as more frequent back-washing and rehabilitation. Barrier injection rates are adjusted based on overall basin storage conditions and seasonally varying coastal water levels. Therefore, injection is typically lower in the winter months and higher in the summer when increased coastal production causes lower coastal groundwater levels. Approximately 85 to 90 percent of barrier injection is typically targeted into the shallow and intermediate aquifer zones for seawater intrusion control on an annual basis, while the other 10 to 15 percent goes into the deeper Main aquifer zone primarily for basin replenishment. Based on the much steeper hydraulic gradient inland toward pumping depressions (relative to that toward the coast), OCWD estimates that approximately 95 percent of the water injected at the Talbert Barrier flows inland to replenish the basin, with the remainder ultimately flowing to the ocean as subsurface outflow.

6.5.2 Alamitos Seawater Intrusion Barrier

The Alamitos Barrier Project was initially constructed in 1964 and went into operation in 1965 to create a freshwater pressure ridge to prevent seawater intrusion from migrating through the Alamitos Gap into the Central Basin of Los Angeles County and the Orange County groundwater basin. The barrier alignment straddles the Los Angeles-Orange County border and spans approximately 1.8 miles across the Alamitos Gap from Bixby Ranch Hill in the City of Long Beach to the vicinity of Landing Hill in the City of Seal Beach.

Under the terms of the 1964 Agreement for Cooperative Implementation of the Alamitos Barrier Project (1964 Agreement), the barrier facilities are co-owned by OCWD and the Los Angeles County Flood Control District (LACFCD, a division of LACDPW) and currently include 41 injection wells and 220 active monitoring wells as shown in Figure 3-26. The barrier is operated and maintained by LACDPW under the direction of the Alamitos Barrier Joint Management Committee (JMC), whose membership includes OCWD, LACDPW, Water Replenishment District of Southern California (WRD), City of Long Beach, and Golden State Water Company.

The barrier has been incrementally expanded over time to include the construction of additional injection and monitoring wells. Since the initial 14 injection wells were constructed in 1964, an additional 27 injection wells have been installed over seven phases of well construction.

Similar to the Talbert Barrier, the Alamitos Barrier consists of both nested and cluster-type injection wells screened discretely in each aquifer zone in order to control the injection rate and injection pressure into each targeted aquifer zone independently since each aquifer zone has different physical characteristics and groundwater levels. In addition, there are a couple “dual-point” injection wells that consist of only one well casing but two different screened interval depths separated inside the well by an inflatable packer and two separate injection drop pipes.

SECTION 7 NOTICE AND COMMUNICATION

7.1 DESCRIPTION OF GROUNDWATER USERS

The local agencies that produce the majority of the groundwater from the basin are listed in Table 7-1 with geographic boundaries shown in Figure 3-3. OCWD meets monthly with 19 major water retail agencies, referred to as the Groundwater Producers, to discuss and evaluate basin management issues and proposed projects and work cooperatively among the agencies in the OCWD Management Area.

Table 7-1: Major Groundwater Producers

CITIES		
Anaheim	Huntington Beach	Santa Ana
Buena Park	La Palma	Seal Beach
Fountain Valley	Newport Beach	Tustin
Fullerton	Orange	Westminster
Garden Grove		

WATER DISTRICTS AND WATER COMPANIES	
East Orange County Water District	Mesa Water District
Golden State Water Company	Serrano Water District
Irvine Ranch Water District	Yorba Linda Water District

The monthly meeting with OCWD staff and the Groundwater Producers provides a forum for the Groundwater Producers to provide their input to OCWD on important issues such as:

- Setting the Basin Production Percentage (BPP) each year;
- Reviewing the merits of proposed capital improvement projects;
- Purchasing imported water to recharge the groundwater basin;
- Reviewing water quality data and regulations;
- Maintaining and monitoring basin water quality; and
- Budgeting, replenishment assessment and considering other important policy decisions.

7.2 PUBLIC PARTICIPATION

With passage of the Sustainable Groundwater Management Act (SGMA) in 2014, OCWD began discussing with Groundwater Producers and other stakeholders the potential impacts of this new law and options for compliance within Basin 8-1 and the OCWD Management Area. OCWD held discussions with Groundwater Producers and published articles concerning SGMA in the *Hydrospectives* newsletter, described below in this section. These forums provided opportunities for discussions about SGMA, the option for OCWD to become a Groundwater Sustainability Agency and prepare a Groundwater Sustainability Plan (GSP), and the option to develop an Alternative to a GSP. These discussions included conducting meetings with affected agencies and local and county government representatives in areas within the boundaries of Basin 8-1 both inside and outside of the service area of OCWD. A joint decision was made to proceed with preparation of this Basin 8-1 Alternative for submittal to DWR in compliance with SGMA.

In 2015, stakeholders within the OCWD Management Area participated in the preparation and completion of an update to the OCWD Groundwater Management Plan. This was the fifth update of OCWD's first Groundwater Management Plan adopted in 1989, under authority granted by the OCWD Act. In preparing each of these plan updates, OCWD presented groundwater basin conditions, the status of water supply monitoring, management of recharge operations, operation of seawater intrusion barriers and coastal water quality monitoring, water quality protection programs, and natural resource and collaborative watershed programs. The Groundwater Management plans were prepared to evaluate basin conditions and to document the continuing long-term sustainable management of the groundwater basin, and provided the foundation for the preparation of the Basin 8-1 Alternative. Preparation and adoption of the Groundwater Management plans included a public participation component with public notices, newsletter articles, posting on the OCWD website, and meetings with Groundwater Producers (see OCWD Groundwater Management Plan 2015 Update, Appendix A).

The draft Basin 8-1 Alternative, including the OCWD Management Area section, was posted on OCWD's website on November 4, 2016, for public review and comment. Additional public notification of the opportunity to review and comment on the draft document was provided through an article in OCWD's *Hydrospectives* newsletter. The OCWD Board of Directors was presented a draft version of the Basin 8-1 Alternative on November 9, 2016.

7.3 COMMUNICATION PLAN

Proactive community outreach and public education are central to OCWD. OCWD is dedicated to the creation, promotion and management of water education and conservation programs throughout Orange County. Each year, staff members give more than 70 offsite presentations to community leaders and citizens, conduct nearly 200 onsite presentations and tours of OCWD facilities, and take an active part in community events. The goal of OCWD's water-use efficiency and education programs, local water briefings, and outreach to organizations is to draw attention to state and local water needs and current issues, teach useful and simple ways to reduce water consumption and respect this natural resource, and encourage local citizens to make life-long commitments to conserving water. The components that comprise OCWD's water-use efficiency, outreach and public education events and programs are described in this section.

Children's Water Education Festival

The Children's Water Education Festival is the largest event of its kind in the nation, serving approximately 7,000 elementary school students annually. Thanks to more than 400 volunteers and the support of the Disneyland Resort, the National Water Research Institute and OCWD's Groundwater Guardian Team, the Festival celebrated its 20th anniversary in March 2016. The two-day Festival teaches children about water and the environment through hands-on educational activities. Topics include water resources, watersheds, wildlife and natural habitats, biology, chemistry and recycling at this unique event. Since inception, more than 110,000 students have attended.

O.C. Water Hero Program

The O.C. Water Hero Program was designed to make water conservation fun while helping children and parents develop effective water-use efficiency habits that will last a lifetime. When children sign up to commit to saving 20 gallons of water per day, they will enjoy videos, games, trivia, and other incentives they can access via the website and smartphone applications. The purpose of the O.C. Water Hero Program is to raise awareness of the need to conserve water and motivate county residents to reduce their water consumption by 20 gallons per day, per person. Since its inception in 2007, nearly 20,000 Water Heroes and Superheroes have enrolled in the program. In 2015, OCWD revamped the program to upgrade the technology platform in order to increase participation.

Groundwater Guardian

OCWD was recognized by The Groundwater Foundation as a Groundwater Guardian member in 1996, thereafter forming the OCWD Groundwater Guardian Team. This program is designed to empower local citizens and communities to take voluntary steps toward protecting groundwater resources. The OCWD Groundwater Guardian Team primarily supports the Children's Water Education Festival.

Social Media

Social media is a unique opportunity to provide information directly to people interested in OCWD and the topics associated with the organization. Through vehicles such as Facebook, Twitter, YouTube, Instagram and others, OCWD posts information of immediate importance, as well as joins the conversation on trending topics. OCWD engages in social media several times during a given week, primarily to followers of its Facebook and Twitter accounts.

OC Water Summit

The annual OC Water Summit teaches individuals, business, and community and civic leaders where our water comes from, and provides information about the water supply crisis and water quality challenges we face. The event, held annually since 2008, educates the public on what temporary measures are in place to address these issues as well as possible solutions to water reliability and preserving the Bay-Delta Region, California's main source of water. A collaborative effort between businesses, water agencies and local governments, the OC Water Summit provides a platform for individuals in the community to work with water utilities and legislators on creating and implementing solutions that will see Orange County through future water challenges. Topics for each Summit are determined according to the topical water issues each year. This event is hosted in conjunction with the Municipal Water District of Orange County and the Disneyland Resort.

Groundwater Adventure Tour

Nearly 150 guests attend the Groundwater Adventure Tour that takes place each fall. The annual event highlights OCWD operations that include the Groundwater Replenishment System, the Advanced Water Quality Assurance Laboratory, Recharge Operations, and Prado Wetlands. The day's activities are designed to provide an inside look at Orange County's water supply, as well as provide a better understanding of groundwater recharge operations.

Tour attendees include staff from cities, offices of elected officials, water districts, universities, state and county agencies, students, chambers of commerce members, service club members, and other stakeholders. Information is presented to attendees in a variety of formats including speeches, tours, video and question and answer sessions. OCWD executive management and supporting staff share their knowledge and facilitate activities throughout the day.

Website

The Public Affairs Department hosts the OCWD website, www.ocwd.com, to provide information on an array of subjects about OCWD, its board, facilities, and its programs. It includes access to important documents and forms providing transparency and public access. In 2015, OCWD merged the website with a separate site that was dedicated to information about the Groundwater Replenishment System, www.gwrsystem.com . The website helps to engage the citizens of north and central Orange County and water-related agencies to learn more about OCWD's operations.

Hydrospectives Newsletter

The *Hydrospectives* newsletter is a monthly OCWD publication with a circulation of approximately 5,700 subscribers from the water industry, government officials and agencies, OCWD staff, and the general public. It reflects the progress and decisions of OCWD, its achievements and influences and information pertinent to the groundwater industry in north and central Orange County. Each month, it offers a variety of subjects that include a message from the board president, important contributions from departments and staff, global and regional news, and celebrations and accomplishments of which OCWD is a part.

Media Coverage/Exposure

OCWD facilities and programs have been featured in thousands of print and broadcast stories, both mainstream and trade press, locally, nationally and internationally. OCWD and the Groundwater Replenishment System have been featured in National Geographic magazine, Wall Street Journal and on the 60 Minutes television program. They have also been featured in several documentaries including “Tapped – The Movie;” “Ecopolis” and “How Stuff Works” for *Discovery TV*; “Urban Evolution: The Story of Pure Water” for London’s Institution of Engineering & Technology; “America’s Infrastructure Report Card- Water” (ASCE 2009); in an episode of “Off Limits” for the *Travel Channel*; and referenced in the documentary titled “Last Call at the Oasis.”

Facility Tours and Speakers Bureau

OCWD receives hundreds of requests each year to provide tours and briefings for visitors from local colleges, water agencies, the surrounding community, and international organizations. Through its active speaker’s bureau program, OCWD also receives requests for representatives to go out to the community and speak to numerous organizations and schools, as well as at local, national and international conferences.

Since the GWRS came online in January 2008, more than 24,000 visitors have toured the facility. During FY 2013-14, OCWD conducted 198 public tours of the GWRS plant and the Advanced Water Quality Laboratory with a total of 3,432 participants.

Public Tours

Since the GWRS came on-line in January 2008, more than 24,000 visitors have toured the facility. During FY 2013-14, OCWD conducted 198 public tours of the GWRS plant and the Advanced Water Quality Laboratory with a total of 3,432 participants. Tour groups included 10 local high schools and 20 colleges and universities. In addition to many groups from throughout the United States, OCWD hosted tours from China, Korea, Japan, Saudi Arabia, Thailand, Australia, Switzerland, and Russia.

SECTION 8 SUSTAINABLE BASIN MANAGEMENT

8.1 SUSTAINABILITY GOAL

The sustainability goal for the OCWD Management Area is as follows:

> Continue to manage the groundwater basin to prevent basin conditions that would lead to significant and unreasonable undesirable results as defined by California Water Code Section 10721 (x).

Existing monitoring and management programs in place today enable OCWD to sustainably manage the groundwater basin. Since its founding in 1933, OCWD has developed a managed aquifer recharge program, constructed hundreds of monitoring wells, developed water quality monitoring programs, constructed a large surface water recharge system, installed seawater intrusion barriers, and managed the volume of groundwater production through a scientifically-based understanding of the basin's sustainable yield and the use of financial incentives. Continued successful protection of the groundwater basin requires that OCWD's management of the basin be able to adapt to changing conditions affecting the groundwater basin. The following sections describe the sustainable basin management for each of the undesirable results as defined in the California Water Code, Section 10721(x).

SECTION 9 SUSTAINABLE MANAGEMENT RELATED TO GROUNDWATER LEVELS

9.1 HISTORY/SUMMARY

OCWD manages the basin for long-term sustainability by maximizing recharge of the basin and managing basin production within sustainable levels. This section will discuss the relationship between groundwater elevations and sustainable groundwater management.

Groundwater elevations over the last twenty years exhibit short-term changes and long-term (multi-year) trends see Figures 3-11 through 3-14). Short-term elevation changes typically reflect seasonal variations in pumping and recharge, while multi-year trends reflect the effects of extended periods of above- or below-average precipitation and/or availability of imported water.

Groundwater elevation is monitored at over 1,000 individual measuring points, including the key wells designated under the California Statewide Groundwater Elevation Monitoring (CASGEM) program. OCWD was designated the Monitoring Entity for the Orange County groundwater basin under the CASGEM program. As such, OCWD designated key wells distributed laterally and vertically throughout the basin for the purpose of monitoring water elevations over the long-term.

In general, groundwater elevations in the Shallow Aquifer system show less amplitude than those in the underlying Principal and Deep Aquifer systems due to the higher degree of pumping and confinement of the Principal and Deep Aquifer systems. Because approximately 95 percent of all production occurs from wells screened within the Principal Aquifer system, groundwater elevations within this system are typically lower than those in the overlying Shallow Aquifer system and, in some areas, the underlying Deep Aquifer system. Vertical hydraulic gradients created by pumping and recharge drive groundwater into the Principal Aquifer system from the overlying Shallow Aquifer system and, to a lesser extent, from the Deep Aquifer system.

Long-term data demonstrates that groundwater elevations in the basin have exhibited multi-year cyclical patterns and have not experienced chronic lowering due to OCWD's management approach of maintaining basin storage within the established operating range. As a result, the undesirable effect of "chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply" is not occurring in the OCWD Management Area and is not expected to occur in the future as OCWD continues to manage the basin as described in this Basin 8-1 Alternative.

9.2 MONITORING OF GROUNDWATER LEVELS FOR SUSTAINABILITY

As explained in Section 3.2, OCWD monitors water levels at over 1,000 individual measuring points on a monthly or bi-monthly basis to evaluate the effects of pumping, recharge or injection operations. Additional monitoring is conducted as needed in the vicinity of OCWD's recharge facilities, seawater barriers and areas of special investigation where drawdown, water quality impacts or contaminants are of concern.

Groundwater elevation contour maps for the Shallow, Principal and Deep Aquifers are prepared annually and are scanned and digitized into OCWD's GIS database. The changes in groundwater elevations for the three aquifers are also calculated on an annual basis. The contoured water level changes for each of the three aquifers for June 2015 to June 2016 are shown in Figures 9-1, 9-2 and 9-3.

9.3 MANAGEMENT OF GROUNDWATER LEVELS FOR SUSTAINABILITY

For each of the three major aquifer systems, GIS mapping is used to multiply the water level changes by a grid of aquifer storage coefficients from OCWD's calibrated groundwater flow model. This results in a storage change volume for each of the three aquifer layers which are totaled to provide a net annual storage change for the basin. Thus, measurements of groundwater elevations are ultimately used to calculate total basin storage levels each year.

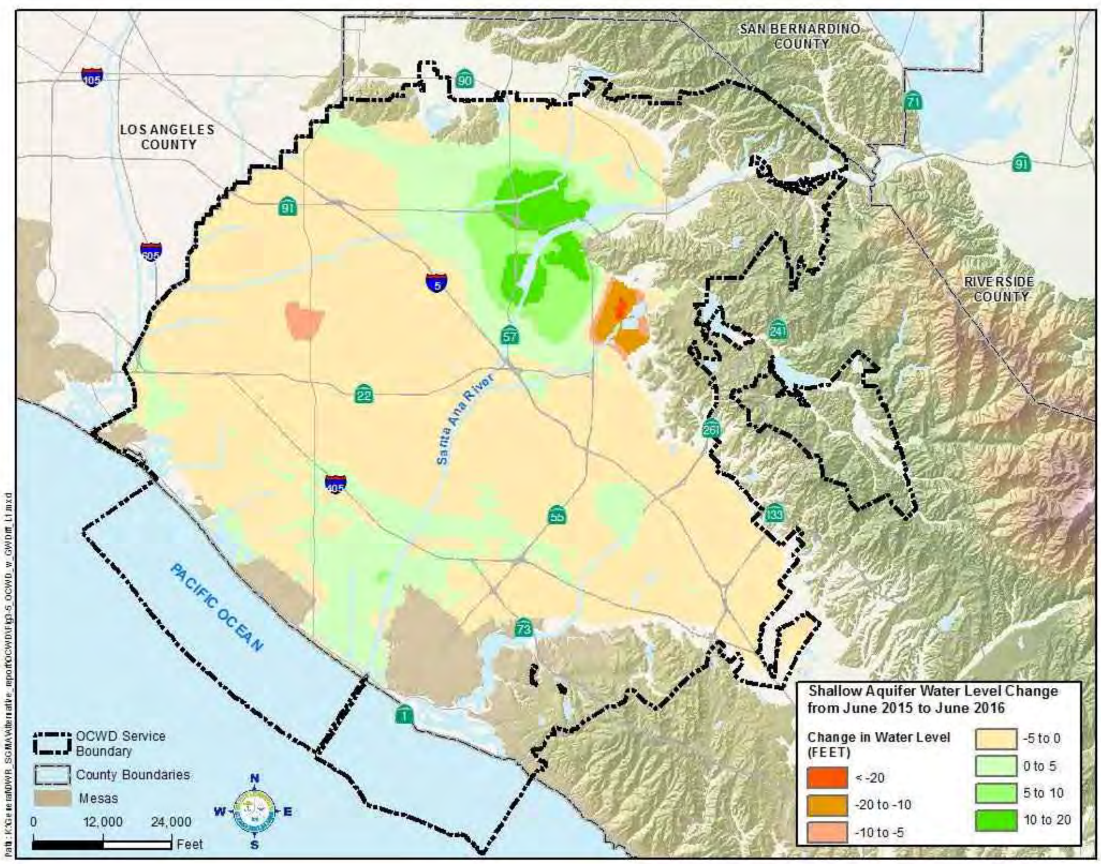


Figure 9-1: Shallow Aquifer Water Level Change, June 2015 to June 2016

In determining the operating range for groundwater storage levels, OCWD considered the potential negative impacts that could occur due to unreasonable and chronic lowering of groundwater elevations. These potential negative impacts include increased costs for groundwater producers to pump groundwater, decreased yield in production wells, increased risk of land subsidence, and increased risk of seawater intrusion.

Monitoring and management of groundwater elevations in the OCWD Management Area is most important in the coastal areas in order to protect groundwater basin water quality from seawater intrusion. Management programs that enable long-term sustainable basin management related to groundwater elevations in the coastal areas include the Coastal Pumping Transfer Program and operation of the Alamitos and Talbert Seawater Intrusion Barriers.

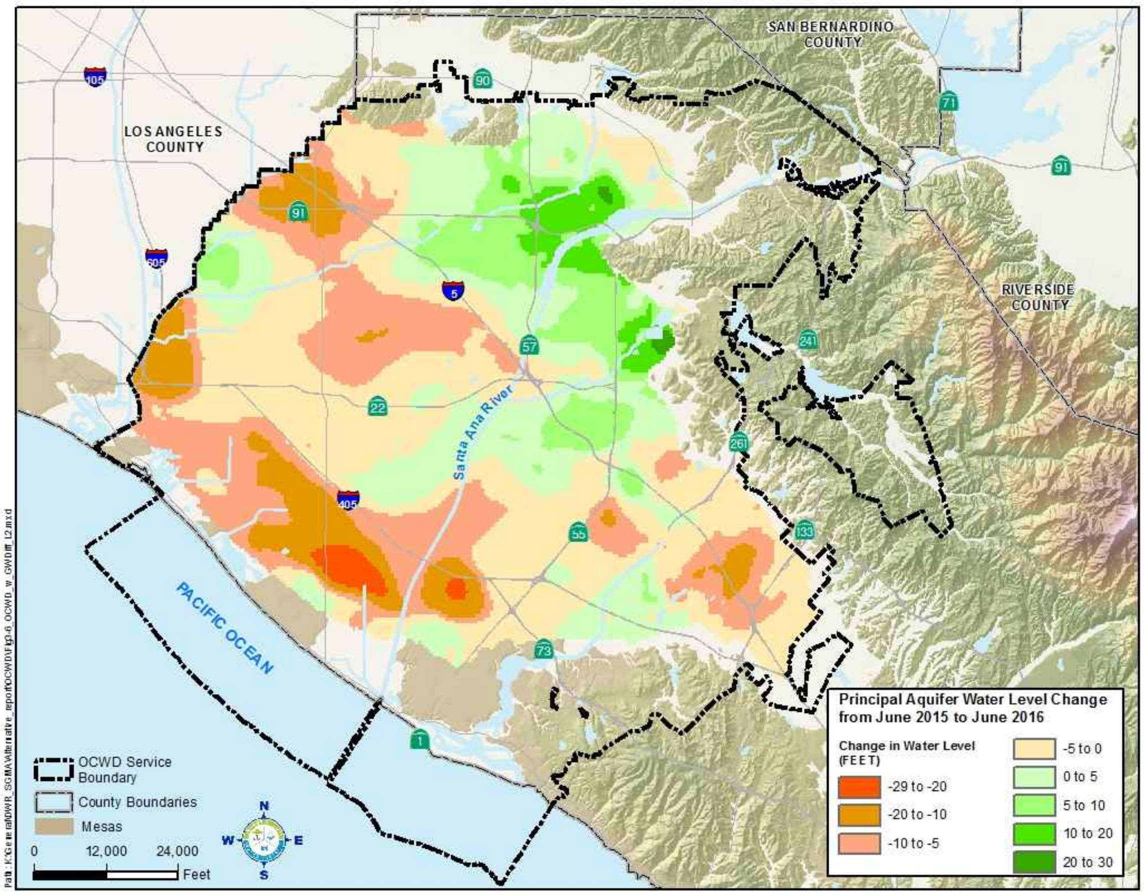


Figure 9-2: Principal Aquifer Water Level Change, June 2015 to June 2016

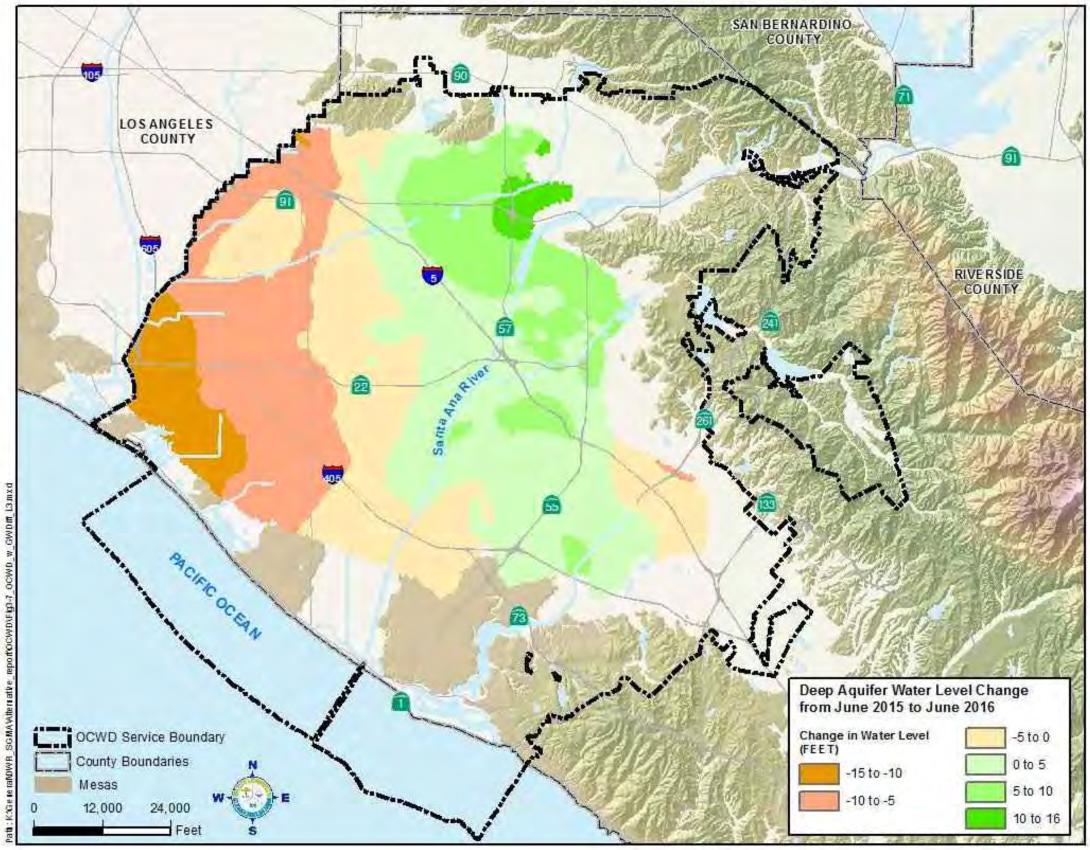


Figure 9-3: Deep Aquifer Water Level Change, June 2015 to June 2016

9.4 DEFINITION OF SIGNIFICANT AND UNREASONABLE LOWERING OF GROUNDWATER LEVELS

OCWD closely monitors groundwater levels in the three major aquifer systems (Shallow, Principal and Deep) for a number of purposes including determination of groundwater storage within the basin. OCWD uses groundwater storage conditions to manage the basin sustainably by keeping storage levels within an operating range up to 500,000 acre-feet below full condition. Significant and unreasonable reduction of groundwater in storage could occur in the event that the volume of groundwater in storage fell below the 500,000 acre-feet below full condition for an extended period of time. If OCWD were to consider an operating range below 500,000 acre-feet from full condition, additional analysis and monitoring would be needed.

9.5 DETERMINATION OF MINIMUM THRESHOLD

The minimum threshold for significant and unreasonable reduction in groundwater levels is reached when the storage volume of the groundwater basin falls below the operating range of up to 500,000 acre-feet below full condition for an extended period of time.

SECTION 10 SUSTAINABLE MANAGEMENT RELATED TO BASIN STORAGE

10.1 HISTORY

Within the Orange County Groundwater Basin, there is an estimated 66 million acre-feet of water in storage (OCWD, 2007). In spite of the large amount of stored water, there is a comparatively narrow operating range within which the basin can be safely operated.

The operating range of the basin is considered to be the maximum allowable storage range over the long-term without incurring detrimental impacts. The upper limit of the operating range is defined by the full basin condition. Although it may be physically possible to fill the basin higher than this full condition, it could lead to detrimental impacts such as percolation reductions in recharge facilities and increased risk of shallow groundwater seepage in low-lying coastal areas.

The lower limit of the operating range is considered to be 500,000 acre-feet below full condition. Although it may be considered to be acceptable to allow the basin to decline below 500,000 acre-feet below full condition for brief periods due to severe drought conditions and lack of imported water for basin recharge, it is not considered to be an acceptable management practice to intentionally manage the basin for sustained periods at this lower limit for the following reasons:

- Increased risk of seawater intrusion
- Increased risk of land subsidence
- Depletion of water in storage available for future drought conditions
- Some wells potentially becoming inoperable due to lower groundwater levels
- Increased costs to pump groundwater for groundwater users
- Increased potential for upwelling of amber-colored groundwater from the Deep Aquifer

It is important to note that detrimental impacts do not suddenly happen when storage levels fall to 500,000 or more acre-feet below full condition; rather, they occur incrementally, or the potential for their occurrence grows as the basin declines to lower levels. OCWD has used the basin model computer simulations to evaluate the potential for detrimental impacts if storage were to fall to 700,000 acre-fee from full. Basin model runs at 700,000 acre-feet below full condition indicates the potential for increased seawater intrusion and considerably more production wells being impacted by low pumping levels. Thus, a reduction of up to 700,000 acre-feet of groundwater in storage is only considered acceptable during an extreme emergency, such as a disruption in imported water supplies due to an earthquake. Negative or adverse impacts that are considered when establishing the operating range include chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the long-term, increased seawater intrusion, significant and unreasonable land subsidence that substantially interferes with surface land uses, and increased pumping costs.

The current policy of maintaining a groundwater storage level of up to 500,000 acre-feet below full was established based on completion of a comprehensive hydrogeological study of the basin in 2007 (OCWD, 2007).

The basin's storage level is quantified based on a benchmark defined as the full basin condition. Although the groundwater basin rarely reaches the full basin condition, basin storage has fluctuated within the operating range for many decades. OCWD manages groundwater pumping such that it is sustainable over the long term; however, in any given year pumping may exceed recharge or vice versa. Thus, the amount of groundwater stored in or withdrawn from the basin varies from year to year and often goes through multi-year cycles of emptying and filling, which typically correlates with state-wide and/or local precipitation patterns.

Each year OCWD calculates the volume of groundwater storage change from a theoretical "full" benchmark condition based on a calculation using changes in groundwater elevations in each of the three major aquifer systems and aquifer storage coefficients. This calculation is checked against an annual water budget that accounts for all production, measured recharge, and estimated unmeasured recharge. The amount of available or unfilled storage from the theoretical full condition from WY 1958-59 to WY 2015-16 is shown in Figure 10-1.

Available storage below
full condition

Figure 10-1: Basin Storage Levels WY 1958-59 to WY 2015-16

Maintaining the basin storage condition on a long-term basis within this operating range allows for long-term sustainable management of the basin without experiencing undesirable effects. Short-term excursions from the operating range due to extreme drought or other factors are not expected to cause adverse impacts but would need to be monitored closely and be of limited duration. In the California Water Plan Update 2013 this manner of groundwater basin management is described as follows:

> "Change in groundwater storage is the difference in stored groundwater volume between two time periods…However, declining storage over a period characterized by average hydrologic conditions does not necessarily mean that the basin is being managed unsustainably or is subject to conditions of overdraft. Utilization of groundwater in storage during years of diminishing surface water supply, followed by active recharge of the aquifer when surface water or other alternative supplies become available, is a recognized and acceptable approach to conjunctive water management." (CWP, p. SC-77)

10.2 CALCULATION OF GROUNDWATER STORAGE LEVELS

The estimated historical minimum storage level of 500,000 to 700,000 acre-feet below full condition occurred in 1956-57 (DWR, 1967; OCWD, 2003). Since this time, the basin storage fluctuated within the operating range reaching a full condition in 1969 and 1983.

OCWD uses two methods to calculate the storage condition of the basin: (1) water budget method and (2) three-layer storage change method. The water budget method is simply an accounting of the inflows to the basin and outflows. This data is collected and compiled on a monthly basis. Estimates of unmeasured or incidental recharge are used based on a statistical relationship between historical local precipitation and calculated unmeasured recharge. Unmeasured recharge is trued up at the end of the year with the final reports of inflows and outflows and basin storage change (based on groundwater level changes). This method produces a monthly estimate of the change in groundwater storage and allows for real-time decision making with respect to managing the basin.

In 2007, OCWD instituted a new three-layer change in storage method for calculating the amount of groundwater in storage (OCWD, 2007). The three-layer method involves creating groundwater elevation contour maps for each of the three aquifer layers (Shallow, Principal and Deep aquifers) for conditions at the end of June of each year. Prior to this time, groundwater storage was determined based on a single groundwater elevation map that was essentially a composite of the Shallow and Principal aquifers.

The need for this revised method was driven by the record-setting wet year of 2004-05, in which water levels throughout the basin approached a near-full condition. An analysis of the amount of groundwater in storage compared to the estimate using a one-layer change in storage method showed a discrepancy of 150,000 acre-feet. The discrepancy of 150,000 acre-feet in two different calculations indicated that the current condition could not be properly rectified back to the prior 1969 benchmark. This brought to light three important discoveries:

- The one-layer storage change calculation contained considerable uncertainty that when cumulatively added over tens of years led to a large discrepancy in the level of water in storage relative to 1969.

- Water level conditions in 1969 no longer represented a full basin, particularly because of changes in pumping and recharge conditions.
- A more accurate storage change calculation should be based on water level changes and storage coefficients for each of the three major aquifer systems, as was now made possible given OCWD's mature groundwater monitoring well network.

In February 2007, OCWD adopted an updated approach to defining the full basin condition and calculating storage changes. This updated approach included:

- A new full-basin groundwater level based on the following prescribed conditions:
  - Observed historical high water levels
  - Present-day pumping and recharge conditions
  - Protection from seawater intrusion
  - Minimal potential for mounding at or near recharge basins
- Calculation of the amount of groundwater in storage in each of the three major aquifer systems.

This method involves annually contouring water levels for each aquifer system annually and digitizing them and storing them in OCWD's GIS database. The previous year's water levels are subtracted from the current water levels to calculate change in water levels. Water level change contour maps are prepared for each of the three aquifer layers. For each of the three aquifers, the GIS data are used to multiply the water level changes by a grid of aquifer storage coefficients from OCWD's calibrated groundwater flow model. This results in a storage change volume for each of the three aquifers which are totaled to provide a net annual storage change for the basin. In cases where there is a calculation discrepancy between the storage changes estimated by the two methods, the unmeasured recharge value (previously estimated based on local rainfall) is adjusted to eliminate the difference.

A more detailed description of the full basin storage determination and three-layer methodology is presented in OCWD's *Report on Evaluation of Orange County Groundwater Basin Storage and Operational Strategy* (OCWD, 2007) and can be found in Appendix D of the *OCWD Groundwater Management Plan 2015 Update* (OCWD, 2015).

10.3 SUSTAINABLE MANAGEMENT PROGRAMS

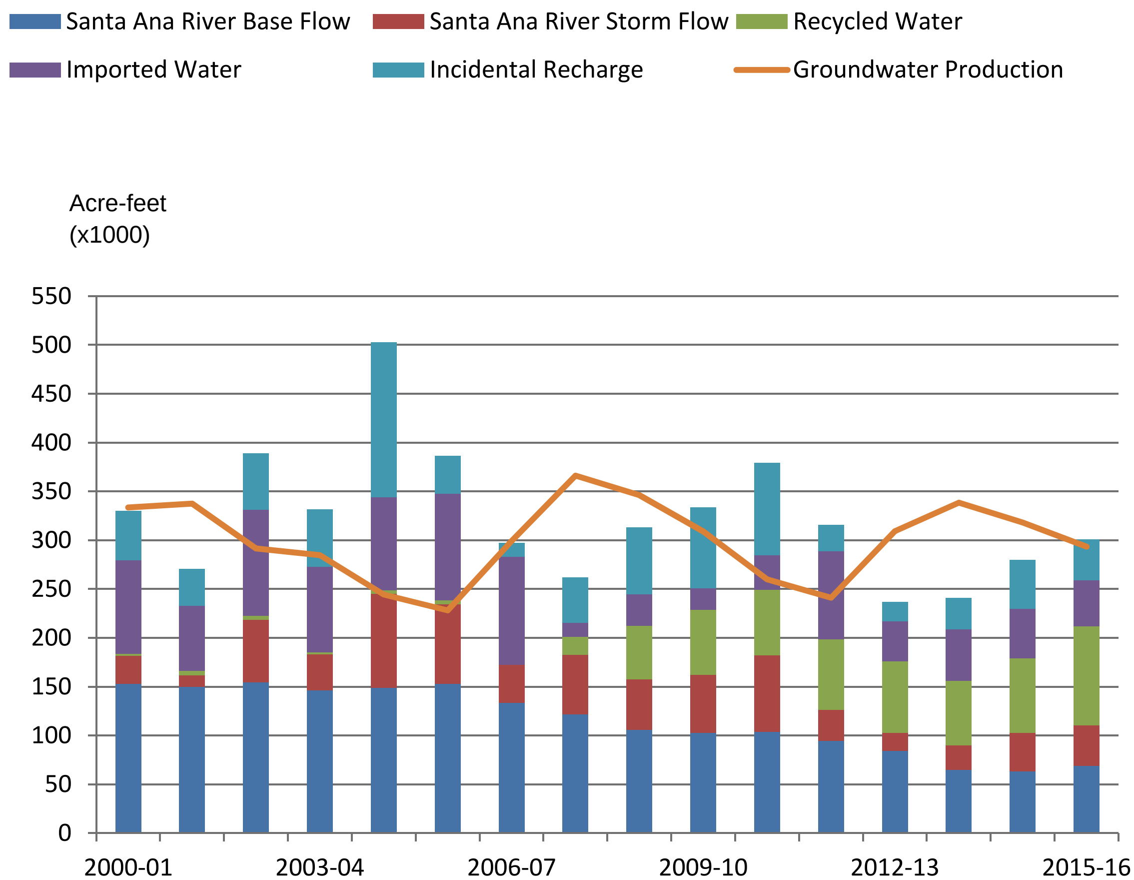
10.3.1 Basin Operating Range

Each year OCWD assesses current basin storage and projected water supply availability as factors in its determination of setting the Basin Production Percentage for the following year, as described in Section 10.3.3. If basin storage approaches or falls within the lower end of the established operating range, issues that are evaluated when considering the management of the basin include the current status of seawater intrusion protective measures, monitoring of ground surface elevations to assess the risk of land subsidence, inflow of amber-colored water or poor quality groundwater into the Principal Aquifer from underlying or overlying aquifers, and the number of shallow production wells that would become affected by lower groundwater levels. On the other hand, when operating the basin near the higher end of the storage range, considerations include the potential to increase the Basin Production Percentage, purchase less imported replenishment water, and the potential for more groundwater outflow to Los Angeles County.

OCWD does not directly limit pumping from the groundwater basin. Instead, basin storage and total pumping are managed by using the Basin Production Percentage and pumping assessments to apply financial incentives to encourage groundwater producers to pump an aggregate amount of water that is sustainable over the long- term. The process that determines a sustainable level of pumping considers the basin’s operating range, basin storage conditions, water demands, the amount of recharge water available to OCWD, and other factors. The basin is managed to avoid groundwater storage levels declining to levels that could result in long-term significant negative or adverse impacts.

10.3.2 Balancing Production and Recharge

Over the long-term, the basin must be maintained in an approximate balance to ensure the long-term viability of basin water supplies. In one particular year, water withdrawals may exceed water recharged as long as over the course of a number of years this is balanced by years where water recharged exceeds withdrawals. Levels of total basin production and total water recharged since WY 2000-01 are shown in Figure 10-2.



Notes: (1) "Imported Water" includes water purchased by OCWD for recharge and water recharged under both the MWD Conjunctive Use Program (CUP) and the in-lieu program. (2) "Production" includes water produced from the basin by groundwater producers and under the MWD CUP program.

Figure 10-2: Basin Production and Recharge Sources, WY 2000-01 to WY 2015-16

10.3.3 Managing Basin Pumping

The primary mechanisms used by OCWD to manage pumping are the Basin Production Percentage (BPP) and the Basin Equity Assessment (BEA). The ability to assess the BPP and the BEA were provided to OCWD through an amendment to the OCWD Act in 1969. Section 31.5 of the OCWD Act empowers the Board to annually establish the BPP, defined as:

> "…the ratio that all water to be produced from groundwater supplies with the district bears to all water to be produced by persons and operators within the District from supplemental sources and from groundwater within the District during the ensuing water year."

In other words, the BPP is a percentage of each Producer's water supply (supplemental and groundwater sources) that comes from groundwater pumped from the basin. The BPP is set uniformly for all Groundwater Producers. Groundwater production at or below the BPP is assessed the Replenishment Assessment (RA). Any production above the BPP is charged the RA plus the Basin Equity Assessment (BEA). The BEA is set by the Board and is presently calculated so that the cost of groundwater production above the BPP is equivalent to the cost of purchasing imported potable supplies. This approach serves to discourage, but not eliminate, production above the BPP. In practice, Groundwater Producers rarely pump in excess of the BPP as doing so triggers a requirement to pay the BEA, thereby eliminating any cost savings that a pumper might obtain by pumping an amount in excess of the BPP. Collection of the BEA provides funds for OCWD to purchase additional replenishment water (where determined appropriate by OCWD). If necessary, the BEA can be increased to even further to discourage production above the BPP.

The BPP is set after evaluating groundwater storage conditions, availability of recharge water supplies and basin management objectives. OCWD's goal is to set the BPP as high as possible to allow Groundwater Producers to sustainably maximize pumping and reduce their overall water supply cost.

To change the BPP, the Board of Directors must hold a public hearing. Raising or lowering the BPP allows OCWD to manage the amount of pumping from the basin. The BPP is lowered when basin conditions necessitate a decrease in pumping. A lower BPP results in the need for Groundwater Producers to purchase additional, more expensive imported water.

Methodology for Setting the Basin Production Percentage

To determine the initial estimated BPP for a given year, the amount of water available for basin recharge in the coming year is estimated. The supplies of recharge water that are estimated are:

- Santa Ana River stormflow
- Natural incidental recharge
- Santa Ana River baseflow
- Highly purified recycled water produced by the GWRS
- "Supplemental" supplies such as imported water originating outside of the Santa Ana River Watershed
- Recycled water purchased by OCWD for operation of the Alamitos Seawater Barrier

Water demands by the Groundwater Producers are also estimated, as this factors into the BPP formula. Expected water quality pumping above the BPP refers to the authorization for a Groundwater Producer to pump above the BPP (with an exempted or reduced BEA) in order to address a localized water quality issue.

BPP Policy

The Board of Directors has several policy considerations that may be considered as the BPP is determined at least annually. For example, the Groundwater Producers generally prefer that the BPP be changed gradually (generally not more than five percent from one year to the next).

In some situations, for example, the Board may need to consider lowering the BPP more than five percent, such as in response to relatively low groundwater storage levels.

In 2013, the Board of Directors adopted a policy to work toward achieving and maintaining a 75% BPP. Principles of this policy include:

- OCWD sets a goal for achieving a stable 75% BPP, while maintaining the same process of setting the BPP on an annual basis, with the BPP set in April of each year after holding a public hearing and based upon the public hearing testimony, presented data and reports provided at that time.
- OCWD must sustainably manage the groundwater basin for future generations. If future conditions warrant, the BPP will be reduced.
- Projects and programs to achieve the 75% BPP goal will be individually reviewed and assessed for their economic viability. Economical projects and programs that could support a BPP above 75% also would be considered.

The groundwater basin's storage levels would be managed to support the 75% BPP policy. As long as the storage levels remain between 100,000 and 300,000 acre-feet from full, there would be a presumption that the BPP would not be decreased. Table 10-1 shows the management actions to be used to guide OCWD in setting the BPP. As the BPP is annually set in April for the following fiscal year (but may be changed throughout the year), the projected change in basin storage would be estimated for the end of that fiscal year (as of June 30), given various assumptions of basin pumping, inflows and outflows.

Table 10-1: Management Actions based on Change in Groundwater Storage

Available Storage Space (amount below full basin condition)	Basin Management Actions to Consider
Less than 100,000 acre-feet	Raise BPP
100,000 to 300,000 acre-feet	Maintain and/or raise BPP towards 75% goal
300,000 to 350,000 acre-feet	Seek additional supplies to refill basin and/or lower the BPP
Greater than 350,000 acre-feet	Seek additional supplies to refill basin & lower the BPP

Maintaining some available storage space in the basin allows for maximizing surface water recharge when such supplies are available, especially in relatively wet years. By keeping the basin relatively full during wet years and for as long as possible in years with near-normal recharge, the maximum amount of groundwater could be maintained in storage for future drought conditions. During dry hydrologic years when less water would be available for recharge, the BPP could need to be lowered to maintain groundwater storage levels.

At the beginning of 2015, OCWD committed to purchase 650,000 acre-feet of imported water to recharge the basin over a ten-year time period. This amount of imported water for recharge into the basin will help maintain the BPP and assist in managing the basin storage level within the operating range. OCWD works to maintain a Water Reserve Fund to purchase imported water from MWD. Each year, a specific amount of money is budgeted to purchase imported water and, if water is not available from MWD, the funds are carried over to the next year in the Water Reserve Fund.

Basin Production Limitation

Another management tool that enables OCWD to sustainably manage the basin is the Basin Production Limitation. Section 31.5(g)(7) of the OCWD Act authorizes limitations on production and the setting of surcharges when those limits are exceeded. This provision can be used when it is necessary to shift pumping from one area of the basin to another. An example of this is the Coastal Pumping Transfer Program, which shifts pumping from the coastal area to inland to minimize seawater intrusion, when necessary.

10.3.4 Supply Management Strategies

One of OCWD's basin management objectives is to maximize groundwater recharge. This is achieved through increasing the efficiency of and expanding OCWD's recharge facilities and the supply of recharge water. Construction and operation of the GWRS has provided a substantial increase in supply of water available to recharge the basin. Additional OCWD supply management programs include developing increased stormwater capture programs behind Prado Dam in cooperation with the U.S. Army Corps of Engineers, encouraging and participating in water conservation efforts, and working with MWD and the Municipal Water District of Orange County in developing and conducting other supply augmentation projects and strategies.

Conjunctive Use and Water Transfers

By agreement with OCWD, MWD established a Conjunctive Use Project (CUP) in the OCWD Management Area by purchasing the right to use up to 66,000 acre-feet of storage space in the groundwater basin until 2028. OCWD used the funds provided by MWD to improve basin management facilities including the construction of eight new production wells for water retail agencies and new injection wells for the Talbert Barrier. Under the agreement, MWD may request that stored water be extracted up to a maximum of 22,000 acre-feet each year.

OCWD reviews opportunities for additional conjunctive use projects that would store water in the basin and potentially in other groundwater basins. Additionally, OCWD reviews opportunities for water transfers that could provide additional sources of recharge water. Such projects are evaluated carefully with respect to their impact on available storage, reliability and cost effectiveness.

10.3.5 Water Demands

Water demands within the OCWD Management Area for WY 2014-15 totaled approximately 425,000 acre-feet. Total demand includes the use of groundwater, surface water from Santiago

Creek and Irvine Lake, recycled water, and imported water. As shown in Figure 6-1, water demands between WY1989-90 and 2014-15 have ranged between approximately 413,000 and 515,000 afy.

Projected Water Demands

OCWD estimated future water demands within the OCWD Management Area to be 447,000 afy in 2035. This is an average of two numbers: (1) a summation of the 19 major Groundwater Producers individually-estimated future water demands provided in their 2015 Urban Water Management Plans, which totaled 459,000 afy; and (2) the Municipal Water District of Orange County's Water Supply Reliability Study estimate of 435,000 afy (MWDOC, 2016). Population within OCWD's service area is projected to increase from the current 2.38 million to 2.54 million by 2035.

Drought Management

During a drought, flexibility to manage pumping from the basin becomes increasingly important. The OCWD Management Area typically experiences a decline in the supply of recharge water (local supply of Santa Ana River water and net incidental recharge) of up to 55,000 afy or more during drought.

Provided that the basin has available water in storage within the established operating range, this stored water provides a valuable water supply asset during drought conditions. Ensuring that the basin can provide a buffer against drought conditions requires:

- Maintaining sufficient water in storage that can be pumped out in time of need; and
- Possessing a plan to recover basin storage following the drought, including having a reserve account with sufficient funds to purchase replenishment water.

A sufficient supply of stored groundwater provides a safe and reliable buffer to manage for drought periods. If the basin, for example, has an available storage level of 150,000 acre-feet and can be drawn down to 500,000 acre-feet without irreparable seawater intrusion, a supply of 350,000 acre-feet is available for increased production. In a hypothetical five-year drought, an additional 70,000 afy may be produced from the basin for five years without jeopardizing the long-term health of the basin. In addition to reducing pumping when the basin is at lower storage levels, planning for refilling the basin is important. Approaches for refilling the basin are described in Table 10-2.

10.4 DEFINITION OF SIGNIFICANT AND UNREASONABLE REDUCTION OF GROUNDWATER STORAGE

OCWD manages the groundwater basin to maintain groundwater storage levels within an operating range of up to 500,000 acre-feet below the full condition. Significant and unreasonable reduction of groundwater in storage would occur when the volume of groundwater in storage fell below the 500,000 acre-feet below full condition for an extended period of time. If

OCWD were to consider an operating range below 500,000 acre-feet additional analysis and monitoring would be needed.

10.5 DETERMINATION OF MINIMUM THRESHOLDS

The minimum threshold for significant and unreasonable reduction in groundwater in storage is reached when the storage volume of the groundwater basin falls below the operating range of up to 500,000 acre-feet below full condition for an extended period of time

Table 10-2: Approaches to Refilling the Basin

APPROACH	DISCUSSION
Decrease Total Water Demands	• Increase water conservation and water-use efficiency measures
Decrease BPP	• Allows groundwater levels to recover rapidly • Decreases revenue to the OCWD • Increases water cost for producers • Does not require additional recharge facilities • Dependent upon other sources of water (e.g., imported water) being available to substitute for reduced groundwater pumping
Increase Recharge	• Dependent on increased supply of recharge water • Replenishment could be in the form of in-lieu water (additional imported water delivered to Producers instead of groundwater pumping) • Water transfers and exchanges could be utilized to provide the increased supply of recharge water • May be dependent on building and maintaining excess recharge capacity (which may be under-utilized in non-drought years)
Combination of the Above	• A combination of the approaches provides flexibility and a range of options for refilling the basin

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SECTION 11 SUSTAINABLE MANAGEMENT RELATED TO WATER QUALITY

OCWD has extensive monitoring and management programs in place to protect the groundwater basin from significant and unreasonable degradation of water quality including migration of contaminant plumes that impair water supplies. These programs are described in previous sections. This section describes sustainable basin management related to the water quality programs and projects instituted to prevent degradation of water quality and to remediate water quality problems in the OCWD Management Area.

11.1 SALINITY MANAGEMENT

Management of salt and nitrate concentrations in groundwater is important to maintaining the long-term sustainable use of groundwater supplies. OCWD's programs to manage water quality include monitoring, remediation of contaminated groundwater, and recharging high-quality recycled water. OCWD also operates the Prado Wetlands to remove nitrate from Santa Ana River (SAR) water that is recharged into the groundwater basin. These efforts help provide high-quality groundwater to water users in Orange County.

In July 2016, OCWD completed an evaluation of future TDS and nitrate concentrations in the OCWD Management Area (OCWD, 2016b). This involved using a model to evaluate the effects of different basin management scenarios on TDS and nitrate concentrations over the next 30 years. The report was prepared to meet regulatory requirements of the Regional Water Board as part of the watershed-wide salt and nutrient management plan.

Data and information used for this analysis included:

- Quantity and quality of water recharged through surface recharge facilities;
- Quantity and quality of water recharged through seawater injection barriers;
- Quantity and quality of unmeasured recharge, such as percolation of irrigation water into the groundwater basin;
- Measurements of groundwater pumping; and
- Estimates of groundwater outflow from the Orange County Management Zone.

Data from a variety of sources, included:

- OCWD measurements of the quantities of water recharged at surface recharge facilities;
- OCWD measurements of the quantities of water recharged at the Talbert Seawater Barrier;
- OCWD measurements of water quality for water recharged at surface recharge facilities and the Talbert Seawater Barrier;

- Los Angeles County Department of Public Works measurements of the quantities of water recharged at the Alamitos Seawater Barrier;
- Water Replenishment District of Southern California measurements of water quality for the Alamitos Seawater Barrier;
- MWD measurements of water quality for imported water purchased by OCWD; and
- OCWD measurements of water quality for imported water purchased from MWD by OCWD.

The quantity and quality of water recharged in the model are shown in Table 11-1.

Table 11-1: Example Projected Future Salt Inflows

Source of Water Recharge	Volume (acre-feet)	TDS Conc. (mg/L)	Mass (tons)
Deep percolation of precipitation*	6,500	100	900
Percolation of applied water*	9,000	1,900	23,200
Subsurface inflow*	37,500	1,177	59,200
SAR baseflow	52,000	700	49,200
SAR stormflow	50,000	200	13,600
Recycled water (Forebay & Talbert Barrier)	103,000	60	8,400
Alamitos Barrier	2,500	350	1,200
MWD imported water	65,000	650	57,300
Total	325,500	479	213,000

*Component of unmeasured recharge

The model was used to predict the ambient water quality of the basin for TDS using nine scenarios with differing volumes of recharge water sources. Sources of water recharge volume and TDS concentrations in Table 11-1 were used as the base case. Eight additional scenarios were chosen to represent potential future portfolios of available water sources.

For the modeled scenarios, the ambient concentration of TDS in the groundwater basin was predicted in 30 years to be between 565 and 588 mg/L. In all cases the long-term flow-weighted concentration of TDS of inflow to the groundwater basin was projected to be below the current ambient concentration of 610 mg/L. The model predicts a gradual decrease in the TDS concentration in the groundwater basin over time. Based on the current ambient TDS concentration of 610 mg/L and the projected inflow TDS of 479 mg/L in Table 11-1, the average mass of TDS pumped from the OCWD Management Zone is projected to surpass the total mass of TDS inflow.

With regards to nitrate, the approach used to estimate future nitrate concentrations was similar to the approached used for TDS projections. The nitrate (as nitrogen, or nitrate-N) concentration for each inflow component was estimated using available data. Table 11-2 summarizes the inflow terms and their nitrate-N concentrations.

The flow-weighted average nitrate-N concentration for all inflows to the management zone is 2.1 mg/L. The initial concentration was set at 2.9 mg/L (based on the current ambient concentration for the most recent 20-year period). Since the inflow concentration is less than the initial concentration, the estimated future nitrate-N concentration gradually decreases.

The model was used to predict the ambient water quality of the basin for nitrate-N using three scenarios with differing volumes of recharge water sources. The concentration of 2.1 mg/L for nitrate-N in inflows is below the water quality objective of 3.4 mg/L nitrate-N. The results indicate a gradual decrease in the nitrate concentration over the long-term. Based on the current ambient nitrate-N concentration of 2.9 mg/L and the projected inflow nitrate-N of 2.1 mg/L, the average mass of nitrate pumped from the OCWD Management Zone is projected to surpass the total mass of nitrate inflow.

Table 11-2: Example Projected Future Nitrate-N Inflows to OCWD Management Area

Inflow	Volume (Acre-Feet)	Nitrate-N Conc.(mg/L)	Mass (tons)
Deep percolation of precipitation*	6,500	1	9
Percolation of applied water*	9,000	10	122
SAR baseflow	52,000	4.5	318
SAR stormflow	50,000	0.9	61
Imported water recharge	65,000	0.6	53
Recycled water recharge (Forebay & Talbert Barrier)	103,000	1.7	238
Subsurface inflow*	37,500	3.5	178
Alamitos Barrier	2,500	2	7
Total	325,500	2.1	986

*component of unmeasured recharge

11.2 GROUNDWATER QUALITY IMPROVEMENT PROJECTS

This section describes specific projects that improve groundwater quality by removing TDS, nitrate, VOCs and other constituents. The location of these projects is shown in Figure 11-1.

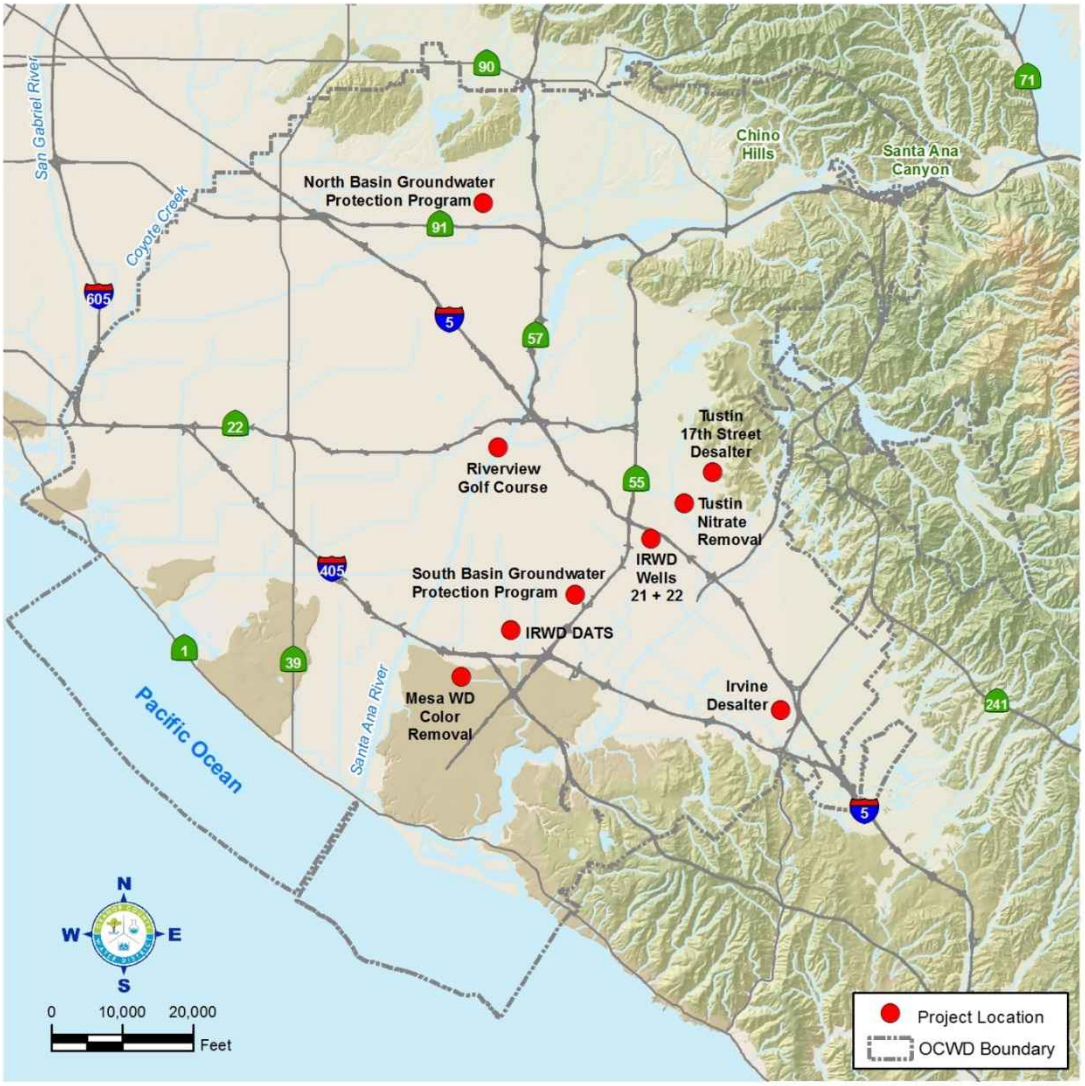

Figure 11-1: Water Quality Improvement Projects and Programs

North Basin Groundwater Protection Program

The U.S. Environmental Protection Agency (USEPA) is taking the lead to remediate a VOC plume in the North Basin area of the groundwater basin as shown in Figure 11-2. Groundwater contamination is primarily found in the Shallow Aquifer, which is generally less than 200 feet deep; however, VOC-impacted groundwater has migrated downward into the Principal Aquifer tapped by production wells. The contamination continues to migrate both laterally and vertically threatening downgradient production wells operated by the cities of Fullerton and Anaheim and other agencies. OCWD is conducting a remedial investigation/feasibility study under USEPA oversight to evaluate and develop effective remedies to address the contamination under the National Contingency Plan (NCP) process.

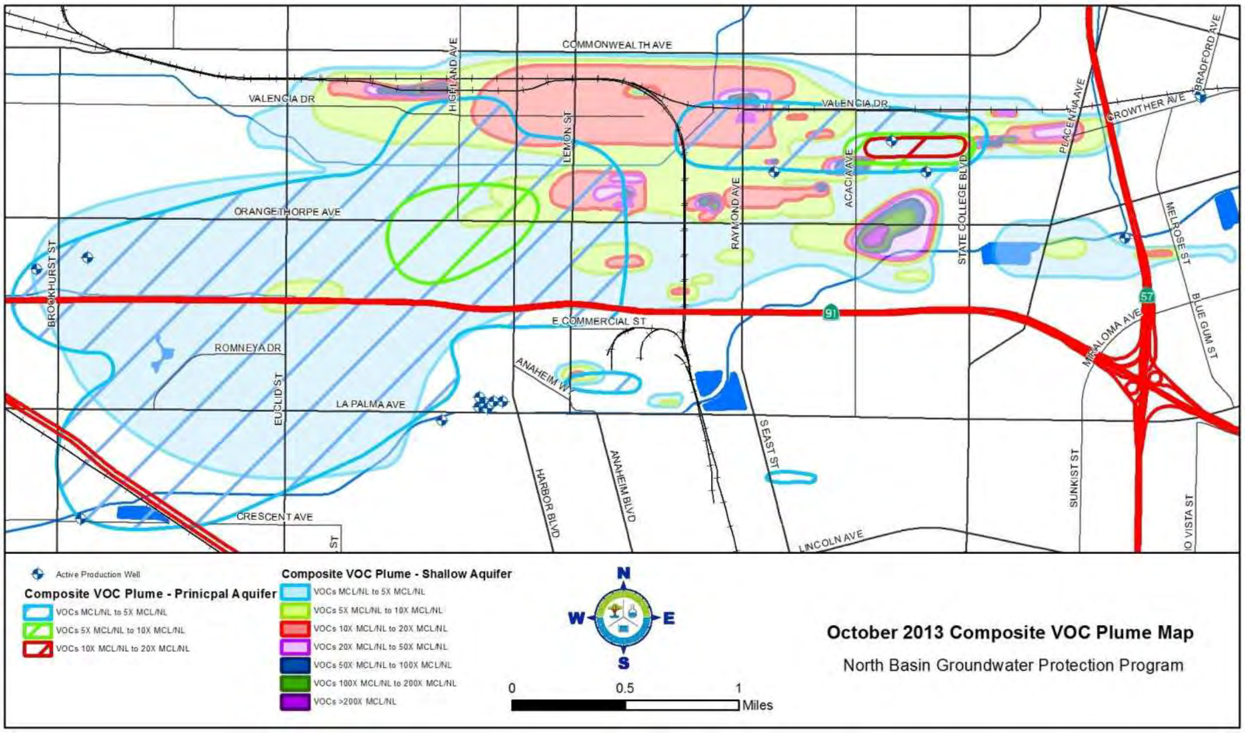

Figure 11-2: North Basin Groundwater Protection Program Plume

South Basin Groundwater Protection Program

Groundwater contaminated with VOCs and perchlorate in the South Basin area of the groundwater basin is shown in Figure 11-3. The extent of groundwater contamination has been investigated, contamination plumes have been delineated, and the remedial program is being developed in cooperation with regulatory agencies and stakeholders following the NCP process.

Elevated concentrations of perchloroethylene (PCE), TCE, and perchlorate were detected in Irvine Ranch Water District's Well No. 3, located in Santa Ana. OCWD is currently working with the Regional Water Board and the California Department of Toxic Substances Control to require aggressive cleanup actions at nearby sites that are sources of the contamination.

MTBE Remediation

In 2003, OCWD filed suit against numerous oil and petroleum-related companies that produce, refine, distribute, market, and sell MTBE and other oxygenates. The suit seeks funding from these responsible parties to pay for the investigation, monitoring and removal of oxygenates from the basin.

Treatment technologies used to remove MTBE from groundwater include granular activated carbon or advanced oxidation. Depending upon site-specific requirements, a treatment train of two or more technologies in series may be appropriate (i.e., use one technology to remove the bulk of MTBE and a follow-up technology to polish the effluent water stream).

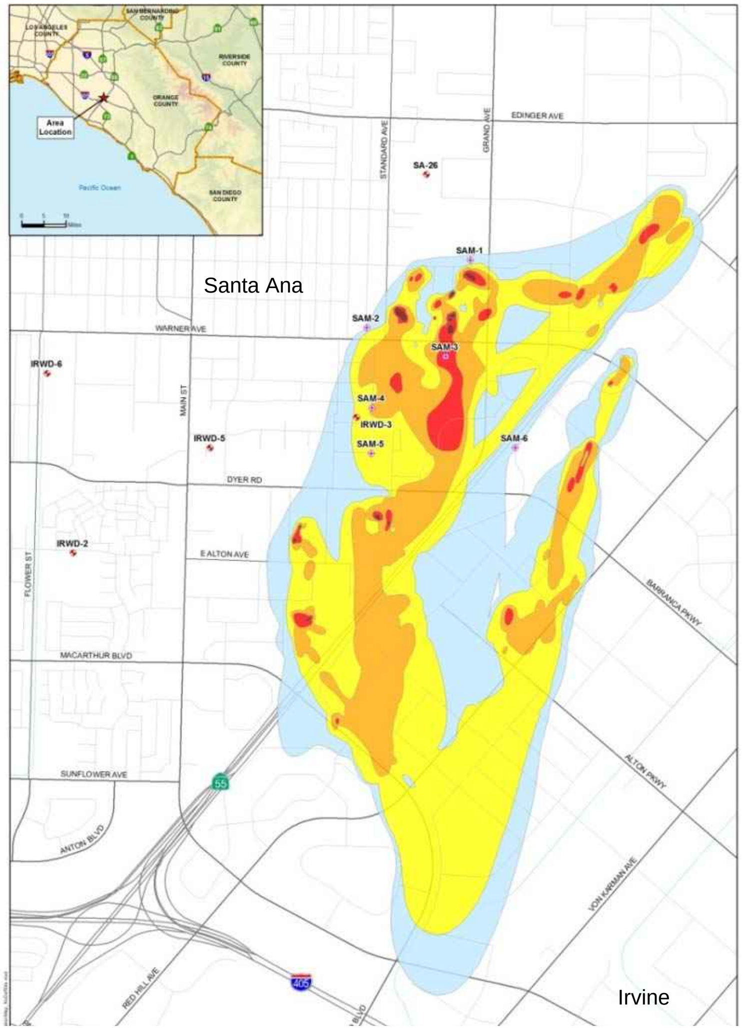

Figure 11-3: South Basin Groundwater Protection Program Plume

Irvine Desalter

The Irvine Desalter was built in response to elevated TDS and nitrate and the discovery in 1985 of VOCs beneath the former El Toro Marine Air Corps Station and the central area of Irvine. A plume of TCE migrated off base and threatened the groundwater basin. Irvine Ranch Water District and OCWD cooperated with the U.S. Department of Navy in building production wells, pipelines and two treatment plants, both of which are now owned and managed by Irvine Ranch Water District. The two plants remove VOCs by air-stripping and vapor-phase carbon adsorption with the treated water used for irrigation and recycled water purposes. A third plant treats groundwater outside the plume to remove excess nitrate and TDS concentrations using reverse osmosis (RO) membranes for drinking water purposes. Combined production of the Irvine Desalter wells is approximately 8,000 afy. OCWD provides a financial subsidy to IRWD in the form of a BEA exemption to help offset the treatment costs.

Tustin Desalters

Tustin's Main Street Treatment Plant has operated since 1989 to reduce nitrate levels from the groundwater produced by Tustin's Main Street Wells Nos. 3 and 4. The groundwater undergoes either RO or ion exchange treatment. The RO membranes and ion exchange units operate in a parallel treatment train. Approximately 1 mgd is bypassed and blended with the treatment plant product water to produce up to 2 mgd or 2,000 afy.

The Tustin Seventeenth Street Desalter began operation in 1996 to reduce high nitrate and TDS concentrations from the groundwater pumped by Tustin's Seventeenth Street Wells Nos. 2 and 4 and Tustin's Newport Well. The desalter utilizes two RO membrane trains to treat the groundwater. The treatment capacity of each RO train is 1 mgd. Approximately 1 mgd is bypassed and blended with the RO product water to produce up to 3 mgd or 3,000 afy. OCWD provides a financial subsidy to the City of Tustin in the form of a BEA exemption to help offset the treatment costs.

River View Golf Course

VOC contamination, originating from an up-gradient source, was discovered in a well owned by the City of Orange in the last 1980s. The well was subsequently closed. After an investigation by OCWD, it was determined that an existing irrigation well operated by River View Golf Course, located in the City of Santa Ana would help to contain and remove the VOC contamination. OCWD provides a financial incentive to keep the golf course well in operation to remove VOC contamination from the basin.

Irvine Ranch Water District Wells 21 and 22

Water produced by IRWD Wells 21 and 22 contain nitrate (as N) at levels exceeding the primary MCL of 10 mg/L. TDS concentrations range from 650-740 mg/L, which is above the secondary MCL of 500 mg/L. Because of the elevated nitrate, TDS, and hardness concentrations, IRWD constructed a RO treatment facility to reduce concentrations in the water before conveying to the potable supply distribution system. Operation of the treatment facility provides 6,300 afy of drinking water and benefits the groundwater basin by reducing the spread of impaired groundwater to other portions of the basin. OCWD provides a financial subsidy to IRWD in the form of a BEA exemption to help offset the treatment costs.

Amber-Colored Groundwater

Amber-colored water is found in the Deep Aquifer (600 to 2,000 feet below ground surface). Natural organic material from ancient buried plant and wood material gives the water an amber tint and a sulfur odor. Although this water is of high quality, its color and odor produce negative aesthetic qualities that require treatment before use as drinking water.

Two facilities currently treat colored groundwater in Orange County. In 2001, Mesa Water District opened its Colored Water Treatment Facility (CWTF) capable of treating 5.8 mgd. This facility was replaced in 2012 by the 8.6-mgd Mesa Water Reliability Facility that uses nanofiltration membranes to remove color. OCWD provides a financial subsidy to Mesa Water District in the form of a BEA exemption to help offset the treatment costs. The second facility is the Deep Aquifer Treatment System (DATS), a treatment facility operated by the IRWD since 2002 that uses nano-filtration membranes. This facility purifies 7.4 mgd of amber- colored water.

BEA Exemption for Water Quality Improvement Projects

In some cases, OCWD encourages the pumping of groundwater that does not meet drinking water standards in order to protect water quality. This is achieved by using a financial incentive called the Basin Equity Assessment (BEA) Exemption. The benefits to the basin include promoting beneficial uses of poor-quality groundwater and reducing or preventing the spread of poor-quality groundwater into non-degraded aquifer zones.

OCWD uses a partial or total exemption of the BEA to compensate a qualified participating agency or Groundwater Producer for the costs of treating poor-quality groundwater. These costs typically include capital, interest and operations and maintenance (O&M) costs for the treatment facilities.

Using this approach, OCWD has exempted all or a portion of the BEA for pumping and treating groundwater for removal of nitrates, TDS, VOCs, and other contaminants. Water quality improvement projects that currently are receiving BEA exemptions are listed in Table 11-3.

Table 11-3 Summary of BEA Exemption Projects

Project Name	Project Description	BEA Exemption Approved	Production above BPP (afy)	OCWD BEA Subsidy
Irvine Desalter	Remove nitrates, TDS, and VOCs	2001	10,000	Exemption
Tustin Desalter	Remove nitrates and TDS	1998	3,500	Exemption
Tustin Nitrate Removal	Remove nitrates	1998	1,000	Exemption
River View Golf Course	Remove VOCs	1998	350	$50/af BEA reduction
Mesa WD Colored Water Removal	Remove color	2000	8,700	Exemption
IRWD Wells 21 and 22	Remove nitrates	2012	7,000	Exemption

11.3 DEFINITION OF SIGNIFICANT AND UNREASONABLE DEGRADATION OF WATER QUALITY

There are three elements that must be considered when evaluating the impact of groundwater quality degradation.

The first element is considering the causal nexus between groundwater management activities and groundwater quality. For example, groundwater contamination due to improper handling of toxic materials impacts groundwater quality; however, this water quality degradation is not caused by groundwater management activities.

The second element is the beneficial uses of the groundwater and water quality regulations, such as MCLs and other potable water quality requirements.

The third element that must be considered is the volume of groundwater impacted by groundwater quality degradation. If small volumes are negatively affected that do not materially affect the use of the aquifer or basin for its existing beneficial uses, then this would not represent a significant and unreasonable degradation of water quality. However, if the impacted volume grows, then it could reach a level that it becomes significant and unreasonable.

When considering all three elements, “significant and unreasonable degradation of water quality” is defined as degradation of groundwater quality attributable to groundwater production or recharge practices in the OCWD Management Area and to the extent that a significant volume of groundwater becomes unusable for its designated beneficial uses.

11.4 DETERMINATION OF MINIMUM THRESHOLDS

The minimum thresholds for groundwater quality are exceedances of MCLs or other applicable regulatory limits that are directly attributable to groundwater management actions in the OCWD Management Area that prevents the use of groundwater for its designated beneficial uses.

SECTION 12 SUSTAINABLE MANAGEMENT RELATED TO SEAWATER INTRUSION

In the coastal area of the Orange County groundwater basin, the primary source of saline groundwater is seawater intrusion through permeable aquifer sediments underlying topographic lowlands or gaps between the erosional remnants or mesas of the Newport-Inglewood Uplift. The susceptible locations from north to south are the Alamitos, Sunset, Bolsa, and Talbert gaps as shown in Figure 3-26.

OCWD's policy regarding control of seawater intrusion is implemented through a comprehensive program that includes operating seawater intrusion barriers, monitoring and evaluating barrier performance, monitoring and evaluating susceptible coastal areas, and coastal groundwater management. These programs, described below, enable OCWD to sustainably manage groundwater conditions in the basin in order to prevent significant and unreasonable seawater intrusion.

12.1 TALBERT GAP

The Talbert Gap, also referred to as the Santa Ana Gap, is shown in Figure 12-1. Figure 12-2 shows a geologic cross-section through the Talbert Gap and the 2015 chloride concentrations within the various aquifers dissected by this cross-section alignment. The furthest seaward mergence zone between the Talbert and Lambda aquifers in the vicinity of Adams Avenue is a primary pathway by which seawater can potentially migrate inland and downward within the Talbert Gap. The chloride concentrations shown on this cross-section are updated annually to determine if intrusion is worsening or being pushed seaward with the information published in the GWRS Annual Report (OCWD, 2016c).

OCWD monitoring well M26 is strategically located seaward of the barrier in the Talbert-Lambda aquifer mergence zone in the middle of the Talbert Gap and is screened within the merged Talbert and Lambda aquifers (see Figure 12-3). Therefore, M26 is a key monitoring well for evaluating barrier injection requirements versus seawater intrusion potential and is used to assess whether protective groundwater elevations are being achieved in the Talbert Gap to prevent seawater intrusion. At the location of well M26, the protective groundwater elevation is approximately 3.5 feet above mean sea level (msl), as explained below.

The protective groundwater elevation is based on the Ghyben-Herzberg relation (Ghyben, 1888; Herzberg, 1901; Freeze and Cherry, 1979, pp. 375-376), which takes into account the depth of the Talbert aquifer at a given location along with the density difference between saline and fresh groundwater. Using this relation, for every 40 feet that the bottom of the aquifer is below sea level, there should be about one foot of head of fresh water above sea level to overcome the density effect of seawater. In the case of well M26, the bottom of the merged Talbert-Lambda aquifer is approximately 140 feet below sea level. Therefore, the fresh water head (protective elevation) should be approximately 140 feet divided by 40 which equals 3.5 feet above sea level. Achieving this protective elevation at well M26 is OCWD's goal to prevent brackish water in the Talbert aquifer from migrating down into the Lambda aquifer that is tapped by inland production wells.

Figure 12-3 shows the historical inter-relationship between coastal groundwater production, Talbert Barrier injection, and groundwater elevations at well M26 over the last 10 years. The largest annual decline in groundwater elevations at well M26 occurred in 2007, from a winter high of approximately 4 ft msl down to a low in the fall of approximately -18 ft msl. This 22-foot decline was primarily due to the unusually large amount of groundwater production that year (historical maximum) combined with an unusually low amount of barrier injection; barrier injection supply was limited to the imported water MWD OC-44 connection during this transition period after Interim Water Factor 21 (IWF-21) was decommissioned and prior to commencement of GWRS operations.

With the commencement of GWRS purified recycled water injection in January 2008 and the contemporaneous startup of 8 new injection well sites, the Talbert Barrier injection volume was essentially doubled from previous years, causing groundwater elevations at well M26 to steadily rise over a two-year period to reach protective elevations. Since 2010, groundwater elevations at well M26 have consistently been maintained at or above protective elevations with the exception of brief periods related to GWRS shutdowns. To date, the longest shutdown occurred in June 2014 (26 days) related to GWRS Initial Expansion construction activities. Most other shutdowns have been one day or less.

Operationally, when groundwater elevations at well M26 rise above 6 ft msl, barrier injection is incrementally reduced by 1 to 2 mgd to prevent additional groundwater elevation increases (ground surface elevation at well M26 is approximately 8 ft msl). Conversely, when groundwater elevations at well M26 drop below 3 ft msl (protective elevation), then barrier injection is incrementally increased by 1 to 2 MGD until groundwater elevations again stabilize within the desired 3 to 6 ft msl range. When groundwater levels drop below mean sea level at M26, like after prolonged barrier shutdowns as occurred in June 2014, subsequent barrier injection is then maximized and prioritized into the shallow and intermediate depth aquifer zones susceptible to seawater intrusion in order to get back to protective elevations as quickly as possible. For more detailed information on the operation of the Talbert Seawater Barrier, see *GWRS 2015 Annual Report* prepared for the Regional Water Board, June 17, 2016.

Since 2010, a seaward gradient has been predominantly maintained in the Talbert aquifer seaward of the barrier within the Talbert Gap. Under these conditions, brackish groundwater that had migrated inland in previous years has slowly begun to migrate back towards the ocean as evidenced by recent declines in chloride concentrations at well M26 and other monitoring wells seaward of the barrier.

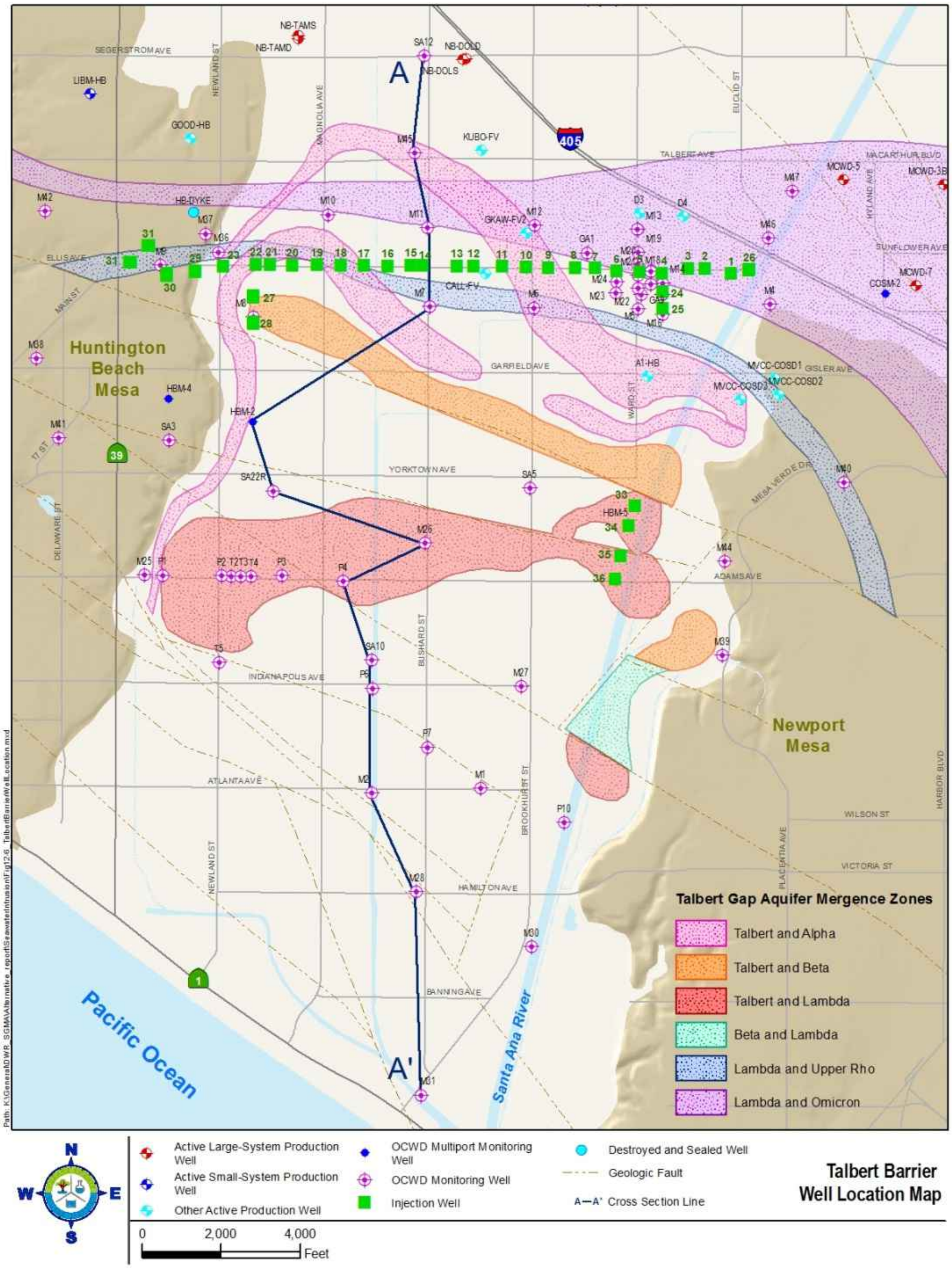

Figure 12-1: Talbert Gap – Seawater Intrusion Barrier and Cross-Section Location

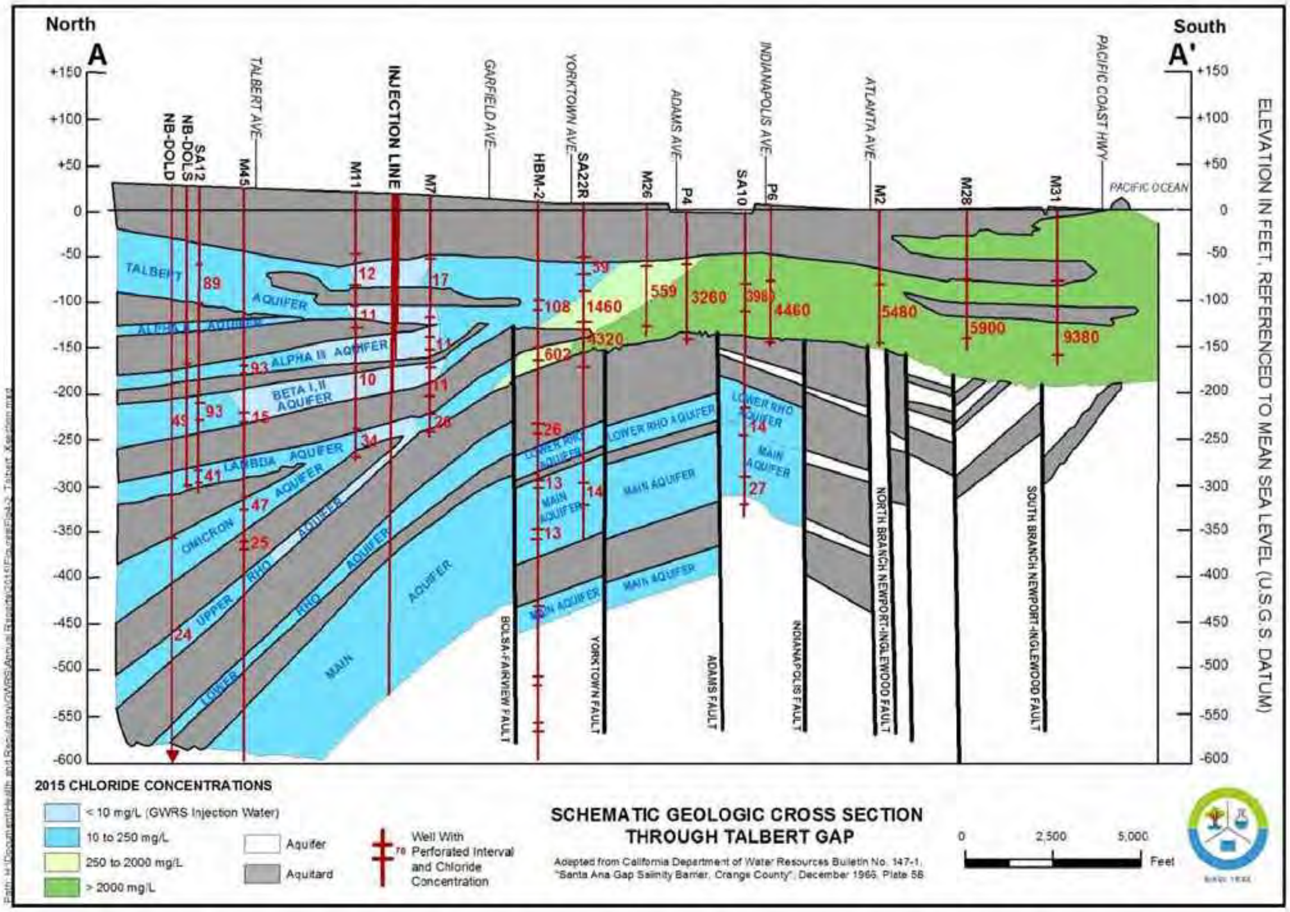

Figure 12-2: Geologic Cross-Section through Talbert Gap Showing 2015 Chloride Concentrations

Figure 12-4 shows the 250 mg/L chloride concentration contour for the selected years of 1993, 1998, 2008, and 2016 in the Talbert and Bolsa gaps and adjacent mesas. The 250 mg/L chloride contour is used to delineate the inland extent of intrusion because this is above ambient (non-intruded) groundwater quality and is equal to the secondary drinking water standard. Native fresh groundwater in this area typically has a chloride concentration well below 100 mg/L, while the GWRS injection supply has a chloride concentration of approximately 10 mg/L. During the 1990s prior to any barrier expansion, the 250 mg/L chloride contour progressed inland. From 1998-2008, intrusion was held at bay without appreciably worsening as five new injection well sites came online. Since 2008 when eight new injection well sites came online along with the GWRS, the 250 mg/L chloride contour has been pushed slightly seaward primarily due to doubling barrier injection and other basin management practices. The Coastal Pumping Transfer Program and Coastal In-Lieu Program reduced coastal groundwater production by either shifting it inland or purchasing imported water in lieu of groundwater, thus helping to raise coastal groundwater levels.

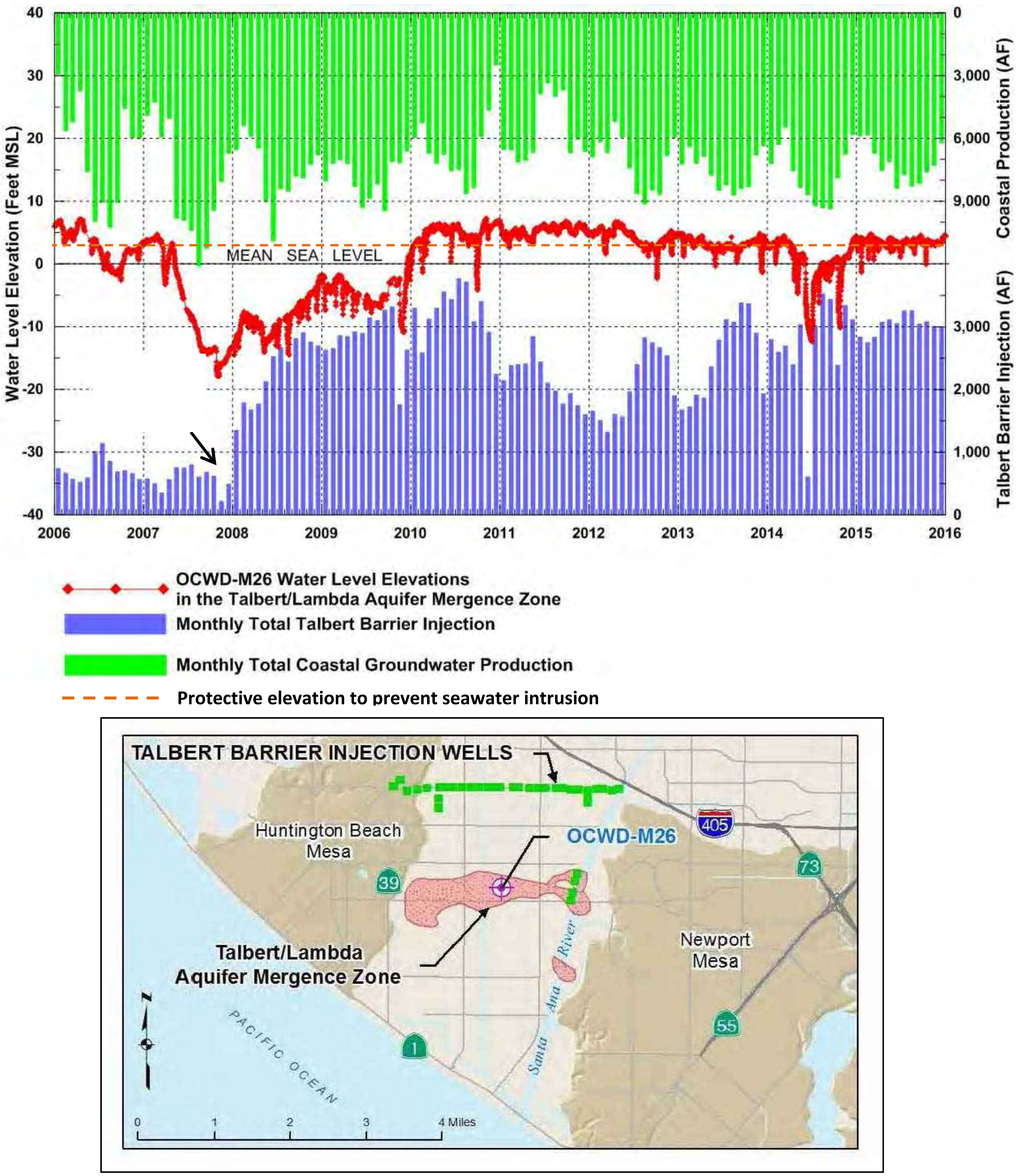

Figure 12-3: Key Well OCWD-M26 Groundwater Levels, Talbert Barrier Injection, and Coastal Pumping

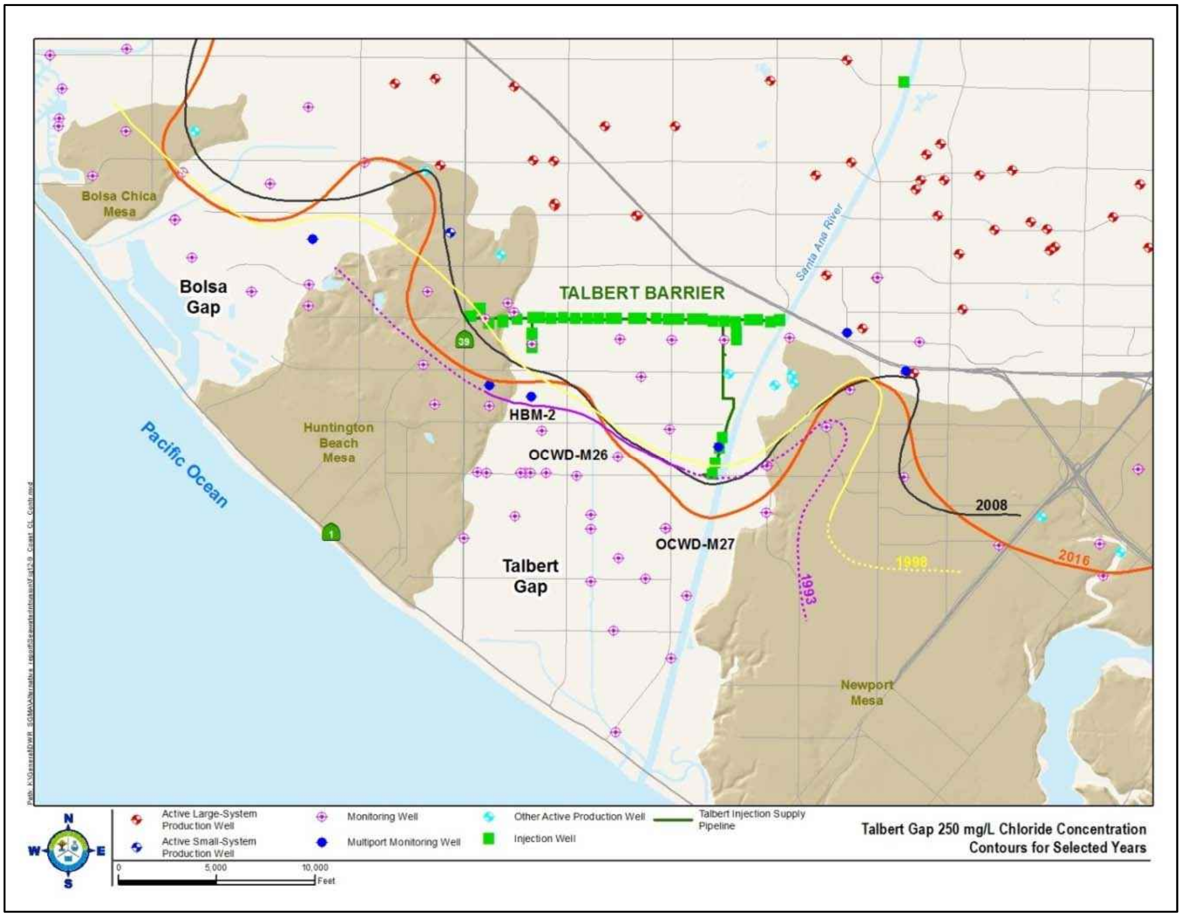

Figure 12-4: Talbert Gap 250 mg/L Chloride Concentration Contours for Selected Years

In addition to chloride contour maps, OCWD prepares and reviews chloride concentration time series graphs at individual wells to identify and evaluate trends in specific aquifer zones. Seaward of the barrier at coastal monitoring wells with elevated salinity, chloride concentrations tend to be inversely related to groundwater elevations. When groundwater elevations decline significantly below mean sea level in the area of the intrusion front, chloride concentrations generally increase and seawater intrusion moves inland. Conversely, when groundwater elevations rise and are sustained above mean sea level, chloride concentrations decrease and intrusion is pushed seaward.

12.1.1 Talbert Barrier Groundwater Model

A numerical groundwater flow model of the Talbert Barrier and surrounding vicinity (Talbert Model) was originally developed by Camp, Dresser & McKee, Inc. (CDM; now CDM Smith) in 1999-2000 with oversight from OCWD. The original Talbert Model was a seven-layer transient model developed as part of the initial planning for the GWRS to evaluate the expansion needs of the existing Talbert Barrier (CDM, 2000). In 2003, the Talbert Model was refined to 13 layers by explicitly modeling the intervening aquitards between the aquifer zones so that the model would be suitable for solute transport simulations in addition to groundwater flow.

The Talbert Model area covers approximately 85 square miles and uses the MODFLOW code (Harbaugh and McDonald, 1996) with 13 vertical layers and 509,000 grid cells (uniform grid with 250 feet x 250 feet horizontal grid cell dimensions). The model layering generally follows the conceptual model of aquifers, aquitards, and mergence zones developed by DWR (1966) with some refinements in the stratigraphy by OCWD based on newer data.

The Talbert Model was calibrated under transient conditions over the nine-year period 1990-99 and provided a sufficient match to observed historical groundwater levels. Along the ocean boundary a constant head condition was employed, whereas time-varying specified head conditions were used along the three inland boundaries based on observed groundwater levels at monitoring wells near those boundaries.

In addition to helping to guide the planning, location, and hydraulic effectiveness of the supplemental injection wells for the Talbert Barrier during pre-GWRS planning activities, the Talbert Model was also used to estimate the general groundwater flow paths and subsurface residence time of barrier injection water by using the USGS particle tracking code MODPATH (Pollack, 1994). This modeling work provided the basis for delineating a recycled water retention buffer area surrounding the Talbert Barrier at a distance of 2,000 feet and one-year travel distance. No new drinking water production wells are allowed within this buffer area, as required by the original California Department of Public Health requirements contained within the original permit to operate GWRS (RWQCB, 2004; OCWD, 2005).

12.2 ALAMITOS GAP

As explained earlier, the Alamitos Barrier Project was initially constructed in 1964 and became operational in 1965 to manage seawater intrusion in the Alamitos Gap. The barrier has been expanded over time to include the construction of additional injection and monitoring wells.

The 41 existing injection wells, shown in Figure 12-5, are screened in several Upper Pleistocene-aged aquifers, referred to locally as the C, B, A and I aquifer zones. The underlying Main and Sunnyside (Lower Main) aquifers are not considered to be susceptible to intrusion due to being offset by the Newport-Inglewood Fault Zone (locally referred to as the Seal Beach Fault) and are not hydraulically merged with either the Recent or the overlying C, B, A, and I aquifers, as shown in Figure 12-6. Consequently, none of the Alamitos Barrier injection wells extend into the Main or Sunnyside aquifers.

The Recent aquifer in Alamitos Gap is age correlative with the Talbert aquifer in Talbert Gap. However, the Recent aquifer in Alamitos Gap is considerably thinner (approximately 40 feet thick) and somewhat finer grained than the more transmissive Talbert aquifer. Since there are no production wells screened in the Recent aquifer and it is generally of poor quality, none of the Alamitos Barrier injection wells are screened in the Recent aquifer.

Similar to the Talbert Barrier, the Alamitos Barrier consists of both nested and cluster-type injection wells screened discretely in each aquifer in order to control the injection rate and injection pressure into each targeted aquifer independently since each aquifer has different physical characteristics and groundwater levels. In addition, there are two “dual-point” injection wells that consist of only one well casing but two different screened interval depths separated inside the well by an inflatable packer and two separate injection drop pipes.

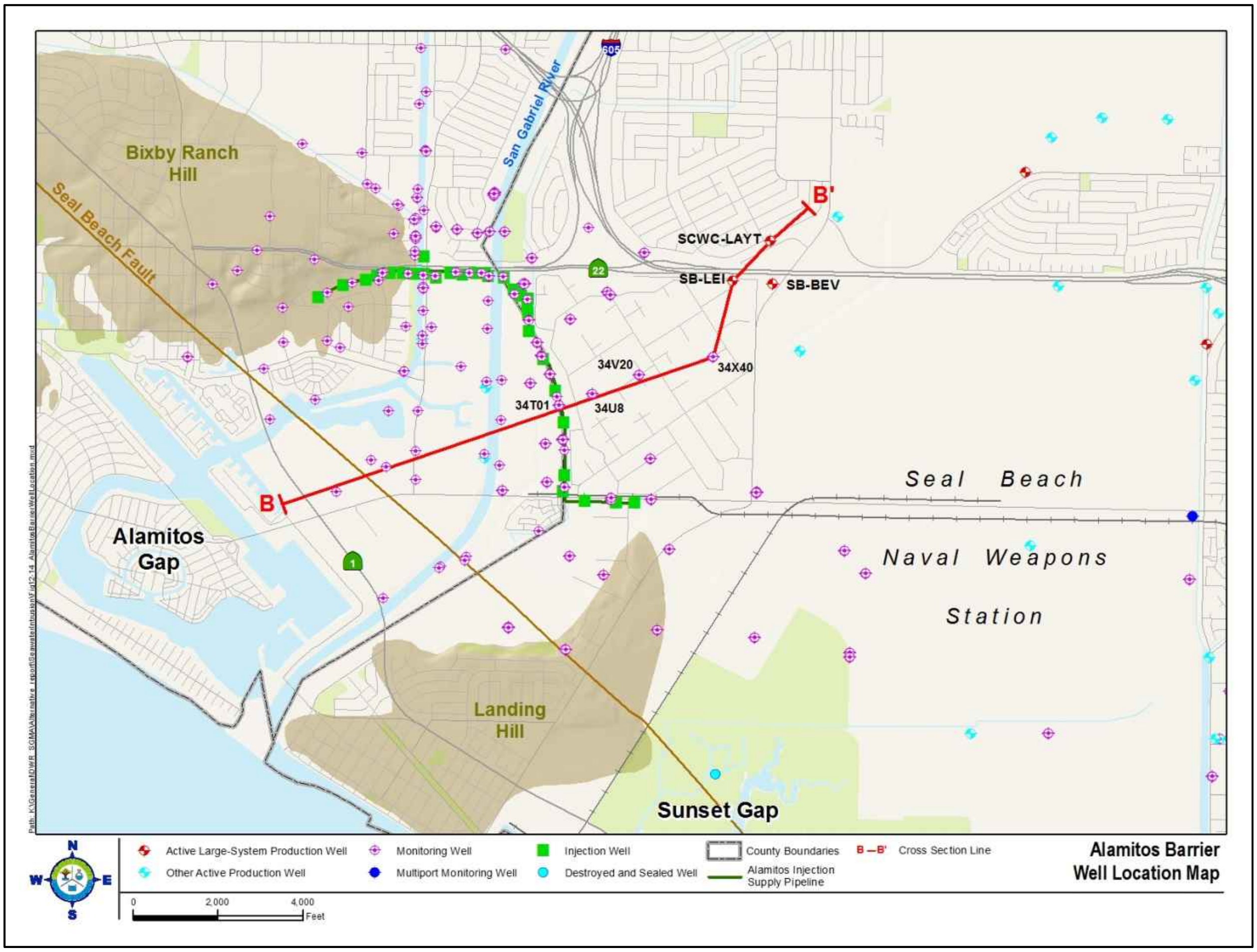

Figure 12-5: Alamitos Barrier

The pathways for intrusion in Alamitos Gap are similar to the Talbert Gap. As previously discussed, the Recent aquifer is connected to the Pacific Ocean. Once seawater migrates inland within the Recent aquifer past the Seal Beach Fault, the brackish water can then migrate downward into the C, B, A, and I aquifers via areas of hydraulic mergence with the Recent aquifer where the intervening low-permeability aquitards are absent. Similar to the Talbert Gap, these susceptible Pleistocene aquifers were warped upward by the Newport-Inglewood Fault Zone and then during Recent geologic time were eroded away and subsequently overlain by the Recent aquifer river deposits. Although similar in structure to the Talbert Gap, the Alamitos Gap aquifers are typically shallower, thinner, and finer grained.

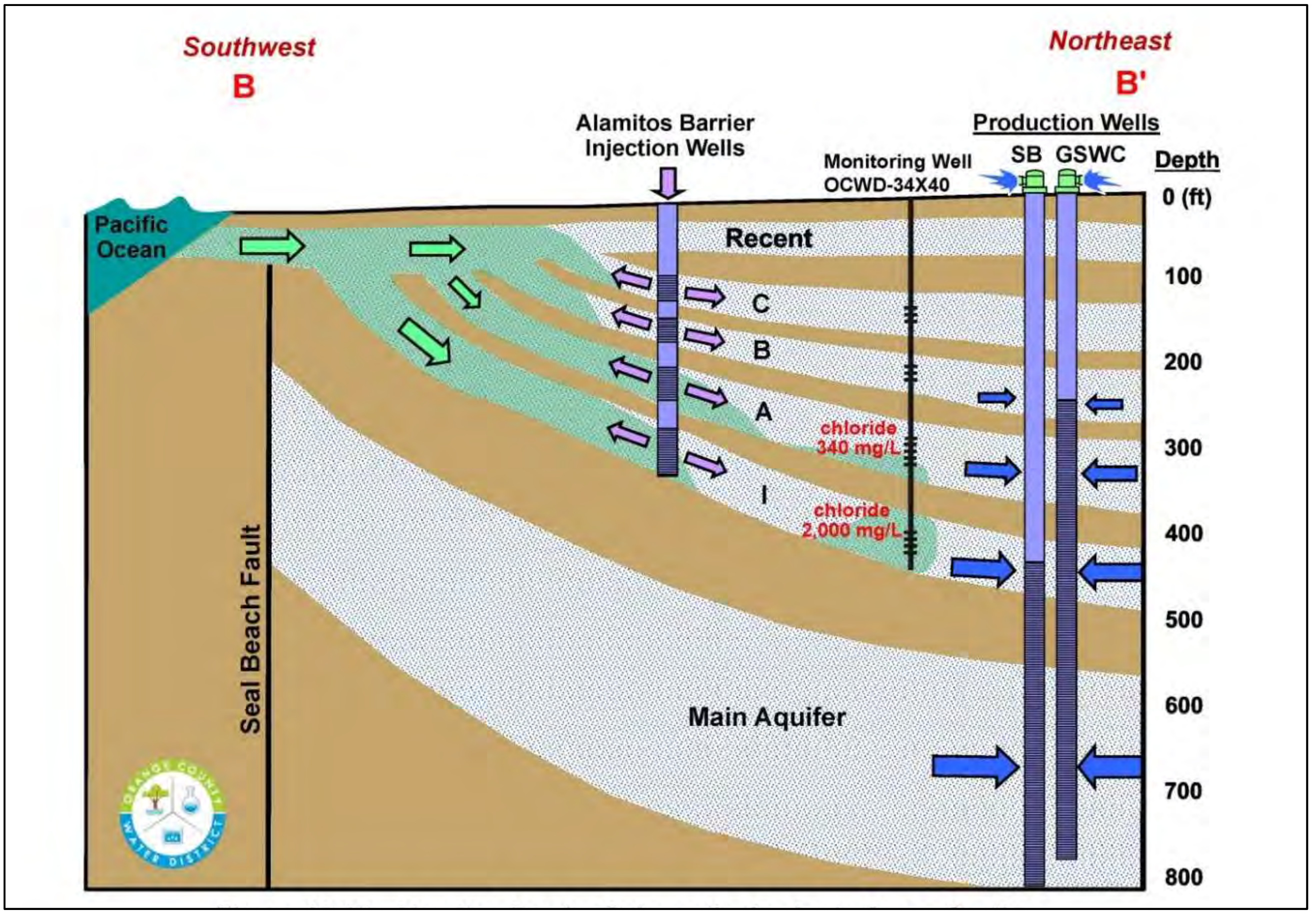

Figure 12-6: Alamitos Barrier Schematic Geologic Cross-Section

In 2008, OCWD identified data gaps where seawater intrusion was suspected but unconfirmed. Staff installed four monitoring wells in 2009 at three sites downgradient of the Orange County portion of the Alamitos Barrier. Analysis of groundwater elevations and chloride concentrations from the existing and new monitoring wells in the area confirmed that pockets of elevated chloride concentrations above the secondary drinking water standard (250 mg/L) had migrated inland of the barrier within Orange County. Potential causes of elevated salinity pulses include insufficient injection well spacing, injection well clogging (low injection rates), and injection wells being offline for extended periods for maintenance and repairs.

The aquifers susceptible to intrusion are generally thinner and finer-grained than their counterparts in Talbert Gap. Therefore, per-well injection capacity is relatively low and thus requires more injection wells and denser spacing to achieve sufficient injection for creating a continuous pressure ridge that achieves protective elevations. Annual Alamitos Barrier injection is typically about 6,000 AF spread over 40 injection well points. In comparison, annual Talbert Barrier injection is typically about 36,000 AF spread over 103 injection well points, resulting in more than double the amount of average injection per well point than Alamitos Barrier.

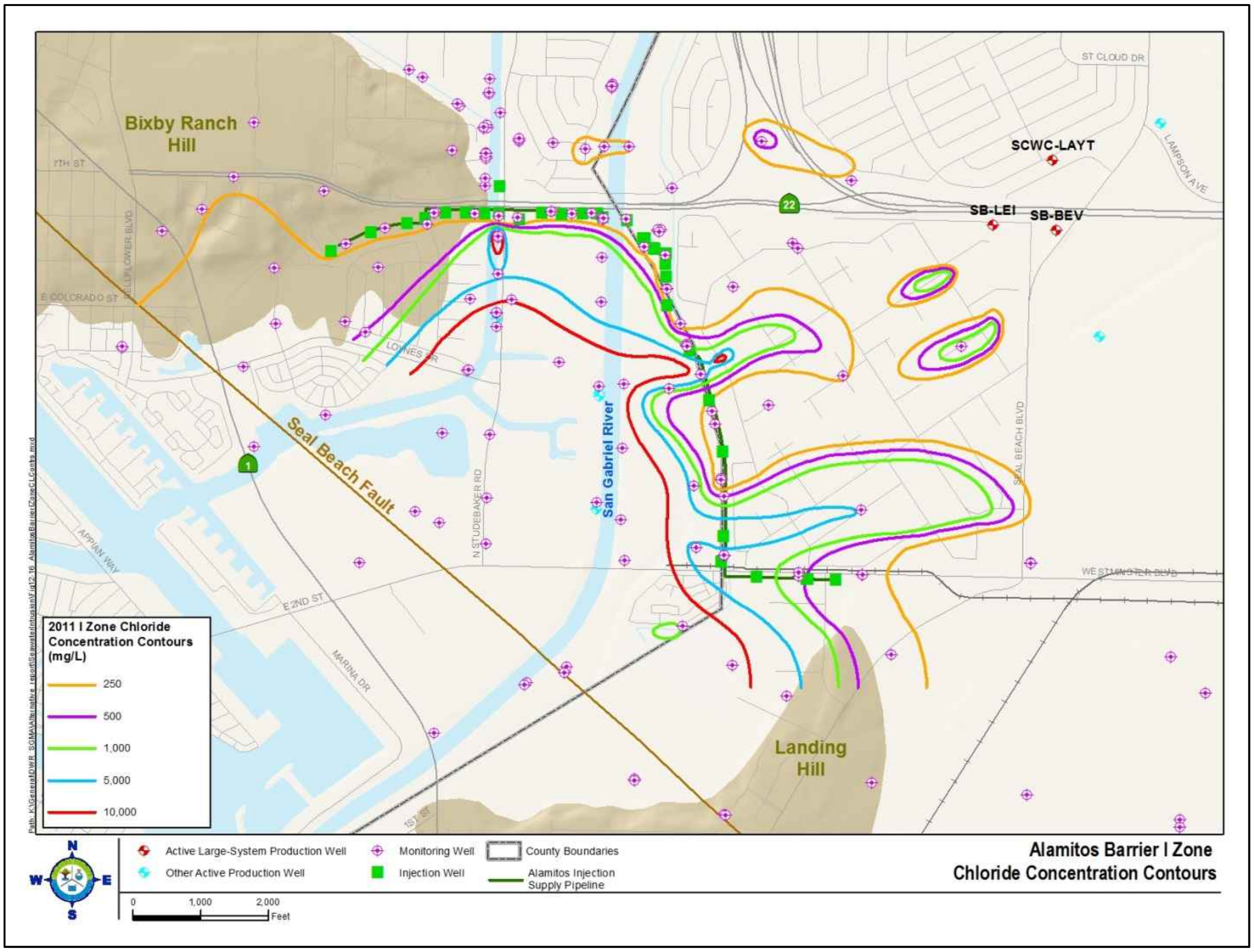

Figure 12-7: Alamitos Barrier I Zone Chloride Concentration Contours

In an effort to control the identified breaches through the barrier and to address barrier deficiencies along the north-south reach where injection well spacing is too large and injection well capacity too small, OCWD developed the Alamitos Barrier Improvement Project consisting of:

- 17 injection wells at eight locations to augment injection capacity along the north-south reach of the barrier
- Four nested monitoring wells to enhance the inter-nodal monitoring network at and near the barrier
- Two piezometers to monitor shallow (semi-perched) groundwater

With a project budget of $15 million, drilling and construction of the wells began in 2016. Once constructed, the new monitoring and injection wells will be operated and maintained by LACDPW along with the existing barrier facilities (OCWD, 2013).

12.2.1 Alamitos Barrier Groundwater Model

A transient groundwater flow and solute transport model of the Alamitos Barrier area was developed and calibrated in 2010 by Intera, Inc. with oversight and cost sharing from OCWD, LACDPW, and Water Replenishment District of Southern California. The model was developed to provide a useful tool to evaluate the existing barrier's effectiveness, determine barrier expansion requirements, evaluate migration of saline intrusion as well as migration of recycled injection water towards production wells for regulatory purposes, and optimize existing barrier operations.

The Alamitos Barrier Model (ABM) has 13 layers, each corresponding to an individual aquifer or aquitard and uses the MODFLOW-2000 code (Harbaugh et al., 2000). The ABM has a uniform grid consisting of 100-ft x 100-ft square grid cells with varying vertical thickness based on the stratigraphy defined in the conceptual model, which was largely based on Callison et al. (1991) in the immediate vicinity of the barrier and OCWD geologic interpretations at monitoring and production wells in the outlying area of the model domain. The 100-ft grid cell size ensures that nearly every monitoring and injection well occupies its own grid cell. The ABM was calibrated to match observed historical groundwater level and chloride (salinity) conditions over the period 1999-2009 (Intera, 2010).

Findings from predictive scenarios simulated with the calibrated model confirmed that new injection wells along the north-south barrier alignment were needed to augment injection capacity in areas where breaches are occurring, and to raise the average groundwater levels to protective elevations. The ABM was also used to determine the number, locations, and approximate flow rates of additional injection wells needed to control seawater intrusion along the north-south reach of the barrier. These findings culminated in the Alamitos Barrier Improvement Project currently under construction, as described above.

Results from the ABM scenarios indicated that approximately 10,400 AFY of total barrier injection may be needed during low-basin conditions to entirely prevent seawater intrusion on both the Los Angeles and Orange County sides of the barrier, including the aforementioned intrusion eastward south of the existing barrier into Sunset Gap. This modeled injection amount represents almost twice the typical historical injection of 6,000 AFY and at least preliminarily confirmed the potential need for a future barrier extension south to the Seal Beach Fault to help protect Sunset Gap.

Upon completion of the current Alamitos Barrier Improvement Project, groundwater elevations and chloride concentrations resulting from the newly expanded barrier will be closely monitored for at least one full year prior to determining potential southerly barrier extension requirements that would trigger the need for an additional injection supply source and new barrier pipeline.

12.3 SUNSET GAP

Sunset Gap has historically been considered to be a much lesser seawater intrusion threat compared to the Talbert and Alamitos Gaps. Recent monitoring data, however, indicate that seawater intrusion is occurring in Sunset Gap, as shown schematically in Figure 12-8.

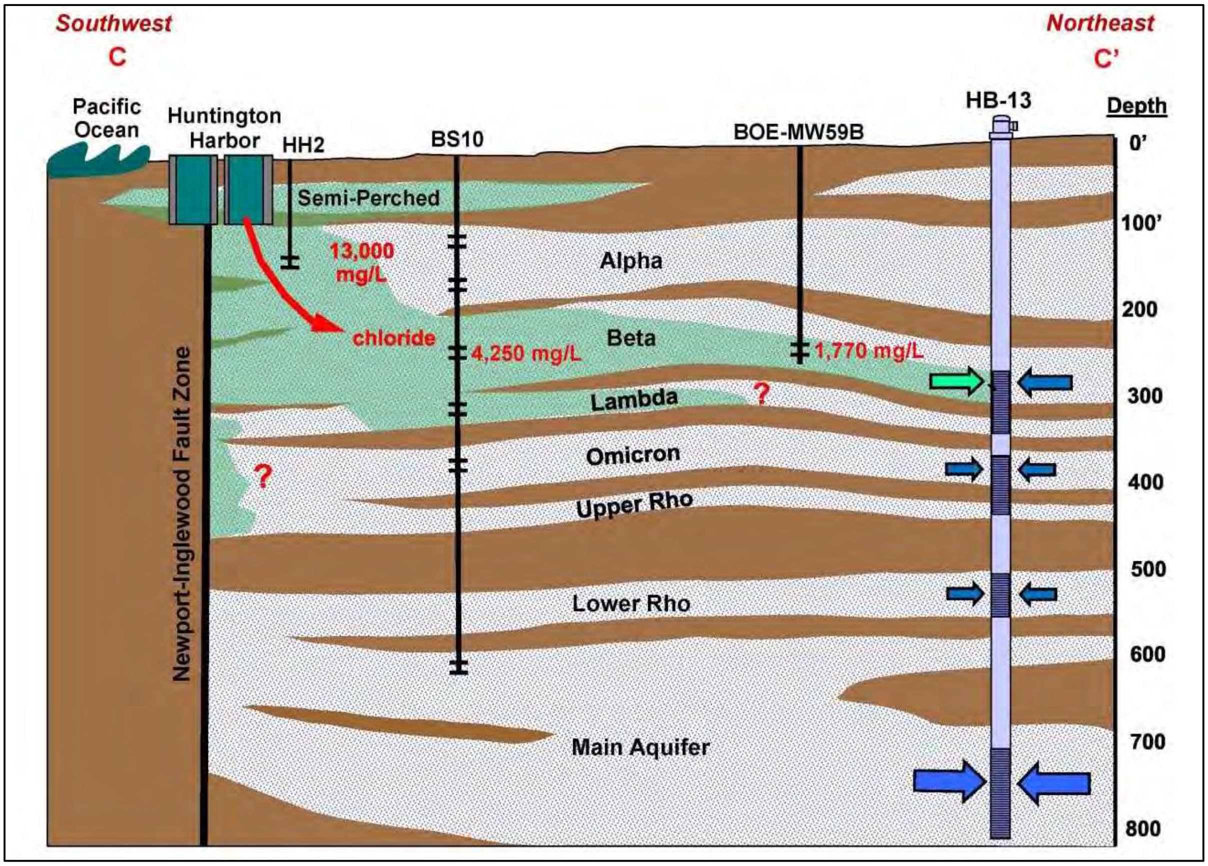

Figure 12-8: Schematic Geologic Cross-Section from Huntington Harbor through Sunset Gap

Three potential source areas appear likely:

- Intrusion from Alamitos Gap south of Alamitos Barrier moving in an easterly direction;
- Intrusion moving north-northeasterly from the Huntington Harbor Marina where dredged canals may have breached through the shallow aquitard overlying the shallow-most potable aquifer; and
- Lateral leakage across the Newport/Inglewood Fault Zone (Seal Beach Fault) in the Landing Hill area in one or more of the Upper Pleistocene aquifers.

In the southeast portion of Sunset Gap, dredging associated with construction of the boat canals in Huntington Harbor during the 1960s was the subject of several studies at that time regarding the potential for causing saline intrusion. Conclusions of these studies were inconsistent and inconclusive. Studies done by the USGS (1966) and DWR (1968) found that seawater intrusion into the semi-perched aquifer (generally the uppermost 50 feet) associated with the harbor development was occurring, but this was considered to be of little to no significance due to the lack of beneficial use of this near-surface water bearing zone.

Approximately 10 years after construction of Huntington Harbor, chloride concentrations began to rise during the mid-1970s at OCWD monitoring well HH2 screened in the shallow-most Pleistocene Alpha aquifer at a depth of 85-95 ft bgs and located just inland of the Bolsa-Fairview Fault in the Huntington Harbor area. The Bolsa-Fairview Fault is the farthest inland branch of the Newport-Inglewood Fault Zone in the area. Chloride concentrations at this well rose steadily over time to very brackish levels today, suggesting an inland gradient and active pathway for inland intrusion.

In 2004, elevated chloride concentrations ranging from 300 to 800 mg/L were first discovered at two monitoring wells owned by the Boeing Corporation (BOE-MW16 and BOE-MW17) screened in the Beta aquifer. OCWD commissioned a geophysical survey in 2010 at the Seal Beach Naval Weapons Station to delineate the extent and depth of intrusion and to help guide the number and location of proposed monitoring wells necessary to sufficiently define the extent of intrusion.

Based on groundwater elevation contours (see Figure 12-9), the elevated salinity plume is not expected to migrate farther inland past wells HB-4, HB-7, and HB-13 since the pumping from these three wells appears to create a local depression and because of the lack of other large system production wells within this vicinity. Only two City of Westminster production wells (WM-125 and WM-RES2) are located within one mile of these three Huntington Beach wells and based on the gradient direction do not appear to be threatened so long as the three Huntington Beach wells remain active.

One large system production well (HB-12) was shut down and destroyed due impacts from advancing intrusion in Sunset Gap. Since 2012, OCWD has constructed seven of nine planned multi-depth monitoring wells to depths up to 1,000 feet in Sunset Gap to better define the source areas, pathways, and overall inland extent of seawater intrusion in that area as the first step towards identifying feasible remedies.

12.3.1 Planned Modeling to Evaluate Sunset Gap Alternatives

Existing data are sufficient to warrant timely evaluation and planning of potential project alternatives to address the intrusion in Sunset Gap. To accomplish this, the existing Alamitos Barrier groundwater model (ABM) is currently being expanded to cover the entire Sunset Gap area and beyond. In addition to expanding the model domain, model layering and aquifer parameters (e.g., hydraulic conductivity) is being refined using data from the new OCWD monitoring wells, which were constructed after completion of the original ABM. Once the model expansion is completed and recalibrated, various predictive model scenarios will be simulated to analyze the effects of potential remedial alternatives.

Potential short-term remedies to evaluate would likely include:

- Reduce coastal pumping in this area and/or shift pumping inland via the Coastal Pumping Transfer or Coastal In-Lieu programs;
- Brackish extraction wells upgradient of Huntington Beach production wells; and
- Equip wells HB-4, HB-7, and HB-13 with liners or packers to prevent production from the uppermost Beta aquifer screened interval.

Potential long-term remedies to evaluate would likely include:

- Southerly extension of Alamitos Barrier to the Seal Beach Fault;
- Sunset Gap injection barrier along the eastern edge of the SBNWS (Bolsa Chica Rd.);
- Combination injection/extraction barrier in Sunset Gap; and
- Physical barrier along Edinger Avenue just north of Huntington Harbor.

The expanded model will be used to evaluate these alternatives as to the number of wells, locations, injection/extraction requirements, and the resulting groundwater elevations and chloride concentrations after several years of simulated operation. In addition, during model development and calibration, areas still lacking sufficient data would be identified for potential locations of additional monitoring wells.

In conjunction with the groundwater modeling activities, engineering feasibility studies would be necessary for the proposed alternatives, such as to determine a reliable water supply for the proposed Alamitos Barrier southerly extension and/or an entirely new Sunset Gap injection barrier. Other potential injection supplies include deep colored water from the Lower Main aquifer, which is not considered to be susceptible to intrusion, and treated brackish water.

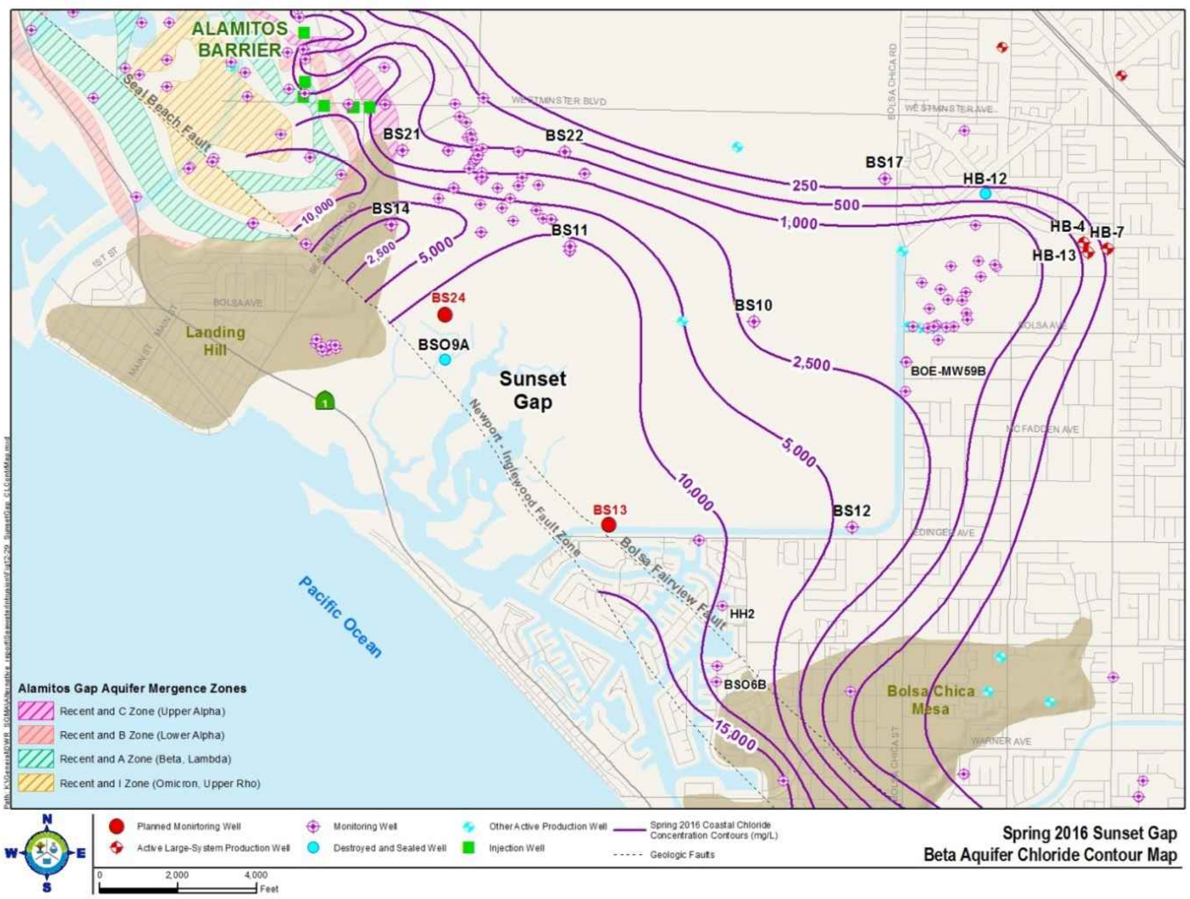

Figure 12-9: Sunset Gap Chloride Contours

12.4 BOLSA GAP

In the Bolsa Gap, seawater intrusion extends approximately 1.3 miles inland from the Pacific Ocean. The highest chloride concentrations in Bolsa Gap have remained seaward of the Bolsa-Fairview Fault, which is the farthest inland branch of the Newport-Inglewood Fault Zone in that area. Therefore, it appears that saline groundwater is largely restricted from migrating inland across these faults within the Bolsa aquifer under normal basin conditions, as the Bolsa aquifer zones of mergence with the underlying Pleistocene aquifers are all inland of the Bolsa-Fairview Fault. An area of slightly elevated salinity has existed beneath the Huntington Beach Mesa for many years and is thought to be due to past disposal practices of oil field brines in the early 1900s rather than active seawater intrusion from the ocean. This area of saline groundwater is being pushed westerly into Bolsa Gap due to increased injection at the west end of the Talbert Barrier but is not expected to be a threat to any active production wells or groundwater resources.

12.5 NEWPORT MESA

Chloride concentrations in the Beta/Lambda aquifers in the Newport Mesa area have either remained stable or decreased over the last 10 years even though groundwater elevations have typically been below sea level in these two aquifers in this area. Main aquifer chloride concentrations in this area have either decreased or have remained relatively stable for the last 10 years. A proposed extension of the Talbert Barrier eastward along Adams Avenue onto the Newport Mesa has been preliminarily evaluated and modeled by OCWD staff using the Talbert Model. Such a project would serve to provide assurance against any future intrusion in the Beta/Lambda and Main aquifers under lower basin conditions and would thus protect production wells owned by Mesa Water District in addition to replenishing the basin. Based on the stability of chloride concentrations in the Newport Mesa, there is no need to advance this project at this time.

In 2014, OCWD constructed four new multi-depth monitoring wells (M51, M52, M53, MRSH) farther east on the Newport Mesa whose locations are shown on Figure 12-10. These four well sites are now a part of OCWD’s coastal monitoring program for both groundwater levels and seawater intrusion sampling. The East Newport Mesa area was previously a data gap in which the aquifer stratigraphy and groundwater flow patterns were not well understood.

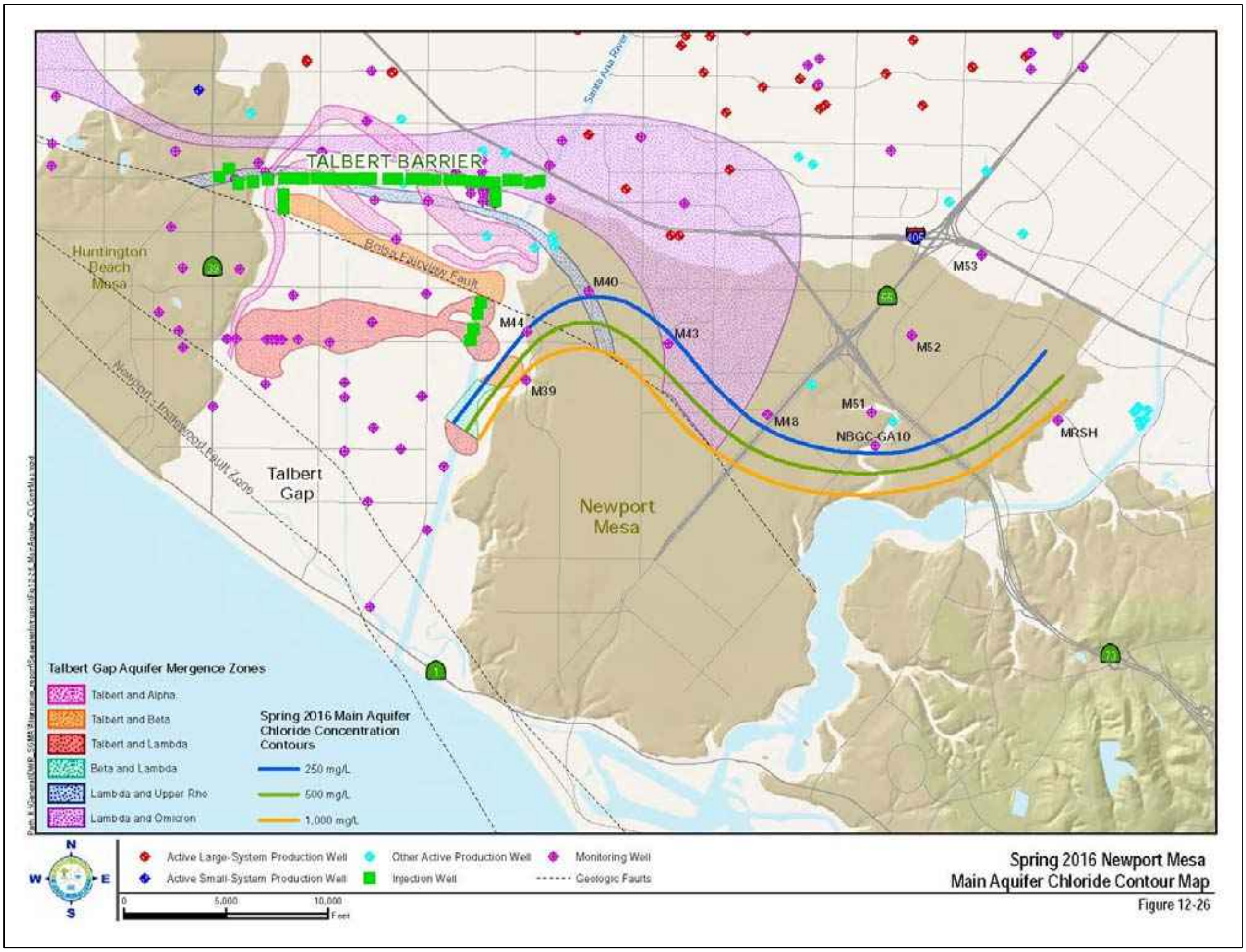

Figure 12-10: Newport Mesa Chloride Contours

12.6 IMPLEMENTATION OF SEAWATER INTRUSION PREVENTION POLICY

Implementation of OCWD's seawater intrusion prevention policy, described in Section 6.5, is summarized below. These programs enable OCWD to continue sustainably managing the groundwater basin to prevent significant and unreasonable seawater intrusion.

12.6.1 Effective Barrier Operations

The effective operation of the Talbert and Alamitos barriers is critical to the protection of the basin aquifers from seawater intrusion. This program includes, but is not limited to, the following activities:

1. Injection of sufficient water quantities combined with other basin management programs, such that protective groundwater elevations are established and maintained, where applicable, based on local hydrogeologic characteristics.
2. Regular maintenance of injection facilities to provide sufficient injection quantities. Such maintenance includes backwashing, redevelopment, and replacement (if necessary) of injection wells and operational fitness checks/repairs of flow meters, pressure reducing valves, and telemetry equipment.
3. Regular communications and coordination between operations, hydrogeology, and engineering staff on barrier operations and activities.
4. Annual reporting on barrier facilities status and operations. The report will include recommendations, as necessary, for barrier improvements to achieve policy objectives.

12.6.2 Barrier Performance Monitoring and Evaluation

Monitoring and evaluating barrier performance provides the basis on which to determine if the barriers are preventing seawater intrusion from occurring. This program consists of the following activities:

1. Semi-annual sampling and testing of designated monitoring wells in the vicinity of the seawater barriers. Testing will include parameters such as total dissolved solids, chloride, and electrical conductivity as indicators of seawater intrusion. Wells will be designated to provide adequate spatial coverage, particularly near likely seawater pathways and near the interface between seawater and freshwater.
2. Quarterly water level measurements at designated monitoring wells in the vicinity of the seawater barriers. More frequent measurements will be collected as needed at key locations.
3. Installation of monitoring wells in areas where it is determined that data gaps exist near the seawater barriers that may allow seawater intrusion to go undetected or would otherwise significantly impede the ability to assess barrier performance.
4. Annual evaluation and reporting of barrier performance based on surrounding groundwater level and quality data.

12.6.3 Susceptible Coastal Area Monitoring and Evaluation

This program addresses the assessment and ongoing monitoring of the coastal gaps and other areas that are not currently protected from seawater intrusion by the Talbert and Alamitos barriers. These areas include the Bolsa and Sunset gaps and adjacent mesas. This program includes the following activities:

1. Semi-annual sampling and testing of designated monitoring wells. Testing includes parameters such as total dissolved solids, chloride, and electrical conductivity as indicators

of seawater intrusion. Wells have been designated to provide adequate spatial coverage, particularly near likely seawater pathways.

2. Quarterly water level measurements at designated monitoring wells. More frequent measurements will be collected as needed at key locations.
3. Installation of monitoring wells in areas where it is determined that data gaps exist that may allow seawater intrusion to go undetected or would significantly impede the ability to understand the location of and trends in seawater intrusion.
4. Annual evaluation and reporting of the coastal area monitoring program, including recommendations, as needed, for further investigation or other potential actions to address seawater intrusion.

12.6.4 Coastal Groundwater Management

In addition to operating the seawater barriers, OCWD has implemented other basin management activities to lessen the potential for seawater intrusion. These activities have included the Coastal Pumping Transfer Program, Coastal In-Lieu Program, and maintaining basin storage levels within the operating range. Each of these activities shall continue to be considered and implemented as deemed necessary along with other potential actions to complement and enhance the OCWD seawater prevention program.

12.7 DEFINITION OF SIGNIFICANT AND UNREASONABLE SEAWATER INTRUSION

As explained above, OCWD conducts comprehensive programs to protect the groundwater basin from the undesirable effect of significant and unreasonable seawater intrusion. Seawater intrusion in the OCWD Management Area would be considered significant and unreasonable if a significant and continuing reduction in usable storage volume in the groundwater basin occurs as a result of increased salinity due to seawater intrusion.

12.8 DETERMINATION OF MINIMUM THRESHOLDS

The minimum threshold for seawater intrusion that defines an undesirable result is (1) the shutdown of active large system production wells due to seawater-derived salinity, and (2) continuing loss of a significant amount of basin storage due to seawater-derived salinity.

SECTION 13 SUSTAINABLE MANAGEMENT RELATED TO LAND SUBSIDENCE

Management of the groundwater basin by maintaining storage levels within OCWD's established operating range has prevented significant and unreasonable land subsidence that substantially interferes with surface uses. Within the OCWD Management Area there is no evidence of continuing irreversible land subsidence, nor is there evidence that land subsidence has interfered with surface uses. Therefore, the undesirable result of "significant and unreasonable land subsidence that substantially interferes with surface uses" is not present and is not anticipated to occur in the OCWD Management Area in the future

Subsidence due to changes in groundwater conditions in the Orange County groundwater basin is variable and does not show a pattern of irreversible permanent lowering of the ground surface. Some subsidence may have occurred before OCWD began refilling the groundwater basin in the late 1950s after storage conditions reached a historic low (Morton, et al., 1976); however, the magnitude and scope of this subsidence is uncertain and it is not clear if this subsidence was permanent. Since this time OCWD has operated the groundwater basin within the established operating range.

More recent data show a consistent pattern of the ground surface rising and falling in tandem with groundwater levels and overall changes in basin groundwater storage. This is referred to as elastic subsidence. Interferometric Synthetic Aperture Radar (InSAR) data collected from satellites and data collected by the Orange County Surveyor (Surveyor) show that ground surface elevations in Orange County both rise and fall in response to groundwater recharge and withdrawals. InSAR data during the period 1993-1999 shows temporary seasonal land surface changes of up to 4.3 inches (total seasonal amplitude from high to low) in the Los Angeles-Orange County area and a net decline of approximately 0.5 inch/year near Santa Ana over the period 1993 to 1999, which happened to coincide with a period of a net decrease in groundwater storage in the basin (Bawden, 2001; 2003).

The Surveyor's office maintains more than 1,500 elevation benchmarks throughout Orange County. Periodically, the Surveyor resurveys the benchmarks to detect changes in elevation. The Surveyor maintains the survey records and makes them available to the public (http://ocpublicworks.com/survey/services/ocrtn) and provides the data to OCWD upon request. The Surveyor also maintains an Orange County Real Time Network (OCRTN) that consists of continuously operating GPS reference stations that monitor horizontal and vertical movement throughout Orange County. Figure 13-1 shows the locations of the GPS stations in Orange County.

Based on real time GPS data, the BLSA and SACY sites show the greatest range of elevation change of any of the sites in Orange County. Ground surface elevation changes at these sites from 2002 to 2014 correlate well with changes in groundwater storage, as shown on Figure 13-2. Note that this period of time includes a very wet period (2004-06) when basin groundwater storage increased significantly and a dry period (2010-2014) when basin groundwater storage decreased significantly.

In reviewing the available sources of data, it is clear that depending on the time period selected, the ground surface is rising, falling, or remaining stable. GPS data collected by the Surveyor over the past 12 years (2002-14) show that the ground surface fluctuations appear to be completely elastic, reversible, and well correlated with fluctuations in groundwater levels. These data indicate that there has not been any permanent, irreversible subsidence of the ground surface over the past 12 years.

Figure 13-1: Orange County Public Works GPS Real Time Network

Finally, there is little potential for future widespread permanent, irreversible subsidence given OCWD's commitment to sustainable groundwater management and policy of maintaining groundwater storage levels within a specified operating range. Nevertheless, OCWD annually reviews Surveyor data to evaluate ground surface fluctuations within OCWD's service area. If irreversible subsidence was found to occur in a localized area in relation to groundwater pumping patterns or groundwater storage conditions, OCWD would coordinate with local officials to investigate and develop an approach to address the subsidence. This could include OCWD managing the basin at higher groundwater storage levels.

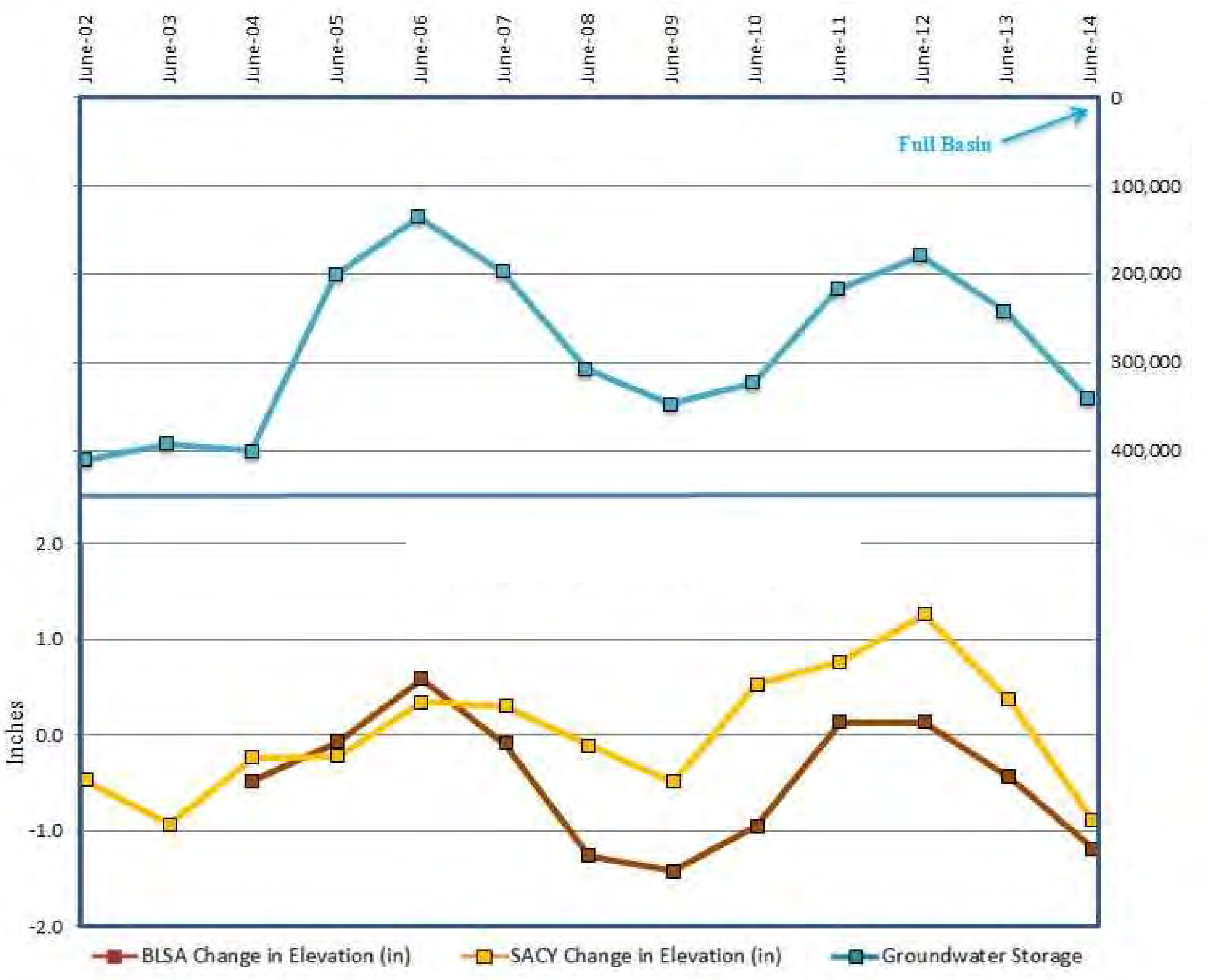

Figure 13-2: Available Groundwater Basin Storage and Ground Surface Elevation Change, 2002-2014

13.1 DEFINITION OF SIGNIFICANT AND UNREASONABLE LAND SUBSIDENCE THAT SUBSTANTIALLY INTERFERES WITH SURFACE USES

As stated above, data indicates that there is no inelastic land subsidence within the OCWD Management Area due to changes in groundwater elevation or groundwater storage levels. Land subsidence would be considered to be significant and unreasonable if ground surface elevation changes as measured by Orange County Public Works are determined to be inelastic over a significant period of time, these elevation changes are attributed to declines in groundwater storage, and these changes are likely to significantly interfere with surface uses.

13.2 DETERMINATION OF MINIMUM THRESHOLDS

The minimum threshold for land subsidence that defines an undesirable result is a sustained lowering of ground surface elevation that is attributable to lowering of groundwater storage in the basin and is likely to significantly interfere with surface uses.

SECTION 14 SUSTAINABLE MANAGEMENT RELATED TO GROUNDWATER DEPLETIONS IMPACTING SURFACE WATER

There are no surface water bodies within the OCWD Management Area that are interconnected and dependent on groundwater basin conditions. Therefore, the undesirable result of "depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water due to groundwater conditions occurring throughout the basin" is not present and in the future is not anticipated to occur in the OCWD Management Area due to OCWD's management programs.

14.1 SANTA ANA RIVER

The Santa Ana River in Orange County flows through a highly urbanized environment. Flood protection infrastructure has constrained the flow of the river with engineered levees along most of its course.

From Imperial Highway to 17th Street in Santa Ana (Figure 14-1 and 14-2), the river is a losing reach with surface water percolating into groundwater. OCWD conducts recharge operations within the soft-bottomed river channel except for a portion of the river where the Riverview Golf Course occupies the river channel. The river levees are constructed of either rip-rap or concrete. The river bed is utilized for groundwater recharge. OCWD diverts surface water flows into recharge basins at Imperial Highway and at another diversion point farther downstream. Nearly all the water that remains in the river during non-storm conditions percolates into the groundwater basin upstream of 17th Street.

When the groundwater basin is in a nearly full condition, groundwater levels in the Shallow Aquifer in this area are generally 20 feet to greater than 60 feet below ground surface. When groundwater storage levels are in the lower portion of the operating range, groundwater levels in the Shallow Aquifer are even further below ground surface. Data indicate that this reach of the river has historically been a losing reach that was frequently dry during summer months. There is no evidence that changes in groundwater levels have had an impact on flows in the Santa Ana River from Imperial Highway to 17th Street in Santa Ana.

From 17th Street to near Adams Avenue in Costa Mesa (Figure 3-28), the river channel is concrete-lined for flood control with sloping or vertical concrete side levees and a concrete bottom. The flood control infrastructure in this section of the Santa Ana River creates a barrier between surface water and underlying groundwater.

From Adams Avenue to the coast, the channel has concrete side walls or rip-rap for flood control and a soft bottom. The river here is brackish as it is subject to tidal influences. Estuary conditions within the concrete or rip-rap channel exist at the mouth of the river where the ocean encroaches at high tide. The tidal prism extends from the ocean to approximately the Adams Avenue Bridge.

Figure 14-1: View of Santa Ana River (left) with OCWD recharge facilities (right). An inflatable rubber dam that crosses the river here enables OCWD to divert some river flows into basins for percolation.

Figure 14-2: Santa Ana River, looking upstream in the vicinity of Ball Road. Here the river, with side levees and a soft bottom, is typically dry during non-storm conditions.

14.2 SANTIAGO CREEK

Santiago Creek is a major tributary of the Santa Ana River. The creek is the primary drainage for the northwest portion of the Santa Ana Mountains. Under natural conditions, the creek is ephemeral, with dry conditions predominant during most of the year (Figures 14-3 and 14-4). Water from the creek is impounded by Santiago Dam and Villa Park Dam. Downstream of the Villa Park Dam, OCWD conducts groundwater recharge operations. OCWD manages infiltration of stormwater in Santiago Basins and releases water into the creek at rates that maximize percolation in the creek bed. Recharge occurs in the basins as well as downstream in the creek from the basins to Hart Park in the city of Orange. OCWD also conveys water via a pipeline from the recharge facilities along the Santa Ana River for percolation in the Santiago recharge facilities. This supply is a combination of Santa Ana River flow and imported water. During most of the year, there is more flow in the creek due to OCWD recharge operations than would be under natural conditions. Data indicates that Santiago Creek naturally loses flow through percolation into the groundwater and that groundwater levels have no impact on creek flows due to the vadose zone being tens of feet thick in this area.

Figure 14-3: Santiago Creek,view upstream in the vicinity of Hart Park in Orange

Figure 14-4: Santiago Creek, view upstream from Tustin Avenue in Orange

SECTION 15 PROTOCOLS FOR MODIFYING MONITORING PROGRAMS

Protocols that trigger a change in a monitoring program include:

- a recommendation by the GWRS Independent Advisory Panel for resampling or increased monitoring of a particular constituent of concern;
- a recommendation by the Independent Advisory Panel that reviews OCWD use of Santa Ana River water for groundwater recharge and related water quality;
- a change in regulation or anticipation of a change in regulation;
- a constituent in a sample approaches or exceeds a regulatory water quality limit or Maximum Contaminant Level, notification level, or first-time detection of a constituent;
- the computer program built by OCWD to validate water quality data prior to transfer to the WRMS data base flags a variation in historical data that may indicate a statistically significant change in water quality;
- analysis of water quality trends conducted by water quality, hydrogeology, or recycled water production staff indicate a need to change monitoring; or
- OCWD initiates a special study, such as quantifying the removal of contaminants using treatment wetlands or testing the infiltration rate of a proposed new recharge basins.

SECTION 16 EVALUATION OF POTENTIAL PROJECTS

16.1 FACILITIES IMPROVEMENT PROJECTS AND STUDIES

OCWD regularly evaluates potential projects and conducts studies to improve the existing facilities and build new facilities, such as:

- Increasing the capacity to transfer water from one basin to another;
- Reconfiguring a basin to improve infiltration rates;
- Evaluating potential sites for new recharge facilities such as existing flood control facilities;
- Developing new water supply sources such as water recycling and increasing stormwater capture; and
- Developing remediation plans to protect basin water quality.

16.2 LONG-TERM FACILITIES PLANS

The Long-Term Facilities Plan (LTFP) is a strategic planning tool which identifies potential projects that advance the mission of OCWD. The key purpose in preparing the LTFP is to identify the most important and effective potential projects so that available resources can be focused appropriately. Preparation of the LTFP helps OCWD prioritize its efforts to those potential projects that should be further developed. Plan development includes consideration of current and projected water demands, current water supplies available for groundwater recharge, and estimated costs and benefits of potential projects.

The Long-Term Facilities Plan 2014 Update evaluated 65 potential projects grouped by project type (water supply, basin management, recharge facilities, operational improvements, and operational efficiency). Each project was reviewed and evaluated by OCWD staff with regards to its economic and technical feasibility. Benefits of projects were evaluated based on the following:

- Increase supply of recharge water;
- Increase recharge capacity and efficiency of recharge facilities;
- Cleanup of contaminated groundwater;
- Protection of groundwater quality; and
- Control of seawater intrusion.

Seventeen of the 65 projects were selected for additional focused study. For these projects more detailed cost estimates were prepared along with an analysis of the project’s feasibility, potential constraints, and estimated timeline for construction. Groundwater recharge projects were evaluated using the Recharge Facilities Model, described in the following section.

16.3 RECHARGE STUDIES AND EVALUATIONS

OCWD has an ongoing program to continually assess potential enhancements to existing recharge facilities, evaluate new recharge methods and analyze potential new recharge facilities. The planning and implementation horizon for recharge facilities varies from a near term horizon of 5 to 10 years for development of specific projects to 50-year projections of the future availability of recharge water supplies, as described below.

Recharge Enhancement Working Group

The Recharge Enhancement Working Group is comprised of OCWD staff from multiple departments that works to maximize the efficiency of existing recharge facilities and evaluate new concepts to increase recharge capacity. Proposed projects under investigation are continually evolving as needs and conditions change. Potential projects/concepts considered include reconfiguration of existing basins, operational improvements to increase flexibility in the management of the basins, alternative basin cleaning methods, potential sites for new basins, and control of sediment concentrations.

Computer Model of Recharge Facilities

One of the challenges OCWD faces in determining the value of improving existing recharge facilities, storing more water at Prado Dam and purchasing new recharge facilities is estimating the amount of additional water that could be recharged due to a potential project. Given the complexity and interconnectivity of the recharge system, a model was needed to isolate the impacts of various proposed projects in order to determine the increased recharge potential due to a specific project.

OCWD developed the Recharge Facilities Model, which is a computer model of the recharge system that simulates Prado Dam operations, Santa Ana River flow and each recharge facility. This model is primarily a planning tool that is used to evaluate various conditions including estimating recharge benefits if new recharge facilities are constructed, existing facilities are improved, increased storage is achieved at Prado Dam, or baseflow changes occur in the Santa Ana River. The model can be operated by OCWD staff from a desktop computer using a graphical user interface.

The Recharge Facilities Model was completed in 2009 with the assistance of CH2M HILL and is based on GoldSim software, which is a general simulation software solution for dynamically modeling complex systems in business, engineering and science http://www.goldsim.com/Home/) (CH2M HILL, 2009).

Key features of the Recharge Facilities Model include:

- Ability to simulate different surface water inflow scenarios (e.g., high base flow, low base flow, etc.)
- Inflatable rubber dam operations (e.g., diversion rates, deflation/inflation)

- Conveyance capacity of system (e.g., pipeline and pumping capacities)
- Basin recharge capacities
- Reductions in basin capacities caused by clogging
- Maintenance thresholds that cause basins to be taken out of service and cleaned
- Different Prado Dam conservation pool elevations and release rates
- Different sedimentation levels behind Prado Dam
- Ability to add imported water to system when excess capacity is available

Output from the model includes:

- Amount of water recharged in each facility, storage at Prado Dam, release rates from Prado Dam, storage in each facility, etc.;
- Amount of water that could not be recharged and water losses to the ocean;
- Optimal amount of cleaning operations;
- Available (unused) recharge capacity; and
- Amount of imported water that can be recharged using unused capacity.

The RFM is flexible and allows for the development and simulation of a wide array of different scenarios. Examples of how the model has been used to evaluate potential recharge projects include:

- Estimate of the additional amount of water available for recharge if the water conservation pool behind Prado Dam is raised to 505 ft msl year round
- Estimate of the impact of the recent trend toward decreasing base flows in the Santa Ana River.
- Estimate of how much imported water could be purchased using unused system capacity.

16.3.1 Future Santa Ana River Flow Projections

OCWD prepares projections and works with other agencies to prepare projections of future Santa Ana River flows. Previous summaries are discussed in OCWD's Groundwater Management Plan (OCWD, 2015). The most recent projection is discussed below.

In 2014, projections of future Santa Ana River flows were developed for OCWD and the Army Corps to evaluate the feasibility of increasing the volume of water that can be stored behind Prado Dam (WEI, 2014). An existing model developed by Wildermuth Environmental, Inc. (WEI) called the Waste Load Allocation Model (WLAM), was used to estimate non-discharge inputs contributing to river flows. The WLAM is a hydrologic simulation tool of the Santa Ana River watershed tributary to Prado Dam and was developed for the Santa Ana Watershed

Project Authority (SAWPA) by WEI (2010). WEI began development of the WLAM for SAWPA in 1994 and has improved it over time to support numerous water resources investigations.

The WLAM uses historic rainfall and stream flow along the model boundaries for the 50-year period from 1950 to 1999. The model also accounts for the contribution of rising groundwater to Santa Ana River flows. The volume of rising groundwater has decreased in recent years due to lower groundwater levels in the southern portion of the Chino Groundwater Basin. Groundwater levels in this area are expected to remain low as this is part of the basin management strategy to reduce the migration of poor quality groundwater into the Santa Ana River.

Estimated future discharges of water from wastewater treatment plants to the Santa Ana River are expected to decline due to conservation and increased recycling. This, along with reductions in rising groundwater, means that projected Santa Ana River base flows reaching Prado Dam are significantly lower than what occurred from the early 1990s to 2005.

As a result of this work, OCWD developed three Santa Ana River base flow projections:

1. High Base Flow Condition: 101,700 afy
2. Medium Base Flow Condition: 52,400 afy
3. Low Base Flow Condition: 36,000 afy

Per the 1969 Stipulated Judgment in the case of Orange County Water District v. City of Chino, et al., Case No. 117628-County of Orange, a minimum annual Santa Ana River base flow of 42,000 afy is required to reach Prado Dam. However, a system of credits in the judgment allows the Santa Ana River base flow to be as low as 34,000 afy until the credits are exhausted. Given the large credit that exists due to many years of base flow exceeding 42,000 afy, the minimum flow of 34,000 afy could be in place for many decades. Even though the minimum allowable base flow is 34,000 afy, the annual base flow simulated was 36,000 afy for the low base flow condition due to minor variations in rising groundwater produced by the WLAM.

In developing estimates of future Santa Ana River storm flows arriving at Prado Dam, land use conditions in the WLAM were reviewed. For future conditions, SCAG 2005 land use data was modified to represent future (2071) land uses. The assumptions made in modifying the 2005 land use data were: (1) already developed urban areas and surrounding mountain areas were assumed not to change; (2) dairy, poultry, intensive livestock, as well as land use classified as “other agriculture” were assumed to be developed; and, (3) vacant and undeveloped areas were also assumed to be developed by 2071. In addition, all new developed land use in 2071 was assumed to be high density residential. This analysis resulted in an increase in high density residential area of approximately 71 square miles, a decrease dairy, poultry, horse ranch, etc. areas by approximately 11 square miles, and a decrease in undeveloped areas by approximately 59 square miles.

The increased runoff generated by future land uses is offset by plans for storm water harvesting by upstream agencies. Plans were identified for future storm water harvesting from Seven Oaks Dam, diversions from the Santa Ana River and its tributaries, and on-site infiltration that would be required by the Municipal Separate Storm Sewer System (MS4) permit. To develop the lowest flow condition possible, it was assumed that projects that have reached the environmental review stage would be constructed. As a result, the average annual storm flow arriving at Prado Dam is reduced by 27,360 afy (WEI, 2014).

Future estimates of Santa Ana River storm flow arriving at Prado Dam are presented in Table 16-1. The three Santa Ana River base flow conditions were combined with the estimated storm flow arriving at Prado Dam to develop three inflow conditions as summarized in Table 16-2.

Table 16-1**:** Estimated Future Santa Ana River Storm Flow Arriving at Prado Dam

STORM FLOW RUNOFF CONDITION	Average Storm Flow to Prado Basin (afy)
Current Land Uses	118,000
Future (2071) Land Uses	125,970
Future (2071) Land Uses, Maximum Storm Water Harvesting	98,610

Table 16-2: Santa Ana River Flow Conditions and Estimated Average Inflow to Prado Dam

<table>
<tr><th rowspan="2">CONDITION</th><th rowspan="2">DESCRIPTION</th><th colspan="2">Santa Ana River Flow to Prado (afy)</th><th rowspan="2">Total Average Flow (afy)</th></tr>
<tr><th>Average Base Flow</th><th>Average Storm Flow</th></tr>
<tr><td>High</td><td>High Base Flow, Current Land Uses</td><td>101,700</td><td>118,000</td><td>219,700</td></tr>
<tr><td>Medium</td><td>Medium Base Flow, Future (2071) Land Uses</td><td>52,400</td><td>125,970</td><td>178,370</td></tr>
<tr><td>Low</td><td>Low Base Flow, Future (2071) Land Uses, Maximum Storm Water Harvesting</td><td>36,000</td><td>98,610</td><td>134,610</td></tr>
</table>

Sixteen potential recharge projects were evaluated using the Recharge Facilities Model (RFM) as part of the preparation of OCWD's Long-Term Facilities Plan 2014 Update. Key assumptions used in the RFM are as follows:

1. The Prado Dam conservation pool is operating at 505 feet year round. Work to raise the flood season pool from 498 to 505 feet is ongoing and is expected to be completed and implemented in the next few years.
2. All GWRS water conveyed to Anaheim, including flows from the final expansion of GWRS, will be recharged in Miraloma Basin and La Palma Basin. This assumption frees up the capacity of the remainder of the recharge system for Santa Ana River flows and imported water.

The approach to modeling each project was to compare the total system recharge with and without the project for each flow condition. For example, total system recharge was modeled for the high flow condition with and without a project. The difference in the recharge obtained for the entire system comparing the two runs defined the benefit of the project being modeled. This was then repeated for the medium and low flow conditions. Table 16-3 shows the additional yield produced by each potential project for the high, medium, and low flow conditions.

The RFM was also used to evaluate the loss of storm flow capture that will result as sediment continues to accumulate in the Prado Basin. Based on the historical rate of sediment accumulation of approximately 350 acre-feet per year, the storage within the conservation pool is projected to fill up within the next 50 years. If the conservation pool becomes filled with sediment, the eventual loss of storm water available for recharge will range from 30,000 to 38,000 acre-feet per year.

Table 16-3: Annual Yield of Potential Surface Water Recharge System Projects based on Recharge Facilities Model

PROJECT NAME	Santa Ana River Flow Condition (afy)		
	High	Medium	Low
Desilting Santa Ana River Flows	10	390	10
Enhanced Recharge in Santiago Creek at Grijalva Park	10	10	85
Subsurface Collection and Recharge System in Off-River and Five Coves	610	730	150
Enhanced Recharge in Santa Ana River Between Five Coves/Lincoln Ave.	10	220	20
Enhanced Recharge in Santa Ana River Below Ball Road	730	600	230
Recharge in Lower Santiago Creek	270	150	90
Five Coves Bypass Pipeline	130	10	10
Five Coves Bypass Pipeline with Lincoln Basin Rehabilitation	710	490	100
Placentia Basin Improvements	75	170	260
Raymond Basin Improvements	40	230	350
River View Basin Expansion	10	100	10
Additional Warner to Anaheim Lake Pipeline	10	10	30
Lakeview Pipeline	10	10	10
Warner System Modifications	210	250	10
Anaheim Lake Re-contouring	10	125	10

SECTION 17 REFERENCES

Alley, William M., 2006, Another Water Budget Myth: The Significance of Recoverable Ground Water in Storage, Ground Water, National Ground Water Association.

Banks, Harvey O., Consulting Engineer, 1984, *Groundwater Management*, Irvine Area, Orange County, California, prepared for the Orange County Water District.

Bawden, Gerald W., Wayne Thatcher, Ross S. Stein, Ken W. Hudnut, and Gilles Peltzer, 2001, *Tectonic Contraction Across Los Angeles After Removal of Groundwater Pumping Effects*, Nature, Vol. 412, pp. 812-815.

Bawden, G.W., 2003, Separating ground-water and hydrocarbon-induced surface deformation from geodetic tectonic contraction measurements across metropolitan Los Angeles, California. In K.R. Prince and Galloway, D.L., eds., U.S. Geological Survey subsidence interest group conference, proceedings of the technical meeting, Galveston, Texas, November 27-29, 2001. U.S. Geological Survey Open-File Report 03-308. http://pubs.usgs.gov/of/2003/ofr03-308/.

Blomquist, William, 1992, *Dividing the Waters: Governing Groundwater in Southern California*, Center for Self-Governance, San Francisco.

Boyle Engineering Corporation and Orange County Water District, 1997*, Coastal Groundwater Management Investigation*.

California Department of Public Health (CDPH), 2013. Groundwater Replenishment Reuse Draft Regulation, March 28, 2013.

California Department of Water Resources, 1966, *Ground Water Basin Protection Project: Santa Ana Gap Salinity Barrier, Orange County*, Bulletin No. 147-1.

***** 1967, *Progress Report on the Ground Water Geology of the Coastal Plain of Orange County*.

***** 1968, *Sea-Water Intrusion: Bolsa-Sunset Area, Orange County*, Bulletin No. 63-2.

Callison, J., M. Amabisco, and A. Wilkens, 1991, *Hydrogeology of Alamitos Gap*" and *Hydrogeology of Alamitos Gap – Appendix C*, Los Angeles County Department of Public Works Hydraulic/Water Conservation Division.

California Regional Water Quality Control Board, Santa Ana Region (RWQCB). 2004. Order No. R8-2004-0002, Producer/User Water Recycling Requirements and Monitoring and Reporting Program for the Orange County Water District Interim Water Factory 21 and Groundwater Replenishment System Groundwater Recharge and Reuse at Talbert Gap Seawater Intrusion Barrier and Kraemer/Miller Basins. March 12, 2004.

***** 2008, Order No. R8-2008-0058

Camp Dresser & McKee Inc., 2000, *Groundwater Replenishment System, Project Development Phase – Development Information Memorandum No. 9A, Barrier System*

Modeling/Design Criteria, 100% Submittal, prepared for OCWD and Orange County Sanitation District.

***** 2003, *Talbert Gap Model Refinement Report*, prepared for OCWD.

Clark, J. F., Hudson G.B, Davisson, M.L., Woodside, G., and Roy Herndon, 2004, *Geochemical Imaging of Flow Near an Artificial Recharge Facility, Orange County, California.* Ground Water. Vol 42, 2, 167-174.

Clark, Jordan F. 2009. The 2008 Kraemer Basin Tracer Experiment Final Report, Department of Earth Sciences, University of California, Santa Barbara. August 7, 2009.

Dasgupta. P.K., et al., 2005. The origin of naturally occurring perchlorate: The role of atmospheric processes. Environmental Science and Technology, 39, 1569-1575.

DDBE, Inc. 2009. Demonstration Mid-Basin Injection Project Plan, prepared for OCWD.

Fairchild, F.B. and Wiebe, K.H., 1976. Subsidence of organic soils and salinity barrier design in coastal Orange County, California. In A.I. Johnson, ed., Proceedings of the Second International Symposium on Land Subsidence, Anaheim, California, December 13–17,1976, *International Association of Hydrological Sciences Publication* 121, 334-346.

Foubister, Vida. 2006. Analytical Chemistry, pages 7914-7915.

Freeze, R. Allan and John A. Cherry. 1979. *Groundwater*. Prentice-Hall, Inc., 604 pp.

Ghyben, W.B. 1888. Nota in verband met de voorgenomen putboring nabij Amsterdam. *Tijdschrift van Let Koninklijk Inst. Van Ing.*

Golder Associates Inc., 2009, Santa Ana River Bed Sediment Gradation Characterization Study: Phase III, prepared for OCWD.

Happel, A. M., Beckenback, E. H., and Halden, R. U., 1998, *An evaluation of MTBE impacts to California groundwater resources* (UCRL-AR-130897), Livermore, CA, Lawrence Livermore National Laboratory.

Harbaugh, A.W., and McDonald, M.G., 1996, User's documentation for MODFLOW-96, an update to the U.S. Geological Survey modular finite-difference ground-water flow model: USGS Open-File Report 96-485, 56 p.

Harbaugh, A.W., Banta, E.R., Hill, M.C., and McDonald, M.G., 2000, *MODFLOW-2000, The U.S. Geological Survey Modular Ground-Water Model – User Guide to Modularization Concepts and the Ground-Water Flow Process*, USGS Open-File Report 00-92, 121 pp.

Hardt, William F. and E. H. Cordes, 1971, *Analysis of Ground-Water System in Orange County, California by Use of an Electrical Analog Model*, USGS Open-File Report.

Harley, et al., 1999, *Model Advisory Panel Report*. Prepared for OCWD.

***** 2001, *Model Advisory Panel Report*. Prepared for OCWD.

Herndon, Roy L. and John D. Bonsangue. 2006. *Hydrogeology of the Orange County Groundwater Basin – An Updated Overview*, Geology of the Orange County Region, Southern California, Annual Field Trip Guide No. 33, South Coast Geological Society, Inc.

Herzberg, A. 1901. Die Wasserversorgung einiger Nordseebader. *J. Gasbeleucht. Wasserversorg., 44, pp. 815-819.*

Intera, Inc., 2010. *Alamitos Barrier Model Final Report*, prepared for OCWD.

Interstate Technology & Regulatory Council. 2005. *Perchlorate: Overview of Issues, Status, and Remedial Options.* Perchlorate-1. Washington D.C.: Interstate Technology & Regulatory Council Perchlorate Team. Available on the internet at http://www.itrcweb.org

Irvine Ranch Water District, May 1994, *Organic Removal Testing Pilot Program*.

Kolpin, et al., 2002, Pharmaceuticals, Hormones, and Other Organic Wastewater Contaminants in U.S. Streams, 1999-2000: A National Reconnaissance, Environmental Science and Technology, 36, 1202-1211.

Leake, S.A. and Prudic, D.E., 1991. Documentation of a computer program to simulate aquifer-system compaction using the modular finite-difference ground-water flow model, USGS, Techniques of Water-Resources Investigations, Book 6, Chapter A2 Appendix C: Time-Variant Specified-Head Package.

Los Angeles County Department of Public Works, 2016. *Alamitos Barrier Project Annual Report on the Control of Seawater Intrusion 2014-2015*.

McDonald and Harbaugh, 1988, *Techniques of Water-Resources Investigations of the United States Geological Survey, Book 6, A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model.*

McGillicuddy, Kevin B., 1989, *Ground Water Underflow Beneath Los Angeles-Orange County Line,* unpubl. M.S. thesis, Univ. of Southern California Dept. of Geological Sciences.

Metropolitan Water District of Southern California and U.S. Department of Interior, Bureau of Reclamation, 1999, *Salinity Management Study*.

Mills, William R. and Associates, 1987, *Hydrogeology of the Yorba Linda Subarea and Impacts from Proposed Class III Landfills*, prepared for OCWD.

Montgomery, James M., Consulting Engineers, Inc., 1974, *Bolsa Chica Mesa Water Quality Study,* prepared for OCWD.

Morton, Paul K., et al., 1976, *Environmental Geology of Orange County, California*, California Division of Mines and Geology Open-File Report No. 79-8 LA.

Municipal Water District of Orange County, 2016, Technical Memorandum on Orange County Reliability Study, Water Demand Forecast and Supply Gap Analysis, prepared by CDM Smith for MWDOC, April 20, 2016.

National Research Council, 2005, *Health Implications of Perchlorate Ingestion*.

National Water Research Institute, 2000, *Treatment Technologies for Removal of MTBE from Drinking Water: Air Stripping, Advanced Oxidation Processes, Granular Activated Carbon, Synthetic Resin Sorbents*, Second Edition.

***** 2013, *Report of the Scientific Advisory Panel, OCWD's Santa Ana River Water Quality and Health Study.*

***** 2014, *Final Report of the November 12, 2013 Meeting of the Independent Advisory Panel on Reviewing the Orange County Water District's Santa Ana River Monitoring Program*, prepared for OCWD.

Nevada Division of Environmental Protection. 2009. http://ndep.nv.gov/BCA/perchlorate05.htm. Accessed on July 7, 2009.

Orange County Water District, 1996, *Evaluation of the Orange County Colored Water Groundwater Resource: Hydrology, Water Quality and Treatment*.

***** June 1997, *Issues Paper – Development of the Colored Water Zone.*

***** 1999, 2020 *Master Plan Report for the Orange County Water District.*

***** 1970 to 2015, *Engineer's Report on Groundwater Conditions, Water Supply and Basin Utilization*.

***** 2003, *Orange County Water District Recharge Study*.

***** 2005. Board of Directors Resolution No. 05-4-40: Establishing a GWR System Buffer Area around the GWR System injection operation at the Talbert Gap Seawater Intrusion Barrier, April 20, 2005, Fountain Valley, California.

***** 2006, OCWD Application to State Water Resources Control Board to Appropriate Santa Ana River Water.

***** 2007, *Report on Evaluation of Orange County Groundwater Basin Storage and Operational Strategy.*

***** 2013, *Geologist's/Engineer's Report: Alamitos Barrier Improvement Project (Construction Unit 14).*

***** 2014, *Orange County Water District Long-Term Facilities Plan.*

***** 2015, *Orange County Water District Groundwater Management Plan 2015 Update,* June 17, 2015.

***** 2016a, *Summary of Seawater Intrusion in Orange County*, OCWD Technical Memorandum by Tim Sovich, December 14, 2016.

***** 2016b, *Salt and Nitrate Projections for Orange County Management Zone*, Final Technical Memorandum by Greg Woodside, July 18, 2016.

***** 2016c, Groundwater Replenishment System 2015 Annual Report, prepared for the California Regional Water Quality Control Board, Santa Ana Region Order No. R8-2004-0002, as amended by Order No. R8-2008-0058.

Poland, J. F. et al., 1956, *Ground Water Geology of the Coastal Zone Long Beach-Santa Ana Area, California*, USGS Water Supply Paper 1109.

Pollack, D.W., 1994. User's Guide for MODPATH/MODPATH-PLOT, Version 3: A particle tracking post-processing package for MODFLOW, the U. S. Geological Survey finite-difference ground-water flow model, USGS Open File Report 94-464.

Santa Ana River Watermaster, 2014, Forty-Third Annual Report, Orange County Water District vs. City of Chino et al., Case No. 117628 – County of Orange.

Santa Ana Watershed Project Authority, 2002, *Integrated Watershed Plan*.

***** 2004*, Santa Ana River Projected Flow Impacts Report*.

Singer, John A., 1973, *Geohydrology and Artificial-Recharge Potential of the Irvine Area, Orange County, California*, USGS Open-File Report 73-264.

Sovich, Tim, 2016, *Summary of Seawater Intrusion in the Orange County Groundwater Basin*, OCWD technical memorandum, September 1, 2016.

Tan, Lo and R. G. Sudak, January 1992, Removing Color From a Groundwater Source, AWWA Journal.

Urbansky, E.T., et al. 2001. Environmental Pollution: 112, pages 299-302.

U.S. Army Corps of Engineers, September 1994, *Water Control Manual for the Prado Dam and Reservoir, Santa Ana River.*

***** 2004, *Prado Basin Water Conservation Feasibility Study, Main Report and Draft Environmental Impact Statement/Environmental Impact Report*, *Draft F5 Document*.

U.S. Bureau of Reclamation, 2013, *Climate Change Analysis for the Santa Ana River Watershed, Santa Ana Watershed Basin Study, California Lower Colorado Region*, U.S. Bureau of Reclamation, Water and Environmental Resources Division (86-68200) Water Resources Planning and Operations Support Group (86-68210) Technical Services Center, Denver Colorado Technical Memorandum No. 86-68210-2013-02.

U.S. Geological Survey, 1953, *Native and Contaminated Ground Waters in the Long Beach-Santa Ana Area, California*, Water-Supply Paper 1136.

***** 1967, *An Investigation of Potential Salt-Water Intrusion from Inland Waterways in the Shallow Alluvial and Coastal Deposits of Sunset and Bolsa Gaps, Orange County, California*, USGS Water Resources Division, Open-File Report, July 17, 1967.

***** 1999*, Land Subsidence in the United States*, Circular 1182.

Wildermuth Environmental, 2010, Recent Changes in Santa Ana River Discharge, White Paper.

***** 2014, *Recomputation of Ambient Water Quality in the Santa Ana Watershed for the Period 1993-2012, Final Technical Memorandum,* prepared for the Basin Monitoring Task Force.

APPENDIX A

List of Wells in OCWD Monitoring Network

List of Wells in OCWD Monitoring Programs

KEY

Aquifer Zone: S=Shallow Aquifer, P=Principal Aquifer, D= Deep Aquifer

Program: 1) monitoring well, 2) production well, 3) irrigation or industrial well, 4) injection well, 5) Mid-Basin Injection well, 6) seawater intrusion monitoring well, 7) well monitored by OCWD for Title 22 compliance, 8) North Basin Groundwater Protection Program wells, 9) South Basin Groundwater Protection Program wells, 10) wells in CASGEM monitoring program

Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
ABC-KISCH	ABC SCHOOL DIST.	0		0	0	Inactive Production		2
ABC-MESCH	ABC SCHOOL DIST.	0		0	0	Other Active Production		2
ABC-TETZL	ABC SCHOOL DIST.	0		0	0	Other Active Production		2
W-5470	ABC SCHOOL DIST.	282		190	240	Inactive Production		2
ACP-I03	AC PRODUCTIONUCTS	460		370	450	Injection		4
ACP-P01	AC PRODUCTIONUCTS	200		90	140	Inactive Production		2,3
ACP-P02	AC PRODUCTIONUCTS	190		100	180	Other Active Production		2
AVCC-P	ALTA VISTA COUNTRY CLUB	438		0	0	Other Active Production		2,3
AVCC-P2	ALTA VISTA COUNTRY CLUB	803		210	770	Other Active Production	P	2,3
A-14	ANAHEIM	450		309	425	Inactive Production	P	2,8
A-36	ANAHEIM	818		651	796	Inactive Production	P	2,7
A-39	ANAHEIM	1493		540	1280	Active Large Production	P	2,7
A-40	ANAHEIM	1308		505	1220	Active Large Production	P	2,7
A-41	ANAHEIM	1532		437	1450	Active Large Production	P	2,7
A-42	ANAHEIM	1260		430	1180	Active Large Production	P	2,7
A-43	ANAHEIM	1400		530	1210	Active Large Production	P	2,7
A-44	ANAHEIM	1155		450	1130	Active Large Production	P	2,7
A-45	ANAHEIM	1430		455	1410	Active Large Production	P	2,7
A-46	ANAHEIM	1565		599	1529	Active Large Production	P	2,7
A-47	ANAHEIM	1500		482	1375	Active Large Production	P	2,7,8
A-48	ANAHEIM	1450		932	1344	Active Large Production	P	2,7
A-49	ANAHEIM	1498		580	1450	Active Large Production	P	2,7,8
A-51	ANAHEIM	1310		525	965	Active Large Production	P	2,7
A-52	ANAHEIM	1210		570	1066	Active Large Production	P	2,7
A-53	ANAHEIM	1350		945	1270	Active Large Production	P	2,7
A-54	ANAHEIM	0		680	1480	Active Large Production	P	2,7
A-55	ANAHEIM	1340		370	1300	Active Large Production	P	2,7
A-56	ANAHEIM	1600		725	1300	Active Large Production	P	2,7
A-58	ANAHEIM	1218		400	930	Inactive Production		2,7
ADEV-AM1	ANAHEIM	157		110	150	Monitoring		1
A-DMGC	ANAHEIM	500		430	482	Other Active Production	P	2,3
A-YARD-MW1	ANAHEIM	112		85	109	Monitoring		1
A-YARD-MW2	ANAHEIM	111		86	110	Monitoring		1
W-15896	ANAHEIM MOTEL, LIMITED	200		0	0	Inactive Production		2,3
ANGE-O	ANGELICA HEALTHCARE SERVICES	670		186	639	Other Active Production		2,3
AET-RMW10	ARCO/TOSCO/EQUIVA	129		127	128	Monitoring		1
AET-RMW14	ARCO/TOSCO/EQUIVA	197		195	196	Monitoring		1
AET-RMW15	ARCO/TOSCO/EQUIVA	142		140	141	Monitoring		1
AET-RMW16	ARCO/TOSCO/EQUIVA	200		189	190	Monitoring		1
AET-RMW17	ARCO/TOSCO/EQUIVA	218		217	218	Monitoring		1
AET-RMW2	ARCO/TOSCO/EQUIVA	199		196	197	Monitoring		1
AET-RMW20	ARCO/TOSCO/EQUIVA	100		98	99	Monitoring		1
AET-RMW23	ARCO/TOSCO/EQUIVA	124		119	120	Monitoring		1
AET-RMW3	ARCO/TOSCO/EQUIVA	200		194	195	Monitoring		1
AET-RMW5	ARCO/TOSCO/EQUIVA	200		195	196	Monitoring		1
AET-RMW6	ARCO/TOSCO/EQUIVA	184		116	117	Monitoring		1
AET-RMW7	ARCO/TOSCO/EQUIVA	113		108	109	Monitoring		1
AET-RMW8	ARCO/TOSCO/EQUIVA	98		94	95	Monitoring		1
AET-RMW9	ARCO/TOSCO/EQUIVA	112		107	108	Monitoring		1
ARMD-LA3	ARMED FORCES RESERVE CENTER	965		333	363	Inactive Production		2
ARMD-LARA	ARMED FORCES RESERVE CENTER	0		0	0	Inactive Production		2
AR-PUMP	ARTESIA	217		0	0	Other Active Production		2,3
W-14107	ARTESIA ICE CO.	51		0	0	Inactive Production		2,3
ARCO-FBH11	ATLANTIC RICHFIELD CO.	62		50	62	Monitoring		1
ARCO-FBH12	ATLANTIC RICHFIELD CO.	75		55	75	Monitoring		1
ARCO-FBH14	ATLANTIC RICHFIELD CO.	75		0	0	Monitoring		1
ARCO-FBH17	ATLANTIC RICHFIELD CO.	140		124	139	Monitoring		1
ARCO-FBH5	ATLANTIC RICHFIELD CO.	75		0	0	Monitoring		1
ARCO-FBH6	ATLANTIC RICHFIELD CO.	80		48	80	Monitoring		1
ARCO-T2209	ATLANTIC RICHFIELD CO.	150		82	143	Injection		4
BF-BF1	BELLFLOWER	1200		574	1160	Active Large Production		2
PEER-17	BELLFLOWER MUNICIPAL WATER CO.	1030		610	1012	Active Small Production		2
PEER-2	BELLFLOWER MUNICIPAL WATER CO.	204		162	177	Active Large Production		2
PEER-7	BELLFLOWER MUNICIPAL WATER CO.	108		0	0	Active Small Production		2
PEER-8	BELLFLOWER MUNICIPAL WATER CO.	174		113	153	Other Active Production		2
FUJI-FV	BERUMEN FARMS	170		0	0	Other Active Production		2,3
FUJI-WM	BERUMEN FARMS	150		0	0	Inactive Production		2,3

List of Wells in OCWD Monitoring Programs

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
BOE-EW101	BOEING CO.	77		57	77	Other Active Production	S	2
BOE-EW102	BOEING CO.	87		62	82	Other Active Production	S	2
BOE-EW103	BOEING CO.	85		63	83	Other Active Production	S	2
BOE-EW104	BOEING CO.	83		57	82	Other Active Production	S	2
BOE-MW16	BOEING CO.	297		260	280	Monitoring		1,6
BOE-MW17	BOEING CO.	298		255	275	Monitoring		1,6
BOE-MW19A	BOEING CO.	173		153	173	Monitoring		1,6
BOE-MW20S	BOEING CO.	84		59	80	Monitoring	S	1
BOE-MW21S	BOEING CO.	81		59	79	Monitoring	S	1
BOE-MW27A	BOEING CO.	172		139	159	Monitoring		1,6
BOE-MW31S	BOEING CO.	92		78	88	Monitoring	S	1
BOE-MW34	BOEING CO.	278		252	267	Monitoring		1,6
BOE-MW37A	BOEING CO.	172		135	165	Monitoring		1,6
BOE-MW38A	BOEING CO.	170		135	165	Monitoring		1,6
BOE-MW41A	BOEING CO.	177		149	169	Monitoring		1,6
BOE-MW42A	BOEING CO.	173		140	170	Monitoring		1,6
BOE-MW57A	BOEING CO.	172		150	170	Monitoring		1,6
BOE-MW58A	BOEING CO.	175		150	170	Monitoring		1,6
BOE-MW59B	BOEING CO.	268		240	250	Monitoring		1,6
BOE-MW60A	BOEING CO.	172		150	170	Monitoring		1,6
BOE-MW61A	BOEING CO.	172		150	170	Monitoring		1,6
BOE-MW72A	BOEING CO.	132		112	127	Monitoring		1,6
BOE-MW73A	BOEING CO.	137		113	133	Monitoring		1,6
BOE-MW75	BOEING CO.	227		202	222	Monitoring		1,6
BOE-MW95A	BOEING CO.	172		135	165	Monitoring		1,6
BOE-MW96A	BOEING CO.	175		150	170	Monitoring		1,6
BOE-MW97A	BOEING CO.	215		170	175	Monitoring		1,6
BOE-MW98A	BOEING CO.	215		169	174	Monitoring		1,6
BOE-MW99A	BOEING CO.	210		146	166	Monitoring		1,6
BOTT-C	BOTT TRACT MUTUAL WATER CO.	150		0	0	Other Active Production		2,3
LB-NLB10	BOY SCOUTS OF AMERICA	378		357	374	Monitoring		1
BR-1	BREA	500		78	115	Other Active Production		2,3
BROS-WM	BRORS OF ST.PATRICK	106		98	105	Other Active Production		2
BP-BALL	BUENA PARK	890		260	870	Active Large Production	P	2,7
BP-BOIS	BUENA PARK	1505		475	1355	Active Large Production	P	2,7
BP-CABA	BUENA PARK	1430		250	1010	Active Large Production	P	2,7
BP-FREE	BUENA PARK	1000		260	1000	Active Large Production	P	2,7
BP-HOLD	BUENA PARK	1020		250	1000	Active Large Production	P	2,7
BP-KNOT	BUENA PARK	1020		260	1000	Active Large Production	P	2,7
BP-LIND	BUENA PARK	1410		470	1221	Active Large Production	P	2,7
BP-SM	BUENA PARK	1038		308	1038	Active Large Production	P	2,7
OCWD-BGO10	CA STATE LANDS COMMISSION	110		80	100	Monitoring		1
SLC-MW1	CA STATE LANDS COMMISSION	25		5	25	Monitoring		1
SLC-MW10	CA STATE LANDS COMMISSION	32		10	30	Monitoring		1
SLC-MW11	CA STATE LANDS COMMISSION	32		10	30	Monitoring		1
SLC-MW12	CA STATE LANDS COMMISSION	32		10	30	Monitoring		1
SLC-MW13	CA STATE LANDS COMMISSION	32		10	30	Monitoring		1
SLC-MW14	CA STATE LANDS COMMISSION	32		10	30	Monitoring		1
SLC-MW15	CA STATE LANDS COMMISSION	32		10	30	Monitoring		1
SLC-MW16	CA STATE LANDS COMMISSION	32		10	30	Monitoring		1
SLC-MW2	CA STATE LANDS COMMISSION	25		5	25	Monitoring		1
SLC-MW3	CA STATE LANDS COMMISSION	25		5	25	Monitoring		1
SLC-MW4	CA STATE LANDS COMMISSION	25		5	25	Monitoring		1
SLC-MW5	CA STATE LANDS COMMISSION	25		5	25	Monitoring		1
SLC-MW6	CA STATE LANDS COMMISSION	25		5	25	Monitoring		1
SLC-MW7	CA STATE LANDS COMMISSION	32		10	30	Monitoring		1
SLC-MW8	CA STATE LANDS COMMISSION	32		10	30	Monitoring		1
SLC-MW9	CA STATE LANDS COMMISSION	32		10	30	Monitoring		1
SLC-P10	CA STATE LANDS COMMISSION	25		5	15	Monitoring		1
SLC-P11	CA STATE LANDS COMMISSION	25		5	15	Monitoring		1
SLC-P13	CA STATE LANDS COMMISSION	25		5	15	Monitoring		1
SLC-P14	CA STATE LANDS COMMISSION	25		5	15	Monitoring		1
SLC-P15	CA STATE LANDS COMMISSION	25		5	15	Monitoring		1
SLC-P16	CA STATE LANDS COMMISSION	25		5	20	Monitoring		1
SLC-P17	CA STATE LANDS COMMISSION	25		5	20	Monitoring		1
SLC-P18	CA STATE LANDS COMMISSION	25		5	20	Monitoring		1
SLC-P19	CA STATE LANDS COMMISSION	40		5	20	Monitoring		1

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
SLC-P20	CA STATE LANDS COMMISSION	25		5	10	Monitoring		1
SLC-P21	CA STATE LANDS COMMISSION	25		5	15	Monitoring		1
SLC-P22	CA STATE LANDS COMMISSION	25		5	20	Monitoring		1
SLC-P23	CA STATE LANDS COMMISSION	25		5	15	Monitoring		1
SLC-P24	CA STATE LANDS COMMISSION	25		5	15	Monitoring		1
SLC-P25	CA STATE LANDS COMMISSION	25		5	20	Monitoring		1
SLC-P26	CA STATE LANDS COMMISSION	25		5	20	Monitoring		1
SLC-P27	CA STATE LANDS COMMISSION	40		5	20	Monitoring		1
SLC-P29	CA STATE LANDS COMMISSION	25		6	21	Monitoring		1
SLC-P30	CA STATE LANDS COMMISSION	46		22	37	Monitoring		1
SLC-P31	CA STATE LANDS COMMISSION	25		5	20	Monitoring		1
SLC-P32	CA STATE LANDS COMMISSION	25		8	23	Monitoring		1
SLC-P33	CA STATE LANDS COMMISSION	40		6	21	Monitoring		1
SLC-P34	CA STATE LANDS COMMISSION	40		6	21	Monitoring		1
SLC-P35	CA STATE LANDS COMMISSION	40		7	22	Monitoring		1
SLC-P36	CA STATE LANDS COMMISSION	40		6	21	Monitoring		1
SLC-P4	CA STATE LANDS COMMISSION	25		5	20	Monitoring		1
SLC-P5	CA STATE LANDS COMMISSION	25		5	15	Monitoring		1
SLC-P6	CA STATE LANDS COMMISSION	25		5	15	Monitoring		1
SLC-P9	CA STATE LANDS COMMISSION	25		5	20	Monitoring		1
CIFM-CH	CA. INSTITUE FOR MEN - CHINO	239		122	226	Other Active Production		2
CIFM-CH1A	CA. INSTITUE FOR MEN - CHINO	529		0	0	Other Active Production		2
CSF-1	CA. STATE UNIV., FULLERTON	842		130	726	Multiport Monitoring	S/P/D	1
FPRK-YLE	CANYON RV PARK	98		60	84	Active Small Production	S	2,7
FPRK-YLW	CANYON RV PARK	98		48	80	Active Small Production	S	2,7
CARD-O	CARDINAL MANAGEMENT	70		0	0	Other Active Production		2,3
MKSSN-A	CCDA WATERS, LLC	800		635	755	Other Active Production		2,3
CE-C1	CERRITOS	1035		295	976	Active Large Production		2
CE-C2	CERRITOS	1050		280	980	Active Large Production		2
CE-C4	CERRITOS	1030		305	955	Active Large Production		2
CHEV-HBP4	CHEVRON U.S.A. - LA HABRA	680		490	640	Inactive Production		2,3
CHEV-NOR4	CHEVRON U.S.A. - LA HABRA	1023		990	1005	Inactive Production		2,3
W-18110	CHEVRON U.S.A.-HUNTINGTON BCH.	116		85	115	Monitoring		1
PLMP-YL	CITY OIL CORP	77		0	0	Inactive Production		2,3
CCOL-C	COMMUNITY COLLEGE DIST.	395		365	395	Other Active Production		2,3
COMM-LP	COMMUNITY WATER ASSOC.	0		0	0	Inactive Production		2
CNXT-NBEI1	CONEXANT SYSTEMS, INC.	100		60	100	Inactive Production		2
CNXT-NBEI2	CONEXANT SYSTEMS, INC.	100		60	100	Inactive Production		2
CNXT-NBEI3	CONEXANT SYSTEMS, INC.	100		60	100	Inactive Production		2
CNXT-NBEI4A	CONEXANT SYSTEMS, INC.	104		65	100	Inactive Production		2
CNXT-NBES1	CONEXANT SYSTEMS, INC.	43		22	42	Inactive Production		2
CNXT-NBES2	CONEXANT SYSTEMS, INC.	45		21	41	Inactive Production		2
CNXT-NBES3A	CONEXANT SYSTEMS, INC.	46		24	44	Inactive Production		2
CNXT-NBES4B	CONEXANT SYSTEMS, INC.	47		23	43	Inactive Production		2
CNXT-NBES5A	CONEXANT SYSTEMS, INC.	42		20	40	Inactive Production		2
CNXT-NBES6	CONEXANT SYSTEMS, INC.	45		25	40	Inactive Production		2
CNXT-NBI17	CONEXANT SYSTEMS, INC.	105		0	0	Injection		4
CNXT-NBMW27	CONEXANT SYSTEMS, INC.	40		10	40	Monitoring		1
CNXT-NBMW28	CONEXANT SYSTEMS, INC.	82		60	82	Monitoring		1
CNXT-NBMW29	CONEXANT SYSTEMS, INC.	42		21	40	Monitoring		1
CNXT-NBMW30	CONEXANT SYSTEMS, INC.	42		21	42	Monitoring		1
CNXT-NBRI1	CONEXANT SYSTEMS, INC.	105		77	102	Injection		4
CNXT-NBRI2	CONEXANT SYSTEMS, INC.	115		75	110	Injection		4
CNXT-NBRI3	CONEXANT SYSTEMS, INC.	122		75	115	Injection		4
CNXT-NBRI4	CONEXANT SYSTEMS, INC.	97		0	0	Injection		4
CO-16	CORONA	850		415	755	Active Large Production		2
CMW-CO	CORONITA MUTUAL WATER CO.	270		126	234	Other Active Production		2
MCWD-GC	COSTA MESA	225		195	215	Monitoring		1,6
W-3799	COSTA MESA SCHOOL DIST.	297		0	0	Inactive Production		2,3
CCC-LA1	COTTONWOOD CHRISTIAN CENTER	340		140	310	Other Active Production		2
MRCF-GG	CROSBY WATER SYSTEM	240		0	0	Other Active Production		2
MBF-FM2	CT STORAGE - FULLERTON, LLC	135		110	134	Monitoring		1,8
MBF-FM3	CT STORAGE - FULLERTON, LLC	135		110	134	Monitoring		1,8
FJC-LAK2	CYPRESS GC LLC/CYPRESS GOLF CL	620		300	570	Other Active Production	P	2,3
W-18698	DEGUSSA FLAVOR & FRUIT SYSTEMS	90		70	90	Monitoring		1
OCWD-BS103	DEPT. OF WATER RESOURCES	484		184	205	Monitoring	S	1,6
OCWD-BS105	DEPT. OF WATER RESOURCES	394		150	197	Monitoring	S	1,6

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				Screened Interval (ft.bgs)				
Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Top	Bottom	Type of Well	Aquifer Zone	Program
OCWD-BS106	DEPT. OF WATER RESOURCES	556		213	255	Monitoring	S	1,6
OCWD-BS107	DEPT. OF WATER RESOURCES	738		398	441	Monitoring		1,6
OCWD-BS111	DEPT. OF WATER RESOURCES	483		184	205	Monitoring		1,6
OCWD-BSO1A	DEPT. OF WATER RESOURCES	500		245	335	Monitoring		1
OCWD-BSO1B	DEPT. OF WATER RESOURCES	500		80	104	Monitoring		1
OCWD-BSO4	DEPT. OF WATER RESOURCES	700		268	498	Monitoring		1
OCWD-BSO6A	DEPT. OF WATER RESOURCES	150		85	135	Monitoring		1,6
OCWD-BSO6B	DEPT. OF WATER RESOURCES	305		235	295	Monitoring		1,6
OCWD-BSO9A	DEPT. OF WATER RESOURCES	445		195	285	Monitoring	S	1,6
OCWD-BSO9B	DEPT. OF WATER RESOURCES	624		520	615	Monitoring	P	1,6
OCWD-BSO9C	DEPT. OF WATER RESOURCES	450		340	435	Monitoring		1,6
OCWD-SA10	DEPT. OF WATER RESOURCES	483		300	330	Monitoring	S/P	1,6
OCWD-SA12	DEPT. OF WATER RESOURCES	715		305	325	Monitoring	S	1
OCWD-SA3	DEPT. OF WATER RESOURCES	401		100	160	Monitoring	S	1,6
OCWD-SA5	DEPT. OF WATER RESOURCES	401		273	312	Monitoring	P	1,6
DICE-SA2	DIAMONITORINGD ICE CORP	1003		330	990	Inactive Production		2,3
SSPG-O	DS WATERS OF AMERICA, INC.	270		250	270	Inactive Production		2
EOCW-E	EAST ORANGE COUNTY WATER DIST.	504		324	450	Active Large Production	P	2,7
EOCW-W	EAST ORANGE COUNTY WATER DIST.	800		315	450	Active Large Production	P	2,7
LKVG-YL	EASTLAKE VILLAGE HOA	124		50	124	Other Active Production		2,3
ESWA-4	EASTSIDE WATER ASSOC.	560		240	520	Active Small Production		2,7
EDGW-SA	EDINGER WATER ASSOC.	308		0	0	Inactive Production		2
EMA-FVRI	ENVIRONMENTAL MGMT AGENCY	0		0	0	Other Active Production		2,3
ALEN-GG	EUCHARISTIC MISSIONARIES	252		0	0	Other Active Production		2
SAKH-A	F S NURSERY	383		0	0	Other Active Production		2,3
FAIR-SA	FAIRHAVEN MEMORIAL PARK	427		0	0	Inactive Production		2,3
FAIR-SA3	FAIRHAVEN MEMORIAL PARK	520		250	500	Other Active Production		2,3
FAA-LA1	FEDERAL AVAIATION ADMIN.	0		0	0	Other Active Production		2,3
FLWN-CQ2	FOREST LAWN	590		160	560	Other Active Production		2,3
FV-10	FOUNTAIN VALLEY	1100		460	980	Active Large Production	P	2,7
FV-11	FOUNTAIN VALLEY	1027		440	950	Active Large Production	P	2,7
FV-12	FOUNTAIN VALLEY	1230		340	1070	Active Large Production	P	2,7
FV-6	FOUNTAIN VALLEY	1150		370	1110	Active Large Production	P	2,7
FV-8	FOUNTAIN VALLEY	920		312	844	Active Large Production	P	2,7
FV-9	FOUNTAIN VALLEY	1114		415	1070	Active Large Production	P	2,7
W-3791	FOUNTAIN VALLEY	0		0	0	Inactive Production		2
F-10	FULLERTON	1350		460	1290	Active Large Production	P	2,7,8
F-3A	FULLERTON	1295		580	1280	Active Large Production	P	2,7,8
F-4	FULLERTON	415		315	405	Active Large Production	P	2,7,8
F-5	FULLERTON	440		350	400	Active Large Production	P	2,7,8
F-6	FULLERTON	430		340	401	Active Large Production	P	2,7,8
F-7	FULLERTON	434		300	410	Active Large Production	P	2,7,8
F-8	FULLERTON	458		324	402	Active Large Production	P	2,7,8
F-AIRP	FULLERTON	1135		435	1080	Active Large Production	P	2,7
F-CHRI2	FULLERTON	1350		520	1330	Active Large Production	P	2,7,8
F-COYO2	FULLERTON	1517		309	919	Inactive Production	P	2
F-KIM1A	FULLERTON	1243		500	1225	Active Large Production	P	2,7,8
F-KIM2	FULLERTON	652		320	626	Active Large Production	P	2,7,8
GG-16	GARDEN GROVE	1000		304	864	Active Large Production	P	2,7
GG-19	GARDEN GROVE	942		818	892	Active Large Production	P	2,7
GG-20	GARDEN GROVE	960		360	912	Active Large Production	P	2,7
GG-21	GARDEN GROVE	1187		428	1080	Active Large Production	P	2,7
GG-22	GARDEN GROVE	1040		416	1020	Active Large Production	P	2,7
GG-23	GARDEN GROVE	860		474	835	Active Large Production	P	2,7
GG-25	GARDEN GROVE	987		442	850	Active Large Production	P	2,7
GG-26	GARDEN GROVE	1120		470	1060	Active Large Production	P	2,7
GG-27	GARDEN GROVE	1215		520	1160	Active Large Production	P	2,7
GG-28	GARDEN GROVE	328		130	240	Active Large Production	S	2,7
GG-29	GARDEN GROVE	1140		465	1110	Active Large Production	P	2,7
GG-30	GARDEN GROVE	1205		390	1146	Active Large Production	P	2,7
GG-31	GARDEN GROVE	1462		739	1373	Active Large Production	P	2,7
WWGC-SAK3	GARDEN GROVE	206		149	170	Other Active Production	S	2,3
WWGC-SAK4	GARDEN GROVE	272		150	249	Other Active Production		2,3
W-15829	GARDEN GROVE UNIF. SCH. DIST.	209		0	0	Inactive Production		2,3
W-4220	GENERAL SERVICE ADMIN.	900		264	887	Inactive Production		2
W-4224	GENERAL SERVICE ADMIN.	602		378	438	Inactive Production		2,3
W-4226	GENERAL SERVICE ADMIN.	586		271	372	Inactive Production		2,3

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
W-4856	GENERAL SERVICE ADMIN.	804		247	427	Inactive Production		2
GSWC-HGC6	GOLDEN STATE WATER CO - LA	1295		180	1170	Active Large Production		2
SCWC-ARR1	GOLDEN STATE WATER CO - LA	1026		919	965	Active Small Production		2
SCWC-HGC3	GOLDEN STATE WATER CO - LA	860		110	852	Inactive Production		2
SCWC-HGC4	GOLDEN STATE WATER CO - LA	861		110	856	Inactive Production		2
SCWC-HGCAR	GOLDEN STATE WATER CO - LA	570		121	327	Inactive Production		2
SCWC-HGJ4	GOLDEN STATE WATER CO - LA	890		530	710	Active Large Production		2
SCWC-LKHAW	GOLDEN STATE WATER CO - LA	822		200	796	Active Large Production		2
SCWC-LKMA	GOLDEN STATE WATER CO - LA	885		215	830	Active Large Production		2
SCWC-NWDAC1	GOLDEN STATE WATER CO - LA	380		0	0	Other Active Production		2
SCWC-NWIMP1	GOLDEN STATE WATER CO - LA	0		0	0	Other Active Production		2
SCWC-NWIMP2	GOLDEN STATE WATER CO - LA	399		0	0	Other Active Production		2
SCWC-NWIMP3	GOLDEN STATE WATER CO - LA	890		0	890	Other Active Production		2
W-17720	GOLDEN STATE WATER CO - LA	0		0	0	Other Active Production		2
GSWC-POR1	GOLDEN STATE WATER CO - OC	1129		350	895	Active Large Production	P	2,7
GSWC-SCL5	GOLDEN STATE WATER CO - OC	1416		700	1000	Active Large Production	P	2,7
RHWC-E	GOLDEN STATE WATER CO - OC	945		410	920	Active Large Production	P	2,7
RHWC-W2	GOLDEN STATE WATER CO - OC	954		474	753	Active Large Production	P	2,7
SCWC-CBAL	GOLDEN STATE WATER CO - OC	990		200	770	Active Large Production	P	2,7
SCWC-CSC	GOLDEN STATE WATER CO - OC	600		526	556	Active Large Production	P	2,7
SCWC-CVV	GOLDEN STATE WATER CO - OC	670		524	645	Active Large Production	P	2,7
SCWC-CVV2	GOLDEN STATE WATER CO - OC	1010		480	981	Active Large Production	P	2,7
SCWC-LABL2	GOLDEN STATE WATER CO - OC	708		460	690	Active Large Production	P	2,7
SCWC-LAC3	GOLDEN STATE WATER CO - OC	632		346	593	Active Large Production	P	2,7
SCWC-LAFL	GOLDEN STATE WATER CO - OC	720		300	680	Active Large Production	P	2,7
SCWC-LAHO	GOLDEN STATE WATER CO - OC	520		386	486	Active Large Production	P	2,7
SCWC-LAYT	GOLDEN STATE WATER CO - OC	812		250	800	Active Large Production	P	2,6,7
SCWC-PBF3	GOLDEN STATE WATER CO - OC	496		220	475	Active Large Production	P	2,7,8
SCWC-PBF4	GOLDEN STATE WATER CO - OC	550		275	520	Active Large Production	P	2,7,8
SCWC-PLJ2	GOLDEN STATE WATER CO - OC	505		402	492	Active Large Production	P	2,7,8
SCWC-PRU	GOLDEN STATE WATER CO - OC	837		430	790	Active Large Production	P	2,7
SCWC-SBCH	GOLDEN STATE WATER CO - OC	600		200	570	Active Large Production	P	2,7
SCWC-SCL4	GOLDEN STATE WATER CO - OC	530		294	488	Active Large Production	P	2,7
SCWC-SDAL	GOLDEN STATE WATER CO - OC	562		500	542	Active Large Production	P	2,7
SCWC-SLON	GOLDEN STATE WATER CO - OC	778		0	0	Active Large Production	P	2,7
SCWC-SORG	GOLDEN STATE WATER CO - OC	302		242	286	Active Large Production	P	2,7
SCWC-SSHR	GOLDEN STATE WATER CO - OC	618		520	580	Active Large Production	P	2,7
SCWC-SSYC	GOLDEN STATE WATER CO - OC	568		500	546	Active Large Production	P	2,7
SCWC-YLCO2	GOLDEN STATE WATER CO - OC	504		100	480	Inactive Production		2
GWRC-SFS8	GOLDEN WEST REFINING CO.	0		0	0	Other Active Production		2
GOOD-HB	GOOD SHEPHERD CEMETERY	244		180	218	Other Active Production		2,3,6
ETCH-AL2	GOODWIN MUTUAL WATER CO.	200		85	185	Inactive Production	S	2,3
GRV-RSIR	GREEN RIVER VILLIAGE	85		50	82	Other Active Production		2,3
HALD-BP	HALDOR PLACE MUTUAL WATER	265		0	0	Inactive Production		2
HMEM-COS	HARBOR LAWN MEMORIAL PARK	280		190	200	Monitoring		1,6
HOLY-A	HOLY CROSS CEMETERY	365		334	364	Other Active Production	P	2,3
HOUS-F	HOUSTON AVE. WATER	156		0	0	Other Active Production		2
W-14801	HUGHES AIRCRAFT CO.	155		135	155	Monitoring		1
W-14803	HUGHES AIRCRAFT CO.	165		144	164	Monitoring		1
HB-1	HUNTINGTON BEACH	306		258	297	Inactive Production		2,6
HB-10	HUNTINGTON BEACH	1000		232	942	Active Large Production	P	2,7
HB-12	HUNTINGTON BEACH	807		265	740	Inactive Production		2,6
HB-13	HUNTINGTON BEACH	860		280	810	Active Large Production	P	2,6,7
HB-3A	HUNTINGTON BEACH	738		370	640	Active Large Production	P	2,6,7
HB-4	HUNTINGTON BEACH	826		252	804	Active Large Production	P	2,6,7
HB-5	HUNTINGTON BEACH	830		223	800	Active Large Production	P	2,7
HB-6	HUNTINGTON BEACH	876		246	810	Active Large Production	P	2,7
HB-7	HUNTINGTON BEACH	930		263	879	Active Large Production	P	2,6,7
HB-8	HUNTINGTON BEACH	1172		256	704	Inactive Production	P	2
HB-9	HUNTINGTON BEACH	1010		556	996	Active Large Production	P	2,7
HB-MEA2	HUNTINGTON BEACH	537		480	510	Or Active Production	P	2,3
W-15104	HUNTINGTON BEACH CO.	130		90	125	Inactive Production		2
W-15819	HUNTINGTON BEACH CO.	181		0	0	Inactive Production		2
W-15821	HUNTINGTON BEACH CO.	155		0	0	Inactive Production		2
W-15823	HUNTINGTON BEACH CO.	123		0	0	Inactive Production		2
HUNT-P13	HUNTINGTON CONDO ASSOC.	9		0	9	Monitoring		1
HUNT-P14	HUNTINGTON CONDO ASSOC.	10		0	10	Monitoring		1

List of Wells in OCWD Monitoring Programs

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
HUNT-P7	HUNTINGTON CONDO ASSOC.	19		4	20	Monitoring		1
OCWD-HH2	HUNTINGTON HARBOUR CORP	150		130	140	Monitoring	S	1,6
OCWD-HH3	HUNTINGTON HARBOUR CORP	150		133	143	Monitoring	S	1,6
OCWD-HH4	HUNTINGTON HARBOUR CORP	145		130	140	Monitoring	S	1,6
OCWD-HH5	HUNTINGTON HARBOUR CORP	138		102	112	Monitoring	S	1,6
OCWD-HH6A	HUNTINGTON HARBOUR CORP	55		40	50	Monitoring		1,6
OCWD-HH6B	HUNTINGTON HARBOUR CORP	110		90	100	Monitoring	S	1,6,10
OCWD-HH6C	HUNTINGTON HARBOUR CORP	202		170	180	Monitoring		1,6
HYNS-S1	HYNES ESTATES, INC.	250		0	0	Active Small Production		2,7
HYNS-S2	HYNES ESTATES, INC.	182		162	182	Active Small Production	S	2,7
IWMD-LVM2	INTERGRATED WASTE MGMT. DIST.	248		223	243	Monitoring		1
IWMD-LVM3	INTERGRATED WASTE MGMT. DIST.	253		223	253	Monitoring		1
IWMD-LVM4	INTERGRATED WASTE MGMT. DIST.	247		206	246	Monitoring		1
IWMD-RPM3	INTERGRATED WASTE MGMT. DIST.	101		76	101	Monitoring		1
IWMD-RPM5	INTERGRATED WASTE MGMT. DIST.	102		70	100	Monitoring		1
TIC-108	IRVINE CO.	1045		200	960	Inactive Production	P	2,3
TIC-194	IRVINE CO.	822		562	726	Monitoring	P/D	1,9
TIC-25	IRVINE CO.	790		666	760	Monitoring	P/D	1,10
TIC-50	IRVINE CO.	1488		475	1070	Monitoring		1
TIC-61	IRVINE CO.	762		240	695	Inactive Production	P	2,3
TIC-80	IRVINE CO.	1553		415	1300	Monitoring		1
TIC-99	IRVINE CO.	692		346	650	Monitoring	P	1
W-285	IRVINE CO.	93		37	84	Inactive Production		2,3
ET-1	IRVINE RANCH WATER DIST.	520		220	490	Other Active Production	P	2,3
ET-2	IRVINE RANCH WATER DIST.	1120		280	1080	Other Active Production	P	2,3
IRWD-1	IRVINE RANCH WATER DIST.	2020		410	860	Active Large Production	P	2,7
IRWD-10	IRVINE RANCH WATER DIST.	1040		419	940	Active Large Production	P	2,7
IRWD-107R	IRVINE RANCH WATER DIST.	1060		275	1000	Active Large Production	P	2,7
IRWD-11	IRVINE RANCH WATER DIST.	1300		410	870	Active Large Production	P	2,7
IRWD-110	IRVINE RANCH WATER DIST.	1070		555	1015	Active Large Production	P	2,7
IRWD-115R	IRVINE RANCH WATER DIST.	1136		290	1080	Active Large Production		2,7
IRWD-12	IRVINE RANCH WATER DIST.	1424		580	1040	Active Large Production	P	2,7
IRWD-13	IRVINE RANCH WATER DIST.	1170		410	980	Active Large Production	P	2,7
IRWD-14	IRVINE RANCH WATER DIST.	1015		470	970	Active Large Production	P	2,7
IRWD-15	IRVINE RANCH WATER DIST.	1085		470	990	Active Large Production	P	2,7
IRWD-16	IRVINE RANCH WATER DIST.	1010		406	807	Active Large Production	P	2,7
IRWD-17	IRVINE RANCH WATER DIST.	1019		504	960	Active Large Production	P	2,7
IRWD-18	IRVINE RANCH WATER DIST.	1120		390	1080	Active Large Production	P	2,7
IRWD-2	IRVINE RANCH WATER DIST.	1450		385	855	Active Large Production	P	2,7,9
IRWD-21	IRVINE RANCH WATER DIST.	1223		290	970	Active Large Production	P	2,7,9
IRWD-22	IRVINE RANCH WATER DIST.	1220		300	970	Active Large Production	P	2,7,9
IRWD-3	IRVINE RANCH WATER DIST.	1309		484	1250	Active Large Production	P	2,7,9
IRWD-4	IRVINE RANCH WATER DIST.	1146		440	910	Active Large Production	P	2,7
IRWD-5	IRVINE RANCH WATER DIST.	1075		554	1028	Active Large Production	P	2,7,9
IRWD-52	IRVINE RANCH WATER DIST.	1400		635	1290	Inactive Production		2,7,9
IRWD-6	IRVINE RANCH WATER DIST.	1175		499	1124	Active Large Production	P	2,7,9
IRWD-7	IRVINE RANCH WATER DIST.	2731		359	660	Active Large Production	P	2,7
IRWD-72	IRVINE RANCH WATER DIST.	1192		254	1151	Other Active Production	P	2,3
IRWD-76	IRVINE RANCH WATER DIST.	1055		450	900	Active Large Production	P	2,7
IRWD-77	IRVINE RANCH WATER DIST.	1000		330	980	Active Large Production	P	2,7
IRWD-78R	IRVINE RANCH WATER DIST.	1010		250	730	Other Active Production	P	2,3
IRWD-98	IRVINE RANCH WATER DIST.	355		115	343	Inactive Production	P	2,3
IRWD-C8	IRVINE RANCH WATER DIST.	2065		1080	1982	Active Large Production	D	2,7
IRWD-C9	IRVINE RANCH WATER DIST.	2106		1055	1930	Active Large Production	D	2,7
IRWD-LA1	IRVINE RANCH WATER DIST.	800		200	790	Inactive Production		2
IRWD-LA3	IRVINE RANCH WATER DIST.	800		0	0	Inactive Production		2
IRWD-LA4	IRVINE RANCH WATER DIST.	810		350	790	Inactive Production		2
IRWD-LA5	IRVINE RANCH WATER DIST.	820		350	780	Inactive Production		2
IRWD-LA7	IRVINE RANCH WATER DIST.	1000		430	980	Inactive Production		2
IRWD-LF2	IRVINE RANCH WATER DIST.	808		280	640	Active Large Production		2
IRWD-MICH10	IRVINE RANCH WATER DIST.	0		0	0	Other Active Production		2
IRWD-MICH2	IRVINE RANCH WATER DIST.	0		30	50	Other Active Production		2
IRWD-MICH3	IRVINE RANCH WATER DIST.	0		30	50	Other Active Production		2
IRWD-MICH4	IRVINE RANCH WATER DIST.	0		17	67	Other Active Production		2
IRWD-MICH5	IRVINE RANCH WATER DIST.	0		17	67	Other Active Production		2
IRWD-MICH6	IRVINE RANCH WATER DIST.	0		40	70	Other Active Production		2
IRWD-MICH7	IRVINE RANCH WATER DIST.	0		40	70	Other Active Production		2

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
IRWD-MICH8	IRVINE RANCH WATER DIST.	0		40	70	Other Active Production		2
IRWD-MICH9	IRVINE RANCH WATER DIST.	0		17	67	Other Active Production		2
IRWD-OPA1	IRVINE RANCH WATER DIST.	1000		390	750	Inactive Production		2,7
TIC-106	IRVINE RANCH WATER DIST.	725		405	715	Other Active Production	P	2,3
TIC-109	IRVINE RANCH WATER DIST.	1145		240	1120	Inactive Production	P	2,3
TIC-112	IRVINE RANCH WATER DIST.	1141		240	1100	Inactive Production	P	2,3
TIC-114	IRVINE RANCH WATER DIST.	1000		300	960	Inactive Production	P	2,3
TIC-55	IRVINE RANCH WATER DIST.	746		300	497	Inactive Production		2,3
TIC-82	IRVINE RANCH WATER DIST.	1145		410	1002	Monitoring	P	1
W-14556	IRVINE RANCH WATER DIST.	0		17	67	Inactive Production		2
ITO-LA	ITO-OZAWA FARMS	860		70	710	Other Active Production		2,3
ITO-LAG3	ITO-OZAWA FARMS	800		170	780	Other Active Production		2,3
JLAW-HB	JANUARY & ELLIS LAW	135		0	0	Inactive Production		2
SAKI-FV	JKS-SF, LLC	450		304	438	Inactive Production		2,3
SULY-OA1	JMI PROPERTIES/SANTIAGO PRTNRS	120		0	0	Other Active Production		2,3
SULY-OA4	JMI PROPERTIES/SANTIAGO PRTNRS	130		0	0	Inactive Production	S	2,3
JWC-NWLEF	JUNIOR WATER CO.	480		416	426	Other Active Production		2
JWC-NWTAD	JUNIOR WATER CO.	614		361	587	Other Active Production		2
W-15825	KAREN STREET WATER CO.	100		0	0	Inactive Production		2
GKAW-FV2	KAWAGUCHI ENTERPRISES û LP	125		120	125	Other Active Production		2
MKAW-FV	KAWAGUCHI ENTERPRISES û LP	225		185	225	Other Active Production	S	2
KAYO-GG	KAYANO FARMS	0		0	0	Inactive Production		2,3
GARD-A	KINDRED COMMUNITY CHURCH	35		0	0	Other Active Production		2,3
KINGK-CE2	KING KELLY MARMILADE CO. INC.	0		0	0	Other Active Production		2
W-18116	KLEINFELDER & ASSOCIATES	250		238	248	Monitoring		1
W-18118	KLEINFELDER & ASSOCIATES	187		176	186	Monitoring		1
W-18120	KLEINFELDER & ASSOCIATES	255		243	253	Monitoring		1
KNOT-BP	KNOTT'S BERRY FARM	447		0	0	Other Active Production		2,3
KNOT-BPBS	KNOTT'S BERRY FARM	730		430	630	Active Small Production	P	2,7
W-14871	KOLL REAL ESTATE	600		0	0	Inactive Production		2,3
LH-2A	LA HABRA	1000		460	950	Active Large Production		2
LH-FS192	LA HABRA	1403		880	1210	Inactive Production		2,10
LH-LBPW	LA HABRA	1000		544	870	Active Large Production		2
LH-PPW	LA HABRA	1290		770	990	Inactive Production		2
LMP-MW	LA HABRA HEIGHTS WATER CO.	593		540	560	Monitoring		1
HALL-O	LA LINDA LLC	280		0	0	Inactive Production		2
LP-CITY	LA PALMA	1516		290	1415	Active Large Production	P	2,7
LP-WALK	LA PALMA	1020		489	919	Active Large Production	P	2,7
LMA-I	LAKES MASTER ASSOC.	0		0	0	Other Active Production		2,3
LW-10	LAKEWOOD	1148		448	471	Active Large Production		2
LW-13A	LAKEWOOD	1120		620	940	Active Large Production		2
LW-15A	LAKEWOOD	1050		470	1030	Active Large Production		2
LW-17	LAKEWOOD	1134		1064	1121	Active Large Production		2
LW-18	LAKEWOOD	1108		1041	1069	Active Large Production		2
LW-22	LAKEWOOD	1500		440	1060	Active Large Production		2
LW-27	LAKEWOOD	990		490	950	Active Large Production		2
LW-2A	LAKEWOOD	656		612	637	Active Large Production		2
LW-4	LAKEWOOD	716		367	388	Active Large Production		2
LW-6	LAKEWOOD	602		224	306	Other Active Production		2,3
LW-8	LAKEWOOD	405		352	380	Active Small Production		2
W-17351	LAKEWOOD	0		0	0	Inactive Production		2
LWPC-LWP1	LAKEWOOD WATER & POWER CO.	870		488	835	Other Active Production		2
LIBM-HB	LIBERTY PARK WATER ASSOC.	160		0	0	Active Small Production		2,6,7
LMC-EW1	LOCKHEED MARTIN CORP.	62		40	60	Other Active Production		2
LMC-EW2	LOCKHEED MARTIN CORP.	62		40	60	Other Active Production		2
LMC-EW3	LOCKHEED MARTIN CORP.	90		58	78	Other Active Production		2
LB-1017	LONG BEACH	875		140	540	Other Active Production		2,3
LB-1017B	LONG BEACH	675		0	0	Monitoring		1
LB-AL13	LONG BEACH	1030		559	902	Active Large Production		2
LB-AL8	LONG BEACH	982		515	978	Active Large Production		2
LB-AL9	LONG BEACH	1152		804	1130	Active Large Production		2
LB-AN201	LONG BEACH	854		507	838	Active Large Production		2
LB-AN204	LONG BEACH	1186		1124	1146	Other Active Production		2,3
LB-AN206	LONG BEACH	1170		300	471	Inactive Production		2
LB-AN26	LONG BEACH	610		364	590	Inactive Production		2
LB-CIT10	LONG BEACH	1020		300	988	Active Large Production		2
LB-CIT7A	LONG BEACH	950		300	898	Active Large Production		2

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
LB-CIT8	LONG BEACH	1516		310	1039	Active Small Production		2
LB-CIT9	LONG BEACH	850		300	808	Active Large Production		2
LB-COM10	LONG BEACH	900		540	685	Active Large Production		2
LB-COM13	LONG BEACH	1634		310	1539	Active Large Production		2
LB-COM14	LONG BEACH	1110		302	1072	Active Large Production		2
LB-COM15	LONG BEACH	1120		303	1008	Active Large Production		2
LB-COM16	LONG BEACH	1023		300	988	Active Large Production		2
LB-COM17	LONG BEACH	1030		300	988	Active Large Production		2
LB-COM18	LONG BEACH	0		303	988	Active Large Production		2
LB-COM19	LONG BEACH	1700		605	1640	Active Large Production		2
LB-COM20	LONG BEACH	1500		602	1240	Active Large Production		2
LB-COM21	LONG BEACH	1691		640	1370	Active Large Production		2
LB-COM22	LONG BEACH	1512		490	1160	Active Large Production		2
LB-COM23	LONG BEACH	1513		480	1020	Active Large Production		2
LB-COM24	LONG BEACH	1500		540	1411	Active Large Production		2
LB-COM25	LONG BEACH	1508		540	900	Active Large Production		2
LB-COM6A	LONG BEACH	1012		412	980	Monitoring		1
LB-DEV1	LONG BEACH	1017		959	1017	Active Large Production		2
LB-DEV2	LONG BEACH	684		390	684	Inactive Production		2
LB-DEV4	LONG BEACH	1004		400	972	Inactive Production		2
LB-DEV5	LONG BEACH	1016		267	990	Active Large Production		2
LB-DEV9	LONG BEACH	1030		260	1030	Active Large Production		2
LB-NLB11	LONG BEACH	2000		412	1431	Active Large Production		2
LB-NLB12	LONG BEACH	1058		300	1000	Active Large Production		2
LB-NLB4	LONG BEACH	1160		972	1142	Active Large Production		2
LB-NLB8	LONG BEACH	1180		1050	1100	Active Large Production		2
LB-NLB9	LONG BEACH	800		445	720	Active Large Production		2
LB-WIL1A	LONG BEACH	1370		272	1351	Active Large Production		2
LB-WS1A	LONG BEACH	1100		272	1078	Active Large Production		2
W-11412	LONG BEACH	639		458	630	Inactive Production		2,3
W-11460	LONG BEACH	994		0	0	Inactive Production		2
LART-CR2	LOS ALAMITOS RACE TRACT	0		0	0	Active Small Production		2,7
LAC-32LP8X	LOS ANGELES COUNTY	120		105	115	Monitoring		1
LAC-32LP8Z	LOS ANGELES COUNTY	945		325	335	Monitoring		1
LAC-32S9	LOS ANGELES COUNTY	885		189	199	Monitoring		1
LAC-32TP25	LOS ANGELES COUNTY	945		252	262	Monitoring		1
LAC-32U15	LOS ANGELES COUNTY	141		117	133	Monitoring		1
LAC-32V22	LOS ANGELES COUNTY	151		120	135	Monitoring		1
LAC-32VP10	LOS ANGELES COUNTY	210		145	180	Monitoring		1
LAC-32X11	LOS ANGELES COUNTY	196		135	165	Monitoring		1
LAC-32YP43	LOS ANGELES COUNTY	55		42	52	Monitoring		1
LAC-32ZP5	LOS ANGELES COUNTY	155		93	133	Monitoring		1
LAC-33D01	LOS ANGELES COUNTY	453		215	275	Monitoring		1
LAC-33D24	LOS ANGELES COUNTY	750		315	325	Monitoring		1
LAC-33DP22	LOS ANGELES COUNTY	825		210	220	Monitoring		1
LAC-33G	LOS ANGELES COUNTY	119		43	103	Injection		4
LAC-33G36	LOS ANGELES COUNTY	525		338	348	Monitoring		1
LAC-33G9	LOS ANGELES COUNTY	147		120	140	Monitoring		1
LAC-33GJ	LOS ANGELES COUNTY	140		52	115	Monitoring		1
LAC-33HP13	LOS ANGELES COUNTY	123		88	103	Monitoring		1
LAC-33J	LOS ANGELES COUNTY	134		66	126	Injection		4
LAC-33JL	LOS ANGELES COUNTY	147		52	137	Monitoring		1
LAC-33KP42	LOS ANGELES COUNTY	86		63	73	Monitoring		1
LAC-33L	LOS ANGELES COUNTY	144		56	136	Injection		4
LAC-33L23	LOS ANGELES COUNTY	405		349	359	Monitoring		1
LAC-33L30	LOS ANGELES COUNTY	73		50	65	Monitoring		1
LAC-33N	LOS ANGELES COUNTY	164		58	148	Injection		4
LAC-33N21	LOS ANGELES COUNTY	497		460	485	Monitoring		1
LAC-33NQ	LOS ANGELES COUNTY	177		60	160	Monitoring		1
LAC-33Q	LOS ANGELES COUNTY	174		69	164	Injection		4
LAC-33Q1	LOS ANGELES COUNTY	58		28	44	Injection		4
LAC-33Q15V	LOS ANGELES COUNTY	232		210	220	Monitoring		1
LAC-33Q15W	LOS ANGELES COUNTY	296		273	283	Monitoring		1
LAC-33Q15X	LOS ANGELES COUNTY	390		346	356	Monitoring		1
LAC-33Q9	LOS ANGELES COUNTY	223		115	145	Monitoring		1
LAC-33S	LOS ANGELES COUNTY	207		73	194	Injection		4
LAC-33S1	LOS ANGELES COUNTY	63		25	45	Injection		4

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
LAC-33S18U	LOS ANGELES COUNTY	101		73	83	Monitoring		1
LAC-33S18V	LOS ANGELES COUNTY	295		231	241	Monitoring		1
LAC-33S18W	LOS ANGELES COUNTY	300		273	283	Monitoring		1
LAC-33S18X	LOS ANGELES COUNTY	405		357	367	Monitoring		1
LAC-33S20	LOS ANGELES COUNTY	514		476	486	Monitoring		1
LAC-33S40	LOS ANGELES COUNTY	527		477	507	Monitoring		1
LAC-33S43	LOS ANGELES COUNTY	615		341	362	Monitoring		1
LAC-33S52	LOS ANGELES COUNTY	393		290	350	Monitoring		1
LAC-33ST	LOS ANGELES COUNTY	195		140	185	Monitoring		1
LAC-33T	LOS ANGELES COUNTY	214		89	199	Injection		4
LAC-33T125	LOS ANGELES COUNTY	487		426	466	Monitoring		1
LAC-33T13U	LOS ANGELES COUNTY	87		63	73	Monitoring		1
LAC-33T13V	LOS ANGELES COUNTY	237		210	220	Monitoring		1
LAC-33T13W	LOS ANGELES COUNTY	294		273	283	Monitoring		1
LAC-33T13X	LOS ANGELES COUNTY	405		336	346	Monitoring		1
LAC-33T15	LOS ANGELES COUNTY	420		341	351	Monitoring		1
LAC-33T29U	LOS ANGELES COUNTY	83		63	73	Monitoring		1
LAC-33T29X	LOS ANGELES COUNTY	405		357	367	Monitoring		1
LAC-33T29Z	LOS ANGELES COUNTY	1926		664	705	Monitoring		1
LAC-33T3	LOS ANGELES COUNTY	141		45	90	Monitoring		1
LAC-33T4	LOS ANGELES COUNTY	330		281	306	Monitoring		1
LAC-33T9U	LOS ANGELES COUNTY	50		25	40	Monitoring		1
LAC-33T9V	LOS ANGELES COUNTY	190		133	158	Monitoring		1
LAC-33T9W	LOS ANGELES COUNTY	200		179	189	Monitoring		1
LAC-33T9X	LOS ANGELES COUNTY	885		273	283	Monitoring		1
LAC-33T9Y	LOS ANGELES COUNTY	400		378	388	Monitoring		1
LAC-33TP13U	LOS ANGELES COUNTY	79		46	66	Monitoring		1
LAC-33TP24U	LOS ANGELES COUNTY	55		30	43	Monitoring		1
LAC-33TP24Y	LOS ANGELES COUNTY	109		63	88	Monitoring		1
LAC-33U	LOS ANGELES COUNTY	254		98	238	Injection		4
LAC-33U11V	LOS ANGELES COUNTY	210		194	204	Monitoring		1
LAC-33U11W	LOS ANGELES COUNTY	295		273	283	Monitoring		1
LAC-33U11X	LOS ANGELES COUNTY	405		357	367	Monitoring		1
LAC-33U3	LOS ANGELES COUNTY	143		70	125	Injection		4
LAC-33UP05	LOS ANGELES COUNTY	83		63	73	Monitoring		1
LAC-33UP34	LOS ANGELES COUNTY	61		53	60	Monitoring		1
LAC-33UP3X	LOS ANGELES COUNTY	120		94	105	Monitoring		1
LAC-33UP3Y	LOS ANGELES COUNTY	169		151	161	Monitoring		1
LAC-33UP3Z	LOS ANGELES COUNTY	1720		378	399	Monitoring		1
LAC-33UV	LOS ANGELES COUNTY	308		213	262	Monitoring		1
LAC-33V	LOS ANGELES COUNTY	294		119	269	Injection		4
LAC-33VP14U1	LOS ANGELES COUNTY	27		23	27	Monitoring		1
LAC-33VP14U2	LOS ANGELES COUNTY	84		79	83	Monitoring		1
LAC-33VP14U3	LOS ANGELES COUNTY	50		40	50	Monitoring		1
LAC-33VP15P	LOS ANGELES COUNTY	100		57	82	Other Active Production		2
LAC-33VP22Z1	LOS ANGELES COUNTY	150		127	137	Monitoring		1
LAC-33VP22Z2	LOS ANGELES COUNTY	780		255	265	Monitoring		1
LAC-33VP46	LOS ANGELES COUNTY	80		61	71	Monitoring		1
LAC-33VP8	LOS ANGELES COUNTY	163		105	145	Monitoring		1
LAC-33W	LOS ANGELES COUNTY	420		120	390	Injection		4
LAC-33W11	LOS ANGELES COUNTY	508		427	482	Monitoring		1,6
LAC-33W54	LOS ANGELES COUNTY	83		40	70	Monitoring		1
LAC-33WP14	LOS ANGELES COUNTY	108		57	87	Monitoring		1
LAC-33WP17	LOS ANGELES COUNTY	78		45	65	Monitoring		1
LAC-33WX	LOS ANGELES COUNTY	448		379	423	Monitoring		1
LAC-33WXU	LOS ANGELES COUNTY	74		45	60	Monitoring		1
LAC-33X	LOS ANGELES COUNTY	452		170	430	Injection		4
LAC-33X10	LOS ANGELES COUNTY	517		425	475	Monitoring		1,6
LAC-33X20U	LOS ANGELES COUNTY	110		85	95	Monitoring		1,6
LAC-33X20W	LOS ANGELES COUNTY	325		294	304	Monitoring		1,6
LAC-33X20X	LOS ANGELES COUNTY	415		377	387	Monitoring		1,6
LAC-33X20Y	LOS ANGELES COUNTY	645		483	493	Monitoring		1,6
LAC-33XY	LOS ANGELES COUNTY	475		409	451	Monitoring		1
LAC-33Y	LOS ANGELES COUNTY	475		218	457	Injection		4
LAC-33Y10	LOS ANGELES COUNTY	125		75	115	Monitoring		1,6
LAC-33Y42U	LOS ANGELES COUNTY	105		89	95	Monitoring		1,6
LAC-33Y42X	LOS ANGELES COUNTY	660		362	372	Monitoring		1,6

List of Wells in OCWD Monitoring Programs

KEY

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Program: 1) monitoring well, 2) production well, 3) irrigation or industrial well, 4) injection well, 5) Mid-Basin Injection well, 6) seawater intrusion monitoring well, 7) well monitored by OCWD for Title 22 compliance, 8) North Basin Groundwater Protection Program wells, 9) South Basin Groundwater Protection Program wells, 10) wells in CASGEM monitoring program

Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
LAC-33YP35	LOS ANGELES COUNTY	103		73	83	Monitoring		1
LAC-33YZ	LOS ANGELES COUNTY	467		408	451	Monitoring		1
LAC-33Z	LOS ANGELES COUNTY	484		206	461	Injection		4
LAC-33Z2	LOS ANGELES COUNTY	499		310	444	Injection		4
LAC-33ZP1T	LOS ANGELES COUNTY	146		116	135	Monitoring		1
LAC-33ZP1U	LOS ANGELES COUNTY	90		62	85	Monitoring		1
LAC-33ZP1X	LOS ANGELES COUNTY	360		336	346	Monitoring		1
LAC-34D	LOS ANGELES COUNTY	494		219	474	Injection		4
LAC-34D01	LOS ANGELES COUNTY	83		73	83	Monitoring		1
LAC-34DG	LOS ANGELES COUNTY	477		405	450	Monitoring		1,6
LAC-34DP6	LOS ANGELES COUNTY	477		415	445	Monitoring		1
LAC-34EP13	LOS ANGELES COUNTY	363		305	335	Monitoring		1
LAC-34EP23	LOS ANGELES COUNTY	108		48	88	Monitoring		1
LAC-34EP48	LOS ANGELES COUNTY	735		255	265	Monitoring		1
LAC-34EV	LOS ANGELES COUNTY	288		145	250	Injection		4
LAC-34EY	LOS ANGELES COUNTY	488		410	455	Injection		4
LAC-34F	LOS ANGELES COUNTY	487		410	450	Injection		4
LAC-34F5T	LOS ANGELES COUNTY	185		140	170	Monitoring		1,6
LAC-34F5V	LOS ANGELES COUNTY	242		195	225	Monitoring		1
LAC-34F5W	LOS ANGELES COUNTY	288		235	275	Monitoring		1
LAC-34F5X	LOS ANGELES COUNTY	372		300	360	Monitoring		1
LAC-34F5Y	LOS ANGELES COUNTY	482		415	455	Monitoring		1
LAC-34FP13V	LOS ANGELES COUNTY	120		95	105	Monitoring		1
LAC-34FP13X	LOS ANGELES COUNTY	315		193	203	Monitoring		1
LAC-34FP40	LOS ANGELES COUNTY	68		45	55	Monitoring		1
LAC-34FX	LOS ANGELES COUNTY	489		410	450	Injection		4
LAC-34G	LOS ANGELES COUNTY	475		285	350	Injection		4
LAC-34G2V	LOS ANGELES COUNTY	280		140	250	Injection		4
LAC-34G2Y	LOS ANGELES COUNTY	489		405	445	Injection		4
LAC-34GH	LOS ANGELES COUNTY	479		415	455	Monitoring		1,6
LAC-34H	LOS ANGELES COUNTY	490		405	445	Injection		4
LAC-34HJX	LOS ANGELES COUNTY	368		315	345	Monitoring		1
LAC-34HJY	LOS ANGELES COUNTY	503		410	440	Monitoring		1,6
LAC-34HP17	LOS ANGELES COUNTY	90		55	75	Monitoring		1
LAC-34HP17P	LOS ANGELES COUNTY	95		51	76	Other Active Production		2
LAC-34HP18P	LOS ANGELES COUNTY	206		145	175	Other Active Production		2
LAC-34J	LOS ANGELES COUNTY	456		270	315	Injection		4
LAC-34JL	LOS ANGELES COUNTY	440		385	420	Monitoring		1,6
LAC-34JP12	LOS ANGELES COUNTY	109		43	93	Monitoring		1
LAC-34L	LOS ANGELES COUNTY	420		146	400	Injection		4
LAC-34LP1U	LOS ANGELES COUNTY	88		67	77	Monitoring		1
LAC-34LP1V	LOS ANGELES COUNTY	210		166	176	Monitoring		1
LAC-34LP1Z	LOS ANGELES COUNTY	900		609	619	Monitoring		1
LAC-34NP16	LOS ANGELES COUNTY	0		41	71	Monitoring		1
LAC-34QP22	LOS ANGELES COUNTY	91		55	80	Monitoring		1
LAC-34SP22P	LOS ANGELES COUNTY	95		52	77	Other Active Production		2
LAC-34VP18	LOS ANGELES COUNTY	85		48	73	Monitoring		1
LAC-35SP24U	LOS ANGELES COUNTY	83		59	69	Monitoring		1
LAC-35SP24Z1	LOS ANGELES COUNTY	180		157	167	Monitoring		1
LAC-35SP24Z2	LOS ANGELES COUNTY	825		210	220	Monitoring		1
LAC-35VP32Z1	LOS ANGELES COUNTY	213		189	199	Monitoring		1
LAC-35VP32Z2	LOS ANGELES COUNTY	855		483	493	Monitoring		1
LAC-36WP80	LOS ANGELES COUNTY	870		293	303	Monitoring		1
LAC-PZ1	LOS ANGELES COUNTY	16		10	16	Monitoring		1
LAC-PZ2	LOS ANGELES COUNTY	14		0	0	Monitoring		1
LAC-PZ3	LOS ANGELES COUNTY	16		0	0	Monitoring		1
LAC-PZ4	LOS ANGELES COUNTY	25		14	22	Monitoring		1
LAC-PZ5	LOS ANGELES COUNTY	64		33	49	Monitoring		1
LXMS-A	LYON CHRISTMAS TREE FARMS	240		0	0	Inactive Production		2,3
MAGM-GG	MAGNOLIA MEMORIAL PARK	168		0	0	Other Active Production		2,3
MNEE-A	MALLONEE	400		0	0	Inactive Production		2,3
HMW-01	MANHEIM CA (COX ENTERPRISES)	75		55	75	Monitoring	S	1
HMW-02	MANHEIM CA (COX ENTERPRISES)	72		52	72	Monitoring		1
HMW-03	MANHEIM CA (COX ENTERPRISES)	50		30	50	Monitoring		1
HMW-04	MANHEIM CA (COX ENTERPRISES)	47		27	47	Monitoring		1
W-3789	MARDEN SUSCO PIPE SUPPLY CO.	0		0	0	Inactive Production		2
USMC-01MW101	MARINE CORPS AIR STATION	159		118	148	Monitoring		1

List of Wells in OCWD Monitoring Programs

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
USMC-01MW102	MARINE CORPS AIR STATION	142		95	135	Monitoring		1
USMC-01MW201	MARINE CORPS AIR STATION	77		27	57	Monitoring		1
USMC-02NEW01	MARINE CORPS AIR STATION	143		115	135	Monitoring		1
USMC-02NEW07	MARINE CORPS AIR STATION	150		103	143	Monitoring		1
USMC-02NEW11	MARINE CORPS AIR STATION	81		45	65	Monitoring		1
USMC-02NEW12	MARINE CORPS AIR STATION	256		209	249	Monitoring		1
USMC-02NEW13	MARINE CORPS AIR STATION	107		60	100	Monitoring		1
USMC-02NEW14	MARINE CORPS AIR STATION	111		40	105	Monitoring		1
USMC-02NEW15	MARINE CORPS AIR STATION	70		25	65	Monitoring		1
USMC-02NEW16	MARINE CORPS AIR STATION	70		25	65	Monitoring		1
USMC-02NEW2	MARINE CORPS AIR STATION	105		75	95	Monitoring		1
USMC-02NEW8A	MARINE CORPS AIR STATION	111		84	104	Monitoring		1
USMC-02UGMW25	MARINE CORPS AIR STATION	84		55	75	Monitoring		1
USMC-05NEW1	MARINE CORPS AIR STATION	210		163	203	Monitoring		1
USMC-16MPE1	MARINE CORPS AIR STATION	194		146	191	Monitoring		1
USMC-16MW1	MARINE CORPS AIR STATION	183		155	180	Monitoring		1
USMC-16MW10	MARINE CORPS AIR STATION	199		165	195	Monitoring		1
USMC-16MW11	MARINE CORPS AIR STATION	182		160	180	Monitoring	S	1
USMC-16MW12	MARINE CORPS AIR STATION	180		160	180	Monitoring		1
USMC-16MW13	MARINE CORPS AIR STATION	181		160	180	Monitoring		1
USMC-16MW14	MARINE CORPS AIR STATION	199		185	195	Monitoring		1
USMC-16MW15	MARINE CORPS AIR STATION	182		160	180	Monitoring		1
USMC-16MW16	MARINE CORPS AIR STATION	201		190	200	Monitoring		1
USMC-16MW2	MARINE CORPS AIR STATION	185		153	178	Monitoring	S	1
USMC-16MW3	MARINE CORPS AIR STATION	185		158	183	Monitoring		1
USMC-16MW4	MARINE CORPS AIR STATION	196		155	190	Monitoring		1
USMC-16MW5	MARINE CORPS AIR STATION	196		155	190	Monitoring		1
USMC-16MW7	MARINE CORPS AIR STATION	194		145	190	Monitoring		1
USMC-16MW8	MARINE CORPS AIR STATION	189		165	183	Monitoring		1
USMC-16MW9	MARINE CORPS AIR STATION	187		165	183	Monitoring		1
USMC-17NEW1	MARINE CORPS AIR STATION	233		186	226	Monitoring		1
USMC-17NEW2	MARINE CORPS AIR STATION	131		83	123	Monitoring		1
USMC-24EX10	MARINE CORPS AIR STATION	165		115	160	Monitoring		1
USMC-24EX11	MARINE CORPS AIR STATION	222		135	180	Monitoring		1
USMC-24EX12A	MARINE CORPS AIR STATION	252		115	160	Monitoring		1
USMC-24EX12B	MARINE CORPS AIR STATION	225		165	210	Monitoring		1
USMC-24EX12C	MARINE CORPS AIR STATION	272		220	260	Monitoring		1
USMC-24EX13A	MARINE CORPS AIR STATION	172		110	160	Monitoring		1
USMC-24EX13B	MARINE CORPS AIR STATION	213		165	205	Monitoring		1
USMC-24EX13C	MARINE CORPS AIR STATION	282		230	270	Monitoring		1
USMC-24EX14	MARINE CORPS AIR STATION	195		115	185	Monitoring		1
USMC-24EX2	MARINE CORPS AIR STATION	215		109	209	Other Active Production		2
USMC-24EX20B	MARINE CORPS AIR STATION	210		107	205	Other Active Production		2
USMC-24EX3	MARINE CORPS AIR STATION	186		0	0	Monitoring		1
USMC-24EX30B1	MARINE CORPS AIR STATION	158		105	150	Monitoring		1
USMC-24EX30B2	MARINE CORPS AIR STATION	156		105	150	Monitoring		1
USMC-24EX30B3	MARINE CORPS AIR STATION	182		170	175	Monitoring		1
USMC-24EX4	MARINE CORPS AIR STATION	195		104	190	Other Active Production		2
USMC-24EX40B2	MARINE CORPS AIR STATION	156		106	106	Monitoring		1
USMC-24EX5	MARINE CORPS AIR STATION	160		104	154	Other Active Production		2
USMC-24EX50B1	MARINE CORPS AIR STATION	156		105	150	Monitoring		1
USMC-24EX50B2	MARINE CORPS AIR STATION	156		105	150	Monitoring		1
USMC-24EX6	MARINE CORPS AIR STATION	178		0	0	Monitoring		1
USMC-24EX60B1	MARINE CORPS AIR STATION	160		106	151	Monitoring		1
USMC-24EX60B2	MARINE CORPS AIR STATION	158		105	150	Monitoring		1
USMC-24EX60B3	MARINE CORPS AIR STATION	225		218	223	Monitoring		1
USMC-24EX9	MARINE CORPS AIR STATION	214		120	200	Monitoring		1
USMC-24IN03	MARINE CORPS AIR STATION	169		91	160	Injection		4
USMC-24IN20B1	MARINE CORPS AIR STATION	300		194	271	Injection		4
USMC-24MW10AB	MARINE CORPS AIR STATION	143		130	140	Monitoring	S	1
USMC-24MW10CD	MARINE CORPS AIR STATION	245		230	240	Monitoring		1
USMC-24MW11AB	MARINE CORPS AIR STATION	145		130	140	Monitoring	S	1
USMC-24MW11CD	MARINE CORPS AIR STATION	240		210	220	Monitoring		1
USMC-24MW12AB	MARINE CORPS AIR STATION	140		127	137	Monitoring	S	1
USMC-24MW12CD	MARINE CORPS AIR STATION	231		203	213	Monitoring		1
USMC-24MW13AB	MARINE CORPS AIR STATION	124		111	121	Monitoring	S	1
USMC-24MW13CD	MARINE CORPS AIR STATION	228		212	222	Monitoring		1

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
USMC-24MW14AB	MARINE CORPS AIR STATION	129		115	125	Monitoring	S	1
USMC-24MW14CD	MARINE CORPS AIR STATION	223		211	221	Monitoring		1
USMC-24MW15AB	MARINE CORPS AIR STATION	137		125	135	Monitoring	S	1
USMC-24MW15CD	MARINE CORPS AIR STATION	236		220	230	Monitoring		1
USMC-24MW16	MARINE CORPS AIR STATION	340		80	300	Multiport Monitoring		1
USMC-24MW17	MARINE CORPS AIR STATION	340		75	310	Multiport Monitoring		1
USMC-24MW5	MARINE CORPS AIR STATION	181		140	168	Monitoring		1
USMC-24MW6	MARINE CORPS AIR STATION	195		170	190	Monitoring		1
USMC-24MW7	MARINE CORPS AIR STATION	208		120	200	Monitoring		1
USMC-24MW8	MARINE CORPS AIR STATION	380		105	350	Multiport Monitoring		1
USMC-24MW9AB	MARINE CORPS AIR STATION	151		140	150	Monitoring	S	1
USMC-24MW9CD	MARINE CORPS AIR STATION	243		230	240	Monitoring		1
USMC-24NEW1	MARINE CORPS AIR STATION	260		225	245	Monitoring		1
USMC-24NEW4	MARINE CORPS AIR STATION	160		108	148	Monitoring	S	1
USMC-24NEW5	MARINE CORPS AIR STATION	262		230	250	Monitoring		1
USMC-24NEW6	MARINE CORPS AIR STATION	193		165	185	Monitoring		1
USMC-24NEW7	MARINE CORPS AIR STATION	174		118	158	Monitoring		1
USMC-24NEW8	MARINE CORPS AIR STATION	170		122	162	Monitoring	S	1
USMC-DW135	MARINE CORPS AIR STATION	135		115	135	Monitoring	S	1
USMC-DW250	MARINE CORPS AIR STATION	254		215	250	Monitoring		1
USMC-DW350	MARINE CORPS AIR STATION	353		310	350	Monitoring		1
USMC-DW450	MARINE CORPS AIR STATION	454		414	450	Monitoring		1
USMC-DW540	MARINE CORPS AIR STATION	541		490	540	Monitoring		1
USMC-MP06	MARINE CORPS AIR STATION	500		105	455	Multiport Monitoring		1
USMC-MP08	MARINE CORPS AIR STATION	500		61	449	Multiport Monitoring		1
USMC-MP09	MARINE CORPS AIR STATION	500		59	463	Multiport Monitoring		1
USMC-MP10	MARINE CORPS AIR STATION	1202		218	1011	Multiport Monitoring		1
USMC-MW01A	MARINE CORPS AIR STATION	500		466	486	Monitoring		1
USMC-MW01B	MARINE CORPS AIR STATION	421		396	416	Monitoring		1
USMC-MW01C	MARINE CORPS AIR STATION	358		330	350	Monitoring		1
USMC-MW01D	MARINE CORPS AIR STATION	270		242	262	Monitoring		1
USMC-MW01E	MARINE CORPS AIR STATION	233		205	225	Monitoring		1
USMC-MW02A	MARINE CORPS AIR STATION	500		462	482	Monitoring		1
USMC-MW02C	MARINE CORPS AIR STATION	386		358	378	Monitoring		1
USMC-MW02D	MARINE CORPS AIR STATION	319		294	314	Monitoring		1
USMC-MW02E	MARINE CORPS AIR STATION	253		198	233	Monitoring		1
USMC-MW03A	MARINE CORPS AIR STATION	471		370	390	Monitoring		1
USMC-MW03B	MARINE CORPS AIR STATION	310		280	300	Monitoring		1
USMC-MW03C	MARINE CORPS AIR STATION	250		222	242	Monitoring		1
USMC-MW03E	MARINE CORPS AIR STATION	172		124	164	Monitoring	S	1
USMC-MW04A	MARINE CORPS AIR STATION	421		286	306	Monitoring		1
USMC-MW04B	MARINE CORPS AIR STATION	421		190	210	Monitoring		1
USMC-MW05A	MARINE CORPS AIR STATION	500		462	482	Monitoring		1
USMC-MW05B	MARINE CORPS AIR STATION	364		321	341	Monitoring		1
USMC-MW05C	MARINE CORPS AIR STATION	500		225	245	Monitoring		1
USMC-MW05D	MARINE CORPS AIR STATION	147		83	133	Monitoring		1
USMC-MW05E	MARINE CORPS AIR STATION	160		80	130	Monitoring		1
USMC-MW07	MARINE CORPS AIR STATION	90		25	65	Monitoring		1
USMC-MW100	MARINE CORPS AIR STATION	179		131	171	Monitoring		1
USMC-MW100A	MARINE CORPS AIR STATION	138		93	132	Monitoring		1
USMC-MW101	MARINE CORPS AIR STATION	140		90	130	Monitoring		1
USMC-MW101A	MARINE CORPS AIR STATION	105		68	98	Monitoring		1
USMC-MW103	MARINE CORPS AIR STATION	499		395	495	Monitoring		1
USMC-MW19A	MARINE CORPS AIR STATION	500		448	468	Monitoring		1
USMC-MW19B	MARINE CORPS AIR STATION	425		400	420	Monitoring		1
USMC-MW19C	MARINE CORPS AIR STATION	500		257	277	Monitoring		1
USMC-MW19D	MARINE CORPS AIR STATION	500		150	170	Monitoring	S	1
USMC-MW19E	MARINE CORPS AIR STATION	148		98	138	Monitoring		1
USMC-MW23	MARINE CORPS AIR STATION	115		64	104	Monitoring	S	1
USMC-MW24	MARINE CORPS AIR STATION	80		51	71	Monitoring		1
USMC-MW25	MARINE CORPS AIR STATION	84		55	75	Monitoring		1
USMC-MW29	MARINE CORPS AIR STATION	120		95	135	Monitoring		1
USMC-MW29A	MARINE CORPS AIR STATION	115		75	100	Monitoring		1
USMC-MW31	MARINE CORPS AIR STATION	153		105	145	Monitoring	S	1
USMC-MW37	MARINE CORPS AIR STATION	137		89	130	Monitoring		1
USMC-MW39	MARINE CORPS AIR STATION	276		230	270	Monitoring		1
USMC-MW398-01	MARINE CORPS AIR STATION	231		198	228	Monitoring		1

List of Wells in OCWD Monitoring Programs

KEY

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
USMC-MW398-02	MARINE CORPS AIR STATION	231		199	229	Monitoring		1
USMC-MW398-03	MARINE CORPS AIR STATION	242		208	238	Monitoring		1
USMC-MW398-04	MARINE CORPS AIR STATION	232		201	231	Monitoring		1
USMC-MW398-05	MARINE CORPS AIR STATION	230		197	227	Monitoring		1
USMC-MW398-06	MARINE CORPS AIR STATION	228		196	226	Monitoring		1
USMC-MW398-08	MARINE CORPS AIR STATION	233		200	230	Monitoring		1
USMC-MW398-09	MARINE CORPS AIR STATION	242		190	240	Monitoring		1
USMC-MW398-10	MARINE CORPS AIR STATION	260		200	250	Monitoring		1
USMC-MW398-11	MARINE CORPS AIR STATION	267		200	250	Monitoring		1
USMC-MW398-12	MARINE CORPS AIR STATION	7		190	240	Monitoring		1
USMC-MW398-13	MARINE CORPS AIR STATION	245		193	243	Monitoring		1
USMC-MW398-13D	MARINE CORPS AIR STATION	301		251	301	Monitoring		1
USMC-MW398-14	MARINE CORPS AIR STATION	242		192	242	Monitoring		1
USMC-MW398-15	MARINE CORPS AIR STATION	249		199	249	Monitoring		1
USMC-MW398-16	MARINE CORPS AIR STATION	247		194	244	Monitoring		1
USMC-MW398-17	MARINE CORPS AIR STATION	241		189	239	Monitoring		1
USMC-MW398-18	MARINE CORPS AIR STATION	267		194	244	Monitoring		1
USMC-MW398-19	MARINE CORPS AIR STATION	252		202	252	Monitoring		1
USMC-MW398-20	MARINE CORPS AIR STATION	253		201	251	Monitoring		1
USMC-MW398-21	MARINE CORPS AIR STATION	254		193	243	Monitoring		1
USMC-MW398-22	MARINE CORPS AIR STATION	162		120	160	Monitoring		1
USMC-MW398-23	MARINE CORPS AIR STATION	160		120	160	Monitoring		1
USMC-MW398-24	MARINE CORPS AIR STATION	162		120	160	Monitoring		1
USMC-MW398-25	MARINE CORPS AIR STATION	254		201	251	Monitoring		1
USMC-MW398-26	MARINE CORPS AIR STATION	253		202	252	Monitoring		1
USMC-MW398-27	MARINE CORPS AIR STATION	0		202	252	Monitoring		1
USMC-MW40	MARINE CORPS AIR STATION	275		220	260	Monitoring		1
USMC-MW41	MARINE CORPS AIR STATION	228		182	222	Monitoring		1
USMC-MW41A	MARINE CORPS AIR STATION	194		145	185	Monitoring		1
USMC-MW43	MARINE CORPS AIR STATION	200		150	190	Monitoring		1
USMC-MW43B	MARINE CORPS AIR STATION	143		100	141	Monitoring		1
USMC-MW45	MARINE CORPS AIR STATION	169		117	157	Monitoring		1
USMC-MW47	MARINE CORPS AIR STATION	169		116	156	Monitoring		1
USMC-MW48	MARINE CORPS AIR STATION	140		95	135	Monitoring		1
USMC-MW48A	MARINE CORPS AIR STATION	111		74	104	Monitoring		1
USMC-MW50	MARINE CORPS AIR STATION	168		120	160	Monitoring		1
USMC-MW51	MARINE CORPS AIR STATION	172		125	165	Monitoring		1
USMC-MW52	MARINE CORPS AIR STATION	228		182	222	Monitoring		1
USMC-MW56	MARINE CORPS AIR STATION	140		92	132	Monitoring		1
USMC-MW57	MARINE CORPS AIR STATION	93		63	83	Monitoring		1
USMC-MW58	MARINE CORPS AIR STATION	86		69	89	Monitoring		1
USMC-MW59	MARINE CORPS AIR STATION	99		69	89	Monitoring		1
USMC-MW63	MARINE CORPS AIR STATION	281		235	237	Monitoring		1
USMC-MW64	MARINE CORPS AIR STATION	294		245	285	Monitoring		1
USMC-MW64A	MARINE CORPS AIR STATION	255		210	250	Monitoring		1
USMC-MW65X	MARINE CORPS AIR STATION	279		230	270	Monitoring		1
USMC-MW65XA	MARINE CORPS AIR STATION	249		201	236	Monitoring		1
USMC-MW66	MARINE CORPS AIR STATION	305		250	290	Monitoring		1
USMC-MW66A	MARINE CORPS AIR STATION	235		190	230	Monitoring		1
USMC-MW67	MARINE CORPS AIR STATION	245		187	227	Monitoring		1
USMC-MW67A	MARINE CORPS AIR STATION	195		150	190	Monitoring		1
USMC-MW68	MARINE CORPS AIR STATION	308		190	210	Monitoring		1
USMC-MW68A	MARINE CORPS AIR STATION	194		147	187	Monitoring		1
USMC-MW70	MARINE CORPS AIR STATION	172		125	165	Monitoring		1
USMC-MW71	MARINE CORPS AIR STATION	163		115	155	Monitoring		1
USMC-MW72	MARINE CORPS AIR STATION	159		90	130	Monitoring		1
USMC-MW73	MARINE CORPS AIR STATION	140		90	130	Monitoring		1
USMC-MW74	MARINE CORPS AIR STATION	140		90	130	Monitoring		1
USMC-MW75	MARINE CORPS AIR STATION	150		114	154	Monitoring		1
USMC-MW77	MARINE CORPS AIR STATION	145		150	170	Monitoring	S	1
USMC-MW79	MARINE CORPS AIR STATION	166		118	158	Monitoring		1
USMC-MW81	MARINE CORPS AIR STATION	223		176	216	Monitoring		1
USMC-MW82	MARINE CORPS AIR STATION	270		235	255	Monitoring		1
USMC-MW90	MARINE CORPS AIR STATION	145		95	135	Monitoring		1
USMC-MW91	MARINE CORPS AIR STATION	160		110	150	Monitoring		1
USMC-PS1	MARINE CORPS AIR STATION	123		102	122	Monitoring		1
USMC-PS2	MARINE CORPS AIR STATION	135		103	133	Monitoring		1

List of Wells in OCWD Monitoring Programs

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
USMC-PS3	MARINE CORPS AIR STATION	123		102	122	Monitoring		1
USMC-PS3A	MARINE CORPS AIR STATION	111		70	105	Monitoring		1
USMC-PS4	MARINE CORPS AIR STATION	123		98	118	Monitoring		1
USMC-PS5	MARINE CORPS AIR STATION	124		106	126	Monitoring	S	1
USMC-PS6	MARINE CORPS AIR STATION	155		130	150	Monitoring		1
USMC-PS7	MARINE CORPS AIR STATION	129		106	126	Monitoring		1
USMC-PS8	MARINE CORPS AIR STATION	145		125	145	Monitoring	S	1
USMC-RW1	MARINE CORPS AIR STATION	504		430	470	Monitoring		1
USMC-RW2	MARINE CORPS AIR STATION	475		270	310	Monitoring		1
USMC-RW3	MARINE CORPS AIR STATION	403		370	390	Monitoring		1
USMC-RW4	MARINE CORPS AIR STATION	86		65	85	Monitoring		1
USMC-SGU1	MARINE CORPS AIR STATION	217		96	206	Other Active Production		2
USMC-SGU10	MARINE CORPS AIR STATION	230		99	199	Other Active Production		2
USMC-SGU11	MARINE CORPS AIR STATION	231		106	216	Other Active Production		2
USMC-SGU12	MARINE CORPS AIR STATION	228		99	219	Other Active Production		2
USMC-SGU13	MARINE CORPS AIR STATION	228		98	218	Other Active Production		2
USMC-SGU14	MARINE CORPS AIR STATION	237		106	226	Other Active Production		2
USMC-SGU15	MARINE CORPS AIR STATION	229		99	219	Other Active Production		2
USMC-SGU16	MARINE CORPS AIR STATION	236		105	185	Other Active Production		2
USMC-SGU17	MARINE CORPS AIR STATION	236		105	180	Other Active Production		2
USMC-SGU18	MARINE CORPS AIR STATION	235		106	226	Other Active Production		2
USMC-SGU19	MARINE CORPS AIR STATION	246		111	231	Other Active Production		2
USMC-SGU2	MARINE CORPS AIR STATION	219		100	170	Other Active Production		2
USMC-SGU20	MARINE CORPS AIR STATION	239		111	231	Other Active Production		2
USMC-SGU21	MARINE CORPS AIR STATION	234		104	194	Other Active Production		2
USMC-SGU22	MARINE CORPS AIR STATION	227		99	219	Other Active Production		2
USMC-SGU23	MARINE CORPS AIR STATION	230		99	219	Other Active Production		2
USMC-SGU24	MARINE CORPS AIR STATION	234		99	224	Other Active Production		2
USMC-SGU25	MARINE CORPS AIR STATION	235		99	224	Other Active Production		2
USMC-SGU26	MARINE CORPS AIR STATION	235		160	225	Other Active Production		2
USMC-SGU27	MARINE CORPS AIR STATION	165		90	155	Other Active Production		2
USMC-SGU28	MARINE CORPS AIR STATION	220		146	211	Other Active Production		2
USMC-SGU29	MARINE CORPS AIR STATION	155		81	146	Other Active Production		2
USMC-SGU3	MARINE CORPS AIR STATION	225		99	114	Other Active Production		2
USMC-SGU30	MARINE CORPS AIR STATION	230		151	221	Other Active Production		2
USMC-SGU31	MARINE CORPS AIR STATION	149		70	140	Other Active Production		2
USMC-SGU32	MARINE CORPS AIR STATION	217		140	205	Other Active Production		2
USMC-SGU33	MARINE CORPS AIR STATION	154		70	145	Other Active Production		2
USMC-SGU34	MARINE CORPS AIR STATION	220		145	210	Other Active Production		2
USMC-SGU35	MARINE CORPS AIR STATION	155		75	145	Other Active Production		2
USMC-SGU36	MARINE CORPS AIR STATION	250		90	240	Other Active Production		2
USMC-SGU37	MARINE CORPS AIR STATION	250		90	240	Other Active Production		2
USMC-SGU38	MARINE CORPS AIR STATION	250		95	240	Other Active Production		2
USMC-SGU39	MARINE CORPS AIR STATION	200		90	190	Other Active Production		2
USMC-SGU4	MARINE CORPS AIR STATION	219		99	209	Other Active Production		2
USMC-SGU5	MARINE CORPS AIR STATION	215		96	206	Other Active Production		2
USMC-SGU6	MARINE CORPS AIR STATION	228		100	200	Other Active Production		2
USMC-SGU7	MARINE CORPS AIR STATION	230		104	224	Other Active Production		2
USMC-SGU8	MARINE CORPS AIR STATION	231		100	210	Other Active Production		2
USMC-SGU9	MARINE CORPS AIR STATION	228		98	218	Other Active Production		2
USMC-TF1MW1	MARINE CORPS AIR STATION	150		109	149	Monitoring		1
USMC-TF2MW1	MARINE CORPS AIR STATION	164		120	160	Monitoring		1
USMC-TF2MW4	MARINE CORPS AIR STATION	161		120	160	Monitoring		1
MSG-BP10L	MCCOLL SITE GROUP	274		247	257	Monitoring	S	1,10
MKSSN-SA	MCKESSON WATER PRODUCTION. CO.	272		160	260	Other Active Production		2,3
W-2048	MEL MACK CO.	358		112	150	Inactive Production		2
ABBY-A	MELROSE ABBEY FUNERAL CENTER	250		0	0	Other Active Production		2,3
MVCC-COSD1	MESA VERDE COUNTRY CLUB	200		0	0	Other Active Production		2,3,6
MVCC-COSD2	MESA VERDE COUNTRY CLUB	462		200	450	Other Active Production	P	2,3,6
MVCC-COSD3	MESA VERDE COUNTRY CLUB	460		200	450	Other Active Production	P	2,3,6
MCWD-11	MESA WATER DIST.	1060		330	1000	Active Large Production	P	2,7
MCWD-1B	MESA WATER DIST.	612		305	580	Active Large Production	P	2,6,7
MCWD-2	MESA WATER DIST.	670		300	650	Monitoring	P	1
MCWD-3B	MESA WATER DIST.	610		242	572	Active Large Production	P	2,6,7
MCWD-3BM	MESA WATER DIST.	1006		880	920	Monitoring	P	1,6
MCWD-5	MESA WATER DIST.	980		400	940	Active Large Production	P	2,6,7
MCWD-6	MESA WATER DIST.	1093		310	1025	Active Large Production	P	2,6,7

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
MCWD-7	MESA WATER DIST.	830		363	753	Active Large Production	P	2,6,7
MCWD-8	MESA WATER DIST.	626		300	572	Inactive Production	P	2,6,7
MCWD-8M	MESA WATER DIST.	1000		870	880	Monitoring	P	1,6
MCWD-9	MESA WATER DIST.	625		350	580	Active Large Production	P	2,6,7
W-12133	METROPOLITAN WATER DIST.	400		0	0	Cathodic Protection		9
MIDC-2	MIDWAY CITY MUTUAL WATER CO.	420		228	420	Active Small Production		2,7
MISQ-FV	MILE SQUARE PARK	300		0	0	Other Active Production		2,3
W-11192	MONITORINGTANA LAND CO.	981		870	916	Inactive Production		2
W-14809	MUTUAL WATER CO.	225		0	0	Inactive Production		2,3
W-14811	MUTUAL WATER CO.	265		0	0	Inactive Production		2,3
NATR-TW1	NATURE CONSERVANCY	150		20	150	Other Active Production		2,3
NVLR-LAG1	NAVAL RECREATION STATION	546		478	524	Other Active Production		2,3
NVLR-LAH1	NAVAL RECREATION STATION	836		0	0	Other Active Production		2,3
NVLR-LAN1	NAVAL RECREATION STATION	634		580	620	Inactive Production		2,3
NVLW-4010	NAVAL WEAPONS STATION	59		45	55	Monitoring		1
NVLW-4012	NAVAL WEAPONS STATION	59		45	55	Monitoring		1
NVLW-4013	NAVAL WEAPONS STATION	58		45	55	Monitoring		1
NVLW-4014	NAVAL WEAPONS STATION	59		30	40	Monitoring		1
NVLW-4016	NAVAL WEAPONS STATION	58		42	52	Monitoring		1
NVLW-4018	NAVAL WEAPONS STATION	62		50	60	Monitoring		1
NVLW-4020	NAVAL WEAPONS STATION	62		50	60	Monitoring		1
NVLW-4021	NAVAL WEAPONS STATION	62		51	61	Monitoring		1
NVLW-7001	NAVAL WEAPONS STATION	33		20	30	Monitoring		1
NVLW-7002	NAVAL WEAPONS STATION	32		20	30	Monitoring		1
NVLW-7003	NAVAL WEAPONS STATION	32		20	30	Monitoring		1
NVLW-7004	NAVAL WEAPONS STATION	62		49	59	Monitoring		1
NVLW-7005	NAVAL WEAPONS STATION	62		50	60	Monitoring		1
NVLW-7006	NAVAL WEAPONS STATION	62		50	60	Monitoring		1
NVLW-7007	NAVAL WEAPONS STATION	62		50	60	Monitoring		1
NVLW-7008	NAVAL WEAPONS STATION	111		96	105	Monitoring	S	1
NVLW-7009	NAVAL WEAPONS STATION	175		160	169	Monitoring		1
NVLW-7010	NAVAL WEAPONS STATION	41		30	40	Monitoring		1
NVLW-7011	NAVAL WEAPONS STATION	102		80	100	Monitoring	S	1
NVLW-7012	NAVAL WEAPONS STATION	115		100	110	Monitoring		1
NVLW-7013	NAVAL WEAPONS STATION	108		95	105	Monitoring	S	1
NVLW-7014	NAVAL WEAPONS STATION	187		160	170	Monitoring		1
NVLW-7015	NAVAL WEAPONS STATION	179		161	170	Monitoring		1
NVLW-7016	NAVAL WEAPONS STATION	110		95	105	Monitoring	S	1
NVLW-7017	NAVAL WEAPONS STATION	42		30	40	Monitoring		1
NVLW-7018	NAVAL WEAPONS STATION	102		80	100	Monitoring	S	1
NVLW-7019	NAVAL WEAPONS STATION	42		30	40	Monitoring		1
NVLW-7020	NAVAL WEAPONS STATION	0		19	29	Monitoring		1
NVLW-7021	NAVAL WEAPONS STATION	172		150	170	Monitoring		1
NVLW-7022	NAVAL WEAPONS STATION	32		20	30	Monitoring		1
NVLW-7023	NAVAL WEAPONS STATION	132		110	130	Monitoring		1
NVLW-7024	NAVAL WEAPONS STATION	27		15	25	Monitoring		1
NVLW-7025	NAVAL WEAPONS STATION	62		50	60	Monitoring	S	1
NVLW-7027	NAVAL WEAPONS STATION	36		26	36	Monitoring		1
NVLW-7028	NAVAL WEAPONS STATION	62		50	60	Monitoring	S	1
NVLW-7031	NAVAL WEAPONS STATION	145		130	140	Monitoring		1
NVLW-7032	NAVAL WEAPONS STATION	110		95	105	Monitoring		1
NVLW-7033	NAVAL WEAPONS STATION	170		155	165	Monitoring		1
NVLW-7034	NAVAL WEAPONS STATION	60		46	56	Monitoring		1
NVLW-7035	NAVAL WEAPONS STATION	103		90	100	Monitoring	S	1
NVLW-7036	NAVAL WEAPONS STATION	170		150	160	Monitoring		1
NVLW-7037	NAVAL WEAPONS STATION	112		89	109	Monitoring		1
NVLW-7038	NAVAL WEAPONS STATION	102		80	100	Monitoring	S	1
NVLW-7039	NAVAL WEAPONS STATION	159		143	153	Monitoring		1
NVLW-7040	NAVAL WEAPONS STATION	160		140	150	Monitoring		1
NVLW-7041	NAVAL WEAPONS STATION	146		133	143	Monitoring	S	1
NVLW-7042	NAVAL WEAPONS STATION	151		136	146	Monitoring	S	1
NVLW-7043	NAVAL WEAPONS STATION	150		136	146	Monitoring	S	1
NVLW-7044	NAVAL WEAPONS STATION	158		123	143	Monitoring	S	1
NVLW-7045	NAVAL WEAPONS STATION	157		135	155	Monitoring	S	1
NVLW-7046	NAVAL WEAPONS STATION	107		85	105	Monitoring		1
NVLW-70POC02	NAVAL WEAPONS STATION	0		190	201	Monitoring		1,6
NVLW-70POC03	NAVAL WEAPONS STATION	205		190	200	Monitoring		1,6

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
NVLW-70POC04	NAVAL WEAPONS STATION	210		195	206	Monitoring		1,6
NVLW-EW7001	NAVAL WEAPONS STATION	33		20	30	Inactive Production		2
NVLW-EW7003	NAVAL WEAPONS STATION	130		95	120	Inactive Production		2
NVLW-RDO1	NAVAL WEAPONS STATION	110		65	105	Monitoring		1
NVLW-RDO2	NAVAL WEAPONS STATION	110		65	105	Monitoring		1
NVLW-RDO3A	NAVAL WEAPONS STATION	31		20	30	Monitoring		1
NVLW-RDO3B	NAVAL WEAPONS STATION	107		65	105	Monitoring		1
NVLW-RDO4	NAVAL WEAPONS STATION	112		65	105	Monitoring		1
NVLW-RDO5	NAVAL WEAPONS STATION	107		65	105	Monitoring		1
NVLW-RDO6A	NAVAL WEAPONS STATION	109		95	105	Monitoring		1
NVLW-RDO6B	NAVAL WEAPONS STATION	145		130	140	Monitoring		1
NVLW-SB2	NAVAL WEAPONS STATION	424		207	407	Inactive Production		2,3,6
NVLW-SB6	NAVAL WEAPONS STATION	802		548	655	Inactive Production	P	2
BYNT-YLSE	NEFF RANCH, LTD	90		34	70	Other Active Production		2,3
NB-DOLD	NEWPORT BEACH	824		399	729	Active Large Production	P	2,7
NB-DOLS	NEWPORT BEACH	385		201	356	Active Large Production	P	2,7
NB-TAMD	NEWPORT BEACH	758		395	690	Active Large Production	P	2,7
NB-TAMS	NEWPORT BEACH	390		170	360	Active Large Production	P	2,7
NBGC-GA10	NEWPORT BEACH GOLF COURSE	65		32	62	Monitoring	S	1,6
NBGC-MW2	NEWPORT BEACH GOLF COURSE	65		35	65	Monitoring		1
NBGC-MW3	NEWPORT BEACH GOLF COURSE	65		35	65	Monitoring		1
NBGC-NB	NEWPORT BEACH GOLF COURSE	498		192	218	Other Active Production		2,3,6
NDW-1	NIAGARA DRINKING WATER	510		270	500	Inactive Production		2,9
COCA-A	NOR-CAL BEVERAGE CO. INC.	654		0	0	Inactive Production		2,3,8
NCS-NO2	NORCO COMMUNITY SERVICES	114		47	114	Other Active Production		2
GRGC-CO1	O.C. FLOOD CONTROL DIST.	96		34	67	Other Active Production		2,3
GRGC-COR1	O.C. FLOOD CONTROL DIST.	92		34	61	Other Active Production		2,3
GRGC-YL14	O.C. FLOOD CONTROL DIST.	0		0	0	Other Active Production		2,3
GRGC-YL15	O.C. FLOOD CONTROL DIST.	0		0	0	Other Active Production		2,3
GRGC-YL16	O.C. FLOOD CONTROL DIST.	0		0	0	Other Active Production		2,3
GRGC-YL4	O.C. FLOOD CONTROL DIST.	0		0	0	Other Active Production		2,3
GRGC-YL9	O.C. FLOOD CONTROL DIST.	0		0	0	Other Active Production		2,3
GRGC-YLA1	O.C. FLOOD CONTROL DIST.	0		0	0	Other Active Production		2,3
W-3763	O.C. FLOOD CONTROL DIST.	610		144	385	Inactive Production		2
W-629	O.C. FLOOD CONTROL DIST.	267		81	256	Monitoring		1
W-638	O.C. FLOOD CONTROL DIST.	176		71	162	Monitoring		1
VECT-GG	O.C. VECTOR CNT. DIST.	224		0	0	Other Active Production		2,3
BSOA-I	OC COUNCIL BOY SCOUTS/ANAHEIM	0		100	200	Other Active Production		2,3
W-19059	OC WASTE MANAGEMENT	60		27	57	Monitoring		1
OVWC-HB	OCEAN VIEW MUTUAL WATER	180		0	0	Inactive Production		2,6
ABS-1	OCWD	286	MP1	25	35	Multiport Monitoring	P	1
ABS-1	OCWD	286	MP2	75	85	Multiport Monitoring	P	1
ABS-1	OCWD	286	MP3	255	265	Multiport Monitoring	P	1
ABS-2	OCWD	180		155	165	Monitoring	S	1
AM-1	OCWD	140		97	115	Monitoring	S	1
AM-10	OCWD	300		217	235	Monitoring	S	1
AM-11	OCWD	278		218	240	Monitoring	P	1
AM-12	OCWD	299		210	225	Monitoring	S	1
AM-13	OCWD	279		252	270	Monitoring	P	1
AM-14	OCWD	321		297	315	Monitoring	P	1,8
AM-15	OCWD	320		300	317	Monitoring	P	1,8
AM-15A	OCWD	231		214	220	Monitoring	S	1,8
AM-16	OCWD	320		300	315	Monitoring	P	1,8
AM-16A	OCWD	227		215	222	Monitoring		1,8
AM-17	OCWD	320		290	308	Monitoring	P	1,8
AM-18	OCWD	320		291	309	Monitoring	P	1,8
AM-18A	OCWD	232		208	215	Monitoring		1,8
AM-19	OCWD	240		217	225	Monitoring		1
AM-19A	OCWD	127		115	123	Monitoring	S	1
AM-2	OCWD	160		87	100	Monitoring	S	1
AM-20	OCWD	397		361	379	Monitoring	P	1
AM-20A	OCWD	268		250	258	Monitoring		1
AM-21	OCWD	269		250	258	Monitoring		1
AM-21A	OCWD	179		157	165	Monitoring	S	1
AM-22	OCWD	356		339	353	Monitoring	P	1,8
AM-22A	OCWD	239		216	224	Monitoring		1,8
AM-23	OCWD	351		330	347	Monitoring	P	1,8

List of Wells in OCWD Monitoring Programs

KEY

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Program: 1) monitoring well, 2) production well, 3) irrigation or industrial well, 4) injection well, 5) Mid-Basin Injection well, 6) seawater intrusion monitoring well, 7) well monitored by OCWD for Title 22 compliance, 8) North Basin Groundwater Protection Program wells, 9) South Basin Groundwater Protection Program wells, 10) wells in CASGEM monitoring program

Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
AM-24	OCWD	378		335	350	Monitoring	P	1,8
AM-24A	OCWD	305		279	294	Monitoring		1,8
AM-25	OCWD	365		340	358	Monitoring	P	1,8
AM-25A	OCWD	217		188	195	Monitoring	S	1,8
AM-26	OCWD	388		377	383	Monitoring	P	1
AM-27	OCWD	337		287	305	Monitoring	P	1
AM-28	OCWD	398		358	376	Monitoring		1
AM-29	OCWD	365		340	358	Monitoring	P	1,8
AM-29A	OCWD	96		75	95	Monitoring		1,8
AM-3	OCWD	115		91	107	Monitoring	S	1,10
AM-30	OCWD	375		349	367	Monitoring	P	1,8
AM-30A	OCWD	398		152	159	Monitoring	S	1,8
AM-31	OCWD	358		335	353	Monitoring	P	1,8
AM-31A	OCWD	360		162	170	Monitoring	S	1,8
AM-32	OCWD	398		335	353	Monitoring	P	1,8
AM-33	OCWD	378		354	372	Monitoring	P	1,8
AM-33A	OCWD	238		206	221	Monitoring		1,8
AM-34	OCWD	354		317	335	Monitoring	P	1
AM-34A	OCWD	271		252	260	Monitoring		1
AM-35	OCWD	400		332	350	Monitoring	P	1
AM-36	OCWD	398		369	387	Monitoring	P	1
AM-37	OCWD	378		349	367	Monitoring	P	1
AM-38	OCWD	358		316	334	Monitoring	P	1
AM-39	OCWD	192		168	188	Monitoring		1,8
AM-39A	OCWD	140		115	135	Monitoring	S	1,8
AM-4	OCWD	300		187	205	Monitoring	S	1
AM-40	OCWD	193		175	190	Monitoring		1,8
AM-40A	OCWD	168		145	165	Monitoring	S	1,8
AM-41	OCWD	200		190	200	Monitoring		1,8
AM-41A	OCWD	167		156	166	Monitoring	S	1,8
AM-42	OCWD	198		180	190	Monitoring		1,8
AM-42A	OCWD	135		115	130	Monitoring	S	1,8
AM-43	OCWD	100		80	100	Monitoring		1
AM-44	OCWD	162		140	160	Monitoring	S	1
AM-44A	OCWD	90		78	88	Monitoring		1
AM-45	OCWD	133		102	132	Monitoring	S	1,8
AM-46	OCWD	130		94	124	Monitoring	S	1
AM-47	OCWD	290		227	242	Monitoring	P	1,8
AM-47A	OCWD	170		160	170	Monitoring	S	1,8
AM-48	OCWD	312		270	300	Monitoring	P	1,8
AM-48A	OCWD	152		116	146	Monitoring	S	1,8
AM-49	OCWD	160		120	150	Monitoring	S	1,8
AM-5	OCWD	250		230	245	Monitoring	P	1
AM-50	OCWD	170		140	150	Monitoring	S	1
AM-51	OCWD	130		105	125	Monitoring	S	1
AM-51A	OCWD	80		50	70	Monitoring		1
AM-5A	OCWD	182		168	175	Monitoring	S	1
AM-6	OCWD	300		232	250	Monitoring	P	1
AM-7	OCWD	296		210	225	Monitoring	S	1
AM-8	OCWD	300		268	285	Monitoring	S	1,8
AM-9	OCWD	317		285	303	Monitoring	S	1,8
AMD-1	OCWD	1511	MP1	104	114	Multiport Monitoring	S/P/D	1,10
AMD-1	OCWD	1511	MP2	135	145	Multiport Monitoring	S/P/D	1,10
AMD-1	OCWD	1511	MP3	180	190	Multiport Monitoring	S/P/D	1,10
AMD-1	OCWD	1511	MP4	246	256	Multiport Monitoring	S/P/D	1,10
AMD-1	OCWD	1511	MP5	330	340	Multiport Monitoring	S/P/D	1,10
AMD-1	OCWD	1511	MP6	384	394	Multiport Monitoring	S/P/D	1,10
AMD-1	OCWD	1511	MP7	524	534	Multiport Monitoring	S/P/D	1,10
AMD-1	OCWD	1511	MP8	760	770	Multiport Monitoring	S/P/D	1,10
AMD-1	OCWD	1511	MP8	1038	1048	Multiport Monitoring	S/P/D	1,10
AMD-1	OCWD	1511	MP10	1390	1400	Multiport Monitoring	S/P/D	1,10
AMD-10	OCWD	1510		934	954	Monitoring	P	1
AMD-11	OCWD	1510		906	926	Monitoring	P	1
AMD-12	OCWD	1020		940	960	Monitoring	P	1
AMD-2	OCWD	1508	MP1	156	166	Multiport Monitoring	S/P/D	1
AMD-2	OCWD	1508	MP2	260	270	Multiport Monitoring	S/P/D	1
AMD-2	OCWD	1508	MP3	384	394	Multiport Monitoring	S/P/D	1

List of Wells in OCWD Monitoring Programs

KEY

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
AMD-2	OCWD	1508	MP4	510	520	Multiport Monitoring	S/P/D	1
AMD-2	OCWD	1508	MP5	658	668	Multiport Monitoring	S/P/D	1
AMD-2	OCWD	1508	MP6	820	830	Multiport Monitoring	S/P/D	1
AMD-2	OCWD	1508	MP7	1012	1022	Multiport Monitoring	S/P/D	1
AMD-2	OCWD	1508	MP8	1150	1160	Multiport Monitoring	S/P/D	1
AMD-2	OCWD	1508	MP9	1290	1300	Multiport Monitoring	S/P/D	1
AMD-2	OCWD	1508	MP10	1440	1450	Multiport Monitoring	S/P/D	1
AMD-3	OCWD	1416	MP1	66	76	Multiport Monitoring	S/P	1,8,10
AMD-3	OCWD	1416	MP2	134	144	Multiport Monitoring	S/P	1,8,10
AMD-3	OCWD	1416	MP3	210	220	Multiport Monitoring	S/P	1,8,10
AMD-3	OCWD	1416	MP4	360	370	Multiport Monitoring	S/P	1,8,10
AMD-3	OCWD	1416	MP5	480	490	Multiport Monitoring	S/P	1,8,10
AMD-3	OCWD	1416	MP6	570	580	Multiport Monitoring	S/P	1,8,10
AMD-3	OCWD	1416	MP7	820	830	Multiport Monitoring	S/P	1,8,10
AMD-3	OCWD	1416	MP8	920	930	Multiport Monitoring	S/P	1,8,10
AMD-3	OCWD	1416	MP9	1170	1180	Multiport Monitoring	S/P	1,8,10
AMD-3	OCWD	1416	MP10	1282	1292	Multiport Monitoring	S/P	1,8,10
AMD-4	OCWD	1515	MP1	204	214	Multiport Monitoring	S/P/D	1,8
AMD-4	OCWD	1515	MP2	295	305	Multiport Monitoring	S/P/D	1,8
AMD-4	OCWD	1515	MP3	380	390	Multiport Monitoring	S/P/D	1,8
AMD-4	OCWD	1515	MP4	560	570	Multiport Monitoring	S/P/D	1,8
AMD-4	OCWD	1515	MP5	700	710	Multiport Monitoring	S/P/D	1,8
AMD-4	OCWD	1515	MP6	790	800	Multiport Monitoring	S/P/D	1,8
AMD-4	OCWD	1515	MP7	935	945	Multiport Monitoring	S/P/D	1,8
AMD-4	OCWD	1515	MP8	1055	1065	Multiport Monitoring	S/P/D	1,8
AMD-4	OCWD	1515	MP9	1120	1130	Multiport Monitoring	S/P/D	1,8
AMD-4	OCWD	1515	MP10	1265	1275	Multiport Monitoring	S/P/D	1,8
AMD-4	OCWD	1515	MP11	1405	1415	Multiport Monitoring	S/P/D	1,8
AMD-5	OCWD	1495	MP1	100	110	Multiport Monitoring	S/P/D	1
AMD-5	OCWD	1495	MP2	200	210	Multiport Monitoring	S/P/D	1
AMD-5	OCWD	1495	MP3	300	310	Multiport Monitoring	S/P/D	1
AMD-5	OCWD	1495	MP4	414	424	Multiport Monitoring	S/P/D	1
AMD-5	OCWD	1495	MP5	495	505	Multiport Monitoring	S/P/D	1
AMD-5	OCWD	1495	MP6	640	650	Multiport Monitoring	S/P/D	1
AMD-5	OCWD	1495	MP7	750	760	Multiport Monitoring	S/P/D	1
AMD-5	OCWD	1495	MP8	920	930	Multiport Monitoring	S/P/D	1
AMD-5	OCWD	1495	MP9	1025	1035	Multiport Monitoring	S/P/D	1
AMD-5	OCWD	1495	MP10	1210	1220	Multiport Monitoring	S/P/D	1
AMD-5	OCWD	1495	MP11	1320	1330	Multiport Monitoring	S/P/D	1
AMD-5	OCWD	1495	MP12	1420	1430	Multiport Monitoring	S/P/D	1
AMD-6	OCWD	1528	MP1	110	120	Multiport Monitoring	S/P	1
AMD-6	OCWD	1528	MP2	150	160	Multiport Monitoring	S/P	1
AMD-6	OCWD	1528	MP3	220	230	Multiport Monitoring	S/P	1
AMD-6	OCWD	1528	MP4	275	285	Multiport Monitoring	S/P	1
AMD-6	OCWD	1528	MP5	370	380	Multiport Monitoring	S/P	1
AMD-6	OCWD	1528	MP6	495	505	Multiport Monitoring	S/P	1
AMD-6	OCWD	1528	MP7	620	630	Multiport Monitoring	S/P	1
AMD-6	OCWD	1528	MP8	710	720	Multiport Monitoring	S/P	1
AMD-6	OCWD	1528	MP9	790	800	Multiport Monitoring	S/P	1
AMD-6	OCWD	1528	MP10	900	910	Multiport Monitoring	S/P	1
AMD-6	OCWD	1528	MP11	1090	1100	Multiport Monitoring	S/P	1
AMD-6	OCWD	1528	MP12	1260	1270	Multiport Monitoring	S/P	1
AMD-6	OCWD	1528	MP13	1405	1415	Multiport Monitoring	S/P	1
AMD-7	OCWD	1520	MP1	120	130	Multiport Monitoring	S/P/D	1,10
AMD-7	OCWD	1520	MP2	220	230	Multiport Monitoring	S/P/D	1,10
AMD-7	OCWD	1520	MP3	270	280	Multiport Monitoring	S/P/D	1,10
AMD-7	OCWD	1520	MP4	310	320	Multiport Monitoring	S/P/D	1,10
AMD-7	OCWD	1520	MP5	370	380	Multiport Monitoring	S/P/D	1,10
AMD-7	OCWD	1520	MP6	470	480	Multiport Monitoring	S/P/D	1,10
AMD-7	OCWD	1520	MP7	578	588	Multiport Monitoring	S/P/D	1,10
AMD-7	OCWD	1520	MP8	690	700	Multiport Monitoring	S/P/D	1,10
AMD-7	OCWD	1520	MP9	805	815	Multiport Monitoring	S/P/D	1,10
AMD-7	OCWD	1520	MP10	930	940	Multiport Monitoring	S/P/D	1,10
AMD-7	OCWD	1520	MP11	1070	1080	Multiport Monitoring	S/P/D	1,10
AMD-7	OCWD	1520	MP12	1165	1175	Multiport Monitoring	S/P/D	1,10
AMD-7	OCWD	1520	MP13	1295	1305	Multiport Monitoring	S/P/D	1,10
AMD-7	OCWD	1520	MP14	1420	1430	Multiport Monitoring	S/P/D	1,10

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
AMD-8	OCWD	2080	MP1	78	88	Multiport Monitoring	S/P/D	1
AMD-8	OCWD	2080	P2	178	188	Multiport Monitoring	S/P/D	1
AMD-8	OCWD	2080	MP3	314	324	Multiport Monitoring	S/P/D	1
AMD-8	OCWD	2080	MP4	524	534	Multiport Monitoring	S/P/D	1
AMD-8	OCWD	2080	MP5	660	670	Multiport Monitoring	S/P/D	1
AMD-8	OCWD	2080	MP6	760	770	Multiport Monitoring	S/P/D	1
AMD-8	OCWD	2080	MP7	856	866	Multiport Monitoring	S/P/D	1
AMD-8	OCWD	2080	MP8	1000	1010	Multiport Monitoring	S/P/D	1
AMD-8	OCWD	2080	MP9	1160	1170	Multiport Monitoring	S/P/D	1
AMD-8	OCWD	2080	MP10	1286	1296	Multiport Monitoring	S/P/D	1
AMD-8	OCWD	2080	MP11	1450	1460	Multiport Monitoring	S/P/D	1
AMD-8	OCWD	2080	MP12	1564	1574	Multiport Monitoring	S/P/D	1
AMD-8	OCWD	2080	MP13	1760	1770	Multiport Monitoring	S/P/D	1
AMD-8	OCWD	2080	MP14	1944	1954	Multiport Monitoring	S/P/D	1
AMD-8	OCWD	2080	MP15	2010	2020	Multiport Monitoring	S/P/D	1
AMD-9	OCWD	1163		896	916	Monitoring	S/P	1
BPM-1	OCWD	2211	MP1	128	138	Multiport Monitoring	S/P/D	1,10
BPM-1	OCWD	2211	MP2	248	258	Multiport Monitoring	S/P/D	1,10
BPM-1	OCWD	2211	MP3	456	466	Multiport Monitoring	S/P/D	1,10
BPM-1	OCWD	2211	MP4	612	622	Multiport Monitoring	S/P/D	1,10
BPM-1	OCWD	2211	MP5	776	786	Multiport Monitoring	S/P/D	1,10
BPM-1	OCWD	2211	MP6	886	896	Multiport Monitoring	S/P/D	1,10
BPM-1	OCWD	2211	MP7	1036	1046	Multiport Monitoring	S/P/D	1,10
BPM-1	OCWD	2211	MP8	1264	1274	Multiport Monitoring	S/P/D	1,10
BPM-1	OCWD	2211	MP9	1388	1398	Multiport Monitoring	S/P/D	1,10
BPM-1	OCWD	2211	MP10	1498	1508	Multiport Monitoring	S/P/D	1,10
BPM-1	OCWD	2211	MP11	1684	1694	Multiport Monitoring	S/P/D	1,10
BPM-1	OCWD	2211	MP12	1800	1810	Multiport Monitoring	S/P/D	1,10
BPM-1	OCWD	2211	MP13	1930	1940	Multiport Monitoring	S/P/D	1,10
BPM-1	OCWD	2211	MP14	2105	2115	Multiport Monitoring	S/P/D	1,10
BPM-2	OCWD	2227	MP1	180	190	Multiport Monitoring	S/P/D	1,10
BPM-2	OCWD	2227	MP2	336	346	Multiport Monitoring	S/P/D	1,10
BPM-2	OCWD	2227	MP3	494	504	Multiport Monitoring	S/P/D	1,10
BPM-2	OCWD	2227	MP4	580	590	Multiport Monitoring	S/P/D	1,10
BPM-2	OCWD	2227	MP5	774	784	Multiport Monitoring	S/P/D	1,10
BPM-2	OCWD	2227	MP6	900	910	Multiport Monitoring	S/P/D	1,10
BPM-2	OCWD	2227	MP7	1024	1034	Multiport Monitoring	S/P/D	1,10
BPM-2	OCWD	2227	MP8	1240	1250	Multiport Monitoring	S/P/D	1,10
BPM-2	OCWD	2227	MP9	1364	1374	Multiport Monitoring	S/P/D	1,10
BPM-2	OCWD	2227	MP10	1490	1500	Multiport Monitoring	S/P/D	1,10
BPM-2	OCWD	2227	MP11	1610	1620	Multiport Monitoring	S/P/D	1,10
BPM-2	OCWD	2227	MP12	1760	1770	Multiport Monitoring	S/P/D	1,10
BPM-2	OCWD	2227	MP13	1928	1938	Multiport Monitoring	S/P/D	1,10
BPM-2	OCWD	2227	MP14	2070	2080	Multiport Monitoring	S/P/D	1,10
BPM-2	OCWD	2227	MP15	2170	2180	Multiport Monitoring	S/P/D	1,10
CB-1	OCWD	1543	MP1	76	86	Multiport Monitoring	S/P/D	1,8
CB-1	OCWD	1543	MP2	140	150	Multiport Monitoring	S/P/D	1,8
CB-1	OCWD	1543	MP3	440	450	Multiport Monitoring	S/P/D	1,8
CB-1	OCWD	1543	MP4	659	669	Multiport Monitoring	S/P/D	1,8
CB-1	OCWD	1543	MP5	870	880	Multiport Monitoring	S/P/D	1,8
CB-1	OCWD	1543	MP6	1050	1060	Multiport Monitoring	S/P/D	1,8
CB-1	OCWD	1543	MP7	1190	1200	Multiport Monitoring	S/P/D	1,8
CB-1	OCWD	1543	MP8	1329	1339	Multiport Monitoring	S/P/D	1,8
CB-1	OCWD	1543	MP9	1460	1470	Multiport Monitoring	S/P/D	1,8
COSM-1	OCWD	2000	MP1	90	100	Multiport Monitoring	S/P/D	1,6,10
COSM-1	OCWD	2000	MP2	152	162	Multiport Monitoring	S/P/D	1,6,10
COSM-1	OCWD	2000	MP3	270	280	Multiport Monitoring	S/P/D	1,6,10
COSM-1	OCWD	2000	MP4	350	360	Multiport Monitoring	S/P/D	1,6,10
COSM-1	OCWD	2000	MP5	450	460	Multiport Monitoring	S/P/D	1,6,10
COSM-1	OCWD	2000	MP6	540	550	Multiport Monitoring	S/P/D	1,6,10
COSM-1	OCWD	2000	MP7	620	630	Multiport Monitoring	S/P/D	1,6,10
COSM-1	OCWD	2000	MP8	720	730	Multiport Monitoring	S/P/D	1,6,10
COSM-1	OCWD	2000	MP9	850	860	Multiport Monitoring	S/P/D	1,6,10
COSM-1	OCWD	2000	MP10	980	990	Multiport Monitoring	S/P/D	1,6,10
COSM-1	OCWD	2000	MP11	1100	1110	Multiport Monitoring	S/P/D	1,6,10
COSM-1	OCWD	2000	MP12	1212	1222	Multiport Monitoring	S/P/D	1,6,10
COSM-1	OCWD	2000	MP13	1432	1442	Multiport Monitoring	S/P/D	1,6,10

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
COSM-1	OCWD	2000	MP14	1594	1604	Multiport Monitoring	S/P/D	1,6,10
COSM-1	OCWD	2000	MP15	1760	1770	Multiport Monitoring	S/P/D	1,6,10
COSM-2	OCWD	1142	MP1	58	68	Multiport Monitoring	S/P	1,6
COSM-2	OCWD	1142	MP2	113	123	Multiport Monitoring	S/P	1,6
COSM-2	OCWD	1142	MP3	198	208	Multiport Monitoring	S/P	1,6
COSM-2	OCWD	1142	MP4	307	317	Multiport Monitoring	S/P	1,6
COSM-2	OCWD	1142	MP5	406	416	Multiport Monitoring	S/P	1,6
COSM-2	OCWD	1142	MP6	540	550	Multiport Monitoring	S/P	1,6
COSM-2	OCWD	1142	MP7	649	659	Multiport Monitoring	S/P	1,6
COSM-2	OCWD	1142	MP8	757	767	Multiport Monitoring	S/P	1,6
COSM-2	OCWD	1142	MP9	886	896	Multiport Monitoring	S/P	1,6
COSM-2	OCWD	1142	MP10	1051	1061	Multiport Monitoring	S/P	1,6
FFS-1	OCWD	1490	MP1	180	190	Multiport Monitoring	S/P/D	1,8,10
FFS-1	OCWD	1490	MP2	360	370	Multiport Monitoring	S/P/D	1,8,10
FFS-1	OCWD	1490	MP3	529	539	Multiport Monitoring	S/P/D	1,8,10
FFS-1	OCWD	1490	MP4	819	829	Multiport Monitoring	S/P/D	1,8,10
FFS-1	OCWD	1490	MP5	1059	1069	Multiport Monitoring	S/P/D	1,8,10
FFS-1	OCWD	1490	MP6	1159	1169	Multiport Monitoring	S/P/D	1,8,10
FFS-1	OCWD	1490	MP7	1299	1309	Multiport Monitoring	S/P/D	1,8,10
FFS-1	OCWD	1490	MP7	1419	1429	Multiport Monitoring	S/P/D	1,8,10
FM-1	OCWD	359		348	356	Monitoring	P	1,8
FM-10	OCWD	250		215	235	Monitoring	P	1,8
FM-10A	OCWD	183		151	171	Monitoring	S	1,8
FM-11	OCWD	280		236	256	Monitoring	P	1,8
FM-11A	OCWD	162		134	154	Monitoring	S	1,8
FM-12	OCWD	241		206	226	Monitoring	P	1,8
FM-12A	OCWD	162		135	155	Monitoring	S	1,8
FM-13	OCWD	243		210	230	Monitoring	P	1,8
FM-13A	OCWD	173		140	160	Monitoring	S	1,8
FM-14	OCWD	277		234	254	Monitoring	P	1,8
FM-14A	OCWD	182		147	167	Monitoring	S	1,8
FM-15	OCWD	261		218	238	Monitoring	P	1,8
FM-15A	OCWD	160		120	140	Monitoring	S	1,8
FM-16	OCWD	282		248	268	Monitoring	P	1,8
FM-16A	OCWD	160		125	145	Monitoring	S	1,8
FM-17	OCWD	280		250	270	Monitoring	P	1,8
FM-18	OCWD	367		224	244	Monitoring	P	1,8
FM-18A	OCWD	160		121	151	Monitoring	S	1,8
FM-19A	OCWD	145		115	135	Monitoring	S	1,8
FM-19B	OCWD	270		230	260	Monitoring		1,8
FM-19C	OCWD	399		365	385	Monitoring	P	1,8
FM-1A	OCWD	197		164	172	Monitoring	S	1,8
FM-2	OCWD	352		320	338	Monitoring	P	1,8
FM-20	OCWD	290		221	241	Monitoring	P	1,8
FM-20A	OCWD	160		130	150	Monitoring	S	1,8
FM-21	OCWD	286		260	270	Monitoring	P	1,8
FM-21A	OCWD	169		140	160	Monitoring	S	1,8
FM-22	OCWD	290		242	262	Monitoring	P	1,8
FM-22A	OCWD	180		150	170	Monitoring	S	1,8
FM-23	OCWD	290		234	249	Monitoring	P	1,8
FM-23A	OCWD	155		128	143	Monitoring	S	1,8
FM-24	OCWD	302		271	291	Monitoring	P	1,8
FM-24A	OCWD	200		154	174	Monitoring	S	1,8
FM-25	OCWD	160		132	152	Monitoring	S	1,8
FM-26	OCWD	155		145	155	Monitoring	S	1,8
FM-27	OCWD	125		105	125	Monitoring	S	1,8
FM-2A	OCWD	237		226	234	Monitoring		1,8
FM-3	OCWD	298		257	263	Monitoring	P	1,8
FM-4	OCWD	355		327	345	Monitoring	P	1,8
FM-4A	OCWD	170		142	160	Monitoring	S	1,8
FM-5	OCWD	142		121	141	Monitoring	S	1,8
FM-6	OCWD	405		150	310	Monitoring	S	1,10
FM-7	OCWD	205		187	197	Monitoring		1,8
FM-7A	OCWD	172		160	170	Monitoring	S	1,8
FM-8	OCWD	150		114	134	Monitoring	S	1,8
FM-9	OCWD	260		220	240	Monitoring	P	1,8
FM-9A	OCWD	240		166	186	Monitoring	S	1,8

List of Wells in OCWD Monitoring Programs

KEY

Aquifer Zone: S=Shallow Aquifer, P=Principal Aquifer, D= Deep Aquifer

Program: 1) monitoring well, 2) production well, 3) irrigation or industrial well, 4) injection well, 5) Mid-Basin Injection well, 6) seawater intrusion monitoring well, 7) well monitored by OCWD for Title 22 compliance, 8) North Basin Groundwater Protection Program wells, 9) South Basin Groundwater Protection Program wells, 10) wells in CASGEM monitoring program

Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
FVM-1	OCWD	2000	MP1	134	145	Multiport Monitoring	S/P/D	1,10
FVM-1	OCWD	2000	MP3	172	182	Multiport Monitoring	S/P/D	1,10
FVM-1	OCWD	2000	MP3	220	230	Multiport Monitoring	S/P/D	1,10
FVM-1	OCWD	2000	MP4	360	370	Multiport Monitoring	S/P/D	1,10
FVM-1	OCWD	2000	MP5	450	460	Multiport Monitoring	S/P/D	1,10
FVM-1	OCWD	2000	MP6	500	510	Multiport Monitoring	S/P/D	1,10
FVM-1	OCWD	2000	MP7	560	570	Multiport Monitoring	S/P/D	1,10
FVM-1	OCWD	2000	MP8	630	640	Multiport Monitoring	S/P/D	1,10
FVM-1	OCWD	2000	MP9	810	820	Multiport Monitoring	S/P/D	1,10
FVM-1	OCWD	2000	MP10	894	904	Multiport Monitoring	S/P/D	1,10
FVM-1	OCWD	2000	MP11	1000	1010	Multiport Monitoring	S/P/D	1,10
FVM-1	OCWD	2000	MP12	1120	1130	Multiport Monitoring	S/P/D	1,10
FVM-1	OCWD	2000	MP13	1175	1185	Multiport Monitoring	S/P/D	1,10
FVM-1	OCWD	2000	MP14	1230	1240	Multiport Monitoring	S/P/D	1,10
FVM-1	OCWD	2000	MP15	1320	1330	Multiport Monitoring	S/P/D	1,10
FVM-1	OCWD	2000	MP16	1492	1502	Multiport Monitoring	S/P/D	1,10
FVM-1	OCWD	2000	MP17	1582	1592	Multiport Monitoring	S/P/D	1,10
FVM-1	OCWD	2000	MP18	1834	1844	Multiport Monitoring	S/P/D	1,10
GGM-1	OCWD	2086	MP1	150	160	Multiport Monitoring	S/P/D	1,10
GGM-1	OCWD	2086	MP2	300	310	Multiport Monitoring	S/P/D	1,10
GGM-1	OCWD	2086	MP3	464	474	Multiport Monitoring	S/P/D	1,10
GGM-1	OCWD	2086	MP4	550	560	Multiport Monitoring	S/P/D	1,10
GGM-1	OCWD	2086	MP5	740	750	Multiport Monitoring	S/P/D	1,10
GGM-1	OCWD	2086	MP6	825	835	Multiport Monitoring	S/P/D	1,10
GGM-1	OCWD	2086	MP7	950	960	Multiport Monitoring	S/P/D	1,10
GGM-1	OCWD	2086	MP8	1070	1080	Multiport Monitoring	S/P/D	1,10
GGM-1	OCWD	2086	MP9	1260	1270	Multiport Monitoring	S/P/D	1,10
GGM-1	OCWD	2086	MP10	1515	1525	Multiport Monitoring	S/P/D	1,10
GGM-1	OCWD	2086	MP11	1650	1660	Multiport Monitoring	S/P/D	1,10
GGM-1	OCWD	2086	MP12	1768	1778	Multiport Monitoring	S/P/D	1,10
GGM-1	OCWD	2086	MP13	2008	2018	Multiport Monitoring	S/P/D	1,10
GGM-2	OCWD	2057	MP1	212	222	Multiport Monitoring	S/P/D	1
GGM-2	OCWD	2057	MP2	294	304	Multiport Monitoring	S/P/D	1
GGM-2	OCWD	2057	MP3	460	470	Multiport Monitoring	S/P/D	1
GGM-2	OCWD	2057	MP4	715	725	Multiport Monitoring	S/P/D	1
GGM-2	OCWD	2057	MP5	950	960	Multiport Monitoring	S/P/D	1
GGM-2	OCWD	2057	MP6	1045	1055	Multiport Monitoring	S/P/D	1
GGM-2	OCWD	2057	MP7	1145	1155	Multiport Monitoring	S/P/D	1
GGM-2	OCWD	2057	MP8	1250	1260	Multiport Monitoring	S/P/D	1
GGM-2	OCWD	2057	MP	1485	1495	Multiport Monitoring	S/P/D	1
GGM-2	OCWD	2057	MP10	1625	1635	Multiport Monitoring	S/P/D	1
GGM-2	OCWD	2057	MP11	1740	1750	Multiport Monitoring	S/P/D	1
GGM-2	OCWD	2057	MP12	1900	1910	Multiport Monitoring	S/P/D	1
GGM-2	OCWD	2057	MP13	1990	2000	Multiport Monitoring	S/P/D	1
GGM-3	OCWD	2020	MP1	195	205	Multiport Monitoring	S/P	1
GGM-3	OCWD	2020	MP2	310	320	Multiport Monitoring	S/P	1
GGM-3	OCWD	2020	MP3	545	555	Multiport Monitoring	S/P	1
GGM-3	OCWD	2020	MP4	640	650	Multiport Monitoring	S/P	1
GGM-3	OCWD	2020	MP5	837	847	Multiport Monitoring	S/P	1
GGM-3	OCWD	2020	MP6	1004	1014	Multiport Monitoring	S/P	1
GGM-3	OCWD	2020	MP7	1104	1114	Multiport Monitoring	S/P	1
GGM-3	OCWD	2020	MP8	1274	1284	Multiport Monitoring	S/P	1
GGM-3	OCWD	2020	MP9	1539	1549	Multiport Monitoring	S/P	1
GGM-3	OCWD	2020	MP10	1680	1690	Multiport Monitoring	S/P	1
GGM-3	OCWD	2020	MP11	1780	1790	Multiport Monitoring	S/P	1
GGM-3	OCWD	2020	MP12	1950	1960	Multiport Monitoring	S/P	1
HBM-1	OCWD	2013	MP1	90	100	Multiport Monitoring	S/P/D	1,10
HBM-1	OCWD	2013	MP2	190	200	Multiport Monitoring	S/P/D	1,10
HBM-1	OCWD	2013	MP3	320	330	Multiport Monitoring	S/P/D	1,10
HBM-1	OCWD	2013	MP4	482	492	Multiport Monitoring	S/P/D	1,10
HBM-1	OCWD	2013	MP5	560	570	Multiport Monitoring	S/P/D	1,10
HBM-1	OCWD	2013	MP6	700	710	Multiport Monitoring	S/P/D	1,10
HBM-1	OCWD	2013	MP7	920	930	Multiport Monitoring	S/P/D	1,10
HBM-1	OCWD	2013	MP8	1034	1044	Multiport Monitoring	S/P/D	1,10
HBM-1	OCWD	2013	MP9	1126	1136	Multiport Monitoring	S/P/D	1,10
HBM-1	OCWD	2013	MP10	1348	1358	Multiport Monitoring	S/P/D	1,10
HBM-1	OCWD	2013	MP11	1460	1470	Multiport Monitoring	S/P/D	1,10

List of Wells in OCWD Monitoring Programs

KEY

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Program: 1) monitoring well, 2) production well, 3) irrigation or industrial well, 4) injection well, 5) Mid-Basin Injection well, 6) seawater intrusion monitoring well, 7) well monitored by OCWD for Title 22 compliance, 8) North Basin Groundwater Protection Program wells, 9) South Basin Groundwater Protection Program wells, 10) wells in CASGEM monitoring program

Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
HBM-1	OCWD	2013	MP12	1540	1550	Multiport Monitoring	S/P/D	1,10
HBM-1	OCWD	2013	MP13	1640	1650	Multiport Monitoring	S/P/D	1,10
HBM-1	OCWD	2013	MP14	1930	1940	Multiport Monitoring	S/P/D	1,10
HBM-2	OCWD	1010	MP1	110	120	Multiport Monitoring	S/P	1,6,10
HBM-2	OCWD	1010	MP2	160	170	Multiport Monitoring	S/P	1,6,10
HBM-2	OCWD	1010	MP3	245	255	Multiport Monitoring	S/P	1,6,10
HBM-2	OCWD	1010	MP4	305	315	Multiport Monitoring	S/P	1,6,10
HBM-2	OCWD	1010	MP5	360	370	Multiport Monitoring	S/P	1,6,10
HBM-2	OCWD	1010	MP6	445	455	Multiport Monitoring	S/P	1,6,10
HBM-2	OCWD	1010	MP7	520	530	Multiport Monitoring	S/P	1,6,10
HBM-2	OCWD	1010	MP8	570	580	Multiport Monitoring	S/P	1,6,10
HBM-2	OCWD	1010	MP9	675	685	Multiport Monitoring	S/P	1,6,10
HBM-2	OCWD	1010	MP10	735	745	Multiport Monitoring	S/P	1,6,10
HBM-2	OCWD	1010	MP11	845	855	Multiport Monitoring	S/P	1,6,10
HBM-2	OCWD	1010	MP12	925	935	Multiport Monitoring	S/P	1,6,10
HBM-4	OCWD	830	MP1	75	85	Multiport Monitoring	S/P	1,6
HBM-4	OCWD	830	MP2	120	130	Multiport Monitoring	S/P	1,6
HBM-4	OCWD	830	MP3	180	190	Multiport Monitoring	S/P	1,6
HBM-4	OCWD	830	MP4	230	240	Multiport Monitoring	S/P	1,6
HBM-4	OCWD	830	MP5	295	305	Multiport Monitoring	S/P	1,6
HBM-4	OCWD	830	MP6	350	360	Multiport Monitoring	S/P	1,6
HBM-4	OCWD	830	MP7	415	425	Multiport Monitoring	S/P	1,6
HBM-4	OCWD	830	MP8	550	560	Multiport Monitoring	S/P	1,6
HBM-4	OCWD	830	MP9	690	700	Multiport Monitoring	S/P	1,6
HBM-5	OCWD	1019	MP3	70	90	Multiport Monitoring	S/P	1,6
HBM-5	OCWD	1019	MP1	70	90	Multiport Monitoring	S/P	1,6
HBM-5	OCWD	1019	MP2	70	90	Multiport Monitoring	S/P	1,6
HBM-5	OCWD	1019	MP4	125	135	Multiport Monitoring	S/P	1,6
HBM-5	OCWD	1019	MP5	170	180	Multiport Monitoring	S/P	1,6
HBM-5	OCWD	1019	MP6	215	225	Multiport Monitoring	S/P	1,6
HBM-5	OCWD	1019	MP7	245	255	Multiport Monitoring	S/P	1,6
HBM-5	OCWD	1019	MP8	270	280	Multiport Monitoring	S/P	1,6
HBM-6	OCWD	800	MP1	52	62	Multiport Monitoring	S/P	1,6,10
HBM-6	OCWD	800	MP2	84	94	Multiport Monitoring	S/P	1,6,10
HBM-6	OCWD	800	MP3	108	118	Multiport Monitoring	S/P	1,6,10
HBM-6	OCWD	800	MP4	214	224	Multiport Monitoring	S/P	1,6,10
HBM-6	OCWD	800	MP5	263	273	Multiport Monitoring	S/P	1,6,10
HBM-6	OCWD	800	MP6	294	304	Multiport Monitoring	S/P	1,6,10
HBM-6	OCWD	800	MP7	506	516	Multiport Monitoring	S/P	1,6,10
HBM-6	OCWD	800	MP8	576	586	Multiport Monitoring	S/P	1,6,10
IDM-1	OCWD	1123	MP1	85	95	Multiport Monitoring	S/P/D	1,10
IDM-1	OCWD	1123	MP2	270	280	Multiport Monitoring	S/P/D	1,10
IDM-1	OCWD	1123	MP3	335	345	Multiport Monitoring	S/P/D	1,10
IDM-1	OCWD	1123	MP4	435	445	Multiport Monitoring	S/P/D	1,10
IDM-1	OCWD	1123	MP5	630	640	Multiport Monitoring	S/P/D	1,10
IDM-1	OCWD	1123	MP6	700	710	Multiport Monitoring	S/P/D	1,10
IDM-1	OCWD	1123	MP7	760	770	Multiport Monitoring	S/P/D	1,10
IDM-1	OCWD	1123	MP8	875	885	Multiport Monitoring	S/P/D	1,10
IDM-1	OCWD	1123	MP9	990	1000	Multiport Monitoring	S/P/D	1,10
IDM-1	OCWD	1123	MP10	1050	1060	Multiport Monitoring	S/P/D	1,10
IDM-2	OCWD	1487	MP1	126	136	Multiport Monitoring	S/P/D	1,9,10
IDM-2	OCWD	1487	MP2	234	244	Multiport Monitoring	S/P/D	1,9,10
IDM-2	OCWD	1487	MP3	284	294	Multiport Monitoring	S/P/D	1,9,10
IDM-2	OCWD	1487	MP4	352	362	Multiport Monitoring	S/P/D	1,9,10
IDM-2	OCWD	1487	MP5	492	502	Multiport Monitoring	S/P/D	1,9,10
IDM-2	OCWD	1487	MP6	612	622	Multiport Monitoring	S/P/D	1,9,10
IDM-2	OCWD	1487	MP7	710	720	Multiport Monitoring	S/P/D	1,9,10
IDM-2	OCWD	1487	MP8	886	896	Multiport Monitoring	S/P/D	1,9,10
IDM-2	OCWD	1487	MP9	1050	1060	Multiport Monitoring	S/P/D	1,9,10
IDM-2	OCWD	1487	MP10	1178	1188	Multiport Monitoring	S/P/D	1,9,10
IDM-2	OCWD	1487	M0-11	1256	1266	Multiport Monitoring	S/P/D	1,9,10
IDM-2	OCWD	1487	M012	1400	1410	Multiport Monitoring	S/P/D	1,9,10
IDM-3	OCWD	704		652	672	Monitoring	S/P	1
IDM-4	OCWD	726		654	674	Monitoring	S/P	1
IDP-1	OCWD	708		121	681	Injection		4
IDP-2R	OCWD	680		300	340	Monitoring	S/P	1
IDP-3	OCWD	602		125	505	Monitoring		1

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
KBS-1	OCWD	244		209	219	Monitoring	S/P	1
KBS-2	OCWD	303	MP1	96	106	Multiport Monitoring	S/P	1
KBS-2	OCWD	303	MP2	210	220	Multiport Monitoring	S/P	1
KBS-3	OCWD	92		80	90	Monitoring		1
KBS-4	OCWD	160		138	158	Monitoring	S	1
KBS-4A	OCWD	92		80	90	Monitoring		1
LAM-1	OCWD	2211	MP1	70	80	Multiport Monitoring	S/P/D	1,10
LAM-1	OCWD	2211	MP2	220	230	Multiport Monitoring	S/P/D	1,10
LAM-1	OCWD	2211	MP3	270	280	Multiport Monitoring	S/P/D	1,10
LAM-1	OCWD	2211	MP4	470	480	Multiport Monitoring	S/P/D	1,10
LAM-1	OCWD	2211	MP5	570	580	Multiport Monitoring	S/P/D	1,10
LAM-1	OCWD	2211	MP6	830	840	Multiport Monitoring	S/P/D	1,10
LAM-1	OCWD	2211	MP7	992	1002	Multiport Monitoring	S/P/D	1,10
LAM-1	OCWD	2211	MP8	1070	1080	Multiport Monitoring	S/P/D	1,10
LAM-1	OCWD	2211	MP9	1150	1160	Multiport Monitoring	S/P/D	1,10
LAM-1	OCWD	2211	MP10	1250	1260	Multiport Monitoring	S/P/D	1,10
LAM-1	OCWD	2211	MP11	1494	1504	Multiport Monitoring	S/P/D	1,10
LAM-1	OCWD	2211	MP12	1610	1620	Multiport Monitoring	S/P/D	1,10
MBI-1	OCWD	1239		530	1190	Injection		4,5
MCAS-1	OCWD	620	MP1	60	70	Multiport Monitoring	S/P	1
MCAS-1	OCWD	620	MP2	150	160	Multiport Monitoring	S/P	1
MCAS-1	OCWD	620	MP3	210	220	Multiport Monitoring	S/P	1
MCAS-1	OCWD	620	MP4	270	280	Multiport Monitoring	S/P	1
MCAS-1	OCWD	620	MP5	330	340	Multiport Monitoring	S/P	1
MCAS-1	OCWD	620	MP6	450	460	Multiport Monitoring	S/P	1
MCAS-1	OCWD	620	MP7	540	550	Multiport Monitoring	S/P	1
MCAS-10	OCWD	389		347	377	Monitoring	P	1
MCAS-2	OCWD	680	MP1	40	50	Multiport Monitoring	S/P	1
MCAS-2	OCWD	680	MP2	130	140	Multiport Monitoring	S/P	1
MCAS-2	OCWD	680	MP3	200	210	Multiport Monitoring	S/P	1
MCAS-2	OCWD	680	MP4	370	380	Multiport Monitoring	S/P	1
MCAS-2	OCWD	680	MP5	420	430	Multiport Monitoring	S/P	1
MCAS-2	OCWD	680	MP6	490	500	Multiport Monitoring	S/P	1
MCAS-2	OCWD	680	MP7	550	560	Multiport Monitoring	S/P	1
MCAS-2	OCWD	680	MP8	620	630	Multiport Monitoring	S/P	1
MCAS-3	OCWD	603	MP1	80	90	Multiport Monitoring	S/P	1,10
MCAS-3	OCWD	603	MP2	160	170	Multiport Monitoring	S/P	1,10
MCAS-3	OCWD	603	MP3	220	230	Multiport Monitoring	S/P	1,10
MCAS-3	OCWD	603	MP4	340	350	Multiport Monitoring	S/P	1,10
MCAS-3	OCWD	603	MP5	420	430	Multiport Monitoring	S/P	1,10
MCAS-3	OCWD	603	MP6	490	500	Multiport Monitoring	S/P	1,10
MCAS-4	OCWD	317		181	238	Monitoring	S/P	1
MCAS-5A	OCWD	159		120	130	Monitoring	S	1
MCAS-6	OCWD	455		167	222	Monitoring	S	1
MCAS-7	OCWD	1297	MP1	90	100	Multiport Monitoring	S/P	1,10
MCAS-7	OCWD	1297	MP2	190	200	Multiport Monitoring	S/P	1,10
MCAS-7	OCWD	1297	MP3	350	360	Multiport Monitoring	S/P	1,10
MCAS-7	OCWD	1297	MP4	440	450	Multiport Monitoring	S/P	1,10
MCAS-7	OCWD	1297	MP5	510	520	Multiport Monitoring	S/P	1,10
MCAS-7	OCWD	1297	MP6	800	810	Multiport Monitoring	S/P	1,10
MCAS-7	OCWD	1297	MP7	910	920	Multiport Monitoring	S/P	1,10
MCAS-7	OCWD	1297	MP8	980	990	Multiport Monitoring	S/P	1,10
MCAS-7	OCWD	1297	MP9	1100	1110	Multiport Monitoring	S/P	1,10
MCAS-8	OCWD	437		392	410	Monitoring	P	1
MCAS-9	OCWD	450		372	445	Monitoring	P	1
MSP-10P	OCWD	59		40	50	Monitoring		1
MSP-10T	OCWD	211		70	140	Monitoring		1
OCWD-33Z11	OCWD	527		435	485	Monitoring		1,6
OCWD-34F10	OCWD	490		420	460	Monitoring		1,6
OCWD-34H25	OCWD	490		410	465	Monitoring		1
OCWD-34H5	OCWD	480		405	455	Monitoring		1,6
OCWD-34L10	OCWD	478		405	450	Monitoring		1,6
OCWD-34LS	OCWD	400		340	380	Monitoring		1,6
OCWD-34N21	OCWD	494		424	464	Monitoring		1,6
OCWD-34NP7	OCWD	312		225	300	Monitoring		1,6
OCWD-34S	OCWD	380		312	347	Injection		4
OCWD-34T01	OCWD	375		290	345	Monitoring		1,6

List of Wells in OCWD Monitoring Programs

KEY

Aquifer Zone: S=Shallow Aquifer, P=Principal Aquifer, D= Deep Aquifer

Program: 1) monitoring well, 2) production well, 3) irrigation or industrial well, 4) injection well, 5) Mid-Basin Injection well, 6) seawater intrusion monitoring well, 7) well monitored by OCWD for Title 22 compliance, 8) North Basin Groundwater Protection Program wells, 9) South Basin Groundwater Protection Program wells, 10) wells in CASGEM monitoring program

Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
OCWD-34U8	OCWD	424		359	384	Monitoring		1,6
OCWD-34V	OCWD	320		260	300	Injection		4
OCWD-34V20	OCWD	456		387	417	Monitoring		1,6
OCWD-34VZX	OCWD	199		147	177	Monitoring		1,6
OCWD-34VZY	OCWD	265		215	235	Monitoring		1,6
OCWD-34WP5	OCWD	212		165	180	Monitoring		1,6
OCWD-34X40	OCWD	450		333	358	Monitoring	S	1,6
OCWD-34Z	OCWD	191		110	150	Injection		4
OCWD-35DP5	OCWD	130		92	107	Monitoring		1,6
OCWD-35E01X	OCWD	98		65	85	Monitoring		1,6
OCWD-35E01Y	OCWD	343		105	125	Monitoring		1,6
OCWD-35F	OCWD	168		80	115	Injection		4
OCWD-35F20	OCWD	300		235	265	Monitoring		1,6
OCWD-35FP21	OCWD	85		36	71	Monitoring		1,6
OCWD-35G	OCWD	182		80	145	Injection		4
OCWD-35H11	OCWD	230		200	220	Monitoring	S	1,6
OCWD-35H12	OCWD	300		137	147	Monitoring		1,6
OCWD-35H1X	OCWD	257		131	171	Injection		4
OCWD-35H1Y	OCWD	271		215	237	Injection		4
OCWD-35H2	OCWD	260		112	241	Injection		4
OCWD-35J1	OCWD	271		190	240	Monitoring		1,6
OCWD-35J1Y	OCWD	378		264	294	Monitoring		1,6
OCWD-35K1	OCWD	275		193	243	Monitoring		1,6
OCWD-35K1V	OCWD	112		90	110	Monitoring		1,6
OCWD-35K1Y	OCWD	395		366	386	Monitoring		1,6
OCWD-35KP12	OCWD	87		47	67	Monitoring		1
OCWD-35N01	OCWD	101		80	85	Monitoring	S	1,6
OCWD-35T9	OCWD	1020		390	411	Monitoring		1,6
OCWD-36FP14Z1	OCWD	150		115	125	Monitoring		1,6
OCWD-36FP14Z2	OCWD	705		357	367	Monitoring		1,6
OCWD-36FP1X	OCWD	160		136	146	Monitoring		1
OCWD-36FP1Z	OCWD	1020		504	514	Monitoring	P	1,6
OCWD-7	OCWD	48		28	48	Monitoring		1
OCWD-AIR1	OCWD	1518		1375	1460	Monitoring	S/P	1,10
OCWD-ALK	OCWD	320		217	317	Other Active Production		2,3
OCWD-AN1	OCWD	115		35	115	Monitoring		1
OCWD-AN2	OCWD	119		35	115	Monitoring		1
OCWD-BESS	OCWD	302		172	189	Other Active Production	S	2,3
OCWD-BIO1	OCWD	124		25	115	Inactive Production	S	2
OCWD-BP1	OCWD	40		20	40	Monitoring		1
OCWD-BP2	OCWD	70		50	70	Monitoring		1
OCWD-BP3	OCWD	205		185	205	Monitoring	S	1
OCWD-BP4	OCWD	180		140	180	Monitoring	S	1
OCWD-BP5	OCWD	240		147	167	Monitoring	S	1
OCWD-BP6	OCWD	245		148	168	Monitoring	S	1
OCWD-BP7	OCWD	270		148	168	Monitoring	S	1
OCWD-BS10	OCWD	906		595	605	Monitoring	S/P	1,6
OCWD-BS103A	OCWD	16		10	15	Monitoring		1,6
OCWD-BS105A	OCWD	12		6	11	Monitoring		1,6
OCWD-BS11	OCWD	741		580	590	Monitoring	S/P	1,6
OCWD-BS15	OCWD	105		60	70	Monitoring		1,6
OCWD-BS16	OCWD	95		60	80	Monitoring	S	1,6
OCWD-BS16A	OCWD	24		16	21	Monitoring		1,6
OCWD-BS18	OCWD	95		72	82	Monitoring	S	1,6
OCWD-BS18A	OCWD	17		11	16	Monitoring		1,6
OCWD-BS19	OCWD	100		63	83	Monitoring	S	1,6
OCWD-BS20A	OCWD	27		6	11	Monitoring		1
OCWD-BS20B	OCWD	85		71	81	Monitoring	S	1,6
OCWD-BS21	OCWD	0		0	0	Monitoring	S	1,6
OCWD-CTG1	OCWD	1330		1060	1220	Monitoring	S/P/D	1,10
OCWD-CTG5	OCWD	1600		1040	1120	Monitoring	P/D	1
OCWD-CTK1	OCWD	1444		1260	1315	Monitoring	P/D	1
OCWD-D1	OCWD	926		780	880	Other Active Production	P	2,3
OCWD-D3	OCWD	1050		560	1000	Other Active Production	P	2,3
OCWD-D4	OCWD	1033		531	979	Other Active Production	P	2,3
OCWD-D5	OCWD	1050		597	1005	Inactive Production		2,3
OCWD-EW1	OCWD	324		160	295	Inactive Production		2,8

List of Wells in OCWD Monitoring Programs

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
OCWD-EW2	OCWD	230		130	196	Inactive Production	S	2,8
OCWD-EW2A	OCWD	207		122	188	Inactive Production	S	2,8
OCWD-EW3	OCWD	270		150	249	Inactive Production		2,8
OCWD-EW3A	OCWD	0		0	0	Inactive Production	S	2,8
OCWD-EW4	OCWD	275		130	255	Inactive Production	S	2,8
OCWD-FBM1	OCWD	140		38	138	Monitoring	S	1
OCWD-FBM2	OCWD	140		39	139	Monitoring	S	1
OCWD-FBR1	OCWD	100		30	90	Injection		4
OCWD-FC1	OCWD	185		165	185	Monitoring	P	1
OCWD-FC2	OCWD	115		95	115	Monitoring	S	1
OCWD-FH1	OCWD	140		120	140	Monitoring	S	1
OCWD-GA1	OCWD	45		30	40	Monitoring		1
OCWD-GA2	OCWD	45		30	40	Monitoring	S	1,6
OCWD-GA3	OCWD	45		30	40	Monitoring		1
OCWD-GA4	OCWD	45		30	40	Monitoring		1
OCWD-GA5	OCWD	45		30	40	Monitoring		1
OCWD-GA6	OCWD	45		30	40	Monitoring		1
OCWD-GA7	OCWD	45		30	40	Monitoring		1,9
OCWD-GA9	OCWD	30		19	29	Monitoring		1
OCWD-HBM5A	OCWD	22		16	21	Monitoring		1
OCWD-HBM6A	OCWD	17		11	16	Monitoring		1
OCWD-I1	OCWD	407		365	400	Injection		4
OCWD-I10	OCWD	330		305	330	Injection		4
OCWD-I11	OCWD	310		200	225	Injection		4
OCWD-I12	OCWD	320		290	310	Injection		4
OCWD-I13	OCWD	315		280	305	Injection		4
OCWD-I14	OCWD	310		265	300	Injection		4
OCWD-I15	OCWD	295		262	285	Injection		4
OCWD-I16	OCWD	308		245	285	Injection		4
OCWD-I17	OCWD	309		250	275	Injection		4
OCWD-I18	OCWD	315		260	275	Injection		4
OCWD-I19	OCWD	292		235	270	Injection		4
OCWD-I2	OCWD	402		350	390	Injection		4
OCWD-I20	OCWD	275		240	265	Injection		4
OCWD-I21	OCWD	265		230	250	Injection		4
OCWD-I22	OCWD	306		250	275	Injection		4
OCWD-I23	OCWD	325		215	255	Injection		4
OCWD-I24	OCWD	720		420	605	Injection	P	4
OCWD-I25	OCWD	662		120	320	Injection		4
OCWD-I26A	OCWD	220		60	195	Injection	S	4
OCWD-I26B	OCWD	430		271	400	Injection		4
OCWD-I26C	OCWD	697		476	660	Injection	P	4
OCWD-I27A	OCWD	171		78	148	Injection	S	4
OCWD-I27B	OCWD	280		211	261	Injection		4
OCWD-I27C	OCWD	592		355	420	Injection	P	4
OCWD-I27M1	OCWD	23		17	22	Monitoring		1
OCWD-I28A	OCWD	163		80	140	Injection	S	4
OCWD-I28B	OCWD	258		185	235	Injection		4
OCWD-I28C	OCWD	698		360	460	Injection	P	4
OCWD-I28M1	OCWD	24		19	24	Monitoring		1
OCWD-I29A	OCWD	156		90	120	Injection	S	4
OCWD-I29B	OCWD	275		200	250	Injection		4
OCWD-I29C	OCWD	515		365	475	Injection	P	4
OCWD-I3	OCWD	380		340	380	Injection		4
OCWD-I30A	OCWD	187		95	160	Injection	S	4
OCWD-I30B	OCWD	322		230	295	Injection		4
OCWD-I30C	OCWD	708		425	650	Injection	P	4
OCWD-I31A	OCWD	192		90	165	Injection	S	4
OCWD-I31B	OCWD	321		235	295	Injection		4
OCWD-I31C	OCWD	688		440	590	Injection	P	4
OCWD-I32A	OCWD	181		90	155	Injection	S	4
OCWD-I32B	OCWD	326		226	295	Injection		4
OCWD-I32C	OCWD	703		425	670	Injection	P	4
OCWD-I33A	OCWD	183		61	156	Injection	S	4
OCWD-I34A	OCWD	160		60	135	Injection	S	4
OCWD-I35A	OCWD	155		60	115	Injection	S	4

List of Wells in OCWD Monitoring Programs

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
OCWD-I36A	OCWD	143		60	110	Injection	S	4
OCWD-I4	OCWD	360		330	355	Injection		4
OCWD-I5	OCWD	365		320	345	Injection		4
OCWD-I6	OCWD	355		315	335	Injection		4
OCWD-I7	OCWD	345		315	336	Injection		4
OCWD-I8	OCWD	335		300	325	Injection		4
OCWD-I9	OCWD	340		300	330	Injection		4
OCWD-KB1	OCWD	200		180	200	Monitoring	S	1
OCWD-LB1	OCWD	177		148	168	Monitoring	S	1
OCWD-LB2	OCWD	65		15	30	Monitoring		1
OCWD-LB3	OCWD	175		145	165	Monitoring	S	1
OCWD-LB4	OCWD	130		78	88	Monitoring	S	1
OCWD-LV1	OCWD	155		135	155	Monitoring	S	1
OCWD-M1	OCWD	123		75	110	Monitoring	S	1,6
OCWD-M10	OCWD	336		280	305	Monitoring	S	1
OCWD-M10A	OCWD	17		11	16	Monitoring		1
OCWD-M11	OCWD	310		260	290	Monitoring	S	1
OCWD-M12	OCWD	400		330	350	Monitoring	S	1
OCWD-M13	OCWD	400		360	395	Monitoring	S	1
OCWD-M13A	OCWD	21		16	21	Monitoring		1
OCWD-M14A	OCWD	360		200	300	Monitoring	S	1
OCWD-M14B	OCWD	360		320	340	Monitoring		1
OCWD-M15A	OCWD	340		195	290	Monitoring	S	1
OCWD-M15B	OCWD	340		310	335	Monitoring		1
OCWD-M16	OCWD	337		295	315	Monitoring	S	1
OCWD-M17A	OCWD	360		330	345	Monitoring	S	1
OCWD-M17B	OCWD	360		210	305	Monitoring		1
OCWD-M18	OCWD	358		310	335	Monitoring		1
OCWD-M19	OCWD	285		215	265	Monitoring	S	1
OCWD-M2	OCWD	162		85	150	Monitoring	S	1,6
OCWD-M20	OCWD	278		255	270	Monitoring	S	1
OCWD-M21	OCWD	355		320	340	Monitoring	S	1
OCWD-M22	OCWD	348		230	270	Monitoring	S	1
OCWD-M23A	OCWD	337		190	260	Monitoring		1
OCWD-M23B	OCWD	337		295	320	Monitoring		1
OCWD-M24	OCWD	330		290	310	Monitoring	S	1
OCWD-M25	OCWD	200		65	185	Monitoring	S	1,6
OCWD-M26	OCWD	151		70	135	Monitoring	S	1,6,10
OCWD-M26A	OCWD	16		11	16	Monitoring		1,6
OCWD-M27	OCWD	127		60	110	Monitoring	S	1,6
OCWD-M27A	OCWD	22		11	16	Monitoring		1,6
OCWD-M28	OCWD	161		80	145	Monitoring	S	1,6
OCWD-M2A	OCWD	25		17	22	Monitoring		1
OCWD-M30	OCWD	128		90	110	Monitoring	S	1,6
OCWD-M31	OCWD	180		82	162	Monitoring	S	1,6
OCWD-M36	OCWD	340		290	300	Monitoring	S	1,6
OCWD-M37	OCWD	368		338	348	Monitoring	S	1,6
OCWD-M38	OCWD	700		516	526	Monitoring	S/P	1,6
OCWD-M39	OCWD	622		250	270	Monitoring	P	1,6
OCWD-M4	OCWD	352		295	330	Monitoring	S	1,6
OCWD-M40	OCWD	900		330	520	Monitoring	S/P	1,6
OCWD-M41	OCWD	450		370	390	Monitoring	S/P	1,6
OCWD-M42	OCWD	645		608	628	Monitoring	S/P	1,6
OCWD-M43	OCWD	695		520	540	Monitoring	P	1,6
OCWD-M44	OCWD	502		295	305	Monitoring	S/P	1,6
OCWD-M44A	OCWD	125		100	125	Monitoring		1,6
OCWD-M45	OCWD	1014		780	790	Monitoring	S/P	1
OCWD-M46	OCWD	1035		890	910	Monitoring	P	1
OCWD-M46A	OCWD	391		350	370	Monitoring		1
OCWD-M47	OCWD	1010		940	960	Monitoring	P	1
OCWD-M48	OCWD	505		470	480	Monitoring	S/P	1,6
OCWD-M49A	OCWD	24		16	21	Monitoring		1,6
OCWD-M49B	OCWD	85		56	81	Monitoring		1,6
OCWD-M5	OCWD	325		285	305	Monitoring	S	1,6
OCWD-M50	OCWD	25		16	21	Monitoring		1,6
OCWD-M51A	OCWD	43		28	38	Monitoring		1,6
OCWD-M51B	OCWD	130		75	105	Monitoring		1,6

List of Wells in OCWD Monitoring Programs

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
OCWD-M52A	OCWD	61		46	56	Monitoring		1,6
OCWD-M52B	OCWD	150		120	140	Monitoring		1,6
OCWD-M52C	OCWD	237		210	230	Monitoring	P	1,6
OCWD-M52D	OCWD	460		330	350	Monitoring	P	1,6
OCWD-M53A	OCWD	38		22	32	Monitoring		1,6
OCWD-M53B	OCWD	132		115	125	Monitoring	S	1,6
OCWD-M53C	OCWD	229		208	218	Monitoring		1,6
OCWD-M54B	OCWD	150		105	125	Monitoring		1,6
OCWD-M6A	OCWD	305		260	285	Monitoring	S	1,6
OCWD-M6B	OCWD	305		185	235	Monitoring		1,6
OCWD-M7A	OCWD	293		190	220	Monitoring	S	1,6
OCWD-M7B	OCWD	293		240	260	Monitoring		1,6
OCWD-M8	OCWD	346		275	310	Monitoring	S	1,6
OCWD-M9	OCWD	311		250	295	Monitoring	S	1,6
OCWD-MRSH	OCWD	540		199	219	Monitoring	P	1,6
OCWD-P1	OCWD	197		64	179	Monitoring	S	1,6
OCWD-P10	OCWD	150		90	130	Monitoring	S	1,6
OCWD-P2	OCWD	186		56	174	Monitoring	S	1
OCWD-P3	OCWD	181		66	166	Monitoring	S	1,6
OCWD-P4	OCWD	163		70	150	Monitoring	S	1,6
OCWD-P6	OCWD	178		85	150	Monitoring	S	1,6
OCWD-P7	OCWD	149		80	135	Monitoring	S	1,6
OCWD-PD3A	OCWD	11		4	9	Monitoring		1
OCWD-PD3B	OCWD	22		15	20	Monitoring		1
OCWD-PD6A	OCWD	10		3	8	Monitoring		1
OCWD-PD6B	OCWD	22		15	20	Monitoring		1
OCWD-PDE4	OCWD	0		30	213	Monitoring		1
OCWD-PDHQ	OCWD	180		100	180	Other Active Production		2
OCWD-PZ6	OCWD	32		10	30	Monitoring		1
OCWD-PZ8	OCWD	32		10	30	Monitoring		1
OCWD-RVW1	OCWD	80		67	77	Monitoring	S	1
OCWD-RVW1A	OCWD	50		39	49	Monitoring		1
OCWD-SA22R	OCWD	350		310	330	Monitoring	S/P	1,6
OCWD-T2	OCWD	380		300	360	Monitoring	S/P	1,6
OCWD-T3	OCWD	180		110	170	Monitoring	S	1,6
OCWD-T4	OCWD	178		68	168	Monitoring	S	1,6
OCWD-T5	OCWD	396		285	295	Monitoring	S	1,6
OCWD-W1	OCWD	398		0	0	Monitoring		1
OCWD-YLR1	OCWD	51		35	40	Monitoring	S	1
OCWD-YLR2	OCWD	51		32	37	Monitoring	S	1
OCWD-YLR3	OCWD	51		31	36	Monitoring	S	1
OM-1	OCWD	245		217	235	Monitoring		1
OM-2	OCWD	250		211	219	Monitoring		1
OM-2A	OCWD	135		118	125	Monitoring	S	1
OM-4	OCWD	253		221	230	Monitoring		1
OM-4A	OCWD	122		112	117	Monitoring	S	1
OM-6	OCWD	251		196	204	Monitoring		1
OM-8	OCWD	320		285	293	Monitoring		1
OM-8A	OCWD	180		156	164	Monitoring	S	1
SAM-1	OCWD	215		191	196	Monitoring	S	1,9
SAM-2	OCWD	220		204	214	Monitoring	S	1,9
SAM-3	OCWD	225		198	208	Monitoring	S	1,9
SAM-4	OCWD	210		185	195	Monitoring	S	1,9
SAM-5	OCWD	205		182	192	Monitoring	S	1,9
SAM-6	OCWD	205		176	186	Monitoring	S	1,9
SAR-1	OCWD	1530	MP1	150	170	Multiport Monitoring	S/P/D	1,10
SAR-1	OCWD	1530	MP2	290	300	Multiport Monitoring	S/P/D	1,10
SAR-1	OCWD	1530	MP3	320	330	Multiport Monitoring	S/P/D	1,10
SAR-1	OCWD	1530	MP4	360	370	Multiport Monitoring	S/P/D	1,10
SAR-1	OCWD	1530	MP5	510	530	Multiport Monitoring	S/P/D	1,10
SAR-1	OCWD	1530	MP6	580	590	Multiport Monitoring	S/P/D	1,10
SAR-1	OCWD	1530	MP7	820	840	Multiport Monitoring	S/P/D	1,10
SAR-1	OCWD	1530	MP8	890	900	Multiport Monitoring	S/P/D	1,10
SAR-1	OCWD	1530	MP9	910	920	Multiport Monitoring	S/P/D	1,10
SAR-1	OCWD	1530	MP10	1010	1020	Multiport Monitoring	S/P/D	1,10
SAR-1	OCWD	1530	MP11	1110	1120	Multiport Monitoring	S/P/D	1,10
SAR-1	OCWD	1530	MP12	1280	1290	Multiport Monitoring	S/P/D	1,10

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
SAR-1	OCWD	1530	MP13	1370	1380	Multiport Monitoring	S/P/D	1,10
SAR-1	OCWD	1530	MP14	1441	1451	Multiport Monitoring	S/P/D	1,10
SAR-10	OCWD	1150		1100	1115	Monitoring	P	1,5
SAR-11	OCWD	1214		1100	1110	Monitoring	P	1,5
SAR-2	OCWD	1520	MP1	140	150	Multiport Monitoring	S/P/D	1
SAR-2	OCWD	1520	MP2	270	280	Multiport Monitoring	S/P/D	1
SAR-2	OCWD	1520	MP3	310	320	Multiport Monitoring	S/P/D	1
SAR-2	OCWD	1520	MP4	470	480	Multiport Monitoring	S/P/D	1
SAR-2	OCWD	1520	MP5	610	620	Multiport Monitoring	S/P/D	1
SAR-2	OCWD	1520	MP6	740	750	Multiport Monitoring	S/P/D	1
SAR-2	OCWD	1520	MP7	880	890	Multiport Monitoring	S/P/D	1
SAR-2	OCWD	1520	MP8	980	990	Multiport Monitoring	S/P/D	1
SAR-2	OCWD	1520	MP9	1020	1030	Multiport Monitoring	S/P/D	1
SAR-2	OCWD	1520	MP10	1100	1110	Multiport Monitoring	S/P/D	1
SAR-2	OCWD	1520	MP11	1230	1240	Multiport Monitoring	S/P/D	1
SAR-2	OCWD	1520	MP12	1350	1360	Multiport Monitoring	S/P/D	1
SAR-3	OCWD	1494	MP1	160	170	Multiport Monitoring	S/P/D	1,10
SAR-3	OCWD	1494	MP2	230	240	Multiport Monitoring	S/P/D	1,10
SAR-3	OCWD	1494	MP3	410	420	Multiport Monitoring	S/P/D	1,10
SAR-3	OCWD	1494	MP4	510	520	Multiport Monitoring	S/P/D	1,10
SAR-3	OCWD	1494	MP5	640	650	Multiport Monitoring	S/P/D	1,10
SAR-3	OCWD	1494	MP6	770	780	Multiport Monitoring	S/P/D	1,10
SAR-3	OCWD	1494	MP7	950	960	Multiport Monitoring	S/P/D	1,10
SAR-3	OCWD	1494	MP8	1070	1080	Multiport Monitoring	S/P/D	1,10
SAR-3	OCWD	1494	MP9	1195	1205	Multiport Monitoring	S/P/D	1,10
SAR-3	OCWD	1494	MP10	1265	1275	Multiport Monitoring	S/P/D	1,10
SAR-3	OCWD	1494	MP11	1390	1400	Multiport Monitoring	S/P/D	1,10
SAR-4	OCWD	1520	MP1	115	125	Multiport Monitoring	S/P/D	1
SAR-4	OCWD	1520	MP2	320	330	Multiport Monitoring	S/P/D	1
SAR-4	OCWD	1520	MP3	470	480	Multiport Monitoring	S/P/D	1
SAR-4	OCWD	1520	MP4	590	600	Multiport Monitoring	S/P/D	1
SAR-4	OCWD	1520	MP5	730	740	Multiport Monitoring	S/P/D	1
SAR-4	OCWD	1520	MP6	860	870	Multiport Monitoring	S/P/D	1
SAR-4	OCWD	1520	MP7	970	980	Multiport Monitoring	S/P/D	1
SAR-4	OCWD	1520	MP8	1060	1070	Multiport Monitoring	S/P/D	1
SAR-4	OCWD	1520	MP9	1160	1170	Multiport Monitoring	S/P/D	1
SAR-4	OCWD	1520	MP10	1395	1405	Multiport Monitoring	S/P/D	1
SAR-5	OCWD	1964	MP1	80	90	Multiport Monitoring	S/P/D	1
SAR-5	OCWD	1964	MP2	170	180	Multiport Monitoring	S/P/D	1
SAR-5	OCWD	1964	MP3	360	370	Multiport Monitoring	S/P/D	1
SAR-5	OCWD	1964	MP4	616	626	Multiport Monitoring	S/P/D	1
SAR-5	OCWD	1964	MP5	760	770	Multiport Monitoring	S/P/D	1
SAR-5	OCWD	1964	MP6	940	950	Multiport Monitoring	S/P/D	1
SAR-5	OCWD	1964	MP7	1080	1090	Multiport Monitoring	S/P/D	1
SAR-5	OCWD	1964	MP8	1190	1200	Multiport Monitoring	S/P/D	1
SAR-5	OCWD	1964	MP9	1290	1300	Multiport Monitoring	S/P/D	1
SAR-5	OCWD	1964	MP10	1540	1550	Multiport Monitoring	S/P/D	1
SAR-5	OCWD	1964	MP11	1730	1740	Multiport Monitoring	S/P/D	1
SAR-5	OCWD	1964	MP12	1820	1830	Multiport Monitoring	S/P/D	1
SAR-6	OCWD	1574	MP1	200	210	Multiport Monitoring	P	1
SAR-6	OCWD	1574	MP2	360	370	Multiport Monitoring	P	1
SAR-6	OCWD	1574	MP3	470	480	Multiport Monitoring	P	1
SAR-6	OCWD	1574	MP4	574	584	Multiport Monitoring	P	1
SAR-6	OCWD	1574	MP5	700	710	Multiport Monitoring	P	1
SAR-6	OCWD	1574	MP6	780	790	Multiport Monitoring	P	1
SAR-6	OCWD	1574	MP7	1080	1090	Multiport Monitoring	P	1
SAR-6	OCWD	1574	MP8	1180	1190	Multiport Monitoring	P	1
SAR-6	OCWD	1574	MP9	1270	1280	Multiport Monitoring	P	1
SAR-6	OCWD	1574	MP10	1500	1510	Multiport Monitoring	P	1
SAR-7	OCWD	1483	MP1	110	120	Multiport Monitoring	S/P	1
SAR-7	OCWD	1483	MP2	170	180	Multiport Monitoring	S/P	1
SAR-7	OCWD	1483	MP3	310	320	Multiport Monitoring	S/P	1
SAR-7	OCWD	1483	MP4	440	450	Multiport Monitoring	S/P	1
SAR-7	OCWD	1483	MP5	604	614	Multiport Monitoring	S/P	1
SAR-7	OCWD	1483	MP6	740	750	Multiport Monitoring	S/P	1
SAR-7	OCWD	1483	MP7	856	866	Multiport Monitoring	S/P	1
SAR-7	OCWD	1483	MP8	1190	1200	Multiport Monitoring	S/P	1

List of Wells in OCWD Monitoring Programs

KEY

Aquifer Zone: S=Shallow Aquifer, P=Principal Aquifer, D= Deep Aquifer

Program: 1) monitoring well, 2) production well, 3) irrigation or industrial well, 4) injection well, 5) Mid-Basin Injection well, 6) seawater intrusion monitoring well, 7) well monitored by OCWD for Title 22 compliance, 8) North Basin Groundwater Protection Program wells, 9) South Basin Groundwater Protection Program wells, 10) wells in CASGEM monitoring program

Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
SAR-7	OCWD	1483	MP9	1350	1360	Multiport Monitoring	S/P	1
SAR-8	OCWD	267	MP1	34	44	Multiport Monitoring	S	1
SAR-8	OCWD	267	MP2	84	94	Multiport Monitoring	S	1
SAR-8	OCWD	267	MP3	150	160	Multiport Monitoring	S	1
SAR-9	OCWD	2008	MP1	148	160	Multiport Monitoring	S/P/D	1,10
SAR-9	OCWD	2008	MP2	236	248	Multiport Monitoring	S/P/D	1,10
SAR-9	OCWD	2008	MP3	406	418	Multiport Monitoring	S/P/D	1,10
SAR-9	OCWD	2008	MP4	488	500	Multiport Monitoring	S/P/D	1,10
SAR-9	OCWD	2008	MP5	604	616	Multiport Monitoring	S/P/D	1,10
SAR-9	OCWD	2008	MP6	724	736	Multiport Monitoring	S/P/D	1,10
SAR-9	OCWD	2008	MP7	872	884	Multiport Monitoring	S/P/D	1,10
SAR-9	OCWD	2008	MP8	1068	1080	Multiport Monitoring	S/P/D	1,10
SAR-9	OCWD	2008	MP9	1258	1270	Multiport Monitoring	S/P/D	1,10
SAR-9	OCWD	2008	MP10	1473	1484	Multiport Monitoring	S/P/D	1,10
SAR-9	OCWD	2008	MP11	1567	1578	Multiport Monitoring	S/P/D	1,10
SAR-9	OCWD	2008	MP12	1719	1730	Multiport Monitoring	S/P/D	1,10
SAR-9	OCWD	2008	MP13	1815	1826	Multiport Monitoring	S/P/D	1,10
SAR-9	OCWD	2008	MP14	1889	1900	Multiport Monitoring	S/P/D	1,10
SBM-1	OCWD	2023	MP1	74	84	Multiport Monitoring	S/P/D	1,6,10
SBM-1	OCWD	2023	MP2	144	154	Multiport Monitoring	S/P/D	1,6,10
SBM-1	OCWD	2023	MP3	240	250	Multiport Monitoring	S/P/D	1,6,10
SBM-1	OCWD	2023	MP4	370	380	Multiport Monitoring	S/P/D	1,6,10
SBM-1	OCWD	2023	MP5	510	520	Multiport Monitoring	S/P/D	1,6,10
SBM-1	OCWD	2023	MP6	696	706	Multiport Monitoring	S/P/D	1,6,10
SBM-1	OCWD	2023	MP7	910	920	Multiport Monitoring	S/P/D	1,6,10
SBM-1	OCWD	2023	MP8	1250	1260	Multiport Monitoring	S/P/D	1,6,10
SC-1	OCWD	720	MP1	44	54	Multiport Monitoring	S/P	1
SC-1	OCWD	720	MP2	90	100	Multiport Monitoring	S/P	1
SC-1	OCWD	720	MP3	150	160	Multiport Monitoring	S/P	1
SC-1	OCWD	720	MP4	194	204	Multiport Monitoring	S/P	1
SC-1	OCWD	720	MP5	294	304	Multiport Monitoring	S/P	1
SC-1	OCWD	720	MP6	390	400	Multiport Monitoring	S/P	1
SC-2	OCWD	879	MP1	46	56	Multiport Monitoring	S/P	1
SC-2	OCWD	879	MP2	94	104	Multiport Monitoring	S/P	1
SC-2	OCWD	879	MP3	146	156	Multiport Monitoring	S/P	1
SC-2	OCWD	879	MP4	190	200	Multiport Monitoring	S/P	1
SC-2	OCWD	879	MP5	248	258	Multiport Monitoring	S/P	1
SC-2	OCWD	879	MP6	300	310	Multiport Monitoring	S/P	1
SC-3	OCWD	1500	MP1	224	234	Multiport Monitoring	P/D	1
SC-3	OCWD	1500	MP2	410	420	Multiport Monitoring	P/D	1
SC-3	OCWD	1500	MP3	576	586	Multiport Monitoring	P/D	1
SC-3	OCWD	1500	MP4	710	720	Multiport Monitoring	P/D	1
SC-3	OCWD	1500	MP5	1018	1028	Multiport Monitoring	P/D	1
SC-3	OCWD	1500	MP6	1150	1160	Multiport Monitoring	P/D	1
SC-3	OCWD	1500	MP7	1230	1240	Multiport Monitoring	P/D	1
SC-3	OCWD	1500	MP8	1370	1380	Multiport Monitoring	P/D	1
SC-3	OCWD	1500	MP9	1460	1470	Multiport Monitoring	P/D	1
SC-4	OCWD	1498	MP1	100	111	Multiport Monitoring	S/P/D	1,10
SC-4	OCWD	1498	MP2	198	209	Multiport Monitoring	S/P/D	1,10
SC-4	OCWD	1498	MP3	268	279	Multiport Monitoring	S/P/D	1,10
SC-4	OCWD	1498	MP4	391	402	Multiport Monitoring	S/P/D	1,10
SC-4	OCWD	1498	MP5	482	493	Multiport Monitoring	S/P/D	1,10
SC-4	OCWD	1498	MP6	572	583	Multiport Monitoring	S/P/D	1,10
SC-4	OCWD	1498	MP7	658	669	Multiport Monitoring	S/P/D	1,10
SC-4	OCWD	1498	MP8	827	838	Multiport Monitoring	S/P/D	1,10
SC-4	OCWD	1498	MP9	1078	1089	Multiport Monitoring	S/P/D	1,10
SC-5	OCWD	1500	MP1	123	133	Multiport Monitoring	S/P/D	1,10
SC-5	OCWD	1500	MP2	196	206	Multiport Monitoring	S/P/D	1,10
SC-5	OCWD	1500	MP3	290	300	Multiport Monitoring	S/P/D	1,10
SC-5	OCWD	1500	MP4	468	478	Multiport Monitoring	S/P/D	1,10
SC-5	OCWD	1500	MP5	667	677	Multiport Monitoring	S/P/D	1,10
SC-5	OCWD	1500	MP6	804	814	Multiport Monitoring	S/P/D	1,10
SC-5	OCWD	1500	MP7	932	942	Multiport Monitoring	S/P/D	1,10
SC-5	OCWD	1500	MP8	1020	1030	Multiport Monitoring	S/P/D	1,10
SC-5	OCWD	1500	MP9	1234	1244	Multiport Monitoring	S/P/D	1,10
SC-5	OCWD	1500	MP10	1426	1436	Multiport Monitoring	S/P/D	1,10
SC-6	OCWD	2213	MP1	90	100	Multiport Monitoring	S/P/D	1

List of Wells in OCWD Monitoring Programs

KEY

Aquifer Zone: S=Shallow Aquifer, P=Principal Aquifer, D= Deep Aquifer

Program: 1) monitoring well, 2) production well, 3) irrigation or industrial well, 4) injection well, 5) Mid-Basin Injection well, 6) seawater intrusion monitoring well, 7) well monitored by OCWD for Title 22 compliance, 8) North Basin Groundwater Protection Program wells, 9) South Basin Groundwater Protection Program wells, 10) wells in CASGEM monitoring program

Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
SC-6	OCWD	2213	MP2	200	210	Multiport Monitoring	S/P/D	1
SC-6	OCWD	2213	MP3	300	310	Multiport Monitoring	S/P/D	1
SC-6	OCWD	2213	MP4	540	550	Multiport Monitoring	S/P/D	1
SC-6	OCWD	2213	MP5	785	795	Multiport Monitoring	S/P/D	1
SC-6	OCWD	2213	MP6	960	970	Multiport Monitoring	S/P/D	1
SC-6	OCWD	2213	MP7	1120	1130	Multiport Monitoring	S/P/D	1
SC-6	OCWD	2213	MP8	1325	1335	Multiport Monitoring	S/P/D	1
SC-6	OCWD	2213	MP9	1460	1470	Multiport Monitoring	S/P/D	1
SC-6	OCWD	2213	MP10	1540	1550	Multiport Monitoring	S/P/D	1
SC-6	OCWD	2213	MP11	1680	1690	Multiport Monitoring	S/P/D	1
SC-6	OCWD	2213	MP12	1890	1900	Multiport Monitoring	S/P/D	1
SC-6	OCWD	2213	MP13	2025	2035	Multiport Monitoring	S/P/D	1
SC-6	OCWD	2213	MP14	2115	2125	Multiport Monitoring	S/P/D	1
SCS-1	OCWD	313	MP1	24	34	Multiport Monitoring	S/P	1
SCS-1	OCWD	313	MP2	90	100	Multiport Monitoring	S/P	1
SCS-1	OCWD	313	MP3	142	152	Multiport Monitoring	S/P	1
SCS-1	OCWD	313	MP4	178	188	Multiport Monitoring	S/P	1
SCS-1	OCWD	313	MP5	220	230	Multiport Monitoring	S/P	1
SCS-1	OCWD	313	MP6	295	305	Multiport Monitoring	S/P	1
SCS-10	OCWD	230		206	216	Monitoring		1
SCS-11	OCWD	405		384	394	Monitoring	S	1
SCS-12	OCWD	405		275	285	Monitoring	S	1
SCS-13	OCWD	200		180	190	Monitoring		1
SCS-2	OCWD	401	MP1	134	145	Multiport Monitoring	S/P	1,10
SCS-2	OCWD	401	MP2	174	185	Multiport Monitoring	S/P	1,10
SCS-2	OCWD	401	MP3	212	223	Multiport Monitoring	S/P	1,10
SCS-2	OCWD	401	MP4	260	270	Multiport Monitoring	S/P	1,10
SCS-2	OCWD	401	MP5	325	335	Multiport Monitoring	S/P	1,10
SCS-3	OCWD	52		31	42	Monitoring		1
SCS-4	OCWD	50		21	32	Monitoring		1
SCS-5	OCWD	51		22	43	Monitoring		1
SCS-6	OCWD	154		147	153	Monitoring	S	1
SCS-7	OCWD	142		125	141	Monitoring	S	1
SCS-8	OCWD	130		108	129	Monitoring	S	1
SCS-9	OCWD	205		153	173	Monitoring	S	1
SCS-B1	OCWD	43		18	43	Monitoring		1
SCS-B2	OCWD	29		19	29	Monitoring		1
SCS-B3	OCWD	26		16	26	Monitoring		1
TIC-67	OCWD	902		245	900	Monitoring	P	1
W-14659	OCWD	27		12	27	Monitoring		1
WBS-2A	OCWD	177	MP1	50	60	Multiport Monitoring	S	1
WBS-2A	OCWD	177	MP2	90	100	Multiport Monitoring	S	1
WBS-2A	OCWD	177	MP3	135	145	Multiport Monitoring	S	1
WBS-3R	OCWD	256	MP1	75	85	Monitoring	S	1
WBS-3R	OCWD	256	MP2	215	225	Monitoring	S	1
WBS-4	OCWD	295		55	220	Multiport Monitoring	S/P	1,10
WMM-1	OCWD	2015	MP1	109	119	Multiport Monitoring	S/P/D	1
WMM-1	OCWD	2015	MP2	359	369	Multiport Monitoring	S/P/D	1
WMM-1	OCWD	2015	MP3	480	490	Multiport Monitoring	S/P/D	1
WMM-1	OCWD	2015	MP4	600	610	Multiport Monitoring	S/P/D	1
WMM-1	OCWD	2015	MP5	740	750	Multiport Monitoring	S/P/D	1
WMM-1	OCWD	2015	MP6	810	820	Multiport Monitoring	S/P/D	1
WMM-1	OCWD	2015	MP7	889	899	Multiport Monitoring	S/P/D	1
WMM-1	OCWD	2015	MP8	980	990	Multiport Monitoring	S/P/D	1
WMM-1	OCWD	2015	MP9	1060	1070	Multiport Monitoring	S/P/D	1
WMM-1	OCWD	2015	MP10	1210	1220	Multiport Monitoring	S/P/D	1
WMM-1	OCWD	2015	MP11	1309	1319	Multiport Monitoring	S/P/D	1
WMM-1	OCWD	2015	MP12	1364	1374	Multiport Monitoring	S/P/D	1
WMM-1	OCWD	2015	MP13	1430	1440	Multiport Monitoring	S/P/D	1
WMM-1	OCWD	2015	MP14	1565	1575	Multiport Monitoring	S/P/D	1
WMM-1	OCWD	2015	MP15	1619	1629	Multiport Monitoring	S/P/D	1
WMM-1	OCWD	2015	MP16	1740	1750	Multiport Monitoring	S/P/D	1
WMM-1	OCWD	2015	MP17	1800	1810	Multiport Monitoring	S/P/D	1
WMM-1	OCWD	2015	MP18	1940	1950	Multiport Monitoring	S/P/D	1
O-1	ORANGE	500		236	416	Inactive Production		2
O-15	ORANGE	506		200	492	Active Large Production	P	2,7
O-18	ORANGE	714		372	574	Active Large Production	P	2,7

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
O-19	ORANGE	1060		444	1014	Active Large Production	P	2,7
O-20	ORANGE	1210		400	1130	Active Large Production	P	2,7
O-21	ORANGE	1366		482	1252	Active Large Production	P	2,7
O-22	ORANGE	1282		342	802	Active Large Production	P	2,7
O-23	ORANGE	958		370	640	Active Large Production	P	2,7
O-24	ORANGE	826		420	800	Active Large Production	P	2,7
O-25	ORANGE	993		430	885	Active Large Production	P	2,7
O-26	ORANGE	1210		460	1170	Active Large Production	P	2,7
O-27	ORANGE	960		425	890	Inactive Production		2,7
O-3	ORANGE	216		207	216	Active Large Production		2,7
O-4	ORANGE	726		280	711	Active Large Production	P	2,7
O-5	ORANGE	751		156	723	Active Large Production		2,7
O-8	ORANGE	870		570	850	Active Large Production	P	2,7
O-9	ORANGE	910		546	888	Active Large Production	P	2,7
OASI-SA	ORANGE COAST PLUMBING	326		226	288	Inactive Production		2
EMA-AH5	ORANGE COUNTY	84		0	0	Other Active Production		2,3
TIC-73	ORANGE COUNTY	926		324	915	Inactive Production		2,3
CEM2-A	ORANGE COUNTY CEMETERY DIST.	401		0	0	Other Active Production		2,3,8
NVLW-SB	ORANGE COUNTY PRODUCTIONUCE LLC	430		200	420	Other Active Production		2,3
RUIZ-5A1	ORANGE COUNTY PRODUCTIONUCE LLC	0		0	0	Other Active Production		2,3
RUIZ-5A3	ORANGE COUNTY PRODUCTIONUCE LLC	425		210	390	Other Active Production		2,3
RUIZ-6F1	ORANGE COUNTY PRODUCTIONUCE LLC	426		210	390	Other Active Production		2,3,6
OWOD-GG	ORANGEWOOD ACADEMY	180		159	179	Other Active Production	S	2,3
PSCI-AM14	PACIFIC SCIENTIFIC	118		93	113	Other Active Production		2
PSCI-AM21	PACIFIC SCIENTIFIC	116		95	116	Other Active Production		2
PSCI-AM22	PACIFIC SCIENTIFIC	119		99	119	Other Active Production		2
PSCI-AM25	PACIFIC SCIENTIFIC	115		69	114	Other Active Production		2
PSCI-AM26	PACIFIC SCIENTIFIC	120		69	114	Other Active Production		2
PSCI-AM31	PACIFIC SCIENTIFIC	114		68	113	Other Active Production		2
PSCI-AM32R	PACIFIC SCIENTIFIC	116		70	115	Monitoring		1
PSCI-AM33	PACIFIC SCIENTIFIC	115		7	114	Other Active Production		2
PSCI-AM34	PACIFIC SCIENTIFIC	114		102	112	Other Active Production		2
PSCI-AM35	PACIFIC SCIENTIFIC	115		7	112	Other Active Production		2
PSCI-AM36	PACIFIC SCIENTIFIC	115		9	114	Other Active Production		2
PSCI-AM37	PACIFIC SCIENTIFIC	114		102	112	Or Active Production		2
PSCI-AM38	PACIFIC SCIENTIFIC	114		69	113	Or Active Production		2
PSCI-AM39	PACIFIC SCIENTIFIC	115		69	113	Or Active Production		2
PSCI-AM40	PACIFIC SCIENTIFIC	127		109	124	Monitoring		1
PSCI-AM41	PACIFIC SCIENTIFIC	116		109	114	Monitoring		1
PSCI-AM6	PACIFIC SCIENTIFIC	115		103	113	Monitoring		1
PSCI-AT1	PACIFIC SCIENTIFIC	146		129	144	Monitoring		1
PAGE-F	PAGE AVE. MUTUAL WATER CO.	378		186	364	Active Small Production		2,7,8
PLMW-A	PALM MUTUAL WATER CO.	280		0	0	Inactive Production		2,3
PLMD-HB	PALMDALE-CEDAR WATER ASSOC.	180		0	0	Inactive Production		2
PUSD-LB	PARAMOUNT UNIFIED SCHOOL DIST.	155		126	139	Other Active Production		2
W-3767	PARK STANTON PLACE	131		0	0	Inactive Production		2,3
PWC-29H	PARK WATER CO.	462		388	409	Inactive Production		2
PWC-6G	PARK WATER CO.	854		421	807	Other Active Production		2
W-15063	PARKVIEW MUTUAL WATER CO.	250		0	0	Inactive Production		2
PAUL-COS	PAULARINO WATER ASSOC.	450		0	0	Inactive Production		2
PINE-O	PINE WATER CO.	0		0	0	Inactive Production		2
PIRT-HB	PIRATE WATER CO.	156		0	0	Other Active Production		2,6
W-17527	POWERLINE OIL CO.	0		0	0	Inactive Production		2,3
SNDR-SA	PRIVATE	1030		930	990	Other Active Production	D	2,3,9
SHAF-WM	PRIVATE	125		0	0	Other Active Production		2
ANDR-A	PRIVATE	82		0	0	Other Active Production		2
ANNA-O	PRIVATE	0		0	0	Other Active Production		2
ARAK-WM	PRIVATE	0		0	0	Other Active Production		2
BLSO-SA	PRIVATE	100		0	0	Inactive Production		2,3
BOIS-A	PRIVATE	235		0	0	Other Active Production		2
BSBY-GG	PRIVATE	148		0	0	Other Active Production		2
BXBY-SB	PRIVATE	305		150	290	Other Active Production		2,3
CALL-FV	PRIVATE	214		0	0	Other Active Production		2,3
CO-8	PRIVATE	221		0	0	Other Active Production		2,3
CO-9	PRIVATE	250		144	234	Other Active Production		2,3
COOP-SA	PRIVATE	138		0	0	Inactive Production		2
COUR-HBB2	PRIVATE	138		0	0	Inactive Production		2

List of Wells in OCWD Monitoring Programs

KEY

Aquifer Zone: S=Shallow Aquifer, P=Principal Aquifer, D= Deep Aquifer

Program: 1) monitoring well, 2) production well, 3) irrigation or industrial well, 4) injection well, 5) Mid-Basin Injection well, 6) seawater intrusion monitoring well, 7) well monitored by OCWD for Title 22 compliance, 8) North Basin Groundwater Protection Program wells, 9) South Basin Groundwater Protection Program wells, 10) wells in CASGEM monitoring program

Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
COUR-HBB3	PRIVATE	226		120	216	Inactive Production		2,3
CREST-BR	PRIVATE	530		187	523	Other Active Production		2,3
CULBK-CE1	PRIVATE	0		0	0	Other Active Production		2
DAVI-O	PRIVATE	185		0	0	Other Active Production		2
DETT-BP	PRIVATE	0		0	0	Inactive Production		2
DOSS-BP	PRIVATE	0		0	0	Inactive Production		2
ECKH-A	PRIVATE	260		0	0	Or Active Production		2
ENCS-GG	PRIVATE	155		0	0	Inactive Production		2,3
FAVI-C	PRIVATE	130		0	0	Inactive Production		2
GHAV-GG	PRIVATE	200		168	188	Other Active Production	S	2,3
GORD-LW	PRIVATE	0		0	0	Other Active Production		2
GRNT-CE	PRIVATE	0		0	0	Other Active Production		2
HNCK-C	PRIVATE	90		0	0	Inactive Production		2,3
HOWD-A	PRIVATE	217		0	0	Inactive Production		2
HTCH-WM	PRIVATE	120		0	0	Inactive Production		2
HUNTZ-SA	PRIVATE	146		100	145	Other Active Production		2,3
ICHI-HB	PRIVATE	128		0	0	Other Active Production		2
JAME-CO	PRIVATE	376		192	250	Other Active Production		2
KNAS-S	PRIVATE	205		0	0	Other Active Production		2
KUBO-FV	PRIVATE	133		122	132	Other Active Production		2
LCRO-FV	PRIVATE	0		0	0	Other Active Production		2
MCGA-A	PRIVATE	0		0	0	Other Active Production		2
MCGN-BP1	PRIVATE	260		50	255	Other Active Production	S	2
MKSN-WM	PRIVATE	137		127	137	Inactive Production		2
MONITORINGG-O	PRIVATE	480		80	480	Other Active Production		2,3
MONITORINGT-A	PRIVATE	110		0	0	Other Active Production		2
MSER-A	PRIVATE	100		0	0	Other Active Production		2
MSSM-A	PRIVATE	135		0	0	Inactive Production		2
NAKM-A	PRIVATE	120		0	0	Inactive Production		2
NAKT-BP	PRIVATE	110		0	0	Other Active Production		2
NESL-GG	PRIVATE	0		0	0	Other Active Production		2
NORT-A	PRIVATE	0		0	0	Inactive Production		2
NVLW-SB3	PRIVATE	680		0	0	Other Active Production	P	2,3
PEAR-GG	PRIVATE	143		0	0	Inactive Production		2
PEIR-A	PRIVATE	137		0	0	Inactive Production		2
PTCK-SA	PRIVATE	300		0	0	Inactive Production		2,3
PURS-SB	PRIVATE	252		0	0	Other Active Production		2,3,6
RMW-SFS	PRIVATE	540		0	0	Other Active Production		2
RWLM-GG	PRIVATE	132		0	0	Other Active Production		2
SAND-BP	PRIVATE	70		0	0	Inactive Production		2
SANZ-C	PRIVATE	84		76	83	Other Active Production	S	2
SCHN-GG	PRIVATE	144		0	0	Other Active Production		2
SINC-C	PRIVATE	130		0	0	Inactive Production		2
SWAN-C	PRIVATE	185		0	0	Inactive Production		2
TAOR-A	PRIVATE	254		0	0	Inactive Production		2
VGNA-A	PRIVATE	165		0	0	Inactive Production		2,3
W-10699	PRIVATE	141		0	0	Inactive Production		2
W-10894	PRIVATE	365		357	364	Inactive Production		2
W-11104	PRIVATE	320		230	300	Inactive Production		2
W-12745	PRIVATE	270		0	0	Inactive Production		2
W-12753	PRIVATE	250		0	0	Inactive Production		2
W-12791	PRIVATE	80		0	0	Inactive Production		2
W-12819	PRIVATE	0		0	0	Inactive Production		2
W-1311	PRIVATE	345		0	345	Inactive Production		2
W-13112	PRIVATE	935		701	933	Inactive Production		2
W-13118	PRIVATE	600		343	575	Inactive Production		2,3
W-13207	PRIVATE	260		0	0	Inactive Production		2
W-13285	PRIVATE	130		0	0	Inactive Production		2
W-14805	PRIVATE	170		0	0	Inactive Production		2,3
W-15791	PRIVATE	0		0	0	Inactive Production		2,3
W-15793	PRIVATE	0		0	0	Inactive Production		2,3
W-15803	PRIVATE	0		0	0	Inactive Production		2,3
W-15817	PRIVATE	158		0	0	Inactive Production		2
W-15857	PRIVATE	100		0	0	Inactive Production		2
W-15880	PRIVATE	97		0	0	Inactive Production		2,3
W-15962	PRIVATE	450		0	0	Inactive Production		2,3
W-16004	PRIVATE	165		0	0	Inactive Production		2

List of Wells in OCWD Monitoring Programs

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
W-18700	PRIVATE	300		200	300	Other Active Production		2,3
W-19049	PRIVATE	340		60	260	Other Active Production		2,3
W-19051	PRIVATE	430		180	400	Other Active Production		2,3
W-19053	PRIVATE	440		360	440	Other Active Production		2
W-19055	PRIVATE	360		140	360	Other Active Production		2,3
W-20906	PRIVATE	0		0	0	Inactive Production		2,3
W-2268	PRIVATE	226		140	190	Inactive Production	S	2,3
W-2447	PRIVATE	180		157	178	Inactive Production	S	2,3
W-3063	PRIVATE	310		292	300	Inactive Production		2,3
W-376	PRIVATE	370		290	370	Inactive Production		2
W-3765	PRIVATE	0		0	0	Inactive Production		2
W-3795	PRIVATE	0		0	0	Inactive Production		2,3
W-428	PRIVATE	311		0	0	Inactive Production		2,10
W-432	PRIVATE	300		117	137	Inactive Production	S	2,10
W-5304	PRIVATE	0		0	0	Inactive Production		2
W-5306	PRIVATE	292		0	0	Inactive Production		2
W-615	PRIVATE	374		188	364	Inactive Production		2,3
W-6523	PRIVATE	175		0	0	Inactive Production		2
W-702	PRIVATE	324		294	318	Inactive Production		2,3
W-7040	PRIVATE	192		0	0	Inactive Production		2,3
W-7046	PRIVATE	257		0	0	Inactive Production	S	2
W-830	PRIVATE	200		191	200	Inactive Production		2
W-856	PRIVATE	406		271	401	Inactive Production		2
W-860	PRIVATE	348		0	0	Inactive Production		2
W-9172	PRIVATE	98		50	97	Inactive Production		2
W-9180	PRIVATE	200		0	0	Inactive Production		2
WALL-A	PRIVATE	45		16	45	Other Active Production		2
WARN-WHNY	PRIVATE	0		0	0	Inactive Production		2,3
WLMS-A	PRIVATE	0		0	0	Other Active Production		2
WMIL-WM	PRIVATE	300		260	300	Inactive Production		2
WMIL-WM2	PRIVATE	650		150	640	Other Active Production		2
WRNE-WTOM	PRIVATE	0		0	0	Other Active Production		2
NOBL-O	R.J. NOBLE CO.	476		290	474	Other Active Production	P	2
FURU-HB	RAINBOW DISPOSAL	150		0	0	Other Active Production		2,6
W-4152	RAINBOW DISPOSAL	202		142	178	Inactive Production		2
RAY-MW06	RAYON CO.	191		150	190	Monitoring		1
RAY-MW09	RAYON CO.	194		152	192	Monitoring		1
RAY-MW16	RAYON CO.	180		149	179	Monitoring		1
RAY-MW17	RAYON CO.	204		173	193	Monitoring		1
RAY-MW21	RAYON CO.	238		212	232	Monitoring		1
RAY-MW23	RAYON CO.	236		215	235	Monitoring		1
RAY-MW24	RAYON CO.	338		310	330	Monitoring	D	1
RAY-MW25	RAYON CO.	805		449	480	Monitoring	D	1
RAY-MW26	RAYON CO.	805		459	499	Monitoring	P	1
RAY-MW27	RAYON CO.	550		475	515	Monitoring	P	1
RAY-MW28	RAYON CO.	425		335	375	Monitoring	P	1
RAY-MW29	RAYON CO.	266		200	240	Monitoring	P	1
RAY-MW30	RAYON CO.	635		596	616	Monitoring	P	1
RAY-MW31	RAYON CO.	1100		946	996	Monitoring	P	1
RAY-MW32	RAYON CO.	1153		1070	1100	Monitoring	P/D	1
RAY-MW33	RAYON CO.	1080		980	1020	Monitoring	P	1
RAY-MW34A	RAYON CO.	290		220	280	Monitoring		1
RAY-MW34B	RAYON CO.	540		486	536	Monitoring	P	1
RAY-MW34C	RAYON CO.	709		556	576	Monitoring	P	1
RAY-MW35	RAYON CO.	1104		990	1040	Monitoring	P	1
RAY-MW36	RAYON CO.	1030		934	994	Monitoring	P	1
RAY-MW37	RAYON CO.	916		770	820	Monitoring	P	1
RAY-MW39	RAYON CO.	1080		982	1012	Monitoring	P	1
RAY-MW40	RAYON CO.	1040		930	970	Monitoring	P	1
RAY-P07	RAYON CO.	117		108	130	Monitoring	S	1
RAY-P09	RAYON CO.	130		110	130	Monitoring	S	1
RIDG-O	RIDGELINE PERATIONS, INC.	63		55	60	Inactive Production		2
RVGC-SA	RIVER VIEW GOLF	300		156	216	Other Active Production		2,3
ROBSN-YL1	ROBERTSON READY MIX	67		21	65	Inactive Production		2,3
RCA-AR	ROMAN CATHOLIC ARCHBISHOP-LA	0		0	0	Other Active Production		2
W-8813	S FARGO BANK, INC.	13		3	13	Monitoring		1
SAKI-SAJ3	SAKIOKA & SONS, ROY K.	463		0	0	Other Active Production		2,3,9

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
SAKI-SAJ1	SAKIOKA FARMS	187		0	0	Inactive Production		2,9
SA-16	SANTA ANA	978		305	950	Active Large Production	P	2,7
SA-18	SANTA ANA	654		245	623	Active Large Production	P	2,7
SA-20	SANTA ANA	981		390	940	Active Large Production	P	2,7
SA-21	SANTA ANA	986		400	960	Active Large Production	P	2,7
SA-24	SANTA ANA	688		352	654	Active Large Production	P	2,7
SA-26	SANTA ANA	1186		330	1140	Active Large Production	P	2,7,9
SA-27	SANTA ANA	1152		396	1140	Active Large Production	P	2,7
SA-28	SANTA ANA	1200		250	980	Active Large Production	P	2,7
SA-29	SANTA ANA	1090		450	1050	Active Large Production	P	2,7
SA-30	SANTA ANA	989		440	900	Active Large Production	P	2,7
SA-31	SANTA ANA	1310		465	1240	Active Large Production	P	2,7
SA-32	SANTA ANA	1060		307	1030	Inactive Production	P	2,7
SA-33	SANTA ANA	1080		425	935	Active Large Production	P	2,7
SA-34	SANTA ANA	1000		370	520	Active Large Production	P	2,7
SA-35	SANTA ANA	1520		429	1480	Active Large Production	P	2,7
SA-36	SANTA ANA	1510		570	1290	Active Large Production	P	2,7
SA-37	SANTA ANA	1560		348	1480	Active Large Production	P	2,7
SA-38	SANTA ANA	1510		400	1270	Active Large Production	P	2,7
SA-39	SANTA ANA	1350		590	1290	Active Large Production	P	2,7
SA-40	SANTA ANA	1335		550	1305	Active Large Production	P	2,7
SA-41	SANTA ANA	1010		525	978	Active Large Production	P	2,7
SA-7	SANTA ANA	960		426	907	Inactive Production		2
W-12903	SANTA ANA	423		0	0	Inactive Production		2
SACC-SA	SANTA ANA COUNTRY CLUB	536		205	406	Other Active Production	P	2,3,6
SAVI-16	SANTA ANA VALLEY IRRIGATION CO	752		262	825	Inactive Production		2,3
SFE-2	SANTA FE ENERGY CO.	294		0	0	Inactive Production		2,3
SFE-3	SANTA FE ENERGY CO.	205		0	0	Inactive Production		2,3
SFE-4	SANTA FE ENERGY CO.	180		0	0	Inactive Production		2,3
SFS-12	SANTA FE SPRINGS	1556		940	1430	Active Large Production		2
SFS-2	SANTA FE SPRINGS	1250		336	1218	Other Active Production		2,3
SAVS-ASC	SAVANNA SCHOOL DIST.	1301		0	0	Other Active Production		2,3
SB-BC	SEAL BEACH	1050		370	1020	Active Large Production	P	2,7
SB-BEV	SEAL BEACH	920		400	800	Active Large Production	P	2,6,7
SB-LAM	SEAL BEACH	1200		360	1170	Active Large Production	P	2,7
SB-LEI	SEAL BEACH	840		420	840	Active Large Production	P	2,6,7
SID-3	SERRANO WATER DIST.	604		296	584	Active Large Production	P	2,7
SID-4	SERRANO WATER DIST.	650		290	520	Active Large Production	P	2,7
SWD-5	SERRANO WATER DIST.	750		310	720	Active Large Production	P	2,7
SCC-D1	SERVICE CHEMICAL	124		113	123	Monitoring		1,9
W-15094	SHELL OIL CO.	104		58	95	Inactive Production		2
W-15098	SHELL OIL CO.	350		0	0	Inactive Production		2
W-15100	SHELL OIL CO.	115		80	115	Inactive Production		2
W-2507	SHELL OIL CO.	437		230	340	Inactive Production		2
W-2523	SHELL OIL CO.	115		70	100	Inactive Production		2
W-2505	SIGNAL OIL AND GAS	121		76	104	Inactive Production		2,3
W-9170	SIGNAL OIL AND GAS	92		80	90	Inactive Production		2
RODE-A	SILICON SALVAGE	218		178	208	Other Active Production	S	2
SILV-YL	SILVERADO CONSTRUCTORS	78		40	66	Other Active Production	S	2,3,10
W-3783	SO. CA EDISON	458		0	0	Inactive Production		2,9
SMWC-BF4	SOMERSET MUTUAL WATER CO.	1070		0	0	Other Active Production		2
SMWC-BFFWR	SOMERSET MUTUAL WATER CO.	1076		0	0	Active Small Production		2
W-13380	SOMERSET MUTUAL WATER CO.	875		0	0	Inactive Production		2
FOND-A	SOURCE REFRIGERATION	250		0	0	Inactive Production		2
MIYA-BP	SOURN CA EDISON	400		0	0	Inactive Production		2,3
SCE-DASUB	SOURN CA EDISON	0		0	0	Other Active Production		2
SCE-LBDM	SOURN CA EDISON	366		100	347	Inactive Production		2,3
SCE-LBSG	SOURN CA EDISON	340		190	340	Inactive Production		2,3
SCE-YLCS	SOURN CA EDISON	104		5	103	Inactive Production	S	2,3,10
TIC-127	SOURN CA EDISON	134		0	0	Monitoring	S	1
TIC-140	SOURN CA EDISON	787		0	0	Monitoring		1
W-13195	SOURN CA EDISON	527		0	0	Inactive Production		2,3
W-15807	SOURN CA EDISON	150		0	0	Inactive Production		2,3
W-15874	SOURN CA EDISON	188		0	0	Inactive Production		2
SCGC-I	SOURN CA GAS CO.	300		0	0	Other Active Production		2,3
SCGC-O	SOURN CA GAS CO.	405		0	0	Other Active Production		2,3
W-11198	SOURN SERVICE CO., LTD.	952		716	948	Other Active Production		2,3

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Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
SCSH-SA1	SOUTH COAST SHORE HOA	450		280	430	Other Active Production		2,3
SMID-D4	SOUTH MIDWAY CITY WATER CO.	142		0	0	Inactive Production		2
SMID-D5	SOUTH MIDWAY CITY WATER CO.	630		300	600	Active Small Production		2,7
SPRK-SA	SPARKLETTS DRINKING WATER CORP	246		154	212	Other Active Production		2,3
W-8292	SPRAYON PRODUCTIONUCTS	105		80	98	Monitoring		1
W-8294	SPRAYON PRODUCTIONUCTS	101		80	100	Monitoring		1
W-8296	SPRAYON PRODUCTIONUCTS	99		70	90	Monitoring		1
W-3801	STATE OF CA	725		254	407	Inactive Production		2,3
STEP-A	STEPAN CO.	275		210	275	Other Active Production		2,3,8
SWS-26B7	SUBURBAN WATER SYSTEMS	820		0	0	Inactive Production		2,3
SWS-409W3	SUBURBAN WATER SYSTEMS	1460		540	1420	Active Large Production		2
SWS-410W1	SUBURBAN WATER SYSTEMS	1312		617	1237	Other Active Production		2
ANGS-HBM3	TERMO PETROLEUM	1510		146	1440	Multiport Monitoring		1
TEX-W1	TEXACO, INC.	30		5	30	Monitoring		1
W-8805	TEXACO, INC.	45		15	45	Monitoring		1
W-8807	TEXACO, INC.	45		15	45	Monitoring		1
W-8809	TEXACO, INC.	45		15	45	Monitoring		1
W-8811	TEXACO, INC.	45		15	45	Monitoring		1
W-8815	TEXACO, INC.	35		25	35	Monitoring		1
W-18289	TOSCO MARKETING CO.	150		120	150	Monitoring		1
W-18291	TOSCO MARKETING CO.	140		105	140	Monitoring		1
W-18293	TOSCO MARKETING CO.	140		105	140	Monitoring		1
T868-S1	TRACT 868 MUTUAL WATER CO.	200		0	0	Inactive Production		2
T868-S2	TRACT 868 MUTUAL WATER CO.	0		0	0	Inactive Production		2
TREE-SA	TREESWEET PRODUCTIONUCT CO.	416		150	398	Inactive Production		2,3
TLLC-F2	TRUE LOVE LURAN CHURCH	350		190	350	Other Active Production		2,3,8
T-17S1	TUSTIN	375		200	311	Inactive Production		2
T-17S2	TUSTIN	1003		310	490	Inactive Production		2
T-17S4	TUSTIN	520		200	480	Active Large Production	P	2,7
T-BENE	TUSTIN	627		290	590	Inactive Production	P	2
T-COLU	TUSTIN	1470		560	1160	Active Large Production	P	2,7
T-ED	TUSTIN	1492		500	840	Inactive Production		2,7
T-LIVI	TUSTIN	617		300	617	Inactive Production		2
T-MS3	TUSTIN	630		300	630	Active Large Production	P	2,7
T-MS4	TUSTIN	1180		330	880	Active Large Production	P	2,7
T-NEWP	TUSTIN	375		234	267	Active Large Production	S	2,7
T-PANK	TUSTIN	614		323	614	Inactive Production	P	2,9
T-PAS	TUSTIN	1260		440	1225	Active Large Production	P	2,7
T-PROS	TUSTIN	630		270	630	Active Large Production	P	2,7
T-TUST	TUSTIN	827		306	776	Active Large Production	P	2,7
T-VNBG	TUSTIN	1129		480	900	Active Large Production	P	2,7
T-WALN	TUSTIN	1191		397	995	Active Large Production	P	2,7,9
T-YORB	TUSTIN	863		385	850	Inactive Production	P	2
USGS-NAWQA1	U.S. GEOLOGICAL SURVEY	24		14	24	Monitoring		1
USGS-NAWQA10	U.S. GEOLOGICAL SURVEY	24		14	19	Monitoring		1
USGS-NAWQA11	U.S. GEOLOGICAL SURVEY	49		39	44	Monitoring		1
USGS-NAWQA12	U.S. GEOLOGICAL SURVEY	24		14	19	Monitoring		1
USGS-NAWQA13	U.S. GEOLOGICAL SURVEY	34		24	29	Monitoring		1
USGS-NAWQA14	U.S. GEOLOGICAL SURVEY	74		69	74	Monitoring		1
USGS-NAWQA15	U.S. GEOLOGICAL SURVEY	39		29	34	Monitoring		1
USGS-NAWQA16	U.S. GEOLOGICAL SURVEY	44		34	39	Monitoring		1
USGS-NAWQA17	U.S. GEOLOGICAL SURVEY	19		9	14	Monitoring		1
USGS-NAWQA18	U.S. GEOLOGICAL SURVEY	29		19	24	Monitoring		1
USGS-NAWQA19	U.S. GEOLOGICAL SURVEY	19		9	14	Monitoring		1
USGS-NAWQA2	U.S. GEOLOGICAL SURVEY	21		10	15	Monitoring		1
USGS-NAWQA20	U.S. GEOLOGICAL SURVEY	0		14	19	Monitoring		1
USGS-NAWQA21	U.S. GEOLOGICAL SURVEY	24		14	19	Monitoring		1
USGS-NAWQA22	U.S. GEOLOGICAL SURVEY	144		134	139	Monitoring		1
USGS-NAWQA23	U.S. GEOLOGICAL SURVEY	34		24	29	Monitoring		1
USGS-NAWQA24	U.S. GEOLOGICAL SURVEY	49		34	39	Monitoring		1
USGS-NAWQA25	U.S. GEOLOGICAL SURVEY	19		9	19	Monitoring		1
USGS-NAWQA26	U.S. GEOLOGICAL SURVEY	29		19	24	Monitoring		1
USGS-NAWQA27	U.S. GEOLOGICAL SURVEY	19		9	19	Monitoring		1
USGS-NAWQA28	U.S. GEOLOGICAL SURVEY	19		9	19	Monitoring		1
USGS-NAWQA29	U.S. GEOLOGICAL SURVEY	19		9	19	Monitoring		1
USGS-NAWQA3	U.S. GEOLOGICAL SURVEY	21		12	17	Monitoring		1
USGS-NAWQA30	U.S. GEOLOGICAL SURVEY	19		9	19	Monitoring		1

List of Wells in OCWD Monitoring Programs

KEY

Aquifer Zone: S=Shallow Aquifer, P=Principal Aquifer, D= Deep Aquifer

Program: 1) monitoring well, 2) production well, 3) irrigation or industrial well, 4) injection well, 5) Mid-Basin Injection well, 6) seawater intrusion monitoring well, 7) well monitored by OCWD for Title 22 compliance, 8) North Basin Groundwater Protection Program wells, 9) South Basin Groundwater Protection Program wells, 10) wells in CASGEM monitoring program

Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
USGS-NAWQA31	U.S. GEOLOGICAL SURVEY	24		14	19	Monitoring		1
USGS-NAWQA4	U.S. GEOLOGICAL SURVEY	24		14	19	Monitoring		1
USGS-NAWQA5	U.S. GEOLOGICAL SURVEY	20		10	15	Monitoring		1
USGS-NAWQA5	U.S. GEOLOGICAL SURVEY	20		10	15	Monitoring		9
USGS-NAWQA6	U.S. GEOLOGICAL SURVEY	20		10	15	Monitoring		1
USGS-NAWQA7	U.S. GEOLOGICAL SURVEY	29		19	24	Monitoring		1
USGS-NAWQA8	U.S. GEOLOGICAL SURVEY	23		13	18	Monitoring		1
USGS-NAWQA9	U.S. GEOLOGICAL SURVEY	29		19	24	Monitoring		1
UOC-B8	UNION OIL CO.	79		60	75	Inactive Production		2,3
UOC-B9	UNION OIL CO.	79		60	75	Inactive Production		2,3
COS-PLAZ	UNKNOWN	779		0	0	Monitoring	P	1
W-14764	UNKNOWN	0		0	0	Inactive Production		2
W-18102	UNKNOWN	130		110	130	Monitoring		1
W-3629	UNKNOWN	162		0	0	Inactive Production		2,3
W-8298	UNKNOWN	115		0	0	Monitoring		1
W-8300	UNKNOWN	85		0	0	Monitoring		1
W-8304	UNKNOWN	49		0	0	Monitoring		1
W-8306	UNKNOWN	85		0	0	Monitoring		1
W-8308	UNKNOWN	182		0	0	Monitoring		1
W-18607	UNOCAL BIRCH HILLS	130		25	130	Other Active Production		2
W-18609	UNOCAL BIRCH HILLS	0		25	120	Monitoring		1
W-18611	UNOCAL BIRCH HILLS	120		25	120	Monitoring		1
W-18613	UNOCAL BIRCH HILLS	120		45	120	Injection		4
W-18615	UNOCAL BIRCH HILLS	120		45	120	Injection		4
W-18617	UNOCAL BIRCH HILLS	120		45	120	Injection		4
W-18637	UNOCAL BIRCH HILLS	120		45	120	Injection		4
W-18639	UNOCAL BIRCH HILLS	120		45	120	Injection		4
W-18641	UNOCAL BIRCH HILLS	120		45	120	Injection		4
MTSN-SA	VERSAILLES ON LAKE APT	914		0	0	Other Active Production		2,3
CRES-A	VICTORY BAPTIST CHURCH	541		485	525	Active Small Production		2,7
A1-HB	VILLAGE NURSERIES	305		188	300	Other Active Production		2,3
W-13235	VIRGINIA COUNTRY CLUB	1285		915	1010	Monitoring		1
CATH-S	W. CARINE ST. MUT. WTR. CO.	170		0	0	Other Active Production		2,3
DISN-AE1	WALT DISNEY PRODUCTIONS	400		0	0	Inactive Production		2,3
DISN-AH1	WALT DISNEY PRODUCTIONS	0		0	0	Inactive Production		2,3
FUJS-A	WALT DISNEY PRODUCTIONS	642		446	628	Inactive Production		2,3
W-846	WALT DISNEY PRODUCTIONS	325		0	0	Inactive Production		2
WRD-CERRITOS-1	WATER REPLENISHMENT DIST.	1221		1155	1175	Monitoring		1
WRD-CERRITOS-2	WATER REPLENISHMENT DIST.	1504		1350	1370	Monitoring		1
WRD-LAKEWOOD-1A	WATER REPLENISHMENT DIST.	1020		989	1009	Monitoring		1
WRD-LAKEWOOD-1B	WATER REPLENISHMENT DIST.	172		140	160	Monitoring		1
WRD-LAKEWOOD-2	WATER REPLENISHMENT DIST.	2160		1960	2000	Monitoring		1
WRD-LAMIRADA-1	WATER REPLENISHMENT DIST.	1257		1130	1150	Monitoring		1
WRD-LONGBEACH-1	WATER REPLENISHMENT DIST.	1495		1430	1450	Monitoring		1,6
WRD-LONGBEACH-6	WATER REPLENISHMENT DIST.	1550		1490	1510	Monitoring		1
WRD-LONGBEACH-8	WATER REPLENISHMENT DIST.	1515		1435	1455	Monitoring		1
WRD-NORWALK-1	WATER REPLENISHMENT DIST.	1432		1400	1420	Monitoring		1
WRD-NORWALK-2	WATER REPLENISHMENT DIST.	1502		1460	1480	Monitoring		1
WRD-SEALBEACH-1	WATER REPLENISHMENT DIST.	1505		1345	1365	Monitoring	S/P/D	1,6
WRD-WHITTIER-1A	WATER REPLENISHMENT DIST.	1298		1180	1200	Monitoring		1
WRD-WHITTIER-1B	WATER REPLENISHMENT DIST.	640		600	620	Monitoring		1
WM-107A	WESTMINSTER	1040		350	980	Active Large Production	P	2,7
WM-11	WESTMINSTER	820		325	790	Active Large Production	P	2,7
WM-125	WESTMINSTER	930		374	860	Active Large Production	P	2,6,7
WM-3	WESTMINSTER	365		285	365	Active Large Production	P	2,7
WM-4	WESTMINSTER	1209		345	1125	Active Large Production	P	2,7
WM-6	WESTMINSTER	694		176	660	Active Large Production		2,7
WM-75A	WESTMINSTER	1041		410	996	Active Large Production	P	2,7
WM-RES1	WESTMINSTER	920		390	880	Active Large Production	P	2,7
WM-RES2	WESTMINSTER	960		340	937	Active Large Production	P	2,6,7
WM-SC4	WESTMINSTER	454		425	454	Active Large Production	P	2,7
WMEM-WE	WESTMINSTER MEMORIAL PARK	149		0	0	Inactive Production		2,3
WMEM-WPAR	WESTMINSTER MEMORIAL PARK	614		140	599	Inactive Production		2,3
WMEM-WW	WESTMINSTER MEMORIAL PARK	488		95	442	Other Active Production		2,3
WHS-CHS40	WHITTIER UNION H.S. DIST.	836		0	0	Inactive Production		2
WHS-SH550	WHITTIER UNION H.S. DIST.	804		228	780	Active Small Production		2
W-14807	WILLIAM LYON CO	490		0	0	Inactive Production		2

List of Wells in OCWD Monitoring Programs

KEY

Aquifer Zone: S=Shallow Aquifer, P=Principal Aquifer, D= Deep Aquifer

Program: 1) monitoring well, 2) production well, 3) irrigation or industrial well, 4) injection well, 5) Mid-Basin Injection well, 6) seawater intrusion monitoring well, 7) well monitored by OCWD for Title 22 compliance, 8) North Basin Groundwater Protection Program wells, 9) South Basin Groundwater Protection Program wells, 10) wells in CASGEM monitoring program

Well Name	Well Owner	Bore Depth (ft. bgs)	Casing Sequence	Screened Interval (ft.bgs) Top	Bottom	Type of Well	Aquifer Zone	Program
WOOD-INLK	WOODBRIDGE VILL HOMEOWNER ASSN	910		370	890	Inactive Production	P	2,3
WOOD-ISLK	WOODBRIDGE VILL HOMEOWNER ASSN	845		210	800	Inactive Production	P	2,3
YLCC-35C2	YORBA LINDA COUNTRY CLUB	425		388	404	Inactive Production		2,3
YLCC-35C4	YORBA LINDA COUNTRY CLUB	510		188	472	Other Active Production		2,3
YLCC-35F3	YORBA LINDA COUNTRY CLUB	460		130	450	Other Active Production		2,3
YLWD-1	YORBA LINDA WATER DIST.	427		90	340	Active Large Production		2,7
YLWD-10	YORBA LINDA WATER DIST.	465		90	406	Active Large Production		2,7
YLWD-11	YORBA LINDA WATER DIST.	547		149	514	Active Large Production		2,7
YLWD-12	YORBA LINDA WATER DIST.	544		80	498	Active Large Production		2,7
YLWD-15	YORBA LINDA WATER DIST.	213		133	198	Active Large Production	S	2,7
YLWD-18	YORBA LINDA WATER DIST.	1050		250	570	Active Large Production	P	2,7
YLWD-19	YORBA LINDA WATER DIST.	611		280	581	Active Large Production	P	2,7
YLWD-20	YORBA LINDA WATER DIST.	600		225	570	Active Large Production	P	2,7
YLWD-5	YORBA LINDA WATER DIST.	395		90	340	Active Large Production		2,7
YLWD-7	YORBA LINDA WATER DIST.	361		137	259	Active Large Production		2,7

Basin 8-1 Alternative

South East Management Area

Prepared by: Irvine Ranch Water District

In collaboration with: El Toro Water District and City of Orange

January 1, 2017

Irvine Ranch
WATER DISTRICT

Basin 8-1 Alternative

South East Management Area

CERTIFIED HYDROGEOLOGIST • THOMAS E. HARDER No: 588 • STATE OF CALIFORNIA

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Prepared for the Department of Water Resources, pursuant to
Water Code §10733.6(b)(3)

January 1, 2017

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SECTION 1. EXECUTIVE SUMMARY

The South East Management Area consists of several small, fringe areas located south east of the Orange County Management Area that overlie portions of Irvine Ranch Water District (IRWD), El Toro Water District (ETWD) and the City of Orange service areas. Figure 1-1 shows the boundary of each South East Management Area agency along with the Orange County Water District (OCWD). Table 1-1 shows the area associated with each agency within the South East Management Area. The South East Management Area represents approximately 4.4 percent of the total area of Basin 8-1.

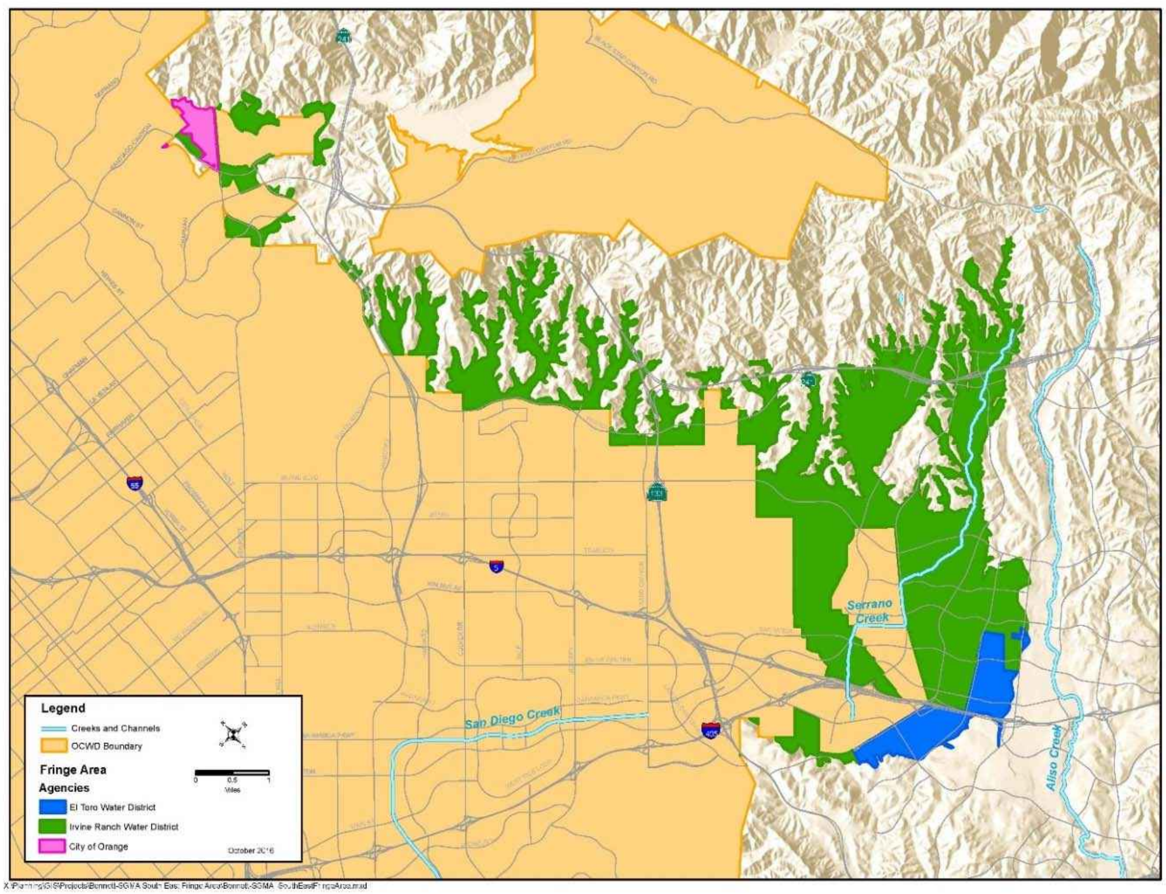

Figure 1-1: Agencies in the South East Management Area

Table 1-1 List of Agencies in South East Management Area and Area Covered

Agency	Area (acres)
Irvine Ranch Water District	8,870
El Toro Water District	762
City of Orange	134
Total Area	9,766

Water resources in the South East Management Area include Serrano Creek, numerous smaller tributaries and groundwater. Serrano Creek provides surface waters that flow into and/or out of the IRWD's Lake Forest portion of the South East Management Area (Boyle, 2002).

The only groundwater production in the South East Management Area has historically been from six wells located in the city of Lake Forest, within IRWD's service area. Currently only one well is active with an average production of about 125 acre-feet per year over the last 10 years. Imported water from the Metropolitan Water District of Southern California is the primary water supply source for the entire South East Management Area. Groundwater production within the South East Management Area represents less than 2 percent of the potable water supply for IRWD's Lake Forest area and less than 0.2 percent of IRWD's 2015 potable supply. And despite several recent years of significant drought, groundwater production in this area has approximately remained the same. Due to the relatively low yield of the Aquifer in the South East Management Area, groundwater production is expected to remain a relatively insignificant water supply source for the area.

The six wells within IRWD's Lake Forest portion of the South East Management Area are currently used for monitoring groundwater levels and water quality on a monthly basis. Because groundwater production is minimal throughout the year, there are no other programs in the South East Management Area responsible for managing or monitoring groundwater resources.

The Sustainability Goal for the South East Management Area is to recognize it is a small part of the larger OCWD management area whose groundwater levels and water quality will be monitored to assure that conditions do not lead to significant and unreasonable (1) lowering of groundwater levels, (2) reduction in storage, (3) water quality degradation, (4) inelastic land subsidence or (5) unreasonable adverse effect on surface water resources

SECTION 2. AGENCY INFORMATION

2.1 HISTORY OF AGENCIES IN SOUTH EAST BASIN MANAGEMENT AREA

As shown in Figure 1-1, the South East Management Area contains portions of IRWD, ETWD and the City of Orange. The South East Management Area was developed in 2016 in collaboration with OCWD, an agency responsible for managing groundwater in Basin 8-1 within OCWD's boundaries. In compliance with the Sustainable Groundwater Management Act (SGMA), the South East Management Area represents the Basin 8-1 areas located southeast and outside of the OCWD boundaries. As agencies within the South East Management Area of Basin 8-1, IRWD, ETWD and the City of Orange have the option to participate in an Alternative to a Groundwater Sustainability Plan (GSP) for Basin 8-1.

The Lake Forest portion of IRWD's South East Management Area was formerly owned and operated by the Los Alisos Water District (LAWD). In 2001 when LAWD consolidated with IRWD the former District became known as the Los Alisos System of IRWD.

2.2 GOVERNANCE AND MANAGEMENT STRUCTURE

As described later in this section, groundwater withdrawals in the South East Management Area are relatively minor. As a result, there is currently no need to establish formal groundwater governance or management via GSA formation in the South East Management Area. However, groundwater production, level and quality data will be collected and reported to DWR, and coordinated with OCWD and La Habra, in compliance with SGMA.

2.3 LEGAL AUTHORITY

The Orange County Well Ordinance (County Ordinance No. 2607) requires that a permit be obtained prior to the construction or destruction of any well. In unincorporated areas and in twenty-nine of thirty-four Orange County cities, the Orange County Health Officer is responsible for enforcement of the well ordinance. In the remaining five cities (Anaheim, Buena Park, Fountain Valley, Orange and San Clemente), well ordinances are enforced by city personnel.

The SGMA allows local agencies to participate in the development of an Alternative to a GSP in accordance with Water Code § 10733.6. As defined by SGMA (Water Code 10721(n), "Local Agency" means a local public agency that has water supply, water management, or land use responsibilities within a groundwater basin), and therefore IRWD, ETWD and City of Orange are all "local agencies" for purposes of SGMA within those areas of their respective jurisdictions that overlie the Basin 8-1. The legal authority for IRWD, ETWD and the City of Orange to participate in the groundwater plan for the South East Management Area is as follows:

<u>IRWD:</u> IRWD's participation in the South East Management Area is within IRWD's legal authority as a Special District formed under the California Water District Code in 1961 that has water supply authority within a portion of the South East Management Area.

ETWD: ETWD's participation in the South East Management Area is within ETWD's legal authority as a Special District formed under the California Water District Code in 1960 that has water supply authority within a portion of the South East Management Area.

City of Orange: The City of Orange is a local municipality within the South East Management Area. Orange's participation in the South East Management Area is within Orange's legal authority as the City is the permitted water supplier as approved by the State of California to supply water for domestic purposes within the City's water service area.

2.4 BUDGET

The budget required to monitor and report groundwater information for the South East Management Area has not been defined. As part of its standard operations, IRWD regularly collects and maintains information on its groundwater production, groundwater levels and water quality testing. Currently, there is no groundwater production in ETWD or City of Orange areas of the South East Management Area, therefore these agencies would not be responsible for monitoring and reporting groundwater information.

SECTION 3. MANAGEMENT AREA DESCRIPTION

3.1 SOUTH EAST SERVICE AREA

The South East Management Area is located in the south east portion of the Coastal Plain of Orange County Groundwater Basin (Basin 8-1). A geologic map of the major geologic formations in the area taken from the U.S. Geological Survey is presented in Figure 3-1.

IRWD: The areas associated with IRWD's portion of the South East Management Area can be broadly broken into two groups; northern and southern. The northern portion is dominated by steep mountain tributaries that contain quaternary alluvium and terrace deposits beneath ephemeral streams that discharge directly to the OCWD Management Area. The southern, or Lake Forest portion, consists of quaternary alluvium, quaternary terrace deposits and the Capistrano formation. These deposits are drained by Serrano Creek, an ephemeral stream that discharges to the OCWD Management Area. Studies referenced in this South East Management Area describe IRWD's southern Lake Forest portion of the South East Management Area.

ETWD: No studies have been performed on the ETWD portion of the South East Management Area.

City of Orange: No studies have been performed on the City of Orange portion of the South East Management Area

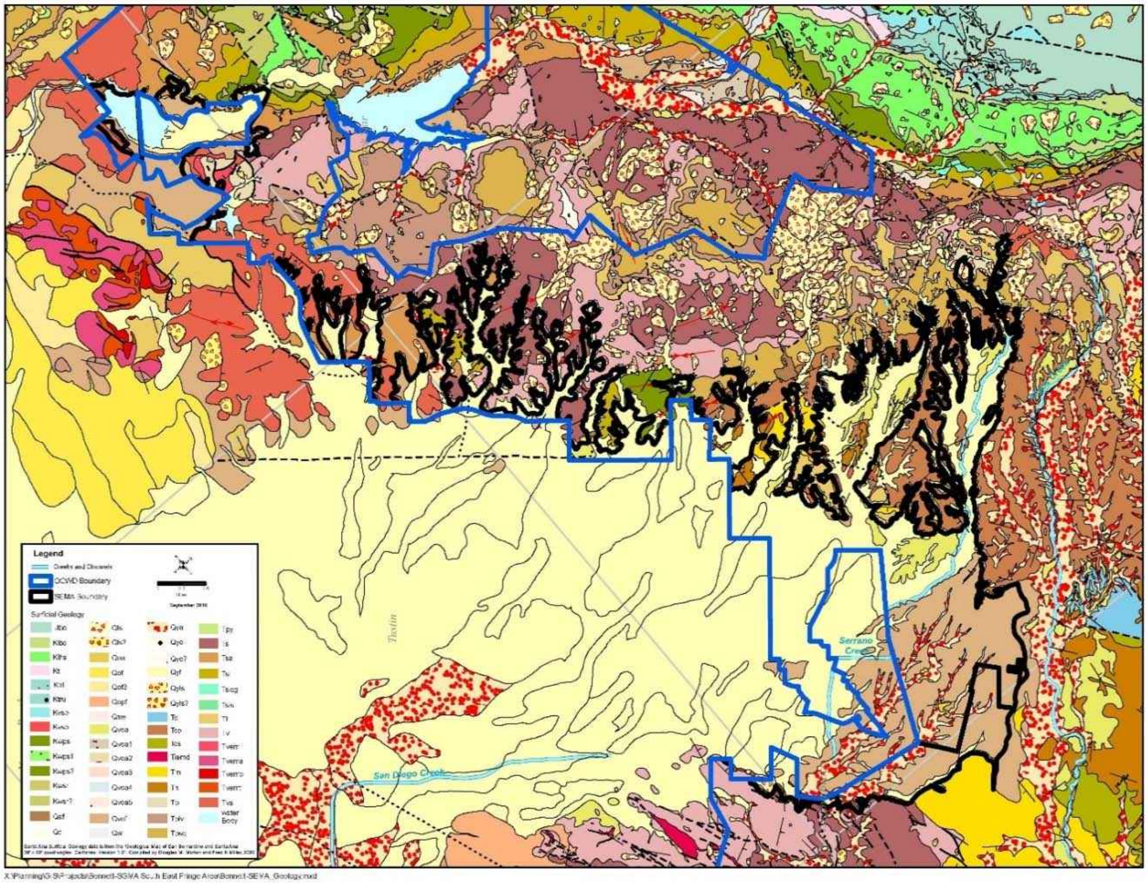

Figure 3-1: Geologic Location Map

3.1.1 Jurisdictional Boundaries

As described in Section 2 and shown in Figure 1-1, there are three jurisdictional agencies within the South East Management Area: IRWD, ETWD and the City of Orange. The western boundary of the South East Management Area is the south-eastern boundary of the OCWD Management Area. The South East Management Area's eastern boundary is the edge of Basin 8-1 as defined by the DWR Bulletin 118.

3.1.2 Land Use Designations

Land use designations for the South East Management Area have been consolidated into three major groups as follows:

1. Residential (single family, multi-family),
2. Commercial (commercial/industrial/mixed use), and
3. Open Space (open space/rights-of-way/water bodies).

As presented in Figure 3-2, IRWD's portion of the South East Management Area is primarily made up of Residential and Commercial land use types. The ETWD's portion is primarily residential, and the City of Orange is primarily Open Space.

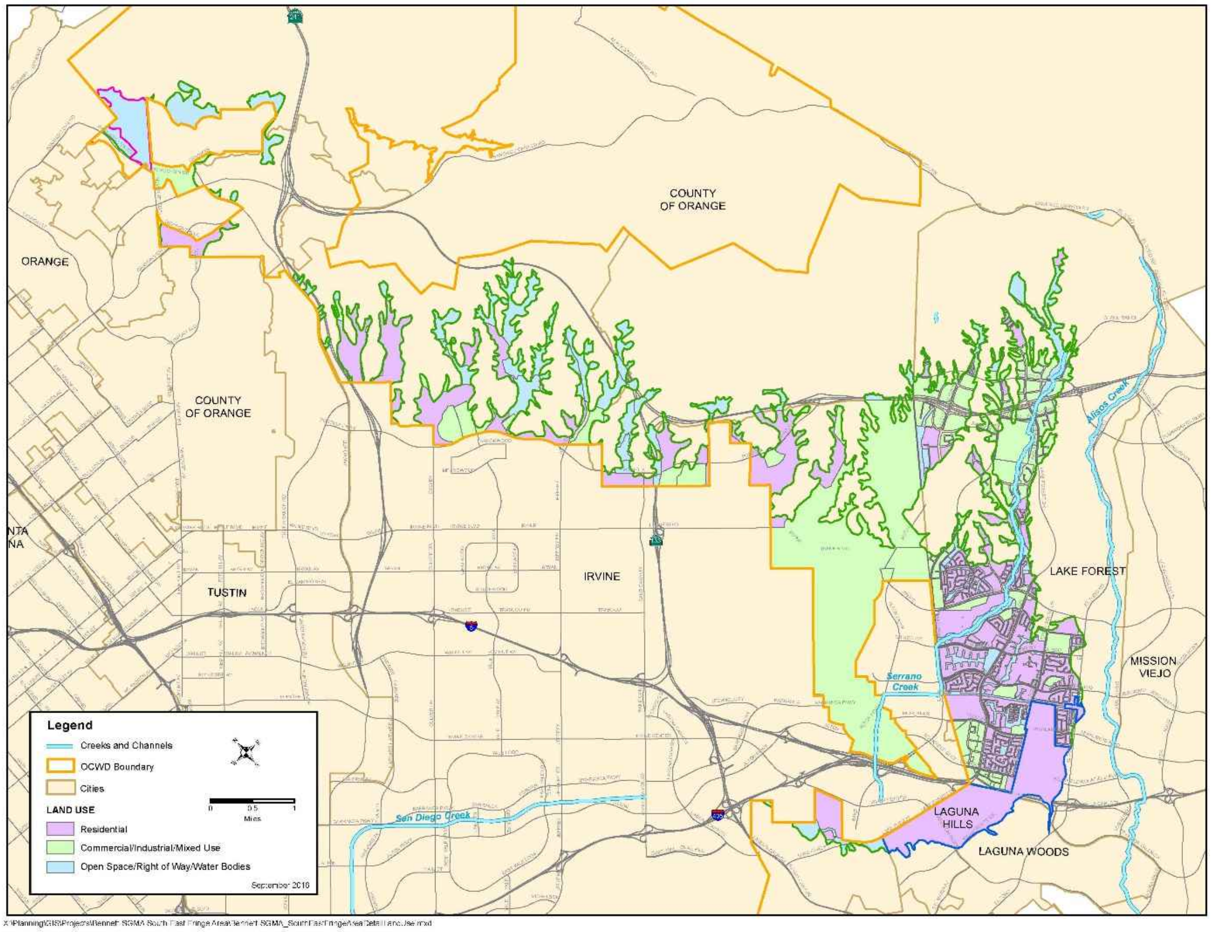

Figure 3-2: Land Use Designations

3.2 GROUNDWATER CONDITIONS

There is relatively little existing, or potential, groundwater development within the South East Management Area. Historically, IRWD's Lake Forest portion of the South East Management Area has had limited, inconsistent groundwater production from six existing wells, of which, only LF-2, is currently operational. Figure 3-3 shows the locations of the constructed wells within the South East Management Area.

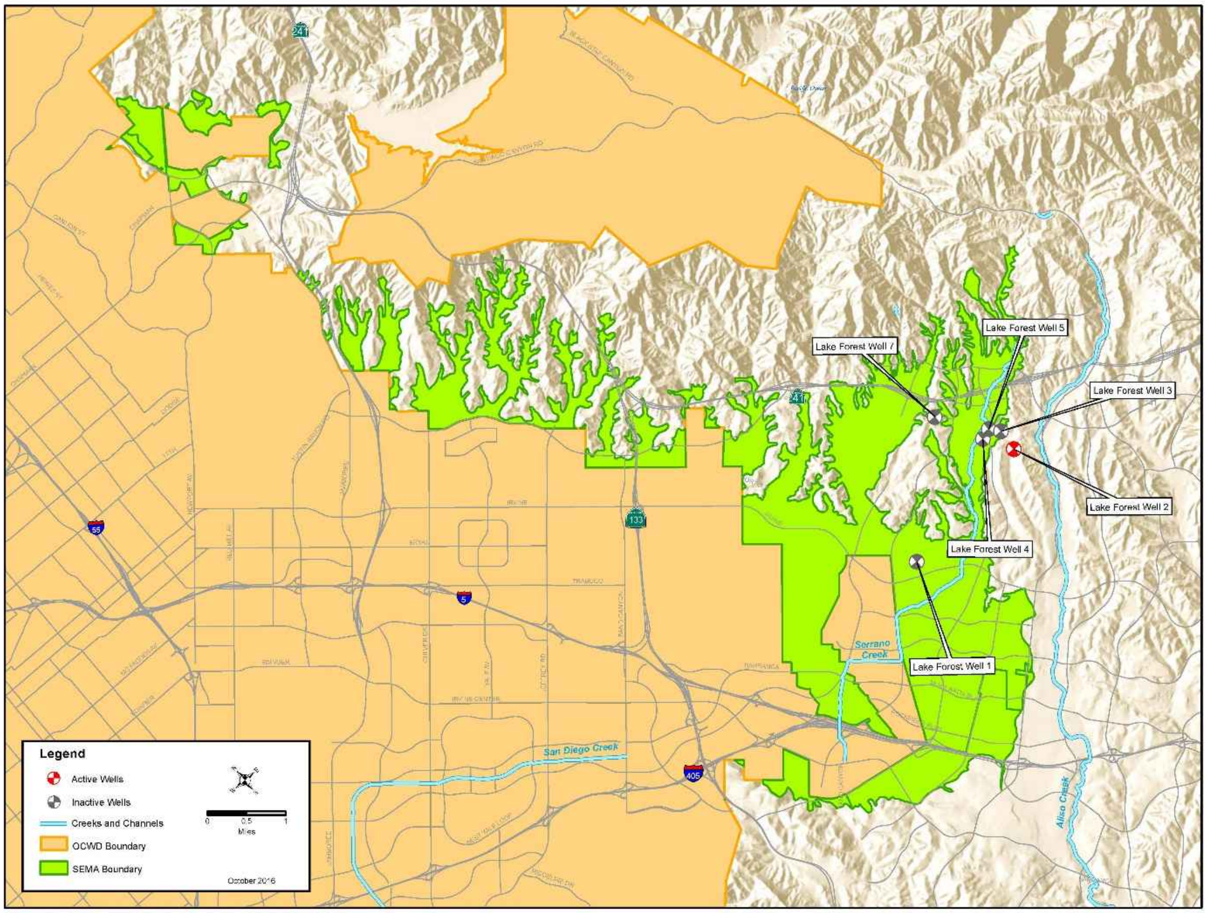

Figure 3-3: Groundwater Production Wells (Active and Inactive)

3.2.1 Groundwater Levels

The range of observed groundwater levels in the South East Management Area from 2012 to 2015 are summarized in Table 3-1 by agency. As shown, no groundwater level data exists in the ETWD and City of Orange portions of the South East Management Area. Historic and estimated groundwater levels from 1991 to 2015 for IRWD's Lake Forest wells are shown in Figure 3-4 where observed data are shown as points connected with solid lines and data estimated by correlation with the CASGEM well MCAS-3/MP2 is shown as a dashed line. Current monthly groundwater levels from IRWD's Lake Forest wells for 2015 to 2016 are shown in Figure 3-5.

Table 3-1: Observed Groundwater Levels 2012-2015

Agency	From (ft-bgs)	To (ft-bgs)
IRWD	17	168
ETWD	N/A	N/A
City of Orange	N/A	N/A

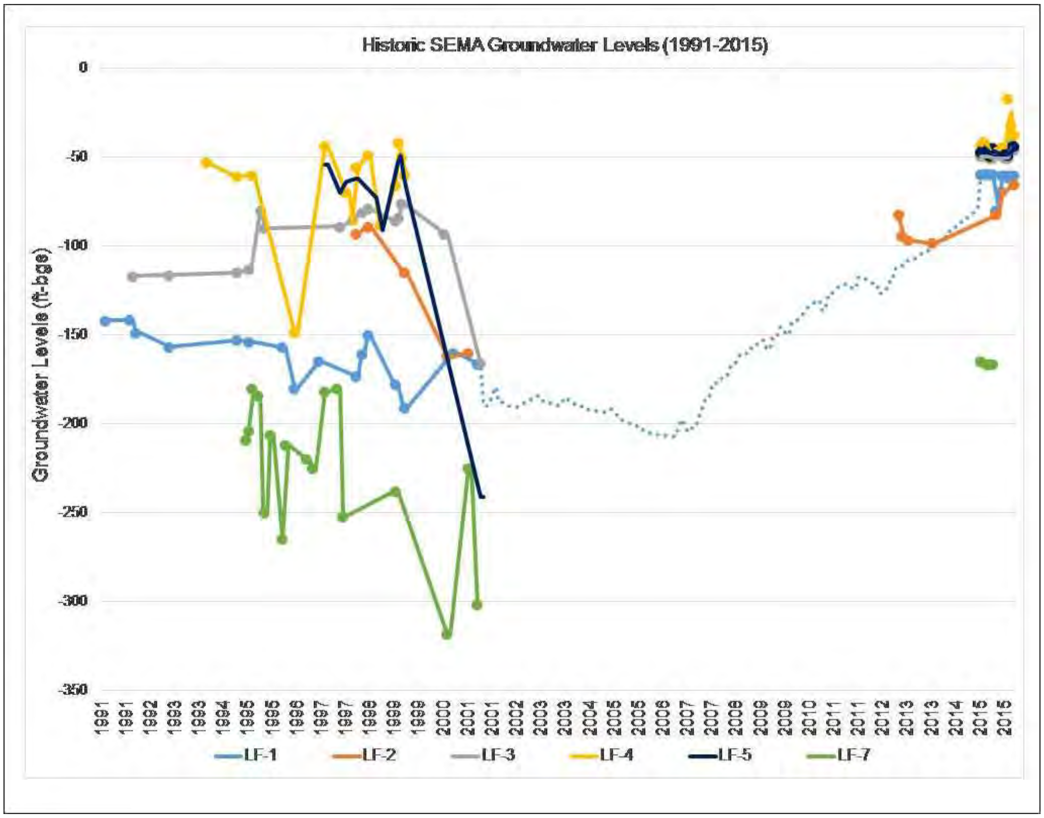

Figure 3-4: Historic Groundwater Levels, 1991-2015

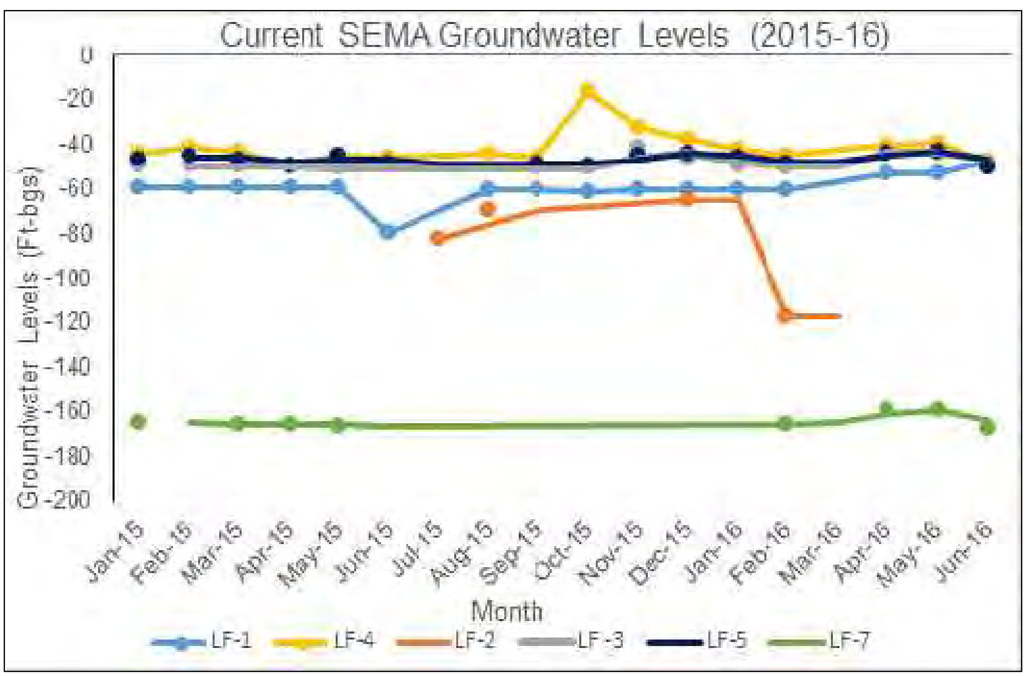

Figure 3-5: Current Groundwater Levels, 2015-16

3.2.2 Regional Pumping Patterns

Table 3-2 summarizes information on all the wells that are known to exist within the South East Management Area by agency. As presented, well design flows range from 125 to 350 gallons per minute (gpm) and well depths range from 675 to 1,000 feet below ground surface (ft-bgs).

Table 3-2: Wells and Flow Data

Agency	Well	State Well No.	System	Status	Design Flow (gpm)	Drilled	Depth (ft-bgs)	Perforated Intervals (ft)
IRWD	LF-1	06S/08W-15A00	Nonpotable	Inactive	300	1989	800	200-790
IRWD	LF-2	06S/08W-12Q02	Potable	Active	300	1957, *redrilled 2010*	675	200-675
IRWD	LF-3	06S/08W-12J01	Potable	Inactive	350	1950	800	270-395; 400-785
IRWD	LF-4	06S/08W-12L02	Nonpotable	Inactive	200	1993	810	350-470 510-790
IRWD	LF-5	06S/08W-12A01	Nonpotable	Inactive	140	1997	800	350-780
IRWD	LF-7	06S/08W-12E00	Potable	Inactive	125	1994	1000	430-980
ETWD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
City of Orange	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 3-3 summarizes average annual pumping from 2006 – 2015 within the South East Management Area by agency. As shown, no groundwater development exists in the ETWD and City of Orange portions of the South East Management Area. In IRWD's portion of the South East Management Area only one well (LF-2) is currently active. Over the last 10 years, LF-2's annual pumping ranged from 0 acre-feet to 436 acre-feet and averaged approximately 125 acre-feet.

Table 3-3: Annual Pumping Average 2006-2015

Agency	Average Annual Production (AF/yr)
IRWD	125
ETWD	0
City of Orange	0
Total	**125**

Historical groundwater development within IRWD's portion of the South East Management Area has been limited to six wells in the Lake Forest region. However, only one well, LF-2, is currently operating. Due to the relatively low yield of these wells, IRWD considers production from these wells as a supplemental supply and does not rely on these wells to meet its firm demands.

Representative monthly pumping patterns for IRWD's LF-2 well are presented in Figure 3-6. As shown, monthly values vary considerably from one year to the next and have consisted of either: year round pumping, partial year pumping (5-7 months), or minimal pumping (0-2 months). Figure 3-7 shows a history of the total annual pumping for IRWD's LF-2 well from 2006 to 2015.

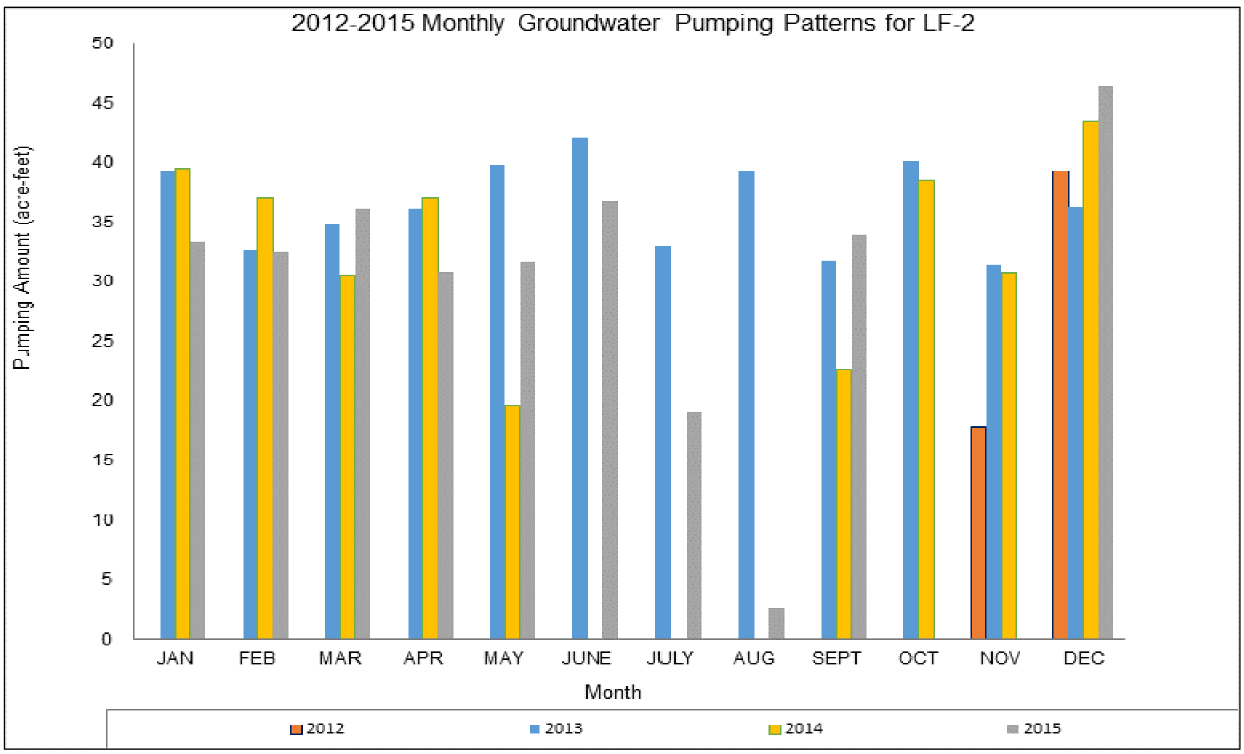

Figure 3-6: Monthly Groundwater Pumping Pattern in Well LF-2, 2012-2015

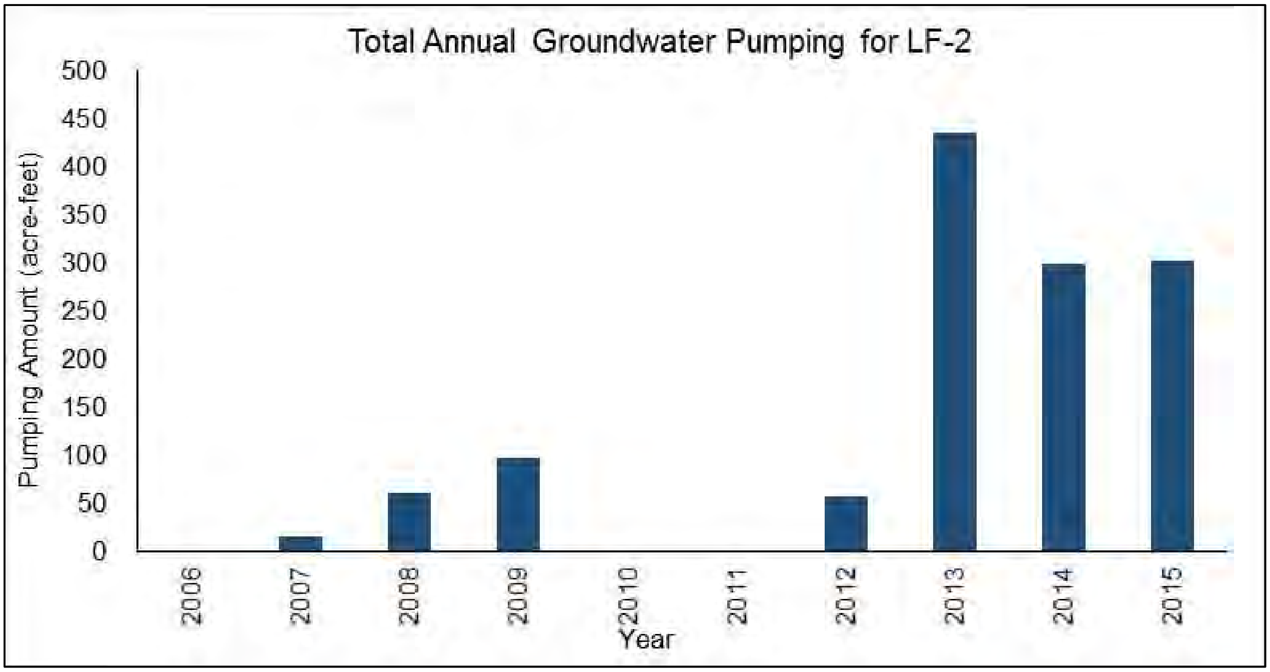

Figure 3-7: Total Annual Pumping for Well LF-2, 2006-2015

3.2.3 Groundwater Storage Data

Groundwater storage data for the South East Management Area are limited to IRWD's southern Lake Forest area. Based on available data, the total storage capacity within the South East Management Area is approximately 360,000 acre-feet: about 350,000 acre-feet in the IRWD's southern Lake Forest portion and about 11,000 acre-feet in the northern portion. The Lake Forest estimate includes the formation thicknesses at each well and an estimate of the aquifer's specific yield. The northern portion is estimated to contain approximately 11,000 acre-feet based on an estimated depth and specific yield of this region. To put this storage capacity into context, the total estimated storage within the OCWD Management Area is over 66 million acre-feet.

3.2.4 Groundwater Quality Conditions

Historically, only three of the six IRWD Lake Forest wells were permitted for potable use as the other three Lake Forest wells have had elevated levels of iron, manganese (Mn), electrical conductivity (EC) and total dissolved solids (TDS). Recent groundwater quality data for the South East Managementg Area which includes results for arsenic (As) is presented in Table 3-4. As presented, no other water quality data exists for the ETWD and City of Orange areas within the South East Management Area.

Table 3-4: Groundwater Quality in Selected Wells

Agency	Well Name	Well Use	Date Range	Avg TDS (#)[1] (mg/L)	Avg As (ug/L)	Avg Mn (mg/L)
IRWD	LF-2	Production	2011-2015	593	0.035	25.5
IRWD	LF-1	Production	1961-2000	>500 (21)		
IRWD	LF-4	Production	1993-2000	>500 (12)		
IRWD	LF-5	Production	1997-2001	>500 (5)		
IRWD	LF-3	Production	1991-1998	>500 (12)		
IRWD	LF-7	Production	1994-2001	<500 (12)		
City of Orange	N/A	N/A	N/A	N/A	N/A	N/A
ETWD	N/A	N/A	N/A	N/A	N/A	N/A

1 # = Number of Samples

3.2.5 Land Subsidence

No known land subsidence issues are known to exist in the South East Management Area.

3.2.6 Groundwater and Surface Water Interactions and Groundwater Dependent Ecosystems

IRWD's Lake Forest portion of the South East Management Area contains quaternary alluvium and terrace deposits that interact with and are drained by Serrano Creek. Serrano Creek is an intermittent stream that only flows during the rainy season following storm events. As a result, there are no groundwater dependent ecosystems present.

SECTION 4. WATER BUDGET

No groundwater development exists in the ETWD and City of Orange portions of the South East Management Area. In IRWD's Lake Forest portion of the South East Management Area only one well (LF-2) is currently operational. IRWD's LF-2 groundwater production is dependent upon infiltration from ephemeral creeks, precipitation and incidental recharge from irrigation. From 2006-2015, LF-2's annual pumping ranged from 0 acre-feet to 436 acre-feet and averaged 125 acre-feet. An average annual groundwater budget for the South East Management Area for the last 10 years is presented in Table 4-1. The development of individual components in the average annual groundwater budget are described in the following subsections.

4.1 BUDGET COMPONENTS

No groundwater development exists in the ETWD and City of Orange portions of the South East Management Area. For IRWD's Lake Forest portion of the South East Management Area, the components of the groundwater budget are presented in Table 4-1 and described below.

Table 4-1: Average Annual Groundwater Budget

Item	Total (acre-feet)
Recharge	2,935
Total Inflow	2,935
Groundwater Production	125
Subsurface Outflow	2,810
Total Outflow	2,935
Change in Storage	0

4.1.1 Recharge

Recharge includes infiltration from ephemeral creeks, precipitation and incidental recharge from irrigation. It was estimated to equal the total outflow as summarized in Table 4-1.

4.1.2 Groundwater Production

Groundwater production was taken from measured records by IRWD as summarized in Table 4-1.

4.1.3 Subsurface Outflow

Subsurface outflow was estimated to equal the subsurface inflow to the OCWD Management Area from foothills into the Irvine subbasin prorated by the fraction of that area located in the South East Management Area as summarized in Table 4-1.

4.2 CHANGES IN GROUNDWATER STORAGE

As presented in Section 4.1, groundwater pumping in the South East Management Area is relatively minor and averages only 125 acre-feet per year over the last 10 years. In addition, Section 3.2 indicates historic groundwater levels from 1991 to 2015 have been highly variable without any undesirable results. Groundwater levels are currently at or above historical high levels despite recent increased groundwater production and multiple years of below normal precipitation. These conditions indicate groundwater storage changes within the South East Management Area are within an acceptable range.

4.3 WATER YEAR TYPE

The water year type has little impact on the water budget in the South East Management Area given the minimal changes in groundwater levels observed through time

4.4 ESTIMATE OF SUSTAINABLE YIELD

As shown in Table 4-1 and described in Section 3.2, average annual groundwater production over the last 10 years has ranged from 0 acre-feet to 436 acre-feet and has averaged approximately 125 acre-feet without significant reductions in groundwater elevations. However, the recent years are considered relatively dry and the sustainable yield of the South East Management Area may be significantly greater than the 10-year average under normal and wet hydrologic cycles. Based upon the limited groundwater resources in the area it is unlikely demands would ever rise to the level of straining the water budget of the area. In terms of sustainable yield, it is more appropriate to look at the South East Management Area as part of the larger OCWD Management Area.

4.5 CURRENT, HISTORICAL, AND PROJECTED WATER BUDGET

No groundwater development exists in the ETWD and City of Orange portions of the South East Management Area. In IRWD's Lake Forest portion of the South East Management Area, a 2002 study by Boyle Engineering Corporation and a 2015 study by Dudek were performed in order to assess the potential for development of two future wells, LF-6 and LF-8, as well as the redrilling of existing inactive wells. A capital project for the design, construction and equipping of LF-1 is included in IRWD's 2016-17 capital budget. IRWD has no near term plans to drill wells LF-6 and LF-8. In 2000, its last active year, LF-1 pumped about 230 acre-feet. Over the last 10 years LF-2's annual pumping has ranged from 0 acre-feet to 436 acre-feet and averaged about 125 acre-feet. It is expected that when LF-1 is redrilled, groundwater production from IRWD's southern portion of the South East Management Area could increase significantly. Water produced from LF-1 could be used to provide supply to the nearby lake which currently is supplied by untreated imported water. Water produced could also potentially be pumped and conveyed to the Baker Water Treatment Plant for treatment if needed (Dudek, 2015). Due to the consistently lower yields from the aquifer in this area, it is expected that additional production from LF-1 will continue to be considered supplemental, and therefore insignificant in terms of IRWD's overall water supply for its Lake Forest area.

SECTION 5. WATER RESOURCE MONITORING PROGRAMS

5.1 OVERVIEW

This section describes surface and groundwater monitoring programs in the South East Management Area

5.2 GROUNDWATER MONITORING PROGRAMS

No groundwater development exists in the ETWD and City of Orange portions of the South East Management Area. In IRWD's Lake Forest portion of the South East Management Area six wells (both active and inactive) have been, and will continue to be, used to monitor the groundwater levels on a monthly basis. Section 3.2.1 provides information on the South East Management Area groundwater levels, and Figure 3-3 shows the locations of the Lake Forest wells within the South East Management Area.

5.3 OTHER MONITORING PROGRAMS

IRWD monitors groundwater quality in LF-2 as required by the California Code of Regulation (Title 22) and California Division of Drinking Water, Santa Ana District.

SECTION 6. WATER RESOURCE MANAGEMENT PROGRAMS

IRWD works with ETWD and City of Orange on plans for groundwater development within the South East Management Area and updates demand projections and the water budget accordingly.

IRWD: The compilation of land use data is the basis for IRWD's water resource planning including its portion of the South East Management Area. Per IRWD's 2015 Urban Water Management Plan (UWMP), the land use data obtained from multiple jurisdictions in IRWD's service area is used in conjunction with IRWD's applied water use factors in order to estimate water requirements.

ETWD: ETWD's water resource planning is based on the 2015 UWMP demand projections. Regional demands are forecasted by the Municipal Water District of Orange County and are then tailored to ETWD's service area using available data for land use, population, and economic growth, intermixed with a trajectory of conservation, which includes both additional future passive measures and active measures.

City of Orange: The City of Orange's current UWMP (2015) provides the basis for water resource planning in Orange's water service area. The UWMP, in conjunction with applicable water use factors, form the basis for any potential water use estimates required for potential planning use in the service area.

SECTION 7. NOTICE AND COMMUNICATION

There are three agencies within the South East Management Area, as follows:

- IRWD
- ETWD
- City of Orange

On May 30, 2016 a meeting was held with representatives from IRWD, ETWD, City of Orange and OCWD to discuss SGMA compliance via an Alternative to a GSP and the designation of IRWD as the lead agency for the South East Management Area. Draft copies of this South East Management Area plan were provided to ETWD and the City of Orange for review on September 15 and October 3, 2016.

The public was notified of this South East Management Area plan when it was presented to each agencies' governing body. Additional public notice and communication of this plan was provided by OCWD prior to its public meeting of its Board of Directors on December 14, 2016.

SECTION 8. SUSTAINABLE MANAGEMENT APPROACH

The Sustainable management approach for the South East Management Area is to continue monitoring groundwater levels and water quality to assure that conditions do not lead to significant and unreasonable (1) lowering of groundwater levels, (2) reduction in storage, (3) water quality degradation, (4) inelastic land subsidence or (5) unreasonable adverse effect on surface water resources.

SECTION 9. SUSTAINABLE MANAGEMENT RELATED TO GROUNDWATER LEVELS

9.1 HISTORY

As shown on Figure 3-4 historic groundwater levels in the IRWD's Lake Forest portion of the South East Management Area have been variable but have recovered to historical highs. Because existing groundwater pumping in the South East Management Area is relatively minor groundwater levels are expected to remain relatively steady in the future.

9.2 MONITORING OF GROUNDWATER LEVELS

Groundwater levels are currently monitored monthly in the six wells located in IRWD's Lake Forest portion of the South East Management Area. Because existing groundwater use is relatively minor the existing level of groundwater monitoring is expected to continue in the future.

9.3 DEFINITION OF SIGNIFICANT AND UNREASONABLE LOWERING OF GROUNDWATER LEVELS

No long-term reduction in groundwater levels in the South East Management Area are expected to occur.

9.4 DETERMINATION OF MINIMUM THRESHOLDS

Determination of a minimum threshold for groundwater levels has not been determined since no undesirable effects due to ground water levels have occurred in the past and are not foreseen in the future. Nevertheless, IRWD's Lake Forest well monitoring program is expected to continue to monitor water levels and groundwater quality in the future. If water levels start to show a consistent, long term decline and undesirable results are observed then minimum thresholds may be established.

SECTION 10. SUSTAINABLE MANAGEMENT RELATED TO BASIN STORAGE

No groundwater development exists in the ETWD and City of Orange portions of the South East Management Area. The total volume of groundwater storage in IRWD's portion of the South East Management Area has been estimated to be approximately 360,000 acre-feet (see Section 3.2.3).

10.1 DEFINITION OF SIGNIFICANT AND UNREASONABLE REDUCTION IN STORAGE

No significant long-term reduction in groundwater storage is expected to occur in the South East Management Area because of the limited groundwater use. However, a decline in groundwater storage may be determined unreasonable if one more of the following occurred:

1. Significant loss of well production capacity.
2. Degradation of water quality that significantly impacts the use of groundwater.

10.2 DETERMINATION OF MINIMUM THRESHOLDS

A minimum threshold for the reduction of groundwater storage in the South East Management Area is not anticipated since no undesirable effects have occurred in the past and are not foreseen in the future. Nevertheless, IRWD's Lake Forest monitoring program continuously tracks water levels and groundwater quality. If water levels show a consistent decline, IRWD's Lake Forest monitoring program would be expanded to examine any potential impacts and action would be taken to identify minimum thresholds as appropriate.

SECTION 11. SUSTAINABLE MANAGEMENT RELATED TO WATER QUALITY

No groundwater development exists in the ETWD and City of Orange portions of the South East Management Area. Groundwater quality in IRWD's portion of the South East Management Area is affected by the quality of recharge from Serrano Creek and precipitation and incidental recharge from irrigation.

11.1 DEFINITION OF SIGNIFICANT AND UNREASONABLE DEGREDATION OF WATER QUALITY

There are three elements that must be considered when evaluating the impact of groundwater quality degradation.

The first element is considering the causal nexus between groundwater management activities and groundwater quality. For example, groundwater contamination due to improper handling of toxic materials impacts groundwater quality; however, this water quality degradation is not caused by groundwater management activities.

The second element is the beneficial uses of the groundwater and water quality regulations, such as Maximum Contaminant Levels (MCLs) and other potable water quality requirements.

The third element that must be considered is the volume of groundwater impacted by groundwater quality degradation. If small volumes are negatively affected that don't materially affect the use of the aquifer or basin for its existing beneficial uses, then this would not represent a significant and unreasonable degradation of water quality. However, if the impacted volume grows, then it could reach a level that it becomes significant and unreasonable.

When considering all three elements, the definition of significant and unreasonable degradation of water quality is defined as degradation of groundwater quality in the South East Management Area to the extent that a significant volume of groundwater becomes unusable for its designated beneficial uses.

11.2 DETERMINATION OF MINIMUM THRESHOLDS

The minimum thresholds for groundwater quality are exceedances of Maximum Contaminant Levels (MCLs) or other applicable regulatory limits that are directly attributable to groundwater management actions in the South East Management Area that prevents the use of groundwater for its designated beneficial uses.

SECTION 12. SUSTAINABLE MANAGEMENT RELATED TO SEAWATER INTRUSION

The South East Management Area is located far from the ocean and thus there is no reason to consider the potential impact of seawater intrusion in this management area.

SECTION 13. SUSTAINABLE MANAGEMENT RELATED TO LAND SUBSIDENCE

Subsidence is not an issue for the South East Management Area given the following:

1. Minimal groundwater development exists in the South East Management Area.
2. The presence of shale and sandstone bedrock underlying the alluvial aquifer.
3. The alluvial aquifer is relatively thin and comprised mainly of sand and gravel with little clay.
4. Steady groundwater and storage levels.
5. Low risk of substantial groundwater level declines due to a minimal amount of groundwater production.

SECTION 14. SUSTAINABLE MANAGEMENT RELATED TO GROUNDWATER DEPLETIONS IMPACTING SURFACE WATER

Existing groundwater use in the South East Management Area is relatively minor (see section 4.1.1) and the surface streams and creeks are ephemeral. Therefore, there is no need for a program to manage groundwater depletions that may impact surface water.

SECTION 15. PROTOCOLS FOR MODIFYING MONITORING PROGRAMS

Protocols for modifying monitoring programs are based on changes from historical conditions or changes in water quality that begin to approach or exceed regulatory limits.

15.1 ESTABLISHMENT OF PROTOCOLS FOR WATER QUALITY

Changes in the South East Management Area water quality sampling program can be triggered by one or more of the following:

1. A change or anticipated change in water quality regulations;
2. A constituent in a sample approaches or exceeds a regulatory water quality limit or Maximum Contaminant Level, notification level, or first time detection of a constituent;
3. Analysis of water quality trends.

15.2 ESTABLISHMENT OF PROTOCOLS FOR GROUNDWATER ELEVATIONS/STORAGE

Because it is desirable to use the same well to obtain water level records over long periods of time it is rare that changes are made to an existing groundwater level monitoring program. The most common reason a well is dropped from a monitoring program is that it is no longer available. If this occurs, IRWD will evaluate the nearest similar well or the need to construct a replacement well and add it to the monitoring program as appropriate.

The frequency of groundwater level monitoring in IRWD's Lake Forest portion of the South East Management Area is monthly and historic water levels tend to be relatively consistent (see Figure 3-4). Therefore, the monitoring frequency may be reduced in the future. However, if water levels start to change and storage levels start to decline, then the frequency of groundwater level monitoring would likely return to a monthly frequency.

SECTION 16. PROCESS TO EVALUATE NEW PROJECTS

When new projects are proposed within the South East Management Area, the agency proposing the project will be responsible for preparing a CEQA document to ensure alternatives have been evaluated and any significant and unreasonable results are mitigated.

SECTION 17. REFERENCES

Following are references and technical studies for the South East Management Area.

- Groundwater Supply Evaluation for the Los Alisos System Phase 1, July 2002, Boyle Engineering Corporation.
- Lake Forest Groundwater Conveyance Analysis Results (Dudek, November 5, 2015).
- Geohydrology and Acritical-Recharge Potential of the Irvine Area Orange County, California (J. A. Singer, January 8, 1973).
- Ground Water Management, Irvine Area, Orange County, California (Harvey O. Banks, Consulting Engineer, Inc.).
- Communication with OCWD. Email dated November 28, 2016.

Basin 8-1 Alternative

Santa Ana Canyon Management Area

Prepared by: Orange County Water District

In collaboration with: Cities of Anaheim, Chino Hills, Yorba Linda, Corona; Yorba Linda Water District; Counties of Orange and Riverside

January 1, 2017

ORANGE COUNTY WATER DISTRICT

SINCE 1933

Basin 8-1 Alternative

Santa Ana Canyon Management Area

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January 1, 2017

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SECTION 1. EXECUTIVE SUMMARY

The Santa Ana Canyon Management Area covers the easternmost extent of the Department of Water Resources (DWR) Basin 8-1, Coastal Plain of Orange County Groundwater Basin. This Management Area is created for this Alternative (under 23 CCR 354.20) because of the unique characteristics of the Santa Ana Canyon and the appropriateness of developing different management objectives and strategies for this portion of the Basin. These different objectives and management approaches, as described in this Section, account for the significant differences in groundwater use, geology, aquifer characteristics, and other factors which distinguish Santa Ana Canyon from other portions of the Basin. Figure 1-1 shows the extent of the Santa Ana Canyon Management Area and the agencies with jurisdiction in the Santa Ana Canyon Management Area. Table 1-1 lists the agencies shown on Figure 1-1.

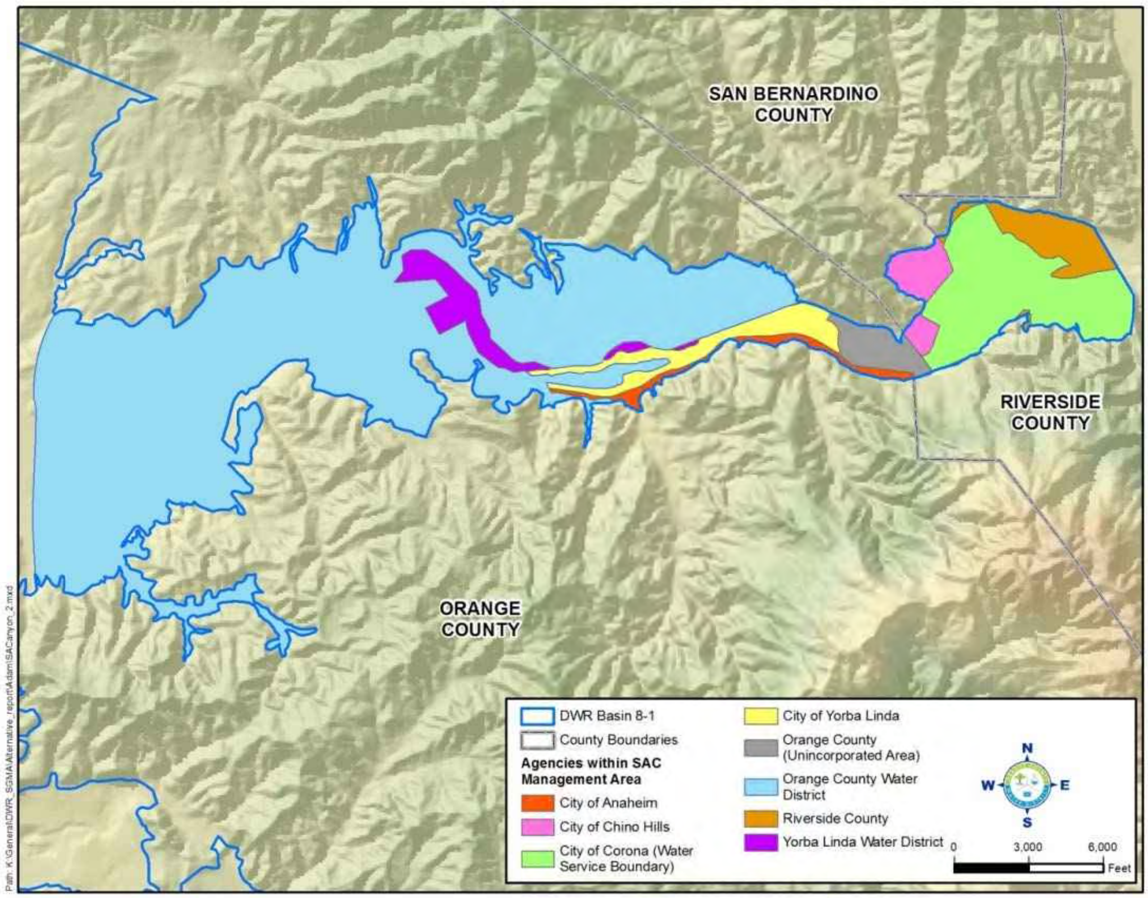


Figure 1-1: Agencies in the Santa Ana Canyon Management Area

The water resources in the Santa Ana Canyon Management Area include the Santa Ana River and limited groundwater. Groundwater is primarily located in a thin alluvial aquifer that is 90 to 100 feet thick and is a combination of infiltrated Santa Ana River water and subsurface inflow from the adjacent foothills. Groundwater production from the alluvial aquifer is primarily used for irrigation but some is also used for potable purposes. Groundwater production represents one to two percent of the total available water supply to the Santa Ana Canyon Management Area due to the significantly larger flow of the Santa Ana River as shown on Table 1-2. Even under projected dry conditions, groundwater production is expected to be less than four percent of the total available water supply.

Table 1-1: Agencies in Santa Ana Canyon Management Area

Agency
City of Anaheim
City of Chino Hills
City of Yorba Linda
City of Corona Water Service Area
Orange County Water District
County of Orange
Riverside County
Yorba Linda Water District

Table 1-2: Water Budget, 10-Year Average (2006-15) and Dry-Year Condition

Flow Component	10-Yr Avg: 2006-15 (afy)	Dry-Year Condition (afy)
Santa Ana River Base Flow	100,400	44,000
Santa Ana River Storm Flow	72,300	11,300
Subsurface Inflow	5,000	5,000
TOTAL INFLOW	**177,700**	**60,300**
Santa Ana River Base Flow	98,820	42,030
Santa Ana River Storm Flow	72,300	11,300
Evapotranspiration	740	740
Groundwater Production	1,840	2,230
Subsurface Outflow	4,000	4,000
TOTAL OUTFLOW	**177,700**	**60,300**

Per the monitoring discussed in Section 5, groundwater levels in the Santa Ana Canyon Management Area are relatively stable, having been consistently 20 to 30 feet below ground surface since 1991, indicating that the supply of subsurface inflow and surface water from the Santa Ana River is more than sufficient to sustain local groundwater production. Groundwater quality is suitable for irrigation and potable uses. Native groundwater from the surrounding foothills tends to have naturally elevated total dissolved solids (TDS) and manganese concentrations. Most wells in the canyon appear to produce a blend of infiltrated Santa Ana River water, and native groundwater, with some wells producing more infiltrated Santa Ana River water than others.

OCWD monitors Santa Ana River flow and quality as well as groundwater levels, quality, and production in the Santa Ana Canyon Management Area (see Section 5). Moreover, OCWD has a wide variety of water resource management programs that cover the OCWD Management Area as well as programs in the upper Santa Ana River watershed to address Santa Ana River flow and quality (see Section 6). These programs are important in protecting the quality of the Santa Ana River, which has a significant influence on the groundwater quality in the Santa Ana Canyon Management Area.

The approach to managing the Santa Ana Canyon Management Area is for OCWD, in cooperation with the County of Orange, to continue monitoring sustainable conditions and monitor to ensure that no significant and unreasonable results occur in the future, both in the Santa Ana Canyon portion of the Basin and in the other hydrologically connected portions of the Basin.

Due to the unique conditions documented within the Santa Ana Canyon Management Area, it will not be difficult to prevent conditions that could lead to significant and unreasonable undesirable results due to the low risk of increased groundwater production, little available developable land, and continued high flows of the Santa Ana River relative to the amount of groundwater production. A summary of the applicable undesirable results that must be prevented under SGMA is presented below. A more detailed description of these can be found in Sections 8 to 13.

1. **Water Levels:** Long-term reduction in groundwater levels in the Santa Ana Canyon Management Area are not foreseeable given the high volume of Santa Ana River flow relative to the amount of groundwater production and the high rate at which the shallow groundwater formations recharge as a result of surface flow in the Santa Ana Canyon; however, if an unforeseen long-term reduction in groundwater levels were to occur, water levels could reach a significant and unreasonable level if one or more of the following occurred as a result of reduced groundwater levels:
    a. Loss of significant riparian habitat along the Santa Ana River.
    b. Significant loss of well production capacity (in the Santa Ana Canyon Management Area).
    c. Degradation of water quality that significantly impacts the beneficial uses of groundwater.
2. **Storage:** As with groundwater levels, long-term reduction in groundwater storage in the Santa Ana Canyon Management Area is not projected to occur; however, an unforeseen decline in groundwater storage could reach a significant and unreasonable level if such a decline caused one or more of the following:
    a. Loss of significant riparian habitat along the Santa Ana River.
    b. Significant loss of well production capacity.
    c. Degradation of water quality that significantly impacts the beneficial uses of groundwater.
3. **Water Quality:** The significant and unreasonable degradation of water quality is defined as the degradation of groundwater quality in the Santa Ana Canyon Management Area that is attributable to groundwater production or recharge practices within the Santa Ana

Canyon Management Area that cause a significant volume of groundwater to become unusable for its designated beneficial uses.

4. **Seawater Intrusion:** This does not apply to the Santa Ana Canyon Management Area because this area if far removed from the coastline.
5. **Subsidence:** This does not apply to the Santa Ana Canyon Management Area due to:
    a. The presence of shale and sandstone bedrock underlying the alluvial aquifer.
    b. The alluvial aquifer is thin, generally less than 100 feet, and comprised mainly of sand and gravel with little clay.
    c. Groundwater levels and groundwater storage are stable.
    d. Very low risk of substantial groundwater level declines due to de minimis amount of groundwater production relative to the overall inflow of water to the Santa Ana Canyon Management Area.
6. **Groundwater Depletions Impacting Surface Water:** Due to hydrogeologic conditions and land use limitations, groundwater production in the Santa Ana Canyon Management area has had and is projected to have a de minimis effect on groundwater conditions and flows of surface water through the canyon. Therefore, this factor does not apply to the Santa Ana Canyon Management Area.

SECTION 2. AGENCY INFORMATION

2.1 HISTORY OF AGENCIES IN SANTA ANA CANYON MANAGEMENT AREA

As shown on Figure 2-1, eight agencies have jurisdiction within the Santa Ana Canyon Management Area. The footprint of the various agencies within the Santa Ana Canyon Management Area has evolved over time due to annexations and changes in the sphere of influence (e.g., City of Corona water service area, OCWD annexation). In Fall 2013 OCWD completed annexing a portion of the Yorba Linda Water District (YLWD) and City of Anaheim into OCWD's service area. The annexation was done in response to a request from these agencies to have a portion of their service area included within OCWD's boundaries. Table 2-1 lists the agencies and the approximate area covered by each.

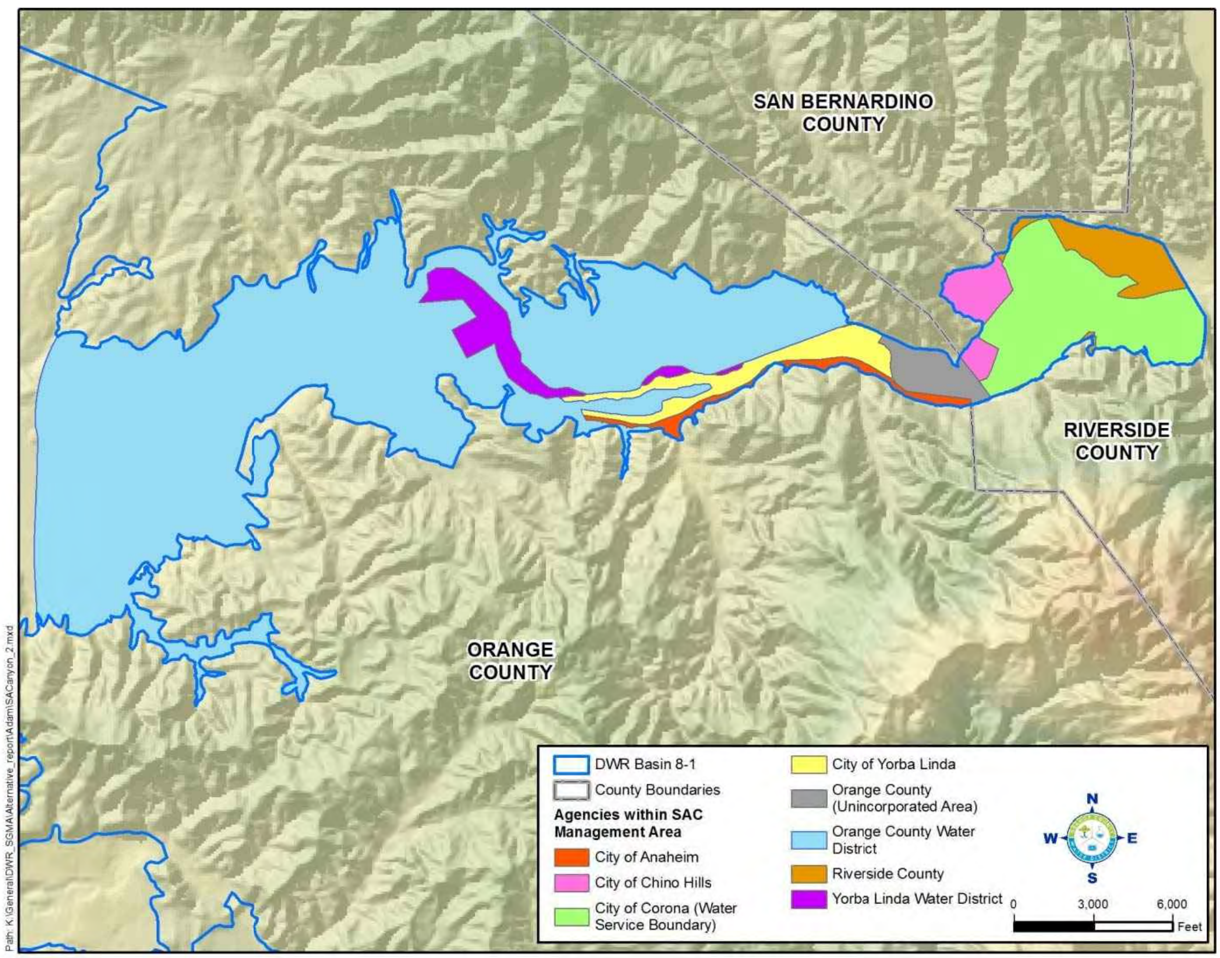


Figure 2-1: Agencies in the Santa Ana Canyon Management Area

Table 2-1: Agencies in Santa Ana Canyon Management Area and Area Covered

Agency	Area Covered (acres)
City of Anaheim	90
City of Chino Hills	130
City of Yorba Linda	220
City of Corona Water Service Area*	660
Orange County Water District	4,310
County of Orange	120
Riverside County	200
Yorba Linda Water District	190
Total Area	**5,920**

*Note that the City of Corona's service area includes areas within the County of Orange.

The Santa Ana Canyon Management Area covers 2.6 percent of Basin 8-1, which has a total area of 223,600 acres or 350 mi^2.

As shown on Figure 2-1 and in Table 2-1, the City of Corona represents the largest water service provider in the Riverside County portion of the Management Area, covering about 660 acres. In this area, Corona provides about 368 acre-feet per year (2015 total) of water to approximately 663 connections, including 639 single family residences, 1 multi-family residence, 17 commercial, and 6 additional connections (including landscape). Water source types include groundwater pumped from the adjacent Temescal Subbasin and treated imported Colorado River water purchased from Metropolitan Water District of Southern California.

2.2 GOVERNANCE AND MANAGEMENT STRUCTURE

There are currently no groundwater withdrawals or plans for withdrawals within the portions of the Santa Ana Canyon Management Area that are overlain by the City of Anaheim, City of Chino Hills, City of Yorba Linda, Riverside County, and the Yorba Linda Water District. Key reasons for the lack of significant production are the lack of demands in these areas, the relatively poor quality of groundwater in the Santa Ana Canyon Management Area, and lack of developable land due to land use limitations. In addition, there are no groundwater withdrawals or plans for withdrawals by the City of Corona; although there are existing groundwater withdrawals within the Corona service area, the wells are owned and operated by the County of Orange for golf course irrigation. As mentioned above, Corona delivers water from sources outside of the Santa Ana Canyon Management Area.

Accordingly, no formal groundwater governance and management structure is needed for the areas in the Santa Ana Canyon Management Area covered by these agencies other than the existing monitoring program that OCWD already carries out in accordance with its authorities under the OCWD Act. The governance and management structure of OCWD is described in the OCWD Management Area part of this report. As will be shown later in this section, groundwater withdrawals by the County of Orange and private users within the Santa Ana

Canyon Management Area are de minimis compared to the overall flow of water through the Santa Ana Canyon Management Area, and they are expected to remain at current sustainable levels. As a result, there is no need for other agencies to establish groundwater governance or management in the Santa Ana Canyon Management Area beyond existing levels of monitoring; however, groundwater production, level and quality data will continue to be collected and reported to DWR by OCWD per CASGEM and SGMA requirements.

2.3 LEGAL AUTHORITY

The legal authority of OCWD is described in the OCWD Management Area part of this report. As described in the OCWD Management Area part of the report, OCWD has obtained water rights from the State Water Resources Control Board (SWRCB) to all of the flows in the Santa Ana River arriving at Prado Dam. As a result, any future groundwater production within the Santa Ana Canyon Management Area would be reviewed by OCWD and the SWRCB to ensure it does not interfere with OCWD's existing water rights. Moreover, though outside of OCWD's boundaries, OCWD currently monitors portions of Santa Ana Canyon pursuant to its authority under Section 2, subparagraphs 5, 6, 7 and 14, of the OCWD Act.

The Orange County Well Ordinance (County Ordinance No. 2607) requires that a permit be obtained from Orange County prior to the construction or destruction of any well. In unincorporated areas and in 29 of 34 Orange County cities, the Orange County Health Officer is responsible for enforcement of the well ordinance. In the remaining five cities (Anaheim, Buena Park, Fountain Valley, Orange and San Clemente), well ordinances are enforced by city personnel. Any plans for wells in areas covered by Riverside and San Bernardino Counties would be reviewed by OCWD to ensure they did not interfere with OCWD's rights to Santa Ana River flows.

2.4 BUDGET

OCWD's costs for data collection within the Santa Ana Canyon Management Area are contained within OCWD's budget for data collection in the OCWD Management Area, which is presented in the OCWD Management Area portion of this report. The only future costs that will be incurred by the County of Orange are related to collecting production data from wells used to irrigate the County-owned Green River Golf Course. The other agencies within the Santa Ana Canyon Management Area will not incur any additional costs to comply with this Section of the Alternative since no further monitoring other that already undertaken by OCWD and Orange County is believed needed in order to prevent undesirable results from occurring. As a result, an estimated budget for other agencies has not been defined for the Santa Ana Canyon Management Area due to the minimal nature of the effort to collect and report groundwater production, level and water quality data.

SECTION 3. MANAGEMENT AREA DESCRIPTION

3.1 SANTA ANA CANYON MANAGEMENT AREA

The Santa Ana Canyon is a narrow east-west trending canyon between the Santa Ana Mountains to the south and the Chino Hills to the north near the intersection of Orange, San Bernardino and Riverside Counties. As shown on Figure 3-1, a key feature is the Santa Ana River, which is southern California's longest coastal river, extending 96 miles from its headwaters in the San Bernardino Mountains to the Pacific Ocean with a watershed that covers over 2,600 square miles. Just upstream of the Santa Ana Canyon is Prado Dam, which was constructed by the US Army Corps of Engineers in 1941 to reduce flood risks to Orange County.

The canyon has been infilled by Quaternary age (2.6M years to present) alluvial deposits of the Santa Ana River. The adjacent Chino Hills and Santa Ana Mountains are composed of various older consolidated sedimentary, igneous and metamorphic rocks. The water resources in the Santa Ana Canyon Management Area include the Santa Ana River and groundwater. Groundwater occurs in the alluvial deposits under generally unconfined conditions and is sourced from a combination of Santa Ana River recharge and subsurface inflow from the adjacent Chino Hills and Santa Ana Mountains. The DWR Basin 8-1 boundary in the Santa Ana Canyon follows the trace of the alluvial deposits as shown on Figure 3-2. In 2016, portions of the previous basin 8-1 boundary were revised by DWR at the request of OCWD to more closely align with the recent geologic mapping of the alluvial deposits.

The Santa Ana Canyon Management Area covers the area of alluvial deposits in the Santa Ana Canyon east of Imperial Highway (Hwy 90), as shown on Figure 3-3. Imperial Highway was selected as the western boundary of the Santa Ana Canyon Management Area because this is where the groundwater basin transitions from a relatively thin alluvial aquifer to a deep multi-layered alluvial basin. Moreover, Imperial Highway is the approximate boundary of OCWD's groundwater flow model, allowing subsurface outflows from the entire Santa Ana Canyon Management Area to be readily quantified for purposes of the water budget and monitoring groundwater in storage.

Previously published reports indicated that the alluvial deposits in Santa Ana Canyon ranged from 90 to 100 feet thick (USGS, 1964). To further characterize the alluvial deposits in the Santa Ana Canyon, all available well logs were reviewed and two cross-sections were developed. Figure 3-4 shows the cross-section locations and the wells used to develop the cross sections. Figure 3-5 presents cross-sections A-A' and B-B'. As shown on Figure 3-5, the thickness of the alluvial deposits in the Santa Ana Canyon are consistent with those reported by the USGS (1964).

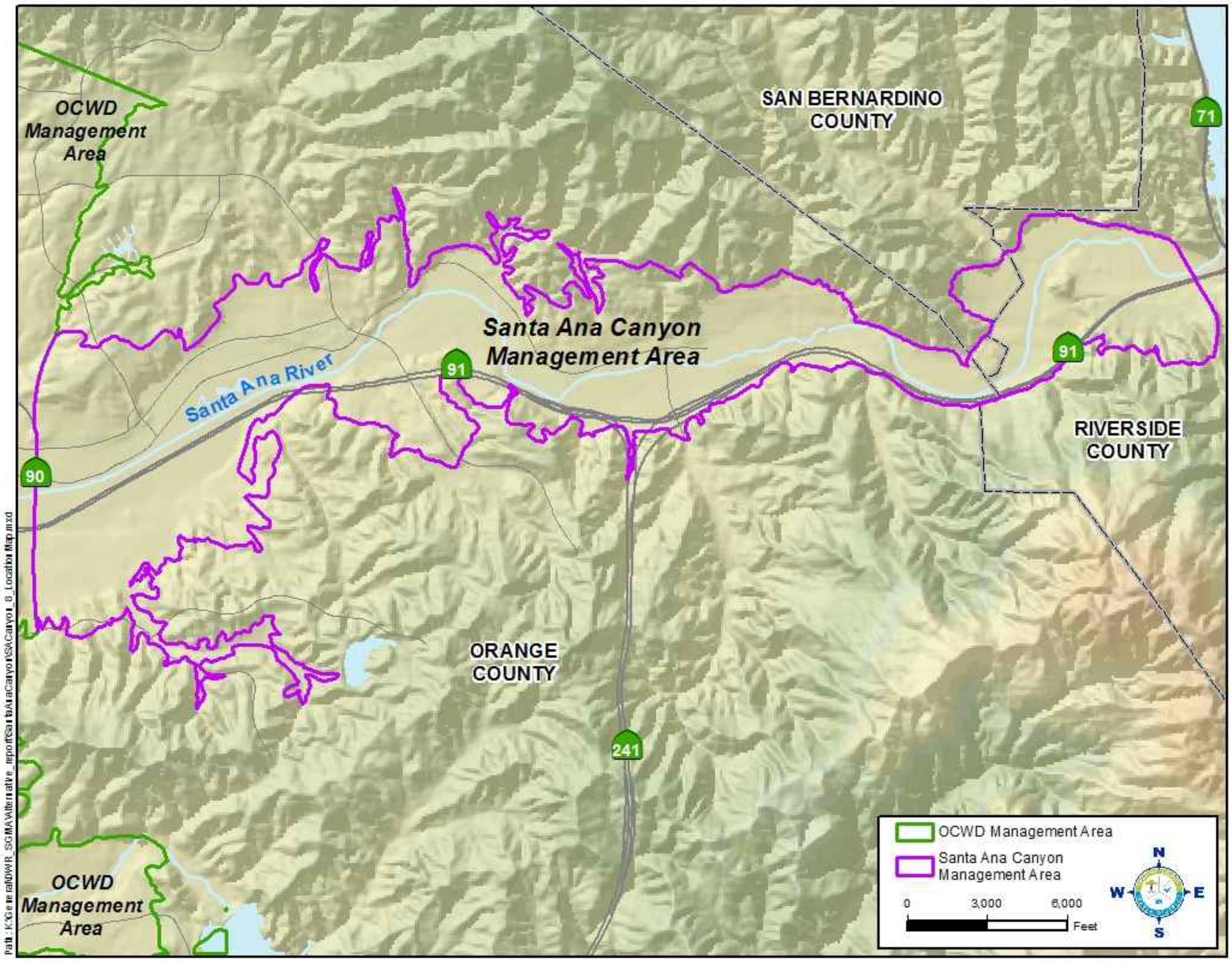


Figure 3-1: Boundaries of Santa Ana Canyon Management Area

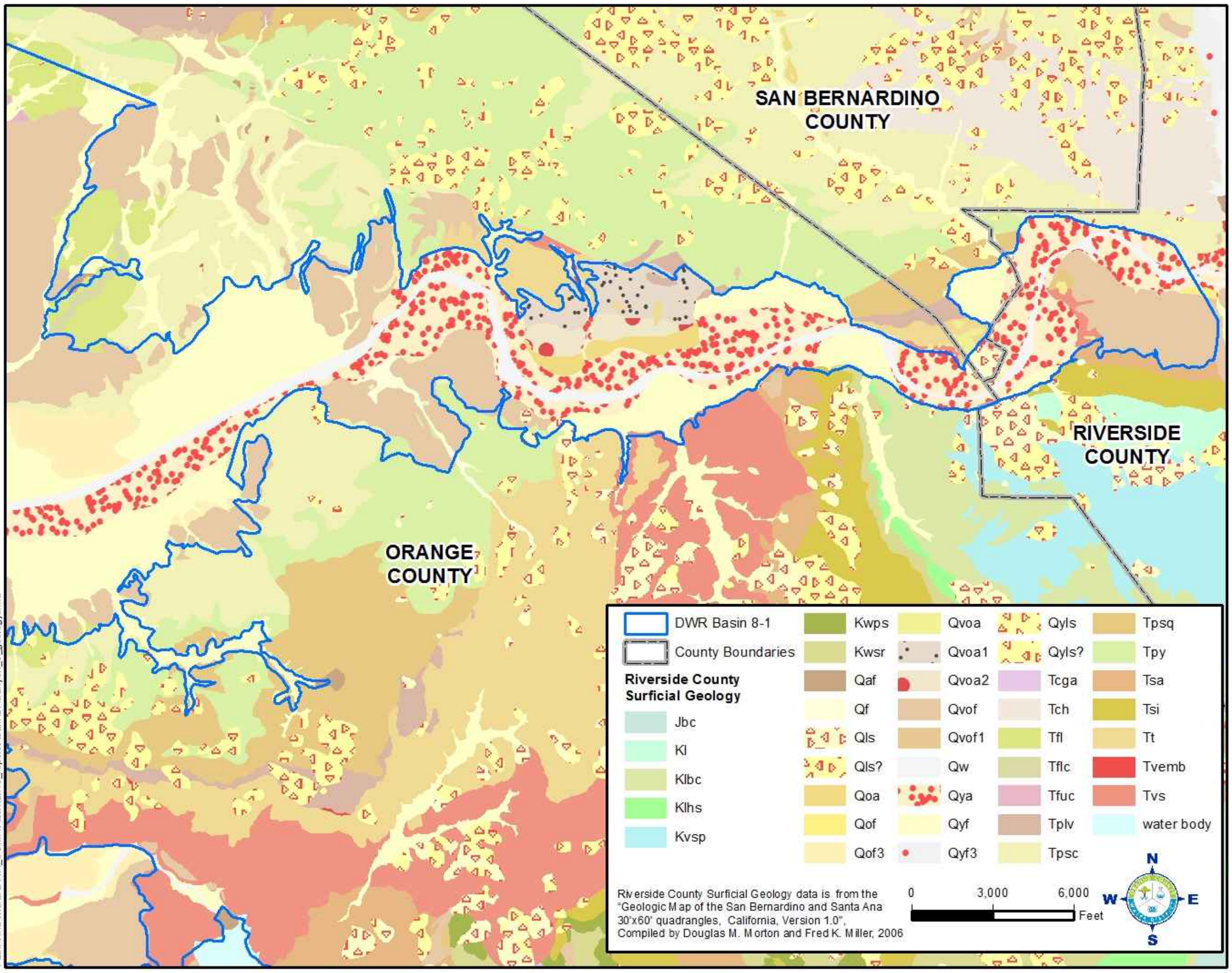


Figure 3-2: Geology

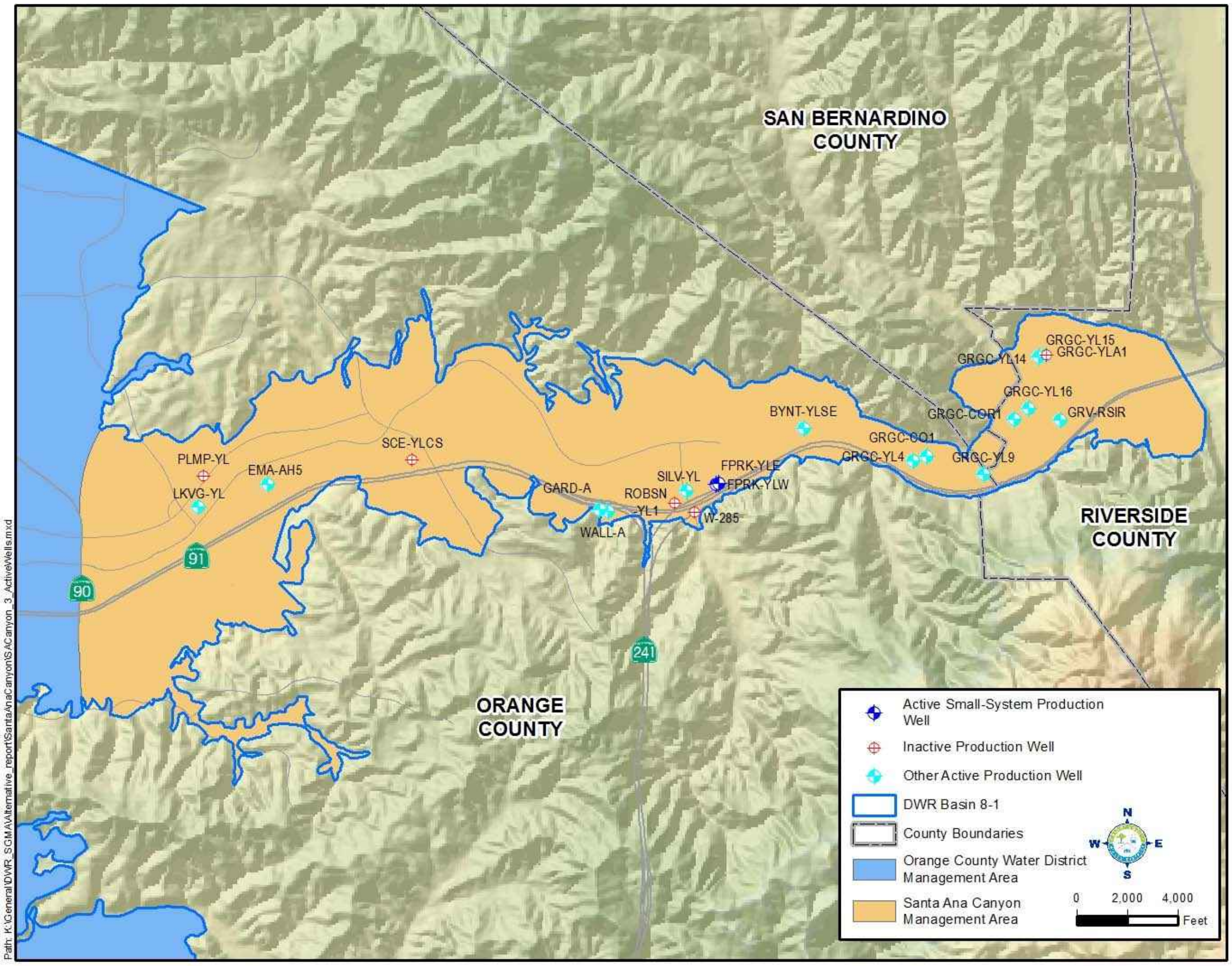


Figure 3-3: Groundwater Production Wells (Active and Inactive)

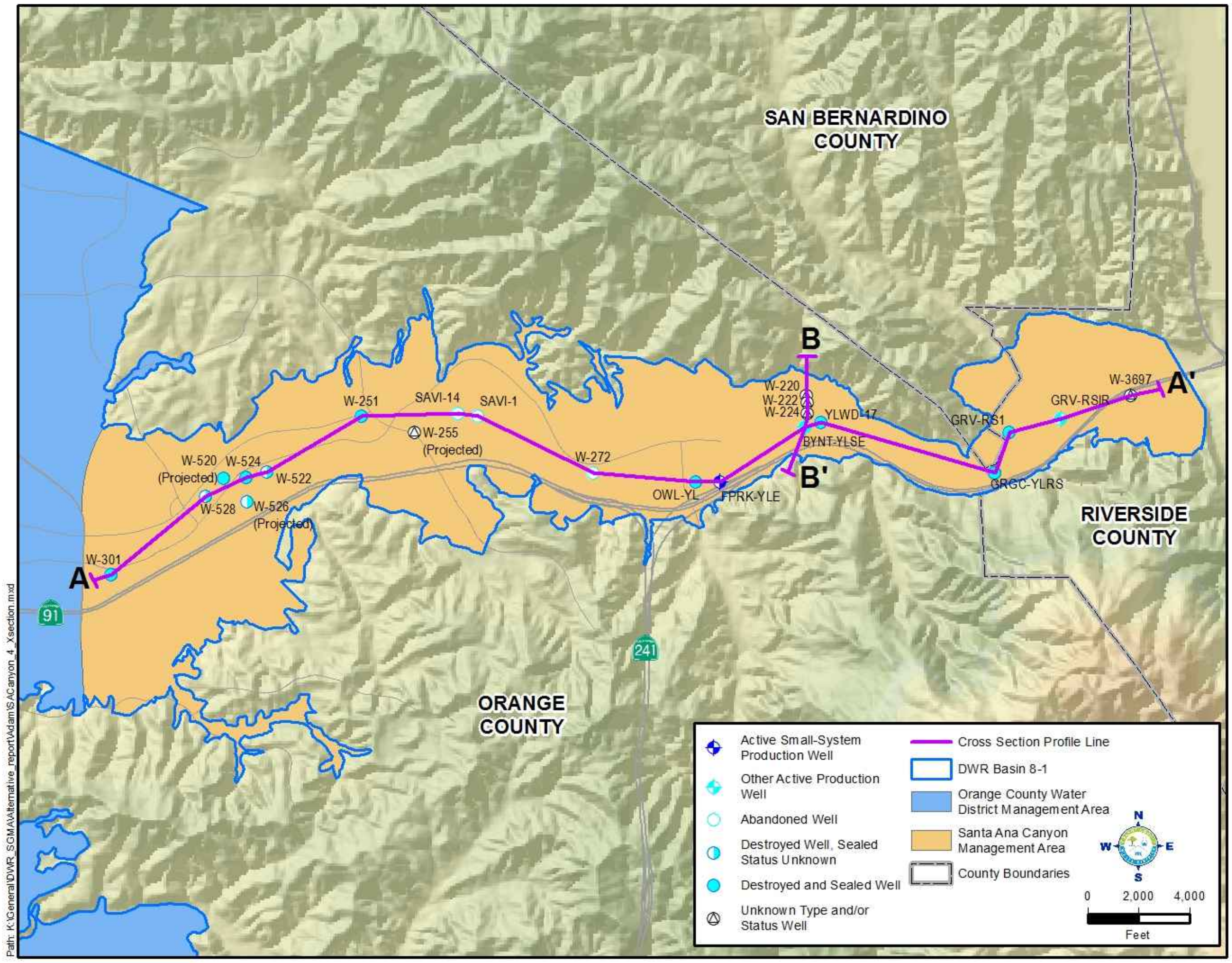


Figure 3-4:Cross-Section Locations

3.1.1 Jurisdictional Boundaries

As described in Section 2, there are eight agencies with jurisdiction in the Santa Ana Canyon Management Area as shown on Figure 2-1. The western boundary of the Santa Ana Canyon Management Area is parallel to Imperial Highway and is within OCWD's jurisdiction.

3.1.2 Existing Land Use Designations

As described in the OCWD Management Area part of this report, much of the land use in Orange County is urban. The Santa Ana Canyon Management Area has some dedicated open-space due to the presence of the Santa Ana River and adjacent floodplain and the Chino Hills State Park, located in the far northeastern portion of the Santa Ana Canyon Management Area. The Green River Golf Club owned by the County of Orange covers approximately 220 acres along the river near the intersections of Orange, Riverside, and San Bernardino counties.

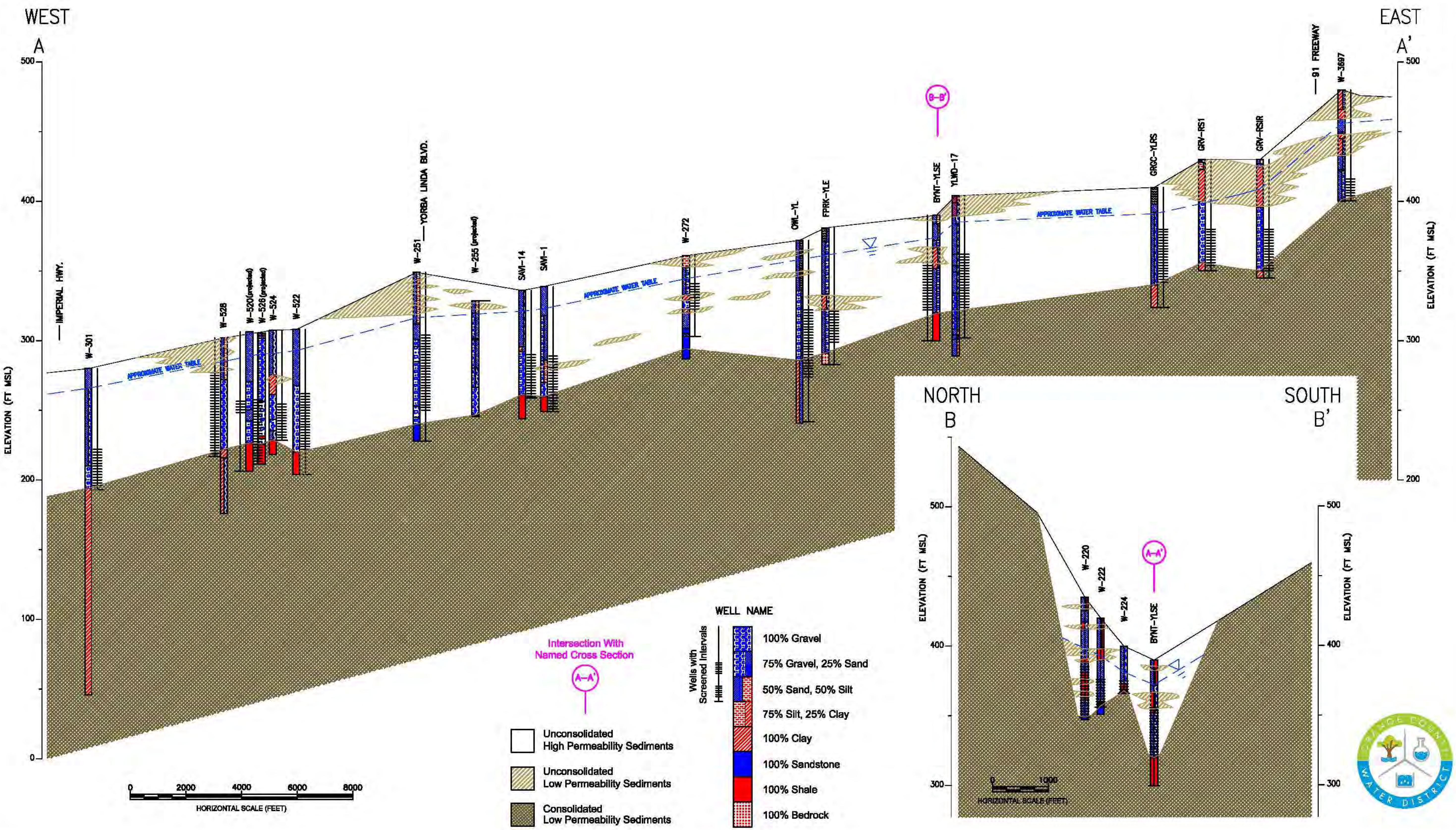


FIGURE 3-5: HYDROGEOLOGIC CROSS SECTION ALONG THE SANTA ANA RIVER BELOW PRADO DAM

Figure 3-6 shows the land uses in the Santa Ana Canyon Management Area as shown by the USGS topographic map of the area. Note that the areas shaded in purple are urbanized areas. There has been additional development in the area since the map was prepared in 2000; however, much of it is outside of the Santa Ana Canyon Management Area in the surrounding foothills.

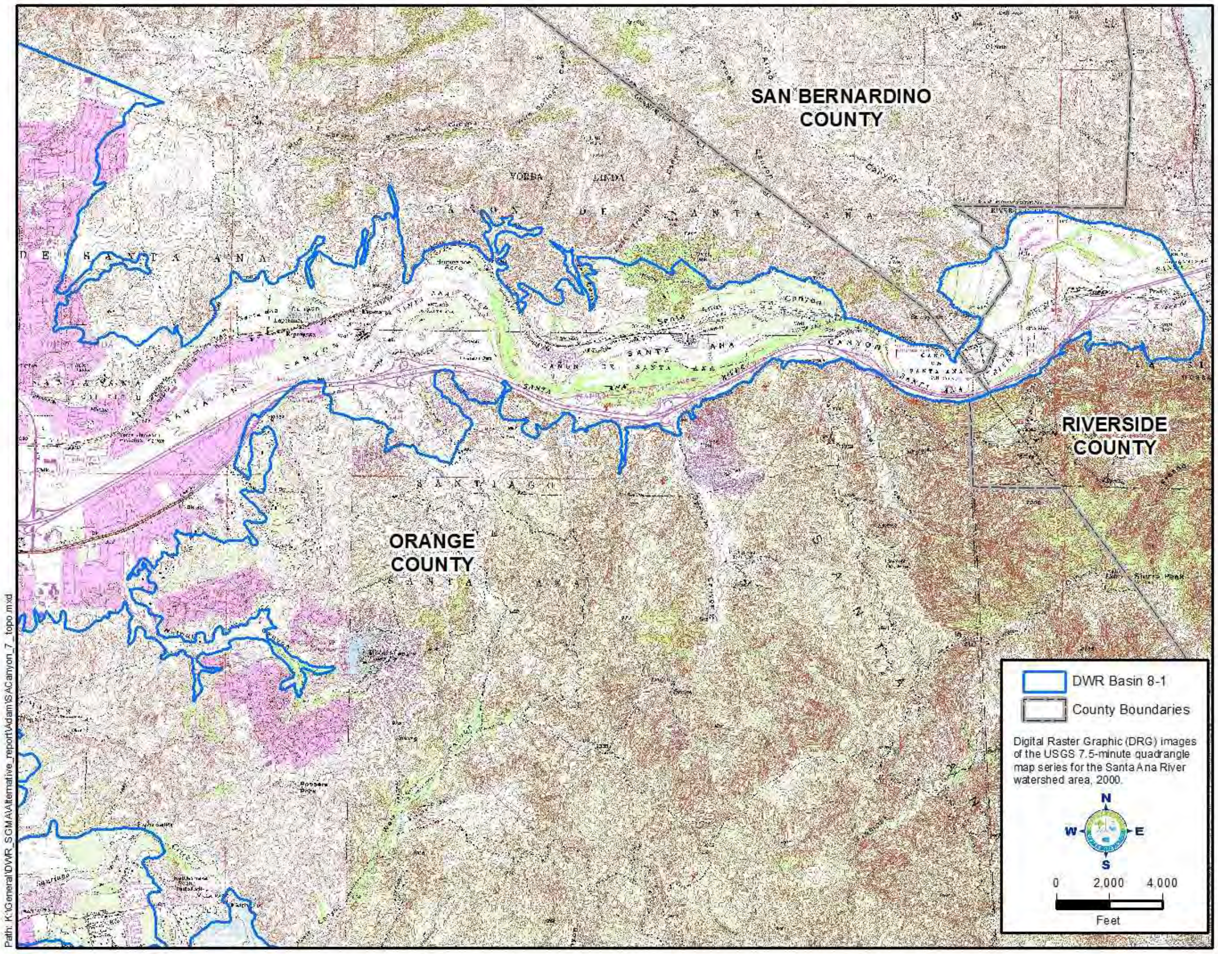


Figure 3-6: Land Uses

3.2 GROUNDWATER CONDITIONS

Groundwater within the Santa Ana Canyon Management Area occurs in a narrow canyon within a relatively thin alluvial aquifer that is less than 100 feet thick in most places (see Figure 3-5).

3.2.1 Groundwater Elevation

Groundwater elevations in the Santa Ana Canyon Management Area tend to be stable. Hydrographs from four wells show that water levels vary over a narrow range as shown on Figure 3-7. Well locations are shown on Figure 3-3 and cover the eastern (GRV-RSIR), south-central (FPRK-YLE/SILV-YL, and western (SCE-YLCS) areas of the Santa Ana Canyon Management Area. Maximum high water levels in many wells were recorded in 2004, which was a record-breaking wet year with very high sustained flows in the Santa Ana River. Low water levels appear to be primarily related to short term local pumping. For all four wells, groundwater is approximately 20 to 30 feet below ground surface in the vicinity of the wells. Since the Santa Ana River channel is incised in some areas by 10 to 15 feet below the surrounding area, the depth to groundwater is even lower directly beneath the river channel.

The consistent, stable nature of groundwater elevations in the Santa Ana Canyon Management Area shows that aquifer is generally full, which is consistent with the finding that here are no measurable losses of flows between upstream Prado Dam and OCWD's diversion to its recharge system just below Imperial Highway.

OCWD, in cooperation with the County of Orange, will begin collecting groundwater elevation data in 2017 at selected wells at the Green River Golf Course to complement existing groundwater elevation monitoring data. Note that wells SILV-YL and SCE-YLCS are monitored for the CASGEM program.

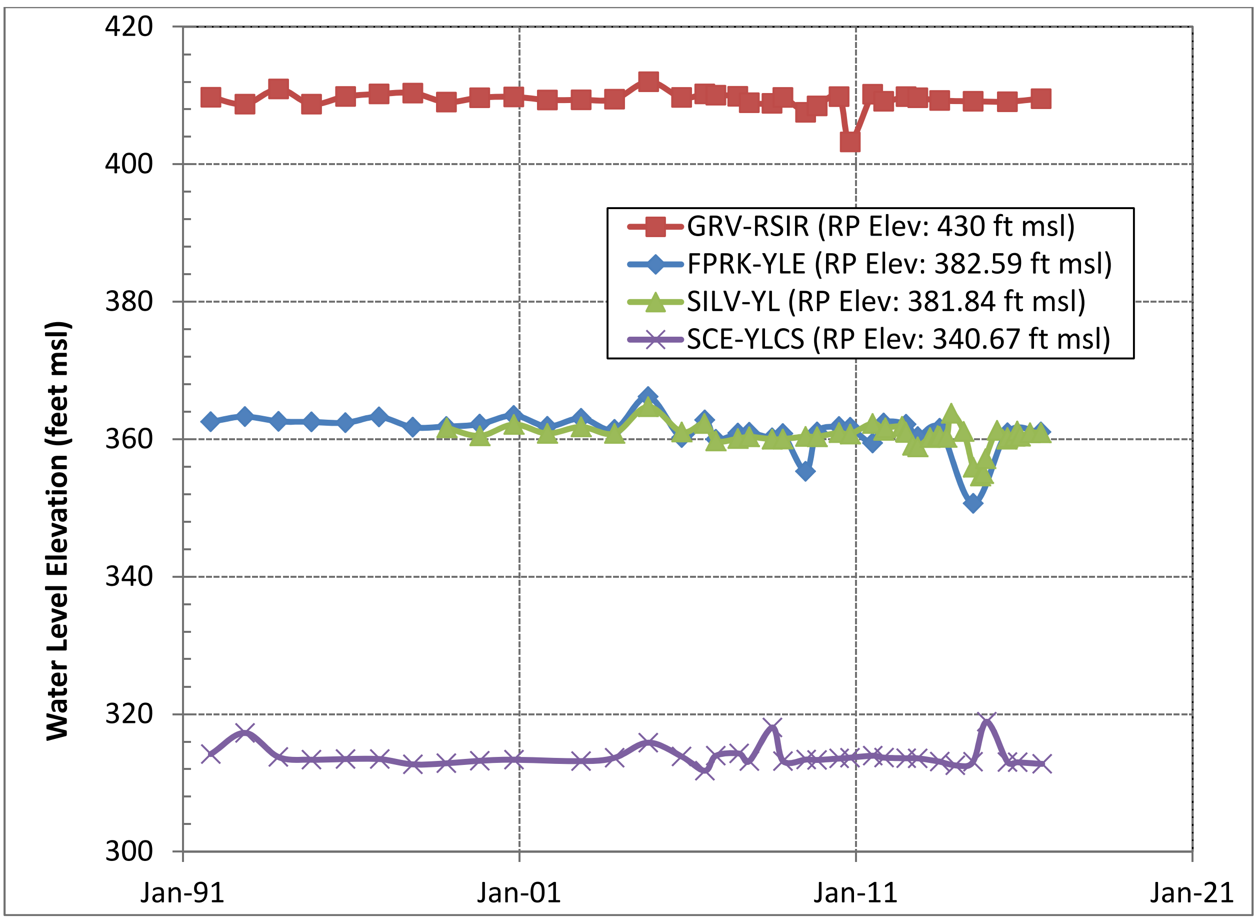


Figure 3-7: Water Level Hydrographs of Selected Wells

3.2.2 Groundwater Beneficial Uses and Regional Pumping Patterns

The Santa Ana Canyon Management Area is within the Santa Ana Region of the California Water Boards and is subject to the Santa Ana Region Basin Plan (January 24, 2014; updated July, 2014). The Basin Plan designates zones related to groundwater management. The Santa Ana Canyon Management Area is included in the Orange County Management Zone. Within this Zone, groundwater has been designated for municipal, agricultural, and industrial (service supply and process) beneficial uses. Currently, local groundwater provides primarily irrigation supply with some residential drinking water (RV Park) and domestic uses.

There are 18 wells that can withdraw groundwater within the Santa Ana Canyon Management Area as shown on Figure 3-2; however, some of the wells shown are not currently being used. Groundwater production at many of the wells is metered and reported to OCWD by the well owners. Eight of the wells are owned by the County of Orange to supply irrigation water to the Green River Golf Course. Even though some of these wells are metered, individual meter readings have not historically been collected by County staff. It is estimated that total production to supply the golf course is approximately 1,000 acre-feet per year (Personal Communication, Merrie Weinstock, County of Orange). The County of Orange will be installing flow meters on wells that are not currently metered and will begin obtaining monthly measurements of production from each well in the near future.

An irrigation well owned by Neff Ranch (BYNT-YLSE) was recently annexed into OCWD’s service area. A request has been sent to the owner to register this well and begin to report production as required by the OCWD Act. An estimate of current production is based on the irrigation of 21 acres of mature orange groves.

As shown on Table 3-1, total groundwater production within the Santa Ana Canyon Management Area over the last 10 years is estimated to range from 1,475 to 2,234 acre-feet per year and averaging 1,839 acre-feet per year. Table 3-1 lists the production wells, meter status, and 10-year average production for wells located within the Santa Ana Canyon Management Area.

Prior to 2012, the City of Corona also owned and operated a local production well in the Santa Ana Canyon Management Area. The well, referred to as Well 18, was located in a field northwest of the 91 Freeway and Prado Road and was reportedly drilled in 1984 to an approximate total depth of 86 feet. Although historical production records are incomplete, Well 18 was apparently pumped over several years for supplemental local water supply prior to being officially destroyed in 2012.

Table 3-1: Production Wells, Flow-Meter Status, and 10-Year Average Production

Well Name	Well Use	Owner	Metered	10-Yr Avg 2006-15 (afy)	Max (af)	Min (af)	Notes
BYNT-YLSE	IR	Neff Ranch, Ltd	No	53	53	53	Estimated use, 21 acres of orange groves, meter install requested
EMA-AH5	IR	County Of Orange	Yes	76	98	52	
FPRK-YLE	DW/IR	Canyon RV Park	Yes	59	67	41	
FPRK-YLW	DW/IR	Canyon RV Park	Yes	55	67	33	
GARD-A	IR	Kindred Outreach Ministries	No	1	1	1	Minimum reportable volume
GRGC-CO1	IR	OCFCD	Yes	See estimate for Green River Golf Course			Flow meter not in ideal location
GRGC-COR1	IR	OCFCD	Yes				Flow meter not in ideal location
GRGC-YL14	IR	OCFCD	Yes				Inactive
GRGC-YL15	IR	OCFCD	No				Flow meter to be installed
GRGC-YL16	IR	OCFCD	No				Flow meter to be installed
GRGC-YL4	IR	OCFCD	Yes				Inactive
GRGC-YL9	IR	OCFCD	Yes				Inactive
GRGC-YLA1	IR	OCFCD	Yes				
GRV-RSIR	IR	Green River Village	Yes	11	25	5	
LKVG-YL	IR	Eastlake Village HOA	Yes	79	89	60	
ROBSN-YL1	IR	Robertson Ready Mix	Yes	1	6	0	Inactive for 5 yrs, No data for 2006-7.
SILV-YL	IR	County Of Orange	Yes	503	827	229	No data for 2006, CASGEM well
WALL-A	DOM	Wallace, Dick	No	1	1	1	Minimum reportable volume
Total Estimated Green River Golf Course Usage				1,000	1,000	1,000	8 OCFCD wells
Totals				**1,839**	**2,234**	**1,475**	

IR= Irrigation; DW=Drinking Water; DOM=Domestic
OCFCD = Orange County Flood Control District

3.2.3 Groundwater Storage Data

Groundwater storage in Basin 8-1 is estimated at 66 million acre-feet (OCWD, 2007), which does not include the Santa Ana Canyon Management Area. To estimate the amount of storage in the alluvial aquifer within Santa Ana Canyon Management Area, all well data were used and depths to bedrock estimated. The thickness of the alluvial deposits is assumed to be zero at the basin margin. Using a Topo to Raster Interpolation function in ArcGIS, the total volume of alluvial deposits was estimated at 174,000 acre-feet. Assuming a porosity of 25 percent gives a total potential groundwater storage volume of 43,500 acre-feet. The actual volume of groundwater in storage is smaller given that this estimate does not take into account that the depth to groundwater is typically 20 to 30 feet below ground surface.

3.2.4 Groundwater Quality Conditions

Groundwater quality in the Santa Ana Canyon Management Area is generally good and suitable to meet beneficial uses. Groundwater in the Santa Ana Canyon Management Area is a mixture of infiltrated Santa Ana River water and subsurface inflow. As shown on Figure 3-8, total dissolved solids (TDS) concentrations in groundwater range from just under 600 to 2,180 mg/L. Santa Ana River water at Prado Dam is characterized by lower TDS concentrations. Since 1972, the flow-weighted average TDS of Santa Ana River water has ranged from a low of 348 mg/L in 2005 to a high of 728 mg/L in 1981 (Santa Ana River Watermaster Reports). Based on TDS concentrations, some wells appear to primarily produce local groundwater sourced from subsurface inflow along the boundaries of the Santa Ana Canyon Management area, while others, such as FPRK-YLE, FPRK-YLW and SILV-YL, appear to produce a blend of local groundwater and infiltrated Santa Ana River water.

Except for a few detections of arsenic and nitrate, groundwater meets primary drinking water standards; however, all wells produce groundwater that exceeds secondary standards for TDS and manganese. No volatile organic compounds (VOCs), semi-volatile organics, or other contaminants have been detected. Table 3-2 summarizes the available water quality data for TDS and Nitrate (NO_3 as N). Table 3-3 summarizes the available water quality data for arsenic (As) and manganese (Mn). Table 5-1 summarizes the water quality analyses and frequency of testing conducted at wells in the Santa Ana Canyon Management Area.

Table 3-2: TDS and Nitrate (as N) in Selected Wells

Well Name	Well Use	Date Range	Avg. TDS		Avg. NO3 as N		Notes
			mg/L	# of samples	µg/L	# of samples	
BYNT-YLSE	IR	1969-2016	1,132	6	2.2	7	Exceeded NO3 MCL 1 time in 1969
FPRK-YLE	DW/IR	1988-2016	726	17	2.3	105	
FPRK-YLW	DW/IR	1969-2016	774	25	2.4	74	
GRGC-COR1	IR	2013-2016	1,910	4	0.4	4	
GRV-RSIR	IR	1970-2013	1,487	12	0.13	14	Original well: GRV-RS1(1972-84)
ROBSN-YL1	IR	2001-2004	666	2	1.9	2	
SILV-YL	IR	1995-2007	597	5	1.4	5	
WALL-A	DOM	1968-2014	1,399	4	3.6	3.6	

IR = Irrigation; DW=Drinking Water; DOM=Domestic
TDS Secondary MCL: 500 mg/L

Table 3-3: Arsenic and Manganese in Selected Wells

Well Name	Well Use	Date Range	Avg. As		Avg. Mn		Notes
			ug/L	# of samples	ug/L	# of samples	
BYNT-YLSE	IR	1969-2016	ND	ND	150	2	
FPRK-YLE	DW/IR	1988-2016	8.3	22	756	45	Exceeded As MCL in 3 samples, Jan-March 2003
FPRK-YLW	DW/IR	1969-2016	4	20	900	45	
GRGC-COR1	IR	2013-2016	NS	NS		NS	
GRV-RSIR	IR	1970-2013	8.2	1	578	6	Original well: GRV-RS1 (1972-84)
ROBSN-YL1	IR	2001-2004	NS			NS	
SILV-YL	IR	1995-2007	NS		350	1	
WALL-A	DOM	1968-2014	NS		200	1	

IR= Irrigation; DW=Drinking Water; DOM=Domestic
ND = Not detected
NS = Not sampled
* Mn Secondary MCL: 50 ug/L.

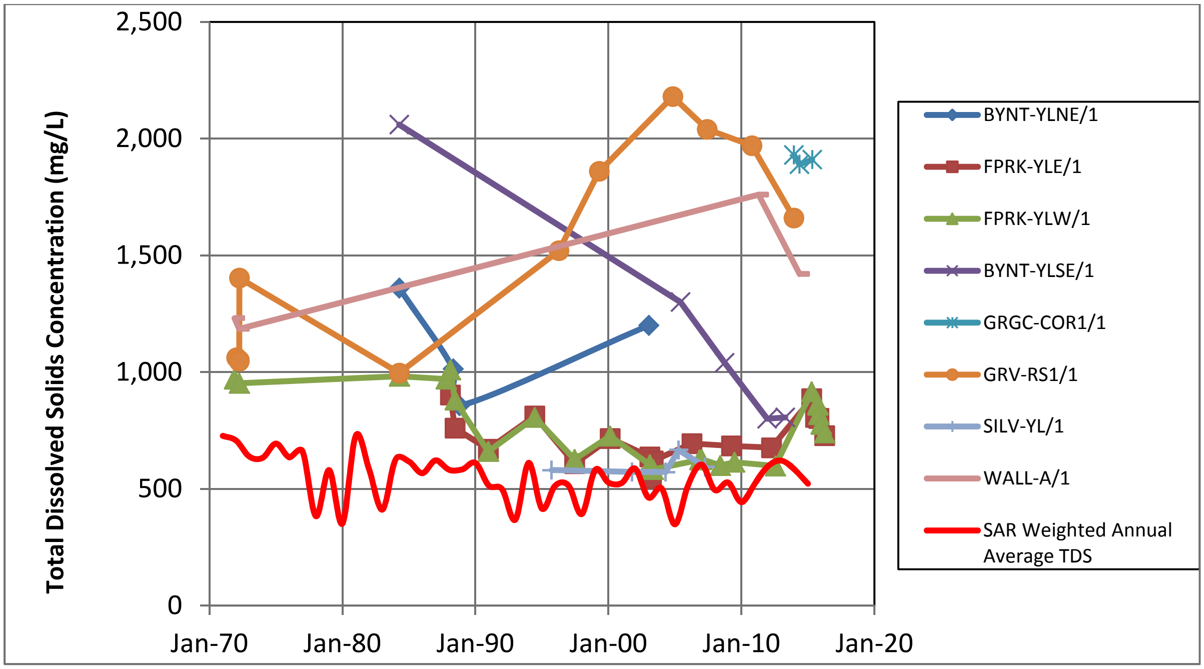


Figure 3-8: TDS Concentrations

3.2.5 Land Subsidence

Land subsidence is monitored within the OCWD Management Area but not within the Santa Ana Canyon Management Area. Subsidence is not an issue for the Santa Ana Canyon Management Area given the following:

1. The presence of shale and sandstone bedrock underlying the alluvial aquifer is not thought to be compressible or subject to inelastic subsidence.
2. The alluvial aquifer is thin, generally less than 100 feet, and comprised mainly of sand and gravel with only minor amounts of clay.
3. Groundwater levels and storage are relatively stable over time.
4. Substantial groundwater level declines are unlikely due to the de minimis amount of groundwater production relative to the overall inflow of water to the Santa Ana Canyon Management Area.

3.2.6 Groundwater and Surface Water Interactions and Groundwater Dependent Ecosystems

Groundwater within the Santa Ana Canyon alluvial aquifer is consistently 20 to 30 feet below ground surface and even less in the incised portions of the Santa Ana River channel. As described in Section 4, Water Budget, the flow of surface water through the canyon dwarfs the documented groundwater production. As a result, groundwater production has a de minimis impact on groundwater conditions and flows of surface water through the canyon. This in turn demonstrates that groundwater production in the Santa Ana Canyon has little to no impact on local groundwater dependent ecosystems in the Santa Ana Canyon Management Area, if any.

SECTION 4. WATER BUDGET

The water budget of the Santa Ana Canyon Management Area is dominated by surface flows of the Santa Ana River with a minor contribution of subsurface inflow, return flows from irrigation, and a small amount of groundwater production. Table 4-1 presents the overall water budget for the Santa Ana Canyon Management Area. This water budget contains both surface water and groundwater components and is not used to analyze change in groundwater storage. The purpose of presenting this water budget is to show the dominance of Santa Ana River flows in the Santa Ana Canyon Management Area.

Table 4-1: Water Budget, 10-Year Average (2006-15)

Flow Component	10-Yr Avg: 2006-15 (afy)	Max (1) (af)	Min (1) (af)
Santa Ana River Base Flow (2)	100,400	147,700	63,500
Santa Ana River Storm Flow (2)	72,300	211,000	18,300
Subsurface Inflow (3)	5,000	5,000	5,000
TOTAL INFLOW	**177,700**	**363,700**	**86,800**
Santa Ana River Base Flow (2)	98,820	145,730	62,280
Santa Ana River Storm Flow (2)	72,300	211,000	18,300
Evapotranspiration (4)	740	740	740
Groundwater Production	1,840	2,230	1,480
Subsurface Outflow (5)	4,000	4,000	4,000
TOTAL OUTFLOW	**177,700**	**363,700**	**86,800**

(1) Note that for Santa Ana River flows, the maximum and minimum base and storm flow years may not occur in the same year. These numbers are for illustrative purposes only.
(2) From Santa Ana River Watermaster Reports (Oct-Sept. Water Year).
(3) Subsurface inflow is estimated and includes irrigation return flow and areal recharge from precipitation.
(4) Evapotranspiration is based on 370 acres of riparian habitat and a usage rate of 2 afy/acre of habitat per Santa Ana River Watermaster Reports.
(5) Subsurface outflow is based on OCWD's calibrated groundwater flow model.

Groundwater level data suggest that groundwater conditions in the Santa Ana Canyon Management Area are essentially at steady state conditions with inflow equaling outflow and no change in groundwater storage. Inflow to the groundwater aquifer includes subsurface inflow and an unquantified amount of infiltrated Santa Ana River water. Outflow includes evapotranspiration, groundwater production and subsurface outflow. Table 4-2 presents the groundwater budget for the Santa Ana Canyon Management Area.

Table 4-2: Groundwater Budget, 10-Year Average (2006-15)

Flow Component	10-Yr Avg: 2006-15 (afy)
Subsurface Inflow (1)	5,000
Infiltrated Santa Ana River Base Flow (2)	1,580
TOTAL INFLOW	**6,580**
Evapotranspiration (3)	740
Groundwater Production	1,840
Subsurface Outflow to OCWD Management Area (4)	4,000
TOTAL OUTFLOW	**6,580**
NET CHANGE	0

(1) Subsurface inflow is estimated and includes irrigation return flow and areal recharge from precipitation.
(2) Estimated infiltration of Santa Ana River base flow to balance outflow.
(3) Evapotranspiration is based on 370 acres of riparian habitat and a usage rate of 2 afy/acre of habitat per Santa Ana River Watermaster Reports.
(4) Subsurface outflow is based on OCWD's calibrated groundwater flow model.

4.1 BUDGET COMPONENTS

The components of the groundwater budget are described below.

4.1.1 Subsurface Inflow/Outflow

During development of OCWD's groundwater flow model, an estimate was made of the inflow to the Santa Ana Canyon Management Area that eventually flowed into the main groundwater basin. The easternmost extent of the groundwater model is at Imperial Highway (SR90), which is also the boundary of the Santa Ana Canyon Management Area with the OCWD Management Area. The outflow estimate is based on the cross-sectional area of the Santa Ana Canyon at Imperial Highway and the average groundwater gradient. This approach yielded an estimated outflow of 4,000 acre-feet per year. During the calibration process it was not necessary to change this estimate and therefore it is assumed to be a reasonable estimate of groundwater outflow from the Santa Ana Canyon Management Area to the main groundwater basin.

Subsurface inflow is a combination of subsurface mountain front recharge, areal recharge from precipitation, and irrigation return flow. It is estimated to be approximately 5,000 afy.

4.1.2 Infiltrated Santa Ana River Base Flow

Water quality data suggests that some of the groundwater produced from wells in the Santa Ana Canyon Management Area is a blend of subsurface inflow and infiltrated Santa Ana River water; however, there is not enough data to determine the relative contribution of each source. For purposes of the groundwater budget, the amount of infiltrated Santa Ana River base flow is the amount necessary to balance the water budget assuming subsurface inflow is 5,000 afy. If the assumed amount of subsurface inflow were to change, the amount of infiltrated Santa Ana River water needed to balance the water budget would change accordingly. Base flow is assumed to be the primary source of supply due to the infrequent nature of storm flows and that groundwater pumping tends to be reduced during the winter months.

4.1.3 Evapotranspiration

Evapotranspiration is assumed to be due to riparian vegetation adjacent to the Santa Ana River. The County of Orange, as part of developing a Habitat Management Plan (HMP), established a baseline of 370 acres of riparian vegetation within the Santa Ana Canyon Management Area (County of Orange, 2016).

The Santa Ana River Watermaster calculates that riparian vegetation consumes approximately 2 afy per acre of vegetated area. Using this approach, the estimated evapotranspiration within the Santa Ana Canyon Management area is estimated to be 740 afy.

4.1.4 Groundwater Production

As described in Section 3.2.2, there are 18 wells that can withdraw groundwater within the Santa Ana Canyon Management Area as shown on Figure 3-3; however, some of the wells shown are not currently being used. Groundwater production from these wells is summarized in Tables 3-1 and 4-1.

4.2 CHANGES IN GROUNDWATER STORAGE

As shown in Figure 3-7, groundwater levels in the Santa Ana Canyon Management Area are stable, indicating that the thin, alluvial aquifer is generally always in a full condition. Therefore, any changes in groundwater storage are small and insignificant.

4.3 WATER YEAR TYPE

The water year type has little impact on the water budget in the Santa Ana Canyon Management Area given the minimal changes in groundwater level observed through time due to the ever present Santa Ana River base flow and subsurface inflow.

4.4 ESTIMATE OF SUSTAINABLE YIELD

As described in Table 4-1, average groundwater production over the last 10 years equates to one percent of the total inflow to the Santa Ana Canyon Management Area. It is clear that the sustainable yield of the Santa Ana Canyon Management Area is much greater than current production levels. Nevertheless, there are no plans for additional wells or groundwater production in the Santa Ana Canyon Management Area and is highly unlikely that groundwater demands would ever rise to the level of changing the water budget of this area significantly. In terms of sustainable yield, it is more appropriate to look at Basin 8-1 as a whole.

4.5 CURRENT, HISTORICAL, AND PROJECTED WATER BUDGET

The current and historical water budget (average over 10 years) is presented in Tables 4-1 and 4-2. A worst-case dry-year water budget is presented in Table 4-3 and is based on the following assumptions:

1. Santa Ana River base flow declines to 44,000 af.
2. Santa Ana River storm flow of only 11,300 af, which equates to the lowest on record (1972) since the Santa Ana River Watermaster started keeping records in 1970.
3. Groundwater production is assumed to be equivalent to the maximum recorded in the period 2006-15, which is 2,230 af.

As shown on Table 4-3, even under dry-year conditions, groundwater production is less than 4 percent of the total water available in the Santa Ana Canyon Management Area. Increases in future production are not likely to be significant given the lack of demands in the area, low well production capacity, availability of imported water sources (such as used in the Corona service area) and relatively poor water quality compared to groundwater in the main OCWD basin.

Table 4-3: Dry-Year Water Budget

Flow Component	Dry-Year Flows (afy)
Santa Ana River Base Flow	44,000
Santa Ana River Storm Flow	11,300
Subsurface Inflow	5,000
TOTAL INFLOW	**60,300**
Santa Ana River Base Flow	42,030
Santa Ana River Storm Flow	11,300
Evapotranspiration	740
Groundwater Production	2,230
Subsurface Outflow	4,000
TOTAL OUTFLOW	**60,300**

SECTION 5. WATER RESOURCE MONITORING PROGRAMS

5.1 OVERVIEW

This section describes OCWD's surface and groundwater monitoring programs in the Santa Ana Canyon Management Area.

5.2 GROUNDWATER MONITORING PROGRAMS

OCWD monitors groundwater levels, quality and production in the Santa Ana Canyon Management Area. As shown on Figure 5-1, groundwater levels are monitored at six wells, two of which are part of the CASGEM program (SCE-YLCS, and SILV-YL).

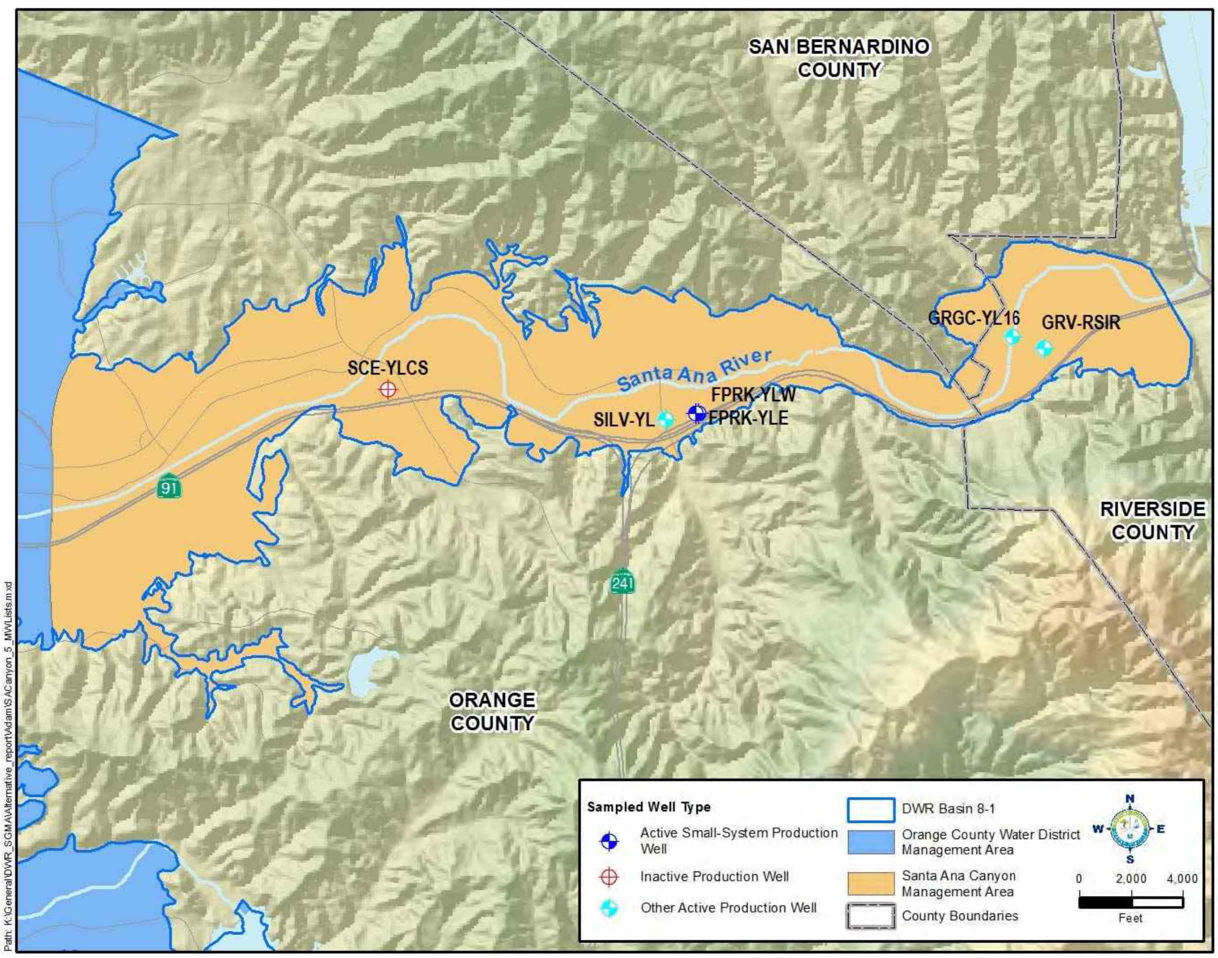


Figure 5-1: Wells Used to Monitor Groundwater Levels

OCWD is collaborating with the County of Orange to collect water levels at selected wells that serve the Green River Golf Course. Data from these wells will be presented in future reports.

For wells within OCWD's boundaries, groundwater production must be reported at a minimum frequency of every 6 months. Groundwater production from the County of Orange's wells that supply the Green River Golf Course will be documented in future reports after meters are installed on all wells and monthly production recorded. It is anticipated that production from all of the wells shown on Table 3-1 will be measured and reported to DWR in future reports.

OCWD also monitors groundwater quality in selected wells in the Santa Ana Canyon Management Area. Table 5-1 lists the wells monitored and the groundwater quality monitoring program each well is part of, which is based on its final use (e.g., irrigation, potable). Wells used for irrigation are sampled every year for volatile organic compounds (VOCs) and every three years for general minerals (major cations and anions), 1,4-dioxane, and perchlorate (ClO_4). The two wells in Featherly Park used for potable supplies are monitored in accordance with drinking water regulations.

Table 5-1: Wells Monitored for Water Quality

Well Name	Water Quality Monitoring Program
BYNT-YLSE EMA-AH5 GARD-A GRGC-CO1 GRGC-COR1 GRGC-YL15 GRGC-YL16 GRGC-YL4 GRV-RSIR LKVG-YL	Annual: Volatile Organic Compounds (VOCs) Every 3 yrs: General Minerals, 1,4-Dioxane, and ClO_4
FPRK-YLE FPRK-YLW	Annual: NO_3, ClO_4, 1,4-Dioxane, Mn, TDS, EC Atrazine/Simazine: every 3 yrs Title 22 Inorganics: every 3 yrs CN: every 9 yrs CrIV: every 3 yrs Radioactivity: every 6 yrs (Gross Alpha, Uranium) Radioactivity: every 9 yrs (Radium 226 & Radium 228)

5.3 OTHER MONITORING PROGRAMS

OCWD monitors the quantity and quality of water in the Santa Ana River just below Prado Dam. The flow of the Santa Ana River below Prado Dam is measured by the USGS at station No. 11074000 (http://waterdata.usgs.gov/ca/nwis/dv/?site_no=11074000). In addition to flow, the USGS measures the electrical conductivity (EC) of the water as well as sampling the water two times per month for TDS. One use of these data is to calculate the flow-weighted average TDS of base and storm flow discharged from Prado Dam (see Figure 3-8). The flow and quality data are collected for the Santa Ana River Watermaster, which was formed to implement the

Stipulated Judgement in the case of Orange County Water District v. City of Chino, et al., Case No. 1172628-County of Orange, entered by the court on April 17, 1969. The most recent watermaster report can be found on OCWD's website at http://www.ocwd.com/media/4247/sar_watermaster_2014-15.pdf. In addition to OCWD, the Santa Ana River Watermaster is comprised of representatives from the Inland Empire Utilities Agency, San Bernardino Valley Municipal Water District, and Western Municipal Water District.

The significance of the 1969 Judgment is that it guarantees a minimum base flow at Prado Dam of 42,000 afy; however, per the terms of the Judgment, the upstream agencies have received (and will continue to receive) credits when base flows exceed of 42,000 af at Prado. With these credits, the required minimum base flow is 34,000 af. As a point of reference, the most recent year base flow in 2014-15 was 63,536 af.

OCWD also closely monitors the quality of water in the Santa Ana River before it is diverted into its recharge system below Imperial Highway. More information about this program can be found in Section 5 of the OCWD Management Area section of this report.

SECTION 6. WATER RESOURCE MANAGEMENT PROGRAMS

OCWD has a wide variety of water resource management programs that cover the main groundwater basin as well as the upper Santa Ana River watershed to address Santa Ana River flow and quality. These programs are important in protecting the quality of the Santa Ana River, which affects groundwater quality in the Santa Ana Canyon Management Area. These programs are described in detail in Section 6 of the OCWD Management Area part of this report. The programs that affect Santa Ana River water quality include:

Groundwater Desalters and the Inland Empire Brineline and Non-Reclaimable Waste Line

Several groundwater desalters have been constructed to reduce the amount of salt buildup in the watershed, which in turn reduces the salinity of the Santa Ana River. The Inland Empire Brine Line (IEBL), formerly called the Santa Ana Regional Interceptor (SARI), built by the Santa Ana Watershed Project Authority (SAWPA), has operated since 1975 to remove salt from the watershed by transporting industrial wastewater and brine produced by desalter operations directly to the Orange County Sanitation District (OCSD) for treatment.

Basin Monitoring Program Task Force

In 1995, a task force of more than 20 water and wastewater resource agencies and local governments, including OCWD, initiated a study to evaluate the impacts to groundwater quality of elevated levels of Total Inorganic Nitrogen (TIN) and TDS in the Santa Ana River watershed. This nearly 10-year effort involved collecting and analyzing data in 25 newly defined groundwater management zones in the watershed to recalculate nitrogen and TDS levels and to establish new water quality objectives. This effort not only protects groundwater quality in the Santa Ana River watershed, it also protects the quality of Santa Ana River water.

Salinity Management and Imported Water Recharge Workgroup

The Salinity Management and Imported Water Recharge Workgroup, in cooperation with the Regional Water Board, implements a cooperative agreement signed in 2008 by water agencies that use imported water for groundwater recharge. The objective of this effort was to evaluate and monitor the long-term impacts of recharging groundwater basins with imported water, which could ultimately impact the quality of Santa Ana River water.

Management of Nitrates

One of the District's programs to reduce nitrate concentrations in Santa Ana River water is diverting Santa Ana River flows through OCWD's extensive system of wetlands in the Prado Basin.

OCWD owns and operates the 465-acre constructed Prado Wetlands. The Prado Wetlands are designed to remove nitrogen and other pollutants from the Santa Ana River before the water is diverted from the river in Orange County into OCWD's surface water recharge system. During summer months the wetlands reduce nitrate concentrations (NO_3 as N) from nearly 10 mg/L to 1 to 2 mg/L.

SECTION 7. NOTICE AND COMMUNICATION

There are eight stakeholder agencies within the Santa Ana Canyon Management Area, including the following:

- City of Anaheim
- City of Chino Hills
- City of Yorba Linda
- City of Corona Water Service Area
- Orange County Water District
- County of Orange
- Riverside County
- Yorba Linda Water District

On May 4, 2016, OCWD sent a letter to each of the agencies listed above to let them know about the option to comply with SGMA via an Alternative. The only exception is the City of Yorba Linda, but contact with them was made through representatives from the Yorba Linda Water District.

Multiple meetings were held with agencies that wished to meet and discuss the Basin 8-1 Alternative. All of the agencies contacted have agreed to participate in the Basin 8-1 Alternative.

The agencies taking the lead to prepare sections of the Basin 8-1 Alternative are summarized in Table 7-1.

Table 7-1: Lead Agencies for Preparation of Basin 8-1 Alternative

Agency	Management Area
City of La Habra	La Habra/Brea
OCWD	OCWD
OCWD	Santa Ana Canyon
Irvine Ranch Water District	South East

OCWD presented a schedule to the agencies listed in Table 7-1 by email for development and completion of the Basin 8-1 Alternative. This schedule included taking the draft Basin 8-1 Alternative to OCWD’s board and groundwater producers for comment as well as posting the draft Basin 8-1 Alternative on OCWD’s website. It was left up to the individual agencies to assess whether or not it was necessary to present the Basin 8-1 Alternative to their governing body or to the public.

SECTION 8. SUSTAINABLE MANAGEMENT APPROACH

The approach to managing the Santa Ana Canyon Management Area is to continue to monitoring sustainable conditions and monitor to ensure that no significant and unreasonable results occur in the future.

SECTION 9. SUSTAINABLE MANAGEMENT RELATED TO GROUNDWATER LEVELS

9.1 HISTORY

As shown on Figure 3-7, groundwater levels in the Santa Ana Canyon Management Area have been steady over the last 25 years. Given the large amount of surface inflow to the Santa Ana Canyon Management Area relative to the amount of groundwater production, groundwater levels are expected to remain steady in the future.

9.2 MONITORING OF GROUNDWATER LEVELS

OCWD monitors groundwater levels at multiple wells in the Santa Ana Canyon Management Area and will continue to do so in the future. Additional wells at the Green River Golf Course will be monitored and reported in the future.

9.3 DEFINITION OF SIGNIFICANT AND UNREASONABLE LOWERING OF GROUNDWATER LEVELS

No long-term reduction in groundwater levels is foreseen in the Santa Ana Canyon Management Area; however, if that were to occur, a decline in groundwater levels could reach a significant and unreasonable level if one more of the following occurred as a result of reduced groundwater levels:

1. Significant and unreasonable loss of significant riparian habitat along the Santa Ana River.
2. Significant and unreasonable loss of well production capacity.
3. Degradation of water quality that significantly impacts the beneficial uses of groundwater.

9.4 DETERMINATION OF MINIMUM THRESHOLDS

It is not possible to determine a minimum threshold at this time since no undesirable effects due to water levels have occurred in the past and are not foreseen. Nevertheless, OCWD's monitoring program continuously tracks water levels and groundwater quality in the Management Area. If water levels ever started to show a consistent long-term decline, OCWD's monitoring program would be expanded to examine any potential impacts to riparian habitat, well yields, and groundwater quality. If impacts were observed, action would be taken and minimum thresholds would be evaluated and established as appropriate.

SECTION 10. SUSTAINABLE MANAGEMENT RELATED TO BASIN STORAGE

The total volume of groundwater storage in the OCWD Basin is estimated to be 66 million acre-feet (OCWD, 2007). The total potential storage volume in the Santa Ana Canyon Management Area is estimated to be 43,500 acre-feet (see Section 3.2.3).

10.1 DEFINITION OF SIGNIFICANT AND UNREASONABLE REDUCTION IN STORAGE

As with groundwater levels, no long-term reduction in groundwater storage is foreseen in the Santa Ana Canyon Management Area; however, if that were to occur, a decline in groundwater storage could reach a significant and unreasonable level if one more of the following occurred due to a reduction in storage:

1. Significant and unreasonable loss of riparian habitat along the Santa Ana River.
2. Significant and unreasonable loss of well production capacity.
3. Degradation of water quality that significantly impacts the beneficial uses of groundwater.

10.2 DETERMINATION OF MINIMUM THRESHOLDS

It is not possible to determine a minimum threshold at this time since no undesirable effects due to a change in groundwater storage levels has occurred in the past and are not foreseen in the future. Nevertheless, OCWD's monitoring program continuously tracks water levels, which is a proxy for groundwater storage, and groundwater quality in the Management Area. If water levels ever started to show a consistent long-term decline, OCWD's monitoring program would be expanded to examine any potential impacts to riparian habitat, well yields and groundwater quality. If impacts were observed, action would be taken and minimum thresholds would be evaluated and established as appropriate.

SECTION 11. SUSTAINABLE MANAGEMENT RELATED TO BASIN WATER QUALITY

Groundwater quality in the Santa Ana Canyon Management Area is affected by the quality of Santa Ana River water and subsurface inflow from the surrounding foothills. As mentioned in Section 6, Water Resource Programs, OCWD is involved in multiple programs to protect and improve the quality of water in the Santa Ana River. Groundwater from subsurface inflow contains naturally elevated concentrations of TDS and manganese.

OCWD has an extensive groundwater monitoring program in the Santa Ana Canyon Management Area as described in Section 5, Water Resource Monitoring Programs.

11.1 DEFINITION OF SIGNIFICANT AND UNREASONABLE DEGRADATION OF WATER QUALITY

There are three elements that must be considered when evaluating the impact of groundwater quality degradation.

The first element is considering the causal nexus between groundwater management activities and groundwater quality. For example, if subsurface inflow from the surrounding foothills increases during a wet period, TDS and manganese levels could increase; however, this increase is not caused by groundwater management activities, but by natural causes. The same applies to the quality of Santa Ana River water. Although OCWD is involved in many programs to protect and improve the quality of Santa Ana River water, there could be changes in water quality that are outside of the control of Santa Ana Canyon Management Area stakeholders.

The second element is the beneficial uses of the groundwater and water quality regulations, such as Maximum Contaminant Levels (MCLs) and other potable water quality requirements.

The third element that must be considered is the volume of groundwater impacted by groundwater quality degradation. If small volumes are negatively affected that do not materially affect the use of the aquifer for its existing beneficial uses, then this would not represent a significant and unreasonable degradation of water quality. However, if the impacted volume grows, then it could reach a level that it becomes significant and unreasonable.

When considering all three elements, “significant and unreasonable degradation of water quality” is defined as degradation of groundwater quality in the Santa Ana Canyon Management Area that is attributable to groundwater production or recharge practices and to the extent that a significant volume of groundwater becomes unusable for its designated beneficial uses.

11.2 DETERMINATION OF MINIMUM THRESHOLDS

The minimum thresholds for groundwater quality are exceedances of Maximum Contaminant Levels (MCLs) or other applicable regulatory limits that are directly attributable to groundwater production and recharge practices in the Santa Ana Canyon Management Area that prevents the use of groundwater for its designated beneficial uses.

SECTION 12. SUSTAINABLE MANAGEMENT RELATED TO SEAWATER INTRUSION

The Santa Ana Canyon Management Area is located far from the ocean and thus there is no reason to consider the potential impact of seawater intrusion in this management area.

SECTION 13. SUSTAINABLE MANAGEMENT RELATED TO LAND SUBSIDENCE

Land subsidence is monitored within the OCWD Management Area but not within the Santa Ana Canyon Management Area. Subsidence is not an issue for the Santa Ana Canyon Management Area given the following:

1. The presence of shale and sandstone bedrock underlying the alluvial aquifer is not thought to be sufficiently compressible to cause inelastic subsidence.
2. The alluvial aquifer is thin, generally less than 100 feet, and composed mainly of sand and gravel with only minor amounts of clay.
3. Groundwater levels and storage volumes are stable.
4. Substantial groundwater level declines are highly unlikely due to the de minimis amount of groundwater production relative to the overall inflow of water to the Santa Ana Canyon Management Area.

SECTION 14. MANAGING GROUNDWATER DEPLETIONS IMPACTING SURFACE WATER

The primary surface water feature in the Santa Ana Canyon Management Area is the Santa Ana River. In the Santa Ana Canyon Management Area, the Santa Ana River is a soft-bottomed channel that supports riparian habitat (Figure 14-1). Riparian habitat is dependent on river water released through Prado Dam, which is predominantly treated wastewater discharged in the upper watershed when storm flow is not present.

Groundwater within the Santa Ana Canyon alluvial aquifer is consistently 20 to 30 feet below ground surface and even shallower in the incised portions of the Santa Ana River channel. As described in Section 4, Water Budget, the flow of surface water through the canyon is two orders of magnitude larger than groundwater production. As a result, groundwater production has a de minimis impact on groundwater conditions and the flows of surface water through the canyon. This, in turn, means that groundwater production in the Santa Ana Canyon has a de minimis impact on the groundwater dependent ecosystems in the Santa Ana Canyon Management Area. Therefore, the undesirable result of “depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water due to groundwater conditions occurring throughout the basin” does not apply.

Figure 14-1: Santa Ana River, downstream of Prado Dam

SECTION 15. PROTOCOLS FOR MODIFYING MONITORING PROGRAMS

Protocols for modifying monitoring programs are based on changes from historical conditions or changes in water quality that begin to approach or exceed regulatory limits.

15.1 ESTABLISHMENT OF PROTOCOLS FOR WATER QUALITY

Changes in OCWD water quality sampling program can be triggered by one or more of the following:

1. A recommendation by the Independent Advisory Panel that reviews OCWD use of Santa Ana River water for groundwater recharge and related water quality;
2. A change or anticipated change in water quality regulations;
3. A constituent in a sample approaches or exceeds a regulatory water quality limit or Maximum Contaminant Level, notification level, or first time detection of a constituent;
4. OCWD's monitoring program identifies a variation in historical data that may indicate a statistically significant change in water quality;
5. Analysis of water quality trends conducted by water quality, hydrogeology, or recycled water production staff indicate a need to change monitoring; and,
6. OCWD initiates a special study, such as quantifying the removal of contaminants using treatment wetlands or testing the infiltration rate of a proposed new recharge basin.

15.2 ESTABLISHMENT OF PROTOCOLS FOR GROUNDWATER ELEVATION/STORAGE

Given that it is desirable to obtain water level records over long periods of time at the same well, changes are rarely made to reduce key wells in groundwater level monitoring programs. The most common reason for a change is that a well is destroyed. If this occurs, OCWD will evaluate the nearest similar well or the need to construct a replacement well and add it to the monitoring program as appropriate.

The frequency of groundwater level monitoring in the Santa Ana Canyon Management Area varies from quarterly to annually. This frequency can be modified based on the variability of water level changes observed. In the Santa Ana Canyon Management Area, water levels tend to be consistent (see Figure 3-7), therefore, annual monitoring is generally sufficient. If water levels start to change and storage levels start to decline, then the frequency of groundwater level monitoring would likely increase. This occurrence would also likely precipitate changes to other monitoring programs, such as monitoring the health of the riparian habitat in the Santa Ana Canyon Management Area.

SECTION 16. PROCESS TO EVALUATE NEW PROJECTS

For projects within OCWD, the process described in the OCWD Management Area part of this report applies. If new projects are proposed by others outside of OCWD's boundaries, OCWD would collaborate with the agency proposing the project to ensure that any proposed project would not cause significant and unreasonable results. Moreover, OCWD would review proposed projects through the CEQA process (i.e., reviewing and commenting on draft CEQA documents).

SECTION 17. REFERENCES

County of Orange, 2016. County of Orange, Santa Ana River Canyon and Brush Canyon Habitat Management Areas, 2016 Annual Monitoring Report, June 2016.

OCWD, 2007. Report on Evaluation of Orange County Groundwater Basin Storage and Operational Strategy, February 2007.

USGS, 1964. Geology and Oil Resources of the Eastern Puente Hills Area, Southern California. By D.L. Durham and R.F. Yerkes. USGS Professional Paper 420-B.

ATTACHMENT ONE

DOCUMENTATION OF

PUBLIC PARTICIPATION AND AGENCY APPROVALS

OCWD Board of Directors Agenda: October 21, 2015

OCWD Board of Directors Water Issues Committee Agenda: November 9, 2016

OCWD *Hydrospectives* Newsletter: November 2016

OCWD Website Screen Shot of Public Notice for Comments: November 9, 2016

OCWD Groundwater Producers Agenda: November 10, 2016

OCWD Board of Directors Water Issues Committee Agenda: December 14, 2016

OCWD Board of Directors Agenda: December 21, 2016

OCWD Board Resolution

CEQA Notice of Exemption

City of La Habra Letter of Support

AGENDA
REGULAR MEETING BOARD OF DIRECTORS
ORANGE COUNTY WATER DISTRICT
18700 Ward Street, Fountain Valley, CA (714) 378-3200
Wednesday, October 21, 2015 – 5:30 p.m.

PLEDGE OF ALLEGIANCE

ROLL CALL

ITEMS RECEIVED TOO LATE TO BE AGENDIZED

RECOMMENDATION: Adopt resolution determining need to take immediate action on item(s) and that the need for action came to the attention of the District subsequent to the posting of the Agenda (requires two-thirds vote of the Board members present, or, if less than two-thirds of the members are present, a unanimous vote of those members present.)

VISITOR PARTICIPATION

Time has been reserved at this point in the agenda for persons wishing to comment for up to three minutes to the Board of Directors on any item that is not listed on the agenda, but within the subject matter jurisdiction of the District. By law, the Board of Directors is prohibited from taking action on such public comments. As appropriate, matters raised in these public comments will be referred to District staff or placed on the agenda of an upcoming Board meeting.

At this time, members of the public may also offer public comment for up to three minutes on any item on the Consent Calendar. While members of the public may not remove an item from the Consent Calendar for separate discussion, a Director may do so at the request of a member of the public.

CONSENT CALENDAR (ITEMS NOS. 1 - 18)

All matters on the Consent Calendar are to be approved by one motion, without separate discussion on these items, unless a Board member or District staff request that specific items be removed from the Consent Calendar for separate consideration.

1. APPROVAL OF CASH DISBURSEMENTS

   RECOMMENDATION: Ratify/authorize payment of bills

2. APPROVAL OF MINUTES OF BOARD OF DIRECTORS MEETING HELD SEPTEMBER 16, 2015

   RECOMMENDATION: Approve minutes as presented

4) Authorize issuance of Amendment No. 1 to Agreement No. 0916 to CH2M Hill for an amount not to exceed $91,328; and

5) Increase the Alamitos Barrier Improvement Project budget as necessary to incorporate the bid from Best Drilling and Pump, Inc.

20. **INFORMATIONAL ITEMS**

A. WATER RESOURCES SUMMARY

B. GROUNDWATER REMEDIATION MONTHLY STATUS UPDATE

C. SUSTAINABLE GROUNDWATER MANAGEMENT ACT: COMPLIANCE OPTIONS

D. SANTA ANA WATERSHED PROJECT AUTHORITY ACTIVITIES

E. GROUNDWATER PRODUCER MEETING MINUTES – OCTOBER 14, 2015

F. COMMITTEE/CONFERENCE/MEETING REPORTS

1) Oct 08 – Communication and Legislative Liaison Committee (Chair Sidhu)
Oct 12 – GWRS Steering Committee (Vice Chair Yoh)
Oct 14 – Water Issues Committee (Chair Bilodeau)
Oct 15 – Administration and Finance Issues Committee (Chair Dewane)

2) Reports on Conferences/Meetings Attended at District Expense (at which a quorum of the Board was present)

21. **VERBAL REPORTS**

- PRESIDENT'S REPORT
- GENERAL MANAGER'S REPORT
- DIRECTORS' REPORTS
- GENERAL COUNSEL REPORT

22. **ADJOURNMENT TO CLOSED SESSION**

- **CONFERENCE WITH LABOR NEGOTIATORS [Government Code Section 54957.6]**
OCWD designated representative: Stephanie Dosier
⊙ Employee Organization: Orange County Employee Association

RECONVENE IN OPEN SESSION

23. **ADJOURNMENT**

AGENDA ITEM SUBMITTAL

Meeting Date: October 21, 2015

To: Board of Directors

From: Mike Markus

Staff Contact: G. Woodside/A. Hutchinson

Budgeted: N/A
Budgeted Amount: N/A
Cost Estimate: N/A
Funding Source: N/A
Program/Line Item No. N/A
General Counsel Approval: N/A
Engineers/Feasibility Report: N/A
CEQA Compliance: N/A

Subject: SUSTAINABLE GROUNDWATER MANAGEMENT ACT: COMPLIANCE OPTIONS

SUMMARY

On January 1, 2015, the Sustainable Groundwater Management Act (Act) took effect. This Act requires that all high and medium priority basins, as ranked by the Department of Water Resources (DWR), be sustainably managed. The Act lists OCWD as the exclusive groundwater manager within its statutory boundaries; however, there are additional steps that must be taken to comply with the Act. Currently available options as well as potential future options will be reviewed with the committee.

Attachment(s): Presentation

RECOMMENDATION

Informational

BACKGROUND/ANALYSIS

On September 16, 2014 Governor Brown signed three bills (SB1168, AB1739, and SB1319), which comprise the Sustainable Groundwater Management Act (Act).

The Act requires that all high- and medium- priority basins designated by the Department of Water Resources (DWR) be sustainably managed by 2020 or 2022 depending on basin conditions. In June 2014, DWR published a report on basin prioritization and designated the Coastal Plain of Orange County Groundwater Basin (Basin 8-1) as a medium-priority basin. This was primarily due to heavy reliance on groundwater within the basin and how this was accounted for in the ranking system. It is not an indication that the basin needs to be managed differently.

The Act requires that there be no unmanaged areas within basin boundaries as defined by DWR Bulletin 118 for high- and medium-priority basins. Bulletin 118 basin boundaries are based on hydrogeologic conditions and political boundary lines whenever practical. OCWD overlies much of the Coastal Plain of Orange County Groundwater Basin (Basin 8-1). Figure 1 shows how the Bulletin 118 boundary compares with the

Figure 1
Areas Outside of OCWD Boundary but Within Bulletin 118 Boundary

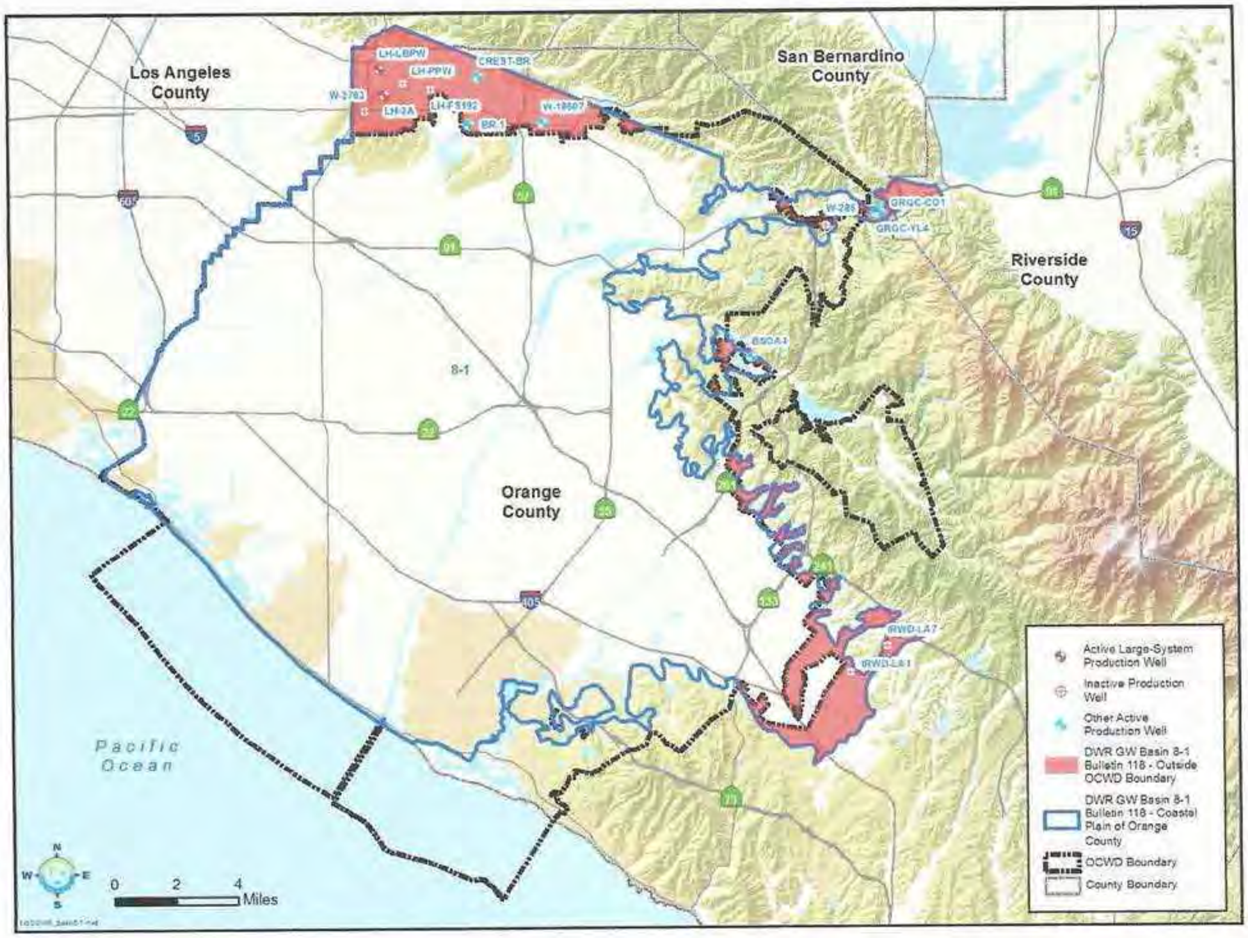


Figure 1 shows how the Bulletin 118 boundary compares with the District's boundary. The red shaded areas are outside of the District's boundary and, per the Act, need to be managed in some fashion. OCWD covers 89 percent of the basin as defined by Bulletin 118. The La Habra area covers 6 percent. The Santa Ana canyon area covers 1 percent and the southern portion covers 4 percent.

District staff worked with the authors of the Act to ensure that special act districts, including OCWD, were listed in the Act as the exclusive groundwater manager within its statutory boundaries. This designation prevents another agency from establishing a Groundwater Sustainability Agency (GSA) within a special district's boundaries. Now that the Act is being implemented and interpreted, compliance options are becoming better defined. At this point, all special act districts must comply with the Act by completing one of two options:

1. Present an Alternative Submittal, which is functionally equivalent to a Groundwater Sustainability Plan.

2. Opting to become a Groundwater Sustainability Agency (GSA) and preparing a Groundwater Sustainability Plan (GSP).

Alternative Submittals

The Department of Water Resources (DWR) is in the process of developing regulations regarding Alternative Submittals, which are described in Water Code Section 10733.6. The key text regarding Alternative Submittals is as follows:

> *10733.6 (a) If a local agency believes that an alternative described in subdivision (b) satisfies the objectives of this part, the local agency may submit the alternative to the department for evaluation and assessment of whether the alternative satisfied the objectives of this part for the **basin** (emphasis mine).*

One key interpretation is that Alternative Submittals must cover the entire Bulletin 118 basin or sub-basin. Since OCWD's boundaries do not cover the entire Bulletin 118 Basin 8-1 boundary, an Alternative Submittal would have to incorporate areas outside of OCWD (areas shown in red in Figure 1).

Staff has had preliminary discussions with agencies with jurisdiction outside of OCWD's boundaries, including Orange County, Irvine Ranch Water District (IRWD) and the cities of La Habra, Brea and Fullerton. For an Alternative Submittal to work, all of these agencies would have to participate. Orange County and IRWD are amenable to participating in an Alternative Submittal; however, at this time, La Habra and Brea are interested in forming a GSA and submitting a GSP (see below). Staff plans to have additional discussions with these agencies about developing an Alternative Submittal that covers the entire Bulletin 118 basin.

Formation of Groundwater Sustainability Agencies (GSAs)

If a special district, like OCWD, does not cover an entire basin or is not able to submit an Alternative Submittal that covers the entire basin, the only compliance option currently available is to form a GSA and submit a GSP. Staff is currently talking with DWR to see if there are other compliance options available within the scope of the Act that would not require formation of a GSA.

If compliance options within the existing Act are not satisfactory, staff may recommend that the District consider proposing cleanup legislation to allow special districts to prepare Alternative Submittals that cover their jurisdictional areas or other potential changes that allow OCWD to manage the basin without having to become a GSA or to require that GSAs be formed in the areas outside of OCWD's boundaries.

La Habra Groundwater Sustainability Agency (GSA) Formation

The City of La Habra is currently planning to form a Groundwater Sustainability Agency (GSA) that covers the northern portion of the groundwater basin that lies outside OCWD's boundary, which includes Brea and a very small portion of Fullerton (see Figure 1). La

Habra has invited OCWD to be part of a Technical Advisory Committee (TAC) that will provide input on the GSA formation process as well as development of their Groundwater Sustainability Plan (GSP).

In addition, La Habra has indicated they are planning to request that DWR create a new Bulletin 118 La Habra Basin that is separate and apart from the Coastal Plain of Orange County Groundwater Basin.

Proposed Adjustments to DWR Bulletin 118 Basin Boundaries

The first Bulletin 118 was published in 1975. The boundaries established for the Coastal Plain of Orange County (Basin 8-1) have significant off-sets in some areas from current GIS data. This off-set could be due to distortions caused by digitizing maps created in the 1970s and then projecting them onto current GIS base maps.

To improve the accuracy of the Basin 8-1 boundary, staff reviewed available geologic information and adjusted the boundary as shown on Figure 2. Staff will share these proposed adjustments with La Habra, Orange County and IRWD to obtain their feedback before submitting them to DWR. Because these adjustments are consistent with the original intent of Bulletin 118, they are considered "administrative changes" and are not subject to the boundary change regulations currently being adopted by DWR.

TABLE 2
Current (Red) and Proposed (Blue) Bulletin 118 Boundary, Coastal Plain of Orange County Groundwater Basin (Basin 8-1)

PRIOR RELEVANT BOARD ACTION(S)

10-15-14, M14-160	Direct Staff to Identify Steps for Managing Groundwater Outside of District Boundaries (Sustainable Groundwater Management Act)
08-20-14, M14-119	Adopt Support if Amended Position on State Legislation - SB1168/ AB1739 (Groundwater Management Legislation)
07-16-14, R14-7-104	Adopt Groundwater Management Legislation Policy Principles

AGENDA
WATER ISSUES COMMITTEE MEETING
WITH BOARD OF DIRECTORS *
ORANGE COUNTY WATER DISTRICT
18700 Ward Street, Fountain Valley, CA 92708
Wednesday, November 9, 2016, 8:00 a.m. - Boardroom

* The OCWD Water Issues Committee meeting is noticed as a joint meeting with the Board of Directors for the purpose of strict compliance with the Brown Act and it provides an opportunity for all Directors to hear presentations and participate in discussions. Directors receive no additional compensation or stipend as a result of simultaneously convening this meeting. Items recommended for approval at this meeting will be placed on the **November 16, 2016** Board meeting Agenda for approval.

ROLL CALL

ITEMS RECEIVED TOO LATE TO BE AGENDIZED

RECOMMENDATION: Adopt resolution determining need to take immediate action on item(s) and that the need for action came to the attention of the District subsequent to the posting of the Agenda (requires two-thirds vote of the Board members present, or, if less than two-thirds of the members are present, a unanimous vote of those members present.)

VISITOR PARTICIPATION

Time has been reserved at this point in the agenda for persons wishing to comment for up to three minutes to the Board of Directors on any item that is not listed on the agenda, but within the subject matter jurisdiction of the District. By law, the Board of Directors is prohibited from taking action on such public comments. As appropriate, matters raised in these public comments will be referred to District staff or placed on the agenda of an upcoming Board meeting.

At this time, members of the public may also offer public comment for up to three minutes on any item on the Consent Calendar. While members of the public may not remove an item from the Consent Calendar for separate discussion, a Director may do so at the request of a member of the public.

CONSENT CALENDAR (ITEMS NO. 1 – 7)

All matters on the Consent Calendar are to be approved by one motion, without separate discussion on these items, unless a Board member or District staff request that specific items be removed from the Consent Calendar for separate consideration.

1. MINUTES OF WATER ISSUES COMMITTEE MEETING HELD OCTOBER 12, 2016

   RECOMMENDATION: Approve minutes as presented

2. ENCROACHMENT AGREEMENT WITH THE CITY OF FULLERTON FOR THE NORTH BASIN EXTRACTION WELL EW-1 CONNECTION TO SANITARY SEWER PROJECT

   RECOMMENDATION: Agendize for November 16 Board meeting: Approve and authorize execution of Encroachment Agreement with the City of Fullerton and provide a deposit to City in the amount of $10,000

3. CONTRACT NO. MBI-2017-1 MID-BASIN INJECTION: CENTENNIAL PARK PROJECT - NOTICE INVITING BIDS AND AGREEMENT TO DDB ENGINEERING FOR PROJECT PERMIT ASSISTANCE

RECOMMENDATION: Agendize for November 16 Board meeting:

1. Authorize publication of Notice Inviting Bids for Contract No. MBI-2017-1, Mid-Basin Injection: Centennial Park; and

2. Authorize issuance of Agreement to DDB Engineering in an amount not to exceed $25,000 for permit consulting services

4. REBUILD GREEN ACRES PROJECT SANTA ANA RESERVOIR EFFLUENT PUMP A01

RECOMMENDATION: Authorize payment to Evans Hydro for an amount not to exceed $16,975 to repair and refurbish Green Acres Project Santa Ana Reservoir Effluent Pump A01

5. REBUILD GREEN ACRES PROJECT HIGH PRESSURE EFFLUENT PUMP A03

RECOMMENDATION: Agendize for November 16 Board meeting: Approve and authorize payment to Pamco Machine for an amount not to exceed $33,832 to repair and refurbish Green Acres Project High Pressure Pump A03

6. REBUILD GREEN ACRES PROJECT INFLUENT PUMP A03

RECOMMENDATION: Agendize for November 16 Board meeting: Approve and authorize Pamco Machine to repair and refurbish Green Acres Project Influent Pump A03, for an amount not to exceed $19,800

7. ANNUAL SANTA ANA RIVER STREAM GAUGING JOINT FUNDING AGREEMENT WITH THE UNITED STATES GEOLOGICAL SURVEY (USGS)

RECOMMENDATION: Agendize for November 16 Board meeting:

1. Approve and authorize execution of Joint Funding Agreement with USGS to conduct flow and quality monitoring of the Santa Ana River below Prado Dam and Santiago Creek at Santa Ana for the period of November 1, 2016 to October 31, 2017; and

2. Authorize payment of $59,372 to the USGS for OCWD’s share of costs for stream flow and quality monitoring services

MATTERS FOR CONSIDERATION

8. OCSD/OCWD JOINT AGREEMENT FOR THE GWRS FINAL EXPANSION PROJECT

RECOMMENDATION: Agendize for November 16 Board meeting: Approve and authorize execution of the Agreement between OCSD and OCWD for each agency’s responsibilities for the GWRS Final Expansion Project, subject to minor changes by legal counsel

9. DRAFT BASIN 8-1 ALTERNATIVE TO COMPLY WITH SUSTAINABLE GROUNDWATER MANAGEMENT ACT

RECOMMENDATION: Provide comments on the draft Basin 8-1 Alternative as appropriate

CHAIR DIRECTION AS TO ITEMS IF ANY TO BE AGENDIZED AS MATTERS FOR CONSIDERATION AT THE NOVEMBER 16 BOARD MEETING

DIRECTORS' ANNOUNCEMENTS/REPORTS

GENERAL MANAGER'S ANNOUNCEMENTS/REPORTS

ADJOURNMENT

AGENDA ITEM SUBMITTAL

Meeting Date: November 9, 2016

To: Board of Directors

From: Mike Markus

Staff Contact: G. Woodside/A. Hutchinson
M. Westropp

Budgeted: N/A
Budgeted Amount: N/A
Cost Estimate: N/A
Funding Source: N/A
Program/Line Item No. N/A
General Counsel Approval: N/A
Engineers/Feasibility Report: N/A
CEQA Compliance: N/A

Subject: **DRAFT BASIN 8-1 ALTERNATIVE TO COMPLY WITH SUSTAINABLE GROUNDWATER MANAGEMENT ACT**

SUMMARY

To comply with the Sustainable Groundwater Management Act, a draft Alternative to a Groundwater Sustainability Plan has been prepared that covers the entirety of the Department of Water Resources Basin 8-1, Coastal Plain of Orange County Groundwater Basin. The draft Basin 8-1 Alternative was prepared by District staff and other stakeholders in Basin 8-1 that are outside of the District's boundary. The Alternative shows that the basin has been sustainably managed.

Attachment(s):
- Presentation
- Draft Basin 8-1 Alternative – (to be posted to www.ocwd.com on 11/08/2016)

RECOMMENDATION

Agendize for November 16 Board meeting: Provide comments on draft Basin 8-1 Alternative as appropriate

BACKGROUND/ANALYSIS

On September 16, 2014 Governor Brown signed three bills (SB1168, AB1739, and SB1319), which comprise the Sustainable Groundwater Management Act (Act).

The Act requires that all high- and medium-priority basins designated by the Department of Water Resources (DWR) be sustainably managed. DWR designated the Coastal Plain of Orange County Groundwater Basin (Basin 8-1) as a medium-priority basin, primarily due to heavy reliance on the basin's groundwater as a source of water supply.

Compliance with the Act can be achieved by one of two options:

1) Forming a Groundwater Sustainability Agency (GSA) and submitting a Groundwater Sustainability Plan (GSP), or
2) Submitting an Alternative to a GSP

Basin 8-1, as defined by DWR, includes areas within and outside of OCWD's service area as shown in Figure 1. Approximately 78 percent of Basin 8-1 is within OCWD's jurisdiction. Areas outside of OCWD include a northern section within the cities of La Habra and Brea, land along the Santa Ana River upstream of Imperial Highway, and land outside of the southern and southeastern OCWD boundary within the jurisdiction of Irvine Ranch Water District, El Toro Water District and the city of Orange. To be eligible to submit an Alternative to a GSP, the entirety of Basin 8-1 must be included in the Alternative and it must be demonstrated that Basin 8-1 has been sustainability managed.

The agencies within Basin 8-1 have agreed to prepare and submit an Alternative to a GSP, which is referred to as the Basin 8-1 Alternative. In accordance with §10733.6(b)(3), the Basin 8-1 Alternative presents an analysis of basin conditions that demonstrates that the basin has operated sustainably over a period of at least 10 years. In fact, Basin 8-1 has been operated sustainably for more than 10 years without experiencing the undesirable results, which are defined by the California Water Code as significant and unreasonable lowering of groundwater levels, reduction in storage, water quality degradation, seawater intrusion, or inelastic land subsidence. Since the basin has been sustainably managed, no new actions are required and the Basin 8-1 Alternative essentially describes the ongoing actions that will continue the sustainable management of the basin.

The Basin 8-1 draft Alternative was jointly prepared by the Orange County Water District (OCWD) and agencies with jurisdiction outside of OCWD's boundaries, including the City of La Habra and the Irvine Ranch Water District (IRWD). Table 1 shows the lead agencies responsible for preparing the sections covering the management areas.

Table 1: Lead Agencies for Preparation of Basin 8-1 Alternative

Agency	Management Area
City of La Habra	La Habra/Brea
OCWD	OCWD
OCWD	Santa Ana Canyon
Irvine Ranch Water District	South East

Other agencies within Basin 8-1 support submission of the Basin 8-1 Alternative and either have participated in preparing the Alternative and/or reviewed the Alternative. These agencies include the cities of Brea, Corona, Orange, and Chino Hills; the Counties of Orange, Riverside, and San Bernardino; Yorba Linda Water District, and El Toro Water District. Pursuant to §10733.2, the Basin 8-1 Alternative has been prepared by or under the direction of a professional geologist or professional engineer.

In the Basin 8-1 Alternative, four management areas were identified as shown in Figure 1. Accordingly, the Basin 8-1 Alternative is organized as follows:

- **Overview**: Provides a map and description of Basin 8-1 and a brief description of the basin management areas.
- **Hydrology of Basin 8-1**: Provides a description of the hydrogeology of Basin 8-1 including a description of the basin, the aquifer systems, fault zones, total basin volume, basin cross-sections, basin characteristics, and general groundwater quality.

- **La Habra-Brea Management Area**
- **OCWD Management Area**
- **South East Management Area**
- **Santa Ana Canyon Management Area**

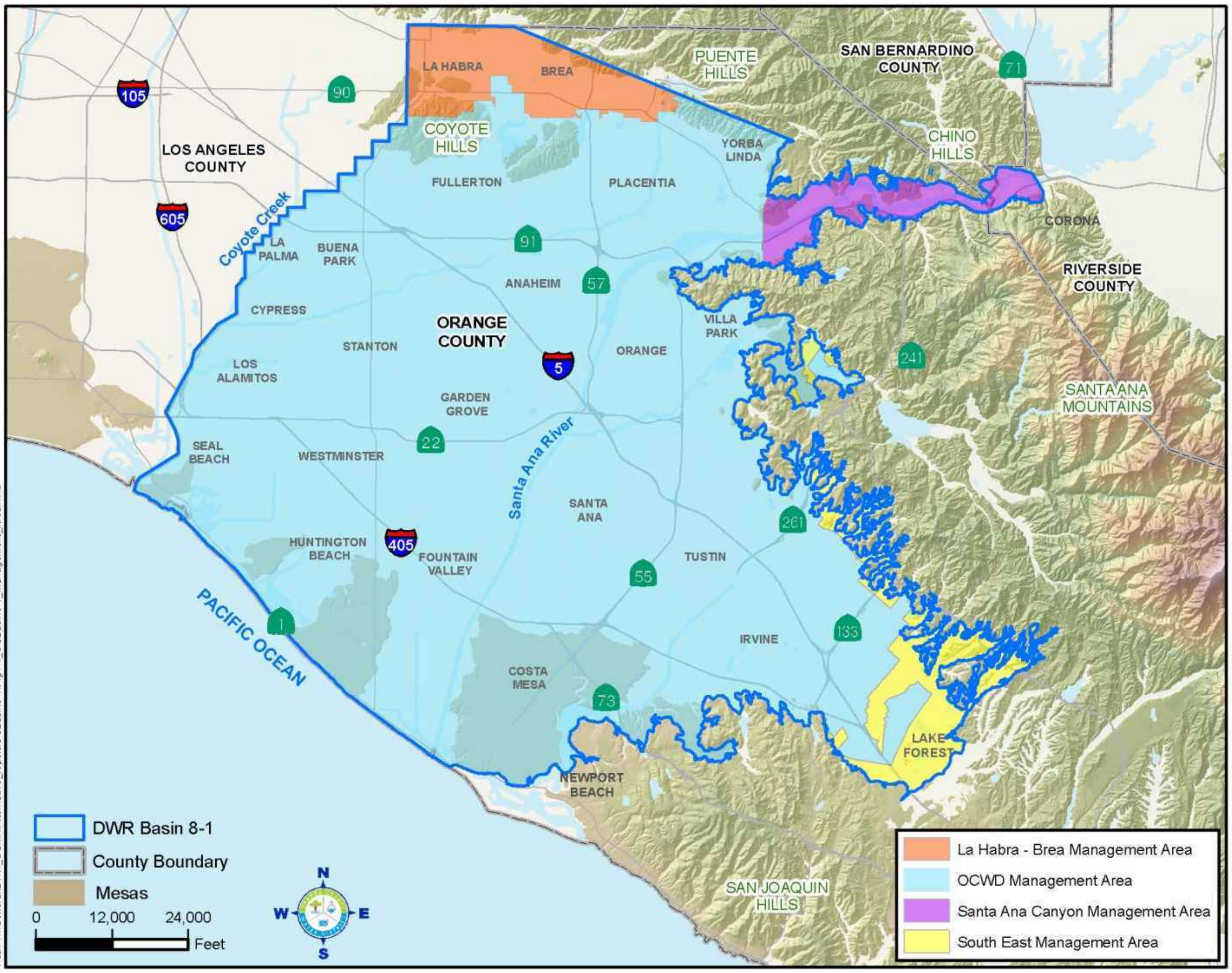
The OCWD Management Area description is based primarily on the information in the OCWD Groundwater Management Plan, which was adopted by the Board in June 2015. The OCWD Management area includes a small portion of the City of Fullerton and unincorporated Orange County that are outside OCWD's boundaries.

The Santa Ana Canyon Management area, which extends eastward into Riverside and San Bernardino Counties, includes the following agencies: OCWD, the cities of Anaheim, Yorba Linda, Chino Hills, Corona, and the counties of Riverside, San Bernardino and Orange.

The Basin 8-1 Alternative is posted on OCWD's website and will also be distributed by the other participating agencies for public review. District staff, La Habra, and IRWD will review the comments submitted on the draft Alternative and prepare the final Basin 8-1 Alternative, which must be submitted to the DWR by the statutory deadline of January 1, 2017.

After the Basin 8-1 Alternative is submitted to DWR, DWR will post on their website to allow for further public review. Once DWR approves the Basin 8-1 Alternative, the lead agencies within each management area will be required to update the Alternative every 5 years.

Figure 1
Management Areas in Basin 8-1 Alternative



PRIOR RELEVANT BOARD ACTION(S)

10-21-15	Informational Item, Sustainable Groundwater Management Act: Compliance Options
10-15-14, M14-160	Direct Staff to Identify Steps for Managing Groundwater Outside of District Boundaries (Sustainable Groundwater Management Act)
08-20-14, M14-119	Adopt Support if Amended Position on State Legislation - SB1168/ AB1739 (Groundwater Management Legislation)
07-16-14, R14-7-104	Adopt Groundwater Management Legislation Policy Principles

OC WATER NEWS
HYDROspectives
ORANGE COUNTY WATER DISTRICT

November 2016

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PRESIDENT'S MESSAGE — STRENGTHENING O.C.'S WATER RELIABILITY
GWRS FINAL EXPANSION AGREEMENT PASSES
OCWD HONORED WITH COOL PLANET AWARD
CALIFORNIA GROUNDWATER BASIN BOUNDARIES CHANGE
DRAFT ALTERNATIVE TO GROUNDWATER SUSTAINABILITY PLAN READY FOR PUBLIC REVIEW
OCWD EXPERTS PRESENT AT KOREA INTERNATIONAL WATER WEEK
MIDGE/MOSQUITO ERADICATION PROGRAM UNDERWAY
MARCOM AWARD RECOGNIZES GWRS PRESENTATION
LAB HOSTS IC USER GROUP
OCWD-UCR COLLABORATE ON GWRS RESEARCH
OUT IN THE COMMUNITY
OCWD IN THE NEWS
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PRESIDENT'S MESSAGE—STRENGTHENING O.C.'S WATER RELIABILITY

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CALIFORNIA GROUNDWATER BASIN BOUNDARIES CHANGE

The California Department of Water Resources (DWR) released final 2016 modifications to California's groundwater basin boundaries, completing a critical step in the implementation of the state's Sustainable Groundwater Management Act (SGMA). DWR presented the final basin boundaries to the California Water Commission, which approved them. Included in the approved boundary modifications were changes proposed by the Orange County Water District to DWR's Basin 8-1, the Coastal Plain of Orange County Groundwater Basin. Read More...

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DRAFT ALTERNATIVE TO GROUNDWATER SUSTAINABILITY PLAN READY FOR PUBLIC REVIEW

Formal groundwater management in California can be traced back to 1934 when the Department of Water Resources (DWR) mapped and numbered the state's groundwater basins. In Orange County, the basin was named Basin 8-1, the Coastal Plain of Orange County Groundwater Basin. Since that time, jurisdiction over groundwater basins remained a local concern and management programs evolved to varying degrees. Recent drought conditions and, in some places the over-drafting of groundwater basins, demonstrated the need to enhance management of these important water supplies. Read More...

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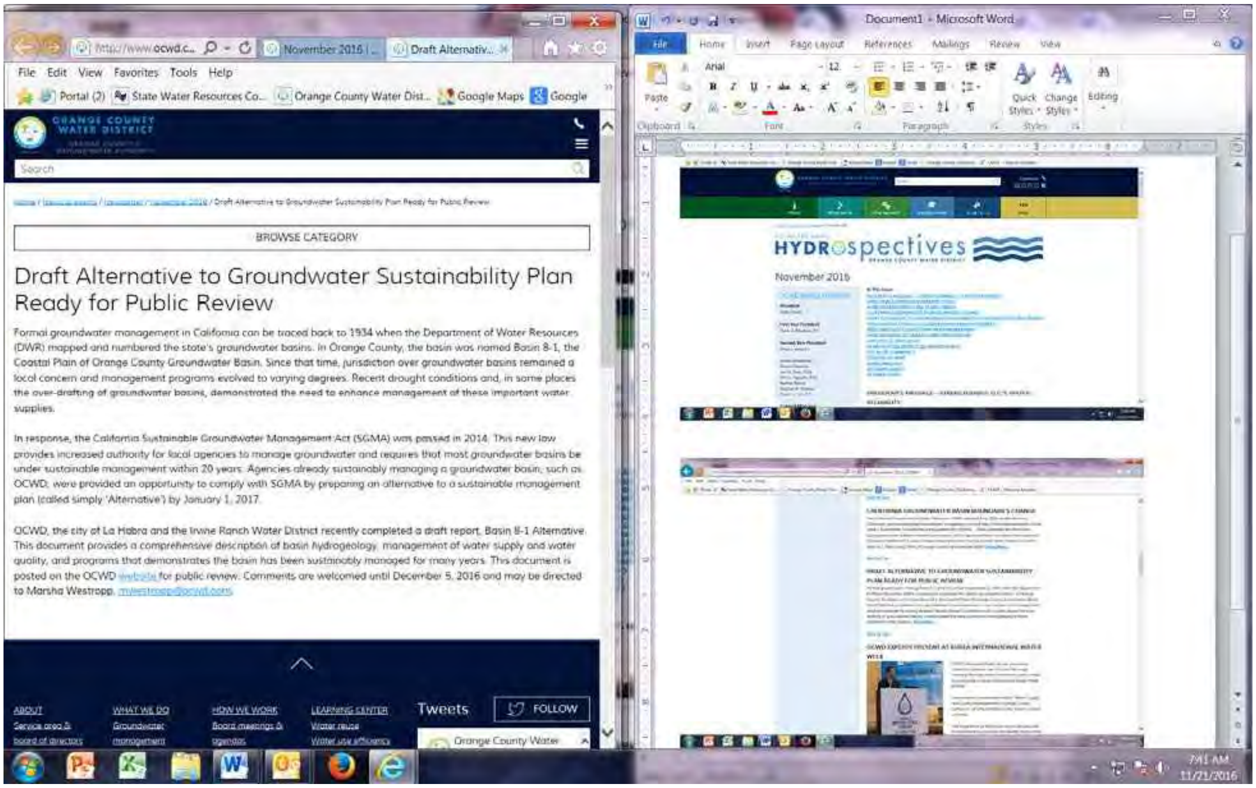
OCWD EXPERTS PRESENT AT KOREA INTERNATIONAL WATER WEEK

OCWD Advanced Water Quality Assurance Laboratory Director Lee Yoo and Recharge Planning Manager Adam Hutchinson were invited to participate in Korea International Water Week (KIWW).

Yoo provided a presentation titled "Water Supply and Quality Management in Orange County, California" at a World Water Cities Forum—a part of KIWW.

The importance of the Forum was to discuss and to share leading practices and identify factors that



BROWSE CATEGORY

Draft Alternative to Groundwater Sustainability Plan Ready for Public Review

Formal groundwater management in California can be traced back to 1934 when the Department of Water Resources (DWR) mapped and numbered the state's groundwater basins. In Orange County, the basin was named Basin 8-1, the Coastal Plain of Orange County Groundwater Basin. Since that time, jurisdiction over groundwater basins remained a local concern and management programs evolved to varying degrees. Recent drought conditions and, in some places the over-drafting of groundwater basins, demonstrated the need to enhance management of these important water supplies.

In response, the California Sustainable Groundwater Management Act (SGMA) was passed in 2014. This new law provides increased authority for local agencies to manage groundwater and requires that most groundwater basins be under sustainable management within 20 years. Agencies already sustainably managing a groundwater basin, such as OCWD, were provided an opportunity to comply with SGMA by preparing an alternative to a sustainable management plan (called simply 'Alternative') by January 1, 2017.

OCWD, the city of La Habra and the Irvine Ranch Water District recently completed a draft report, Basin 8-1 Alternative. This document provides a comprehensive description of basin hydrogeology, management of water supply and water quality, and programs that demonstrates the basin has been sustainably managed for many years. This document is posted on the OCWD website for public review. Comments are welcomed until December 5, 2016 and may be directed to Marsha Westropp, mwestropp@ocwd.com.

Screen shot of OCWD Webpage

Posted 11/9/16

Public notices

OCWD believes in open and honest government. It strives to be clear about the motivations and standards driving its activities, policy decisions and investments.

OCWD ensures that a proposed project complies with the California Environmental Quality Act (CEQA) and that the appropriate level of CEQA documentation is prepared. CEQA is a multi-purpose law in the State of California that is intended to inform decision makers and the public of the environmental consequences of projects, involve the public in decision-making related to environmental effects, and to prevent needless environmental damage. It is a tool to evaluate the potential impacts on the environment by a proposed project. CEQA review is required for any project undertaken by a public agency.

Current public notices are posted below. If you are seeking a document from a past project, please fill out a public records request.

> South basin additional groundwater monitoring program

> Water production enhancement project

> East Newport Mesa groundwater investigation

View the Basin 8-1 Alternative draft report

OCWD, the city of La Habra and the Irvine Ranch Water District recently completed a draft report, *Basin 8-1 Alternative.** This document provides a comprehensive description of basin hydrogeology, management of water supply and water quality, and programs that provide for sustainable basin management over the long-term.

The Basin 8-1 Alternative is prepared to comply with the California Sustainable Groundwater Management Act (SGMA) passed in 2014. This new law provides increased authority for local agencies to manage groundwater and requires that most groundwater basins be under sustainable management within 20 years. Agencies already sustainably managing a groundwater basin are eligible to comply with SGMA by preparing an alternative to a sustainable management plan (called simply an Alternative) by January 1, 2017. The agencies with jurisdiction within the boundaries of Basin 8-1 jointly decided to prepare this plan and submit to the Department of Water Resources to comply with provisions of SGMA.

This document is posted here for public review. Comments are welcomed until December 5, 2016. Please direct comments to Marsha Westropp (714-378-8248).

* The California Department of Water Resources mapped the Orange County Groundwater Basin in 1934 and named the basin: *Basin 8-1, the Coastal Plain of Orange County Groundwater Basin.*

- Basin 8-1 Alternative

From: Kennedy, John
Sent: Wednesday, November 09, 2016 11:16 AM
To: avalenzuela@tustinca.org; Bill Murray; Brian A. Ragland ; Carlo Nafarrete (La Palma) (carlon@cityoflapalma.org); 'Cel Pasillas'; Cook@irwd.com; David Spitz (dspitz@sealbeachca.gov); George Murdoch, NB; Hye Jin Lee - City of Fullerton (HyeJinL@ci.fullerton.ca.us); Jerry Vilander; Jose Diaz (jdiaz@cityoforange.org); Lisa Ohlund; Marc Marcantonio (mmarcantonio@ylwd.com); Mark Lewis (mark.lewis@fountainvalley.org); Michael Grisso (mgrisso@buenapark.com); Michael Moore (mrmoore@anaheim.net); Nabil Saba (Santa Ana); pauls@mesawater.org; Scott Miller - City of Westminster (scottm@CI.WESTMINSTER.CA.US); Steffen Catron (scatron@newportbeachca.gov); Vecchiarelli, Ken
Cc: Markus, Mike; Woodside, Greg; Hutchinson, Adam; Westropp, Marsha
Subject: November 10th Producers Meeting - Sustainable Groundwater Management Act - Alternative Plan

All

At tomorrow's Producers meeting we will discuss the Alternative plan that OCWD has prepared to comply with the Sustainable Groundwater Management Act. Below is a link to the plan if you want to review it ahead of the meeting.

http://www.ocwd.com/media/4792/basin-8-1-alternative-draft-november-4-2016.pdf

John Kennedy
Executive Director of Engineering and Water Resources
Orange County Water District
18700 Ward Street
Fountain Valley, CA 92708
tel: (714) 378-3304
email: jkennedy@ocwd.com

AGENDA ITEM SUBMITTAL

Meeting Date: November 16, 2016

To: Board of Directors

From: Mike Markus

Staff Contact: G. Woodside/A. Hutchinson
M. Westropp

Budgeted: N/A
Budgeted Amount: N/A
Cost Estimate: N/A
Funding Source: N/A
Program/Line Item No. N/A
General Counsel Approval: N/A
Engineers/Feasibility Report: N/A
CEQA Compliance: N/A

Subject: **DRAFT BASIN 8-1 ALTERNATIVE TO COMPLY WITH SUSTAINABLE GROUNDWATER MANAGEMENT ACT**

SUMMARY

To comply with the Sustainable Groundwater Management Act, a draft Alternative to a Groundwater Sustainability Plan has been prepared that covers the entirety of the Department of Water Resources Basin 8-1, Coastal Plain of Orange County Groundwater Basin. The draft Basin 8-1 Alternative was prepared by District staff and other stakeholders in Basin 8-1 that are outside of the District's boundary. The Alternative shows that the basin has been sustainably managed.

Attachment(s):
- Presentation
- Draft Basin 8-1 Alternative – (posted to www.ocwd.com)

RECOMMENDATION

Provide comments on draft Basin 8-1 Alternative as appropriate

BACKGROUND/ANALYSIS

On September 16, 2014 Governor Brown signed three bills (SB1168, AB1739, and SB1319), which comprise the Sustainable Groundwater Management Act (Act).

The Act requires that all high- and medium-priority basins designated by the Department of Water Resources (DWR) be sustainably managed. DWR designated the Coastal Plain of Orange County Groundwater Basin (Basin 8-1) as a medium-priority basin, primarily due to heavy reliance on the basin's groundwater as a source of water supply.

Compliance with the Act can be achieved by one of two options:

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Habra and Brea, land along the Santa Ana River upstream of Imperial Highway, and land outside of the southern and southeastern OCWD boundary within the jurisdiction of Irvine Ranch Water District, El Toro Water District and the city of Orange. To be eligible to submit an Alternative to a GSP, the entirety of Basin 8-1 must be included in the Alternative and it must be demonstrated that Basin 8-1 has been sustainability managed.

The agencies within Basin 8-1 have agreed to prepare and submit an Alternative to a GSP, which is referred to as the Basin 8-1 Alternative. In accordance with §10733.6(b)(3), the Basin 8-1 Alternative presents an analysis of basin conditions that demonstrates that the basin has operated sustainably over a period of at least 10 years. In fact, Basin 8-1 has been operated sustainably for more than 10 years without experiencing the undesirable results, which are defined by the California Water Code as significant and unreasonable lowering of groundwater levels, reduction in storage, water quality degradation, seawater intrusion, or inelastic land subsidence. Since the basin has been sustainably managed, no new actions are required and the Basin 8-1 Alternative essentially describes the ongoing actions that will continue the sustainable management of the basin.

The Basin 8-1 draft Alternative was jointly prepared by the Orange County Water District (OCWD) and agencies with jurisdiction outside of OCWD's boundaries, including the City of La Habra and the Irvine Ranch Water District (IRWD). Table 1 shows the lead agencies responsible for preparing the sections covering the management areas.

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Agency	Management Area
City of La Habra	La Habra/Brea
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Other agencies within Basin 8-1 support submission of the Basin 8-1 Alternative and either have participated in preparing the Alternative and/or reviewed the Alternative. These agencies include the cities of Brea, Corona, Orange, and Chino Hills; the Counties of Orange, Riverside, and San Bernardino; Yorba Linda Water District, and El Toro Water District. Pursuant to §10733.2, the Basin 8-1 Alternative has been prepared by or under the direction of a professional geologist or professional engineer.

In the Basin 8-1 Alternative, four management areas were identified as shown in Figure 1. Accordingly, the Basin 8-1 Alternative is organized as follows:

- **Overview**: Provides a map and description of Basin 8-1 and a brief description of the basin management areas.
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- **La Habra-Brea Management Area**

- **OCWD Management Area**
- **South East Management Area**
- **Santa Ana Canyon Management Area**

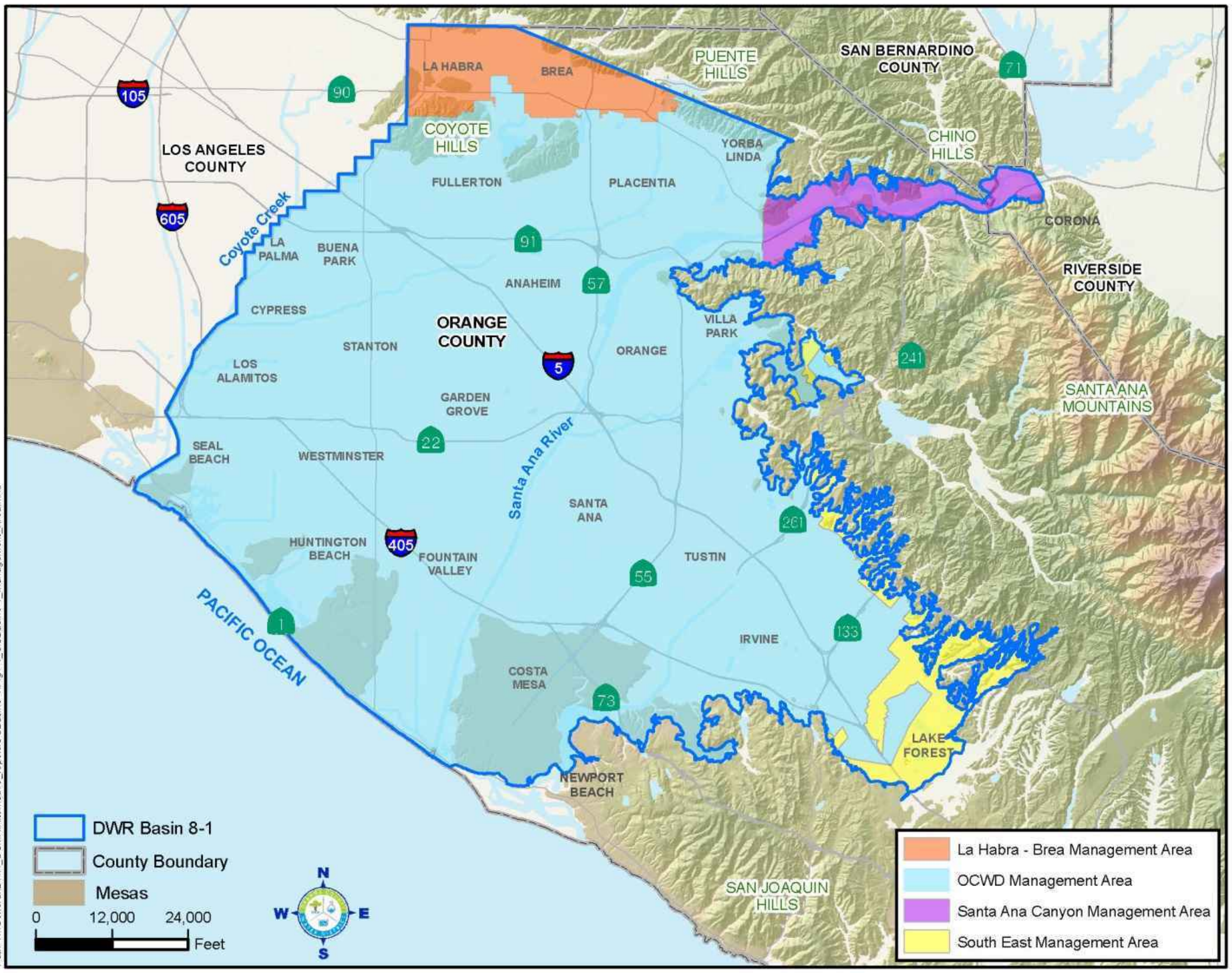
The OCWD Management Area description is based primarily on the information in the OCWD Groundwater Management Plan, which was adopted by the Board in June 2015. The OCWD Management area includes a small portion of the City of Fullerton and unincorporated Orange County that are outside OCWD's boundaries.

The Santa Ana Canyon Management area, which extends eastward into Riverside and San Bernardino Counties, includes the following agencies: OCWD, the cities of Anaheim, Yorba Linda, Chino Hills, Corona, and the counties of Riverside, San Bernardino and Orange.

The Basin 8-1 Alternative is posted on OCWD's website and will also be distributed by the other participating agencies for public review. District staff, La Habra, and IRWD will review the comments submitted on the draft Alternative and prepare the final Basin 8-1 Alternative, which must be submitted to the DWR by the statutory deadline of January 1, 2017.

After the Basin 8-1 Alternative is submitted to DWR, DWR will post on their website to allow for further public review. Once DWR approves the Basin 8-1 Alternative, the lead agencies within each management area will be required to update the Alternative every 5 years.

Figure 1
Management Areas in Basin 8-1 Alternative



PRIOR RELEVANT BOARD ACTION(S)

10-21-15	Informational Item, Sustainable Groundwater Management Act: Compliance Options
10-15-14, M14-160	Direct Staff to Identify Steps for Managing Groundwater Outside of District Boundaries (Sustainable Groundwater Management Act)
08-20-14, M14-119	Adopt Support if Amended Position on State Legislation - SB1168/ AB1739 (Groundwater Management Legislation)
07-16-14, R14-7-104	Adopt Groundwater Management Legislation Policy Principles

AGENDA ITEM SUBMITTAL

Meeting Date: December 14, 2016

To: Water Issues Committee
Board of Directors

From: Mike Markus

Staff Contact: G. Woodside/A. Hutchinson /M. Westropp

Budgeted: N/A
Budgeted Amount: N/A
Cost Estimate: N/A
Funding Source: N/A
Program/Line Item No: N/A
General Counsel Approval: N/A
Engineers/Feasibility Report: N/A
CEQA Compliance: Notice of Exemption

Subject: **FINAL BASIN 8-1 ALTERNATIVE TO COMPLY WITH SUSTAINABLE GROUNDWATER MANAGEMENT ACT**

SUMMARY

To comply with the Sustainable Groundwater Management Act, an Alternative to a Groundwater Sustainability Plan has been prepared that covers the entirety of the Department of Water Resources Basin 8-1, Coastal Plain of Orange County Groundwater Basin. The Basin 8-1 Alternative was prepared by District staff and other stakeholders in Basin 8-1 that are outside of the District's boundary. The Alternative shows that the basin has been sustainably managed for more than 10 years.

Attachment(s):
- Resolution
- Presentation
- Final Basin 8-1 Alternative

RECOMMENDATION

Agendize for December 21 Board meeting: Adopt resolution to support submission of the Basin 8-1 Alternative to the California Department of Water Resources to comply with the Sustainable Groundwater Management Act which includes the following actions:
- Authorize the General Manager to submit the Alternative to DWR
- Authorize the General Manager to submit other required information and make minor modifications to the Alternative
- Authorize staff to file a notice of exemption with respect to the California Environmental Quality Act

BACKGROUND/ANALYSIS

On September 16, 2014 Governor Brown signed three bills (SB1168, AB1739, and SB1319), which comprise the Sustainable Groundwater Management Act (Act).

The Act requires that all high- and medium-priority basins designated by the Department of Water Resources (DWR) be sustainably managed. DWR designated the Coastal Plain of Orange County Groundwater Basin (Basin 8-1) as a medium-priority basin, primarily due to heavy reliance on the basin's groundwater as a source of water supply.

Compliance with the Act can be achieved by one of two options:

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Basin 8-1, as defined by DWR, includes areas within and outside of OCWD's jurisdiction as shown in Figure 1. Approximately 89 percent of Basin 8-1 is within OCWD's jurisdiction. Areas outside of OCWD include a northern section within the cities of La Habra and Brea, land along the Santa Ana River upstream of Imperial Highway, and land outside of the southern and southeastern OCWD boundary within the jurisdiction of Irvine Ranch Water District, El Toro Water District and the city of Orange.

SGMA identified OCWD as the exclusive local agency to comply with the SGMA within its boundaries (§10723(c)(1)(K)); however, to be eligible to submit an Alternative to a GSP, the entirety of Basin 8-1 must be included in the Alternative and it must be demonstrated that Basin 8-1 has been sustainability managed.

The agencies within Basin 8-1 have agreed to prepare and submit an Alternative to a GSP, which is referred to as the Basin 8-1 Alternative. In accordance with §10733.6(b)(3), the Basin 8-1 Alternative presents an analysis that demonstrates the basin has operated sustainably over a period of at least 10 years. In fact, Basin 8-1 has been operated sustainably for more than 10 years without experiencing the undesirable results, which are defined by the California Water Code as significant and unreasonable lowering of groundwater levels, reduction in storage, water quality degradation, seawater intrusion, inelastic land subsidence, or depletions of interconnected surface water that impacts beneficial uses of surface water. Since the basin has been sustainably managed and no new actions are required, the Basin 8-1 Alternative essentially describes the ongoing actions that will continue sustainable management of the basin. The Alternative does not authorize or otherwise empower the other submitting agencies (La Habra and IRWD) to require OCWD to take any action or refrain from taking any action.

The Basin 8-1 Alternative was jointly prepared by the Orange County Water District (OCWD) and agencies with jurisdiction outside of OCWD's boundaries, including the City of La Habra and the Irvine Ranch Water District (IRWD). Table 1 shows the lead agencies responsible for preparing the sections covering the management areas.

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In the Basin 8-1 Alternative, four management areas were identified as shown in Figure 1. Accordingly, the Basin 8-1 Alternative is organized as follows:

- **Overview**: Provides a map and description of Basin 8-1 and a brief description of the basin management areas.
- **Hydrology of Basin 8-1**: Provides a description of the hydrogeology of Basin 8-1 including a description of the basin, the aquifer systems, fault zones, total basin volume, basin cross-sections, basin characteristics, and general groundwater quality.
- **La Habra-Brea Management Area**
- **OCWD Management Area**
- **South East Management Area**
- **Santa Ana Canyon Management Area**

A draft Basin 8-1 Alternative was posted on OCWD's website on November 8, 2016 and was distributed to the other participating agencies for public review. No public comments were received on the draft document. The final version of this report is complete and ready to submit to DWR.

The Basin 8-1 Alternative is exempt from CEQA because the Alternative is an informational document that does not bind, commit or predispose OCWD or other cooperating agencies to further consideration, approval or implementation of any potential project. Submission of the Basin 8-1 Alternative would not cause either a direct physical change to the environment or a reasonably foreseeable indirect physical change to the environment.

Submission to DWR

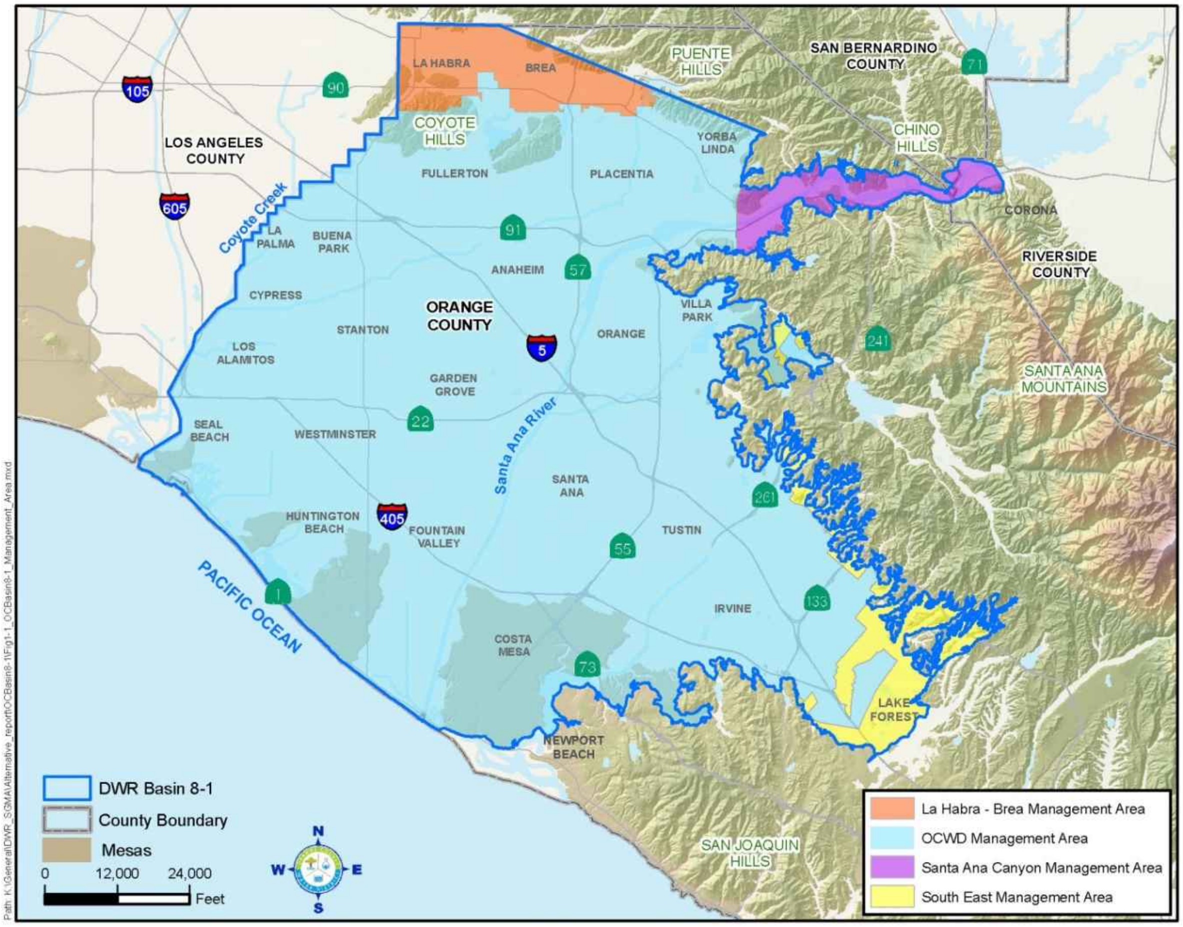
The Basin 8-1 Alternative must be submitted to the DWR by the statutory deadline of January 1, 2017. If the Alternative is not submitted by January 1, 2017, the District would need to become a GSA and submit a GSP. Development of a GSP is more arduous than an Alternative and it is advantageous for the District to comply with SGMA by submitting the Alternative. Additionally, if the District becomes a GSA for the OCWD boundaries, one or more separate GSAs would need to be formed for the areas outside OCWD's boundaries in the Irvine area and the Santa Ana Canyon area.

As part of the submittal to DWR, OCWD must include a resolution or other evidence of compliance that indicates that the Alternative satisfies the objectives of SGMA. The attached resolution satisfied this requirement and authorizes:

- The General Manager or designee to submit the Basin 8-1 Alternative to DWR
- The General Manager or designee to submit other required information and make minor modifications to the Alternative
- District staff to file a notice of CEQA exemption regarding submission of the Basin 8-1 Alternative.

After the Basin 8-1 Alternative is submitted to DWR, DWR will post on their website to allow for 60 days of public review. DWR has indicated that it may take up to one year to complete their review of Alternatives. Once DWR approves the Basin 8-1 Alternative, the lead agencies within each management area will be required to update the Alternative every 5 years.

Figure 1
Management Areas in Basin 8-1 Alternative



PRIOR RELEVANT BOARD ACTION(S)

07-16-14, R14-7-104	Adopt Groundwater Management Legislation Policy Principles
08-20-14, M14-119	Adopt Support if Amended Position on State Legislation - SB1168/ AB1739 (Groundwater Management Legislation)
10-15-14, M14-160	Direct staff to identify steps for managing Groundwater Outside of District Boundaries (Sustainable Groundwater Management Act)
10-21-15	Water Issues Committee – Informational Sustainable Groundwater Management Act: Compliance Options
11-9-16	Water Issues Committee - Provide comments as appropriate on Draft Basin 8-1 Alternative to Comply with the Sustainable Groundwater Management Act.

CERTIFICATION OF SECRETARY

I do hereby certify that at its meeting held December 21, 2016, the Orange County Water District Board of Directors approved and adopted the following resolution:

RESOLUTION OF THE
BOARD OF DIRECTORS OF THE ORANGE COUNTY WATER DISTRICT
TO SUPPORT SUBMISSION OF BASIN 8-1 ALTERNATIVE TO THE CALIFORNIA
DEPARTMENT OF WATER RESOURCES TO COMPLY WITH THE SUSTAINABLE
GROUNDWATER MANAGEMENT ACT.
(CCR, Title 23, Division 2, Chapter 1.5, Subchapter 1)

WHEREAS, California Governor Jerry Brown signed into law Senate Bills 1168 and 1319 and Assembly Bill 1739, collectively comprising the Sustainable Groundwater Management Act (SGMA), which took effect on January 1, 2015; and,

WHEREAS, the SGMA requires all high and medium priority groundwater basins as designated by the California Department of Water Resources (DWR) to develop a process that will lead to or ensure continuation of sustainable groundwater management; and,

WHEREAS, the SGMA has designated the Orange County Water District (OCWD) as the exclusive local agency within its statutory boundaries to comply with SGMA per Water Code Section 10723 (c)(1); and,

WHEREAS, the SGMA allows local agencies to submit an Alternative to a Groundwater Sustainability Plan (Alternative) by January 1, 2017 that shows an entire basin has been sustainably managed for 10 years or more and otherwise satisfies the objectives of SGMA (Water Code Section 10733.6 (b)(3)); and,

WHEREAS, OCWD has consulted with and has been working with other affected Counties, local agencies, public water systems, and stakeholders that are within or adjacent to the Coastal Plain of Orange County Groundwater Basin, a medium priority basin, designated in DWR Bulletin 118 as Basin 8-1 (Basin 8-1); and,

WHEREAS, to be approved by DWR an Alternative must demonstrate management of an entire Bulletin 118 basin; and

WHEREAS, OCWD's boundaries cover a majority of, but not all of the area within Basin 8-1; and,

WHEREAS, a number of local agencies overlie areas of Basin 8-1 that fall outside of OCWD's boundaries; and,

WHEREAS, OCWD, in collaboration with other agencies, principally the City of La Habra and Irvine Ranch Water District, has prepared and compiled an Alternative that will facilitate and ensure sustainable management in the entirety of the Basin 8-1; and,

WHEREAS, OCWD, the City of La Habra, and the Irvine Ranch Water District have agreed to jointly submit the Alternative to DWR and are referred to in the Alternative submission as 'submitting agencies'; and,

WHEREAS, the Alternative does not authorize (or otherwise empower) the other submitting agencies to require OCWD to take any action, or refrain from taking any action; and,

WHEREAS, the Alternative discusses Basin 8-1's physical features, the OCWD's facilities and monitoring and operating programs, and the management tools available to manage the basin for each of the submitting agencies, but does not bind, commit, or predispose OCWD to further consideration, approval or implementation of any potential project; and,

WHEREAS, Submission of the Alternative to DWR does not have the effect of approving any current or future project but instead describes a continuing process of groundwater management that OCWD has utilized in largely the same manner since prior to the enactment of the California Environmental Quality Act (CEQA) in 1970; and,

WHEREAS, If any individual future project discussed in the Alternative is carried forward by the District for approval, an Engineer's Report will be prepared for that potential project for consideration by the Board of Directors, as required by Section 20.7 of the District Act. The District will also concurrently conduct appropriate environmental analysis in accordance with CEQA with respect to each potential project that is carried forward for consideration and possible approval by the OCWD Board of Directors; and,

WHEREAS, submission of the Alternative will not cause either a direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment, and is therefore not a "project" regulated by CEQA. To the extent it could be considered a "project" for purposes of CEQA, the Alternative is exempt from CEQA per State CEQA Guidelines Sections 15261 (Ongoing Project), 15262 (Feasibility and Planning Studies), and 15306 (Information Collection and Management); and,

WHEREAS, DWR has a statutory deadline of January 1, 2017 by which the Alternative for all of Basin 8-1, must be submitted to DWR; and,

WHEREAS, the submitting agencies are prepared to submit the Alternative covering all of Basin 8-1 to DWR.

NOW, THEREFORE, BE IT RESOLVED AND HEREBY ORDERED that the Orange County Water District Board of Directors approves the following:

1. The Orange County Water District authorizes the General Manager or his designee to submit the Basin 8-1 Alternative to DWR.
2. The General Manager or his designee is authorized to submit other required information associated with the Alternative to DWR and/or make minor modifications to the Alternative in response to comments on the Alternative.

3. District staff is authorized and directed to file a notice of exemption in accordance with CEQA regarding OCWD's submission of the Alternative.

IN WITNESS WHEREOF, I have executed this Certificate on December 21, 2016

Judy-Rae Karlsen, Assistant District Secretary

Orange County Water District
18700 Ward Street
Fountain Valley, CA 92708
(714) 378-3200

NOTICE OF EXEMPTION

From the Requirements of the California Environmental Quality Act (CEQA)

TO: County Clerk/County of Orange
P.O. Box 238
Santa Ana, CA 92702

State Clearinghouse
P.O. Box 3044
Sacramento, CA 95812-3044

FROM: Orange County Water District
Planning & Watershed Management
18700 Ward Street
Fountain Valley, CA 92708

PROJECT TITLE: Submission of Basin 8-1 Alternative to comply with Sustainable Groundwater Management Act

APPROVAL DATE: December 21, 2016

PROJECT LOCATION: CA Department of Water Resources Basin 8-1 (primarily in north & central Orange County) – see figure on next page
CITY: Various **COUNTY**: Orange, Riverside, San Bernardino

DESCRIPTION OF THE PROJECT: The submission of the Basin 8-1 Alternative to comply with the Sustainable Groundwater Management Act assists the Orange County Water District with documenting that Basin 8-1 identified by the CA Department of Water Resources (DWR) has been sustainably managed over a period of at least 10 years.

NAME & ADDRESS OF APPLICANT: Orange County Water District, 18700 Ward Street, Fountain Valley CA 92708

NAME OF PUBLIC AGENCY APPROVING PROJECT: Orange County Water District

EXEMPT STATUS:

- ☐ Ministerial (Sec. 15268)
- ☐ Declared Emergency (Sec. 15269 (a))
- ☐ Emergency Project (Sec. 15269(a)&(b))
- ☐ General Rule (Sec. 15061(b)(3))
- X Statutory Exemption: Section 15261, Section 15262
- X Categorical Exemption: Class 6 Section 15306

REASON(S) WHY PROJECT IS EXEMPT FROM CEQA:
Submission of the Basin 8-1 Alternative to DWR does not have the effect of approving any current or future project but instead describes a continuing process of groundwater management that OCWD has utilized in largely the same manner since prior to the enactment of the California Environmental Quality Act (CEQA) in 1970. Additionally, submission of the Alternative will not cause either a direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment, and is therefore not a "project" regulated by CEQA. To the extent it could be considered a "project" for purposes of CEQA, the Alternative is exempt from CEQA per State CEQA Guidelines Sections 15261 (Ongoing Project), 15262 (Feasibility and Planning Studies), and 15306 (Information Collection and Management).

Orange County Water District
18700 Ward Street
Fountain Valley, CA 92708
(714) 378-3200

CONTACT PERSON: Adam Hutchinson

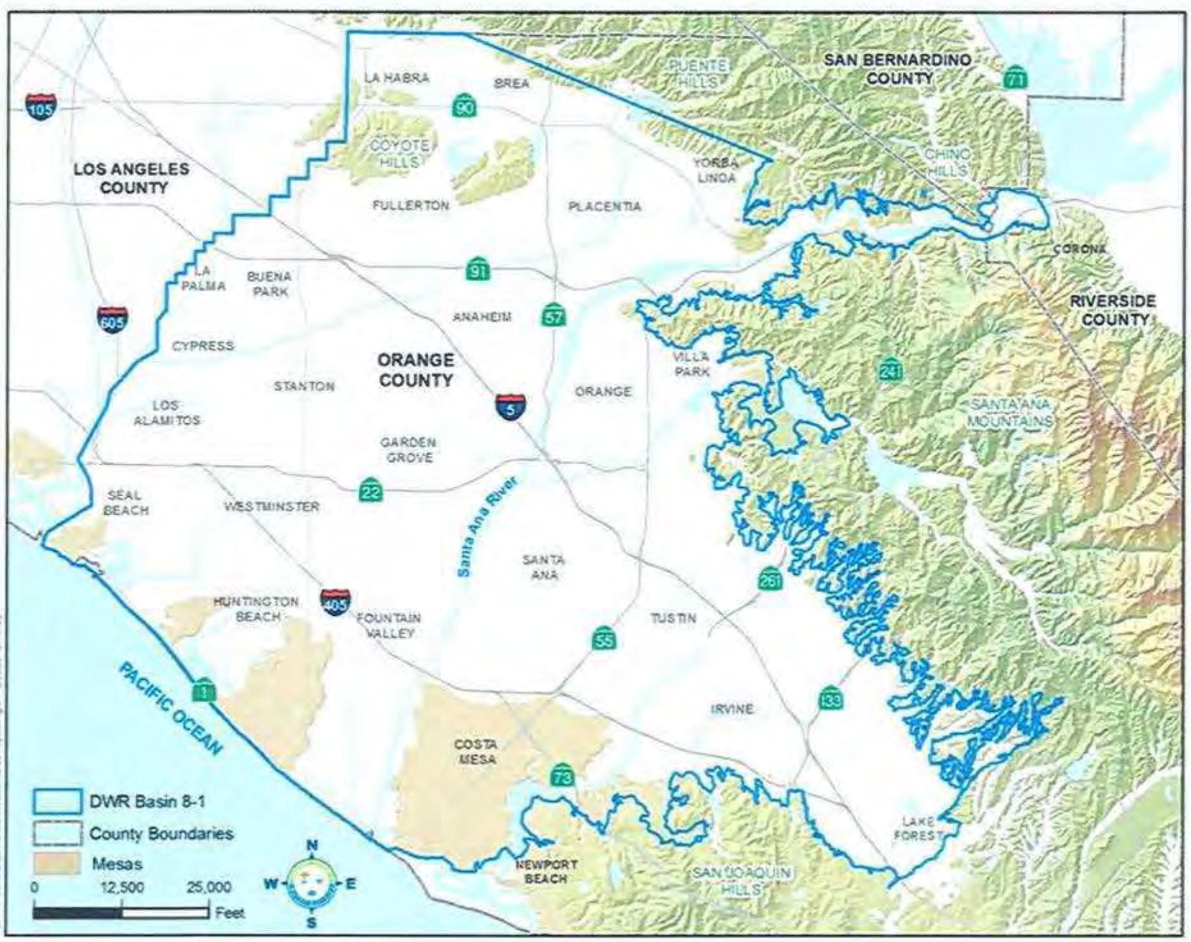
TELEPHONE No: 714 378-3214

SIGNATURE: ______________

DATE: December 22, 2016

TITLE: Recharge Planning Manager

Figure showing Location of CA Department of Water Resources Basin 8-1



City of La Habra

ADMINISTRATION

"A Caring Community"

201 E. La Habra Boulevard
Post Office Box 337
La Habra, CA 90633-0785
Office: (562) 383-4010
Fax: (562) 383-4474

December 19, 2016

Michael R. Markus
General Manager
Orange County Water District
18700 Ward Street,
Fountain Valley, CA 92708

Re: City of La Habra Support for Orange County Water District Alternative Plan for Basin 8-1 Under the Sustainable Groundwater Management Act

Dear Mr. Markus:

The City of La Habra ("City") supports Orange County Water District's Alternative Plan under the Sustainable Groundwater Management Act. The City recognizes OCWD's dilemma in satisfying the Department of Water Resources' requirement that the OCWD Alternative Plan must cover portions of Basin 8-1 (DWR Bulletin 118) which are outside of OCWD's jurisdiction. So, when we met in June this year the City agreed to collaborate with OCWD in preparation of the OCWD Alternative Plan. Reciprocally, OCWD adopted a resolution in support the City's request to DWR to re-establish the La Habra Basin as separate from the balance of Basin 8-1.

The City staff, consultants and attorneys have collaborated with OCWD in the development of the OCWD Alternative Plan. The Plan accurately characterizes La Habra Basin as a management area separate and apart from the OCWD management area, even though both are depicted in Bulletin 118 as being within Basin 8-1. The OCWD Alternative plan also accurately describes the City as the recognized the GSA for groundwater resources underlying the cities of La Habra and Brea. The Plan also accurately describes the City's past and current sustainable groundwater management practices and City's intent to develop a Groundwater Sustainability Plan under SGMA for the La Habra management area. The City endorses the portions of the OCWD Alternative Plan which describe the La Habra management area and the past and intended future groundwater sustainability actions therein.

Separate and independent sustainable groundwater management programs for the Orange County Basin and the La Habra Basin have co-existed for many years. The City of La Habra fully intends that relationship to continue into the future. To that end, the City, as GSA for La Habra Basin, will continue to cooperate and collaborate with OCWD on mutual concerns related to SGMA and to sustainable groundwater management practices.

The City of La Habra endorses those portions of the OCWD Alternative Plan related to the La Habra management area and fully supports OCWD's efforts to comply with SGMA through the OCWD Alternative Plan. If OCWD desires, you may use this letter as part of the

OCWD Alternative Plan submittal to DWR.

Sincerely,

Jim Sadro
City Manager

CC: City Manager, City of Brea
City Manager, City of Fullerton

APPENDIX E

San Juan Basin Groundwater and Facilities Management Plan

San Juan Basin Groundwater and Facilities Management Plan

Final Report

Prepared for

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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

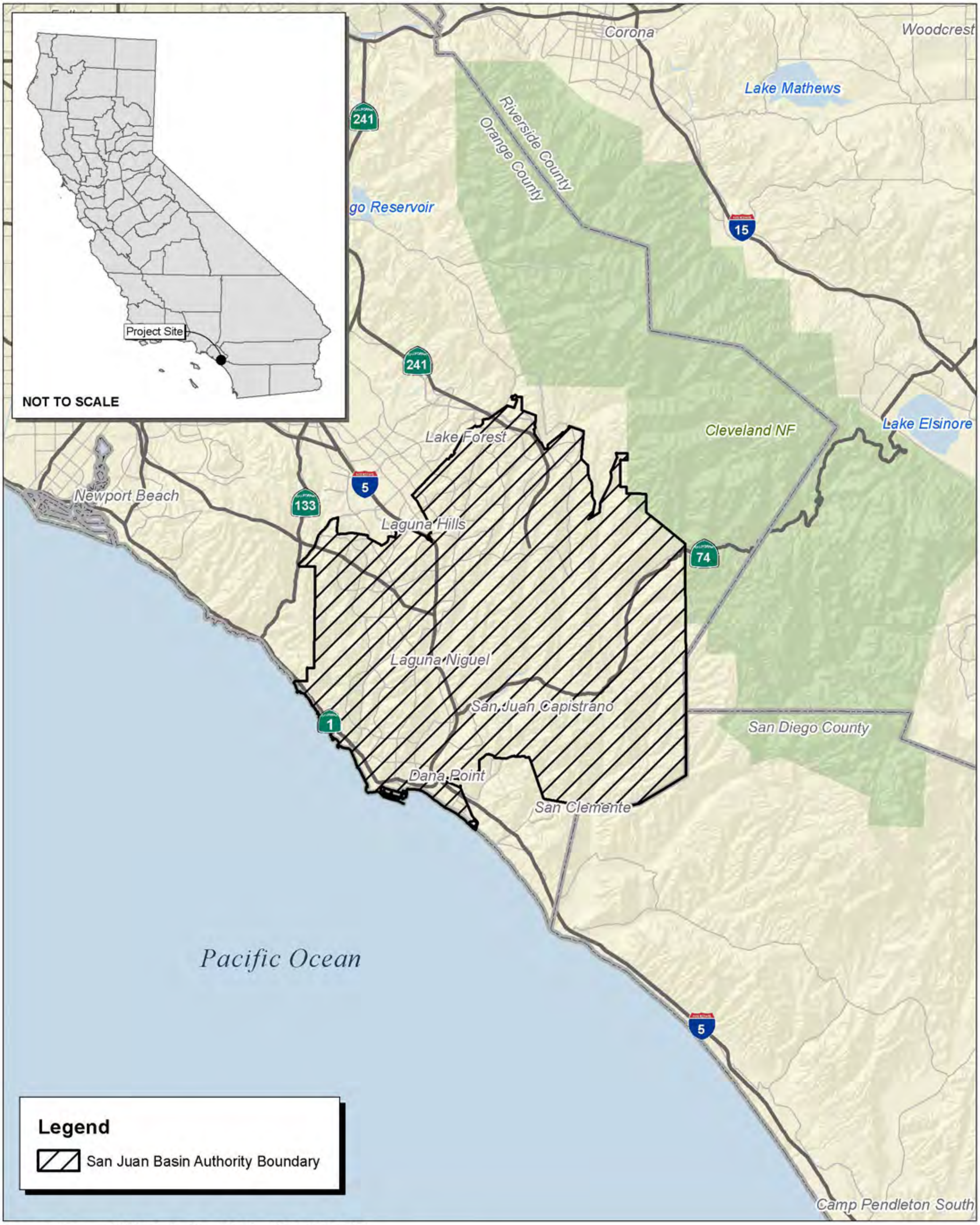
ft = feet

* 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

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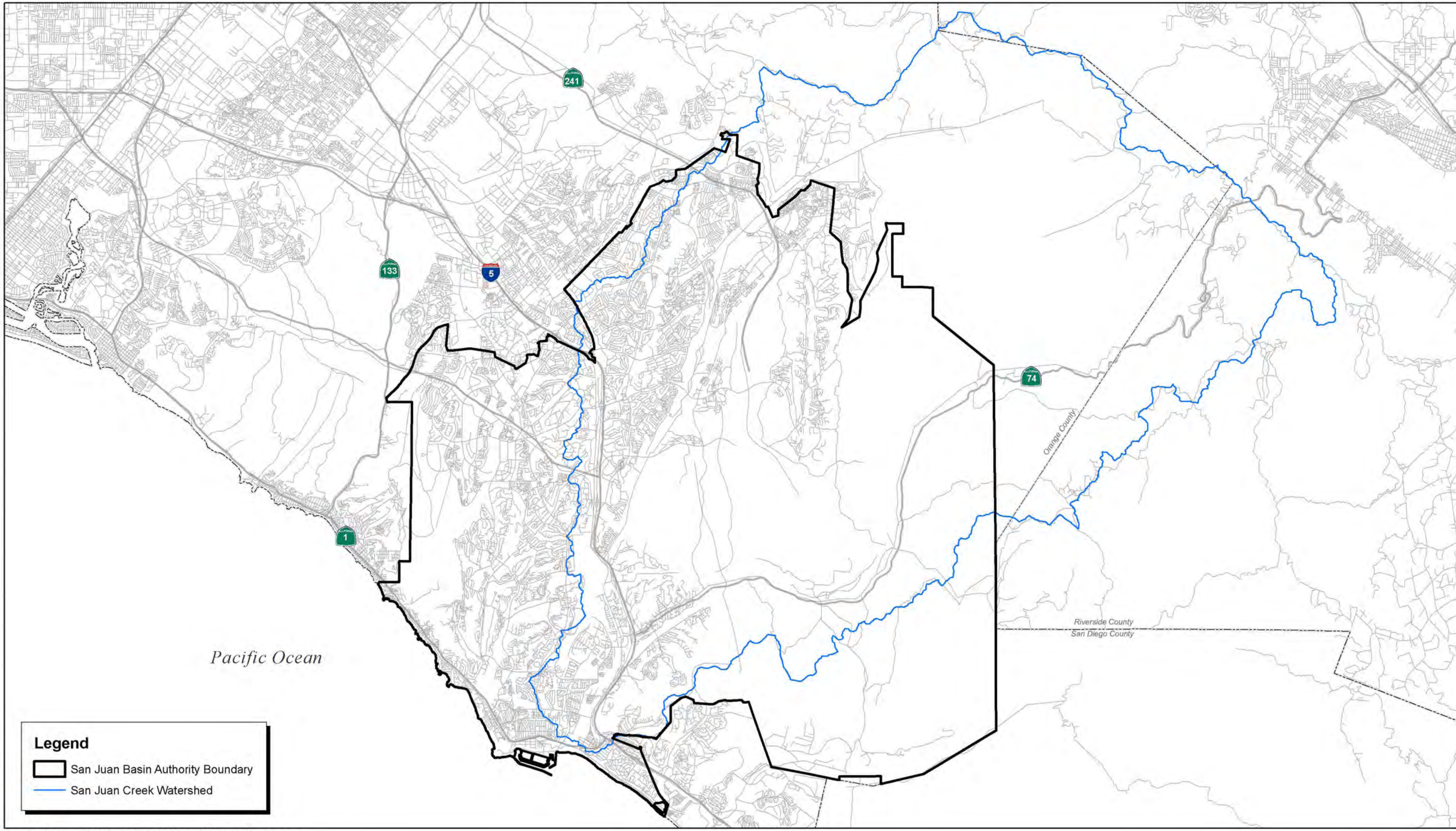
5 2.5 0 5 Miles

Figure 2-1
Regional Location Map



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

Michael Brandman Associates

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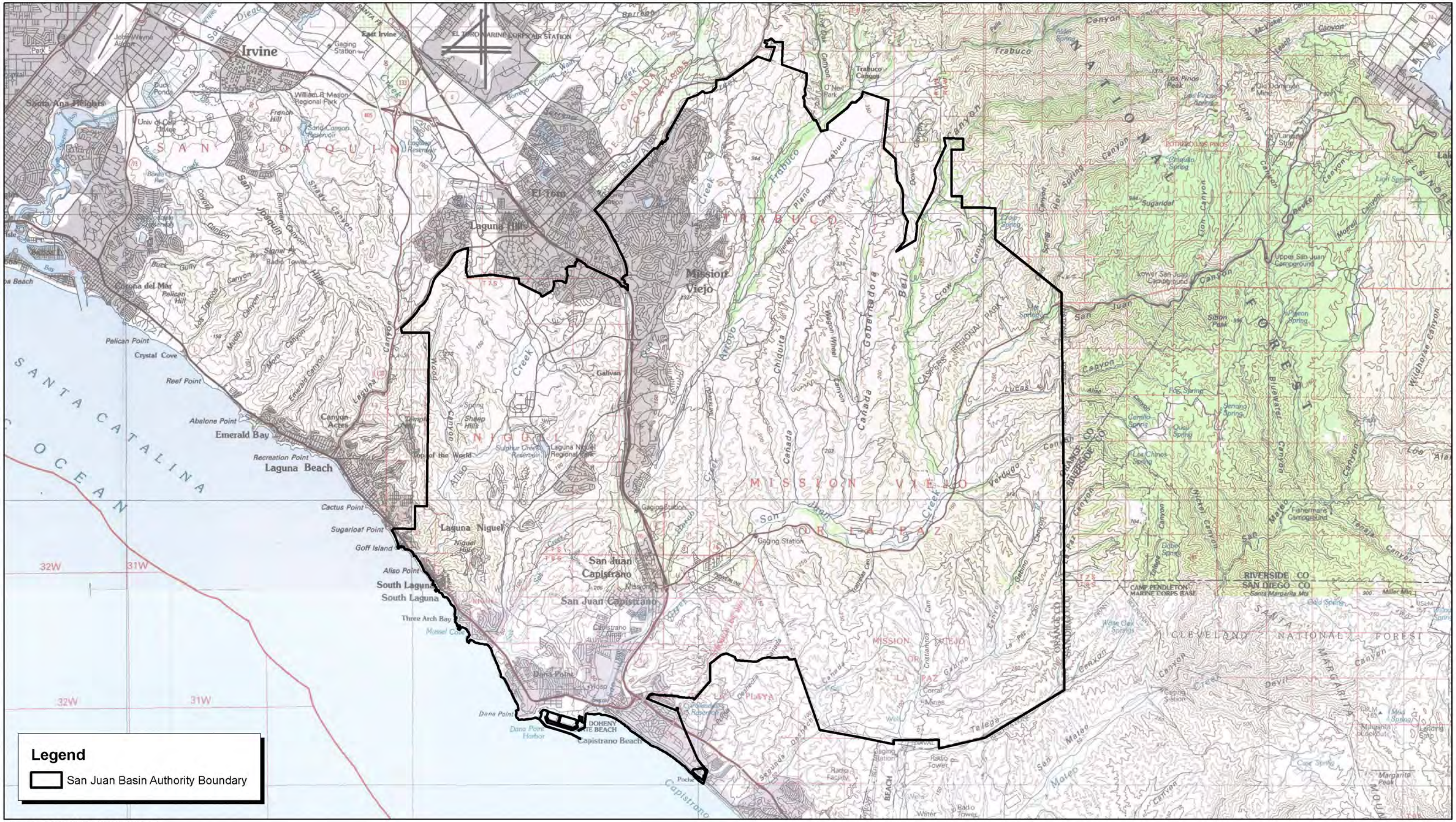
2.2 1.1 0 2.2 Miles

Figure 2-2
Local Vicinty Map



Source: TOPO! USGS 100K DRG.

Michael Brandman Associates

NORTH

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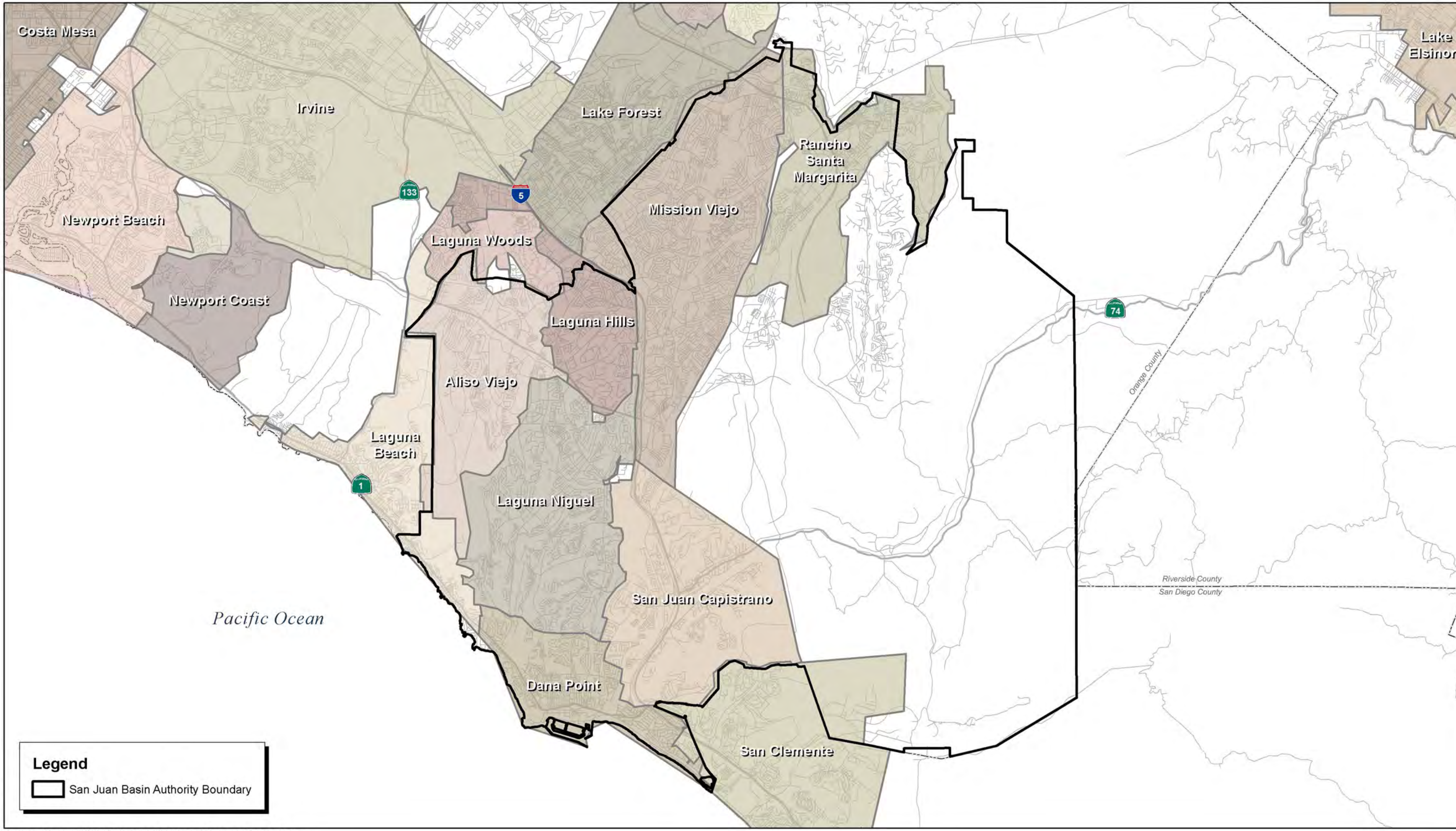
Figure 2-3
Topographic Map



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

Michael Brandman Associates

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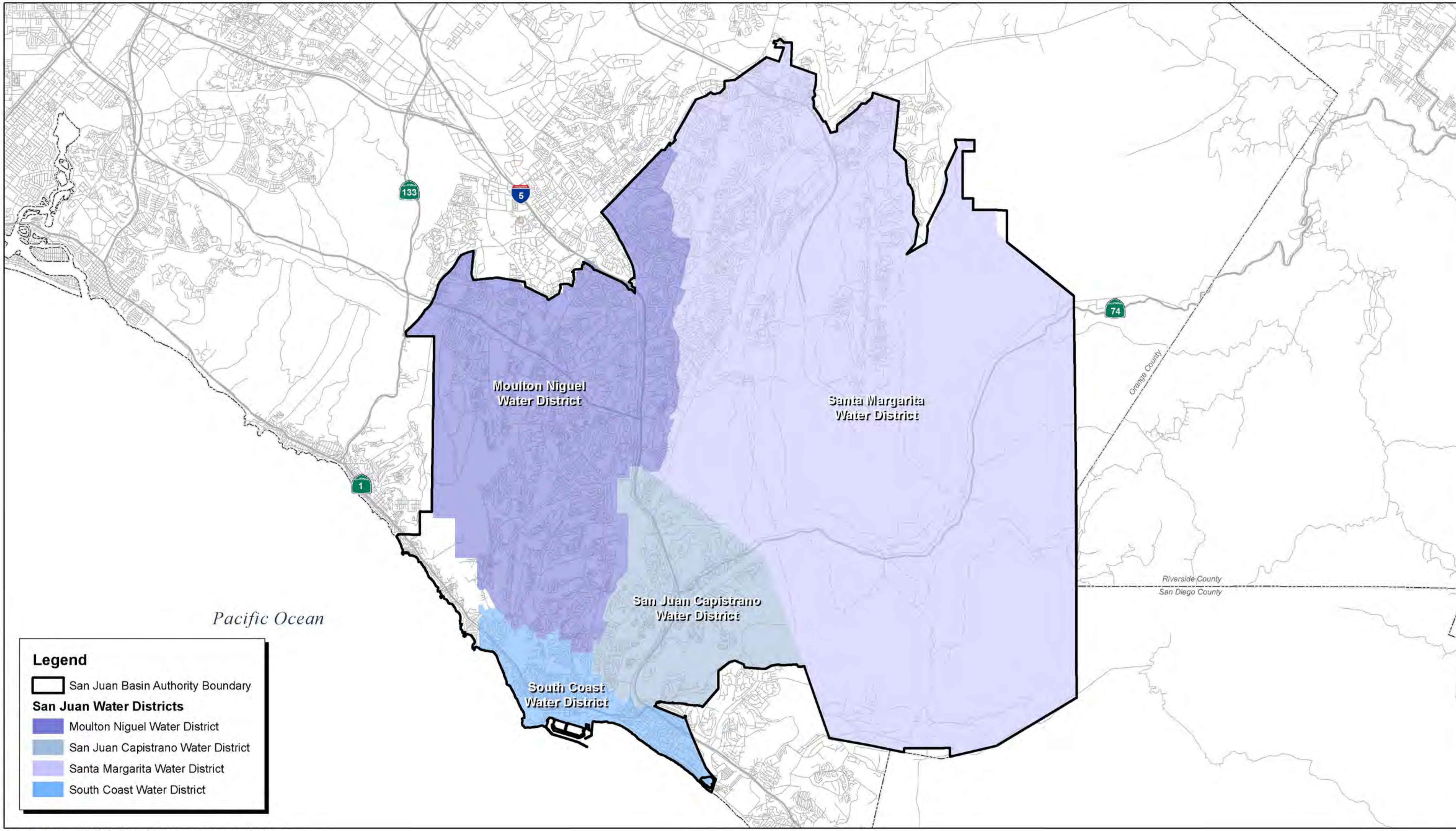
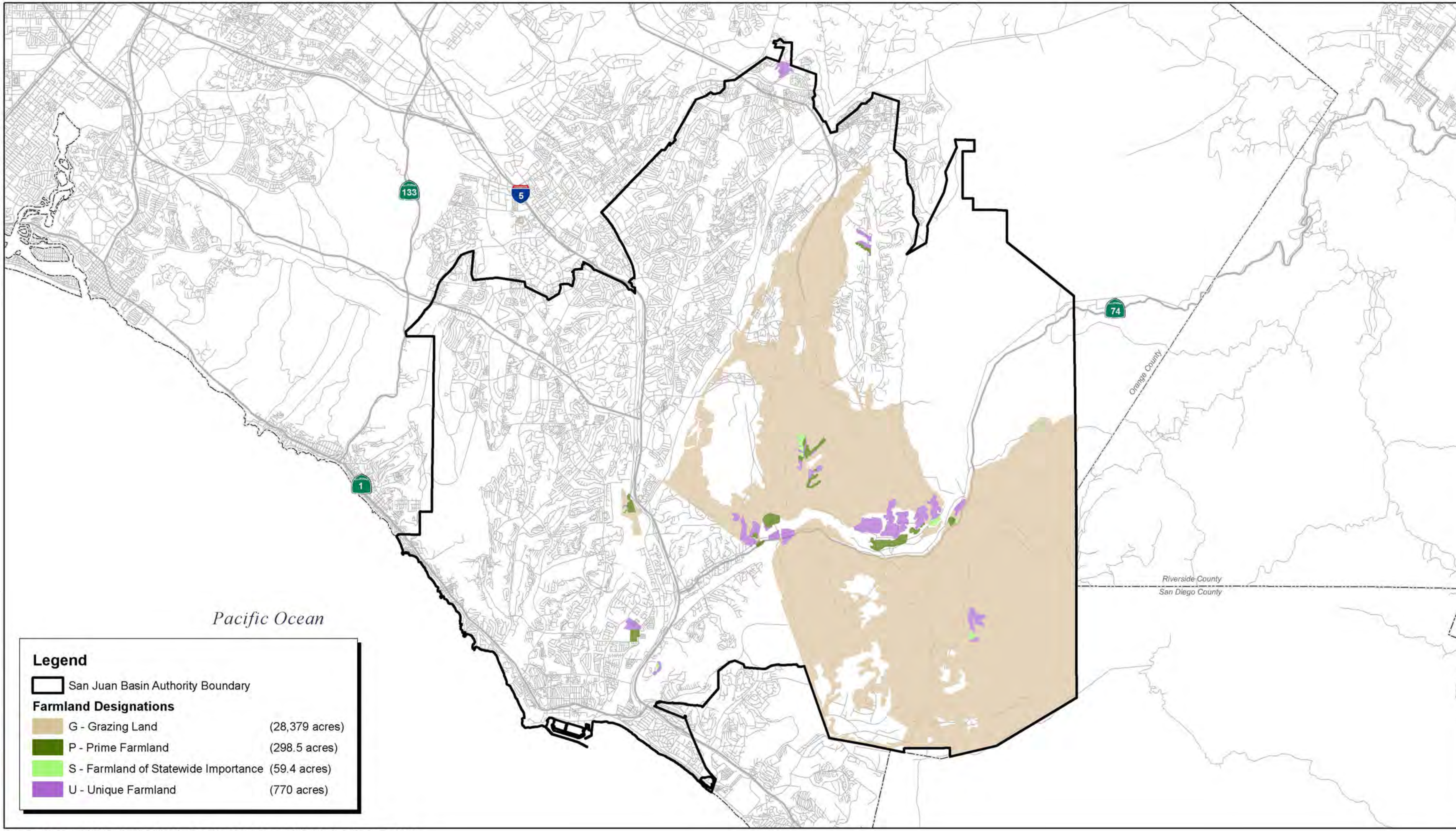
Figure 2-4
City Boundaries



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

Figure 2-5
San Juan Water Districts



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

Michael Brandman Associates

NORTH

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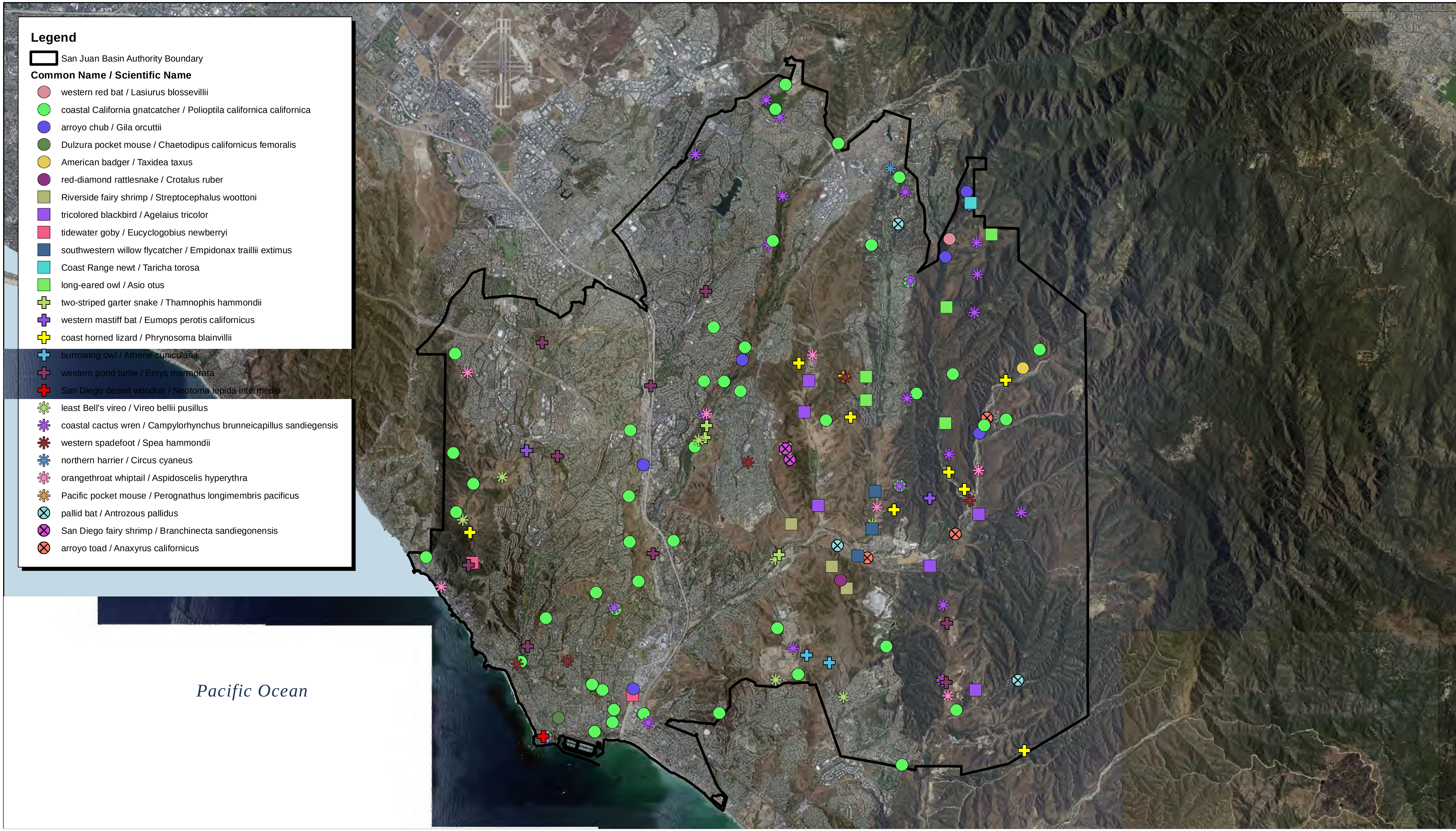
Figure 2-6
Agricultural Resources Map



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

Michael Brandman Associates

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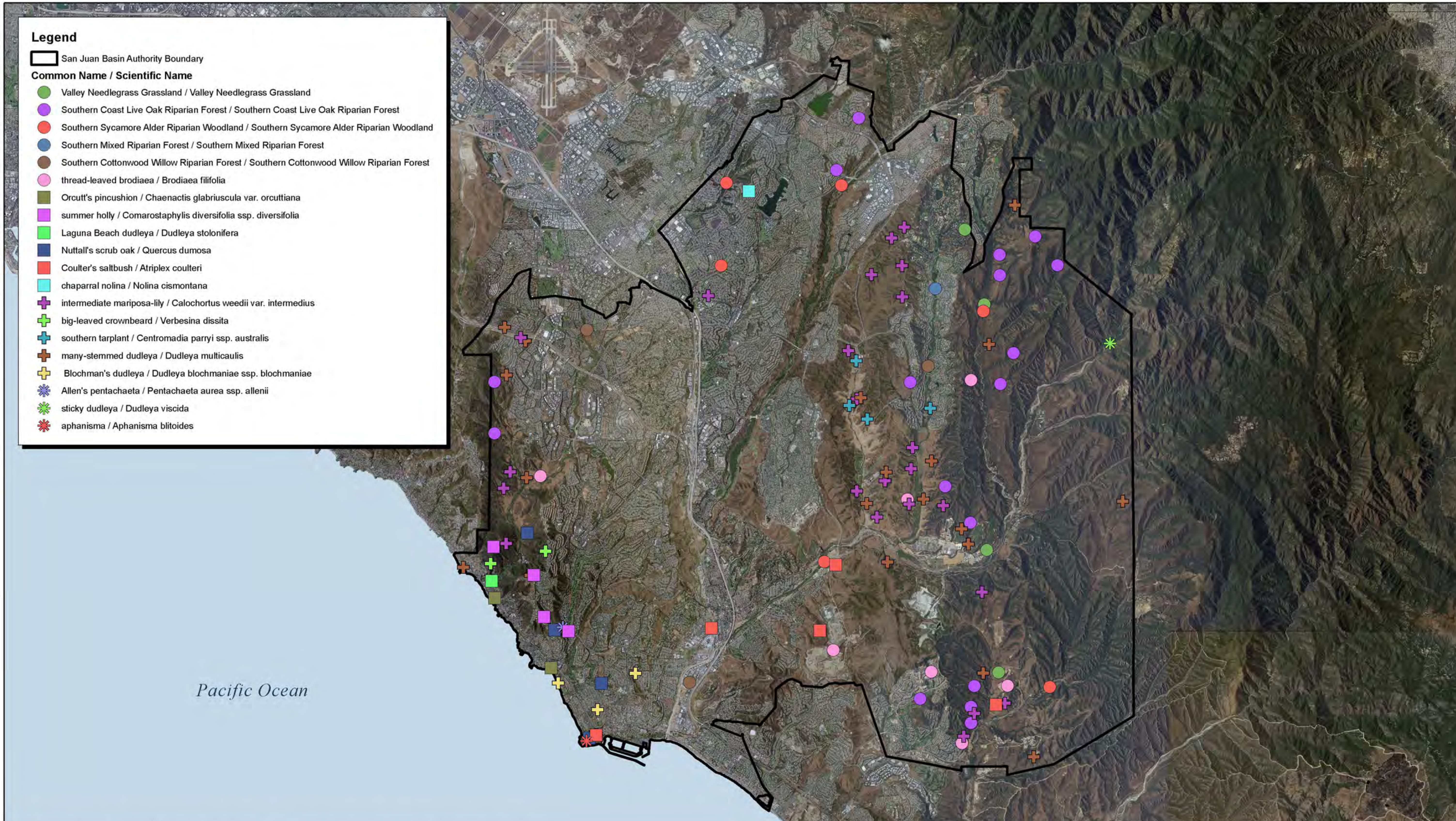
Miles

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

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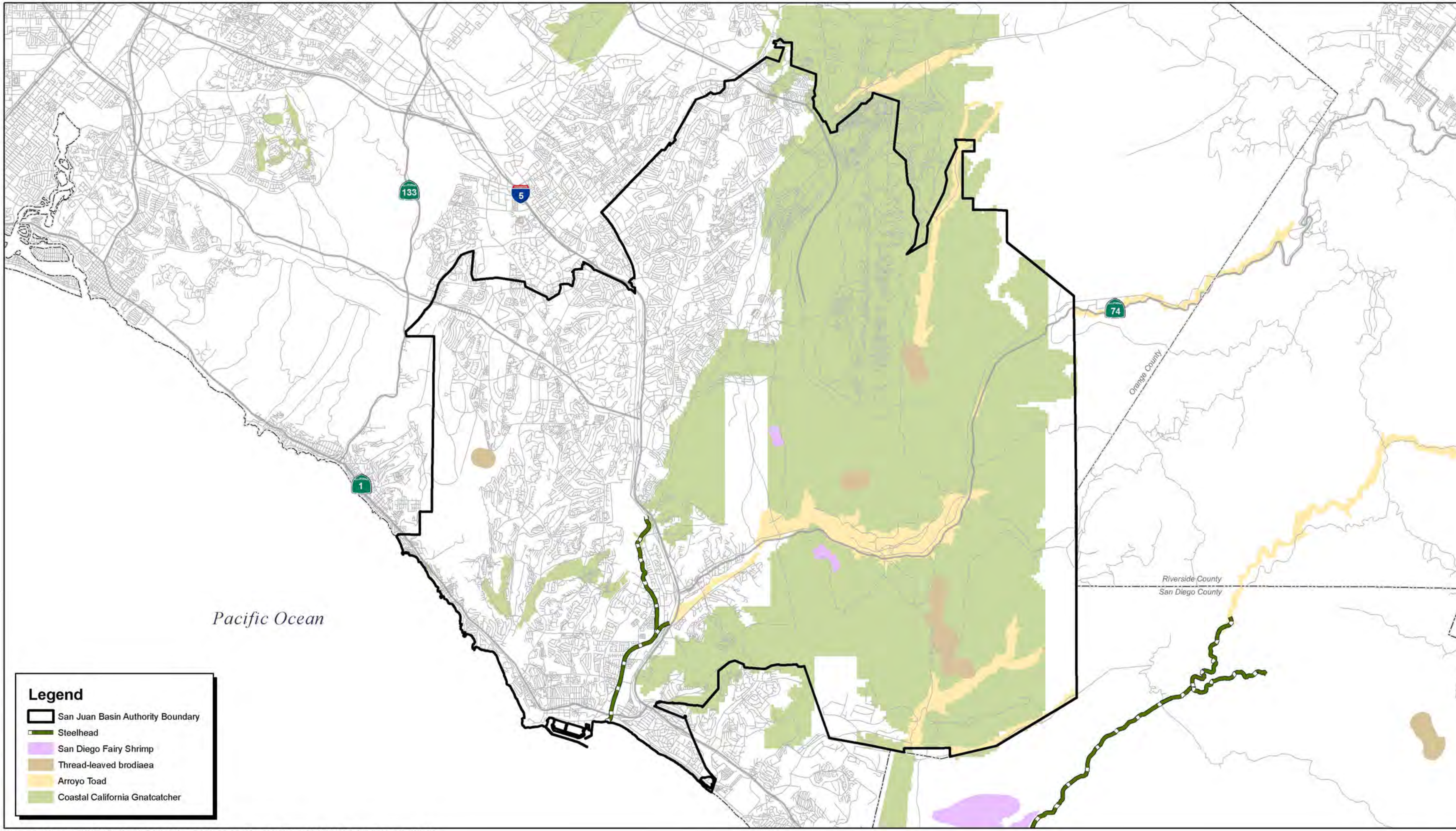
Figure 2-8
CNDDB Recorded Occurences of
Special-Status Plant Species within the San Juan Basin Boundary



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

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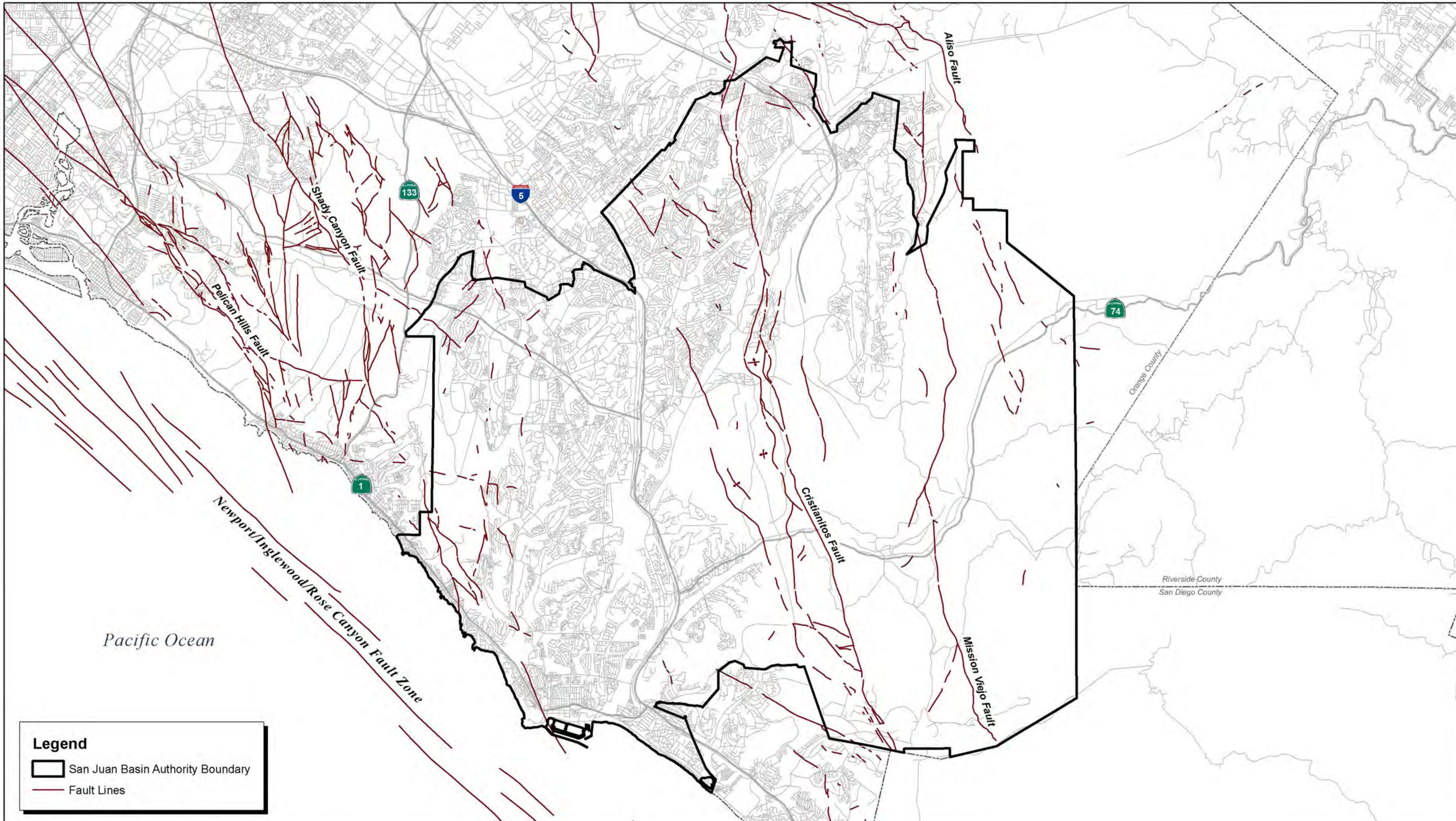
NORTH

2 1 0 2 Miles

Figure 2-9
Critical Habitat Areas



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

Michael Brandman Associates

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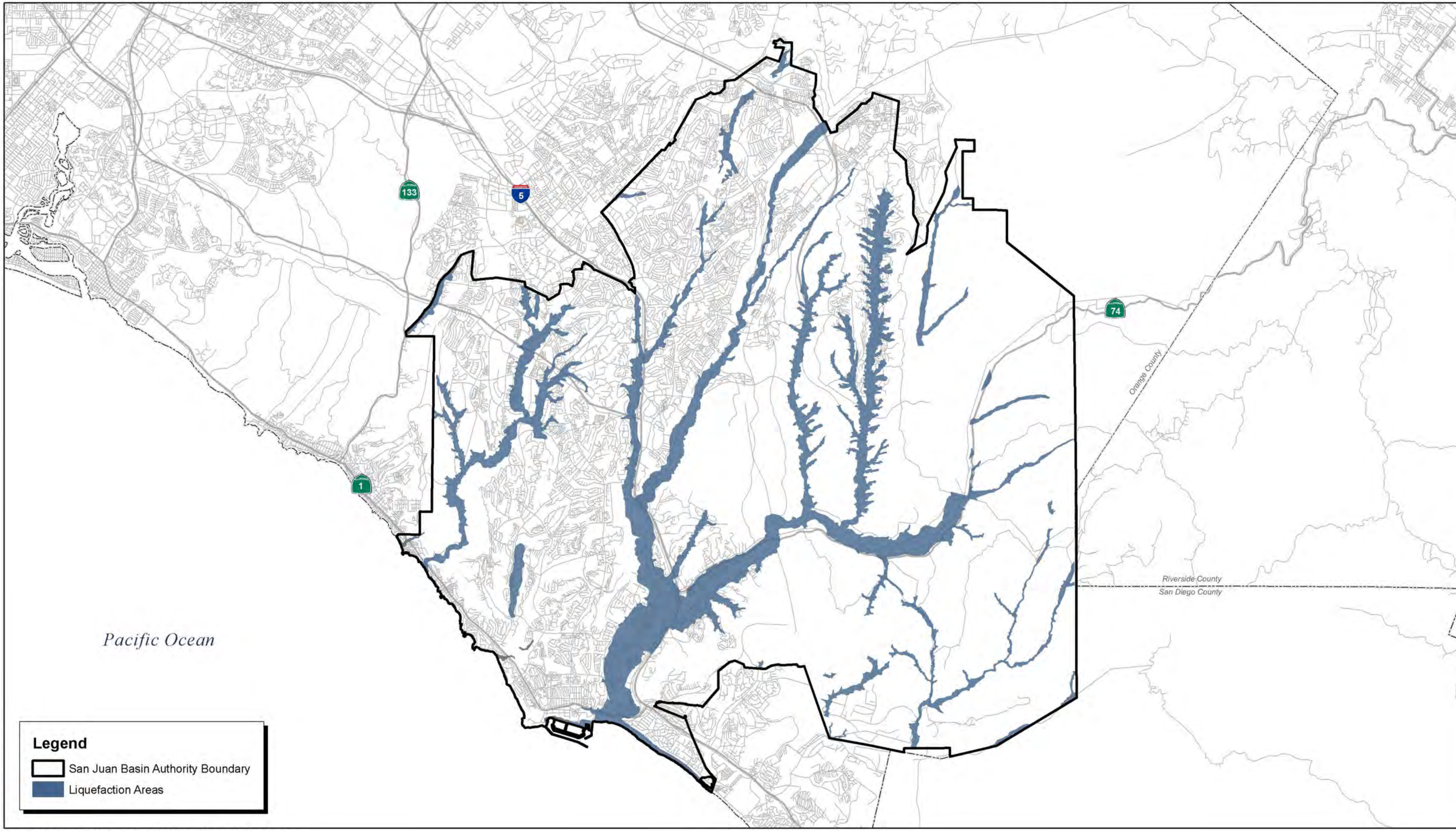
Figure 2-10
Fault Lines



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

Michael Brandman Associates

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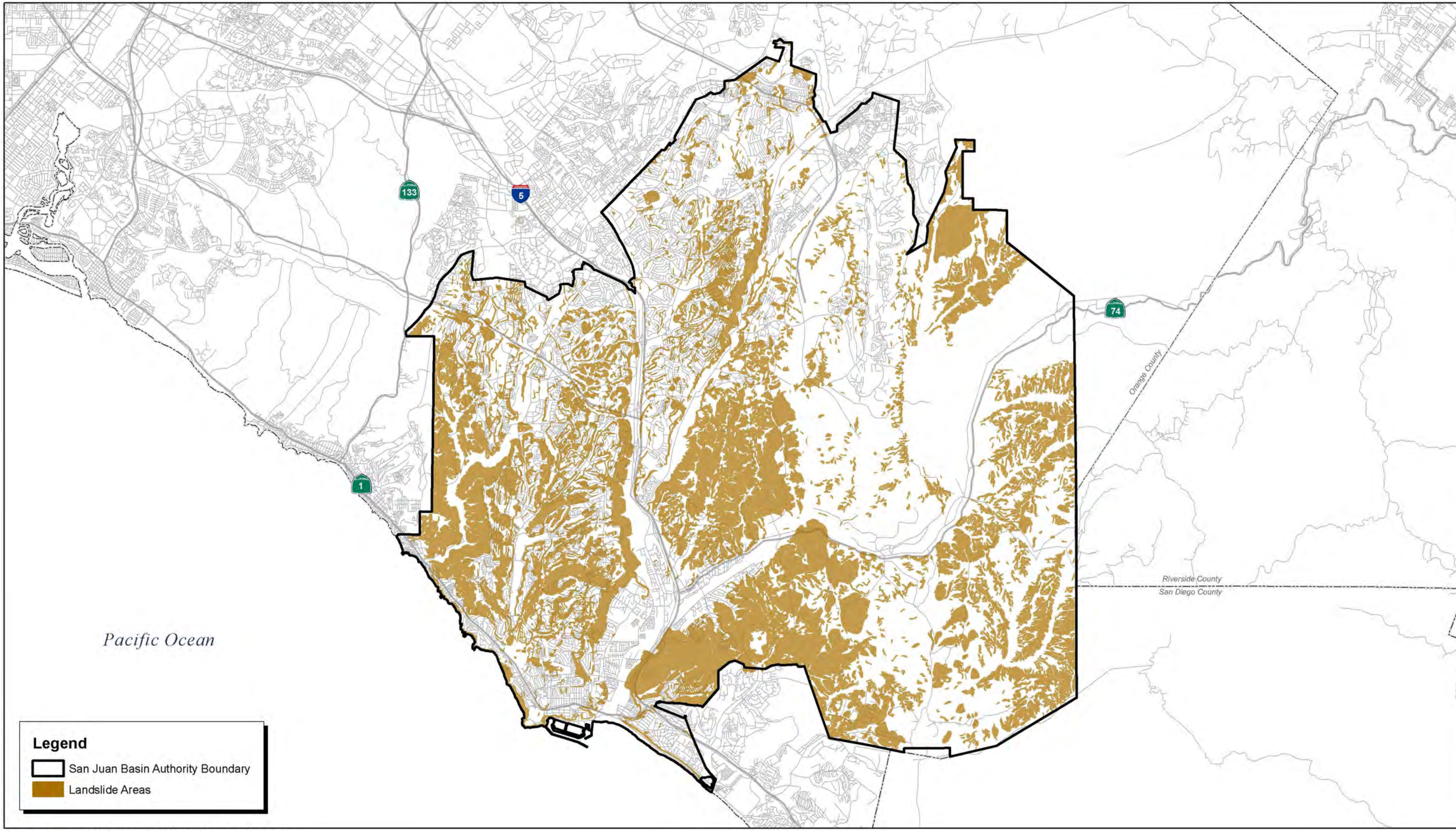
Miles

Figure 2-11
Liquefaction Areas



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

Michael Brandman Associates

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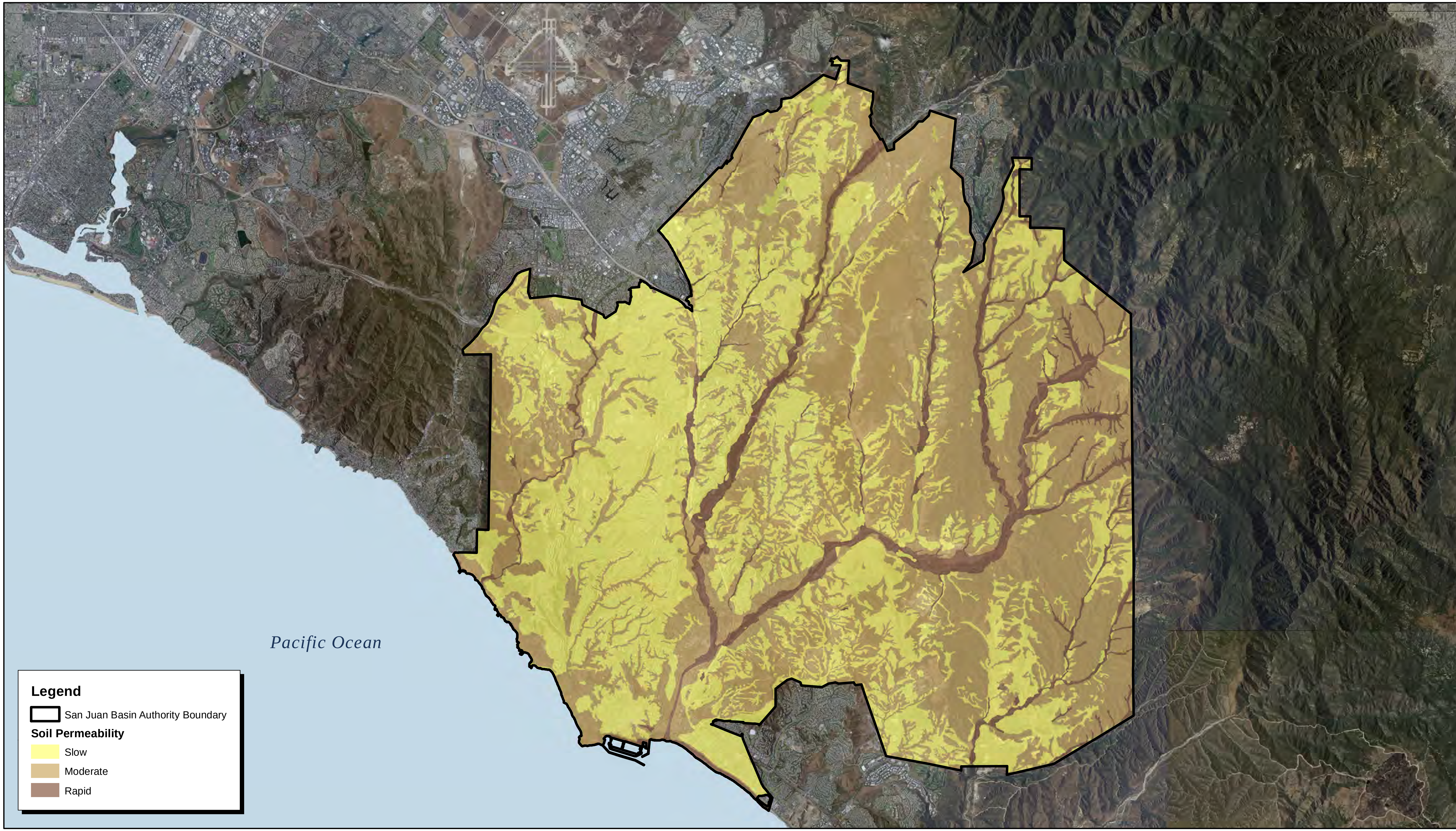
Figure 2-12
Landslide Areas



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

Michael Brandman Associates

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2 1 0 2 Miles

Figure 2-13
Soil Permeability

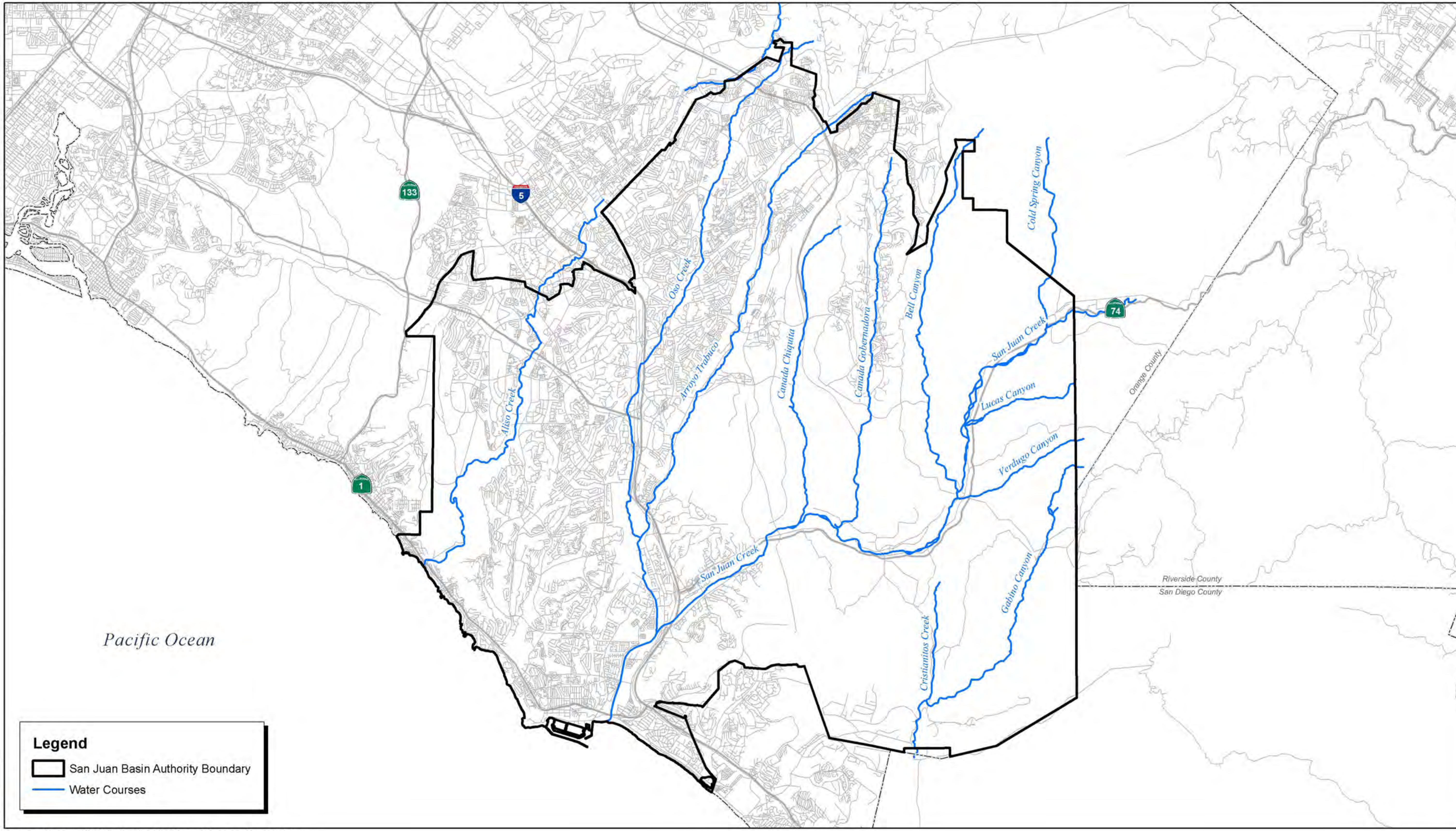
Source: Orange County, Riverside County and San Diego Diego County NAIP, 2009. USDA Soils Data.

Michael Brandman Associates

NORTH

2 1 0 2 Miles

Figure 2-14
Shallow Excavation Development Constraint



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

Michael Brandman Associates

NORTH

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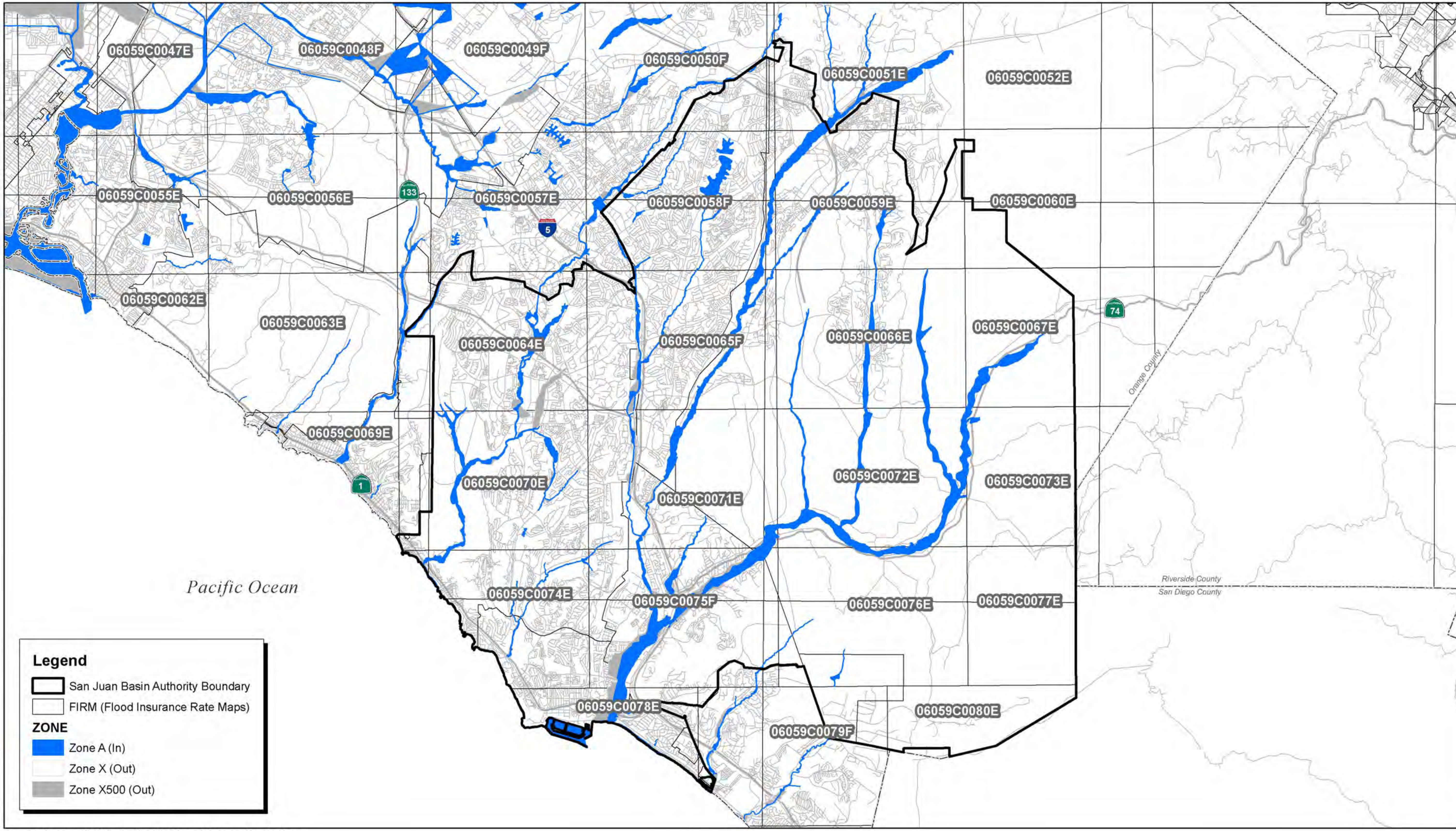
Miles

Figure 2-15
Water Courses



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

Michael Brandman Associates

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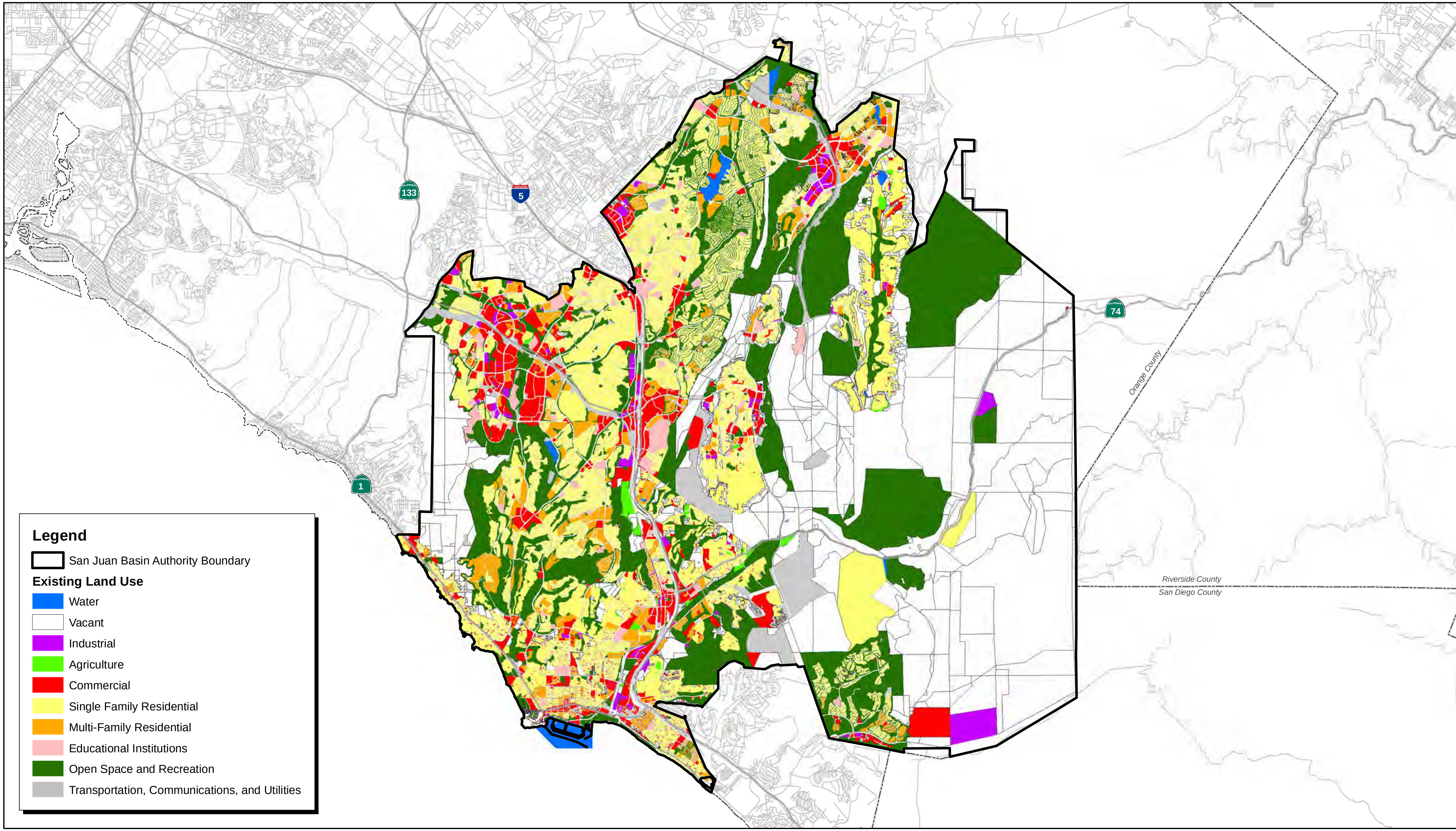
Figure 2-16
FEMA Flood Zone Map



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

Michael Brandman Associates

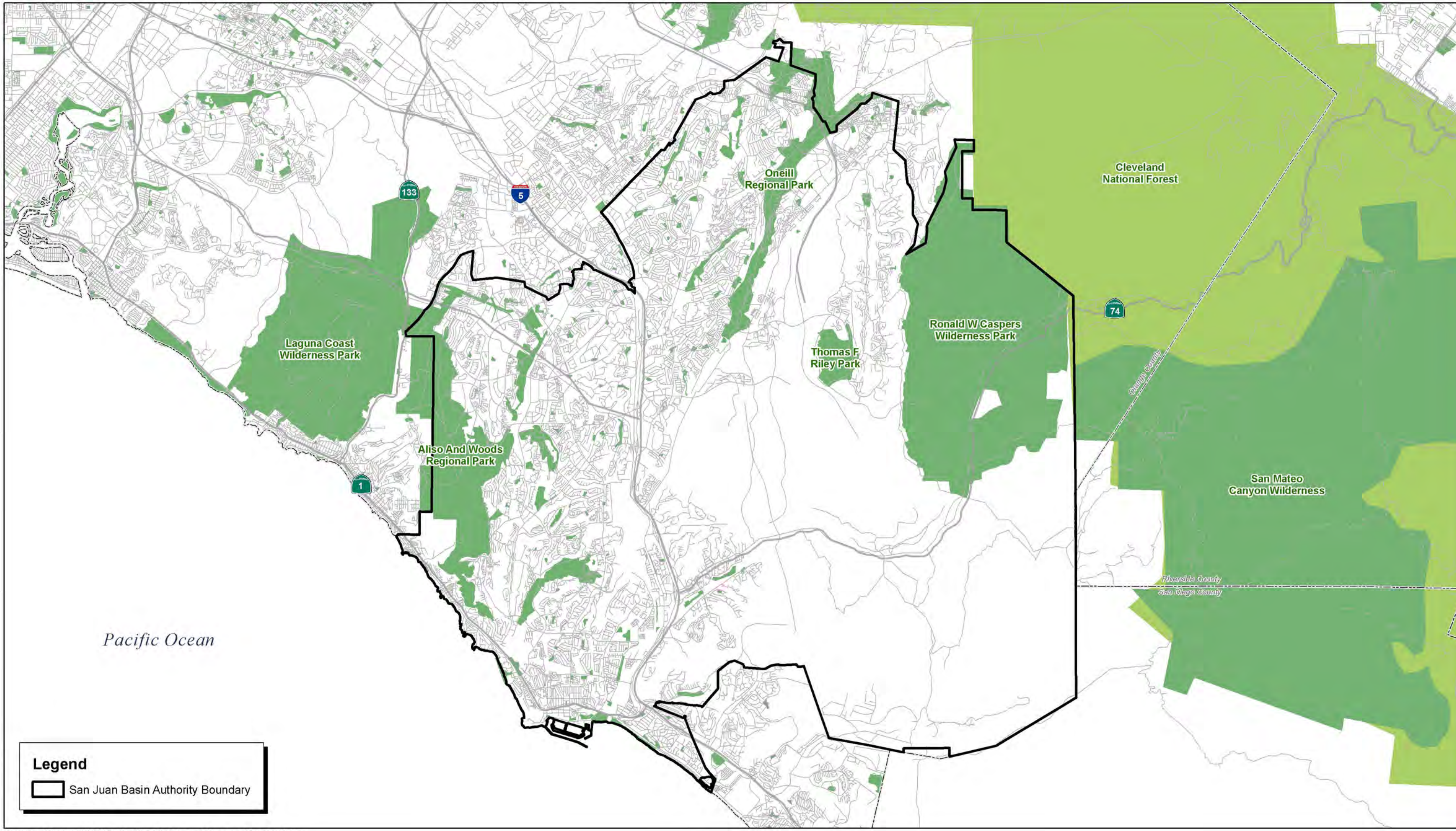
NORTH

2 1 0 2

Miles

Exhibit 2-17
Existing Land Use

Figure 2-17
Existing Land Use



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

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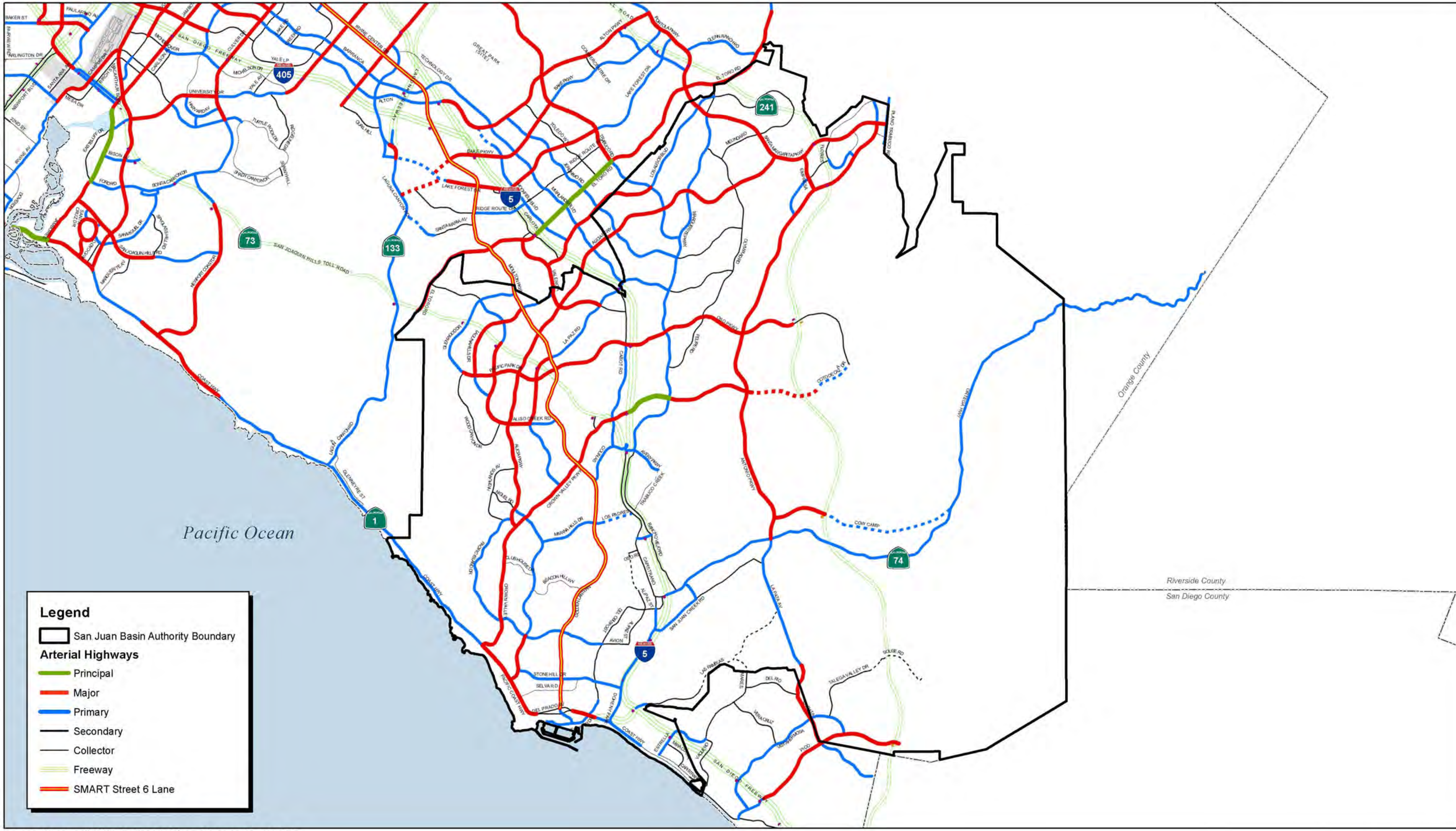
NORTH

2 1 0 2
Miles

Figure 2-18
Parks and Recreation



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

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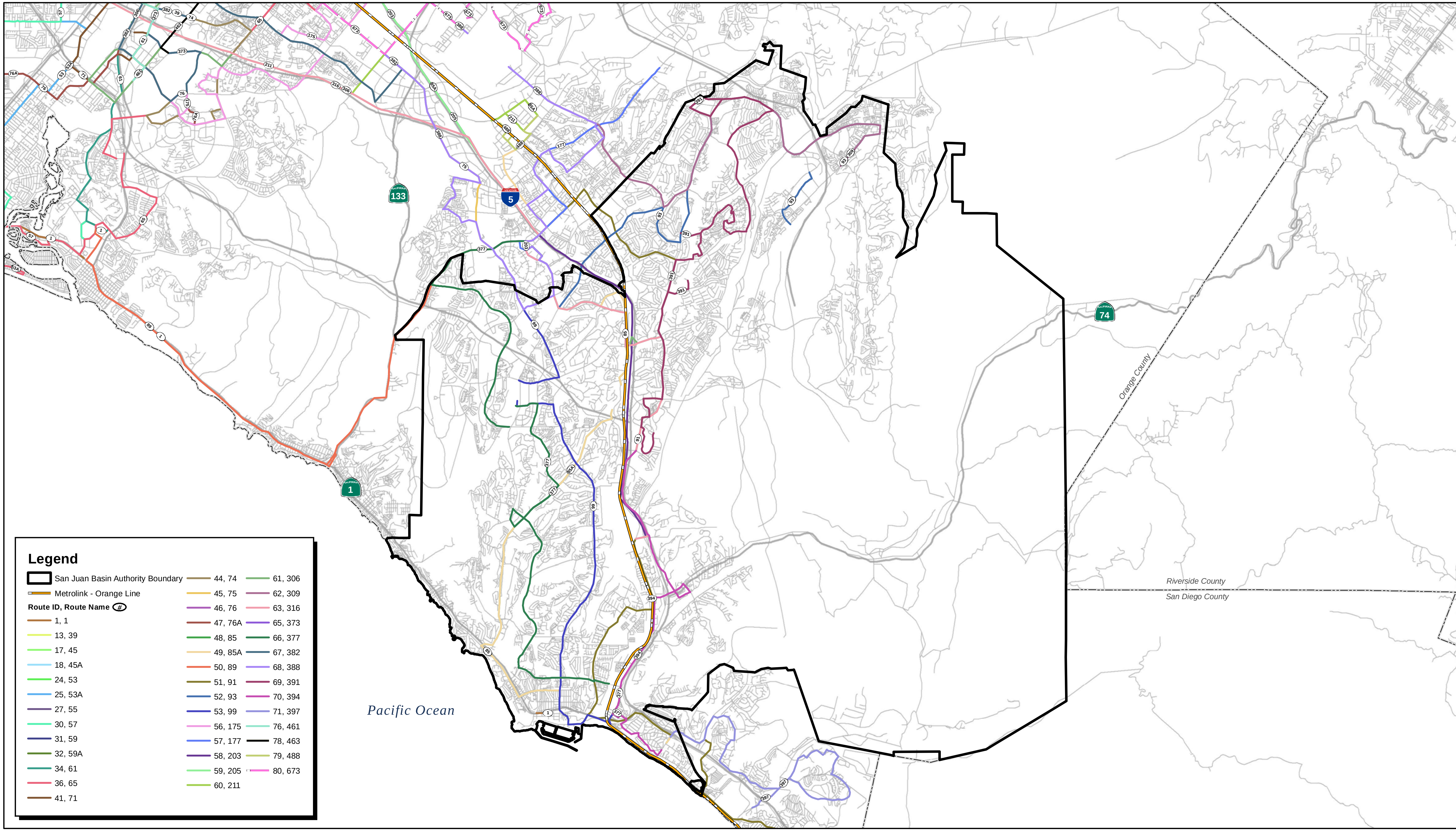
2 1 0 2 Miles

NORTH

Figure 2-19
Master Plan of Arterial Highways



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

Michael Brandman Associates

NORTH

2 1 0 2
Miles

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

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[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
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

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[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]

[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

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[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		
		Latitude (dms)	Longitude (dms)	Elevation (feet)	San Juan Basin	Start Year	End Year		Minimum	Maximum	Average
									(inches/yr)		
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

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	Evapotranspiration	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**			**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
08S08W01F001	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
CMW-11(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
Crean 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
CVWD #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
CVWD-1	1	4	0	2	0	3	2	3	0	2	0	3	1	0	4	1	1	3	1	4	0	3	0	2	3	0	2	1	0	4	1	0	4	2	0	3
Dance Hall	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	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	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	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	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	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	4	0	1
MW-02(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-02A(T0605902510)	5	0	0	4	0	1	4	0	1	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-02B(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-03(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

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

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-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

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

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
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

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
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
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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
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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
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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
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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
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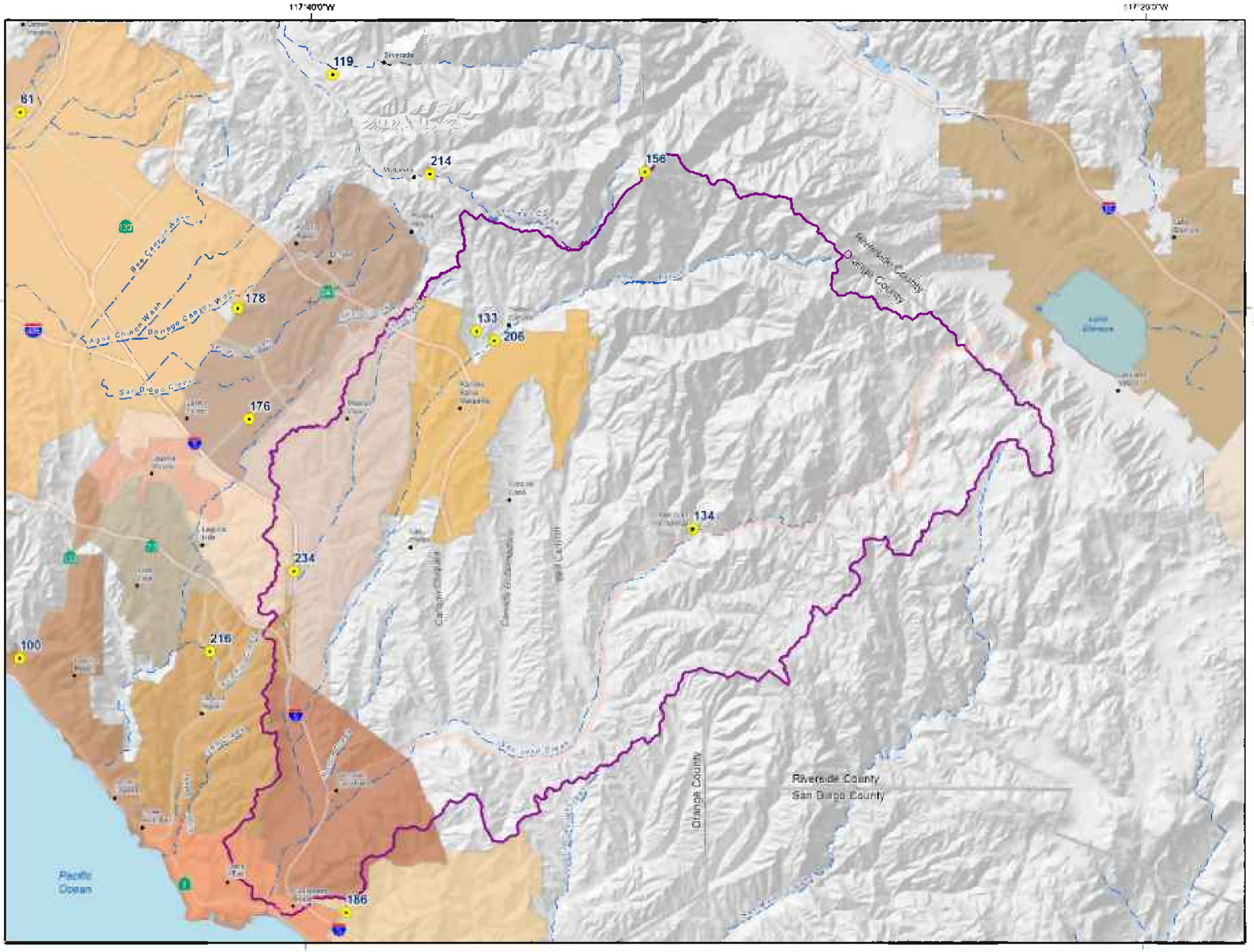
VEW-7(T0605902455)	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0	5	0	0



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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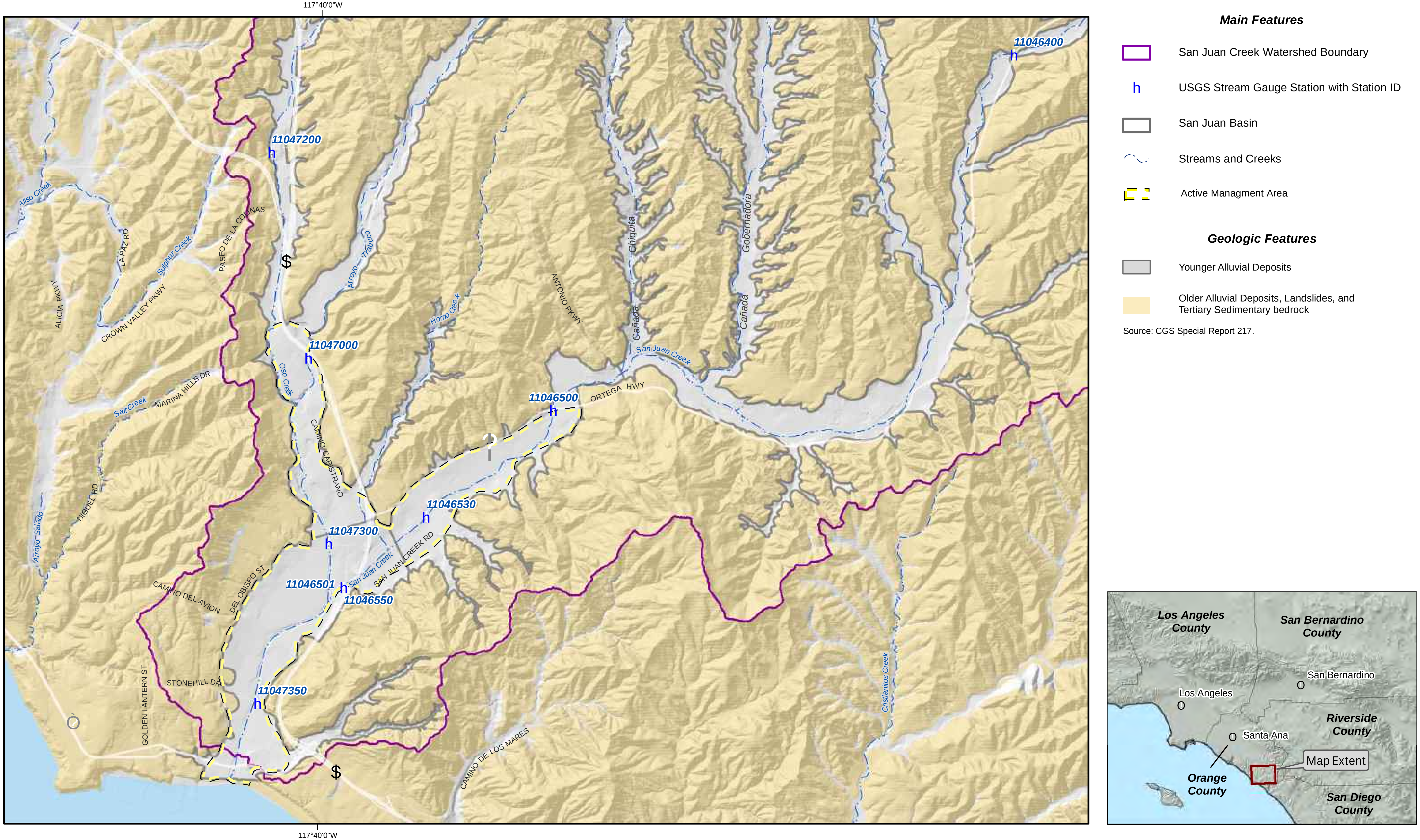
The San Juan Creek Watershed

City Boundaries and Precipitation Station Locations

Figure 3-1



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Location of USGS Stream Gauging Stations

Figure 3-2

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

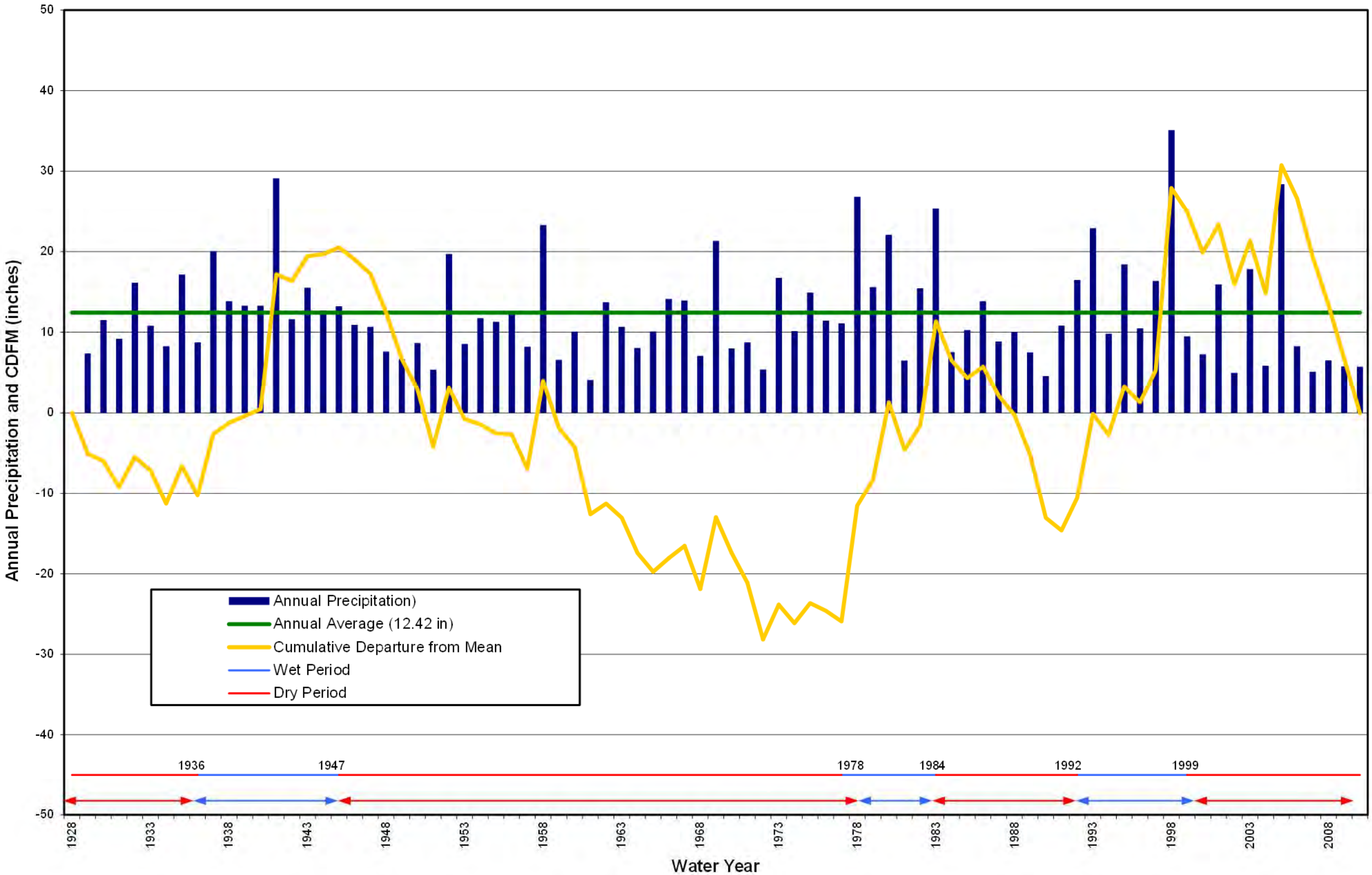

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Figure 3-4 Monthly Precipitation Variability in Laguna Beach Station from 1928 to 2010

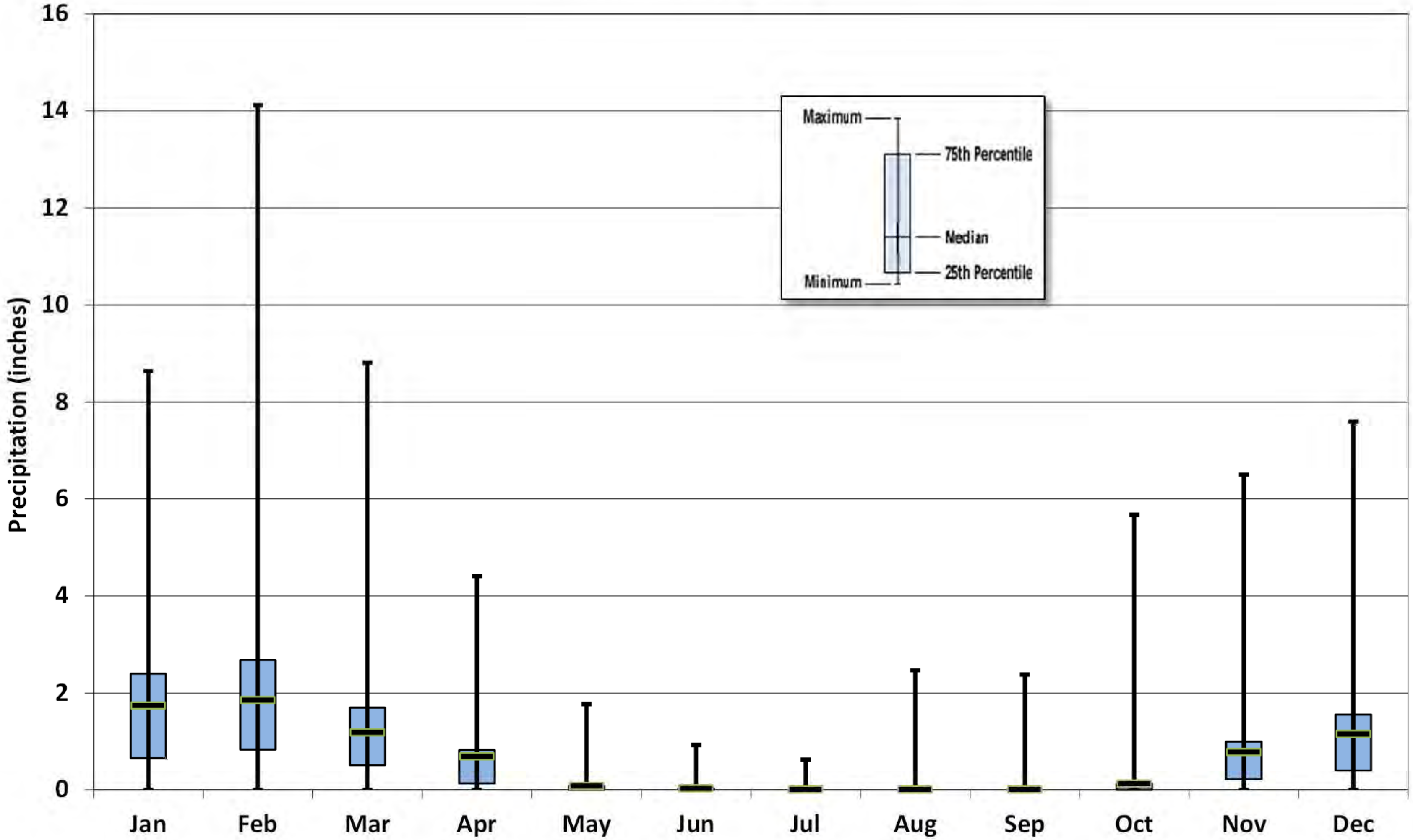

Figure 3-4-- Fig 3-4

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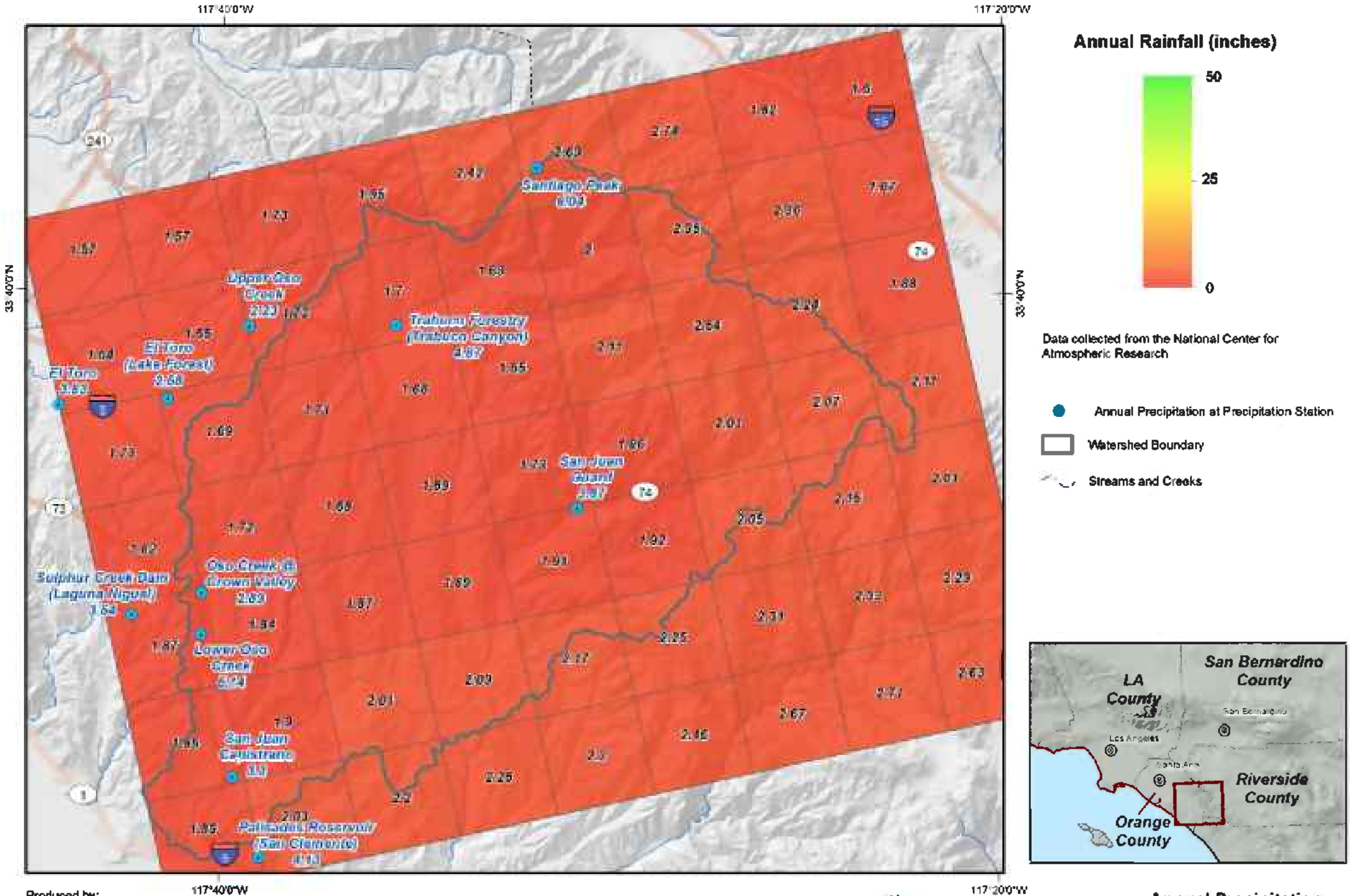

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0 2 Miles
0 2 4 6 Kilometers

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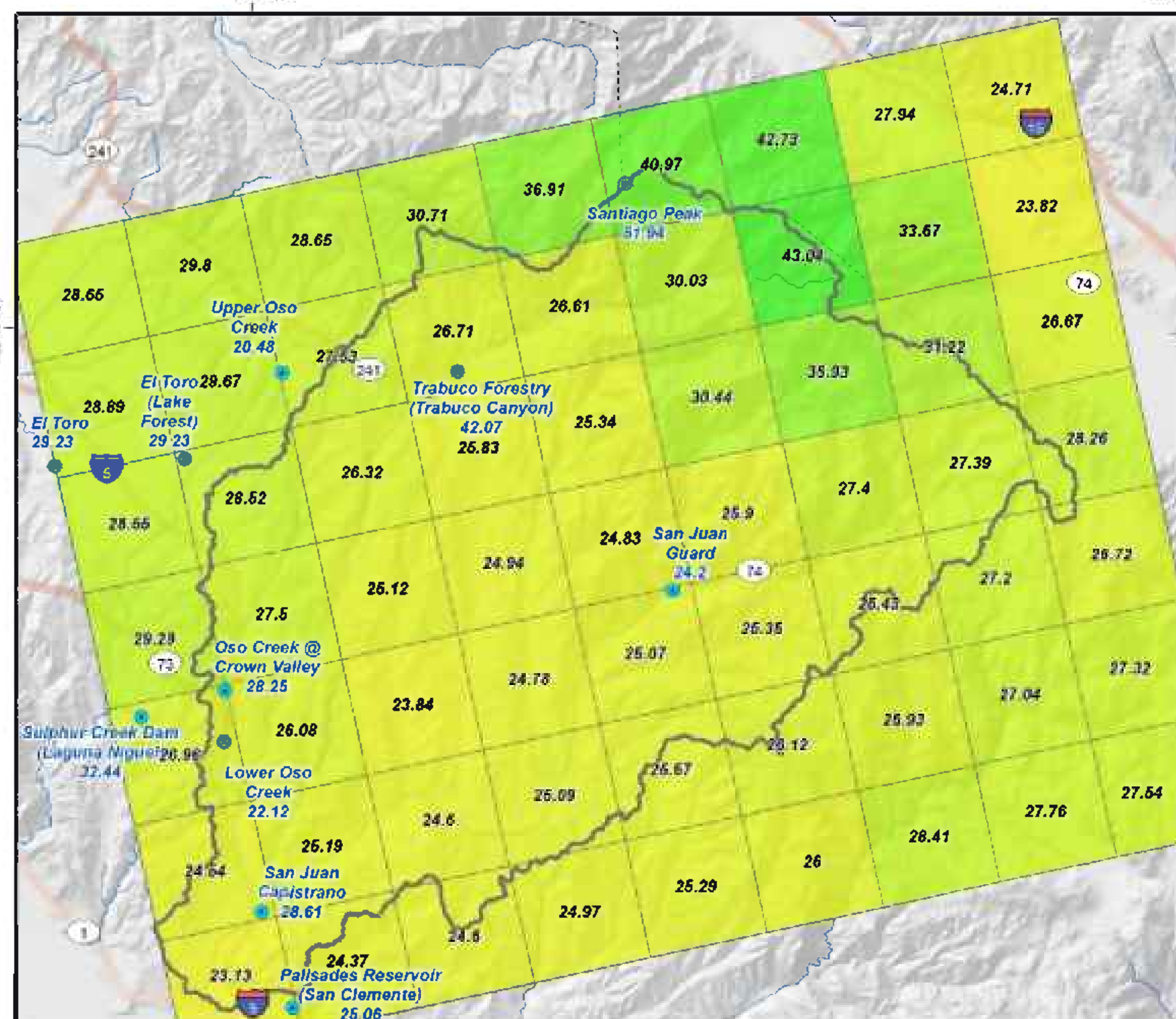
Annual Precipitation on San Juan Basin in Fiscal Year 2007

Figure 3-5



Annual Rainfall (inches)

50

25

0

Data collected from the National Center for Atmospheric Research

Annual Precipitation at Precipitation Station

Watershed Boundary

Streams and Creeks

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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

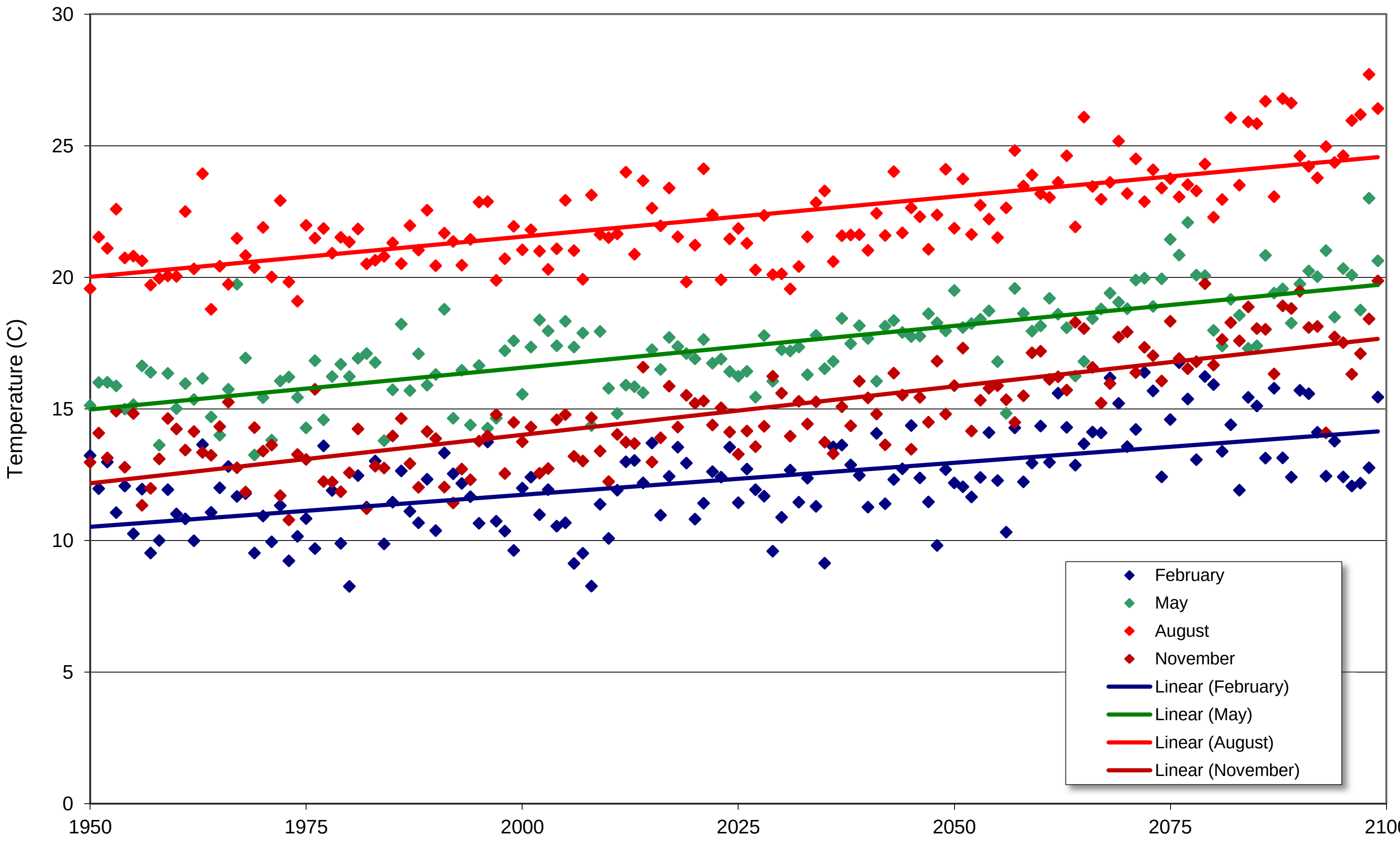

Figure 3-8 Projected Precipitation on the San Juan Creek Watershed
MPI-ECHAM 5.1 Model - A2 Emissions Scenario

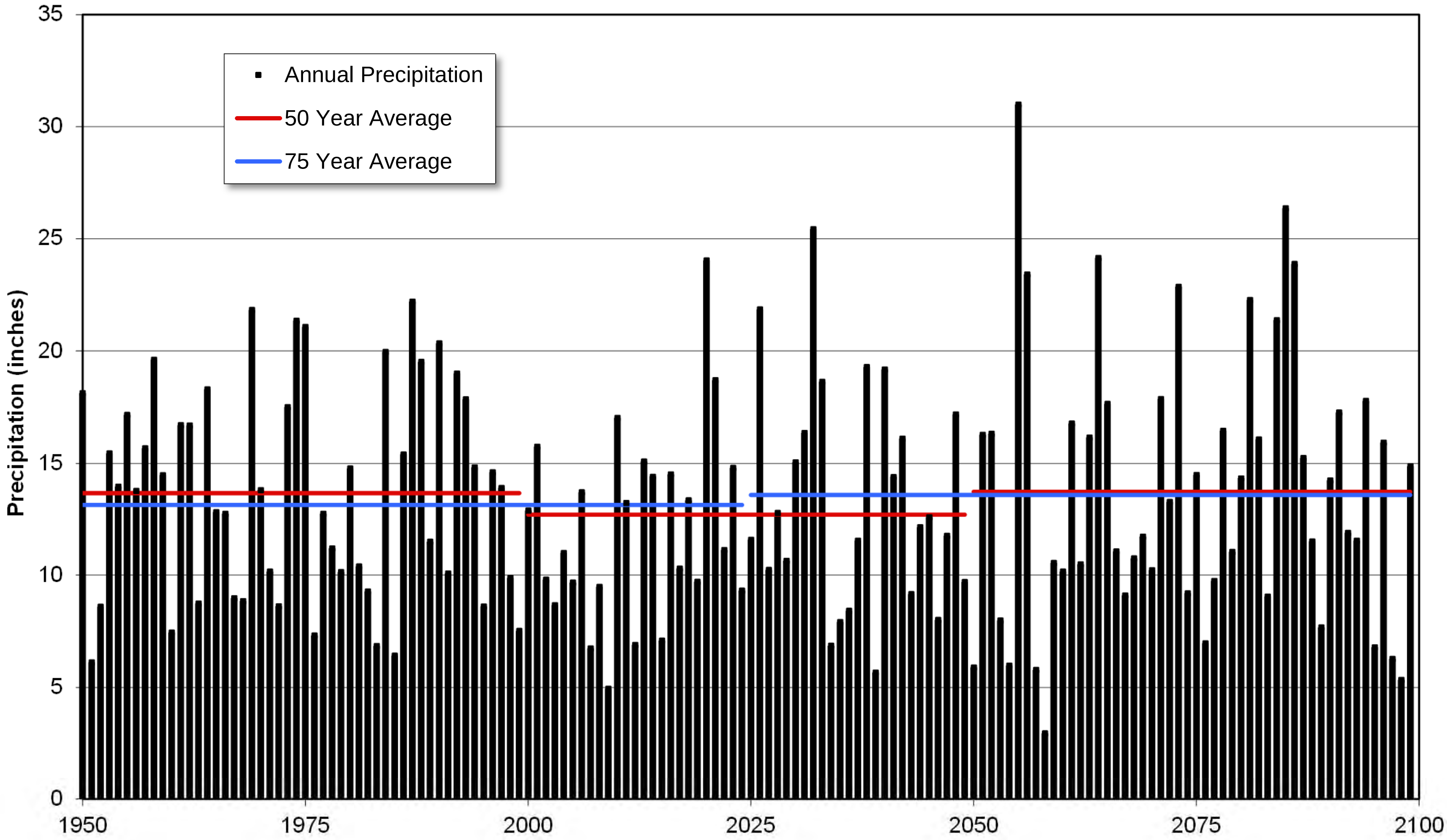

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Figure 3-9 Projected Annual Precipitation on the San Juan Watershed 1950 through 2100 Based on the IPCC A2 Emission Scenario and the MPI-ECHAM5 Model

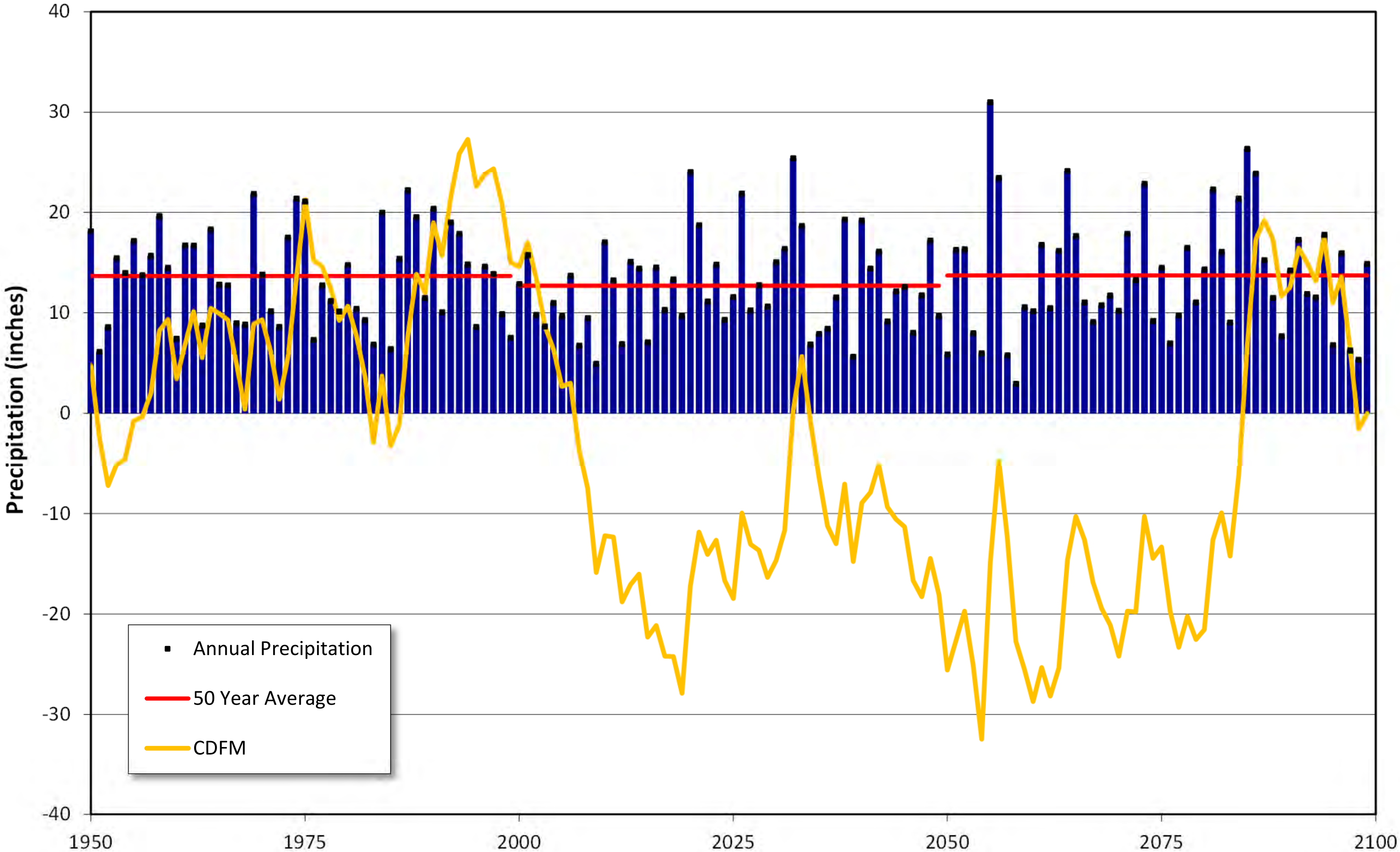

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Figure 3-10 Mass Curve of Stream Flow
San Juan Creek (1928 - 2010)

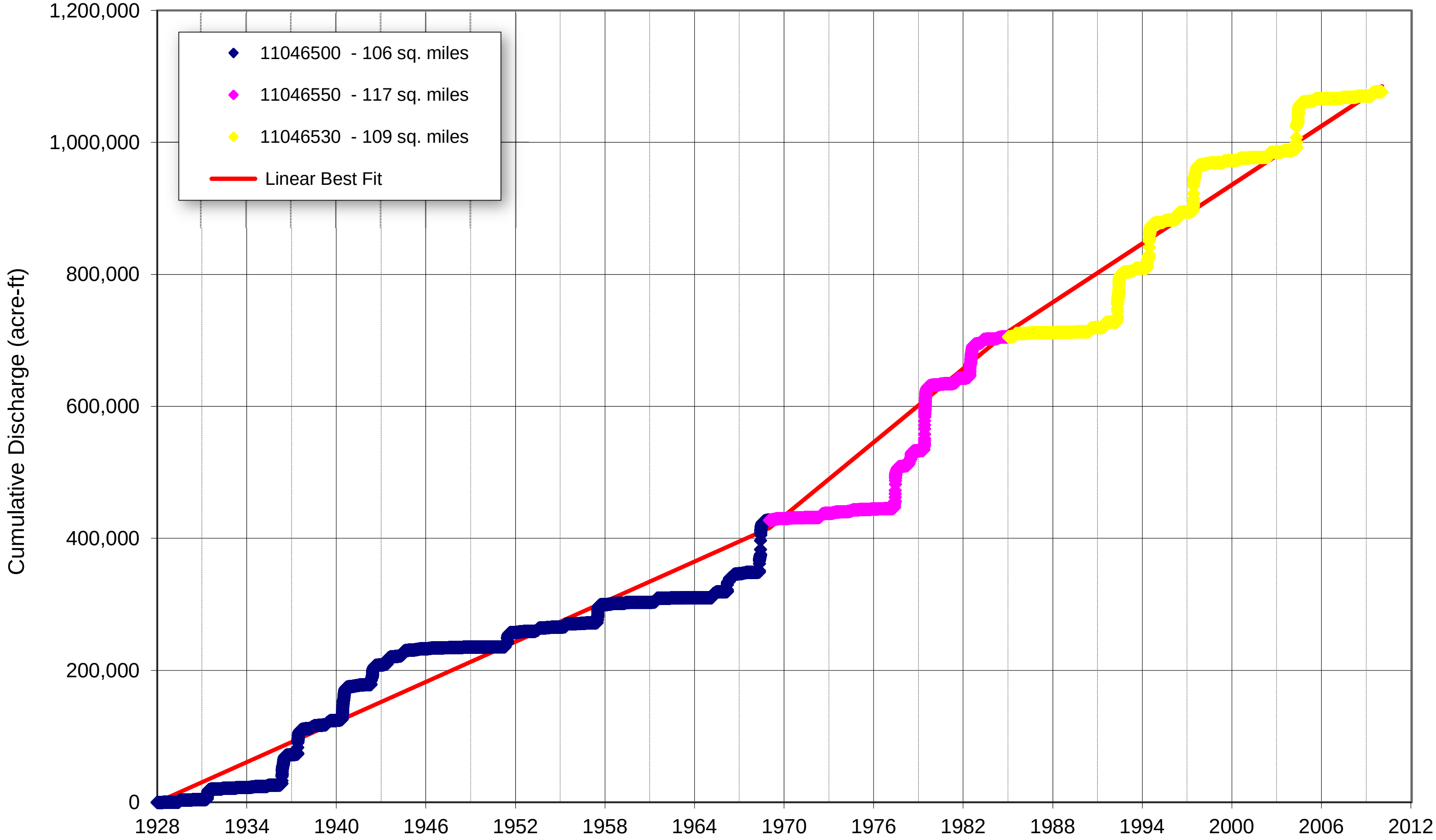

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Figure 3-11 Annual Stream Discharge with CDFM
San Juan Creek Composite Gage

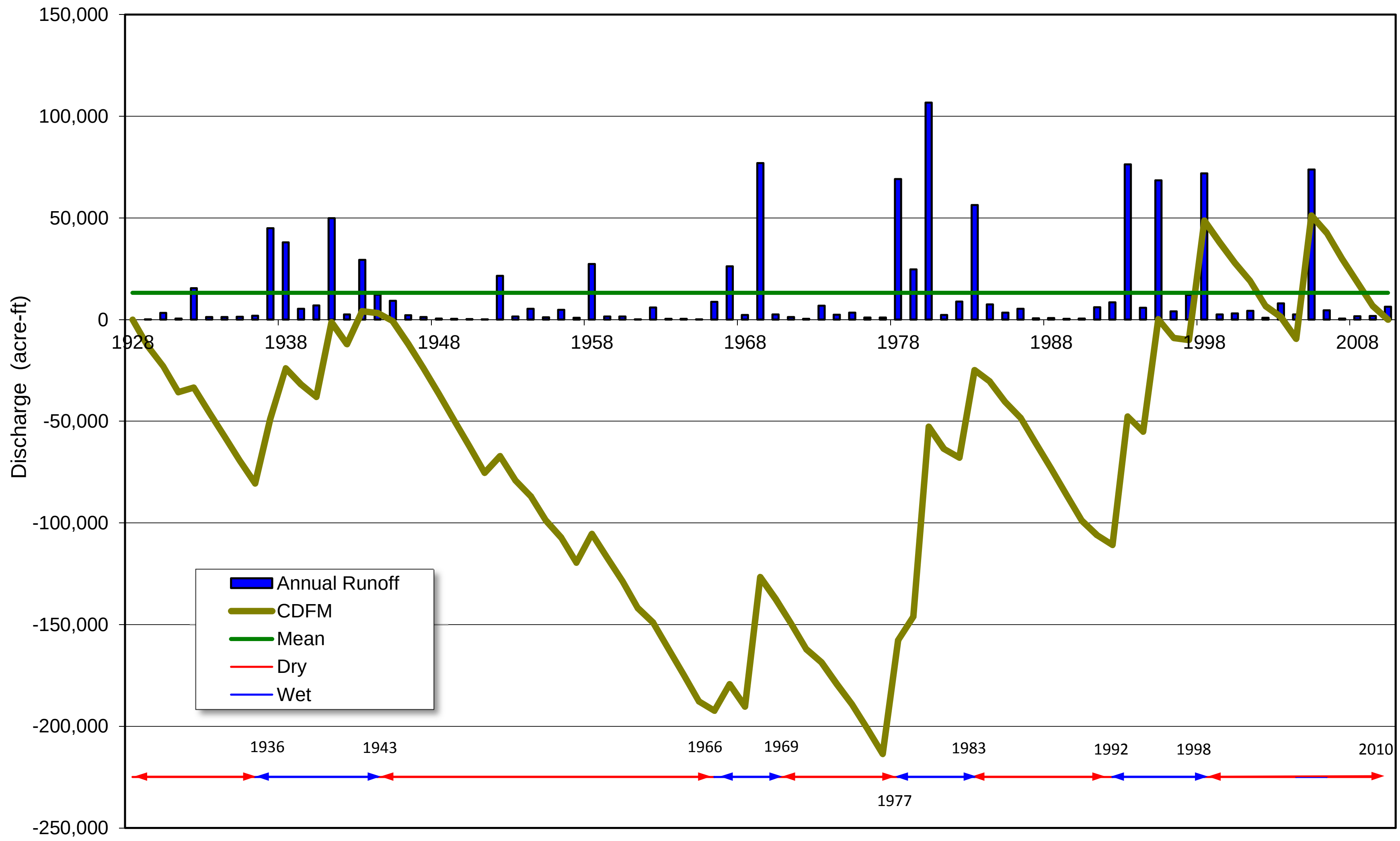

Fig 3-10 3-11 and 3-12-- Fig 3-11

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

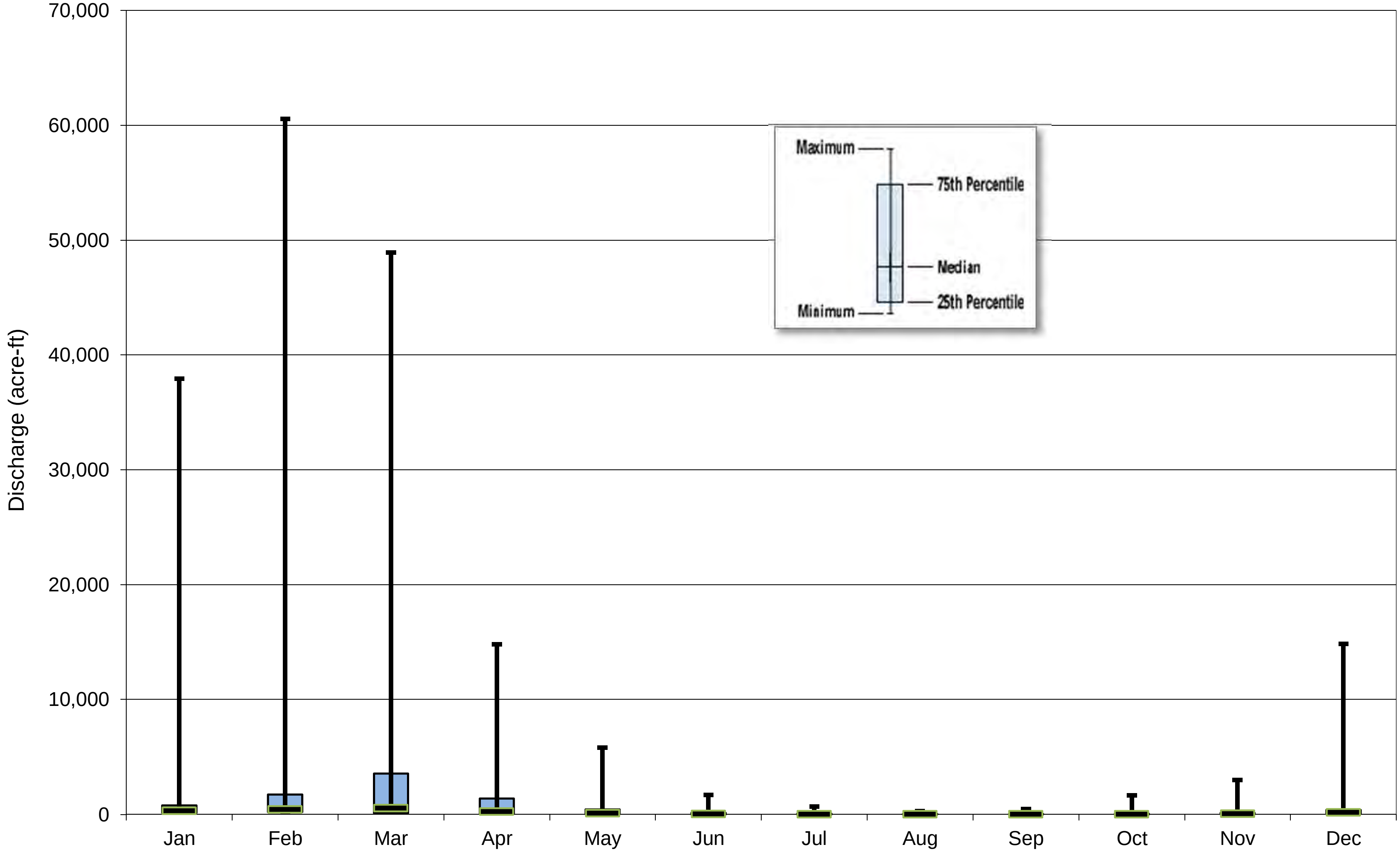

Fig 3-10 3-11 and 3-12-- Fig 3-12

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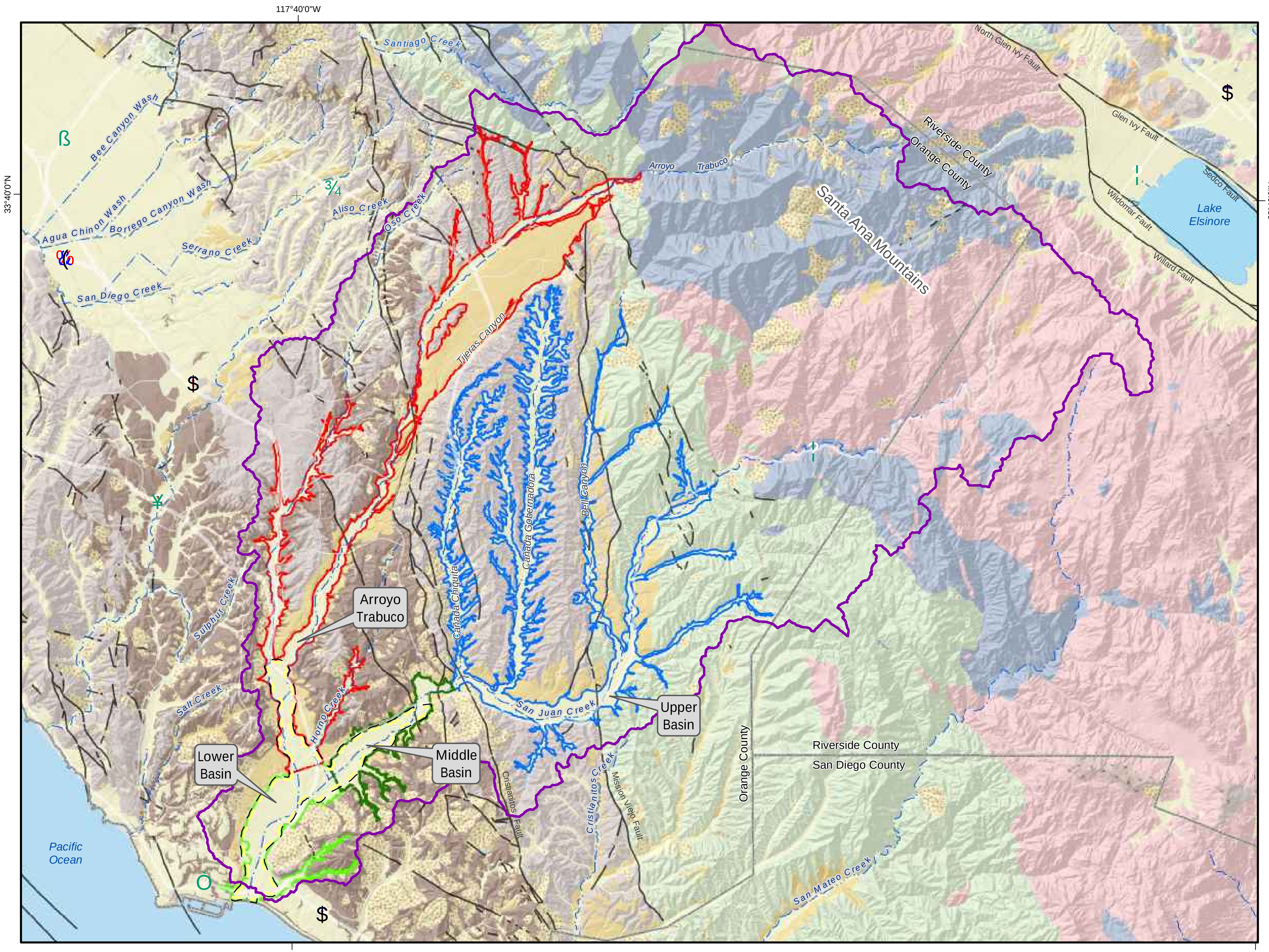

Hydrologic Features

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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0 1 2 3 4 Miles
0 2 4 6 KM

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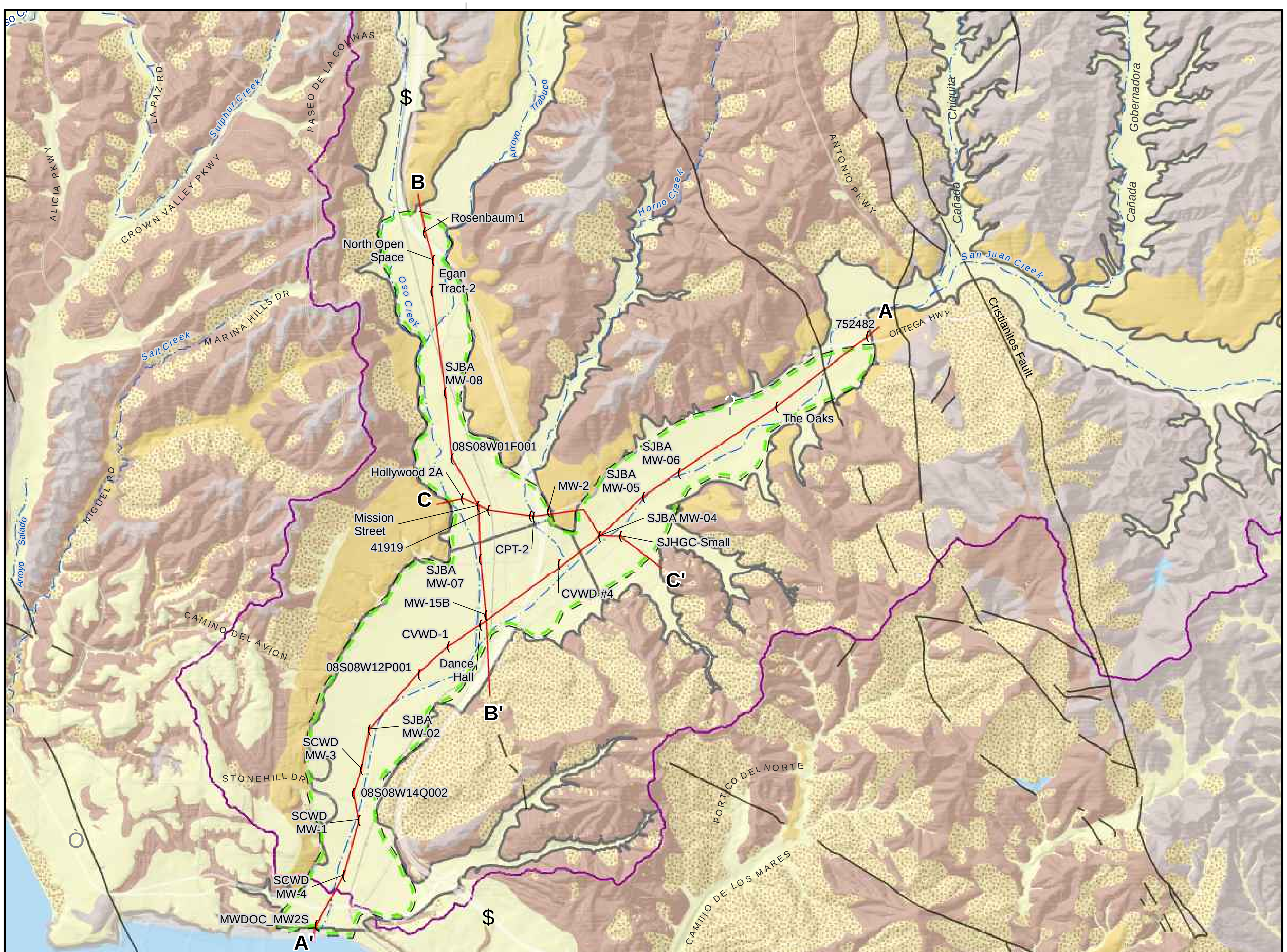
Generalized Geology and Locations of Groundwater Sub-Basins

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)

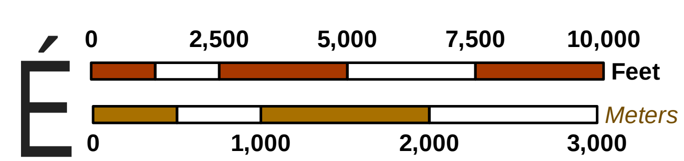
Coarse-grained Formations (Santiago,Sespe, and Niguel Formations)

Source: CGS Special Report 217.

Faults

Location Certain

Location Approximate



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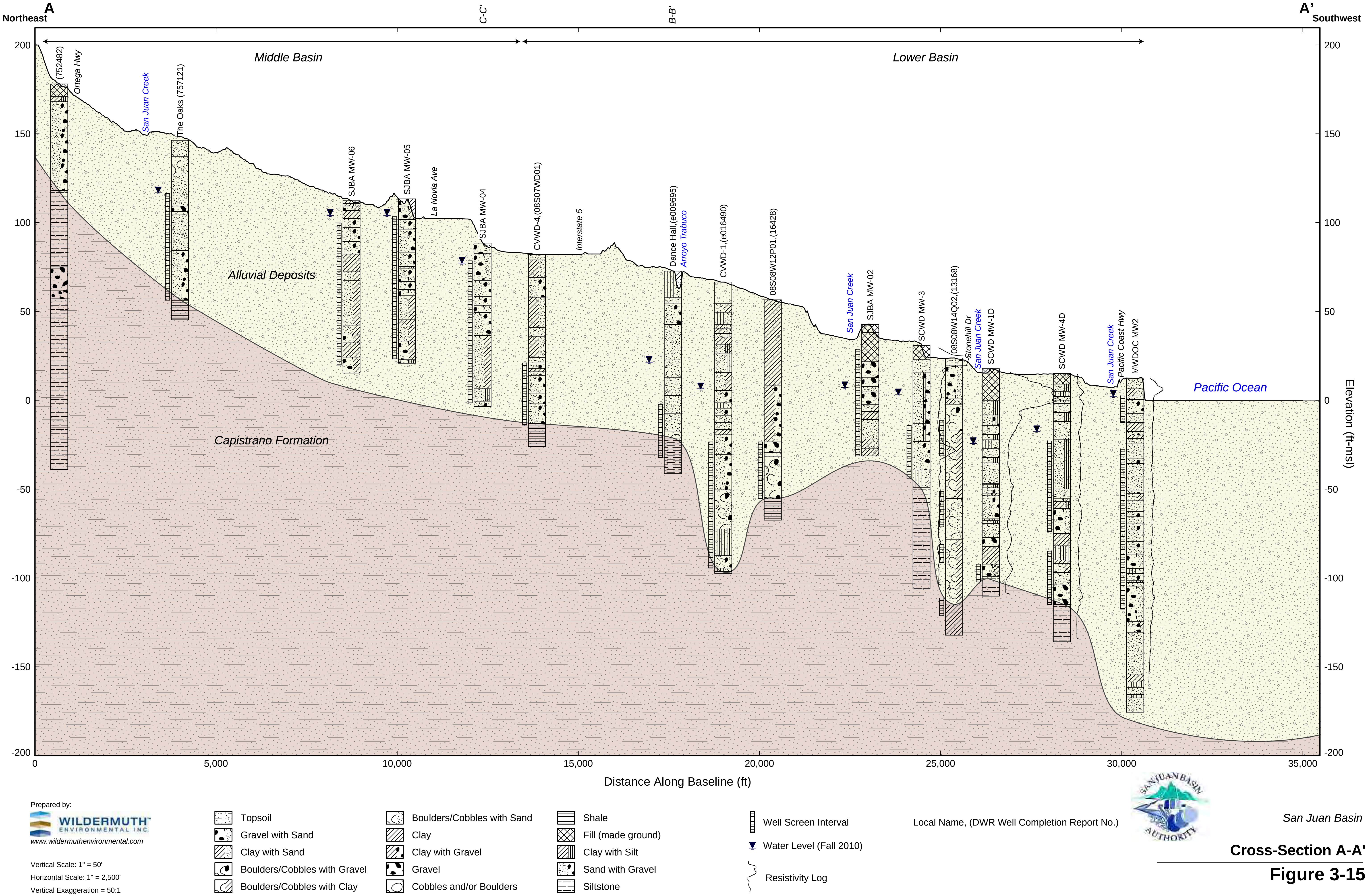
Plan View of Geologic Cross Sections

Figure 3-14

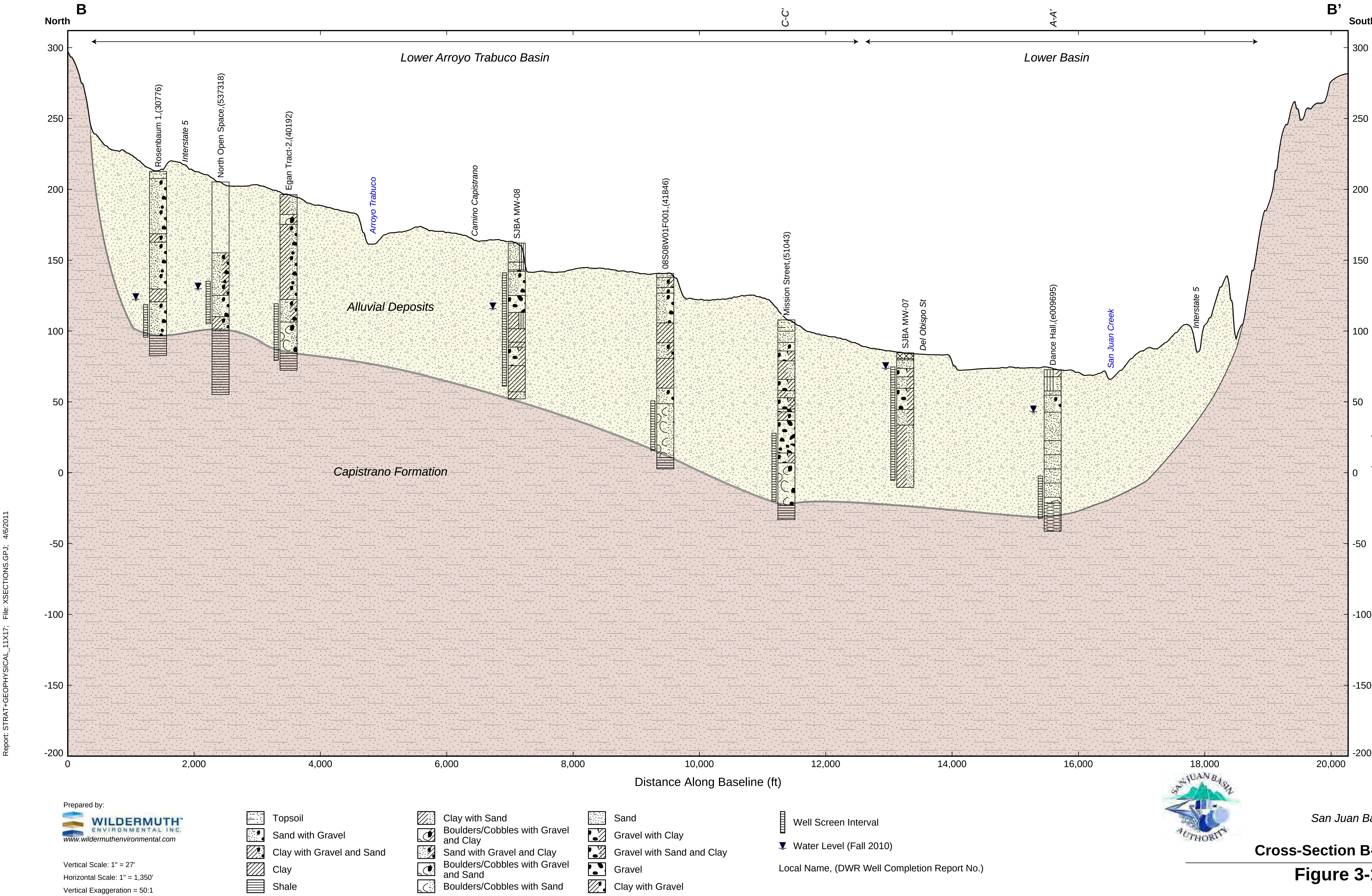


San Juan Basin

Cross-Section A-A'

Figure 3-15

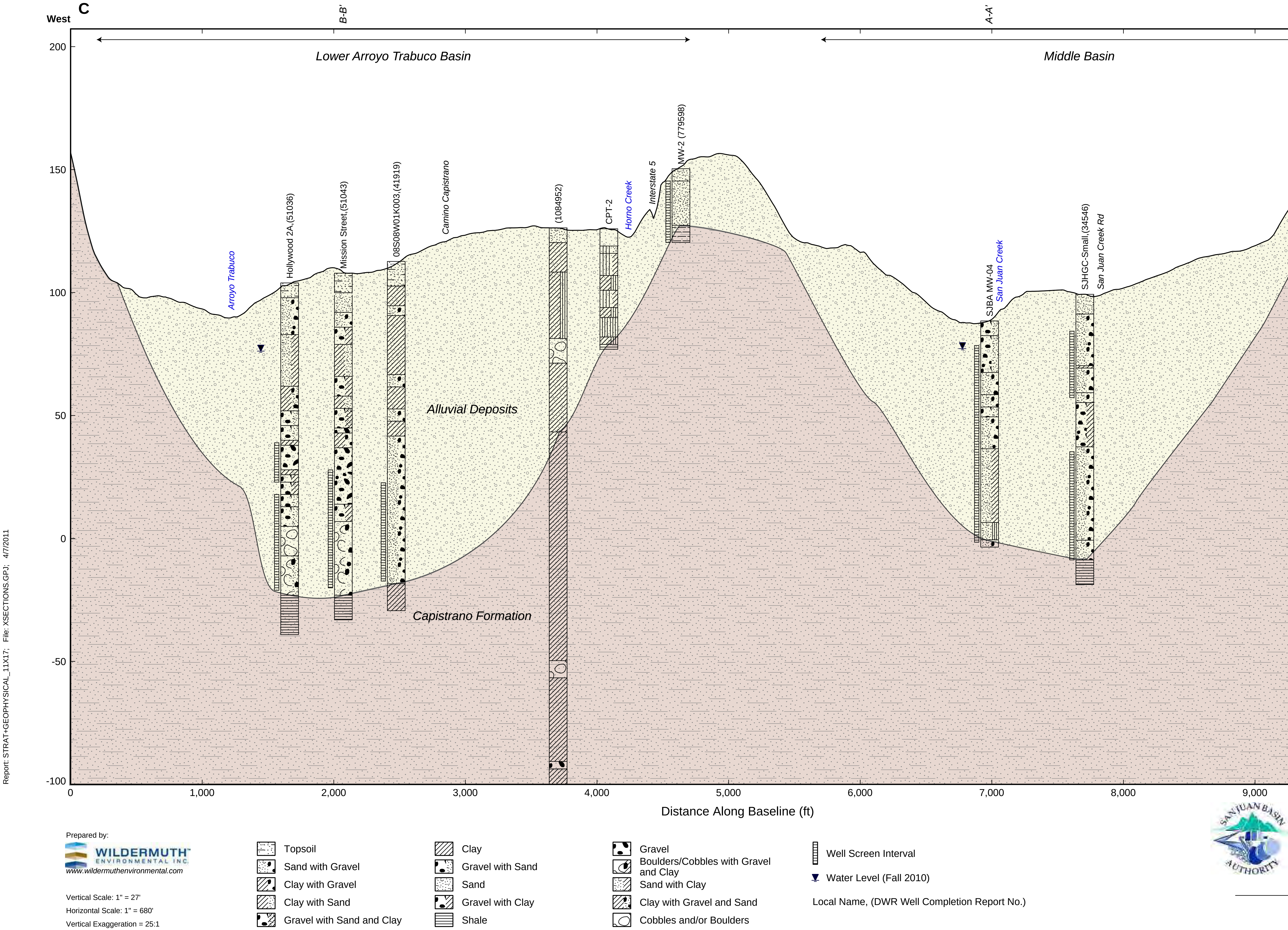
Report: STRAT+GEOPHYSICAL_11X17; File: XSECTIONS.GPJ; 4/6/2011



San Juan Basin

Cross-Section B-B'

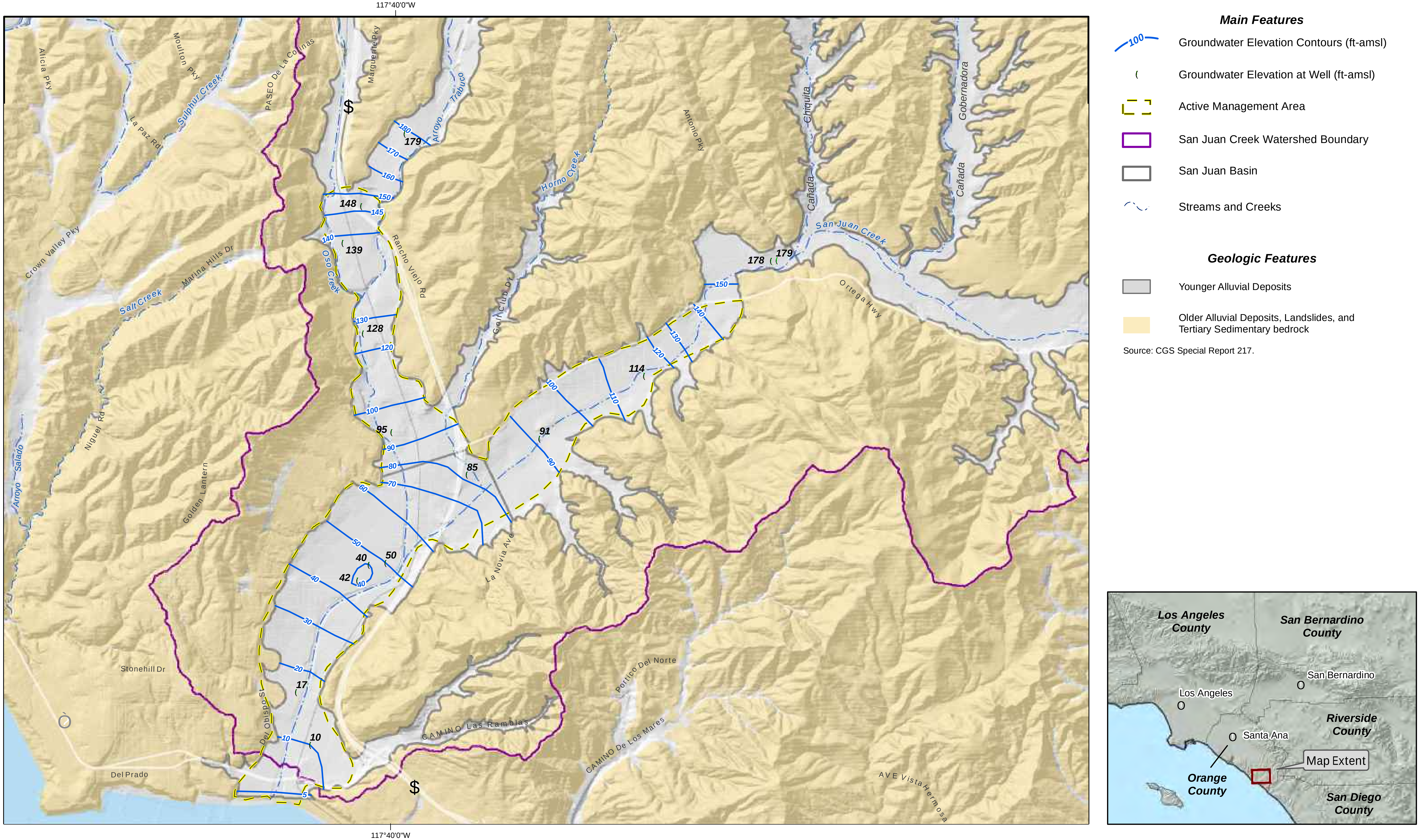
Figure 3-16



San Juan Basin

Cross-Section C-C'

Figure 3-17



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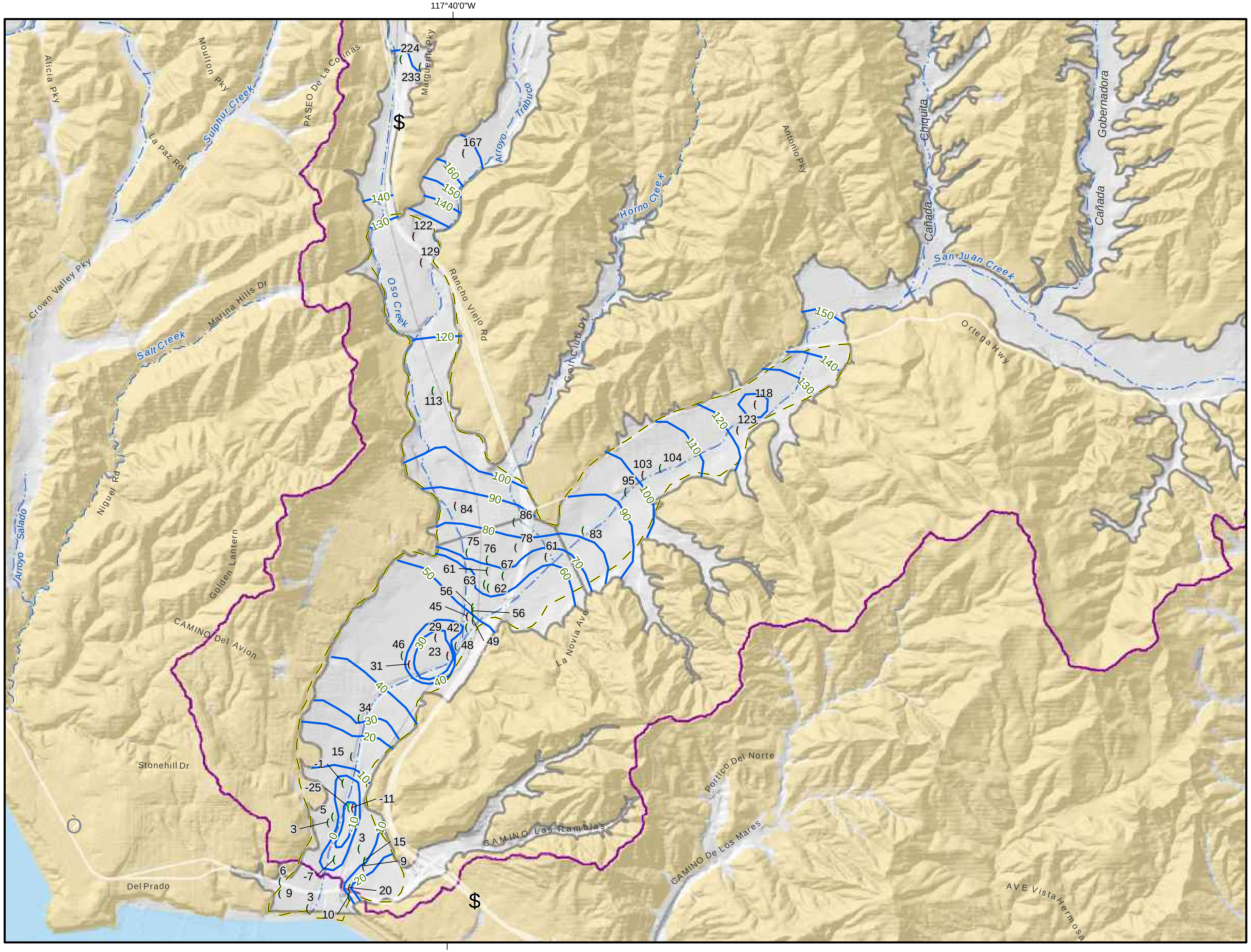
Date: 11/6/2013
Path: N:\MapDocs\Clients\SJBA\2011 GWMP\Figure 3-18.mxd

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

075-003
004

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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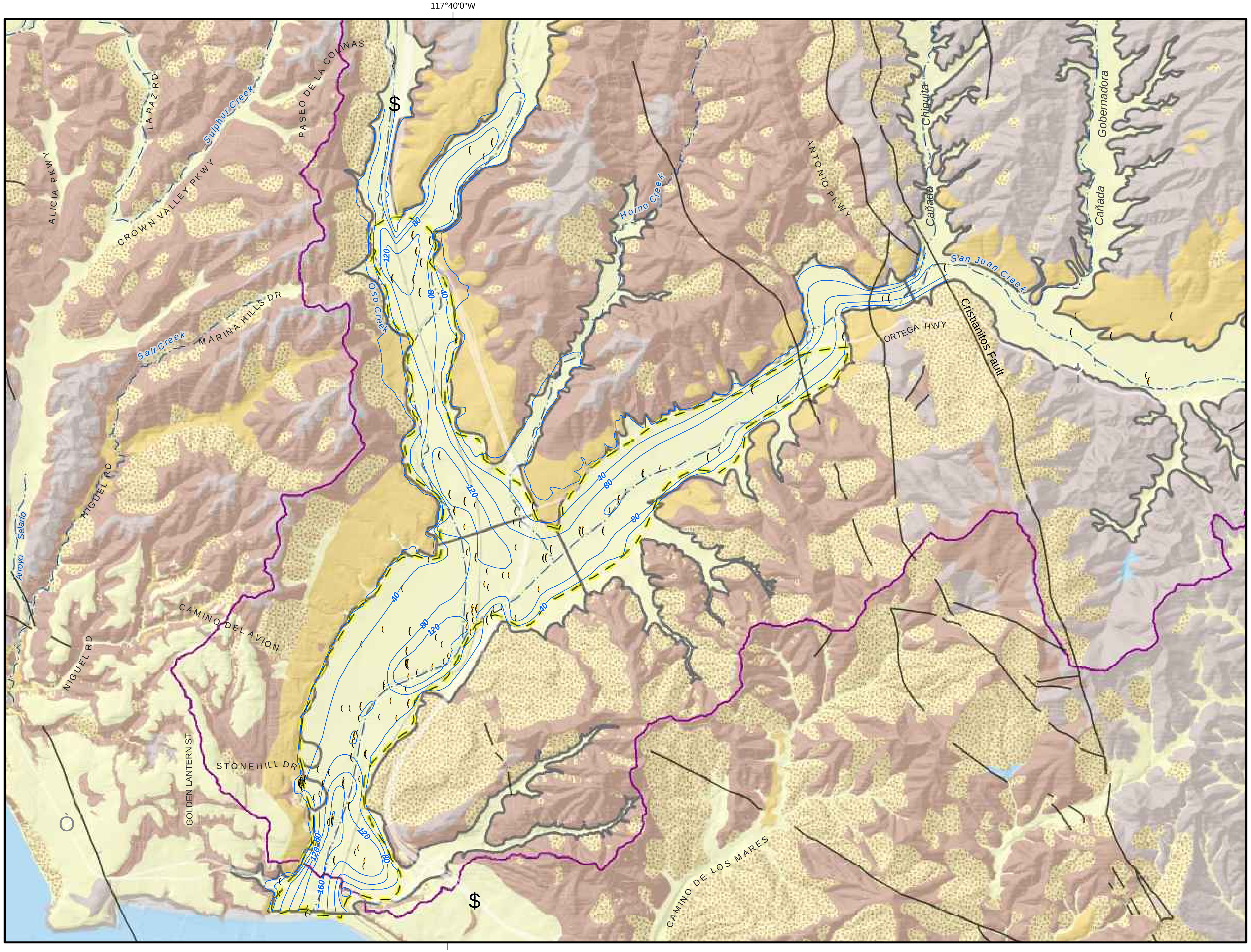
004

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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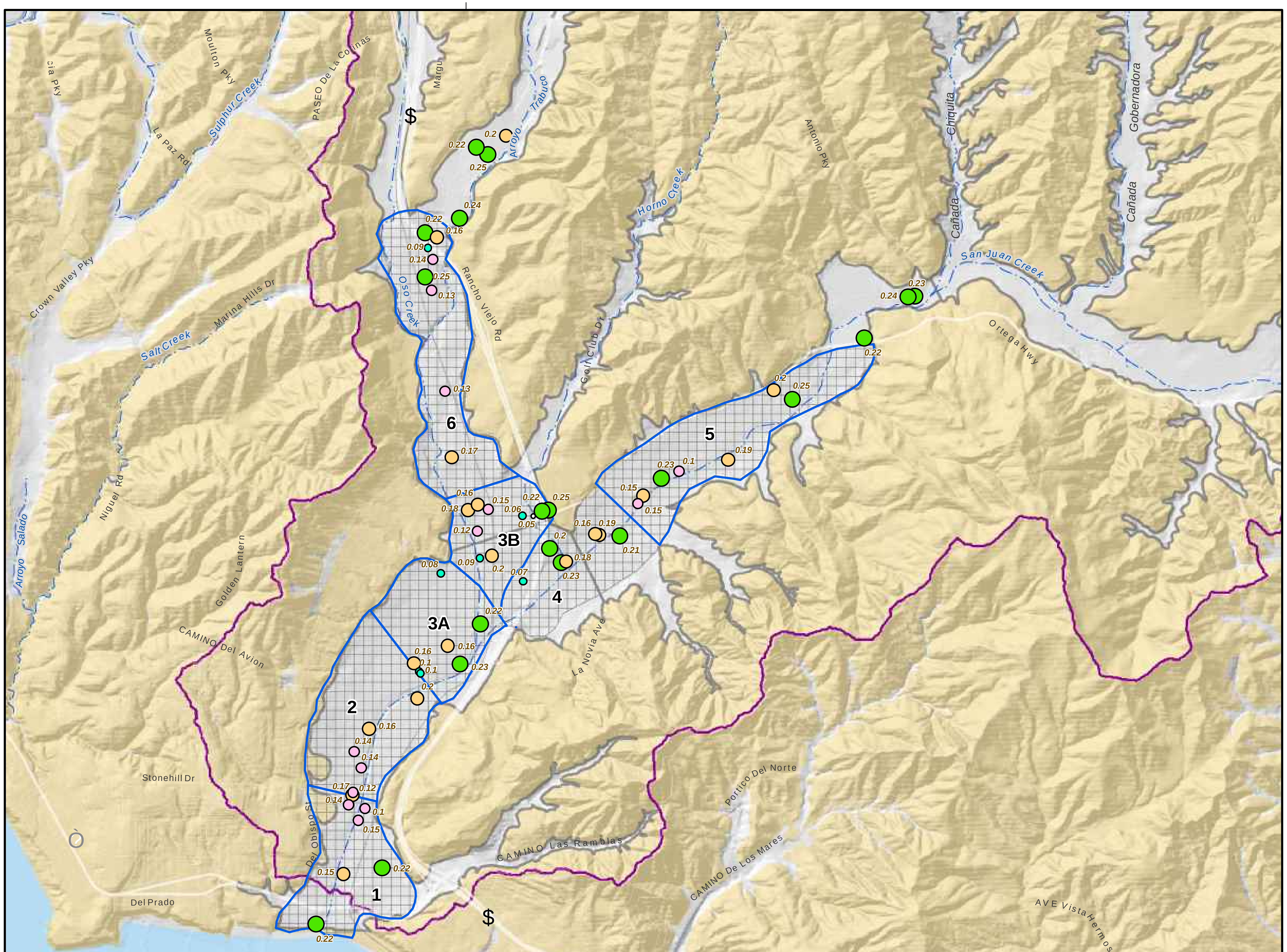
004

Effective Base of Alluvial Aquifer

Figure 3-20



Main Features

Specific Yield at Well Sites (percentage)

- 0 - 0.05
- 0.05 - 0.10
- 0.10 - 0.15
- 0.15 - 0.2
- 0.2 - 0.25

Storage Grid (100 m x 100 m)

Active Managment Area Segments

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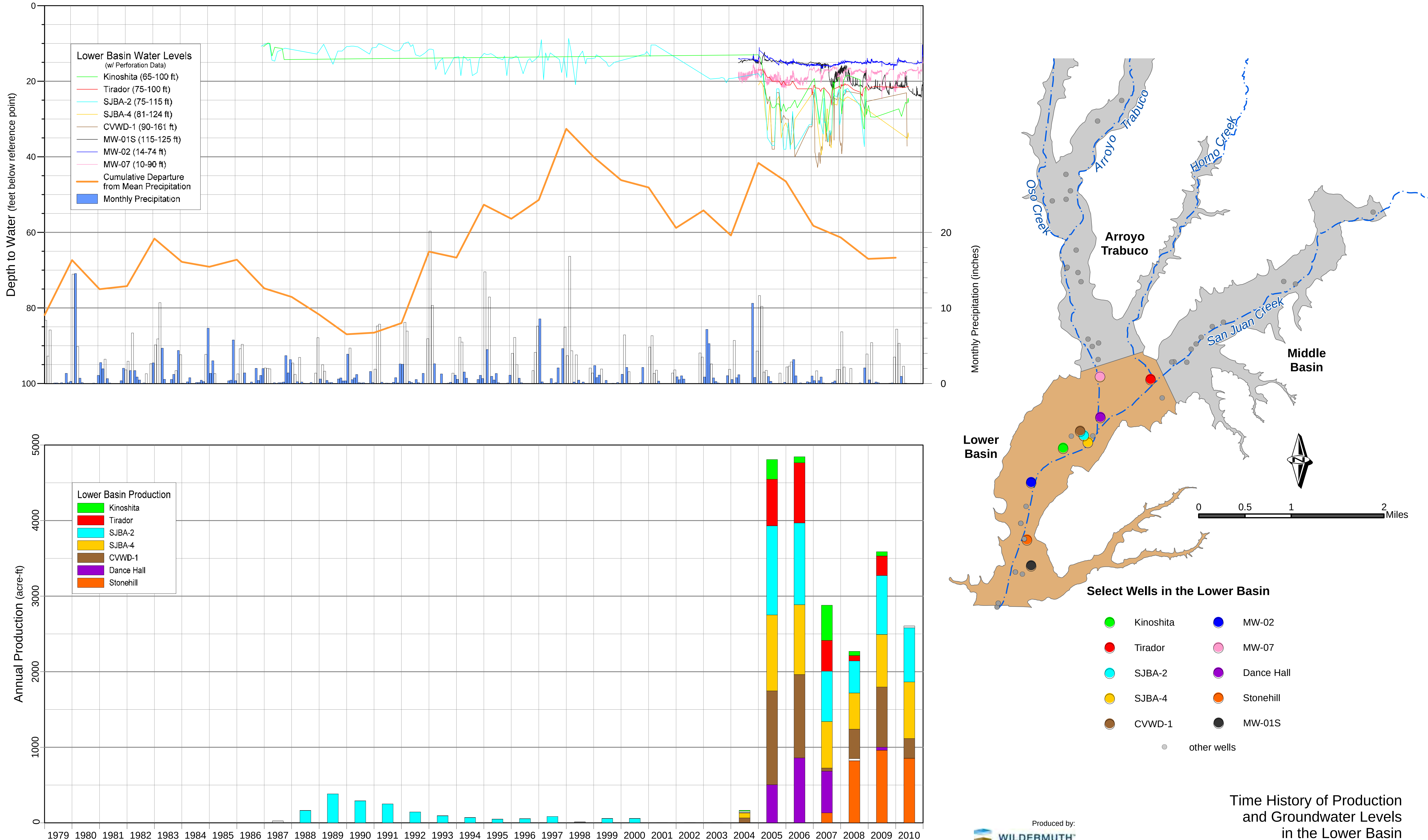
0 2,500 5,000 7,500 10,000 Feet

0 1,000 2,000 3,000 Meters

075-003
004

Storage Capacity Grid and Estimated Specific Yield

Figure 3-21



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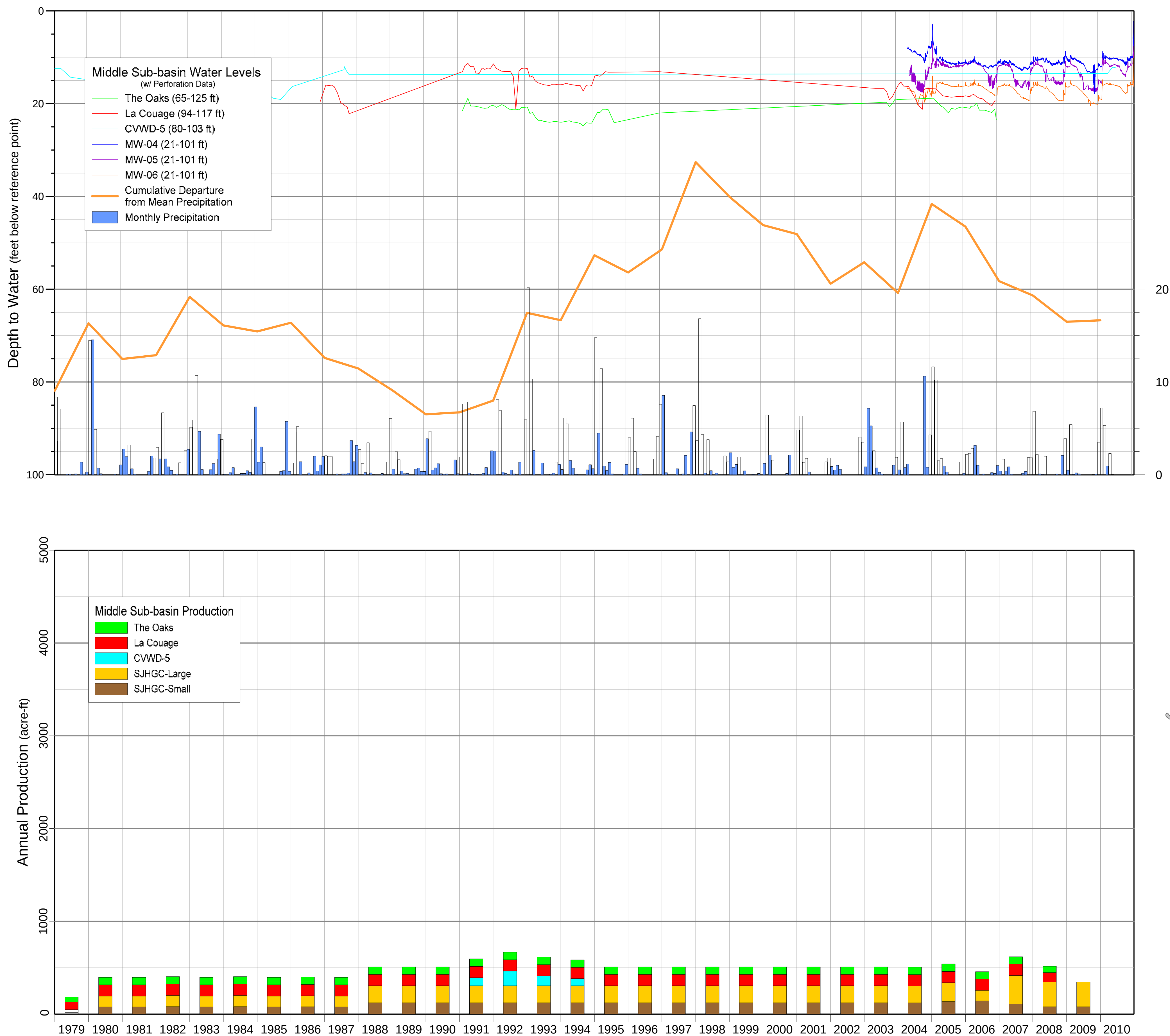
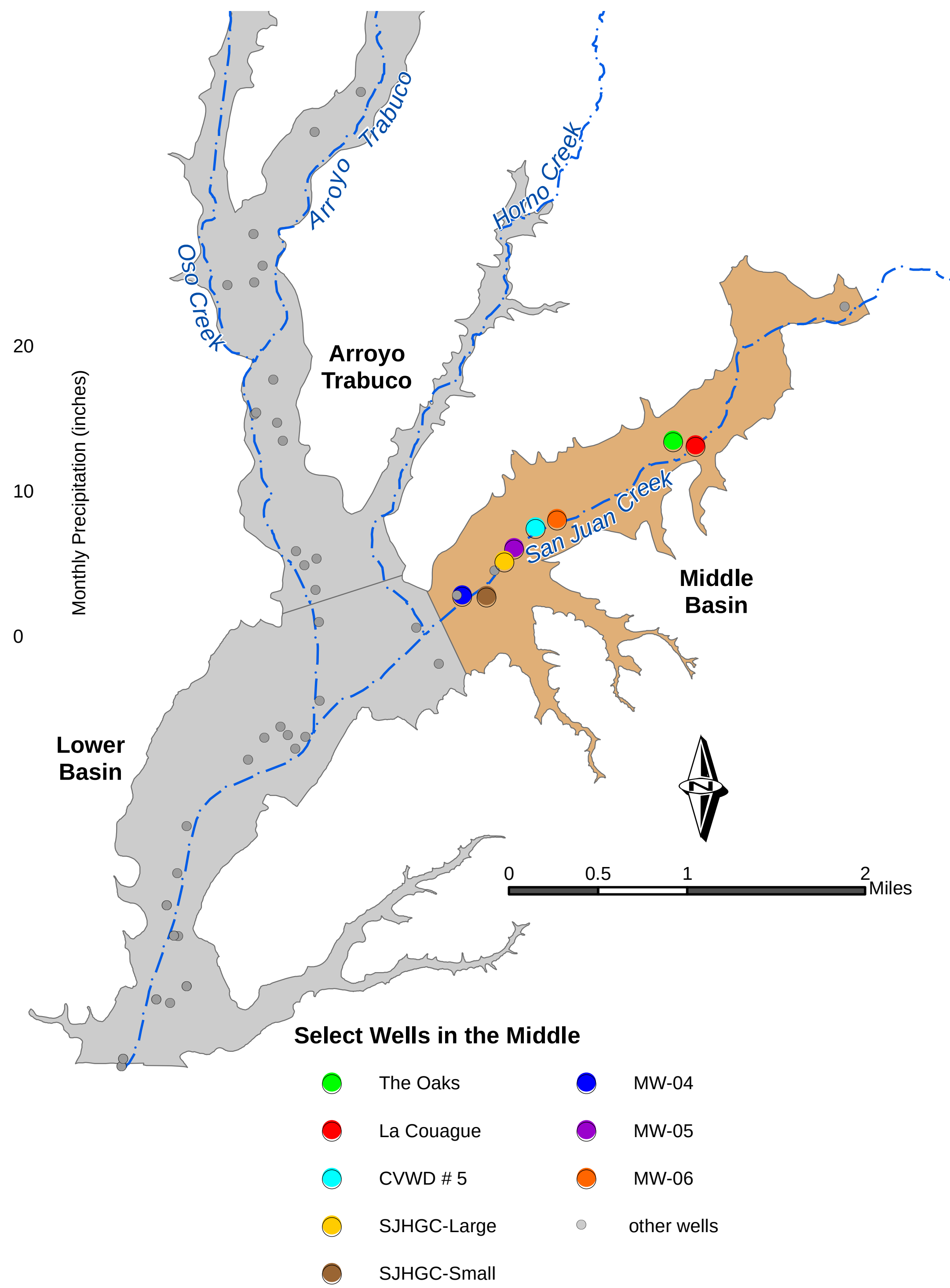
Date: 20110218
Filename: Figure_3.grf

Time History of Production and Groundwater Levels in the Lower Basin

Figure 3-22





Produced by:

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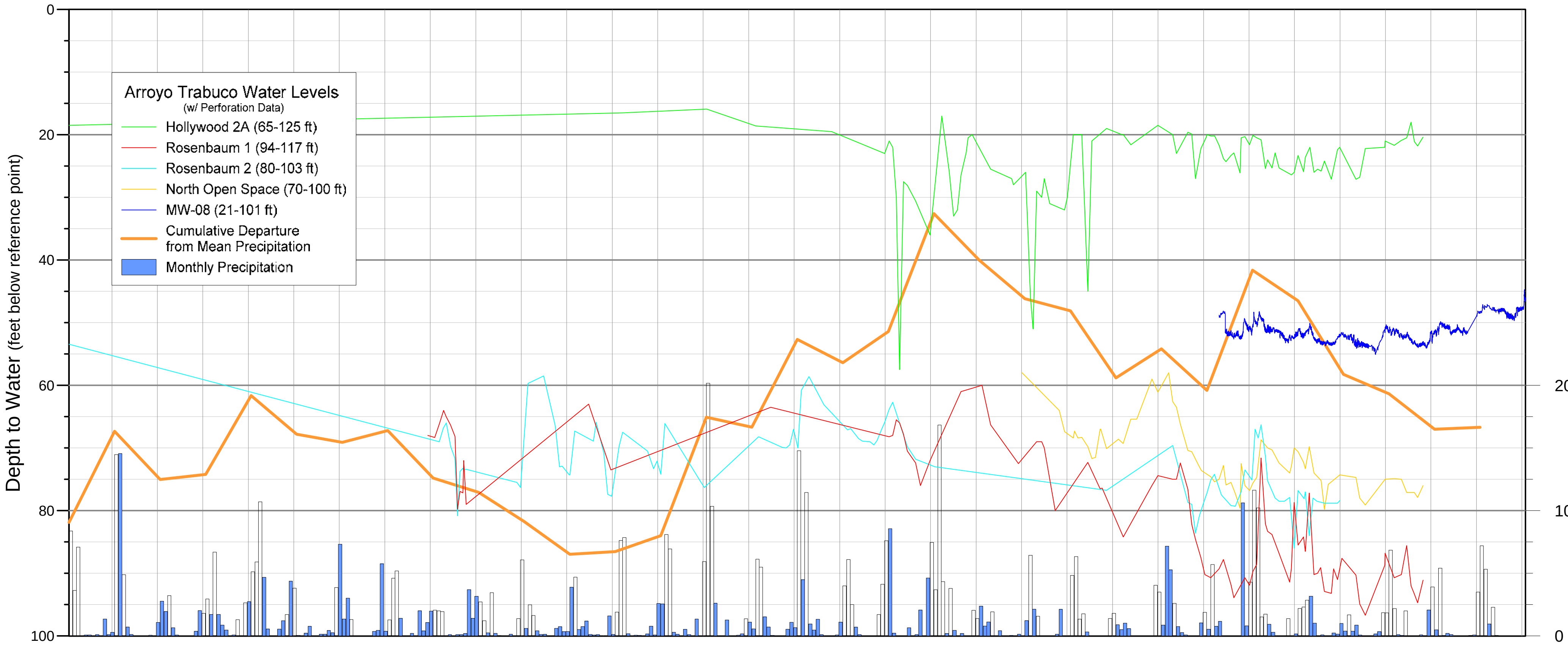
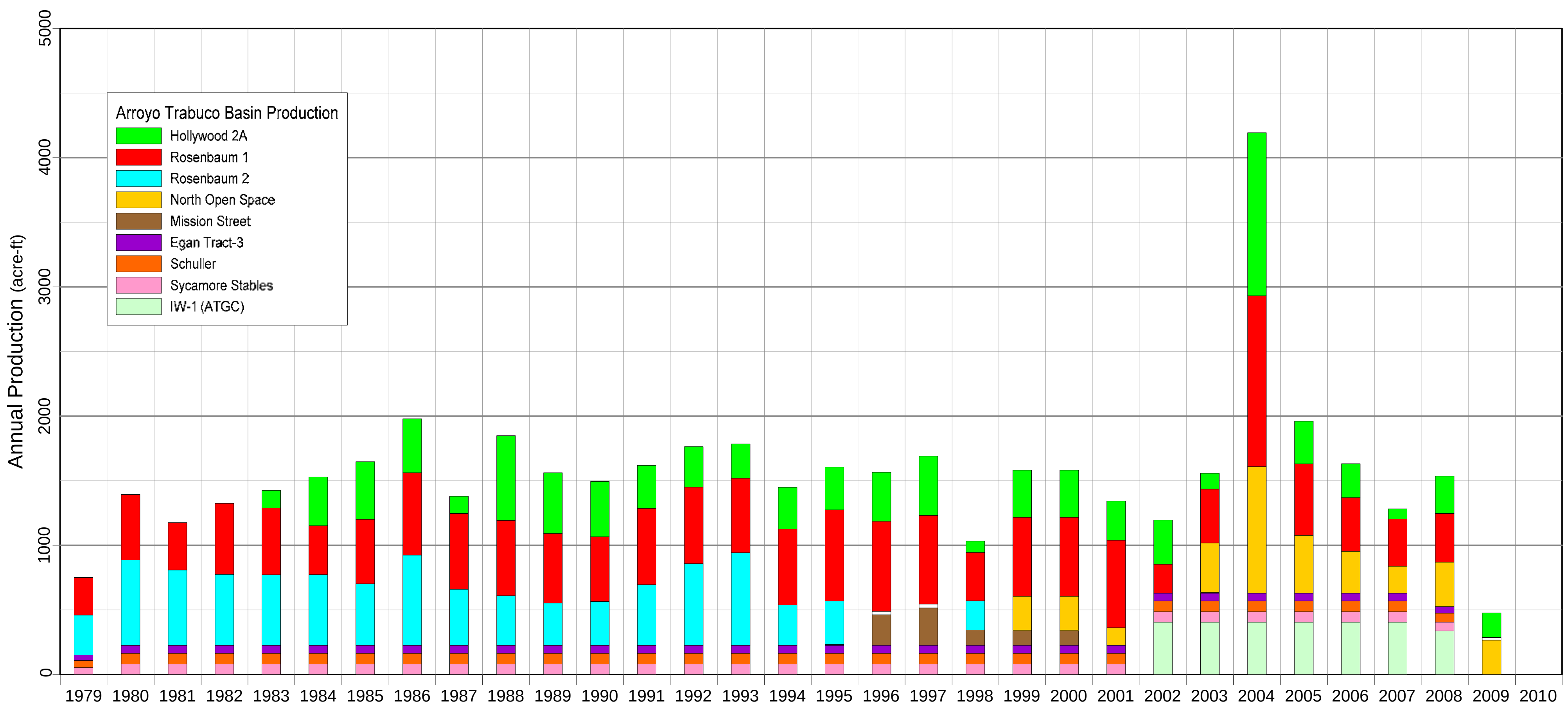
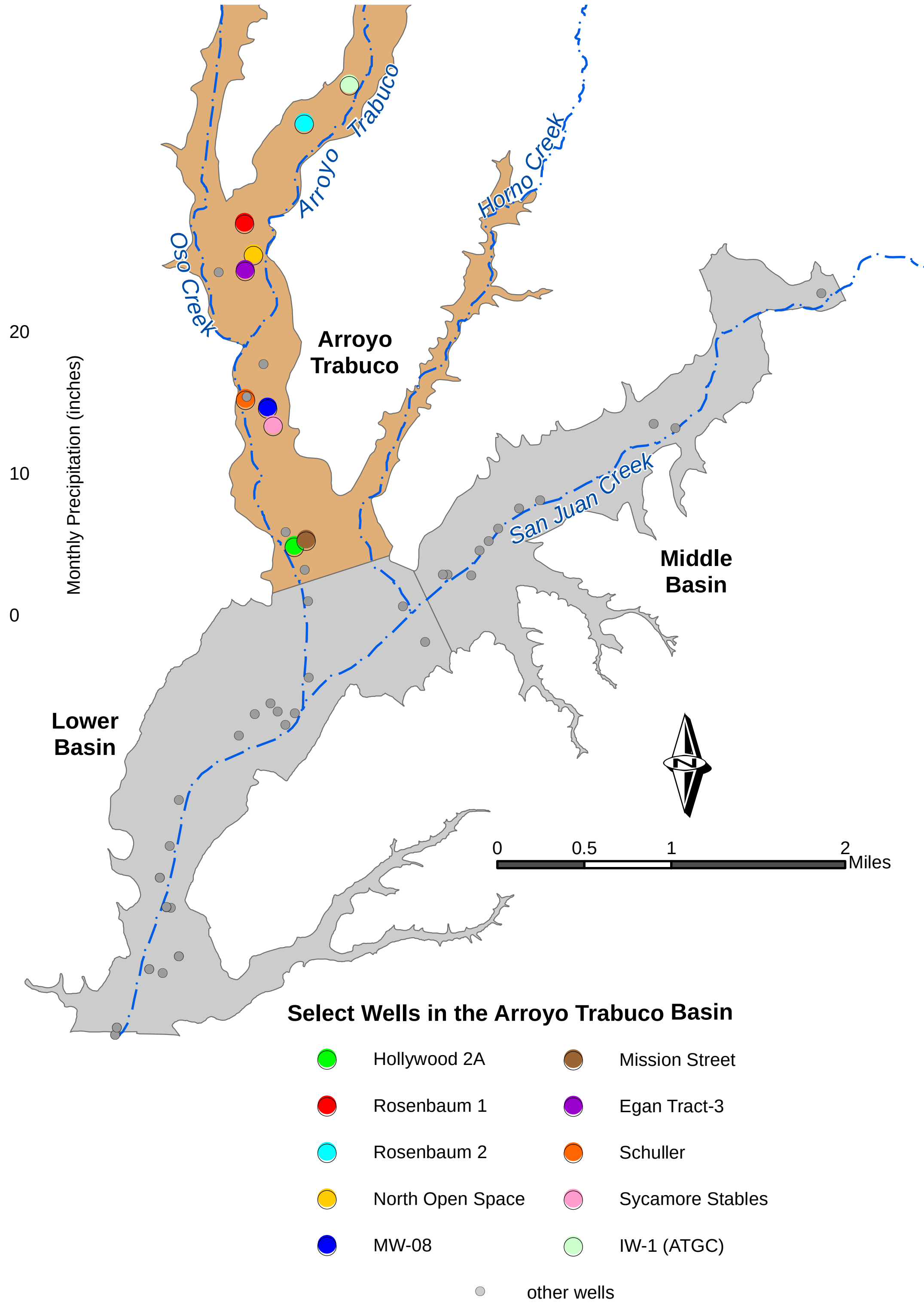
Filename: Figure_3.grf

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

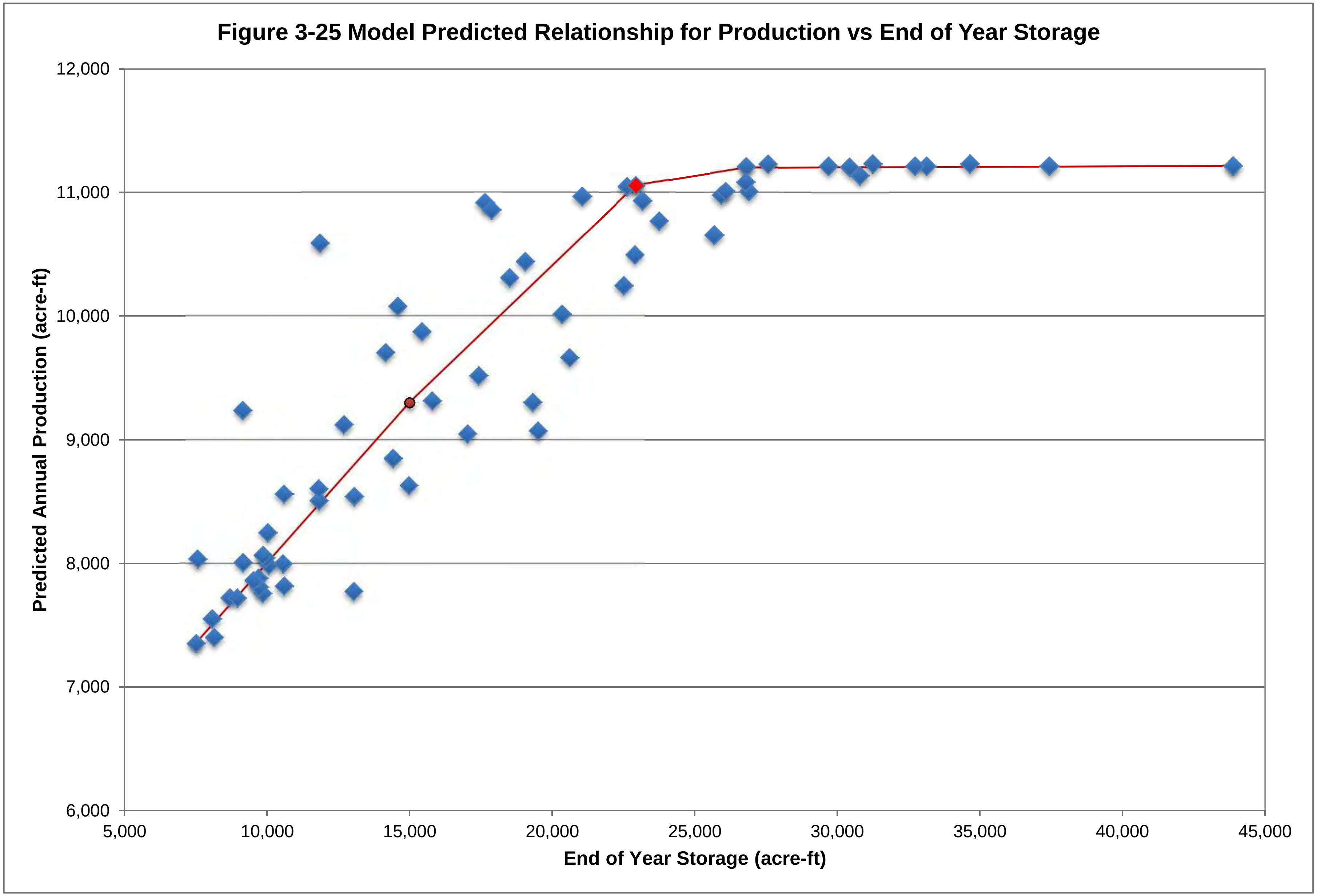
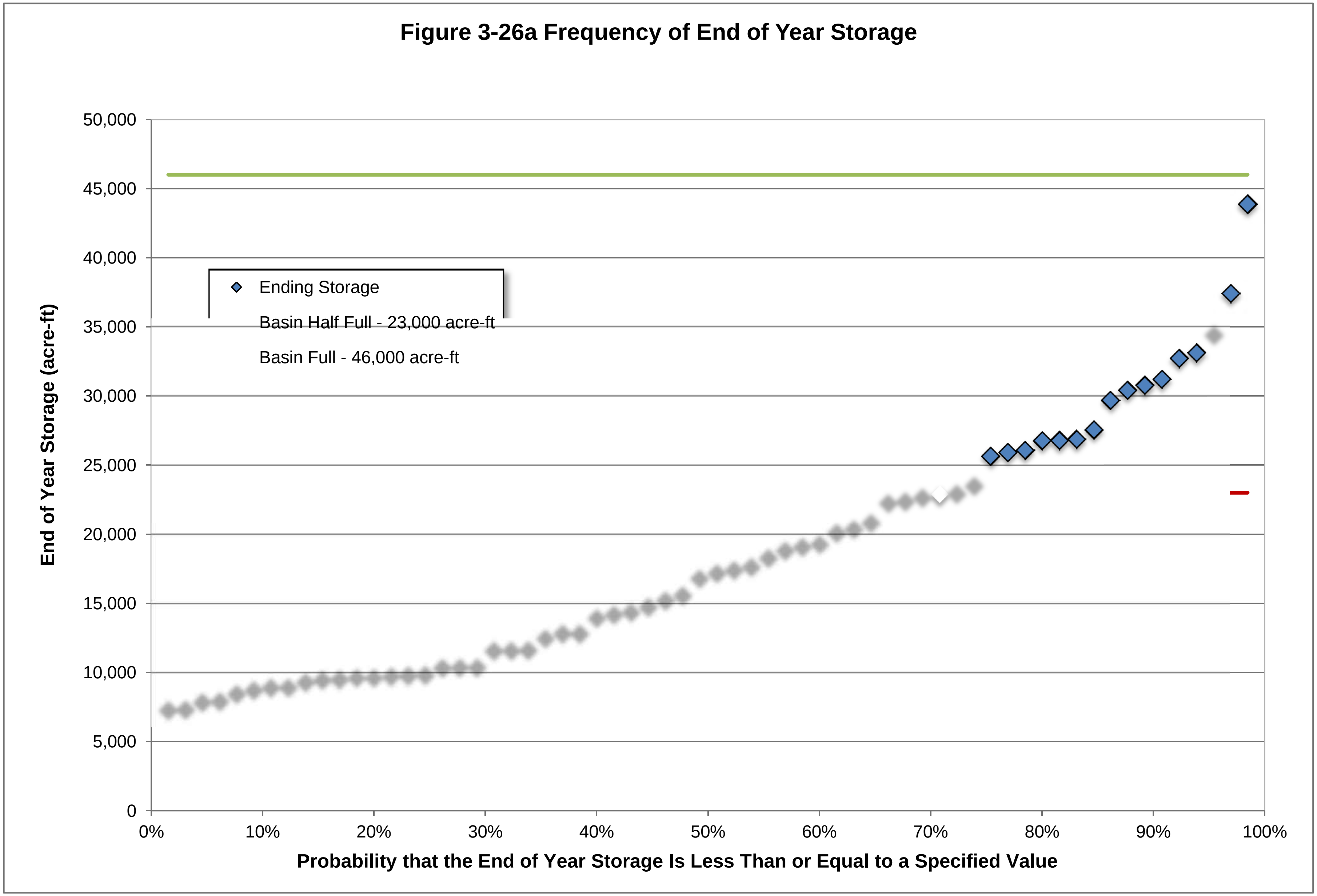


Figure 3-25 Model Predicted Relationship for Production vs End of Year Storage
12,000
11,000
10,000
9,000
8,000
7,000
6,000
Predicted Annual Production (acre-ft)
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
45,000
End of Year Storage (acre-ft)



S:\Clients\San Juan Basin Authority\Groundwater Management Plan\Report\FINAL_GWPM_20130810\Figures\Figures 3-25_ 26a_26b.xlsx_figure 3-26a

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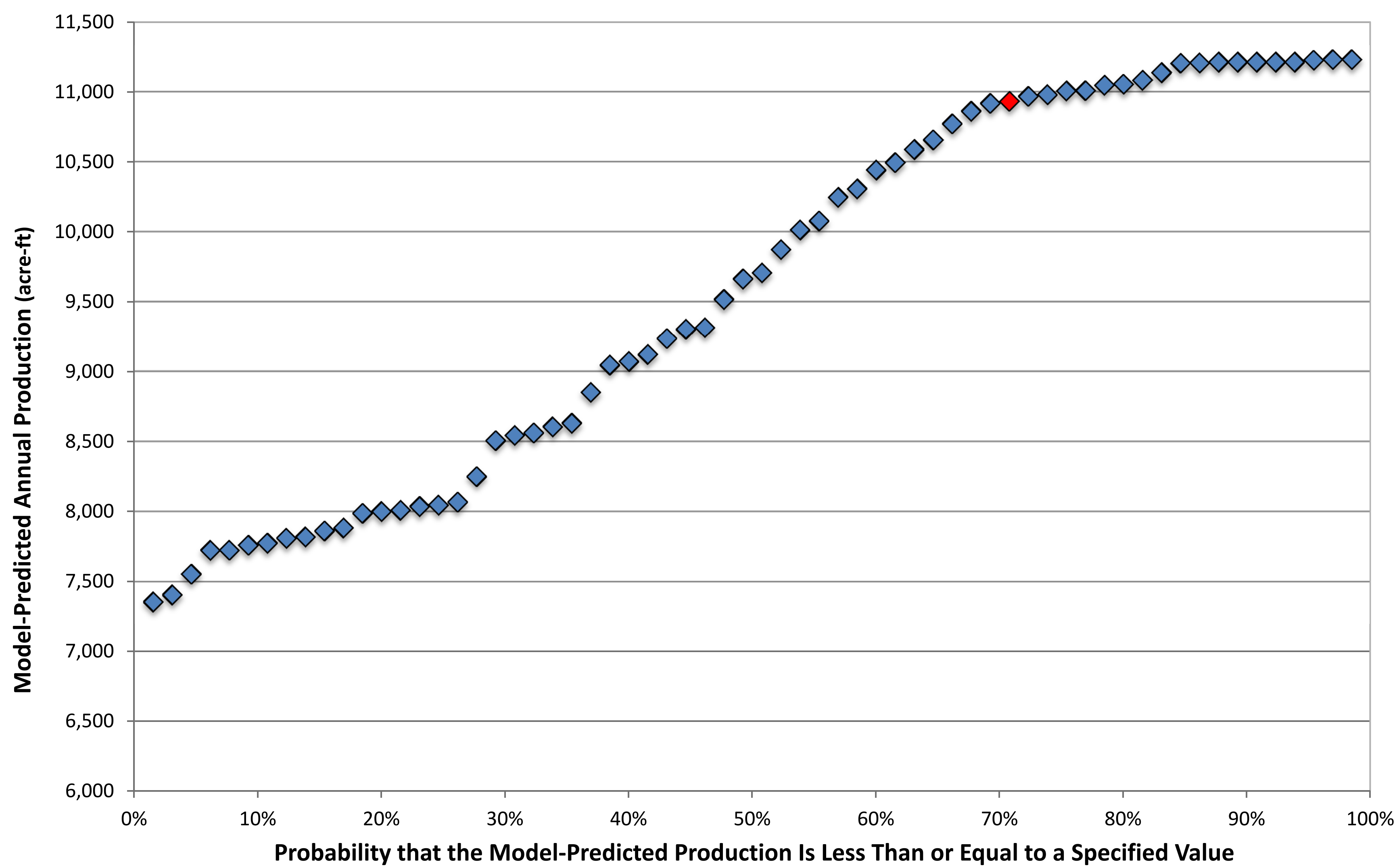
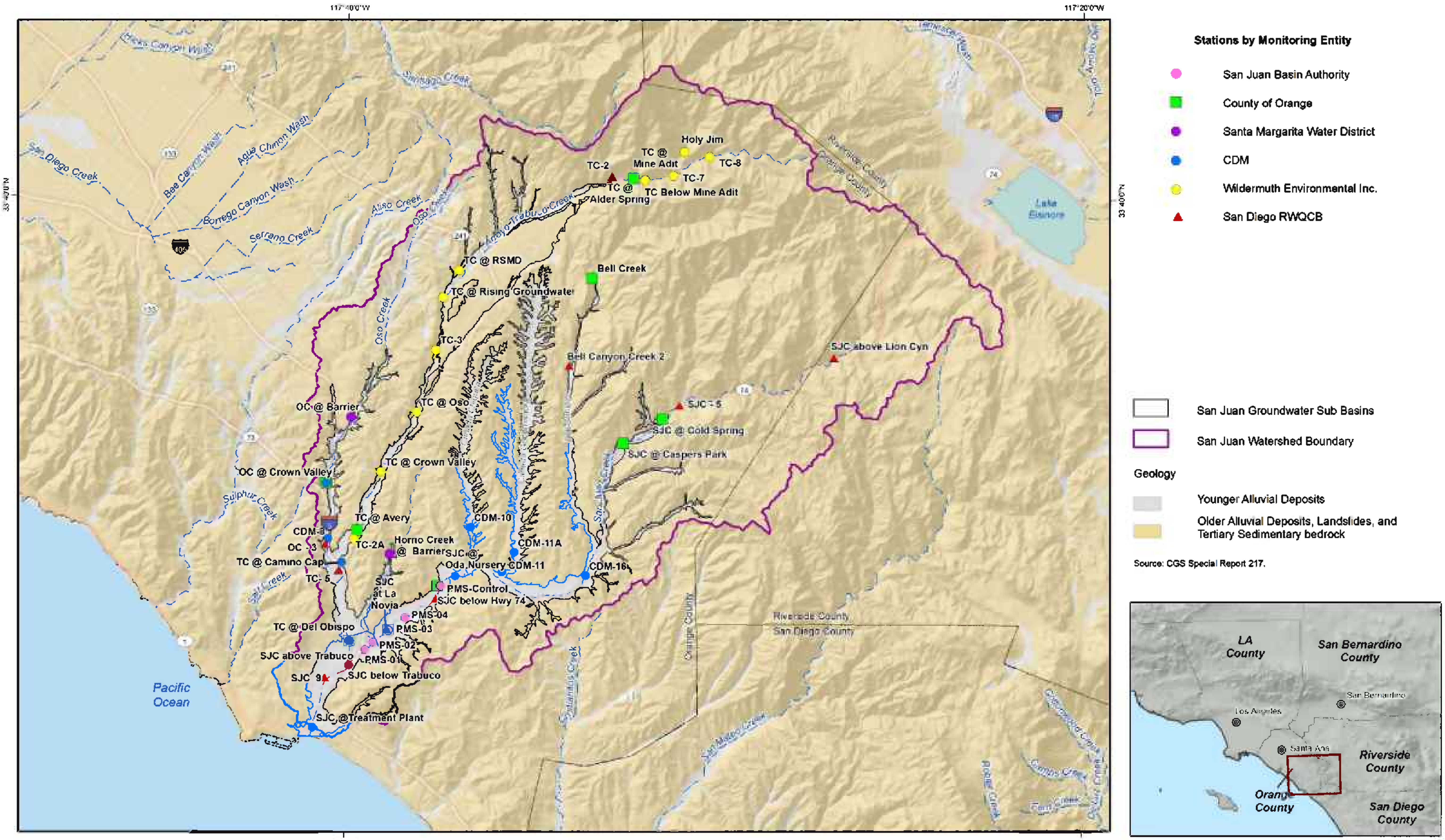
Figure 3-26b Frequency of Model-Predicted Annual Production





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0 1 2 3 4 Miles
0 2 4 6 KM

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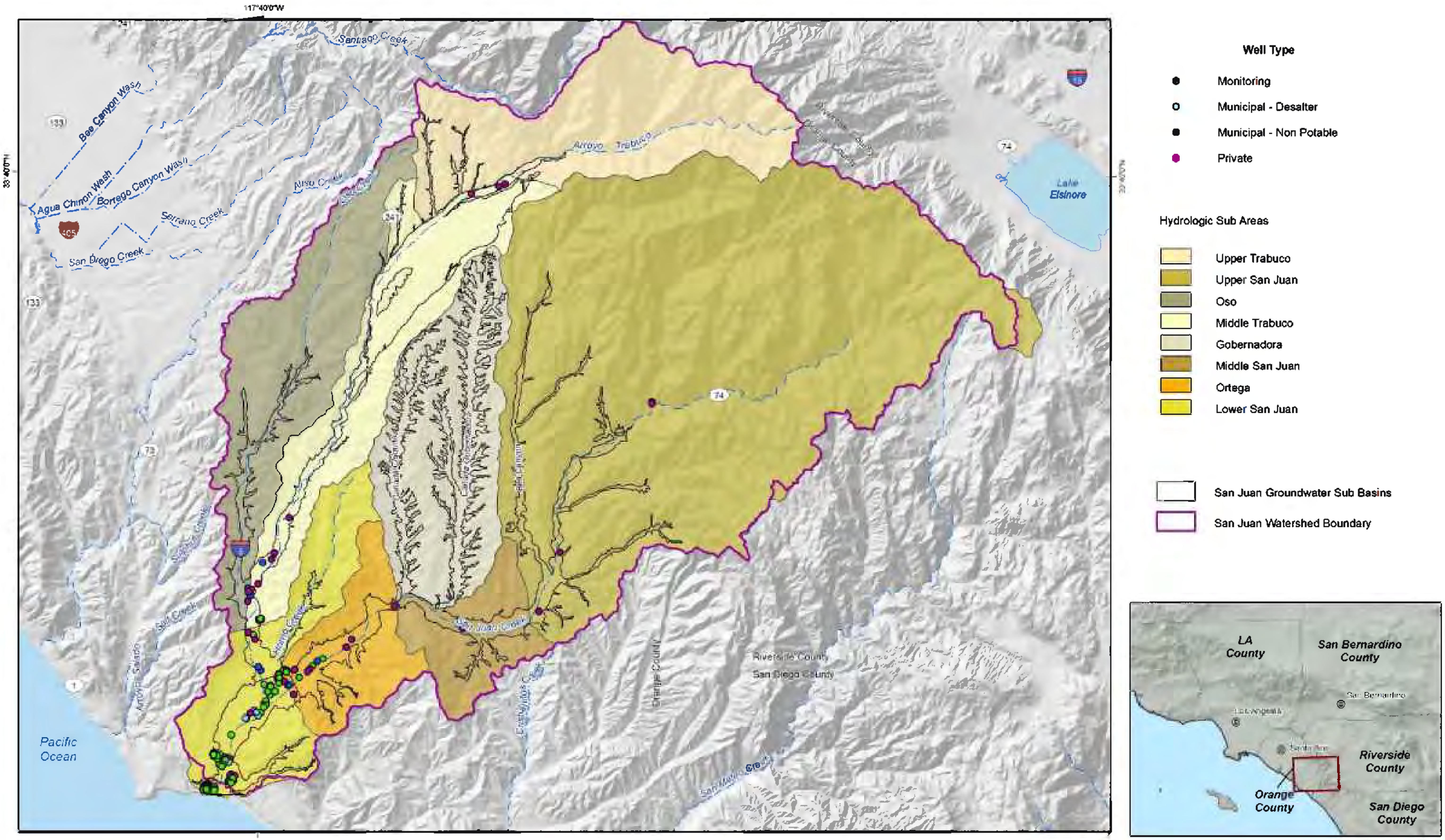
San Juan Watershed
Surface Water Quality Monitoring Stations

Figure 3-27



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0 1 2 3 4 Miles

0 2 4 6 KM

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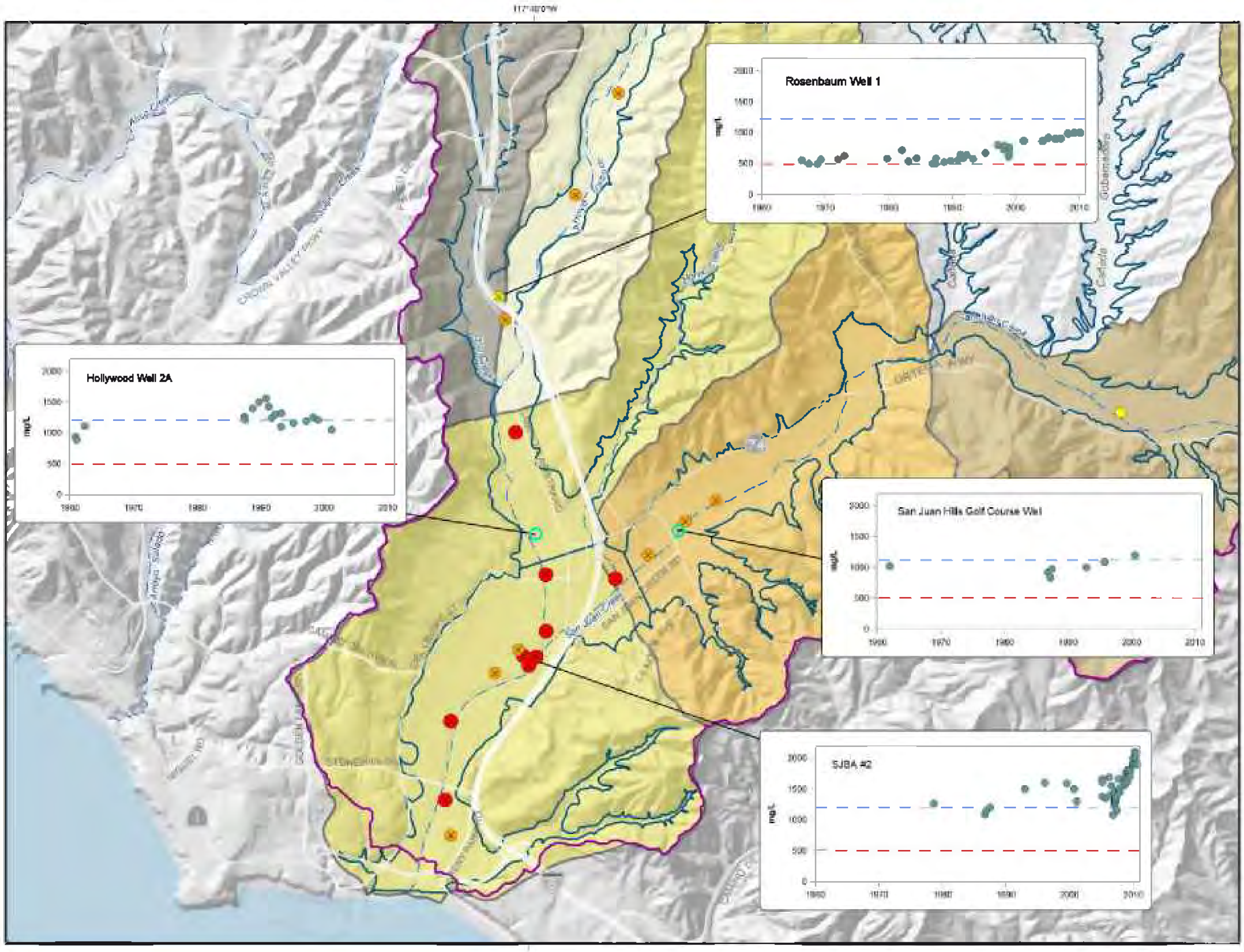
San Juan Watershed
Wells with Water Quality Data

Figure 3-28



Total Dissolved Solids (TDS)

mg/L | Basin Plan Objective Specific to Sub Area | US EPA Secondary MCL = 500 mg/L

Year

Maximum TDS (mg/L) 2006 - 2010

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

Secondary US EPA MCL = 500 mg/L

Hydrologic Sub Area and Basin Plan Objective for TDS

- Lower San Juan - 1200 mg/L
- Ortega - 1100 mg/L
- Middle San Juan - 750 mg/L
- Middle Trabuco - 750 mg/L
- Oso - 1200 mg/L

- Maximum Concentration of TDS 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

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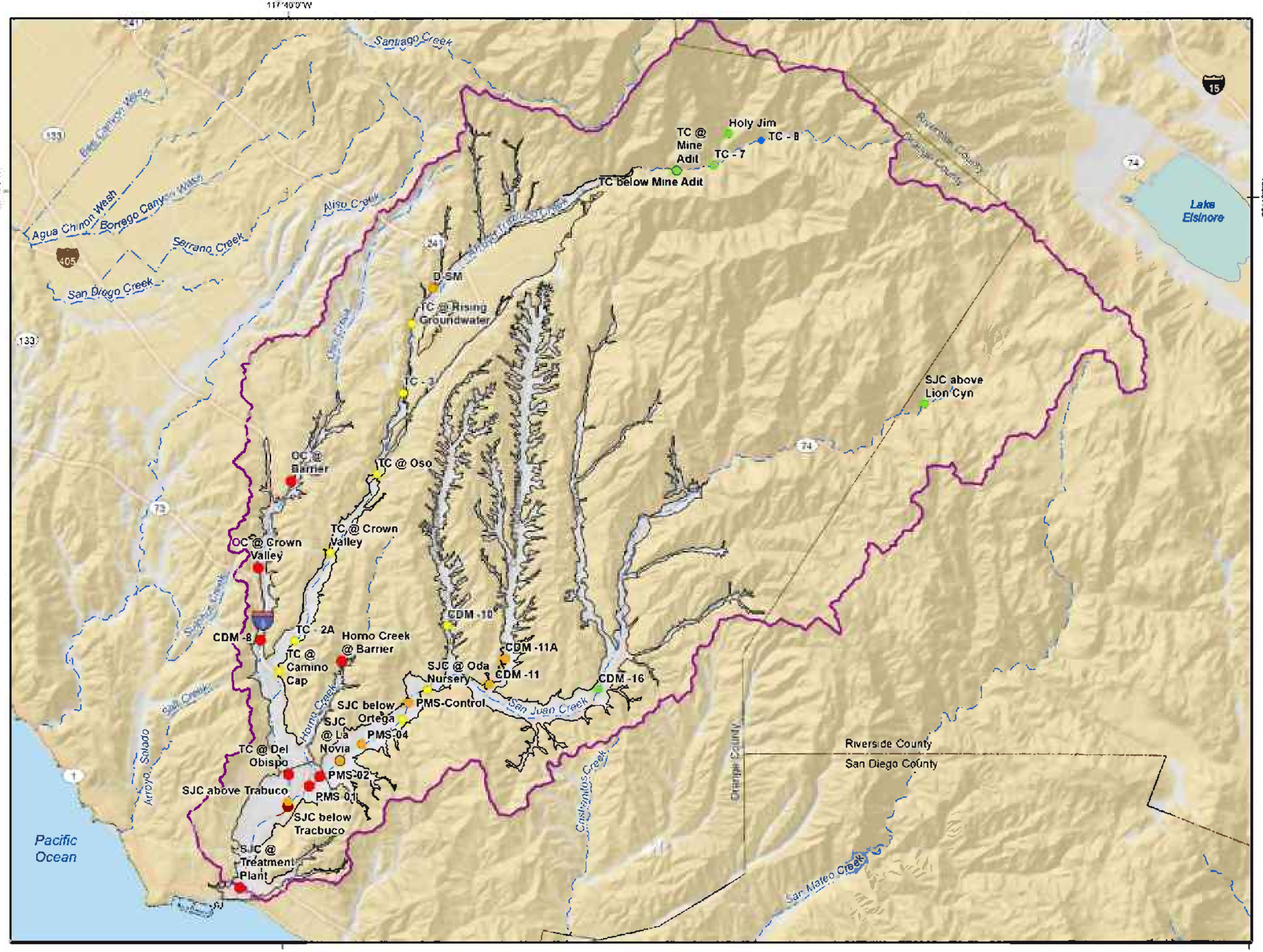
075-003
004

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

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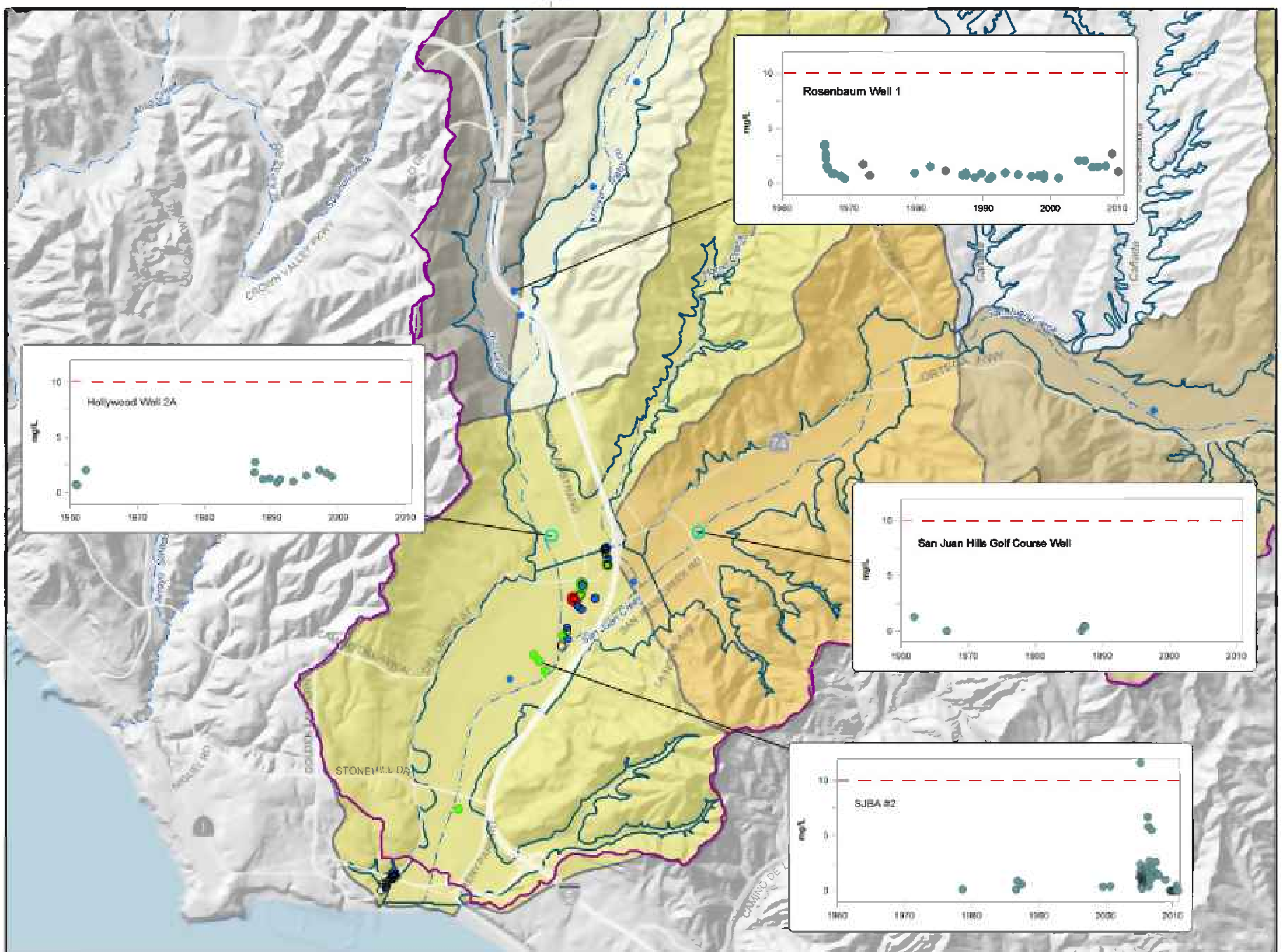
Total Dissolved Solids in Surface Water

Maximum Concentration for Historical Record

Figure 3-30



Nitrate as Nitrogen (NO3-N)

Basin Plan Objective = 10 mg/L

Primary US EPA & CA MCL = 10 mg/L

mg/L

Year

Maximum NO3-N (mg/L) 2006 - 2010

- ND
- < 5
- 5 - 10
- 10 - 20
- 20 - 40
- > 40

Primary US EPA MCL = 10 mg/L
Primary CA MCL = 10 mg/L

Hydrologic Sub Area and Basin Plan Objective for NO3-N

- Lower San Juan - 10 mg/L
- Ortega - 10 mg/L
- Middle San Juan - 10 mg/L
- Middle Trabuco - 10 mg/L
- Oso - 10 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

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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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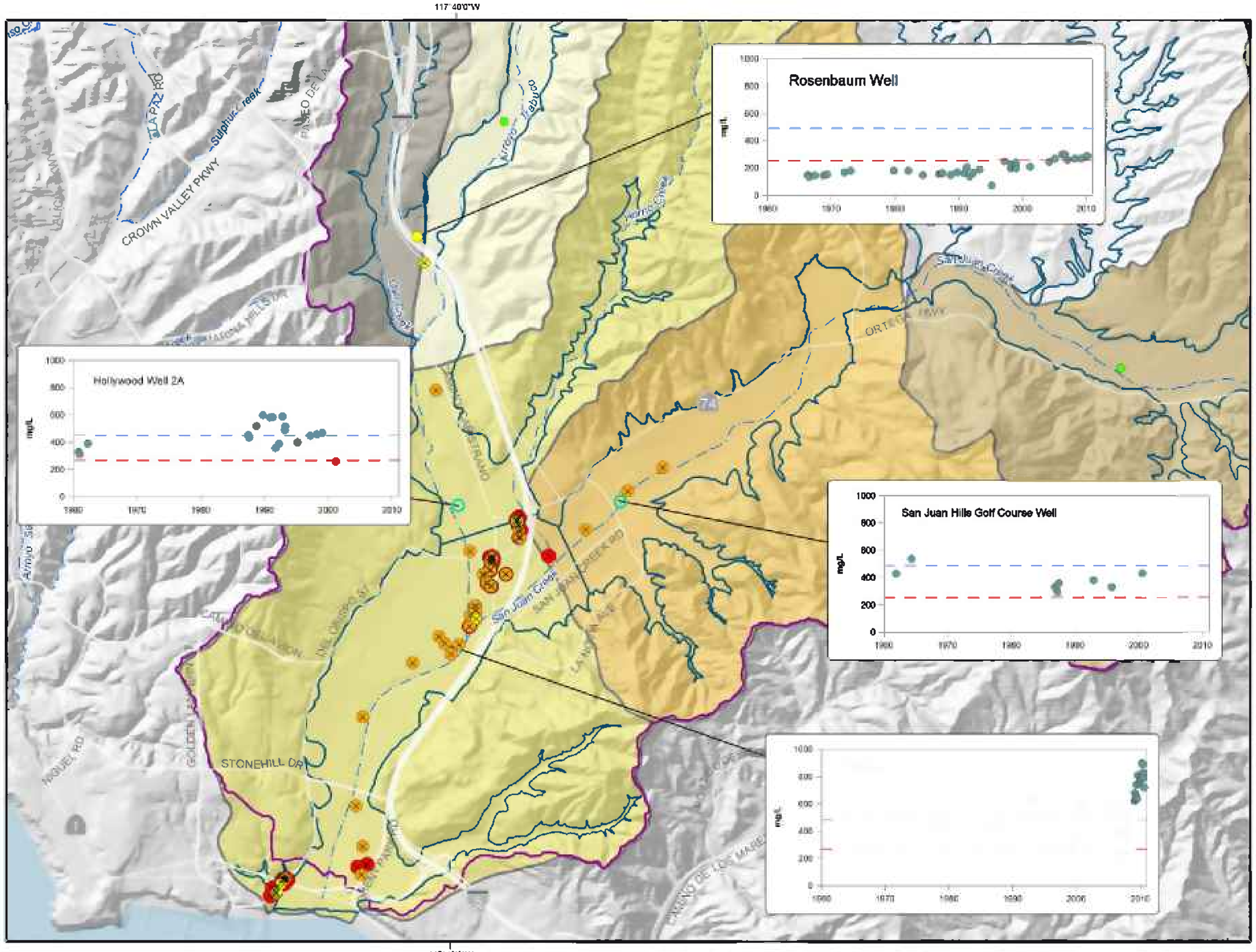
Nitrate as Nitrogen in Groundwater

Maximum Concentration 2006 - 2010 and Historical Trends

Figure 3-31



Sulfate

Basin Plan Objective Specific to Sub Area

US EPA & CA Secondary MCL = 250 mg/L

Maximum Sulfate (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 Sulfate

- Lower San Juan - 500 mg/L
- Ortega - 450 mg/L
- Middle San Juan - 375 mg/L
- Middle Trabuco - 375 mg/L
- Oso - 500 mg/L

- Maxmium Concentration of Sulfate 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

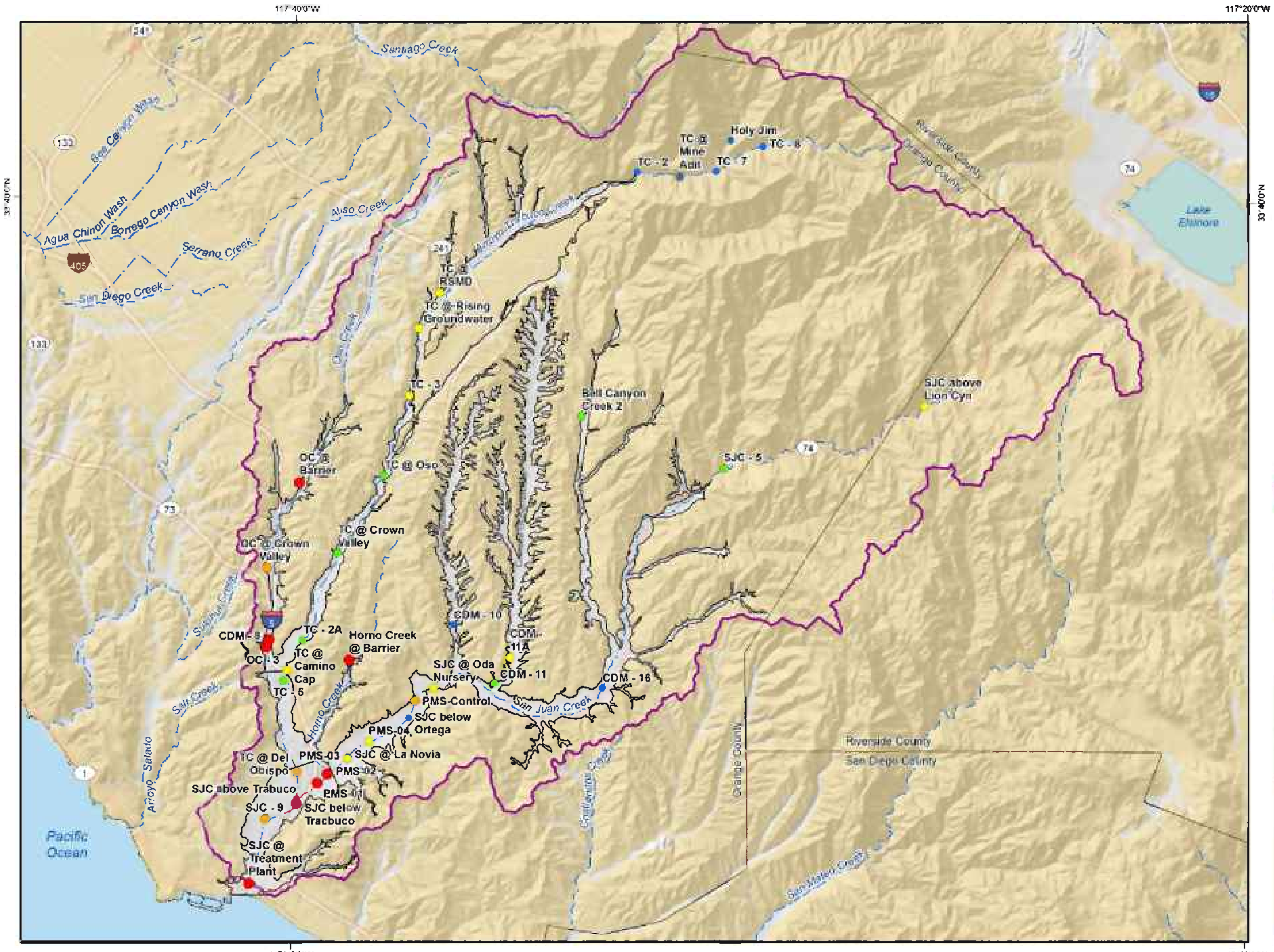
SAN JUAN BASIN AUTHORITY

075-003
004

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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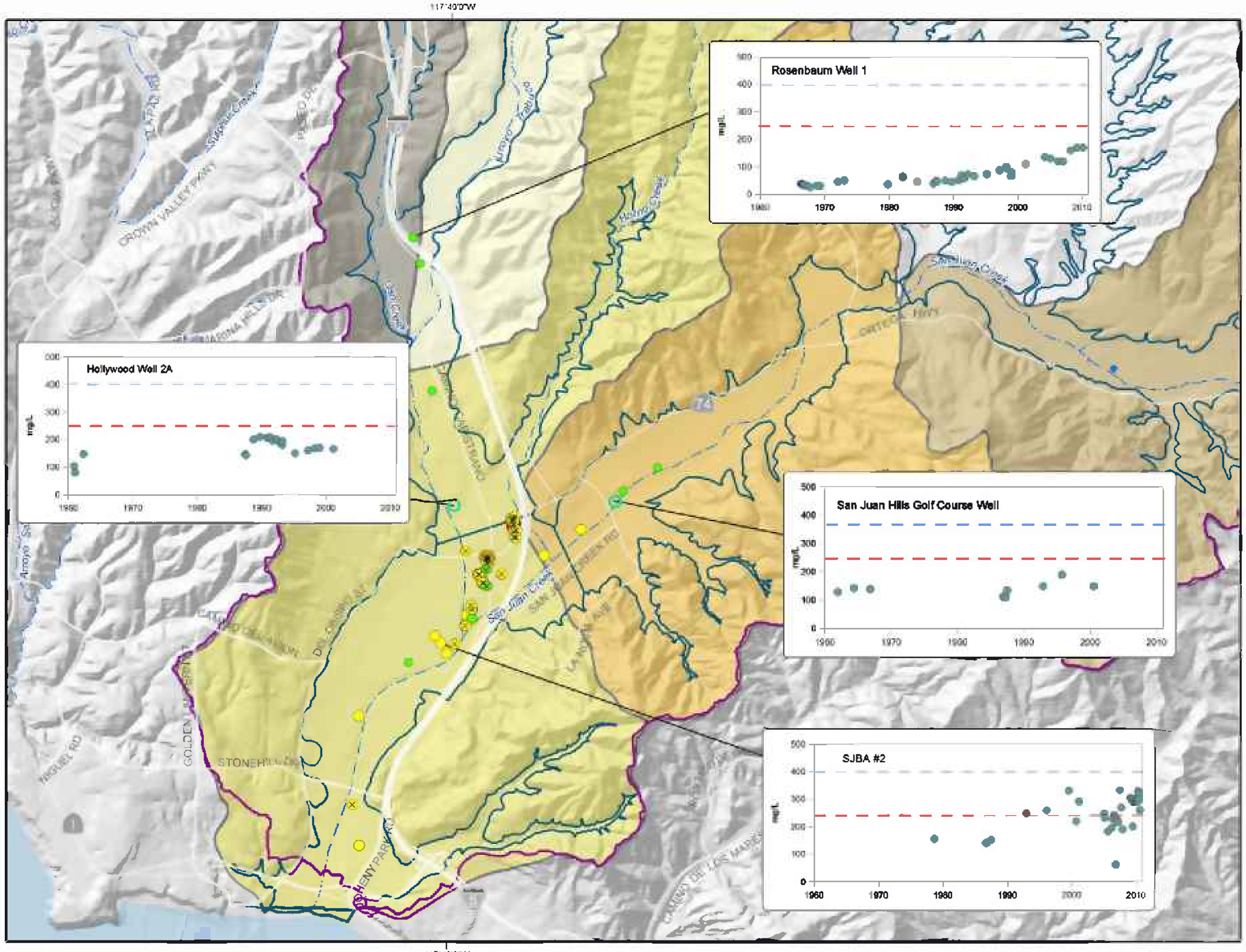
Sulfate in Surface Water

Maximum Concentration for Historical Record

Figure 3-33



Chloride

mg/L

Year

Basin Plan Objective Specific to Sub Area

US EPA & CA Secondary MCL = 250 mg/L

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

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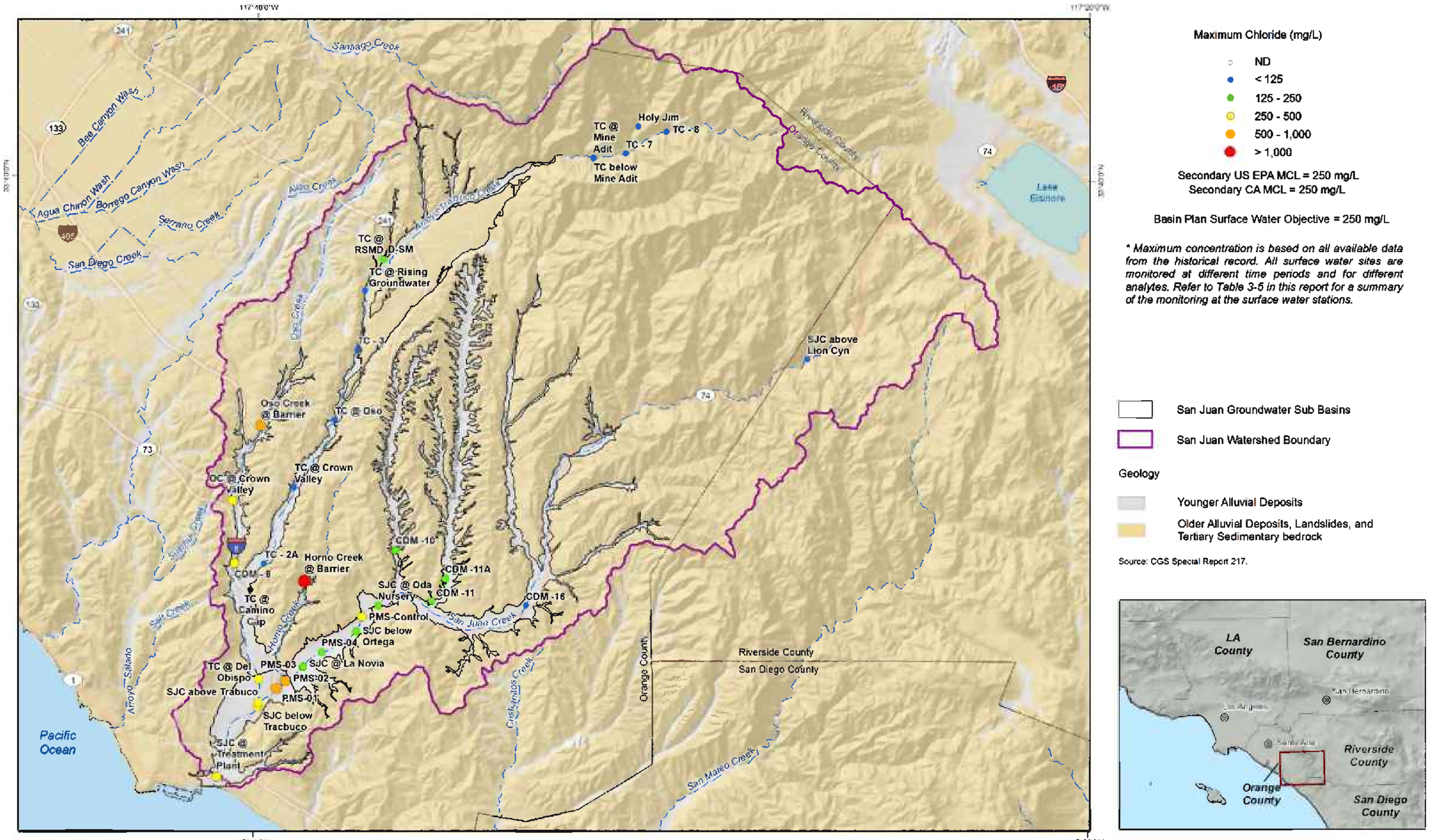
075-003
004

Chloride in Groundwater

Maximum Concentration 2006 - 2010 and Historical Trends

Figure 3-34



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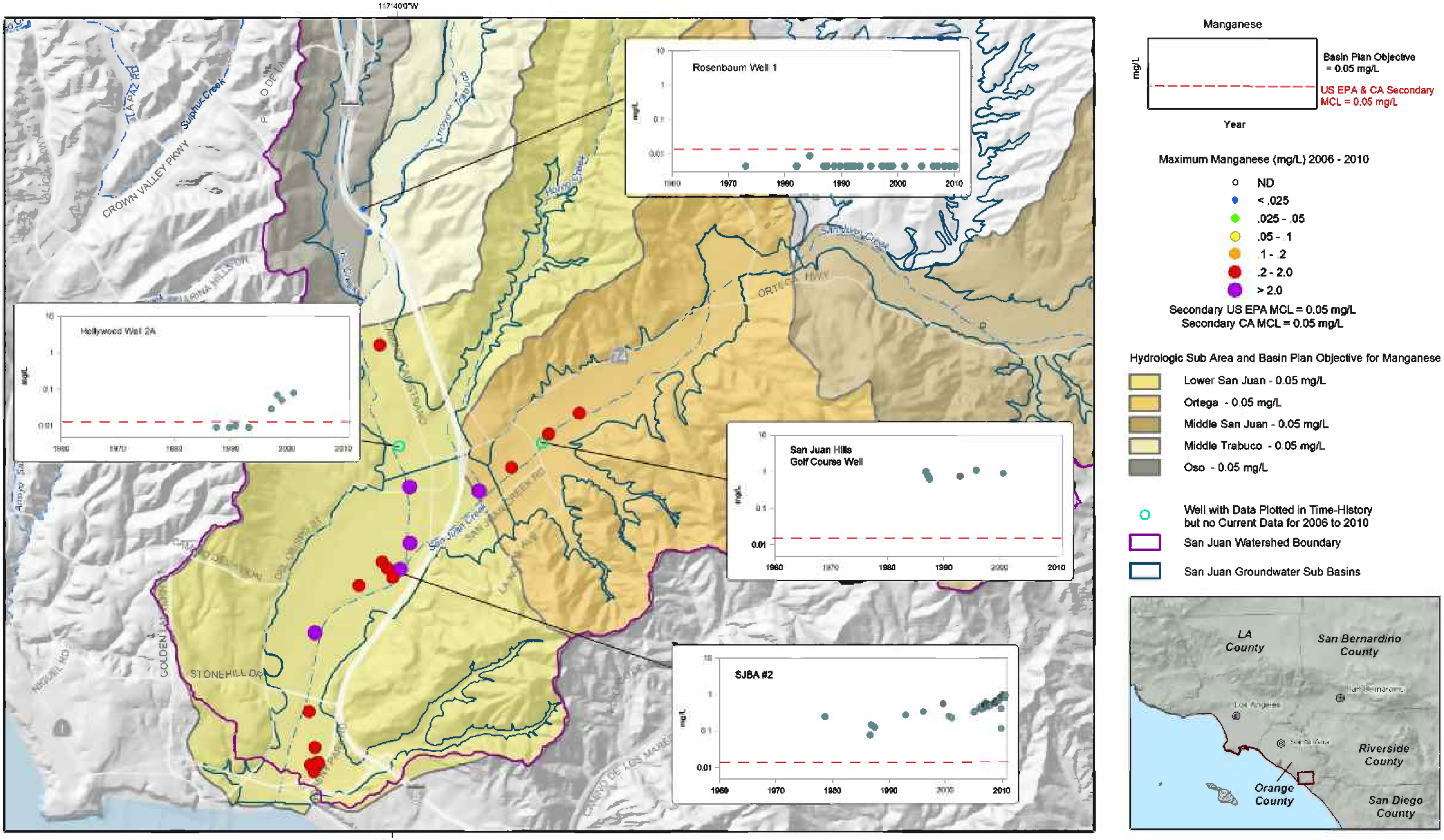
Chloride in Surface Water

Maximum Concentration for Historical Record

Figure 3-35



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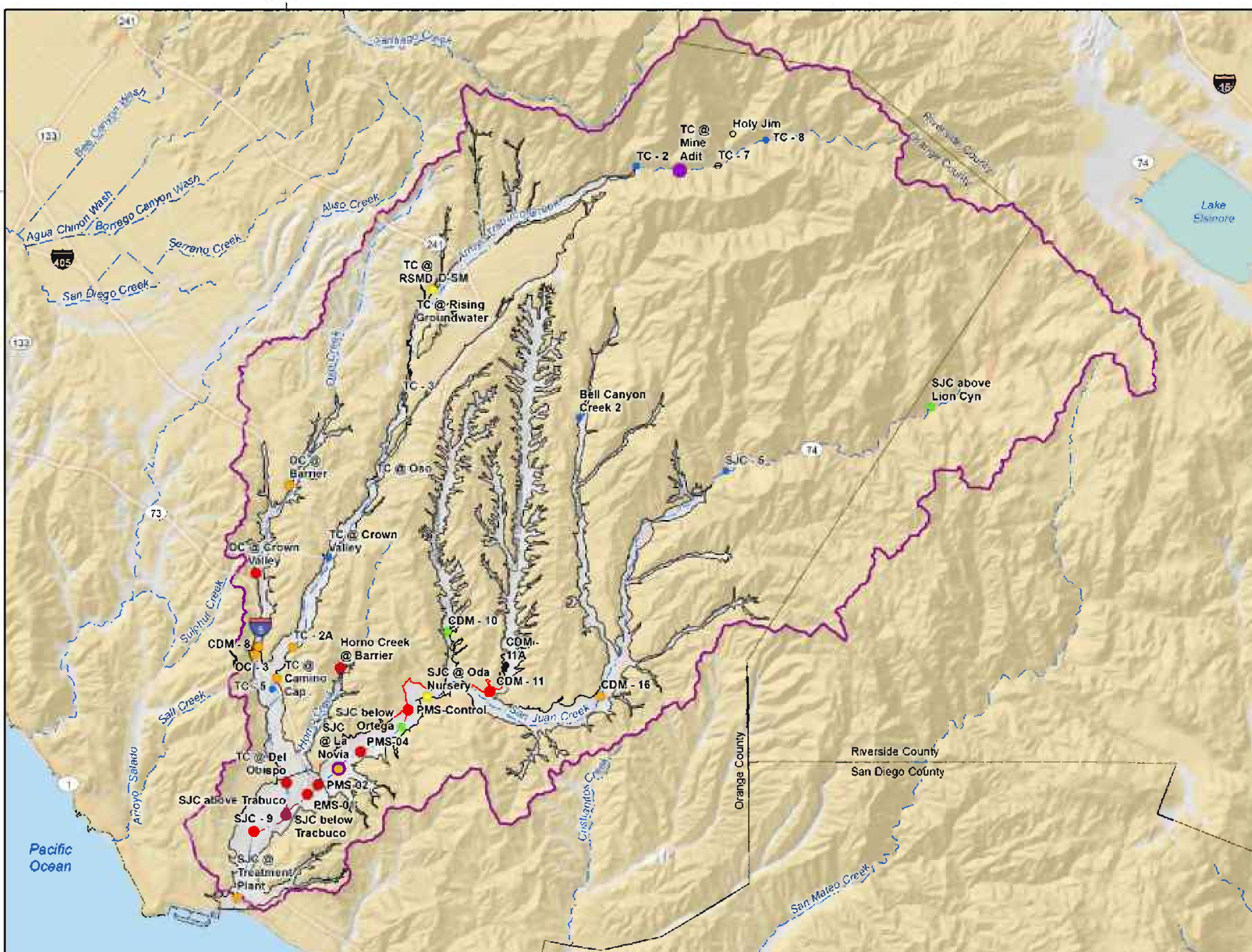
075-003
004

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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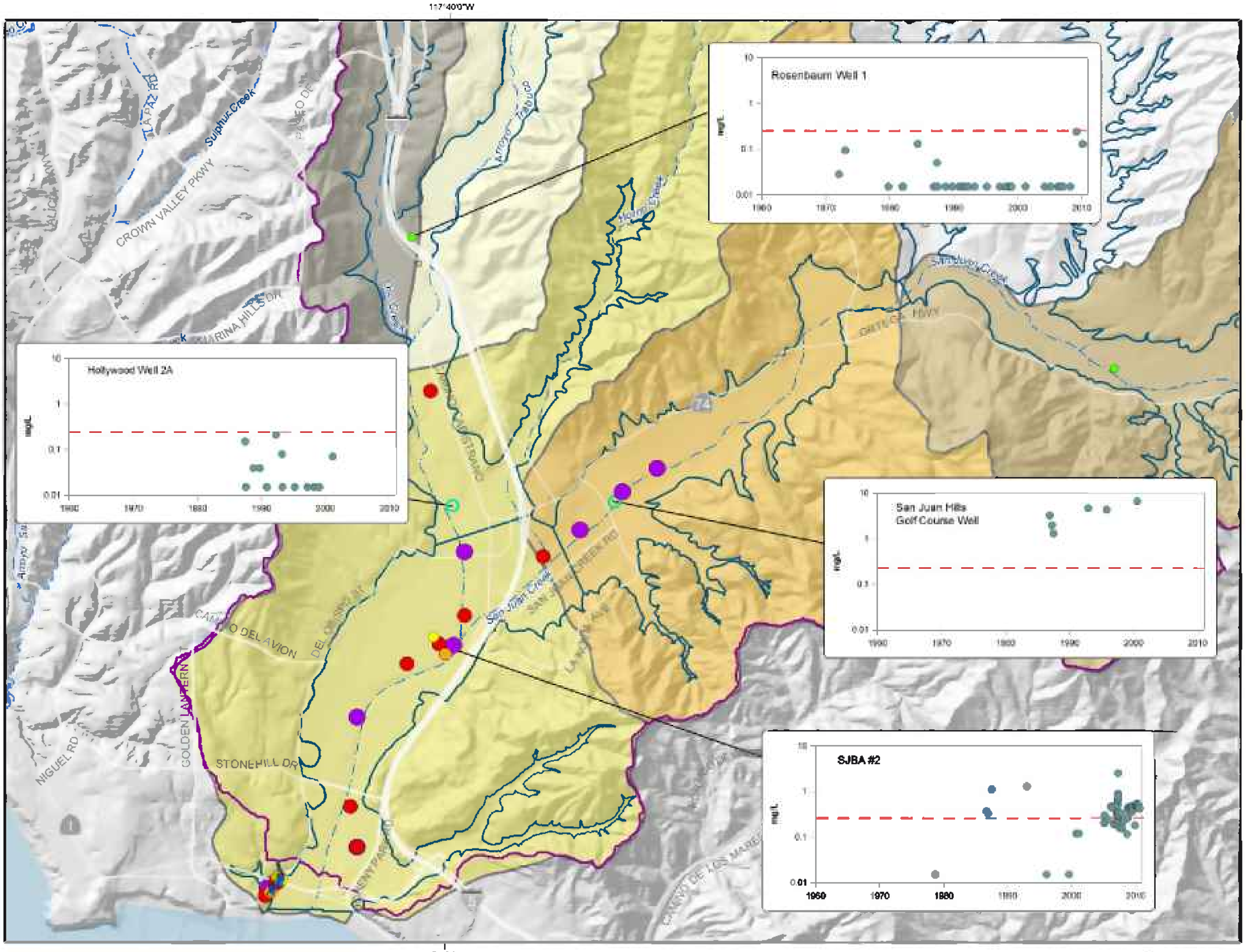
0 1 2 3 4 Miles
0 2 4 6 KM

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

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Author: VMW
Date: 4/15/2013
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0 2,500 5,000 7,500 10,000 Feet

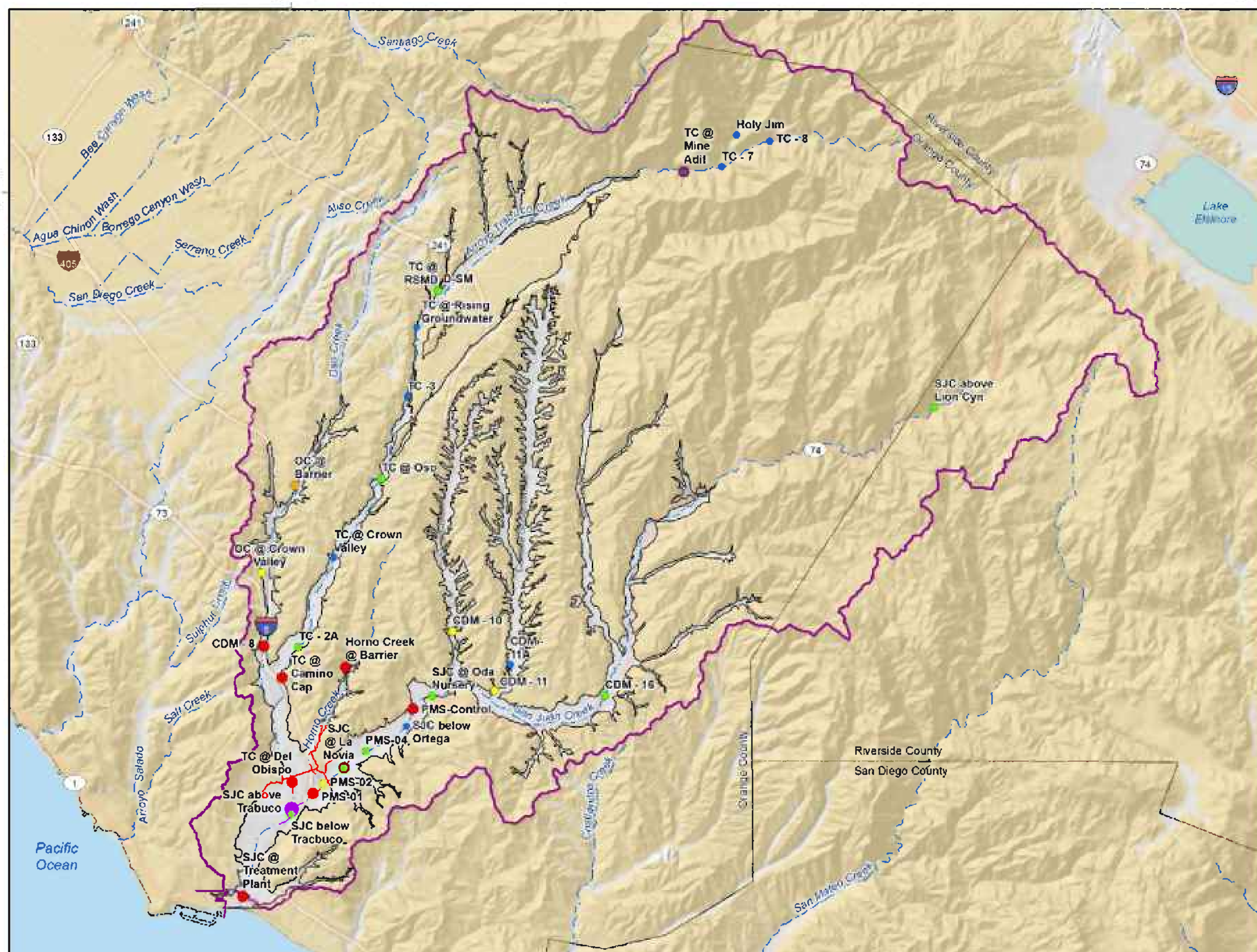
0 1,000 2,000 3,000 Meters

075-003
004

Iron in Groundwater

Maximum Concentration 2006 - 2010 and Historical Trends

Figure 3-38



Maximum Iron (mg/L)

- 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

Basin Plan Surface Water Objective = 0.3 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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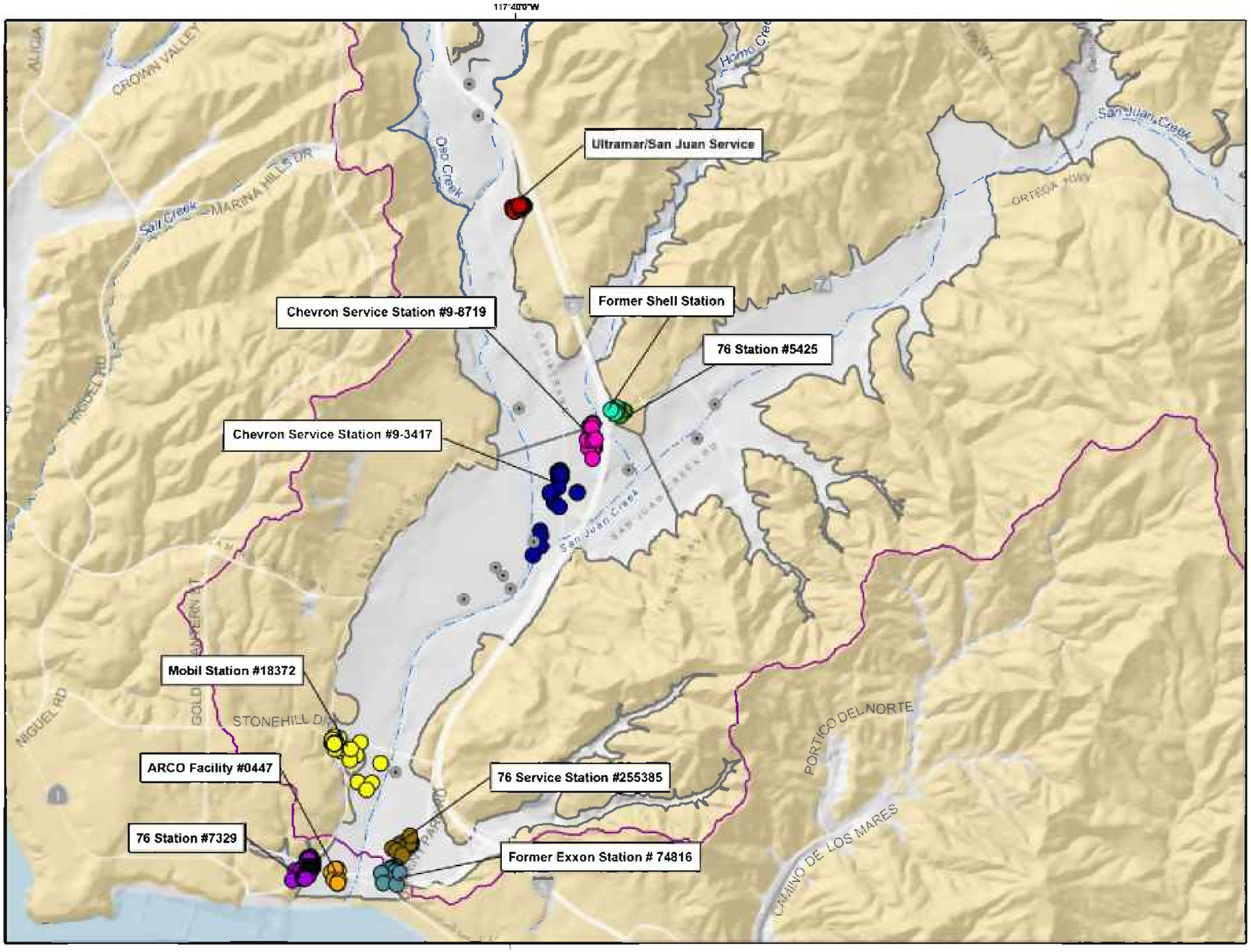
Iron in Surface Water

Maximum Concentration for Historical Record

Figure 3-39



Cleanup Site Monitoring Wells

- Ultramar/San Juan Sevice (ID # T0605902555)
- Former Shell Station -Closed (ID # T0605902592)
- 76 Station #5425 (ID # T0605902561)
- Chevron Service Station #9-8719 (ID # T0605902510)
- Chevron Service Station #9-3417 (ID # T0605902379)
- Mobil Station # 18372 (ID # T0605902502)
- 76 Service Station # 255385 (ID # T0605902362)
- Former Exxon Station 74816 (ID # T0605902575)
- ARCO Facility # 0447 (ID # T0605902526)
- 76 Station #7329 (ID # T0605902573)

** The ID # listed above is the Global ID # assigned for the State of California Water Resources Control Board*

- Active Production Wells
- 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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Path: N:\MapDocs\Clients\SJBA\2011 GWMP\Figure 3-40.mxd

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

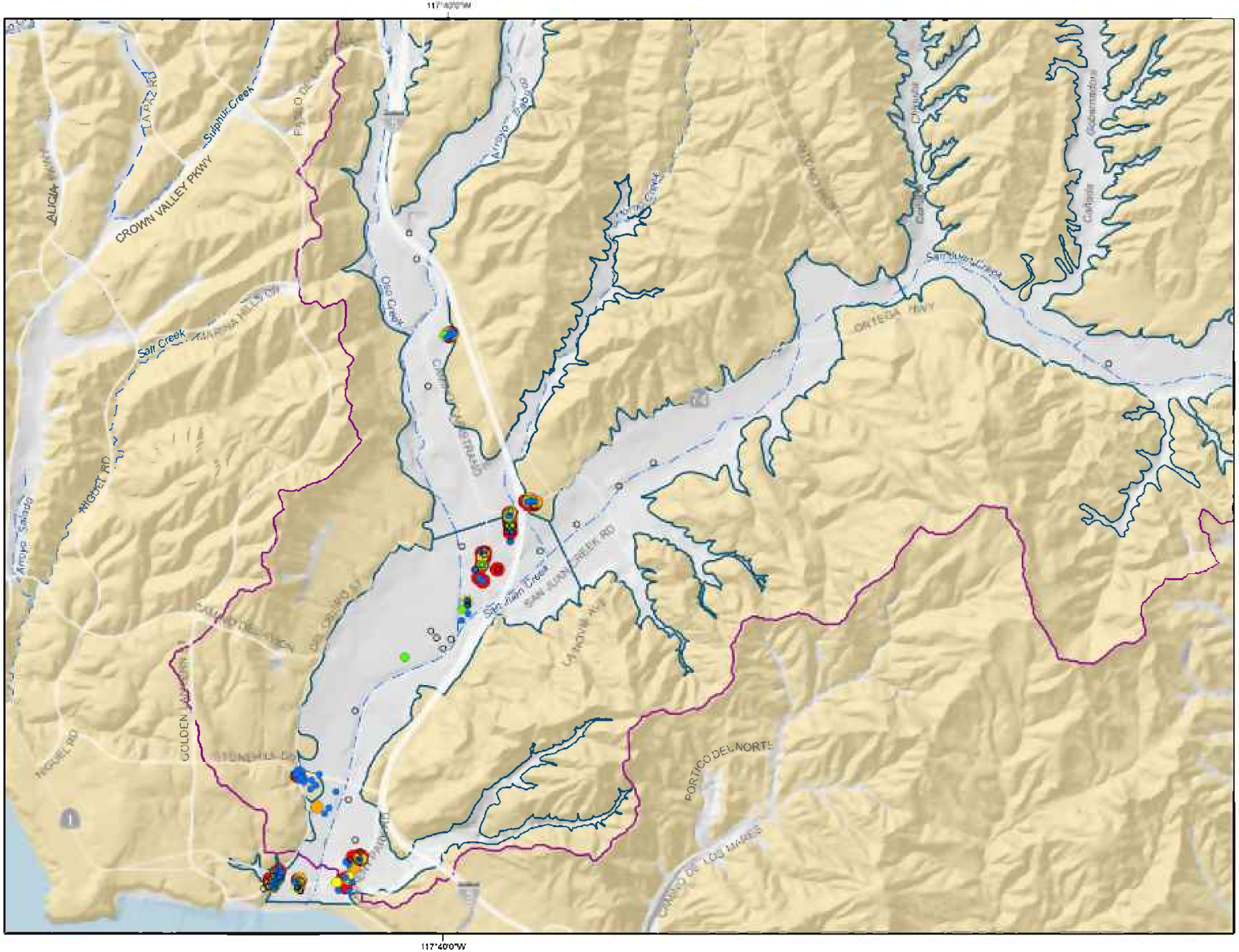
0 1,000 2,000 3,000 Meters

SAN JUAN BASIN AUTHORITY

075-003
004

San Juan Basin Point Source Contamination Cleanup Sites and Monitoring Wells

Figure 3-40



Maximum MTBE (ug/L) 2006 - 2010

- ND
- < 2.5
- 2.5 - 5
- 5 - 10
- 10 - 20
- > 20

Primary CA MCL = 13 ug/L
Secondary CA MCL = 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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Path: N:\MapDocs\Clients\SJBA\2011 GWMP\Figure 3-41.mxd

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

SAN JUAN BASIN AUTHORITY

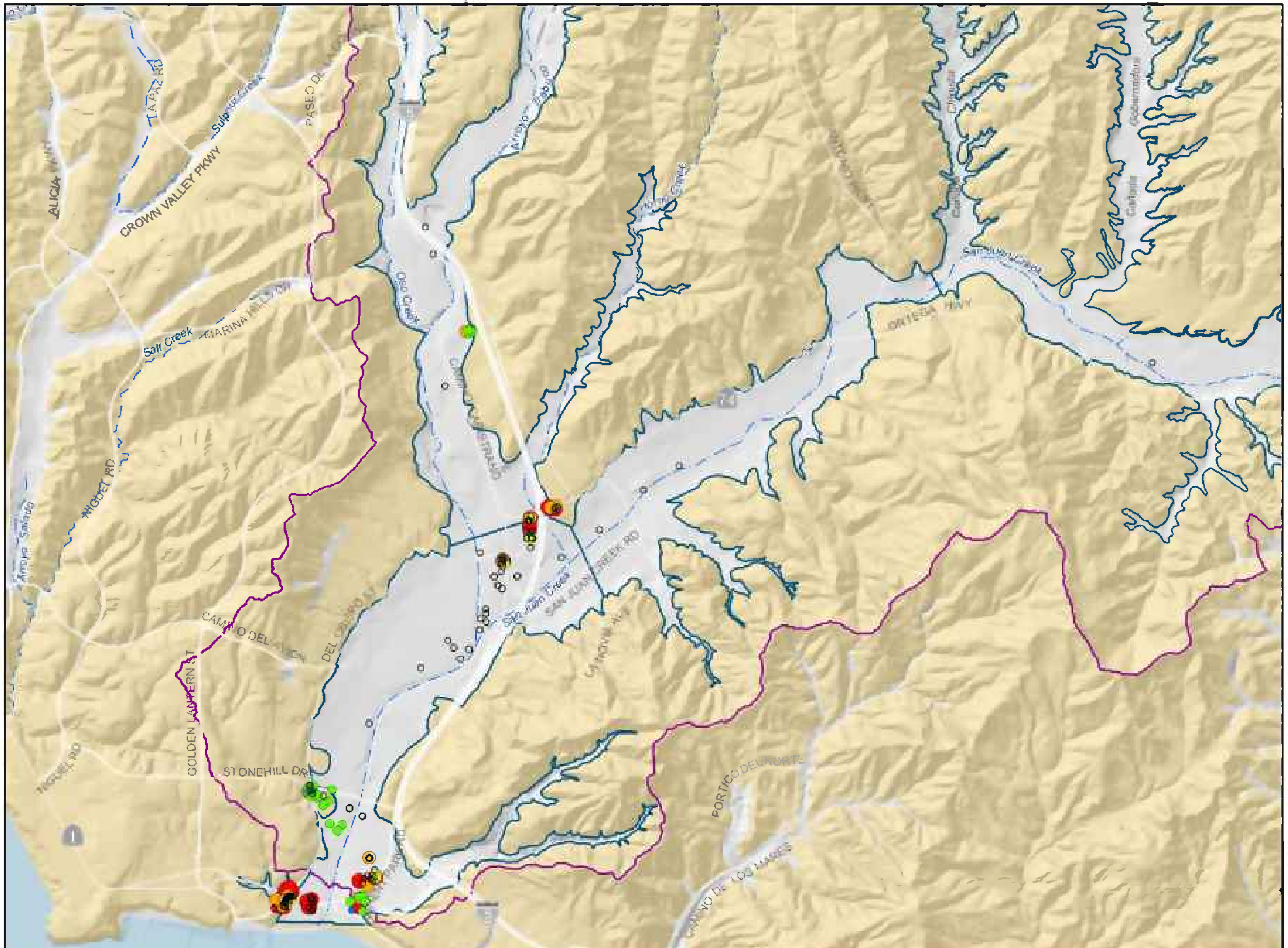
075-003
004

Methyl Tert-Butyl Ether in Groundwater

Maximum Concentration 2006 to 2010

Figure 3-41

117°40'0"W



Maximum TBA (ug/L) 2006 - 2010

- ND
- < 6
- 6 - 12
- 12 - 24
- 24 - 48
- > 48

CA Notification Level = 12 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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Path: N:\MapDocs\Clients\SJBA\2011 GWMP\Figure 3-42.mxd

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

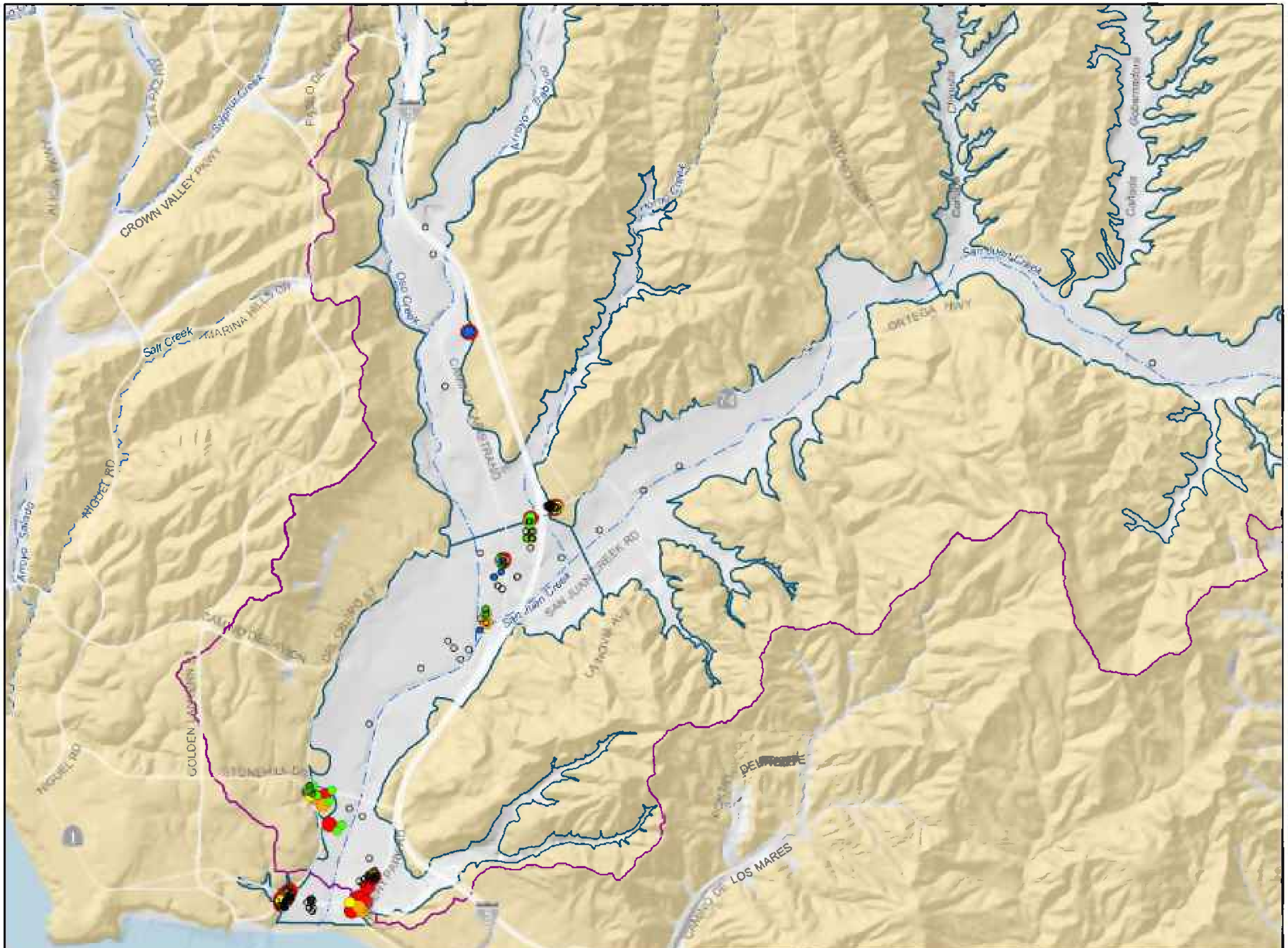
SAN JUAN BASIN AUTHORITY

075-003
004

Tert-Butyl Alcohol in Groundwater

Maximum Concentration 2006 to 2010

Figure 3-42



Maximum Benzene (ug/L) 2006 - 2010

- ND
- < 0.5
- 0.5 - 1
- 1 - 2
- 2 - 4
- > 4

Primary EPA MCL = 5 ug/L
Primary CA MCL = 1 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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Path: N:\MapDocs\Clients\SJBA\2011 GWMP\Figure 3-43.mxd

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

0 1,000 2,000 3,000 Meters

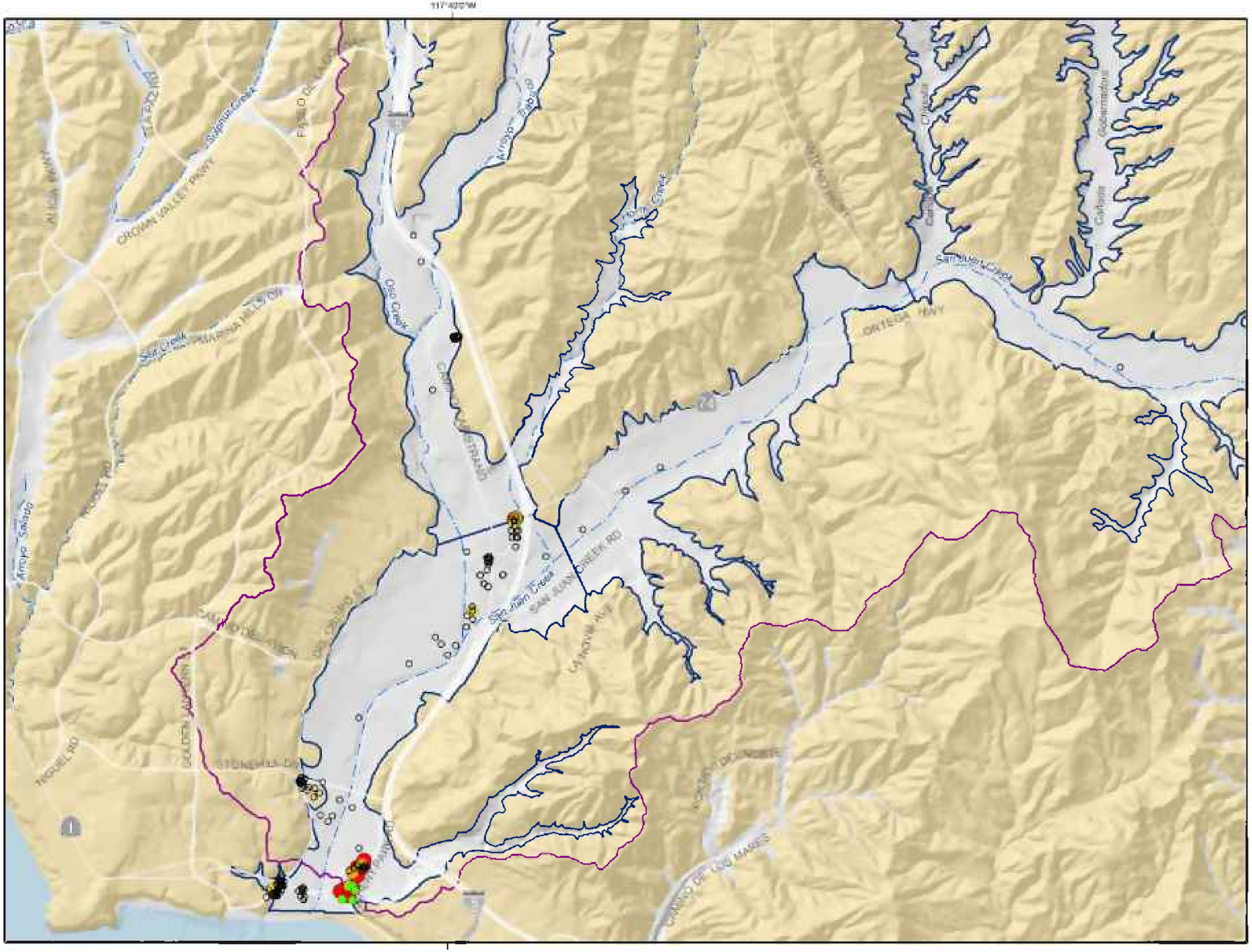
SAN JUAN BASIN AUTHORITY

075-003
004

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

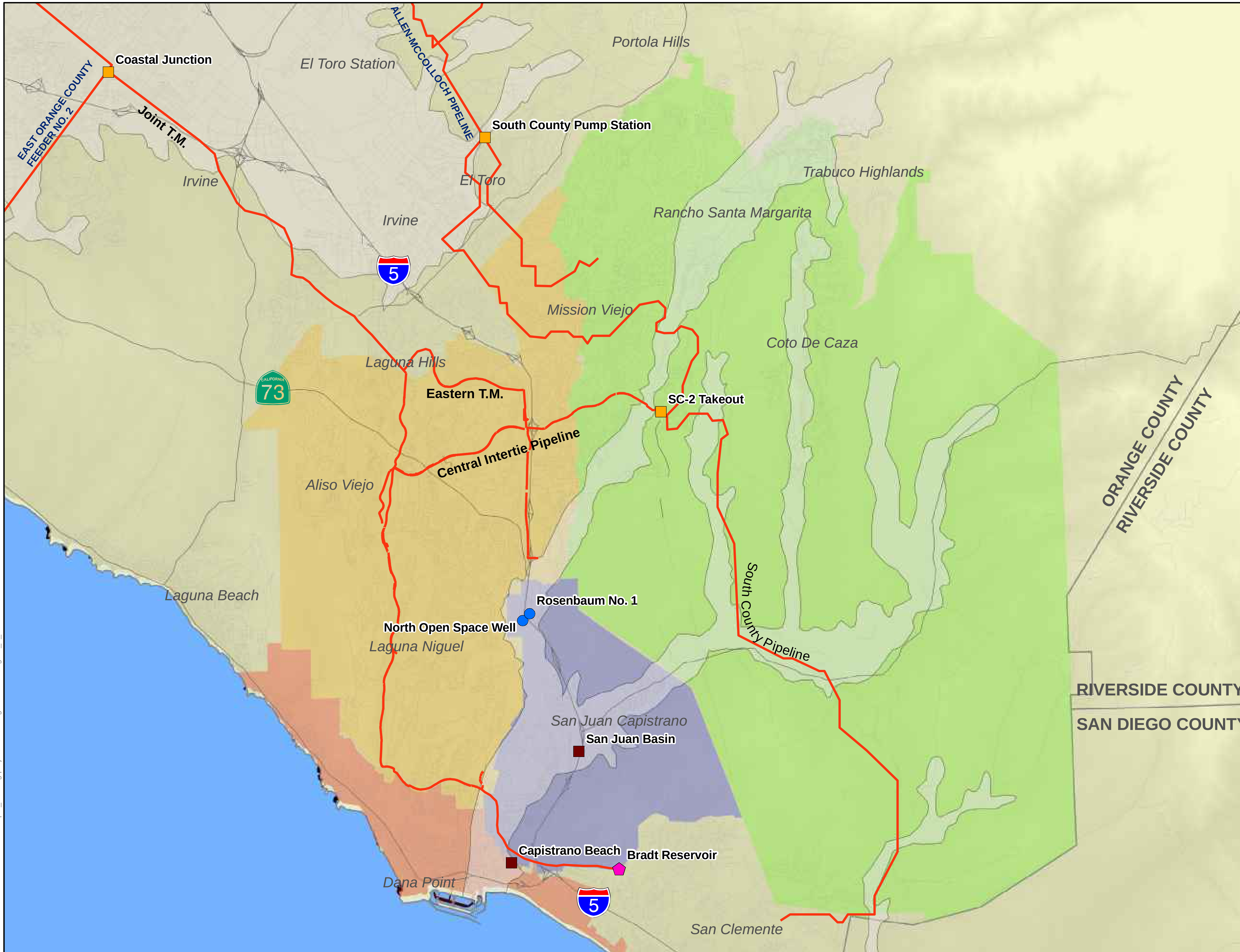
SAN JUAN BASIN AUTHORITY

075-003
004

1,2 - Dichloroethane in Groundwater

Maximum Concentration 2006 to 2010

Figure 3-44



Legend

- Groundwater Recovery Facility
- Junction Box
- Groundwater Well
- Reservoir
- Potable Water Transmission Mains
- MWD Feeders
- Groundwater Basin

Water Purveyors

- City of San Juan Capistrano
- Moulton-Niguel Water District
- Santa Margarita Water District
- South Coast Water District
- County Line

N

1 0 1 2 3
Miles

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

carollo

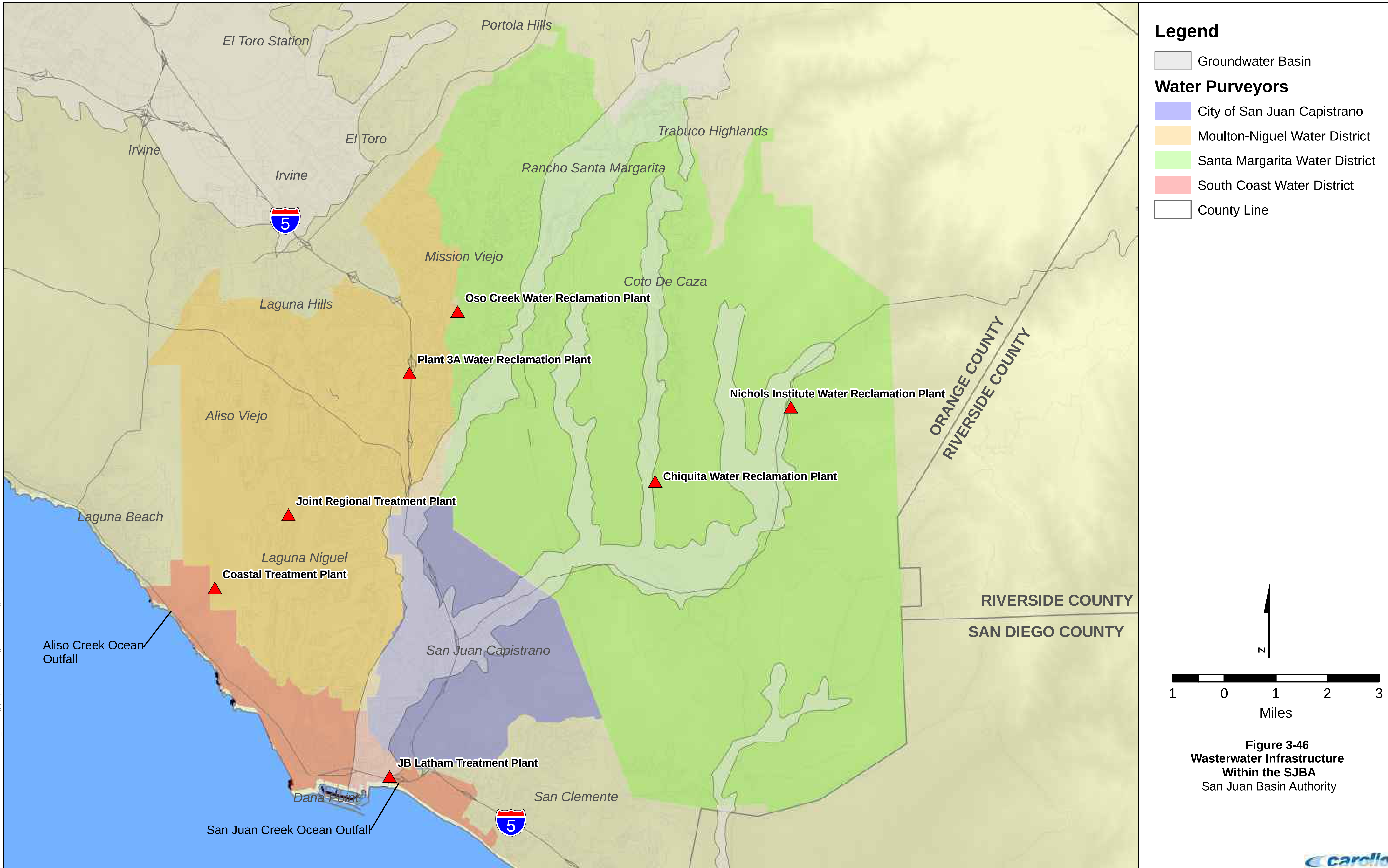


Figure 3-46
Wasterwater Infrastructure
Within the SJBA
San Juan Basin Authority

FILENAME: c:\pw_working\projectwise\wangld\0127168\Figure_3_SJBA.mxd
DATE: 2/9/2011

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

FILENAME: c:\pw_working\projectwise\lwang\d0127168\Figure_4_SJBA.mxd
DATE: 2/9/2011

Section 4 Historical and Projected Water Demands

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				●				

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.

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, <u>diversions for beneficial use for each party</u>, 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.

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.

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[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

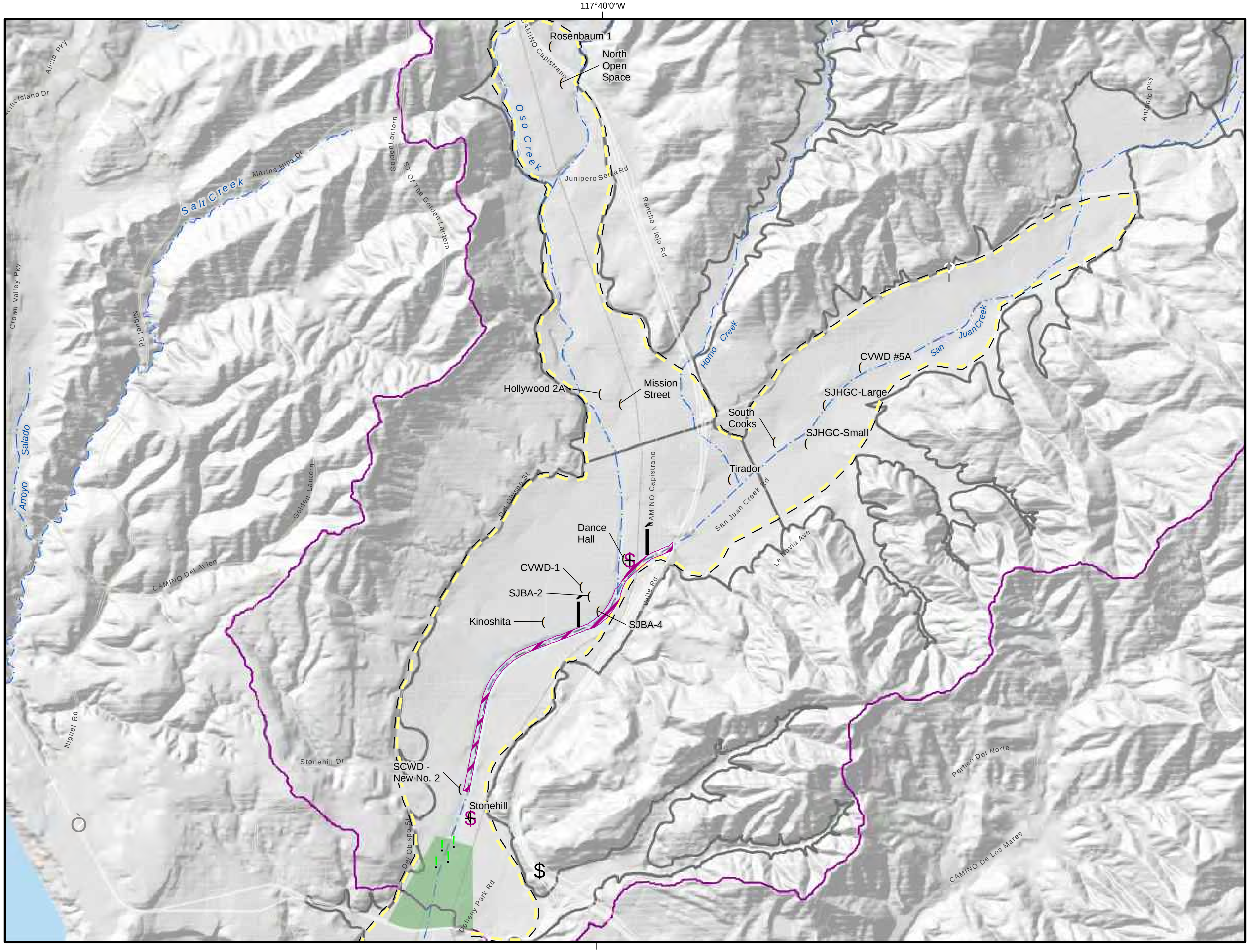
This alternative is identical to Alternative 8 with the addition of in-stream recharge facilities (as described in Alternative 5). The average yield of the Basin would be increased from about 7,500 acre-ft/yr to about 9,500 acre-ft/yr.

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.



Main Features

- Proposed Instream Recharge Facilities
- Proposed Extraction Barrier Area
- Existing Well
- Proposed Injection Well
- Proposed Ranney Collector Well - (location shown is conceptual)
- Existing Desalter Facility

Hydrologic Features

- Groundwater Sub-basin
- San Juan Creek Watershed Boundary
- Active Managment Area

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Author: lboehm
Date: 11/6/2013
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0 2,500 5,000 Feet

0 1,000 2,000 Meters

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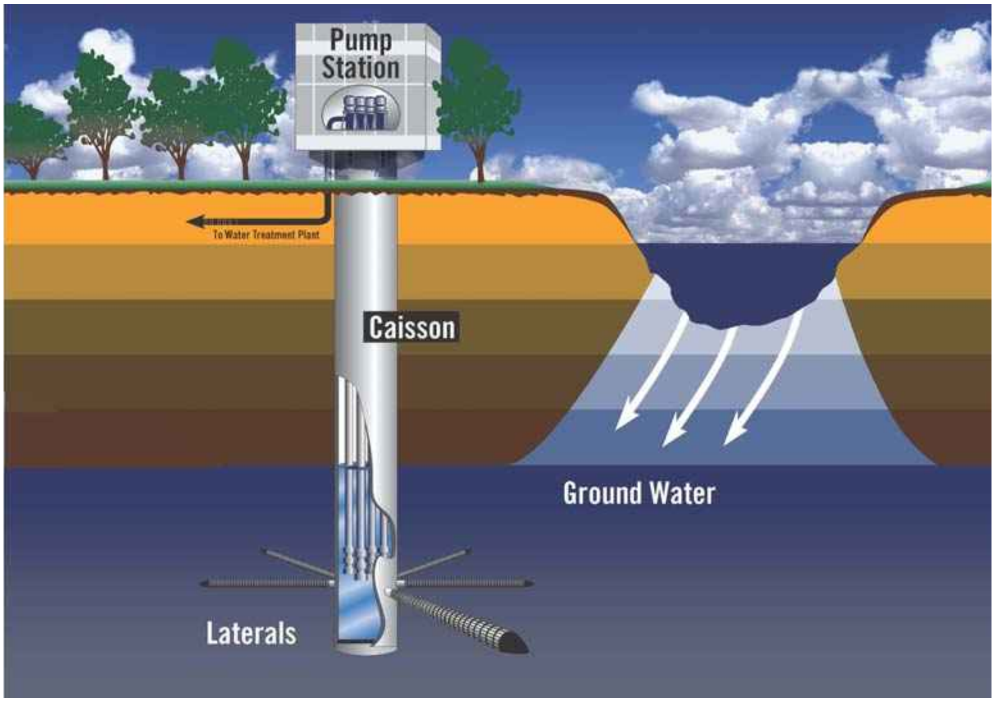
Management Components

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

[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

[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.

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

Section 8 Implementation and Monitoring Plans

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

[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										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.

Antea Group, 2011. Site Status Report. Fourth Quarter 2010 - 76 Service Station No. 255385 - 34131 Doheny Park Road Capistrano Beach, California USA - OCHCA Case No. 89UT007 Antea Group Project No. 140255385. January 30, 2011.

Arcadis. 2011. BP West Coast Products, LLC. Quarterly Monitoring Report. First Quarter 2011. April 6, 2011. 34342 Pacific Coast Highway, Dana Point, California.

California Natural Diversity Database (CNDDB), 2011. *http://www.dfg.ca.gov/biogeodata/cnddb/. Accessed February 2011.*

California Native Plant Society (CNPS) Electronic Database, 2011. *http://www.rareplants.cnps.org/. Accessed February 2011*

California Regional Water Quality Control Board –San Diego Region (Regional Board), 1995. Water Quality Control Plan for the San Diego Basin (9). September 8, 1994 (with amendment effective on or before April 4, 2011).

Camp Dresser & McKee Inc (CDM). 1987. Task 5 – Field Program Sampling/Quality Assurance Plan for the San Juan Creek Basin Groundwater Management Plan. Updated February 1987.

Cardno ERI. 2011a. Interim Remedial Action Plan Former Exxon Station 74816 34295 Doheny Park Road Capistrano Beach, California OCHCA Case No. 99UT010. May 10, 2011.

Cardno ERI. 2011b. Second Quarter 2011 Groundwater Monitoring and Status Report (April 21, 2011 through May 23, 2011) Former Exxon Station 74816 34295 Doheny Park Road, Capistrano Beach, California OCHCA Case No. 99UT010; Global ID No. T0605902575. July 7, 2011.

Converse Environmental West. 1993. Report of Additional Subsurface Characterization, Chevron Service Station No. 9-3417, 32001 Camino Capistrano, San Juan Capistrano, California. CEW Project No. 91-82-123-04. May 26, 1993.

County of Orange, 2006. South Orange county Integrated Regional Water Management Plan. May 2006

Delta Consultants. 2010. Workplan for Additional Groundwater Investigation, 76 Service Station No. 2705676, 27164 Ortega Highway San Juan Capistrano, California, Case ID No. 98UT066, Global ID No: TO605902561. May 5, 2010.

Department of Water Resources (DWR). 1971. Hydrologic Region South Coast San Juan Valley Groundwater Basin. Bulletin No. 118. Updated February 2004.

Department of Water Resources (DWR). 1972. Planned Utilization of Water Resources in the San Juan Creek Basin Area. Bulletin No. 104-7. June 1972.

Department of Water Resources (DWR, 2010). The State Water Project Delivery Reliability Report 2009, 139 pages, http://baydeltaoffice.water.ca.gov/swpreliability/Reliability2010final101210.pdf

Environmental Resolutions, Inc., 2009. Request for Case Closure Report. Mobil Station 18372. 33571 Del Obispo Street, Dana Point, California. Prepared for ExxonMobil Oil Corporation. R101331114.R05. OCHCA Case No. 86UT134. March 25, 2010.

Freeze, Allan R., Cherry, John A. (Freeze and Cherry) 1979. Groundwater.

Frey Environmental, Inc. 2005. On- and Off-Site Subsurface Investigation – Ultramar/San Juan Service - 26572 Junipero Serra Road – San Juan Capistrano, California (OCHCA Case #98UT36, Geotracker Global ID T0605902555). Prepared for Adam Enterprises, Inc. August 5, 2005.

Geoscience Support Services, 2010. Requested available data. December 2010.

Geosceince Support Services, 2013. 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 for the Municipal Water District of Orange County.

GeoTechnical Consultants, Inc (GTC). 2001. Preliminary Well Design and Site Selection Report - Domestic, Non-Domestic and Brackish Water Wells For the Capistrano Valley Water District. June, 2001.

Holguin, Fahan & Associates, Inc. (HFA). 2011a. Fourth Quarter 2010 Groundwater Monitoring Progress Report for Chevron Service Station #9-3417, 32001 Camino Capistrano, San Juan Capistrano, California (CRWQCB-SDR Case #9UT1351, GeoTracker Site ID #T0605902379:bpulver). January 28, 2011.

Holguin, Fahan & Associates, Inc. (HFA). 2011b. Fourth Quarter 2010 Groundwater Monitoring Progress Report for Chevron Service Station #9-8719, 26988 Ortega Highway, San Juan Capistrano, California (CRWQCB-SDR Case #9UT3039, GeoTracker Site ID #T0605902510:bpulver). January 28, 2011.

Holguin, Fahan & Associates, Inc. (HFA). 2010. Comprehensive Site Assessment Report for Chevron Service Station #9-8719, 26988 Ortega Highway San Juan Capistrano, California (CRWQCB-SDR #9UT3039, GeoTracker Site ID #TO6059025:bpulver). December 20, 2010.

Intergovernmental Panel on Climate Change (IPCC), 2000, Emissions Scenarios, Summary for Policymakers, A special Report of IPCC Working Group III.

Maurer et al, 2007. (http://gdo-dcp.ucllnl.org /downscaled_cmip3_projections)

Metropolitan Water District of Southern California (MWDSC), 2007. Groundwater Basin Reports – Orange County. Chapter Four Orange County Basins – San Juan Basin, September 2007.

Miller Brooks Environmental, Inc. 2006. Summary of Additional Site Assessment Activities. Former Shell Service Station 27101 Ortega Highway San Juan Capistrano, California. VCEHD File #C01024. January 18, 2006.

National Center for Atmospheric Research (http://data.eol.ucar.edu/codiac/dss/id=21.093

NBS/Lowry, 1994. San Juan Basin Groundwater Management and Facility Plan. May 1994.

NBS Lowry, 1994. San Juan Basin, Authority San Juan Basin Groundwater Study, Available Data. July 1994.

Orange County Health Care Agency. 2006. Case Closure Summary Leaking Underground Fuel Tank Program. April 20, 2006.

Orange County Public Works. 2004. General Plan 2005. June, 2005.

PACE, 2008. Hydrology Study - San Juan Creek Watershed Hydrology Study. Prepared for County of Orange. Updated August 2008.

Santa Margarita Water District (SMWD), 2010. 2010 Urban Water Management Plan. June 2011.

Stetson Engineering Inc. / Boyle Engineering Corporation (Stetson/Boyle), 1998. Availability of Unappropriated Water San Juan Creek Basin. Prepared for San Juan Basin Authority. November 1998.

TRC. 2006. Additional Site Assessment Report, 76 Station 5425, 27164 Ortega Highway San Juan Capistrano, California, OCHCA Case # 98UT66, TRC Project No. 200593. July 17, 2006.

URS. 2011. Quarterly Status Report. October through December 2010. 76 Station 7329 – 34306 Pacific Coast Highway Dana Point, California. OCHCA CASE #99UT015. Global ID: T0605902573 January 26, 2011.

Wildermuth Environmental, Inc (WEI). 1999. Arroyo Trabuco Water Supply Study: Source Water Determination. Prepared for the Santa Margarita Water District. May 1999.

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 addit ional 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.)

<u>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</u>. (*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, <u>the City lacks an independent right to draw water from the Basin</u> 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." <u>An agreement not to challenge is not equivalent to a right to take</u>. 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

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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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

Da

Dear ~~Dan~~,

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.

<u>Basin Yield.</u> 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

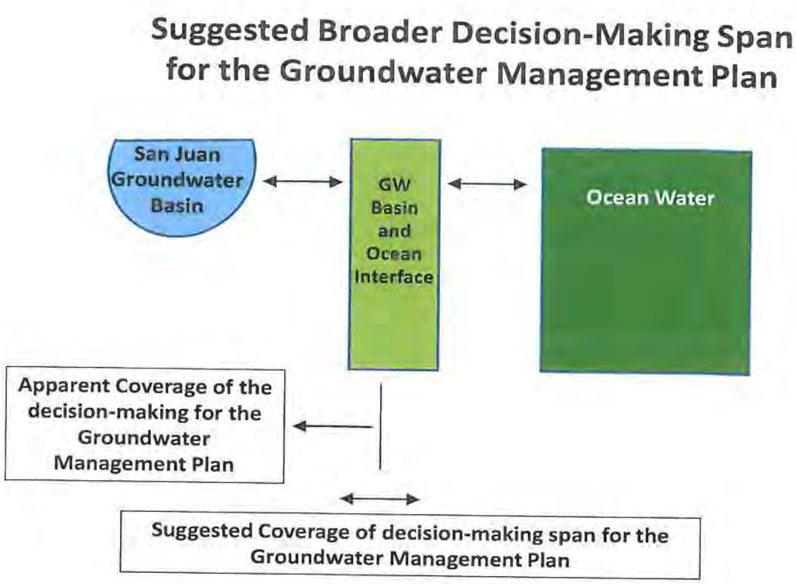
(1) Includes a low level of seawater intrusion of approximately 300 to 400 afy (needs confirmation)

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

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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

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WILDERMUTH™
ENVIRONMENTAL INC.

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	Mark J. Wildermuth, PE
Supervising Scientist	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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APPENDIX F

2020 Adaptive Pumping Management Plan Technical Memorandum

Technical Memorandum

To:	San Juan Basin Authority Attn: Norris Brandt, Administrator
From:	Mike Blazevic, PG, CHG Supervising Hydrogeologist Samantha Adams, Principal Scientist
Date:	May 6, 2020
Subject:	Recommended 2020 Adaptive Pumping Management Plan

Summary

The recommended 2020 Adaptive Pumping Management plan for the Stonehill and Inland management zones is based on the most up-to-date understanding of the hydrogeologic conceptual model and current climatic, groundwater level, and groundwater quality conditions in the San Juan Basin. **Based on these conditions, the initial 2020 pumping allocation may be set at the maximum limits allowed under existing agreements for wells in the Stonehill and Inland management zones.** The 2020 pumping allocation is as follows:

- 1,300 acre-feet per year for the South Coast Water District within the Stonehill management zone.
- 6,150 acre-feet per year for the City of San Juan Capistrano within the Inland management zone (up to 5,800 acre-feet per year at the Alipaz well field plus the Tirador well and up to 350 acre-feet per year at CVWD-5A and South Cooks on behalf of the San Juan Hills Golf Club).

In addition, the 2020 Adaptive Pumping Management plan includes criteria for adjusting pumping based on changing conditions in the San Juan Basin observed through monthly monitoring protocol. The Stonehill management zone's monitoring plan is documented on **pages 17 and 18**, and the Inland management zone's monitoring plan is documented on **pages 18 and 19**.

This document also recommends a supplemental monitoring and testing program for the 2020 Adaptive Pumping Management plan: passive aquifer testing (**page 19**). Another testing program: tracer testing (**pages 19 and 20**), is also discussed in this document. The information derived from tracer testing could support the development of future Adaptive Pumping Management plans.

The recommended 2020 Adaptive Pumping Management plan has been reviewed by the San Juan Basin Authority's Technical Advisory Group, and their comments have been incorporated into this technical memorandum.

Introduction

Pursuant to the recommendations of the 2014 San Juan Basin Groundwater and Facilities Management Plan[1] (SJBGFMP), the San Juan Basin Authority (Authority) directed Wildermuth Environmental, Inc. (WEI) to develop an Adaptive Pumping Management (APM) plan to assist it in the annual allocation and management of groundwater pumping to ensure compliance with its water rights permit for the diversion and use of water in the San Juan Basin (Basin). The first APM plan, the 2016 APM plan,[2] was adopted by the Authority in August 2016. The APM plan is updated each April, after most of the rainy season has passed, to define an initial pumping allocation for the subsequent 12-month period (May to April), based on current Basin conditions. The APM plan also includes a monitoring and reporting program to support adjustments to the initial allocation, if appropriate, based on changes in Basin conditions. This technical memorandum defines the recommended 2020 APM plan for the period of May 2020 to April 2021.

Background on Permit 21074 and the Determination of Water Available for Pumping

Groundwater in the Basin is regulated by the State Water Resources Control Board (State Board) as flow of an underground stream. As such, the Authority holds a *Permit for Diversion and Use of Water* (Permit 21074) that regulates its extractions (pumping) from the Basin. Permit 21074 was issued by the State Board in October 2000 and amended in October 2011. Under Permit 21074, the Authority may extract up to 8,026 acre-feet per year (afy), subject to various terms and conditions. The conditions that limit pumping rights allocated by Permit 21074 include, but are not limited to:

> **Groundwater storage**. Pumping must be managed to ensure that the cumulative pumping by all producers does not decrease the volume of water in storage in the Basin to less than 50 percent of full capacity.
>
> **Water quality**. Pumping must be managed to ensure that water quality degradation that would cause injury to the reasonable and beneficial uses of water recognized for the San Juan Creek Watershed in the Water Quality Control Plan for the San Diego Basin (Basin Plan) does not occur—the Authority interprets this condition to specifically ensure that

[1] WEI. (2013). *San Juan Basin Groundwater and Facilities Management Plan*. Prepared for the San Juan Basin Authority. November 2013. Available at: http://www.sjbauthority.com/programs.html#1

[2] WEI. (2016). *San Juan Basin 2016 Adaptive Pumping Management (APM) Plan*. Prepared for the San Juan Basin Authority. August 30, 2016. http://sjbauthority.com/assets/downloads/20160830_APM_Memo.pdf

pumping does not result in increased chloride and total dissolved solids (TDS) concentrations, resulting from seawater intrusion.

Riparian vegetation. Pumping must be managed to ensure that riparian vegetation along San Juan Creek in the reach between Interstate 5 and Ortega Highway is not impacted.

Currently, the City of San Juan Capistrano (City) is the only member of the Authority pumping water under Permit 21074, and it is doing so pursuant to the October 2002 *Project Implementation Agreement for the San Juan Basin Desalter Project.*[3] Groundwater pumped pursuant to Permit 21074 is treated at the City's Groundwater Recovery Plant (GWRP). The agreement allows the City to produce up to 5,800 afy of the Authority's water right.

The South Coast Water District (SCWD) also holds a permit to divert and use water in the Basin. Permit 21138 was issued by the State Board in December 2002 and amended in July 2012. Under amended Permit 21138, the SCWD may extract up to 1,300 afy, subject to various terms and conditions that are similar to those of Permit 21074 (excluding requirements to protect riparian vegetation between Interstate 5 and Ortega Highway). Groundwater pumped pursuant to Permit 21138 is treated at the SCWD's Groundwater Recovery Facility (GRF).

In 1998, prior to the issuance of Permits 21074 and 21138, the Authority and the SCWD (successor to the Capistrano Beach Water District) entered into an agreement that settled their protests on each other's applications to appropriate water.[4] Pursuant to the 1998 agreement, the Authority serves as the "Basin Manager" responsible for annually determining the amounts of "available safe yield" that it and the SCWD can pump pursuant to their water rights. Once determined, the water available for pumping is allocated as follows:

- 80 percent to the Authority, up to a maximum of 12,500 afy
- 20 percent to the SCWD, up to a maximum of 1,300 afy[5]

The Authority established the "Basin Management Committee," to perform the monitoring activities required to support compliance with the water rights permits, which subsequently developed a comprehensive monitoring program and began implementing it in 2004. Today, the Authority Board of Directors serves as the Committee. In 2010, the Authority began developing the SJBGFMP to improve Basin operations and management. The SJBGFMP recommended, as a first step, the development and implementation of an APM program that would enable the Authority to annually determine the water available for pumping based on the latest hydrogeologic characterization and current Basin conditions. To collect the data needed to support the APM program development, the Authority began implementing an expanded

[3] The implementation agreement is available at http://www.sjbauthority.com/programs/project-committee.html; once at the site, click on the link for Project Committee #4.

[4] *Protest Settlement Agreement Between San Juan Basin Authority and Capistrano Beach Water District*. Dated March 1, 1998. Available at http://www.sjbauthority.com/programs/project-committee.html; once at the site, click on the link for Project Committee #10.

[5] Note that the SCWD's permit limit of 1,300 afy is about 18 percent of the total rights of 7,100 afy (5,800 + 1,300) that can currently be allocated.

groundwater monitoring program in 2013. The objectives of the expanded groundwater monitoring program were to (1) collect baseline groundwater quality and groundwater level data that could be used to define metrics for monitoring the occurrence of seawater intrusion, and (2) expand groundwater level monitoring to improve annual characterizations of groundwater storage. Data collected by cooperating agencies (including members of the Authority) and provided to the Authority continue to be used to support these management efforts. Figure 1 shows the location of all sites in the San Juan Basin where data is collected to support the Authority's Basin management efforts, including those referenced in this report.

The 2016 APM plan documented a technical methodology for determining the pumping allocation, a monitoring and reporting program to continually evaluate Basin conditions, and criteria for adjusting an initial allocation based on Basin conditions. Since the development of the 2016 APM plan, the understanding of the Basin's hydrogeology has continually improved, and the technical methodology for setting the annual APM allocation has evolved accordingly. Though the technical methodology to establish the initial allocation may change from year to year, the basic framework of the plan remains the same: an initial pumping allocation is established in April, but it can be adapted based on changes in Basin conditions, observed through monthly monitoring protocols.

Updated Hydrogeologic Conceptual Model of the Lower San Juan Basin

This section summarizes the most up-to-date understanding of the hydrogeologic conceptual model of the Basin, based on the recently completed Bedrock Barrier Investigation (Investigation)[6,7] and subsequent passive aquifer testing. This discussion focuses on the area shown in Figure 2.

Test Hole Drilling and Monitoring Well Completions

In early 2017, during investigations performed in support of the San Juan Watershed Project,[8] WEI identified an unmapped bedrock-high located approximately between the City and SCWD well fields and hypothesized that the bedrock-high acts, at least partially, as an impediment to groundwater flow. It was previously assumed that the aquifers from which the City and SCWD pumped groundwater were hydraulically connected and that pumping operations by the City and SCWD impacted each other and therefore had to be managed together. For example, in past APM plans (2016 and 2017), both the City and SCWD pumping allocations were managed (reduced) to protect against seawater intrusion when groundwater levels declined along the coast. The

[6] WEI. (2018). *Summary of Work Completed and Results of the Bedrock Barrier Investigation*. Prepared for the San Juan Basin Authority. April 2018.

[7] WEI. (2019). *Drilling, Construction, and Development of the SJBA Wells: SJC18 MW-9 and SJC18 MW-10*. Prepared for the San Juan Basin Authority. April 2019.

[8] The San Juan Watershed Project is the follow-on work to design and implement the groundwater management facilities defined in the San Juan Basin Optimization Program, an engineering study to refine the management alternatives defined in the SJBGFMP. The San Juan Watershed Project is being implemented by the Santa Margarita Water District and the SCWD.

existence of the bedrock-high has potential implications for how pumping in the Basin is managed to comply with the Authority and SCWD water rights permits. In other words, if the bedrock-high, or other hydrogeologic features, prove to limit interaction between the two areas from which the City and SCWD produce groundwater, pumping could be managed separately to comply with the water rights permits.

In September 2017, the Authority authorized WEI to perform an Investigation to determine the extent of the bedrock-high and its impact on the groundwater flow system. Figure 2 shows the Investigation study area. The Investigation was completed in two phases. The first phase of the Investigation consisted of the exploratory drilling and logging of nine test holes within the study area to characterize the lateral extent, depth, and lithologic characteristics of the hypothesized bedrock-high, and to determine if the bedrock-high acts as an impediment to groundwater flow between the City and SCWD well fields. The second phase of the Investigation consisted of drilling and constructing two monitoring wells east of San Juan Creek—SJC18 MW-9 and SJC18 MW-10 (see Figure 2)—to further characterize the hydrogeology east of San Juan Creek. The two monitoring wells have been equipped with pressure transducer, temperature, and electrical conductivity data loggers that continuously record data. The data collected from the two monitoring wells are currently being used to help understand the groundwater flow system east of San Juan Creek.

Lithologic data collected as part of the Investigation were analyzed and used to develop several hydrostratigraphic[9] cross-sections that illustrate the subsurface lithology and to update the Basin's bottom of aquifer geometry. Appendix A contains the hydrostratigraphic cross-sections, and Figure 2 shows the cross-section profile locations. The hydrostratigraphic cross-sections show:

1. the bottom of the aquifer geometry as understood before the Investigation, as characterized by Geoscience Support Services, Inc.[10];
2. updated bottom of the aquifer geometry based on new drilling results;
3. subsurface lithology at boreholes, color-coded based on the lithology and general hydraulic conductivities of the materials;
4. well-screen intervals, if applicable; and,
5. the locations and depths of the Orange County Public Works (OCPW) sheet-piles

The bedrock-high extends from about Via Del Rey south to Calle Jardin (about 1,500 feet) and from the western boundary of the Basin to the eastern levee of San Juan Creek (about 2,300 feet). The general extent of the bedrock-high is shown in Figure 2 as a dashed polygon. For a

[9] A hydrostratigraphic unit is a geologic formation, or part of a formation, or a group of formations with similar hydrologic characteristics or properties (e.g. hydraulic conductivity or permeability) relating to groundwater flow.

[10] Geoscience Support Services (2013). *South Orange County Ocean Desalination Project, Phase 3 Extended Pumping and Pilot Plant Testing, Volume 3 – San Juan Basin Regional Watershed and Groundwater Models.* Prepared for the Municipal Water District of Orange County.

more detailed discussion on the hydrogeology of the Basin to the west and east of the San Juan Creek eastern levee, see footnotes 8 and 9 referenced in this document.

Figure 3 shows the depth to the bottom of the aquifer[11] and illustrates the thickness of the aquifer in the Investigation area in plan-view. Figure 3 also shows the approximate extent of the bedrock-high as characterized based on available data. The Investigation determined that the bedrock-high west of the San Juan Creek eastern levee is likely considered to be an impediment to groundwater flow between the City and SCWD well fields. For example, if groundwater levels north of the bedrock-high are deeper than about 13 ft-bgs (an elevation of about 42 feet-msl), groundwater will not be able to flow over the bedrock-high. Instead, groundwater will follow a tortuous flow path around the bedrock-high.

Aquifer Testing

To better understand the groundwater flow system east of the San Juan Creek eastern levee, aquifer tests were conducted at the SCWD's Stonehill well and the City's Kinoshita well in fall 2018. The objectives of the aquifer tests were to collect data and information to support the characterization of the Basin's aquifer and groundwater flow system, update the aquifer's hydraulic properties, and assess if any groundwater no-flow boundaries (i.e. Basin boundaries, bedrock-high, and/or the OCPW sheet-piles) are impacting groundwater flow to the City and SCWD well fields. The aquifer tests, methods, and results are discussed in the well completion report for SJC18 MW-9 and SJC18 MW-10 (see footnote 9). Based on the aquifer tests results, the following key observations were derived regarding the Basin's groundwater flow system and the hydraulic connection between the City and SCWD well fields:

- During the Kinoshita well aquifer test, the cone of depression centered at the well did not extend much further beyond SJC18 MW-10 or reach the northern extent of the bedrock-high mapped west of the San Juan Creek western levee. In other words, SJC18 MW-10 is located within the Kinoshita well's cone of influence.
- During the Stonehill well aquifer test, the cone of depression centered at the well did not extend much further beyond SCWD MW-2S or reach the southern extent of the bedrock-high. Likewise, the cone of depression did not extend to SJC18 MW-9 on the east side of San Juan Creek. In other words, SCWD MW-2S is located within the Stonehill well's cone of influence, but SJC18 MW-9 is not.

There may be several reasons why groundwater levels in SJC18 MW-9 did not respond to the Stonehill well aquifer test. For example, the 24-hour aquifer test period may not have been long enough to stress the system, and a longer pumping period, higher production rate, and/or different aquifer conditions (i.e. lower groundwater elevations) may have been needed to stress the aquifer-system and produce a groundwater level response in SJC18 MW-9. The lack of a

[11] The depth to the bottom of the aquifer for the Investigation area shown in Figure 3 was developed by adjusting the prior bottom of the aquifer contours developed by GSSI, based on information developed during the Investigation. Both the WEI- and GSSI-estimated bottom of aquifer elevations are shown in the hydrostratigraphic cross-sections in Appendix A.

groundwater level response in SJC18 MW-9 could also indicate that some type of hydraulic barrier[12] exists in the aquifer-system between the Stonehill well and SJC18 MW-9. Such a hydraulic barrier could be represented as a zone of low hydraulic conductivity materials or some type of ridge or escarpment in the Capistrano Formation that is acting as a groundwater flow impediment between the Stonehill well and SJC18 MW-9. The general area where the hydraulic barrier is hypothesized to occur is shown in Figure 3 as a red dashed line.

Groundwater-flow Gradients

The groundwater-flow gradients, calculated from groundwater level data currently available through the Authority's monitoring programs, are among the primary lines of evidence indicating a hydraulic barrier may exist between the Stonehill well[13] and SJC18 MW-9. Figure 4 is a hydrostratigraphic cross-section that extends from MWDOC MW-2M to SJC18 MW-10. Figure 2 shows the location of this hydrostratigraphic cross-section (E-E'). Figure 4 illustrates graphically the groundwater-flow gradients between monitoring wells at the coast (MWDOC MW-2M) and monitoring wells east of San Juan Creek for three points in time: October 2018, March 2019, and March 2020.

The groundwater-flow gradients are expressed as a line representing the groundwater level elevation change between each pair of wells. Expressed as a value (percentage), the groundwater-flow gradient is equal to the difference in groundwater level elevation at two locations divided by the distance between these two locations and is directly proportional to the amount of water flowing across the two locations. The table below summarizes the groundwater-flow gradients for the monitoring wells shown in Figure 4 at the same three points in time. The value is positive when the groundwater-flow gradient between two points is seaward and the value is negative when the groundwater-flow gradient is landward. When the groundwater-flow gradient is zero, the slope of the water table is flat and the groundwater-flow between two points is considered to be stagnant.

Monitoring Wells	Groundwater flow Gradients		
	October 2018	March 2019	March 2020
SJC18 MW-10 to SJC18 MW-9	-0.03%	0.22%	0.23%
SJC18 MW-9 to SCWD MW-1S	**1.3%**	**0.82%**	**1.14%**
SJC18 MW-9 to SCWD MW-4S	**0.53%**	**0.50%**	**0.61%**
SCWD MW-4S to MWDOC MW-2M	0%	0.19%	0.01%

As shown in Figure 4 and the above table, the groundwater-flow gradients between SJC18 MW-9 and SCWD MW-1S and SJC18 MW-9 and SCWD MW-4S are greater than the other well pairs and

[12] A general term referring to modifications of a groundwater flow system to restrict or impede movement of groundwater.

[13] The groundwater level elevations measured at SCWD MW-1S (adjacent to the Stonehill well) are used as a proxy for the groundwater level elevations at the Stonehill well to assess the groundwater-flow gradients between the Stonehill well and SJC18 MW-9.

are higher when the Stonehill well is continuously pumped (i.e. March 2020) versus when not pumped (i.e. March 2019). This indicates: (1) there is likely some type of hydraulic barrier in the aquifer-system located between the Stonehill well and SJC18 MW-9, (2) the hydraulic barrier is likely controlling the shape and upgradient extent of the Stonehill well's cone of depression, and (3) the lack of groundwater-flow from upgradient causes the well's cone of influence to preferentially expand towards the coast and not inland towards SJC18 MW-9. This supports the hypotheses that pumping from the Stonehill well may not impact groundwater levels east of the San Juan Creek eastern levee between the Stonehill well and SJC18 MW-9 and that pumping from the Stonehill well hydraulically prevents high-chloride waters from flowing upgradient towards the City's well field.

Passive Aquifer Testing

In the SJC18 MW-9 and -10 well completion report and in the 2019 APM plan, WEI recommended performing passive aquifer testing[14] to further refine the characterization of the groundwater flow system to the east of San Juan Creek and to support the development of future adaptive pumping plans. The Authority's passive aquifer testing program began in June 2018 and consisted of collecting and analyzing high-frequency measurements of the groundwater level response to fluctuations in recharge and discharge from natural (i.e. precipitation-induced changes in streamflow or rising groundwater) and anthropogenic activities (i.e. changes in groundwater pumping) over a long period of time.

Figure 5 is a time-history chart that shows groundwater level responses at four monitoring wells (SCWD MW-4S, SCWD MW-2S, SJC18 MW-9, and SJC18 MW-10) to pumping from the Stonehill and Alipaz well fields between June 2018 and March 2020. Also shown are daily precipitation and streamflow measured at the La Novia station over the same time-period. The main observations and interpretations from this chart are:

- During summer months (June to August) and fall months (September to November), groundwater levels at each monitoring well show a general declining trend in response to drier climatic conditions and increased pumping. During winter months (December to February) and spring months (March to May), groundwater levels at each monitoring well show an increasing trend in response to wetter climatic conditions and decreased pumping.
- The groundwater level response at monitoring well SJC18 MW-9 shows a more muted response to the above noted seasonal groundwater level fluctuations compared to the groundwater level response at the other monitoring wells.
- Groundwater levels at monitoring wells SCWD MW-4S and -2S respond to immediate (instantaneous) and short-term (about one week) changes in pumping at the Stonehill well. Groundwater levels at these two wells show distinct drawdown and recovery curves in response to the Stonehill well turning on and off.

[14] Passive aquifer testing involves collecting production and water level data to observe the basin response to the intermittent cessation of pumping (for a minimum of four hours) after production wells have pumped continuously for at least 30 days.

- Groundwater levels at monitoring well SJC18 MW-10 respond to immediate (instantaneous) and short-term (about one week) changes in pumping at the Alipaz well field. Groundwater levels at this well show distinct drawdown and recovery curves in response to the Alipaz well field turning on and off. Groundwater levels at monitoring well SJC18 MW-9 do not appear to respond to immediate (instantaneous) and short-term (about one week) changes in pumping at either the Stonehill well or Alipaz well field.

The "hydraulic barrier" observations are most notable when the Stonehill well was shutdown between December 15, 2018 and May 9, 2019. When it shutdown, there was an immediate groundwater level recovery response at SCWD MW-4S and -2S but not at SJC18 MW-9. Conversely, on May 9, 2019, when the Stonehill well resumed pumping an immediate and persistent groundwater level drawdown response was observed at SCWD MW-4S and -2S, but not at SJC18 MW-9. This suggests that the Stonehill well produces some groundwater from a small portion of the aquifer immediately upgradient of the pumping well, but it mainly produces groundwater from the downgradient aquifer(s). It also indicates that other areas contributing recharge to the Stonehill well (surface water recharge and groundwater-flow upgradient of the Stonehill well) are limited. Taken collectively, these observations indicate the potential existence of a hydraulic barrier between the Stonehill well and SJC18 MW-9.

Implications for Adaptive Pumping Management

The bedrock-high west of the San Juan Creek eastern levee and the potential hydraulic barrier between the Stonehill well and SJC18 MW-9 suggest that there may be two distinct sub-basins in the lower Basin that are connected primarily by surface water flow in San Juan Creek. Based on the updated hydrogeologic conceptual model discussed above and for the purpose of complying with water rights permits, pumping in the two sub-basin areas should be managed separately. The downstream sub-basin is referred to as the Stonehill management zone and the upstream sub-basin is referred to as the Inland management zone.

The recommended 2020 APM is based on this updated and current understanding of the Basin's hydrogeologic conditions, and the pumping allocation and methodology for adjusting the allocation for each management zone are based on current Basin conditions (Spring 2020). The hydrogeologic criteria for managing pumping to comply with the water rights permits are described below.

Criteria for Managing Pumping in the Stonehill Management Zone

Figure 6 is a time-history chart that shows the groundwater level response at SCWD MW-4S and MWDOC MW-2M to pumping at the Stonehill well. Figure 6 also shows the theoretical optimal operating range of groundwater elevations that would need to be maintained to prevent seawater intrusion (lower limit) and the rejection of groundwater recharge (upper limit). The lower limit elevation of 5.1 feet above mean sea level was computed based on the Ghyben-Herzberg principal and is intended to represent the elevation at which the freshwater/seawater interface would terminate downgradient of SCWD MW-4S, thus protecting the Basin from seawater intrusion. If, as described in the discussion of the hydrogeologic conceptual model, the

Stonehill well predominantly pumps groundwater from the downgradient aquifers, groundwater levels at downgradient SCWD MW-4S would need to be maintained at elevations that prevent the occurrence of seawater intrusion. Data collected since 2017 suggest that this is not a practical management criterion. For example, under this criterion, the SCWD would have been required to cease pumping just six months after resuming operations in February 2017 under "full" Basin conditions.

In order to make practical beneficial use of the groundwater, the SCWD needs to be able to pump more consistently than six months at a time. Therefore, developing a pumping plan for the Stonehill management zone based on criteria that completely prevents seawater intrusion is not practical. However, if the management criterion is defined to manage pumping to "not cause injury to the reasonable and beneficial uses of water designated in the Basin Plan," as is the intention of the water rights permits, a practical APM methodology can be developed that allows some increase in TDS and chloride concentrations and less frequent periods of non-operation.

The designated beneficial uses of the Lower San Juan Hydrologic Sub-Area are municipal water supply, agricultural water supply, and industrial water supply.[15] From a beneficial use standpoint, the water quality of the Basin (in both the Stonehill and Inland management zones) is naturally high in TDS, and in fact, absent the GRF and GWRP, groundwater cannot be put to beneficial use—the existence of these treatment plants enables the beneficial use of the water and creates space for low-TDS stormwater to recharge. Thus, allowing for some increases in TDS and chloride concentrations in the Stonehill management zone does not constitute "degradation that would cause injury to the reasonable and beneficial uses of water designated in the Basin Plan."

Currently, the SCWD is the only entity using groundwater in the Stonehill management zone, and for this reason, pumping should be managed to protect the SCWD's beneficial use. This translates to managing pumping such that TDS and chloride concentrations do not exceed the concentrations the GRF can successfully treat to meet potable municipal supply standards. This requires a method that considers:

1. the duration of time between the onset of conditions conducive to seawater intrusion and when TDS and chloride concentrations increase at a sentinel monitoring well;
2. the duration of time from which the occurrence of seawater intrusion is observed at a sentinel monitoring well and its subsequent occurrence at the SCWD well field;
3. whether groundwater quality can generally return to pre-intrusion conditions; and,
4. TDS and/or chloride concentration limits that protect the SCWD's beneficial use.

Collectively, the time durations defined in (1) and (2) above are referred to herein as "lag times." An analysis of the data available to characterize these lag times, based on the one observed occurrence of seawater intrusion for the period of record for the coastal monitoring wells, is

[15] See chapter 2 of the San Diego Basin Plan:
https://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/docs/update082812/Chpt_2_2012.pdf

documented in the 2018 APM plan.[16] The 2014 occurrence of seawater intrusion was the result of both pumping and streambed recharge conditions: pumping was occurring near design rates, and there was limited streambed recharge over multiple years due to extreme dry climate conditions. These extreme conditions suggest that the lag times estimated based on this event are representative of worst case (fastest) lag times. The main conclusions from the analysis presented in the 2018 APM Plan are as follows:

- It took about 22 months between the onset of conditions conducive to seawater intrusion —when the groundwater-flow gradient reversed from seaward to landward between SCWD MW-4S and MWDOC MW-2M[17] in July 2012—and when TDS and chloride concentrations increased at SCWD MW-4S in April 2014. Figure 6 illustrates this time lag by comparing the groundwater level time history at SCWD MW-4S and MWDOC MW-2M with the time history of chloride concentrations measured at SCWD MW-4S.
- It took about five months for the TDS and chloride concentration increases observed at SCWD MW-4S to be observed at upgradient SJBA MW-01S (Costco well) and about seven months to be observed at further upgradient SCWD MW-1S.
- Following a seawater intrusion event, TDS and chloride concentrations can generally return to pre-intrusion concentrations with the recovery time dependent on climate conditions—recovery will occur faster in wet periods than dry periods.

The chloride concentration time history shown in Figure 6 demonstrates that the increase in chloride concentrations can generally be reversed: it is not permanent. Chloride concentrations at both SCWD MW-4S and SCWD MW-1S returned to pre-intrusion concentrations following a wet period. However, at the Costco well – which is located between SCWD MW-4S and -1S and further east of San Juan Creek, – chloride concentrations did not fully return to pre-intrusion concentrations. This is likely because there is less influence from streambed recharge and less circulation of groundwater in this area. A more detailed discussion of the chloride concentration trends observed at the Costco well is described in the section, "Chloride Concentrations in the Stonehill Management Zone."

Based on the lag time and water quality analysis, it is reasonable to allow TDS and chloride concentrations to increase in the Stonehill management zone until they approach the beneficial use limits defined by the SCWD. The limits have to be determined by the SCWD to accurately account for the specifics of plant operations and the goals for GRF product water to protect the SCWD's beneficial use. These limits are subject to refinement by the SCWD.

A preliminary TDS concentration limit of 3,500 mgl was defined by the SCWD to protect its beneficial use. This translates to an approximate chloride concentration limit of 1,000 mgl, as

[16] WEI. (2018). *San Juan Basin 2018 Adaptive Pumping Management (APM) Plan*. Prepared for the San Juan Basin Authority. May 30, 2018.

[17] When groundwater elevations at SCWD MW-4S are greater than those at MWDOC MW-2M, the groundwater-flow gradient is seaward, and when groundwater elevations at SCWD MW-4S are less than those at MWDOC MW-2M, the groundwater-flow gradient is landward.

estimated in the 2018 APM plan analysis. Thus, pumping would have to be reduced or curtailed once chloride concentrations approaching 1,000 mgl are estimated to imminently arrive at the Stonehill well. This occurrence can be estimated based on (1) the lag time (at least 22 months) once conditions of seawater intrusion are observed at SCWD MW-4S and continue to persist, and (2) the lag time (about five months) once the chloride concentration at SCWD MW-4S is 1,000 mgl.

In order to confirm and refine these estimated lag times, it will be necessary to continue pumping until the chloride and TDS concentrations measured at the Stonehill well reach 1,000 and 3,500 mgl, respectively. Although it is believed there likely is a hydraulic barrier between the City and SCWD well fields, additional safeguards should be included in the APM plan to ensure that any increase in TDS and chloride concentrations that occur in the Stonehill management zone do not have the ability to impact the Inland management zone. Based on analysis to date, one way for groundwater to potentially migrate upgradient into the Inland management zone is through the aquifer channel to the east of San Juan Creek, and this that can only occur if the groundwater-flow gradient (direction of flow) is landward. Thus, the APM monitoring program should regularly assess the groundwater-flow gradient to the east of San Juan Creek to ensure that groundwater cannot move landward beyond SJC18 MW-9.

Criteria for Managing Pumping in the Inland Management Zone

Based on the updated hydrogeologic conceptual model, pumping in the Inland management zone needs to be managed to: (1) protect riparian vegetation in the reach of San Juan Creek between I-5 and Ortega Highway (green shaded area on Figure 1), and (2) ensure that pumping does not decrease the volume of water in storage in the Basin to less than 50 percent of full capacity.

During the development of the 2016 APM plan, WEI collaborated with Glenn Lukos Associates (GLA), the Authority's Biologist of Record, to define groundwater level elevation thresholds that are protective of riparian habitat based on historical observed groundwater level elevations at three monitoring wells and riparian habitat conditions. The thresholds represent the minimum groundwater level elevation that can support riparian vegetation in the absence of precipitation and surface water flows and are generally about twenty feet below ground surface.[18]

Figure 7 is a time-history chart of pumping and groundwater level elevations in the riparian habitat area for January 2004 to April 2020 and shows the protective thresholds defined for the Authority's three monitoring wells in this area (SJBA MW-4, SJBA MW-5, and SJBA MW-6). To ensure these thresholds would be maintained, the 2016 APM plan also recommended that all Authority pumping pursuant to the plan be limited to the City's Alipaz well field, meaning that the City could not pump the allocation from its three production wells in the riparian habitat

[18] For a full discussion of the protective thresholds, refer to WEI. (2016). *San Juan Basin 2016 Adaptive Pumping Management (APM) Plan*. Prepared for the San Juan Basin Authority. August 30, 2016. http://sjbauthority.com/assets/downloads/20160830_APM_Memo.pdf

area—the Tirador, South Cooks, and CVWD-5A wells. The basis of this recommendation was twofold:

1. prior to the initiation of pumping at the South Cooks and CVWD-5A wells in 2011, the City's pumping was limited to the Tirador well, and groundwater level elevations were generally always above the protective thresholds; and,
2. groundwater modeling performed in support of the 2016 APM plan suggested that not pumping all three wells was required to guarantee that groundwater level elevations would remain at or above the protective thresholds.

As part of the 2018 APM plan, based on the results of the monitoring through March 2018, shown in Figure 7, which shows that the City's prior pumping at the Tirador well did not result in groundwater level elevations declining below the protective thresholds, WEI and GLA concluded that it is reasonable to allow some pumping in the riparian area, but that pumping should be limited to the Tirador well and the APM should include monitoring protocols to adjust pumping if groundwater levels decline below the protective thresholds. The pumping allocation would need to be incrementally adjusted from month-to-month to observe groundwater level responses to reduced production.

In 2019, the City informed the Authority that it needed to resume pumping at its South Cooks and CVWD-5A wells in the riparian habitat area in order to meet its obligations to provide water to the San Juan Hills Golf Club (SJHGC). The agreement between the City and the SJHGC calls for the City to deliver up to 350 afy, and the City generally expects deliveries to range between 220 and 350 afy. These deliveries are meant to supplement or replace pumping from the SJHGC's two production wells. The pumping rights are being exercised under the SJHGC's water rights permit 21142. The location of the SJHGC's production wells are shown in Figure 1. Although the criteria for pumping discussed above recommend limiting pumping in the riparian habitat area to the Tirador well, because the pumping volumes proposed by the City at the South Cooks and CVWD-5A wells are small and are substituting or replacing pumping that would otherwise occur at the adjacent SJHGC wells, the impacts to groundwater levels in the riparian habitat area are expected to be minimal.

The City has recently expressed interest in increasing pumping at the South Cooks and CVWD-5A wells beyond its obligations to provide water to the SJHGC. In a letter dated July 27, 2015, the Biologist of Record (GLA) recommended that resuming groundwater pumping in the riparian habitat area should be considered only if pumping does not result in the expansion of impacts to riparian vegetation and does not impede the long-term recovery of riparian habitat. In the same letter, GLA also recommended developing a sustainable groundwater pumping plan and establishing a series of monitoring protocols prior to and during pumping if the City pursues pumping from the South Cooks and CVWD-5A wells. Such a pumping and monitoring plan would need to be developed in consultation with GLA.

With regard to managing storage in the Basin, storage should continue to be assessed quarterly based on groundwater level monitoring to ensure that levels are not approaching 50 percent of full capacity.

Current Basin Conditions

This section summarizes the current Basin conditions that, in combination with the criteria for managing pumping in the Stonehill and Inland management zones, serve as the basis for the 2020 APM Plan.

Climate

The Authority reviews precipitation data measured at the Orange County's San Juan Capistrano Station at La Novia (Station 215) to characterize and understand historic as well as real-time and local precipitation trends. Table 1 summarizes the measured monthly and annual precipitation at Station 215. The period of record for this station is 1991 to present. Table 1 also shows summary statistics for the station's period of record and for water years (WY) 2005 through 2020[19] – the time period since pumping began pursuant to Permit 21074. Total precipitation in WY 2019 was 16.3 inches, about 13 inches greater than precipitation in the prior water year (WY 2018), about four inches higher than the average for the period of record (1991 to present), and about five inches higher than the average for the 2005 through 2019 period. Thus far, total precipitation in WY 2020, as of April 19, 2020, was 15.5 inches.

Figure 8 shows the cumulative precipitation by water year for the wettest, driest, average, previous, and current year at Station 215.[20] The average precipitation is about 12 inches per year and primarily occurs between the months of October and April. The driest year occurred in 2018, with a total precipitation of about 4 inches. The wettest year occurred in 2005, with a total precipitation of about 28 inches. WY 2019 was above average at about 16 inches. Precipitation Thus far in WY 2020, is just above the average precipitation recorded at Station 215, totaling 15.5 inches through April 19, 2020.

Figure 9 is a time-history chart of daily (cfs) and annual (af) streamflow in San Juan Creek at the La Novia and in Arroyo Trabuco stations by water year. The above average precipitation observed in WY 2019, in November and December 2019 and March 2020 contributed significant streamflow to San Juan Creek and Arroyo Trabuco. As of April 19, 2020, there was still measurable streamflow at both surface water stations.

Based on these conditions, the initial 2020 pumping allocation should be set at the maximum limit for both the Stonehill and Inland management zones.

[19] The water year is October 1 through September 30. Water year 2020 corresponds to the period from October 1, 2019 through September 30, 2020. For the purposes of the 2020 APM, total precipitation is reported through the end of March 2020.

[20] Note that the period of record for the La Novia station only extends back to 1984. However, due to the strong correlation between measured precipitation at this station and the annual watershed precipitation based on the PRISM dataset, an estimated historical record for the La Novia station can be extrapolated back to 1895.

Groundwater Levels

Coastal area. Figure 6 shows that as of the end of March 2020, the groundwater level at SCWD MW-4S is just above the lower limit of the theoretical optimal operating range, which is preventative of seawater intrusion. The groundwater level elevation at SCWD MW-4S is also just slightly above the groundwater level elevation at MWDOC MW-2M, which indicates that the groundwater flow-gradient is flat[21]; a flattened groundwater-flow gradient is not, by itself conducive to seawater instruction. Figure 4 illustrates this: the groundwater-flow gradient between SCWD MW-4S and MWDOC MW-2M was approximately 0.01% as of March 2020.

East of San Juan Creek. Figure 4 shows the groundwater-flow gradients from SJC18 MW-10 to MWDOC MW-2M. At the end of March 2020, all gradients were positive, indicating that the gradient of flow was seaward from the Inland management zone to the Stonehill management zone.

Riparian vegetation monitoring area. Figure 7 shows the time series of groundwater level elevations in the riparian vegetation monitoring area as observed at monitoring wells SJBA MW-4, -5, and -6. For each well, the 2016 APM groundwater elevation thresholds that are protective of riparian vegetation are shown as horizontal lines. As of the end of March 2020, the groundwater level elevations at SJBA MW-4, -5, and -6 were eleven, seven, and five feet above the protective threshold, respectively. There has been little to no change in groundwater level elevations in the riparian habitat monitoring area since March 2017. This is in large part due to the cessation of pumping in this area.

Basin-wide Levels and Storage. Figure 10 shows the time series of groundwater level elevations at selected wells from January 2005 through March 2020 in four areas of the Basin: the Stonehill management zone, the Alipaz well field, the San Juan Creek arm (riparian vegetation monitoring area), and the Arroyo Trabuco arm. For each area, the chart shows monthly groundwater pumping within the area and measured groundwater level elevations for the representative well. Also shown, as a horizontal line, is the elevation of the stream bottom near the representative wells; this is the elevation at which the Basin is considered to be 100 percent full at that location. This figure shows that groundwater level elevations across the Basin are close to or above the stream bottom elevation as of March 2020, indicating that the Basin is full.

Based on these four area assessments of groundwater level conditions across the Inland and Stonehill management zones, the Basin is near full, suggesting that the initial 2020 pumping allocations should be set at the maximum limits.

Chloride Concentrations in the Stonehill Management Zone

Figure 6 includes a time-history chart of the chloride concentration measured at SCWD MW-4S, SCWD MW-1S, Stonehill, and the Costco well since in 2010. As of March 26, 2020, the chloride concentration at SCWD MW-4S was 220 mgl, which is at the bottom range of observed

[21] A hydraulic gradient greater than -0.05% (a negative gradient indicates a landward gradient) and less than 0.05% (a positive gradient indicates a seaward gradient) is considered to be flat. Typical hydraulic gradients in California's basins and valleys range from 0.05% to 1% (Harter, 2003).

concentrations since water quality returned to pre-seawater intrusion conditions in March 2017 (220 to 430 mgl).

As of March 26, 2020, the chloride concentration at the Costco well was 1,600 mgl, which is higher than any other monitoring wells located adjacent to San Juan Creek (SCWD MW-1S and -4S) and higher than the maximum observed chloride concentration of 1,200 mgl at the Costco well during the seawater intrusion event in 2014. As previously discussed, chloride concentrations at the Costco well did not fully return to pre-seawater intrusion concentrations in 2017. One explanation may be that there is less influence from low-TDS streambed recharge and less circulation of groundwater near the Costco well. As such, it is possible that when groundwater-flow gradients are landward (i.e., summer 2014, summer 2018, and fall 2019, as shown on Figure 6) due to groundwater level declines from seasonal dry climatic conditions and consistent pumping from the Stonehill well, high-chloride seawater likely migrates landwards and preferentially towards the Costco well and the high-chloride seawater is then subsequently "cut-off" from the larger groundwater flow system. Based on available information, it is not possible to know if the high chloride concentrations currently observed are from a prior seawater intrusion event or representative of an active occurrence of seawater intrusion following a different preferential path than was observed in 2014. For reference, Figure 11 shows chloride concentrations from wells in the Stonehill management zone (including SJC18 MW-9) between January 2010 and March 2020. It is important to note that the chloride concentrations, variability, and overall increasing trend observed at the Costco well is not observed in any other wells in the Stonehill management zone. It is also important to note that the Costco well is a monitoring well, not a production well representing a beneficial use.

Based on the chloride concentration trends observed exclusively at the Costco well, the 2020 APM monitoring plan should include monthly sampling of the Stonehill well (when it is in operation) and monthly review of the continuously recorded electrical conductivity (EC) data from the data logger installed in the Costco well to asses and verify the chloride concentration trends described above and to ensure the Stonehill well doesn't exceed the beneficial use threshold defined by the SCWD.

Based on current groundwater quality conditions, the initial 2020 pumping allocation should be set at the maximum limit for the Stonehill management zone.

Recommended 2020 APM Plan: May 2020 to April 2021

This section summarizes the recommended 2020 APM plan for the Stonehill and Inland management zones based on the most up-to-date understanding of the hydrogeologic conceptual model of the Basin, criteria for managing pumping in the Stonehill and Inland management zones, and current Basin conditions (climate, groundwater levels, and groundwater quality). Both management plans will be complemented with the passive aquifer testing program recommended as part of this APM plan.

APM Plan for the Stonehill Management Zone

Based on the preceding discussions, the recommended 2020 APM plan for the Stonehill management zone is as follows:

- Pumping by the SCWD is limited to the amount allowed under Permit 21138: 1,300 afy. Note that the SCWD's current maximum pumping capacity at the Stonehill well is about 1,100 afy.
- To track changes in groundwater-flow gradients, groundwater level data from the continuously recording data loggers installed at the following wells will be downloaded on a monthly basis: MWDOC MW-2M, SCWD MW-4S, SCWD MW-1S, SJC18 MW-9, and SJC18 MW-10.[22]
- To track the changes in coastal groundwater quality:
  - Grab samples for laboratory analysis will be collected monthly at SCWD MW-4S and the Stonehill well (when it is in operation).[23] The list of analytes to be tested is provided in Table 2.
  - EC data from the continuously recording data loggers installed at the following wells will be downloaded monthly: SCWD MW-4S, SCWD MW-4D, SCWD MW-1S, SCWD MW-1D, and the Costco well.[24]
- When the chloride concentration at SCWD MW-4S equals or exceeds 1,000 mgl, water quality samples will also be collected monthly at SCWD MW-4D, the Costco well, SCWD MW-1S, and SCWD MW-1D.
- The Authority will recommend that the SCWD cease pumping when the TDS concentration at the Stonehill well exceeds 3,500 mgl.
- The TDS and chloride concentration metrics defined in this plan can be updated upon notification from the SCWD that influent to the GRF can be managed to an alternative concentration limit.

The recommended monitoring frequencies in this plan are necessary to refine the understanding of chloride concentration travel times and to provide sufficient lead time for the SCWD to plan for shutdown of the GRF. It may also be appropriate to adjust the monitoring protocols during the year based on monitoring results or changes to the pumping plan.

WEI will analyze the data monthly and prepare quarterly reports to the Authority that summarize monitoring results and include any recommended modifications to the 2020 APM plan for the

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[22] The data loggers in SCWD monitoring wells are downloaded by SCWD staff, and the data are provided to the Authority monthly. The remaining data loggers are downloaded by the Authority.

[23] Water quality samples from Stonehill well are collected by the SCWD staff, and the data are provided to the Authority monthly. The remaining wells are sampled by the Authority.

[24] The data loggers in SCWD monitoring wells are downloaded by the SCWD staff, and the data are provided to the Authority monthly. The remaining data loggers are downloaded by the Authority.

Stonehill management zone. The recommended reporting schedule for the 2020 APM plan is: August 2020, November 2020, February 2021, and May 2021.

APM Plan for the Inland Management Zone

Based on the preceding discussions, the recommended 2020 APM pumping plan for the Inland management zone is as follows:

- Pumping by the City under the Authority's allocation is limited to the amount allowed under the October 2002 *Project Implementation Agreement for the San Juan Basin Desalter Project*: 5,800 afy.
- Pumping by the City under the Authority's allocation is limited to the wells in the Alipaz well field plus the Tirador well.
- Pumping by the City under the SJHGC's permit pursuant to its agreement with the SJHGC is limited to 350 afy.[25] To the extent that the pumping continues at the SJHGC wells, the total combined pumping by the SJHGC and by the City for SJHGC is limited to 350 afy. If the City uses the South Cooks and CVWD-5A wells to meet its obligation to the SJHGC, total pumping from these two wells is limited to 350 afy.
- If the City would like to resume production at the South Cooks and CVWD-5A for uses beyond meeting the agreement with the SJHGC, a consultation with the Biologist of Record must be initiated and a plan developed and implemented to ensure the protection of riparian vegetation.
- To track that groundwater levels are being maintained at levels that are protective of riparian vegetation:
    - Groundwater level elevation data from the continuously recording data logger installed at SJBA MW-4 will be downloaded monthly.
    - Groundwater level elevation data from the continuously recording data loggers installed at SJBA MW-5 and -6 will be downloaded quarterly.
- When groundwater level elevations at SJBA MW-4, -5, and/or -6 drop below the protective threshold, the City will either change its pumping allocation among the riparian habitat area wells or reduce pumping in the riparian habitat area; this will trigger monthly monitoring at these three monitoring wells.
- If the groundwater level elevations remain below the protective threshold under the adjusted pumping in the riparian habitat area, the Authority will request that the City reduce or cease pumping in the riparian habitat area.

If the groundwater level elevations remain below the protective threshold under ceased pumping, the City will reduce pumping in the Alipaz well field and consult with the Biologist of Record to develop additional criteria for pumping. WEI will analyze the data monthly and prepare

[25] In other words, the City's total pumping limit is 6,150 afy (5,800 + 350).

quarterly reports to the Authority that summarize current Basin conditions and include any recommended modifications to the 2020 APM plan for the Inland management zone. The recommended reporting schedule for the 2020 APM plan is: August 2020, November 2020, February 2021, and May 2021.

Passive Aquifer Testing Program

Based on the results of the Investigation and the 2019 APM plan recommendation, the passive aquifer testing program began in June 2018 and has continued through present day. An important aspect of the passive aquifer testing program is that it provides an assessment of groundwater level changes and aquifer-system responses to both natural and man-made stresses over a large area and over a long-period of time. The overall intent of the passive aquifer testing program is to support the development of future adaptive pumping plans that ensure the protection of beneficial uses of the Basin, as required by water rights permits.

The 2019 APM plan recommended the passive aquifer testing program to occur for a minimum of 12 months and up two to three years to observe a full range of seasonal aquifer conditions (different groundwater levels), hydrologic conditions (changes in streamflow), and pumping conditions (i.e., pumping rates, pumping duration, and shutdown periods). An assessment of hydrologic, pumping, and aquifer-system conditions indicates that the above average annual precipitation for WY 2019 (see Table 1) and prolonged shutdown period of the Stonehill well between mid-December 2018 and mid-May 2019 (see Figure 5) had kept groundwater levels in the lower Basin elevated for much of 2019. Because of these conditions, the Basin was not "stressed" sufficiently to test or observe, specifically, the groundwater level response in the program's monitoring wells. It is recommended the passive aquifer testing program continue as part of the 2020 APM plan to capture more variability in the lower Basin's groundwater level response to hydrologic, pumping, and aquifer-system conditions.

Tracer Testing

In 2018, WEI and the TAG members began discussing possible technical approaches to further test for the presence of a potential hydraulic discontinuity between the Stonehill well and SJC18 MW-9 and to better characterize the groundwater flow-system east of San Juan Creek between the City and SCWD wells fields. Based on these discussions, the TAG directed WEI to perform research and scope out a work plan to implement a tracer study as a next step. Tracer testing is a well-established technique that can be used in a wide variety of subsurface environments to further hydrogeologic site characterization. Specifically, for the lower Basin, results from tracer testing would yield information on groundwater-flow paths, groundwater velocities and travel times, and aquifer parameters. The information derived from tracer testing could also support the development of adaptive pumping plans that ensure the protection of beneficial uses of the Basin as required by water rights permits and would be used to refine the analytical and numerical tools to support current and future water resources management plans.

The work plan is currently being prepared and will include a description of the tracer testing options including tracer type, tracer application(s) (location and dosing method), other implementation logistics, tracer monitoring (sample collection), field and laboratory analysis, and reporting. The work plan will also characterize the risks and challenges associated with implementing a tracer study (e.g. the risk that the tracer is never detected downgradient of the application point). As originally proposed, the work plan is intended to be completed, including review by the TAG by the end of fiscal year 2019/20~~.~~

If the work plan identifies a feasible and economic approach to a tracer study, it is recommended that the tracer study be implemented in fiscal year 2020/21 to support the development of future APM plans.

Attachments

Table 1	Monthly and Annual Precipitation: San Juan Capistrano Station at La Novia (Station 215) Water Years: 1991 - 2020
Table 2	Analytes Sampled for the 2020 APM Monthly Water Quality Field Program
Figure 1	Monitoring Sites in the San Juan Basin
Figure 2	Lower San Juan Basin Key Well Locations and Other Features
Figure 3	Lower San Juan Basin Depth to the Bottom of the Aquifer
Figure 4	Groundwater-flow Gradients East of the San Juan Creek
Figure 5	Groundwater Levels, Pumping, Precipitation and Streamflow in the Alipaz and Stonehill Management Zones
Figure 6	Groundwater Levels, Pumping, and Chloride Concentrations in the Stonehill Management Zone
Figure 7	Groundwater Levels and Pumping in the Riparian Habitat Area
Figure 8	San Juan Basin Cumulative Precipitation: San Juan Capistrano Station at La Novia (No. 215) Water Years: 1896 - 2020
Figure 9	Streamflow at San Juan Creek and Arroyo Trabuco
Figure 10	Groundwater Elevations and Pumping at Four Areas in the Basin
Figure 11	Chloride Concentrations in the Stonehill Management Zone
Appendix A	Lower San Juan Basin Hydrostratigraphic Cross-sections

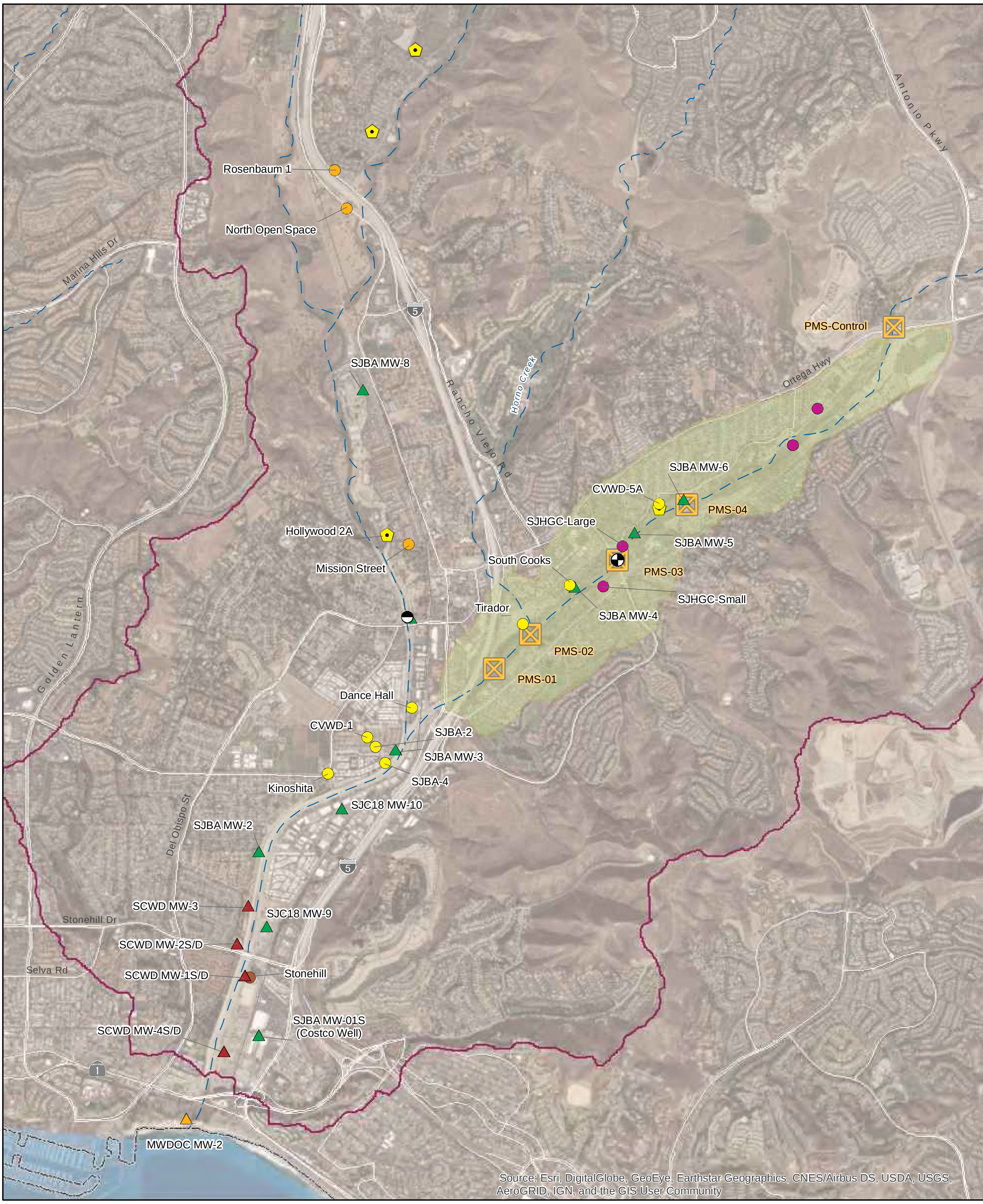
Table 1
Monthly and Annual Precipitation: San Juan Capistrano Station at La Novia (Station 215)
Water Years: 1991 - 2020
(inches)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1991	0.08	1.42	0.31	1.18	4.29	5.67	0.00	0.00	0.00	0.04	0.00	0.08	**13.1**
1992	0.35	0.00	1.85	2.13	7.32	4.48	0.28	0.00	0.00	0.00	0.00	0.00	**16.4**
1993	0.59	0.00	3.82	4.25	2.28	IR	IR	IR	IR	IR	IR	IR	IR
1994	0.35	0.67	0.56	0.67	4.61	1.45	0.83	0.20	0.00	0.00	0.00	0.00	**9.3**
1995	0.04	0.00	0.86	10.55	1.30	6.58	1.65	0.40	0.23	0.16	0.00	0.00	**21.8**
1996	0.04	0.04	1.26	3.74	4.52	1.18	0.32	0.43	0.00	0.00	0.00	0.00	**11.5**
1997	1.34	2.99	3.19	5.15	0.16	0.00	0.04	0.00	0.00	0.00	0.08	0.00	**13.0**
1998	0.00	2.05	2.71	3.00	12.44	4.53	1.10	1.18	0.12	0.00	0.00	0.35	**27.5**
1999	0.00	1.54	1.69	1.14	0.51	1.07	1.33	0.00	0.36	0.00	0.00	0.00	**7.6**
2000	0.00	0.00	0.00	0.00	5.08	2.44	1.06	0.00	0.00	0.00	0.00	0.04	**8.6**
2001	1.69	0.32	0.00	4.25	7.48	0.91	0.90	0.04	0.00	0.00	0.00	0.00	**15.6**
2002	0.00	1.85	0.46	0.28	0.00	0.83	0.39	0.04	0.04	0.00	0.00	0.00	**3.9**
2003	0.00	1.57	2.68	0.00	5.20	3.46	1.69	0.59	0.04	0.32	0.00	0.00	**15.6**
2004	0.59	0.47	0.75	0.35	3.67	1.10	0.43	0.00	0.00	0.00	0.00	0.08	**7.4**
2005	5.67	1.26	3.03	8.47	7.72	0.90	1.38	0.12	0.00	0.00	0.00	0.00	**28.6**
2006	1.22	0.19	0.59	0.79	1.14	2.76	2.16	0.56	0.07	0.00	0.00	0.00	**9.5**
2007	0.00	0.12	0.82	0.48	1.14	0.12	0.78	0.00	0.00	0.00	0.00	0.43	**3.9**
2008	0.00	1.26	1.03	3.30	2.21	0.00	0.04	0.31	0.00	0.00	0.00	0.04	**8.2**
2009	0.12	2.28	3.23	0.35	3.55	0.04	0.00	0.04	0.03	0.00	0.00	0.00	**9.6**
2010	0.67	0.00	2.36	3.98	3.50	0.16	0.63	0.00	0.00	0.04	0.00	0.00	**11.3**
2011	2.44	1.14	10.87	1.10	2.05	2.64	0.15	0.55	0.04	0.08	0.00	0.08	**21.1**
2012	0.75	1.93	0.19	0.94	1.03	1.65	1.27	0.20	0.00	0.27	0.00	0.00	**8.2**
2013	0.94	0.63	2.26	1.14	0.40	0.67	0.00	0.27	0.00	0.00	0.00	0.00	**6.3**
2014	0.55	0.08	0.43	0.00	2.05	0.23	0.55	0.00	0.00	0.00	0.04	0.00	**3.9**
2015	0.08	0.23	3.39	0.79	0.74	0.12	0.04	0.36	0.00	0.82	0.00	0.75	**7.3**
2016	0.16	1.38	1.14	2.32	0.24	1.45	0.20	0.12	0.00	0.00	0.00	0.00	**7.0**
2017	0.00	1.38	4.13	7.77	3.27	0.04	0.00	0.55	0.00	0.00	0.00	0.08	**17.2**
2018*	0.04	0.00	0.00	1.63	0.24	1.42	0.04	0.32	0.00	0.00	0.00	0.08	**3.8**
2019	0.83	0.48	2.04	4.91	6.15	1.10	0.16	0.67	0.00	0.00	0.00	0.00	**16.3**
2020**	0.00	2.88	4.26	0.48	0.59	3.47	3.81						**15.5**
Statistics for the Period of Record (1991 to 2020)													
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**3.8**
Max	5.67	2.99	10.87	10.55	12.44	6.58	3.81	1.18	0.36	0.82	0.08	0.75	**28.6**
Average	0.62	0.94	2.00	2.50	3.16	1.74	0.73	0.25	0.03	0.06	0.00	0.07	**11.9**
Median	0.14	0.65	1.48	1.16	2.25	1.10	0.43	0.16	0.00	0.00	0.00	0.00	**9.6**
Standard Dev.	1.12	0.91	2.14	2.71	2.93	1.79	0.85	0.29	0.08	0.17	0.02	0.17	**6.7**
Coeff. of Variation	1.82	0.97	1.07	1.08	0.93	1.03	1.16	1.16	2.44	2.74	3.89	2.34	**0.6**
Summary Statistics for the Period of Operation under Permit 21074 (2005 to 2020)													
Min	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**3.8**
Max	5.67	2.88	10.87	8.47	7.72	3.47	3.81	0.67	0.07	0.82	0.04	0.75	**28.6**
Average	0.84	0.95	2.49	2.40	2.25	1.05	0.70	0.27	0.01	0.08	0.00	0.10	**10.8**

Notes:

Table 2
Analytes Sampled for the 2020 APM Monthly Water Quality Field Program

Analyte
Potassium
Specific Conductance (at 25° Celsius)
Total Dissolved Solids
Hydroxide as OH (calculated)
Nitrate as Nitrogen
Nitrite as Nitrogen
Sulfate
Chloride
Bromide
Carbonate as CO_3 (calculated)
Alkalinity as $CaCO_3$ (calculated)
Iron
Magnesium
Manganese
Sodium
Boron
Calcium
Fluoride
Bicarbonate Alkalinity as HCO_3 (calculated
Total Hardness as CaCO3 (calculated)
pH
Total Nitrate, Nitrite-N



Author: AP Date: 4/14/2020 N:\MapDocs\Clients\SJBA\2020 APM\MonitoringPrgrm_LocationMapv1.mxd

Monitoring Sites

- SJBA Monitoring Well
- SCWD Monitoring Well
- MWDOC Monitoring Well
- Plant and Surface Water Monitoring Station
- San Juan Capistrano Surface Water and Precipitation Station at La Novia
- San Juan Capistrano Surface Water Station at Arroyo Trabuco

Other Wells in the San Juan Basin

- SCWD GRF Desalter Well
- CSJC GWRP Desalter Well
- Other CSJC Production Well
- CSJC Inactive Production Well
- Private Production Well

Boundaries

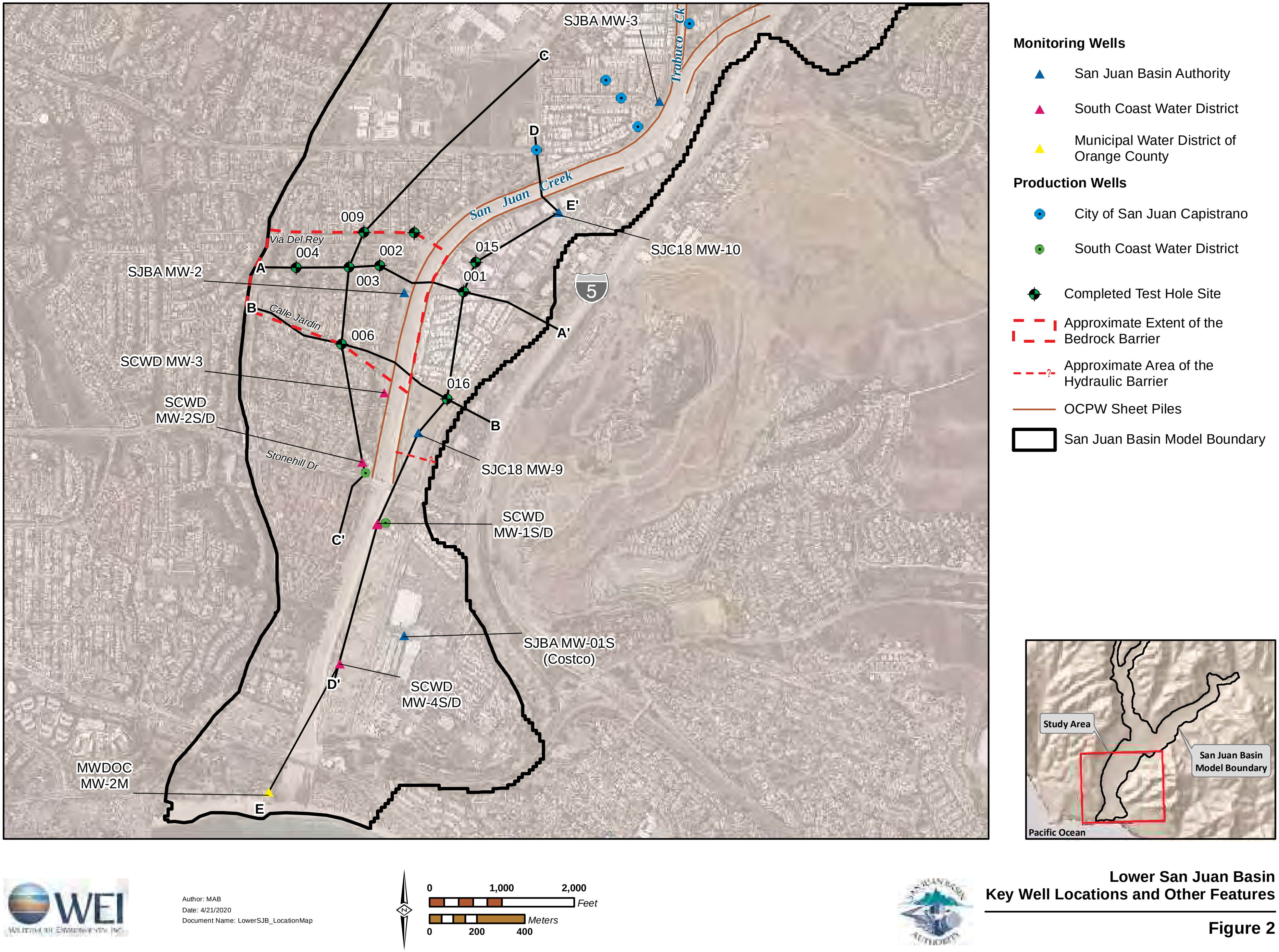
- Riparian Vegetation Monitoring Area
- San Juan Basin Watershed

0 1,000 2,000 Feet

0 400 800 Meters

Monitoring Sites in the San Juan Basin

Figure 1

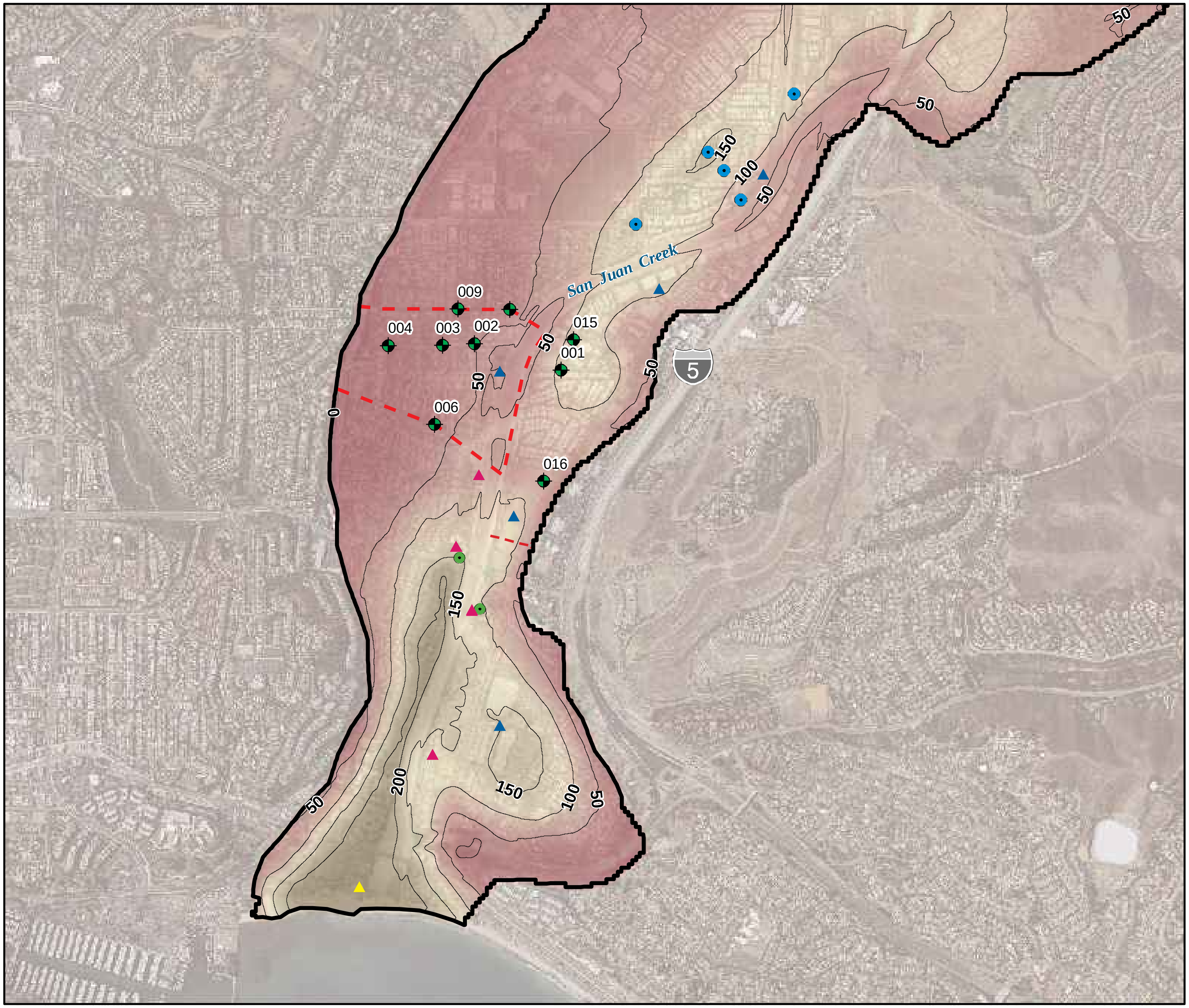


WEI

Author: MAB
Date: 4/21/2020
Document Name: LowerSJB_LocationMap

Lower San Juan Basin
Key Well Locations and Other Features

Figure 2



Monitoring Wells

- San Juan Basin Authority
- South Coast Water District
- Municipal Water District of Orange County

Production Wells

- City of San Juan Capistrano
- South Coast Water District

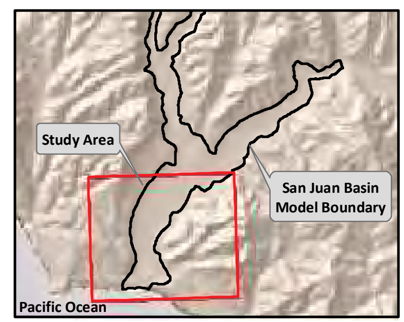
- Completed Test Hole Site
- Approximate Extent of the Bedrock Barrier
- Approximate Area of the Hydraulic Barrier

Depth to the Bottom of the Aquifer (ft)

High : 250

Low : 0

- Contour of equal depth
- San Juan Basin Model Boundary



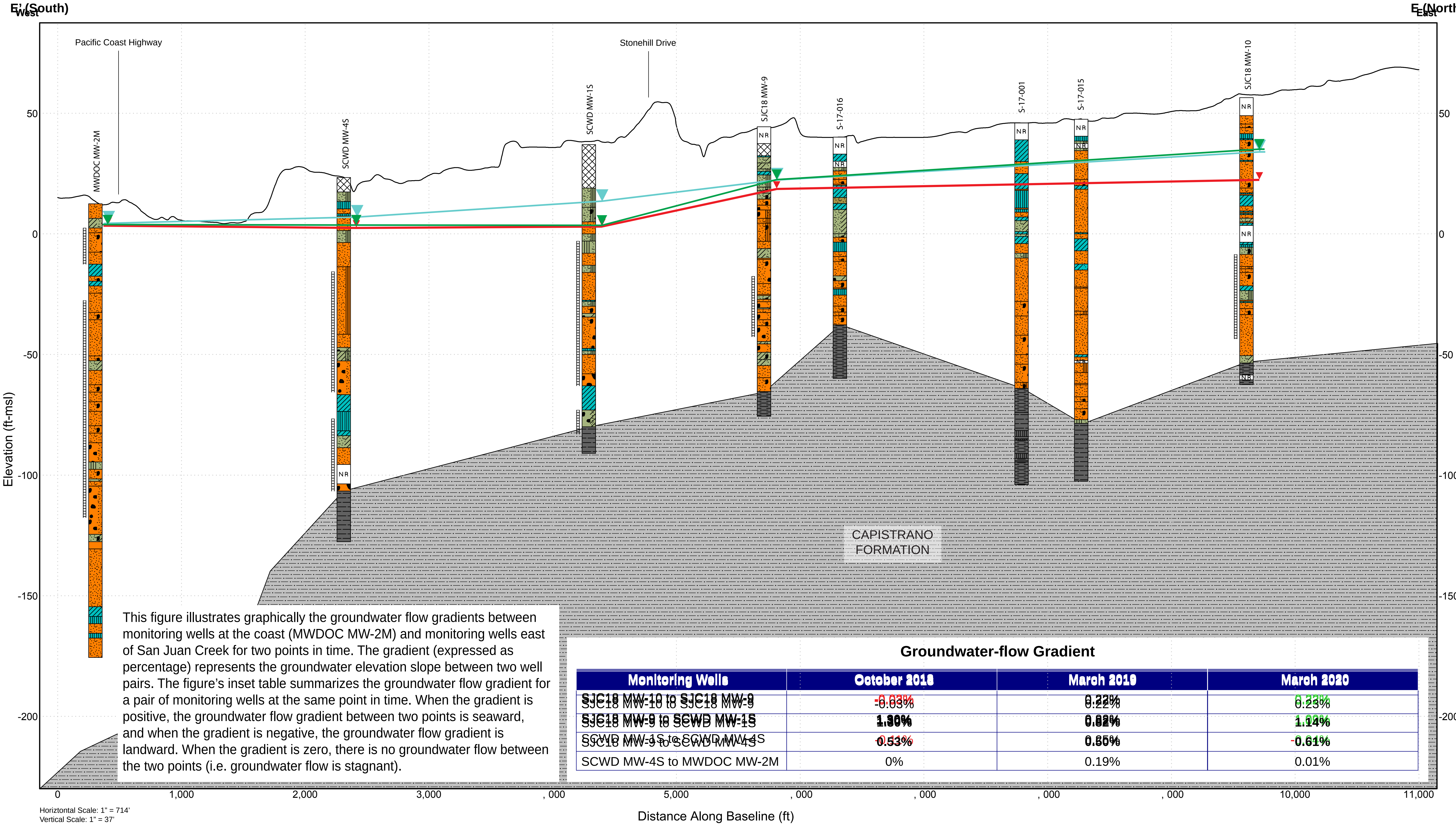
Author: MAB
Date: 4/21/2020
Document Name: LowerSJB_BOA

0 1,000 2,000 Feet

0 200 400 Meters

Lower San Juan Basin
Depth to the Bottom of the Aquifer

Figure 3



This figure illustrates graphically the groundwater flow gradients between monitoring wells at the coast (MWDOC MW-2M) and monitoring wells east of San Juan Creek for two points in time. The gradient (expressed as percentage) represents the groundwater elevation slope between two well pairs. The figure's inset table summarizes the groundwater flow gradient for a pair of monitoring wells at the same point in time. When the gradient is positive, the groundwater flow gradient between two points is seaward, and when the gradient is negative, the groundwater flow gradient is landward. When the gradient is zero, there is no groundwater flow between the two points (i.e. groundwater flow is stagnant).

Groundwater-flow Gradient

Monitoring Wells	October 2018	March 2019	March 2020
SJC18 MW-10 to SJC18 MW-9	-0.03%	0.22%	0.23%
SJC18 MW-9 to SCWD MW-1S	1.30%	0.82%	1.14%
SJC18 MW-9 to SCWD MW-4S	0.53%	0.50%	-0.61%
SCWD MW-4S to MWDOC MW-2M	0%	0.19%	0.01%

Fine-grained deposits (low hydraulic conductivity)
Coarse-grained deposits (high hydraulic conductivity)
Fine- and coarse-grained deposit mixtures (low to medium hydraulic conductivity)
Capistrano FM/ (non-water bearing)
Fill (made ground)
NR No Sample
October 2018 Groundwater Elevation
March 2019 Groundwater Elevation
March 2020 Groundwater Elevation

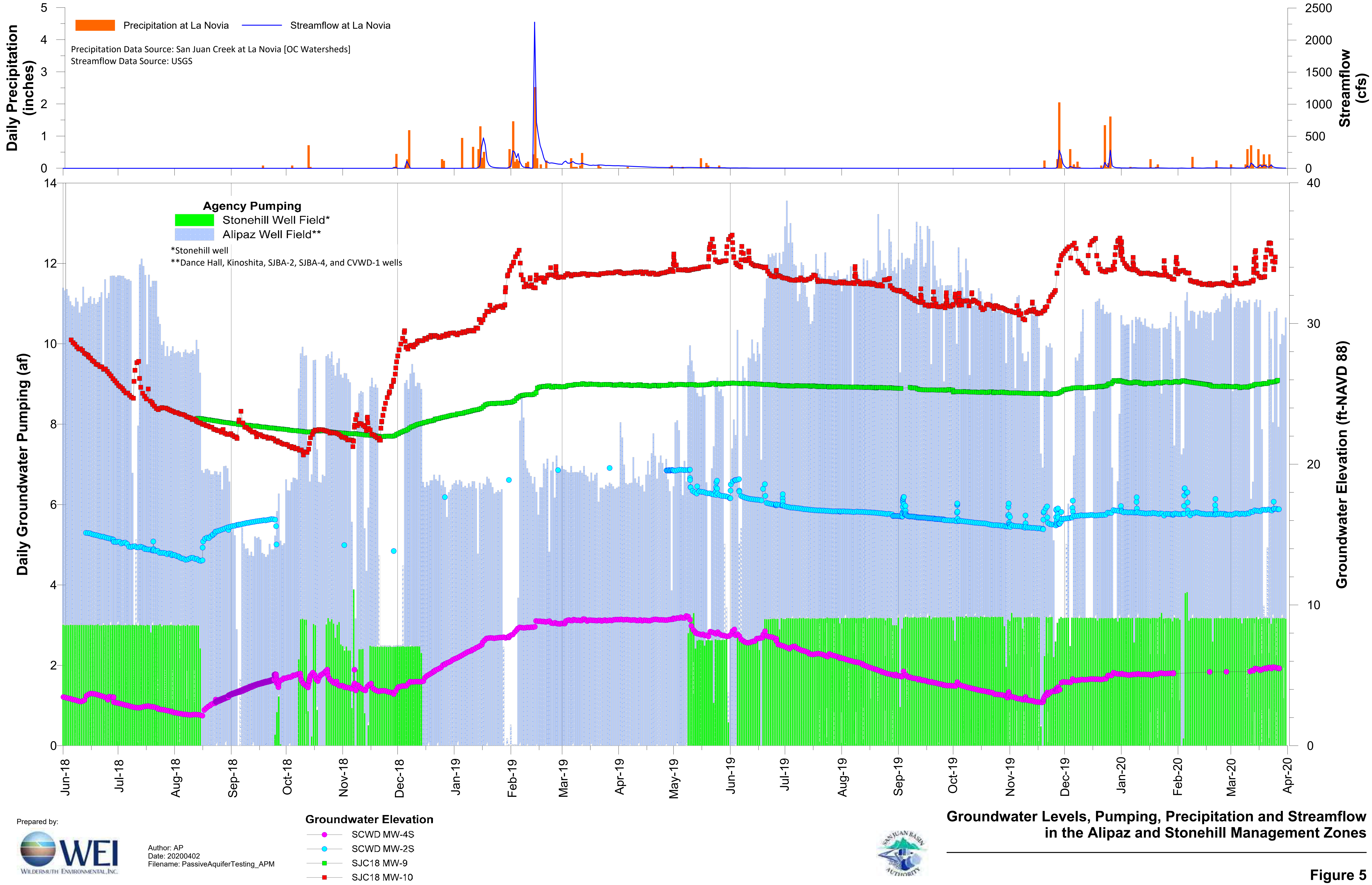
Prepared by:
WEI Wildermuth Environmental, Inc.

Author: AP
Date: 20200331
Filename: GWgradients_eastSJC.ai

Groundwater-flow Gradients East of the San Juan Creek

MWDOC MW-2M to SJC18 MW-10

Figure 4



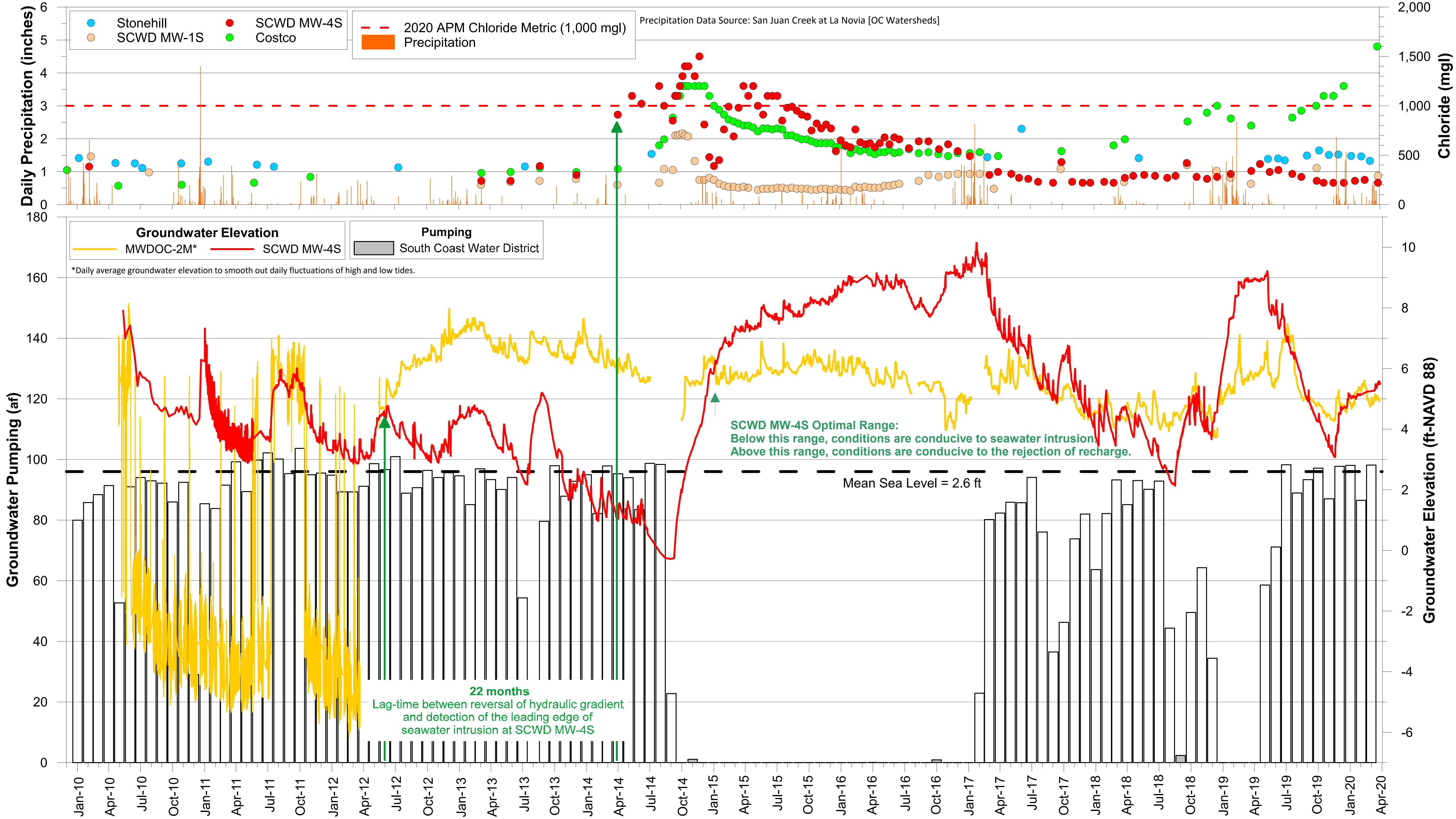
Prepared by:

WEI
WILDERMUTH ENVIRONMENTAL, INC.

Author: AP
Date: 20200402
Filename: PassiveAquiferTesting_APM

Groundwater Levels, Pumping, Precipitation and Streamflow in the Alipaz and Stonehill Management Zones

Figure 5



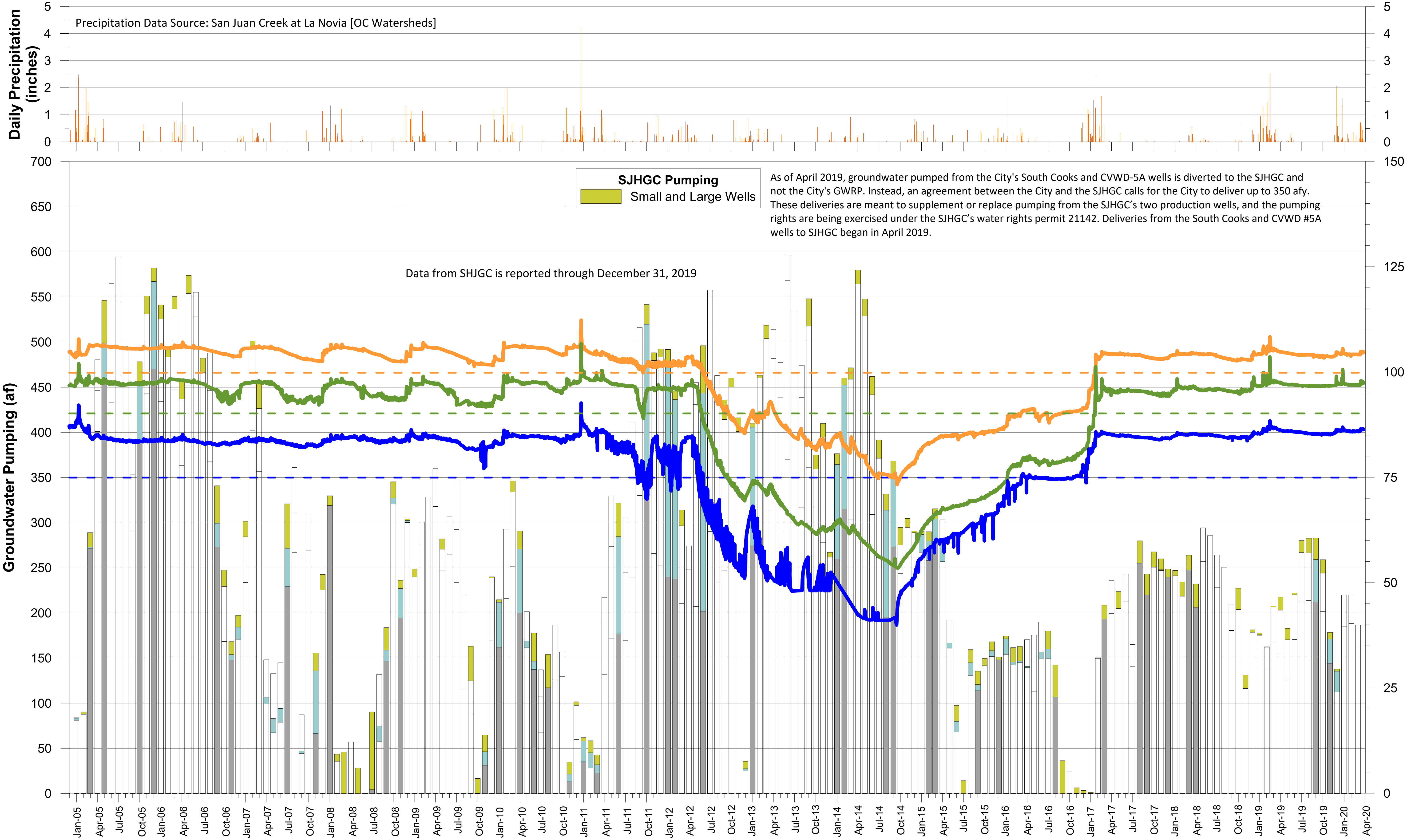
Prepared by:

WEI
WILDERMUTH ENVIRONMENTAL, INC.

Author: AP
Date: 20200402
Filename: Stonehill_MZ_APM.grf

Groundwater Levels, Pumping, and Chloride Concentrations in the Stonehill Management Zone

Figure 6



Prepared by:

WEI
Wildermuth Environmental, Inc.

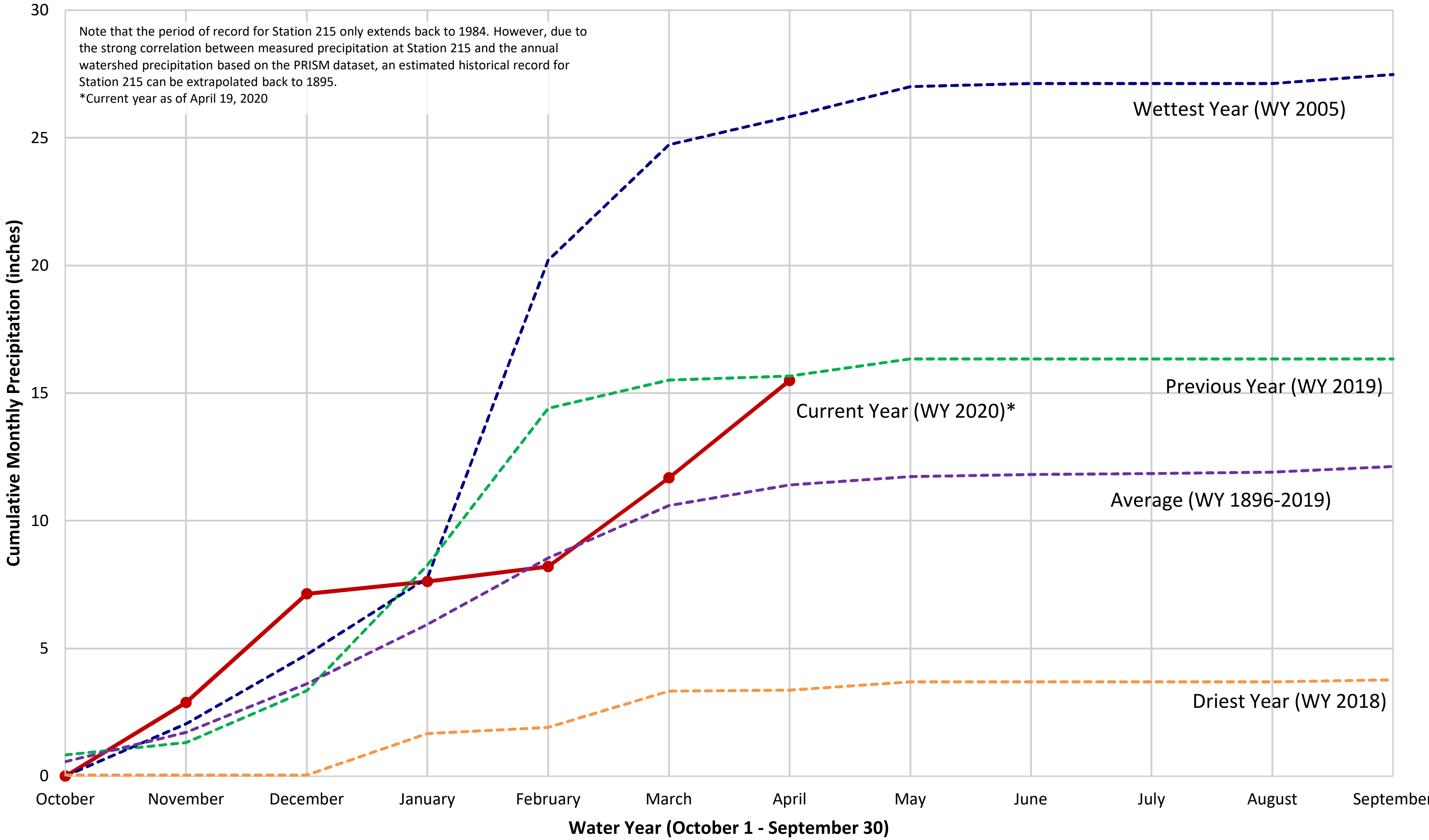
Author: AP
Date: 20200402
Filename: Inland_MZ_APM.grf

San Juan Basin Authority

Groundwater Levels and Pumping in the Riparian Habitat Area

Figure 7

Figure 8
San Juan Basin Cumulative Precipitation: San Juan Capistrano Station at La Novia (No. 215)
Water Years: 1896 - 2020



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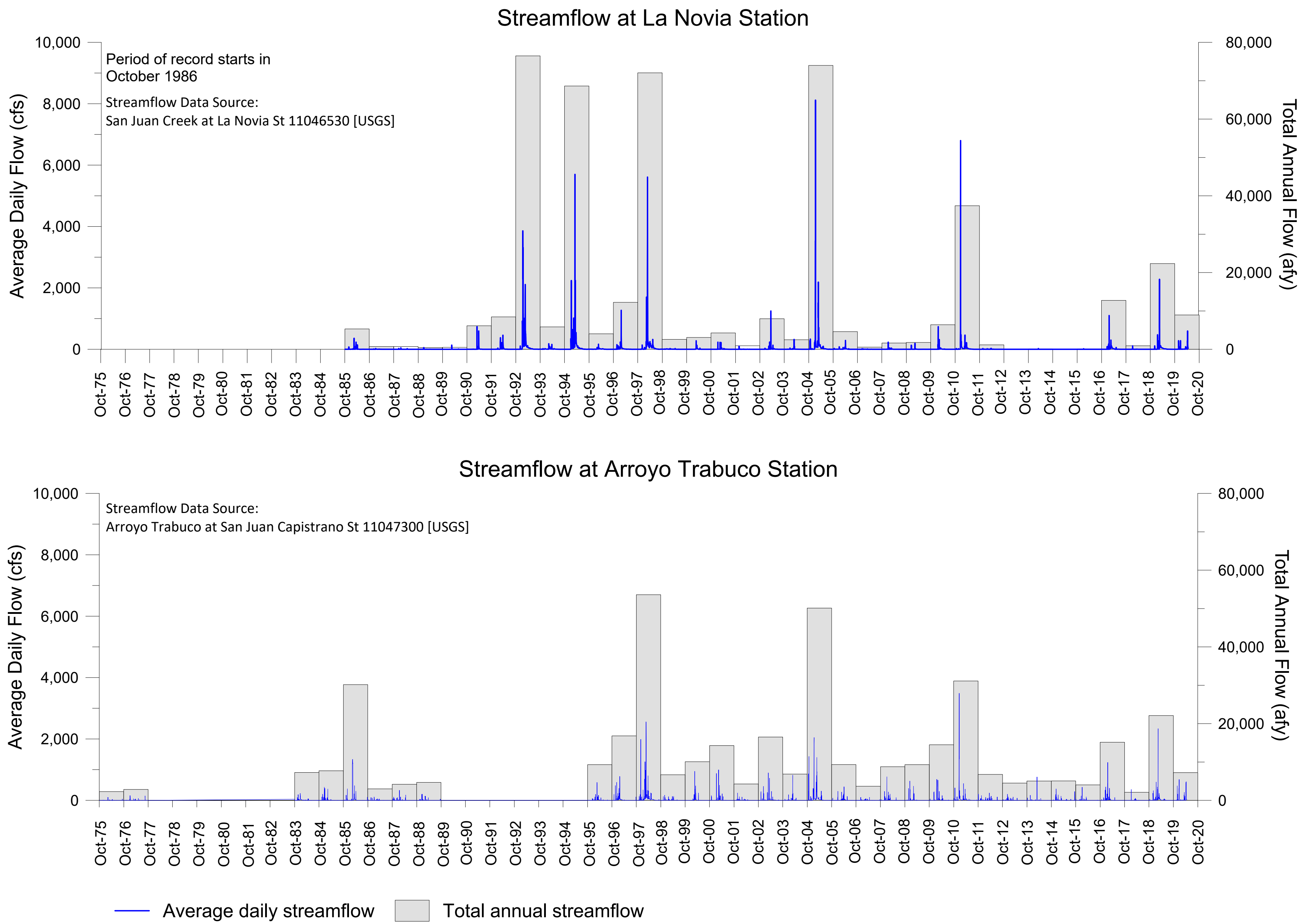
CumulativePrecip (version 2)



Data for WY 2020 ends on March 31, 2020

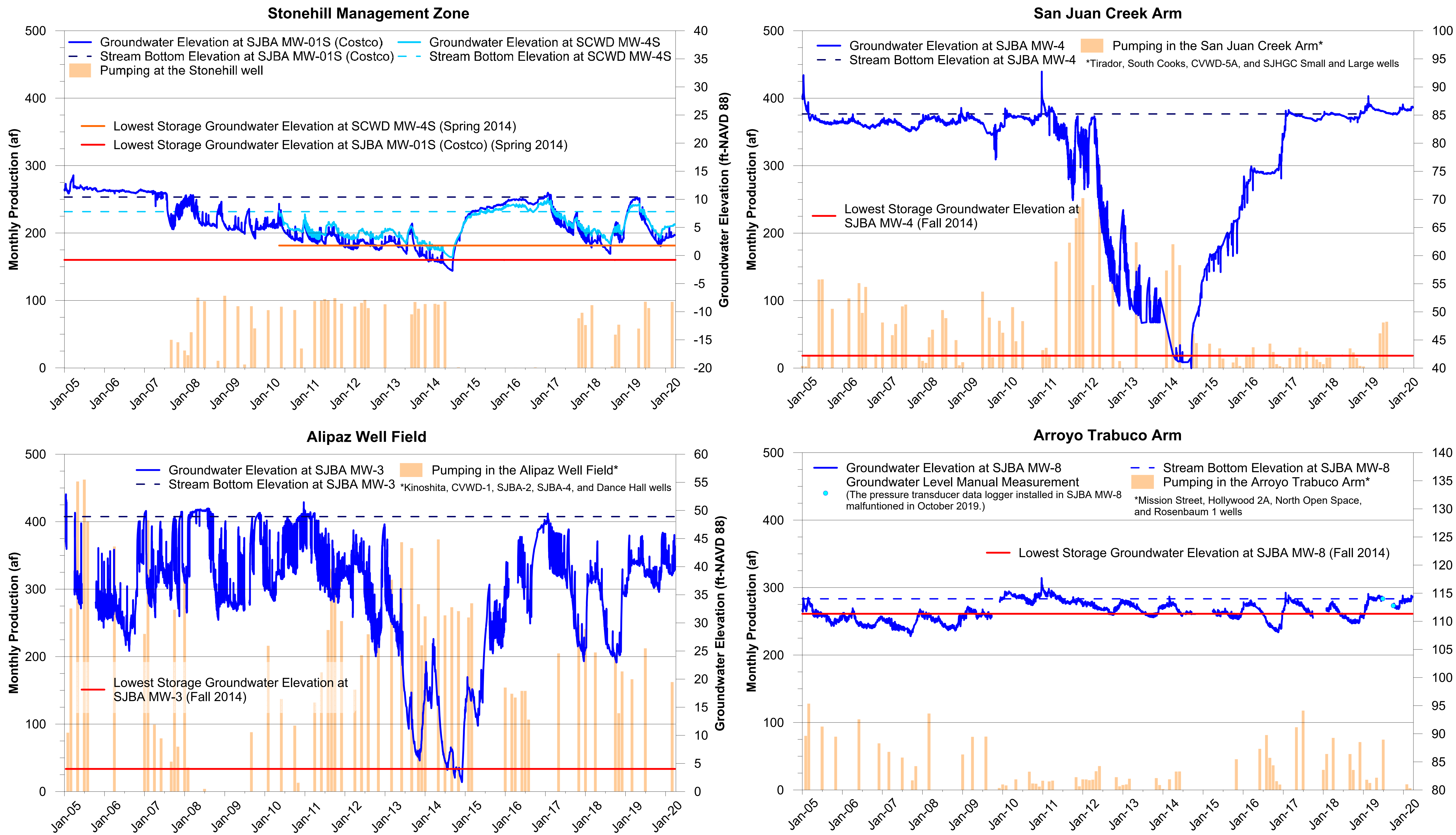
Prepared by:

WEI
Wildermuth Environmental, Inc.

Author: AP
Date: 20200402

Streamflow at San Juan Creek and Arroyo Trabuco

Figure 9



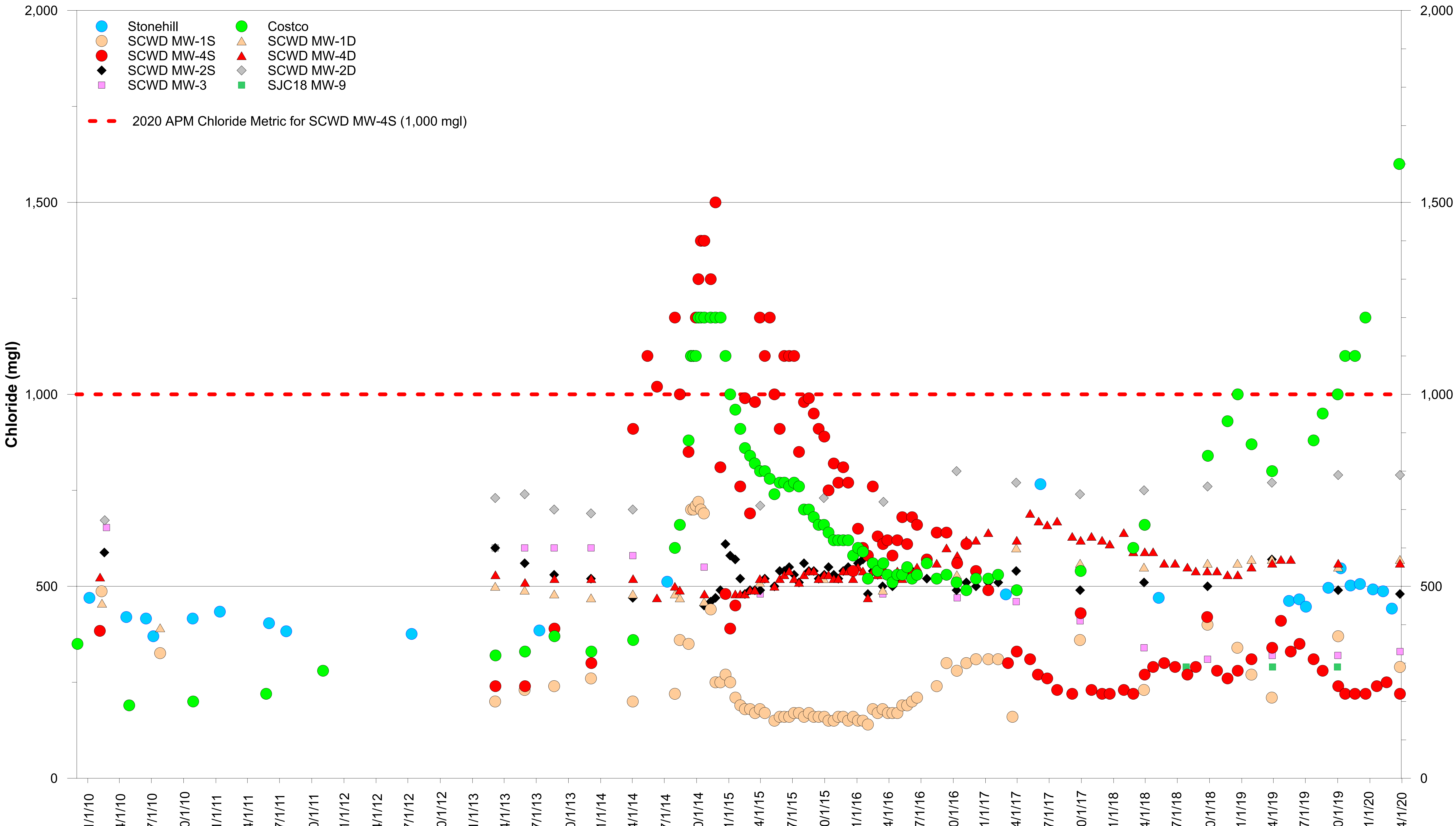
Prepared by:

WEI
Wildermuth Environmental, Inc.

Author: AP
Date: 20200402
Filename: PumpingStorage_APM

Groundwaterwater Level Elevations and Pumping at Four Areas in the Basin

Figure 10



Prepared by:

WEI
WILDERMUTH ENVIRONMENTAL, INC.

Author: CS
Date: 20200414
Filename: Stonehill_MZ_APM.grf

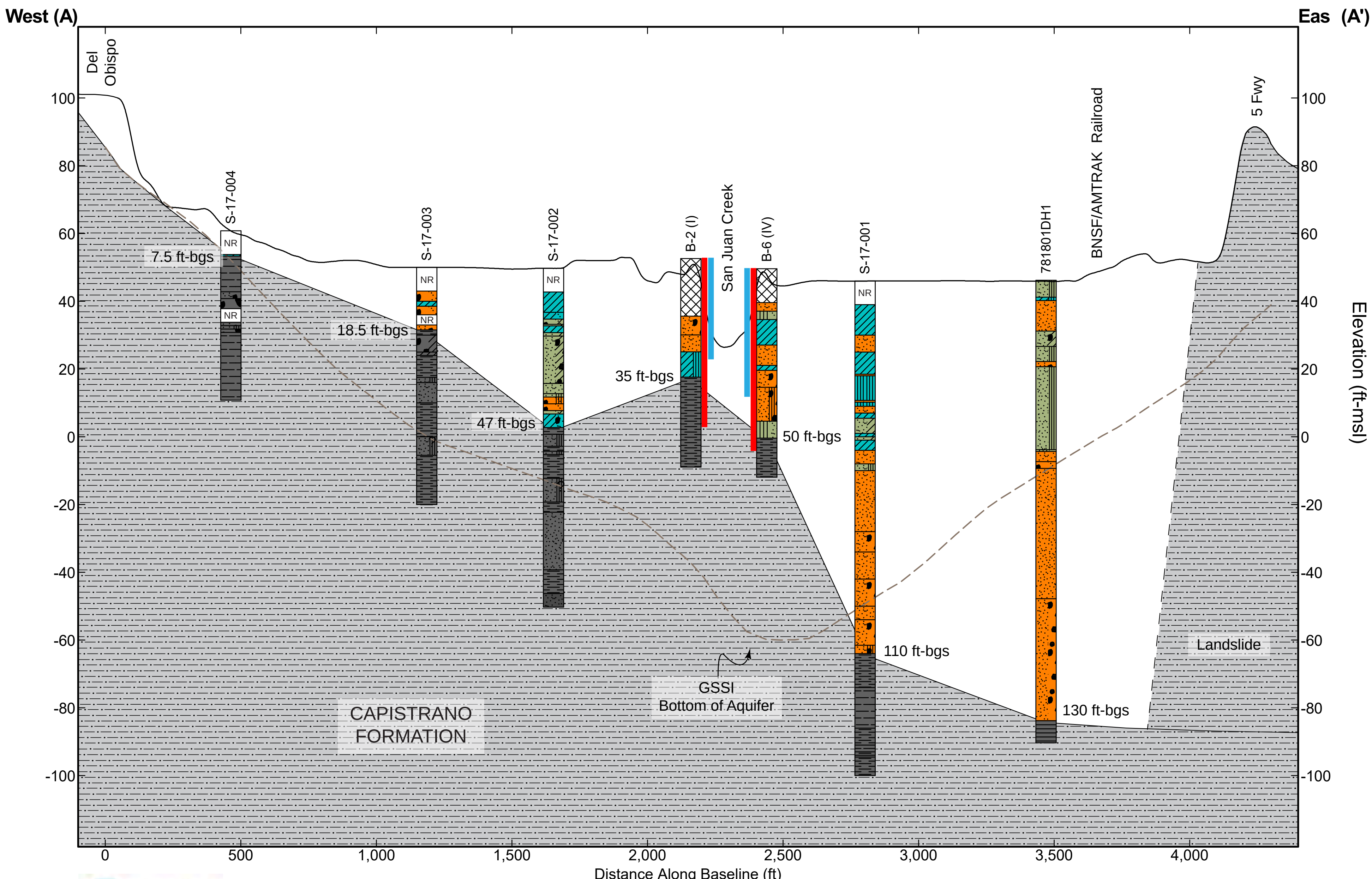
SAN JUAN BASIN AUTHORITY

Chloride Concentrations in the Stonehill Management Zone

Figure 11

Appendix A

Lower San Juan Basin Hydrostratigraphic Cross-sections



Fine-grained deposits (low hydraulic conductivity)

Coarse-grained deposits (high hydraulic conductivity)

Fine- and coarse-grained deposit mixtures (low to medium hydraulic conductivity)

Capistrano FM/Landslide (non-water bearing)

Fill (made ground)

NR No Sample

OCPW Sheetpile
Sheetpile system is made up of three long piles (red) followed by one short pile (blue).
The exact location of the long/short piles is unknown at this time.

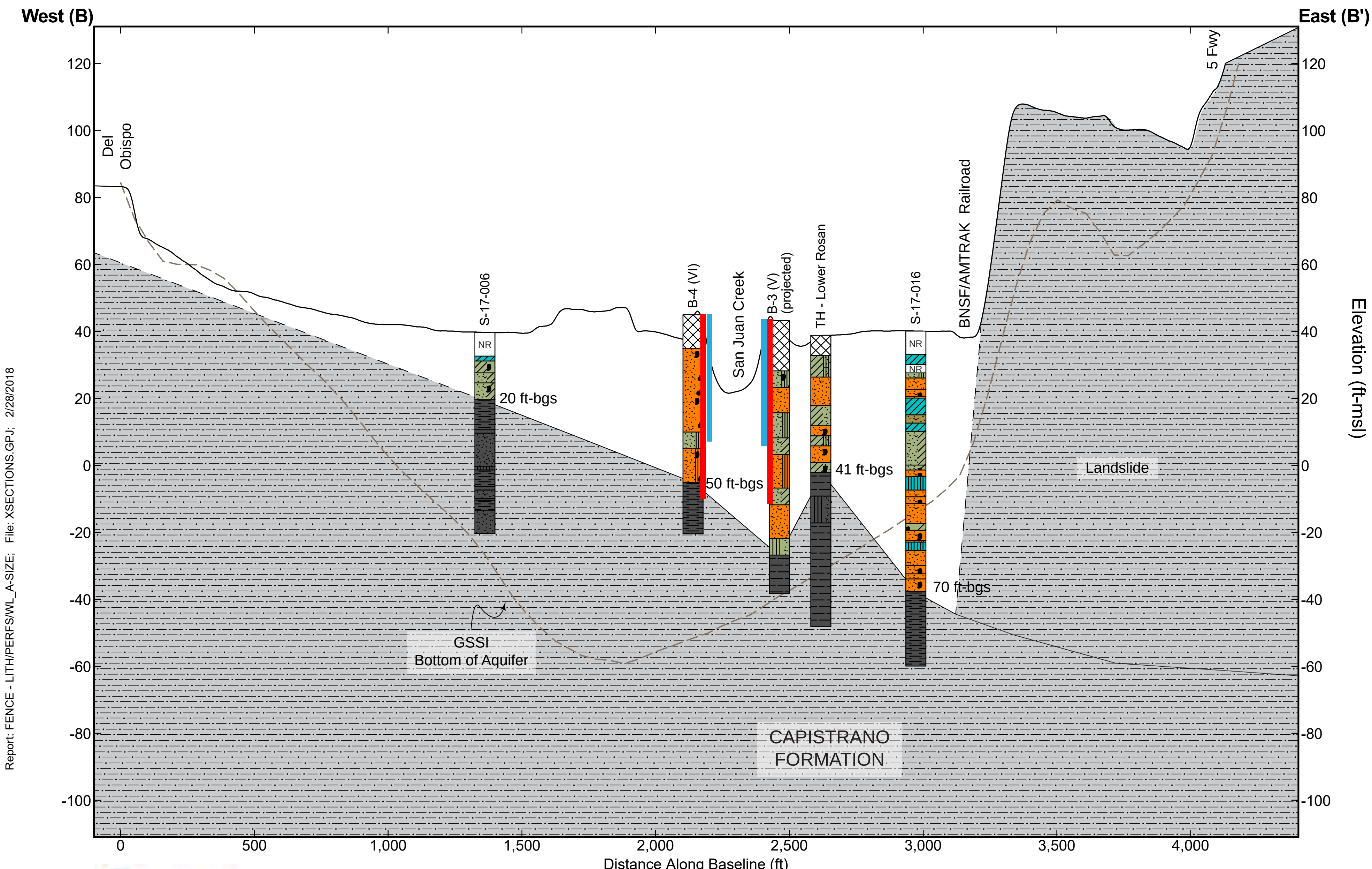
Vertical Scale: 1" = 40'

Horizontal Scale: 1" = 500'

Vertical Exaggeration = 12.5:1

Cross-Section A-A'

Figure 5a



Vertical Scale: 1" = 40'

Horizontal Scale: 1" = 500'

Vertical Exaggeration = 12.5:1

Fine-grained deposits (low hydraulic conductivity)

Coarse-grained deposits (high hydraulic conductivity)

Fine- and coarse-grained deposit mixtures (low to medium hydraulic conductivity)

Capistrano FM/Landslide (non-water bearing)

Fill (made ground)

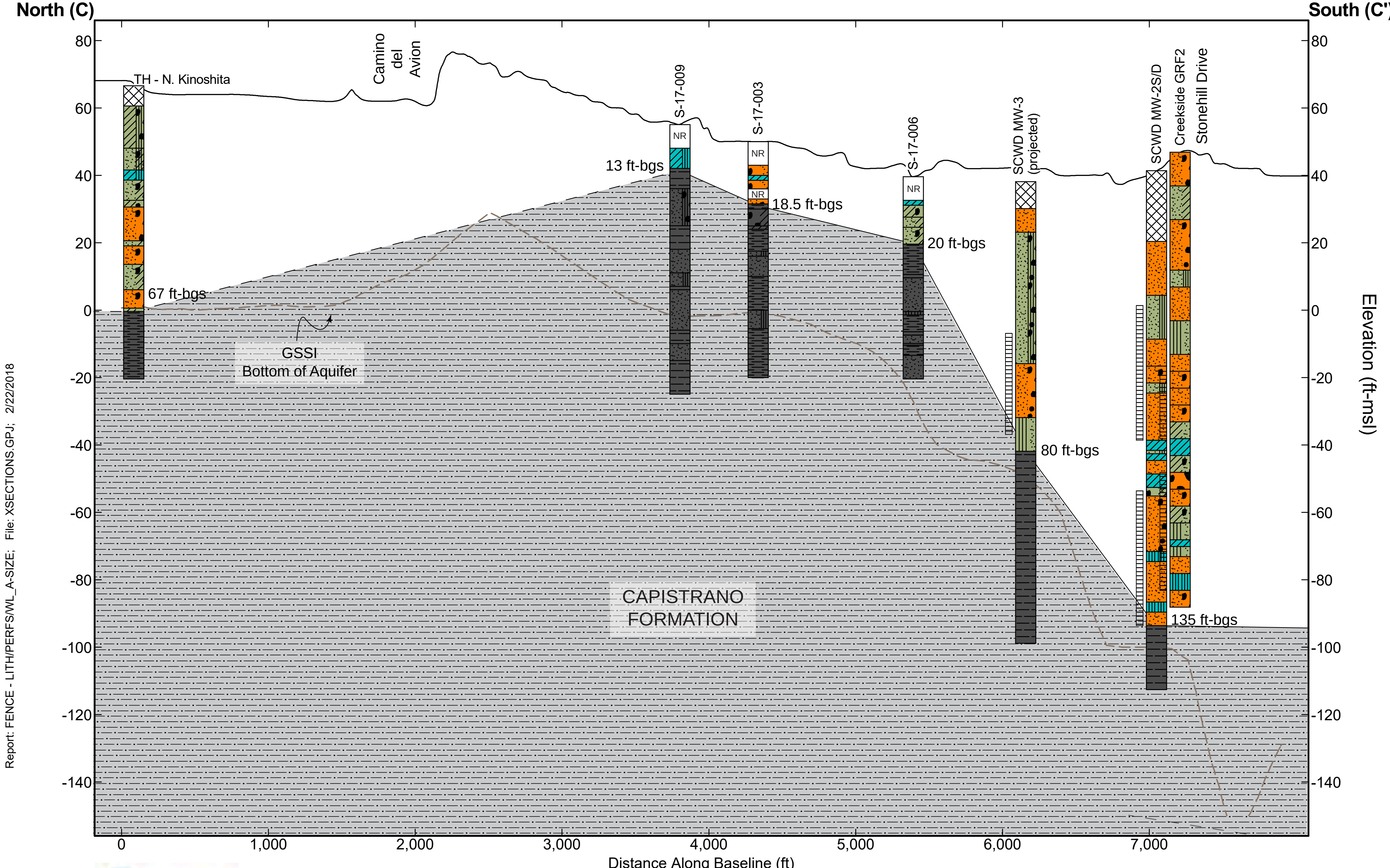
NR No Sample

OCPW Planned Sheetpile

Sheetpile system is made up of three long piles (red) followed by one short pile (blue).
The exact location of the long/short piles is unknown at this time.

Cross-Section B-B'

Figure 5b



WEI

Vertical Scale: 1" = 40'

Horizontal Scale: 1" = 915'

Vertical Exaggeration = 5.7:1

Fine-grained deposits (low hydraulic conductivity)

Coarse-grained deposits (high hydraulic conductivity)

Fine- and coarse-grained deposit mixtures (low to medium hydraulic conductivity)

Capistrano FM/Landslide (non-water bearing)

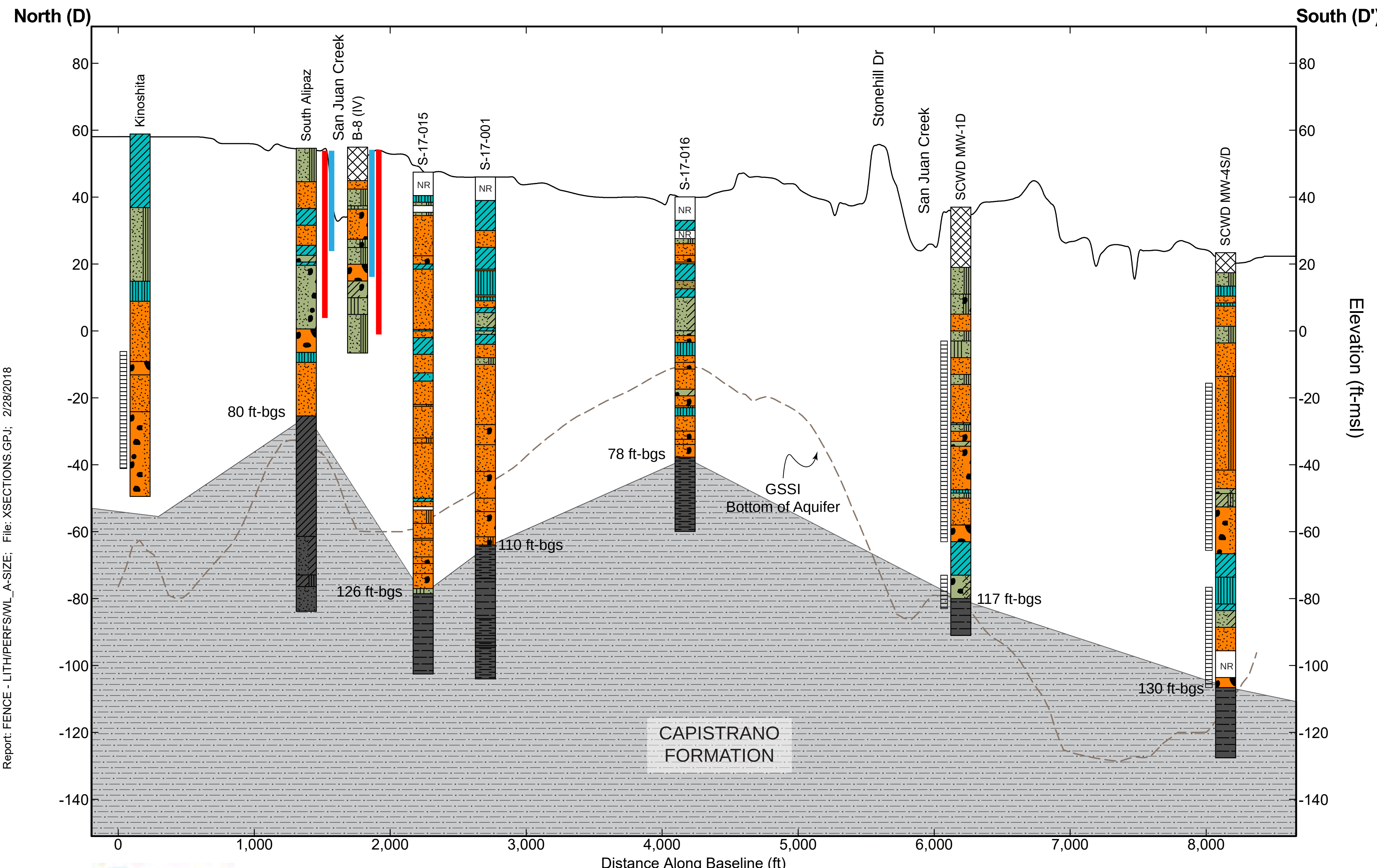
Fill (made ground)

NR No Sample

Cross-Section C-C'

Figure 5c

Report: FENCE - LITH/PERFS/WL_A-SIZE; File: XSECTIONS.GPJ; 2/28/2018



WEI

Vertical Scale: 1" = 40'

Horizontal Scale: 1" = 1000'

Vertical Exaggeration = 25:1

Fine-grained deposits (low hydraulic conductivity)

Coarse-grained deposits (high hydraulic conductivity)

Fine- and coarse-grained deposit mixtures (low to medium hydraulic conductivity)

Capistrano FM/Landslide (non-water bearing)

Fill (made ground)

NR No Sample

OCPW Sheetpile

Sheetpile system is made up of three long piles (red) followed by one short pile (blue). The exact location of the long/short piles is unknown at this time.

Cross-Section D-D'

Figure 5d

APPENDIX G

Amended Main San Gabriel Basin Judgment

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SUPERIOR COURT OF THE STATE OF CALIFORNIA

FOR THE COUNTY OF LOS ANGELES

Upper San Gabriel Valley Municipal Water District, Plaintiff, vs. City of Alhambra, et al, Defendants	Case No.: 924128 **AMENDED JUDGMENT** (And Exhibits Thereto)

HONORABLE MAUREEN DUFFY-LEWIS

Assigned Judge Presiding

DEPARTMENT 38

June 21, 2012

(This version includes prior Amendments

and updated Exhibits through June 21, 2012.)

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"B" – Boundaries of Relevant Watershed

"C" – Table Showing Base Annual Diversion Rights of Certain Diverters

"D" – Table Showing Prescriptive Pumping Rights and Pumper's Share of Each Pumper

"E" – Table Showing Production Rights of Each Integrated Producer

"F" – Table Showing Special Category Rights

"G" – Table Showing Non-consumptive Users

"H" – Watermaster Operating Criteria

"J" – Puente Narrows Agreement

"K" – Overlying Rights

(Exhibit "K" Includes - Nature of Overlying Right, Description of Overlying Lands To Which Overlying Rights Are Appurtenant, Producers Entitled To Exercise Overlying Rights and Their Respective Consumptive Use Portions, and Map of Overlying Lands.)

"L" – List of Producers and Other Parties and Their Designees (June 2012) (New)

"M" – Watermaster Members, Officers, and Staff, Including Calendar Year 2012 (New)

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SUPERIOR COURT OF CALIFORNIA, COUNTY OF LOS ANGELES

Upper San Gabriel Valley Municipal Water District, Plaintiff, vs. City of Alhambra, et al, Defendant	Case No.: 924128 **AMENDED JUDGMENT** Hearing: June 21, 2012 Department 38, 9:30 A.M.

The Petition of the MAIN SAN GABRIEL BASIN WATERMASTER for this AMENDED JUDGMENT herein, came on regularly for hearing in this Court before the **HONORABLE MAUREEN DUFFY-LEWIS**, ASSIGNED JUDGE PRESIDING, on June 21, 2012; Frederic A. Fudacz appeared as attorney for Watermaster - Petitioner; and good cause appearing, the following **ORDER** and **AMENDED JUDGMENT** are, hereby, made:

I. INTRODUCTION

1. Pleadings, Parties, and Jurisdiction. The complaint herein was filed on January 2, 1968, seeking an adjudication of water rights. By amendment of said complaint and dismissals of certain parties, said adjudication was limited to the Main San Gabriel Basin and its Relevant Watershed. Substantially all defendants and the cross-defendant have appeared herein, certain defaults have been entered, and other defendants dismissed. By the pleadings herein and by

Order of this Court, the issues have been made those of a full inter se adjudication of water rights as between each and all of the parties. This Court has jurisdiction of the subject matter of this action and of the parties herein.

2. Stipulation for Entry of Judgment. A substantial majority of the parties, by number and by quantity of rights herein Adjudicated, Stipulated for entry of a Judgment in substantially the form of the original Judgment herein.

3. Lis Pendens. (New) A Lis Pendens was recorded August 20, 1970, as Document 2650, in Official Records of Los Angeles County, California, in Book M 3554, Page 866.

4. Findings and Conclusions. (Prior Judgment Section 3) Trial was had before the Court, sitting without a jury, John Shea, Judge Presiding, commencing on October 30, 1972, and Findings of Fact and Conclusions of Law have been entered herein.

5. Judgment. (New) Judgment (and Exhibits Thereto), Findings of Fact and Conclusions of Law (and Exhibits Thereto), Order Appointing Watermaster, and Initial Watermaster Order were signed and filed December 29, 1972, and Judgment was entered January 4, 1973, in Book 6791, Page 197.

6. Intervention After Judgment. (New) Certain defendants have, pursuant to the Judgment herein and the Court's continuing jurisdiction, intervened and appeared herein after entry of Judgment.

7. Amendments of Judgment. (New) The original Judgment herein was previously amended on March 29 1979, by: (1) adding definition (r [1]) thereto, (2) amending definition (bb) therein, (3) adding Exhibit "K" thereto, (4) adding Sections 14.5 and 16.5 thereto, and (5) amending Sections 37(b), 37(c), 37(d), and Section 47 therein; it was again amended on December 21, 1979, by amending Section 38(c) thereof; again amended on February 21, 1980, by amending Section 24 thereof; again amended on September 12, 1980, by amending Sections 35(a), 37(a), and 38(a); again amended on December 22, 1987, by adding Section 37(e) thereto; amended again on July 22, 1988 by amending Section 37(e) thereof and Ordering an Amended Judgment herein; again amended on January 29, 1991, by amending Sections 10(j), 40, and by adding Sections 40(a), 40(b), 40(c), 40(d), 40(e) and 40(f); again amended on April 2, 1991, by

amending Sections 10(ff), 10(jj), and 34(h); again amended on February 24, 1992, by amending Section 40(b); again amending Appendices in 2000; and again on June 21, 2012 by amending Sections 10(ff), 26, 29(d), 34(b), 34(c), 34(g), 34(h), 34(j), 36, 42, 44, 45, 46(a), 47, 50, 54, Exhibit H Sections 2, 3(d), 4; adding Sections 34(p), 34(q), 34(r); and deleting Section 53 entirely.

8. Transfers. (New) Since the entry of Judgment herein there have been numerous transfers of Adjudicated water rights. To the date hereof, said transfers are reflected in Exhibits "C", "D", and "E".

9. Producers and Their Designees. (New) The current status of Producers and their Designees is shown on Exhibit "L".

10. Definitions. (Prior Judgment Section 4) As used in this Judgment, the following terms shall have the meanings herein set forth:

(a) Base Annual Diversion Right – The average annual quantity of water which a Diverter is herein found to have the right to Divert for Direct Use.

(b) Direct Use – Beneficial use of water other than for spreading or Ground Water recharge.

(c) Divert or Diverting – To take waters of any surface stream within the Relevant Watershed.

(d) Diverter – Any party who Diverts.

(e) Elevation – Feet above mean sea level.

(f) Fiscal Year – A period July 1 through June 30, following.

g) Ground Water – Water beneath the surface of the ground and within the zone of saturation.

(h) Ground Water Basin – An interconnected permeable geologic formation capable of storing a substantial Ground Water supply.

(i) Integrated Producer – Any party that is both a Pumper and a Diverter, and has elected to have its rights adjudicated under the optional formula provided in Section 18 of this Judgment.

(j) In-Lieu Water Cost – The differential between a particular Producer's cost of Watermaster directed produced, treated, blended, substituted, or Supplemental Water delivered or substituted to, for, or taken by, such Producer in-lieu of his cost of otherwise normally Producing a like amount of Ground Water from the Basin. (Amended 1/29/91)

(k) Key Well – Baldwin Park Key Well, being elsewhere designated as State Well No. 1S/10W-7R2, or Los Angeles County Flood Control District Well No. 3030-F. Said well has a ground surface Elevation of 386.7.

(l) Long Beach Case – Los Angeles Superior Court Civil Action No. 722647, entitled, "Long Beach, et al., v. San Gabriel Valley Water Company, et al."

(m) Main San Gabriel Basin or Basin – The Ground Water Basin underlying the area shown as such on Exhibit "A".

(n) Make-Up Obligation – The total cost of meeting the obligation of the Basin to the area at or below Whittier Narrows, pursuant to the Judgment in the Long Beach Case.

(o) Minimal Producer – Any party whose Production in any Fiscal Year does not exceed five (5) acre-feet. (Prior to June 21, 2012)

(p) Natural Safe Yield – The quantity of natural water supply which can be extracted annually from the Basin under conditions of long term average annual supply, net of the requirement to meet downstream rights as determined in the Long Beach Case (exclusive of Pumped export), and under cultural conditions as of a particular year.

(q) Operating Safe Yield – The quantity of water which the Watermaster determines hereunder may be Pumped from the Basin in a particular Fiscal Year, free of the Replacement Water Assessment under the Physical Solution herein.

(r) Overdraft – A condition wherein the total annual Production from the Basin exceeds the Natural Safe Yield thereof.

(s) Overlying Rights – (Prior Judgment Section 4(r)[1]) The right to Produce water from the Basin for use on Overlying Lands, which rights are exercisable only on specifically defined Overlying Lands and which cannot be separately conveyed or transferred apart therefrom.

(t) Physical Solution – (Prior Judgment Section 4(s)) The Court decreed method of managing the waters of the Basin so as to achieve the maximum utilization of the Basin and its water supply, consistent with the rights herein declared.

(u) Prescriptive Pumping Right – (Prior Judgment Section 4(t)) The highest continuous extractions of water by a Pumper from the Basin for beneficial use in any five (5) consecutive years after commencement of Overdraft and prior to filing of this action, as to which there has been no cessation of use by that Pumper during any subsequent period of five (5) consecutive years, prior to the said filing of this action.

(v) Produce or Producing – (Prior Judgment Section 4(u)) To Pump or Divert Water.

(w) Producer – (Prior Judgment Section 4(v)) A party who Produces water.

(x) Production – (Prior Judgment Section 4(w)) The annual quantity of water Produced, stated in acre feet.

(y) Pump or Pumping – (Prior Judgment Section 4(x)) To extract Ground Water from the Basin by Pumping or any other method.

(z) Pumper – (Prior Judgment Section 4(y)) Any party who Pumps water.

(aa) Pumper's Share – (Prior Judgment Section 4(z)) A Pumper's right to a percentage of the entire Natural Safe Yield, Operating Safe Yield and appurtenant Ground Water storage.

(bb) Relevant Watershed – (Prior Judgment Section 4(aa)) That portion of the San Gabriel River watershed tributary to Whittier Narrows which is shown as such on Exhibit "A", and the exterior boundaries of which are described in Exhibit "B".

(cc) Replacement Water – (Prior Judgment Section 4(bb)) Water purchased by Watermaster to replace: (1) Production in excess of a Pumper's Share of Operating Safe Yield; (2) The consumptive use portion resulting from the exercise of an Overlying Right; and (3) Production in excess of a Diverter's right to Divert for Direct Use.

(dd) Responsible Agency – (Prior Judgment Section 4(cc)) The municipal water district which is the normal and appropriate source from whom Watermaster shall purchase Supplemental Water for replacement purposes under the Physical Solution, being one of the following:

(1) Upper District – Upper San Gabriel Valley Municipal Water District, a member public agency of the Metropolitan Water District of Southern California (MWD).

(2) San Gabriel District – San Gabriel Valley Municipal Water District, which has a direct contract with the State of California for State Project Water.

(3) Three Valleys District – Three Valleys Municipal Water District, formerly, "Pomona Valley Municipal Water District", a member public agency of MWD.

(ee) Stored Water – (Prior Judgment Section 4(dd)) Supplemental Water stored in the Basin pursuant to a contract with Watermaster as authorized by Section 34(n).

(ff) Supplemental Water – (Prior Judgment Section 4(ee)) Nontributary water imported through a Responsible Agency and reclaimed water or water obtained from other available sources when water is not available in a timely fashion from a Responsible Agency. (Amended 6/21/12)

(gg) Transporting Parties – (Prior Judgment Section 4(ff)) Any party presently transporting water (i.e., during the 12 months immediately preceding the making of the findings herein) from the Relevant Watershed or Basin to an area outside thereof, and any party presently or hereafter having an interest in lands or having a service area outside the Basin or Relevant Watershed contiguous to lands in which it has an interest or a service area within the Basin or Relevant Watershed. Division by a road, highway, or easement shall not interrupt contiguity. Said term shall also include the City of Sierra Madre, or any party supplying water thereto, so long as the corporate limits of said City are included within one of the Responsible Agencies and if said City, in order to supply water to its corporate area from the Basin, becomes a party to this action bound by this Judgment.

(hh) Water Level – (Prior Judgment Section 4(gg)) The measured Elevation of water in the Key Well, corrected for any temporary effects of mounding caused by replenishment or local depressions caused by Pumping.

(ii) Year – (Prior Judgment Section 4(hh)) A calendar year, unless the context clearly indicates a contrary meaning.

(jj) Reclaimed Water – Water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur. (Amended 4/2/91)

11. Exhibits. (Prior Judgment Section 5) The following exhibits are attached to this Judgment and incorporated herein by this reference:

Exhibit "A" – Map entitled, "San Gabriel River Watershed Tributary to Whittier Narrows", showing the boundaries and relevant geologic and hydrologic features in the portion of the watershed of the San Gabriel River lying upstream from Whittier Narrows.

Exhibit "B" – Boundaries of Relevant Watershed.

Exhibit "C" – Table Showing Base Annual Diversion Rights of Certain Diverters.

Exhibit "D" – Table Showing Prescriptive Pumping Rights and Pumper's Share of Each Pumper.

Exhibit "E" – Table Showing Production Rights of Each Integrated Producer.

Exhibit "F" – Table Showing Special Category Rights.

Exhibit "G" – Table Showing Non-consumptive Users.

Exhibit "H" – Watermaster Operating Criteria.

Exhibit "J" – Puente Narrows Agreement.

Exhibit "K" – Overlying Rights, Nature of Overlying Right, Description of Overlying Lands to which Overlying Rights are Appurtenant, Producers Entitled to Exercise Overlying Rights and their Respective Consumptive Use Portions, and Map of Overlying Lands.

Exhibit "L" – (New) List of Producers And Their Designees, as of June 2012.

Exhibit "M" – (New) Watermaster Members, Officers and Staff, Including

Calendar Year 2012.

II. DECREE

NOW, THEREFORE, IT IS HEREBY DECLARED, ORDERED, ADJUDGED AND DECREED:

A. DECLARATION OF HYDROLOGIC CONDITIONS

12. Basin as Common Source of Supply. (Prior Judgment Section 6) The area shown on Exhibit "A" as Main San Gabriel Basin overlies a Ground Water basin. The Relevant Watershed is the watershed area within which rights are herein adjudicated. The waters of the Basin and Relevant Watershed constitute a common source of natural water supply to the parties herein.

13. Determination of Natural Safe Yield. (Prior Judgment Section 7) The Natural Safe Yield of the Main San Gabriel Basin is found and declared to be one hundred fifty-two thousand seven-hundred (152,700) acre-feet under Calendar Year 1967 cultural conditions.

14. Existence of Overdraft. (Prior Judgment Section 8) In each and every Calendar year commencing with 1953, the Basin has been and is in Overdraft.

B. DECLARATION OF RIGHTS

15. Prescription. (Prior Judgment Section 9) The use of water by each and all parties and their predecessors in interest has an open, notorious, hostile, adverse, under claim of right, and with notice of said overdraft continuously from January 1, 1953 to January 4, 1973. The rights of each party herein declared are prescriptive in nature. The following aggregate consequences of said prescription within the Basin and Relevant Watershed are hereby declared:

(a) Prior Prescription. Diversions within the Relevant Watershed have created rights for direct consumptive use within the Basin, as declared and determined in Sections 16 and 18 hereof, which are of equal priority inter se, but which are prior and paramount to Pumping Rights in the Basin.

(b) Mutual Prescription. The aggregate Prescriptive Pumping Rights of the parties who are Pumpers now exceed, and for many years prior to filing of this action, have exceeded, the Natural Safe Yield of the Basin. By reason of said condition, all rights of said Pumpers are declared to be mutually prescriptive and of equal priority, inter se.

(c) Common Ownership of Safe Yield and Incidents Thereto. By reason of said Overdraft and mutual Prescription, the entire Natural Safe Yield of the Basin, the Operating Safe Yield thereof and the appurtenant rights to Ground Water storage capacity of the Basin are owned by Pumpers in undivided Pumpers' Shares as hereinafter individually declared, subject to the control of Watermaster, pursuant to the Physical Solution herein decreed. Nothing herein shall be deemed in derogation of the rights to spread water pursuant to rights set forth in Exhibit "G".

16. Surface Rights. (Prior Judgment Section 10) Certain of the aforesaid prior and paramount prescriptive water rights of Diverters to Divert for Direct Use stream flow within the Relevant Watershed are hereby declared and found in terms of Base Annual Diversion Right as set forth in Exhibit "C". Each Diverter shown on Exhibit "C" shall be entitled to Divert for Direct Use up to two hundred percent (200%) of said Base Annual Diversion Right in any one (1) Fiscal Year; provided that the aggregate quantities of water Diverted in any consecutive ten (10) Fiscal Year period shall not exceed ten (10) times such Diverter's Base Annual Diversion Right.

17. Ground Water Rights. (Prior Judgment Section 11) The Prescriptive Pumping Right of each Pumper, who is not an Integrated Producer, and his Pumper's Share are declared as set forth in Exhibit "D".

18. Optional Integrated Production Rights. (Prior Judgment Section 12) Those parties listed on Exhibit "E" have elected to be treated as Integrated Producers. Integrated Production Rights have two (2) historical components:

(1) a fixed component based upon historic Diversions for Direct Use; and

(2) a mutually prescriptive Pumper's Share component based upon Pumping during the period 1953 through 1967.

Assessment and other Watermaster regulation of the rights of such parties shall relate to and be based upon each such component. So far as future exercise of such rights is concerned, however, the gross quantity of the aggregate right in any Fiscal Year may be exercised, in the sole discretion of such party, by either Diversion or Pumping or any combination or apportionment thereof; provided, that for Assessment purposes the first water Produced in any Fiscal Year (other than "Carry-over", under Section 49 hereof) shall be deemed an exercise of the Diversion Component, and any Production over said quantity shall be deemed Pumped water, regardless of the actual method of Production.

19. Special Category Rights. (Prior Judgment Section 13) The parties listed on Exhibit "F" have water rights in the Relevant Watershed which are not ordinary Production rights. The nature of each such right is as described in Exhibit "F".

20. Non-consumptive Practices. (Prior Judgment Section 14) Certain Producers have engaged in Water Diversion and spreading practices which have caused such Diversions to have a non-consumptive or beneficial impact upon the aggregate water supply available in the Basin. Said parties, and a statement of the nature of their rights, uses and practices, are set forth in Exhibit "G". The Physical Solution decreed herein, and particularly its provisions for Assessments, shall not apply to such non-consumptive uses. Watermaster may require reports on the operations of said parties.

21. Overlying Rights. (Prior Judgment Section 14.5) Producers listed in Exhibit "K" hereto were not parties herein at the time of the original entry of Judgment herein. They have exercised in good faith Overlying Rights to Produce water from the Basin during the periods subsequent to the entry of Judgment herein and have by self-help initiated or maintained appurtenant Overlying Rights. Such rights are exercisable without quantitative limit only on specifically described Overlying Land and cannot be separately conveyed or transferred apart therefrom. As to such rights and their exercise, the owners thereof shall become parties to this action and be subject to Watermaster Replacement Water assessments under Section 45(b) hereof, sufficient to purchase Replenishment Water to offset the net consumptive use of such Production and practices. In addition, the gross amount of such Production for such overlying use shall be subject to Watermaster Administration Assessments under Section 45(a) hereof and the consumptive use portion of such Production for overlying use shall be subject to

Watermaster's In-Lieu Water Cost Assessments under Section 45(d) hereof. The Producers presently entitled to exercise Overlying Rights, a description of the Overlying Land to which Overlying Rights are appurtenant, the nature of use and the consumptive use portion thereof are set forth in Exhibit "K" hereto. Watermaster may require reports and make inspections of the operations of said parties for purposes of verifying the uses set forth in said Exhibit "K", and, in the event of a material change, to redetermine the net amount of consumptive use by such parties as changed, in the exercise of such Overlying Rights.

Annually, during the first two (2) weeks of June in each calendar year, such Overlying Rights Producers shall submit to Watermaster a verified statement as to the nature of the then current uses of said Overlying Rights on said Overlying Lands for the next ensuing Fiscal Year, whereupon Watermaster shall either affirm the prior determination or redetermine the net amount of the consumptive use portion of the exercise of such Overlying Right by said Overlying Rights Producer.

C. INJUNCTION

22. Injunction Against Unauthorized Production. (Prior Judgment Section 15) Effective July 1, 1973, each and every party, its officers, agents, employees, successors and assigns, to whom rights to waters of the Basin or Relevant Watershed have been declared and decreed herein is **ENJOINED AND RESTRAINED** from Producing water for Direct Use from the Basin or the Relevant Watershed except pursuant to rights and Pumpers' Shares herein decreed or which may hereafter be acquired by transfer pursuant to Section 55, or under the provisions of the Physical Solution in this Judgment and the Court's continuing jurisdiction, provided that no party is enjoined from Producing up to five (5) acre feet per Fiscal Year.

23. Injunction re Non-consumptive Uses. (Prior Judgment Section 16) Each party listed in Exhibit "G", its officers, agents, employees, successors and assigns, is **ENJOINED AND RESTRAINED** from materially changing said non-consumptive method of use.

24. Injunction re Change in Overlying Use Without Notice Thereof to Watermaster. (Prior Judgment Section 16.5) Each party listed in Exhibit "K", its officers, agents, employees, successors and assigns, is **ENJOINED AND RESTRAINED** from materially changing said

overlying uses at any time without first notifying Watermaster of the intended change of use, in which event Watermaster shall promptly redetermine the consumptive use portion thereof to be effective after such change.

25. Injunction Against Unauthorized Recharge. (Prior Judgment Section 17) Each party, its officers, agents, employees, successors and assigns, is **ENJOINED AND RESTRAINED** from spreading, injecting or otherwise recharging water in the Basin except pursuant to: (a) an adjudicated non-consumptive use, or (b) consent and approval of or Cyclic Storage Agreement with Watermaster, or (c) subsequent order of this Court.

26. Injunction Against Transportation from Basin or Relevant Watershed. (Prior Judgment Section 18) Except upon further order of Court and except as provided in section 34(r) herein, all parties, other than Transporting Parties and MWD in its exercise of its Special Category Rights, to the extent authorized therein, are **ENJOINED AND RESTRAINED** from transporting water hereafter Produced from the Relevant Watershed or Basin outside the areas thereof. For purposes of this Section, water supplied through a city water system which lies chiefly within the Basin shall be deemed entirely used within the Basin. Transporting Parties are entitled to continue to transport water to the extent that any Production of water by any such party does not violate the injunctive revisions contained in Section 22 hereof; provided that said water shall be used within the present service areas or corporate or other boundaries and additions thereto so long as such additions are contiguous to the then existing service area or corporate or other boundaries; except that a maximum of ten percent (10%) of use in any Fiscal Year may be outside said then existing service areas or corporate or other boundaries. Notwithstanding the foregoing and without in any way changing or limiting the Transporting Parties' entitlement to transport water as set forth herein, any party may enter into an agreement with Watermaster to store Supplemental Water and export said stored Supplemental Water under specific terms and conditions approved by Watermaster. Such storage and export shall be subject to (1) a determination by Watermaster that no material injury to the Basin or parties will result therefrom; (2) execution of an agreement with Watermaster setting forth the terms and conditions upon which water may be stored in or exported from the Basin; and (3) compliance

with Watermaster Rules and Regulations respecting Basin storage and export. (Amended 6/21/12)

D. CONTINUING JURISDICTION

27. Jurisdiction Reserved. (Prior Judgment Section 19) Full jurisdiction, power and authority are retained by and reserved to the Court for purposes of enabling the Court upon application of any party or of the Watermaster, by motion and upon at least thirty (30) days notice thereof, and after hearing thereon, to make such further or supplemental orders or directions as may be necessary or appropriate for interim operation before the Physical Solution is fully operative, or for interpretation, enforcement or carrying out of this Judgment, and to modify, amend or amplify any of the provisions of this Judgment or to add to the provisions thereof consistent with the rights herein decreed. Provided, that nothing in this paragraph shall authorize:

(1) modification or amendment of the quantities specified in the declared rights of any party;

(2) modification or amendment of the manner of exercise of the Base Annual Diversion Right or Integrated Production Right of any party; or

(3) the imposition of an injunction prohibiting transportation outside the Relevant Watershed or Basin as against any Transporting Party transporting in accordance with the provisions of this Judgment or against MWD as to its Special Category Rights.

E. WATERMASTER

28. Watermaster to Administer Judgment. (Prior Judgment Section 20) A Watermaster comprised of nine (9) persons, to be nominated as hereinafter provided and appointed by the Court, shall administer and enforce the provisions of this Judgment and any subsequent instructions or orders of the Court thereunder.

29. Qualification, Nomination and Appointment. (Prior Judgment Section 21) The nine (9) member Watermaster shall be composed of six (6) Producer representatives and three (3) public representatives qualified, nominated and appointed as follows:

(a) Qualification. Any adult citizen of the State of California shall be eligible to serve as Watermaster; provided, however, that no officer, director, employee or agent of Upper District or San Gabriel District shall be qualified as a Producer member of Watermaster.

(b) Nomination of Producer Representatives. A meeting of all parties shall be held at the regular meeting of Watermaster in November of each year, at the offices of Watermaster. Nomination of the six (6) Producer representatives shall be by cumulative voting, in person or by proxy, with each Producer entitled to one (1) vote for each one hundred (100) acre-feet, or portion thereof, of Base Annual Diversion Right or Prescriptive Pumping Right or Integrated Production Right.

(c) Nomination of Public Representatives. On or before the regular meeting of Watermaster in November of each year, the three (3) public representatives shall be nominated by the boards of directors of Upper District (which shall select two [2]) and San Gabriel District (which shall select one [1]). Said nominees shall be members of the board of directors of said public districts.

(d) Appointment. All Watermaster nominations shall be promptly certified to the Court, which will in ordinary course confirm the same by an appropriate order appointing said Watermaster; provided, however, that the Court at all times reserves the right and power to refuse to appoint, or to remove, any member of Watermaster. Notwithstanding section 27 herein, Watermaster nominations may be promptly certified by the Court upon 10 calendar days' notice thereof, plus the time prescribed by statute for service by mail, e-mail or other electronic means. (Amended 6/21/12)

30. Term and Vacancies. (Prior Judgment Section 22) Each member of Watermaster shall serve for a one (1) year term commencing on January 1, following his appointment, or until his successor is appointed. In the event of a vacancy on Watermaster, a successor shall be nominated at a special meeting to be called by Watermaster within ninety (90) days (in the case of a Producer representative) or by action of the appropriate district board of directors (in the case of a public representative).

31. Quorum. (Prior Judgment Section 23) Five (5) members of the Watermaster shall constitute a quorum for the transaction of affairs of the Watermaster. Action by the affirmative vote of five (5) members shall constitute action by Watermaster, except that the affirmative vote of six (6) members shall be required:

(a) to approve the purchase, spreading or injection of water for Ground Water recharge, or

(b) to enter in any Agreement pursuant to Section 34 (n) hereof.

32. Compensation. (Prior Judgment Section 24) Each Watermaster member shall receive compensation of One Hundred Dollars ($100.00) per day for each day's attendance at meetings of Watermaster or for each day's service rendered as a Watermaster member at the request of Watermaster, together with any expenses incurred in the performance of his duties required or authorized by Watermaster. No member of the Watermaster shall be employed by or compensated for professional services rendered by him to Watermaster, other than the compensation herein provided, and any authorized travel or related expense.

33. Organization. (Prior Judgment Section 25) At its first meeting in each year, Watermaster shall elect a chairman and a vice chairman from its membership. It shall also select a secretary, a treasurer and such assistant secretaries and assistant treasurers as may be appropriate, any of whom may, but need not be, members of Watermaster.

(a) Minutes. Minutes of all Watermaster meetings shall be kept, which shall reflect all actions taken by Watermaster. Draft copies thereof shall be furnished to any party who files a request therefor in writing with Watermaster. Said draft copies of minutes shall constitute notice of any Watermaster action therein reported; failure to request copies thereof shall constitute waiver of notice.

(b) Regular Meetings. Watermaster shall hold regular meetings at places and times to be specified in Watermaster's rules and regulations to be adopted by Watermaster. Notice of the scheduled or regular meetings of Watermaster and of any changes in the time or place thereof shall be mailed to all parties who shall have filed a request therefor in writing with Watermaster.

(c) Special Meetings. Special meetings of Watermaster may be called at any time by the chairman or vice chairman or by any three (3) members of Watermaster by written notice delivered personally or mailed to each member of Watermaster and to each party requesting notice, at least twenty-four (24) hours before the time of each such meeting in the case of personal delivery, and forty-eight (48) hours prior to such meeting in the case of mail. The calling notice shall specify the time and place of the special meeting and the business to be transacted at such meeting. No other business shall be considered at such meeting.

(d) Adjournments. Any meeting of Watermaster may be adjourned to a time and place specified in the order of adjournment. Less than a quorum may so adjourn from time to time. A copy of the order or notice of adjournment shall be conspicuously posted on or near the door of the place where the meeting was held within twenty-four (24) hours after adoption of the order of adjournment.

34. Powers and Duties. (Prior Judgment Section 26) Subject to the continuing supervision and control of the Court, Watermaster shall have and may exercise the following express powers, and shall perform the following duties, together with any specific powers, authority and duties granted or imposed elsewhere in this Judgment or hereafter ordered or authorized by the Court in the exercise of its continuing jurisdiction.

(a) Rules and Regulations. To make and adopt any and all appropriate rules and regulations for conduct of Watermaster affairs. A copy of said rules and regulations and any amendments thereof shall be mailed to all parties.

(b) Acquisition of Facilities. To purchase, own, lease, acquire and hold, as trustee for the benefit of the Parties, all necessary personal property and equipment, and such limited real property such as office quarters, monitoring wells, the key well, and other facilities necessary to fulfill Watermaster's basin management responsibilities under this Judgment. (Amended 6/21/12)

(c) Employment of Experts and Agents. To employ such administrative personnel, engineering, geologic, accounting, legal, public policy education or other specialized services (but not including registered lobbyists) and consulting assistants as may be deemed appropriate in the carrying out of its powers and to require appropriate bonds from all officers and employees handling Watermaster funds. (Amended 6/21/12)

(d) Measuring Devices, etc. To cause parties, pursuant to uniform rules, to install and maintain in good operating condition, at the cost of each party, such necessary measuring devices or meters as may be appropriate; and to inspect and test any such measuring device as may be necessary.

(e) Assessments. To levy and collect all Assessments specified in the Physical Solution.

(f) Investment of Funds. To hold and invest any and all funds which Watermaster may possess in investments authorized from time to time for public agencies in the State of California.

(g) Borrowing. To borrow in anticipation of receipt of Assessment proceeds an amount not to exceed the annual amount of Assessments levied but uncollected, or in accordance with the provisions of Sections 45 and 46 hereto. Upon approval by the Watermaster at its regularly scheduled public meeting, when necessary to secure Supplemental Water, Watermaster may borrow funds in excess of the annual amount of Assessments levied but uncollected. Prior to borrowing funds, Watermaster shall meet and confer with Responsible Agencies and seek their input. Watermaster shall adopt Rules and Regulations specifying: (i) how debt repayment will be allocated among the Parties; (ii) that Watermaster obtain prior approval of the Court before incurring debt that exceeds the total of one year's levied Assessments; and (iii) such other matters as Watermaster deems appropriate for Rules and Regulations respecting the purchase of Supplemental Water using debt. (Amended 6/21/12)

(h) Purchase of and Recharge with Supplemental Water. To purchase Supplemental Water and to introduce the same into the Basin, including Reclaimed Water, for replenishment, Replacement Water, and cyclic storage purposes in the Basin subject to the affirmative vote of six (6) members of Watermaster, provided, the

California Department of Public Health and the Los Angeles Regional Water Quality Control Board have approved such Reclaimed Water for said uses, Watermaster has given prior notice to all parties of its intention to use said Reclaimed Water for such purposes, held noticed hearings thereon, and approves such uses. Reclaimed Water used by Watermaster as Supplemental Water for said purposes shall not be a violation of Sections 3(b) or 3(c) of Exhibit "H" hereto. (Amended 4/2/91 and 6/21/12)

(i) Contracts. To enter into contracts for the performance of any administrative powers herein granted, subject to approval of the Court.

(j) Cooperation with Existing Agencies. To act jointly or cooperate with agencies of the United States and the State of California or any political subdivision, municipality or district to the end that the purposes of the Physical Solution may be fully and economically carried out. (Amended 6/21/12)

(k) Assumption of Make-Up Obligation. Watermaster shall assume the Make-Up Obligation for and on behalf of the Basin.

(m) Water Quality. Water quality in the Basin shall be a concern of Watermaster, and all reasonable steps shall be taken to assist and encourage appropriate regulatory agencies to enforce reasonable water quality regulations affecting the Basin, including regulation of solid and liquid waste disposal.

(n) Cyclic Storage Agreements. To enter into appropriate contracts, to be approved by the Court, for utilization of Ground Water storage capacity of the Basin for cyclic or regulatory storage of Supplemental Water by parties and non-parties, for subsequent recovery or Watermaster credit by the storing entity, pursuant to uniform rules and conditions, which shall include provision for:

(1) Watermaster control of all spreading or injection and extraction scheduling and procedures for such stored water;

(2) calculation by Watermaster of any special costs, damages or burdens resulting from such operations;

(3) determination by Watermaster of, and accounting for, all losses in

stored water, assuming that such stored water floats on top of the Ground Water supplies, and accounting for all losses of water which otherwise would have replenished the Basin, with priorities being established as between two or more such contractors giving preference to parties over non-parties; and

(4) payment to Watermaster for the benefit of the parties hereto of all special costs, damages or burdens incurred (without any charge, rent, assessment or expense as to parties hereto by reason of the adjudicated proprietary character of said storage rights, nor credit or offset for benefits resulting from such storage); provided, that no party shall have any direct interest in or control over such contracts or the operation thereof by reason of the adjudicated right of such party, the Watermaster having sole custody and control of all Ground Water storage rights in the Basin pursuant to the Physical Solution herein, and subject to review of the Court.

(o) Notice List. Maintain a current list of party designees to receive notice hereunder, in accordance with Section 54 hereof.

(p) Authority to Sue. To prosecute litigation, engage in dispute resolution and file amicus curiae briefs in the furtherance of Watermaster's responsibilities under this Judgment. (Amended 6/21/12)

(q) Public Policy Education. To perform public policy education activities in furtherance of Watermaster's responsibilities under this Judgment. (Amended 6/21/12)

(r) Export Agreements. Watermaster may fix terms and conditions under which parties and non-parties may store Supplemental Water in and export said stored Supplemental Water from the Basin. (Amended 6/21/12)

35. Policy Decisions – Procedure. (Prior Judgment Section 27) It is contemplated that Watermaster will exercise discretion in making policy decisions relating to Basin management under the Physical Solution decreed herein. In order to assure full participation and opportunity to be heard for those affected, no policy decision shall be made by Watermaster until thirty (30) days after the question involved has been raised for discussion at a Watermaster

meeting and noted in the draft of minutes thereof.

36. Reports. (Prior Judgment Section 28) Watermaster shall annually file with the Court and mail to the parties a report of all Watermaster activities during the preceding year, including an audited statement of all accounts and financial activities of Watermaster, summary reports of Diversions and Pumping, and all other pertinent information. To the extent practical, said report shall be mailed to all parties on or before November 1. The tables set forth in Exhibits C, D, E, K, L and M are listed for reference purposes only. Future updates to those exhibits shall be set forth in the Watermaster annual report. In lieu of mailing the annual report, Watermaster in its discretion may post the report on its website, mail or e-mail a notice of availability to the parties, and/or provide a hard copy of the report upon request. If a party does not have a valid e-mail address or internet access, that party shall identify an alternative method of service to be approved by Watermaster in its sole discretion. (Amended 6/21/12)

37. Review Procedures. (Prior Judgment Section 29) Any action, decision, rule or procedure of Watermaster (other than a decision establishing Operating Safe Yield, see Section 43(c)) shall be subject to review by the Court on its own motion or on timely motion for an Order to Show Cause by any party, as follows:

(a) Effective Date of Watermaster Action. Any order, decision or action of Watermaster shall be deemed to have occurred on the date that written notice thereof is mailed. Mailing of draft copies of Watermaster minutes to the parties requesting the same shall constitute notice to all such parties.

(b) Notice of Motion. Any party may, by a regularly noticed motion, petition the Court for review of said Watermaster's action or decision. Notice of such motion shall be mailed to Watermaster and all parties. Unless so ordered by the Court, such petition shall not operate to stay the effect of such Watermaster action.

(c) Time for Motion. Notice of motion to review any Watermaster action or decision shall be served and filed within ninety (90) days after such Watermaster action or decision.

(d) De Novo Nature of Proceeding. Upon filing of such motion for hearing, the

Court shall notify the parties of a date for taking evidence and argument, and shall review de novo the question at issue on the date designated. The Watermaster decision or action shall have no evidentiary weight in such proceeding.

(e) Decision. The decision of the Court in such proceeding shall be an appealable Supplemental Order in this case. When the same is final, it shall be binding upon the Watermaster and the parties.

F. PHYSICAL SOLUTION

38. Purpose and Objective. (Prior Judgment Section 30) Consistent with the California Constitution and the decisions of the Supreme Court, the Court hereby adopts and Orders the parties to comply with this Physical Solution. The purpose and objective of these provisions is to provide a legal and practical means for accomplishing the most economic, long term, conjunctive utilization of surface, Ground Water, Supplemental Water and Ground Water storage capacity to meet the needs and requirements of the water users dependent upon the Basin and Relevant Watershed, while preserving existing equities.

39. Need for Flexibility. (Prior Judgment Section 31) In order that Watermaster may be free to utilize both existing and new and developing technological, social and economic concepts for the fullest benefit of all those dependent upon the Basin, it is essential that the Physical Solution hereunder provide for maximum flexibility and adaptability. To that end, the Court has retained continuing jurisdiction to supplement the broad discretion herein granted to the Watermaster.

40. Watermaster Control. (Prior Judgment Section 32) In order to develop an adequate and effective program of Basin management, it is essential that Watermaster have broad discretion in the making of Basin management decisions within the ambit hereinafter set forth. The maintenance, improvement, and control of the water quality and quantity of the Basin, withdrawal and replenishment of supplies of the Basin and Relevant Watershed, and the utilization of the water resources thereof, must be subject to procedures established by Watermaster in implementation of the provisions of this Judgment. Both the quantity and quality of said water resource are thereby preserved and its beneficial utilization maximized.

(Amended 1/29/91)

(a) Watermaster shall develop an adequate and effective program of Basin management. The maintenance, improvement, and control of the water quality and quantity of the Basin, withdrawal and replenishment of supplies of the Basin and Relevant Watershed, and the utilization of the water resources thereof, must be subject to procedures established by Watermaster in implementation of the Physical Solution provisions of this Judgment. All Watermaster programs and procedures shall be adopted only after a duly noticed public hearing pursuant to Section 37 and 40 of the Amended Judgment herein. (Amended 1/29/91)

(b) Watermaster shall have the power to control pumping in the Basin by water Producers therein for Basin cleanup and water quality control so that specific well production can be directed as to a lesser amount, to total cessation, as to an increased amount, and even to require pumping in a new location in the Basin. Watermaster's right to regulate pumping activities of Producers shall be subordinate to any conflicting Basin cleanup plan established by the EPA or other public governmental agency with responsibility for ground water management or clean up, whether existing at the time of this Judgment or subsequent hereto. (Amended 2/24/92)

(c) Watermaster may act individually or participate with others to carry on technical and other necessary investigations of all kinds and collect data necessary to carry out the herein stated purposes. It may engage in contractual relations with the EPA or other agencies in furtherance of the clean up of the Basin and enter into contracts with agencies of the United States, the State of California, or any political subdivision, municipality, or district thereof, to the extent allowed under the applicable federal or state statutes. Any cooperative agreement between the Watermaster and EPA shall require the approval of the appropriate Agency(s) of the State of California. (Amended 1/29/91)

(d) For the regulation and control of pumping activity in the Basin, Watermaster shall adopt Rules and Regulations and programs to promote, manage and accomplish clean up of the Basin and its waters, including, but not limited to, measures to confine, move, and remove contaminants and pollutants. Such Rules and Regulations and programs shall be adopted only after a duly Noticed Public Hearing by Watermaster and shall be subject to Court review pursuant to Section 37 of the Amended Judgment herein. (Amended 1/29/91)

(e) Watermaster shall determine whether funds from local, regional, state or federal agencies are available for regulating pumping and the various costs associated with, or arising from such activities. If no public funds are available from local, regional, state, or federal agencies, the costs shall be obtained and paid by way of an In-Lieu Assessment by Watermaster pursuant to Section 10(j) of the Amended Judgment herein. Provided such In-Lieu Assessments become necessary, the costs shall be borne by all Basin Producers. (Amended 1/29/91)

(f) Watermaster is a Court empowered entity with limited powers, created pursuant to the Court's Physical Solution Jurisdiction under Article X, Section 2 of the California Constitution. None of the powers granted herein to Watermaster shall be construed as designating Watermaster a political subdivision of the State of California or authorizing Watermaster to act as "lead agency" to administer the federal Superfund for clean up of the Basin. (Amended 1/29/91)

41. <u>General Pattern of Contemplated Operations.</u> (Prior Judgment Section 33) In general outline (subject to the specific provisions hereafter and to Watermaster Operating Criteria set forth in Exhibit "H"), Watermaster will determine annually the Operating Safe Yield of the Basin and will notify each Pumper of his share thereof, stated in acre feet per Fiscal Year. Thereafter, no party may Produce in any Fiscal Year an amount in excess of the sum of his Diversion Right, if any, plus his Pumper's Share of such Operating Safe Yield, or his Integrated Production Right, or the terms of any Cyclic Storage Agreement, without being subject to Assessment for the purpose of purchasing Replacement Water. In establishing the Operating Safe Yield, Watermaster shall follow all physical, economic, and other relevant parameters provided in the Watermaster Operating Criteria. Watermaster shall have Assessment powers to

raise funds essential to implement the management plan in any of the several special circumstances herein described in more detail.

42. Basin Operating Criteria. (Prior Judgment Section 34) Until further order of the Court, Watermaster shall recharge Replacement Water in accordance with the Watermaster Operating Criteria and, insofar as practicable, to maintain the water level at the Key Well above Elevation two hundred (200). (Amended 6/21/12)

43. Determination of Operating Safe Yield. (Prior Judgment Section 35) Watermaster shall annually determine the Operating Safe Yield applicable to the succeeding Fiscal Year and estimate the same for the next succeeding four (4) Fiscal Years. In making such determination, Watermaster shall be governed in the exercise of its discretion by the Watermaster Operating Criteria. The procedures with reference to said determination shall be as follows:

(a) Preliminary Determination. On or before Watermaster's first meeting in April of each year, Watermaster shall make a Preliminary Determination of the Operating Safe Yield of the Basin for each of the succeeding five Fiscal Years. Said determination shall be made in the form of a report containing a summary statement of the considerations, calculations and factors used by Watermaster in arriving at said Operating Safe Yield.

(b) Notice and Hearing. A copy of said Preliminary Determination and report shall be mailed to each Pumper and Integrated Producer at least ten (10) days prior to a hearing to be held at Watermaster's regular meeting in May, of each year, at which time objections or suggested corrections or modifications of said determinations shall be considered. Said hearing shall be held pursuant to procedures adopted by Watermaster.

(c) Watermaster Determination and Review Thereof. Within thirty (30) days after completion of said hearing, Watermaster shall mail to each Pumper and Integrated Producer a final report and determination of said Operating Safe Yield for each such Fiscal Year, together with a statement of the Producer's entitlement in each such Fiscal Year stated in acre-feet. Any affected party, within thirty (30) days of mailing of notice of said Watermaster determination, may, by a regularly noticed motion, petition the Court for an Order to Show Cause for review of said Watermaster finding, and thereupon the Court shall hear such objections and settle such dispute. Unless so ordered by the Court, such petition shall not operate to stay the effect of said report and determination. In the absence of such review proceedings, the Watermaster determination shall be final.

44. Reports of Pumping and Diversion. (Prior Judgment Section 36) Each party shall file with the Watermaster quarterly, on or before the last day of January, April, July and October, a report on a form to be prescribed by Watermaster showing the total Pumping and Diversion (separately for Direct Use and for non-consumptive use, if any) of such party during the preceding calendar quarter.

45. Assessments – Purpose. (Prior Judgment Section 37)

(a) Statement of Authority and Need for Flexibility: Watermaster shall have the power to levy and collect Assessments from the parties (other than non-consumptive users, or Production under Special Category Rights or Cyclic Storage Agreements) based upon Production during the preceding Fiscal Year. Assessments on Minimal Producers will apply only to (1) existing parties who become Minimal Producers in the future; and (2) Minimal Producers who intervene after June 21, 2012. Because Supplemental Water may not be available for extended periods of time, Watermaster requires flexibility with respect to the procedures for purchasing Supplemental Water supplies, as and when those supplies become available. This Judgment is a Physical Solution entered pursuant to California Constitution Article X, Section 2, which recognizes that the timing and amount of Watermaster Assessments for Replacement Water costs must be determined in light of this uncertainty. This Judgment therefore grants Watermaster the flexibility and discretion necessary to purchase and pre-purchase Supplemental Water and levy assessments in an appropriate and equitable manner and amount to maximize the opportunities to secure necessary Supplemental Waters in the best interest of the parties and the long-term sustainability of the Basin. In accordance with Rules and Regulations adopted by Watermaster, to further enhance flexibility, Watermaster may borrow money from any available fund maintained by it for purposes other than Replacement Water purchases, or use accrued funds, to purchase Supplemental Water. (Amended 6/21/12)

(b) Authorized Assessments: Said Assessments may be for one or more of the following purposes:

(1) Watermaster Administration Costs. (Former Section 45(a)) Within thirty (30) days after completion of the hearing on the Preliminary Determination of the Operating Safe Yield of the Basin and Watermaster's determination thereof, pursuant to Section 43 hereof, Watermaster shall adopt a proposed budget for the succeeding Fiscal Year and shall mail a copy thereof to each party, together with a statement of the level of Administration Assessment levied by Watermaster which will be collected for purposes of raising funds for said budget. Said Assessment shall be uniformly applicable to each acre-foot of Production. (Amended 6/21/12)

(2) Replacement Water Costs. (Former Section 45(b)) Replacement Water Assessments shall be collected from each party on account of such party's Production in excess of its Diversion Rights, Pumper's Share or Integrated Production Right, and on account of the consumptive use portion of Overlying Rights, computed at the applicable rate established by Watermaster consistent with the Watermaster Operating Criteria, and other relevant factors, including the projected cost and availability of Supplemental Water supplies. Subject to Rules and Regulations adopted by Watermaster, Watermaster Replacement Water Assessment rates may be in an amount calculated to allow Watermaster to purchase more than one acre-foot of Supplemental Water for each acre-foot of excess Production to which such Assessment applies, when such purchases are necessary to secure Supplemental Water supplies for the benefit of the Basin and parties. (Amended 6/21/12)

(3) Make-Up Obligation. (Former Section 45(c)) An Assessment shall be collected equally on account of each acre-foot of Production, which does not

bear a Replacement Assessment hereunder, to pay all necessary costs of Administration and satisfaction of the Make-Up Obligation. Such Assessment shall not be applicable to water Production for an Overlying Right.

(4) In-Lieu Water Cost. (Former Section 45(d)) Watermaster may levy an Assessment against all Pumping to pay reimbursement for In-Lieu Water Costs except that such Assessment shall not be applicable to the non-consumptive use portion of an Overlying Right.

(5) Basin Water Quality Improvement. (Former Section 45(e)) For purposes of testing, protecting or improving the water quality in the Basin, Watermaster may, after a noticed hearing thereon, fix terms and conditions under which it may waive all or any part of its Assessments on such ground water Production and if such Production, in addition to his other Production, does not exceed such Producer's Share or entitlement for that Fiscal Year, such stated Production shall be allowed to be carried over for a part of such Producer's next Fiscal Year's Producer's Share or entitlement. In connection therewith, Watermaster may also waive the provisions of Section 25, 26 and 57 hereof, relating to Injunction Against Unauthorized Recharge, Injunction Against Transportation From Basin or Relevant Watershed, and Intervention After Judgment, respectively. Nothing in this Judgment is intended to allow an increase in any Producer's annual entitlement nor to prevent Watermaster, after hearing thereon, from entering into contracts to encourage, assist and accomplish the clean up and improvement of degraded water quality in the Basin by non-parties herein. Such contracts may include the exemption of the Production of such Basin water therefor from Watermaster Assessments and, in connection therewith, the waiver of the provisions of Judgment Sections 25, 26, and 57 hereof.

(6) Export and Storage. Watermaster shall levy an assessment to account for costs, burdens or losses incurred in connection with such exported or stored

water, including a fee for storage administration. Such storage or export shall be subject to (1) a determination by Watermaster that no material injury to the Basin or parties will result therefrom; (2) execution of an agreement with Watermaster setting forth the terms and conditions upon which water may be stored in or exported from the Basin; and (3) compliance with Watermaster Rules and Regulations respecting Basin storage and export. (Amended 6/21/12)

(7) Water Resource Development Assessment. Watermaster may levy an Assessment on all Pumping, as determined through Rules and Regulations to be adopted by the Watermaster, to support the purchase, financing, and/or development of new or additional Supplemental Water sources, in cooperation with one or more Responsible Agencies as appropriate. (Amended 6/21/12)

46. Assessments – Procedure. (Prior Judgment Section 38) Assessments herein provided for shall be levied and collected as follows:

(a) Levy and Notice of Assessment. Within thirty (30) days of Watermaster's annual determination of Operating Safe Yield of the Basin for each Fiscal Year and succeeding four (4) Fiscal Years, and at such other time[s] of the year as determined by Watermaster, Watermaster shall levy applicable Administration Assessments, Replacement Water Assessments, Make-Up Water Assessments, In-Lieu Water Assessments, and Water Resource Development Assessments, if any. Watermaster shall give written notice of all applicable Assessments to each party on or before August 15, of each year, and at such other time[s] as determined by Watermaster. To provide flexibility and maximize the opportunity to secure Replacement Water supplies when available, in accordance with criteria set forth in the Watermaster Rules and Regulations, Watermaster may levy supplemental assessments as necessary to create sufficient funds to purchase and pre-purchase such Replacement Water supplies for the benefit of the Basin and parties. (Amended 6/21/12)

(b) Payment. Each Assessment shall be payable, and each party is Ordered to pay the same, on or before September 20, following such Assessment, subject to the rights reserved in Section 37 hereof.

(c) Delinquency. Any Assessment which becomes delinquent after January 1, 1980, shall bear interest at the annual prime rate plus one percent (1%) in effect on the first business day of August of each year. Said prime interest rate shall be that fixed by the Bank of America NT&SA for its preferred borrowing customers on said date. Said prime interest rate plus one percent (1%) shall be applicable to any said delinquent Assessment from the due date thereof until paid. Provided, however, in no event shall any said delinquent Assessment bear interest at a rate of less than ten percent (10%) per annum. Such delinquent Assessment and interest may be collected in a Show Cause proceeding herein or any other legal proceeding instituted by Watermaster, and in such proceeding the Court may allow Watermaster its reasonable costs of collection, including attorney's fees.

47. Availability of Supplemental Water from Responsible Agencies. (Prior Judgment Section 39) If any Responsible Agency shall, for any reason, be unable to deliver Supplemental Water to Watermaster in a timely fashion when needed, Watermaster may (1) collect funds at an appropriate level and hold them in trust, together with interest accrued thereon, for purchase of such water when available; (2) purchase water from the remaining Responsible Agencies which are the most beneficial and appropriate sources observing all legal and contractual constraints on the availability of such water; or (3) purchase Supplemental Water from any other available source. Watermaster shall consult with the Responsible Agencies involved and in good faith shall determine the appropriate source of Supplemental Water under such circumstances. Should Watermaster arrange to purchase Supplemental Water from a source not involving a Responsible Agency, Watermaster shall provide the Responsible Agencies an opportunity to provide said Supplemental Water or comparable water supplies on comparable terms. (Amended 6/21/12)

48. Accumulation of Replacement Water Assessment Proceeds. (Prior Judgment Section 40) In order to minimize fluctuation in Assessments and to give Watermaster flexibility in Basin management, Watermaster may make reasonable accumulations of Replacement Water

Assessments. Such moneys and any interest accrued thereon shall only be used for the purchase of Replacement Water.

49. Carry-over of Unused Rights. (Prior Judgment Section 41) Any Pumper's Share of Operating Safe Yield, and the Production right of any Integrated Producer, which is not Produced in a given Fiscal Year may be carried over and accumulated for one Fiscal Year, pursuant to reasonable rules and procedures for notice and accounting which shall be adopted by Watermaster. The first water Produced in the succeeding Fiscal Year shall be deemed Produced pursuant to such Carry-over Rights.

50. Minimal Producers. (Prior Judgment Section 42) In the interest of Justice, Minimal Producers who initiated production on or before June 21, 2012, are exempted from the operation of this Physical Solution, so long as such party's annual Production does not exceed five (5) acre-feet. Watermaster may require, and Minimal Producers shall furnish, specific periodic reports. In addition, Watermaster may conduct such investigation of future operations of any Minimal Producer as may be appropriate. As of June 21, 2012, there shall be no new Minimal Producers, and any new Producer shall be subject to all provisions of the Judgment. (Amended 6/21/12)

51. Effective Date. (Prior Judgment Section 43) The effective date for commencing accounting and operation under this Physical Solution, other than for Replacement Water Assessments, shall be July 1, 1972. The first Assessment for Replacement Water shall be payable on September 20, 1974, on account of Fiscal Year 1973-74 Production.

G. MISCELLANEOUS PROVISIONS

52. Puente Narrows Flow. (Prior Judgment Section 44) The Puente Basin is tributary to the Main San Gabriel Basin. All Producers within said Puente Basin have been dismissed herein, based upon the Puente Narrows Agreement (Exhibit "J"), whereby Puente Basin Water Agency agreed not to interfere with surface inflow and to assure continuance of historic subsurface contribution of water to Main San Gabriel Basin. The Court declares said Agreement to be reasonable and fair and in full satisfaction of claims by Main San Gabriel Basin for natural water from Puente Basin.

53. Deleted Section (Amended 6/21/12)

54. Service Upon and Delivery to Parties of Various Papers. (Prior Judgment Section 46) Service of the Judgment on those parties who have executed the Stipulation for Judgment shall be made by first class mail, postage prepaid, addressed to the Designee and at the address designated for that purpose in the executed and filed counterpart of the Stipulation for Judgment, or in any substitute designation filed with the Court.

Each party who has not heretofore made such a designation shall, within thirty (30) days after the Judgment shall have been served upon that party, file with the Court, with proof of service of a copy thereof upon Watermaster, a written designation of the person to whom and the address at which all future notices, determinations, requests, demands, objections, reports and other papers and processes to be served upon that party or delivered to that party are to be so served or delivered.

A later substitute designation filed and served in the same manner by any party shall be effective from the date of filing as to the then future notices, determinations, requests, demands, objections, reports and other papers and processes to be served upon or delivered to that party.

Delivery to or service upon any party by Watermaster, by any other party, or by the Court, of any item required to be served upon or delivered to a party under or pursuant to the Judgment may be made by deposit thereof (or by copy thereof) in the mail, first class, postage prepaid, addressed to the Designee of the party and at the address shown in the latest designation filed by that party. In lieu of mailing any item required to be served under this Judgment, Watermaster may serve such item by electronic service, which may include posting the document to Watermaster's website, sending an e-mail of the document to that party, or sending a notice of availability to that party indicating the document's availability for viewing on the Watermaster website. If a party does not have a valid e-mail address or internet access, that party shall identify an alternative method of service to be approved by Watermaster in its sole discretion.

Any party desiring to be relieved of receiving notices of Watermaster activity may file a waiver of notice on a form to be provided by Watermaster. Thereafter such party shall be removed from the active party service list and not receive any notices required under this Judgment. The parties have a duty to keep Watermaster informed of their current e-mail and mailing addresses. If mail or e-mail is returned undeliverable to Watermaster for an incorrect address, Watermaster in its sole discretion may remove that party from the active party service list. (Amended 6/21/12)

55. Assignment, Transfer, etc., of Rights. (Prior Judgment Section 47) Any rights Adjudicated herein except Overlying Rights, may be assigned, transferred, licensed or leased by the owners thereof; provided however, that no such assignment shall be complete until the appropriate notice procedures established by Watermaster have been complied with. No water Produced pursuant to rights assigned, transferred, licensed, or leased may be transported outside the Relevant Watershed except by:

(1) a Transporting Party, or

(2) a successor in interest immediate or mediate to a water system on lands or portion thereof, theretofore served by such a Transporting Party, for use by such successor in accordance with limitations applicable to Transporting Parties, or

(3) a successor in interest to the Special Category rights of MWD.

The transfer and use of Overlying Rights shall be limited, as provided in Section 21 hereof, as exercisable only on the specifically defined Overlying Lands and they cannot be separately conveyed or transferred apart therefrom.

56. Abandonment of Rights. (Prior Judgment Section 48) It is in the interest of reasonable beneficial use of the Basin and its water supply that no party be encouraged to take and use more water in any Fiscal Year than is actually required. Failure to Produce all of the water to which a party is entitled hereunder shall not, in and of itself, be deemed or constitute an abandonment of such party's right, in whole or in part. Abandonment and extinction of any right herein Adjudicated shall be accomplished only by:

(1) a written election by the party, filed in this case, or

(2) upon noticed motion of Watermaster, and after hearing.

In either case, such abandonment shall be confirmed by express subsequent order of this

Court.

57. Intervention After Judgment. (Prior Judgment Section 49) Any person who is not a party or successor to a party and who proposes to Produce water from the Basin or Relevant Watershed, may seek to become a party to this Judgment through a Stipulation For Intervention entered into with Watermaster. Watermaster may execute said Stipulation on behalf of the other parties herein but such Stipulation shall not preclude a party from opposing such Intervention at the time of the Court hearing thereon. Said Stipulation For Intervention must thereupon be filed with the Court, which will consider an order confirming said Intervention following thirty (30) days' notice to the parties. Thereafter, if approved by the Court, such Intervenor shall be a party bound by this Judgment and entitled to the rights and privileges accorded under the Physical Solution herein.

58. Judgment Binding on Successors, etc. (Prior Judgment Section 50) Subject to specific provisions hereinbefore contained, this Judgment and all provisions thereof are applicable to and binding upon and inure to the benefit of not only the parties to this action, but as well to their respective heirs, executors, administrators, successors, assigns, lessees, licensees and to the agents, employees and attorneys in fact of any such persons.

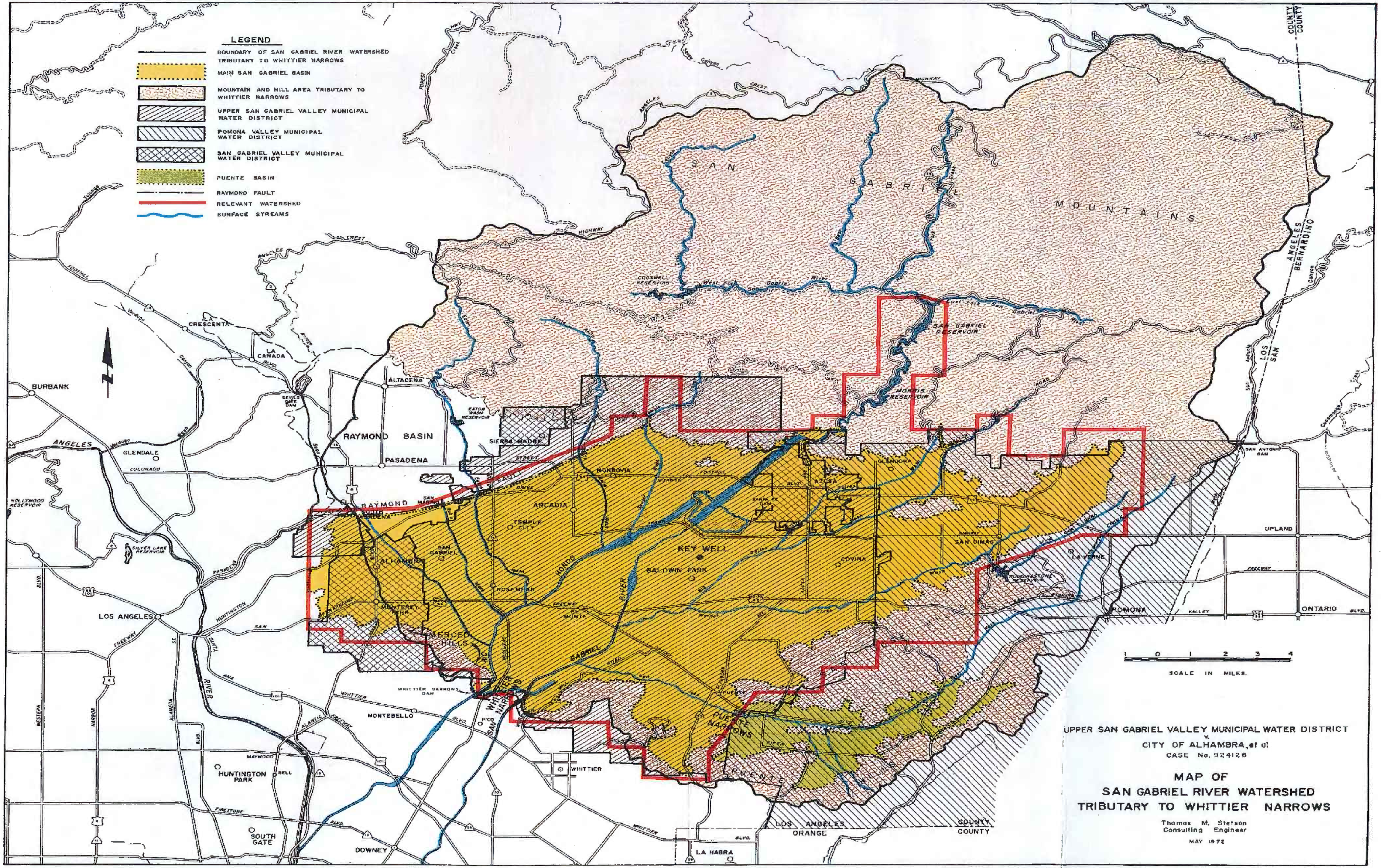
59. Water Rights Permits. (Prior Judgment Section 51) Nothing herein shall be construed as affecting the relative rights and priorities between MWD and San Gabriel Valley Protective Association under State Water Rights Permits Nos. 7174 and 7175, respectively.

60. Costs. (Prior Judgment Section 52) No party shall recover any costs in this proceeding from any other party.

61. Entry of Judgment. (New) The Clerk shall enter this Judgment.

DATED: June 21, 2012

s/ Maureen Duffy-Lewis
Maureen Duffy-Lewis, Judge
Specially Assigned



LEGEND
BOUNDARY OF SAN GABRIEL RIVER WATERSHED TRIBUTARY TO WHITTIER NARROWS
MAIN SAN GABRIEL BASIN
MOUNTAIN AND HILL AREA TRIBUTARY TO WHITTIER NARROWS
UPPER SAN GABRIEL VALLEY MUNICIPAL WATER DISTRICT
POMONA VALLEY MUNICIPAL WATER DISTRICT
SAN GABRIEL VALLEY MUNICIPAL WATER DISTRICT
PUENTE BASIN
RAYMOND FAULT
RELEVANT WATERSHED
SURFACE STREAMS
SAN GABRIEL MOUNTAINS
RAYMOND BASIN
BURBANK
GLENDALE
LA CRESCENTA
LA CANADA
ALTADENA
PASADENA
SIERRA MADRE
ARCADIA
MONROVIA
AZUSA
GLENDORA
SAN DIMAS
LA VERNE
UPLAND
POMONA
ONTARIO
COVINA
KEY WELL
BALDWIN PARK
TEMPLE CITY
SAN GABRIEL
ALHAMBRA
ROSEMEAD
MONTEREY PARK
EL MONTE
LOS ANGELES
MONTEBELLO
WHITTIER
HUNTINGTON PARK
SOUTH GATE
DOWNEY
LA HABRA
PUENTE NARROWS
WHITTIER NARROWS
SAN GABRIEL RESERVOIR
MORRIS RESERVOIR
COGSWELL RESERVOIR
LOS ANGELES COUNTY
ORANGE COUNTY
0 1 2 3 4
SCALE IN MILES.
UPPER SAN GABRIEL VALLEY MUNICIPAL WATER DISTRICT
v.
CITY OF ALHAMBRA, et al
CASE No. 924128
MAP OF
SAN GABRIEL RIVER WATERSHED
TRIBUTARY TO WHITTIER NARROWS
Thomas M. Stetson
Consulting Engineer
MAY 1972

EXHIBIT "A"

EXHIBIT "B"

BOUNDARIES OF RELEVANT WATERSHED

The following described property is located in Los Angeles County, State of California:

Beginning at the Southwest corner of Section 14, Township 1 North, Range 11 West, San Bernardino Base and Meridian;

Thence Northerly along the West line of said Section 14 to the Northwest corner of the South half of said Section 14;

Thence Easterly along the North line of the South half of Section 14 to the East line of said Section 14;

Thence Northerly along the East line of said Section 14, Township 1 North, Range 11 West and continuing Northerly along the East line of Section 11 to the Northeast corner of said Section 11;

Thence Easterly along the North line of Section 12 to the Northeast corner of said Section 12;

Thence Southerly along the East line of said Section 12 and continuing Southerly along the East line of Section 13 to the Southeast corner of said Section 13, said corner being also the Southwest corner of Section 18, Township 1 North, Range 10 West;

Thence Easterly along the South line of Sections 18, 17, 16 and 15 of said Township 1 North, Range 10 West to the Southwest corner of Section 14;

Thence Northerly along the West line of Section 14 to the Northwest corner of the South half of Section 14;

Thence Easterly along the North line of the South half of Section 14 to the East line of said section;

Thence Northerly along the East line of said Section 14, and continuing Northerly along the West line of Section 12 of said Township 1 North, Range 10 West to the North line of said Section 12;

Thence Easterly along the North line of said Section 12, to the Northeast corner of said Section 12, said corner being also the Southwest corner of Section 6, Township 1 North, Range 9 West;

Thence Northerly along the West line of said Section 6 and continuing Northerly along West line of Sections 31 and 30, Township 2 North, Range 9 West to the Westerly prolongation of the North line of said Section 30;

Thence Easterly along said Westerly prolongation of the North line of said Section 30 and continuing Easterly along the North line of Section 29 to the Northeast corner of said Section 29;

Thence Southerly along the East line of said Section 29 and continuing Southerly along the East line of Section 32, Township 2 North, Range 9 West, and thence continuing Southerly along the East line of Section 5, Township 1 North, Range 9 West to the Southeast corner of said Section 5;

Thence Westerly along the South line of said Section 5 to the Southwest corner of said Section 5, said point being also the Northwest corner of Section 8;

Thence Southerly along the West line of said Section 8 and continuing Southerly along the West line of Section 17, to the Southwest corner of said Section 17, said corner being also the Northwest corner of Section 20;

Thence Easterly along the North line of Sections 20 and 21 to the Northwest corner of Section 22, said corner being also the Southwest corner of Section 15;

Thence Northerly along the West line of said Section 15 to the Northwest corner of the South half of said Section 15;

Thence Easterly along the North line of said South half of Section 15 to the Northeast corner of said South half of Section 15;

Thence Southerly along the East line of Section 15 and continuing Southerly along the East line of Section 22 to the Southeast corner of said Section 22, said point being also the Southwest corner of Section 23;

Thence Easterly along the South line of Sections 23 and 24 to the East line of the West half of said Section 24;

Thence Northerly along said East line of the West half of Section 24 to the North line thereof;

Thence Easterly along said North line of Section 24 to the Northeast corner thereof, said point also being the Northwest corner of Section 19, Township 1 North, Range 8 West;

Thence continuing Easterly along the North line of Section 19 and Section 20 of said Township 1 North, Range 8 West to the Northeast corner of said Section 20;

Thence Southerly along the East line of Sections 20, 29 and 32 of said Township 1 North, Range 8 West to the Southeast corner of said Section 32;

Thence Westerly along the South line of Section 32 to the Northwest corner of the East half of Section 5, Township 1 South, Range 8 West;

Thence Southerly along the West line of the East half of said Section 5 to the South line of said Section 5;

Thence West to the East line of the Northerly prolongation of Range 9 West;

EXHIBIT "C"

TABLE SHOWING BASE ANNUAL DIVERSION RIGHTS OF CERTAIN DIVERTERS AS OF JUNE 21, 2012

DIVERTER	BASE ANNUAL DIVERSION RIGHT (ACRE-FEET)
Covell, Ralph	2.12
(Successor to Rittenhouse, Catherine and Rittenhouse, James)[1]	
(Transferred to Aqua Capital Management LP)[2]	-2.12
	0.00
Maddock, A. G.	3.40
(Transferred to San Gabriel Valley Water Company)[2]	-3.40
	0.00
Rittenhouse, Catherine	**0.00**
(Transferred to Covell, Ralph)[1]	
Rittenhouse, James	**0.00**
(Transferred to Covell, Ralph)[1]	
Ruebhausen, Arline	18.34
(Held in common with Ruebhausen, Victor)	
(Transferred to City of Glendora)[2]	-18.34
	0.00
Ruebhausen, Victor	--
(See Ruebhausen, Arline)	
TOTAL	0.00

1/ Permanent transfer of rights as recorded at entry of Judgment.
2/ Permanent transfer of rights after entry of Judgment.
3/ Intervenor after Judgment.

EXHIBIT "D"

TABLE SHOWING RIGHTS AND PUMPER'S SHARE OF EACH PUMPER AS OF JUNE 21, 2012

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
6W Farms, Inc.	1,217.40	0.61599
(Formerly Woodland Farms, Inc.)		
(Transferred to:		
Miller Brewing Company	-919.50	-0.46526
Richard J. Woodland)[2]	-297.90	-0.15073
	0.00	**0.00000**
Adams Ranch Mutual Water Company	**100.00**	**0.05060**
A & E Plastik Pak Co., Inc.	**0.00**	**0.00000**
(Transferred to Industry Properties, Ltd.)[1]		
Alhambra, City of	**8,812.05**	**4.45876**
Amarillo Mutual Water Company	**709.00**	**0.35874**
American Sheds, Inc.[3]		
(Successor to Southwestern Portland Cement Company)[2]	742.00	0.37544
(Transferred to USA Waste of California, Inc.)[2]	-742.00	-0.37544
	0.00	**0.00000**
Anchor Plating Co., Inc.[3]		
(Successor to Bodger & Sons, DBA Bodger Seeds Ltd.)[2]	10.00	0.00506
(Transferred to Crown City Plating Co.)[2]	-10.00	-0.00506
	0.00	**0.00000**
Anderson Family Marital Trust[3]		
(Successor to Anderson, Ray L. and Helen T.)[2]	50.16	0.02538
(Transferred to:		
Brondino, Jeanne	-25.08	-0.01269
Heinrich, Carolyn)[2]	-25.08	-0.01269
	0.00	**0.00000**

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
Anderson, Ray[3]		
(Successor to Covina Valley Unified School District)[2]	50.16	0.02538
(Transferred to Anderson, Ray L. and Helen T.)[2]	-50.16	-0.02538
	0.00	**0.00000**
Anderson, Ray L. and Helen T.[3]		
(Successor to Anderson, Ray)[2]	50.16	0.02538
(Transferred to Anderson Family Marital Trust)[2]	-50.16	-0.02538
	0.00	**0.00000**
Andrade, Macario and Consuelo; and Andrade, Robert and Jayne [3]		
(Successor to J. F. Isbell Estate, Inc.)[2]	8.36	0.00423
(Transferred to Susan Andrade)[2]	-8.36	-0.00423
	0.00	**0.00000**
Andrade, Susan[3]		
(Successor to Andrade, Macario and Consuelo; and Andrade, Robert and Jayne)[2]	8.36	0.00423
	8.36	**0.00423**
Arcadia, City of	9,252.00	4.68137
(Successor to First National Finance Corporation)[2]	60.90	0.03081
(Transferred to City of Monrovia)[2]	-951.00	-0.48119
	8,361.90	**4.23099**
Associated Southern Investment Company	16.50	0.00335
(Transferred to Southern California Edison Company)[2]	-16.50	-0.00335
	0.00	**0.00000**
AZ-Two, Inc.[3]	--	--
(See Southdown, Inc.)		
Azusa Associates, LLC[3]		
(Successor to Snyder, Esther)[2]	18.51	0.00937
(Transferred to Aqua Capital Management LP)[2]	-18.51	-0.00937
	0.00	**0.00000**
Azusa-Western Inc.	742.00	0.37544
(Transferred to Southwestern Portland Cement Co.)[2]	-742.00	-0.37544
	0.00	**0.00000**
Bahnsen & Beckman Ind., Inc.	840.50	0.42528
(Transferred to Woodland, Richard)[2]	-840.50	-0.42528
	0.00	**0.00000**

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
Bahnsen, Betty M.	441.90	0.22359
(Transferred to Dawes, Mary Kay)[2]	-441.90	-0.22359
	0.00	**0.00000**
Baldwin Park County Water District	--	--
(See Valley County Water District)		
Bandel Family Trust[3]		
(Successor to Garnier, Camille A, Deceased,	16.70	0.00845
Estate of)[2]	**16.70**	**0.00845**
Banks, Gale C. and Vicki Lynn[3]		
(Successor to Doyle, Mr. and Mrs.; and	50.00	0.02530
Madruga, Mr. and Mrs.)[2]	**50.00**	**0.02530**
Base Line Water Company	430.20	0.21767
(Transferred to Hughes Development Corporation)[2]	-430.20	-0.21767
	0.00	**0.00000**
Beverly Acres Mutual Water Company	--	--
(See Beverly Acres Mutual Water Users Association)		
Beverly Acres Mutual Water Users Association	93.00	0.04706
(Formerly Beverly Acres Mutual Water Company)		
(Transferred to:		
San Gabriel Valley Water Company;	-50.00	-0.02530
Nicholson Trust)[2]	-43.00	-0.02176
	0.00	**0.00000**
Birenbaum, Max	6.00	0.00304
(Held in common with Birenbaum, Sylvia;		
Schneiderman, Alan; Schneiderman, Lydia;		
Wigodsky, Bernard; Wigodsky, Estera)		
(Transferred to City of Whittier)[2]	-6.00	-0.00304
	0.00	**0.00000**
Birenbaum, Sylvia	--	--
(See Birenbaum, Max)		
Blue Diamond Concrete Materials Div., The Flintkote Company	1,399.33	0.70804
(Transferred to Sully-Miller Contracting Co.)[2]	-1,399.33	-0.70804
	0.00	**0.00000**

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
Bodger & Sons DBA Bodger Seeds Ltd.	10.00	0.00506
(Transferred to Anchor Plating Co., Inc.)[2]	-10.00	-0.00506
	0.00	**0.00000**
Botello Water Company	**0.00**	**0.00000**
Brezina, Raymond W. and Susan W. Trust 2001[3]	**0.00**	**0.00000**
Brondino, Jeanne[3]		
(Successor to Anderson Family Marital Trust)[2]	25.08	0.01269
	25.08	**0.01269**
Burbank Development Company	50.85	0.02563
(Transferred to Wright, Darrell A., Wright, Merle M. & Carlson, Jeanne W.)[2]	-50.85	-0.02563
	0.00	**0.00000**
Cadway, Inc.[3]		
(Successor to:		
Corcoran, Jack S. and R. L.	100.00	0.05060
Corcoran, Jack S. and R. L.	100.00	0.05060
Corcoran, Jack S. and R. L.	273.50	0.13839
Corcoran, Jack S. and R. L.	30.00	0.01518
Garnier, Janus	203.00	0.10272
Sloan Ranches	129.60	0.06558
Corcoran, Jack S. and R.L.)[2]	243.50	0.12320
(Transferred to:		
California Domestic Water Company	-243.50	-0.12321
California Domestic Water Company	-129.60	-0.06558
California Domestic Water Company)[2]	-63.30	-0.03203
	643.20	**0.32545**
Cal Fin	118.10	0.05976
(Transferred to Suburban Water Systems)[2]	-118.10	-0.05976
	0.00	**0.00000**
California-American Water Company (San Marino System)	**7,868.70**	**3.98144**
California Country Club[3] (Formerly CCC Management)	**0.00**	**0.00000**

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
California Domestic Water Company	11,024.82	5.57839
(Successor to:		
Cantrill Mutual Water Company[1]	42.50	0.02150
Industry Properties, Ltd.[2]	73.50	0.03719
Modern Accent Corporation[2]	256.86	0.12997
Fisher, Russell[2]	19.00	0.00961
Graveline, George Wayne and Alexis June, Trust[2]	216.60	0.10959
Cadway, Inc.[2]	243.50	0.12321
Cadway, Inc[2]	129.60	0.06558
Cadway, Inc.[2])	63.30	0.03203
	12,069.68	**6.10707**
California Materials Company	**0.00**	**0.00000**
CalMat	--	--
(Formerly Conrock Company)		
(See Vulcan Materials Company)		
Cantrill Mutual Water Company	**0.00**	**0.00000**
(Transferred to California Domestic Water Company)[1]		
Canyon Water Company [3]		
(Successor to McIntyre, William)[2]	1.00	0.00051
	1.00	**0.00051**
Canyon Water & Development Corporation[3]	**0.00**	**0.00000**
CCC Management [3]	--	--
(See California Country Club)		
Cedar Avenue Mutual Water Company	121.10	0.06127
(Transferred to San Gabriel Valley Water Company)[2]	-121.10	-0.06127
	0.00	**0.00000**
CEMEX California Aggregates, Inc. [3]	--	--
(Formerly Southdown)		
Champion Mutual Water Company	**147.68**	**0.07472**
Chevron U.S.A.	**2.00**	**0.00101**
(Formerly Standard Oil of California)		
Chronis, Christine[3]	--	--
(See Polopolus, et al.)		

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
Clayton Manufacturing Company	511.80	0.25896
(Transferred to City of Glendora)[2]	-511.80	-0.25896
	0.00	**0.00000**
Coiner, James W., dba Coiner Nursery[3]	--	--
Collison, E. O.	**0.00**	**0.00000**
Comby, Erma M.	--	--
(See Wilmott, Erma M.)		
Conrock Company	--	--
(See CalMat)		
(Formerly Consolidated Rock Products Co.)		
Consolidated Rock Products Co.	--	--
(See Conrock Company)		
Corcoran, Jack S.	747.00	0.37797
(Held in common with Corcoran, R. L.)		
(Transferred to:		
Cadway, Inc.	-100.00	-0.05060
Cadway, Inc.	-100.00	-0.05060
Cadway, Inc.	-273.50	-0.13839
Cadway, Inc.	-30.00	-0.01518
Cadway, Inc.)[2]	-243.50	-0.12320
	0.00	**0.00000**
Corcoran, R. L.	--	--
(See Corcoran, Jack S.)		
County Sanitation District No. 18 of Los Angeles County	**4.50**	**0.00228**

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
Covell, et al.	111.05	0.05619
(Successor to Rittenhouse, Catherine and Rittenhouse, James)[1]		
(Held in common with Tate, Phillip G. and Sieglinde A.; Goedert, Lillian E.; Goedert, Marion W.; Lakin, Kendall R.; Lakin, Kelly R.; Snyder, Harry; Snyder, Esther)		
(Transferred to:		
Lakin, Kelly R.	-9.26	-0.00468
Goedert, Lillian E.	-9.26	-0.00468
Tate, Phillip G. and Sieglinde A.	-57.83	-0.02926
Snyder, Esther	-18.51	-0.00937
Aqua Capital Management LP)[2]	-16.19	-0.00820
	0.00	**0.00000**
Covina, City of	2,507.89	1.26895
(Transferred to:		
Covina Irrigating Company	-1,734.00	-0.87737
Covina Irrigating Company)[2]	-300.00	-0.15179
	473.89	**0.23979**
Covina-Valley Unified School District	50.16	0.02538
(Transferred to Anderson, Ray)[2]	-50.16	-0.02538
	0.00	**0.00000**
Crevolin, A. J.	**2.25**	**0.00114**
Crocker National Bank, Executor of the Estate of A. V. Handorf	**0.00**	**0.00000**
(Transferred to Modern Accent Corp.)[1]		
Cross Water Company	1,103.00	0.05581
(Transferred to Industry Waterworks System, City of)[2]	-1,103.00	-0.05581
	0.00	**0.00000**
Crown City Plating Company	190.00	0.09614
(Successor to Anchor Plating Co., Inc.)[2]	10.00	0.00506
(Transferred to Valencia Heights Water Company)[2]	-200.00	-0.10120
	0.00	**0.00000**
Davidson Optronics, Inc.	22.00	0.01113
(Transferred to Covina Irrigating Company)[2]	-22.00	-0.01113
	0.00	**0.00000**

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
Dawes, Mary Kay[3]	**441.90**	**0.22359**
(Successor to Bahnsen, Betty M.)[2]		
Del Rio Mutual Water Company	**199.00**	**0.10069**
Denton, Kathryn W., Trustee for San Jose Ranch Company	185.50	0.09386
(Transferred to White, June G., Trustee of the June G. White share of the Garnier Trust)[2]	-185.50	-0.09386
	0.00	**0.00000**
Doyle, Mr. and Mrs.; and Madruga, Mr. and Mrs.[3]		
(Successor to Sawpit Farms, Limited)[2]	50.00	0.02530
(Transferred to Banks, Gale C. and Vicki Lynn)[2]	-50.00	-0.02530
	0.00	**0.00000**
Driftwood Dairy	**163.80**	**0.08288**
Duhalde, L.	**0.00**	**0.00000**
(Transferred to El Monte Union High School District)[1]		
Dunning, George		
(Held in common with Dunning, Vera H.)		
(Successor to Vera H. Dunning)[2]	324.00	0.16394
(Transferred to Dunning Trust, George A. V.)[2]	-324.00	-0.16394
	0.00	**0.00000**
Dunning Trust, George A. V. [3]		
(Successor to Dunning, George)[2]	324.00	0.16394
(Transferred to Loyola Marymount University)[2]	-324.00	-0.16394
	0.00	**0.00000**
Dunning, Vera H.	324.00	0.16394
(See Dunning, George)		
(Transferred to Dunning, George)[2]	-324.00	-0.16394
	0.00	**0.00000**
Durfee Property, LLC[3]		
(Successor to Texaco, Inc.)[2]	50.00	0.02530
(Transferred to San Gabriel Valley Water Company)[2]	-50.00	-0.02530
	0.00	**0.00000**
East Pasadena Water Company, Ltd.	**1,407.69**	**0.71227**

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
Eckis, Rollin[3]		
(Successor to Sawpit Farms, Limited)[2]	123.00	0.06224
(Transferred to City of Monrovia)[2]	-123.00	-0.06224
	0.00	**0.00000**
El Encanto Properties	33.40	0.01690
(Transferred to La Puente Valley	-33.40	-0.01690
County Water District)[2]	**0.00**	**0.00000**
El Monte, City of	2,784.23	1.40878
(Successor to W. E. Hall Company)[2]	0.20	0.00010
	2,784.43	**1.40888**
El Monte Cemetery Association	**18.50**	**0.00936**
El Monte Union High School District	9.80	0.00496
(Successor to Duhalde, L.)[1]	6.40	0.00324
(Transferred to City of Whittier)[2]	-16.20	-0.00820
	0.00	**0.00000**
Everett, Mrs. Alda B.	**0.00**	**0.00000**
(Held in common with Everett, W.B., Executor of the Estate of I. Worth Everett)		
Everett, W.B., Executor of the Estate of I. Worth Everett	**--**	**--**
(See Everett, Mrs. Alda B.)		
Faix, Incorporated	**0.00**	**0.00000**
(Successor to Frank F. Pellissier & Sons, Inc.)[1]		
(Transferred to Faix, Ltd.)[1]		
Faix, Ltd.	6,490.00	3.28384
(Successor to Faix, Incorporated)[1]		
(Transferred to Pellissier Irrevocable QTIP Trust, et al,	-6,490.00	-3.28384
Laurence R., Co-tenancy of)[2]	**0.00**	**0.00000**
First National Finance Corporation	60.90	0.03081
(Transferred to City of Arcadia)[2]	-60.90	-0.03081
	0.00	**0.00000**
Fisher, Russell	19.00	0.00961
(Held in common with Hauch, Edward and Warren, Clyde)		
(Transferred to California Domestic Water Company)[2]	-19.00	-0.00961
	0.00	**0.00000**

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
Fox Family Trust Michael Edward Fox and Crystal Marie Fox, Trustees[3]		
(Successor to Maggiore, Valarie; Fox, Crystal; and Kirklen, Jeffery)[2]	**145.83**	**0.07378**
Frank F. Pellissier & Sons, Inc.	**0.00**	**0.00000**
(Transferred to Faix, Incorporated)[1]		
Fruit Street Water Company	207.00	0.10474
(Transferred to:		
Gifford, Brooks, Jr.,	-101.29	-0.05125
City of La Verne)[2]	-105.71	-0.05349
	0.00	**0.00000**
Garnier, Anton C. and Anita, Family Trust[3]		
(Successor to:		
South Covina Water Service	203.00	0.10271
Garnier, Camille A., Deceased, Estate of	8.30	0.00420
Garnier, Janus)[2]	3.00	0.00152
	214.30	**0.10843**
Garnier, Camille A., Deceased, Estate of[3]		
(Successor to South Covina Water Service)[2]	83.30	0.04215
(Transferred to:		
The Ruth Elaine Ailor Garnier Trust	-41.70	-0.02110
The George Wayne and Alexis June Graveline Trust	-8.30	-0.00420
The Anton C. and Anita Garnier Family Trust	-8.30	-0.00420
Janus Garnier	-8.30	-0.00420
The Bandel Family Trust)[2]	-16.70	-0.00845
	0.00	**0.00000**
Garnier, Janus[3]		
(Successor to :		
Garnier, Camille A. Deceased, Estate of	8.30	0.00420
South Covina Water Service)[2]	203.00	0.10272
(Transferred to:		
George Wayne and Alexis June Graveline Trust	-5.30	-0.00268
The Anton C. and Anita Garnier Family Trust	-3.00	-0.00152
Cadway, Inc.)[2]	-203.00	-0.10272
	0.00	**0.00000**
Garnier, Ruth Elaine Ailor, Trust[3]		
(Successor to Garnier, Camille A. Deceased, Estate of)[2]	41.70	0.02110
	41.70	**0.02110**

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
Gates, James Richard[3]	**0.00**	**0.00000**
Gifford, Brooks, Jr.[3]		
(Successor to:		
Fruit Street Water Company,	101.29	0.05125
Mission Gardens Mutual Water Company)[2]	96.96	0.04906
(Transferred to City of Whittier)[2]	-198.25	-0.10031
	0.00	**0.00000**
Gilkerson, Frank B.	--	--
(Formerly part of Covell, et al.)		
(Transferred interest in Covell, et al. to Jobe, Darr)[2]		
Glendora Unified High School District	99.00	0.05009
(Transferred to City of Glendora)[2]	-99.00	-0.05009
	0.00	**0.00000**
Goedert, Lillian E.		
(See Covell, et al.)		
(Successor to Covell, et al.)[2]	9.26	0.00468
(Transferred to Covina Irrigating Co.)[2]	-7.00	-0.00354
	2.26	**0.00114**
Goedert, Marion W.	--	--
(See Covell, et al.)		
Golden State Water Company,	**5,773.00**	**2.92105**
San Gabriel Valley District		
(Formerly Southern California Water Company)		
Graham, William	--	--
(Formerly part of Covell, et al.)		
(Transferred interest in Covell et al. to Jobe, Darr)[2]		
Graveline, George Wayne and Alexis June, Trust[3]		
(Successor to:		
South Covina Water Service	203.00	0.10271
Garnier, Camille A., Deceased, Estate of	8.30	0.00420
Garnier, Janus)[2]	5.30	0.00268
(Transferred to California Domestic Water Company)[2]	-216.60	-0.10959
	0.00	**0.00000**
Green, Walter	**71.70**	**0.03628**

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
Grizzle, Lissa B.	184.00	0.09310
(Held in common with Grizzle, Mervin A.; Wilson, Harold R.; Wilson, Sarah C.)		
(Transferred to City of Whittier)[2]	-184.00	-0.09310
	0.00	**0.00000**
Grizzle, Mervin A.	--	--
(See Grizzle, Lissa B.)		
Hansen, Alice	**0.75**	**0.00038**
Hanson Aggregates West, Inc. [3]		
(Successor to:		
Livingston-Graham, Inc.	1,824.40	0.92312
Sully-Miller Contracting Company)[2]	489.77	0.24782
	2,314.17	**1.17094**
Hartley, David[3]	**0.00**	**0.00000**
Hauch, Edward	--	--
(See Fisher, Russell)		
Heinrich, Carolyn[3]		
(Successor to Anderson Family Marital Trust)[2]	25.08	0.01269
	25.08	**0.01269**
Hemlock Mutual Water Company	**166.00**	**0.08399**
Hollenbeck Street Water Company	**0.00**	**0.00000**
(Transferred to Suburban Water Systems)[1]		
Hughes Development Corporation[3]		
(Successor to Base Line Water Company)[2]	430.20	0.21767
(Transferred to:		
San Gabriel County Water District	-400.00	-0.20239
San Gabriel County Water District)[2]	-30.20	-0.01528
	0.00	**0.00000**
Hunter, Lloyd F.[3]		
(Successor to Wade, R.)[2]	4.40	0.00223
(Transferred to Covina Irrigating Company)[2]	-4.40	-0.00223
	0.00	**0.00000**
Hydro-Conduit Corporation	**0.00**	**0.00000**

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
Industry Waterworks System, City of[3]		
(Successor to Cross Water Company)[2]	1,103.00	0.55810
	1,103.00	**0.55810**
Industry Properties, Ltd.		
(Successor to A & E Plastik Pak Co., Inc.)[1]	73.50	0.03719
(Transferred to California Domestic Water Co.)[2]	-73.50	-0.03719
	0.00	**0.00000**
Irwindale, City of[3]		
(Successor to United Concrete Pipe Corporation)[2]	376.00	0.19025
	376.00	**0.19025**
J. F. Isbell Estate, Inc.	8.36	0.00423
(Transferred to Andrade, Macario and	-8.36	-0.00423
Consuelo; and Andrade, Robert and Jayne)[2]	**0.00**	**0.00000**
Jerris, Helen[3]	--	--
(See Polopolus, et al.)		
Jobe, Darr[3]	--	--
(Formerly part of Covell, et al.)		
(Successor to:		
Gilkerson, Frank B. interest in Covell et al.		
Graham, William interest in Covell et al.)[2]		
(Transferred interest in Covell et al. to Tate, Phillip G. and Sieglinde A.)[2]		
Kirklen Family Trust[3]	375.00	0.18974
(Formerly Kirklen, Dawn L.)		
(Held in common with Kirklen, William R.)		
(Successor to San Dimas-La Verne	62.50	0.03162
Recreational Facilities Authority)[2]		
(Transferred to		
Maggiore, Valarie; Fox, Crystal; and Kirklen, Jeffery)[2]	-437.50	-0.22136
	0.00	**0.00000**
Kirklen, Dawn L.	--	--
(See Kirklen Family Trust)		
Kirklen, Jeffery[3]	**145.84**	**0.07379**
(Successor to Maggiore, Valarie; Fox, Crystal; and Kirklen, Jeffery)[2]		
Kirklen, William R.	--	--
(See Kirklen, Dawn L.)		

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
Kiyan Farms	30.00	0.01518
(Formerly Kiyan, Hideo)		
(Transferred to West Covina Venture, Ltd.)[2]	-30.00	-0.01518
	0.00	**0.00000**
Kiyan, Hideo	--	--
(See Kiyan Farms)		
(Held in common with Kiyan, Hiro)		
Kiyan, Hiro	--	--
(See Kiyan, Hideo)		
Knight, Kathryn M.[3]		
(Successor to Knight, William)[2]	227.88	0.11530
(Transferred to Knight, William)[2]	-227.88	-0.11530
	0.00	**0.00000**
Knight, William	227.88	0.11530
(Transferred to Knight, Kathryn M.)[2]	-227.88	-0.11530
(Successor to Knight, Kathryn M.)[2]	227.88	0.11530
	227.88	**0.11530**
Lakin, Kelly R.[3]		
(See Covell, et al.)		
(Successor to Covell, et al.)[2]	9.26	0.00468
(Transferred to:		
Covina Irrigating Co.	-6.03	-0.00305
Covina Irrigating Co.)[2]	-3.23	-0.00163
	0.00	**0.00000**
Lakin, Kendall R.[3]	--	--
(See Covell, et al.)		
Landeros, John	**0.75**	**0.00038**
La Grande Source Water Company	**0.00**	**0.00000**
(Transferred to Suburban Water Systems)[1]		
Lang, Frank	**0.00**	**0.00000**
(Transferred to San Dimas-La Verne Recreational Facilities Authority)[1]		
La Puente Cooperative Water Co.	**0.00**	**0.00000**
(Transferred to Suburban Water Systems)[1]		

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
La Puente Valley County Water District	1,097.00	0.55507
(Successor to El Encanto Properties)[2]	33.40	0.01690
	1,130.40	**0.57197**
La Verne, City of	250.00	0.12650
(Successor to Fruit Street Water Co.)[2]	105.71	0.05349
(Transferred to Covina Irrigating Co.)[2]	-355.71	-0.17999
	0.00	**0.00000**
Lee, Paul M. and Ruth A.; Nasmyth, Virginia; Nasmyth, John[3]	**0.00**	**0.00000**
Little John Dairy	**0.00**	**0.00000**
Livingston-Graham, Inc.	1,824.40	0.92312
(Transferred to Hanson Aggregates West, Inc.)[2]	-1,824.40	-0.92312
	0.00	**0.00000**
Los Flores Mutual Water Company	26.60	0.01346
(Transferred to City of Monterey Park)[2]	-26.60	-0.01346
	0.00	**0.00000**
Loucks, David	**3.00**	**0.00152**
Lovelady, June G., Trustee[3]		
(Successor to White, June G., Trustee of the June G. White Share of the Garnier Trust)[2]	185.50	0.09386
	185.50	**0.09386**
Loyola Marymount University[3]		
(Successor to George A.V. Dunning Trust)[2]	324.00	0.16394
(Transferred to City of Glendora)[2]	-324.00	-0.16394
	0.00	**0.00000**
Maggiore, Valarie[3]		
(Successor to Maggiore, Valarie; Fox, Crystal; and Kirklen, Jeffrey)[2]	**145.83**	**0.07379**
Maggiore, Valarie; Fox, Crystal; and Kirklen, Jeffery[3]		
(Successor to Kirklen Family Trust)[2]	437.50	0.22136
(Transferred to:		
(Maggiore, Valarie;	-145.83	-0.07379
Kirklen, Jeffrey;	-145.84	-0.07379
Fox Family Trust, Michael Edward Fox and Crystal Marie Fox, Trustees)[2]	-145.83	-0.07378
	0.00	**0.00000**

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
Manning Bros. Rock & Sand Co.	328.00	0.16596
(Transferred to Conrock Company)[2]	-328.00	-0.16596
	0.00	**0.00000**
Maple Water Company	118.50	0.05996
(Transferred to Southwest Water Co.)[2]	-118.50	-0.05996
	0.00	**0.00000**
Martinez, Frances Mercy	**0.75**	**0.00038**
(Held in common with Martinez, Jaime)		
Martinez, Jaime	--	--
(See Martinez, Frances Mercy)		
Massey-Ferguson Company	**0.00**	**0.00000**
McIntyre, William[3]		
(Successor to West Covina Venture, Ltd.)[2]	30.00	0.01518
(Transferred to Canyon Water Company)[2]	-1.00	-0.00051
	29.00	**0.01467**
Miller Brewing Company	111.01	0.05617
(Successor to:		
Maechtlen, Estate of J.J.	151.50	0.07666
Phillips, Alice B., et al.	50.00	0.02530
South Covina Water Service	300.00	0.15180
Woodland Farms	919.50	0.46526
Woodland, Richard)[2]	840.50	0.42528
(Transferred to Miller Breweries West, L.P.)[2]	-2,372.51	-1.20047
	0.00	**0.00000**
Miller Breweries West, L.P.[3]		
(Successor to Miller Brewing Company)[2]	2,372.51	1.20047
(Transferred to MillerCoors LLC)[2]	-2,372.51	-1.20047
	0.00	**0.00000**
MillerCoors LLC[3]		
(Successor to Miller Breweries West, L.P.)[2]	**2,372.51**	**1.20047**
Mission Gardens Mutual Water Company	96.96	0.04906
(Transferred to Gifford, Brooks, Jr.)[2]	-96.96	-0.04906
	0.00	**0.00000**

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
Modern Accent Corporation		
(Successor to Crocker National Bank,	256.86	0.12997
Executor of the Estate of A. V. Handorf)[1]		
(Transferred to California Domestic Water Co.)[2]	-256.86	-0.12997
	0.00	**0.00000**
Monterey Park, City of	6,677.48	3.37870
(Successor to Los Flores Mutual Water Co.)[2]	26.60	0.01346
	6,704.08	**3.39216**
Munoz, Ralph E. [3]	**0.00**	**0.00000**
Murphy Ranch Mutual Water Company	223.23	0.11295
(Transferred to Southwest Suburban Water)[2]	-223.23	-0.11295
	0.00	**0.00000**
Namimatsu Farms	196.00	0.09917
(Transferred to California Cities Water Co.)[2]	-196.00	-0.09917
	0.00	**0.00000**
Nick Tomovich & Sons	**0.02**	**0.00001**
Nicholson Trust[3]		
(Successor to Beverly Acres	43.00	0.02176
Mutual Water Users Association)[2]		
(Transferred to:		
Nicholson Family Trust	-7.00	-0.00354
Nicholson Trust, Helene S.)[2]	-12.00	-0.00607
	24.00	**0.01215**
Nicholson Family Trust[3]		
(Successor to Nicholson Trust)[2]	7.00	0.00354
	7.00	**0.00354**
Nicholson Trust, Helene S.[3]		
(Successor to Nicholson Trust)[2]	12.00	0.00607
(Transferred to San Gabriel Valley Water Co.)[2]	-12.00	-0.00607
	0.00	**0.00000**
New Owl Rock Products[3]		
(Successor to Owl Rock Products Co.)[2]	715.60	0.36208
(Transferred to Robertson's Ready Mix, Ltd.)[2]	-715.60	-0.36208
	0.00	**0.00000**

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
No. 17 Walnut Place Mutual Water Co.	21.50	0.01088
(Transferred to San Gabriel Valley Water Co.)[2]	-21.50	-0.01088
	0.00	**0.00000**
Orange Production Credit Association[3]	**0.00**	**0.00000**
Owl Rock Products Co.	715.60	0.36208
(Transferred to New Owl Rock Products)[2]	-715.60	-0.36208
	0.00	**0.00000**
Pacific Rock & Gravel Co.	408.00	0.20644
(Transferred to:	-208.00	-0.10524
City of Whittier,	-200.00	-0.10120
Rose Hills Memorial Park Association)[2]	**0.00**	**0.00000**
Park Water Company	184.01	0.09311
(Transferred to Valley County Water District)[2]	-184.01	-0.09311
	0.00	**0.00000**
Parton Family Trust[3]	46.20	0.02338
(Formerly Via, H., Trust of)[2]		
(Transferred to San Gabriel Valley Water Company)[2]	-46.20	-0.02338
	0.00	**0.00000**
Pellissier Irrevocable QTIP Trust, et al, Laurence R., Co-tenancy of[3]		
(Successor to Faix, Ltd)[2]	6,490.00	3.28384
	6,490.00	**3.28384**
Penn, Margaret[3]	--	--
(See Polopolus, et al.)		
Pico County Water District	**0.75**	**0.00038**
Polopolus, John[3]	--	--
(See Polopolus, et al.)		
Polopolus, et al.[3]		
(Successor to Polopolus, Steve)[2]	22.50	0.01138
(Held in common with Chronis, Christine; Jerris, Helen; Penn, Margaret; Polopolus, John)	**22.50**	**0.01138**
Polopolus, Steve	22.50	0.01138
(Transferred to Polopolus, et al.)[2]	-22.50	-0.01138
	0.00	**0.00000**

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
Rados, Alexander	**43.00**	**0.02176**
(Held in common with Rados, Stephen and Rados, Walter)		
Rados, Stephen	--	--
(See Rados, Alexander)		
Rados, Walter	--	--
(See Rados, Alexander)		
Richwood Mutual Water Company	192.60	0.09745
(Transferred to San Gabriel Valley Water Company)[2]	-192.60	-0.09745
	0.00	**0.00000**
Rincon Ditch Company	628.00	0.31776
(Transferred to Workman Mill Investment Company)[2]	-628.00	-0.31776
	0.00	**0.00000**
Rincon Irrigation Company	314.00	0.15888
(Transferred to Workman Mill Investment Company)[2]	-314.00	-0.15888
	0.00	**0.00000**
Rio Hondo Memorial Foundation, The[3]	--	--
(Formerly Rose Hills Foundation, The) (See Rose Hills Foundation, The)		
Rittenhouse, Catherine	**0.00**	**0.00000**
(Transferred to Covell, Ralph)[1]		
Rittenhouse, James	**0.00**	**0.00000**
(Transferred to Covell, Ralph)[1]		
Robertson's Ready Mix, Ltd.[3]		
(Successor to New Owl Rock Products)[2]	715.60	0.36208
(Transferred to San Gabriel County Water District)[2]	-715.60	-0.36208
	0.00	**0.00000**
Rose Hills Memorial Park Association	--	--
(See Rose Hills Foundation, The)		

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
Rose Hills Foundation, The [3]		
(Formerly Rose Hills Memorial Park Association)		
(See Rio Hondo Memorial Foundation, The)		
(Formerly Rio Hondo Memorial Foundation, The)	594.00	0.30055
(Successor to Pacific Rock & Gravel Co.)[2]	200.00	0.10120
(Transferred to:		
Workman Mill Investment Co.	-594.00	-0.30055
Workman Mill Investment Co.)[2]	-200.00	-0.10120
	0.00	**0.00000**
Rosemead Development, Ltd.[3]		
(Successor to Thompson, Earl W.)[2]	1.00	0.00051
	1.00	**0.00051**
Rurban Homes Mutual Water Company	**217.76**	**0.11018**
Ruth, Roy	**0.75**	**0.00038**
San Dimas Golf Inc. DBA Via Verde County Club[3]	**0.00**	**0.00000**
San Dimas-La Verne Recreational Facilities Authority		
(Successor to Lang, Frank)[1]	62.50	0.03162
(Transferred to Kirklen, Dawn L. and William R.)[2]	-62.50	-0.03162
	0.00	**0.00000**
San Gabriel Country Club	**286.10**	**0.14476**
San Gabriel County Water District	4,250.00	2.15044
(Successor to:		
Hughes Development Corporation	400.00	0.20239
Hughes Development Corporation	30.20	0.01528
Robertson's Ready Mix, Ltd.)[2]	715.60	0.36208
	5,395.80	**2.73019**
San Gabriel Valley Municipal Water District	**0.00**	**0.00000**
Sawpit Farms, Limited	173.00	0.08754
(Transferred to:		
Eckis, Rolin	-123.00	-0.06224
Doyle and Madruga)[2]	-50.00	-0.02530
	0.00	**0.00000**
Schneiderman, Alan	--	--
(See Birenbaum, Max)		

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
Schneiderman, Lydia	--	--
(See Birenbaum, Max)		
Security Pacific National Bank,	38.70	0.01958
Co-trustee for the Estate of Winston F. Stoody		
(See Stoody, Virginia A.)		
(Transferred to City of Whittier)[2]	-38.70	-0.01958
	0.00	**0.00000**
Sierra La Verne Country Club[3]	**0.00**	**0.00000**
Sierra Madre, City of	**0.00**	**0.00000**
Sloan Ranches	129.60	0.06558
(Transferred to Cadway, Inc.)[2]	-129.60	-0.06558
	0.00	**0.00000**
Smith, Charles[3]	**0.00**	**0.00000**
Snyder, Esther[3]		
(Successor to Covell, et al)[2]	18.51	0.00937
(Transfered to Azusa Associates, LLC)[2]	-18.51	-0.00937
	0.00	**0.00000**
Snyder, Harry	--	--
(See Covell, et al.)		
Sonoco Products Company	**311.60**	**0.15766**
South Covina Water Service	992.30	0.50209
(Transferred to:		
Miller Brewing Company	-300.00	-0.15180
Anton C. and Anita Garnier Family Trust	-203.00	-0.10271
The George Wayne and Alexis June Graveline Trust	-203.00	-0.10271
The Estate of Camille A. Garnier, Deceased	-83.30	-0.04215
Garnier, Janus)[2]	-203.00	-0.10272
	0.00	**0.00000**
Southdown, Inc.[3]	--	--
(Formerly AZ-Two, Inc.)		
(See CEMEX California Aggregates, Inc.)		
Southern California Edison Company	155.25	0.07855
(Successor to Associated		
Southern Investment Company)[2]	16.50	0.00835
	171.75	**0.08690**

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
Southern California Water Company,	--	--
San Gabriel Valley District		
(See Golden State Water Company, San Gabriel Valley District)		
South Pasadena, City of	**3,567.70**	**1.80520**
Southwest Suburban Water	--	--
(See Suburban Water Systems)		
Southwest Water Company [3]		
(Successor to Maple Water Company)[2]	118.50	0.05996
	118.50	**0.05996**
Southwestern Portland Cement Company[3]		
(Successor to Azusa Western, Inc.)[2]	742.00	0.37544
(Transferred to American Sheds, Inc.)[2]	-742.00	-0.37544
	0.00	**0.00000**
Speedway 605, Inc.[3]	**0.00**	**0.00000**
Standard Oil Company of California	--	--
(See Chevron U.S.A.)		
Sterling Mutual Water Company	**120.00**	**0.06072**
Stoody, Virginia A., Co-trustee for the	--	--
Stoody, Winston F., Estate of	--	--
(See Security Pacific National Bank, Co-trustee)		
Suburban Water Systems	20,462.47	10.35370
(Formerly Southwest Suburban Water)		
(Successor to:		
Hollenbeck Street Water Company[1]	646.39	0.32706
La Grande Source Water Company[1]	1,078.00	0.54545
La Puente Cooperative Water Co.[1]	1,210.90	0.61270
Valencia Valley Water Company[1]	651.50	0.32965
Victoria Mutual Water Company[1]	469.60	0.23761
Cal Fin[2]	118.10	0.05976
Murphy Ranch Mutual Water Co.[2])	223.23	0.11295
	24,860.19	**12.57888**

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
Sully-Miller Contracting Company[3]		
(Successor to Blue Diamond Concrete	1,399.33	0.70804
Materials Div., The Flintkote Company)[2]		
(Transferred to:		
United Rock Products Corporation	-909.56	-0.46022
Hanson Aggregates West, Inc.)[2]	-489.77	-0.24782
	0.00	**0.00000**
Sunny Slope Water Company	**2,228.72**	**1.12770**
Tate, Phillip G. and Sieglinde A.[3]	**57.83**	**0.02926**
(See Covell,et al.)		
(Successor to Jobe, Darr interest in Covell, et al.)[2]		
(Successor to Covell, et al.)[2]		
Taylor Herb Garden	6.00	0.00304
(Transferred to Covina Irrigating Company)[2]	-6.00	-0.00304
	0.00	**0.00000**
Texaco, Inc. (Chevron U.S.A., Inc.)	50.00	0.02530
(Transferred to Durfee Property, LLC)[2]	-50.00	-0.02530
	0.00	**0.00000**
Thompson, Earl W.	1.00	0.00051
(Held in common with Thompson, Mary)		
(Transferred to Rosemead Development, Ltd.)[2]	-1.00	-0.00051
	0.00	**0.00000**
Thompson, Mary	--	--
(See Thompson, Earl W.)		
Tran, Hieu[3]	**0.00**	**0.00000**
Tyler Nursery	**3.21**	**0.00162**
United Concrete Pipe Corporation	376.00	0.19025
(Transferred to Irwindale, City of)[2]	-376.00	-0.19025
	0.00	**0.00000**
United Rock Products Corporation[3]		
(Successor to:		
Sully Miller Contracting Company)[2]	909.56	0.46022
	909.56	**0.46022**
USA Waste of California, Inc.[3]		
(Successor to American Sheds, Inc.)[2]	742.00	0.37544
(Transferred to Aqua Capital Management LP)[2]	-742.00	-0.37544
	0.00	**0.00000**

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
U.S. Pipe & Foundry Company[3] (See United Concrete Pipe Corporation)	--	--
Valencia Heights Water Company	861.00	0.43565
(Successor to Crown City Plating Company)[2]	200.00	0.10120
	1,061.00	**0.53685**
Valencia Valley Water Company (Transferred to Suburban Water Systems)[1]	**0.00**	**0.00000**
Vallecito Water Company	2,867.00	1.45066
(Transferred to San Gabriel Valley Water Company)[2]	-2,867.00	-1.45066
	0.00	**0.00000**
Valley County Water District	5,775.00	2.92206
(Formerly Baldwin Park County Water District)		
(Successor to Park Water Company)[2]	184.01	0.09311
	5,959.01	**3.01517**
Valley Crating Company	**0.00**	**0.00000**
Valley View Mutual Water Company	**616.00**	**0.31169**
Via, H. (See Via, H., Trust of)	--	--
Via, H., Trust of (Formerly Via, H.) (See Parton Family Trust)	--	--
Victoria Mutual Water Company (Transferred to Suburban Water Systems)[1]	**0.00**	**0.00000**
Vietnamese American Buddhist Temple Congregation[3]	**0.00**	**0.00000**
Vulcan Materials Company (Formerly CalMat)		
(Successor to Manning Bros. Rock & Sand Co.)[2]	1,793.35	0.90740
	1,793.35	**0.90740**
Wade, R.	4.40	0.00223
(Transferred to Hunter, Lloyd F.)[2]	-4.40	-0.00223
	0.00	**0.00000**
Ward Duck Company (See Woodland Farms, Inc.)	--	--

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
Warren, Clyde	--	--
(See Fisher, Russell)		
W. E. Hall Company	0.20	0.00010
(Transferred to City of El Monte)[2]	-0.20	-0.00010
	0.00	**0.00000**
West Covina Venture, Ltd.[3]		
(Successor to Kiyan Farms)[2]	30.00	0.01518
(Transferred to McIntyre, William)[2]	-30.00	-0.01518
	0.00	**0.00000**
White, June G., Trustee of the June G. White Share of the Garnier Trust[3]		
(Successor to Denton, Kathryn W., Trustee for the San Jose Ranch Company)[2]	185.50	0.09386
(Transferred to Lovelady, June G., Trustee)[2]	-185.50	-0.09386
	0.00	**0.00000**
Whittier, City of	7,620.23	3.85572
(Successor to:		
Grizzle, Lissa B.	184.00	0.09310
Pacific Rock and Gravel Co.	208.00	0.10524
Security Pacific National Bank, Co-trustee for the Estate of Winston F. Stoody	38.70	0.01958
El Monte Union High School District	16.20	0.00820
Gifford, Brooks, Jr.	198.25	0.10031
Birenbaum, Max)[2]	6.00	0.00304
	8,271.38	**4.18519**
Wigodsky, Bernard	--	--
(See Birenbaum, Max)		
Wigodsky, Estera	--	--
(See Birenbaum, Max)		
Wilmott, Erma M.	**0.75**	**0.00038**
(Formerly Comby, Erma M.)		
Wilson, Harold R.	--	--
(See Grizzle, Lissa B.)		
Wilson, Sarah C.	--	--
(See Grizzle, Lissa B.)		

PUMPER	PRESCRIPTIVE PUMPING ACRE-FEET	PUMPER'S SHARE %
Woodland Farms, Inc.	--	--
(See 6W Farms, Inc.)		
(Formerly Ward Duck Company)		
Woodland, Frederick G.[3]	--	--
Woodland, Richard[3]		
(Successor to Bahnsen & Beckman Ind., Inc.)[2]	840.50	0.42528
(Transferred to Miller Brewing Company)[2]	-840.50	-0.42528
(Successor to 6W Farms, Inc.)[2]	297.90	0.15073
(Transferred to Aqua Capital Management LP)[2]	-297.90	-0.15073
	0.00	**0.00000**
Workman Mill Investment Company[3]		
(Successor to:		
Rincon Ditch Company	628.00	0.31776
Rincon Irrigation Company	314.00	0.15888
Rose Hills Memorial Park Association	594.00	0.30055
Rose Hills Foundation, The)[2]	200.00	0.10120
	1,736.00	**0.87839**
Wright, Darrell A., Wright, Merle M. & Carlson, Jeanne W.[3]		
(Successor to Burbank Development Co.)[2]	50.65	0.02563
(Transferred to San Gabriel Valley Water Company)[2]	-50.65	-0.02563
	0.00	**0.00000**
Totals for Exhibit "D"	**129,765.87**	**65.65953**
Totals for Exhibit "E"	**67,868.56**	**34.34047**
GRAND TOTALS	**197,634.43**	**100.00000**

1/ Permanent transfer of rights as recorded at entry of Judgment.
2/ Permanent transfer of rights after entry of Judgment.
3/ Intervenor after Judgment.

EXHIBIT "E"

TABLE SHOWING PRODUCTION RIGHT OF EACH INTEGRATED PRODUCER AS OF JUNE 21, 2012

INTEGRATED PRODUCER	DIVERSION COMPONENT ACRE-FEET	PRESCRIPTIVE PUMPING COMPONENT ACRE-FEET	PUMPING COMPONENT SHARE %
Aqua Capital Management LP[3]			
(Successor to:			
Covell, Ralph	2.12	0.00	0.00000
Covell et al.	0.00	16.19	0.00820
Azusa Associates, LLC	0.00	18.51	0.00937
USA Waste of California, Inc.	0.00	742.00	0.37544
Richard Woodland)[2]	0.00	297.90	0.15073
	2.12	**1,074.60**	**0.54374**
Azusa, City of	0.00	3,655.99	1.84988
(Successor to Monrovia Nursery Company)[2]	363.00	0.00	0.00000
	363.00	**3,655.99**	**1.84988**
Azusa Agricultural Water Company	1,000.00	1,732.20	0.87647
(Transferred to:			
Azusa Valley Water Company	-830.00	-1,437.73	-0.72747
Azusa Valley Water Company)[2]	-170.00	-294.47	-0.14900
	0.00	**0.00**	**0.00000**
Azusa Foot-Hill Citrus Company	718.50	0.00	0.00000
(Transferred to Monrovia Nursery Company)[2]	-718.50		
	0.00	**0.00**	**0.00000**
Azusa Valley Water Company	2,422.00	8,274.00	4.18652
(Successor to:			
Azusa Agricultural Water Company	830.00	1,437.73	0.72747
Azusa Agricultural Water Company)[2]	170.00	294.47	0.14900
	3,422.00	**10,006.20**	**5.06299**
Brierly, Susan K.[3]			
(Successor to Monrovia Nursery Company)[2]	24.00	0.00	0.00000
(Transferred to Miles R. Rosedale)[2]	-8.00		
	16.00	**0.00**	**0.00000**
California-American Water Company	**1,672.00**	**3,649.00**	**1.84634**
(Duarte System)			

INTEGRATED PRODUCER	DIVERSION COMPONENT ACRE-FEET	PRESCRIPTIVE PUMPING COMPONENT ACRE-FEET	PUMPING COMPONENT SHARE %
California Cities Water Company	--	--	--
(See Southern California Water Company, San Dimas District)			
Covina Irrigating Company	2,514.00	4,140.00	2.09478
(Successor to:			
City of Covina		1,734.00	0.87737
City of Covina		300.00	0.15179
Taylor Herb Garden		6.00	0.00304
La Verne, City of		355.71	0.17999
Davidson Optronics, Inc.		22.00	0.01113
Goedert, Lillian		7.00	0.00354
Lakin, Kelly R.		6.03	0.00305
Hunter, Lloyd F.		4.40	0.00223
Lakin, Kelly R.)[2]		3.23	0.00163
	2,514.00	**6,578.37**	**3.32855**
CV Glendora 3 Site, LLC)[3]			
(Successor to:			
Rosedale, Miles R.	184.00	0.00	0.00000
Monrovia Nursery Company)[2]	10.00	0.00	0.00000
	194.00	**0.00**	**0.00000**
DeFalco, John and Carole[3]			
(Successor to Nickowitz, at al.)[2]	1.49	0.00	0.00000
	1.49	**0.00**	**0.00000**
Glendora, City of	17.00	8,258.00	4.17842
(Successor to:			
Maechtlen, Estate of J. J.		150.00	0.07590
Maechtlen, Trust of P. A.		50.00	0.02530
Ruebhausen, Arline	18.34		
Glendora Unified High School District		99.00	0.05009
Loyola Marymount University		324.00	0.16394
Clayton Manufacturing Company)[2]		511.80	0.25896
	35.34	**9,392.80**	**4.75261**
Golden State Water Company, San Dimas District[3]	500.00	3,242.53	1.64067
(Formerly California Cities Water Company)			
(Successor to Namimatsu Farms)[2]		196.00	0.09917
	500.00	**3,438.53**	**1.73984**

INTEGRATED PRODUCER	DIVERSION COMPONENT ACRE-FEET	PRESCRIPTIVE PUMPING COMPONENT ACRE-FEET	PUMPING COMPONENT SHARE %
JUH#1[3]			
(Successor to Monrovia Nursery Company)[2]	48.00	0.00	0.00000
(Transferred to Miles R. Rosedale)[2]	-16.00		
	32.00	**0.00**	**0.00000**
Los Angeles, County of	**310.00**	**3,721.30**	**1.88292**
Maechtlen, Estate of J. J., Trustee for the Estate of P.A. Maechtlen	0.00	301.50	0.15256
(Transferred to:			
City of Glendora		-150.00	-0.07590
Miller Brewing Company)[2]		-151.50	-0.07666
	0.00	**0.00**	**0.00000**
Maechtlen, Trust of J. J.[3]	1.49	0.00	0.00000
(Transferred to Otting, David; Otting, Larry; and Webster, Scott)[2]	-1.49	0.00	0.00000
(Successor to Otting, David; Otting, Larry; and Webster, Scott)[2]	1.49	0.00	0.00000
(Transferred to Nikowitz, et al)[2]	-1.49	0.00	0.00000
	0.00	**0.00**	**0.00000**
Maechtlen, Trust of P. A.[3]	0.50	100.50	0.05085
(Transferred to:			
City of Glendora		-50.00	-0.02530
Alice B. Phillips, et al.)[2]	-0.50	-50.50	-0.02555
	0.00	**0.00**	**0.00000**
The Metropolitan Water District of of Southern California	**9.59**	**165.00**	**0.08349**
Monrovia, City of	1,098.00	5,042.22	2.55129
(Successor to:			
Eckis, Rollin		123.00	0.06224
City of Arcadia)[2]		951.00	0.48119
	1,098.00	**6,116.22**	**3.09472**

INTEGRATED PRODUCER	DIVERSION COMPONENT ACRE-FEET	PRESCRIPTIVE PUMPING COMPONENT ACRE-FEET	PUMPING COMPONENT SHARE %
Monrovia Nursery Company	239.50	0.00	0.00000
(Successor to Azusa Foothill	718.50	0.00	0.00000
Citrus Company)[2]			
(Transferred:			
City of Azusa	-363.00	0.00	0.00000
Brierly, Susan K.	-24.00	0.00	0.00000
Rosedale, Miles R.	-191.00	0.00	0.00000
VanLandingham, Richard	-21.00	0.00	0.00000
JUH#1	-48.00	0.00	0.00000
Rosedale, Lance	-32.00	0.00	0.00000
CV Glendora 3 Site, LLC)[2]	-10.00	0.00	0.00000
	269.00	**0.00**	**0.00000**
Nikowitz, et al[3]			
(Successor to Maechtlen, Trust of J. J.)[2]	1.49	0.00	0.00000
(Held in common with Nikowitz, Sheryl M. and Walter P.; Pellegrino, Mark and Roxanne; Verdegem, Thomas and Sandra B.)			
(Transferred to DeFalco, John and Carole)[2]	-1.49	0.00	0.00000
	0.00	**0.00**	**0.00000**
Otting, David; Otting, Larry; and Webster, Scott[3]			
(Successor to Maechtlen, Trust of J. J.)[2]	1.49	0.00	0.00000
(Transferred to Maechtlen, Trust of J. J.)[2]	-1.49	0.00	0.00000
	0.00	**0.00**	**0.00000**
Phillips, Alice B., et al.[3]			
(Successor to Maechtlen, Trust of P. A.)[2]	0.50	50.50	0.02555
(Transferred to Miller Brewing Co.)[2]		-50.00	-0.02530
	0.50	**0.50**	**0.00025**
Rosedale, Lance[3]			
(Successor to Monrovia Nursery Company)[2]	**32.00**	**0.00**	**0.00000**
Rosedale, Miles R.[3]			
(Successor to Monrovia Nursery Company)[2]	191.00	0.00	0.00000
(Transferred to CV Glendora 3 Site, LLC)[2]	-184.00	0.00	0.00000
(Successor to:			
Susan K. Brierly	8.00	0.00	0.00000
JUH#1)[2]	16.00	0.00	0.00000
	31.00	**0.00**	**0.00000**

INTEGRATED PRODUCER	DIVERSION COMPONENT ACRE-FEET	PRESCRIPTIVE PUMPING COMPONENT ACRE-FEET	PUMPING COMPONENT SHARE %
San Gabriel Valley Water Company	0.00	16,659.00	8.42920
(Successor to:			
Vallecito Water Co.		2,867.00	1.45066
No. 17 Walnut Place Mutual Water Co.		21.50	0.01088
Cedar Avenue Mutual Water Company		121.10	0.06127
Beverly Acres Mutual Water Users Association		50.00	0.02530
Richwood Mutual Water Company		192.60	0.09745
Nicholson Trust, Helene S.		12.00	0.00607
Durfee Property, LLC		50.00	0.02530
Wright, Darrell A., Wright, Merle M. and Carlson, Jeanne W.		50.65	0.02563
Parton Family Trust		46.20	0.02338
Maddock, A.G.)[2]	3.40		
	3.40	**20,070.05**	**10.15514**
VanLandingham, Richard[3]			
(Successor to Monrovia Nursery Company)[2]	21.00	0.00	0.00000
TOTAL	**10,526.44**	**67,868.56**	**34.34047**

1/ Permanent transfer of rights as recorded at entry of Judgment.

2/ Permanent transfer of rights after entry of Judgment.

3/ Intervenor after Judgment.

EXHIBIT "F"

TABLE SHOWING
SPECIAL CATEGORY RIGHTS

PARTY	NATURE OF RIGHT
*The Metropolitan Water District of Southern California *Transferred to the San Gabriel Valley Protective Association 05/07/1996.	Morris Reservoir Storage and Withdrawal (a) A right to divert, store and use San Gabriel River Water, pursuant to Permit No. 7174. (b) Prior and paramount right to divert 72 acre-feet annually to offset Morris Reservoir evaporation and seepage losses and to provide the water supply necessary for presently existing incidental Morris Dam facilities.
Los Angeles County Flood Control District (now Los Angeles County Department of Public Works)	Puddingstone Reservoir Prior Prescriptive right to divert water from San Dimas Wash for storage in Puddingstone Reservoir in quantities sufficient to offset annual evaporation and seepage losses of the reservoir at approximate elevation 942.

EXHIBIT "G"

TABLE SHOWING NON-CONSUMPTIVE USERS

PARTY	NATURE OF RIGHT
Covina Irrigating Company Azusa Valley Water Company Azusa Agricultural Water Co. Azusa Foot-Hill Citrus Co. Monrovia Nursery	"Committee-of-Nine" Spreading Right To continue to divert water from the San Gabriel River pursuant to the 1888 Settlement, and to spread in spreading grounds within the Basin all water thus diverted without the right to recapture water in excess of said parties' rights as adjudicated in exhibit "E".
California-American Water Company (Duarte System)	Spreading Right To continue to divert water from the San Gabriel River pursuant to the 1888 Settlement, and to continue to divert water from Fish Canyon and to spread said waters in its spreading grounds in the Basin without the right to recapture water in excess of said party's rights as adjudicated in Exhibit "E".
City of Glendora	Spreading Right To continue to spread the water of Big and Little Dalton Washes, pursuant to License No. 2592 without the right to recapture water in excess of said party's rights as adjudicated in Exhibit "E".
San Gabriel Valley Protective Association	Spreading Right To continue to spread San Gabriel River water pursuant to License Nos. 9991 and 12,209, without the right to recapture said water.
Golden State Water Company (formerly *California Cities Water Company*)	Spreading Right To continue to spread waters from San Dimas Wash without the right to recapture water in excess of said party's rights as adjudicated in Exhibit "E".
Los Angeles County Flood Control District	Temporary storage of storm flow for regulatory purposes; Spreading and conservation for general benefit in streambeds, reservoirs and spreading grounds without the right to recapture said water. Maintenance and operation of dams and other flood control works.

EXHIBIT "H"

WATERMASTER OPERATING CRITERIA

1. **Basin Storage Capacity.** The highest water level at the end of a water year during the past 40 years was reached at the Key Well on September 30, 1944 (elevation 316). The State of California, Department of Water Resources, estimates that as of that date, the quantity of fresh water in storage in the Basin was approximately 8,600,000 acre-feet. It is also estimated by said Department that by September 30, 1960, the quantity of fresh water in storage had decreased to approximately 7,900,000 acre-feet (elevation 237 at the Key Well).

The lowest water level at the end of a water year during the past 40 years was reached at the Key Well on September 30, 1965 (elevation 209). It is estimated that the quantity of fresh water in storage in the Basin on that date was approximately 7,700,000 acre-feet.

Thus, the maximum utilization of Basin storage was approximately 900,000 acre-feet, occurring between September 30, 1944, and September 30, 1965 (between elevations 316 and 209 at the Key Well). This is not to say that more than 900,000 acre-feet of storage space below the September 30, 1944 water levels cannot be utilized. However, it demonstrates that pumpers have deepened their wells and lowered their pumps so that such 900,000 acre-feet of storage can be safely and economically utilized.

The storage capacity of the Basin between elevations of 200 and 250 at the Key Well represents a usable volume of approximately 400,000 acre-feet of water.

2. **Operating Safe Yield and Spreading.** Watermaster in determining Operating Safe Yield and the importation of Replacement Water shall be guided by water level elevations in the Basin. He shall give recognition to, and base his operations on, the following general objectives insofar as practicable and subject to Section 47 of the Judgment (Amended 6/21/12):

(a) The replenishment of ground water from sources of supplemental water should not cause excessively high levels of ground water and such replenishment should not cause undue waste of local water supplies.

(b) Certain areas within the Basin are not at the present time capable of being recharged with supplemental water. Efforts should be made to provide protection to such areas from excessive ground water lowering either through the "in lieu" provisions of the

Judgment or by other means.

(c) Watermaster shall consider and evaluate the long-term consequences on ground water quality, as well as quantity, in determining and establishing Operating Safe Yield. Recognition shall be given to the enhancement of ground water quality insofar as practicable, especially in the area immediately upstream of Whittier Narrows where degradation of water quality may occur when water levels at the Key Well are maintained at or below elevation 200.

(d) Watermaster shall take into consideration the comparative costs of supplemental and Make-up Water in determining the savings on a present value basis of temporary or permanent lowering or raising of water levels and other economic data and analyses indicating both the short-term and long-term propriety of adjusting Operating Safe Yield in order to derive optimum water levels during any period. Watermaster shall utilize the provisions in the Long Beach Judgment which will result in the least cost of delivering Make-up Water.

3. **Replacement Water -- Sources and Recharge Criteria.** The following criteria shall control purchase of Replacement Water and Recharge of the Basin by Watermaster.

(a) **Responsible Agency From Which to Purchase.** Watermaster, in determining the Responsible Agency from which to purchase supplemental water for replacement purposes, shall be governed by the following:

(1) **Place of Use of Water** which is used primarily within the Basin or by cities within San Gabriel District in areas within or outside the Basin shall control in determining the Responsible Agency. For purposes of this subparagraph, water supplied through a municipal water system which lies chiefly within the Basin shall be deemed entirely used within the Basin; and

(2) **Place of production of water** shall control in determining the Responsible Agency as to water exported from the Basin, except as to use within San Gabriel District.

Any Responsible Agency may, at the request of Watermaster, waive its right to act as the source for such supplemental water, in which case Watermaster shall be free to purchase such water from the remaining Responsible Agencies which are the most beneficial and appropriate sources; provided, however, that a Responsible Agency shall not authorize any sale of water in violation of the California Constitution.

(b) **Water Quality.** Watermaster shall purchase the best quality of supplemental water available for replenishment of the Basin, pursuant to subsection (a) hereof.

(c) **Reclaimed Water.** It is recognized that the technology and economic and physical necessity for utilization of reclaimed water is increasing. The purchase of reclaimed water in accordance with the Long Beach Judgment to satisfy the Make-up Obligation is expressly authorized. At the same time, water quality problems involved in the reuse of water within the Basin pose serious questions of increased costs and other problems to the pumpers, their customers and all water users. Accordingly, Watermaster is authorized to gather information, make and review studies, and make recommendations on the feasibility of the use of reclaimed water for replacement purposes; provided that no reclaimed water shall be recharged in the Basin by Watermaster without the prior approval of the court, after notice to all parties and hearing thereon.

(d) **Purchased Water Plan.** On or before November 1 of each year, Watermaster shall prepare and distribute to the Responsible Agencies a three-year projection of its Supplemental Water purchases from each agency. Watermaster shall, to the extent feasible, coordinate the tentative schedule for delivery and payment of those purchases with each agency. (Amended 6/21/12)

4. **Replacement Assessment Rates.** The Replacement Assessment rates may be in an amount calculated to allow Watermaster to purchase more than one acre-foot of Supplemental Water for each acre-foot of excess Production to which such Assessment applies, when such purchases are prudent in order to secure necessary Supplemental Water supplies for the benefit of the Basin and parties. In accordance with Rules and Regulations adopted by Watermaster, to the extent Watermaster purchases more than one acre-foot of Supplemental Water for each acre-foot of excess Production to which such Assessment applies, a credit shall be issued to the affected Producers at the time such excess water is purchased. (Amended 6/21/12)

EXHIBIT "J"

PUENTE NARROWS AGREEMENT

THIS AGREEMENT is made and entered into as of the 8th day of May, 1972, by and between PUENTE BASIN WATER AGENCY, herein called "Puente Agency", and UPPER SAN GABRIEL VALLEY MUNICIPAL WATER DISTRICT, herein called "Upper District".

A. RECITALS

1. Puente Agency. Puente Agency is a joint powers agency composed of Walnut Valley Water District, herein called "Walnut District", and Rowland Area County Water District, herein called "Rowland District". Puente Agency is formed for the purpose of developing and implementing a ground water basin management program for Puente Basin. Pursuant to said purpose, said Agency is acting as a representative of its member districts and of the water users and water right claimants therein in the defense and maintenance of their water rights within Puente Basin.

2. Upper District. Upper District is a municipal water district overlying a major portion of the Main San Gabriel Basin. Upper District is plaintiff in the San Gabriel Basin Case, wherein it seeks to adjudicate rights and implement a basin management plan for the Main San Gabriel Basin.

3. Puente Basin is a ground water basin tributary to the Main San Gabriel Basin. Said area was included within the scope of the San Gabriel Basin Case and substantially

all water rights claimants within Puente Basin were joined as defendants therein. The surface contribution to the Main San Gabriel Basin from Puente Basin is by way of the paved flood control channel of San Jose Creek, which passes through Puente Basin from the Pomona Valley area. Subsurface outflow is relatively limited and moves from the Puente Basin to the Main San Gabriel Basin through Puente Narrows.

4. Intent of Agreement. Puente Agency is prepared to assure Upper District that no activity within Puente Basin will hereafter be undertaken which will (1) interfere with surface flows in San Jose Creek, or (2) impair the subsurface flow from Puente Basin to the Main San Gabriel Basin. Walnut District and Rowland District, by operation of law and by express assumption endorsed hereon, assume the covenants of this agreement as a joint and several obligation. Based upon such assurances and the covenants hereinafter contained in support thereof, Upper District consents to the dismissal of all Puente Basin parties from the San Gabriel Basin Case. By reason of said dismissals, Puente Agency will be free to formulate a separate water management program for Puente Basin.

B. DEFINITIONS AND EXHIBITS

5. Definitions. As used in this Agreement, the following terms shall have the meanings herein set forth:

(a) Annual or Year refers to the fiscal year July 1 through June 30.

(b) Base Underflow. The underflow through

Puente Narrows which Puente Agency agrees to maintain, and on which accrued debits and credits shall be calculated.

(c) Make-up Payment. Make-up payments shall be an amount of money payable to the Watermaster appointed in the San Gabriel Basin Case, sufficient to allow said Watermaster to purchase replacement water on account of any accumulated deficit as provided in Paragraph 9 hereof.

(d) Puente Narrows. The subsurface geologic constriction at the downstream boundary of Puente Basin, located as shown on Appendix "B".

(e) Main San Gabriel Basin, the ground water basin shown and defined as such in Exhibit "A" to the Judgment in the San Gabriel Basin Case.

(f) San Gabriel Basin Case. Upper San Gabriel Valley Municipal Water District v. City of Alhambra, et al., L. A. Sup. Ct. No. 924128, filed January 2, 1968.

6. Appendices. Attached hereto and by this reference made a part hereof are the following appendices:

"A" -- Location Map of Puente Basin, showing major geographic, geologic, and hydrologic features.

"B" -- Map of Cross-Section Through Puente Narrows, showing major physical features and location of key wells.

Exhibit "J"

"C" -- Engineering Criteria, being a description of a method of measurement of subsurface outflow to be utilized for Watermaster purposes.

C. COVENANTS

7. Watermaster. There is hereby created a two member Watermaster service to which each of the parties to this agreement shall select one consulting engineer. The respective representatives on said Watermaster shall serve at the pleasure of the governing body of each appointing party and each party shall bear its own Watermaster expense.

a. Organization. Watermaster shall perform the duties specified herein on an informal basis, by unanimous agreement. In the event the two representatives are unable to agree upon any finding or decision, they shall select a third member to act, pursuant to the applicable laws of the State of California. Thereafter, until said issue is resolved, said three shall sit formally as a board of arbitration. Upon resolution of the issue in dispute, the third member shall cease to function further.

b. Availability of Information. Each party hereto shall, for itself and its residents and water users, use its best efforts to furnish all appropriate information to the Watermaster in order that the required determination can be made.

Exhibit "J"

c. Cooperation With Other Watermasters. Watermaster hereunder shall cooperate and coordinate activities with the Watermasters appointed in the San Gabriel Basin Case and in Long Beach v. San Gabriel Valley Water Company, et al.

d. Determination of Underflow. Watermaster shall annually determine the amount of underflow from Puente Basin to the San Gabriel Basin, pursuant to Engineering Criteria.

e. Perpetual Accounting. Watermaster shall maintain a perpetual account of accumulated base underflow, accumulated subsurface flow, any deficiencies by reason of interference with surface flows, and the offsetting credit for any make-up payments. Said account shall annually show the accumulated credit or debit in the obligation of Puente Agency to Upper District.

f. Report. Watermaster findings shall be incorporated in a brief written report to be filed with the parties and with the Watermaster in the San Gabriel Basin Case. Said report shall contain a statement of the perpetual account heretofore specified.

8. Base Underflow. On the basis of a study and review of historic underflow from Puente Basin to the Main San Gabriel Basin, adjusted for the effect of the paved flood control channel and other relevant considerations, it is

mutually agreed by the parties that the base underflow is and shall be 580 acre feet per year, calculated pursuant to Engineering Criteria.

9. Puente Agency's Obligation. Puente Agency covenants, agrees and assumes the following obligation hereunder:

a. Noninterference with Surface Flow. Neither Puente Agency nor any persons or entities within the corporate boundaries of Walnut District or Rowland District will divert or otherwise interfere with or utilize natural surface runoff now or hereafter flowing in the storm channel of San Jose Creek; provided, however, that this covenant shall not prevent the use, under Watermaster supervision, of said storm channel by the Puente Agency or Walnut District or Rowland District for transmission within Puente Agency of supplemental or reclaimed water owned by said entities and introduced into said channel solely for transmission purposes. In the event any unauthorized use of surface flow in said channel is made contrary to the covenant herein provided, Puente Agency shall compensate Upper District by utilizing any accumulated credit or by make-up payment in the same manner as is provided for deficiencies in subsurface outflow from Puente Basin.

b. Subsurface Outflow. To the extent that the accumulated subsurface outflow falls below the accumulated base underflow and the result thereof is an accumulated deficit in the Watermaster's annual accounting, Puente Agency agrees to provide make-up payments during the next year in an amount not less than one-third of the accumulated deficit.

c. Purchase of Reclaimed Water. To the extent that Puente Agency or Walnut District or Rowland District may hereafter purchase reclaimed water from the facilities of Sanitation District 21 of Los Angeles County, such purchaser shall use its best efforts to obtain waters originating within San Gabriel River Watershed.

10. Puente Basin Parties Dismissal. In consideration of the assumption of the obligation hereinabove provided by Puente Agency, Upper District consents to entry of dismissals as to all Puente Basin parties in San Gabriel Basin Case. This agreement shall be submitted for specific approval by the Court and a finding that it shall operate as full satisfaction of any and all claims by the parties within Main San Gabriel Basin against Puente Basin parties by reason of historic surface and subsurface flow.

IN WITNESS WHEREOF the parties hereto have caused this Agreement to be executed as of the day and date first above written.

Approved as to form:
CLAYSON, STARK, ROTHROCK & MANN

By ______________________
Attorneys for Puente Agency

PUENTE BASIN AGENCY

By ______________________
EDMOND M. BIEDERMAN
President

Approved as to form:

By ______________________
Attorney for Upper District

UPPER SAN GABRIEL VALLEY
MUNICIPAL WATER DISTRICT

By ______________________
Howard H. Hawkins
President

The foregoing agreement is approved and accepted, and the same is acknowledged as the joint and several obligation of the undersigned.

Approved as to form:

____
Attorney for Walnut District

WALNUT VALLEY WATER DISTRICT

By ______________________
J. P. BOURDET
Vice President

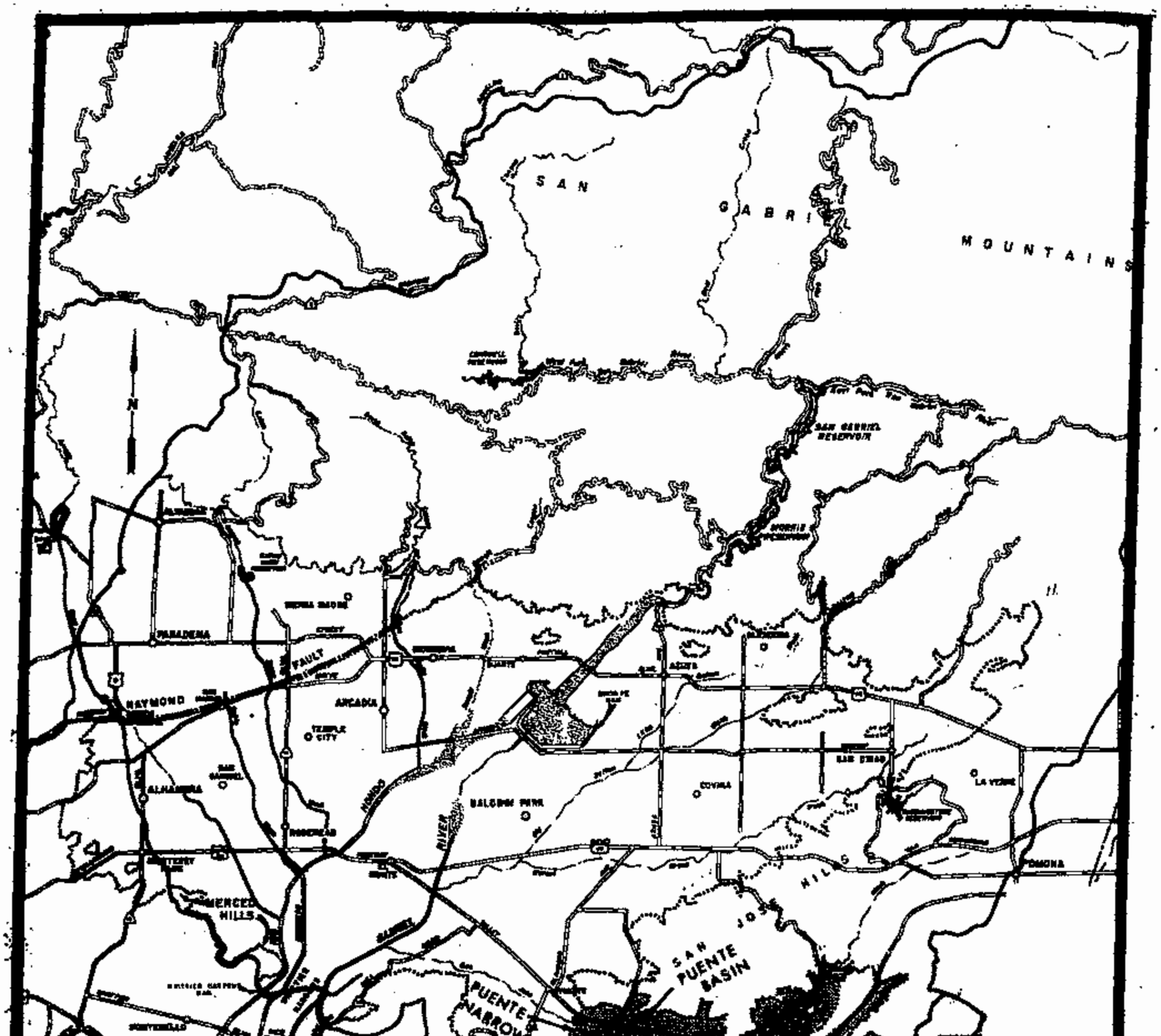
Approved as to form:

____
Attorneys for Rowland District

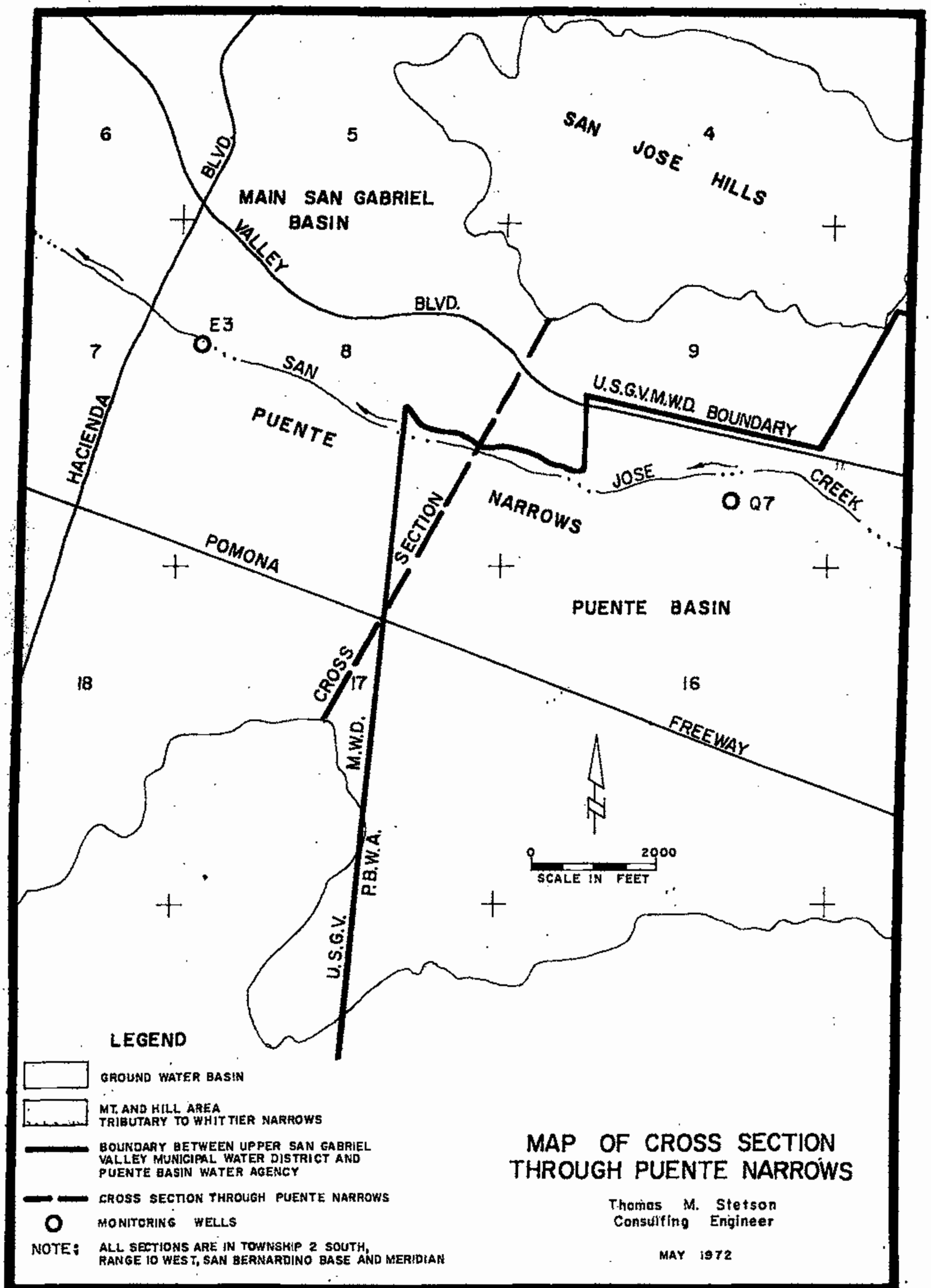
ROWLAND AREA COUNTY WATER DISTRICT

By ______________________
President
Wm. A. Simmons

Exhibit "J"



APPENDIX "A"
EXHIBIT "J"



APPENDIX "B"
EXHIBIT "J"

ENGINEERING CRITERIA

APPENDIX "C"

1. Monitoring Wells. The wells designated as State Wells No. 2S/10W-9Q7 and 2S/10W-8E3 and Los Angeles County Flood Control District Nos. 3079M and 3048B, respectively, shall be used to measure applicable ground water elevations. In the event either monitoring well should fail or become unrepresentative, a substitute well shall be selected or drilled by Watermaster. The cost of drilling a replacement well shall be the obligation of the Puente Agency.

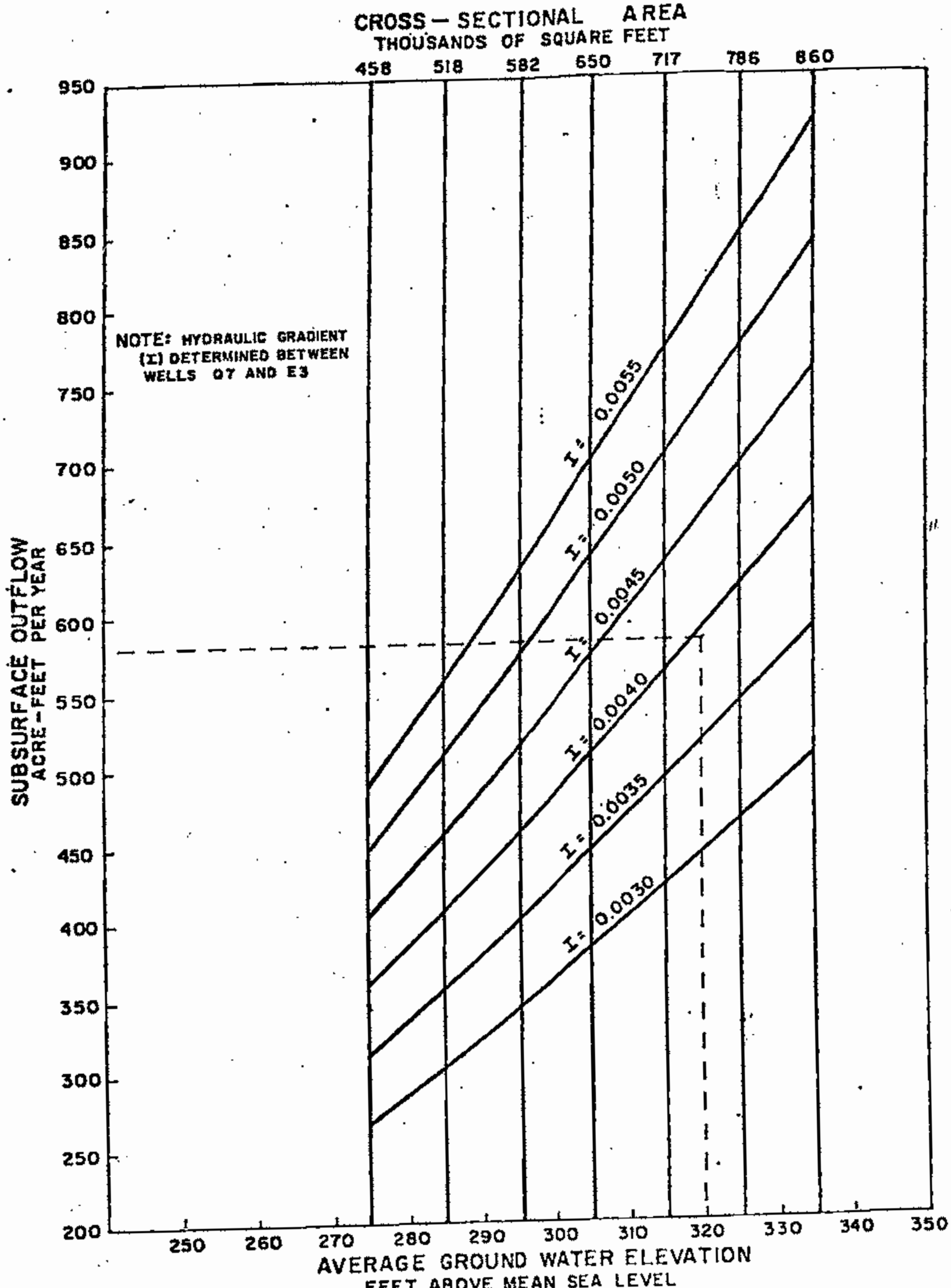
2. Measurement. Each monitoring well shall be measured and the ground water elevation determined semi-annually on or about April 1 and October 1 of each year. Prior to each measurement, the pump shall be turned off for a sufficient period to insure that the water table has recovered to a static or near equilibrium condition.

3. Hydraulic Gradient. The hydraulic gradient, or slope of the water surface through Puente Narrows, shall be calculated between the monitoring wells as the difference in water surface elevation divided by the distance, approximately 9,000 feet, between the wells. The hydraulic gradient shall be determined for the spring and fall and the average hydraulic gradient calculated for the year.

4. Ground Water Elevation at Puente Narrows Cross Section. The ground water elevation at the Puente Narrows

cross section midway between the monitoring wells shall be the average of the ground water elevation at the two wells. This shall be determined for the spring and fall and the average annual ground water elevation calculated for the year.

5. Determination of Underflow. The chart attached is a photo-reduction of a full scale chart on file with the Watermaster. By applying the appropriate average annual hydraulic gradient (I) to the average annual ground water elevation at the Puente Narrows cross section (involving the appropriate cross-sectional area [A]), it is possible to read on the vertical scale the annual acre feet of underflow.



RELATIONSHIP OF AVERAGE GROUND WATER ELEVATION AT PUENTE NARROWS AND APPLICABLE CROSS-SECTIONAL AREA WITH SUBSURFACE OUTFLOW THROUGH PUENTE NARROWS FOR VARIOUS HYDRAULIC GRADIENTS

Thomas M. Stetson
Consulting Engineer
MAY 1972

EXHIBIT "J"

EXHIBIT "K"

OVERLYING RIGHTS

I. NATURE OF OVERLYING RIGHT

An "Overlying Right" is the right to Produce water from the Main San Gabriel Basin for use on the overlying lands hereinafter described. Such rights are exercisable without quantitative limit only on said overlying land and cannot be separately conveyed or transferred apart therefrom. The exerciser of such right is assessable by Watermaster as provided in Paragraph 21 of the Amended Judgment herein (prior Paragraph 14.5 of the Judgment herein) and is subject to the other provisions of said Paragraph.

II. OVERLYING LANDS (Description)

The overlying lands to which Overlying Rights are appurtenant are described as follows:

> "Those portions of Lots 1 and 2 of the lands formerly owned by W.A. Church, in the Rancho San Francisquito, in the City of Irwindale, County of Los Angeles, State of California, as shown on recorder's filed map No. 509, in the office of the County Recorder of said County, lying northeasterly of the northeasterly line and its southeasterly prolongation of Tract 1888, as shown on map recorded in Book 21 page 183 of Maps, in the office of the County Recorder of said County.
>
> "EXCEPT the portions thereof lying northerly and northwesterly of the center line of Arrow Highway described 'Sixth' and the center line of Live Oak Avenue described 'Third' in a final decree of condemnation, a certified copy of which was recorded August 18, 1933 as Instrument No. 354, in Book 12289, Page 277, Official Records.
>
> "ALSO EXCEPT that portion of said land described in the final decree of condemnation entered in Los Angeles County Superior Court Case No. 805008, a certified copy of which was recorded September 21, 1964, as Instrument No. 3730 in Book D-2634, Page 648, Official Records."

III. PRODUCERS ENTITLED TO EXERCISE OVERLYING RIGHTS AND THEIR RESPECTIVE CONSUMPTIVE USE PORTIONS

The persons entitled to exercise Overlying Rights are both the owners of Overlying Rights and persons and entities licensed by such owners to exercise such Overlying Rights. The persons entitled to exercise Overlying Rights and their respective Consumptive Use portions are as follows:

OWNER PRODUCERS	**CONSUMPTIVE USE PORTION**
BROOKS GIFFORD, SR. BROOKS GIFFORD, JR. PAUL MNOIAN JOHN MGRDICHIAN J. EARL GARRETT	3.5 acre-feet per year
Present User: Nu-Way Industries	

PRODUCERS UNDER LICENSE

A. WILLIAM C. THOMAS and EVELYN F. THOMAS, husband and wife, and MALCOLM K. GATHERER and JACQUELINE GATHERER, husband and wife, doing business by and through B & B REDI-I-MIX CONCRETE, INC., a corporation	45.6 acre-feet per year
B. PRE-STRESS CRANE RIGGING & TRUCK CO., INC., a corporation	1.0 acre-foot per year
Present Users: Pre-Stress Crane Rigging & Truck Co., Inc., a corporation	
TOTAL	50.1 acre-feet per year

IV. **ANNUAL GROSS AMOUNT OF PRODUCTION FROM WHICH CONSUMPTIVE USE PORTIONS WERE DERIVED**	183.65 acre-feet

EXHIBIT "K"

CONSUMPTIVE USE PORTIONS OF PRODUCERS WITH OVERLYING RIGHTS AS OF JUNE 30, 2013

OVERLYING PRODUCER	CONSUMPTIVE USE PORTION (ACRE-FEET)
<u>1. Mnoian-Gifford Interests</u>	
<u>Owner Producers</u>	
Paul Mnoian[3]	
Brooks Gifford, Sr.[3]	
Brooks Gifford, Jr.[3]	
John Mgrdichian[3]	
J. Earl Garrett[3]	
Present User: Nu-Way Industries	**3.5**
<u>Producers Under License</u>	
William C. Thomas[3]	
Evelyn F. Thomas[3]	
Malcolm K. Gatherer[3]	
Jacqueline Gatherer[3]	
Present User: B & B Red-I-Mix Concrete, Inc.	45.6
Pre-Stress Crane Rigging and Truck, Co., Inc.[3]	<u>1.0</u>
	50.1
<u>2. Attalla, Phillip Y. and Mary L.[3]</u>	**29.9**
<u>3. Citrus Valley Medical Center, Queen of the Valley Campus.[3]</u> (Formerly Queen of the Valley Hospital.[3])	**4.5**
<u>4. S.L.S & N. Inc.[3]</u>	--
TOTAL	**84.5**

1/ Permanent transfer of rights as recorded within Exhibits "C", "D", and "E" of Judgment.

2/ Permanent transfer of rights after entry of Judgment.

3/ Intervenor after Judgment.

EXHIBIT "L"

LIST OF PRODUCERS AND THEIR DESIGNEES
June 21, 2012

PRODUCER	DESIGNEE
Adams Ranch Mutual Water Company	Domenic T. Cimarusti
Alhambra, City of	Mary Chavez
Amarillo Mutual Water Company	John Holzinger
Anderson Family Marital Trust	Carolyn Heinrich
Andrade, Susan	Susan Andrade
Aqua Capital Management LP	David L. Penrice
Arcadia, City of	Tom Tait
Azusa, City of	Chet Anderson
Azusa Agricultural Water Company	Chet Anderson
Azusa Valley Water Company	Chet Anderson
Bandel Family Trust	Candace Garnier Bandel
Banks, Gale C. and Vicki L.	Gale and Vicki Banks
Brezina Trust 2001, Raymond W. and Susan W.	Raymond W. Brezina
Brierly, Susan K.	Reiner Kruger
Brondino, Jeanne	Jeanne Brondino
Cadway, Inc.	James M. Byerrum
California-American Water Company (Duarte System)	Todd Brown
California-American Water Company (San Marino System)	Todd Brown
California Domestic Water Company	James M. Byerrum
Canyon Water Company	William McIntyre
Canyon Water & Development Corporation	Chet Anderson
Champion Mutual Water Company	Bryan P. Hellein
Chevron U.S.A.	Leon F. Drozd, Esq.
Citrus Valley Medical Center, Queen of the Valley Campus	Gregory J. Landers
Coiner, James W., dba Coiner Nursery	James W. Coiner
County Sanitation District No. 18	Raymond Tremblay
Covina, City of	Daryl Parrish
Covina Irrigating Company	David D. De Jesus
Crevolin, A. J.	A. J. Crevolin
CV Glendora 3 Site, LLC	Bill McReynolds
Dawes, Mary Kay	Mary Kay Partridge
DeFalco, John and Carole	John and Carole DeFalco
Del Rio Mutual Water Company	Dario Herrera
Driftwood Dairy	David Trenkenschuh

PRODUCER	DESIGNEE
East Pasadena Water Company	Lawrence M. Morales
El Monte, City of	Rene Bobadilla
El Monte Cemetery Association	Todd Brown
Fox Family Trust Michael Edward Fox and Crystal Marie Fox, Trustees	Michael and Crystal Fox
Garnier Family Trust, Anton C. and Anita	Anton C. and Anita Garnier
Garnier, Ruth Elaine Ailor Trust	Renee Garnier Poivre
Gates, James Richard	James Richard Gates
Glendora, City of	Steve Patton
Golden State Water Company - San Dimas District	Patrick Scanlon
Golden State Water Company - San Gabriel Valley District	Benjamin Lewis, Jr.
Green, Walter	Dr. Walter Green
Hanson Aggregates West, Inc.	Michael Rogers
Heinrich, Carolyn	Carolyn Heinrich
Hemlock Mutual Water Company	Robert McClung
Industry Waterworks Systems, City of	Gregory B. Galindo
Irwindale, City of	Sol Benudiz
JUH #1	Reiner Kruger
Kirklen, Jeffery B.	Jeffery B. Kirklen
Knight, William J.	William J. Knight
Landeros, John	John Landeros
La Puente Valley County Water District	Gregory B. Galindo
Lovelady, June G., Trustee	June G. Lovelady
Los Angeles, County of	Robert Maycumber
Loucks, David	David Loucks
Maddock, A.G.	S. Joellen Maddock
Maggiore, Valarie	Valarie Maggiore
McIntyre, William	William McIntyre
Metropolitan Water District of Southern California	Lorraine Aoys
Miller Coors LLC	Jeffrey D. Arbour
Monrovia, City of	Ron Bow
Monrovia Nursery	Reiner Kruger
Monterey Park, City of	Elias Saykali
Munoz, Ralph	Ralph Munoz
Nicholson Trust, The	M. L. Whitehead
Nicholson Family Trust, The	M. L. Whitehead

PRODUCER	DESIGNEE
Parton Family Trust	Vernal O. and Marverna Parton
Pellissier Irrevocable QTIP Trust, et al, Laurence R., Co-tenancy of	James M. Byerrum
Pico County Water District	Mark Grajeda
Polopolus, et. Al	Helen Gaskins
Rados Brothers	Alexander S. Rados
Rosedale, Lance	Reiner Kruger
Rosedale, Miles R.	Reiner Kruger
Rosemead Development LTD.	John W. Lloyd
Rurban Homes Mutual Water Company	George W. Bucey
Ruth, Roy	Roy Ruth
San Gabriel Country Club	Eddie Villanueva
San Gabriel County Water District	Barbara A. Carrera
San Gabriel Valley Municipal Water District	Darin Kasamoto
San Gabriel Valley Water Company	Michael L. Whitehead
Sierra La Verne Country Club	Donald Johnson
Sierra Madre, City of	Bruce Inman
Sonoco Products Company	Khaleda Hamid
South Pasadena, City of	Marcelino Aguilar
Southern California Edison Company	Jorge A. Rosa, Jr.
Southwest Water Company	Richard J. Rich
Sterling Mutual Water Company	Joy Ann Burt
Suburban Water Systems	Michael Quinn
Sunny Slope Water Company	Ken Tcheng
Tate, Phillip G. and Sieglinde A.	Phillip Tate
Three Valleys Municipal Water District	Richard W. Hansen
Tomovich, Nick and Sons	Nick Tomovich
Hieu Tran	Hieu Tran
Tyler Nursery	Fumiko Kishi
USA Waste of California, Inc.	Joseph J. Cassin
United Rock Products Corporation	Russ Caruso
Upper San Gabriel Valley Municipal Water District	Steven P. O'Neill
Valencia Heights Water Company	P. David Michalko
Valley County Water District	Lynda A. Noriega
Valley View Mutual Water Company	Sukie Madrid
VanLandingham, Richard	Reiner Kruger
Vietnamese American Buddhist Temple Congregation	Thích Viên Ly
Vulcan Materials Company	Robert W. Bowcock

PRODUCER	DESIGNEE
Whittier, City of	Daniel Wall
Wilmott, Erma M.	Erma M. Wilmott
Woodland, Richard	Richard J. Woodland
Workman Mill Investment Company	Bruce A. Lazenby

EXHIBIT "M"

WATERMASTER MEMBERS

FOR CALENDAR YEAR 1973

ROBERT T. BALCH (Producer Member), Chairman

LINN E. MAGOFFIN (Producer Member), Vice Chairman

RICHARD L. ROWLAND (Producer Member), Secretary

BOYD KERN (Public Member), Treasurer

WALKER HANNON (Producer Member)

HOWARD H. HAWKINS (Public Member)

M.E. MOSLEY (Producer Member)

CONRAD T. REIBOLD (Public Member)

HARRY C. WILLS (Producer Member)

STAFF

Carl Fossette, Assistant Secretary-Assistant Treasurer
Ralph B. Helm, Attorney
Thomas M. Stetson, Engineer

FOR CALENDAR YEAR 1974

ROBERT T. BALCH (Producer Member), Chairman

LINN E. MAGOFFIN (Producer Member), Vice Chairman

RICHARD L. ROWLAND (Producer Member), Secretary

BOYD KERN (Public Member), Treasurer

WALKER HANNON (Producer Member)

BURTON E. JONES (Public Member)

M.E. MOSLEY (Producer Member)

CONRAD T. REIBOLD (Public Member)

HARRY C. WILLS (Producer Member)

STAFF

Carl Fossette, Assistant Secretary-Assistant Treasurer
Ralph B. Helm, Attorney
Thomas M. Stetson, Engineer

FOR CALENDAR YEAR 1975

ROBERT T. BALCH (Producer Member), Chairman

LINN E. MAGOFFIN (Producer Member), Vice Chairman

HARRY C. WILLS (Producer Member), Secretary

BOYD KERN (Public Member), Treasurer

WALKER HANNON (Producer Member)

BURTON E. JONES (Public Member)

D.J. LAUGHLIN (Producer Member)

M.E. MOSLEY (Producer Member)

CONRAD T. REIBOLD (Public Member)

STAFF

Carl Fossette, Assistant Secretary-Assistant Treasurer
Ralph B. Helm, Attorney
Thomas M. Stetson, Engineer

FOR CALENDAR YEAR 1976

ROBERT T. BALCH (Producer Member), Chairman

LINN E. MAGOFFIN (Producer Member), Vice Chairman

HARRY C. WILLS (Producer Member), Secretary

BOYD KERN (Public Member), Treasurer

WALKER HANNON (Producer Member)

BURTON E. JONES (Public Member)

D.J. LAUGHLIN (Producer Member)

M.E. MOSLEY (Producer Member)

CONRAD T. REIBOLD (Public Member)

STAFF

Jane M. Bray, Assistant Secretary-Assistant Treasurer
Ralph B. Helm, Attorney
Thomas M. Stetson, Engineer

FOR CALENDAR YEAR 1977

ROBERT T. BALCH (Producer Member), Chairman

LINN E. MAGOFFIN (Producer Member), Vice Chairman

HARRY C. WILLS (Producer Member), Secretary

CONRAD T. REIBOLD (Public Member), Treasurer

WALKER HANNON (Producer Member)

BURTON E. JONES (Public Member)

BOYD KERN (Public Member)

D.J. LAUGHLIN (Producer Member)

R.H. NICHOLSON, JR. (Producer Member)

STAFF

Jane M. Bray, Assistant Secretary-Assistant Treasurer
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Ralph B. Helm, Attorney
Thomas M. Stetson, Engineer

* Elected March 1979 to replace D.J. Laughlin, following his resignation.
** Resigned from Watermaster in February 1979.

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NELS PALM (Producer Member)**

THOMAS E. SHOLLENBERGER (Producer Member)

STAFF

Robert G. Berlien, Assistant Secretary-Assistant Treasurer
Ralph B. Helm, Attorney
Thomas M. Stetson, Engineer

* DECEASED APRIL 25, 1989

** Appointed August 24, 1989, for the balance of the calendar year term, to replace deceased member, Robert T. Balch.

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NELS PALM (Producer Member)

THOMAS E. SHOLLENBERGER (Producer Member)

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Ralph B. Helm, Attorney
Thomas M. Stetson, Engineer

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ROYALL K. BROWN (Public Member)

MARVIN JOE CICHY (Public Member)

EDWARD R. HECK (Producer Member)

C. ROBER KEISER (Public Member)

ANDREW A. KRUEGER (Producer Member)

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John E. Maulding, Executive Officer
Ralph B. Helm, Attorney
Thomas M. Stetson, Engineer

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BURTON E. JONES (Public Member)

C. ROBER KEISER (Public Member)

ANDREW A. KRUEGER (Producer Member)

STAFF

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Ralph B. Helm, Attorney
Thomas M. Stetson, Engineer

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ANDREW A. KRUEGER (Producer Member)

LEROY E. MOELLER (Public Member)

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Frederic A. Fudacz, Attorney (Effective February 1993)
Ralph B. Helm, Attorney (Retired January 1993)
Thomas M. Stetson, Engineer

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P. GEOFFREY NUNN (Producer Member)*******

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STAFF

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Carol Williams, Executive Officer*****
Frederic A. Fudacz, Attorney
Thomas M. Stetson, Engineer

*	Mr. Black resigned from Watermaster on February 4, 1994
**	Mr. Whitehead was nominated to Watermaster on March 2, 1994
***	Mr. Cantwell was elected as Watermaster Secretary on May 4, 1994
****	Mr. Maulding passed away on March 13, 1994
*****	Ms. Williams was appointed Executive Officer on August 3, 1994
******	Mr. Magoffin resigned from Watermaster on August 3, 1994
*******	Mr. Nunn was nominated to Watermaster on August 8, 1994

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STAFF

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Thomas M. Stetson, Engineer

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JUDITH L. ALMOND (Producer Member)

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Thomas M. Stetson, Engineer

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RICHARD W. CANTWELL (Producer Member), Vice Chairman

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MICHAEL L. WHITEHEAD (Producer Member), Treasurer

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ROBERT W. BOWCOCK (Producer Member)

MARVIN JOE CICHY (Public Member)

FRANK F. FORBES (Public Member)

LEROY E. MOELLER (Public Member)

STAFF

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Frederic A. Fudacz, Attorney
Thomas M. Stetson, Engineer

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JAMES B. GALLAGHER (Producer Member)

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Thomas M. Stetson, Engineer

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MICHAEL L. WHITEHEAD (Producer Member), Treasurer

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FRANK F. FORBES (Public Member)

JAMES B. GALLAGHER (Producer Member)

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MARVIN JOE CICHY (Public Member)

FRANK F. FORBES (Public Member)

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STAFF

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Thomas M. Stetson, Engineer*
Stephen B. Johnson, Engineer**

* Thomas M. Stetson passed away 4/14/2011
** Stephen B. Johnson replaced Mr. Stetson

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STAFF

Carol Thomas Williams, Executive Officer *
Anthony C. Zampiello, Executive Officer**
Frederic A. Fudacz, Attorney
Stephen B. Johnson, Engineer

* Carol Thomas Williams resigned on 5/12/12
** Anthony C. Zampiello appointed to Executive Officer 9/26/12

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Anthony C. Zampiello, Executive Officer
Frederic A. Fudacz, Attorney
Stephen B. Johnson, Engineer

APPENDIX H

2021 OC Water Demand Forecast for MWDOC and OCWD Technical Memorandum

Memorandum

To: *Rob Hunter, General Manager, MWDOC*
John Kennedy, Assistant General Manager, OCWD

From: *Dan Rodrigo, CDM Smith*

Date: *March 30, 2021*

Subject: *Orange County Water Demand Forecast for MWDOC and OCWD*

Purpose and Background

For the purposes of water supply reliability planning and to support the preparation of 2020 UWMPs, CDM Smith prepared water demand forecasts for the MWDOC and OCWD service areas using a consistent forecast methodology. While the methodology was a bottoms-up approach—meaning water demand forecasts were developed for every retail water agency in Orange County—the results presented in this technical memorandum are for the total service areas for MWDOC and OCWD, as well as a total for Orange County. All retail water agencies were given an opportunity to review both the forecast methodology and forecast results to determine if they wanted to utilize the information for their own 2020 UWMPs and local planning.

CDM Smith developed and presented a draft forecast methodology to a meeting of both MWDOC and OCWD member agencies for input. CDM Smith then developed draft retail agency forecasts for agency review. Based on interest, several retail water agencies met with CDM Smith individually to refine assumptions specific to their agency. We believe these meetings with the retail agencies improved both the methodology and demand forecast results. In the end, six retail water agencies decided to utilize their own water demand forecast.

Demand Forecast Methodology

Given the significant changes in residential water use in the past 5 years due to California plumbing codes and landscape ordinances, as well as substantial customer participation in agency rebates for water use efficiency programs, the focus of the forecast methodology was on single-family and multifamily residential sectors. This decision to focus more on residential sectors was also supported by the relatively constant commercial/institutional/industrial (CII) water demands on a per account basis for the last five years.

The forecast methodology for residential sectors also provided the ability to separate indoor vs outdoor water use to support agency reporting for California's indoor residential target of 55 gallons per capita per day (gpcd) by 2025 and approximately 50 gpcd by 2030.

The forecast methodology began with a retail water agency survey that asked for FY2018, 2019 and 2020 water use by major sector, including number of accounts (see Figure 1 for example survey for FY2018). If an agency provided recycled water to customers that information was also requested. All retail agencies had provided the requested information to MWDOC and OCWD by December of 2020.

Figure 1. Member Agency Water Use Survey

Please fill out **all** three worksheets for **FY Ending 2017-18, 2018-19, and 2019-20**.

Input billed water demand data by sector, use **either:** AFY, CCF, or GPD columns.

If non-residential sectors are combined for commercial, institutional, industrial, enter values under commercial sector and provide comments to indicate what is included.

Non-revenue water, the difference between total water production from all sources of water supply minus total billed water, includes system losses, fire protection, system flushing and meter error.

FY Ending 2017-18					
Water Demand by Billing Sector	Water Demand (AFY)	Water Demand (CCF)	Water Demand (GPD)	Number of Accounts	Comments
Residential, Single-Family					
Residential, Multifamily					
Government/Institutional					
Commercial					
Industrial					
Large Landscape (Irrigation)					
Recycled Water					
Other					
Total Consumptive Demand					
Non-Revenue Water					
Total Water Production					

Given that FY 2018 was a slightly above-normal demand year (warmer/drier than average) and FY 2019 was a slightly below-normal demand year (cooler/wetter than average), water use from these two years were averaged to represent an average-year base water demand. FY 2020 was examined to determine potential impacts of the COVID-19 pandemic on water use.

Residential Forecast Methodology

For the residential sectors (single-family and multifamily) the base year water demand was divided by households in order to get a total per unit water use (gallons per home per day). In order to split household water use into indoor and outdoor uses, three sources of information were used, along with professional judgement. The sources of information included: (1) *the Residential End Uses of Water* (Water Research Foundation, 2016); (2) California's plumbing codes and landscape ordinances; and (3) CA DWR's Model Water Efficient Landscape Ordinance (MWELO) calculator.

Three different periods of residential end uses of water were analyzed as follows:

- **Pre-2010 efficiency levels** – Has an average indoor water use that is considered to be moderately efficient, also does not include the most recent requirements for MWELO.

- **High-efficiency levels** – Includes the most recent plumbing codes that are considered to be highly efficient, and also includes the most recent requirements for MWELO.

- **Current average efficiency levels** – Represents the weighted average between pre-2010 efficiency and high efficiency levels, based on average age of homes for each retail water agency.

Table 1. Shows the three indoor single-family residential end uses of water for the three efficiency levels assumed for the Orange County water demand forecast.

Table 1. Single-Family Residential Indoor End Uses of Water Used for OC Water Demand Forecast

Indoor Single-Family End Use of Water	Unit	Per Person Use Rate	Pre-2010 Efficiency Level Flow Rate per Day	Pre-2010 Efficiency Level Per Capita Use (gal/day)	High Efficiency Level Flow Rate per Day	High Efficiency Level Per Capita Use (gal/day)	Current Avg. Efficiency Level Flow Rate per Day	Current Avg. Efficiency Level Per Capita Use (gal/day)
Toilet (gal/flush)	gal/flush	5	1.4	7.0	1.28	6.40	1.36	6.80
Shower (gmp)	gal/min	5.1	2.1	10.7	1.8	9.18	2.00	10.19
Bathroom Faucet (gpm)	gal/min	4.2	1.8	7.6	1.2	5.04	1.60	6.71
Kitchen Faucet (gpm)	gal/min	6.2	2.1	13.0	1.8	11.16	2.00	12.39
Dishwashing	gal/load	0.1	12	1.2	9	0.90	10.98	1.10
Clotheswashing	gal/load	0.3	30	9.0	28	8.40	29.32	8.80
All Others	gal/day	1	3.5	3.5	3	3.00	3.33	3.33
Leaks	gal/day	1	6.8	6.8	6.5	6.50	6.70	6.70
Total				**58.79**		**50.58**		**56.01**

The multifamily residential uses were similar in magnitude as shown in Table 1, although slightly lower for certain end uses.

For outdoor residential water use, the indoor per capita total was multiplied by each retail agency-specific persons per household in order to get an indoor residential household water use (gallons per day per home), and then was subtracted from the base year total household water use for single-family and multifamily for each agency based on actual water use as reported by the agency surveys.

For illustrative purposes, the average single-family household water use for Orange County was derived showing indoor and outdoor water uses for both single-family and multifamily homes (see Figures 2 and 3).

Figure 2. Single-Family Indoor and Outdoor Water Use per Household

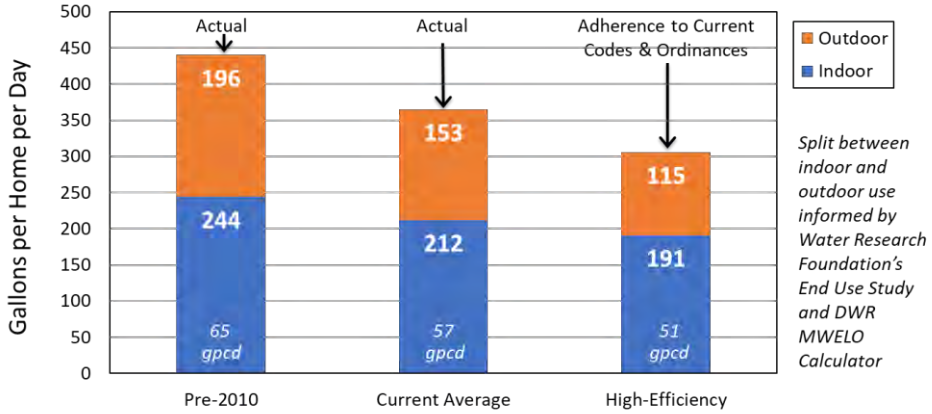
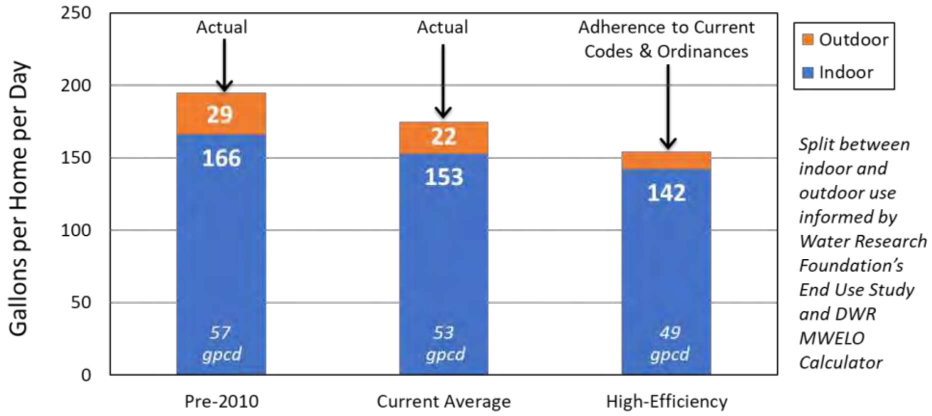


Figure 3. Multifamily Indoor and Outdoor Water Use per Household

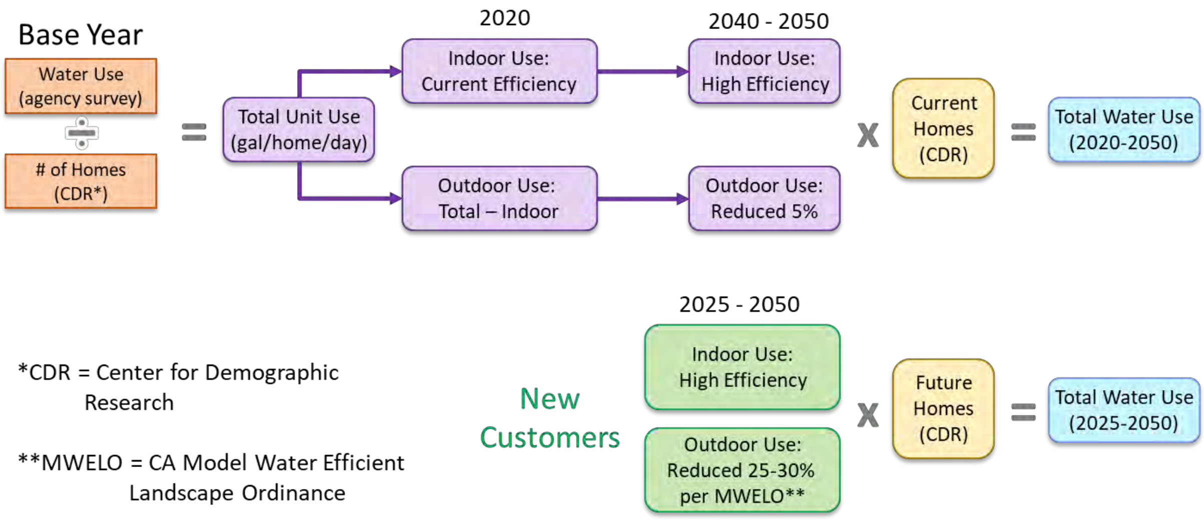


For existing residential homes, the current average indoor and outdoor water use (as illustrated in Figures 2 and 3) for each agency were used for the year 2020. It was assumed that indoor water uses would reach the high efficiency level by 2040. Based on current age of homes, replacement/remodeling rates, and water utility rebate programs it is believed this assumption is very achievable. It was also assumed that current outdoor water use would be reduced by 5% by 2050.

For new homes, the indoor high efficiency level was assumed for the years 2025 through 2050. Outdoor uses for new homes were assumed to be 25% and 30% lower than current household water use for single-family and multifamily homes, respectively.

The residential water demand methodology is depicted in Figure 4.

Figure 4. Residential Water Demand Methodology for Orange County



Existing and projected population, single-family and multifamily households for each retail water agency were provided by the Center for Demographic Research (CDR) under contract by MWDOC and OCWD. CDR provides historical and future demographics by census tracts for all of Orange County. Census tract data is then clipped to retail water agency service boundaries in order to produce historical and projected demographic data by agency.

CII Forecast Methodology

For the CII water demands, which have been fairly stable from a unit use perspective (gallons/account/day), it was assumed that the unit demand in FY2020 would remain the same from 2020-2025 to represent COVID-19 impacts. Reviewing agency water use data from FY2018 through FY2020 revealed that residential water use increased slightly in FY2020 while CII demands decreased slightly as a result of COVID-19. From 2030 to 2050, the average CII unit use from FY2018 and 2019 was used. These unit use factors were then multiplied by an assumed growth of CII accounts under three broad scenarios:

- Low Scenario – assuming no growth in CII accounts
- Mid Scenario – assuming 0.5% annual growth in CII accounts
- High Scenario – assuming 1.5% annual growth in CII accounts

For most retail agencies, the Mid Scenario of CII account growth was used, but for those retail agencies that have had faster historical growth the High Scenario was used. For those retail agencies that have had relatively stable CII water demand, the Low Scenario was used.

Other Demand Categories Forecast Methodology

For those agencies that supply recycled water for non-potable demands, we used agency-specified growth assumptions. Most agencies have already maximized their recycled water and thus are not expecting for this category of demand to grow. However, a few agencies in South Orange County do expect moderate growth in recycled water customers.

For large landscape customers served currently by potable water use, we assumed these demands to be constant through 2050, except for agencies that have growing recycled water demands. For the agencies that have growing recycled water demands, we reduced the large landscape demands served by potable water accordingly.

For non-revenue water, which represents the difference in total water production less all water billed to customers, we held this percentage constant through 2050.

Demand Forecast Results

The results of the water demand forecast for MWDOC's service area are presented in Table 2 by major category of demand and for average weather under Mid Scenario for CII. MWDOC's service area includes all retail water agencies in Orange County except Anaheim, Fullerton and Santa Ana.

Table 2. MWDOC Service Area Water Demand Under Average Weather and Mid Scenario Growth

Sector Demand (AFY)	2020	2025	2030	2035	2040	2045	2050
Single-Family Residential	171,622	170,108	168,573	167,335	164,546	163,979	163,411
Multifamily Residential	60,013	61,411	60,994	60,916	60,364	61,123	61,882
CII	65,252	66,868	76,557	78,450	80,391	80,391	80,391
Large Landscape Potable	36,819	35,439	35,169	35,119	35,094	35,094	35,094
Non-Potable Recycled Water	50,174	52,645	54,094	56,774	56,829	56,829	56,829
Non-Revenue	27,102	27,267	28,198	28,384	28,470	28,507	28,544
Grand Total	**410,982**	**413,738**	**423,584**	**426,978**	**425,694**	**425,923**	**426,151**

As CDR is projecting only slight single-family housing growth for MWDOC's area, plus the impacts of highly efficient plumbing codes and MWELO on new development and retrofits, it is forecasted that single-family water use will steadily decrease from current 171,622 acre-feet (AFY) in 2020 to 163,411 AFY in 2050. While plumbing codes and MWELO will impact multifamily water demand in similar ways as single-family, CDR is projecting significantly more multifamily units—thus, these two factors are countering each other somewhat and results in a relatively constant multifamily water demand. CII water demands, based on 0.5% annual growth in CII accounts, are forecasted to increase from 65,252 AFY in 2020 to 80,391 AFY in 2040 and then hold relatively constant. Large landscape demands served by potable water are expected to decrease somewhat due to increases in non-potable recycled water (although not on a one to one basis). Finally, there will be a slight increase in non-revenue water in the planning horizon. In total, MWDOC's average year water demands under Mid Scenario CII growth are expected to increase from 410,982 AFY in 2020 to 426,978 AFY in 2035, and then level off through 2050.

The results of the water demand forecast for OCWD's service area are presented in Table 3 by major category of demand and for average weather under Mid Scenario for CII. OCWD's service area includes all retail water agencies in Orange County that produce groundwater from the Orange County Basin, including Anaheim, Fullerton and Santa Ana. It also includes a portion of IWRD's service area that overlays the groundwater basin.

Table 3. OCWD Service Area Water Demand Under Average Weather and Mid Scenario Growth

Sector Demand (AFY)	2020	2025	2030	2035	2040	2045	2050
Single-Family Residential	157,755	155,725	153,616	151,319	148,737	148,311	147,885
Multifamily Residential	69,188	72,351	72,778	73,137	73,132	74,534	75,937
CII	86,886	89,043	100,752	103,251	105,812	105,812	105,812
Large Landscape Potable	22,988	22,988	22,988	22,988	22,988	22,988	22,988
Non-Potable Recycled Water	24,899	24,899	24,899	24,899	24,899	24,899	24,899
Non-Revenue	22,406	22,719	23,671	23,881	24,044	24,111	24,178
Grand Total	**384,123**	**387,726**	**398,705**	**399,475**	**399,613**	**400,656**	**401,699**

OCWD's service area demands for single-family are decreasing until 2040, but then stabilize due to the older housing stock which uses more water per home than new development in Anaheim, Fullerton and Santa Ana. Multifamily water demands for OCWD's area are expected to increase from 2020 to 2050 due to significantly greater projected multifamily housing in Anaheim, Fullerton, and Santa Ana. CII water demands, based on 0.5% annual growth in CII accounts, are forecasted to increase from 86,886 AFY in 2020 to 105,812 AFY in 2040 and then hold relatively constant. Large landscape served by potable water and non-potable recycled water demands served by potable water are forecasted to remain fairly constant. Finally, there will be a slight increase in non-revenue water in the planning horizon. In total, OCWD's average year water demands under Mid Scenario CII growth are expected to increase from 384,123 AFY in 2020 to 401,699 AFY in 2050.

The results of the water demand forecast for the total Orange County are presented in Table 4 by major category of demand and for average weather under Mid Scenario for CII. The total Orange County area includes all retail water agencies in Orange County.

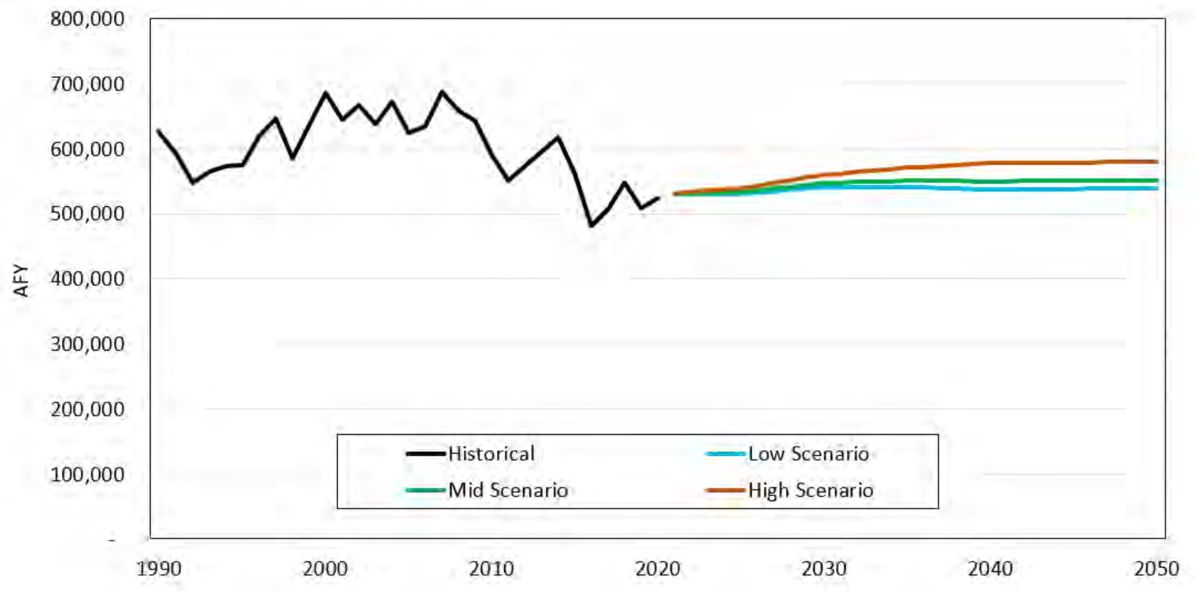
Table 4. Total Orange County Water Demand Under Average Weather and Mid Scenario Growth

Sector Demand (AFY)	2020	2025	2030	2035	2040	2045	2050
Single-Family Residential	215,900	213,658	211,302	209,257	205,649	204,951	204,253
Multifamily Residential	86,584	89,866	90,222	90,473	90,262	91,853	93,443
CII	101,418	103,939	118,298	121,235	124,246	124,246	124,246
Large Landscape Potable	39,545	38,165	37,895	37,845	37,820	37,820	37,820
Non-Potable Recycled Water	50,518	52,989	54,438	57,118	57,173	57,173	57,173
Non-Revenue	31,739	32,012	33,181	33,432	33,587	33,656	33,725
Grand Total	**525,704**	**530,628**	**545,335**	**549,360**	**548,737**	**549,698**	**550,659**

The total water demand for all of Orange County is forecasted to increase from 525,704 AFY in 2020 to 550,659 AFY in 2050.

Figure 5 presents the historical and forecasted water demand over time for the total Orange County area under average weather and for all three scenarios of CII growth.

Figure 5. Total Orange County Water Demand Forecast Under Average Weather



For comparison, the previous water demand used for the 2014 Orange County Water Reliability Study was approximately 580,000 AFY in 2050. Which compares closely with the demands under the High Scenario of CII growth for this forecast of 579,500 AFY. However, the Mid Scenario demand forecast is about 30,000 AFY lower than the 2014 forecast in 2050.

Weather Variability and Long-Term Climate Change Impacts

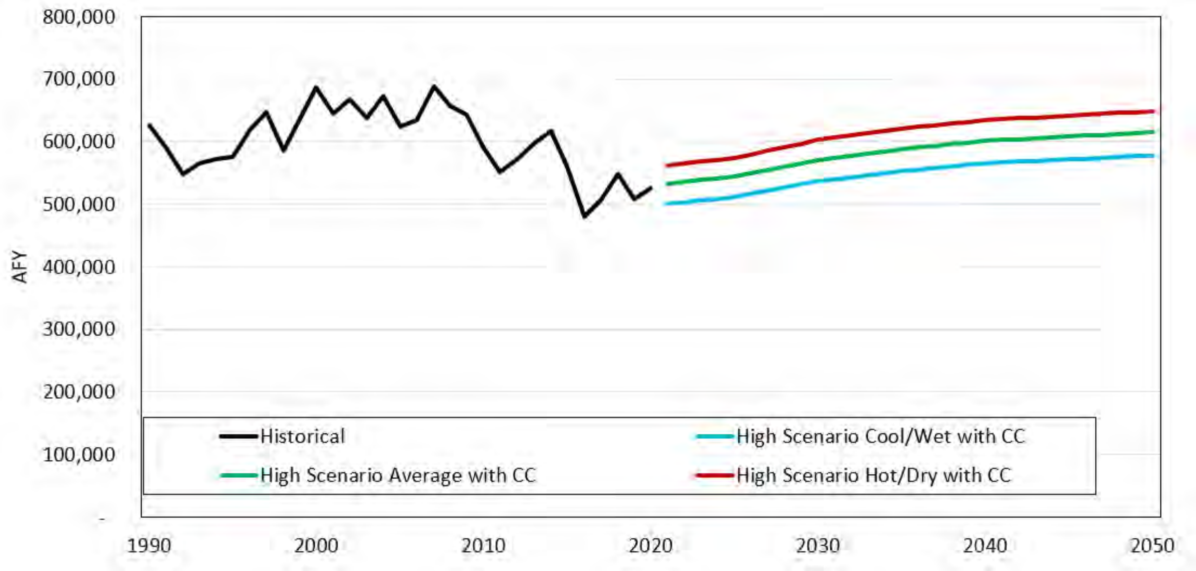
In any given year water demands can vary substantially due to weather. In addition, long-term climate change can have an impact on water demands into the future. For the 2014 OC Water Reliability Study, CDM Smith developed a robust statistical model of total water monthly production from 1990 to 2014 from a sample of retail water agencies. This model removed impacts from population growth, the economy and drought restrictions in order to estimate the impact on water use from temperature and precipitation.

The results of this statistical analysis are:

- Hot/dry weather demands will be 5.5% greater than current average weather demands
- Cooler/wet weather demands will be 6% lower than current average weather demands
- Climate change impacts will increase current average weather demands by:
  - 2% in 2030
  - 4% in 2040
  - 6% in 2050

Figure 6 presents the water demand forecast for the total Orange County area under the High Scenario showing climate change impacts and year-to-year weather variability. This forecast represents the likely higher-end range of future water demands.

Figure 6. Total Orange County Water Demand Forecast Under High Scenario with Climate Change



Comparison with Retail Agency Specified Demand Forecasts

At the start of this effort, MWDOC and OCWD committed to use retail water agency generated water demand forecasts for official reporting purposes (i.e., MWDOC's 2020 UWMP) if agencies decided not to use CDM Smith's methodology. As stated earlier, six retail water agencies either provided their own water demand forecast or made significant modifications to CDM Smith's methodology such that it was no longer considered uniform.

Table 5 compares the water demand forecast generated using CDM Smith's methodology applied uniformly across all retail agencies with a forecast that represents a combination of agency-generated forecasts (for the six retail agencies that supplied them) along with CDM Smith's methodology applied to the rest of the retail agencies for MWDOC and OCWD service areas.

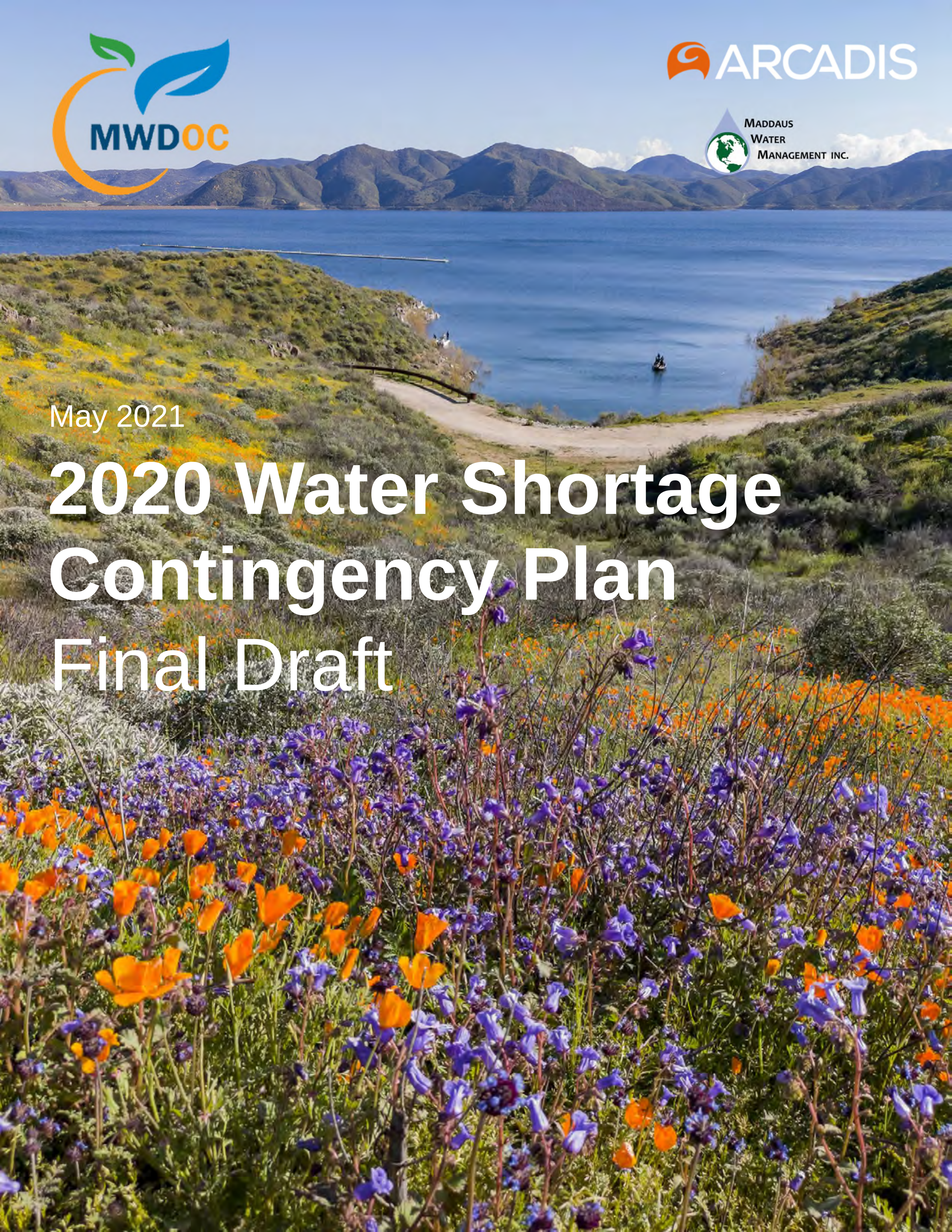
Table 5. Comparison of Water Demand Forecasts Under Average Weather without Climate Change

	MWDOC Service Area			OCWD Service Area		
Year	CDM Smith Method Uniformly Applied	CDM Smith + Agency Provided Method	Difference	CDM Smith Method Uniformly Applied	CDM Smith + Agency Provided Method	Difference
Act. 2020	409,025	409,025	NA	387,317	387,317	NA
2025	413,738	431,130	(17,392)	387,726	400,460	(12,734)
2030	423,584	440,341	(16,757)	398,705	412,568	(13,863)
2035	426,978	446,398	(19,420)	399,475	415,973	(16,498)
2040	425,694	445,870	(20,176)	399,613	417,371	(17,758)
2045	425,923	445,778	(19,855)	400,656	418,308	(17,652)
2050	426,151	445,416	(19,265)	401,699	418,973	(17,274)

The difference between the CDM Smith method applied uniformly to all agencies vs the CDM Smith method plus agency provided forecast is between 4.3 and 4.5 percent by 2050, certainly within the reasonable range of error.

APPENDIX I

MWDOC's 2020 Water Shortage Contingency Plan



MWDOC

ARCADIS

Maddaus Water Management Inc.

May 2021

2020 Water Shortage Contingency Plan

Final Draft

2020 Water Shortage Contingency Plan

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Appendix A. **DWR Submittal Tables**

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Submittal Table 8-2: Demand Reduction Actions

Submittal Table 8-3: Supply Augmentation Actions

Appendix B. **MWDOC Water Supply Allocation Plan**

Appendix C. **MWDOC Strategic Communications Program and Plan**

Appendix D. **Notice of Public Hearing**

Appendix E. **Adopted WSCP Resolution**

Acronyms and Abbreviations

%	Percent
Act	Urban Water Management Planning Act
AF	Acre-Feet
AFY	Acre-Feet per Year
Annual Assessment	Annual Water Supply and Demand Assessment
BPP	Basin Production Percentage
CRA	Colorado River Aqueduct
CVP	Central Valley Project
CWC	California Water Code
DDW	Division of Drinking Water
Delta	Sacramento-San Joaquin River Delta
DRA	Drought Risk Assessment
DVL	Diamond Valley Lake
DWR	California Department of Water Resources
EBSD	Emerald Bay Services District
EOCWD	East Orange County Water District
EOC	Emergency Operation Center
EOP	Emergency Operations Plan
ERP	Emergency Response Plan
ETWD	El Toro Water District
FY	Fiscal Year
GPCD	Gallons per Capita per Day
GPD	Gallons per Day
GSP	Groundwater Sustainability Plan
GSWC	Golden State Water Company
HMP	Hazard Mitigation Plan
IRP	Integrated Water Resource Plan
IRWD	Irvine Ranch Water District
LBCWD	Laguna Beach County Water District
M&I	Municipal and industrial
MAF	Million Acre-Feet
MCL	Maximum Contaminant Level
Mesa Water	Mesa Water District
MET	Metropolitan Water District of Southern California
Metropolitan Act	Metropolitan Water District Act
MGD	Million Gallons per Day
MNWD	Moulton Niguel Water District
MWDOC	Municipal Water District of Orange County
OC	Orange County

OC Basin	Orange County Groundwater Basin
OC San	Orange County Sanitation District
OCWD	Orange County Water District
SCAB	South Coast Air Basin
SCWD	South Coast Water District
Serrano	Serrano Water District
SMWD	Santa Margarita Water District
SOCWA	South Orange County Water Authority
Supplier	Urban Water Supplier
SWP	State Water Project
SWRCB	California State Water Resources Control Board
TCWD	Trabuco Canyon Water District
UWMP	Urban Water Management Plan
WEROC	Water Emergency Response Organization of Orange County
WSAP	Water Supply Allocation Plan
WSCP	Water Shortage Contingency Plan
WSDM	Water Surplus and Drought Management Plan
WUE	Water Use Efficiency
YLWD	Yorba Linda Water District

1 INTRODUCTION AND WSCP OVERVIEW

The Water Shortage Contingency Plan is a strategic planning document designed to prepare for and respond to water shortages. This Water Shortage Contingency Plan (WSCP) complies with California Water Code (CWC) Section 10632, which requires that every urban water supplier (Supplier) shall prepare and adopt a WSCP as part of its Urban Water Management Plan (UWMP). This level of detailed planning and preparation is intended to help maintain reliable supplies and reduce the impacts of supply interruptions.

The WSCP is MWDOC's operating manual that is used to prevent catastrophic service disruptions through proactive, rather than reactive, management. A water shortage, when water supply available is insufficient to meet the normally expected customer water use at a given point in time, may occur due to a number of reasons, such as population and land use growth, climate change, drought, and catastrophic events. This Plan provides a structured guide for MWDOC to deal with water shortages, incorporating prescriptive information and standardized action levels, along with implementation actions in the event of a catastrophic supply interruption. This way, if and when shortage conditions arise, MWDOC's governing body, its staff, and retail agencies can easily identify and efficiently implement pre-determined steps to manage a water shortage. A well-structured WSCP allows real-time water supply availability assessment and structured steps designed to respond to actual conditions, to allow for efficient management of any shortage with predictability and accountability.

The WSCP also describes MWDOC's procedures for conducting an Annual Water Supply and Demand Assessment (Annual Assessment) that is required by CWC Section 10632.1 and is to be submitted to the California Department of Water Resources (DWR) on or before July 1 of each year, or within 14 days of receiving final allocations from the State Water Project (SWP), whichever is later. MWDOC's 2020 WSCP is included as an appendix to its 2020 UWMP which will be submitted to DWR by July 1, 2021. However, this WSCP is created separately from MWDOC's 2020 UWMP and can be amended, as needed, without amending the UWMP. Furthermore, the CWC does not prohibit a Supplier from taking actions not specified in its WSCP, if needed, without having to formally amend its UWMP or WSCP.

1.1 Water Shortage Contingency Plan Requirements and Organization

The WSCP provides the steps and water shortage response actions to be taken in times of water shortage conditions. WSCP has prescriptive elements, such as: an analysis of water supply reliability; the water shortage response actions for each of the six standard water shortage levels that correspond to water shortage percentages ranging from 10% to greater than 50%; an estimate of potential to close supply gap for each measure; protocols and procedures to communicate identified actions for any current or predicted water shortage conditions; procedures for an Annual Assessment; and reevaluation and improvement procedures for evaluating the WSCP.

This WSCP is organized into three main sections, with Section 3 aligned with the CWC Section 16032 requirements.

Section 1 Introduction and WSCP Overview gives an overview of the WSCP fundamentals.

Section 2 Background provides a background on MWDOC's water service area.

Section 3 Water Shortage Contingency Preparedness and Response

Section 3.1 Water Supply Reliability Analysis provides a summary of the water supply analysis and water reliability findings from the 2020 UWMP.

Section 3.2 Annual Water Supply and Demand Assessment Procedures provide a description of procedures to conduct and approve the Annual Assessment.

Section 3.3 Six Standard Water Shortage Stages explains the WSCP's six standard water shortage levels corresponding to progressive ranges of up to 10, 20, 30, 40, 50, and more than 50% shortages.

Section 3.4 Shortage Response Actions describes the WSCP's shortage response actions that align with the defined shortage levels.

Section 3.5 Communication Protocols addresses communication protocols and procedures to inform customers, the public, interested parties, and local, regional, and state governments, regarding any current or predicted shortages and any resulting shortage response actions.

Section 3.6 Compliance and Enforcement is not required by wholesale water providers.

Section 3.7 Legal Authorities is a description of the legal authorities that enable MWDOC to implement and enforce its shortage response actions.

Section 3.8 Financial Consequences of the WSCP provides a description of the financial consequences of and responses for drought conditions.

Section 3.9 Monitoring and Reporting is not required by wholesale water providers.

Section 3.10 WSCP Refinement Procedures addresses reevaluation and improvement procedures for monitoring and evaluating the functionality of the WSCP.

Section 3.11 Special Water Feature Distinction is a required definition per the CWC for retail water agencies, not applicable to MWDOC as wholesale water supplier.

Section 3.12 Plan Adoption, Submittal, and Implementation provides a record of the process MWDOC followed to adopt and implement its WSCP.

1.2 Integration with Other Planning Efforts

As a retail water supplier in Orange County, MWDOC considered other key entities in the development of this WSCP, including the Metropolitan Water District of Southern California (MET) (regional wholesaler for Southern California and the direct supplier of imported water to MWDOC), and Orange County Water District (OCWD) (Orange County Groundwater Basin manager and provider of recycled water in North Orange County). As a wholesale water provider, MWDOC also worked with its retail agencies to align WSCP strategies to ensure robust water shortage planning and response across the District. The DWR Submittal tables for MWDOC's WSCP can be found in Appendix A.

Some of the key planning and reporting documents that were used to develop this WSCP are:

- **MWDOC's 2020 UWMP** provides the basis for the projections of the imported supply availability over the next 25 years for MWDOC's service area.

- **MWDOC's Orange County Reliability Study** provides the basis for water demand projections for MWDOC's member agencies as well as Anaheim, Fullerton, and Santa Ana.
- **MET's 2020 Integrated Water Resources Plan (IRP)** is a long-term planning document to ensure water supply availability in Southern California and provides a basis for water supply reliability in Orange County.
- **MET's 2020 UWMP** was developed as a part of the 2020 IRP planning process and was used by MWDOC as another basis for the projections of supply capability of the imported water received from MET.
- **MET's 2020 WSCP** provides a water supply assessment and guide for MET's intended actions during water shortage conditions.
- **OCWD's 2021 Water Reliability Plan** provides the latest information on groundwater management and supply projection for the Orange County Groundwater Basin (OC Basin), the primary source of groundwater for a significant number of water suppliers in Orange County.
- **OCWD's 2018-19 Engineer's Report** provides information on the groundwater conditions and basin utilization of the OC Basin.
- **OCWD's 2017 Basin 8-1 Alternative Plan i**s an alternative to the Groundwater Sustainability Plan (GSP) for the OC Basin and provides significant information related to sustainable management of the basin in the past and hydrogeology of the basin, including groundwater quality and basin characteristics.
- **2020 Local Hazard Mitigation Plan** provides the basis for the seismic risk analysis of the water system facilities.
- **Orange County Local Agency Formation Commission's 2020 Municipal Service Review for MWDOC Report** provides a comprehensive service review of the municipal services provided by MWDOC.
- **Water Master Plan and Sewer Master Plan** of MWDOC provide information on water infrastructure planning projects and plans to address any required water system improvements.
- **Groundwater Management Plans** provide the groundwater sustainability goals for the basins in the MWDOC's service area and the programs, actions, and strategies activities that support those goals.

2 BACKGROUND INFORMATION

MWDOC was formed by Orange County voters in 1951 under the Municipal Water District Act of 1911 to provide imported water to inland areas of Orange County. Governed by an elected seven-member Board of Directors, MWDOC is MET's third largest member agency based on assessed valuation.

MWDOC is a regional water wholesaler and resource planning agency, managing all of Orange County's imported water supply except for water imported to the cities of Anaheim, Fullerton, and Santa Ana. MWDOC is committed to ensuring water reliability for 28 water entities and retail water agencies in its 600-square-mile service area. To that end, MWDOC focuses on sound planning and appropriate investments in water supply, water use efficiency, regional delivery infrastructure, and emergency preparedness.

Lying in the South Coast Air Basin (SCAB), its climate is characterized by southern California's "Mediterranean" climate with mild winters, warm summers, and moderate rainfall. In terms of land use, MWDOC's service area in the North Orange County is almost built out with predominantly residential units with pockets dedicated to commercial, institutional, governmental uses and open space and parks and the existing vacant lots in South Orange County are gradually transitioning to residential and commercial mixed-use areas. The current population of 2,342,740 is projected to increase by 8% over the next 25 years.

MWDOC is governed by an elected seven-member Board of Directors, with each board member representing a specific area of the County and elected to a four-year term by voters who reside within that part of the MWDOC service area. Each director is a member of at least one of the following standing committees: Planning and Operations; Administration and Finance; and Executive.

2.1 MWDOC Service Area

MWDOC serves more than 2.34 million residents in a 600-square-mile service area (Figure 2-1). Although MWDOC does not have its own water facilities and does not have jurisdiction over local supplies, it works to ensure the delivery of reliable water supplies to the region.

MWDOC serves imported water in Orange County to 28 water agencies. These entities, comprised of cities and water districts, are referred to as MWDOC member agencies and provide water to approximately 2.34 million residents. MWDOC retail agencies include:

- City of Brea
- City of Buena Park
- City of Fountain Valley
- City of Garden Grove
- City of Huntington Beach
- City of La Habra
- City of La Palma
- East Orange County Water District (EOCWD)
- El Toro Water District (ETWD)
- Emerald Bay Services District (EBSD)
- Irvine Ranch Water District (IRWD)
- Golden State Water Company (GSWC)
- Laguna Beach County Water District (LBCWD)
- Mesa Water District (Mesa Water)

- City of Newport Beach
- City of Orange
- City of San Clemente
- City of San Juan Capistrano
- City of Seal Beach
- City of Tustin
- City of Westminster
- Moulton Niguel Water District (MNWD)
- Orange County Water District (OCWD)
- Santa Margarita Water District (SMWD)
- Serrano Water District (Serrano)
- South Coast Water District (SCWD)
- Trabuco Canyon Water District (TCWD)
- Yorba Linda Water District (YLWD)

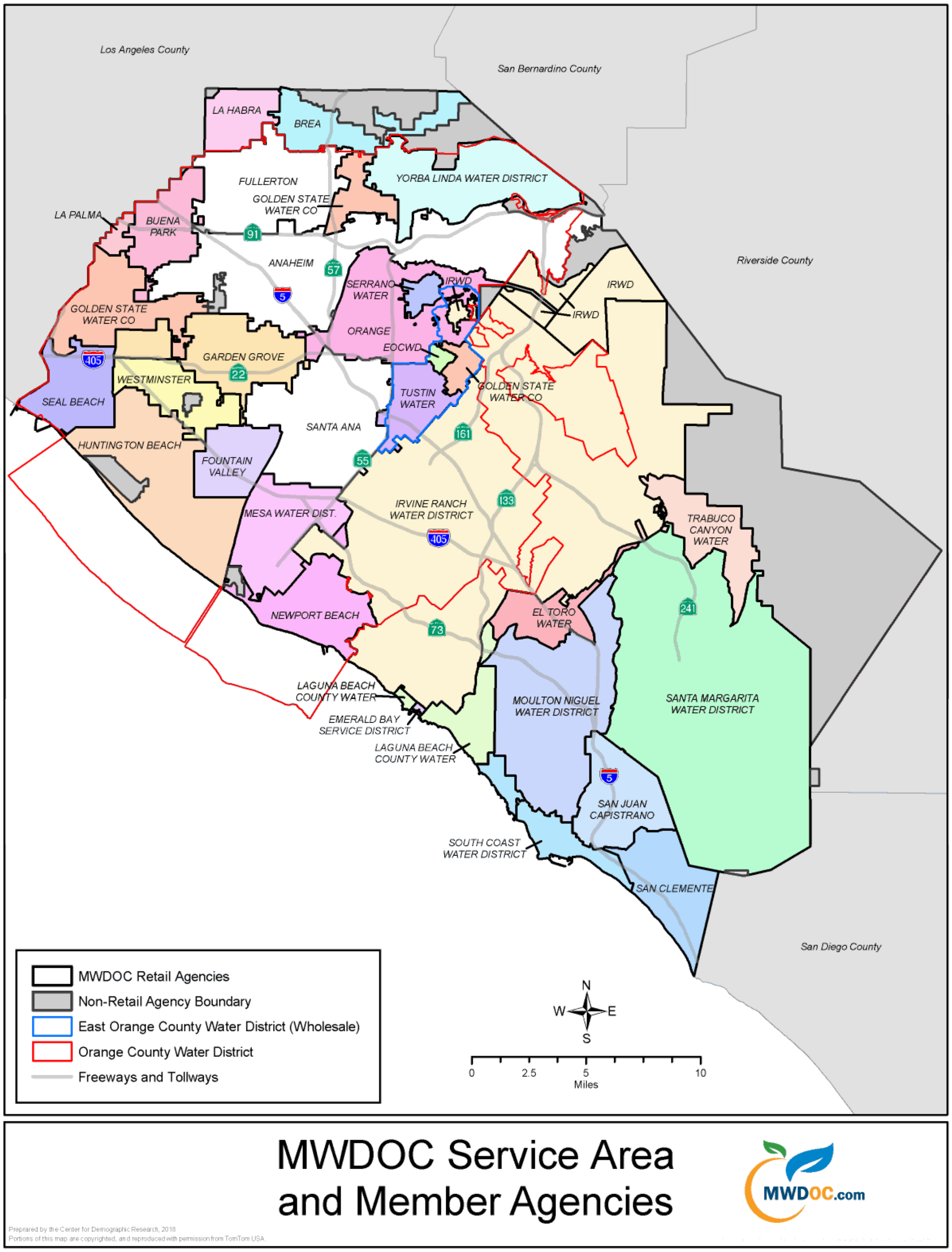


Figure 2-1: MWDOC Service Area

2.2 Relationship to MET

MWDOC became a member agency of MET in 1951 to bring supplemental imported water supplies to parts of Orange County. MET is the largest water wholesaler for domestic and municipal uses in California, serving approximately 19 million customers. MET wholesales imported water supplies to 26 member cities and water districts in six southern California counties. Its service area covers the southern California coastal plain, extending approximately 200 miles along the Pacific Ocean from the City of Oxnard in the north to the international boundary with Mexico in the south. This encompasses 5,200 square miles and includes portions of Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura counties. The regional locations of MET's member agencies are shown in Figure 2-2. Approximately 85% of the population from the aforementioned counties reside within MET's boundaries.

MET is governed by a Board of Directors comprised of 38 appointed individuals with a minimum of one representative from each of MET's 26 member agencies. The allocation of directors and voting rights are determined by each agency's assessed valuation. Each member of the Board shall be entitled to cast one vote for each ten million dollars ($10,000,000) of assessed valuation of property taxable for district purposes, in accordance with Section 55 of the Metropolitan Water District Act (Metropolitan Act). Directors can be appointed through the chief executive officer of the member agency or by a majority vote of the governing board of the agency. Directors are not compensated by MET for their service.

MET is responsible for importing water into the region through its operation of the Colorado River Aqueduct (CRA) and its contract with the State of California for SWP supplies. Member agencies receive water from MET through various delivery points and pay for service through a rate structure made up of volumetric rates, capacity charges and readiness to serve charges. Member agencies provide estimates of imported water demand to MET annually in April regarding the amount of water they anticipate they will need to meet their demands for the next five years.

In Orange County, MWDOC and the cities of Anaheim, Fullerton, and Santa Ana are MET member agencies that purchase imported water directly from MET. Furthermore, MWDOC purchases both treated potable and untreated water from MET to supplement its retail agencies' local supplies.

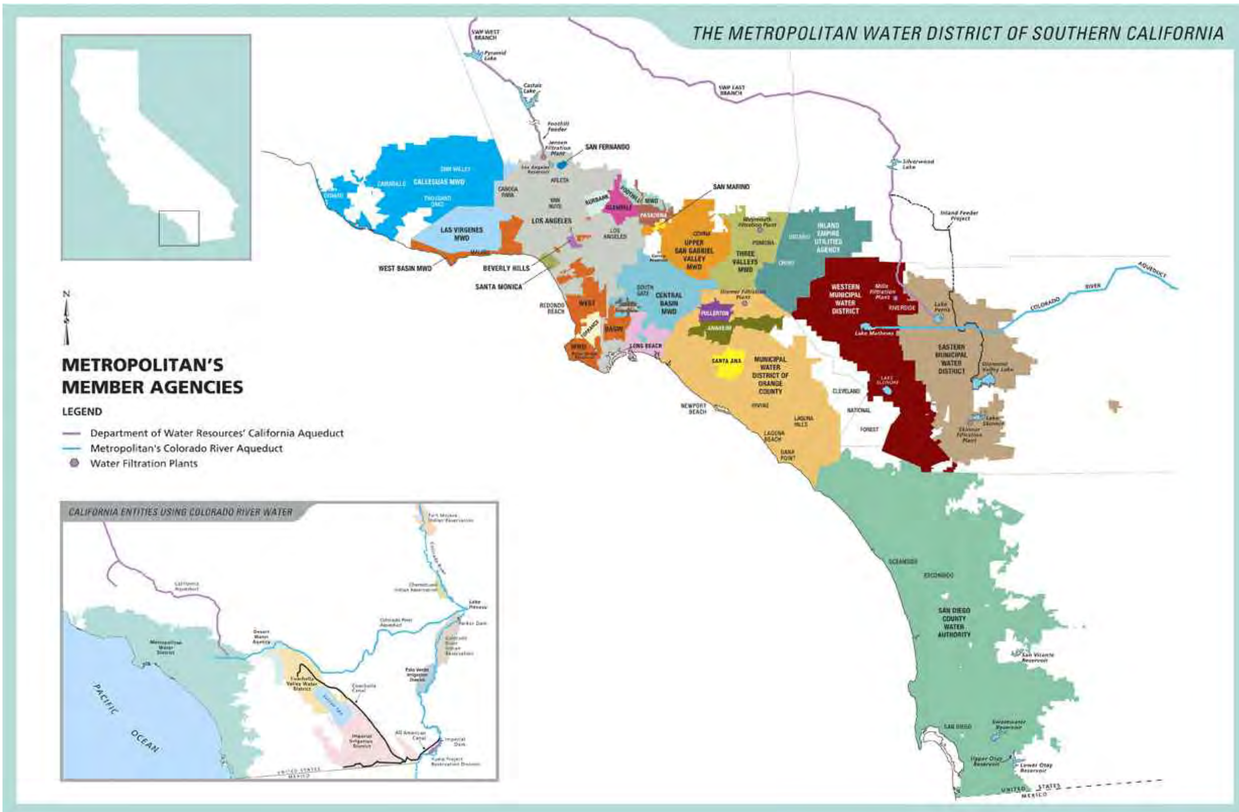


Figure 2-2: Regional Location of MET's Member Agencies

2.3 Relationship with MET Water Shortage Planning

The WSCP is designed to be consistent with MET's Water Shortage and Demand Management (WSDM) Plan, MET's Water Supply Allocation Plan (MET WSAP), MWDOC's Water Supply Allocation Plan (WSAP), and other emergency planning efforts as described below. MET and MWDOC's WSAPs are integral to the WSCP's shortage response strategy. In the event that MET determines that supply augmentation (including dedicated drought storage supply) and demand reduction measures would not be sufficient to meet projected supply needs, MET will determine shortage conditions exist and assign a water shortage level required for MWDOC's service area to meet a reduction in demands. In turn, MWDOC will need to further assess the shortage conditions within their service area to meet member agencies' demands and as required activate MWDOC's WSAP. If applicable, MWDOC will also need to need invoke water shortage level conditions appropriate to meet projected member agencies' demands as described further in Section 2.3.3 below.

2.3.1 MET Water Surplus and Drought Management Plan

MET evaluates the level of supplies available and existing levels of water in storage to determine the appropriate management stage annually. Each stage is associated with specific resource management actions to avoid extreme shortages to the extent possible and minimize adverse impacts to retail customers should an extreme shortage occur. The sequencing outlined in the WSDM Plan reflects anticipated responses towards MET's existing and expected resource mix.

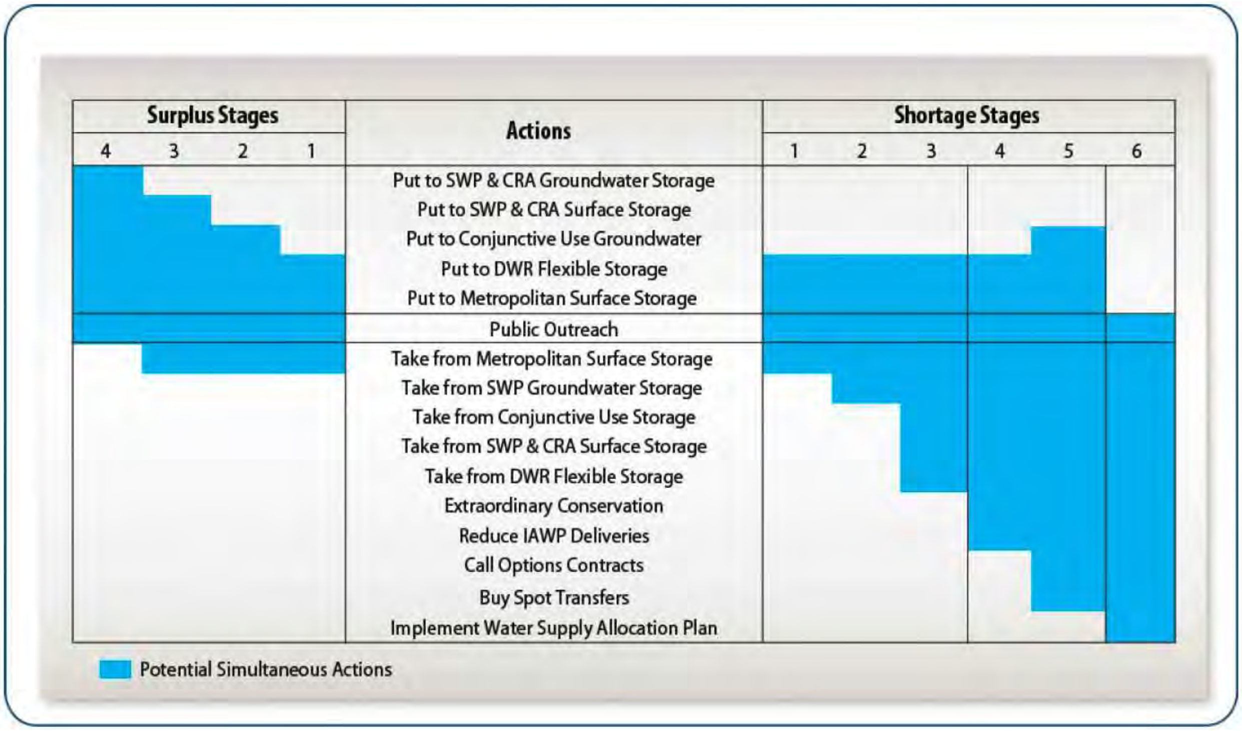
Surplus stages occur when net annual deliveries can be made to water storage programs. Under the WSDM Plan, there are four surplus management stages that provides a framework for actions to take for surplus supplies. Deliveries in Diamond Valley Lake (DVL) and in SWP terminal reservoirs continue through each surplus stage provided there is available storage capacity. Withdrawals from DVL for regulatory purposes or to meet seasonal demands may occur in any stage.

The WSDM Plan distinguishes between shortages, severe shortages, and extreme shortages. The differences between each term are listed below.

- Shortage: MET can meet full-service demands and partially meet or fully meet interruptible demands using stored water or water transfers, as necessary.
- Severe Shortage: MET can meet full-service demands only by using stored water, transfers, and possibly calling for extraordinary conservation.
- Extreme Shortage: MET must allocate available supply to full-service customers.

There are six shortage management stages to guide resource management activities. These stages are defined by shortfalls in imported supply and water balances in MET's storage programs. When MET must make net withdrawals from storage to meet demands, it is considered to be in a shortage condition. Source: MET's WSDM, 1999.

Figure 2-3 gives a summary of actions under each surplus and shortage stages when an allocation plan is necessary to enforce mandatory cutbacks. The goal of the WSDM plan is to avoid Stage 6, an extreme shortage (MET, 1999).



Source: MET's WSDM, 1999.

Figure 2-3: Resource Stages, Anticipated Actions, and Supply Declarations

MET's Board of Directors adopted a Water Supply Condition Framework in June 2008 in order to communicate the urgency of the region's water supply situation and the need for further water conservation practices. The framework has four conditions, each calling increasing levels of conservation. Descriptions for each of the four conditions are listed below:

- Baseline Water Use Efficiency: Ongoing conservation, outreach, and recycling programs to achieve permanent reductions in water use and build storage reserves.
- Condition 1 Water Supply Watch: Local agency voluntary dry-year conservation measures and use of regional storage reserves.
- Condition 2 Water Supply Alert: Regional call for cities, counties, member agencies, and retail water agencies to implement extraordinary conservation through drought ordinances and other measures to mitigate use of storage reserves.
- Condition 3 Water Supply Allocation: Implement MET's WSAP.

As noted in Condition 3, should supplies become limited to the point where imported water demands cannot be met, MET will allocate water through the WSAP (MET, 2021a).

2.3.2 MET Water Supply Allocation Plan

MET's imported supplies have been impacted by a number of water supply challenges as noted earlier. In case of extreme water shortage within the MET service area is the implementation of its WSAP.

MET's Board of Directors adopted the WSAP in February 2008 to fairly distribute a limited amount of water supply and applies it through a detailed methodology to reflect a range of local conditions and needs of the region's retail water consumers (MET, 2021a).

The WSAP includes the specific formula for calculating member agency supply allocations and the key implementation elements needed for administering an allocation. MET's WSAP is the foundation for the urban water shortage contingency analysis required under CWC Section 10632 and is part of MET's 2020 UWMP.

MET's WSAP was developed in consideration of the principles and guidelines in MET's 1999 WSDM Plan with the core objective of creating an equitable "needs-based allocation". The WSAP's formula seeks to balance the impacts of a shortage at the retail level while maintaining equity on the wholesale level for shortages of MET supplies of greater than 50%. The formula takes into account a number of factors, such as the impact on retail customers, growth in population, changes in supply conditions, investments in local resources, demand hardening aspects of water conservation savings, recycled water, extraordinary storage and transfer actions, and groundwater imported water needs.

The formula is calculated in three steps: 1) based period calculations, 2) allocation year calculations, and 3) supply allocation calculations. The first two steps involve standard computations, while the third step contains specific methodology developed for the WSAP.

Step 1: Base Period Calculations – The first step in calculating a member agency's water supply allocation is to estimate their water supply and demand using a historical based period with established water supply and delivery data. The base period for each of the different categories of supply and demand is calculated using data from the two most recent non-shortage years.

Step 2: Allocation Year Calculations – The next step in calculating the member agency's water supply allocation is estimating water needs in the allocation year. This is done by adjusting the base period estimates of retail demand for population growth and changes in local supplies.

Step 3: Supply Allocation Calculations – The final step is calculating the water supply allocation for each member agency based on the allocation year water needs identified in Step 2.

In order to implement the WSAP, MET's Board of Directors makes a determination on the level of the regional shortage, based on specific criteria, typically in April. The criteria used by MET includes, current levels of storage, estimated water supplies conditions, and projected imported water demands.
The allocations, if deemed necessary, go into effect in July of the same year and remain in effect for a 12-month period. The schedule is made at the discretion of the Board of Directors (MET, 2021b).

As demonstrated by the findings in MET's 2020 UWMP both the Water Reliability Assessment and the Drought Risk Assessment (DRA) demonstrate that MET is able to mitigate the challenges posed by hydrologic variability, potential climate change, and regulatory risk on its imported supply sources through the significant storage capabilities it has developed over the last two decades, both dry-year and emergency storage (MET, 2021a).

Although MET's 2020 UWMP forecasts that MET will be able to meet projected imported demands throughout the projected period from 2025 to 2045, uncertainty in supply conditions can result in MET needing to implement its WSAP to preserve dry-year storage and curtail demands (MET, 2021b).

2.3.3 MWDOC Water Supply Allocation Plan

To prepare for the potential allocation of imported water supplies from MET, MWDOC worked collaboratively with its 28 retail agencies to develop its own WSAP that was adopted in January 2009 and amended in 2020. The MWDOC WSAP outlines how MWDOC will determine and implement each of its retail agencies' allocation during a time of shortage.

The MWDOC WSAP uses a similar method and approach, when reasonable, as that of the MET's WSAP. However, MWDOC's plan remains flexible to use an alternative approach when MET's method produces a significant unintended result for the member agencies. The MWDOC WSAP model follows five basic steps to determine a retail agency's imported supply allocation.

Step 1: Determine Baseline Information – The first step in calculating a water supply allocation is to estimate water supply and demand using a historical based period with established water supply and delivery data. The base period for each of the different categories of demand and supply is calculated using data from the last two non-shortage years.

Step 2: Establish Allocation Year Information – In this step, the model adjusts for each retail agency's water need in the allocation year. This is done by adjusting the base period estimates for increased retail water demand based on population growth and changes in local supplies.

Step 3: Calculate Initial Minimum Allocation Based on MET's Declared Shortage Level – This step sets the initial water supply allocation for each retail agency. After a regional shortage level is established, MWDOC will calculate the initial allocation as a percentage of adjusted Base Period Imported water needs within the model for each retail agency.

Step 4: Apply Allocation Adjustments and Credits in the Areas of Retail Impacts and Conservation– In this step, the model assigns additional water to address disparate impacts at the retail level caused by an across-the-board cut of imported supplies. It also applies a conservation credit given to those agencies that have achieved additional water savings at the retail level as a result of successful implementation of water conservation devices, programs and rate structures.

Step 5: Sum Total Allocations and Determine Retail Reliability – This is the final step in calculating a retail agency's total allocation for imported supplies. The model sums an agency's total imported allocation with all of the adjustments and credits and then calculates each agency's retail reliability compared to its Allocation Year Retail Demand.

The MWDOC WSAP includes additional measures for plan implementation, including the following (MWDOC, 2016):

- **Appeal Process** – An appeals process to provide retail agencies the opportunity to request a change to their allocation based on new or corrected information. MWDOC anticipates that under most circumstances, a retail agency's appeal will be the basis for an appeal to MET by MWDOC.
- **Melded Allocation Surcharge Structure** – At the end of the allocation year, MWDOC would only charge an allocation surcharge to each retail agency that exceeded their allocation if MWDOC exceeds its total allocation and is required to pay a surcharge to MET. MET enforces allocations to retail agencies through an allocation surcharge to a retail agency that exceeds its total annual allocation at the end of the 12-month allocation period. MWDOC's surcharge would

be assessed according to the retail agency’s prorated share (AF over usage) of MWDOC amount with MET. Surcharge funds collected by MET will be invested in its Water Management Fund, which is used to in part to fund expenditures in dry-year conservation and local resource development.

- **Tracking and Reporting Water Usage** – MWDOC will provide each retail agency with water use monthly reports that will compare each retail agency’s current cumulative retail usage to their allocation baseline. MWDOC will also provide quarterly reports on its cumulative retail usage versus its allocation baseline.
- **Timeline and Option to Revisit the Plan** – The allocation period will cover 12 consecutive months and the Regional Shortage Level will be set for the entire allocation period. MWDOC only anticipates calling for allocation when MET declares a shortage; and no later than 30 days from MET’s declaration will MWDOC announce allocation to its retail agencies.

3 WATER SHORTAGE CONTINGENCY PREPAREDNESS AND RESPONSE PLANNING

MWDOC's WSCP is a detailed guide of how MWDOC intends to act in the case of an actual water shortage condition. The WSCP anticipates a water supply shortage and provides pre-planned guidance for managing and mitigating a shortage. Regardless of the reason for the shortage, the WSCP is based on adequate details of demand reduction and supply augmentation measures that are structured to match varying degrees of shortage will ensure the relevant stakeholders understand what to expect during a water shortage situation.

3.1 Water Supply Reliability Analysis

Per CWC Section 10632 (a)(1), the WSCP shall provide an analysis of water supply reliability conducted pursuant to CWC Section 10635, and the key issues that may create a shortage condition when looking at MWDOC's water asset portfolio.

Understanding water supply reliability, factors that could contribute to water supply constraints, availability of alternative supplies, and what effect these have on meeting customer demands provides MWDOC with a solid basis on which to develop appropriate and feasible response actions in the event of a water shortage. In the 2020 UWMP, MWDOC conducted a Water Reliability Assessment to compare the total water supply sources available to the water supplier with long-term projected water use over the next 20 years, in five-year increments, for a normal water year, a single dry water year, and a drought lasting five consecutive water years (MWDOC, 2021).

MWDOC also conducted a DRA to evaluate a drought period that lasts five consecutive water years starting from the year following when the assessment is conducted. An analysis of both assessments determined that MWDOC is capable of meeting all of its member agencies' demands from 2021 through 2045 for a normal year, a single dry year, and a drought lasting five consecutive dry years with significant supplemental dedicated drought supplies from MET and ongoing conservation program efforts from its member agencies. MET's projections take into account the imported demands from Orange County and as so, MET's water reliability assessments determine that demands within MWDOC can be met, and the development of numerous local sources further augments the reliability of the imported water system. As a result, there is no projected shortage condition due to drought that will trigger agency demand reductions until MET notifies MWDOC of its implementation of its WSAP. More information is available in MWDOC's 2020 UWMP Section 6 and 7 (MWDOC, 2021).

3.2 Annual Water Supply and Demand Assessment Procedures

Per CWC Section 10632.1, MWDOC will conduct an annual water supply and demand assessment pursuant to subdivision (a) of Section 10632 and by July 1st of each year, beginning in 2022, submit an annual water shortage assessment with information for anticipated shortage, triggered shortage response actions, compliance and enforcement actions, and communication actions consistent with the supplier's water shortage contingency plan.

MWDOC must include in its WSCP the procedures used for conducting an Annual Assessment. The Annual Assessment is a determination of the near-term outlook for supplies and demands and how a perceived shortage may relate to WSCP shortage stage response actions in the current calendar year. This determination is based on information available to MWDOC at the time of the analysis. Starting in 2022, the Annual Assessment will be due by July 1 of every year.

This section documents the decision-making process required for formal approval of MWDOC's Annual Assessment determination of water supply reliability each year and the key data inputs and the methodologies used to evaluate the water system reliability for the coming year, while considering that the year to follow would be considered dry.

3.2.1 Decision-Making Process

The following decision-making process describes the functional steps that MWDOC will take to formally approve the Annual Assessment determination of water supply reliability each year.

3.2.1.1 MWDOC Steps to Approve the Annual Assessment Determination

The MWDOC Annual Assessment will be predicated on MET's WSDM supply demand tracking, which is reported monthly to their Board of Directors. MET WSDM planning involves the examination of developing demand and supply conditions for the calendar year, as well as considerations of potential actions consistent with the WSDM Plan. Additionally, MWDOC staff simultaneously provides water supplies and demand reports to its Board of Directors to inform them of emerging demand and supply conditions. These monthly analyses provide key information for MWDOC and MET to manage resources to meet a range of estimated demands and adjust to changing conditions throughout the year.

For many of MWDOC's member agencies, their primary source of water is produced locally from groundwater basins, recycle water projects, surface reservoirs, and groundwater recovery projects. Their remaining source to meet retail demands comes from the purchase of imported water from MWDOC. However, some member agencies, particularly in South Orange County, rely heavily on imported water due to limited local supplies. As described below, MWDOC surveys each member agency to project near term and long-term consumptive and replenishment imported water demands.

Annually, MWDOC surveys its member agencies for anticipated water demands and supplies for the upcoming year. MWDOC utilizes this information to plan for the anticipated imported water supplies for the MWDOC service area. This information is then shared and coordinated with MET and is incorporated into their analysis of their service area's annual imported water needs. Based on the year's supply conditions and WSDM actions, MET will present a completed Annual Assessment for its member agencies' review from which they will then seek Board approval in April of each year.

Additionally, MET expects that any triggers or specific shortage response actions that result from the Annual Assessment would be approved by their Board at that time. Based upon MET's Assessment and taking into consideration information provided to MWDOC through the annual survey, MWDOC will provide each member agency an anticipated estimate of imported supplies by member agency to be incorporated into each agency's annual supply and demand assessment. MWDOC will then adopt its completed Annual Assessment prior to the July 1 deadline, so MWDOC's member agencies will be able to submit their annual assessment by the July 1 DWR deadline. Figure 3-1 provides a breakdown of the decision-making process.

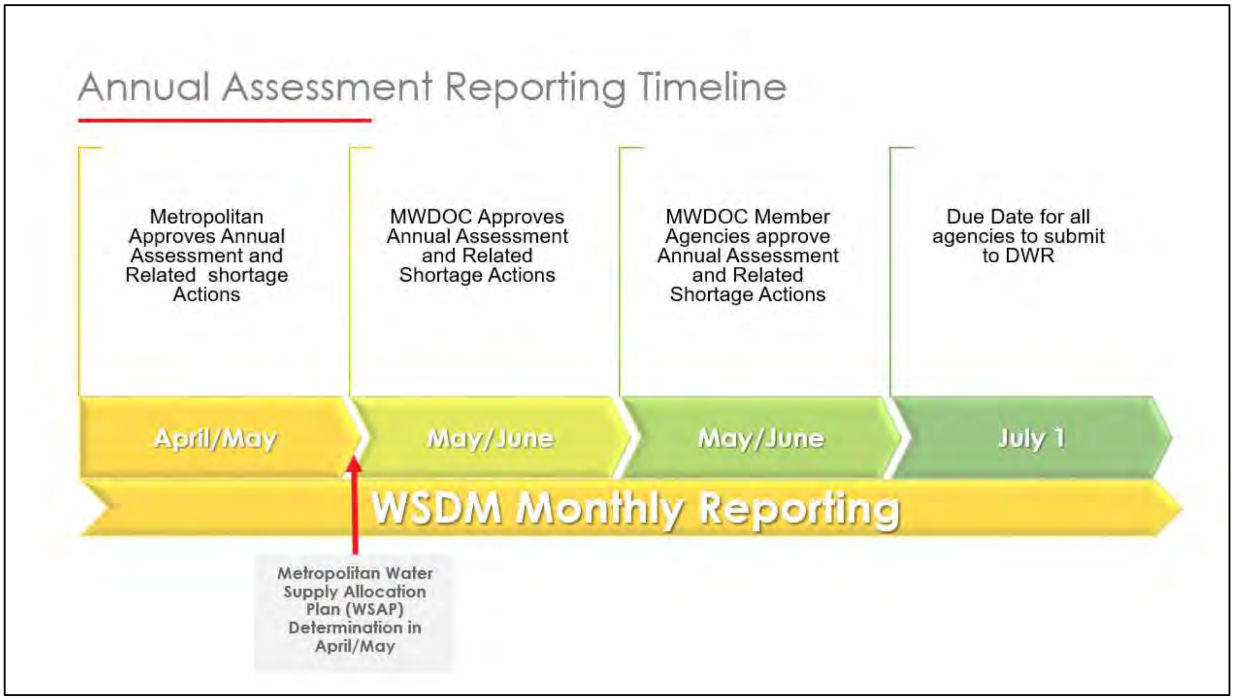


Figure 3-1: Sample Annual Assessment Reporting Timeline

3.2.2 Data and Methodologies

The following paragraphs document the key data inputs and methodologies that are used to evaluate MWDOC's water system reliability for the coming year, while considering that the year to follow would be considered dry.

3.2.2.1 Assessment Methodology

MWDOC will evaluate water supply reliability for the current year and one dry year for the purpose of the Annual Assessment. The Annual Assessment determination will be based on considerations of unconstrained water demand, local water supplies, MET imported water supplies, planned water use, and infrastructure considerations. The balance between projected in-service area supplies, coupled with MET imported supplies, and anticipated unconstrained demand will be used to determine what, if any, shortage stage is expected under the WSCP framework as presented in Figure 3-2. The WSCP's standard shortage stages are defined in terms of shortage percentages. Shortage percentages will be calculated by dividing the difference between water supplies and unconstrained demand by total unconstrained demand. This calculation will be performed separately for anticipated current year conditions and for assumed dry year conditions. More information on the basis of this calculation is available in MWDOC's 2020 UWMP Section 6 and 7.

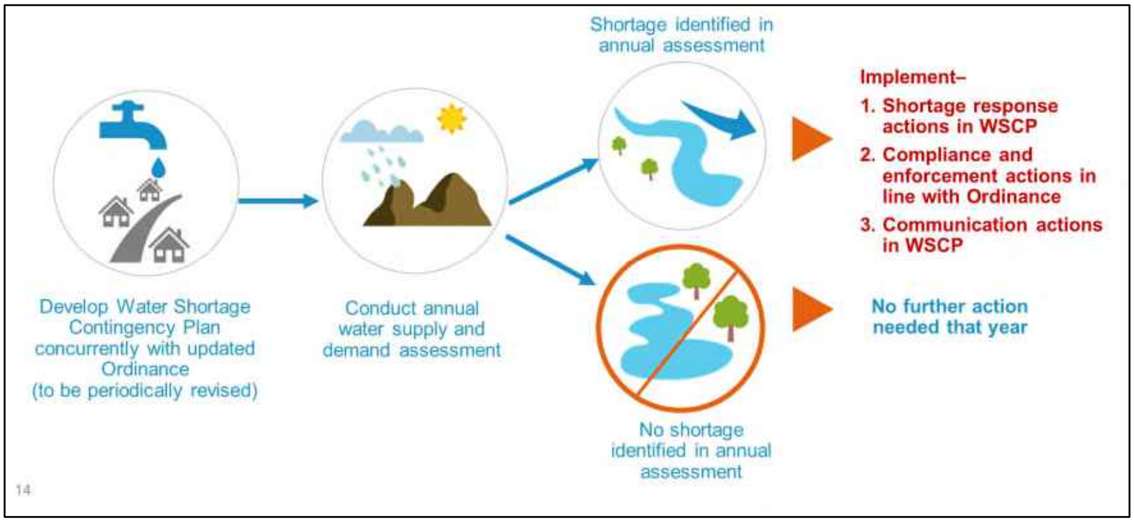


Figure 3-2: Water Shortage Contingency Annual Assessment Framework

3.2.2.2 Locally Applicable Evaluation Criteria

The information and analyses that comprise the Annual Assessment are based on ongoing planning processes that include the monthly WSDM supply-demand reporting. The Annual Assessment represents a mid-year evaluation at a given point in time; even after formal approval and submittal of the Annual Assessment determination by July 1, MWDOC will continue to monitor emerging supply and demand conditions and take appropriate actions consistent with the flexibility and adaptiveness inherent to the WSCP. Some conditions that affect MWDOC's wholesale supply and demand, such as groundwater replenishment, surface water and local supply production, can differ significantly from earlier projections throughout the year.

Within Orange County, there are no significant local applicable criteria that directly affect reliability. Through the years, the water agencies in Orange County have made tremendous efforts to integrate their systems to provide flexibility to interchange with different sources of supplies. There are emergency agreements in place to ensure all parts of the County have an adequate supply of water. In the northern part of the County, agencies have the ability to meet a majority of their demands through groundwater with very little limitation, except for the OCWD Basin Production Percentage (BPP) as provided to each agency. For the agencies in southern Orange County, most of their demands are met with imported water where their limitation is based on the capacity of their system, which is considered sufficient to meet anticipated demands.

However, if a major earthquake on the San Andreas Fault occurs, it has the potential to damage all three key regional water aqueducts and disrupt imported supplies for up to six months. The region would likely impose a water use reduction ranging from 10-25% until the system is repaired. However, MET has taken proactive steps to handle such disruption, such as constructing DVL, which mitigates potential impacts. DVL, along with other local reservoirs, can store a six to twelve-month supply of emergency water (MET, 2021b).

3.2.2.3 Water Supply

MWDOC is the regional wholesaler of imported water that provides treated and untreated water purchased from MET for Municipal and Industrial (M&I) (direct) and non-M&I (indirect) uses within its service area. Imported water represents 35% of total water supply in MWDOC's service area. As detailed in MWDOC's 2020 UWMP, water supplies within MWDOC's service area are from local and imported sources. Local supplies developed by other entities and retail agencies include groundwater, recycled water, and surface water, accounting for 65% of the service area's water supplies. In North Orange County, imported water from MWDOC is supplemental, as agencies can pump a significant amount of their water demand from the OC Basin as set by the BPP; however, member agencies in South Orange County rely more heavily on imported water due to limited local resources.

3.2.2.4 Unconstrained Customer Demand

The WSCP and Annual Assessment define unconstrained demand as expected water use prior to any projected shortage response actions that may be taken under the WSCP. Unconstrained demand is distinguished from observed demand, which may be constrained by preceding, ongoing, or future actions, such as emergency supply allocations during a multi-year drought. WSCP shortage response actions to constrain demand are inherently extraordinary; routine activities such as ongoing conservation programs and regular operational adjustments are not considered as constraints on demands.

MWDOC's DRA reveals that its supply capabilities are expected to balance anticipated total water use and supply, assuming a five-year consecutive drought from 2021 through 2045. Water demands in a five-year consecutive drought are calculated as a six percent increase in potable water demand above a normal year for each year of the drought. MWDOC purchases a fixed amount of untreated imported water from MET for use in groundwater recharge for the OC Basin and surface storage in Irvine Lake, which accounts for its non-potable demand that does not experience a six percent increase in demand, as these volumes are not affected by changes in hydrological conditions. MWDOC purchases a fixed amount of untreated imported water from MET for use in groundwater recharge for the OC Basin and surface storage in Irvine Lake, which accounts for its non-potable demand that does not experience a six percent increase in demand, as these volumes are not directly affected by changes in hydrological conditions.

3.2.2.5 Planned Water Use for Current Year Considering Dry Subsequent Year

CWC Section 10632(a)(2)(B)(ii) requires the Annual Assessment to determine "current year available supply, considering hydrological and regulatory conditions in the current year and one dry year."

The Annual Assessment will include two separate estimates of MWDOC's annual water supply and unconstrained demand using: 1) current year conditions, and 2) assumed dry year conditions. Accordingly, the Annual Assessment's shortage analysis will present separate sets of findings for the current year and dry year scenarios. The CWC does not specify the characteristics of a dry year, allowing discretion to the Supplier. MWDOC will use its discretion to refine and update its assumptions for a dry year scenario in each Annual Assessment as information becomes available and in accordance with best management practices.

In MWDOC's 2020 UWMP, the "single dry year" is characterized to resemble conditions as a year in which conditions reflect the lowest water supply available to the Supplier. Supply and demand analyses for the single-dry year case was based on conditions affecting the SWP as this supply availability fluctuates the most among MET's, and therefore MWDOC's, sources of supply. Fiscal Year 2013-14 is considered the single driest year for SWP supplies with an allocation of 5% to M&I uses. Unique to this year, the 5% SWP allocation was later reduced to 0%, before ending up at its final allocation of 5%, highlight the stressed water supplies for the year. Furthermore, on January 17, 2014 Governor Brown declared the drought State of Emergency, citing 2014 as the driest year in California history. Additionally, within MWDOC's service area, precipitation for FY 2013-14 was the second lowest on record, with 4.37 inches of rain, significantly impacting water demands (MWDOC, 2021).

3.2.2.6 Infrastructure Considerations

With the sale of the Allen-McColloch Pipeline to MET in 1995, MWDOC no longer owns or operates a distribution system. However, as the regional wholesale agency, MWDOC closely coordinates with MET and its member agencies on any planned infrastructure work that may impact water supply availability. The Annual Assessment will include consideration of any infrastructure issues that may pertain to near-term water supply reliability, including repairs, construction, and environmental mitigation measures that may temporarily constrain capabilities, as well as any new projects that may add to system capacity. Throughout each year, MET regularly carries out preventive and corrective maintenance of its facilities within the MWDOC service area that may require shutdowns. MET plans and performs shutdowns to inspect and repair pipelines and facilities and support capital improvement projects. These shutdowns involve a high level of planning and coordination between MWDOC, MWDOC's Member Agencies, and MET. These shutdowns are scheduled to ensure that major portions of the distribution system are not out of service at the same time. Operational flexibility within MET's system and the cooperation of member agencies allow shutdowns to be successfully completed while continuing to meet all system demands.

3.3 Six Standard Water Shortage Levels

Per CWC Section 10632 (a)(3)(A), MWDOC must include the six standard water shortage levels that represent shortages from the normal reliability as determined in the Annual Assessment. The shortage levels have been standardized to provide a consistent regional and statewide approach to conveying the relative severity of water supply shortage conditions. This is an outgrowth of the severe statewide drought of 2012-2016, and the widely recognized public communication and state policy uncertainty associated with the many different local definitions of water shortage Levels.

The six standard water shortage levels correspond to progressively increasing estimated shortage conditions (up to 10%, 20%, 30%, 40%, 50%, and greater than 50% shortage compared to the normal reliability condition) and align with the response actions MWDOC would implement to meet the severity of the impending shortages (Table 3-1).

Table 3-1: Water Shortage Contingency Plan Levels

DWR Submittal Table 8 1 Water Shortage Contingency Plan Levels		
Shortage Level	**Percent Shortage Range**	**Shortage Response Actions**
0	0% (Normal)	A Level 0 Water Supply Shortage –Condition exists when MWDOC notifies its water users that no supply reductions are anticipated in this year. MWDOC proceeds with planned water efficiency best practices to support consumer demand reduction in line with state mandated requirements and local MWDOC goals for water supply reliability.

DWR Submittal Table 8 1 Water Shortage Contingency Plan Levels		
1	Up to 10%	A Level 1 Water Supply Shortage – Condition exists when no supply reductions are anticipated, a consumer imported demand reduction of up to 10% is recommended to make more efficient use of water and respond to existing water conditions. Upon the declaration of a Water Aware condition, MWDOC shall implement the mandatory Level 1 conservation measures identified in this WSCP. The type of event that may prompt MWDOC to declare a Level 1 Water Supply Shortage may include, among other factors, a finding that its wholesale water provider (MET) calls for extraordinary water conservation efforts.
2	Up to 20%	A Level 2 Water Supply Shortage – Condition exists when MWDOC notifies its member agencies that due to drought or other supply reductions, a consumer imported demand reduction of up to 20% is necessary to make more efficient use of water and respond to existing water conditions. Upon declaration of a Level 2 Water Supply Shortage condition, MWDOC shall implement the mandatory Level 2 conservation measures identified in this WSCP.
3	Up to 30%	A Level 3 Water Supply Shortage – Condition exists when MWDOC declares a water shortage emergency condition pursuant to California Water Code section 350 and notifies its member agencies that up to 30% consumer imported demand reduction is required to ensure sufficient supplies for human consumption, sanitation, and fire protection. MWDOC must declare a Water Supply Shortage Emergency in the manner and on the grounds provided in California Water Code section 350. A member agencies water supply shortage level is the governing shortage level for their respective service area.
4	Up to 40%	A Level 4 Water Supply Shortage – Condition exists when MWDOC declares a water shortage emergency condition pursuant to California Water Code section 350 and notifies its member agencies that up to 40% consumer imported demand reduction is required to ensure sufficient supplies for human consumption, sanitation, and fire protection. MWDOC must declare a Water Supply Shortage Emergency in the manner and on the grounds provided in California Water Code section 350. A member agencies water supply shortage level is the governing shortage level for their respective service area.

DWR Submittal Table 8 1 Water Shortage Contingency Plan Levels		
5	Up to 50%	A Level 5 Water Supply Shortage – Condition exists when MWDOC declares a water shortage emergency condition pursuant to California Water Code section 350 and notifies its member agencies that up to 50% or more consumer imported demand reduction is required to ensure sufficient supplies for human consumption, sanitation, and fire protection. MWDOC must declare a Water Supply Shortage Emergency in the manner and on the grounds provided in California Water Code section 350. A member agencies water supply shortage level is the governing shortage level for their respective service area.
6	>50%	A Level 6 Water Supply Shortage – Condition exists when MWDOC declares a water shortage emergency condition pursuant to California Water Code section 350 and notifies its member agencies that greater than 50% or more consumer imported demand reduction is required to ensure sufficient supplies for human consumption, sanitation, and fire protection. MWDOC must declare a Water Supply Shortage Emergency in the manner and on the grounds provided in California Water Code section 350. A member agencies water supply shortage level is the governing shortage level for their respective service area.
NOTES: MWDOC's water shortage levels are aligned with MET's (MET, 2021a).		

3.4 Shortage Response Actions

CWC Section 10632 (a)(4) requires the WSCP to specify shortage response actions that align with the defined shortage levels. MWDOC has defined specific shortage response actions that align with the defined shortage levels in DWR Tables 8-2 and 8-3 (Appendix A). These shortage response actions were developed with consideration to the system infrastructure and operations changes, supply augmentation responses, customer-class or water use-specific demand reduction initiatives, and increasingly stringent water use prohibitions.

3.4.1 Demand Reduction

The demand reduction measures that would be implemented to address shortage levels are described in DWR Table 8-2 (Appendix A). This table indicates which actions align with specific defined shortage levels and estimates the extent to which that action will reduce the gap between supplies and demands. DWR Table 8-2 (Appendix A) demonstrates the chosen suite of shortage response actions anticipated to deliver the expected outcomes necessary to meet the requirements of a given shortage level (e.g., target of an additional 10% water savings). This table also identifies the enforcement action, if any, associated with each demand reduction measure.

MWDOC's demand reduction actions correspond to shortage Levels 0 through 6, with coordination with the Water Emergency Response Organization of Orange County (WEROC) anticipated to begin at Level 4 or greater.

At Level 0, MWDOC has ongoing long-term conservation savings measures including providing rebates for landscape irrigation efficiency, plumbing fixtures and devices, and turf replacement and providing programmatic support to retail agencies to reduce system water loss. For Shortage Levels 1 through 6, MWDOC will continuously expand public awareness campaigns to encourage consumers to reduce their water usage and implement voluntary demand reduction and its WSAP to further reduce the imported water shortage gap at each level, reaching up to greater than 50% of the shortage gap at Level 6.

3.4.2 Supply Augmentation

Supply Augmentation actions represent short-term management objectives triggered by the MET's WSDM Plan and do not overlap with the long-term new water supply development or supply reliability enhancement projects. Supply Augmentation is made available to MWDOC through MET. MWDOC relies on MET's reliability portfolio of water supply programs including existing water transfers, storage, and exchange agreements to supplement gaps in the supply/demand balance. MET has developed significant storage capacity (over 5 MAF) in reservoirs and groundwater banking programs both within and outside of the Southern California region. Additionally, MET can pursue additional water transfer and exchange programs with other water agencies to help mitigate supply/demand imbalances and provide additional dry-year supply sources.

MWDOC will work in close coordination with MET on their supply augmentation projects during normal conditions and shortage Levels 1 through 6 to ensure reliability of imported water for the service area. MWDOC's supply augmentation actions are described in DWR Table 8-3 (Appendix A).

3.4.3 Operational Changes

During shortage conditions, water operations in Orange County may be affected depending on the specific condition or situation. As noted in section 3.2.2.6, MWDOC does not own any infrastructure, nor does it direct the operations of infrastructure in Orange County. MWDOC will coordinate and facilitate operational changes that may result from shortage conditions or arise from an emergency situation.

3.4.4 Additional Mandatory Restrictions

CWC Section 10632(a)(4)(D) calls for "additional, mandatory prohibitions against specific water use practices that are in addition to state-mandated prohibitions and appropriate to the local conditions" to be included among the WSCP's shortage response actions. These prohibitions are in addition to the proposed State Board regulation in California Code of Regulations, title 23, division 3, a new chapter 3.5 on Conservation and the Prevention of Waste and Unreasonable Use; and within chapter 3.5, a new article 2 pertaining to Wasteful and Unreasonable Uses. Mandatory prohibitions include:

- Hosing off sidewalks, driveways, and other hardscapes;
- Washing automobiles with hoses not equipped with a shut-off nozzle;
- Using non-recirculated water in a fountain of other decorative water feature;
- Watering lawns in a manner that causes runoff, or within 48 hours after measurable precipitation;
- Irrigating ornamental turf on public street medians.

MWDOC currently does not have any additional restrictions above the Statewide Mandatory prohibitions. However, State law gives substantial discretion to wholesale and retail water agencies to promulgate regulations and restrictions to conserve and allocate water in the event of a water shortage.

3.4.5 Emergency Response Plan (Hazard Mitigation Plan)

A catastrophic water shortage would be addressed according to the appropriate water shortage level and response actions. It is likely that a catastrophic shortage would immediately trigger a shortage level of up to Level 6 in the impacted area, and response actions have been put in place to mitigate a catastrophic shortage. In addition, there are several Plans that address catastrophic failures and align with the WSCP, including MET's WSDM and WSAP and MWDOC's Hazard Mitigation Plan (HMP) and Emergency Operations Plan (EOP).

3.4.5.1 MET's Water Surplus and Drought Management and Water Supply Allocation Plans

MET has comprehensive plans for stages of actions it would undertake to address a catastrophic interruption in water supplies through its WSDM and WSAP. MET also developed an Emergency Storage Requirement to mitigate against potential interruption in water supplies resulting from catastrophic occurrences within the southern California region, including seismic events along the San Andreas Fault. In addition, MET is working with the state to implement a comprehensive improvement plan to address catastrophic occurrences outside of the southern California region, such as a maximum probable seismic event in the Sacramento-San Joaquin River Delta (Delta) that would cause levee failure and disruption of SWP deliveries.

3.4.5.2 Water Emergency Response Organization of Orange County Emergency Operations Plan

In 1983, the Orange County water community identified a need to develop a plan on how agencies would respond effectively to disasters impacting the regional water distribution system. The collective efforts of these agencies resulted in the formation of WEROC to coordinate emergency response on behalf of all Orange County water and wastewater agencies, develop an emergency plan to respond to disasters, and conduct disaster training exercises for the Orange County water community. WEROC was established with the creation of an indemnification agreement between its member agencies to protect each other against civil liabilities and to facilitate the exchange of resources. WEROC is unique in its ability to provide a single point of contact for representation of all water and wastewater utilities in Orange County during a disaster. This representation is to the county, state, and federal disaster coordination agencies. Within the Orange County Operational Area, WEROC is the recognized contact for emergency response for the water community, including MWDOC.

As a member of WEROC, MWDOC will follow WEROC's EOP in the event of an emergency and coordinate with WEROC to assess damage, initiate repairs, and request and coordinate mutual aid resources for MWDOC's service area.

The EOP defines the actions to be taken by WEROC Emergency Operations Center (EOC) staff to reduce the loss of water and wastewater infrastructure; to respond effectively to a disaster; and to coordinate recovery operations in the aftermath of any emergency involving extensive damage to Orange County water and wastewater utilities. The EOP includes activation notification protocol that will be used to contact partner agencies to inform them of the situation, activation status of the EOC, known damage or impacts, or resource needs. The EOP is a standalone document that is reviewed annually and approved by the Board every three years.

MWDOC is responsible for managing the response effort within the service area in the event of an emergency. In order to avoid duplicating requests and efforts, MWDOC can use the California Standardized Emergency Management System (SEMS) and the National Incident Management System (NIMS). SEMS and

NIMS implement an organized system of information flow to ensure a timely and coordinated effort in response to any sort of disaster to meet specific emergency needs within its service area.

The WEROC EOC is responsible for assessing the overall condition and status of the Orange County regional water distribution and wastewater collection systems including MET facilities that serve Orange County. The EOC can be activated during an emergency situation that can result from both natural and man-made causes, and can be activated through automatic, manual, or standby for activation.

WEROC recognized four primary phases of emergency management, which include:

- **Preparedness:** Planning, training, and exercises that are conducted prior to an emergency to support and enhance response to an emergency or disaster.
- **Response:** Activities and programs designed to address the immediate and short-term effects of the onset of an emergency or disaster that helps to reduce effects to water infrastructure and speed recovery. This includes alert and notification, EOC activation, direction and control, and mutual aid.
- **Recovery:** This phase involved restoring systems to normal, in which short-term recovery actions are taken to assess the damage and return vital life-support systems to minimum operating standards, while long-term recovery actions have the potential to continue for many years.
- **Mitigation/Prevention:** These actions prevent the occurrence of an emergency or reduce the area's vulnerability in ways that minimize the adverse impacts of a disaster or emergency. MWDOC's HMP outlines threats and identifies mitigation projects.

The EOC Action Plans (EAP) provide frameworks for EOC staff to respond to different situations with the objectives and steps required to complete them, which will in turn serve the WEROC member agencies. In the event of an emergency which results in a catastrophic water shortage, MWDOC will declare a water shortage condition of up to Level 6 for the impacted area depending on the severity of the event, and coordination with WEROC is anticipated to begin at Level 4 or greater (WEROC, 2018).

3.4.6 Seismic Risk Assessment and Mitigation Plan

Per CWC Section 10632.5, Suppliers are required to assess seismic risk to water supplies as part of their WSCP. The plan also must include the mitigation plan for the seismic risk(s). Given the great distances that imported supplies travel to reach Orange County, the region is vulnerable to interruptions along hundreds of miles aqueducts, pipelines and other facilities associated with delivering the supplies to the region. Additionally, the infrastructure in place to deliver supplies are susceptible to damage from earthquakes and other disasters.

In lieu of conducting a seismic risk assessment specific to its 2020 UWMP, MWDOC has included the previously prepared regional HMP for the Orange County region and its member agencies, as the regional imported water wholesaler, that is required under the federal Disaster Mitigation Act of 2000 (Public Law 106-390).

MWDOC's HMP identified that the overarching goals of the HMP were the same for all of its member agencies, which include:

- Goal 1: Minimize vulnerabilities of critical infrastructure to minimize damages and loss of life and injury to human life caused by hazards.
- Goal 2: Minimize security risks to water and wastewater infrastructure.
- Goal 3: Minimize interruption to water and wastewater utilities.
- Goal 4: Improve public outreach, awareness, education, and preparedness for hazards in order to increase community resilience.

- Goal 5: Eliminate or minimize wastewater spills and overflows.
- Goal 6: Protect water quality and supply, critical aquatic resources, and habitat to ensure a safe water supply.
- Goal 7: Strengthen Emergency Response Services to ensure preparedness, response, and recovery during any major or multi-hazard event.

MWDOC's HMP evaluates hazards applicable to all jurisdictions in its entire planning area, prioritized based on probability, location, maximum probable extent, and secondary impacts. Earthquake fault rupture and seismic hazards, including ground shaking and liquefaction, are among the highest ranked hazards to the region as a whole because of its long history of earthquakes, with some resulting in considerable damage. A significant earthquake along one of the major faults could cause substantial casualties, extensive damage to infrastructure, fires, damages and outages of water and wastewater facilities, and other threats to life and property.

Nearly all of Orange County is at risk of moderate to extreme ground shaking, with liquefaction possible throughout much of Orange County, but the most extensive liquefaction zones occur in coastal areas. Based on the amount of seismic activity that occurs within the region, there is no doubt that communities within Orange County will continue to experience future earthquake events, and it is a reasonable assumption that a major event will occur within a 30-year timeframe.

MWDOC's mitigation actions identify the hazard, proposed mitigation action, location/facility, local planning mechanism, risk, cost, timeframe, possible funding sources, status, and status rationale, as applicable. It is envisioned that the mitigation actions will mostly be implemented on a jurisdiction-by-jurisdiction basis; however, MWDOC will provide facilitation to spearhead coordination of initiatives on a regional level. This includes acting as a lead on water related hazard mitigation projects that are regional in nature, such as projects that cross several jurisdictional boundaries and work planned on behalf of MET, while Orange County Sanitation District (OC San) and South Orange County Water Authority (SOCWA) will take the lead on wastewater related hazard mitigation projects that are regional and within their service areas (MWDOC, 2019). In South Orange County, MNWD works with OCWD to transfer water to the area, and MWDOC has a goal to pursue additional local projects in South Orange County.

3.4.7 Shortage Response Action Effectiveness

For each specific Shortage Response Action identified in the plan, the WSCP also estimates the extent to which that action will reduce the gap between supplies and demands identified in DWR Table 8-2 (Appendix A). To the extent feasible, MWDOC has estimated percentage savings for the chosen suite of shortage response actions, which can be anticipated to deliver the expected outcomes necessary to meet the requirements of a given shortage level.

3.5 Communication Protocols

Timely and effective communication is a critical element of the WSCP implementation. Per CWC Section 10632 (a)(5), MWDOC has established communication protocols and procedures to inform the public, stakeholders, and local, regional, and state governments regarding any current or predicted water supply shortages as determined by the annual water supply and demand assessment described pursuant to

Section 10632.1; any water shortage response actions triggered or anticipated to be triggered by the annual water supply and demand assessment described pursuant to Section 10632.1; and any other relevant communications.

This section includes specific communications protocols to address each water shortage level and response action that can be derived from the results of the Annual Assessment This element would likely be triggered based upon the decision-making process in Section 3.2 and/or emergency communications protocols to address earthquakes, fires, infrastructure failures, civil unrest, and other catastrophic events.

Strategic communication is an ongoing activity where the purpose, audience, message, tools, and channels may change at any given moment. In the context of water shortage response, the purpose may be an emergency water shortage like what may result from the impacts of an earthquake or a longer-term, non-emergency shortage condition like drought. In an emergency, MWDOC will activate the communication protocoldetailed in the WEROC Emergency Operations Plan. In a non-emergency water shortage situation, MWDOC will implement the procedures identified in the Strategic Communications Program and Plan.

3.5.1 WEROC Emergency Operations Plan Communication

This Plan defines the actions to be taken by WEROC EOC staff to reduce the loss of water and wastewater infrastructure; to respond effectively to a disaster; and to coordinate recovery operations in the aftermath of any emergency involving extensive damage to Orange County water and wastewater utilities. The EOC Plan includes activation notification protocol that will be used to contact partner agencies to inform them of the situation, activation status of the EOC, known damage or impacts, or resource needs. The EOC Plan is a standalone document that is reviewed annually and approved by the Board every three years.

The WEROC EOC is responsible for assessing the overall condition and status of the Orange County regional water distribution and wastewater collection systems including MET facilities that serve Orange County.
The EOC can be activated during an emergency situation that can result from both natural and human-made causes, and can be activated through automatic, manual, or standby for activation. The WEROC EOC activation decision steps include the following (WEROC, 2018):

- **Categorize incident:** Using information gathered from one or more sources, the WEROC primary contact will categorize the incident as a natural disaster, human-made disaster, terrorist threat, or terrorist physical attack.
- **Initial determination of situation:** WEROC and MWDOC management will make an initial determination of the situation based on scope and severity of the incident, damage to affected agencies, and potential impacts.
- **WEROC activation level:** WEROC and MWDOC management will determine the appropriate level of WEROC activation.
- **Groups that will be notified:** When the EOC is activated, at a minimum, WEROC EOC staff, affected water utilities, MET's EOC at Eagle Rock, the Operational Area EOC, the Division of Drinking Water, health care agency, and California Department of Public Health should be notified.

3.5.2 Strategic Communications Program and Plan

MWDOC presently develops, coordinates, and delivers a substantial number of programs and services to elevate stakeholders' awareness about water policy, efficient water use, and the District's role in advocating for water reliability investments that are in the best interest of Orange County. MWDOC's award-winning Strategic Communications Program and Plan serves as a blueprint for District communications, establishing a baseline understanding for how MWDOC's programs and activities provide information to the public, various stakeholders, partners, and employees during normal and non-emergency water shortage conditions.

The MWDOC Public Affairs Department (Department) elevates public awareness, garners support, and works to establish confidence in the District's initiatives by providing transparent, accurate, and reliable information to the public, stakeholders, partners, and 28 member agencies. Serving all 3.2 million Orange County residents and businesses in some fashion, MWDOC utilizes various communications tools and channels to reach and unify a vast and diverse group of audiences.

The Department stays up-to-date on water supply conditions and shortage actions through active participation in local, regional, and statewide meetings. Additionally, the Department continuously evaluates its programs and communications tools and channels to reach the District's identified goals and objectives, actively support its member agencies, and effectively inform the Orange County community. Upon declaration of a non-emergency, water shortage condition, the Department has the appropriate tools and systems to implement the communication protocols defined in the MWDOC Strategic Communications Program and Plan.

3.5.2.1 Goals & Objectives

The MWDOC Strategic Communications Program and Plan aligns the District's identified goals and objectives with the respective audiences and outlines the appropriate communications tools and channels used to connect them. Specifically, water shortage communication will follow the protocols designed for Goal #2, Objective 2.2 as defined by the Board of Directors, executive management, and the District's Mission Statement:

- **Goal #2:** Examine, develop, and implement sound policies and programs that support Orange County water investments, and provide recognized value to the region.
- **Objective 2.2:** Be the trusted, leading voice for the region on water reliability, water policy, efficient water use, water education, and emergency preparedness and response.

3.5.2.2 Target Audiences

The MWDOC Strategic Communications Program and Plan provides a detailed framework of the District's target audience groups to provide clear and concise messaging based on the audience's needs, wants, and interests. Understanding MWDOC's identified audience groups will make it possible to logically align messaging with the appropriate communications tools and channels and reach the District's identified goals and objectives during a non-emergency water shortage.

3.5.2.3 Communications Tools and Channels

As a guiding reference, the MWDOC Strategic Communications Program and Plan defines communications tools, activities, and channels and identifies how MWDOC currently utilizes each of these resources to reach the goals and objectives of the District. During a normal and non-emergency water shortage condition, MWDOC will use these readily available communication tools and resources to successfully reach the District's target audience groups with intended messages.

3.5.2.4 Implementation, Assignments, and Schedules

A carefully developed and executed communications plan can establish trust and credibility for the public, stakeholders, partners, member agencies, and employees. A clearly outlined plan must be in place to effectively communicate water supply conditions and water shortage actions. Once described, all strategic targets should include an implementation plan which identifies tactics and logistics, and eventually, active monitoring, evaluation, and amending. This step is essential as the District's communications tools, resources, and messaging must adapt and evolve, sometimes rapidly, in the ever-changing landscape of water policy and regulation.

Assignments are essential to maintaining productivity and accountability as well as collectively accomplishing the goals of a project. The Department has developed a Programs and Responsibility flowchart which breaks down the Department's primary roles and assignments by team member (See Strategic Communications Program and Plan). Additionally, the Department has developed a series of logistical checklists to efficiently plan, implement, and control the flow of information during a water shortage. It will continue to do so as the situation evolves. Furthermore, the Department uses robust program management software tools such as Asana and CoSchedule to stay in touch with impending deadlines and to keep everything, including assignments and checklists, organized and in one place.

3.5.2.5 Monitor, Evaluate, and Amend

The effectiveness of the MWDOC Strategic Communications Program and Plan depends on a large variety of factors, including technological advancements or changes, the rise and fall of audience engagement, current news or media concentration, political changes in leadership and focus, and even the weather. The Department currently utilizes a robust set of Key Performance Indicators (KPI), metrics, and measurements to track the effectiveness of MWDOC's programs, activities, and communication efforts. Through this process, the District's programs and activities are continuously shaped and refined to remain relevant and valuable to the public, stakeholders, partners, employees, and its 28 member agencies.

3.5.2.6 Water Shortage Communication

The type and degree of communication varies with each shortage level; thus, predefined and actionable communication protocols improve MWDOC's ability to message necessary events. These communication protocols and procedures are summarized in Table 3-2.

Table 3-2: Communication Procedures

Communications Procedures Matrix				
Level 0 Permanent Water Waste Prohibitions	**Level 1 Up to 10% Voluntary Conservation**	**Level 2 Up to 20% Mandatory Conservation**	**Levels 3-4 Up to 30% or 40% Mandatory Conservation**	**Levels 5-6 Up to 50% or >50% Mandatory Conservation**
Standard outreach efforts in effect (media relations, social media, websites, etc.)	Update message platform to reflect conditions and needed actions from the public	Update campaigns and messages to generate immediate actions and behaviors by the public	Update campaigns and messages to raise awareness for more severe water-saving actions and behaviors by the public	Update campaigns and messages to reflect extreme or emergency conditions, and likely need to focus water use on health and safety needs
Promote ongoing WUE programs, tools, partnerships designed to achieve long-term water management goals	Announce status change to the public, key stakeholders, partners, and employees (News release, social media, etc.)	Announce status change to the public, key stakeholders, partners, and employees (News release, social media, etc.)	Announce status change to the public, key stakeholders, partners, and employees (News release, social media, etc.)	Announce status change to the public, key stakeholders, partners, and employees (News release, social media, etc.)
Standard coordination with member agencies	Include increased conservation messages on MWDOC.com and in standard outreach efforts; provide regular condition updates to stakeholders and the media	Supplement Level 1 activities with additional tactics (mass media ads, partnerships, events,, etc.) as needed; provide regular condition updates to Stakeholders and the media	Supplement Level 2 outreach with additional tactics (supplemental ads, etc.) as needed; provide regular updates to stakeholders and the media on conditions	Supplement Level 3-4 outreach with additional tactics as needed; provide regular condition updates to stakeholders and the media on conditions
As-needed Board reports on public communication and WUE outreach activities	Enhance promotion of ongoing WUE programs and tools; deploy targeted advertising	Conduct issue briefings with elected officials, and other key civic and business leaders	Conduct specialized outreach to reduce discretionary outdoor use while minimizing landscape damage	Suspend promotion of long-term WUE programs and tools to focus on imminent needs

Communications Procedures Matrix				
	Increase coordinationwith member agencies	Continue promotion ofongoing WUE programs and tools	Promote available water assistance resources for vulnerable populations; specialized outreach to impacted industries	Continue enhanced coordination with member agencies asneeded (daily or weekly briefings, email updates, etc.)
		Enhance coordination with member agenciesas needed	Continue enhanced coordination with member agencies asneeded	Analyze water use andother data to determine any appropriate supplemental actions
	Analyze water use andother data to determine any appropriate supplemental actions	Analyze water use andother data to determine any appropriate supplemental actions	Analyze water use andother data to determine any appropriate supplemental actions	

3.6 Compliance and Enforcement

Per the CWC Section 10632 (a)(6), wholesale water providers are not subject to these requirements.

3.7 Legal Authorities

As a regional wholesaler, MWDOC does not have the legal authority to implement and enforce its shortage response in its service area; however, to comply with CWC Section 10632 (a)(6), MWDOC uses pricing to discourage their member agencies from purchasing greater amounts of water during a shortage.

Per CWC Section 10632 (a)(7) (B), MWDOC shall declare a water shortage emergency condition to prevail within the area served by such wholesaler whenever it finds and determines that the ordinary demands and requirements of water consumers cannot be satisfied without depleting the water supply of the distributor to the extent that there would be insufficient water for human consumption, sanitation, and fire protection.

Per CWC Section 10632 (a)(7)(C), MWDOC shall coordinate with any agency or county within which it provides water supply services for the possible proclamation of a local emergency under California Government Code, California Emergency Services Act (Article 2, Section 8558). Table 3-3 identifies the contacts for all cities or counties for which the Supplier provides service in the WSCP, along with developed coordination protocols, can facilitate compliance with this section of the CWC in the event of a local emergency as defined in subpart (c) of Government Code Section 8558.

Table 3-3: Agency Contacts and Coordination Protocols

Contact	Agency	Coordination Protocols
Assistant General Manager, Water Services	Anaheim Public Utilities	Notification, Coordination, and provide supportive actions
Public Works Director	City of Brea	Notification, Coordination, and provide supportive actions
Director of Public Works/City Engineer	City of Buena Park	Notification, Coordination, and provide supportive actions
Director of Public Works/City Engineer	City of Fountain Valley	Notification, Coordination, and provide supportive actions
Director of Public Works	City of Fullerton	Notification, Coordination, and provide supportive actions
Director of Public Works	City of Garden Grove	Notification, Coordination, and provide supportive actions
Director of Public Works	City of Huntington Beach	Notification, Coordination, and provide supportive actions
Director of Public Works	City of La Habra	Notification, Coordination, and provide supportive actions
Public Works & Community Services Director	City of La Palma	Notification, Coordination, and provide supportive actions
Utilities Director	City of Newport Beach	Notification, Coordination, and provide supportive actions
Director of Public Works	City of Orange	Notification, Coordination, and provide supportive actions
Public Works Director	City of San Clemente	Notification, Coordination, and provide supportive actions
Director of Public Works	City of San Juan Capistrano	Notification, Coordination, and provide supportive actions

Contact	Agency	Coordination Protocols
Acting Public Works Director	City of Santa Ana	Notification, Coordination, and provide supportive actions
Director of Public Works	City of Seal Beach	Notification, Coordination, and provide supportive actions
Director of Public Works	City of Tustin	Notification, Coordination, and provide supportive actions
Director of Public Works	City of Westminster	Notification, Coordination, and provide supportive actions
General Manager	East Orange County Water District	Notification, Coordination, and provide supportive actions
General Manager	El Toro Water District	Notification, Coordination, and provide supportive actions
General Manager	Emerald Bay Service District	Notification, Coordination, and provide supportive actions
General Manager, Orange County	Golden State Water Company	Notification, Coordination, and provide supportive actions
General Manager	Irvine Ranch Water District	Notification, Coordination, and provide supportive actions
General Manager	Laguna Beach County Water District	Notification, Coordination, and provide supportive actions
General Manager	Mesa Water	Notification, Coordination, and provide supportive actions
General Manager	Moulton Niguel Water District	Notification, Coordination, and provide supportive actions
General Manager	Orange County Water District	Notification, Coordination, and provide supportive actions

Contact	Agency	Coordination Protocols
General Manager	Santa Margarita Water District	Notification, Coordination, and provide supportive actions
General Manager	Serrano Water District	Notification, Coordination, and provide supportive actions
General Manager	South Coast Water District	Notification, Coordination, and provide supportive actions
General Manager	Trabuco Canyon Water District	Notification, Coordination, and provide supportive actions
General Manager	Yorba Linda Water District	Notification, Coordination, and provide supportive actions
Public Works Director	Orange County	Notification
Public Works Director	City of Aliso Viejo	Notification
Director of Public Services	City of Costa Mesa	Notification
Public Works Director	City of Cypress	Notification
Public Works Director	City of Dana Point	Notification
Public Works Director	City of Irvine	Notification
Public Works Director	City of Laguna Beach	Notification
Public Works Director	City of Laguna Hills	Notification

Contact	Agency	Coordination Protocols
Public Works Director	City of Laguna Niguel	Notification
City Engineer	City of Laguna Woods	Notification
Public Works Director	City of Lake Forest	Notification
City Engineer	City of Los Alamitos	Notification
Public Works Director	City of Mission Viejo	Notification
Public Works Director	City of Placentia	Notification
Public Works Director	City of Rancho Santa Margarita	Notification
Public Works Director	City of Stanton	Notification
Public Works Director	City of Villa Park	Notification
Public Works Director	City of Yorba Linda	Notification

3.8 Financial Consequences of WSCP

Per CWC Section 10632(a)(8), Suppliers must include a description of the overall anticipated financial consequences to the Supplier of implementing the WSCP. This description must include potential reductions in revenue and increased expenses associated with implementation of the shortage response actions. This should be coupled with an identification of the anticipated mitigation actions needed to address these financial impacts.

MWDOC’s rates and fees fall into three general categories: (1) the pass through of costs from MET for imported water rates and charges; (2) specific charges for MWDOC services contracted by our Member Agencies (Choice Budget); and (3) charges for MWDOC services that apply to all our member agencies (Core Budget). Below is a more detail description on each category:

1. The pass-through rates and charges from MET are billed on a monthly basis to our member agencies with the majority of the cost allocation based on their volumetric purchases. MWDOC does not collect any revenue from these charges.
2. The Choice Budget fees are primarily associated with the water education school program and the water use efficiency program, including conservation rebates. MWDOC member agencies elect to subscribe to specific programs and can opt-out of program participation. These fees are assessed to recover the entire cost of these “Choice” programs. Any additional revenue collected is either reimbursed to the participating agencies at the end of the year or credited the following year. No additional revenue is collected for MWDOC.
3. MWDOC’s Core Budget includes all other programs and functions provided to our member agencies. Among them are: Water Reliability Planning, MET Activities, Government Affairs, Public Affairs, Water Use Efficiency, Emergency Response, Board Functions, Finance, Information Technology, and Administration.

MWDOC’s Core Budget is funded through a fixed charge assessed on each agency’s retail meter and a fixed groundwater service charge, which are both collected at the beginning of each fiscal year.
Because MWDOC’s rate structure is completely fixed and does not fluctuate with volumetric sales, the implementation of the WSCP will not impact MWDOC’s revenues. There may be an increase in MWDOC’s expenditures as it relates to additional public and media outreach. However, as experienced in the last drought of 2014-2015, MWDOC coordinated such outreach efforts with its member agencies and most costs were shared among the participating agencies. Therefore, any additional expenditures are not anticipated to be significant and can be recovered by MWDOC reserves.

MWDOC’s choice budget would also not be adversely impacted by implementation of the WSCP. Although we anticipate during a shortage there will be an increase in funding to support the implementation of member agency WSCPs, as described above, MWDOC’s Choice Budget are selected by our member agencies to participate and pay their share according to the service received.

Lastly, the pass-through rates and charges from MET do not have a financial impact on MWDOC and will not be adversely impacted by the implementation of the WSCPs.

3.9 Monitoring and Reporting

Per CWC Section 10632(a)(9), water provider wholesalers are not subject to this requirement.

3.10 WSCP Refinement Procedures

Per CWC Section 10632 (a)(10), MWDOC must provide reevaluation and improvement procedures for systematically monitoring and evaluating the functionality of the water shortage contingency plan in order to ensure shortage risk tolerance is adequate and appropriate water shortage mitigation strategies are implemented as needed.

MWDOC’s WSCP is prepared and implemented as an adaptive management plan. In addition, if certain procedural refinements or new actions are identified by MWDOC staff, or suggested by customers or other interested parties, MWDOC will evaluate their effectiveness, incorporate them into the WSCP, and implement them quickly at the appropriate water shortage level.

It is envisioned that the WSCP will be periodically re-evaluated to ensure that its shortage risk tolerance is adequate, and the shortage response actions are effective and up to date based on lessons learned from implementing the WSCP. The WSCP will be revised and updated during the UWMP update cycle to incorporate updated and new information. For example, new supply augmentation actions will be added, and actions that are no longer applicable for reasons such as program expiration will be removed. However, if revisions to the WSCP are warranted before the UWMP is updated, the WSCP will be updated outside of the UWMP update cycle. In the course of preparing the Annual Assessment each year, MWDOC staff will routinely consider the functionality the overall WSCP and will prepare recommendations for MWDOC Board of Directors if changes are found to be needed.

3.11 Special Water Feature Distinction

As a wholesaler, CWC Section 10632 (b) is not applicable to MWDOC.

3.12 Plan Adoption, Submittal, and Availability

Per CWC Section 10632 (a)(c), MWDOC provided notice of the availability of the draft 2020 UWMP and draft 2020 WSCP and notice of the public hearing to consider adoption of the WSCP. The public review drafts of the 2020 UWMP and the 2020 WSCP were posted prominently on MWDOC's website, in advance of the public hearing on May 19, 2021. Copies of the draft WSCP were also made available for public inspection at MWDOC Clerk's and Utilities Department offices and public hearing notifications were published in local newspapers. A copy of the published Notice of Public Hearing is included in Appendix D.

MWDOC held the public hearing for the draft 2020 UWMP and draft WSCP on May 19, 2021 at the Board meeting. MWDOC Board reviewed and approved the 2020 UWMP and the WSCP at its May 19, 2021 meeting. See Appendix E for the resolution approving the WSCP.

By July 1, 2021, MWDOC's adopted 2020 UWMP and WSCP was filed with DWR, California State Library, and the County of Orange. MWDOC will make the WSCP available for public review on its website no later than 30 days after filing with DWR.

Based on DWR's review of the WSCP, MWDOC will make any amendments in its adopted WSCP, as required and directed by DWR.

If MWDOC revises its WSCP after UWMP is approved by DWR, then an electronic copy of the revised WSCP will be submitted to DWR within 30 days of its adoption.

4 REFERENCES

Metropolitan Water District of Southern California (MET). (2021a, March). *Water Shortage Contingency Plan*. http://www.mwdh2o.com/PDF_About_Your_Water/Draft_Metropolitan_WSCP_March_2021.pdf

Metropolitan Water District of Southern California (MET). (2021b, June). *2020 Urban Water Management Plan.*

Metropolitan Water District of Southern California (MET). (1999, August). *Water Surplus and Drought Management Plan*. http://www.mwdh2o.com/PDF_About_Your_Water/2.4_Water_Supply_Drought_Management_Plan.pdf

Municipal Water District of Orange County (MWDOC). (2016). *Water Supply Allocation Plan*.

Municipal Water District of Orange County (MWDOC). (2019, August). *Orange County Regional Water and Wastewater Hazard Mitigation Plan*.

Municipal Water District of Orange County (MWDOC). (2021, May). *2020 Urban Water Management Plan*.

Water Emergency Response Organization of Orange County (WEROC). (2018, March). *WEROC Emergency Operations Plan (EOP).*

Appendix A

DWR Submittal Tables

Submittal Table 8-1: Water Shortage Contingency Plan Levels

Submittal Table 8-2: Demand Reduction Actions

Submittal Table 8-3: Supply Augmentation Actions

DWR Submittal Table 8-1
Water Shortage Contingency Plan Levels

Shortage Level	Percent Shortage Range	Shortage Response Actions (*Narrative description)*
0	0% (Normal)	A Level 0 Water Supply Shortage –Condition exists when MWDOC notifies its water users that no supply reductions are anticipated in this year. MWDOC proceeds with planned water efficiency best practices to support consumer demand reduction in line with state mandated requirements and local MWDOC goals for water supply reliability.
1	Up to 10%	A Level 1 Water Supply Shortage – Condition exists when no supply reductions are anticipated, a consumer imported demand reduction of up to 10% is recommended to make more efficient use of water and respond to existing water conditions. Upon the declaration of a Water Aware condition, MWDOC shall implement the mandatory Level 1 conservation measures identified in this WSCP. The type of event that may prompt MWDOC to declare a Level 1 Water Supply Shortage may include, among other factors, a finding that its wholesale water provider (MET) calls for extraordinary water conservation efforts.
2	Up to 20%	A Level 2 Water Supply Shortage – Condition exists when MWDOC notifies its member agencies that due to drought or other supply reductions, a consumer imported demand reduction of up to 20% is necessary to make more efficient use of water and respond to existing water conditions. Upon declaration of a Level 2 Water Supply Shortage condition, MWDOC shall implement the mandatory Level 2 conservation measures identified in this WSCP.
3	Up to 30%	A Level 3 Water Supply Shortage – Condition exists when MWDOC declares a water shortage emergency condition pursuant to California Water Code section 350 and notifies its member agencies that up to 30% consumer imported demand reduction is required to ensure sufficient supplies for human consumption, sanitation and fire protection. MWDOC must declare a Water Supply Shortage Emergency in the manner and on the grounds provided in California Water Code section 350.
4	Up to 40%	A Level 4 Water Supply Shortage - Condition exists when MWDOC declares a water shortage emergency condition pursuant to California Water Code section 350 and notifies its member agencies that up to 40% consumer imported demand reduction is required to ensure sufficient supplies for human consumption, sanitation and fire protection. MWDOC must declare a Water Supply Shortage Emergency in the manner and on the grounds provided in California Water Code section 350.
5	Up to 50%	A Level 5 Water Supply Shortage - Condition exists when MWDOC declares a water shortage emergency condition pursuant to California Water Code section 350 and notifies its member agencies that up to 50% or more consumer imported demand reduction is required to ensure sufficient supplies for human consumption, sanitation and fire protection. MWDOC must declare a Water Supply Shortage Emergency in the manner and on the grounds provided in California Water Code section 350.

DWR Submittal Table 8-1 Water Shortage Contingency Plan Levels		
6	>50%	A Level 6 Water Supply Shortage – Condition exists when MWDOC declares a water shortage emergency condition pursuant to California Water Code section 350 and notifies its member agencies that greater than 50% or more consumer imported demand reduction is required to ensure sufficient supplies for human consumption, sanitation and fire protection. MWDOC must declare a Water Supply Shortage Emergency in the manner and on the grounds provided in California Water Code section 350.
NOTES:		

DWR Submittal Table 8 2: Demand Reduction Actions

Shortage Level	Demand Reduction Actions ***Drop down list*** *These are the only categories that will be accepted by the WUEdata online submittal tool. Select those that apply.*	How much is this going to reduce the shortage gap? *Include units used (volume type or percentage)*	Additional Explanation or Reference *(optional)*	Penalty, Charge, or Other Enforcement? ***For Retail Suppliers Only*** *Drop Down List*
0	Provide Rebates for Landscape Irrigation Efficiency	On-going Long Term-Conservation Savings Measure. Not applicable to Water Shortage Contingency Plan quantifiable savings.	Base level of support to retail agencies and their customers through Landscape Irrigation Efficency rebates.	No
0	Provide Rebates on Plumbing Fixtures and Devices	On-going Long Term-Conservation Savings Measure. Not applicable to Water Shortage Contingency Plan quantifiable savings.	Base level of support to retail agencies and their customers through water saving device rebates.	No
0	Provide Rebates for Turf Replacement	On-going Long Term-Conservation Savings Measure. Not applicable to Water Shortage Contingency Plan quantifiable savings.	Base level of support to retail agecies and their customers through MWDOC's Turf Removal Program.	No
0	Reduce System Water Loss	On-going Long Term-Conservation Savings Measure. Not applicable to Water Shortage Contingency Plan quantifiable savings.	Base level of programatic support to retail agencies through MWDOC's Water Loss Program.	No
1	Expand Public Information Campaign	0 to 5% of total imported water use met by voluntary Demand Reduction	Expand Public Awareness to encourage residents and industries to reduce their usage of water.	No
1	Other	0 to 10% of total imported water use met by voluntary Demand Reduction	Implement Voluntary Demand Reduction	No
1	Other	0 to 10% of total imported base demand met by WSAP supply allocation	Implement Water Supply Allocation Plan	Yes
2	Expand Public Information Campaign	0 to 20% of total imported water use met by voluntary Demand Reduction	Increase Public Awareness efforts to encourage residents and industries to reduce their usage of water.	No
2	Other	0 to 20% of total imported water use met by voluntary Demand Reduction	Implement Voluntary Recommended Demand Reduction	No
2	Other	0 to 20% of total imported base demand met by WSAP supply allocation	Implement Water Supply Allocation Plan	Yes
3	Expand Public Information Campaign	0 to 30% of total imported water use met by voluntary Demand Reduction	Pursue an aggressive Public Awareness Campaign to encourage residents and industries to reduce their usage of	No
3	Other	0 to 30% of total imported water use met by voluntary Demand Reduction	Work with retail agencies to review and update as needed water waste prohibitions and ordinances to discourage unnecessary water usage.	No
3	Other	0 to 30% of total imported water use met by voluntary Demand Reduction	Implement Voluntary Demand Reduction	No
3	Other	0 to 30% of total base demand met by WSAP supply allocation	Implement Water Supply Allocation Plan	Yes
4	Expand Public Information Campaign	0 to 40% of total imported water use met by voluntary Demand Reduction	Pursue an aggressive Public Awareness Campaign to encourage residents and industries to reduce their usage of water.	No
4	Other	0 to 40% of total imported water use met by voluntary Demand Reduction	Implement Voluntary Demand Reduction	No
4	Other	0 to 40% of total base demand met by WSAP supply allocation	Implement Water Supply Allocation Plan	Yes

DWR Submittal Table 8 2: Demand Reduction Actions				
Shortage Level	Demand Reduction Actions ***Drop down list*** *These are the only categories that will be accepted by the WUEdata online submittal tool. Select those that apply.*	How much is this going to reduce the shortage gap? *Include units used (volume type or percentage)*	Additional Explanation or Reference *(optional)*	Penalty, Charge, or Other Enforcement? ***For Retail Suppliers Only*** *Drop Down List*
5	Expand Public Information Campaign	0 to 50% of total imported water use met by voluntary Demand Reduction	Pursue an aggressive Public Awareness Campaign to encourage residents and industries to reduce their usage of water.	No
5	Other	0 to 50% of total imported water use met by voluntary Demand Reduction	Implement Voluntary Demand Reduction	No
5	Other	0 to 50% of total base demand met by WSAP supply allocation	Implement Water Supply Allocation Plan	Yes
6	Other	0 to 50% of total imported water use met by voluntary Demand Reduction	Implement Voluntary Demand Reduction	No
6	Other	>50% of total base demand met by WSAP supply allocation	Implement Water Supply Allocation Plan	Yes
NOTES: Coordination with WEROC is anticipated to begin at Level 4 or greater. In the event of a short or long-term emergency MWDOC will utilize the WEROC Emergency Operations Plan and follow the detailed steps and process as specified.				

DWR Submittal Table 8 3: Supply Augmentation and Other Actions			
Shortage Level	Supply Augmentation Methods and Other Actions by Water Supplier ***Drop down list*** *These are the only categories that will be accepted by the WUEdata online submittal tool*	How much is this going to reduce the shortage gap? *Include units used (volume type or percentage)*	Additional Explanation or Reference *(optional)*
0 through 6	Other Actions (describe)	TBD	MWDOC will work in close coordination with MET on their supply augmentation projects during this time to ensure reliability for the service area.
NOTES:			

Appendix B

MWDOC Water Supply Allocation Plan

Municipal Water District of Orange County

Water Supply Allocation Plan

DRAFT
Revised 2016

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Section 1: Introduction

The Municipal Water District of Orange County (MWDOC) is dedicated to ensuring water reliability for the communities we serve. Hundreds of thousands of Orange County residents have taken advantage of our water conservation rebates to install water saving toilets, clothes washers, and other water saving devices. We continue to partner with our client agencies to develop new local supplies such as recycled water, brackish water desalting, ocean water desalination, and the Groundwater Replenishment System.

However, a combination of water supply challenges have brought about the possibility that MWDOC may not have access to the imported supplies necessary to meet the demands of its client agencies in the coming years. The following factors have dramatically impacted water supply conditions not only in Orange County, but all of Southern California:

- In CY 2013 many areas of California experienced the driest year on record. California received record low snowpack in FY 2014-15. On January 17, 2014, Governor Brown proclaimed a statewide drought emergency. On May 5, 2015, the State Water Resources Control Board adopted an emergency conservation regulations in accordance with the Governor's directive. The provisions of the emergency regulations went into effect on May 18, 2015. On February 2, 2016, the SWRCB will consider a resolution to extend the existing May 2015 Emergency Regulation as directed in the November 2015 executive order.

- The Colorado River is recovering from a long-term drought. Reservoirs along the river are less than half full. In the summer of 2015, Lake Mead water levels reached record lows. Supplies from this source have been reduced since 2003 and will continue to be limited.

To meet the imported water demands of its member agencies, the Metropolitan Water District of Southern California (MET) is quickly withdrawing supplies from surface and groundwater storage. Over the past three years, MET has drawn down 67% of its available reserves.

The recent dry conditions and the uncertainty about future supplies from the State Water Project have raised the possibility that MET will not have access to the supplies necessary to meet the imported water demands of its member agencies. As a result, MET has developed a Water Supply Allocation Plan that allocates wholesale imported water supplies among its 26 member agencies throughout Southern California.

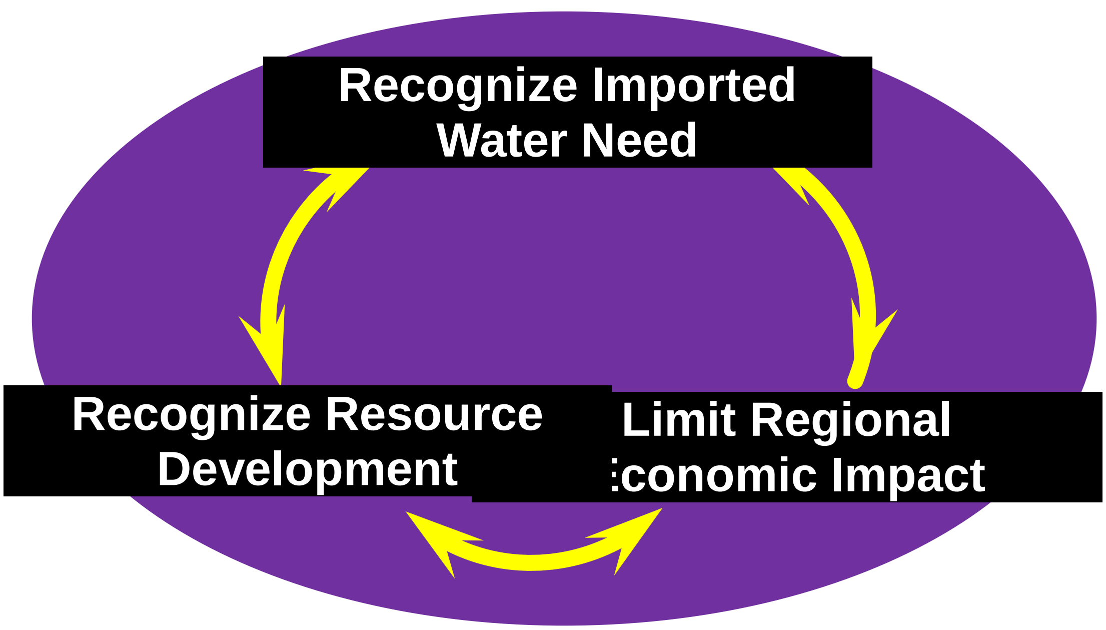
To prepare for the possibility of an allocation of imported water supplies from MET, MWDOC has worked in collaboration with its 28 client agencies to develop this Water Supply Allocation Plan to allocate imported water supplies at the retail level. This document lays out the essential components of how MWDOC plans to determine and implement each agency’s allocation during a time of shortage.

Section 2: Metropolitan Water District's Water Supply Allocation Plan

In February 2008, MET approved a Water Supply Allocation Plan (WSAP) designed to allocate imported water to all of its member agencies during a shortage. In June 2014 MET convened a member agency working group to revisit the WSAP. The purpose of the working group was to collaborate with member agencies to identify potential revisions to the WSAP in preparation for mandatory supply allocations in 2015. There were eight working group meetings and three discussions at the monthly Member Agency Managers' Meetings. The WSAP follows the principles and considerations identified in MET's Water Surplus and Drought Management Plan, which calls upon the allocation of water in a fair and equitable manner to all of MET's member agencies. To the extent possible, this means developing a plan that minimizes regional hardship during times of shortage.

The MET WSAP seeks to balance the impacts of a shortage at the retail level while maintaining equity on the wholesale level. To achieve this, it takes into account:

- The impact to retail customers and the economy
- Allowance for population and growth
- Change and/or loss of local supply
- Reclamation/Recycling
- Conservation
- Investments in local resources
- Investments in MET's facilities



The WSAP states that MET staff will go before the Board with a recommendation in April, from which the Board of Directors will make a determination on the level of the Regional Shortage. If the Board determines allocations are necessary, they will go into effect in July and remain for a twelve-month period. *Note: This schedule is at the discretion of the MET Board, and is subject to change.*

The recommendation to declare a regional shortage will be based upon water supply availability from the State Water Project, the Colorado River Aqueduct, and the amount of surface and groundwater storage remaining in MET's reserves. It will also take into account the implementation of MET's water management actions i.e. Five Year Water Supply Plan, extraordinary conservation efforts, the acceleration of local resource projects, and the purchases of water transfers.

A full copy of MET's Water Supply Allocation Plan as revised in December 2014 is available in Appendix B.

Section 3: Development Process

In preparation for possible allocation of imported water supplies from MET, MWDOC's Board first adopted the following policy principles to help guide staff and the client agency technical workgroup to develop a plan that is fair and equitable for everyone within its service area:

- **Seek best allocation available from MET**
- **Develop MWDOC Plan in collaboration with client agencies**
- **When reasonable, use similar method/approach as MET**
- **When MET's method would produce significant unintended result, use an alternative approach**
- **Develop accurate data on local supply, conservation, recycling, rate structures, growth and other relevant adjustment factors**
- **Seek opportunities within MWDOC service area to provide mutually beneficial shortage mitigation**

Client Agency Input

Between the months of September and January of 2014-15, MWDOC staff worked cooperatively with the client agencies through a series of technical workgroups to develop a formula and implementation plan to allocate imported supplies in the event that MET declares a regional shortage. These workgroups provided an arena for in-depth discussion of the objectives, mechanics, and policy aspects of the different parts of the Plan. MWDOC staff also met individually with a number of client agencies for detailed discussions on elements of the Plan. The discussions, suggestions, and comments expressed by the client agencies during this process played a key part in the development of this Plan.

The following MWDOC client agencies participated in the Technical Workgroup:

- **City of Buena Park**
- **City of Fountain Valley**
- **City of Garden Grove**
- **City of Huntington Beach**
- **City of Newport Beach**
- **City of Orange**
- **City of San Clemente**
- **City of San Juan Capistrano**
- **City of Tustin**
- **City of Westminster**
- **East Orange County Water District**
- **El Toro Water District**
- **Golden State Water Co.**
- **Irvine Ranch Water District**
- **Laguna Beach County Water District**

- **Mesa Water District**
- **Moulton Niguel Water District**
- **Orange County Water District**
- **Serrano Water District**
- **Santa Margarita Water District**
- **South Coast Water District**
- **Trabuco Canyon Water District**
- **Yorba Linda Water District**

In addition to the workshops, individual meetings were held between MWDOC staff and the following MWDOC client agencies to address more specific and agency-related questions.

These individual meetings provided MWDOC staff with a great deal of insight on exactly how a retail agency would implement allocations at the customer level. Such information was extremely valuable in our regional discussion at MET and in the development of this Plan.

Board of Directors Input

Throughout the Plan's development process, the MWDOC Board of Directors was provided with regular progress reports on the status of the Plan and the technical workgroup discussions. During the months the Plan was being developed, the Board Planning and Operations Committee was kept apprised of key issues regarding MET's and MWDOC's allocation plan. Moreover, the Committee played an integral part in the development of key implementation issues such as the appeal process and the surcharge rate structure.

Section 4: Water Supply Allocation Formula

The MWDOC Water Supply Allocation Model follows five (5) basic steps to determine an agency's imported supply allocation:

- Step 1: Determine Baseline Information
- Step 2: Establish Allocation Year Information
- Step 3: Assess the Shortage Reduction Stage (Based on MET's Declared Shortage Level)
- Step 4: Apply Allocation Adjustments and Credits in the areas of retail impacts, conservation, groundwater recharge.
- Step 5: Sum total allocations and determine retail reliability

A description of how the calculation is used in each step is described below:

Step 1 – Determine Baseline Information

In order to determine a client agency's retail demands and imported supply needs in the allocation year, the model needs to establish a historical base period for water supply and delivery data. The base period for each of the different categories of demands and supplies is calculated using data from fiscal years (July through June) ending 2013 and 2014.

The following is a description of the base period calculations:

Base Period Local Supplies: Local supplies for the base period are calculated using a two-year average (from fiscal years ending 2013 and 2014) of groundwater production, groundwater recovery, surface water production, and other non-imported supplies.

Base Period Wholesale ("Imported") Firm Demands: Firm demands on MWDOC for the base period are calculated using a two-year average (from fiscal years ending 2013 and 2014) of full-service, and surface storage operating agreement demands.

Base Period In-lieu Deliveries: Base period in-lieu deliveries to client agencies are calculated using a two year average (from fiscal years ending 2013 and 2014) of In-lieu deliveries to long-term groundwater replenishment, conjunctive use, cyclic, and supplemental storage programs. In-lieu deliveries are not calculated as imported supplies from MET. They are calculated as local supplies to account for the corresponding reduction in base year local production that was required to take In-lieu deliveries.

Base Period Retail Demands: Total retail municipal and industrial demands for the base period are calculated by adding the Base Period Local Supplies, Base Period Wholesale Imported Firm Demands, and Base Period In-Lieu Deliveries.

Step 2 – Establish Allocation Year Information

In this step, the model adjusts for each member agency's water need in the allocation year. To do so, it adjusts the base period estimates for population growth and changes in local supplies.

The following is a description of how the allocation year information is established:

Allocation Year Retail Demands: Total retail M&I demands for the allocation year are calculated by adjusting the Base Period Retail Demands for growth. The method in which MWDOC determines each client agency's growth is through population increases for the fiscal years ending 2013 to 2014[1]. Based on the data received from California State University of Fullerton, Center for Demographic Research, MWDOC prorates each agency's population increase share to MWDOC's growth adjustment received from MET[2], as shown in Appendix C.

Growth Adjustment: The growth adjustment is calculated by taking the average percent of growth from fiscal years ending 2013 and 2014, as generated by the Center for Demographic Research at California State University, Fullerton.

Allocation Year Local Supplies: Allocation year local supplies include groundwater production, groundwater recovery, surface water production, and other imported supplies not from MET. In-lieu deliveries are considered as local supplies to account for the corresponding reduction in base year local production that was required to take in-lieu deliveries. Allocation year local supplies reflect a more accurate estimate of actual supplies in the allocation year, and in turn more accurately estimates an agency's demand for imported supplies.

Extraordinary Increased Production Adjustment: This adjustment accounts for extraordinary increases in local supplies above the base period. Extraordinary increases in production include such efforts as purchasing water transfers. In order not to discourage such extraordinary efforts, a percentage of the yield from these supplies is added back to Allocation Year Local Supplies in shortage levels as shown below. This has the effect of "setting aside" the majority of the yield for the agency who procured the supply. The percentage of the extraordinary increases in local supply corresponds according to the regional shortage level, as shown in Table 4.1.

---

[1] Although many options were discussed in the technical workgroup sessions, this option was chosen to best reflect the increase in water demand due to population growth as intended by MET's allocation formula for each client agency in the MWDOC service area.

[2] MET's growth adjustment is calculated by using the average of the last two year County-wide population growth rates, which include not only MWDOC's service area but also the cities of Fullerton, Anaheim, and Santa Ana.

Table 4.1
Extraordinary Increased Production Adjustment

Regional Shortage Level	Regional Shortage Percentage	Extraordinary Increase Percentage
1	5%	5%
2	10%	10%
3	15%	15%
4	20%	20%
5	25%	25%
6	30%	30%
7	35%	35%
8	40%	40%
9	45%	45%
10	50%	50%

Step 3 – Calculate Initial Minimum Allocation Based on Declared Shortage Level

This step sets the initial allocation. After a regional shortage level is established, MWDOC will calculate the initial allocation as a percentage of adjusted Demand for Firm MET Supplies within the model for each client agency.

Regional Shortage Levels: The model allocates shortages of supplies over ten levels: from 5 to 50 percent, in 5 percent increments.

Initial (Wholesale Minimum) Allocation: The Wholesale Minimum Allocation is established to ensure a minimum level of imported supplies. The Wholesale Minimum Allocation ensures that client agencies will not experience shortages on the wholesale level that are greater than one-and-a-half times the percentage shortage of MET's regional water supplies. As illustrated in Table 4.2, the Wholesale Minimum Allocation percentage is equal to 100 minus one-and-a-half times the shortage level. The allocation is based on each agency's demand of firm MET water.

Table 4.2
Wholesale (“Imported”)
Supply Minimum Allocation

Regional Shortage Level		Wholesale Minimum Allocation
1		92.5%
2		85.0%
3		77.5%
4		70.0%
5		62.5%
6		55.0%
7		47.5%
8		40.0%
9		32.5%
10		25.0%

Step 4 – Assign Allocation Adjustments and Conservation Credit

In this step, the model assigns additional water to address disparate impacts at the retail level caused by an across-the-board cut of imported supplies. It also applies a conservation credit given to those agencies that have achieved additional water savings at the retail level as a result of successful implementation of water conservation devices, programs and rate structures.

Retail Impact Adjustment: The Retail Impact Adjustment is the factor used to address major differences in retail level shortages associated with across-the-board cuts. The purpose of this adjustment is to ensure that agencies with a high level of dependence on MET do not experience highly disparate shortages compared to other agencies when faced with a reduction in imported supplies. The Retail Impact Adjustment is calculated as the difference between the Regional Shortage Percentage and the Wholesale Imported Minimum Allocation. The amount of the adjustment each client agency receives is prorated on a linear scale, based on its dependence on imported water at the retail level. The prorated amount of allocation is referred to as the Retail Impact Adjustment Allocation. Table 4.3 below illustrates the maximum adjustment an agency may receive according to the regional shortage level.

Table 4.3
Retail Impact Adjustment

Regional Shortage Level	Regional Shortage Percentage	Retail Impact Adjustment Maximum
1	5%	2.5%
2	10%	5.0%
3	15%	7.5%
4	20%	10.0%
5	25%	12.5%
6	30%	15.0%
7	35%	17.5%
8	40%	20.0%
9	45%	22.5%
10	50%	25.0%

Unfortunately, the Retail Impact Adjustment MWDOC receives from MET may be less than the aggregate retail impact adjustment for its client agencies. To mitigate this difference, MWDOC decreases each client agency's retail impact adjustment according to their prorated share.

Conservation Demand Hardening Credit: The Conservation Demand Hardening Credit addresses the increased difficulty in achieving additional water savings at the retail level that comes as a result of successful implementation of water conserving devices and conservation savings programs. To estimate conservation savings, each member agency has a historical baseline Gallons Per Person Per Day (GPCD) calculated by the maximum usage from fiscal year ending 2004 to fiscal year ending 2014. Reductions from the baseline GPCD to the Allocation Year are used to calculate the equivalent conservation savings in acre-feet. The Conservation Demand Hardening Credit is based on an initial 10 percent of the GPCD-based Conservation savings plus an additional 5 percent for each level of Regional Shortage set by the Board during implementation of the WSAP. The credit will also be adjusted for:

- The overall percentage reduction in retail water demand
- The member agency's dependence on Metropolitan

The credit is calculated using the following formula:

Conservation Demand Harding Credit = Conservation Savings x (10% + Regional Shortage Level Percentage) x (1 +((Baseline GPCD – Allocation Year GPCD)/Baseline GCPD))x Dependence on MWD Percentage.

Minimum Per-Capita Water Use Credit: This adjustment creates a minimum daily gallons per capita (GPCD) water use threshold. Member agencies' retail-level water use is compared to a total water use of 100 GPCD. Agencies that fall below this threshold receive additional allocation to bring them up to the minimum GPCD water use level[3].

Step 5 – Sum Total Allocations and Calculate Retail Reliability

This is the final step in calculating an agency's total allocation for imported supplies. The model sums an agency's total imported allocation with all of the adjustments and credits and then calculates each agency's retail reliability compared to its Allocation Year Retail Demand.

Final Metropolitan Allocation: The final allocation of imported supplies to an agency for its retail demand is the sum of the Wholesale Imported Minimum Allocation, their Retail Impact Adjustment, their Conservation Demand Hardening Credit, and Per-Capita Adjustment Allocation (if applicable).

Total Metropolitan Supply Allocations: In addition to the WSAP Allocation described above, agencies may also receive separate allocations of supplies for seawater barrier and groundwater replenishment demands. Allocations of supplies to meet seawater barrier demands are to be determined by the MET Board of Directors independently, but in conjunction with the WSAP. Separating the seawater barrier allocation from the WSAP allocation allows the MET Board to consider actual barrier requirements in the Allocation Year and address the demand hardening issues associated with cutting seawater barrier deliveries. According to the principles outlined for allocating seawater barrier demands, allocations should be no deeper than the WSAP Wholesale Minimum Percentage implemented at that time. The WSAP also provides a limited allocation for drought-impacted groundwater basins based on the following framework:

1. Metropolitan staff will hold a consultation with the requesting member agency and the appropriate groundwater basin manager to document whether the basin is in one of the following conditions:

    a. Groundwater basin overdraft conditions that will result in water levels being outside normal operating ranges during the WSAP allocation period; or
    b. Violations of groundwater basin water quality and/or regulatory parameters that would occur without imported deliveries.

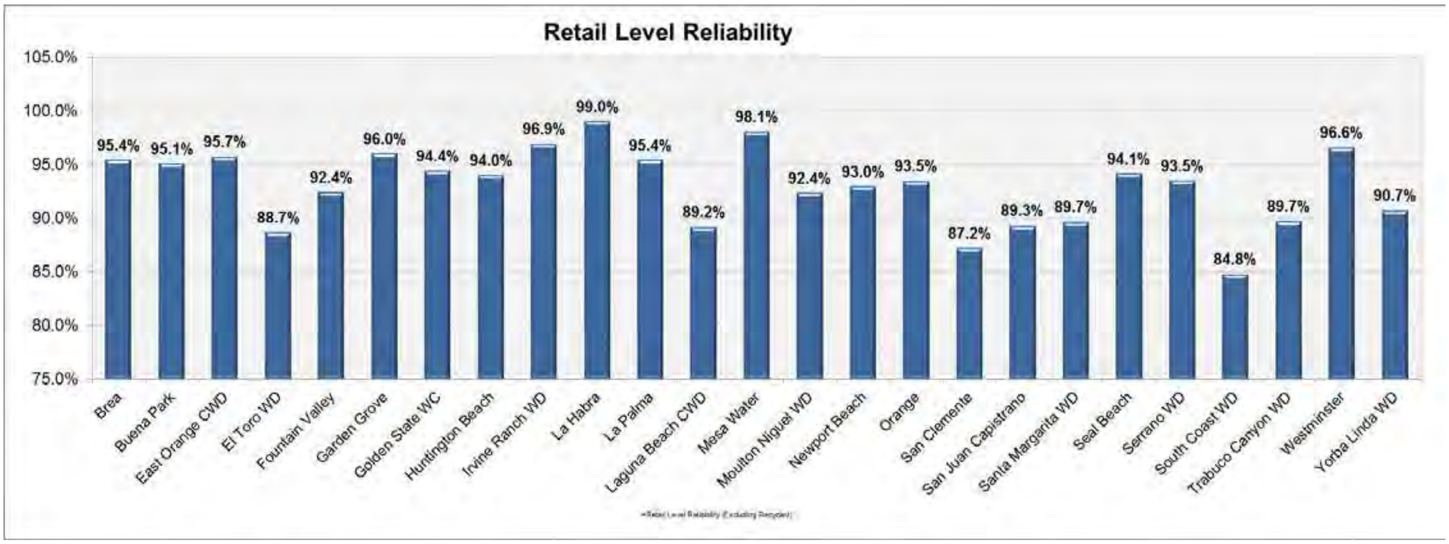
2. An allocation is provided based on the verified need for groundwater replenishment. The allocation would start with a member agency's ten-year average purchases of imported groundwater replenishment supplies (excluding years in which deliveries were curtailed). The amount would then be reduced by the declared WSAP Regional Shortage Level.

Agency's Retail Reliability: This calculates an agency's total MET allocation versus their allocation year retail demands to determine their overall reliability percentage (supplies

3 Per capita water used based on Total Retail-Level Use and population data received from California State University of Fullerton, Center for Demographic Research

as a percentage of retail demand) under a regional shortage level. This percentage excludes recycled water supplies from an agency's total water supply. Figure 4.1 illustrates the MWDOC client agencies' reliability percentages under a stage 3 regional shortage level (15%).

Figure 4.1
MWDOC's Water Supply Allocation Plan
Stage 3 with a Regional Shortage of 15%*



Source: MWDOC Allocation Model Version 3.1 and assumes a BPP of 75%.
[*] These are estimated reliability percentages for MWDOC client agencies under a regional shortage stage 3 (15%) based on initial local supply data received from the client agencies and OCWD's projected BPP for 2015/16.

Section 5: Plan Implementation

This section covers implementation issues which include: the appeal process, penalties rate structure and billing, tracking and reporting water usage, timeline and option to revisit the plan.

Allocation Appeals Process

The purpose of the appeals process is to provide client agencies the opportunity to request a change to their allocation based on new or corrected information. The grounds for appeal can include but are not limited to:

- Adjusting errors in historical data used in the Base period calculations
- Adjusting for unforeseen losses or gains in local supplies
- Adjusting for extraordinary increases in local supplies
- Adjusting for population growth rates
- Adjusting for credits with the Conservation base data, including Conservation Rate Structure

MWDOC anticipates that under most circumstances, a client agency's appeal will be the basis for an appeal to MET by MWDOC. MWDOC staff will work with client agencies to ensure that such an appeal is a complete and accurate reflection of the client agency's allocation and is properly reviewed by MET. To accomplish this, MWDOC will require the following information from the client agency submitting an appeal:

- ➢ Written letter (in the form of a letter or e-mail) from the client agency requesting an appeal
- ➢ Brief description of the type of appeal e.g. incorrect base data, loss/gain in local supply, extraordinary increase in local supply, adjustment in agency's conservation base data, or other
- ➢ Rationale for the appeal
- ➢ Quantity in acre-feet in question
- ➢ Verifiable documentation that supports the rationale i.e. billing statements, invoices for conservation device installations, Groundwater reports

To provide clarity of the process and ensure your appeal is properly handled, the following steps will occur:

Step 1 – Submit Appeal – Client agency will submit the necessary information, described above, to MWDOC.

Step 2 – Notification of Response and Appeal Meeting – Once MWDOC staff receives the appeal information, MWDOC will send a response and schedule a meeting with MWDOC staff and the client agency, within two weeks of receiving the information, to discuss the appeal in further detail.

Step 3 – Submittal to MET & MWDOC Board Notification – Using the information received from the client agency, MWDOC will prepare and submit the appeal to MET no later than one month of receiving the information. In addition, MWDOC staff will notify its Board of the submittal to MET.

Step 4 – MET Appeal Process - MWDOC will follow the terms of MET's appeal process, as described in Appendix B. Client agencies will also be invited, as deemed appropriate, by MWDOC to attend any meetings with MET on their appeal.

Step 5 –Client Agency Notification of MET's Decision – Once MET has made a determination of the appeal, MWDOC staff will notify the client agency of the decision and determine if additional actions are needed i.e. Appeal to MET Board.

In the event that MET denies the appeal, MWDOC staff will continue to work with the appealing agency to resolve their issue(s). Any action that will result in adjustments to client agency's allocation will be submitted to the Board for review and approval.

Allocation Surcharge Rates & Billing

MET's Surcharge Rates

MET will enforce its allocations through a tiered surcharge rate structure. MET will assess surcharge rates to a member agency that exceeds its total annual allocation at the end of the twelve-month allocation period, according to the rate structure below:

Table 5.1: Metropolitan Water District
Allocation Surcharge Rate Structure
(FY2015/16 Rates)*

Water Use up to:	(1) **Base Rate**	(2) **Surcharge Rate****	(1)+(2) = **Total Rate**
100% Allocation	Tier 1 ($942/AF)	-	**$942/AF**
100% < = 115%	Tier 1 ($942/AF)	Tier 1 + (1,480/AF)***	**$2,422/AF**
Use > 115%	Tier 1 ($942/AF)	Tier 1 + (2,960/AF)***	**$3,902/AF**

[*] The base rate shall be the applicable water rate for the water being purchased (Model shows CY 2016 rate).
[**] If MWDOC exceeds its allocation limit but is within its equivalent preferential right amount, MET will decrease the surcharge rate by one level.
[***] Surcharge rate is applied to water use in excess of an agency's WSAP allocation.

These surcharge rates will be assessed according to MET water rates in effect at the time of billing. Any surcharge funds collected by MET will be invested back to the MET member agency through conservation and local resource development.

MWDOC Surcharge Rates

As a water wholesaler, MWDOC has the opportunity to assess penalties in many different ways. A number of options were discussed and analyzed with the client agencies and Board Committee members. The key components that helped guide development of a surcharge structure included:

- A financial incentive to discourage water usage above a client agency's allocation
- A surcharge rate structure that is administratively easy to understand and implement
- Surcharge rates that are fair and appropriate during a shortage

From these components and input received from both the MWDOC Board and the client agencies, a melded surcharge rate structure was recommended. This was mainly due to its "region-wide" style approach and similar structure to other MWDOC rates and charges.

MWDOC Surcharge Rate Structure – At the end of the allocation year, MWDOC would charge a surcharge to each client agency that exceeded their allocation. This surcharge would be assessed according to the client agency's prorated share (acre-feet over usage) of MWDOC surcharge amount with MET. Below is an example of how this surcharge rate structure would apply:

[redacted]

Under the melded surcharge rate structure, client agencies will only be assessed penalties if MWDOC exceeds its total allocation and is required to pay a surcharge to MET.

MWDOC Billing

During the allocation period, MWDOC billing will remain the same. Only at the end of the twelve-month allocation period will MWDOC calculate each member agency's total potable water use based on the local supply certification and MWDOC allocation model and determine which agencies exceeded their annual allocation. From those agencies that exceeded their allocation, MWDOC will assess surcharge rates according to the melded surcharge rate structure on their next water invoice.

Understanding that the penalties can be significant to a retail agency, MET and MWDOC will allow payment of these penalties to be spread over three monthly billing periods. Therefore, a third of the penalties will be applied each month to the agency's water invoice over a three-month period

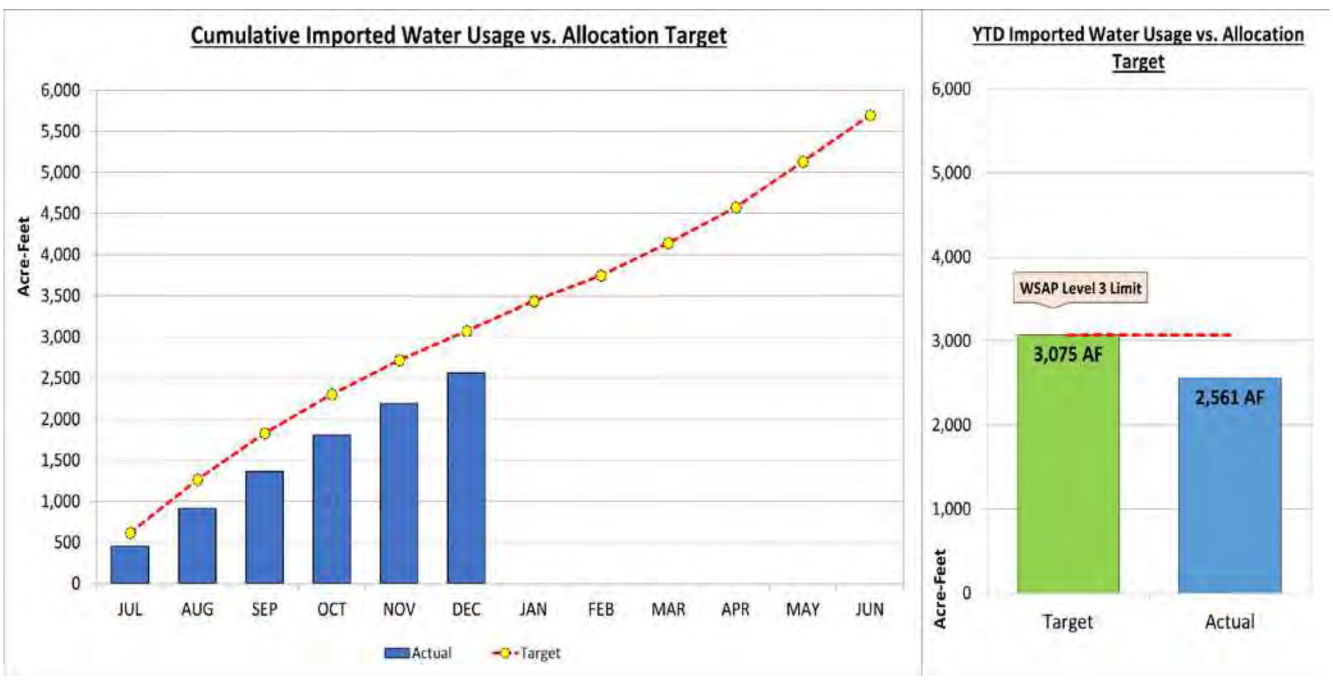
Tracking and Reporting

In preparing for allocations, it is important to track the amount of water the region and each client agency is using monthly. This data is important to help MWDOC and client agencies project their annual usage, evaluate their current demands, and avoid any over usage that will result in allocation penalties. MWDOC will provide water use monthly reports upon request or when necessary that will compare each client agency's current cumulative imported usage to their allocation target (Based off historical monthly percentages of imported usage). In addition, MWDOC will provide quarterly reports on its cumulative retail usage compared to its allocation baseline.

To develop these reports, MWDOC will need to work closely with each client agency to get their local supply data on a monthly basis. This data will not only be used by MWDOC to track monthly usage, but also by MET to assess MWDOC's total projected water demands.

Below in Figure 5.2 is an example of the type of monthly report MWDOC will provide to each client agency during the allocation period.

Figure 5.2
Example of a Client Agency's Monthly Usage Report



Key Dates for Implementation

If a regional shortage is declared, the allocation period will cover twelve consecutive months, e.g. July 1st of a given year through June 30. Barring unforeseen large-scale circumstances, the Regional Shortage Level will be set for the entire allocation period, which will provide the client agencies an established water supply shortage allocation amount. Figure 5.3 Illustrates the Metropolitan timeline for allocations during a two year period.

Figure 5.3: Metropolitan Water District
Adopted Allocation Timeline

Year	Month	Year 1 Board Allocation Decision	Year 1 Allocation Year	Year 2 Board Allocation Decision	Year 2 Allocation Year
YEAR 1	January				
	February				
	March				
	April	**Declaration**			
	May				
	June				
	July		**Effective Period** Continuous Tracking of Member Agency Local Supply and Imported Water Use		
	August				
	September				
	October				
	November				
	December				
YEAR 2	January				
	February				
	March				
	April			**Declaration**	
	May				
	June				
	July				
	August		**Assess Penalties**		**Effective Period** Continuous Tracking of Member Agency Local Supply and Imported Water Use
	September				
	October				
	November				
	December				
YEAR 3	January				
	February				
	March				
	April				
	May				
	June				

It is important to note that MWDOC does not anticipate calling for allocation unless the MET Board declares a shortage through it WSAP; and no later than 30 days from MET's declaration will MWDOC announce allocation to its client agencies.

Revisiting the Plan

Calculating the amount of imported water each client agency receives during a water shortage is not an easy task. The key objective in developing this allocation plan is to ensure that a proper and fair distribution of water is given to each client agency. However, due to the complexity of this issue and the potential for unforeseen circumstances that may occur during an allocation year, MWDOC offers the opportunity to review and refine components of this plan where deemed necessary.

The MWDOC staff and client agencies have the opportunity to revisit the plan and offer any recommendations to the MWDOC Board that will improve the method, calculation, and approach of this plan.

MET has a similar process which will allow opportunity to review their plan when deemed necessary.

Appendix A

List of Acronyms:

AF- Acre-feet
M&I- Municipal and Industrial
MET-Metropolitan Water District of Southern California
SWRCB-State Water Resources Control Board
WSAP-Water Supply Allocation Plan

Definitions:

Extraordinary Increases in Production: water production efforts that increase local supplies during an allocation year such as purchasing water transfers.

Groundwater Recovery: The extraction and treatment of groundwater making it usable for a variety of applications by removing high levels of chemicals and/or salts.

In-lieu deliveries: MET-supplied water bought to replace water that would otherwise be pumped from the groundwater basin.

Overproducing groundwater yield: Withdrawal (removal) of groundwater over a period of time that exceeds the recharge rate of the supply aquifer. Also referred to as overdraft or mining the aquifer.

Seawater Barrier: The injection of water into wells along the coast to protect the groundwater basin from seawater intrusion. The injected water acts like a wall, blocking seawater that would otherwise migrate into groundwater basins as a result of pumping inland.

Appendix B

Metropolitan’s Draft Water Supply Allocation Plan

MET Final Water
Supply Allocation Pl

Appendix C
MWDOC Growth Adjustment Table per Client Agency

Population of MWDOC Retail Water Agencies

Water Agency	Jan-13	Jan-14	Avg of 2013 & 2014
Brea	41,129	42,181	**41,655**
Buena Park	82,053	82,364	**82,209**
East Orange CWD Retail Zone	3,233	3,247	**3,240**
El Toro WD	48,453	48,628	**48,541**
Fountain Valley	57,129	57,590	**57,360**
Garden Grove	175,096	175,873	**175,485**
Golden State Water Company	167,779	168,561	**168,170**
Huntington Beach	193,873	196,041	**194,957**
Irvine Ranch WD	357,781	369,724	**363,753**
La Habra	60,989	61,455	**61,222**
La Palma	15,890	15,946	**15,918**
Laguna Beach CWD includ. Emerald Bay Service District	20,130	20,204	**20,167**
Mesa Water	105,779	106,152	**105,966**
Moulton Niguel WD	168,301	169,405	**168,853**
Newport Beach	65,404	65,551	**65,478**
Orange	137,814	138,182	**137,998**
San Clemente	50,757	50,960	**50,859**
San Juan Capistrano	37,943	38,491	**38,217**
Santa Margarita WD	152,245	153,358	**152,802**
Seal Beach	23,543	23,618	**23,581**
Serrano WD	6,408	6,437	**6,423**
South Coast WD	34,672	34,816	**34,744**
Trabuco Canyon WD	12,588	12,640	**12,614**
Tustin	67,445	67,700	**67,573**
Westminster	92,939	93,322	**93,131**
Yorba Linda WD	73,378	73,990	**73,684**
Total of MWDOC Agencies	**2,252,751**	**2,276,436**	**2,264,594**

Source: Center for Demographic Research, CSU Fullerton, December 2014. CDR s estimates were based on the 2010 Census. Water agency counts were made for the actual area served, which may be different than the political boundary. Numbers are tied to the State Dept. of Finance numbers for total population of Orange County.

Water Agency	Growth % from 2012 to 2013	Growth % from 2013 to 2014	Avg Growth % 2013 to 2014
Brea	1.13%	2.56%	1.84%
Buena Park	0.62%	0.38%	0.50%
East Orange CWD Retail Zone	0.56%	0.43%	0.50%
El Toro WD	0.56%	0.36%	0.46%
Fountain Valley	0.71%	0.81%	0.76%
Garden Grove	0.19%	0.44%	0.32%
Golden State Water Company	0.87%	0.47%	0.67%
Huntington Beach	0.61%	1.12%	0.87%
Irvine Ranch WD	2.68%	3.34%	3.01%
La Habra	0.53%	0.76%	0.65%
La Palma	0.75%	0.35%	0.55%
Laguna Beach CWD includ. Emerald Bay Service District	0.60%	0.37%	0.48%
Mesa Water	0.58%	0.35%	0.47%
Moulton Niguel WD	0.78%	0.66%	0.72%
Newport Beach	0.51%	0.22%	0.37%
Orange	0.59%	0.27%	0.43%
San Clemente	0.55%	0.40%	0.48%
San Juan Capistrano	0.89%	1.44%	1.17%
Santa Margarita WD	0.55%	0.73%	0.64%
Seal Beach	0.59%	0.32%	0.45%
Serrano WD	0.60%	0.45%	0.52%
South Coast WD	0.61%	0.42%	0.51%
Trabuco Canyon WD	0.55%	0.41%	0.48%
Tustin	0.63%	0.38%	0.50%
Westminster	0.64%	0.41%	0.53%
Yorba Linda WD	1.11%	0.83%	0.97%
Total of MWDOC Agencies	**0.95%**	**1.05%**	1.00%

Appendix D

MWDOC Conservation Hardening Credit Table per Client Agency

Member Agency	GPCD Baseline	GPCD for 2014	Change in GPCD	AF Savings
Brea	288.58	246.61	**41.97**	**1,983**
Buena Park	199.59	165.57	**34.02**	**3,138**
East Orange CWD includ. Tustin	196.19	170.20	**25.99**	**2,065**
El Toro WD	214.96	185.54	**29.42**	**1,748**
Fountain Valley	192.48	184.64	**7.84**	**506**
Garden Grove	166.11	133.16	**32.95**	**6,491**
Golden State Water Company	175.11	146.27	**28.84**	**5,445**
Huntington Beach	163.73	141.79	**21.94**	**4,818**
Irvine Ranch WD	304.13	244.30	**59.83**	**24,778**
La Habra	160.60	150.19	**10.41**	**717**
La Palma	154.88	123.75	**31.13**	**556**
Laguna Beach CWD includ. EBSD	203.74	173.46	**30.28**	**685**
Mesa WD	191.25	166.35	**24.90**	**2,961**
Moulton Niguel WD	236.66	194.91	**41.75**	**7,922**
Newport Beach	258.85	239.36	**19.49**	**1,431**
Orange	231.08	210.84	**20.24**	**3,134**
San Clemente	198.09	178.51	**19.58**	**1,118**
San Juan Capistrano	236.93	206.65	**30.28**	**1,306**
Santa Margarita WD	235.06	201.77	**33.29**	**5,719**
Seal Beach	157.34	147.07	**10.27**	**272**
Serrano WD	485.61	468.88	**16.73**	**121**
South Coast WD	205.86	196.91	**8.95**	**349**
Trabuco Canyon WD	314.13	270.88	**43.25**	**612**
Tustin	191.31	164.21	**27.10**	**2,055**
Westminster	145.76	120.75	**25.01**	**2,614**
Yorba Linda WD	299.73	272.75	**26.98**	**2,236**

[*] The GPCD Baseline" is the highest Ten-year average from 2004 to present, and includes Recycled water in order to normalize the conservation savings

Source: MWDOC 20% by 2020 OC Regional Alliance Model updated in 2014

WSAP GPCD.pdf

Appendix C

MWDOC Strategic Communications Program and Plan

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY
STRATEGIC COMMUNICATIONS PROGRAM AND PLAN

MWDOC

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INTRODUCTION

"The art of communication is the language of leadership."
~ James Humes, Author & President Reagan's Speechwriter

Strategic communication is the process of relaying specific, purposeful ideas and information to targeted audience groups in order to reach identified goals and objectives. The Municipal Water District of Orange County's (MWDOC or District) goals and objectives are identified in the District's Mission Statement:

Our mission is to ***provide reliable****, high-quality* ***supplies*** *from Metropolitan Water District of Southern California and other sources* ***to meet present and future needs*** *at an* ***equitable and economical cost,*** *and* ***to promote water use efficiency*** *for* ***all of Orange County.***

MWDOC presently develops, coordinates, and delivers a substantial number of programs and services aimed at elevating stakeholders' awareness about water policy, efficient water use, and the District's role in advocating for sound policy and water reliability investments that are in the best interest of Orange County. As water is a necessary resource to all life, these efforts encourage and benefit all Orange County residents and businesses, across all demographics.

Over the past decade, there has been a significant shift in the way people receive information. The media market is overcrowded and constantly evolving. The public is bombarded minute by minute with news from their phones, televisions, computers and tablets. Traditional media has been on the decline and at the same time, digital media continues to explode. Water providers must prove themselves to be relatable, trustworthy, and essential. This is accomplished by communicating more frequently and more effectively using a wider array of tools and channels to meet the needs and interests of an extremely diverse demographic. It is important to recognize that no single communications tool or channel can fulfill all of the District's identified goals and objectives. Instead, a holistic approach should be taken, utilizing all the tools in the toolbox to create a compounding and inclusive impact.

Historically, and typical for the industry, MWDOC has maintained a modest public profile, however, the District's influence continues to grow, and MWDOC has quickly become a leading regional voice for water in the State. MWDOC's very vocal support for the Delta Conveyance Project (DCP), investments in quality water education, water use efficiency, and emergency management, as well as increased participation in state water regulations and policy has elevated the District's profile in the water industry. It has become necessary to expand communications efforts to reach people where they spend the most time - on social media and through other firmly established electronic channels.

Strategic communication is an ongoing activity where the purpose, audience, message, tools, and channels may change at any given moment, however, for the most part, the overarching goals remain the same. As a result of this, MWDOC's Strategic Communications Program and Plan must remain a living document in order to implement effective, relevant communication with timeliness and accuracy. This document serves as a blueprint, establishing a baseline understanding for how MWDOC's programs will provide information and value to its various stakeholders, partners, and employees; enhance the District's image; and, support MWDOC's mission, goals and objectives to secure long term water reliability for the region.

COMMUNICATIONS GOALS & OBJECTIVES

"The two words 'Information' and 'Communication' are often used interchangeably but they signify quite different things. 'Information' is getting out; 'Communication' is getting through."

~ Sydney J. Harris, American Journalist

The charge of the MWDOC Public Affairs Department (Department) is to elevate public awareness, garner support, and establish confidence in the District's initiatives. Additionally, the Department is tasked with providing transparent, reliable, and accurate information to the public, our partners, and our member agencies. These commitments support not only the MWDOC mission, but also an ongoing districtwide stance to be the leading regional voice for water issues throughout the State. With 28 member agencies in the District's service area - many with competing interests - and a complex, ever-changing landscape of water policy and regulation, MWDOC must utilize various communications tools and channels to reach and unify such a vast and diverse group of stakeholders and audiences.

The MWDOC Strategic Communications Program and Plan aligns the District's identified goals and objectives with the respective audiences, and outlines the appropriate communications tools and channels used to connect them all together. This living document will continue to be updated and amended as the District's goals and objectives evolve, shift, or change.

GOALS & OBJECTIVES

As defined by the Board of Directors, executive management, and the District's Mission Statement, MWDOC'S primary goals and present objectives are as follows:

GOAL #1: SECURE LONG TERM WATER RELIABILITY FOR ORANGE COUNTY AND THE REGION.

- **OBJECTIVE 1.1:** Provide recognized, effective leadership and sound representation across all MWDOC organizational roles, including at the District level, at Metropolitan Water District of Southern California (Metropolitan), as well as at the County, State, and Federal levels.

- **OBJECTIVE 1.2:** Provide leadership, water education, and outreach support towards the successful advancement and completion of the **Delta Conveyance Project (DCP)**.

- **OBJECTIVE 1.3:** Provide unwavering advocacy on behalf of the region to invest in, improve, and expand Orange County's water supply portfolio by continuing to study, evaluate, and recommend opportunities identified in the **Orange County Water Reliability Study.**

GOAL #2: EXAMINE, DEVELOP, AND IMPLEMENT SOUND POLICIES AND PROGRAMS THAT SUPPORT ORANGE COUNTY WATER INVESTMENTS, AND PROVIDE RECOGNIZED VALUE TO THE REGION.

- **OBJECTIVE 2.1:** Provide unbiased analysis of water reliability programs, projects, and accompanying policies that affect Orange County, and to identify and ensure implementation of cost efficient solutions for the region.

- **OBJECTIVE 2.2:** Be the trusted, leading voice for the region on water reliability, water policy, efficient water use, water education, and emergency preparedness and response.

- **OBJECTIVE 2.3:** Educate, inform, and involve Orange County stakeholders and California civic, business, education, and community leaders of today and tomorrow.

GOAL #3: PROVIDE EFFECTIVE COMMUNICATION AND ADVOCACY PROMOTING MWDOC PROGRAMS, POSITIONS, AND SERVICES.

- **OBJECTIVE 3.1** Expand and refine communications efforts to ensure stakeholders, partners, employees, and other decision makers have the information and education they need to make judicious decisions regarding water-saving opportunities and best practices, as well as pending policy matters that affect Orange County.

- **OBJECTIVE 3.2:** Grow and improve MWDOC's traditional and electronic media presence to establish trust and credibility in the District's programs, positions, and activities.

- **OBJECTIVE 3.3:** Define and enhance the District's brand identity.

This award winning Strategic Communications Program and Plan articulates the process of communicating the value of the aforementioned goals and objectives to the District's identified audience members who may *or may not* be engaged in MWDOC's programs or activities.

TARGET AUDIENCES

"To effectively communicate, we must realize that we are all different in the way we perceive the world and use this understanding as a guide in our communication with others."

~ Tony Robbins, Author & Entrepreneur

The ability to understand MWDOC's identified audience groups makes it possible to logically align messaging with the appropriate communications tools and channels to reach the District's identified goals and objectives. There are many ways to categorize MWDOC's audience groups and determine which tools and channels the District can use to best connect with those groups. These categories may include demographics, geography, employer, behavior, and attitudes, to name a few.

Accordingly, the Department has identified several key audience groups (See Appendix A). This by no means is a complete list since our business is water, and every person on the planet needs, and uses it. Water is an essential resource for all life, and for the success and sustainability for all societies regardless of how identified audience groups are categorized.

SAMPLE PERSONAS FOR TARGET AUDIENCES

TARGET AUDIENCES

Student K-6th Grade

Curious, Impressionable, Enthusiastic, Imaginative, Adaptive

Goals & Objectives

- Goal #2

Activities & Partnerships

- Boy/Girl Scouts Organization
- Educators
- OCDE
- OC STEM
- CAELI
- Wyland Foundation
- MWDOC Water Awareness Poster Contest

Messages

- Message #1-#5
- Message #8-#10
- Message #17-#19

Channels

- Ricky Raindrop
- Community events
- Boy/Girl Scouts Program
- Choice School Programs

OC Elected Official

Ambitious, Engaged, Traditional, Invested, Informed

Goals & Objectives

- Goal #1
- Goal #2
- Goal #3

Activities & Partnerships

- Elected Officials Forum
- ACC-OC
- Metropolitan & Member Agencies
- OCBC
- SoCal Water Committee
- SWRCB
- UWI
- AMWA
- ACWA
- AWWA

Messages

- Message #1-#5
- Message #8-#9
- Message #11-#14
- Message #17

Channels

- Introduction to Water Booklet
- Briefing papers
- Written correspondence
- Virtual platforms
- Inspection Trips
- D.C. Luncheon
- Water Policy Forum
- O.C. Water Summit
- Speaker presentations

MESSAGING AND TACTICS

"Many attempts to communicate are nullified by saying too much."

~ Robert K. Greenleaf, Author

Modern day society is exposed to thousands of bits of information each day. The barrage of messages received through billboards, television, radio ads, as well as print media, email, and text notifications, has given many people a sense of anxiety from information saturation to overload. To be effective, the District must start by stripping out the unnecessary complexities. Messaging needs to be purposeful, simple, clear, concise, and consistent.

Messaging guidelines:

- Before engaging any audience group, be clear about what the District is trying to accomplish.
- Determine what the intended audience needs, wants, and cares about, then get to the point.
- Use words and language that the audience easily understands and can relate to. Be careful not to include industry jargon, technical terms, or excessive detail.
- Use an active voice and clearly define the call to action.

Messages also must be consistent in order to effectively engage audience groups in the District's programs and activities. Important messages become more memorable through repetition. Consistency should be practiced across all District organizational roles as it is vital to the effectiveness of MWDOC's communications efforts and can prevent confusion or misunderstanding.

MESSAGES:

1. Nearly half of all Orange County water is imported from hundreds of miles away AND local water supply sources meet only about half of what Orange County needs.
   a. Protecting our water supply is everyone's responsibility.
   b. Using water more efficiently is everyone's responsibility.
   c. We can all do our part to protect and secure Orange County's water supply for generations to come.
2. Your tap water is clean, safe, and reliable.
3. Providing a healthy, dependable supply of water is our highest priority.
4. Water is our most precious natural resource.
5. Water is life.
6. Less water, more savings.
7. MWDOC can help you save WATER, TIME, and MONEY.
8. Orange County IS Water Smart / OC IS Water Smart (Hook / Lead: Did You Know? / Hashtag: #OCisWaterSmart).
9. We're in this together.
10. Save together.
11. Orange County's primary water source from Northern California is at risk.
12. California (Orange County) needs the **Delta Conveyance Project (DCP) -** the most sound, economical, and environmentally sustainable solution for the region.
13. Climate change, droughts, and other natural disasters will happen. Californians need to invest in a variety of reliable water sources.

14. MWDOC's **Orange County Water Reliability Study** identifies the best water infrastructure projects available to the region based on reliability and value. Through MWDOC's water use efficiency programs and incentives, Orange County saves more than 17.1 billion gallons of water each year.
15. MWDOC has been educating Orange County students about the importance and value of water for nearly five decades through the MWDOC Choice School Programs.
16. Through strong leadership and sound representation, MWDOC works diligently to secure a dependable water future for all of Orange County.
17. Water industry jobs provide steady, long-term careers that ultimately contribute to the welfare of workers, their families, and to the health of the state's economy.
18. MWDOC is committed to educating and encouraging water leaders of today and tomorrow.

While strategy provides the path towards reaching an end goal, tactics define the specific actions taken along the way. Tactics have a definite beginning and end, and are more about the planning and detailed components of a plan.

Some tactics can be utilized to accomplish several, if not all objectives in some cases, however **Tactics** identified for each of the primary MWDOC GOAL objectives are as follows:

OBJECTIVE 1.1 Tactics:

- Maintain a steady, clear, accurate voice throughout the organization by ensuring that all outreach materials both traditional and digital are reviewed and updated frequently.
- Participate in one-on-one and group conversations or meetings with decision makers and partners, and provide informational materials and guidance whenever appropriate.
- Engage stakeholders, partners, and member agency representatives across all MWDOC organizational roles in order to ensure the District is providing needed and necessary support and advocacy.
- Discover common ground and identify opportunities to partner with other organizations to advance the District's goals, objectives, and initiatives.

OBJECTIVE 1.2 Tactics:

- Identify opportunities to keep **DCP** at the forefront of messaging, such as earned media, social media, print media, and other effective forms of communication.
- Identify leading voices in **DCP** as MWDOC Water Policy Forum & Dinner and OC Water Summit speakers.
- Invite speakers from both sides of the **DCP** to participate as Inspection Trip presenters.
- Provide briefing papers, hands-on activities, and presentations to educator groups, teachers, and students to integrate water supply sources and **DCP** into classroom lessons where appropriate.

OBJECTIVE 1.3 Tactics:

- Work with member agencies and partners to educate and advocate for the completion of local projects deemed most valuable by the **Orange County Water Reliability Study.**
- Produce collateral and content such as briefing papers, media kits, and videos highlighting the **Orange County Water Reliability Study** for stakeholders including elected officials, member agencies, as well as traditional and social media audiences.

OBJECTIVE 2.1 Tactics:

- Host a learning workshop targeting leaders from member agencies; include a messaging component for attendees.

OBJECTIVE 2.2 Tactics:

- Present a MWDOC Water Policy Forum & Dinner ***Speakers Series*** each fiscal year and secure top-level expert speakers to discuss timely, relevant water related topics with Orange County stakeholders and leaders.
- Develop messaging that amplifies MWDOC's opposition to any potential legislation that imposes a "public goods charge" "water user fee", or "water tax" on public water agencies or their ratepayers.
- Assume leadership roles where possible at the local, County, and State levels in all areas of expertise and District focus.
- Provide comprehensive tool kits to stakeholders, partners, and member agencies that support and promote water-centric programs, activities, and campaigns, offering direction for implementation and ensuring a unified message.
- Provide hands-on water education activities to Orange County K-12 teachers that enhance and extend classroom lessons.
- Administer the Water Energy Education Alliance that strengthens career pathways and builds and bolsters technical training programs for Southern California students.
- Administer a water-centric K-12 MWDOC Choice School Program for Orange County students that enhance their ability to become responsible environmental stewards
- Support and advance environmental literacy, giving students the knowledge and understanding they need to create ecologically sound, economically prosperous, and equitable communities.

OBJECTIVE 3.1 Tactics:

- Provide stakeholders with valuable resources such as the OC Water 101 Booklet (volume 1) and other MWDOC collateral (briefing papers).
- Integrate District partners and their target audiences (i.e. ACCOC, OCBC, and others) into Inspection Trips and Policy Dinners.
- Provide briefing papers, hands-on activities, and focused presentations where appropriate.
- Utilize all communications tools and channels to engage and inform identified audience groups.

OBJECTIVE 3.2 Tactics:

- Cultivate relationships with traditional media (Newspaper Editorial Boards, Radio and Television News outlets) to maintain a steady voice on water issues, and utilize Social Media to maximize the reach of earned media opportunities and events.
- Evaluate and amend where necessary all current communications platforms and tools to ensure the District is utilizing the most effective and contemporary systems.

OBJECTIVE 3.3 Tactics:

- Apply approved Logo and Brand Identity Guidelines to all MWDOC outreach materials and platforms, activities, programs, and events.
- Promote districtwide buy-in by implementing the MWDOC Logo and Brand Identity Guide.

COMMUNICATIONS TOOLS AND CHANNELS

"If you have an important point to make, don't try to be subtle or clever. Use a pile driver. Hit the point once. Then come back and hit it again. Then hit it a third time- a tremendous whack."

~ Winston Churchill, British Politician, Army Officer & Author

Most of the District's audience groups will already have preconceived notions about who MWDOC is based on past or current collaborations, our website structure and social media content, as well as any interaction with our communications materials including articles, print materials, and news media. To successfully reach these individuals with our intended messages, MWDOC must utilize the tried-and-true tools and resources that are readily available, and strategically place the messages where they can easily be found.

As a guiding reference, the MWDOC Public Affairs Department has defined communications tools, activities, and channels, and identified how MWDOC currently utilizes each of these resources to effectively reach the goals and objectives of the District.

A communications tool is the partnership or activity used to interface with an identified audience to achieve goals and objectives. Some examples include:

- **Partnerships -** *S*uccessful partnerships are developed through an understanding of each th ' pe ific ds to ch id ntified go l d bj tiv P rt typi lly reward involved with coming together and are able to offer each other a choice of tools, services, and solutions to meet those needs. Exceptional partnerships act as a catalyst for those involved to grow and prosper.

  MWDOC's RECOGNIZED PARTNERS*:

  - MWDOC member agencies
  - Metropolitan and its member agencies
  - Department of Water Resources (DWR)
  - State Water Resources Control Board (SWRCB)
  - Media
  - Technical Consultants
  - School Program Contractors
  - Educators
  - Boy Scouts/Girl Scouts Organizations
  - Association of California Cities – Orange County (ACC-OC)
  - Orange County Business Council (OCBC)
  - Association of California Water Agencies (ACWA)
  - American Water Works Association (AWWA)
  - Association of Metropolitan Water Agencies (AMWA)
  - Council for Environmental and Economic Balance (CEEB)
  - Urban Water Institute (UWI)
  - So Cal Water Committee
  - Wyland Foundation

- Bolsa Chica Conservancy
- Orange County Coastkeepers
- UCCE Master Gardeners
- Orange County Department of Education (OCDE)
- OC STEM
- California Environmental Literacy Initiative (CAELI)
- California Environmental Education Foundation (CEEF)
- Orange County and Pacific West Association of Realtors (OCAR) and (PWR)
- Other Contractors

*This is by no means an exhaustive list, but gives an indication of the many partners of the District.

- **Activities-** An activity is a planned course of action taken in order to achieve a specific aim. Activities have a distinct beginning and end and usually contain several tasks within

  - Annual Campaigns
    - MWDOC Water Awareness Poster Contest
    - Fix-a-Leak Week
    - Irrigation Week
    - Smart Irrigation Month
    - Wyland National Mayor's Challenge for Water Conservation
    - Imagine A Day Without Water
    - Emergency Preparedness Month
    - Garden Smart campaign, and more
  - Workgroup Meetings
  - D.C. Luncheon
  - Water Energy Education Alliance (WEEA) Leadership Roundtable meetings
  - Surveys
  - Water saving programs and incentives

- **A Communications Channel** is the medium through which a message is sent to its intended receiver. The basic channels are visual, written, spoken, or electronic. Examples of District communications channels:

  - **Word of mouth**
  - **Speaker presentations**
  - **Trainings**
  - **Conferences/Meetings**
    - Elected Officials Forum
    - Water Policy Forum
    - Orange County Water Summit
  - **Community Events**
  - **Print media**
    - News stories/News Releases

    - Newsletters
    - Briefing papers/Talking points
    - Media kits
    - Written correspondence
    - Introduction to Water booklet (Volumes)
    - Flyers/Signage/Brochures
    - Promotional giveaways
    - Door hangers/Bill inserts
    - Consumer Confidence Reports (CCRs)
- **Electronic media**
    - Social Media
    - Email blasts
    - Radio
    - Television
- **District Programs**
    - Choice School Programs
    - Scouts Programs
    - WEEA
    - Inspection Trip Program
    - WEROC
- **Ricky Raindrop**

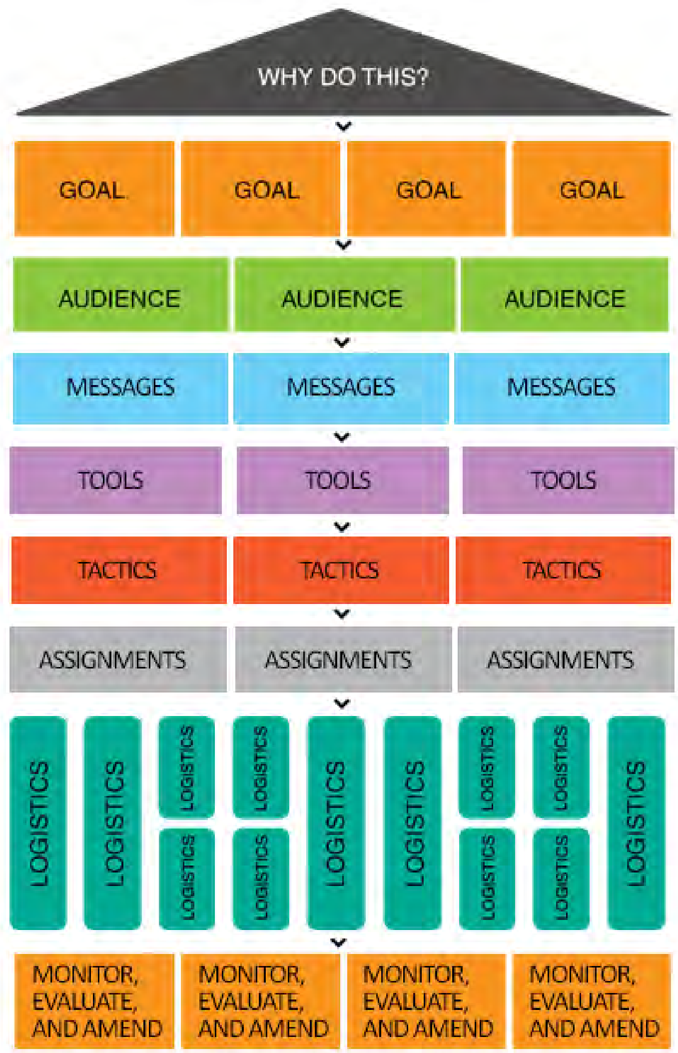
IMPLEMENTATION, ASSIGNMENTS, AND SCHEDULES

"Individual commitment to a group effort – that is what makes a team work, a company work, a society work, a civilization work."

~ Vince Lombardi, American Football Player & Coach

Public sector organizations shoulder a unique responsibility to be transparent, accountable, and have a positive impact on the community. A carefully developed and executed communications plan can establish trust and credibility in the District's programs and activities for our stakeholders, partners, audience members, and employees. This holds especially true in the water industry which is often vulnerable to changes in the political climate.

To effectively reach MWDOC's identified goals and objectives, each of the District's programs and activities must include *basic strategic targets* such as goals, intended audiences, messages, and tools. To ensure the benefit or value received is worth the time, money, talent, and effort expended by the District and its staff, every task, project, or program should start with the question "Why are we doing this?" In turn, all strategic targets should include an *implementation plan* which identifies tactics and logistics, and eventually, active monitoring, evaluation, and amending.



Assignments are essential to maintaining productivity and accountability as well as collectively accomplishing the goals of a project. The MWDOC Public Affairs Department has developed a Programs and Responsibility flowchart which breaks down the Department's primary roles and assignments by team member (See Appendix B).

Additionally, the MWDOC Public Affairs Department has developed a series of logistical checklists to efficiently plan, implement, and control the flow of information for each program and activity, and will continue to do so as new activities and programs are developed. Furthermore, the Department uses robust program management software tools such as Asana and CoSchedule to stay in touch with impending deadlines and to keep everything, including assignments and checklists, organized and in one place.

IMPLEMENTATION, ASSIGNMENTS, AND SCHEDULES

	Federal or State Elected Officials	Legislative Staffers	Orange County Elected Officials	Business Community Leaders	Environmental Organization Leaders	Community Organization Leaders	Water Industry Professionals	Landscape Contractor	Media	Educators	Students K – 6th	Students 7th–12th	College Students	Orange County Residents	Emergency Manager	Human Resources
GOALS																
Goal #1	X	X	X		X		X		X	X						
Goal #2	X	X	X	X	X	X	X		X	X	X	X	X	X	X	
Goal #3	X		X	X	X	X	X	X	X	X			X	X	X	X
MESSAGES																
Message #1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Message #2	X	X	X	X	X	X			X	X	X	X	X	X	X	
Message #3	X	X	X	X	X	X	X		X	X	X	X	X	X	X	
Message #4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Message #5	X		X	X	X	X	X			X	X	X	X	X		
Message #6				X				X					X	X		
Message #7				X		X		X					X	X		
Message #8	X		X	X	X	X	X	X		X	X	X	X	X	X	
Message #9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Message #10	X			X	X	X	X	X		X	X	X	X	X		
Message #11	X	X	X	X	X		X		X	X			X	X	X	
Message #12	X	X	X	X	X		X		X	X			X	X	X	
Message #13	X	X	X	X	X		X		X	X			X	X	X	
Message #14		X	X		X		X		X	X			X	X	X	
Message #15				X	X	X	X	X	X	X			X	X		
Message #16							X			X				X		
Message #17	X	X	X	X	X	X	X		X	X	X	X	X	X	X	
Message #18		X		X		X	X			X	X	X	X	X		X
Message #19	X	X		X	X	X	X			X	X	X	X	X		X
COMMUNICATIONS TOOLS AND CHANNELS																
Partnerships	X	X	X	X	X	X	X	X		X	X	X	X	X		X
Annual Campaigns	X	X	X	X	X	X	X		X	X	X	X	X	X		
Surveys	X	X	X	X	X		X	X		X				X	X	X
Word of Mouth	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Speaker Presentations	X	X	X	X	X	X	X		X	X	X	X			X	
Trainings							X	X		X				X	X	X
Conferences/Meetings	X	X	X	X	X	X	X		X	X					X	X
Community Events	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Print Media	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Electronic Media	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
District Programs	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Ricky Raindrop									X	X	X	X		X		
Virtual Platforms	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X

MONITOR, EVALUATE, AND AMEND

"Everything that can be counted does not necessarily count; everything that counts cannot necessarily be counted."

~ Albert Einstein, Theoretical Physicist

The effectiveness of the MWDOC Strategic Communications Program and Plan depends on a large variety of factors including technological advancements or changes, the rise and fall of audience engagement, current news or media concentration, political changes in leadership and focus, and even the weather.

There are a significant number of Key Performance Indicators (KPI), metrics and measurements that the MWDOC Public Affairs Department currently uses. Some of the most common include:

- Constant Contact activity reports- email marketing for surveys, events, newsletters, and news release distribution (results per activity)
    - Open rate
    - Click rate
    - Registration rate
        - Includes financial indicators
    - Responses
- Website (Google) Analytics
    - Return Visitor and First Visitor metrics
    - Web traffic and Search Engine Optimization (SEO) including landing pages and time spent on specific pages
    - Click through rate
    - Page views per session
    - Referral traffic
    - Content downloads
    - Use of forms such as newsletter, interest lists, and mailing list sign ups
- Social Media Dashboard Analytics (Facebook, Twitter, Instagram)
    - Followers
    - Likes/Fans
    - Post engagements
    - Content sharing
    - Sentiments
    - Link clicks
    - Inbound messages
    - Ad campaign performance
    - Ranking
- Verbal and Written Feedback
    - Phone calls
    - Email and written correspondence
    - Public comment at meetings

Program and activity evaluation is constant, and through this evaluation process the District's messaging and activities continue to be shaped and refined. Additionally, the tools mentioned here will remain relevant and useful no matter how the goals and objectives or messaging changes.

MWDOC BRAND

"Your brand is what people say about you when you're not in the room."

~ Jeff Bezos, American Technology Entrepreneur, Founder, Chairman, & CEO of Amazon

Many organizations downplay the value of branding because they view themselves as a business, not a brand. However, branding is a critical step to achieving success in communications, creating meaningful interactions, and establishing credibility. Branding is the sum of all the impressions an audience has of an organization. This is based on the interactions they have had with employees and Board members, as well as with the communications tools and channels that are used to reach them. Each of these interactions tells a story to the audience. For example, if materials are presented in a clean, organized, skillful, and contemporary fashion, the audience associates those materials with sophistication, expertise, and trustworthiness. The most important thing is to set expectations for the experience that the audience will have each time they interact with the brand, making it instantly recognizable. People need to identify with, and understand what information comes to them and from whom. How an audience perceives the brand will ultimately determine how successful an organization's efforts are. If an organization does not create and establish their own brand, their audience and competitors will do it for them.

Decades ago, branding was simply labeled a visual representation of an organization - a name, slogan, logo, or combination of all three. Today, it is understood that these elements, while extremely powerful and important, are just one piece of the puzzle. A brand is far more encompassing—it defines an organization's identity. Some of the benefits gained by strengthening the MWDOC brand include:

- **Builds trust and establishes credibility** – Credibility is at the heart of any successful outreach effort. Maintaining a consistent message demonstrates expertise, professionalism, and experience. Brand credibility is established by:
  - Non-verbal identifiers such as a logo or graphic materials
  - Verbal or written communications through marketing efforts
  - The organization's mission statement
  - Delivering expertise regularly through all identified channels
  - Consistently providing valuable information and resources

- **Fosters loyalty** – Once trust has been established, loyalty will soon follow. People who are loyal to a brand continue to support that organization in good times and bad, share positive messages, and introduce new audience groups to the organization.

- **Increased recognition or brand awareness** – One measurement of brand success is if an organization can be identified simply by its attributes such as the logo, tagline, or materials packaging. Brand familiarity can influence decisions when an audience must differentiate between messages that contain conflicting information. People are more likely to trust a brand they recognize.

- **Supports marketing and outreach efforts** – A brand links the name, logo, print materials, online presence, and professional services together bringing a united, clear, consistent message to all audience groups, and across all channels.

- **Extends range of influence** – Consistent branding is a powerful tool that has the potential to reach a large amount of people across a wide variety of channels including online, offline, mobile, and niche markets.

- **Motivates employees** – To build a strong brand, it is essential to have brand ambassadors – individuals, both internal and external, who are engaged, connected, and committed to the organization's activities and priorities. One of the most powerful, and more frequently overlooked brand assets is an organization's workforce. Employees spend a great deal of time at work, and as a result, form solid opinions about their employer. A contemporary, clean, consistent, and well-respected brand can institute a sense of pride, and can help inspire strong, internal brand ambassadors.

A strategic and thoughtfully developed brand should become the backbone of an organization's identity. It is a powerful communications tool which, when utilized correctly, will enable the District to build and establish credibility, as well as present an overall positive experience for identified audience groups. The MWDOC Public Affairs Department has developed the MWDOC Logo and Brand Identity Guidelines as a living document that will continue to grow and evolve along with the District (See Appendix C). The Department's consistent branding efforts align with the MWDOC Strategic Communications Program and Plan goals and objectives to successfully maintain and continue to enhance a brand presence throughout the Orange County region.

Federal or State Elected Official

Ambassador, Busy, Engaged, Educated, Driven

Goals & Objectives

- Goal #1
- Goal #2
- Goal #3

Activities & Partnerships

- ACWA
- OCBC
- SoCal Water Committee
- SWRCB
- Metropolitan & Member Agencies
- Media
- D.C. Luncheon

Messages

- Message #1-5
- Message #8-13
- Message #17
- Message #19

Channels

- Introduction to Water Booklet
- Briefing papers
- Written correspondence
- Virtual platforms
- Water Policy Forum
- O.C. Water Summit
- Elected Officials Forum
- Inspection Trips

Legislative Staffer

Political Emphasis, Educated, Involved, Ambitious, Adaptable

Goals & Objectives

- Goal #1
- Goal #2

Activities & Partnerships

- MWDOC Member Agencies
- ACC-OC
- Surveys
- D.C. Luncheon

Messages

- Message #1-4
- Message #9
- Message #11-14
- Message #17-19

Channels

- Introduction to Water Booklet
- Briefing papers
- Social media
- Virtual platforms
- Inspection Trips
- Water Policy Forum
- O.C. Water Summit
- Elected Officials Forum

OC Elected Official

Ambitious, Engaged, Traditional, Invested, Informed

Goals & Objectives

- Goal #1
- Goal #2
- Goal #3

Activities & Partnerships

- Elected Officials Forum
- ACC-OC
- Metropolitan & Member Agencies
- OCBC
- SoCal Water Committee
- SWRCB
- UWI
- AMWA
- ACWA
- AWWA

Messages

- Message #1-#5
- Message #8-#9
- Message #11-#14
- Message #17

Channels

- Introduction to Water Booklet
- Briefing papers
- Written correspondence
- Virtual platforms
- Inspection Trips
- D.C. Luncheon
- Water Policy Forum
- O.C. Water Summit
- Speaker presentations

Water Industry Professional

Authority, Steward, Knowledgeable, Focused, Forward-thinking

Goals & Objectives

- Goal #1
- Goal #2
- Goal #3

Activities & Partnerships

- Water-saving programs & incentives
- MWDOC Member Agencies
- Boy/Girl Scouts Organization
- Surveys
- Annual campaigns
- SWRCB
- AWWA
- UWI
- ACWA
- So Cal Water Committee

Messages

- Message #1
- Message #3-#5
- Message #8-#19

Channels

- Trainings and Workgroup Meetings
- Print media
- Electronic media
- CCRs
- Virtual platforms
- Community events
- District Programs
- Conferences and Meetings

Media

Persistent, Proactive, Inquisitive, Adventurous, Resilient

Goals & Objectives

- Goal #1
- Goal #2
- Goal #3

Activities & Partnerships

- Annual campaigns
- All identified partners if newsworthy

Messages

- Message #1-#4
- Message #9
- Message #11-#15
- Message #17

Channels

- Print media
- Electronic media
- Word of mouth
- Virtual platforms
- Water Policy Forum
- O.C. Water Summit
- Inspection Trips
- Ricky Raindrop

Business Community Leader

Influential, Resourceful, Accomplished, Motivated, Active

Goals & Objectives

- Goal #2
- Goal #3

Activities & Partnerships

- OCAR
- OCBC
- ACC-OC
- Imagine a Day Without Water
- Garden Smart campaign

Messages

- Messages #1-13
- Messages #15
- Messages #17-19

Channels

- Social media
- Flyers/Signage/Brochures
- Speaker presentations
- Door Hangers/Bill Inserts
- Surveys
- Word of mouth
- Virtual platforms
- WEEA
- Inspection Trips
- O.C. Water Summit
- Water Policy Forum

Community Organization Leader

Purposeful, Dynamic, Trustworthy, Dedicated, Economical

Goals & Objectives

- Goal #2
- Goal #3

Activities & Partnerships

- Boy/Girl Scouts Organizations
- Inspection Trips
- OCAR
- Water-saving programs & incentives
- Orange County Coastkeeper
- CAELI
- UCCE Master Gardeners
- Imagine a Day Without Water
- Garden Smart campaign
- Wyland National Mayor's Challenge for Water Conservation

Messages

- Message #1-5
- Message #7-10
- Message #15
- Message #17-19

Channels

- Social media
- Flyers/Signage/Brochures
- Speaker presentations
- Door Hangers/Bill Inserts
- Virtual platforms
- Word of mouth
- News stories
- Newsletters
- Briefing papers
- CCRs

Environmental Community Leader

Service-oriented, Passionate, Invested, Motivated, Aware

Goals & Objectives

- Goal #1
- Goal #2
- Goal #3

Activities & Partnerships

- Orange County Coastkeeper
- Bolsa Chica Conservancy
- CAELI
- Imagine a Day Without Water
- Wyland National Mayor's Challenge for Water Conservation

Messages

- Message #1-5
- Message #8-15
- Message #17
- Message #19

Channels

- Social media
- Surveys
- Speaker presentations
- Water Policy Forum
- Briefing papers
- CCRs
- Virtual platforms
- Community events
- Inspection Trips

Emergency Manager

Organized, Persuasive, Responsible, Driven, Decisive

Goals & Objectives

- Goal #2
- Goal #3

Activities & Partnerships

- Surveys
- DWR
- Technical consultants
- ACWA
- Other contractors
- Imagine a Day Without Water
- Emergency Preparedness Month
- MWDOC Member Agencies

Messages

- Message #1-4
- Message #8-9
- Message #11-14
- Message #17

Channels

- Speaker presentations
- Electronic media
- Trainings
- Conferences
- Virtual platforms
- Community events
- WEROC

Landscape Contractor

Expert, Thrifty, Creative, Hands-on, Detail-oriented

Goals & Objectives

- Goal #3

Activities & Partnerships

- MWDOC Member agencies
- OCAR
- Wyland Foundation
- UCCE Master Gardeners
- Smart Irrigation Month
- Irrigation Week
- Garden Smart campaign

Messages

- Message #1
- Message #4
- Message #6-10
- Message #15

Channels

- Flyers/Signage/Brochures
- Door Hangers/Bill Inserts
- Social media
- Trainings
- Virtual platforms

OC Residents

Diverse, Penny-wise, Family focused, Casual, Industrious

Goals & Objectives
- Goal #2
- Goal #3

Activities & Partnerships
- MWDOC Member Agencies
- Annual campaigns
- Water-saving programs & incentives
- Orange County Coastkeeper
- UCCE Master Gardeners
- OCDE
- CAELI
- OC STEM
- Boy/Girl Scouts Organizations

Messages
- Message #1-19

Channels
- Electronic media
- Surveys
- District Programs
- Word of mouth
- Door Hangers/Bill Inserts
- CCRs
- Promotional items
- Virtual platforms
- Community events

College Student

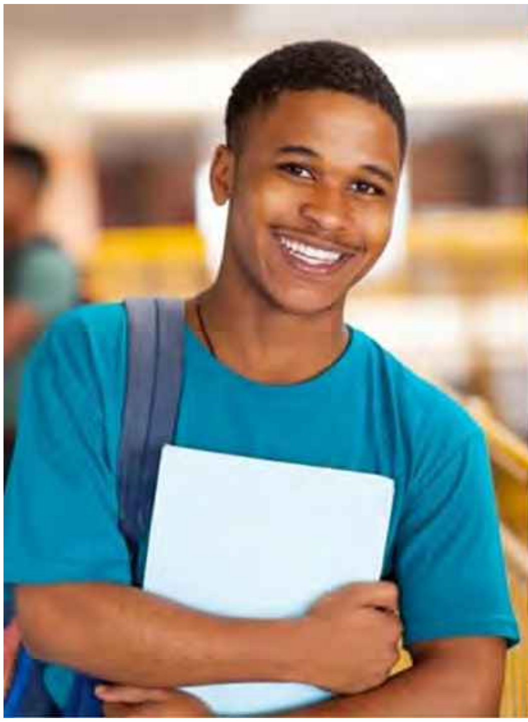
Independent, Perceptive, Receptive, Social, Frugal

Goals & Objectives
- Goal #2
- Goal #3

Activities & Partnerships
- Educators
- Surveys
- Bolsa Chica Conservancy
- Orange County Coastkeeper
- CAELI
- Imagine a Day Without Water
- Wyland National Mayor's Challenge for Water Conservation

Messages
- Messages #1-15
- Messages #17-19

Channels
- Social media
- Word of mouth
- Print media
- Electronic media
- Virtual platforms
- Community events



Student 7-12th Grade

Opinionated, Vulnerable, Eager, Trendy, Utopian

Goals & Objectives

- Goal #2

Activities & Partnerships

- Boy/Girl Scouts Organization
- Educators
- OCDE
- OC STEM
- CAELI
- Wyland Foundation
- MWDOC Water Awareness Poster Contest

Messages

- Message #1-#5
- Message #8-#15
- Message #17-#19

Channels

- Ricky Raindrop
- Community events
- Boy/Girl Scouts Programs
- MWDOC Choice School Programs
- Speaker presentations
- WEEA

Student K-6th Grade

Curious, Impressionable, Enthusiastic, Imaginative, Adaptive

Goals & Objectives

- Goal #2

Activities & Partnerships

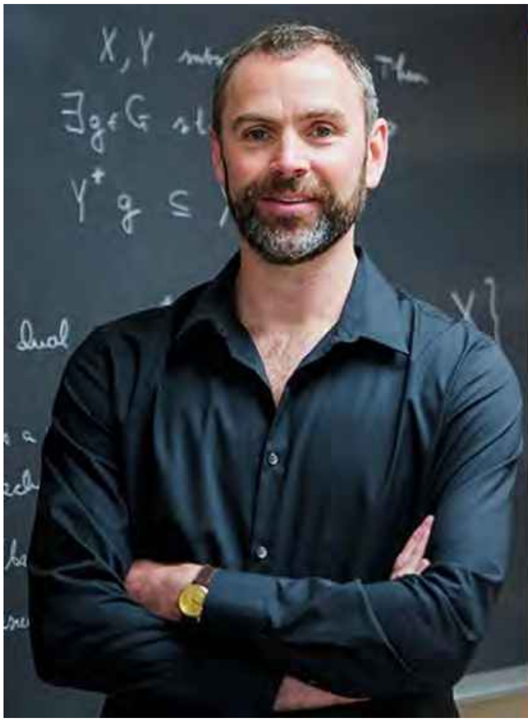
- Boy/Girl Scouts Organization
- Educators
- OCDE
- OC STEM
- CAELI
- Wyland Foundation
- MWDOC Water Awareness Poster Contest

Messages

- Message #1-#5
- Message #8-#10
- Message #17-#19

Channels

- Ricky Raindrop
- Community events
- Boy/Girl Scouts Program
- Choice School Programs



Educators

Intellectual, Industrious, Influential, Inventive, Innovative

Goals & Objectives

- Goal #1
- Goal #2
- Goal #3

Activities & Partnerships

- OCDC
- OC STEM
- CAELI
- School Program Contractor
- Imagine a Day Without Water
- MWDOC Water Awareness Poster Contest
- Wyland National Mayor's Challenge for Water Conservation

Messages

- Message #1-5
- Message #8-19

Channels

- Briefing papers
- Virtual platforms
- Trainings
- Word of mouth
- WEEA
- Boy/Girl Scouts Programs
- MWDOC Choice School Programs
- Introduction to Water Booklet
- Ricky Raindrop

APPENDIX B

Public Affairs Team Programs/Responsibilities

#P Digital Strategic Communications Consultant & Video Production

Damon Micalizzi
PA Director

Board Liaison and Support

Executive Management Team

Communications Advisor

Strategic Communications Forecasting and Planning

Member Agency Support

Media Relations and District Spokesperson

Influencer Partnerships

Interdepartmental Liaison

Interagency Relationship Development

Editorial Content Development

News Releases

OC Water Summit

Tiffany Baca
PA Manager

Daily Program, Staff, and Project Management

Evaluate, Refine, and Advance Existing Programs

New Program Development

Establish, Maintain, and Grow Strategic Partnerships

Strategic Message Development

Leader, Water Energy Education Alliance (WEEA)

Develop and Advance Education Program Initiatives

News Releases / Media Relations

Website Management

Social Media Oversight

Brand Manager

Public Affairs Workgroup

Sarah Wilson
PA Specialist

Member Agency and Board Support

Choice School Programs Coordination and Oversight

Scouts Programs Oversight

Public Outreach

Press Kit Development

Marketing Material Development

Graphic Support

Water Policy Dinners & Special Event Coordination

eCurrents Newsletter

Editorial Content Development

News Releases

Community Event Oversight

Bryce Roberto
PA Coordinator

Member Agency and Board Support

Inspection Trips Program Coordination

Public Outreach

Boy Scouts Program Coordination

Social Media Content Development

Marketing Material Development

Graphic Support

Briefing Papers/ Fact Sheets Maintenance

Research Projects Including Event Speaker Recommendations

Consumer Confidence Reports

Traci Muldoon
PA Assistant

Member Agency Support

PA Department Support

Registration Special Events

Social Media Content Development

Marketing Material Development

Graphic Support

Poster Contest Coordination

Community Event Coordination & Participation

Editorial Calendar

Research Projects

Press Clips

Promotional Items

Katie Vincent
Education Programs Assistant

Water Energy Education Alliance (WEEA) Program Support

Research Projects Related to Career Technical Education (CTE)

Identify, Secure, and Coordinate Grant and Sponsorship Funding

Identify and Secure WEEA Meeting Speakers

Provide Presentations on Workforce Development and CTE

Coordinate with Educators, Workforce Development Entities, and Industry on CTE

Marketing Material Development Specific to WEEA

Other Duties as Assigned

Municipal Water District of Orange County

Logo and Brand Identity Guidelines

Updated 06.29.2018

Brand Implementation

03 **Introduction**
Guidelines for brand identity and logo usage

04 **Color Palette**
Use these values when referring to color options

05 **Typeface**
Simple. Legible. Clean.

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Clean, crisp imagery

10 **Logo Design**
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11 **Logo Usage and Guidelines**
Always use approved artwork

Introduction

Guidelines for Brand Identity and Logo Usage

This logo and brand identity resource will provide guidelines for using the Municipal Water District of Orange County (MWDOC) logo and will introduce the color, typeface, and brand voice that should be used across all MWDOC communications. The elements described in this guide are a fundamental part of how others recognize and relate to MWDOC and these standards have been established to ensure the brand remains consistent in appearance, sound, and feel. While this resource covers most basic applications and instances of the MWDOC brand and use of the logo, it cannot anticipate all possible scenarios.

Any logo or brand identity issues not covered in this guide must be referred to:

MWDOC Public Affairs
Attn: Tiffany Baca
(714) 593.5013
tbaca@Mwdoc.com
18700 Ward Street
Fountain Valley, CA 92708

Color Palette

Use these values when referring to color options

The MWDOC brand and logo color palette was selected to project a modern, clean look while remaining true to the brand's historic color background. The basic, primary colors orange, green, and blue have been used in MWDOC's visual communications since 1971.

The colors shown on the opposite page should be incorporated into all MWDOC branded materials. Spot, process, and web color equivalents have been provided as reference in order to ensure consistency.

It is important to note that it is impossible to foretell what differences will occur between every printed and digital application of these selected colors. There are countless factors in which the appearance of any color may vary. To ensure the best result, always default to this guide, or when producing print or electronic materials through a selected vendor, consult a professional graphic designer or professional printer.

MWDOC White
Pantone: Bright White
Hex: ffffff
R: 255 G: 255 B: 255
C: 0 M: 0 Y: 0 K: 0
HTML: ffffff

MWDOC Green
Pantone: 7739
Hex: 319B42
R: 49 G: 155 B: 66
C: 80 M: 14 Y: 100 K: 2
HTML: 339933

MWDOC Light Blue
Pantone: Medium Blue C
Hex: 0084CA
R: 0 G: 132 B: 202
C: 82 M: 39 Y: 0 K: 0
HTML: 0099CC

MWDOC Dark Blue
Pantone: 7693
Hex: 004976
R: 0 G: 73 B: 118
C: 100 M: 75 Y: 30 K: 14
HTML: 003366

MWDOC Orange
Pantone: 1375 C
Hex: FF9E1B
R: 248 G: 156 B: 34
C: 0 M: 45 Y: 97 K: 0
HTML: FF9933

Typeface

Simple. Legible. Clean.

All variations of the MWDOC logo use only one font, **Franklin Gothic Demi**. This font style was selected for it's simplicity and legibility, and also because it is included as a default font style with any Microsoft Office installation. The goal with all of the selected typeface across the MWDOC brand is to keep it clean and simple.

That said, when producing materials with text, the typeface used should be consistent with the brand image. Typeface to be used in instances that require text are: **Franklin Gothic Demi, Franklin Gothic Medium, Franklin Gothic Book**, **Calibri**, **Calibri Light, Arial,** and in certain cases, **English**. The typeface referenced here should be used for all internal and public documents, stationery, outreach materials, promotional items, and correspondence.

(Franklin Gothic Demi)

Municipal Water District of Orange County

1234567890!@#$%^&*()

(Franklin Gothic Medium)

Municipal Water District of Orange County

1234567890!@#$%^&*()

(Franklin Gothic Book)

Municipal Water District of Orange County

1234567890!@#$%^&*()

(Calibri)

Municipal Water District of Orange County

1234567890!@#$%^&*()

(Calibri Light)

Municipal Water District of Orange County

1234567890!@#$%^&*()

(Arial)

Municipal Water District of Orange County

1234567890!@#$%^&*()

(English)

Municipal Water District of Orange County

1234567890!@#$%^&()*

Brand Voice and Messaging

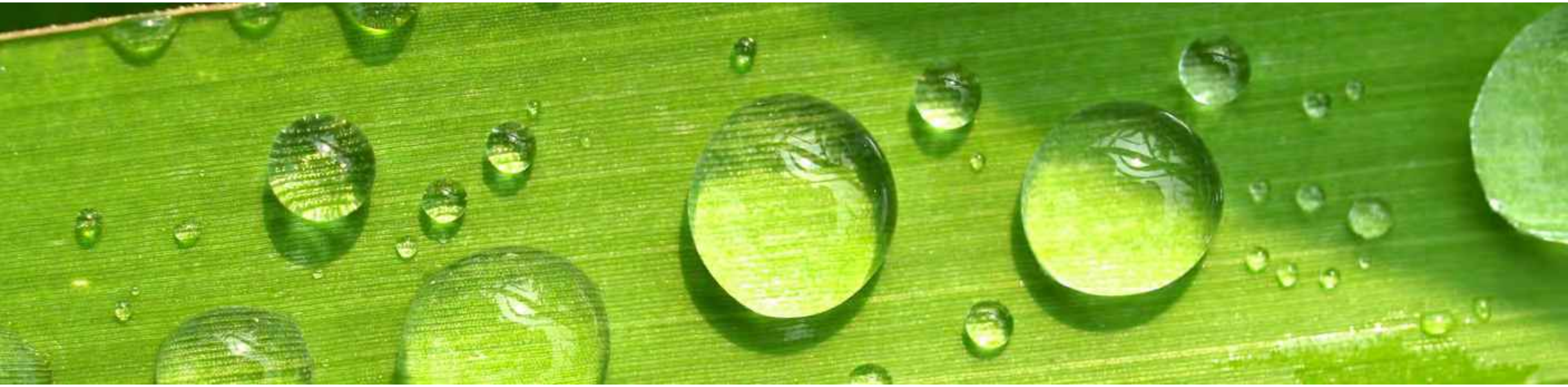
Purposeful, consistent expression through words

The brand voice consists of both **messaging** and **tone**. These two aspects come together to create an effective strategy when speaking to the public. It is important to create clear, consistent messaging that reflects the MWDOC brand personality. The brand message is simply MWDOC's mission statement. All roads lead back to the mission statement. The tone is how you are communicating the message.

Our Mission:

"To provide reliable, high-quality supplies from MWD and other sources to meet present and future needs, at an equitable and economical cost, and to promote water use efficiency for all of Orange County."

~ MWDOC



Brand Message

Have a plan – Have a goal

To create effective messaging, is important to tell a story from start to finish. Clarity and consistency are key. Always have a goal when preparing messages for both internal and external audiences. Define what you are trying to achieve. Plan key messages and action points before creating content to avoid including technical jargon and fluff where it is not needed. If your message requires the use of technical language and/or acronyms, spell it out in clear language for your audience. Avoid colloquialisms. Stick to the point, and be as succinct as possible.

The Lead

Introduction and main point(s)
Who, What, When, Where, Why

The Body

Evidence, background, primary details that support The Lead

The Tail

Least important information; details for those most interested

Brand Tone

Everything we write should be thoughtful, interesting, and human

In order to communicate effectively, you have to know who your audience is and present your message in a way that they understand and respond to. Essentially, each time you communicate with an audience, you need to tailor your message in order to engage them. Your voice is your voice, but you take on different tones depending on who you are speaking to - Elected Official vs Typical Homeowner, Education Partner vs School Children, or describing an event vs giving instructions. You may have to stretch or adapt your tone to fit the audience or platform. The tone that should be used to communicate the brand effectively should always be:

KNOWLEDGEABLE

INFORMATIVE

ENGAGING

PROFESSIONAL

TRUSTWORTHY

FOCUSED

CLEAR

CONSISTENT

APPROACHABLE

PHOTOGRAPHY

BRANDING





PHOTOGRAPHY

When choosing photographs for presentations, outreach, and promotional materials, select simple, clean imagery that aligns with the MWDOC brand. Whenever possible, use professional stock images that are clean and crisp. To assist with this, the MWDOC Public Affairs Department has put together a selection of presentation images that have been saved in the Shared O drive under Presentation Images.

BRANDING

Logo Design

The conceptual background

The original MWDOC logo was adopted in 1971 and since that time, has represented the organization throughout Southern California's water industry. The MWDOC logo became a recognized symbol of water resource planning, advocacy, and reliability for Orange County. When preparing the design for the new logo, it became very clear that the organization's history and reputation needed to be acknowledged by maintaining several key brand elements.

Staying true to the history of the MWDOC brand, colors in the original logo design, orange, green and blue, were maintained.

The water element was reintroduced in the new MWDOC logo design in a revitalized, modern way. The cool, water-blue-colored leaf was placed in the forefront of the design to symbolize water as MWDOC's primary focus.

There are hundreds of water agencies that serve California, and it can be difficult to differentiate which agency serves who. Through the use of color, a subtle statement is made by clearly separating MWD and OC.

MWDOC

Since 1971, the orange has been a primary element of the MWDOC brand, and it made sense to keep it. MWDOC serves and advocates on behalf of 2.3 million Orange County residents.

The font that was selected for the refreshed MWDOC logo is nearly the same weight as the font in the original logo design. However, the new design has cleaner lines with defined space between the letters, which will make it easier to read on embroidered materials.

Logo Usage and Guidelines

Always use approved artwork

The MWDOC logo acts as the primary visual component of the MWDOC brand. Therefore, it is critical to maintain the integrity of the logo and to be consistent with its usage. Never recreate, modify, or distort the MWDOC logo in any way, and always ensure you are using the correct logo artwork for the application or occasion. If for some reason another variation is needed outside of the scope defined in this guide, refer to the Public Affairs Department representative listed on page 3.

The distinct use of color helps to define MWDOC's brand identity. The MWDOC logo was developed to be most impactful in a four-color format. Although the four-color version is preferred and should be used whenever possible, black, white, and blue versions are available for secondary use in one-color media.

Logo Variations

Approved designs

The MWDOC logo was created with three approved versions, as shown on the right. These versions allow for flexibility to optimize the logo's visual presence across multiple applications and should not be altered.

The official logo consists of the MWDOC icon and acronym and should be considered the default choice for all applications. The secondary logo consists of the MWDOC icon and the full name "Municipal Water District of Orange County" and should be used in less formal applications or when the organization name is unknown or necessary. The third logo option includes the MWDOC icon and the official MWDOC website url. This option should be used in promotional applications only or in instances where it is critical to direct others to the official MWDOC website. A gradient version for all three logos is available for use only where you have flexibility to be more artistic or expressive.

Official MWDOC logo (Acronym only)

Promotional version referencing the website

Secondary MWDOC logo

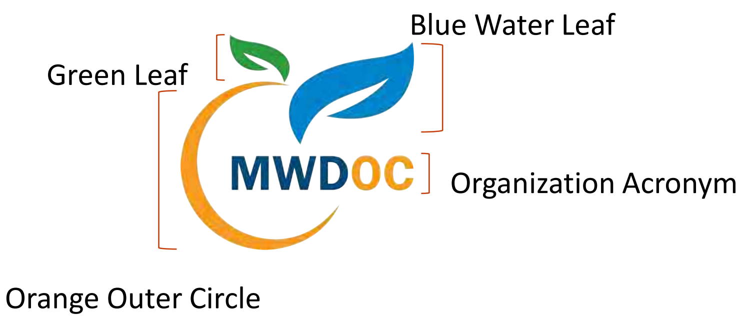
All three approved versions include a gradient option

Logo Configuration

Size relationship among the MWDOC logo elements and clearance area

The illustration below indicates the correct size relationship and configuration among the logo elements. These elements, their relative sizes, and their placement relative to each other must never be altered or modified.

Clearance area is the minimum distance allowed between the logo and any other element (graphic, type, or edge of page). This helps ensure legibility and enhances recognition. The clearance area around all four sides of the MWDOC logo must never be less than the height of the uppercase “M” in the official version of the logo. This is known as the “cap-height.”



Minimum Size

Maintain a minimum size for logo recognition

To ensure legibility of all versions of the MWDOC logo, a minimum size must be maintained at all times. All color and gradient variations of the **official logo** must not be displayed in any Microsoft Office program in a size smaller than 0.6 inches in height and 0.65 in width as shown in the example on the right.

All color and gradient variations of the **secondary logo** must not be displayed in any Microsoft Office program in a size smaller than 0.7 inches in height and 1.34 inches in width, as shown in the example on the right.

All color and gradient variations of the **MWDOC .com logo** must not be displayed in any Microsoft Office program in a size smaller than 0.6 inches in height and 0.88 inches in width, as shown in the example on the right.

The objective is to maintain legibility. If you cannot read the text, the logo is too small and needs to be resized.

Official version (Acronym only)
No smaller than 0.6 inches in height and 0.65 inches in width

Secondary logo (full text)
No smaller than 0.7 inches in height and 1.34 inches in width

.com logo
No smaller than 0.6 inches in height and 0.88 inches in width

Reverse Treatment

When to use the black and white MWDOC logo

A reversed (white) version of the MWDOC logo can be reproduced on a black or dark colored background. In one-color applications, sufficient contrast should be maintained by using the reverse logo on tonal values of 40% black or darker and a one-color black version of the logo on tonal values of lighter than 40%. If the MWDOC logo is superimposed upon or reversed out of a photograph, it should always be placed in an area that offers a consistent background and provides sufficient contrast.

Black	MWDOC Dark Blue	MWDOC Light Blue	MWDOC Orange
100%	85%	75%	65%
50%	40%	30%	20%

Incorrect Usage

Examples of common mistakes

In an attempt to prevent common mistakes when using the MWDOC logo, several examples of incorrect uses are displayed here for reference. These variations are representative, however, and are not all inclusive. Please refer to the overall standards throughout this guide when considering any form of reproduction or application of the MWDOC logo.

Before using any questionable variation of the logo, refer to the Public Affairs Department representative listed on page 3.

Do not change brand colors. Use the official color specification detailed in this guide.

Do not stretch, alter, or skew the logo. Resizing must be proportionate.

Do not rotate or flip the logo.

Do not reconfigure the logo elements.

Do not remove any of the logo elements.

Do not use the acronym element without the icon.

Do not crop the logo.

Do not modify the logo colors even if they look similar. Use the official color specification detailed in this guide.

Do not place the logo on top of a busy background.

Do not make the logo transparent.

Do not place the logo on top of a white box to make the logo legible, unless that box is part of an overall design.

Do not place the logo on a low-contrast or similar colored background if the logo elements are not clearly identifiable.

Logo on Low-Contrast or Similar Colored Background

Rule of thumb, refer to the Public Affairs representative on page 3

One of the most common issues with any logo placement is the unavoidable instance where the logo will be displayed on a low-contrast or similar colored background. One example of this is when you must use someone else's template for a presentation. The easiest fix is to select the white one-color logo option. However, when the best representation of the brand is to display the logo in full color, there are a few alternatives. The first is to select the full color option with MWD in white text. Another is to add a drop shadow (from the Microsoft shape options, shadow offset center option) to the logo which makes it pop out from the background. The last and least preferable option is to place a white stroke or outline around the logo. As mentioned in the introduction text, it is impossible to predict all scenarios or background variations that might come up. The rule of thumb is when in doubt, seek assistance from the Public Affairs representative on page 3 of this guide.

White stroke and drop shadow alternatives

MWD white text

THANK YOU

Thank you for supporting this significant milestone for our agency and for helping build the MWDOC brand. If you have any questions, please contact the Public Affairs representative referenced on page 3 of this guide.

Appendix D

Notice of Public Hearing (Pending)

MWDOC

Street Address:
18700 Ward Street
Fountain Valley, California 92708

Mailing Address:
P.O. Box 20895
Fountain Valley, CA 92728-0895

(714) 963-3058
Fax: (714) 964-9389
www.mwdoc.com

February 24, 2021

Michael Moore
Assistant General Manager, Water Services
Anaheim Public Utilities
Anaheim West Tower, 201 South Anaheim Blvd.
Anaheim, CA 92805

Subject: MWDOC 2020 Urban Water Management Plan Update

The Municipal Water District of Orange County (MWDOC) is in the process of preparing and updating its 2020 Urban Water Management Plan (UWMP) in compliance with the Urban Water Management Planning Act and the Water Conservation Act of 2009, commonly referred to as SBX7-7. An update of MWDOC's UWMP is required every five (5) years.

Water Code section 10621(b) requires an urban water supplier updating its UWMP to notify cities and counties within its service area of the update at least sixty (60) days prior to holding a public hearing. This letter serves as MWDOC's notice that it is preparing and updating its 2020 UWMP, to be adopted and submitted to the California Department of Water Resources before the July 1, 2021 deadline. Additionally, MWDOC will be adopting its Water Shortage Contingency Plan as part of the 2020 UWMP.

MWDOC is also considering an Addendum to the 2015 UWMP to demonstrate consistency with the Delta Plan Policy to Reduce Reliance on the Delta Through Improved Regional Water Self-Reliance (California Code Reg., tit. 23, § 5003). The 2015 UWMP Addendum and a copy of MWDOC's draft 2020 UWMP will be available for review on the MWDOC website (www.mwdoc.com) in spring of 2021, and MWDOC will subsequently hold noticed public hearings on the 2020 UWMP, Water Shortage Contingency Plan, and 2015 UWMP Addendum in advance of their adoption.

MWDOC invites you to submit comments and consult with MWDOC regarding its 2020 UWMP update, Water Shortage Contingency Plan, and 2015 UWMP Addendum. MWDOC anticipates holding a public comment period in spring 2021, with a public hearing planned during that time.

If you have any input for the matters contained in this notice letter, require additional information, or would like to set up a meeting to discuss MWDOC's 2020 UWMP update, please contact me at (714) 593-5027, or by email at hdelatorre@mwdoc.com.

Sincerely,

Harvey De La Torre
Assistant General Manager

MWDOC

Street Address:
18700 Ward Street
Fountain Valley, California 92708

Mailing Address:
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Fountain Valley, CA 92728-0895

(714) 963-3058
Fax: (714) 964-9389
www.mwdoc.com

February 24, 2021

Tony Olmos
Public Works Director
City of Brea
1 Civic Center Circle
Brea, CA 92821

Subject: MWDOC 2020 Urban Water Management Plan Update

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Harvey De La Torre
Assistant General Manager

MWDOC

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February 24, 2021

Nabil Henein
Director of Public Works/City Engineer
City of Buena Park
6650 Beach Boulevard
Buena Park, CA 90621

Subject: MWDOC 2020 Urban Water Management Plan Update

The Municipal Water District of Orange County (MWDOC) is in the process of preparing and updating its 2020 Urban Water Management Plan (UWMP) in compliance with the Urban Water Management Planning Act and the Water Conservation Act of 2009, commonly referred to as SBX7-7. An update of MWDOC's UWMP is required every five (5) years.

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Sincerely,

Harvey De La Torre
Assistant General Manager

MWDOC

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February 24, 2021

Hyejin Lee
Director of Public Works/City Engineer
City of Fountain Valley
10200 Slater Avenue
Fountain Valley, CA 92708

Subject: MWDOC 2020 Urban Water Management Plan Update

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Sincerely,

Harvey De La Torre
Assistant General Manager

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Fountain Valley, California 92708

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February 24, 2021

Meg McWade
Director of Public Works
City of Fullerton
303 W. Commonwalth Ave.
Fullerton, CA 92832

Subject: MWDOC 2020 Urban Water Management Plan Update

The Municipal Water District of Orange County (MWDOC) is in the process of preparing and updating its 2020 Urban Water Management Plan (UWMP) in compliance with the Urban Water Management Planning Act and the Water Conservation Act of 2009, commonly referred to as SBX7-7. An update of MWDOC's UWMP is required every five (5) years.

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Sincerely,

Harvey De La Torre
Assistant General Manager

MWDOC

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18700 Ward Street
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February 24, 2021

William Murray
Director of Public Works
City of Garden Grove
13802 Newhope Street
Garden Grove, CA 92840

Subject: MWDOC 2020 Urban Water Management Plan Update

The Municipal Water District of Orange County (MWDOC) is in the process of preparing and updating its 2020 Urban Water Management Plan (UWMP) in compliance with the Urban Water Management Planning Act and the Water Conservation Act of 2009, commonly referred to as SBX7-7. An update of MWDOC's UWMP is required every five (5) years.

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Sincerely,

Harvey De La Torre
Assistant General Manager

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February 24, 2021

Tom Herbel
Director of Public Works
City of Huntington Beach
2000 Main Street
Huntington Beach, ca 92648

Subject: MWDOC 2020 Urban Water Management Plan Update

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Sincerely,

Harvey De La Torre
Assistant General Manager

MWDOC

Street Address:
18700 Ward Street
Fountain Valley, California 92708

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February 24, 2021

Elias Saykali
Director of Public Works
City of La Habra
P.O. Box 337
La Habra, CA 90633-0337

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Mike Belknap
Public Works & Community Services Director
City of La Palma
7821 Walker Street
La Palma, CA 90623

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Mark Vukojevick
Utilities Director
City of Newport Beach
P.O. Box 1768
Newport Beach, CA 92660

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Christopher Cash
Director of Public Works
City of Orange
P.O. Box 449
Orange, CA 92886

Subject: MWDOC 2020 Urban Water Management Plan Update

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Harvey F. De La Torre

Harvey De La Torre
Assistant General Manager

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February 24, 2021

Tom Bonigutt
Public Works Director
City of San Clemente
910 Calle Negocio, Suite 100
San Clemente, CA 92672

Subject: MWDOC 2020 Urban Water Management Plan Update

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MWDOC

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February 24, 2021

Thomas Toman
Director of Public Works
City of San Juan Capistrano
32450 Paseo Adelanto
San Juan Capistrano, CA 92675

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Nabil Saba
Acting Public Works Director
City of Santa Ana
P.O. Box 1988, M-24
Santa Ana, CA 92702

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Steve Myrter
Director of Public Works
City of Seal Beach
211 8th Street
Seal Beach, CA 90740

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Douglas Stack
Director of Public Works
City of Tustin
300 Centennial Way
Tustin, CA 92780

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Marwan Youssef
Director of Public Works
City of Westminster
8200 Westminster Boulevard
Westminster, CA 92683

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

David Youngblood
General Manager
East Orange County Water District
185 North McPherson Road
Orange, CA 92869-3720

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Dennis Cafferty
General Manager
El Toro Water District
24251 Los Alisos Boulevard
Lake Forest, CA 92630

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Michael Dunbar
General Manager
Emerald Bay Service District
600 Emerald Bay
Laguna Beach, CA 92651

Subject: MWDOC 2020 Urban Water Management Plan Update

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Sincerely,

Harvey F. De La Torre

Harvey De La Torre
Assistant General Manager

MWDOC

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February 24, 2021

Ken Vecchiarelli
General Manager, Orange County
Golden State Water Company
2283 E. Via Burton
Anaheim, CA 92806

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Paul Cook
General Manager
Irvine Ranch Water District
P.O. Box 57000
Irvine, CA 92618

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Keith Van Der Maaten
General Manager
Laguna Beach County Water District
P.O. Box 987
Laguna Beach, CA 92651

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Paul Shoenberger, PE
General Manager
Mesa Water
1965 Placentia Avenue
Costa Mesa, CA 92627

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Joone Lopez
General Manager
Moulton Niguel Water District
P.O. Box 30203
Laguna Hills, CA 92607-0203

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Michael Markus
General Manager
Orange County Water District
P.O Box 8300
Fountain Valley, CA 92708

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Daniel Ferons
General Manager
Santa Margarita Water District
26111 Antonio Parkway
Rancho Santa Margarita, CA 92688

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Jerry Vilander, Jr.
General Manager
Serrano Water District
18021 East Lincoln Street
Villa Park, CA 92861-6446

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Rick Shintaku
General Manager
South Coast Water District
31592 West Street
Laguna Beach, CA 92651

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Fernando Paludi
General Manager
Trabuco Canyon Water District
32003 Dove Canyon Drive
Trabuco Canyon, CA 92679

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Brett Barbre
General Manager
Yorba Linda Water District
1717 East Miraloma Avenue
Placentia, CA 92870

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

James Treadaway
Public Works Director
Orange County
601 North Ross Street
Santa Ana, ca 92701

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Shaun Pelletier
Public Works Director
City of Aliso Viejo
12 Journey Suite 100
Aliso Viejo, CA 92656

Subject: MWDOC 2020 Urban Water Management Plan Update

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Sincerely,

Harvey De La Torre
Assistant General Manager

MWDOC

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18700 Ward Street
Fountain Valley, California 92708

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February 24, 2021

Raja Sethuraman
Director of Public Services
City of Costa Mesa
77 Fair Drive
Costa Mesa, CA 92626

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Doug Dancs
Public Works Director
City of Cypress
5275 Orange Avenue
Cypress, CA 90630

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Matt Sinacori
Public Works Director
City of Dana Point
33282 Golden Lantern
Dana Point, CA 92629

Subject: MWDOC 2020 Urban Water Management Plan Update

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Harvey F. De La Torre

Harvey De La Torre
Assistant General Manager

MWDOC

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February 24, 2021

Mark Steuer
Public Works Director
City of Irvine
1 Civic Center Plaza
Irvine, CA 92606

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Mark McAvoy
Public Works Director
City of Laguna Beach
505 Forest Avenue
Laguna Beach, CA 92651

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Ken Reynolds
Public Works Director
City of laguna Hills
24035 El Toro Road
Laguna Hills, CA 92653

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Jacki Scott
Public Works Director
City of Laguna Niguel
30111 Crown Valley Parkway
Laguna Niguel, CA 92677

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Akram Hindiyeh
City Engineer
City of Laguna Woods
24264 El Toro Road
Laguna Woods, CA 92637

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Thomas Wheeler
Public Works Director
City of Lake Forest
100 Civic Center Dr.
Lake Forest, CA 92630

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Chris kelley
City Engineer
City of Los Alamitos
3191 Katella Avenue
Los Alimitos, CA 90720

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Mark Chagnon
Public Works Director
City of Mission Viejo
200 Civic Center
Mission Viejo, CA 92691

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Luis Estevez
Public Works Director
City of Placentia
401 E Chapman Avenue
Placentia, CA 92870

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Brendan Dugan
Public Works Director
City of Rancho Santa Margarita
22112 El Paseo
Rancho Santa Margarita, CA 92688

Subject: MWDOC 2020 Urban Water Management Plan Update

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If you have any input for the matters contained in this notice letter, require additional information, or would like to set up a meeting to discuss MWDOC's 2020 UWMP update, please contact me at (714) 593-5027, or by email at hdelatorre@mwdoc.com.

Sincerely,

Harvey De La Torre
Assistant General Manager

MWDOC

Street Address:
18700 Ward Street
Fountain Valley, California 92708

Mailing Address:
P.O. Box 20895
Fountain Valley, CA 92728-0895

(714) 963-3058
Fax: (714) 964-9389
www.mwdoc.com

February 24, 2021

Allan Rigg
Public Works Director
City of Stanton
7800 Katella Avenue
Stanton, CA 90680

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Mike Knowles
Public Works Director
City of Villa Park
17855 Santiago Boulevard
Villa Park, CA 92861

Subject: MWDOC 2020 Urban Water Management Plan Update

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Assistant General Manager

MWDOC

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February 24, 2021

Jamie Lai
Public Works Director
City of Yorba Linda
4845 Casa Loma Avenue
Yorba Linda, CA 92886

Subject: MWDOC 2020 Urban Water Management Plan Update

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Sincerely,

Harvey De La Torre
Assistant General Manager

Appendix E

Adopted WSCP Resolution (Pending)

Arcadis U.S., Inc.
320 Commerce, Suite 200
Irvine
California 92602
Phone: 714 730 9052
www.arcadis.com

Maddaus Water Management, Inc.
Danville, California 94526
Sacramento, California 95816
Phone: 916 730 1456
www.maddauswater.com

APPENDIX J

Water Use Efficiency Implementation Report

Orange County

Water Use Efficiency Programs Savings
and
Implementation Report

Retrofits and Acre-Feet Water Savings for Program Activity

Program	Program Start Date	Retrofits Installed in	Month Indicated		Current Fiscal Year		Overall Program		
			Interventions	Water Savings	Interventions	Water Savings	Interventions	Annual Water Savings[4]	Cumulative Water Savings[4]
High Efficiency Clothes Washer Program	2001	June-20	91	0.26	0	0.00	121,432	4,189	33,965
Smart Timer Program - Irrigation Timers	2004	June-20	228	3.40	0	0.00	27,423	8,885	64,167
Rotating Nozzles Rebate Program	2007	June-20	0	0.00	0	0.00	570,818	2,789	23,762
Commercial Plumbing Fixture Rebate Program	2002	June-20	584	2.69	0	117.64	110,302	5,295	60,670
Industrial Process/Water Savings Incentive Program (WSIP)	2006	July-20	0	0.00	3	0.00	0	1,257	5,149
Turf Removal Program[3]	2010	July-20	87,920	1.03	87,920	8.20	23,023,586	3,224	16,549
High Efficiency Toilet (HET) Program	2005	June-20	8	0.03	0	0.00	60,567	2,239	21,870
Water Smart Landscape Program [1]	1997						12,677	10,621	72,668
Home Water Certification Program	2013						312	7.339	15.266
Synthetic Turf Rebate Program	2007						685,438	96	469
Ultra-Low-Flush-Toilet Programs [2]	1992						363,926	13,452	162,561
Home Water Surveys [2]	1995						11,867	160	1,708
Showerhead Replacements [2]	1991						270,604	1,667	19,083
Total Water Savings All Programs				**7**	**87,923**	**126**	**25,258,952**	**53,882**	**482,636**

(1) Water Smart Landscape Program participation is based on the number of water meters receiving monthly Irrigation Performance Reports.
(2) Cumulative Water Savings Program To Date totals are from a previous Water Use Efficiency Program Effort.
(3) Turf Removal Interventions are listed as square feet.
[4] Cumulative & annual water savings represents both active program savings and passive savings that continues to be realized due to plumbing code changes over time.

HIGH EFFICIENCY CLOTHES WASHERS INSTALLED BY AGENCY

through MWDOC and Local Agency Conservation Programs

Agency	FY 12/13	FY13/14	FY14/15	FY15/16	FY16/17	FY17/18	FY18/19	FY19/20	FY20/21	Total	Current FY Water Savings Ac/Ft (Cumulative)	Cumulative Water Savings across all Fiscal Years	15 yr. Lifecycle Savings Ac/Ft
Brea	93	115	114	76	57	55	53	36	-	2,011	0.00	562.09	1,041
Buena Park	105	106	91	76	54	50	46	28	-	1,642	0.00	447.38	850
East Orange CWD RZ	10	8	8	8	3	1	6	2	-	201	0.00	59.47	104
El Toro WD	134	121	111	65	47	50	40	29	-	1,640	0.00	448.04	849
Fountain Valley	115	102	110	76	65	48	39	34	-	2,521	0.00	736.15	1,304
Garden Grove	190	162	165	251	127	87	70	63	-	3,783	0.00	1,058.84	1,957
Golden State WC	265	283	359	260	138	156	92	95	-	5,358	0.00	1,503.23	2,772
Huntington Beach	334	295	319	225	180	139	93	115	-	8,593	0.00	2,548.98	4,446
Irvine Ranch WD	1,763	1,664	1,882	1,521	1,369	1,194	883	490	-	27,229	0.00	7,265.10	14,089
La Habra	82	114	87	66	53	48	48	46	-	1,469	0.00	394.49	760
La Palma	34	25	34	29	10	14	7	12	-	491	0.00	135.74	254
Laguna Beach CWD	38	37	39	32	19	20	18	16	-	986	0.00	280.60	510
Mesa Water	114	86	89	113	79	53	42	41	-	2,653	0.00	783.81	1,373
Moulton Niguel WD	442	421	790	688	574	524	357	298	-	11,099	0.00	2,893.60	5,743
Newport Beach	116	92	95	66	61	51	41	28	-	2,744	0.00	824.95	1,420
Orange	218	163	160	124	80	73	56	59	-	4,086	0.00	1,216.88	2,114
San Juan Capistran o	76	73	92	63	33	32	23	26	-	1,540	0.00	436.50	797
San Clemente	140	94	141	75	70	83	64	61	-	2,828	0.00	792.41	1,463
Santa Margarita WD	553	662	792	466	367	271	213	251	-	10,251	0.00	2,785.14	5,304
Seal Beach	31	29	38	23	9	17	8	21	-	648	0.00	182.31	335
Serrano WD	13	10	26	8	11	8	2	7	-	374	0.00	110.35	194
South Coast WD	89	79	68	43	44	36	28	30	-	1,678	0.00	470.72	868
Trabuco Canyon WD	30	45	47	34	28	22	13	12	-	845	0.00	235.90	437
Tustin	78	59	80	66	44	48	34	29	-	1,723	0.00	497.50	892
Westminster	121	82	109	149	84	65	46	36	-	2,733	0.00	773.73	1,414
Yorba Linda	181	167	156	123	55	66	43	62	-	3,922	0.00	1,166.59	2,029
MWDOC Totals	5,365	5,094	6,002	4,726	3,661	3,211	2,365	1,927	-	103,060	0.00	28,614.91	19,911
Anaheim	331	285	295	266	213	173	135	119	-	11,109	0.00	3,328.69	5,748
Fullerton	200	186	211	165	107	99	113	84	-	3,991	0.00	1,114.54	2,065
Santa Ana	163	131	132	259	141	124	128	49	-	3,272	0.00	906.40	1,693
Non-MWDOC Totals	694	602	638	690	461	396	376	252	-	18,372	0.00	5,349.63	3,549
Orange County Totals	6,059	5,696	6,640	5,416	4,122	3,607	2,741	2,179	-	121,432	0.00	33,964.54	23,460

SMART TIMERS INSTALLED BY AGENCY

through MWDOC and Local Agency Conservation Programs

	FY 12/13		FY 13/14		FY 14/15		FY 15/16		FY16/17		FY17/18		FY18/19		FY19/20		FY20/21		Total Program		Cumulative Water Savings across all Fiscal Years
Agency	**Res**	**Comm**	**Res**	**Comm**	**Res**	**Comm**	**Res**	**Comm**	**Res**	**Comm**	**Res**	**Comm**	**Res**	**Comm**	**Res**	**Comm**	**Res**	**Comm**	**Res**	**Comm.**	
Brea	9	8	4	0	43	6	20	4	31	4	32	0	33	0	31	0	0	0	227	80	650.09
Buena Park	3	0	0	0	4	10	7	4	10	7	15	3	17	7	22	1	0	0	85	52	225.69
East Orange CWD RZ	2	0	0	0	2	0	1	0	11	1	6	0	1	0	1	0	0	0	33	1	34.78
El Toro WD	7	2	11	0	8	9	9	17	33	8	29	4	34	0	21	3	0	0	199	362	2,982.96
Fountain Valley	3	2	4	0	7	10	13	1	33	12	28	12	36	4	41	(2)	0	0	196	54	278.03
Garden Grove	5	2	9	0	10	14	13	11	28	0	27	2	36	3	31	0	0	0	195	43	249.83
Golden State WC	9	49	9	25	39	12	35	16	56	37	88	6	85	15	89	0	0	0	487	213	1,147.32
Huntington Beach	18	33	20	35	19	2	42	12	88	94	70	30	105	65	71	21	0	0	518	384	1,631.53
Irvine Ranch WD	414	135	71	59	67	310	239	207	344	420	416	78	379	105	292	146	0	0	2,856	2,615	15,058.23
La Habra	4	7	2	0	4	7	3	1	12	7	8	0	19	3	22	(2)	0	0	85	45	272.16
La Palma	1	0	2	0	2	0	3	2	1	0	5	0	7	0	6	0	0	0	28	2	11.21
Laguna Beach CWD	76	2	71	0	86	0	86	1	27	0	11	0	8	0	15	0	0	0	531	20	310.69
Mesa Water	10	2	15	2	17	28	36	12	149	41	49	0	34	55	31	3	0	0	432	212	1,056.92
Moulton Niguel WD	51	74	40	45	46	95	163	100	236	129	284	33	316	64	279	45	0	0	1,793	943	5,001.61
Newport Beach	242	26	168	75	11	9	28	43	30	12	24	0	21	0	11	32	0	0	1,094	441	3,288.87
Orange	20	24	13	9	18	31	51	13	69	10	61	13	93	26	99	15	0	0	538	219	1,268.69
San Juan Capistrano	14	18	6	11	6	19	20	8	22	8	23	5	20	1	24	9	0	0	289	140	854.67
San Clemente	26	7	28	2	28	24	26	3	37	13	38	41	36	0	35	16	0	0	1,160	431	3,359.54
Santa Margarita WD	53	171	64	93	53	321	189	136	326	221	273	220	222	37	223	31	0	0	1,872	1,660	8,154.35
Seal Beach	1	0	1	36	1	12	2	2,446	2	4	5	0	6	31	10	0	0	0	28	2,533	8,531.75
Serrano WD	1	0	0	0	4	0	11	2	4	0	8	0	10	0	9	0	0	0	65	2	22.60
South Coast WD	13	16	8	4	104	73	9	11	7	0	15	2	7	7	14	0	0	0	314	221	1,475.46
Trabuco Canyon WD	6	0	2	0	6	1	16	50	13	3	20	0	33	0	35	0	0	0	191	157	1,178.53
Tustin	8	4	9	1	18	14	33	8	33	23	27	1	37	0	40	0	0	0	247	81	470.96
Westminster	1	1	2	0	13	17	7	1	17	12	22	0	24	0	20	0	0	0	131	44	268.38
Yorba Linda	20	0	12	5	32	2	61	27	72	71	68	10	74	4	111	5	0	0	591	202	1,154.22
MWDOC Totals	**1,017**	**583**	**571**	**402**	**648**	**1,026**	**1,123**	**3,136**	**1,691**	**1,137**	**1,652**	**460**	**1,693**	**427**	**1,583**	**323**	**0**	**0**	**14,185**	**11,157**	**58,939.06**
Anaheim	19	10	9	26	7	52	30	34	87	10	66	0	142	73	111	9	0	0	563	539	3,375.50
Fullerton	9	29	8	0	40	26	32	12	53	7	45	0	77	0	61	8	0	0	382	207	1,241.33
Santa Ana	8	19	7	8	9	27	22	26	15	3	16	0	24	20	19	129	0	0	141	249	611.32
Non-MWDOC Totals	**36**	**58**	**24**	**34**	**56**	**105**	**84**	**72**	**155**	**20**	**127**	**0**	**243**	**93**	**191**	**146**	**0**	**0**	**1086**	**995**	**5,228.15**
Orange County Totals	**1,053**	**641**	**595**	**436**	**704**	**1,131**	**1,207**	**3,208**	**1,846**	**1,157**	**1,779**	**460**	**1,936**	**520**	**1,774**	**469**	**-**	**-**	**15,271**	**12,152**	**64,167**

ROTATING NOZZLES INSTALLED BY AGENCY
through MWDOC and Local Agency Conservation Programs

	FY 13/14			FY 14/15			FY 15/16			FY 16/17			FY 17/18			FY 18/19			FY 19/20			FY 20/21			Total Program			Cumulative Water Savings across all Fiscal Years
	Small		Large	Small		Large	Small		Large	Small		Large	Small		Large	Small		Large	Small		Large	Small		Large	Small		Large	
Agency	Res	Comm.	Comm.	Res	Comm.	Comm.	Res	Comm.	Comm	Res	Comm.	Comm.	Res	Comm.	Comm.	Res	Comm.	Comm.	Res	Comm.	Comm.	Res	Comm.	Comm.	Res	Comm.	Comm.	
Brea	84	0	0	157	45	0	74	2,484	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	572	2,749	0	86.96
Buena Park	53	0	0	248	0	0	45	98	0	0	0	0	0	0	0	0	0	0	49	0	0	0	0	0	558	173	2,535	909.02
East Orange	30	0	0	221	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	781	0	0	25.10
El Toro	56	3,288	0	1,741	28,714	0	730	4,457	0	55	242	0	36	0	0	0	0	0	0	0	0	0	0	0	3,405	46,222	890	1,786.08
Fountain Valley	0	0	0	107	0	0	222	0	0	0	0	0	85	0	0	0	283	0	0	0	0	0	0	0	795	283	0	27.71
Garden Grove	80	0	0	88	50	0	110	0	0	55	98	0	52	0	0	0	0	0	72	0	0	0	0	0	1,057	299	0	43.46
Golden State	192	0	0	583	1,741	0	1,088	0	0	207	6,008	0	161	-495	0	35	259	0	63	1,652	0	0	0	0	3,707	12,732	0	414.03
Huntington Beach	120	0	0	798	1,419	0	1,345	2,836	0	149	3,362	0	-37	0	0	0	0	0	65	0	0	0	0	0	3,825	12,526	2,681	1,552.33
Irvine Ranch	11,010	4,257	0	1,421	632	0	1,989	5,047	0	335	9,511	0	356	-215	0	72	0	0	157	0	0	0	0	0	47,722	94,346	2,004	5,867.21
La Habra	15	0	0	109	338	0	300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	481	1,236	900	410.43
La Palma	0	0	0	0	0	0	46	505	0	0	2,385	0	33	0	0	0	0	0	0	0	0	0	0	0	89	2,890	0	61.87
Laguna Beach	2,948	878	0	2,879	1,971	0	1,390	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12,139	2,896	0	470.55
Mesa Water	361	0	0	229	0	0	166	0	0	113	0	0	36	0	0	0	0	0	50	0	0	0	0	0	2,116	385	343	226.89
Moulton Niguel	361	227	0	1,596	4,587	0	5,492	1,441	0	153	5,872	0	893	0	0	713	38	0	687	0	0	0	0	0	14,167	20,553	2,945	2,122.70
Newport Beach	19,349	6,835	0	460	3,857	0	348	670	0	0	0	0	45	0	0	0	0	0	0	0	0	0	0	0	46,723	21,413	0	2,312.34
Orange	245	120	0	304	668	0	631	91	0	0	0	0	0	0	0	30	0	0	67	0	0	0	0	0	3,267	1,072	0	145.68
San Juan Capistrano	370	0	0	495	737	0	310	593	0	75	123	0	59	0	0	40	1,400	0	58	0	0	0	0	0	5,652	10,252	0	548.86
San Clemente	415	5,074	0	326	0	0	426	0	0	0	0	0	146	0	0	0	0	0	35	0	0	0	0	0	10,170	7,538	1,343	975.61
Santa Margarita	389	0	0	1,207	1,513	0	1,820	837	0	15	0	0	224	0	0	30	0	0	229	0	0	0	0	0	16,648	6,921	611	997.51
Seal Beach	0	0	0	40	5,261	0	0	2,300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	155	7,852	0	220.24
Serrano	105	0	0	377	0	0	695	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,405	0	0	117.83
South Coast	70	0	0	4,993	13,717	0	1,421	2,889	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,130	18,870	0	768.96
Trabuco Canyon	0	0	0	56	0	0	130	0	0	0	4,339	0	0	0	0	0	0	0	0	0	0	0	0	0	2,086	5,130	0	196.90
Tustin	329	0	0	408	0	0	317	386	0	65	-341	0	30	0	0	47	0	0	55	0	0	0	0	0	3,503	1,058	0	152.23
Westminster	0	0	0	54	0	0	73	0	0	105	0	0	50	0	0	42	0	0	0	0	0	0	0	0	556	0	0	16.12
Yorba Linda	40	990	0	921	0	0	1,715	0	0	213	0	0	0	0	0	34	0	0	0	0	0	0	0	0	6,115	4,359	500	556.57
MWDOC Totals	36,622	21,669	0	19,818	65,250	0	20,883	24,634	0	1,556	31,599	0	2,199	-710	0	1,043	1,980	0	###	1,652	0	0	0	0	197,824	281,755	14,752	21,013.19
Anaheim	338	0	0	498	712	0	794	5,221	0	147	3,953	0	0	0	0	0	0	0	0	0	0	0	0	0	4,020	49,799	105	1,672.74
Fullerton	107	0	0	684	1,196	0	521	7,015	0	65	3,034	0	0	0	0	140	0	0	75	0	0	0	0	0	3,125	11,309	1,484	881.09
Santa Ana	86	2,533	0	310	0	0	0	1,420	0	0	1,106	0	0	0	0	0	0	0	34	0	0	0	0	0	893	5,752	0	195.31
Non-MWDOC Totals	531	2,533	0	1,492	1,908	0	1,315	13,656	0	212	8,093	0	0	0	0	140	0	0	109	0	0	0	0	0	8,038	66,860	1,589	2,749.14
Orange County Totals	37,153	24,202	0	21,310	67,158	0	22,198	38,290	0	1,768	39,692	0	2,199	-710	0	1,183	1,980	0	###	1,652	0	0	0	0	205,862	348,615	16,341	23,762.33

COMMERCIAL PLUMBING FIXTURES INSTALLED BY AGENCY[1]

through MWDOC and Local Agency Conservation Programs

Agency	FY 12/13	FY 13/14	FY 14/15	FY 15/16	FY 16/17	FY 17/18	FY 18/19	FY 19/20	FY 20/21	Totals	Cumulative Water Savings across all Fiscal Years
Brea	234	0	10	91	734	242	0	74	0	**1,681**	**756**
Buena Park	5	23	56	591	133	49	0	94	0	**2,632**	**1,656**
East Orange CWD RZ	0	0	0	0	0	0	0	0	0	**0**	**0**
El Toro WD	0	212	6	268	35	737	717	0	0	**2,516**	**929**
Fountain Valley	0	0	1	249	0	895	0	398	0	**2,165**	**946**
Garden Grove	4	1	167	676	410	0	354	388	0	**3,193**	**2,175**
Golden State WC	0	1	0	1,008	53	93	86	80	0	**3,124**	**2,676**
Huntington Beach	104	144	7	783	641	10	208	270	0	**3,442**	**2,352**
Irvine Ranch WD	1,090	451	725	11,100	5,958	1,599	1,000	15	0	**30,480**	**12,331**
La Habra	0	0	0	340	42	0	0	59	0	**984**	**786**
La Palma	0	0	0	0	509	0	0	0	0	**675**	**215**
Laguna Beach CWD	0	27	0	0	0	0	0	0	0	**446**	**435**
Mesa Water	6	0	79	661	782	0	110	19	0	**4,383**	**3,035**
Moulton Niguel WD	0	0	3	413	281	506	4,392	764	0	**6,939**	**1,808**
Newport Beach	0	0	566	0	0	0	1,596	16	0	**3,446**	**1,998**
Orange	1	271	81	275	2,851	458	532	395	0	**6,415**	**2,805**
San Juan Capistrano	0	14	0	0	0	0	0	0	0	**260**	**518**
San Clemente	0	0	1	0	0	0	0	321	0	**753**	**530**
Santa Margarita WD	0	0	2	90	743	598	699	0	0	**2,247**	**528**
Seal Beach	0	0	0	0	184	278	0	0	0	**816**	**611**
Serrano WD	0	0	0	0	0	0	0	0	0	**0**	**0**
South Coast WD	148	0	382	0	0	0	0	0	0	**1,320**	**782**
Trabuco Canyon WD	0	0	0	0	0	0	0	0	0	**11**	**20**
Tustin	0	0	75	358	212	2	408	254	0	**2,066**	**1,251**
Westminster	1	28	0	146	177	25	0	252	0	**1,415**	**1,401**
Yorba Linda	1	0	0	226	84	338	0	83	0	**1,016**	**815**
MWDOC Totals	**1,594**	**1,172**	**2,161**	**17,275**	**13,829**	**5,830**	**10,102**	**3,482**	**0**	**82,425**	**41,363**
Anaheim	165	342	463	3,072	309	1,808	686	592	0	**16,839**	**10,159**
Fullerton	94	0	178	476	621	274	384	356	0	**3,792**	**2,474**
Santa Ana	16	17	5	1,293	238	582	7	920	0	**7,246**	**6,675**
Non-MWDOC Totals	**275**	**359**	**646**	**4,841**	**1,168**	**2,664**	**1,077**	**1,868**	**0**	**27,877**	**19,308**
Orange County Totals	**1,869**	**1,531**	**2,807**	**22,116**	**14,997**	**8,494**	**11,179**	**5,350**	**0**	**110,302**	**60,670**

[1] Retrofit devices include ULF Toilets and Urinals, High Efficiency Toilets and Urinals, Multi-Family and Multi-Family 4-Liter HETs, Zero Water Urinals, High Efficiency Clothes Washers, Cooling Tower Conductivity Controllers, Ph Cooling Tower Conductivity Controllers, Flush Valve Retrofit Kits, Pre-rinse Spray heads, Hospital X-Ray Processor Recirculating Systems, Steam Sterilizers, Food Steamers, Water Pressurized Brooms, Laminar Flow Restrictors, and Ice Making Machines.

INDUSTRIAL PROCESS/WATER SAVINGS INCENTIVE PROGRAM

Number of Projects by Agency

Agency	FY 11/12	FY 12/13	FY 13/14	FY 14/15	FY 15/16	FY 16/17	FY 17/18	FY 18/19	FY 19/20	FY 20/21	Overall Program Interventions	Annual Water Savings[1]	Cumulative Water Savings across all Fiscal Years[1]
Brea	0	0	0	0	0	0	0	0	0	0	0	0	0
Buena Park	0	0	0	0	1	0	0	0	0	0	2	54	627
East Orange	0	0	0	0	0	0	0	0	0	0	0	0	0
El Toro	0	0	0	0	0	0	0	1	0	0	1	9	17
Fountain Valley	0	0	0	0	0	1	0	0	0	0	1	23	79
Garden Grove	0	0	0	0	1	0	0	0	1	0	2	7	6
Golden State	0	0	0	0	0	0	0	0	1	0	2	58	78
Huntington Beach	0	2	0	1	2	0	1	0	0	0	6	180	987
Irvine Ranch	1	1	1	0	2	1	1	0	0	0	10	119	910
La Habra	0	0	0	0	1	0	0	0	0	0	1	0	1
La Palma	0	0	0	0	0	0	0	0	0	0	0	0	0
Laguna Beach	0	0	0	0	0	0	0	0	0	0	0	0	0
Mesa Water	0	0	0	0	0	0	0	0	0	0	0	0	0
Moulton Niguel	0	0	0	0	0	0	0	0	0	0	0	0	0
Newport Beach	0	0	0	1	0	0	0	0	0	0	1	21	120
Orange	0	0	0	0	1	2	1	0	0	0	5	97	723
San Juan Capistrano	0	0	0	0	0	0	0	0	0	0	0	0	0
San Clemente	0	0	0	0	0	0	0	0	0	0	0	0	0
Santa Margarita	0	0	0	0	0	0	0	0	0	0	0	0	0
Seal Beach	0	0	0	0	0	0	0	0	0	0	0	0	0
Serrano	0	0	0	0	0	0	0	0	0	0	0	0	0
South Coast	0	0	0	0	1	1	0	0	0	0	2	134	459
Trabuco Canyon	0	0	0	0	0	0	0	0	0	0	0	0	0
Tustin	0	0	0	0	0	0	0	0	0	0	0	0	0
Westminster	0	0	0	0	0	0	0	1	0	0	1	117	146
Yorba Linda	0	0	0	0	0	0	0	1	0	0	1	20	38
MWDOC Totals	1	3	1	2	9	5	3	3	2	0	35	840	4192
Anaheim	0	0	0	0	0	0	0	0	0	0	0	0	0
Fullerton	0	0	0	0	0	0	0	0	1	0	1	282	282
Santa Ana	0	0	0	0	1	0	0	0	0	0	1	135	675
OC Totals	1	3	1	2	10	5	3	3	3	0	37	1257	5149

[1] Acre feet of savings determined during a one year monitoring period.

If monitoring data is not available, the savings estimated in agreement is used.

TURF REMOVAL BY AGENCY[1]

through MWDOC and Local Agency Conservation Programs

Agency	FY 13/14		FY 14/15		FY 15/16		FY 16/17		FY 17/18		FY 18/19		FY 19/20		FY 20/21		Total Program		Cumulative Water Savings across all Fiscal Years
	Res	Comm.	Res	Comm.	Res	Comm.	Res	Comm.	Res	Comm.	Res	Comm.	Res	Comm.	Res	Comm.	Res	Comm.	
Brea	5,697	0	71,981	30,617	118,930	404,411	8,354	479	9,853	27,234	3,180	44,733	8,244	0	0	0	237,241	516,940	
Buena Park	0	0	11,670	1,626	77,127	16,490	3,741	0	4,586	0	1,230	0	7,222	0	0	0	105,576	18,116	
East Orange	1,964	0	18,312	0	27,844	0	0	0	0	0	0	0	0	0	0	0	48,120	0	
El Toro	4,582	0	27,046	221,612	63,546	162,548	13,139	48,019	7,273	42,510	12,856	9,895	5,203	21,290	3,018	0	146,066	578,592	
Fountain Valley	4,252	0	45,583	5,279	65,232	0	3,679	0	8,631	0	5,764	28,700	734	0	0	0	135,857	41,503	513.87
Garden Grove	8,274	0	67,701	22,000	177,408	49,226	11,504	0	4,487	0	0	0	0	0	0	0	287,921	117,403	82.44
Golden State	32,725	8,424	164,507	190,738	310,264	112,937	0	0	0	0	0	48,595	0	0	0	0	581,902	394,867	36.80
Huntington Beach	20,642	0	165,600	58,942	305,420	270,303	9,560	21,534	14,236	6,032	9,539	40,135	10,225	13,193	3,235	0	576,107	475,065	526.23
Irvine Ranch	36,584	76,400	234,905	317,999	782,844	2,675,629	231,483	46,725	86,893	61,037	55,346	203,014	23,465	30,267	1,992	3,164	1,498,269	3,461,079	117.71
La Habra	0	0	14,014	1,818	49,691	72,164	0	0	3,003	0	1,504	0	6,102	0	1,793	0	76,107	90,019	337.17
La Palma	0	0	4,884	0	10,257	59,760	0	0	0	0	0	0	0	0	0	0	15,141	59,760	780.47
Laguna Beach	4,586	226	13,647	46,850	47,614	0	3,059	0	589	0	0	0	1,217	0	0	0	76,887	48,788	782.22 3,389.45
Mesa Water	22,246	0	131,675	33,620	220,815	106,896	4,173	77,033	17,373	77,785	3,023	0	16,189	47,075	0	0	432,938	342,409	
Moulton Niguel	14,739	40,741	314,250	1,612,845	889,748	1,059,279	220,749	0	98,271	0	106,574	0	81,778	18,951	3,052	61,129	1,746,138	2,920,134	122.86
Newport Beach	894	0	33,995	65,277	76,675	375,404	2,924	0	5,938	6,499	0	90,403	1,294	0	455	0	129,177	539,929	53.11
Orange	11,244	0	120,093	281,402	289,990	106,487	12,847	2,366	11,956	0	13,645	1,798	2,190	0	0	0	490,887	400,776	100.54
San Clemente	18,471	13,908	90,349	1,137	215,249	438,963	4,267	0	33,083	7,098	6,500	0	6,420	13,719	5,213	0	417,116	487,990	492.34 3,403.10
San Juan Capistrano	12,106	0	101,195	32,366	197,290	143,315	2,624	40,748	0	0	0	0	0	0	0	0	365,415	347,277	
Santa Margarita	17,778	48,180	211,198	514,198	534,048	550,420	17,010	28,094	62,706	25,000	24,616	23,198	11,357	51,999	2,542	0	897,853	1,269,650	442.28
Seal Beach	0	0	15,178	504	17,349	15,911	1,234	0	752	0	0	0	996	0	0	0	39,120	16,415	686.27
Serrano	2,971	0	41,247	0	127,877	4,403	5,450	0	555	0	4,000	0	840	0	0	0	182,940	4,403	644.62
South Coast	15,162	116,719	84,282	191,853	181,102	128,290	14,967	0	13,319	7,806	7,574	0	25,465	50,879	0	0	358,106	516,266	609.46 1,560.40
Trabuco Canyon	2,651	0	14,771	0	42,510	88,272	1,465	0	4,788	0	1,536	0	4,752	49,533	0	0	74,287	160,245	
Tustin	1,410	0	71,285	14,137	232,697	33,362	11,173	0	16,926	0	13,189	6,894	15,343	6,936	1,613	0	373,616	61,329	41.54
Westminster	0	0	14,040	34,631	71,833	23,902	11,112	0	10,033	0	5,924	0	1,962	0	0	0	114,904	58,533	134.60
Yorba Linda	0	0	112,136	12,702	360,279	116,985	19,420	0	9,529	3,696	12,590	12,020	7,773	0	714	0	533,790	145,403	651.77
MWDOC Totals	**238,978**	**304,598**	**2,195,544**	**3,692,153**	**5,493,639**	**7,015,357**	**613,934**	**264,998**	**424,780**	**264,697**	**288,590**	**509,385**	**238,771**	**303,842**	**23,627**	**64,293**	**9,941,481**	**13,072,891**	**143.94**
																			290.29 **118.86**
Anaheim	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**16,539.75 477.38**
Fullerton	0	9,214	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,214	
Santa Ana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Non-MWDOC Totals	**0**	**9,214**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**9,214**	**9.03**
Orange County Totals	**238,978**	**313,812**	**2,195,544**	**3,692,153**	**5,493,639**	**7,015,357**	**613,934**	**264,998**	**424,780**	**264,697**	**288,590**	**509,385**	**238,771**	**303,842**	**23,627**	**64,293**	**9,941,481**	**13,082,105**	**16,549**

[1]Installed device numbers are listed as square feet

9.03

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HIGH EFFICIENCY TOILETS (HETs) INSTALLED BY AGENCY

through MWDOC and Local Agency Conservation Programs

Agency	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19	FY 19-20	FY 20-21	Total	Cumulative Water Savings across all Fiscal Years
Brea	0	38	146	154	4	6	1	0	0	**457**	**135.98**
Buena Park	0	96	153	112	13	3	0	2	0	**689**	**244.67**
East Orange CWD RZ	0	13	26	24	0	0	0	2	0	**88**	**27.92**
El Toro WD	133	218	869	264	12	6	10	5	0	**2,058**	**699.67**
Fountain Valley	0	41	132	220	7	8	1	3	0	**835**	**314.34**
Garden Grove	0	63	350	363	7	4	5	3	0	**1,496**	**538.88**
Golden State WC	2	142	794	512	9	11	5	7	0	**2,813**	**997.71**
Huntington Beach	0	163	1,190	628	4	3	4	2	0	**2,910**	**946.09**
Irvine Ranch WD	1,449	810	1,777	2,798	638	239	162	66	0	**17,376**	**6,772.94**
Laguna Beach CWD	0	45	112	81	1	4	0	2	0	**394**	**134.95**
La Habra	0	37	94	83	5	1	0	0	0	**591**	**241.01**
La Palma	0	21	59	52	4	2	4	3	0	**231**	**76.14**
Mesa Water	0	147	162	162	7	3	3	15	0	**1,639**	**720.61**
Moulton Niguel WD	0	400	2,497	1,939	49	38	21	17	0	**5,766**	**1,591.16**
Newport Beach	0	49	168	243	11	6	0	0	0	**731**	**239.39**
Orange	1	142	978	416	17	10	5	4	0	**2,198**	**702.74**
San Juan Capistrano	0	35	140	202	3	9	4	0	0	**536**	**162.75**
San Clemente	0	72	225	246	11	6	10	1	0	**889**	**294.17**
Santa Margarita WD	0	528	997	1,152	114	33	11	18	0	**3,371**	**938.51**
Seal Beach	2	17	50	69	-1	0	0	0	0	**857**	**458.19**
Serrano WD	0	2	40	55	3	0	3	0	0	**124**	**34.09**
South Coast WD	64	102	398	235	11	7	0	0	0	**1,028**	**310.30**
Trabuco Canyon WD	0	10	108	169	2	3	2	0	0	**344**	**92.74**
Tustin	0	64	132	201	12	10	4	7	0	**1,527**	**654.64**
Westminster	0	35	161	359	3	4	0	0	0	**1,335**	**517.43**
Yorba Linda WD	0	40	280	379	12	8	2	6	0	**1,267**	**442.95**
MWDOC Totals	1,651	3,330	12,038	11,118	958	424	257	163	0	**51,550**	**18,289.97**
Anaheim	0	156	1,188	614	70	19	5	11	0	**5,900**	**2,444.76**
Fullerton	0	61	293	286	14	9	8	7	0	**1,079**	**360.48**
Santa Ana	0	33	602	293	20	0	4	8	0	**2,033**	**774.58**
Non-MWDOC Totals	0	250	2,083	1,193	104	28	17	26	0	**9,012**	**3,579.81**
Orange County Totals	**1,651**	**3,580**	**14,121**	**12,311**	**1,062**	**452**	**274**	**189**	**0**	**60,562**	**21,869.79**

APPENDIX K

MWDOC's Demand Management Measures

1 WHOLESALE SUPPLIER ASSISTANCE PROGRAMS

As described in the 2020 UWMP Section 9, MWDOC provides financial incentives, conservation-related technical support, and regional implementation of a variety of demand management programs. In addition, MWDOC is providing assistance with compliance of the Conservation Framework and conducts research projects to evaluate implementation of both existing programs and new pilot programs. On behalf of its member agencies, MWDOC also organizes and provides the following:

- Monthly coordinator meetings
- Marketing materials
- Public speaking
- Community events
- Legislation compliance assistance

The many programs that MWDOC offers to Orange County on behalf of retail water agencies is described in detail in the following sections.

1.1 Landscape Ordinance

The Water Conservation in Landscaping Act (Assembly Bill 1881, Laird) was passed in 2006 to increase outdoor water use efficiency. Governor Brown's Drought Executive Order of April 1, 2015 (EO B-29-15) directed DWR to update the State's Model Water Efficient Landscape Ordinance (Ordinance) through expedited regulation. The California Water Commission approved the revised Ordinance on July 15, 2015.

This legislation required cities and counties to adopt a Water Efficient Landscape Ordinance by December 1, or adopt their own ordinance, which must be at least as effective in conserving water as the State's Ordinance. Local agencies working together to develop a regional ordinance had until February 1, 2016. MWDOC worked in partnership with the Orange County Division of the League of Cities, the County of Orange, Orange County cities, retail water providers, building industry, landscape architects, and irrigation consultants to develop an Orange County Model Water Efficient Landscape Ordinance specific to the needs of Orange County. The foundation of the Orange County Model Ordinance was based on the State Model Ordinance.

This collaborative, regional approach has ensured that local ordinances are consistent from city to city, and has limited the cost and complexity of implementing the mandate. Based on the Orange County model ordinance, cities and unincorporated areas have adopted local ordinances that set guidelines for designing and approving landscape projects. The new ordinance imposes a lower Maximum Applied Water Allowance (MAWA) that new and rehabilitated landscapes must be designed to meet.

Through this effort, cities throughout Orange County have adopted and are implementing landscape ordinances that are consistent with the requirements of the updated Water Conservation in the Landscape Act.

Today, MWDOC continues to provide the County and city planning departments with training on administering the Landscape Ordinance. This is done in partnership with the California Department of Water Resources, Metropolitan Water District of Southern California and California Landscape Contractors Association (Orange County Chapter). Additionally, MWDOC acts as a communication channel to disseminate reporting requirements and workshop notices from DWR to local ordinance administrators.

1.2 Metering

Metering with commodity rates by wholesale and retail agencies has been an industry standard throughout Orange County for many years. All customers are metered and billed based on commodity rates either monthly or bi-monthly.

With the sale of the Allen-McColloch Pipeline to Metropolitan in 1995, MWDOC no longer owns or operates a distribution system. Water purchased and sold by MWDOC is distributed through Metropolitan's system to the MWDOC retail agencies.

1.3 Conservation Pricing

MWDOC promotes conservation pricing and has helped water retailers shift away from uniform rates in Orange County. In 2008, MWDOC was awarded an Urban Drought Assistance grant from Department of Water Resources to assist Orange County retailers examine and implement budget-based tiered rates. This included assistance with irrigable area mapping, rate stud development, billing system modifications, and more. Progress and results from this project have been monitored up to the present. Table 1-1 shows the progression of agencies shift away from uniform rates towards conservation-based pricing, such as budget-based tiered rates.

Table 1-1: Summary of Rate Structure Types Used in Orange County

Types of Rate Structure	Number of Agencies Utilizing Different Rate Structure Types						
	1990	1995	2000	2005	2010	2015	2020
Declining Block	0	0	0	0	0	0	0
Uniform or Flat	22	23	19	16	8	9	10
Inclined Block	13	9	10	12	14	-	12
Seasonal Inclined Block	1	2	3	3	6	-	1
Seasonal Flat	-	-	-	-	-	-	1
Budget Based Tiered Rate	0	1	1	1	2	-	5

1.4 Public Information, Education, and Outreach

Municipal Water District of Orange County (MWDOC or District) develops, coordinates, and delivers a substantial number of public information, education, and outreach programs aimed at elevating water agency and consumer awareness and understanding of current water issues as well as efficient water use and water-saving practices, sound policy, and water reliability investments that are in the best interest of the region. As water is a necessary resource to all life, these efforts encourage good water stewardship that benefit all Orange County residents, businesses, and industries across all demographics.

MWDOC is steadfast in its mission to keep Orange County involved and up to date on current water news, water-saving opportunities, and pending policy matters through its award-winning public information programs and activities. A few examples are described below.

Print and Electronic Materials

MWDOC offers a variety of print and electronic materials that are designed to assist Orange County water users of all ages in discovering where their water comes from, what the District and other water industry professionals are doing to address water challenges, how to use water most efficiently, and more. Through the District's robust social media presence, award-winning website, eCurrents newsletter, media tool kits, public service announcements, flyers, brochures, and other outreach materials, MWDOC ensures that stakeholders are equipped with sufficient information and subject knowledge to assist them in making good behavioral and civic choices that ultimately affect the quality and quantity of the region's water supply.

Figure 1-1: Samples of Print and Electronic Outreach Materials

Public Events

Each year, MWDOC hosts an array of public events intended to engage a diverse range of water users in targeted discussions and actions that homes in on their specific interests or needs. Some of these public events include:

> **MWDOC Water Policy Forums and Orange County Water Summit** are innovative and interactive symposiums that bring together hundreds of business professionals, elected officials, water industry stakeholders, and community leaders from throughout the state for a discussion on new and ongoing water supply challenges, water policy issues, and other important topics that impact our water supply, economy, and public health.
>
> **Inspection Trips** of the state's water supply systems are sponsored each year by MWDOC and Metropolitan Water District of Southern California. Orange County elected officials, residents,

business owners, and community leaders are invited to tour key water facilities throughout the state and learn more about the critical planning, procurement, and management of southern California's water supply, as well as the issues surrounding delivery and management of our most precious natural resource – water.

Community Events and Events Featuring MWDOC Mascot Ricky the Rambunctious Raindrop provide opportunities to interact with Orange County water users in a fun and friendly way, offer useful water-related information or education, and engage them in important discussions about the value of water and how their decisions at home, at work, and as tax- or ratepayers may impact Orange County's quality and quantity of water for generations to come.



Figure 1-2: Left to Right - MWDOC Water Policy Forum | Inspection Trip of Hoover Dam | Ricky the Rambunctious Raindrop at a Water Smart Community Event

Education Programs and Initiatives

Over the past several years, MWDOC has amplified its efforts in water education programs and activities for Orange County's youngest water users. This is accomplished by continuing to grow professional networks and partnerships that consist of leading education groups, advisors, and teachers, and by leading the way for the District and its 28 member agencies to be key contributors of both southern California and Orange County water-centric learning. Several key water education programs and initiatives include:

Environmental Literacy is an individual's awareness of the interconnectedness and interdependency between people and natural systems, being able to identify patterns and systems within their communities, while also gathering evidence to argue points and solve problems. By using the environment as the context for learning, K-12 students gain real-world knowledge by asking questions and solving problems that directly affect them, their families, and their communities. This approach to K-12 education builds critical thinking skills and promotes inquiry, and is the foundation for all MWDOC education programs, initiatives, and activities.

MWDOC Choice School Programs have provided Orange County K-12 students water-focused learning experiences for nearly five (5) decades. Interactive, grade-specific lessons invite students to connect with, and learn from, their local ecosystems, guiding them to identify and solve local water-related environmental challenges affecting their communities. Choice School Programs are aligned with state standards, and participation includes a dynamic in-class or virtual presentation, and pre- and post-activities that encourage and support Science

Technology Engineering Arts and Mathematics (STEAM)-based learning and good water stewardship.

Water Energy Education Alliance (WEEA) is a coalition of education and water and energy industry professionals led by MWDOC that works together to build and bolster Career Technical Education programs (CTE) for southern California high school students. These CTEs focus on workforce pathways in the Energy, Environment, and Utility Sectors, and connections established through this powerful southern California alliance assist stakeholders as they thoughtfully step up their investment in the education and career success of California's future workforce.

MWDOC Water Awareness Poster Contest is an annual activity developed to encourage Orange County's K-12 students to investigate and explore their relationship to water, connect the importance of good water stewardship to their daily lives, and express their conclusions creatively through art. Each year, MWDOC receives hundreds of entries, and 40 winners from across Orange County are invited to attend a special awards ceremony with their parents and teachers, and Ricky the Rambunctious Raindrop.

Boy Scouts Soil and Water Conservation Merit Badge and Girl Scouts Water Resources and Conservation Patch Programs guide Orange County Scouts on a learning adventure of where their water comes from, the importance of Orange County water resources, and how to be water efficient. These STEAM-based clinics are hosted by MWDOC and include interactive learning stations, hands-on activities, and a guided tour of an Orange County water source, water treatment facility, or ecological reserve



Figure 1-3: Left to Right - MWDOC Choice School Program Assembly | Girl Scouts Water Resources and Conservation Patch Clinic - Soil and Water Testing | Boy Scouts Soil and Water Conservation Merit Badge Clinic - Tour of a Water Treatment Plant

Partnerships are an integral part of achieving water-related goals that impact all Orange County water users. MWDOC's partner list is extensive, and acts as a collective catalyst for all those involved to grow and prosper. Some of the District's most recognized partners include local, regional, state, and federal legislators, educators, water and energy industry leaders, environmental groups, media, and business associations all focused on the common goals of water education, water use efficiency, and advocacy on behalf of the region.

Figure 1-4: Left to Right - MWDOC/Wyland Public Service Announcement | California Next Generation Science Standards State Rollout – Panel Participation with Local and State Education Partners | Orange County Department of Education and Bioneers STEM Symposium – Co-Presentation with Metropolitan Water District of Southern California

1.5 Programs to Assess and Manage Distribution System Real Loss

With the sale of the Allen-McColloch Pipeline to Metropolitan in 1995, MWDOC no longer owns or operates a distribution system. Water purchased and sold by MWDOC is distributed directly from Metropolitan's system into the MWDOC retail agency systems. However, MWDOC does help member agencies evaluate and reduce their distribution systems' real and apparent losses through comprehensive Water Loss Control Programs.

In October 2015, the MWDOC Board of Directors authorized staff to begin implementing a Water Loss Control Technical Assistance Program (TAP) to support member agency compliance with Senate Bills 1420 and 555, both of which address distribution system Water Loss. The TAP program established a menu of technical assistance that water retailers can elect to participate in. These programs connect water retailers with industry experts who provide one on one technical assistance through data analysis, agency specific advising and assessment. The TAP services include:

- Water Balance Compilation
- Component Analysis of Real and Apparent Losses
- Source/Production Meter Accuracy Testing
- Billing Data Chain Assessment
- Internal Water Loss Committee Planning

MWDOC's Water Loss Control TAP has a very positive impact on building knowledge of water loss recovery strategies by all retail water agencies in the County and implementation of those strategies. To date MWDOC has hosted 30 Water Loss Work Group Meetings with approximately 35 agency representatives' attending each meeting. A total of 137 Annual Water Balances have been compiled and validated over the last five years, vastly improving water agency understanding of volumes of real and apparent losses, strategies to recovery losses and value of losses.

Because the OC area retailers were so receptive to the TAP, MWDOC began to consider other services that would assist in controlling water loss. MWDOC sent out a survey to OC retailers in 2018 to collect information on what services were most needed and would be the most beneficial. In 2019, the MWDOC Board authorized the implementation of a Water Loss Control Shared Services Business Plan (Business Plan) based on the needs outlined in the survey and the direction of the Water Loss Control Performance Standards currently in development.

The following are guiding tenets of MWDOC's Water Loss Control Shared Services:

- Offer shared services at a competitive or lower cost than the same services provided by the private sector
- Provide quality shared services on par with or better than the same services provided by the private sector
- Realize economies of scale for these services by providing services at a regional level that cannot be justified at many local levels
- Continue collaboration and shared learning among all agencies throughout this process
- Phase implementation of new shared services over time, starting with the services that have the highest level of interest or demand by water agencies
- Integrate program administration and data management to share results and customize program offerings to the unique conditions of each member agency

The Business plan included hiring specialized MWDOC staff to provide services directly to retail water suppliers in OC. These services include:

- Water Balance Validation
- Customer Meter Accuracy Testing
- Distribution System Pressure Surveys
- Distribution System Leak Detection
- Suspected Leak Investigations
- No Discharge Distribution System Flushing

Since the start of the shared services program in August 2019, more than 780 miles of distribution system leak detection has been completed which resulted in discovery of 373 hidden leaks that have been repaired or are in the process of being repaired. These leak repairs result in recovering more than 84.5 million gallons of water valued at more than $300,000 per year. A total of 1,439 water meter accuracy tests have been completed by 6 agencies improving agency knowledge of meter performance and accuracy of water balance results. A total of thirty-two sites have been monitored during pressure surveys for three agencies that were used to calculate average system pressure, calibrate hydraulic models and investigate pressure anomalies. And lastly, 12 miles of distribution system mains have been flushed resulting in improved water quality for consumers and recovery of 176,200 gallons of water that was filtered and returned to the distribution system for beneficial use.

1.6 Water Conservation Program Coordination and Staffing Support

MWDOC's Water Use Efficiency Department is comprised of five (5) full time equivalent (FTE) positions and three (3) student intern positions. Heading the department is the Water Use Efficiency (WUE) Director. Beneath him on the department organizational chart are Water Use Efficiency Supervisor, Senior Water Use Efficiency Analyst, Water Use Efficiency Analyst II, and Water Use Efficiency Analyst I. The department also employs three part-time student interns who function in a support role to the full time staff. The department works together in a collaborative nature, assisting one another in the implementation of the many Water Use Efficiency Programs.

MWDOC's WUE Department has a rich history of writing successful grant proposal from both State and Federal sources. State granting agencies include the SWRCB, DWR, and Natural Resource Conservation

Service (NRCS); most state funding is procured through IRWM processes. Federal granting agencies include the United States Bureau of Reclamation (USBR). Local Funding is also a core component of MWDOC's WUE programs. This funding comes from two sources: Metropolitan Water District of Southern California and MWDOC's retail water agencies. MWDOC, as a regional wholesaler of imported water, is one of Metropolitans member agencies, and through water rates paid to Metropolitan, MWDOC recoups funding for water efficiency programs through Metropolitan's Conservation Credits program. Metropolitan establishes a bi-yearly funding budget for both WUE programs and devices, and MWDOC, in turn, establishes its own WUE programs using Conservation Credit funds. MWDOC assists Orange County retail agencies by implementing an array of regional and local water use efficiency programs and projects. All retail agencies elect to participate in the MWDOC programs and several provide funding of their own for select devices or services.

MWDOC's WUE department has a long standing practice of conducting regular investigations of program effectiveness via statistical program process and impact evaluations. The process evaluations are utilized to ensure administrative quality control and ease of access to consumers. An adaptive management approach is taken to implement efficiency practices or to correct for identified process deficiencies. The impact evaluations utilize robust statistical methodologies to measure the actual water saving achieved in comparison to the expected industry water savings estimates. Results from impact evaluations have provided insight relating to those devices and programs that yield the best water savings in relationship to program administrative effort, cost effectiveness, and appropriate rebate levels.

1.6.1 Residential Conservation Implementation (non-landscape)

MWDOC assists its retail water agencies to implement residential DMMs by making available the following programs aimed at increasing landscape and indoor water use efficiency for residential customers. MWDOC has implemented successful water use efficiency programs for residential customers for over 30 years. This began with our highly successful Ultra-Low-Flush Toilet Rebate Program, continued on through the High Efficiency Washer Program, and now continues with the High Efficiency Toilet Programs and more.

High Efficiency Clothes Washer Rebate Program

The High Efficiency Clothes Washer (HECW) Rebate Program provides residential customers with rebates for purchasing and installing HECWs that. Approximately 15% of home water use goes towards laundry, and HECWs use 35-50 percent less water than standard washer models, with savings of approximately 10,500 gallons per year, per device. Devices must meet or exceed the Consortium for Energy Efficiency (CEE) Tier 1 Standard, and a listing of qualified products can be found at ocwatersmart.com. There is a maximum of one rebate per home. Since 2011, MWDOC has facilitated the installation of over 122,000 high efficiency clothes washers saving over 4,220 AFY. Funding for this rebate comes from Metropolitan and Orange County retailers.

	High Efficiency Clothes Washers	<u>Standard Incentive:</u> $85 per washer <u>Enhanced Incentive</u>: up to $285 <u>Per Unit Savings:</u> 29 gallons per day (GPD) 14 year useful life .46 AF lifetime savings <u>Cost per AF:</u> **$185 with base rebate; $621with enhanced rebate**

Premium High Efficiency Toilet Rebate Program

The largest amount of water used inside a home, 30 percent, goes toward flushing the toilet. The Premium High Efficiency Toilet (HET) Rebate Program offers incentives to residential customers for replacing their toilets using 1.6 gallons per flush or more. Premium HETs use just 1.1 gallons of water or less per flush, which is 20 percent less water than WaterSense standard toilets. In addition, Premium HETS save an average of 9 gallons of water per day while maintaining high performance standards. Since 2005, MWDOC has facilitated the installation of over 60,000 high efficiency toilets saving more than 2,240 AFY. Funding for this rebate comes from Metropolitan and Orange County retailers.

	Premium High Efficiency Toilets	<u>Standard Incentive:</u> $40 per toilet <u>Enhanced Incentive</u>: up to $100 per toilet <u>Per Unit Savings:</u> 9 GPD 20 year useful life .21 AF lifetime savings <u>Cost per AF:</u> **$190** per AF

Pressure Regulating Valve Pilot Program

The Pressure Regulating Valve (PRV) Pilot Program seeks to test and replace broken residential PRVs. A PRV is a plumbing device typically installed on the intake pipe between the street and the front hose bib in homes in high pressure zones and is used to moderate high water pressure coming into the home. A failed PRV allows water to enter a home at a higher rate may increase the rate of leaks and cause appliances and fixtures to use more water when operated. This pilot will be used to determine the potential water savings associated with replacing failed PRVs. To date 135 PRVs have been assessed. Funding for this pilot comes from Metropolitan and DWR.

	Pressure Regulation Valve Pilot Program	Standard Incentive: Test & Replacement free to public Enhanced Incentive: none Per Unit Savings: To be determined by Pilot Study 20 year useful life .21 AF lifetime savings Cost per AF: **$190** per AF

1.6.2 Conservation Programs for Commercial, Industrial and Institutional Accounts (non-landscape)

MWDOC provides a variety of financial incentives to help Orange County businesses, restaurants, institutions, hotels, hospitals, industrial facilities, and public sector sites achieve their efficiency goals. Water users in these sectors have options to choose from a standardized list of water efficient equipment/devices or may complete customized projects through a pay-for-performance where the incentive is proportional to the amount of water saved. Such projects include high efficiency commercial equipment installation and manufacturing process improvements.

Water Savings Incentive Program

The Water Savings Incentive Program (WSIP is designed for non-residential customers to improve their water efficiency through upgraded equipment or services that do not qualify for standard rebates. WSIP is unique because it provides an incentive based on the amount of water customers actually save. This "pay-for-performance" design lets customers implement custom projects for their sites.

Projects must save at least 10 million gallons of water to qualify for the Program and are offered from $195 to $390 per acre foot of water saved. Examples of successfully projects include but are not limited to changing industrial process system water, capturing condensation and using it to supplement cooling tower supply, and replacing water-using equipment with more efficient products. Thirty-eight customized water efficiency improvements have been completed since 2008 saving more than 1,280 AFY. This Program is funded by Metropolitan and supplemental funding is provided by DWR, Orange County retailers and US Bureau of Reclamation.

On-site Retrofit Program

The On-site Retrofit Program provides another pay-for-performance financial incentive to commercial, industrial and institutional property owners, including Homeowner Associations, who convert potable water irrigation or industrial water systems to recycled water use.

Projects commonly include the conversion of mixed or dedicated irrigation meters using potable water to irrigate with reclaimed water, or convert industrial processes use to recycled water, such as a cooling towers. Financial incentives of up to $1,300 per AF of potable water saved are available for customer-side on the meter retrofits. Funding is provided by Metropolitan, USBR, and DWR. Since 2015, 166 projects have been completed saving 3,489 AFY.

Multi-Family Premium High Efficiency Toilet Incentive Program

MWDOC makes an effort to reach all water-users in Orange County. For the Multi-Family Premium High Efficiency Toilet Rebate Program, MWDOC targets multi-family buildings in both disadvantaged communities (DAC) and non-DAC communities, in addition to targeting all commercial buildings, and single-family residential homes through Premium HET device rebates.

MWDOC offers the DAC Multi-Family HET Program, a special version of the High Efficiency Toilet Program, to ensure regardless of economic status all water-users in Orange County can benefit from the rebate. This Program targets 3.5 gallon per flush (gpf) or greater toilets to replace them with WaterSense Labeled 1.1 gpf or less. For this purpose, DAC are referenced as communities facing economic hardship. This is defined using criteria established by DWR and the County of Orange, which includes communities where the median household income (MHI) is less than 85% of the Orange County MHI.

The DAC Multi-Family Program is contractor-driven, where a contractor works with building owners to replace all of the toilets in the building(s). To avoid any cost to tenants, the rebate is $200 per toilet paid to the contractor, essentially covering the contractor's cost; therefore, there is little to no charge to the building owners that may be passed through to tenants. This process was formed after consulting contractors and multi-family building owners in Orange County. To serve those in multi-family buildings outside of designated DAC locations, MWDOC offers $75 per toilet through the same contractor-driven format. An additional option is available through SoCalWater$mart, which offers up to $250 per toilet to multi-family buildings that were built before 1994, therefore targeting buildings built before legislation required low-flow plumbing fixtures in new construction.

Device Retrofits

MWDOC offers additional financial incentives under the Socal Water$mart Rebate Program which offers rebates for various water efficient devices to CII customers. Core funding is provided by Metropolitan and supplemental funding is sourced from MWDOC via grant funds and/or retail water agencies.

	Ultra Low Water / Zero Water Urinals	Standard Incentive: $200 Enhanced Incentive: up to $310 Per Unit Savings: 110 GPD 20 year useful life 2.45 AF lifetime savings Cost per AF: Standard Incentive: $81–$127 per AF

	High Efficiency Toilet *(HETs)*	Standard Incentive: $40 Enhanced Incentive: up to $150 Per Unit Savings: 9 GD 20 year useful life 0.21 lifetime savings Cost per AF: $190–$750 per AF
	Connectionless Food Steamers (aka Boiler-less)	Standard Incentive: $485 per compartment Enhanced Incentive: up to $985 Per Unit Savings: 223 GPD 10 year useful life 2.5 AF lifetime savings Cost per AF: $194–$394 per AF
	Air-Cooled Ice Machines	Standard Incentive: $300 per machine Enhanced Incentive: Up to $1,050 Per Unit Savings: 137 GPD 10 year useful life 1.54 AF lifetime savings Cost per AF: $195–$682 per AF
	Standard Cooling Tower Conductivity Controller	Standard Incentive: $625 per controller Enhanced Incentive: up to $1,325 Per Unit Savings: 575 GPD 5 year useful life 3.22 AF lifetime savings Cost per AF: $195–$411 per AF
	pH-Cooling Tower Controller	Standard Incentive: $1,750 per controller Enhanced Incentive: up to $2,750 Per Unit Savings: 1,735 GPD 5 year useful life 9.72 AF lifetime savings Cost per AF: $180–$283 per AF

 Laminar Flow Restrictors	<u>Incentive:</u> $10 per restrictor <u>Per Unit Savings:</u> 21 GPD 5 year useful life 0.115 AF lifetime savings <u>Cost per AF:</u> $86 per AF
 Dry Vacuum Pumps	<u>Incentive:</u> $125 per 0.5 Horse Power <u>Per Unit Savings:</u> 82 GPD 7 year useful life 0.64 AF lifetime savings <u>Cost per AF:</u> $195 per AF

1.6.3 Residential and CII Landscape Conservation Programs and Incentives

One of the most active and exciting water use efficiency sectors MWDOC provides services for are those programs that target the reduction of outdoor water use. With close to 60 percent of water consumed outdoors, this sector has been and will continue to be a focus for MWDOC. MWDOC has pioneered numerous landscape water use efficiency programs aimed at both residential, commercial, and public agency water users that takes a holistic, sustainable approach to saving water that produces additional benefits to the watershed. Such benefits include reductions in dry and wet weather runoff and associated non-point source pollution, energy savings, green-waste reductions, and increases in biomass and carbon sequestration.

Water Efficiency Programs

Turf Removal Program

The Orange County Turf Removal Program offers incentives to remove turf grass from residential, commercial, and public properties throughout the County. This program is a partnership between MWDOC, Metropolitan, and local retail water agencies. The goals of this program are to increase water use efficiency through sustainable landscaping practices that result in multi-benefit projects across Orange County. Participants replace their turf grass with drought-tolerant, CA Friendly, or CA Native landscaping, and retrofit their irrigation systems to high efficiency equipment, such as drip, or remove it entirely, and are encouraged to utilize smart irrigation timers. Furthermore, projects are required to include a stormwater capture feature, such as a rain garden or dry stream bed, and have a minimum of three plants per 100 square feet to increase plant density and promote healthy soils. These projects save water and also reduce dry and wet weather runoff, increase urban biomass, and sequester more carbon than turf landscapes. Examples of projects are listed in Figure 1-5 below. Through December 2020, Orange County residents and commercial properties removed 23.2 million square feet of turf, resulting in approximately 3,245 AFY of water savings. This Program is funded by Metropolitan, DWR, USBR, and retail water agencies.

Figure 1-5: Examples of completed Turf Removal Projects as a residential home (left) and a City center median strip (right).

	Turf Removal Program	Standard **Residential & Commercial** Incentive: $2 per ft^2 Enhanced **Residential & Commercial** Incentive: up to $4 per ft^2 Per Unit **Residential & Commercial** Savings: 0.121 GPD per square foot 10 year useful life 0.001 AF lifetime savings per square foot Cost per AF: Residential $1,538–$3,077per AF

Landscape Design and Maintenance Plan Assistance Programs

To maximize the water efficiency and quality of Orange County's Turf Removal Program Projects, MWDOC offers free landscape designs and free landscape maintenance plans to participating residential customers. The Landscape Design Assistance Program is offered at the beginning stages of their turf removal project so that customers may receive a customized, professionally designed landscape to replace their turf. Landscape designs include plant selection, layout, irrigation plans, and a stormwater capture feature. These designs help ensure climate appropriate plants are chosen and planted by hydrozone, that appropriate high efficiency irrigation is properly utilized, that water savings are maximized as a result of the transformation. An example design is shown in Figure 1-6. Additionally, generic designs are available for free on MWDOC's website as an additional landscape resources. The Landscape Maintenance Assistance Plan provides a post-installation care plan to help ensure that the new landscape is properly cared for and is not overwatered. Approximately 375 participants have received customized Design templates and 87 participants have received customized maintenance plans.

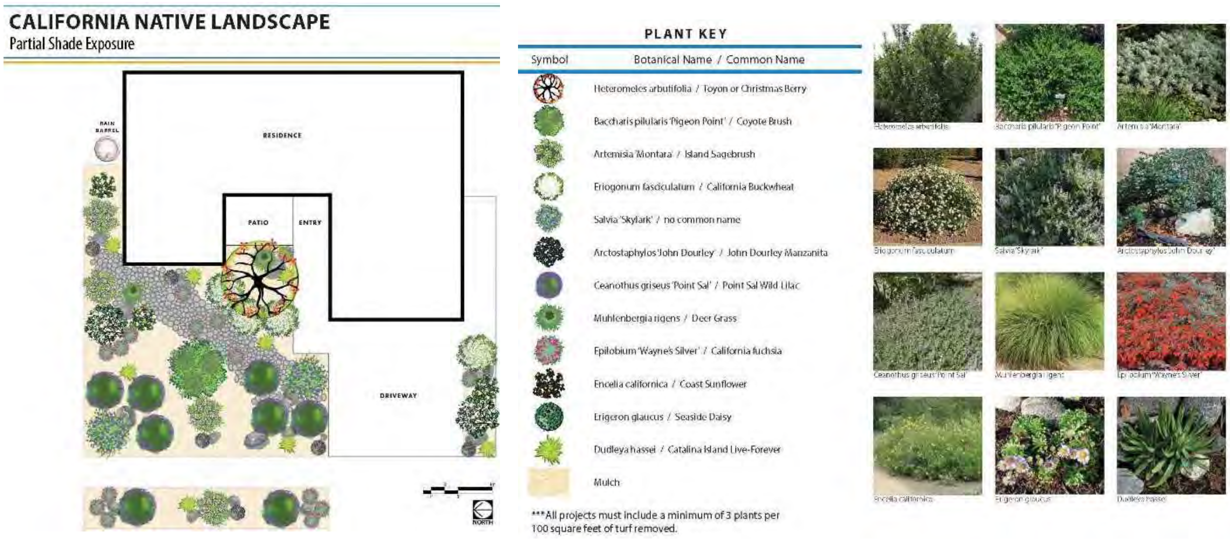


Figure 1-6: Examples of completed Turf Removal Projects as a residential home (left) and a City center median strip (right).

Spray-to-Drip Rebate Program

The Spray to Drip Rebate Program offers residential, commercial, and public agency customers rebates for converting areas irrigated by traditional high-precipitation rate spray heads to low-precipitation rate drip irrigation. Drip irrigation systems are extremely water-efficient. Rather than spraying wide areas subject to wind drift, overspray and runoff, drip systems use point emitters to deliver water to specific locations at or near plant root zones. Water drips slowly from the emitters either onto the soil surface or below ground. As a result, less water is lost to wind, evaporation, and overspray, saving water and reducing irrigation runoff and non-point source pollution.

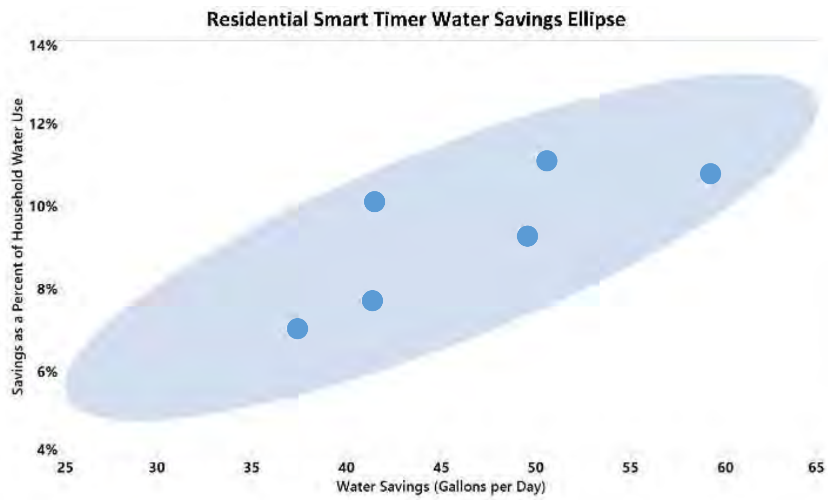
MWDOC pioneered drip conversion programs with the start of the Spray to Drip Pilot Program in 2012. In 2017, MWDOC evaluated its Spray-to-Drip Pilot Program through a processes and impact evaluation. Over 70% of survey participants reported observed water savings and positive impacts to their landscape since completing their project. The statistical impact analysis found that the average residential project saved over 31,000 gallons saved per site annually and 44 gallons per year to square foot of irrigated area converted. Commercial projects, on average, saved more than 4 million gallons per site annually and 35 gallons per year per square foot. Based on the positive pilot program results, MWDOC has continued to offer the successful Spray-to-Drip Program to Orange County and through December 2020 has converted 1.1 million square feet of inefficiently irrigated landscapes to drip irrigation saving approximately 132 AFY. Based on MWDOC's positive results, drip conversion programs are now becoming an industry standard landscape rebate with quantifiable and reliable water savings. See Figure 1-7 for projects installing dripline before being covered with mulch. Funding for this Program is provided by Metropolitan, DWR, USBR, and Orange County Retailers.

Figure 1-7: Examples of completed drip line installed through the Spray-to-Drip Program.

	Spray-to-Drip Irrigation	Standard **Residential** Incentive: \$0.25 per ft^2 Standard **Commercial** Incentive: \$0.20 per ft^2 Enhanced **Residential & Commercial** Incentive: up to \$0.70 per ft^2 Per Unit **Residential** Savings: 0.121 GPD per square foot 10 year useful life 0.001 AF lifetime savings per square foot Per Unit **Commercial** Savings: 0.095 GPD per square foot 10 year useful life 0.001 AF lifetime savings per station Cost per AF: Residential \$188–\$368 per AF Commercial \$195–\$470 per AF

Smart Timer Rebate Program

Smart Timers are irrigation clocks that are either weather-based irrigation controllers (WBIC) or soil moisture sensor systems. WBICs adjust the irrigation schedule automatically (usually daily) to reflect changes in local weather and site-specific landscape needs, such as sun exposure, soil type, slopes, and plant material, prompting turf and plants to receive the proper amount of water throughout the year. During the fall months, when property owners and landscape professionals often overwater, Smart Timers can save significant amounts of water. Soil moisture sensors determine the amount of water in the soil by way of sensors placed in the actual root zone of a given landscape area. This measurement of water is then relayed back to the controller and through the controller's programming, and the correct amount of water is then applied. MWDOC has been a pioneer of smart irrigation technology, which is not an industry standard landscape program that is associated with quantifiable and reliable water savings. MWDOC has conducted and disseminated several water savings research studies of Smart Timer Programs over the last sixteen years. Water savings predicative ellipses based on MWDOC's numerous research studies are shown in Figure 1-8. This representation is useful to visualize the correlation between water savings in gallons per day and savings as a percent of the site's overall water use, and also the mean of residential and commercial studies. Since 2004, MWDOC has facilitated the installation of close to 30,000 timers saving over 9,000 AFY.



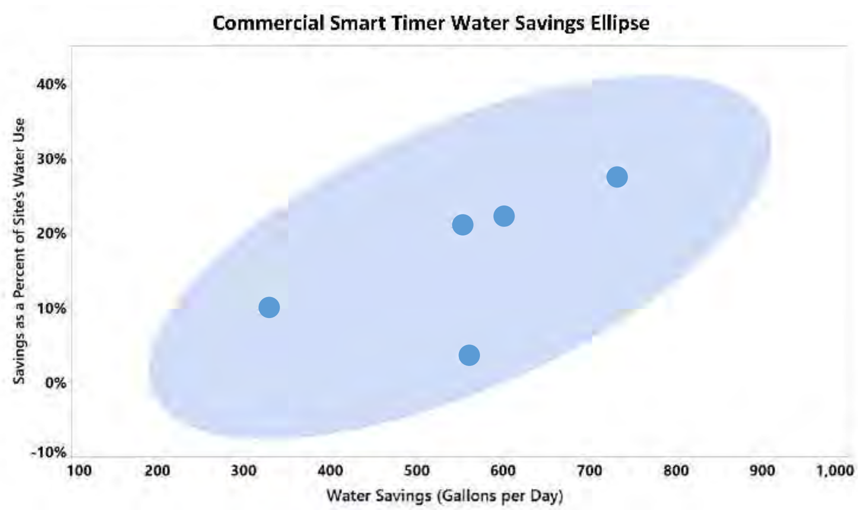


Figure 1-8: Water savings predictive ellipses based on MWDOC's smart irrigation timer research. Dark blue points represent results from MWDOC studies, the light blue ellipses represent the predicted location of a new observation, at 95% confidence.

	Smart Controllers (Weather-Based Irrigation Controllers and Soil Moisture Sensor Systems)	Standard **Residential** Incentive: $80 per controller Enhanced **Residential** Incentive: Up to $330 per controller Standard **Commercial** Incentive: $35 per station Enhanced **Commercial** Incentive: $75 per station Per Unit **Residential** Savings: 37 GPD 10 year useful life 0.41 Per Unit **Commercial** Savings: 16 GPD per station 10 year useful life 0.179 AF lifetime savings per station Cost per AF: Residential $193–$1,844 per AF Commercial $195–$419 per AF

Rotating Nozzles Rebate Program

The Rotating Nozzle Rebate Program provides incentives to residential and commercial properties for the replacement of high-precipitation rate spray nozzles with low-precipitation rate multi-stream, multi-trajectory rotating nozzles. The rebate offered through this Program aims to offset the cost of the device and installation. MWDOC has pioneered high efficiency rotating nozzle programs, which are now an industry standard landscape program associated with quantifiable and reliable water savings. Since 2007, MWDOC has facilitated the installation of over 570,000 high efficiency rotating nozzles, savings approximately 2,790 AFY. This Program is funded by Metropolitan and Orange County retailers.

	High Efficiency Rotating Nozzles	Incentive: $2 per nozzle for residential, commercial Enhanced Incentive: up to $6 per nozzle for residential, commercial Per Unit Savings: 2.36 GPD per nozzle 5 year useful life 0.013 AF lifetime savings Cost per AF: **$152** per AF

Additional Device Retrofits

MWDOC also offers additional financial incentives under the SoCal Water$mart Rebate Program for a variety of other water efficient landscape devices.

 Central Computer Irrigation Controllers	Standard Incentive: $35 per station Per Unit Savings: Same as standalone smart controllers 16 GPD per station 10 year useful life 0.179 AF lifetime savings per station Cost per AF: $196 per AF
 Large Rotary Nozzles	Standard Incentive: $13 per set of two nozzles Per Unit Savings: 16 GPD per set of two nozzles 10 year useful life 0.18 AF lifetime savings per set of two nozzles Cost per AF: $72 per AF.
 In-Stem Flow Regulators	Standard Incentive: $1 per flow regulator Per Unit Savings: 2.7 GPD per device 5 year useful life 0.015 AF lifetime savings per station Cost per AF: $67 per AF.
 Rain Barrels (50-99 gall.) Cisterns Small (200-500 gal.) Cistern Medium (501-999 gal.) Cistern Large (1,000+ gal.)	Standard Incentive: Rain Barrel: $35 per barrel Cistern Small: $250 per cistern Cistern Medium: $300 per cistern Cistern Large: $350 per cistern Enhanced Incentive: Rain Barrel: $75 per barrel Per Unit Rain Barrel Savings: 1.7 GPD per barrel 10 year useful life 0.010 AF Saved

	Per Unit Cistern Small Savings: 6.8 GPD per cistern 10 year useful life 0.076 AF Saved Per Unit Cistern Medium Savings: 8.4 GPD per cistern 10 year useful life 0.094 AF saved Per Unit Cistern Large Savings: 9.6 GPD per cistern 10 year useful life 0.108 AF Saved Cost Per AF: Rain Barrel: $1,837-$3,947 Cistern Small: $3,289 Cistern Medium: $3,191 Cistern Large: $3,241

Water Efficiency Landscape Classes, Certifications, and Resources

Landscape Training Classes

The California Friendly and Native Landscape Training and the Turf Removal and Garden Transformation Workshop provide education to residential homeowners, property managers, and professional landscape contractors on a variety of landscape water efficiency practices that they can employ and use to help design a beautiful garden using California Friendly and native plant landscaping principles. The California Friendly and Native Landscape Class demonstrates how to: implement storm water capture features in the landscape; create a living soil sponge that holds water; treat rainwater by a resource; select and arrange plants to maximize biodiversity and minimize water use; and control irrigation to minimize water waste, runoff and non-point source pollution.

The Turf Removal and Garden Transformation Workshop teaches participants how to transform thirsty turfgrass into a beautiful, climate-appropriate water efficient garden. This class teaches how to: evaluate the landscape's potential; plan for garden transformation; identify the type of turfgrass in the yard; remove grass without chemicals; build healthy, living soils; select climate-appropriate plants that minimize water use and maximize beauty and biodiversity; and implement a maintenance schedule to maintain the garden.

Qualified Water Efficient Landscape Certification (Commercial)

Since 2018, the Municipal Water District of Orange County (MWDOC), along with participating MWDOC member agencies, has offered free Qualified Water Efficient Landscaper (QWEL) certification classes designed for landscape professionals. Classes are open to any city staff, professional landscaper, water district employee, or maintenance personnel that would like to become a Qualified Water Efficient Landscaper. The QWEL certification program provides 20 hours of instruction on water efficient areas of expertise such as local water supply, sustainable landscaping, soil types, irrigation systems and maintenance, as well as irrigation controller scheduling and programing. QWEL has received recognition from EPA WaterSense for continued promotion of water use efficiency. To earn the QWEL certification, class participants must demonstrate their ability to perform an irrigation audit as well as pass the QWEL exam. Successful graduates will be listed as a Certified Professional on the WaterSense website as well as on MWDOC's landscape resources page, to encourage Turf Removal participants or those making any landscape improvements to hire a QWEL certified professional.

Started in December 2020, a hybrid version of QWEL is available in conjunction with the California Landscape Contractors Association's Water Management Certification Program. This joint effort allows landscape industry an opportunity to obtain two nationally recognized EPA WaterSense Professional Certifications with one course and one written test. This option is offered through Metropolitan Water District of Southern California.

OC Water Smart Gardens Resource Page

MWDOC's OC Water Smart Gardens webpage provides a surplus of helpful guides and fact sheets, as well as an interactive photo gallery of water-saving landscape ideas. The purpose of this resource is to help Orange County residents find a broad variety of solutions for their water efficient landscaping needs. This includes a detailed plant database with advanced to search features; photo and/or video-based garden tours; garden gallery with images organized into helpful landscape categories such as back yards, hillsides, full sun, and/or shade with detailed plant information; and the ability to select and store plants in a list that the user can print for use when shopping.

Additional technical resources are available such as a watering calculator calibrated for local evapotranspiration rates, and a garden resources section with fact sheets on sustainable landscape fundamentals, water and soil management, composting, solving run-off, and other appropriate topics. Web page is accessible through mwdoc.com and directly at www.ocwatersmartgardens.com.

APPENDIX L

Notice of Public Hearing (Pending)

MWDOC

Street Address:
18700 Ward Street
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Mailing Address:
P.O. Box 20895
Fountain Valley, CA 92728-0895

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www.mwdoc.com

February 24, 2021

Michael Moore
Assistant General Manager, Water Services
Anaheim Public Utilities
Anaheim West Tower, 201 South Anaheim Blvd.
Anaheim, CA 92805

Subject: MWDOC 2020 Urban Water Management Plan Update

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Sincerely,

Harvey De La Torre
Assistant General Manager

MWDOC

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Fountain Valley, California 92708

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February 24, 2021

Tony Olmos
Public Works Director
City of Brea
1 Civic Center Circle
Brea, CA 92821

Subject: MWDOC 2020 Urban Water Management Plan Update

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Sincerely,

Harvey De La Torre
Assistant General Manager

MWDOC

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February 24, 2021

Nabil Henein
Director of Public Works/City Engineer
City of Buena Park
6650 Beach Boulevard
Buena Park, CA 90621

Subject: MWDOC 2020 Urban Water Management Plan Update

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Sincerely,

Harvey De La Torre
Assistant General Manager

MWDOC

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February 24, 2021

Hyejin Lee
Director of Public Works/City Engineer
City of Fountain Valley
10200 Slater Avenue
Fountain Valley, CA 92708

Subject: MWDOC 2020 Urban Water Management Plan Update

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Sincerely,

Harvey De La Torre
Assistant General Manager

MWDOC

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February 24, 2021

Meg McWade
Director of Public Works
City of Fullerton
303 W. Commonwalth Ave.
Fullerton, CA 92832

Subject: MWDOC 2020 Urban Water Management Plan Update

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Sincerely,

Harvey De La Torre
Assistant General Manager

MWDOC

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February 24, 2021

William Murray
Director of Public Works
City of Garden Grove
13802 Newhope Street
Garden Grove, CA 92840

Subject: MWDOC 2020 Urban Water Management Plan Update

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Sincerely,

Harvey De La Torre
Assistant General Manager

MWDOC

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February 24, 2021

Tom Herbel
Director of Public Works
City of Huntington Beach
2000 Main Street
Huntington Beach, ca 92648

Subject: MWDOC 2020 Urban Water Management Plan Update

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Sincerely,

Harvey De La Torre
Assistant General Manager

MWDOC

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February 24, 2021

Elias Saykali
Director of Public Works
City of La Habra
P.O. Box 337
La Habra, CA 90633-0337

Subject: MWDOC 2020 Urban Water Management Plan Update

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Sincerely,

Harvey De La Torre
Assistant General Manager

MWDOC

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February 24, 2021

Mike Belknap
Public Works & Community Services Director
City of La Palma
7821 Walker Street
La Palma, CA 90623

Subject: MWDOC 2020 Urban Water Management Plan Update

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Sincerely,

Harvey De La Torre
Assistant General Manager

MWDOC

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February 24, 2021

Mark Vukojevick
Utilities Director
City of Newport Beach
P.O. Box 1768
Newport Beach, CA 92660

Subject: MWDOC 2020 Urban Water Management Plan Update

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Sincerely,

Harvey De La Torre
Assistant General Manager

MWDOC

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18700 Ward Street
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February 24, 2021

Christopher Cash
Director of Public Works
City of Orange
P.O. Box 449
Orange, CA 92886

Subject: MWDOC 2020 Urban Water Management Plan Update

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Sincerely,

Harvey De La Torre
Assistant General Manager

MWDOC

Street Address:
18700 Ward Street
Fountain Valley, California 92708

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February 24, 2021

Tom Bonigutt
Public Works Director
City of San Clemente
910 Calle Negocio, Suite 100
San Clemente, CA 92672

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Thomas Toman
Director of Public Works
City of San Juan Capistrano
32450 Paseo Adelanto
San Juan Capistrano, CA 92675

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Nabil Saba
Acting Public Works Director
City of Santa Ana
P.O. Box 1988, M-24
Santa Ana, CA 92702

Subject: MWDOC 2020 Urban Water Management Plan Update

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Assistant General Manager

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February 24, 2021

Steve Myrter
Director of Public Works
City of Seal Beach
211 8th Street
Seal Beach, CA 90740

Subject: MWDOC 2020 Urban Water Management Plan Update

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Harvey F. De La Torre

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Assistant General Manager

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February 24, 2021

Douglas Stack
Director of Public Works
City of Tustin
300 Centennial Way
Tustin, CA 92780

Subject: MWDOC 2020 Urban Water Management Plan Update

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MWDOC

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February 24, 2021

Marwan Youssef
Director of Public Works
City of Westminster
8200 Westminster Boulevard
Westminster, CA 92683

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

David Youngblood
General Manager
East Orange County Water District
185 North McPherson Road
Orange, CA 92869-3720

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Dennis Cafferty
General Manager
El Toro Water District
24251 Los Alisos Boulevard
Lake Forest, CA 92630

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Michael Dunbar
General Manager
Emerald Bay Service District
600 Emerald Bay
Laguna Beach, CA 92651

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Ken Vecchiarelli
General Manager, Orange County
Golden State Water Company
2283 E. Via Burton
Anaheim, CA 92806

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Paul Cook
General Manager
Irvine Ranch Water District
P.O. Box 57000
Irvine, CA 92618

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Keith Van Der Maaten
General Manager
Laguna Beach County Water District
P.O. Box 987
Laguna Beach, CA 92651

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Paul Shoenberger, PE
General Manager
Mesa Water
1965 Placentia Avenue
Costa Mesa, CA 92627

Subject: MWDOC 2020 Urban Water Management Plan Update

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Sincerely,

Harvey De La Torre
Assistant General Manager

MWDOC

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18700 Ward Street
Fountain Valley, California 92708

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February 24, 2021

Joone Lopez
General Manager
Moulton Niguel Water District
P.O. Box 30203
Laguna Hills, CA 92607-0203

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Michael Markus
General Manager
Orange County Water District
P.O Box 8300
Fountain Valley, CA 92708

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Daniel Ferons
General Manager
Santa Margarita Water District
26111 Antonio Parkway
Rancho Santa Margarita, CA 92688

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Jerry Vilander, Jr.
General Manager
Serrano Water District
18021 East Lincoln Street
Villa Park, CA 92861-6446

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Rick Shintaku
General Manager
South Coast Water District
31592 West Street
Laguna Beach, CA 92651

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Fernando Paludi
General Manager
Trabuco Canyon Water District
32003 Dove Canyon Drive
Trabuco Canyon, CA 92679

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Brett Barbre
General Manager
Yorba Linda Water District
1717 East Miraloma Avenue
Placentia, CA 92870

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

James Treadaway
Public Works Director
Orange County
601 North Ross Street
Santa Ana, ca 92701

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Shaun Pelletier
Public Works Director
City of Aliso Viejo
12 Journey Suite 100
Aliso Viejo, CA 92656

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Raja Sethuraman
Director of Public Services
City of Costa Mesa
77 Fair Drive
Costa Mesa, CA 92626

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Doug Dancs
Public Works Director
City of Cypress
5275 Orange Avenue
Cypress, CA 90630

Subject: MWDOC 2020 Urban Water Management Plan Update

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Harvey De La Torre
Assistant General Manager

February 24, 2021

Matt Sinacori
Public Works Director
City of Dana Point
33282 Golden Lantern
Dana Point, CA 92629

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Mark Steuer
Public Works Director
City of Irvine
1 Civic Center Plaza
Irvine, CA 92606

Subject: MWDOC 2020 Urban Water Management Plan Update

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Sincerely,

Harvey De La Torre
Assistant General Manager

MWDOC

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Fountain Valley, California 92708

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February 24, 2021

Mark McAvoy
Public Works Director
City of Laguna Beach
505 Forest Avenue
Laguna Beach, CA 92651

Subject: MWDOC 2020 Urban Water Management Plan Update

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Assistant General Manager

MWDOC

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February 24, 2021

Ken Reynolds
Public Works Director
City of laguna Hills
24035 El Toro Road
Laguna Hills, CA 92653

Subject: MWDOC 2020 Urban Water Management Plan Update

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Sincerely,

Harvey F. De La Torre

Harvey De La Torre
Assistant General Manager

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February 24, 2021

Jacki Scott
Public Works Director
City of Laguna Niguel
30111 Crown Valley Parkway
Laguna Niguel, CA 92677

Subject: MWDOC 2020 Urban Water Management Plan Update

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Harvey De La Torre
Assistant General Manager

MWDOC

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February 24, 2021

Akram Hindiyeh
City Engineer
City of Laguna Woods
24264 El Toro Road
Laguna Woods, CA 92637

Subject: MWDOC 2020 Urban Water Management Plan Update

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Assistant General Manager

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February 24, 2021

Thomas Wheeler
Public Works Director
City of Lake Forest
100 Civic Center Dr.
Lake Forest, CA 92630

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Chris kelley
City Engineer
City of Los Alamitos
3191 Katella Avenue
Los Alimitos, CA 90720

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Mark Chagnon
Public Works Director
City of Mission Viejo
200 Civic Center
Mission Viejo, CA 92691

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Luis Estevez
Public Works Director
City of Placentia
401 E Chapman Avenue
Placentia, CA 92870

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Brendan Dugan
Public Works Director
City of Rancho Santa Margarita
22112 El Paseo
Rancho Santa Margarita, CA 92688

Subject: MWDOC 2020 Urban Water Management Plan Update

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MWDOC

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February 24, 2021

Allan Rigg
Public Works Director
City of Stanton
7800 Katella Avenue
Stanton, CA 90680

Subject: MWDOC 2020 Urban Water Management Plan Update

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February 24, 2021

Mike Knowles
Public Works Director
City of Villa Park
17855 Santiago Boulevard
Villa Park, CA 92861

Subject: MWDOC 2020 Urban Water Management Plan Update

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Assistant General Manager

MWDOC

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February 24, 2021

Jamie Lai
Public Works Director
City of Yorba Linda
4845 Casa Loma Avenue
Yorba Linda, CA 92886

Subject: MWDOC 2020 Urban Water Management Plan Update

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Harvey De La Torre
Assistant General Manager

APPENDIX M

Adopted UWMP and WSCP Resolutions (Pending)