ATTACHMENT 2

Source: Thomson, 2007.

EIP ASSOCIATES

A Division of PBSJ

Muni/Western Ex. **9-21**

Seven Oaks Dam Debris Pool on 27 March 2007 Showing the 2005 Maximum Waterline and Dead Vegetation

D51063.01

Seven Oaks

Source: Leidy, 2007.

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Muni/Western Ex. **9-22**

Warm Springs Cienga and SAR Canyon Post 2005-2006 Flood Control Operations, April 2007

D51063.01

Seven Oaks

Source: Leidy, 2007.

EIP ASSOCIATES

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Muni/Western Ex. **9-23**

Warm Springs Cienega from the SAR Channel Looking Toward Seven Oaks Dam, April 2007

D51063.01

Seven Oaks

Source: Leidy, 2007.

EIP ASSOCIATES

A Division of PBSJ

Muni/Western Ex. 9-27

View from Warm Springs Cienega Toward Seven Oaks Dam Showing Substantial Erosion of Sediments Deposited in 2004-2005, April 2007

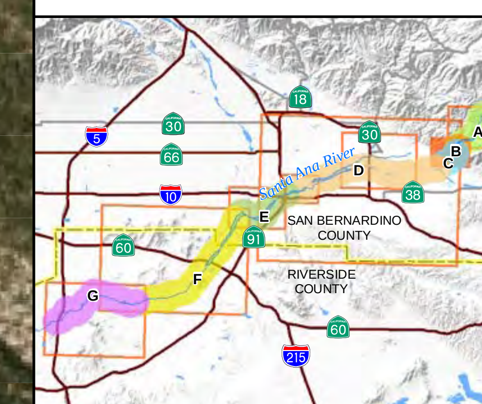
D51063.01

Seven Oaks

Multi/Western Ex. 9-38
Aerial View of SAR Segment B

Santa Ana River
San Bernardino County, CA

Exhibit Outline
Segment Start/End



N

0 350 700
Feet
1 inch equals 350 feet

Source: USDA/FSA - Aerial Photography Field Office, 2006.

EIP ASSOCIATES
A Division of PBSJ

D51063.01

N:\GISProjects\SAR_Riparian_11106\exhibit39.mxd

Source: Huffstutler, 2005.

EIP ASSOCIATES

A Division of PBS&J

Muni/Western Ex. **9-39**

Oblique View of Segment B from the Top of Seven Oaks Dam

D51063.01

Seven Oaks

Source: Leidy, 2005.

EIP ASSOCIATES

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Muni/Western Ex. **9-43**

Segment B Plunge Pool Showing Absence of Riparian Vegetation

D51063.01

Seven Oaks

Source: Leidy, 2005.

EIP ASSOCIATES

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Muni/Western Ex. **9-44**

Segment B Dewatered SAR Channel Downstream of Plunge Pool

D51063.01

Seven Oaks

Source: Leidy, 2005.

EIP ASSOCIATES

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Muni/Western Ex. **9-45**

Segment B Cuttle Weir and SBVWCD Diversion Looking Downstream at the SAR in a Wet Year

D51063.01

Seven Oaks

Source: Huffstutler, 2004.

EIP ASSOCIATES

A Division of PBSJ

Muni/Western Ex. **9-46**

Segment B Cuttle Weir and SBVWCD Diversion Looking Downstream at the SAR in a Dry Year

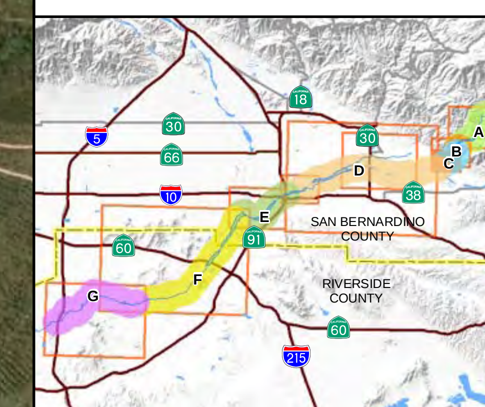
D51063.01

Seven Oaks

Multi/Western Ex. 9-47
Aerial View of SAR Segment C

Santa Ana River
San Bernardino County, CA

Exhibit Outline
Segment Start/End
County Boundary



N

0 500 1,000 1,500
Feet

1 inch equals 750 feet

Source: USDA/FSA - Aerial Photography Field Office, 2006.

EIP ASSOCIATES
A Division of PBSJ
D51063.01

N:\GISProjects\SAR_Riparian_11106\exhibitC.mxd

Source: Leidy/Thompson, 2005.

EIP ASSOCIATES

A Division of PBS&J

Muni/Western Ex. **9-48**

Segment C View Upstream (North) Toward Seven Oaks Dam Showing SAR Channel Down-cutting and Substrate Coarsening Due to Flood Pool Releases in 2004-2005

D51063.01

Seven Oaks

Source: Leidy, 2007.

EIP ASSOCIATES

A Division of PBSJ

Muni/Western Ex. **9-49**

Segment C View Upstream (North) Toward Seven Oaks Dam, Spring 2007

D51063.01

Seven Oaks

Source: Leidy/Thompson, 2005.

EIP ASSOCIATES

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Muni/Western Ex. **9-50**

Segment C Downstream View of SAR Channel Showing Armored Channel Bank

D51063.01

Seven Oaks

Muni/Western Ex. **9-51**

Segment C Downstream View of SAR Channel in Spring 2007

Source: Leidy/Thompson, 2005.

EIP ASSOCIATES

A Division of PBS&J

Muni/Western Ex. **9-52**

Segment C of the SAR Downstream of the Greenspot Road Bridge in the Summer 2005 Showing Channel Braiding and Absence of Riparian Vegetation

D51063.01

Seven Oaks

Source: Leidy, 2007.

EIP ASSOCIATES

A Division of PBS&J

Muni/Western Ex. **9-53**

Segment C of the SAR Downstream of the Greenspot Road Bridge in the Spring 2007

D51063.01

Seven Oaks

Source: Leidy/Thompson, 2005.

EIP ASSOCIATES

A Division of PBS&J

Muni/Western Ex. **9-54**

Segment C of the SAR a Short Distance Upstream of the Mill Creek Confluence in the Summer 2005

D51063.01

Seven Oaks

Source: Leidy, 2007.

EIP ASSOCIATES

A Division of PBS&J

Muni/Western Ex. **9-55**

Segment C of the SAR a Short Distance Upstream of the Mill Creek Confluence in the Spring 2007

D51063.01

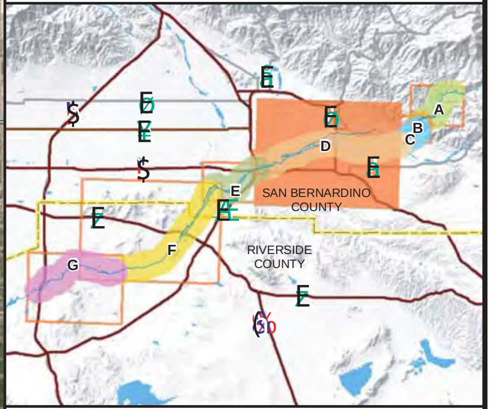
Seven Oaks

Multi/Western Ex. 9-56
Aerial View of SAR Segment D

Santa Ana River
San Bernardino County, CA

Exhibit Outline

Segment Start/End



N

0 0.75 1.5
Miles

1 inch equals 0.75 miles

Source: USDA/FSA - Aerial Photography Field Office, 2006.

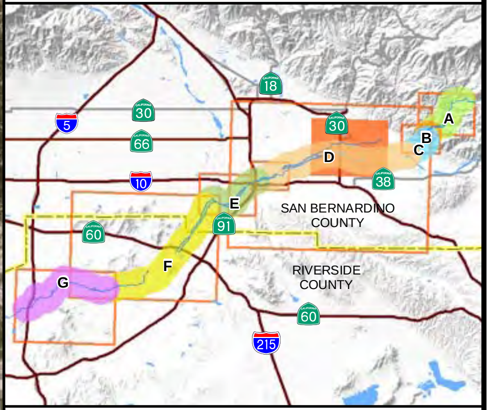
EIP
A Division of PBSJ

N:\GISProjects\SAR_Riparian_11106\exhibit44.mxd

Multi/Western Ex. 9-57
SAR Segment D
Intermittent Reach

Santa Ana River
San Bernardino County, CA

Exhibit Outline



N

0 1,000 2,000 3,000 4,000
Feet

1 inch equals 2,000 feet

Source: USDA/FSA - Aerial Photography Field Office, 2006.

EIP
A Division of PBSJ

D51063.01

N:\GISProjects\SAR_Riparian_11106\exhibit45.mxd

Source: Leidy, 2005.

EIP ASSOCIATES

A Division of PBS&J

Muni/Western Ex. **9-58**

Segment D Intermittent Reach Downstream of Orange Avenue Bridge During a Wet Water Year, 2005

D51063.01

Seven Oaks

Source: Leidy, 2007.

EIP ASSOCIATES

A Division of PBS&J

Muni/Western Ex. **9-59**

Segment D Intermittent Reach Downstream of Orange Avenue Bridge During a Dry Water Year, 2007

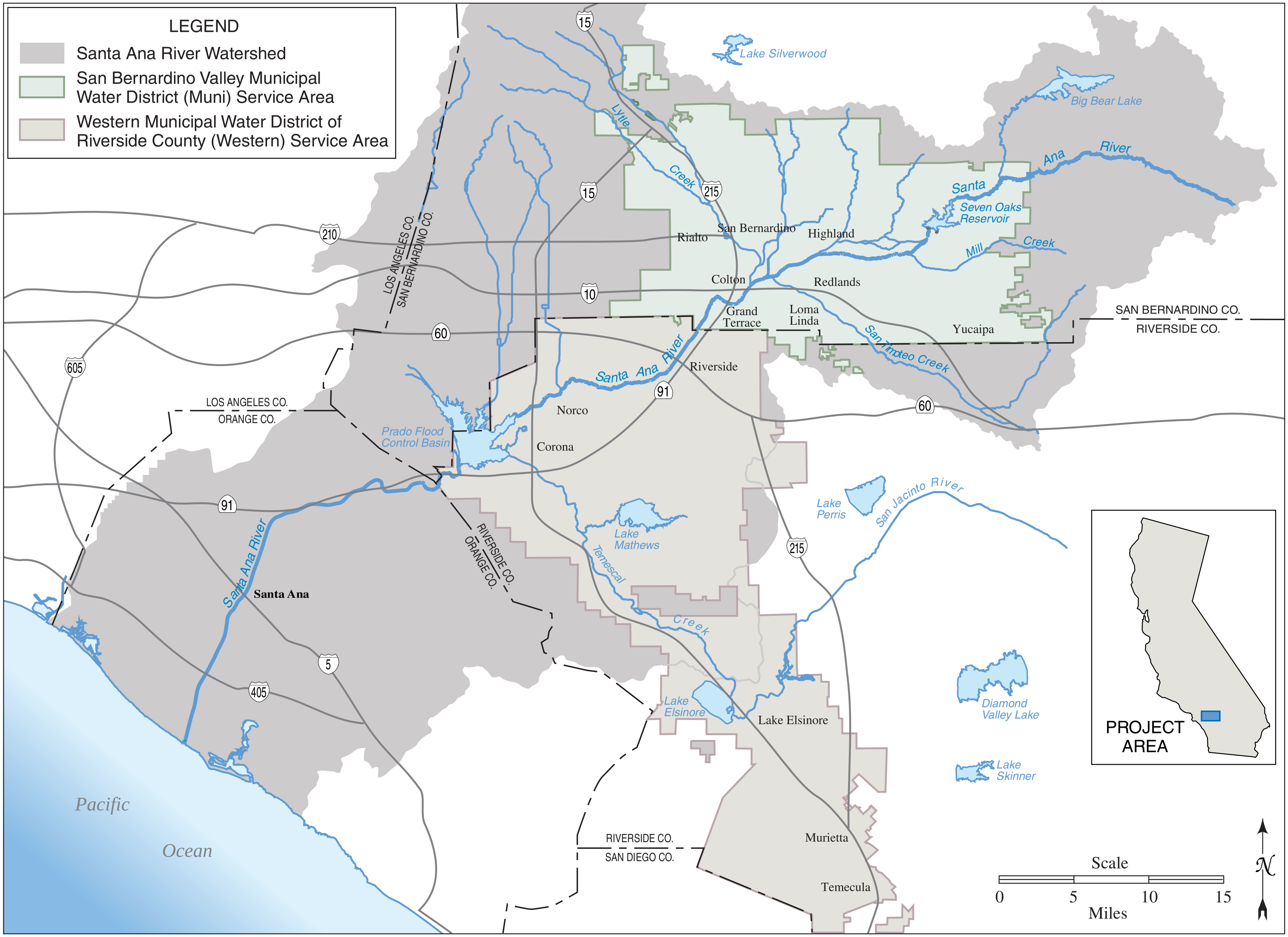


Figure 1-1. Muni and Western Service Areas

MUNI/WESTERN EXHIBIT 4-7

EXHIBIT A

San Bernardino Valley Municipal Water District

1350 SOUTH "E" STREET - P. O. BOX 5906 - SAN BERNARDINO, CALIFORNIA 92412-5906 -(909) 387-9200
FAX (909) 387-9247

January 24, 2008

Colonel Thomas H. Magness, IV
Commander
U.S. Army Corps of Engineers District, Los Angeles
Post Office Box 532711
Los Angeles CA 900530-2325

Dear Colonel Magness:

Request that you initiate a deviation study for Seven Oaks Dam Water Conservation.

In a letter to Col. Dornstauder on October 25, 2005, the District discussed the need for a Deviation Study for short-term water conservation at Seven Oaks Dam and the Corps' willingness to begin determining what would be needed to complete such a study in an expeditious manner. Subsequent to that letter, the Corps informed the District that preparation of a Deviation Report would take almost as long as completing the long-term water conservation study which was then being organized. That being the case, the Deviation Study was dropped to focus on the long-term study. This summer San Bernardino Valley Municipal Water District and Western Municipal Water District of Riverside County agreed to upfront any costs for the Conservation Study so that we would be able to restart the completion of the earlier study. However, the long-term study is not, as yet, completed and will not be completed until many months from now.

Over the last few months the water supply situation in West and particularly in California has become more problematic as the State Water Project supplies have been reduced because of the drought as well as recent Federal Litigation (Wanger decision).

The District, along with our partner Western Municipal Water District have just this week approved requesting the State Water Resources Control Board authorize a one-year urgency permit to appropriate water in the Santa Ana River near the Seven Oaks Dam. Such a permit will allow during the next year the Districts to divert, use and or store river water and Dam releases below Seven Oaks which otherwise would not be available to us under the current allocations and availability.

The Districts request that the Corps expedite a Deviation Study to be completed in time to allow conservation of spring runoff during this year. There are several items which necessitate the District renewing this request:

1. The past water year (October 1, 2006 through September 20, 2007) was the driest year on record in the Santa Ana River Watershed. Surface supplies and recharge of underground water supplies were severely reduced due the absence of rainfall/snowpack in the local mountains.

2. The forecast for the current water year is for below normal precipitation in our area.

3. Colorado River Supplies are at a low point, also. Exporting Producers from our local basin who are within Western MWD's service area will be affected by reduced Colorado River Supplies.

4. The State Water Project, in which the District is one of 29 contractors, has likewise suffered from reduced supplies due to reduced precipitation in the northern California watersheds feeding the Project. More recently, a Federal judge's decision to drastically reduce the ability of the State Water and the Federal Central Valley Projects to pump water out of the Sacramento Delta in order to protect an endangered species found in the waters of the Delta has further impaired and reduced deliveries from both Projects. The State has currently authorized only 25% of the water which has been requested from the State Water Project in 2008.

The Districts believe that the looming water shortage in Southern California is such that every opportunity to conserve native supplies should be pursued vigorously. Interim water conservation at Seven Oaks Dam pursuant to a Deviation Report is one such opportunity which should be implemented immediately.

In addition to preparing a Deviation Report, the Districts request that, if the State Water Resources Control Board grants the one-year permit, the Corps act, to the fullest extent of your authority and in a manner consistent with the current Operations Manual for Seven Oaks Dam, to respond to the present water supply emergency by coordinating with the Districts so as to allow for the maximum diversion and underground storage of water regulated by Seven Oaks Dam.

The District appreciates your cooperation and prompt action on this matter. Please contact me at 909/387-9218 to coordinate efforts and with any questions.

Very truly yours,

Randy Van Gelder
General Manager

cc: John Rossi - WMWD
cc: Ruth Villalobos

903594.1

EXHIBIT B

Santa Ana River - Mill Creek Cooperative Water Project

Daily Flow Report

Date: 01-02-08
Time:0730

State Water Project

Inflows	Flow Rate (cfs)	Deliveries	Flow Rate (cfs)		
BBMWD In-lieu	0.0	EVWD Treatment Plant	0.0	BVMWC Boullioun Box	0.0
Muni test @ Greenspot Sta.	0.0	Santa Ana Low Turnout	0.0	SARC West	0.0
Exchange Water	0.0	Northfork Canal	5.0	Zanja	0.0
Purchased Water	5.0	Edwards Canal	0.0	Tate Treatment Plant	0.0
Construction In-lieu	0.0	Redlands Aqueduct	0.0	SBCFCD Grove	0.0
Recharge Project	0.0	Crafton Unger Lane	0.0	Newport for BVMWC	0.0
Total SWP Inflows	5.0	Total SWP Deliveries	5.0	M/C spreading @ ZT	0.0
				SOD Reservoir Elevation	2172.05
				Debris Pool Elevation	2200.00

Santa Ana River

Inflows	Flow Rate (cfs)	Deliveries	Flow Rate (cfs)	Deliveries	Flow Rate (cfs)
PH #3 Penstock (CALC)	13.4	Greenspot Pipeline	0.0	BVMWC Highline	1.2
BVMWC Highline	0.0	SBCFCD Grove	0.0	Newport	0.0
Greenspot Pipeline	0.0	BVMWC Highline	0.0	Boullioun Box Weir	1.2
BVMWC River PU (USGS)	3.8	Newport for BVMWC	0.0	Gay Overflow	0.8
Greenspot Spill	0.0	SBVWCD Mill Creek Spreading	0.0	Boullioun Box to Zanja	0.0
Main River Gage (USGS)	0.0	Crafton WC Unger Lane	0.0	SBVWCD Mill Creek Spread	0.0
SBVWCD Diversion	0.0	BVMWC Highline to Boullioun	0.0	Tailrace Pipeline	2.8
Redlands Tunnel	0.4	Crafton WC Boullioun	0.0	Northfork Canal Weir	1.9
Big Bear Lake Release	1.0	Tate Pump Station to Zanja	0.0	Edwards Canal	0.9
PH#3 Penstock (SCADA)	13.0	SAR PH #3 Afterbay Spill	0.0	Tailrace Valve	0.0
SCE SAR AVM (SCADA)	13.0	Redlands Aqueduct Weir	13.6	Northfork Parshall Flume	0.0
Total SAR Inflows	17.2	SBVWCD Mill Creek Spreading	0.0	SBVWCD Parshall Flume	0.0
		Redlands Sandbox Spill	0.0	Cuttle Weir	0.0
				Total SAR Deliveries	17.2

Mill Creek

Inflows	Flow Rate (cfs)	Deliveries	Flow Rate (cfs)	Deliveries	Flow Rate (cfs)
M/C #1 Penstock Flow	13.4	Yucaipa Pipeline	0.0	Mill Creek #1 Flow (Cooley Hat)	12.2
Stream Parshall Flume to Yuca	0.0	Yucaipa Regional Park	0.0	Tate Inflow	10.1
SBVWCD Mill Creek Diversion	0.0	Wilson Creek Spreading	0.0	East Weir to Mill Creek	0.0
RPU Flow	7.2	SBVWCD Spreading	0.0	Boullioun to BVMWC Highline	0.0
M/C #3 Penstock	6.2	East Weir (MC)	0.0	East Weir to Zanja	2.1
Observation at Garnet Bridge	0.0	BVHL (SAR)	0.0	Zanja West Weir to CWC Canal	0.0
		Mill Creek Diversion (MC)	0.0	Mill Creek PH #2,3 Afterbay Spill	0.0
Total MC Inflows	13.4			Total MC Deliveries	12.2
Mentone Reser. Level (23.0)	20.8			Crafton Reser. Level (21.3)	21.3

SBVWCD Recharge

Location	Type	Previous Day (AF)		WY To Date (AF)	Target
Santa Ana River	SAR	0		1,226	10,500
Santa Ana River	SWP	0		0	6,000
Mill Creek	MC	0		217	6,000
Mill Creek	SWP				4,000

Comments:

1) Total SAR Deliveries = Greenspot Pipeline + BVMWC Highline + North Fork Canal Weir + Edwards Canal + SBVWCD PF + Cuttle Weir + Redlands Aqueduct Weir + Redlands Aqueduct to Spreading + SAR PH#3 Afterbay Spill - Redlands Tunnel
2) Total MC Deliveries = Yucaipa Pipeline + Mill Creek Diversion + Cooley Hat
   a) Per fish release.

EXHIBIT C

Technical Memorandum

GEOSCIENCE Support Services, Inc.
Tel: (909) 920-0707 Fax: (909) 920-0403
Mailing Address: P.O. Box 220, Claremont, CA 91711
Physical Address: 1326 Monte Vista, Suite 3, Upland, CA 91786
www.gssiwater.com

To:	Mr. Randy Van Gelder / San Bernardino Valley Municipal Water District Mr. John Rossi / Western Municipal Water District
From:	Dennis E. Williams, Ph.D. President GEOSCIENCE Support Services, Inc.
Date:	January 29, 2008
	Temporary Urgency Petition with SWRCB - Estimated Potential Amount of Water Available for Diversion by Valley District and Western for the 2008 Water Year

1.0 INTRODUCTION

1.1 Purpose and Scope

The purpose of this technical memorandum is to summarize estimates of the potential amount of streamflow available from the Santa Ana River (SAR) for diversion by San Bernardino Valley Municipal Water District (Valley District) and Western Municipal Water District (Western) for the water year (October 1, 2007 through September 30, 2008). Specifically, this memorandum provides technical information in support of Valley District and Western's Temporary Urgency Petition with the State Water Resources Control Board (SWRCB). The scope of this study included the following:

- Compilation of precipitation data up to the most recent storm event (January 28, 2008) for the 2008 water year;
- Statistical regression analyses of annual streamflow at the SAR near Mentone (Combined) Gaging Station (No. 11051501) and precipitation at San Bernardino County Hospital Station (No. 2146); and
- Preparation of this technical memorandum.

1.2 Sources of Data

Data sources used to conduct the study included the following:

- Precipitation data obtained from the San Bernardino County Flood Control District and the SAR Watermaster Annual Reports;
- Streamflow data obtained from the U.S. Geological Survey; and
- Historical diversions by Senior Water Rights holders (Bear Valley Mutual Water Company *et al.*) provided by SAIC.

2.0 ESTIMATION OF POTENTIAL AMOUNT OF WATER AVAILABLE AT THE SAR NEAR MENTONE FOR THE 2008 WATER YEAR

2.1 Statistical Regression Analysis Method

The potential amount of water available at the SAR near Mentone for the 2008 water year was estimated based on a statistical regression analysis method. The statistical regression analysis method develops an equation that can be used to estimate the annual streamflow at the SAR near Mentone based on the amount of precipitation. The following sections discuss the estimations for the 2008 water year.

2.2 Regression Analysis of Precipitation and Annual Streamflow

Regression analysis was performed between precipitation at the San Bernardino County Hospital Station (No. 2146) and the annual streamflow at the SAR near Mentone (Combined) Gaging Station (No. 11051501) using data from water years 1913-2006 (94 years). For the precipitation, variable lengths of time periods, including the 3-month period (1-Oct to 31-Dec), the 4-month period (1-Oct to 31-Jan), the 5-month period (1-Oct to 28-Feb), the 6-month period (1-Oct to 31-Mar) and the 7-month period (1-Oct to 30-Apr), were used. There is little correlation between the 3-month precipitation (1-Oct to 31-Dec) and annual streamflow (R^2 = 0.04)[1]. In general, a goodness-of-fit less than 0.3 represents a "poor" fit. A Goodness-of-fit of 0.4 to 0.6 yields predictable trends. With an increasing time period, the R^2 improves. The regression analysis was done using both linear regression and exponential regression. The following table summarizes the R^2 of these analyses.

Summary of Square of the Coefficient of Correlation (R^2)
Between Precipitation and Annual Streamflow

Time Period	Linear Regression	Exponential Regression
3-Months (1-Oct to 31-Dec)	0.05	0.11
4-Months (1-Oct to 31-Jan)	0.39	0.40
5-Months (1-Oct to 28-Feb)	0.53	0.54
6-Months (1-Oct to 31-Mar)	0.58	0.63
7-Months (1-Oct to 30-Apr)	0.55	0.62

As shown in the above table, the shortest time period needed for a predictable trend is the 4-month period (1-Oct to 31-Jan).

2.3 Estimated Streamflow from the SAR near Mentone for the 2008 Water Year Using Regression Equation

Regression equations were derived based on the relationship between the 4-month precipitation at the San Bernardino County Hospital Station (No. 2146) and the annual streamflow at the SAR near Mentone Gaging Station (No. 11511501) using data from water years 1913-2006 (94 years) and 1962-2000 (the 39-year hydrologic base period used for ground water modeling in the San Bernardino Basin area), respectively. The analyses were performed using both linear and

[1] R^2 is square of the coefficient of correlation (also called coefficient of determination or goodness-of-fit).

exponential regression (see Figures 1 through 4). The square of the coefficient of correlation (R^2) ranges from 0.39 to 0.50 and indicates a predictable trend between the 4-month precipitation and annual streamflow.

In the 2008 water year, the precipitation during the first 120-day period (1-Oct-07 through 28-Jan-08) was 8.23 inches recorded at the San Bernardino County Station (No. 2820)[2]. Station No. 2820 is located approximately one mile south of the San Bernardino County Hospital Station (No. 2146). The precipitation at the San Bernardino County Hospital Station (No. 2146) during the same 120-day period from 1-Oct-07 to 28-Jan-08 was estimated as 8.69 inches based on a regression analysis with precipitation measured at the San Bernardino County Station (No. 2820). The Station No. 2820 data was adjusted by a factor of 1.0563 based on the regression analysis between the two stations (see Figure 5).

Based on a current forecast[3], there are three storm events[4] that are expected to occur in the next five days (29-Jan-08 to 2-Feb-08). The total precipitation for these three upcoming storm events was estimated to be 1.53 inches assuming 0.51 inches of precipitation for each storm event (0.51 x 3 = 1.53). The 0.51 inches of precipitation per storm event was assumed for the upcoming storms based on the average amount of precipitation which occurred for the last eight storm events occurring between January 4 and January 28, 2008. Measured precipitation for the first 120 days of the 2008 water year (1-Oct-07 to 28-Jan-08) was 8.69 inches. Therefore, based on measured data and the assumptions presented above, the 4-month precipitation[5] for the 2008

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2 The precipitation data at the San Bernardino County Hospital (No. 2146) for water year 2008 was not available at the time of preparation of this technical memorandum.

3 Based on information from http://weather.msn.com :Local Weather Forecast for the San Bernardino, California dated 28-Jan-08

4 For purpose of this report, the total precipitation for each storm event is the total precipitation during a 24-hour period (i.e. a day).

5 For purpose of this analysis, all three storms forecasted were included in the 4-month precipitation.

water year was estimated to be 10.22 inches (8.69 + 1.53 = 10.22) at the San Bernardino County Hospital Station (No. 2146).

Using the best-fit straight lines derived from the linear regression analysis, the annual streamflow at the SAR near Mentone was estimated to range between 73,000 acre-ft and 79,000 acre-ft (see Figures 1 and 2). Using the best-fit curves derived from the exponential regression analysis, the annual streamflow was estimated to range between 56,000 acre-ft and 59,000 acre-ft (see Figures 3 and 4).

3.0 POTENTIAL AMOUNT OF WATER AVAILABLE FOR DIVERSION BY VALLEY DISTRICT AND WESTERN IN THE 2008 WATER YEAR

The potential amount of water available for diversion by Valley District and Western for the 2008 water year can be estimated using the following equation:

$$D_{VDW} = SAR_M - D_{Senior} - D_{SBVWCD} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..(1)$$

Where:

D_{VDW}	=	Potential Diversion by Valley District and Western for the 2008 Water Year, acre-ft
SAR_M	=	Estimated Annual Streamflow at the SAR near Mentone (Combined) for the 2008 Water Year, acre-ft
D_{Senior}	=	Diversion by Senior Water Rights for the 2008 Water Year, acre-ft
D_{SBVWCD}	=	Diversion by San Bernardino Valley Water Conservation District (SBVWCD) between 1-Oct-07 and 31-Dec-07 plus SBVWCD Licensed Right Diversions between 1-Jan-08 and 31-May-08, acre-ft

As shown in Section 2 of this technical memorandum, the estimated annual streamflow at the SAR near Mentone for the 2008 water year ranges from 56,000 acre-ft to 79,000 acre-ft (see column [3] of Table 1). Diversion by the Senior Water Rights holders for the 2008 water year was estimated to be 26,000 acre-ft based on the median diversion during the period from 1962 to 2000 (see column [5] of Table 1). The diversion by SBVWCD between 1-Oct-07 and 31-Dec-07 (1,226 acre-ft) plus the SBVWCD licensed right diversions between 1-Jan and 31-May (8,300 acre-ft) are 9,526 acre-ft (9,526 = 1,226 + 8,300, see column [4] of Table 1).

Table 1 summarizes the estimated potential amount of water available for diversion by Valley District and Western for the 2008 water year using equation (1) above. As shown in the table, the potential amount of water available for diversion by Valley District and Western is estimated to range from 20,000 acre-ft to 43,000 acre-ft with an average of approximately 31,000 acre-ft.

4.0 FINDINGS

Based on the analyses as discussed in the previous sections, there is approximately a 50% probability that there will be between 20,000 and 43,000 acre-ft available for diversion by Valley District and Western. The expected value of such diversions would be approximately 31,000 acre-ft.

Estimated Potential Amount of Water Available for Diversion by Valley District and Western for the 2008 Water Year

[1] Methods	[2] Time Period of Data Used for Analysis	[3] Predicted Streamflow at the SAR near Mentone (Combined) Gaging Station for the 2008 Water Year [acre-ft]	[4] Diversion by SBVWCD [acre-ft]	[5] Diversion by Senior Water Rights [acre-ft]	[6] Amount of Water Available for Diversion by Valley District and Western [acre-ft]
Equation of Best-Fit Straight Line (R^2 = 0.39, See Figure 1)	1913-2006 (94 Years)	73,000	9,526	26,000	37,474
Equation of Best-Fit Straight Line (R^2 = 0.45, See Figure 2)	1962-2000 (39 Years)	79,000	9,526	26,000	43,474
Equation of Best-Fit Exponential Curve (R^2 = 0.40, See Figure 3)	1913-2006 (94 Years)	56,000	9,526	26,000	20,474
Equation of Best-Fit Exponential Curve (R^2 = 0.50, See Figure 4)	1962-2000 (39 Years)	59,000	9,526	26,000	23,474

Maximum	**43,474**
Minimum	**20,474**
Average	**31,224**

[1], [2], [3] See Figures 1 through 4
[4] Diversion by SBVWCD between 1-Oct-07 and 31-Dec-07 (1,226 acre-ft) plus SBVWCD Licensed Right Diversions between January 1 and May 31 (8,300 acre-ft)
[5] Estimated based on the median diversion by the Senior Water Rights during the period 1962-2000
[6] = [3] - [4] - [5]

Table 1

Annual Streamflow at SAR near Mentone (Combined) Gaging Station (No. 11051501) versus 4-Month Precipitation (1-Oct to 31-Jan) at San Bernardino County Hospital Station Based on Data from Water Years 1913-2006 (94 Years) - Linear Regression

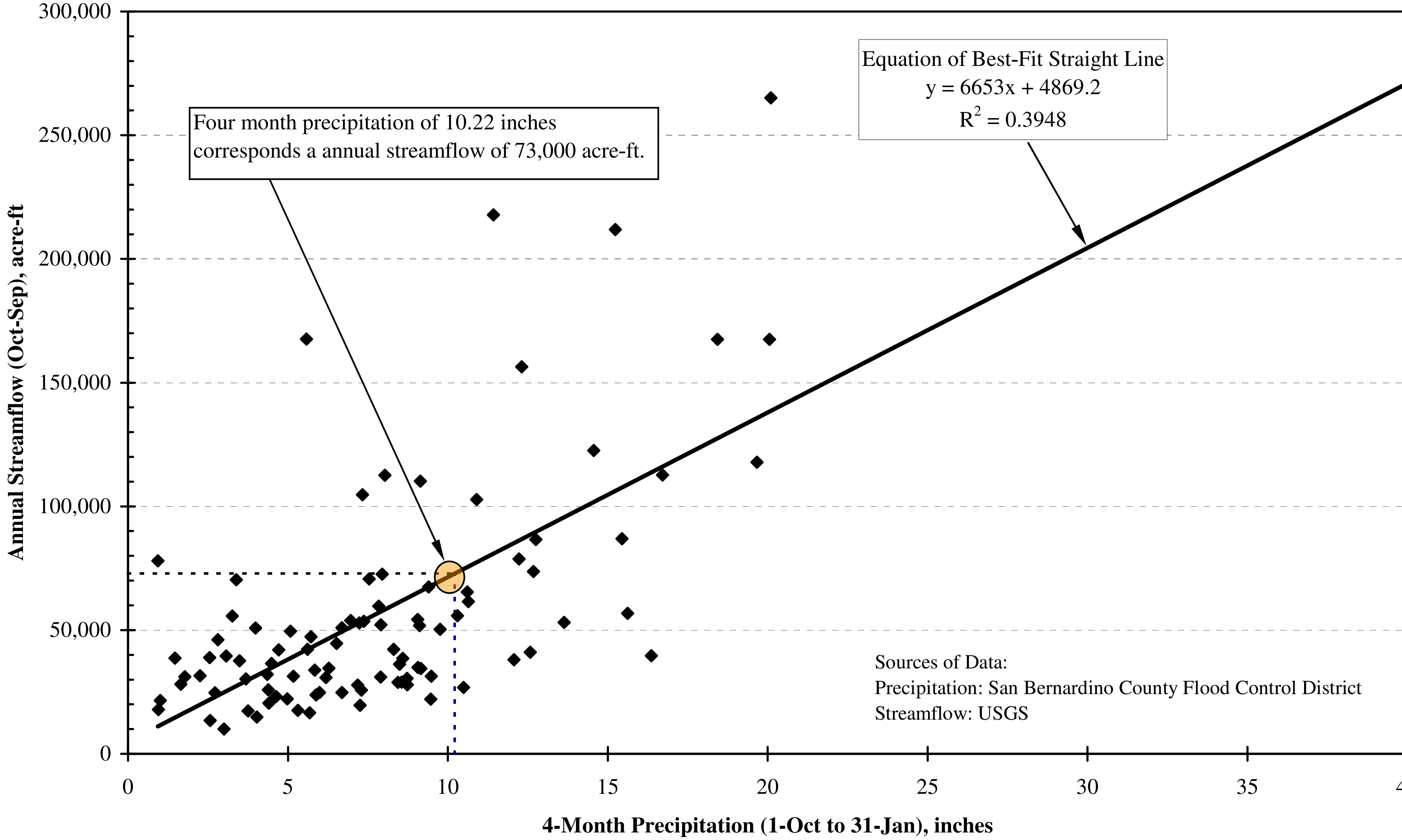

Figure 1

Annual Streamflow at SAR near Mentone (Combined) Gaging Station (No. 11051501) versus 4-Month Precipitation (1-Oct to 31-Jan) at San Bernardino County Hospital Station Based on Data from Water Years 1962-2000 (39 Years) - Linear Regression

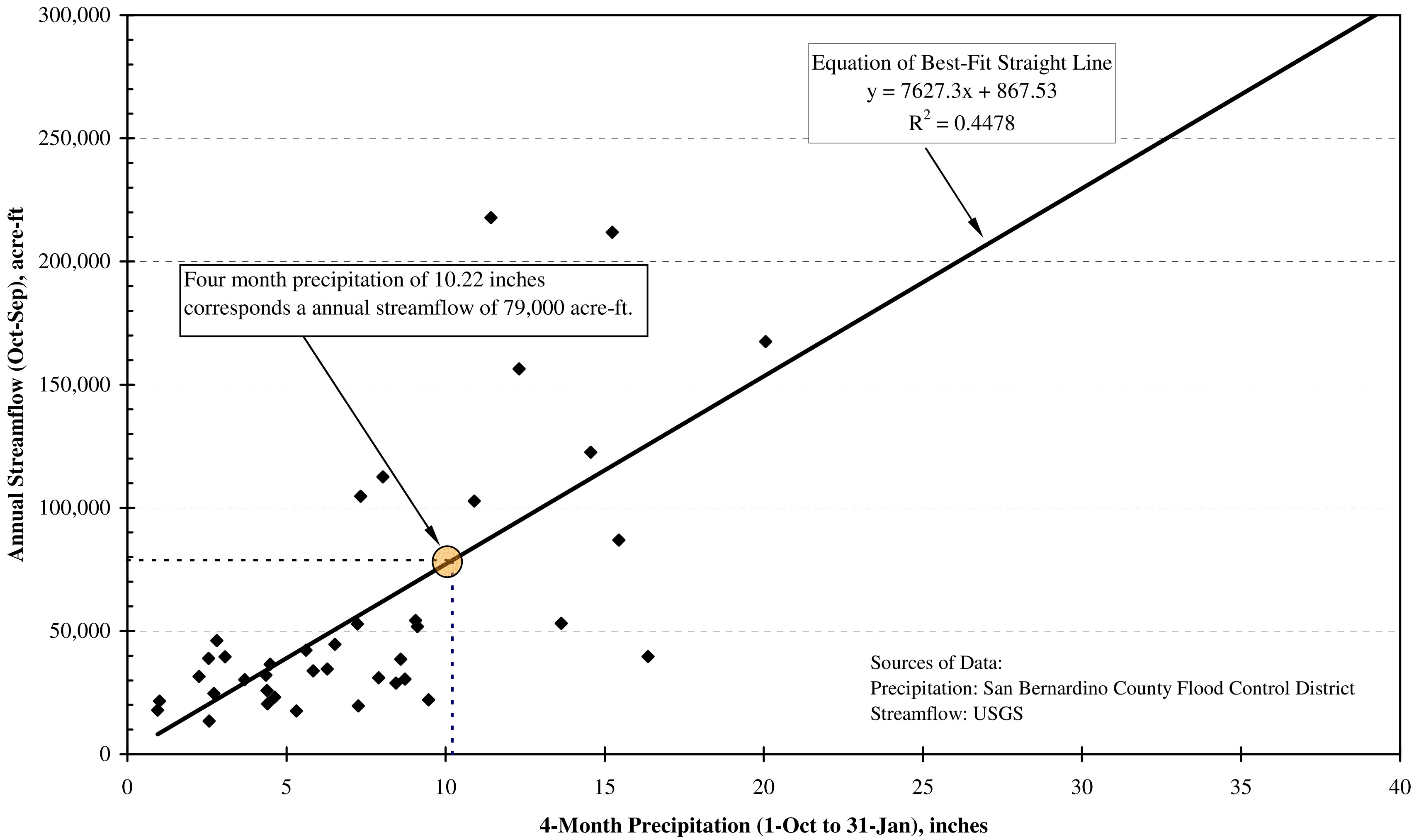

Figure 2

Annual Streamflow at SAR near Mentone (Combined) Gaging Station (No. 11051501) versus 4-Month Precipitation (1-Oct to 31-Jan) at San Bernardino County Hospital Station Based on Data from Water Years 1913-2006 (94 Years) - Exponential Regression

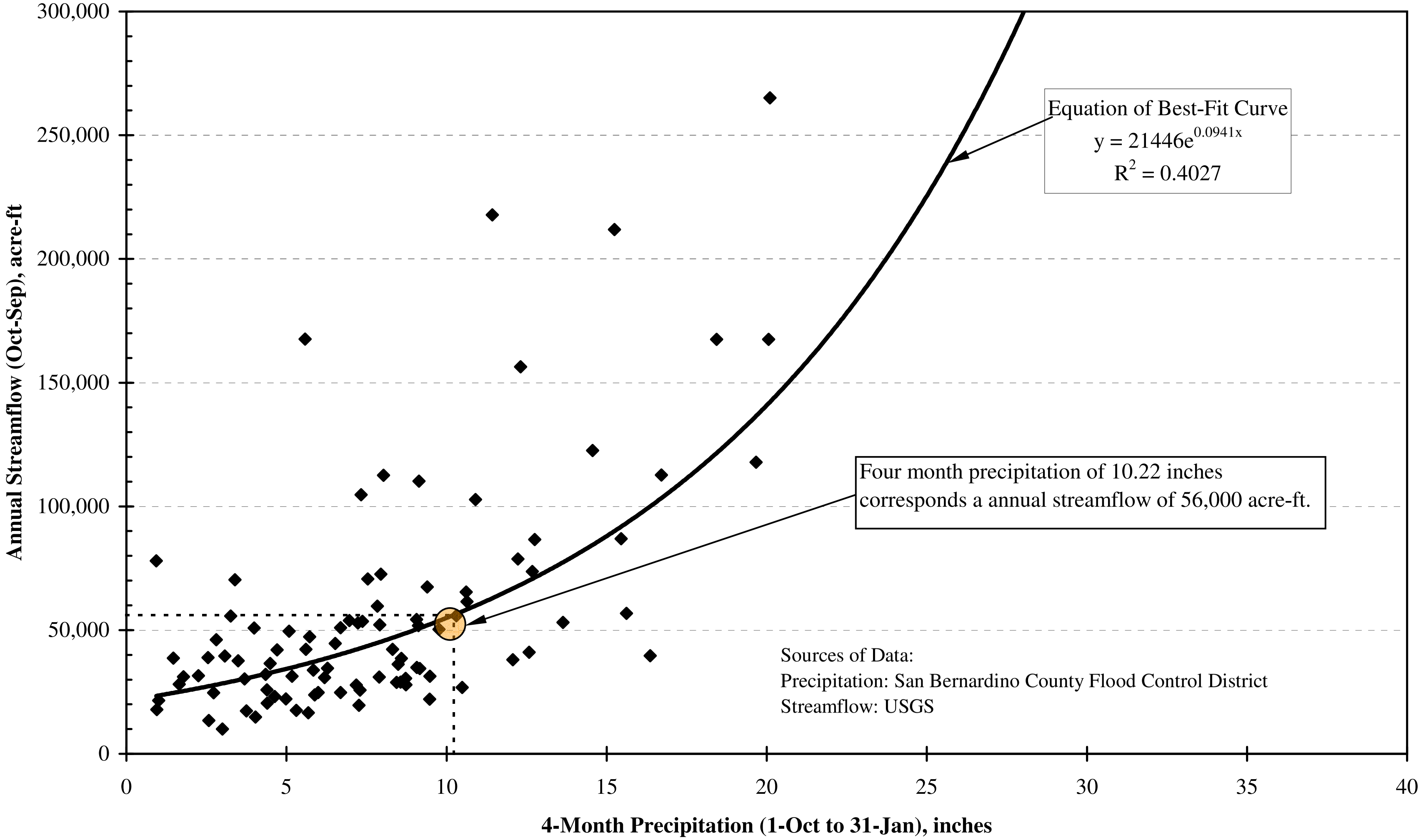

Figure 3

Annual Streamflow at SAR near Mentone (Combined) Gaging Station (No. 11051501) versus 4-Month Precipitation (1-Oct to 31-Jan) at San Bernardino County Hospital Station Based on Data from Water Years 1962-2000 (39 Years) - Exponential Regression

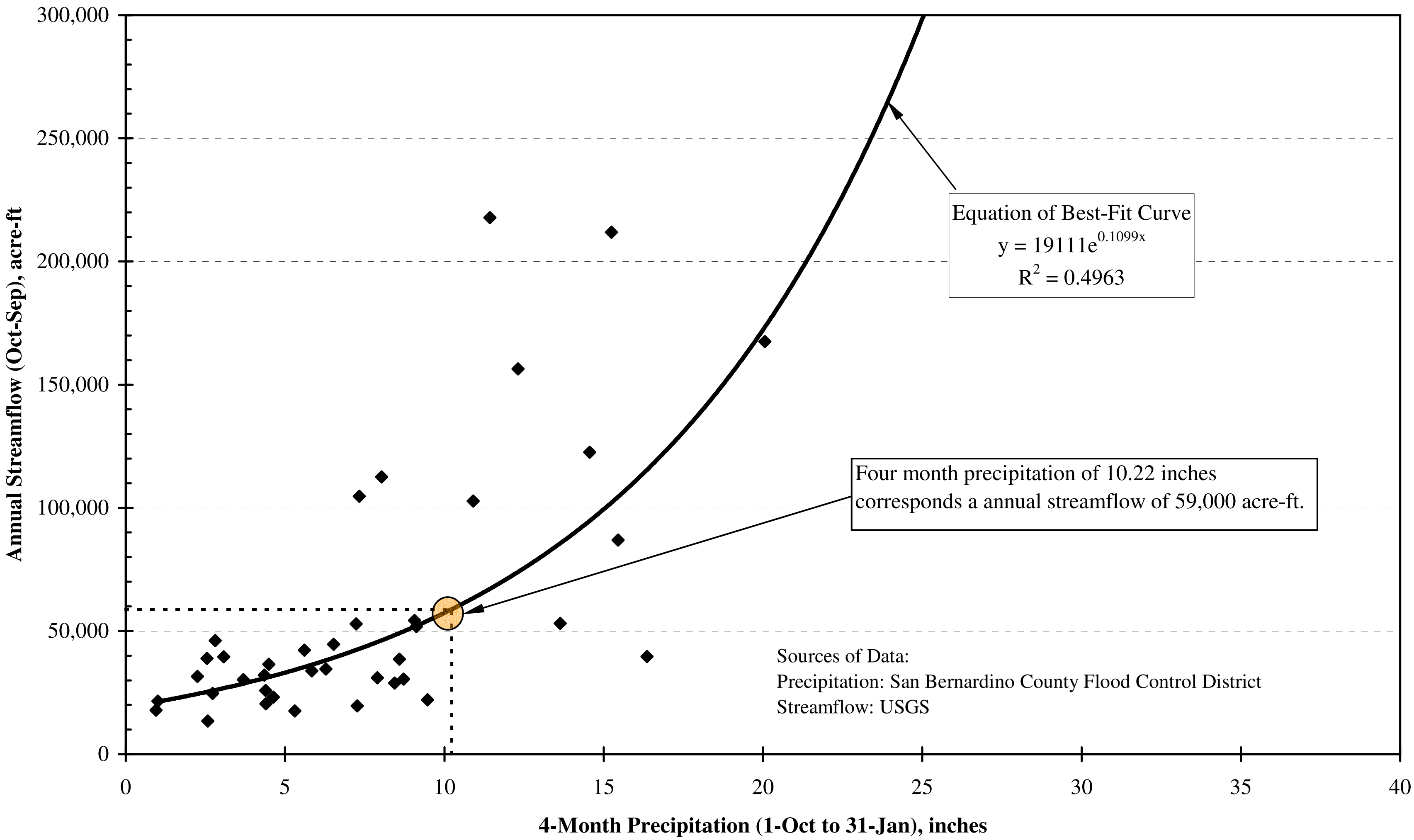

Figure 4

Annual Precipitation at San Bernardino County Station (No. 2820) versus Annual Precipitation at San Bernardino County Hospital Station (No. 2146)

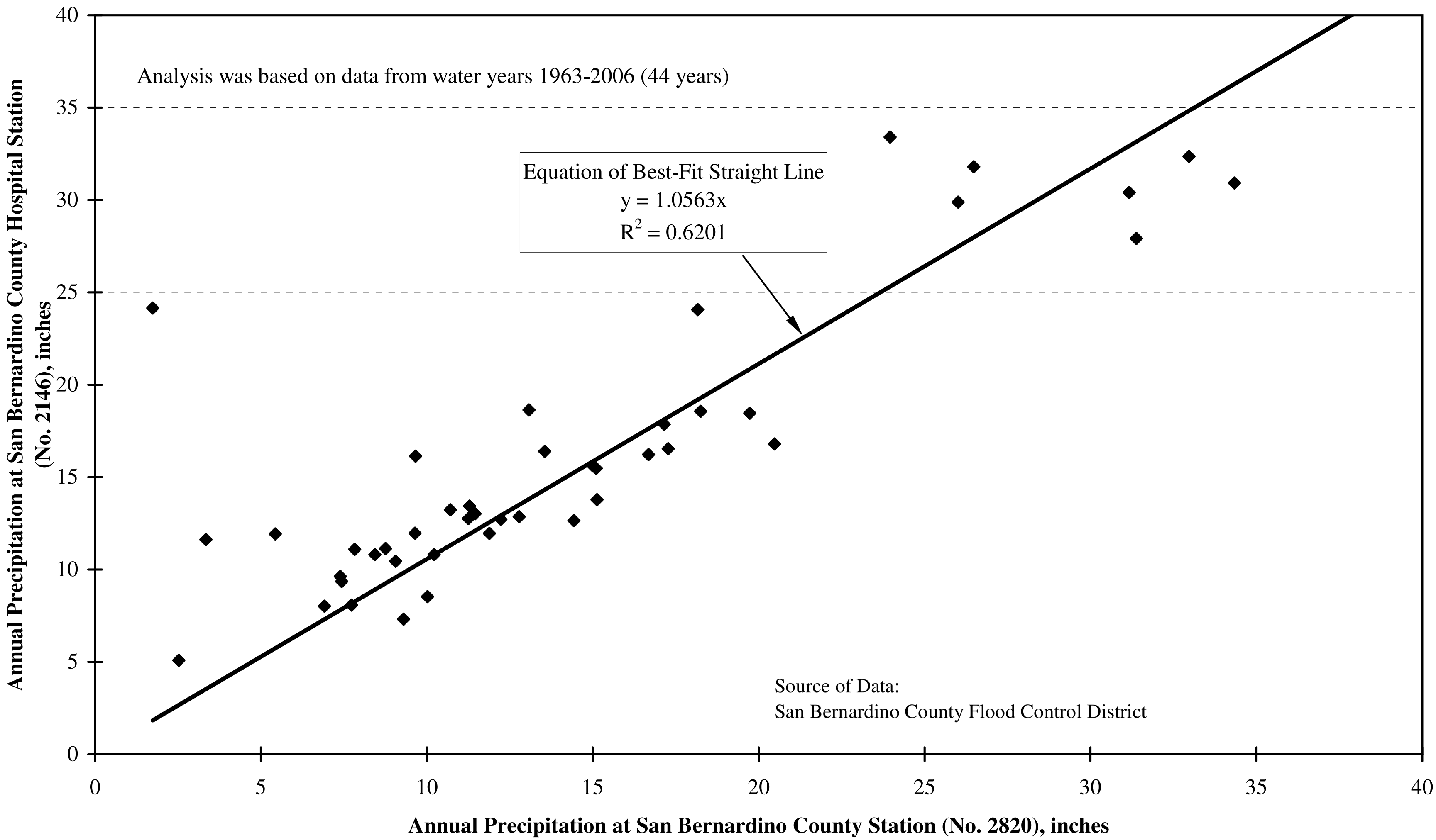

Figure 5

EXHIBIT D

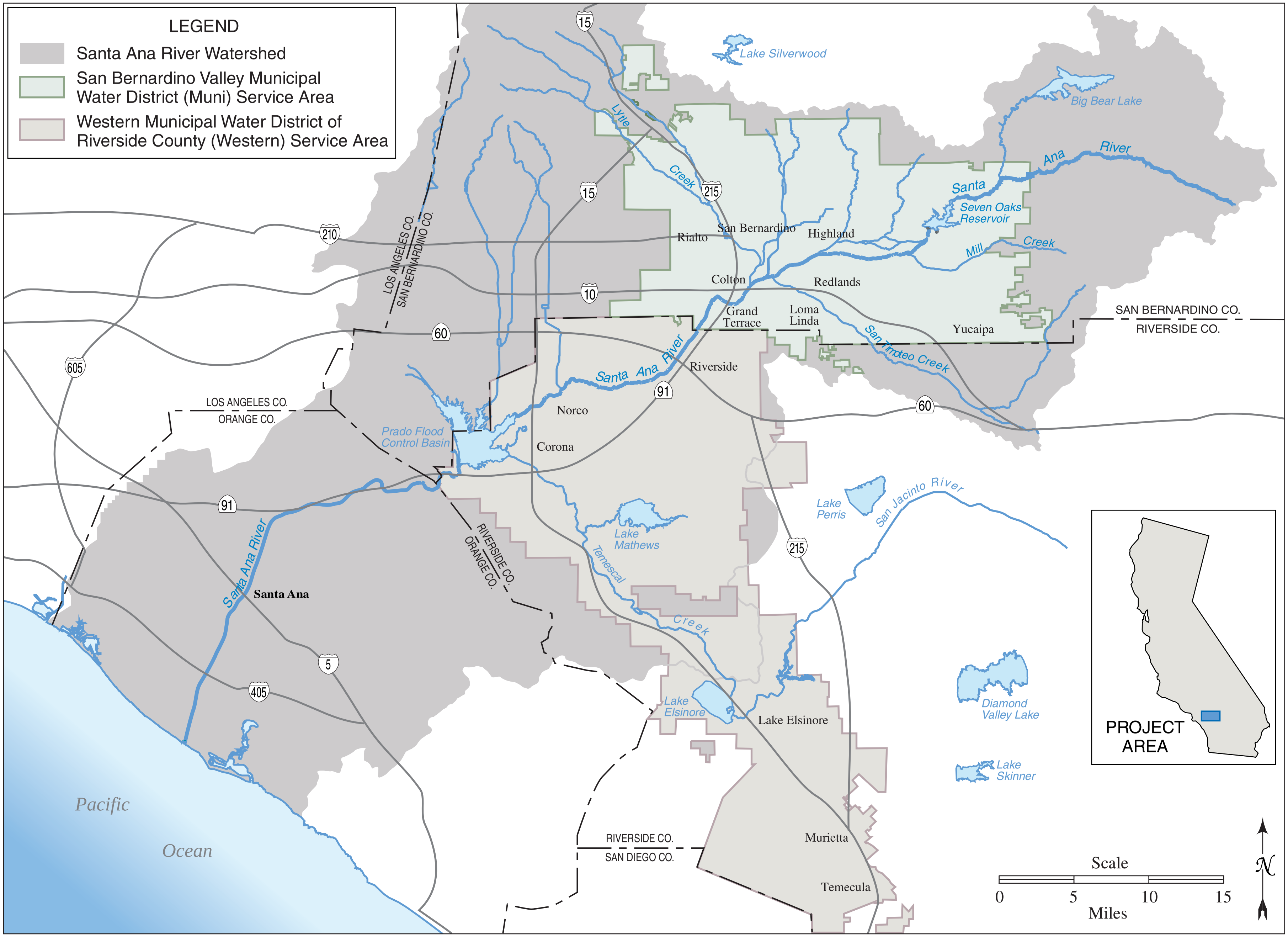

Figure 1-1. Muni and Western Service Areas

MUNI/WESTERN EXHIBIT 4-7

EXHIBIT E

Santa Ana River Water Rights

Testimony of Dennis E. Williams

April 16, 2007

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VII. Project Area Geohydrology

44. The Project Area comprises Muni/Western's service areas, which includes all or portions of the groundwater basins: Bunker Hill, Lytle Creek, Rialto-Colton, Yucaipa, and San Timoteo. However, the main focus of the study was on the Bunker Hill and Lytle Basins, which collectively are referred to as the San Bernardino Basin Area (SBBA). The groundwater modeling work carried out by GEOSCIENCE was limited to the SBBA, with an analytical expression used to determine impacts from artificial recharge basins outside of the model area.

San Bernardino Basin Area

Location

45. The SBBA plays a central role in the water supply for communities within the Muni/Western service areas. The SBBA has a surface area of approximately 90,000 acres (141 square miles) and lies between the San Andreas and San Jacinto faults, as shown in Muni/Western Ex. 6-117. The basin is bordered on the northwest by the San Gabriel Mountains; on the northeast by the San Bernardino Mountains; on the east by the Banning fault and Crafton Hills; and on the south by a low, east-facing escarpment of the San Jacinto fault and the San Timoteo Badlands. Alluvial fans extend from the base of the mountains and hills that surround the valley and coalesce to form a broad, sloping alluvial plain in the central part of the valley.

46. The SBBA traditionally refers to two groundwater basins: Bunker Hill and Lytle Creek, (see Muni/Western Ex. 6-118). The Bunker Hill Groundwater Basin is further divided into sub-areas, including the Cajon, City Creek, Devil Canyon, Divide, Mill Creek, Pressure Zone, Redlands, and Reservoir sub-areas (see Muni/Western Ex. 6-119).

Geology and Aquifer System

47. The primary water-bearing formations of the SBBA are the unconsolidated sediments of older and younger alluvium and river channel material deposited and reworked by the Santa Ana River and tributaries such as Lytle Creek and Cajon Creek (Dutcher and Garrett, 1963). Near the mountain front, the unconsolidated deposits tend to be coarse-

grained and poorly sorted, becoming finer-grained and well sorted downstream. The older alluvium consists of continental, fluvial deposits, ranging in thickness from tens of feet to more than 800 ft. The younger alluvium is approximately 100 ft thick, composed mainly of floodplain deposits. The relatively recent river channel deposits are less than 100 ft thick but are among the most permeable sediments in the SBBA and contribute to large seepage losses from streams (Danskin et al., 2006).

48. Dutcher and Garrett (1963) divided the SBBA alluvial sediments into upper, middle, and lower confining members and upper, middle, and lower water-bearing members. However, the aquifer system of the SBBA is generally unconfined with water moving vertically between the multiple water-bearing layers. The confining members are more accurately described as leaky aquitards[2] of finer grained sediments.

49. The upper and middle water-bearing members provide most of the water to municipal and agricultural wells. In the central part of the SBBA, these areas are separated by as much as 300 ft of interbedded silt, clay, and sand (the middle confining member). This middle confining member produces confined conditions over the central part of the basin (referred to locally as the "confined area" or pressure zone), but thins and becomes less effective toward the margins of the basin (Dutcher and Garrett, 1963). Although the middle confining member is not as permeable as the adjacent water-bearing zones, this unit consists primarily of continuous sand and silt (not silt and clay as is found in most aquitards) and yields water to wells (Danskin et al., 2006). The lower confining and lower water-bearing member are not typically penetrated by most production wells and play a smaller role in the valley-fill aquifer, mainly due to deeper depths and generally lower permeability.

50. Three exceptions to the general presence of the leaky stratified system in the SBBA occur in the southwestern, southern, and eastern portions of the basin. The three separate water-bearing zones are not identifiable in the southwestern part of the basin, between the San Jacinto and Loma Linda faults (i.e., the Lytle Creek Basin - see Muni/Western

[2] An aquitard is a low-permeability sedimentary unit that can store groundwater and also transmit it slowly from one aquifer to another (Fetter 1988). An aquitard is generally considered to be a barrier or partial barrier to movement of groundwater because water tends to move substantially slower through aquitards than aquifers.

Ex. 6-117 and 6-119), but are generally recognizable up to approximately four miles east of the Loma Linda Fault.

51. In part of a former marshland in the south part of the basin, between Warm Creek and the Santa Ana River, thick clay sequences in the Holocene younger alluvium result in confined to semi-confined aquifer conditions in the upper 50 to 100 ft of saturated materials. This area containing the upper confining member is referred to as the "Pressure Zone" (see Muni/Western Ex. 6-119). The upper aquitard is also absent adjacent to the San Bernardino Mountains (i.e., the "forebay"), allowing groundwater recharge from mountain stream runoff to percolate into the basin.

Groundwater Flow

52. The areal pattern of groundwater flow, from areas of recharge along the base of the mountains, to areas of discharge where the Santa Ana River crosses the San Jacinto Fault, has historically remained relatively unchanged. Groundwater elevation contours shown in Muni/Western Ex. 6-120 illustrate this flow regime in the SBBA. However, vertical groundwater movement has changed through time due to groundwater extraction and artificial recharge. Groundwater pumping has occurred from increasingly deeper depths, altering the natural vertical movement of groundwater by progressively draining deeper zones of groundwater (Danskin et al., 2006).

Recharge and Discharge

53. Percolation from gaged streams (such as the Santa Ana River, Lytle Creek, Cajon Creek, Devil Canyon Creek, East Twin Creek, Warm Creek, City Creek, Plunge Creek, and Mill Creek) is the major source of recharge in the SBBA. Recharge occurs both in the stream channels and in nearby artificial recharge basins. As a result of the highly permeable river-channel deposits and the artificial recharge operations, nearly all of the flow in the smaller gaged streams (Devil Canyon, Waterman, East Twin, Plunge, and San Timoteo creeks) is recharged to the aquifer close to the mountain front. During floods, the major streams (Santa Ana River, Mill Creek, and Lytle Creek) transmit large volumes of water over a short period, resulting in some surface water exiting the basin without contributing to groundwater recharge. Percolation from un-gaged streams and other runoff sources (i.e., streams that do not have USGS gages, or runoff from urban areas that is not gaged)

is less important than runoff in gaged streams since the total quantity of ungaged runoff is approximately one-tenth that of gaged runoff.

54. Recharge to the SBBA also results from underflow (subsurface inflow), direct infiltration of precipitation, return flow, infiltration from underground sanitary sewer lines and storm drains, and artificial recharge of imported water. Subsurface inflow to the SBBA occurs (1) across the Crafton Fault and through the poorly transmissive materials comprising the Badlands, (2) across a small section of unconsolidated deposits north of the Crafton Hills, and (3) through materials beneath the Cajon Creek and Lytle Creek channels. Underflow across the Crafton Fault and through the Badlands was defined by Dutcher and Fenzel (1972) to be approximately 6,000 acre-ft per year (acre-ft/year) for the period 1945 to 1965, and underflow beneath the creek channels was estimated by the DWR (1970) to be approximately 3,300 acre-ft/year for the period 1935 to 1960. Recharge from direct precipitation on the valley floor is generally minimal. An additional source of recharge is derived from return flow of water pumped from and used locally within the SBBA. Hardt and Hutchinson (1980) estimated return flow to be 30 percent of total extractions, except for wells that export groundwater directly out of the San Bernardino area. Artificial recharge of imported water to the SBBA began in 1972. Because of the extremely permeable sand and gravel deposits, recharge rates are high. Based on a recharge efficiency rate of 95 percent (applied water less losses), the total quantity of artificial recharge in the basin averaged approximately 7,400 acre-ft/year from 1972 to 1992. Because of the size of several of the recharge basins and exceptionally permeable material, a larger quantity of water could be imported and recharged along the base of the San Bernardino Mountains if necessary (i.e., recharge basin capacity and infiltration rates are not currently limiting the amount of imported water recharged).

55. Groundwater discharge from the SBBA occurs from (1) rising water, (2) subsurface outflow, and (3) groundwater extractions. Rising water primarily occurs in the lower reaches of Warm Creek, when nearby groundwater rises above the level of the channel bottom. The quantity of groundwater discharge into the creek for the period 1945 to 1992 was determined to be highly variable, with a maximum discharge exceeding 40,000 acre-ft/year and a minimum discharge of zero for 16 consecutive years, from 1963 to 1978 (Danskin et al., 2006). Subsurface outflow occurs across the San Jacinto Fault and

Barrier E[3] at two locations, including in the vicinity of the Santa Ana River at the Colton Narrows, and where Lytle Creek emerges from the San Gabriel Mountains, north of Barrier J (see Muni/Western Ex. 6-117). In the vicinity of the Santa Ana River at the Colton Narrows, subsurface outflow occurs in the younger alluvium. For the period 1936 to 1949, subsurface outflow in this area was estimated to range from 14,300 to 23,700 acre-ft/year (Dutcher and Garrett, 1963). Subsurface outflow north of Barrier J was estimated to be approximately 4,000 acre-ft/year, by Dutcher and Garrett (1963), and between 2,700 and 4,200 acre-ft/year during water years 1935 to 1960, by DWR (1970).

56. While stream flow and subsurface outflow contribute to basin discharge, groundwater extraction is the primary model discharge term. Extracted water is used for agricultural, municipal, and industrial purposes. Most pumping is located near major streams, including the Santa Ana River, Lytle Creek, Warm Creek, and East Twin Creek. This areal distribution of pumpage reflects the exceptionally permeable deposits that underlie stream channels and the abundant nearby recharge (Danskin et al., 2006). As the area has become urbanized, the quantity of agricultural pumpage has declined considerably, presently accounting for less than 20 percent of the gross pumpage (Danskin et al., 2006). However, overall pumpage has increased in the basin due to increased pumping for municipal and industrial purposes. Prior to 1940, gross pumpage in the basin was less than 110,000 acre-ft/year, while currently pumping has reached as high as approximately 200,000 acre-ft/year (Western–San Bernardino Watermaster, 2002).

57. Per the provisions of the Western Judgment, operational criteria with regard to the amount of water in storage, along with extractions and additions that are made on an annual basis, apply to the SBBA. The basin is maintained to not exceed the long-term natural safe yield, so that extractions made by pumping on the part of agencies with authority to do so must be replaced (or replenished) to the extent that they exceed the natural safe yield. Muni plays a critical role in these replenishment activities.

[3] A groundwater barrier may be formed by faults transecting alluvial groundwater basins. The fault may create partial (i.e., leaky) or complete barriers to groundwater flow. It is well accepted in the groundwater industry that the barrier effect is the result of local and incomplete offsetting of gravel beds against clay beds, development of secondary clay gouge zones along the faults, and/or cementation of the gravel and sand beds immediately adjacent to the fault by deposition of carbonate minerals from rising water (Dutcher and Garrett, 1963). The barrier may have the affect of “damming” up groundwater on the upgradient side of the barrier, thereby causing differences in water levels on either side of the barrier.

Groundwater Storage and Groundwater Levels

58. The basin has an estimated total storage capacity of approximately 5,976,000 acre-ft (DWR, 2003).

59. Estimates are made annually of the change in groundwater volume (i.e., storage) in the SBBA by both Muni and the San Bernardino Valley Water Conservation District (Conservation District), from which a cumulative change in basin storage is calculated. The approach employed by Muni calculates the change in storage for nine sub-areas: Cajon, Devil Canyon, Lytle Creek, Pressure Zone, City Creek, Redlands, Mill Creek, Reservoir, and Divide (see Muni/Western Ex. 6-119). Calculating the change in storage for the SBBA is accomplished by summing individual values for each of the sub-areas.

60. The first change in storage calculation was completed for the years 1934-1960 by the DWR (DWR, 1970). The values were calculated using the Specific Yield Method and a mathematical model developed by TRW, Inc. (TRW, 1967). In 1980, Muni updated the change in storage calculation to include the years 1961-1980. In the early 1990s, Muni created a new change in storage model using software developed by Environmental Systems Research Institute (ESRI). In years of low precipitation, infiltration (direct from precipitation and from surface streams) decreases while groundwater extractions increase, thereby causing the cumulative storage to decrease. The trend in cumulative change in storage over the period 1934-2002 is shown in Muni/Western Ex. 6-121. The cumulative change in storage is cyclical based upon weather conditions. For example, 1934 through 1945 and 1979 through 1983 were wet periods, which produced increases in storage, while 1950 through 1966 was a dry period, resulting in decreased storage. To assist in the interpretation of Muni/Western Ex. 6-121 (and Muni/Western Ex. 6-122), an inset representing cumulative departure from average annual precipitation over the same time period is shown. These cycles are also evident in Muni/Western Ex. 6-123, which illustrates the average annual increase or decline in depth to groundwater across the entire basin.

61. The San Jacinto Fault generally runs perpendicular to the groundwater flow and acts as a partial barrier (e.g., similar to a subsurface, leaky dam) resulting in groundwater level differences across the fault. This phenomenon also contributes to the high groundwater located within the City of San Bernardino commonly referred to as the Pressure Zone.

Muni/Western Ex. 6-124 depicts depth to groundwater contours throughout the SBBA, Rialto-Colton Basin, and Yucaipa Basin, including those reflecting shallow groundwater conditions in the Pressure Zone. In the past, the groundwater level in the Pressure Zone has risen high enough to cause artesian flowing conditions[4].

62. For the basin as a whole, there can be wide fluctuations in the average depth to groundwater from year to year, with annual changes as high as approximately 40 feet (see Muni/Western Ex. 6-123). However, for the most part, annual changes register less than 20 feet (+ or -), with only six years exceeding this range. There are, however, noticeable variations in behavior across management zones.

63. The Lytle Creek Basin contains Lytle Creek with extensive headwaters in the adjacent mountain areas and a river channel comprised of deep, porous alluvial deposits. Due to the presence of Lytle Creek and its relatively small size, this management zone exhibits far greater and more extreme changes than any other management zone of the SBBA. In 40 of the 68 years, the annual average change in depth to groundwater exceeds 20 feet, with 8 years showing changes greater than 50 feet, and 3 years showing changes greater than 100 feet (see Muni/Western Ex. 6-125).

__Groundwater Quality__

64. Groundwater in the SBBA is generally a sodium/calcium bicarbonate type, containing equivalent amounts of sodium and calcium near the land surface and an increasing predominance of sodium in deeper parts of the valley-fill aquifer. A total dissolved solids (TDS) range of 150 to 550 milligrams per liter (mg/L), with an average of 324 mg/L, is found in public water supply wells (DWR, 2003). The water quality objectives (WQOs) for the SBBA are provided in Table 8, with the management zones locations of the SBBA shown on Muni/Western Ex. 6-126.

4 Condition where the groundwater level rises above the land surface in confined aquifers.

Table 8. Groundwater Quality Objectives for the SBBA[a]

Groundwater Management Zone	*Total Dissolved Solids (TDS)*	*Nitrate-Nitrogen (NO_3-N)*	*Nitrate (NO_3)*
Bunker Hill A	310	2.7	12.1
Bunker Hill B	330	7.3	32.8
Lytle Creek	260	1.5	6.7

a. All measurement units are milligrams per liter (mg/L) which is the equivalent of parts per million (ppm).
Source: SARWQCB, 2004.

65. The Office of Environmental Health Hazard Assessment (OEHHA) developed Public Health Goals (PHGs) for nitrate. These are equivalent to California's current drinking water standards of 45 parts per million (ppm) for NO_3, the equivalent of 10 ppm NO_3-N.

66. The inorganic composition of the groundwater may be affected by warm water emanating from faults and fractures in the bedrock surface underlying the aquifer. For example, concentrations of fluoride that exceed drinking water standards have limited the use of groundwater extracted near some faults and from deeper parts of the aquifer. In some public water supply wells in the SBBA, some inorganics (primary and secondary), radiological constituents, nitrates, pesticides, VOCs, and synthetic organic chemicals (SOCs) were found above the applicable MCL (see Table 9). However, all water delivered to public water users is treated prior to delivery and the quality of this water meets or is of better quality than the applicable state and Federal standards.

Table 9. Prevalence of Contaminants in SBBA Wells

Constituent	*No. Wells Sampled*	*No. Wells with a Concentration Above an MCL*
Inorganics (primary)	212	13
Radiological	207	34
Nitrates	214	34
Pesticides	211	20
VOCs and SOCs	211	32
Inorganics (secondary)	212	25

Source: DWR, 2003.

67. The SBBA is affected by five major groundwater contaminant plumes: the Redlands-Crafton, Norton Air Force Base, Muscoy, Newmark, and Santa Fe plumes. The major constituents of each plume are summarized in Table 10 and their locations shown on Muni/Western Ex. 6-127.

Table 10. Constituents in Groundwater Contamination Plumes in the SBBA

Contaminant Plume	*TCE*[a]	*Perchlorate*	*PCE*[b]	*DBCP*[c]	*VOC*[d]	*Superfund Site*
Redlands-Crafton	X	X		X		
Norton AFB	X		X			
Muscoy	X		X			X
Newmark	X		X			X
Santa Fe	X		X		X	

Notes:
a. TCE = trichloroethylene
b. PCE = tetrachloroethylene
c. DBCP = dibromochloropropane
d. VOCs = volatile organic compounds

Updated table from comments addressed in Final EIR (page 3-290)

Rialto–Colton Groundwater Basin

Location

68. The approximately 30,100-acre (47 square mile) Rialto–Colton Basin lies to the west of the SBBA. The basin is bounded on the northwest by the San Gabriel Mountains; on the northeast by the San Jacinto Fault and Barrier E; on the southeast by the Badlands; and on the southwest by the Rialto-Colton Fault (see Muni/Western Ex. 6-117 and 6-118). Except in the southeastern part of the basin, the San Jacinto and Rialto–Colton faults act as groundwater barriers that impede flow into and out of the basin (Woolfenden and Koczot, 1999).

Aquifer System and Groundwater Flow

69. The basin consists of four water-bearing units: the river channel; upper; middle; and lower. Groundwater generally moves from east to west in the river channel and upper water-bearing units. In the middle and lower water-bearing units, water moves from

EXHIBIT F

Muni/Western Ex. 6-117

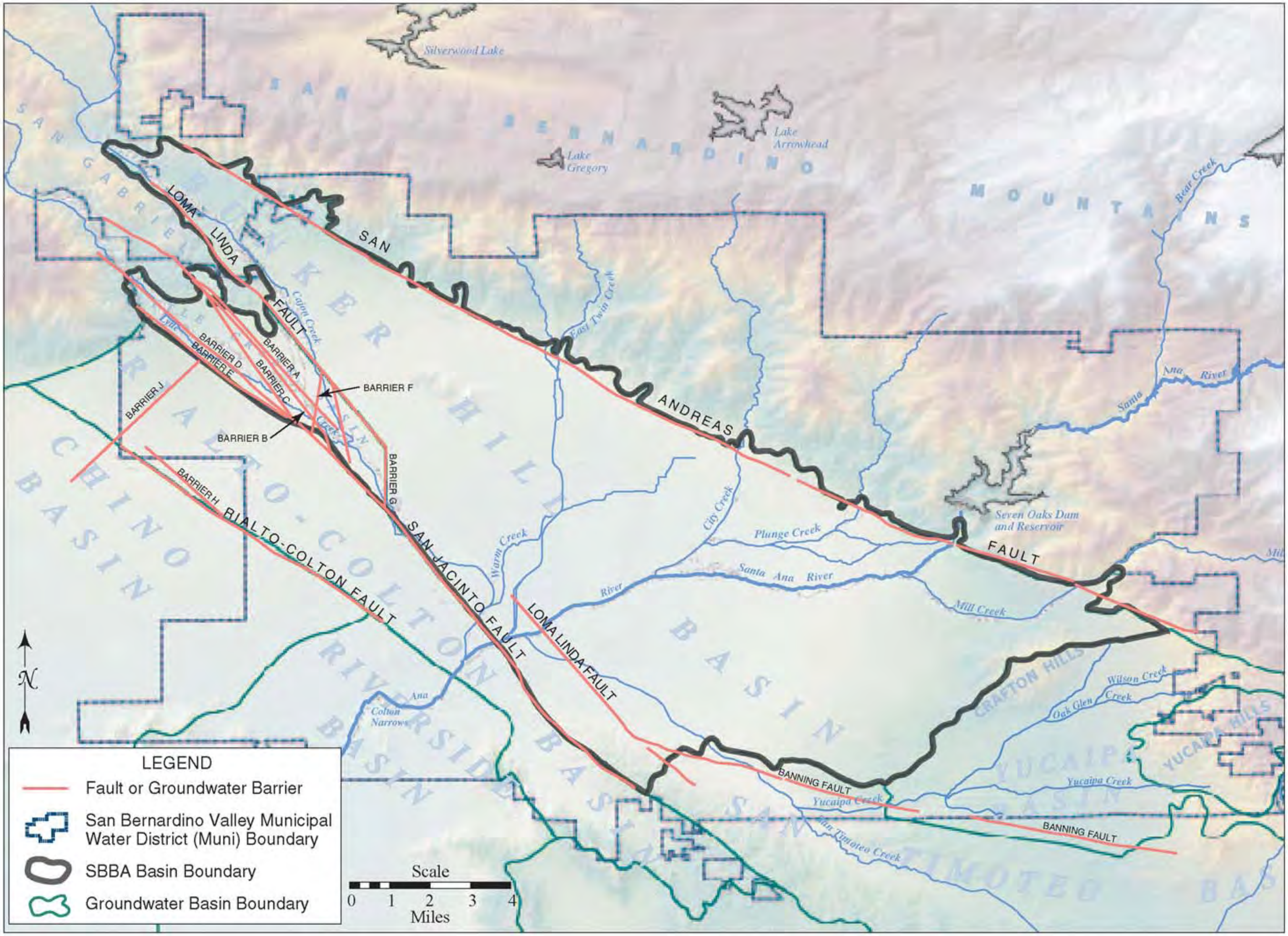

Figure 3.2-2. San Bernardino Basin Area (SBBA)