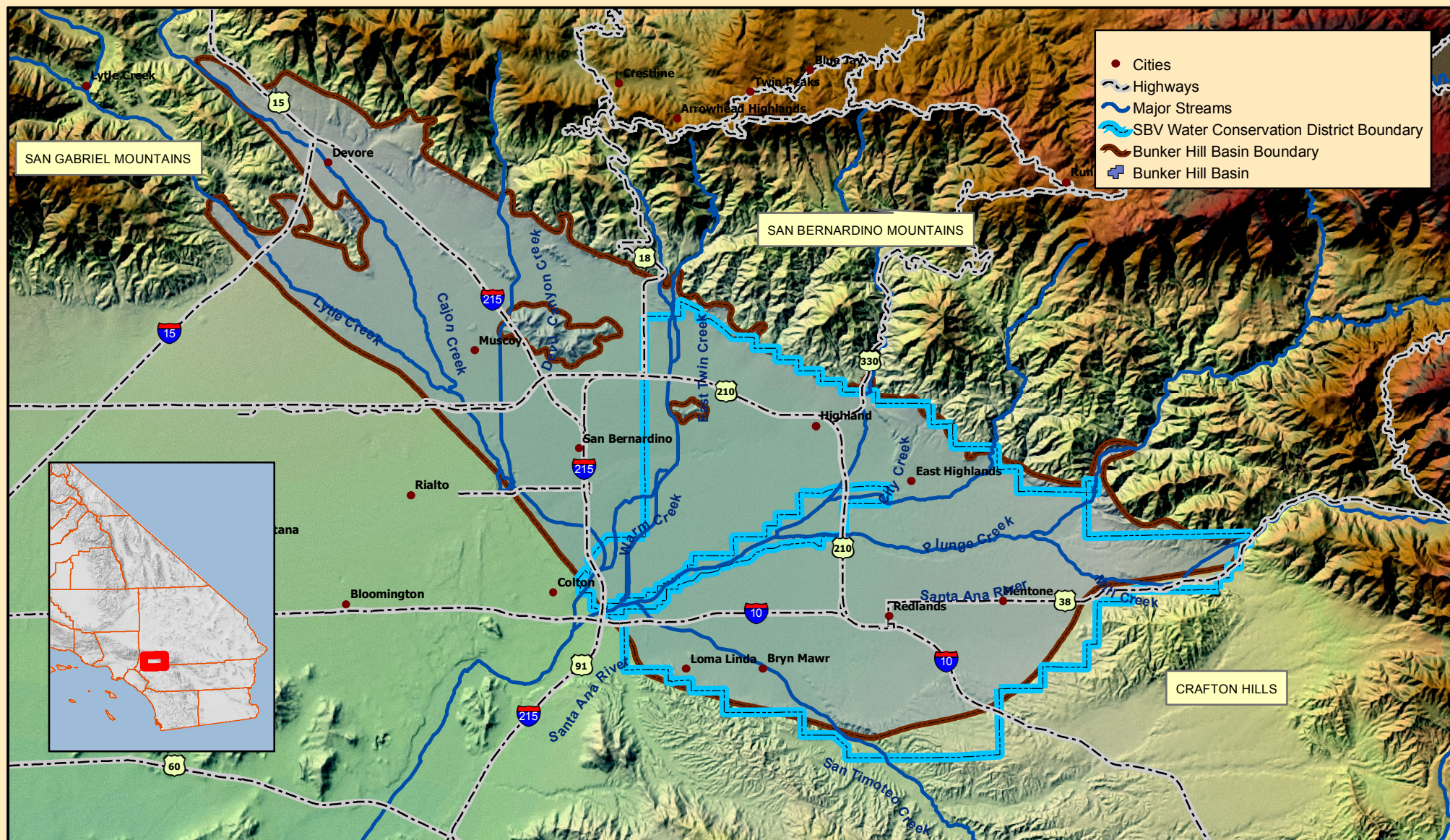


Engineering Investigation of the Bunker Hill Basin 2014–2015

Figures





Coordinate System:
NAD 1983 StatePlane California V FIPS 0405 Feet

Projection:
Lambert Conformal Conic

Data Sources:
SBVWCD, CASIL, SBVMWD



0 0.5 1 2 3 Miles

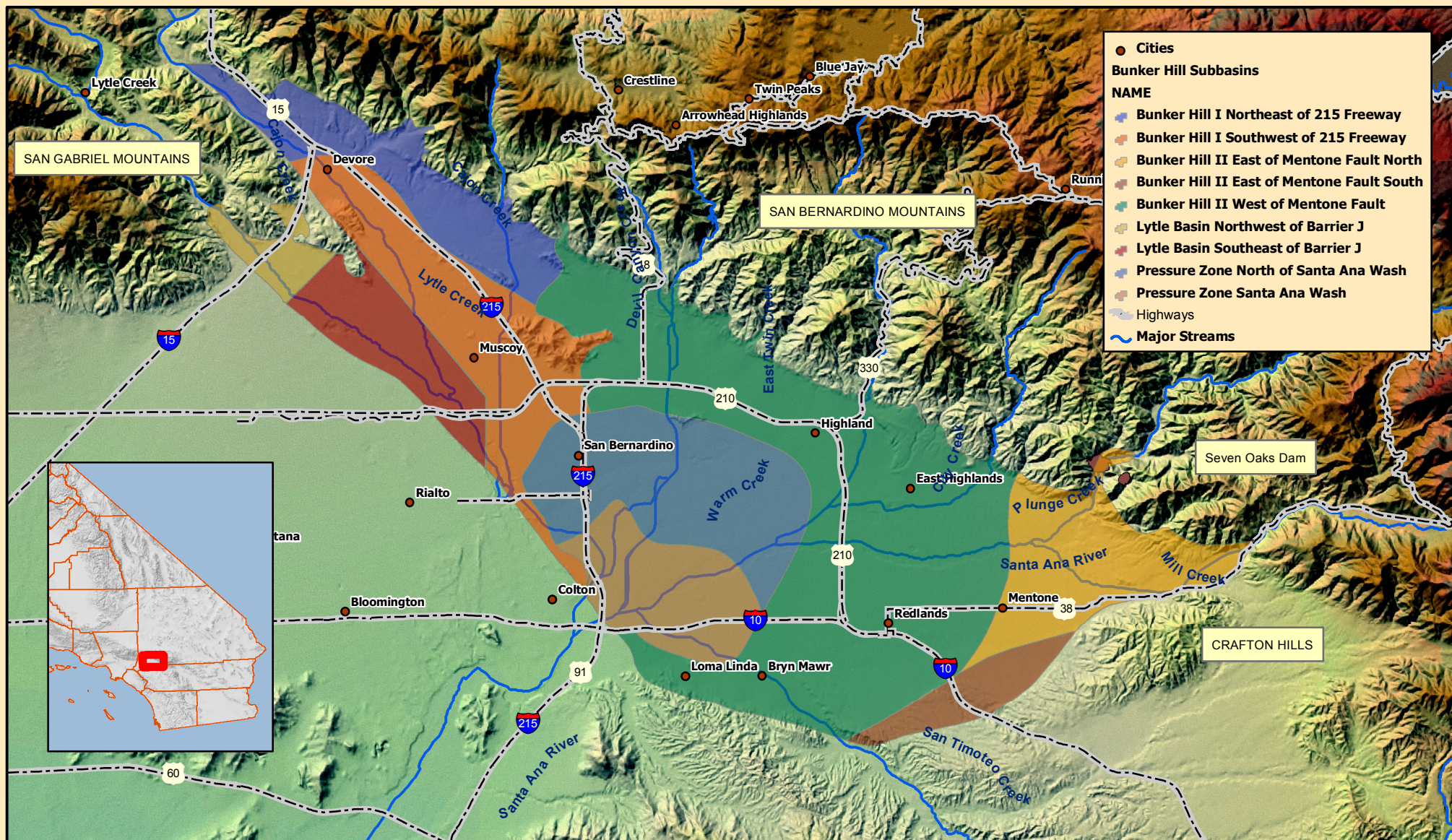
Project Area Engineering Investigation Report 2016

Engineering Investigation
January 2016

GIS Contacts: L. Pierce, E. Mancilla
& K. Scholte



Figure 1



Coordinate System:
NAD 1983 StatePlane California V FIPS 0405 Feet

Projection:
Lambert Conformal Conic

Data Sources:
SBVMWD, SBVMWD

0 0.47 0.95 1.9 2.85 Miles



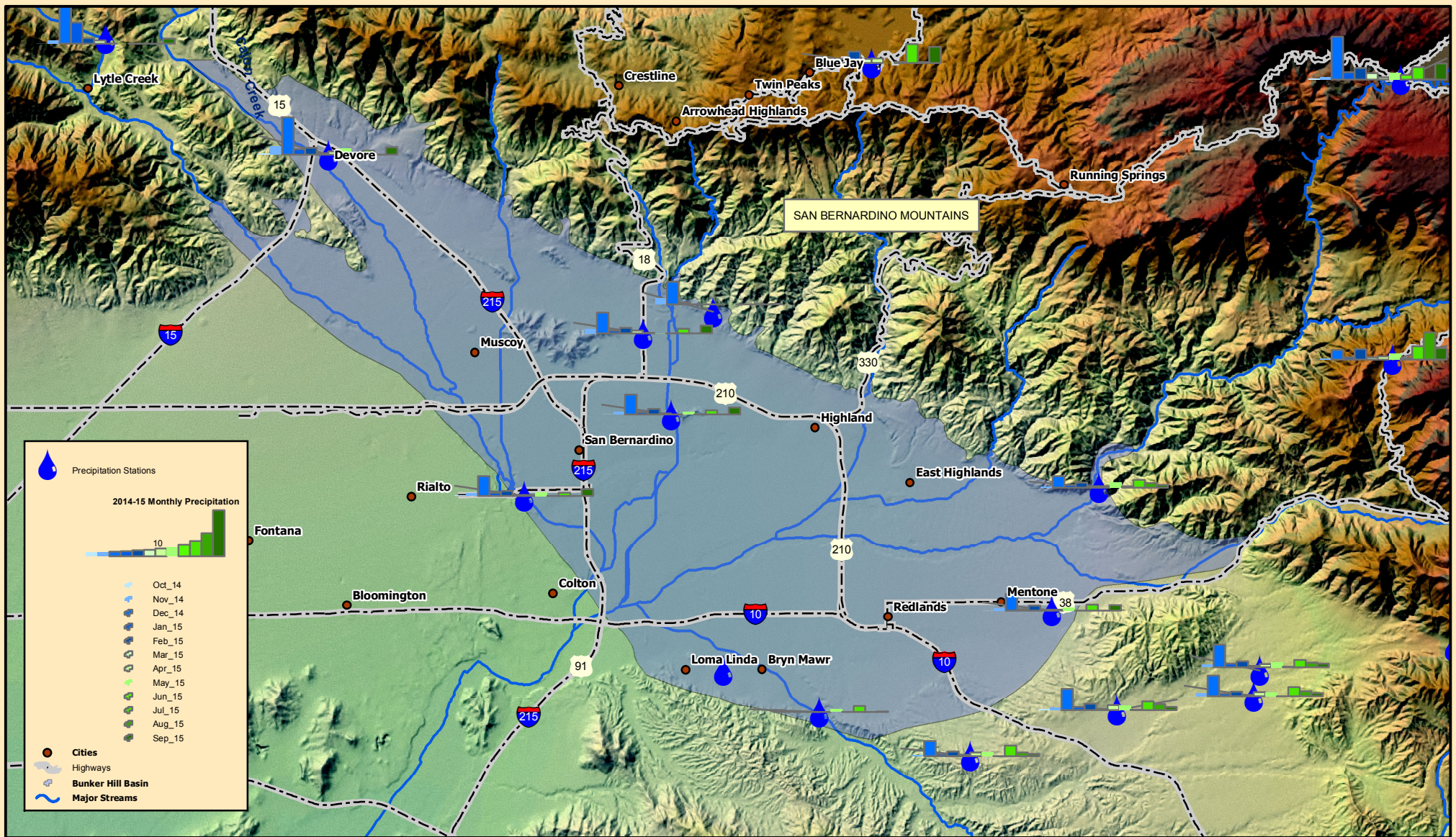
Bunker Hill SubBasins Engineering Investigation Report 2016

Engineering Investigation
January 2016

GIS Contacts: L. Pierce, E. Mancilla
& K. Scholte



Figure 3



State Plane
NAD 83, Zone V, feet
10M DEM - DWR 2008
Data Sources:
19 Active Gauging Stations
2016



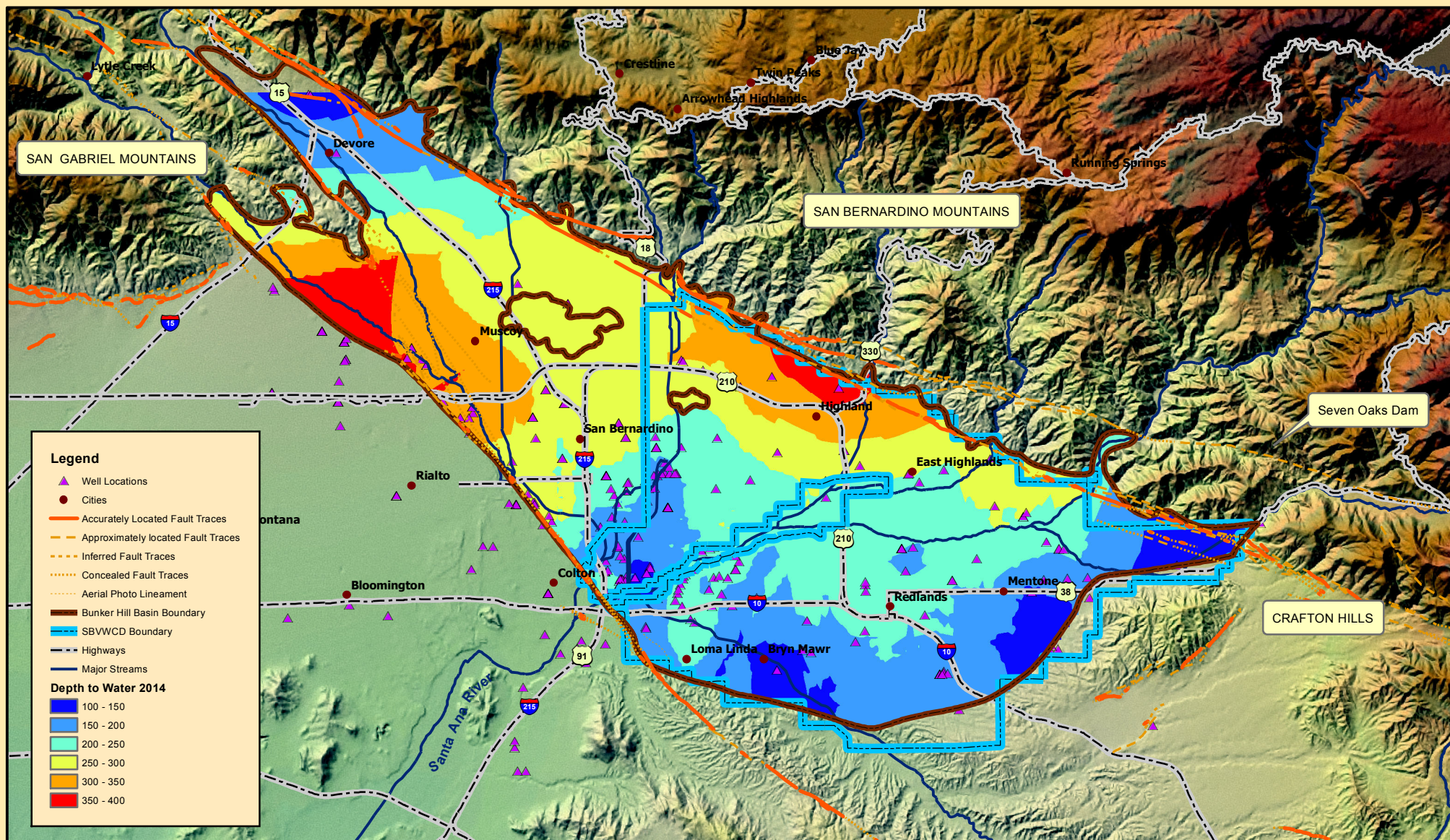
Precipitation Trends and Station Locations October 2014 - September 2015 Engineering Investigation Report 2016

Engineering Investigation
January 2016

Map Creation: SBWCD GIS
E. Mancilla & K. Scholte



Figure 4



State Plane NAD 83, Zone V, feet
 10M DEM DWR
 SBVWCD Water Elevation
 2016 - 289 Wells
 IDW Interpolation Method
 Watermaster Services,
 All City Water Agencies
 and SBVMWD



0 0.5 1 2 3 Miles

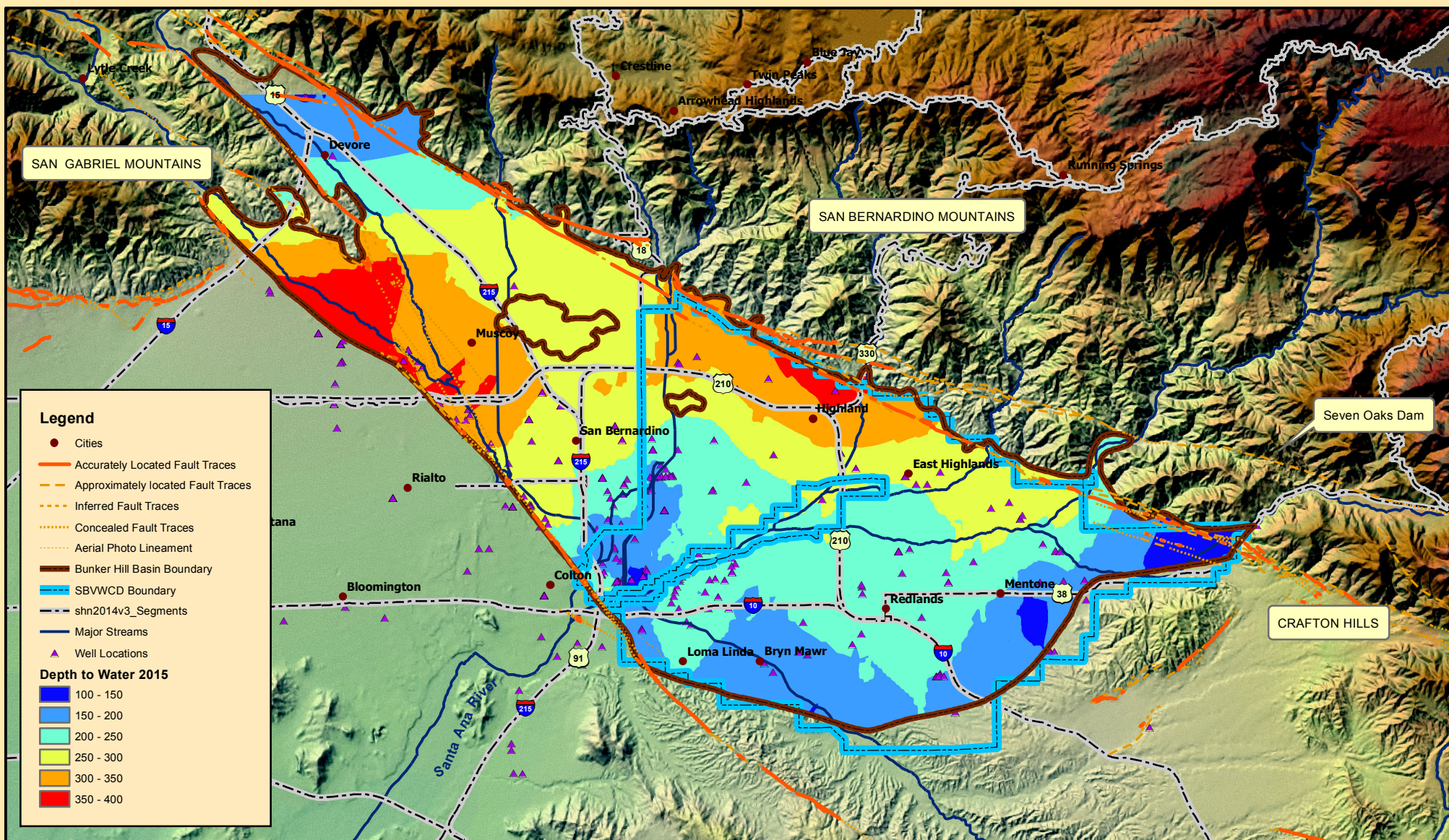
Water Elevation Contour Surface Fall 2014 Engineering Investigation Report 2016

Engineering Investigation
 January 2016

Source: SBVWCD GIS
 E.Mancilla & K.Scholte



Figure 5



State Plane NAD 83, Zone V, feet
 10M DEM DWR
 SBVWCD Water Elevation
 2016 - 305 Wells
 IDW Interpolation Method
 Watermaster Services,
 All City Water Agencies
 and SBVMWD



0 0.5 1 2 3 Miles

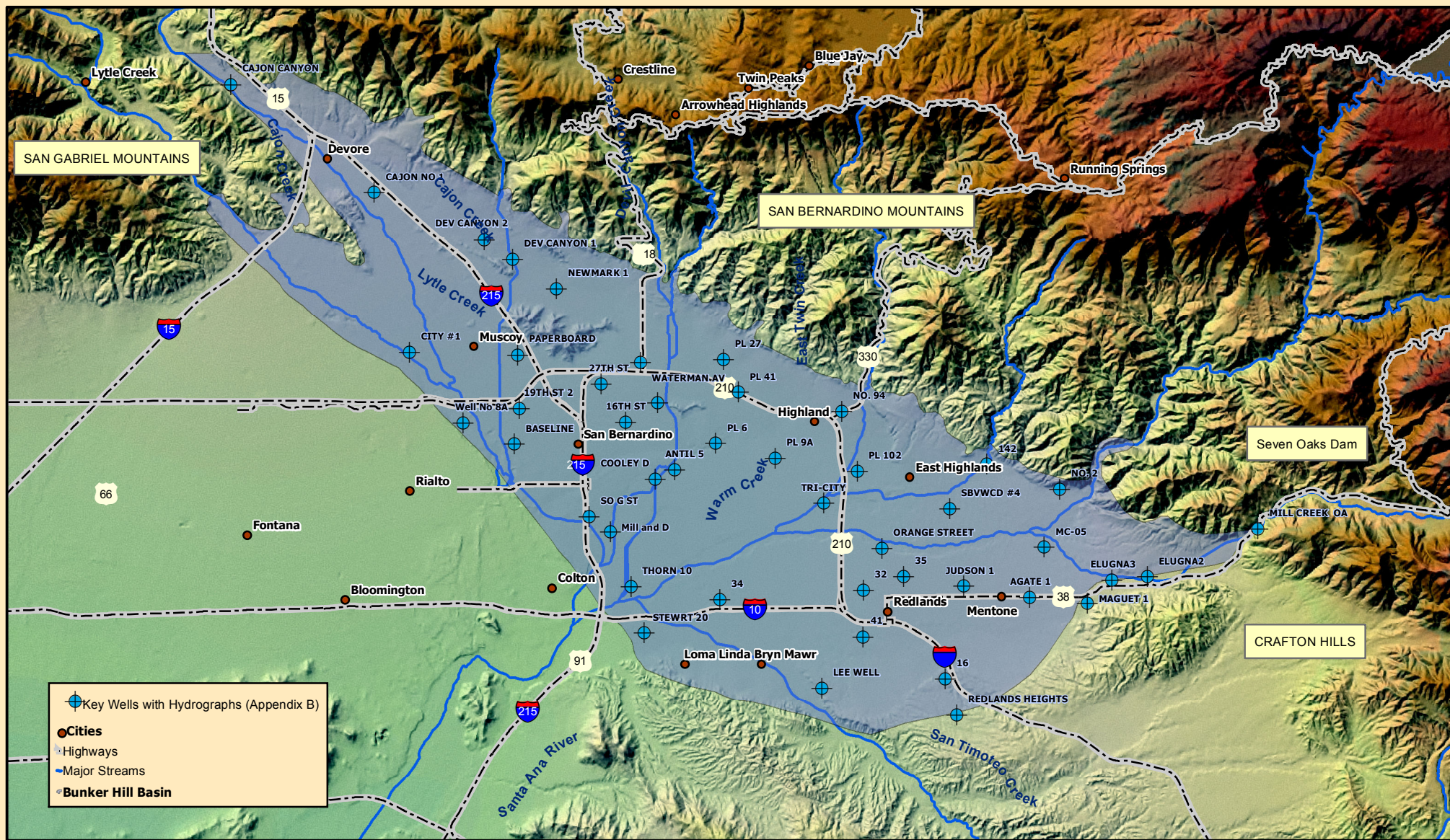
Water Elevation Contour Surface Fall 2015 Engineering Investigation Report 2016

Engineering Investigation
 January 2016

Source: SBVWCD GIS
 E.Mancilla, K. Scholte



Figure 6



State Plane
NAD 83, Zone V, feet
10M DEM - DWR 2008
Data Sources: 2014 -15
SBVWCD, SBVMWD, WVWD



0 0.5 1 2 3 Miles

X:\Engineering Investigation\2016EI\GIS\Maps

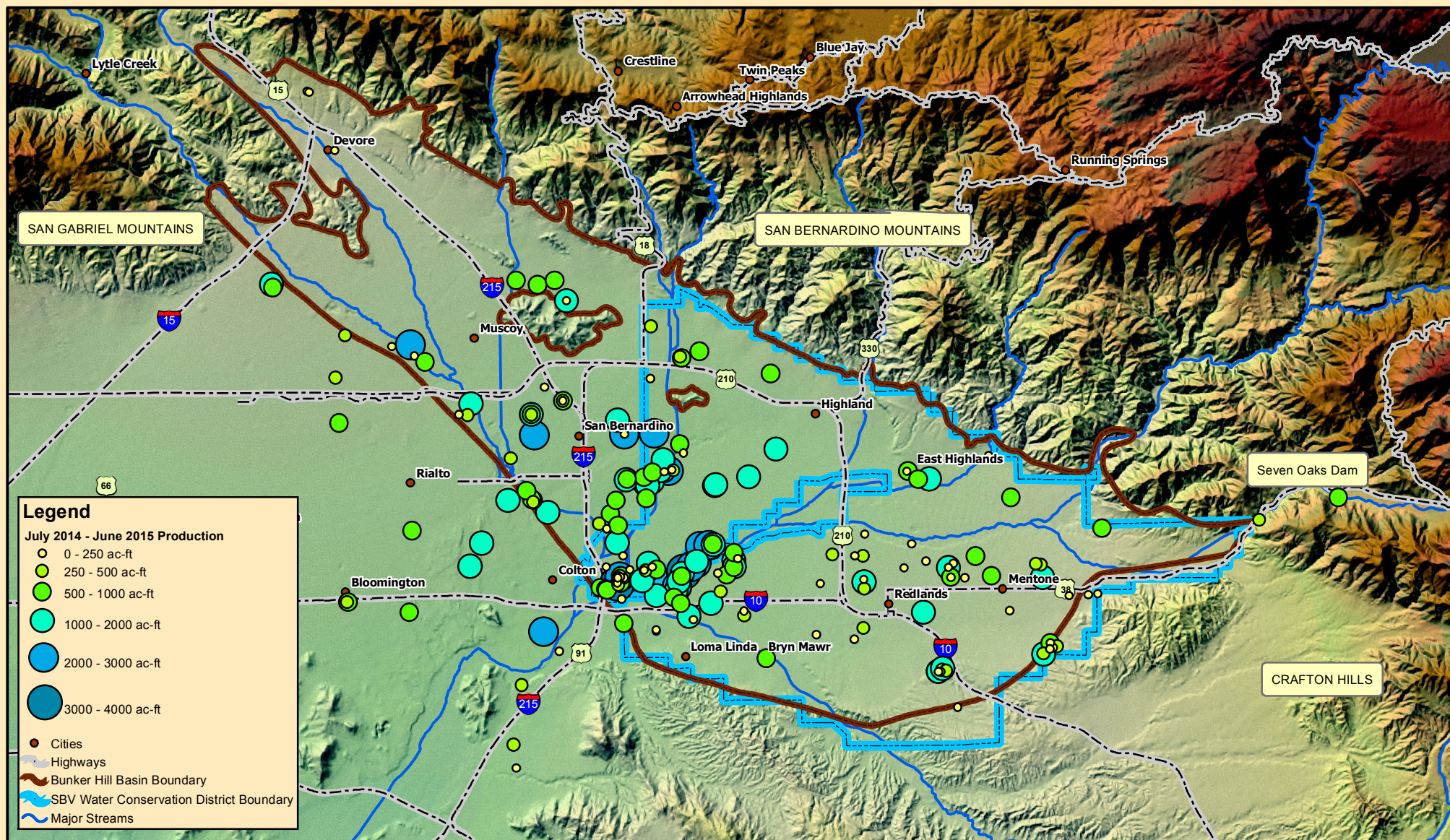
Key Wells (Appendix B Hydrographs) 2014 - 2015 Engineering Investigation Report

Engineering Investigation
January 2016



Map Creation: SBVWCD GIS
E.Mancilla & K. Scholte

Figure 7



State Plane
NAD 83, Zone V, feet
10M DEM DWR
Data Sources:
SBVWCD EI Production
201 Wells with Values
Watermaster Services,
All City Water Agencies
and SBVMWD



0 0.5 1 2 3 Miles

Groundwater Production -Bunker Hill Basin Subbasins Total Well Production for July 2014 - June 2015 (Water Year) Engineering Investigation Report 2016

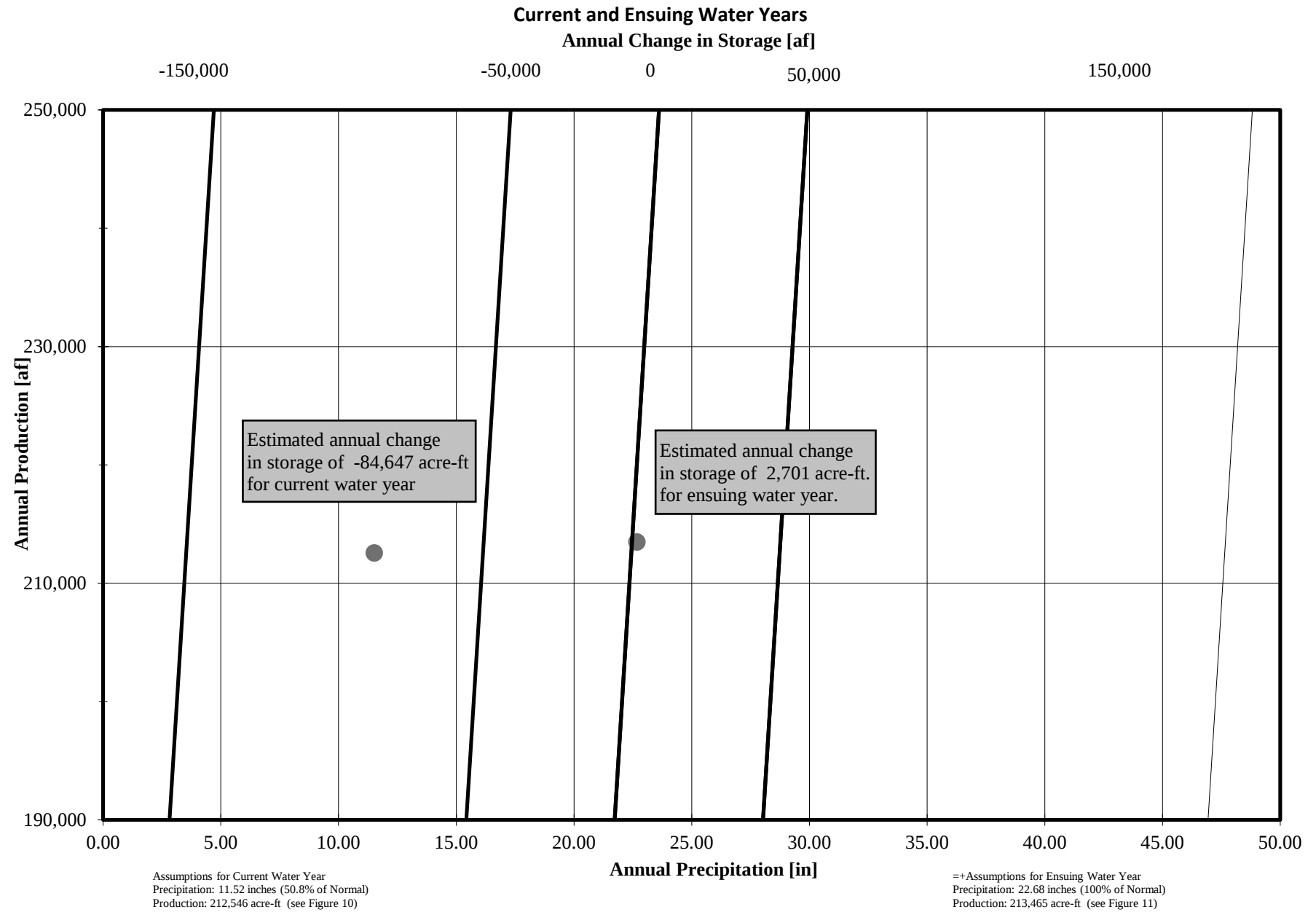
Engineering Investigation
January 2016



Source: SBVWCD GIS
E.Mancilla & K. Scholte

Figure 8

Prediction Chart for Annual Change in Storage

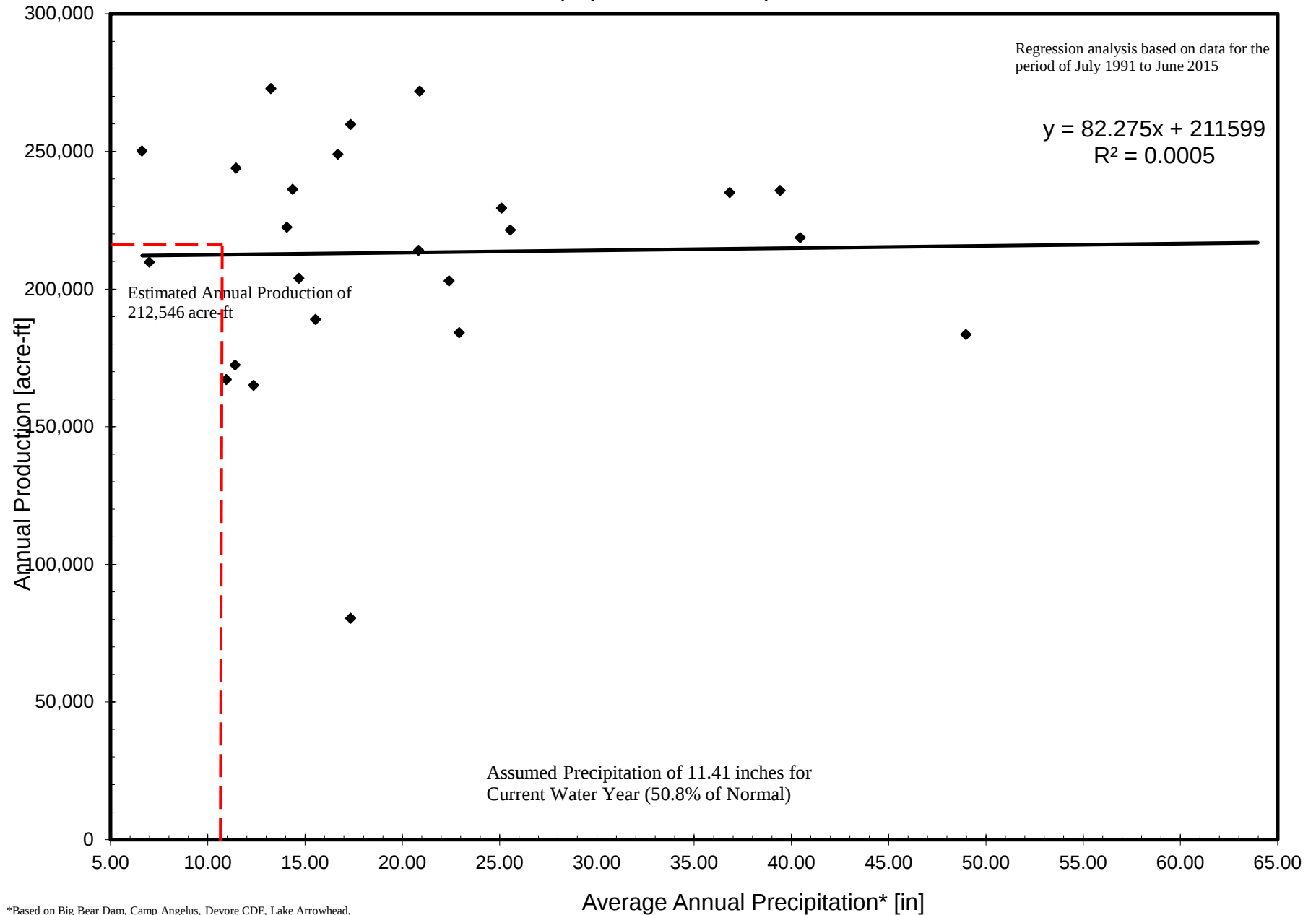


* Based on Big Bear Dam, Camp Angelus, Devore CDF, Lake Arrowhead, Redlands Country Club, San Bernardino County Hospital, Santa Ana Powerhouse #3, and Yucaipa CDF.

$$\text{Change in Storage} = -116,789 + 7,850 * \text{Precipitation} - 0.274 * \text{Production} \quad (R^2 = 0.80)$$

Estimate of Production for Current Water Year

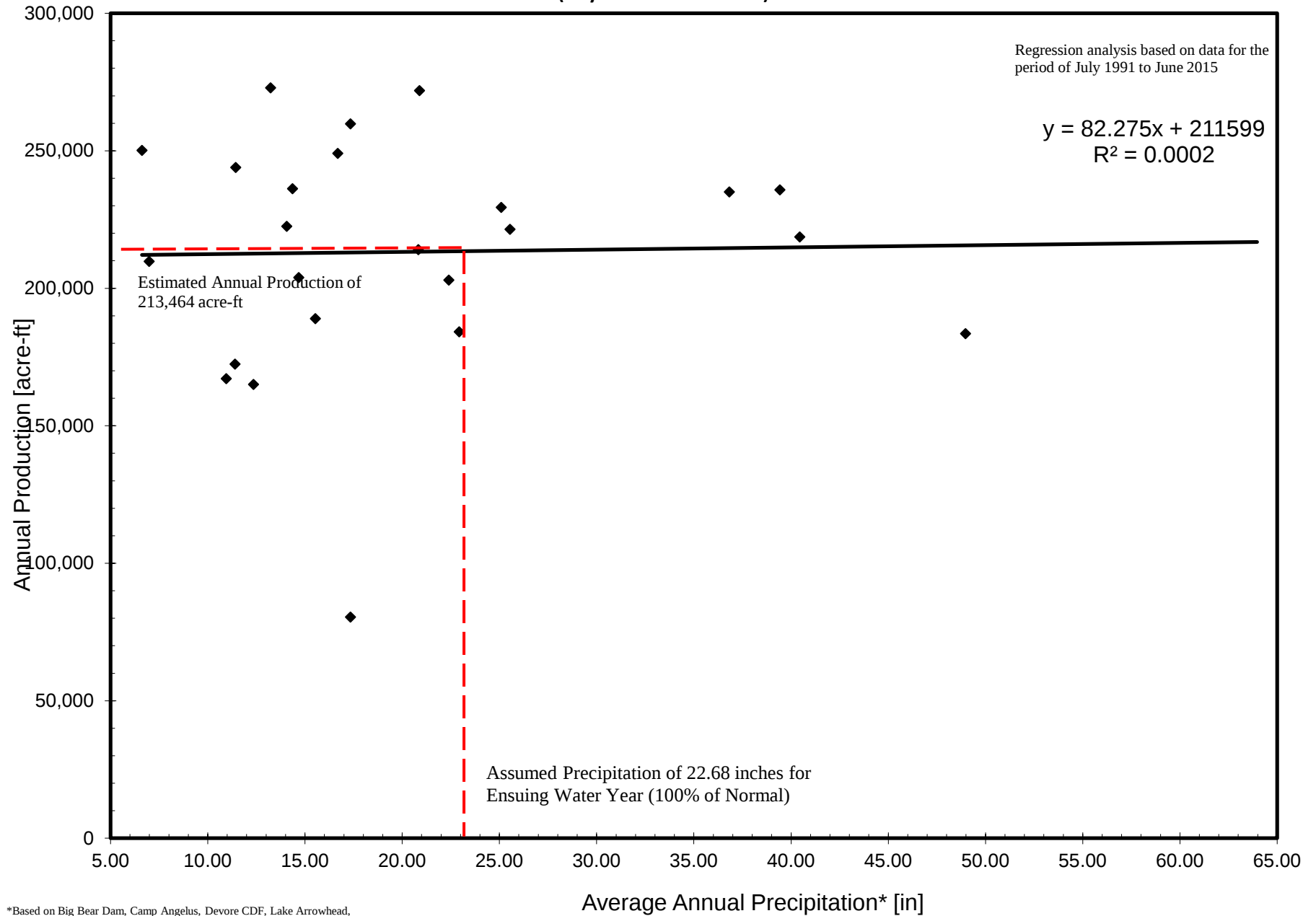
(July 2014 to June 2015)



*Based on Big Bear Dam, Camp Angelus, Devore CDF, Lake Arrowhead, Redlands Country Club, San Bernardino County Hospital, Santa Ana Powerhouse #3, and Yucaipa CDF.

Estimate of Production for Ensuing Water Year

(July 2016 to June 2017)



*Based on Big Bear Dam, Camp Angelus, Devore CDF, Lake Arrowhead, Redlands Country Club, San Bernardino County Hospital, Santa Ana Powerhouse #3, and Yucaipa CDF.

Engineering Investigation of the Bunker Hill Basin 2014–2015

Tables



Summary of Percentage of Normal Precipitation

1986 to 2015 (Water Year - Oct. to Sept.)

Station	Historic Annual Avg. [in]	1986 -1987 [in]	1987 -1988 [in]	1988 -1989 [in]	1989 -1990 [in]	1990 -1991 [in]	1991 -1992 [in]	1992 -1993 [in]	1993 -1994 [in]	1994 -1995 [in]	1995 -1996 [in]	1996 -1997 [in]	1997 -1998 [in]	1998 -1999 [in]	1999 -2000 [in]	2000 -2001 [in]	2001 -2002 [in]	2002 -2003 [in]	2003 -2004 [in]	2004 -2005 [in]	2005 -2006 [in]	2006 -2007 [in]	2007 - 2008 [in]	2008 - 2009 [in]	2009 - 2010 [in]	2010 - 2011 [in]	2011 - 2012 [in]	2012 - 2013 [in]	2013 - 2014 [in]	2014 - 2015 [in]	Each Station 29 Yr. Avg. [in.]
Big Bear City	13.75	10.18	10.59	9.37	10.23	17.81	13.96	22.92	11.53	18.59	11.17	12.06	16.83	6.53	4.75	20.14	3.33	12.62	7.55	23.25	14.36	3.67	8.53	3.51	16.24	24.55	16.27	10.46	9.2	9.28	12.40
Big Bear Dam	35.53	19.17	28.89	20.84	17.60	34.79	38.90	81.92	28.67	52.65	24.40	29.97	51.70	14.20	20.60	21.40	9.20	38.10	19.60	59.10	26.40	10.30	23.00	19.70	26.00	20.24	11.83	18.73	13.34	25.74	27.83
Camp Angelus	28.41	20.50	4.95	17.20	17.90	26.44	28.16	61.14	17.20	46.70	26.00	29.00	49.52	16.10	21.10	21.50	7.70	35.40	13.20	35.20	41.90	0.00	2.70	18.00	18.80	1.60	17.49	13.89	9.93	19.69	22.03
Crafton Hills	12.47	9.00	12.11	10.00	6.30	12.27	10.69	22.99	5.45	27.10	7.84	16.67	25.55	7.29	6.40	10.49	2.46	17.57	9.47	31.39	11.45	3.34	13.34	8.82	17.80	24.52	9.57	9.16	6.55	13.76	12.74
Del Rosa Ranger Station	18.20	9.48	18.92	13.16	12.85	8.79	24.24	41.39	12.30	27.69	14.21	17.31	37.26	8.30	12.73	16.60	6.09	19.69	13.02	38.55	17.40	8.77	17.77	13.57	22.01	30.84	13.57	2.22	4.54	6.75	16.90
Devore CDF	27.34	12.39	17.90	10.75	15.00	20.41	31.32	63.98	15.40	45.44	20.58	33.10	45.13	13.61	8.04	15.52	10.90	35.35	16.44	60.36	24.80	8.86	25.21	16.51	34.12	43.20	17.47	14.04	13.81	18.14	24.41
Fallsvale	31.67	23.00	20.30	3.50	51.00	22.50	36.00	71.90	52.00	54.90	22.10	33.80	53.00	16.30	21.20	15.30	6.50	37.50	25.20	61.40	26.90	11.10	29.30	24.70	2.85	29.52	22.9	14.1	26.3	25.57	28.99
Lake Arrowhead	40.09	23.74	40.39	28.51	26.62	23.68	45.24	85.00	28.20	74.51	30.84	36.50	72.80	18.10	25.80	28.60	10.70	36.50	22.70	69.70	46.20	18.50	41.91	30.28	26.00	37.76	25.1	32.6	26.7	13.27	35.39
Loma Linda FD	10.92	7.41	10.45	8.84	7.69	7.16	13.44	25.56	10.99	19.02	7.15	9.78	22.74	5.12	7.74	6.38	2.45	14.48	8.06	22.59	11.06	3.51	9.63	8.95	13.10	18.24	6.79	7.32	9.06	9.5	10.83
Lytle Creek at Foothill	13.40	7.00	12.96	3.90	8.50	15.51	14.91	31.61	9.16	25.51	12.23	13.83	25.84	6.25	9.81	12.12	4.00	13.60	7.16	27.23	11.22	3.84	11.89	9.03	13.03	0.23	6.9	4.51	8.34	10.18	11.73
Lytle Creek Fire Station	23.56	11.20	22.40	12.83	17.90	32.07	49.09	87.71	20.50	47.57	24.49	23.10	52.18	11.81	20.40	18.34	4.47	16.96	12.09	44.11	18.92	4.22	21.89	3.32	0.00	28.46	8.18	7.32	8.03	23.79	22.53
Mentone CDF	12.54	9.23	8.85	8.64	6.13	12.55	15.93	23.85	8.35	17.10	9.42	15.73	27.09	4.28	9.08	10.16	4.06	15.00	10.38	24.94	11.01	5.41	10.75	9.38	14.96	17.77	7.9	7.33	3.11	1.51	11.38
Oak Glen	26.80	19.29	21.46	17.82	17.71	26.92	30.78	57.96	18.76	57.92	20.04	30.39	49.46	11.32	17.12	12.28	6.72	14.28	18.39	34.14	22.58	9.71	27.60	19.92	29.72	36.82	15.13	15.65	14.07	22.07	24.00
Redlands - Roth	12.13	7.79	11.18	8.08	7.21	13.34	14.96	25.57	10.06	20.49	8.08	10.77	22.29	6.46	7.41	10.38	3.35	12.18	9.16	24.43	9.52	3.31	9.46	8.82	15.12	17.38	4.34	1.54	2.08	2.72	10.60
Redlands Country Club	13.71	8.80	14.18	10.68	8.58	14.48	16.11	29.44	12.55	19.76	8.52	9.03	17.22	6.30	5.68	9.96	3.97	16.45	11.58	29.37	10.30	4.13	11.93	11.35	17.25	22.33	7.74	8.71	6.92	10.88	12.56
San Bernardino CDF	17.34	9.27	18.26	12.85	10.55	15.49	21.89	37.35	4.46	20.29	15.77	16.17	34.32	9.30	13.62	16.61	5.29	13.14	11.52	37.28	16.39	6.33	18.91	9.85	20.45	27.94	10.63	7.69	11.3	11.19	16.00
San Bernardino Co. Hospital	15.88	8.08	13.53	12.63	8.12	15.48	16.54	30.78	11.65	24.10	11.92	17.80	32.67	8.02	11.09	2.33	3.60	17.06	10.49	29.89	13.20	4.68	12.81	10.05	17.03	21.76	9.58	9.31	10.97	10.85	14.00
Santa Ana Pumphouse #3	16.94	12.28	14.67	9.38	10.32	15.84	18.38	22.98	15.92	24.85	11.05	16.60	27.95	7.01	6.78	8.63	3.23	18.24	9.40	27.65	11.78	6.13	10.73	9.73	14.58	20.18	8.62	9.05	7.42	9.97	13.43
Yucaipa CDF	15.82	11.02	11.33	9.74	7.25	11.16	17.85	34.20	11.40	30.24	10.52	15.62	24.70	7.63	11.10	9.92	5.66	19.47	11.84	32.70	13.14	6.56	14.67	12.11	18.79	25.09	11.8	11.1	6.87	13.28	14.72
Yucaipa Valley Water District	15.85	10.55	14.36	10.55	10.84	16.98	18.68	18.08	12.51	25.20	10.88	16.93	28.60	9.87	9.63	9.65	5.27	19.50	11.10	32.73	12.52	5.53	14.79	12.11	17.68	22.74	10.8	9.37	7.58	13.07	14.42

Percent of Normal	100%	62%	81%	59%	69%	90%	119%	218%	79%	169%	76%	100%	178%	48%	62%	69%	27%	105%	64%	185%	92%	32%	84%	65%	88%	117%	60%	53%	51%	67%	89%
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Total Station Average	20.12
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Source: San Bernardino County Department of Transportation/Flood Control

Change in Groundwater Levels in Key Wells

Fall 2014 to Fall 2015

WCDCode	Recordation Number	State Well Number	Well Name	Owner Or Measuring Agency	2014 Depth To Water (ft)	2015 Depth To Water (ft)	Difference Fall 2014 to Fall 2015
1865	3601675	1N4W25A01S	27	East Valley Water District			
1984	3602113	1N3W30N01S	41	East Valley Water District	311.2	313.5	-2.3
1364	3600026	1S3W04J01S	102	East Valley Water District	242.8	252.0	-9.2
1401	3600220	1S3W01H01S	142 Mt. Harrison	East Valley Water District	292.0	309.0	-17.0
1660	3601184	1N3W33F01S	94 Corwin	East Valley Water District	396.4	399.8	-3.4
1851	3601660	1S3W06H04S	9A	East Valley Water District	227.3	232.0	-4.7
1668	3601225	1S4W02P02S	Cooley D	East Valley Water District			
1010	9900021	1S3W09E02S	Tri-City Concrete	East Valley Water District	237.0	238.8	-1.8
1727	3601308	1S2W19K01S	Agate #1	Redlands, City of	150.0	186.0	-36.0
1708	3601283	1S2W22C02S	E. Lugonia #2	Redlands, City of			
1712	3601287	1S2W21B02S	E. Lugonia #3	Redlands, City of	30.0	27.0	3.0
1714	3601290	1S2W21D01S	E. Lugonia #6	Redlands, City of	68.0	66.0	2.0
1970	3602065	1S3W32J02S	Lee Well	Redlands, City of	223.0	229.0	-6.0
1706	3601281	1S2W36F01S	Maguet #1	Redlands, City of	27.0	27.0	0.0
1709	3601284	1S2W21E01S	Maguet #2	Redlands, City of	58.0	66.0	-8.0
1707	3601282	1S1W08H01S	Mill Creek #1	Redlands, City of			
1819	3601586	1S3W15F01S	Orange Street	Redlands, City of	161.0	176.0	-15.0
1591	3600918	2S3W01E01S	Redlands Heights	Redlands, City of	171.0	174.0	-3.0
1718	3601294	1S3W35G09S	Well #13	Redlands, City of	60.0	67.0	-7.0
1720	3601296	1S3W35H03S	Well #16	Redlands, City of	46.0	49.0	-3.0
1722	3601298	1S3W21H01S	Well #32	Redlands, City of	209.0	221.0	-12.0
1723	3601299	1S4W24K01S	Well #34	Redlands, City of	200.0	217.0	-17.0
1964	3602032	1S3W22A02S	Well #35	Redlands, City of	225.0	259.0	-34.0
1725	3601301	1S3W28H01S	Well #41	Redlands, City of		188.0	
1702	3601263	1N5W23Q01S	City 1	Rialto, City of	258.0	260.0	-2.0
1668	3601225	1S4W02P02S	Cooley D	Riverside, City of	187.2	190.8	-3.7
1662	3601218	1S4W14P02S	Raub 1	Riverside, City of	176.6		
1677	3601234	1S4W27A19S	Stewart 19	Riverside, City of	173.7	182.0	-8.3
1744	3601431	1S4W27H01S	Stewart 20	Riverside, City of	161.5	168.4	-6.8
1767	3601478	1S4W22B03S	Thorn 10	Riverside, City of			
1683	3601240	1S4W22H04S	Warren 1	Riverside, City of		165.7	
1554	3600787	1S4W23A02S	26-1	Riverside, City Of-Gage Canal	162.0	170.0	-8.0
2291	229101	1S2W07B01S	SBVWCD #1	San Bernardino Valley Water Cons. Dist.			
2290	229001	1S2W07K01S	SBVWCD #2	San Bernardino Valley Water Cons. Dist.	228.6	218.9	9.8
2286	228601	1S3W12J01S	SBVWCD #3	San Bernardino Valley Water Cons. Dist.	271.3	288.2	-16.8
2288	228801	1S3W11H01S	SBVWCD #4	San Bernardino Valley Water Cons. Dist.	208.8		
1525	3600725	1N4W34G01S	17th & Sierra Way #2	San Bernardino, City of	241.9	265.2	-23.3
1517	3600717	1N4W32D03S	19th Street No. 1	San Bernardino, City of	325.5	337.0	-11.5
1520	3600720	1N4W27M02S	27th Street Well	San Bernardino, City of	290.4	305.2	-14.8
1519	3600719	1N4W27G01S	30th & Mtn. View	San Bernardino, City of	336.1	341.0	-4.9
1979	3602081	1N4W27B01S	31st & Mtn. View	San Bernardino, City of	326.4	350.2	-23.8
2066	3602422	1S4W02K08S	Antil Well #6	San Bernardino, City of	185.3	185.3	0.0
2062	3602400	1N4W32N01S	Baseline Well	San Bernardino, City of	324.0	334.0	-10.0
1510	3600710	2N5W19K02S	Cajon Canyon Well	San Bernardino, City of	94.6	91.9	2.8
1910	3601844	1N5W03H02S	Cajon Well #2	San Bernardino, City of		245.0	
2115	3602821	1N5W03A02S	Cajon Well #3	San Bernardino, City of	225.0	234.0	-9.0
2008	3602206	1N4W06H02S	Devil Canyon #3	San Bernardino, City of	27.4	28.2	-0.8
2007	3602205	1N4W06H01S	Devil Canyon #4	San Bernardino, City of	41.0	41.5	-0.5
3139	G363790	1N04W32PS	EPA EXTRAC WELL 112	San Bernardino, City of	475.4	486.6	-11.2
1537	3600737	1S4W10N06S	Mill & D	San Bernardino, City of	157.3	162.5	-5.2
1514	3600714	1N4W16E01S	Newmark #1	San Bernardino, City of	198.4	203.3	-4.9
1516	3600716	1N4W16E03S	Newmark #3	San Bernardino, City of	201.0	205.7	-4.7
1647	3601115	1N4W26P03S	Perris Hill #5	San Bernardino, City of	260.1	288.8	-28.7
		1S04W22C	#21,Wastewater N MW #1	San Bernardino, City of / shallow wells			
2448	9900045	1S4W23H	#52 Brier/Gould/Tippecanoe	San Bernardino, City of / shallow wells			
1537	3600737	1S4W10N	#62, Mill & "D"	San Bernardino, City of / shallow wells	157.3	162.5	-5.2
1936	3601944	1N5W23Q01S	2/Lower 7	West Valley Water District	353.0	364.0	-11.0
1419	3600305	1N5W25E01S	5A/Lower 5	West Valley Water District	322.0	331.0	-9.0

Annual Change in Storage for Bunker Hill Basin

Fall 2014 to Fall 2015

Sub-area	[1] Annual Change in Water Level 2015 [ft]	[2] Area [acres]	[3] Storativity (S)	[4] Annual Change in Storage** [acre-ft]
Bunker Hill I - Northeast of 215 Freeway	0.3	7,795	0.11	258
Bunker Hill I - Southwest of 215 Freeway	-9.0	11,714	0.09	-9,539
Bunker Hill II - West of Mentone Fault	-11.2	35,206	0.06	-23,589
Bunker Hill II - East of Mentone Fault, North	-6.1	8,584	0.13	-6,841
Bunker Hill II - East of Mentone Fault, South	-3.1	2,507	0.13	-1,019
Lytle Basin - Northwest of Barrier J	-1.0	1,924	0.13	-250
Lytle Basin - Southeast of Barrier J	-5.0	5,237	0.07	-1,846
Pressure Zone - North of Santa Ana Wash	-13.5	11,920	0.02	-3,226
Pressure Zone - Santa Ana Wash	-11.4	6,686	0.02	-1,518

Total = -47,570

[1] Based on average changes in water level within each Sub-area

[2] Estimated using GIS

[3] Based on data from Hardt and Hutchinson (1980).

S, storativity: The amount of water stored or released per unit area of aquifer given unit head change.

[4] = [1] x [2] x [3]

*A positive sign denotes an increase in water level and a negative sign represents a decline in water level.

Accumulated Change in Storage for Bunker Hill Basin

1989 to 2015 (Based on "Zero Year" of 1993)

Year	Accumulated Storage [acre-ft]
1989	-58,000
1990	-170,700
1991	-196,000
1992	-191,000
1993	0
1994	-50,000
1995	41,100
1996	-43,100
1997	-75,500
1998	40,400
1999	-85,700
2000	-131,100
2001	-212,200
2002	-301,500
2003	-338,800
2004	-406,900
2005	-183,100
2006	-245,500
2007	-359,400
2008	-362,000
2009	-397,600
2010	-340,623
2011	-224,603
2012	-314,377
2013	-444,322
2014	-535,877
2015	-583,447

Note: A negative sign indicates a decline in storage and
a positive sign represents an increase in storage.

Production for Sub-basins of Bunker Hill Basin

Preceding Water Year (July 2014 to June 2015)

Sub-area	Production July 2014 to June 2015 [acre-ft] ²
Bunker Hill I - Northeast of Interstate 215	4,478
Bunker Hill I - Southwest of Interstate 215	10,037
Bunker Hill II - West of Mentone Fault	31,144
Bunker Hill II - East of Mentone Fault, North	6,280
Bunker Hill II - East of Mentone Fault, South	1,393
Lytle Basin - Northwest of Barrier J	404
Lytle Basin - Southeast of Barrier J	10,249
Pressure Zone - North of Santa Ana Wash	49,834
Pressure Zone - Santa Ana Wash	56,048
Total	169,866

Notes: 207 Wells Used in these Calculations

1 - Refer to Appendix C for Well Values Compiled for Estimate.

2 - Estimated for Water Year July 2014-June 2015 production.

*Data Sources: 25 Primary Water Purveyors (excluding Fontana Union),
as well as San Bernardino Watermaster, and SBVMWD.*

Estimates of Percentage of Normal Precipitation for Previous Water Year

July 2014 to June 2015

	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	
	July to June	July to June	Season - July to December			Season - January to June			Jul. 2014 to Jun. 2015
Station	Historic Average Annual	2014-2015	Historic Average	Sum Jul 2014 to Dec 2014	% of Normal	Historic Average	Sum Jan 2015 to Jun 2015	% of Normal	Water Year % of Normal
	[inches]	[inches]	[inches]	[inches]	[%]	[inches]	[inches]	[%]	[%]
Big Bear Dam	35.40	22.05	11.61	10.49	90%	23.40	11.56	49%	63%
Devore CDF	26.92	16.51	8.47	11.37	134%	18.86	5.14	27%	60%
Camp Angelus	27.97	9.55	9.60	3.86	40%	18.29	5.69	31%	34%
Lake Arrowhead	39.85	7.21	13.04	2.20	17%	27.10	5.01	18%	18%
Mentone CDF	12.31		3.86			8.65			
Redlands Country Club	13.48	7.57	4.25	4.12	97%	9.73	3.45	35%	54%
San Bernardino County Hospital	15.79	10.38	4.95	7.38	149%	10.89	3.00	28%	65%
Santa Ana Pumphouse #3	16.75	7.40	5.43	3.58	66%	11.41	3.82	33%	44%
Yucaipa CDF	15.61	10.62	4.94	6.52	132%	10.93	4.10	38%	67%

Avg (in) = 22.68 11.41

Average = 90.7%

Average = 32.5%

2014-15 Average = 50.8%

[1], [4]: Based on data provided by San Bernardino County Department of Transportation/Flood Control

[3] = ([2] / [1]) x 100

[5] = [0] - [2]

[6] = ([5] / [4]) x 100

[7] = (([2] + [5]) / ([1] + [4])) x 100

Average Annual Change in Storage for Bunker Hill Basin

Fall 2005 to Fall 2015

(The Immediate Past 10 Water Years)

Sub-area	[1] Average Change in 10 Years in Water Level* [ft]	[2] Area [acres]	[3] Storativity (S)	[4] Average Annual Change in Storage** [acre-ft]
Bunker Hill I - Southwest of 215 Freeway	-4.83	11,714	0.09	-4,978
Bunker Hill I - Northeast of 215 Freeway	-6.51	7,795	0.11	-5,583
Bunker Hill II - West of Mentone Fault	-9.59	35,206	0.06	-19,928
Bunker Hill II - East of Mentone Fault	-8.45	11,091	0.13	-12,180
Lytle Basin - Southeast of Barrier J	12.80	5,237	0.07	4,692
Lytle Basin - Northwest of Barrier J	-3.19	1,924	0.13	-797
Pressure Zone - North of Santa Ana Wash	13.24	11,920	0.02	3,157
Pressure Zone - Santa Ana Wash	-6.32	6,686	0.02	-845

Total = -36,461

[1] Based on average annual changes in water level within each Sub-area over last 10 years.

[2] Estimated using GIS.

[3] Based on data from Hardt and Hutchinson (1980).

S storativity: The amount of water stored or released per unit area of aquifer given unit head change.

[4] = [1] x [2] x [3]

*A positive sign denotes an increase in water level and a negative sign represents a decline in water level.

Summary of Surface Distribution Water for Bunker Hill Basin

1987 to 2015

Streamflow Diversions	1987 [acre-ft]	1988 [acre-ft]	1989 [acre-ft]	1990 [acre-ft]	1991 [acre-ft]	1992 [acre-ft]	1993 [acre-ft]	1994 [acre-ft]	1995 [acre-ft]	1996 [acre-ft]	1997 [acre-ft]	1998 [acre-ft]	1999 [acre-ft]	2000 [acre-ft]	2001 [acre-ft]
Lytle Creek															
Fontana Union WC	2,725	2,991	2,245	204	1,633	12,980	7,860	12,270	10,000	10,100					
Mount Vernon WC	724	724	724	724	724	724	1,143	102	0	0	0	0	312	786	778
Rialto, City of	539	1,111	1,005	792	1,014	743	193	843	44	1,070	393	896	1,461	NA	1,305
San Bernardino, City of	1,448	1,448	1,448	1,448	1,448	1,448	520		2,400	2,400	0	0	0	0	0
West Valley Water District	3,686	3,696	3,696	2,554	3,701	3,696	3,696	3,697	3,696	3,686	4,079	3,696	3,408	3,047	3,175
Subtotal	9,122	9,970	9,118	5,722	8,520	19,591	13,412	16,912	16,140	17,256	4,472	4,592	5,181	3,833	5,258
Mill Creek															
Redlands, City of	11,178	7,731	8,285	6,794	11,109	14,559	19,086	14,505	9,786	12,250	10,250	11,224	11,951	8,852	9,496
SBVWCD Mill Creek Spreading															
SBVWCD-MC-DWR															
Subtotal	11,178	7,731	8,285	6,794	11,109	14,559	19,086	14,505	9,786	12,250	10,250	11,224	11,951	8,852	9,496
Bunker Hill Creeks															
Arrowhead Water & Power West Twin Crk															
Arrowhead Water & Power East Twin Crk															
Devore Water Company Kimbark Lower Cajon															
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Santa Ana River															
Bear Valley Mutual WC	16,373	14,170	14,785	11,244	20,651	26,014	42,079	23,812	30,794	38,252	31,479	36,632	30,245	29,498	26,301
Redlands Water Co	961	963	890	577							760				
SBVWCD SAR Spreading															
SBVWCD-DWR-SAR															
Subtotal	17,334	15,133	15,675	11,821	20,651	26,014	42,079	23,812	30,794	38,252	32,239	36,632	30,245	29,498	26,301

Streamflow Diversions	2002 [acre-ft]	2003 [acre-ft]	2004 [acre-ft]	2005 [acre-ft]	2006 [acre-ft]	2007 [acre-ft]	2008 [acre-ft]	2009 [acre-ft]	2010 [acre-ft]	2011 [acre-ft]	2012 [acre-ft]	2013 [acre-ft]	2014 [acre-ft]	2015 [acre-ft]	Avg. [acre-ft]
Lytle Creek															
Fontana Union WC						8,209	7,336	5,050	5,000	6027	6027	5424.3	4882	4394	6,071
Mount Vernon WC	975	1,442	754	70	250	437	927	1,132	167	685	578	520	468	421	562
Rialto, City of	1,143	726	1,707	1,209	1,448	1,160	1165.00	1,135	1,000	1,148	1,319	996	1020	871	981
San Bernardino, City of	0	0	580	5	254	483	498	450	450	0	0	0	0	0	597
West Valley Water District	2,573	2,380	4,710	2,079	3,081	NA	3,369	2,435	3,322	3382	2954	2369	2897	3425	3,292
Subtotal	4,691	4,548	7,751	3,363	5,033	10,289	13,295	10,202	9,939	11,242	10,878	9,309	9,267	9,111	11,503
Mill Creek															
Redlands, City of	5,867	12,541	10,168	12,574	15,409	9,607	12,332	7,785	10,076	13,492	6,085	7041	4657	3912	10,297
SBVWCD MC				29,138	9,510	1,531	3,810	4,450	8,891	16,185	4,666	1,734	888	1,080	7,444
SBVWCD-MC-DWR				0	0	0	431	555	831	1,434	0	515	0	0	342
Subtotal	5,867	12,541	10,168	41,712	24,919	11,138	16,573	12,790	19,798	31,111	10,751	9,290	5,545	4,992	18,083
Bunker Hill Creeks															
Arrowhead Water & Power West Twin Crk			50	50	50	50	40	40	40	46	46	41.4	46	46	45
Arrowhead Water & Power East Twin Crk			2,500	1,750	1,700	1,725	3	0	0	1097	1097	987	889	800	1,046
Devore Water Company Kimbark			29	97	80	62	68	68	68	0	0	0	0	0	39
Subtotal	0	0	2,579	1,897	1,830	1,837	111	108	108	1,143	1,143	1,029	935	846	1,130
Santa Ana River															
Bear Valley Mutual WC	23,458	12,633	11,227	12,516	17,689	11,560	13,519	7,303	7,000	15,445	17,218	5,923	5,271	4,823	19,238
Redlands Water Co			588	981	1,044	884	625	654	629	739	4,917	2,036	5,201	5,629	1,652
SBVWCD SAR Spreading				27,841	14,476	4,002	17,550	8,456	21,662	36,801	9,073	5,519	1,537	2,982	13,627
SBVWCD-DWR-SAR				0	5,855	1,993	0	981	1,115	1,511	441	169	0	81	1,104
Subtotal	23,458	12,633	11,815	41,338	39,064	18,439	31,694	17,394	30,406	54,496	31,649	13,647	12,009	13,515	35,621

Assumed as average and are provisional data.

Total =	66,338
2015 Total =	28,463

Surface Diversions, comments:

The amount of water for surface distribution for the ensuing water year (October 1, 2016 to September 30, 2017) was estimated based on the average surface for the Santa Ana River, Bunker Hill Creeks, Mill Creek, and Lytle Creek for the period of 1987 to 2015. As shown in Table 8 above, the average surface diversion for the Santa Ana River, Mill Creek, and Lytle Creek, including Department of Water Resources purchased water, between 1987 to 2015 was 35,621; 1,130; 18,083; 11,503 acre-feet respectively.