Upper Santa Ana Valley Groundwater Basin, Bunker Hill Subbasin

- Groundwater Basin Number: 8-2.06
- County: San Bernardino
- Surface Area: 89,600 acres (120 square miles)

Basin Boundaries and Hydrology

The Bunker Hill Subbasin consists of the alluvial materials that underlie the San Bernardino Valley. This subbasin is bounded by contact with consolidated rocks of the San Gabriel Mountains, San Bernardino Mountains, and Crafton Hills, and by several faults. The southern boundary is the Banning fault, the east boundary is the Redlands fault, the San Andreas fault is roughly the northern boundary, the Glen Helen fault abuts the northwest boundary, and the southwest boundary is the San Jacinto fault. The Santa Ana River, Mill Creek, and Lytle Creek are the main tributary streams in the subbasin (SBVWCD 2000). The range in annual precipitation is 13 to 31 inches.

Hydrogeologic Information

Water Bearing Formations

The water-bearing material in the subbasin consists of Holocene and Pleistocene age alluvial deposits of sand, gravel, and boulders interspersed with deposits of silt and clay. The water-bearing material has been divided into upper and lower aquifers (Hardt and Hutchinson 1980). In the central part of the subbasin, a poorly permeable clay layer separates the aquifers, creating confined conditions in the lower aquifer under about 25 square miles of the valley. Maximum thickness of the upper aquifer is approximately 350 feet, and maximum thickness of the lower aquifer is approximately 650 feet. Groundwater generally converges toward the Santa Ana River in the southwestern part of the subbasin and discharges over the San Jacinto fault at Colton Narrows (USGS 1989). Wells yield up to 5,000 gpm and average about 1,245 gpm. Specific yield of these deposits ranges from 7 – 21 percent and average 13 percent (WE 2000).

Restrictive Structures

The San Andreas fault zone impedes movement of ground water, producing springs and a groundwater level change that marks the fault trace along the northern boundary of the subbasin. The San Jacinto fault forms a strong barrier to groundwater that raises the water table nearly to the surface below the course of the Santa Ana river. The combination of alluvial material with a high water table in a seismically active area creates a hazard for liquifaction. The Redlands and Banning faults also impede ground water movement along the borders of the subbasin (DWR 1986).

Recharge Areas

Recharge to the Bunker Hill Subbasin historically has resulted from infiltration of runoff from the San Gabriel and San Bernardino Mountains. The Santa Ana River, Mill Creek, and Lytle Creek contribute more than 60

percent of the total recharge to the ground-water system (USGS 1989). Lesser contributors include Cajon Creek, San Timoteo Creek, and most of the creeks flowing southward out of the San Bernardino Mountains. The subbasin is also replenished by deep percolation of water from precipitation and resulting runoff, percolation from delivered water, and water spread in streambeds and spreading grounds.

Groundwater Level Trends

In general the far eastern and northwestern portions of the Bunker Hill Subbasin show the largest decreases while the rest of the subbasin shows mostly stable or increasing ground water elevations. Average changes in ground water level elevations between Fall 1998 and Fall 1999 ranged up to an increase of about three feet (SBVWCD 2000).

Groundwater Storage

Groundwater Storage Capacity. Total groundwater storage of the subbasin is 5,976,000 (DWR 1986).

Groundwater in Storage. As of 1998, the total amount of water in storage in the Bunker Hill Subbasin was 5,890,300 (SBVWCD 2000).

Groundwater Budget (Type A)

Pumping data indicate 164,319 af of urban extraction and 23,977 af for water year 1998 (SBVWCD 2000). Natural recharge for 1998 is reported at 23,861 af (SBVWCD 2000) and artificial recharge is reported at 15,835 af (Crowly 2000). DWR (1986) determined an average subsurface inflow to be about 22,500 af.

Groundwater Quality

Characterization. Groundwater within the subbasin is predominately calcium-bicarbonate (USGS 1989) with a TDS range of 150 mg/l to 550 mg/l (DWR 1986). Department of Health Services data for 204 public supply wells show an average TDS content of 324 mg/l, with a range of 155 – 1,140 mg/l. Reported EC measurements range from 95 μmhos – 2,920 μmhos and average 523 μmhos (Vitt 2000).

Impairments. The Bunker Hill Subbasin contains several contamination plumes. The Redlands plume, located between Judson Street and Mountain Avenue in Redlands, is primarily composed of TCE, with lower levels of PCE and DBCP, and contaminates approximately 150,000 acre-ft of groundwater. The Norton Air Force Base plume consists of TCE and PCE. This plume stretches 2 ½ miles long, and contaminates 100,000 acre-ft of groundwater. The Newark and Muscoy plumes are spread around the east and west sides of the Shandon Hills in northern San Bernardino. These plumes consist of TCE and PCE, and are designated Superfund sites. The Santa Fe plume is primarily of petroleum based contaminates. (SBVWCD 2000).

Water Quality in Public Supply Wells

Constituent Group[1]	Number of wells sampled[2]	Number of wells with a concentration above an MCL[3]
Inorganics – Primary	212	13
Radiological	207	34
Nitrates	214	34
Pesticides	211	20
VOCs and SVOCs	211	32
Inorganics – Secondary	212	25

[1] A description of each member in the constituent groups and a generalized discussion of the relevance of these groups are included in *California's Groundwater – Bulletin 118* by DWR (2003).
[2] Represents distinct number of wells sampled as required under DHS Title 22 program from 1994 through 2000.
[3] Each well reported with a concentration above an MCL was confirmed with a second detection above an MCL. This information is intended as an indicator of the types of activities that cause contamination in a given basin. It represents the water quality at the sample location. It does not indicate the water quality delivered to the consumer. More detailed drinking water quality information can be obtained from the local water purveyor and its annual Consumer Confidence Report.

Well Characteristics

	Well yields (gal/min)	
Municipal/Irrigation	Range: to 5,000 gal/min	Average: 1,245 gal/min
	Total depths (ft)	
Domestic	Range:	Average:
Municipal/Irrigation	Range:	Average:

Active Monitoring Data

Agency	Parameter	Number of wells /measurement frequency
City of Colton	Water Levels	14/Annually (SBVWCD 2000)
East Valley Water District	Water Levels	42/Annually (SBVWCD 2000)
Loma Linda University	Water Levels	1/Annually (SBVWCD 2000)
City of Loma Linda	Water Levels	5/Annually (SBVWCD 2000)
Meeks & Daley Water Co.	Water Levels	4/Annually (SBVWCD 2000)
City of Redlands	Water Levels	46/Annually (SBVWCD 2000)
City of Rialto	Water Levels	10/Annually (SBVWCD 2000)
Riverside Highland Water Co	Water Levels	14/Annually (SBVWCD 2000)
City of Riverside	Water Levels	62/Annually (SBVWCD 2000)

San Bernardino Valley Water District	Water Levels	8/Annually (SBVWCD 2000)
City of San Bernardino	Water Levels	58/Annually (SBVWCD 2000)
USGS/SBVMWD	Water Levels	106/Annually (SBVWCD 2000)
West San Bernardino Co. Water District	Water Levels	27/Annually (SBVWCD 2000)
Western Municipal	Water Levels	1/Annually (SBVWCD 2000)
USGS	Water Levels	74
Department of Health Services and cooperators	Title 22 water quality	204
USGS	Water Quality	29
SBVWCD	Water Quality	140/monthly, quarterly

Basin Management

Groundwater management:	Groundwater management in the Bunker Hill Basin is performed by the San Bernardino Valley Water Conservation District, and is based primarily on the maintenance of groundwater levels in the pressure zone. Inflows and outflows are monitored and adjusted so as not to allow water levels to rise to the ground surface in downtown San Bernardino, where the pressure zone exists.(Crowly 2000)
Water agencies	
Public	City of Colton, East Valley Water District, City of Loma Linda, City of Redlands, City of Rialto, City of Riverside, San Bernardino Valley Municipal Water District, City of San Bernardino, West San Bernardino County Water District.
Private	Arroyo Mutual Water Co., Baseline Gardens Mutual Water Co., Bear Valley Mutual Water Co., Bryn Mawr Mutual Water Co., Cardiff Farms Mutual Water Co., Eastwood Farms Community Water, Kansas Street Mutual Water Co., King Street Mutual Water Co., Devore Water Co., Crafton Water Co., J.J. Ramirez Stowe Water Co., Mentone Acres Mutual Water Co., Montecito Mutual Water Co., Muscoy Mutual Water Co., Pioneer Mutual Water Co., City Creek Water Co., Fariview Water Co., Tennessee Mutual Water Co., Victory Farms Mutual Water Co., Fontana Union Water Co., Lugo Water Co., Mascart Water Co., Meeks & Daley Water Co., New England Water Co., Pharaoh-Powell Water Co., Riverside Highland Water Co., San Bernardino Avenue Water Co., Tennessee Water Co., Terrace Water Co. (SBVWCD 2000)

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Errata

Substantive changes made to the basin description will be noted here.