Livermore Valley Groundwater Basin

- Groundwater Basin Number: 2-10
- Counties: Alameda and Contra Costa
- Surface Area: 69,600 acres (109 square miles)

Basin Boundaries and Hydrology

The Livermore Valley lies about 40 miles east of San Francisco and 30 miles southwest of Stockton within a structural trough of the Diablo Range. The groundwater basin extends from the Pleasonton Ridge east to the Altamont Hills (about 14 miles) and from the Livermore Upland north to the Orinda Upland (about 3 miles). Surface drainage features include Arroyo Valle, Arroyo Mocho, and Arroyo las Positas as principal streams, with Alamo Creek, South San Ramon Creek, and Tassajara Creek as minor streams. All streams converge on the west side of the basin to form Arroyo de la Laguna, which flows south and joins Alameda Creek in Sunol Valley. Some geologic structures restrict the lateral movement of groundwater, but the general groundwater gradient is to the west, then south towards Arroyo de la Laguna. Elevations within the basin range from about 600 ft in the east, near the Altamont Hills, to about 280 ft in the southwest, where Arroyo de la Laguna flows into Sunol Groundwater Basin. Average annual precipitation ranges from 16 inches on the valley floor to more than 20 inches along the southeast and northwest basin margins.

Hydrogeologic Information

Water Bearing Formations

The entire floor of Livermore Valley and portions of the upland areas on all sides of the valley overly groundwater-bearing materials. The materials are continental deposits from alluvial fans, outwash plains, and lakes. They include valley-fill materials, the Livermore Formation, and the Tassajara Formation. Under most conditions, the valley-fill and Livermore sediments yield adequate to large quantities of groundwater to all types of wells. The quality of water produced from these rocks ranges from poor to excellent, with most waters in the good to excellent range.

The following information on the water bearing units is from Bulletin 118-2 (DWR 1966, DWR 1974).

Valley-fill. The Holocene age surficial valley-fill materials range in thickness from a few tens of feet to nearly 400 feet. They occur as stream channel deposits, alluvium, alluvial fan deposits, and terrace deposits, and are composed of unconsolidated sand, gravel, silt, and clay. In the central and southern portions of the valley, 50 to 80 percent of the valley-fill is comprised of aquifer material that yields significant quantities of water to wells. Clay deposits up to 40 feet thick cap the valley-fill in the western part of the Basin; where deep wells draw groundwater from underlying aquifer material. (Zone 7, 2002) Several gravel extraction pits have been dug into the upper portions of the valley fill material near the central portion of the basin. Dewatering activities related to the mining change ground water flow patterns and locally limit the storage capacity of the basin. Mining activities are scheduled to cease by 2030.

Livermore Formation. The Plio-Pleistocene Livermore Formation is primarily exposed over the south and southwest regions of the Livermore Valley groundwater basin, but occurs almost everywhere beneath the surface at depths up to 400 ft. This formation is up to 4,000 feet thick and consists of unconsolidated to semi-consolidated beds of gravel, sand, silt, and clay. Limey concretions are fairly common in its lower portion, and tuffaceous beds are present at its base. Erosion of Jurassic and Cretacious rocks to the south of the basin produced the coarse-grained Livermore Formation. These grains consist of black to red chert, micaceous sandstone, black shale, and quartizite. (DWR, 1966) Deep wells in the eastern half of the basin produce from the Livermore Formation. Upland wells to the South have limited groundwater yields. (Zone 7, 2002) Generally, yields are adequate for most irrigation, industrial, or municipal purposes.

Tassajara Formation. The Pliocene-age Tassajara Formation surfaces in the uplands to the north of the Livermore Valley and occurs beneath the central portion of the valley at depths ranging from 200 to 750 feet. Beds of the Tassajara are composed of sandstone, siltstone, shale, conglomerate, and limestone. Coarse-grained beds typically contain tuff and clay particles, reducing their overall permeability. Wells tapping the Tassajara Formation yield only sufficient water for domestic or stock purposes. There is little hydrologic continuity between the Tassajara and overlying water-bearing units.

Restrictive Structures

Within the Livermore Valley groundwater basin, faults are the major structural features known to have marked affect on the movement of groundwater. Faults in this region tend to act as barriers to the lateral movement of groundwater. The resulting groundwater levels stand higher on the up-gradient side. The Livermore, Pleasanton and Parks faults act as such barriers, dividing the Quaternary Alluvium into 5 groundwater sub-basins.

Groundwater Level Trends

Groundwater Storage

Groundwater Storage Capacity. Total storage capacity of the basin is estimated at about 500,000 af. (Zone 7, 2002)

Groundwater in Storage. Groundwater in storage in 1999 is estimated at 219,000 af.

Groundwater Budget (Type A)

Alameda County Flood Control and Water Conservation District, Zone 7 (Zone 7) has maintained an annual hydrologic inventory of supply and demand since 1974. The inventory describes the balance between groundwater supply and demand. Under average hydrologic conditions, the groundwater budget is essentially in balance. Groundwater budget inflow components include natural recharge of 10,000 af, artificial recharge of 10,900 af, applied water recharge of 1,740 af, and subsurface inflow of 1,000 af. Groundwater budget outflow components include urban extraction of

10,290 af, agricultural extraction of 190 af, other extraction and evaporation associated with gravel mining operations of 12,620 af, and subsurface outflow of 540 af.

Groundwater Quality

Characterization. Water chemistry is highly varied around the basin. Generally, the northern extent of the basin is dominated by a sodium cation water. Much of the water underlying the western part of the basin near Pleasanton has magnesium-sodium as the dominant cation. The area along the eastern portion of the basin beneath Livermore typically has magnesium as the dominant cation. Nearly the entire basin has bicarbonate as the dominant anion (Sorenson and others 1985). TDS ranges from 300 mg/L to 550 mg/L with an average of 450 mg/L based on analyses from 27 municipal wells.

Impairments. Some areas have boron concentrations exceeding 2 mg/L (16 wells of approximately 137 wells sampled in 1982). Boron is generally highest in shallow wells because of marine sediments adjacent to the basin. The most areally-extensive elevated boron concentrations occur in the northeast part of the basin (Sorenson and others 1985).

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	33	0
Radiological	24	0
Nitrates	33	5
Pesticides	31	1
VOCs and SVOCs	31	2
Inorganics – Secondary	33	5

[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 Main Basin: Valley Fill & Livermore Formation	Range: 500 – 4,500	Average: 1,500 (Well Completion Reports)
Irrigation: Fringe Sub-basins: Tassajara Formation	Range: 2 – 300	Average: 40 (Zone 7 Monitoring Data)
	Total depths (ft)	
Domestic	Range: 100 - 350	Average: 180 (Well Completion Reports)
Municipal/Irrigation	Range: 315 - 810	Average: 500 (Well Completion Reports)

Active Monitoring Data

Agency	**Parameter**	**Number of wells /measurement frequency**
Zone 7 Water Agency	Groundwater levels Mineral, nutrient, & minor element.	210 wells annually 50 wells monthly 10 wells continuously
DWR	Mineral, nutrient, & minor element.	27 wells every three years
Department of Health Services and cooperators	Coliform, nitrates, mineral, organic chemicals, and radiological.	36 wells as required in Title 22, Calif. Code of Regulations

Basin Management

Groundwater management:	Zone 7 manages groundwater in the basin under authority from California Water Code Section 30000 (County Water District). In 1995, Zone 7 created a Groundwater Management Advisory Committee comprised of 10 members of the public. The GMAC reviews groundwater-related issues and makes recommendations to the Zone 7 board and staff. Zone 7 adopted a groundwater management plan on September 21, 2005.
Water agencies	
Public	Zone 7, City of Pleasanton, City of Livermore, Dublin San Ramon CSD
Private	California Water Service Company

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Errata

Updated groundwater management information and added hotlinks to applicable websites. (1/20/06)