San Joaquin Valley Groundwater Basin
Kaweah Subbasin

- Groundwater Subbasin Number: 5-22.11
- County: Tulare, Kings
- Surface Area: 446,000 acres (696 square miles)

Basin Boundaries and Hydrology

The San Joaquin Valley is surrounded on the west by the Coast Ranges, on the south by the San Emigdio and Tehachapi Mountains, on the east by the Sierra Nevada and on the north by the Sacramento-San Joaquin Delta and Sacramento Valley. The northern portion of the San Joaquin Valley drains toward the Delta by the San Joaquin River and its tributaries, the Fresno, Merced, Tuolumne, and Stanislaus Rivers. The southern portion of the valley is internally drained by the Kings, Kaweah, Tule, and Kern Rivers that flow into the Tulare drainage basin including the beds of the former Tulare, Buena Vista, and Kern Lakes.

The Kaweah subbasin lies between the Kings Groundwater Subbasin on the north, the Tule Groundwater Subbasin on the south, crystalline bedrock of the Sierra Nevada foothills on the east, and the Kings River Conservation District on the west. The subbasin generally comprises lands in the Kaweah Delta Water Conservation District. Major rivers and streams in the subbasin include the Kaweah and St. Johns Rivers. The Kaweah River is the primary source of recharge to the area. Average annual precipitation is seven to 13 inches, increasing eastward.

Hydrogeologic Information

The San Joaquin Valley represents the southern portion of the Great Central Valley of California. The San Joaquin Valley is a structural trough up to 200 miles long and 70 miles wide. It is filled with up to 32,000 feet of marine and continental sediments deposited during periodic inundation by the Pacific Ocean and by erosion of the surrounding mountains, respectively. Continental deposits shed from the surrounding mountains form an alluvial wedge that thickens from the valley margins toward the axis of the structural trough. This depositional axis is below to slightly west of the series of rivers, lakes, sloughs, and marshes, which mark the current and historic axis of surface drainage in the San Joaquin Valley.

Water Bearing Formations

The sediments that comprise the Kaweah Subbasin aquifers are unconsolidated deposits of Pliocene, Pleistocene, and Holocene age. On the east side of the subbasin, these deposits consist of arkosic material derived from the Sierra Nevada and are divided into three stratigraphic units: continental deposits, older alluvium and younger alluvium. In the western portion of the subbasin, near Tulare Lake bed, unconsolidated deposits consisting of flood-subbasin and lacustrine and marsh deposits interfinger with east side deposits.

The continental deposits of Pliocene and Pleistocene age are divided into oxidized and reduced deposits based on depositional environment. The oxidized deposits, which crop out along the eastern margin of the valley, consist of deeply weathered, poorly permeable, reddish-brown sandy silt and clay with well-developed soil profiles. The reduced deposits are moderately permeable and consist of micaceous sand, silt, and clay that extend across the trough in the subsurface to the west side of the valley.

Older alluvium, which overlies the continental deposits, is moderately to highly permeable and is the major aquifer in the subbasin. Younger alluvium consists of arkosic beds, moderately to highly permeable consisting of sand and silty sand. Flood-basin deposits consist of poorly permeable silt, clay, and fine sand. Ground water in the flood-basin deposits is often of poor quality. Lacustrine and marsh deposits consist of blue, green, or gray silty clay and fine sand and underlie the flood-subbasin deposits. Clay beds of the lacustrine and marsh deposits form aquitards that control the vertical and lateral movement of ground water. The most prominent clay bed is the Corcoran clay which underlies the western half of the Kaweah Subbasin at depths ranging from about 200 to 500 feet (DWR 1981). In the eastern portion of the subbasin, ground water occurs under unconfined and semi-confined conditions. In the western half of the subbasin, where the Corcoran Clay is present, ground water is confined below the clay.

Land subsidence of up to 4 feet due to deep compaction of fine-grained units has occurred in separate areas of the southern and western portion of the Subbasin (Ireland and others 1984). The estimated average specific yield for this subbasin is 10.8 percent (based on DWR internal data and Davis 1959).

Restrictive Structures

Groundwater flow is generally southwestward. Small groundwater depressions occurred to the north and south of Visalia and at the subbasin's northwest corner, and a groundwater mound was present in the central western subbasin during 1999 (DWR 2000). Based on current and historical groundwater elevation maps, horizontal groundwater barriers do not appear to exist in the Subbasin.

Groundwater Level Trends

Changes in groundwater levels are based on annual water level measurements by DWR and cooperators. Water level changes were evaluated by quarter township and computed through a custom DWR computer program using geostatistics (kriging). On average, the subbasin water level has declined about 12 feet from 1970 through 2000. The period from 1970 through 1978 showed steep declines totaling about 25 feet. The ten-year period from 1978 to 1988 saw stabilization and rebound of about 50 feet, bringing water levels above the 1970 water level by 25 feet. 1988 through 1995 again showed steep declines, bottoming out in 1995 at nearly 35 feet below the 1970 level. Water levels then rose about 22 feet from 1996 to 2000, bringing water levels to approximately 12 feet below 1970 levels.

Groundwater Storage

Estimations of the total storage capacity of the subbasin and the amount of water in storage as of 1995 were calculated using an estimated specific yield of 10.8 percent and water levels collected by DWR and cooperators.

According to these calculations, the total storage capacity of this subbasin is estimated to be 15,400,000 af to a depth of 300 feet and 107,000,000 af to the base of fresh groundwater. These same calculations give an estimate of 11,600,000 af of groundwater to a depth of 300 feet stored in this subbasin as of 1995 (DWR 1995). According to published literature, the amount of stored groundwater in this subbasin as of 1961 is 34,000,000 af to a depth of $\leq$ 1000 feet (Williamson 1989).

Groundwater Budget (Type B)

Although a detailed budget was not available for this subbasin, an estimate of groundwater demand was calculated based on the 1990 normalized year and data on land and water use. A subsequent analysis was done by a DWR water budget spreadsheet to estimate overall applied water demands, agricultural groundwater pumpage, urban pumping demand and other extraction data.

Natural recharge is estimated to be 62,400 af. Artificial recharge was not determined for all entities, but Lakeside Irrigation District has recharged about 7,000 af per year and in wet years may recharge up to 30,000 af (Cartwright 2001). There is approximately 286,000 af of applied water recharge into the subbasin. Subsurface inflow was not determined. Annual urban and agricultural extraction is estimated to be 58,800 af and 699,000 af, respectively. Other extractions and subsurface inflow were not determined.

Groundwater Quality

Characterization. The groundwater in this basin is generally of a calcium bicarbonate type, with sodium bicarbonate waters near the western margin. TDS values range from 35 to 1,000 mg/L, with a typical range of 300 to 600 mg/L. The Department of Health Services, which monitors Title 22 water quality standards, reports TDS values in 153 wells ranging from 35 to 580 mg/L, with an average value of 189 mg/L.

Impairments. There are localized areas of high nitrate pollution on the eastern side of the basin. There is also high salinity water between Lindsay and Exeter (Edwards 2001).

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	157	1
Radiological	158	8
Nitrates	165	13
Pesticides	167	16
VOCs and SVOCs	165	5
Inorganics – Secondary	157	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: 100 – 2,500	Average: 1,000 – 2,000
	Total depths (ft)	
Domestic		
Municipal/Irrigation	Range: 100 - 500	

Active Monitoring Data

Agency	Parameter	Number of wells /measurement frequency
DWR (incl. Cooperators)	Groundwater levels	568 Semi-annually
Department of Health Services (inc. cooperators)	Title 22 water quality	270 Varies

Basin Management

Groundwater management:	Kings County Water District promulgated a Ground Water Management Plan under AB 255 during 1992, and the Kaweah Delta Water Conservation District passed a Ground Water Management Plan under AB 3030 in 1995.
Water agencies	
Public	Exeter I.D., Ivanhoe I.D., Kaweah-Delta Water Conservation District, Kings River Conservation District, Lakeside Irrigation Water District, Lindmore I.D., Lindsay-Strathmore I.D., St. Johns W.D., Tulare I.D., and Stone Corral W.D.
Private	California Water Service – Visalia; Melga Canal Company; Settlers Ditch Company; Corcoran Irrigation Company.

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Errata

Changes made to the basin description will be noted here.