Petaluma Valley Groundwater Basin

- Groundwater Basin Number: 2-1
- County: Sonoma
- Surface Area: 46,043 acres (72 square miles)

Basin Boundaries and Hydrology

The Petaluma Valley Groundwater Basin occupies a structural depression in California's Coast Ranges immediately north of San Pablo Bay. The basin extends from San Pablo Bay northward to a series of low hills near the town of Penngrove. It is bounded on the west by the Mendocino Range and on the east by the Sonoma Mountains. Northwest trending folds and a few faults are the most important geologic structures of the Petaluma Valley (Cardwell 1958). The Petaluma River is the principal stream draining the Petaluma Valley and is tidally influenced from its mouth at San Pablo Bay upstream to the town of Petaluma. Flow in the river reach above the tidewater is seasonal (Cardwell 1958). Precipitation averages 24 to 28 inches in the valley and up to 40 inches in the highland areas northeast of the valley.

Hydrogeologic Information

Water-Bearing Formations

The Petaluma Valley Groundwater Basin is comprised of late Tertiary to Quaternary age sedimentary deposits of marine and continental origin and volcanic rocks (Cardwell 1958). The major water-bearing units in the basin are the Younger Alluvium, Older Alluvium, and the Merced Formation, while the Petaluma Formation typically has low yields and the Sonoma Volcanics has highly variable yields (DWR 1982).

Holocene Younger Alluvium. The Younger Alluvium forms alluvial fan deposits at the margin of the valley, which spread out to cover the valley troughs in a relatively thin layer. The Younger Alluvium unconformably overlies the Older Alluvium and was deposited by aggradation along streams, sheet wash, and other colluvial processes. It is chiefly fine grained, composed of silt, sandy-clay, some sand, and scattered thin beds of gravel. The permeability of this unit is low because of the fine-grained nature of the deposits. Specific yields for the Younger Alluvium are variable ranging from 3 to15 percent (DWR 1982). Well yields range from 50 to 150 gallons per minute (gpm) (Cardwell 1958). The maximum thickness of this unit occurs in the southeastern portion of the valley where it is perhaps 300 feet (Cardwell 1958). Seawater intrusion degrades groundwater quality in the southern Petaluma Valley and the tidal portion of the Petaluma River (DWR 1982).

Pleistocene Older Alluvium. The Older Alluvium is probably of late Pleistocene age is exposed in the northeastern portion of the valley, and extends beneath the Younger Alluvium to the west and southwest across the valley. It consists of unconsolidated, poorly sorted sand and sandy gravel interbedded with silt and silty clay. The Older Alluvium is of principal importance as an aquifer in northern portion of the Petaluma Valley where it supplies water to wells of intermediate depth. Yields range from 20 to 200 gpm. Specific yield for this unit is moderate to high, ranging between 8 and 17 percent (DWR 1982). Specific capacities range from less than 1 to 5 gpm per foot of drawdown (Cardwell 1958). Groundwater quality is good for most uses.

Pliocene-Pleistocene Merced Formation. The late Pliocene to possibly early Pleistocene Merced Formation is one of the most important water-bearing formations in the Petaluma Valley Groundwater Basin. It consists of massive beds of fine-grained marine sand and sandstone, interbedded with clay, silty clay, and gravel. The formation ranges in thickness from 300 to 2,000 feet and crops out along the northwestern and southeastern margins of the Basin. The formation is tapped by deeper wells near the center and southern portion of the basin. The specific yield of the Merced Formation is high, with a range from 10 to 20 percent. The formation has a high porosity but only a moderate transmissibility due to the small fraction of coarse material. The formation is known to be confined in the northern portion of the Petaluma Valley and is likely confined in other places. The yields of wells in the Merced Formation range from 100 to 1,500 gpm. Specific capacities range from 2 to 30 gpm per foot of drawdown. Wells are commonly drilled to depths of 200 to 600 feet to obtain these yields (Cardwell 1958). The quality of water in the Merced Formation is satisfactory for most uses although locally near the bay, water may be brackish.

Pliocene Sonoma Volcanics. The Pliocene-age Sonoma Volcanics form only a small part of the groundwater reservoir in the Petaluma Valley. This formation is exposed in the upland area along the northeastern portion of the valley. Locally, the Sonoma Volcanics supply moderate yields to a few wells south of Penngrove, probably from tuff and fractured andesite. Volcanic rocks are generally not encountered in wells beneath the alluvial plain (Cardwell 1958). The Sonoma Volcanics have a highly variable specific yield of between 0 to 15 percent (DWR 1982). The quality of the groundwater obtained from the Sonoma Volcanics is satisfactory for most uses.

Pliocene Petaluma Formation. The Petaluma Formation is middle to late Pliocene in age and of continental and marine origin. It consists mostly of poorly stratified clay with some lenses of sand or poorly consolidated sandstone and is estimated to be as much as 4,000 feet thick. The formation is exposed in a 1 to 2 mile belt along the northeastern margin of the Petaluma Valley. It is an important water-bearing formation in the northeastern part of the Petaluma Valley, where the sand and sandstone lenses yield water to wells. Well yields vary with the thickness and extent of sands encountered in the well, but are generally low. Well yields are usually sufficient only for domestic use (Cardwell 1958).

Recharge Areas

Groundwater in the Petaluma Valley is recharged mostly by the deep percolation of rainfall. Suitable recharge areas (those with slopes less than 15 percent and with sufficiently permeable materials) are concentrated northwest of the City of Petaluma and are also scattered on the western flank of the Sonoma Mountains to the east. The rate of recharge is generally slow, depending on the annual precipitation (DWR 1982).

Groundwater Level Trends

Ground water levels near the city of Petaluma dropped from the mid-1950's until the early 1960's. Seawater intrusion occurred in the alluvial fan deposits along the Petaluma River as a result of groundwater pumping. Groundwater levels began to recover after water was imported from the Russian River in 1962 and in some cases they have returned to historic high levels. Groundwater levels have remained steady with the exception of the 1976-77 drought, during which time water levels dropped an average of 10 feet below the normal annual low. Groundwater levels in monitored wells normally fluctuate 10 feet between spring and fall. In most cases, levels had returned to normal by spring 1978 (DWR 1982).

Groundwater Storage

Groundwater Storage Capacity. In the California Department of Water Resources, Bulletin 118-4, *Evaluation of Ground Water Resources Sonoma County Volume 3: Petaluma Valley* published June 1982, the total storage capacity for the study area was estimated to be 1,697,000 ac-ft. The Groundwater Basin as defined in Bulletin 118-4 encompassed an area of 60,000 acres. Portions of that study area are now included in the Wilson Grove Formation Highlands Groundwater Basin and the Napa Sonoma Volcanic Highlands Groundwater Basin. As presently defined, the Petaluma Valley Groundwater Basin contains 46,000 acres. Total storage capacity will therefore be less than this reported figure.

Groundwater in Storage. Total groundwater in storage was estimated to be 1,420,000 acre-feet in DWR's, Bulletin 118-4 (DWR 1982). As noted above, redefinition of the Petaluma Valley Groundwater Basin boundary has reduced its areal extent. This will result in a reduction in the volume of groundwater in storage.

Groundwater Budget (Type C)

Not enough data exists presently to provide either an estimate of the basin's groundwater budget or the groundwater extraction from the basin. The estimated natural recharge for the study area was 40,000 acre-feet (DWR 1982). As noted above, this estimate was based on an area of 60,000 acres, of which 46,000 acres were the currently defined Petaluma Valley Groundwater Basin. Artificial recharge has not been considered in this Basin, as natural recharge exceeds the storage capacity (DWR 1982).

Groundwater Quality

Characterization. With the exception of the Merced Formation most of the water-bearing formations in the basin are generally discontinuous. Groundwater quality varies considerably within the Petaluma Valley due to the general discontinuous nature of the water-bearing formations, which results in a number of isolated groundwater bodies (DWR 1982). The sands and gravels of the Merced Formation are the exception to this. Groundwater from the hills west of Petaluma is a calcium-bicarbonate-chloride type. Wells beneath the valley floor east of Petaluma produce sodium-bicarbonate water. Wells in intermediate geographic locations produce water that is midway in quality between the Merced of the hills and the Merced underlying the valley, indicating some degree of aquifer continuity (DWR 1982). Groundwater of the Petaluma Formation varies considerably. Since the Petaluma Formation is a marine deposit, it frequently contains highly mineralized connate water (DWR 1982). There is widespread and serious nitrate contamination affecting shallow wells in the upland area northwest of Petaluma. This appears to be the result of large amounts of animal wastes disposed on the permeable soils in this area. The upper 50 feet is generally affected. Hydrologic conditions in this upland area will allow for the continued spread of this polluted water. Continued use of this resource is possible as long as the wells are of sufficient depth and adequately sealed to prevent near surface contamination from entering the wells (DWR 1982). Generally there is poor quality groundwater in the Petaluma Valley south of Petaluma. The potential for renewed seawater intrusion exists in the tidal reaches near the Petaluma River if groundwater extraction were to increase to historically high levels (DWR 1982). There is an increasing problem with MTBE contamination. Two wells within the county have already been shut down. (Hodge 2000).

Well Characteristics

	Well yields (gal/min)	
Domestic	Range: 1 – 360	Average: 38 (based on 463 well completion reports [WCRs])
Municipal/Irrigation	Range: 3 – 600	Average: 140 (based on 78 WCRs)
	Total depths (ft)	
Domestic	Range: 20 – 1,107	Average: 262 (based on 929 WCRs)
Municipal/Irrigation	Range: 60 – 1,300	Average: 477 (based on 118 WCRs)

Active Monitoring Data

Agency	Parameter	Number of wells /measurement frequency
DWR	Groundwater levels	2 wells/semiannually 1 well/monthly
DWR	Miscellaneous water quality	4 wells/biennially
Department of Health Services and cooperators	Title 22 water quality	24 wells/annually

Basin Management

Groundwater management:	No known water management agency
Water agencies	
Public	Sonoma County Water Agency, North Marin Water District, City of Petaluma
Private	none

References Cited

Cardwell GT. 1958. Geology and Groundwater in the Santa Rosa and Petaluma Valley Areas, Sonoma County California. US geological Survey Water-Supply Paper 1427.

California Department of Water Resources (DWR). 1982. Evaluation of Groundwater Resources, Sonoma County, Volume 3: Petaluma Valley Bulletin 118-4.

Hodge L. October 18, 2000. (City of Petaluma, Water Assistance Supervisor). Personal Communication.

Errata

Changes made to the basin description will be noted here.