Napa-Sonoma Valley Groundwater Basin, Sonoma Valley Subbasin

- Groundwater Basin Number: 2-2.02
- County: Sonoma
- Surface Area: 44,626 acres (70 square miles)

Basin Boundaries and Hydrology

The Sonoma Valley Subbasin occupies a northwest trending structural depression in the Coast Ranges immediately north of San Pablo Bay. The subbasin is one of three subbasins of the Napa-Sonoma Valley Groundwater Basin. It is bounded on the west by the Sonoma Mountains and on the east by the Mayacamas Mountains. The subbasin extends from San Pablo Bay northward to about 2 miles south of the town of Kenwood where the alluvial plain terminates (Kunkel and Upson 1960). The principal stream draining the subbasin is Sonoma Creek which is tidally influenced from Schellville downstream to its mouth at San Pablo Bay. Annual precipitation for the Sonoma Valley Subbasin ranges from less than 28 inches in the south to more than 40 inches in the north.

Hydrogeologic Information

Water-Bearing Formations

The Sonoma Valley Subbasin is comprised of late Tertiary to Quaternary-age volcanic rocks and continental sedimentary deposits. The water-bearing units within this Subbasin include the Sonoma Volcanics, Glen Ellen Formation, Huichica Formation, Older Alluvium, and Younger Alluvium. The Alluvial deposits constitute the primary aquifers. However, significant quantities of water can be pumped from the Sonoma Volcanics. The Huichica and Glen Ellen typically have low yields, often sufficient only for limited domestic needs (Kunkel and Upson 1960).

Younger Alluvium. This unit is of late Pleistocene to Recent age and consists of interbedded deposits of unconsolidated gravel, sand, silt, clay, and peat (Kunkel and Upson 1960). This formation underlies the stream channels, flood plain deposits, and salt marsh deposits along Sonoma Creek and is generally less than one mile wide. Recent alluvial fan deposits are small and confined to the lower reaches of tributary streams along Sonoma Creek. The Younger Alluvium overlies all other formations of the Sonoma Valley (Kunkel and Upson 1960). This unit is generally unconfined and is usually less than 30 feet thick. The specific yield for this formation ranges from 3 to 15 percent (DWR 1982). The high percentage of sand and gravel in this unit enables it to yield groundwater freely. However, the thickness of the deposit is usually insufficient for large well yields (Kunkel and Upson 1960).

Older Alluvium. This deposit is of late Pleistocene age and consists of unconsolidated, poorly sorted clay, silt, sand, and gravel. It generally overlies the Glen Ellen and Huichica formations and underlies the Younger Alluvium. This unit is composed of stream channel and alluvial fan deposits. It is exposed on most of the alluvial plain except on the flood channel deposits adjacent to Sonoma Creek and where overlain by the Younger Alluvium. This deposit has a maximum thickness of 500 feet. Most wells completed in

this formation are less than 200 feet in depth and intersect lenses of gravel or clay and gravel. Groundwater in the Older Alluvium is unconfined to semi-confined. Specific yields range from 8 to17 percent (DWR 1982). Well yields range to 400 gallons per minute (gpm), but yields in excess of 50 (gpm) are rare. Wells to depths of 100 feet or more generally yield enough groundwater for domestic purposes. The outcrop area of the Older Alluvium is well suited for development and a large number of wells have been drilled in it, making it one of the chief sources of groundwater in the Sonoma Valley (Kunkel and Upson 1960).

Pleistocene Huichica Formation. The Huichica Formation is of Pleistocene age and composed of deformed fluvial deposits of gravels, sand and clay with interbedded tuffs (USGS 2006). The Huichica rests unconformably on the Sonoma Volcanics and underlies the Older and Younger Alluvium. It is typically poorly sorted, lenticular, somewhat crossbedded, and is fine grained except at the very bottom. The total thickness of this formation is estimated to be at least 900 feet. The permeability of the Huichica Formation is low and generally yields insufficient water even for domestic purposes (Kunkel and Upson 1960).

Plio-Pleistocene Glen Ellen Formation. The Glen Ellen Formation is of Pliocene to Pleistocene age. It surfaces only in the northwestern portion of the Sonoma Valley and unconformably underlies the Older and Younger Alluvium. It likely is in contact with the Huichica Formation. The Glen Ellen Formation is composed mainly of alluvial fans deposited in a subsiding basin near the Sonoma Volcanics terrane. It consists of poorly sorted lenticular beds of clay, silt, sand, and gravel. The Glen Ellen Formation is perhaps equivalent to the Huichica Formation. The uppermost Sonoma Volcanics appear to interbed with the Glen Ellen Formation. The total thickness of this formation is unknown (Kunkel and Upson 1960). Groundwater within this formation is semi-confined to confined. Specific yields range from 3 to 7 percent (DWR 1982). Permeability is low in the Glen Ellen Formation and yields from wells are usually adequate only for limited domestic needs.

Pliocene Sonoma Volcanics. The Sonoma Volcanics constitute a thick highly variable series of continental volcanic rocks, including andesite, basalt, and minor rhyolite flows with interbedded coarse- to fine-grained pyroclastic tuff and breccia, re-deposited tuff and pumice, and diatomaceous mud, silt, and sand. There is also a distinctive body of rhyolite flows and tuff with some obsidian and perlitic glass (Kunkel and Upson 1960). Specific yields vary from 0 to 15 percent (DWR 1982). The Sonoma Volcanics is believed to have been formed in the interval between late Miocene and early Pleistocene times. The Sonoma Volcanics is composed of three units, the St. Helena rhyolite member, the Diatomaceous member, and an undifferentiated unit, each several hundred feet thick: (1) the basal undifferentiated volcanic unit is composed of tuff, pumice, breccia, and agglomerate with interbedded flows of andesite and basalt. Wells within the basal unit derive groundwater principally from the pumice and tuffs. The tuff beds are locally semi-confined to confined. Well yields within this unit are moderate and proportional to the thickness of the tuff penetrated below the water table (Kunkel and Upson 1960). (2) The Diatomaceous member, near the middle of the formation, is composed of diatomaceous clay and diatomaceous tuff.

The diatomaceous deposits are generally of low yield. The groundwater is of poor quality and is reported to have high iron and sulfur concentrations (Kunkel and Upson 1960). (3) The St. Helena rhyolite member rests unconformably on the other two members of the Sonoma Volcanics. It is composed of banded rhyolitic flows, welded rhyolitic tuff, with some obsidian and perlitic glass. Permeability is very low and few wells are drilled in this member (Kunkel and Upson 1960).

Restrictive Structures

The Eastside Fault may restrict groundwater movement either because of the presence of fault gouge or secondary mineralization (Campion and others 1984).

Recharge Areas

Groundwater recharge in the Sonoma Creek watershed is principally sourced from precipitation and predominantly occurs as seepage from creeks, lakes, reservoirs and direct infiltration of precipitation on soils. In a groundwater flow simulation model the USGS estimated long-term average groundwater recharge to range from 2.90 to 4.90 x 10^4 acre-feet per year (USGS 2006).

Groundwater Level Trends

Groundwater levels in monitored wells normally fluctuate at least 10 feet between spring and fall. Most hydrographs indicate that groundwater levels have remained steady since 1965, with the exception of the 1976-77 drought, during which time groundwater levels dropped an average of 7 feet below the normal yearly low, recovering by spring 1978 (DWR 1982). Two areas in the central part of the subbasin (City of Sonoma and southwest of El Verano) were identified by the USGS to have substantial groundwater level declines beginning in the late 1990s. These declines were likely caused by increased groundwater pumping (USGS 2006). Long-term hydrographs from DWR monitored wells in those areas also indicated declining groundwater levels since the late 1990s.

Groundwater Storage

Groundwater Storage Capacity. Groundwater storage capacity has been addressed in two separate studies in the Sonoma Valley Subbasin. Storage to a depth of 200 feet was estimated by the USGS to be 180,000 acre-feet (Kunkel and Upson, 1960). This estimate is based on a study area approximately 22,400 acres in extent. An area within the Sonoma Valley, underlain by the Younger and Older Alluvium, and generally south of State Highway 121 near Schellville was excluded. In this area, all deposits to a depth of 200 feet contain salty water and have no usable storage capacity as defined by this study (Kunkel and Upson, 1960). In a DWR study, the total storage capacity was reported to be 708,000 acre-feet. The Sonoma Volcanics were not included in this estimate due to their highly variable yield. This estimate was based on a study area including 103,000 acres (DWR 1982). The current DWR defined portion of the Sonoma Valley Subbasin has resulted in portions of this study area being allocated to the Napa Sonoma Volcanic Highlands Subbasin and to the Kenwood Valley Groundwater Basin (DWR 1982). As presently defined the Sonoma Valley

Groundwater Subbasin contains 44,650 acres. Consequently, the total storage capacity of this Subbasin is less than this previous estimate.

Groundwater in Storage. Total groundwater in storage was estimated to be 559,000 acre-feet in DWR's Bulletin 118-4. As noted in the section on groundwater storage capacity, the redefinition of the Sonoma Valley Subbasin has reduced its areal extent and this will result in a reduction in the volume of groundwater in storage (DWR 1982).

Groundwater Budget (Type A)

As part of its Scientific Investigations Report for the Sonoma Valley area, the USGS developed a groundwater flow simulation model for the time period from 1974 to 2000. The simulated total inflow was approximately 3.94×10^4 acre-feet per year (AFY), of which 3.66×10^4 AFY was from natural recharge, 1.57×10^3 AFY was from San Pablo Bay, and 1.27×10^3 AFY was from Sonoma Creek. Total estimated pumping from 1975 to 2000 was 1.07×10^5 AFY. Approximately 1.73×10^4 acre-feet (or 9 percent of total pumpage) was removed from storage (USGS 2006).

Groundwater Quality

Characterization. Groundwater of the Sonoma Valley Subbasin is generally good for most purposes. Sodium bicarbonate and sodium chloride are the most frequently occurring water types. Groundwater of better quality is generally obtained from the alluvium than from other formations (DWR 1964). The Sonoma Volcanics frequently contain water that is highly mineralized (DWR 1982). The Regional Water Quality Control Board reports that 43 underground fuel tank leaks have occurred in the Sonoma Valley (Luhdorff & Scalmanini 1999). From 2002 to 2004, the USGS collected groundwater samples from wells throughout the Subbasin and analyzed them for pH, specific conductance, chloride, fluoride, arsenic, boron, iron, and manganese. Of the 240 total analytes, 45 had concentrations greater than or equal to the Federal or State drinking-water standards and advisory levels. The majority (53 percent) of these exceedence analytes came from wells in the northern portion of the Subbasin. Saline groundwater has historically been found south of State Highway 12/121 although data collected in 2003 by the USGS indicates that the saline groundwater may have moved northward (USGS 2006).

Well Characteristics

	Well yields (gal/min)	
Municipal/Irrigation	Range: 3 – 800	Average: 127 (based on 134 well completion reports [WCRs])
	Total depths (ft)	
Domestic	Range: 20 – 1,370	Average: 416 (based on 837 WCRs)
Municipal/Irrigation	Range: 56 – 1,255	Average: 524 (based on 180 WCRs)

Active Monitoring Data

Agency	Parameter	Number of wells /measurement frequency
DWR	Groundwater levels	1 well/monthly 2 wells/semiannually
DWR	Miscellaneous water quality	10 wells/biennially
Department of Health Services and cooperators	Title 22 water quality	35 wells/annually

Basin Management

Groundwater management:	Sonoma County Water Agency, Sonoma Valley Groundwater Management Plan, December 2007
Water agencies	
Public	Sonoma County Water Agency, City of Sonoma, Valley of the Moon Water District
Private	Unknown

References Cited

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Errata

Changes made to the basin description will be noted here.