Surprise Valley Groundwater Basin

- Groundwater Basin Number: 6-1
- County: Modoc and Lassen, CA, and Washoe, NV
- Surface Area: 228,460 acres (CA) (357 square miles)

Basin Boundaries and Hydrology

Surprise Valley is a complexly faulted graben filled with alluvial and lacustrine sediments. The valley is bounded on all sides by block-faulted structures. The Surprise Valley fault is on the west side, and Hays Canyon fault is on the east side. To the south the valley is bounded topographically by a block-faulted horst. The northern half of the eastern side of the valley is bounded by an irregularly block faulted region. The basin is approximately 50 miles long and 12 miles wide.

The margins of the valley are covered with coalesced alluvial fan and near-shore deposits. The central portion of the valley floor consists of basin and lake deposits. The basin is closed and has no hydrologic outlet. Most of the streams draining into Surprise Valley originate along the eastern slopes of the Warner Mountains and empty into the Upper, Middle, and Lower Alkali lakes. These lakes are shallow and alkaline and usually become dry in summer months. The surface water flows are adjudicated in most streams. Annual precipitation in the basin ranges from 13- to 17 inches, increasing to the north.

Hydrogeologic Information

Water-Bearing Formations

The water-bearing formations consist of Holocene alluvium and alluvial fan deposits, Pleistocene near-shore deposits, and Pliocene to Pleistocene lake deposits. The following summary of the water-bearing formations is from DWR (1965).

Holocene Alluvial Fans. The alluvial fan deposits consist of unconsolidated to partly consolidated, poorly stratified gravel, sand, and silt with clay lenses. They are found near the surface with thicknesses ranging to 1,000 feet and are important recharge areas for the valley. The alluvial fans slope toward the valley floor and coalesce to form a continuous alluvial apron around much of the valley. These deposits form the principal aquifers in the basin and are capable of yielding large quantities of confined and semi-confined groundwater to wells. The fans are generally coarser at the mountain front and finer toward the basin center.

Holocene Alluvium Deposits. Intermediate alluvial deposits are found along stream channels on the eastern side of the valley and along the flatter distal portions of alluvial fan deposits in the northern, western, and southern portions of the basin. The alluvium consists of poorly sorted sand and silt with some lenses of gravel and clay. Sand, gravel, and cobbles are predominant along stream channels. The thickness of the deposits range up to 50 feet. The alluvium is moderately permeable and is capable of providing good quantities of water to shallow wells.

Pleistocene Near-shore Deposits. The near-shore deposits are highly permeable terraces, beaches, spits and deltas formed in ancient Lake Surprise. They consist of poorly consolidated gravel, sand, and silt deposited as deltas and terraces. They are coarser-grained along the margins of the valley and become finer-grained toward the center ranging up to 5,000 feet in thickness. These deposits have moderate to high permeability and are capable of yielding large amounts of water to wells.

Pleistocene to Holocene Lake Deposits. The lake deposits consist of unconsolidated to semi-consolidated fine sand, silt, and clay. The thickness of the deposits range up to 5,000 feet in the central portion of Middle Alkali Lake. The permeability is low but may be sufficient for limited development of water for stock purposes.

Recharge Areas

Recharge to groundwater on the west side of the valley is from infiltration of surface water into the apexes of the alluvial fans located below the mouths of canyons along the base of the Warner Mountains. In the extreme northern portion of the valley, surface water from the north infiltrates coarse stream deposits and recharges underlying groundwater bodies. As these recharge areas are all within the valley floor area, no true upland recharge areas exist along the western and northern sides of the valley (DWR 1963).

Groundwater Level Trends

Section incomplete.

Groundwater Storage

Groundwater Storage Capacity. Groundwater storage capacity to a depth of 400 feet is estimated to be approximately 4,000,000 acre-feet (DWR 1963).

Groundwater Budget (Type B)

Estimates of groundwater extraction for the basin are based on a survey conducted by the California Department of Water Resources during 1997. The survey included land use and sources of water. Estimates of groundwater extraction for agricultural and municipal/industrial uses are 41,000 and 290 acre-feet, respectively. Deep percolation from applied water is estimated to be 6,600 acre-feet.

Groundwater Quality

Characterization. Calcium bicarbonate type waters occur on the western edge of the basin and sodium bicarbonate type waters occur easterly. Calcium to sodium bicarbonate water occurs west of Lower and Middle Alkali Lakes. Total dissolved solids range from 87- to 1,800-mg/L, averaging 224 mg/L.

Impairments. Poor quality water of sodium sulfate to sodium sulfate chloride character is present east of Middle Alkali Lake and along the southern and western edges of Upper Alkali Lake. Some thermal waters along the Surprise Valley and Lake City fault zones have high ASAR, high

concentrations of sulfate, sodium, boron, fluoride, and arsenic and total dissolved solids concentrations greater than 1,000 mg/L.

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	2	0
Radiological	1	0
Nitrates	4	0
Pesticides	0	0
VOCs and SOCs	1	0
Inorganics – Secondary	2	0

[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 Production Characteristics

	Well yields (gal/min)	
Irrigation	Range: 350 – 2,500	Average: 1,383 (154 Well Completion Reports)
	Total depths (ft)	
Domestic	Range: 60 – 580	Average: 199 (161 Well Completion Reports)
Irrigation	Range: 100 – 812	Average: 347 (154 Well Completion Reports)

Active Monitoring Data

Agency	Parameter	Number of wells /measurement frequency
DWR	Groundwater levels	16 wells /semi-annually
Soil Conservation Service		26 wells/ semi-annually
DWR	Miscellaneous water quality	11 wells
Department of Health Services		4 wells

Basin Management

Groundwater Management	Modoc County adopted a groundwater management ordinance in 2000
Water Agencies	
Public	Surprise Valley Management District, enacted 1995
Private	

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Errata

Changes made to the basin description will be noted here.