Lower Mojave River Valley Groundwater Basin

- Groundwater Basin Number: 6-40
- County: San Bernardino
- Surface Area: 286,000 acres (447 square miles)

Basin Boundaries and Hydrology

The Lower Mojave River Valley Groundwater Basin underlies an elongate east-west valley, with the Mojave River flowing (occasionally) through the valley from the west across the Waterman fault and exiting the valley to the east through Afton Canyon. The contact between unconsolidated Quaternary sediments and consolidated Tertiary and older rocks of the Waterman and Calico Mountains forms the northern boundary of the basin. The southern boundary is the contact between unconsolidated sediments and consolidated rocks forming Daggett Ridge, the Newberry Mountains, and the Rodman Mountains. This groundwater basin is bounded on the west by the Camp Rock-Harper Lake fault zone and the southeast by the Pisgah fault. The northeastern boundary is an arbitrary divide between the adjacent Coyote Lake Valley Basin and Caves Canyon Valley Basin. Average precipitation varies across the basin from 4 to 6 inches with the average for the basin near 4 inches.

Hydrogeologic Information

Water Bearing Formations

The two primary water-bearing units within the Mojave River Valley Basin system consist of regional Pliocene and younger alluvial fan deposits (fan unit) and of overlying Pleistocene and younger river channel and floodplain deposits, which are called the floodplain unit (DWR 1967), or the flood-plain aquifer (Lines 1996). Other potential, but not regionally significant, water-bearing units include older alluvium, old fan deposits, old lake and lakeshore deposits, and dune sand deposits (DWR 1967). Water-bearing deposits in this basin are predominantly unconfined. Wells yield range from 100 to 4,000 gpm (Hardt 1969, Lines 1996), and the average well yield is about 480 gpm for all units (BEE 1994).

Pleistocene and Younger Floodplain Unit. The floodplain unit is the more productive and extensively studied of the two units and extends an average of 200 feet deep, but is restricted to within about 1 mile of the active Mojave River channel (Stamos and others 2001). Specific yields for the floodplain unit deposits range from 14 to 21 percent, averaging about 18 percent, and wells yield up to 4,000 gpm (Lines 1996).

Pliocene and Younger Fan Unit. The regional fan unit, is composed of Late Tertiary and younger unconsolidated to partially consolidated alluvial fan deposits up to 2,000 feet thick (Stamos and Predmore 1995, Lines 1996, Stamos and others 2001). Permeability decreases with depth (Stamos and others 2001) and the estimated average effective thickness in the Lower Mojave River Valley Groundwater Basin is about 300 feet thick (DWR 1967). Available information indicates that specific yields and well yields are generally less for the fan unit compared to the floodplain unit, but suggest generally higher well yields for younger fan deposits and lower well yields for older fan deposits (DWR 1967). Specific yield in this deposit averages about 10 percent (DWR 1967).

Restrictive Structures

The basin is transected or bounded by the Camp Rock-Harper Lake, Calico-Newberry, and Pisgah fault zones. These northwest-trending faults form barriers or partial barriers to groundwater flow, which cause a stair-step pattern, lowering the water table eastward across each of the faults (Stamos and Predmore 1995, Lines 1996, Stamos and others 2001). Historically, important springs were located on the west side of many of these faults (Stamos and Predmore 1995, Lines 1996), but most are no longer flowing because of a decline in the water table. In the northeastern portion of the basin, relatively shallow clay layers result in shallow water levels near Camp Cady (Lines 1996).

Recharge Areas

Natural recharge of the basin is from direct precipitation, ephemeral stream flow, infrequent surface flow of the Mojave River, and underflow of the Mojave River into the basin from the west (Eccles 1981, Lines 1996). Treated wastewater effluent, septic tank effluent, and irrigation waters are allowed to percolate into the ground and recharge the groundwater system (Eccles 1981, Lines 1996). A large, but sporadic contribution to recharge occurs when the Mojave River is flowing, with 40 feet of rise in the water table observed during 1969 and 87 feet of rise observed in 1993 (Hardt 1969, Robson 1974, Lines 1996).

Groundwater Level Trends

Groundwater levels in wells in the floodplain unit near the Mojave River tend to vary in concert with rainfall and runoff rates, whereas groundwater levels in the fan unit do not show significant changes due to local rainfall (MWA 1999). The general trend in this basin is for declining groundwater levels, particularly in the fan unit. Three of the ten highest precipitation years over a 60-year base period occurred during 1991 through 1999 (MWA 1999). Infiltration of the runoff from this relatively abundant precipitation has produced an increase in the groundwater level (and groundwater storage) in the floodplain unit near the Mojave River (MWA 1999). Hydrographs for wells near Yermo and Newberry Springs show a decline in water level of about 80 to 100 feet over the last fifty years and an decrease of 1 to 2 feet over the last ten years (MWA 1999). The general groundwater flow pattern follows topography toward the active Mojave River channel, then it follows the course of the Mojave River eastward to Afton Canyon (Stamos and Predmore 1995; Lines 1996).

Groundwater Storage

Groundwater Storage Capacity. Published total storage capacity for the Lower Mojave River Valley Basin varies. The boundaries of the Lower Mojave River Valley Groundwater Basin of this report correspond closely to the boundaries of the Troy and Daggett storage units discussed by DWR (1967). DWR (1967) calculated the total storage capacity for these storage units using the base of water-bearing materials, an average of about 300 feet.

The total storage for the Troy and Daggett storage units is 7,950,000 af (DWR 1967). The Lower Mojave River Valley Groundwater Basin underlies the Baja subarea administered by the Mojave Water Agency. The Baja subarea also extends to include parts of the neighboring Coyote Lake Valley and Caves Canyon Valley Groundwater Basins of this report (MWA 1999). MWA calculated a total effective storage capacity of the Baja subarea using an economic pumping depth of 100 feet to limit the depth of the basin (BEE 1994), to be about 1,544,000 af. Using an overlying area of about 286,000 acres, an average thickness of about 300 feet, and a specific yield of 10.5 percent indicates a total storage capacity of about 9,010,000 af for the Lower Mojave River Valley Groundwater Basin.

Groundwater in Storage. MWA (1999) calculated the available stored groundwater in the Baja subarea at the end of 1998 to be about 1,130,000 af, leaving about 414,000 af of additional storage space available. MWA considers the basin to be effectively full when 1930 water level elevations are reached (BEE 1994). Assuming an average of 250 feet of saturated material, an area of 286,000 acres, and an average specific capacity of 10.5 percent indicates about 7,510,000 af of stored groundwater was available at the end of 1998. This amount of groundwater in storage leaves about 1,500,000 af of storage space available.

Groundwater Budget (Type A)

Not enough data exist to compile a detailed groundwater budget for the basin. However, the MWA monitors groundwater extraction and reports extractions of 3,300 af for urban uses, 28,900 af for agriculture, and 6,400 af for industrial and recreational uses in the 1997-1998 water year (MWA 1999). In addition to the extraction data, several other components of the water budget have been reported. For the 1997-1998 water year, MWA (1999) estimated natural recharge at 27,400 af, artificial recharge at 3,390 af, and applied water recharge at 14,500 af. Subsurface inflow and outflow averages are estimated by DWR (1967) at 2,000 af inflow and 1,000 af outflow, and have been corroborated by Bookman-Edmonston Engineering (1994).

Groundwater Quality

Characterization. The groundwater in the Lower Mojave River Valley Basin is mainly sodium bicarbonate in character. Sodium-calcium sulfate character occurs near Daggett and Newberry Springs. Sodium chloride, sodium-calcium chloride, and sodium chloride-sulfate characters occur east of Troy Lake. Sodium bicarbonate-chloride predominates at Afton (DWR 1967). Total dissolved solids content ranges from 300 mg/L near Daggett to 2,000 mg/L near Newberry Springs (BEE 1994). Data from 41 public supply wells included in the Title 22 monitoring program indicated a range of TDS from 265 mg/L to 2,370 mg/L with an average of 665 mg/L. Electrical Conductivity values were 533 µmhos near Yermo, 475 µmhos near Toomey, and 61 µmhos near Troy Lake (DWR 1967).

Impairments. Fluoride concentrations are elevated near Newberry Springs, and fluoride and boron concentrations are elevated near Camp Cady (BEE 1994). There are nine sites in the Barstow area where underground fuel storage tanks are leaking, introducing benzene, toluene, ethylbenzene, xylene and methyl-tertiary-butyl-ether (MTBE) into groundwater. Federal Superfund sites are located in the Nebo and Yermo Marine Corps depots for contamination plumes of the industrial solvent trichloroethane (TCE; BEE 1994, MWA 1999).

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	41	2
Radiological	38	6
Nitrates	41	4
Pesticides	36	0
VOCs and SVOCs	36	0
Inorganics – Secondary	41	9

[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)	
Municipal/Irrigation	Range: 10–2,700	Average: 770 Median: 570 (80 Well Completion Reports)
	100-4,000 gpm for floodplain unit (Hardt 1969	Average for basin, all units = 480 gpm (BEE 1994).
	Total depths (ft)	
Domestic	Range: 50-420	Average: 188 Median: 180 (1,016 Well Completion Reports)
Municipal/Irrigation	Range: 63-800	Average: 270 Median: 250 (283 Well Completion Reports)

Active Monitoring Data

Agency	Parameter	Number of wells /measurement frequency
U.S. Geological Survey	Water Levels	70/Annually??
U.S. Geological Survey	Water Quality	21/Annually??
Department of Health Services	Title 22 Water Quality	52

Basin Management

Groundwater management:	The Lower Mojave River Valley Groundwater Basin is a portion of an area adjudicated in 1996 setting the Mojave Water Agency as watermaster. MWA has proposed three basic management strategy alternatives that would reduce and eliminate the decline of water levels in the basin. These alternatives—water conservation, water supply enhancement, and water allocation—will likely be implemented together in the final management strategy adopted by MWA
Water agencies	
Public	MWA, Dagget CSD
Private	Southern California WC, Yermo WC

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Errata

Substantive changes made to the basin description will be noted here.