UNIVERSITY OF NEVADA-RENO

Nevada Bureau of Mines and Geology
University of Nevada-Reno
Reno, Nevada 89557-0088
(702) 784-6691

1986

NBMG OPEN FILE REPORT 86-4
(supplements NBMG Map 2Af)

HYDROLOGY
SOUTH LAKE TAHOE QUADRANGLE
NEVADA AND CALIFORNIA

James R. Harrill
U.S. Geological Survey

Prepared cooperatively by the
United States Geological Survey

This report has been edited, reviewed, and approved
by the U.S. Geological Survey.

[redacted]

GENERAL FEATURES

Three geographic features shown on the South Lake Tahoe Quadrangle dominate the hydrologic regimen of the area: The Carson Range, bordering the east side of the quadrangle; Lake Valley and adjacent valley areas along the west base of the range; and Lake Tahoe.

The Carson Range has 3,800 feet (about 1,160 meters) of local topographic relief. Land-surface altitudes range from 6,230 feet (slightly less than 1,899 meters) at the lake shore to 10,067 feet (3,068 meters) on Monument Peak. The combination of substantial relief and high altitude makes the Carson Range the catchment area for most of the locally derived water supply.

Lake Valley and adjacent valley areas along the base of the Carson Range are typified by alluvial surfaces with slopes generally less than 15 percent as indicated on the slope map, South Lake Tahoe folio. Flood plains of the principal streams occupy parts of this area. The principal ground-water reservoir is formed by unconsolidated deposits underlying the valley. Most high density development has occurred in this area and additional future development is anticipated.

Lake Tahoe forms the principal base level for the local hydrologic system. Both surface water and ground water flow into the lake. Lake stage affects channel downcutting of tributary streams and controls the position of the water table in adjacent unconsolidated deposits near the shore. The stage is regulated by gates in a concrete dam at the northwest corner of the lake. A federal court decree has set the maximum permissible stage at 6,229.1 feet (1,898.6 meters). The natural rim of the lake, which defines the lower limit of stage for practical purposes, is at an altitude of 6,223 feet (1,896.7 meters). The lake also forms a constant head boundary to the ground-water system. This means that if wells near the shore are pumped heavily and ground-water levels begin to decline significantly, lake water will temporarily recharge the ground-water reservoir and help to stabilize ground-water levels. Consequently, drawdowns are lessened during periods of heavy pumping and, over the long term, intermittent recharge of lake water helps to prevent significant ground-water storage depletion as a result of pumping.

PRECIPITATION

Average annual precipitation ranges from about 20 inches (roughly 50 centimeters) at the edge of the lake to more than 40 inches (roughly 100 centimeters) in the higher parts of the Carson Range. Most precipitation occurs between November and April and falls as snow. Snow generally covers the ground throughout most of the area for about 4 months of the year. At higher elevations, substantial snow accumulations are usually present for about 8 months of the year. Most of the surface runoff and ground water recharge is generated from snowmelt between the first of April and the end of June.

RUNOFF

All but a minor amount of runoff is by way of nine principal streams. Two of these, the Upper Truckee River and Trout Creek, account for about 86 percent of the runoff and are supplied largely by areas upstream from the area of the South Lake Tahoe Quadrangle. The remaining seven are supplied from drainages entirely within the quadrangle. The following listing summarizes mean annual runoff from these streams. Values for Trout Creek and the Upper Truckee River are the average of 15 years of gaging station record (October 1960 through September 1975). Other values were estimated by T. L. Katzer of the U.S. Geological Survey using indirect techniques developed by Moore (1968).

GROUND-WATER RESOURCES

Ground water is generally found at shallow depth throughout most of the South Lake Tahoe Quadrangle. It occurs in the zone of saturation in both unconsolidated deposits and consolidated rocks. In unconsolidated deposits the water table forms a nearly continuous surface throughout most of the valley. This is in contrast to the mountains where ground water occurs in a complex system of joints and fractures. These structural features probably form a series of perched or semiperched ground-water bodies rather than a continuous zone of saturation.

Lines of equal depth to water table for the major valley area are shown on the hydrologic map. Depth to water increases slightly toward the mountains, but local topography and the presence of perennial-stream flood plains appear to be the most significant factors controlling depth to water. Lines drawn in the southwest quarter of the quadrangle in areas of glacial till are estimated on the basis of very few precise data points. Field observations in the fall of 1975 revealed small seepage areas in several road cuts and along the bases of steep sloping hillsides. This suggested that saturated deposits could be encountered at shallow depths, as is shown on the map.

Most of the ground water is discharged by evapotranspiration in the areas where the water table is near or at the land surface; some ground water is discharged into streams near the lake and directly into Lake Tahoe at and near the shore. The most extensive discharge areas are those along flood plains of the principal streams. Shallow ground water, within a few feet of land surface, is hydraulically connected with streams in the same areas. This allows the roots of certain herbaceous plants, riparian shrubs, and broad-leaf trees (i.e., grasses, willows and aspen) to withdraw ground water recharged from the streams to help satisfy their water requirements. The general distribution of these plant communities is shown on the vegetation map in this folio.

Shallow ground-water areas are also present in the mountains; most occur in areas of low gradient along the principal perennial stream channels and in

---

[1] Moore, D. O., 1968, Estimating mean runoff in ungaged semiarid areas: Internat. Assoc. Sci, Hydrology Bull. 13, v. 1, p. 29-39. (Reprinted as Nevada Dept. Conserv. and Nat. Resources Water Resources Bull. 36, p. 36-39.)

Stream	Location	Mean annual runoff acre-feet	Mean annual runoff Cubic hectometers
McFaul Creek	NE 1/4 NE 1/4 sec. 15, T13N, R18E. Upstream from rockslide at inlet to reservoir	500	0.62
Burke Creek	SW 1/4 SW 1/4 sec. 23, T13N, R18E. Upstream from Tahoe Village	400	.49
Edgewood Creek	NW 1/4 NW 1/4 sec. 26, T13N, R18E. 100 yds (91 meters) upstream from reservoir	2,500	3.1
Unnamed tributary	NE 1/4 SE 1/4 sec. 27, T13N, R18E. East of Harrah's parking lot	50	.06
Bijou Creek	NW 1/4 NE 1/4 sec. 2, T12N, R18E	150	.18
Heavenly Valley Creek	SE 1/4 NW 1/4 sec. 2, T12N, R18E. At Pioneer Trail	1,500	1.8
Cold Creek	NE 1/4 NW 1/4 sec. 11, T12N, R18E. At Pioneer Trail	7,500	9.2
Trout Creek	NW 1/4 SE 1/4 sec. 3, T12N, R18E. At gaging station	28,000	34
Upper Truckee River	NE 1/4 SE 1/4 sec. 31, T12N, R18E. At gaging station	49,000	60

small basins or other flat-sloping areas where the conditions are favorable for some recharge and storage of ground water. After the spring snowmelt and during wet years many other mountain areas contain saturated joints and fractures within a very short distance of the land surface. However, water levels in these areas may fluctuate markedly from both season to season and year to year. It is uncertain whether reliable ground-water supplies could be developed in these areas.

Rock units have been classified on the basis of their general water-yielding character. These groupings are listed on the hydrologic map where they are presented in terms of relative well yield. The classification relies on both hydrologic characteristics (permeability of alluvium and fracture characteristics of consolidated rocks), and on geometry and occurrence of the deposits.

Unconsolidated alluvial deposits of sand and gravel are probably the most permeable materials in the area. They occur in both mountain and valley areas; however, their geometry and size vary significantly. In the mountains, most alluvial deposits are either "shoestring" channel deposits along the principal streams, or veneers of unconsolidated material overlying consolidated rocks. Small saturated thickness and limited areal extent adversely affect their ability to yield substantial water to wells on a sustained basis. In the valley, unconsolidated alluvial fill forms a wedge-shaped deposit which is perhaps 10 to 20 feet (3 to 6 meters) thick near the mountains and generally more than several hundreds of feet (several tens of meters) thick near the lake. Thick sequences of permeable material and the presence of the lake as a potential source of recharge under conditions of heavy pumping create favorable prospects for well yields. Consequently, alluvial deposits are differentiated as valley alluvium, which generally has a high yield to wells, and upland alluvium, which generally has only an intermediate yield.

Consolidated rocks, primarily granodiorite, were differentiated on the basis of the severity of slope. Generally, steep slopes tend to promote faster drainage from shallow fractures. This results in greater depths to water and less ground-water storage to sustain pumping during dry periods. These factors, as well as practical problems associated with locating developments on a steep slope, are the primary reasons for classifying consolidated rocks with slopes greater than 30 percent as areas with very low relative well yields. Consolidated rock exposures with flat lying or gradually sloping surfaces are considered more favorable for development; however, well yield in these areas is likely to be low.