STATE OF NEVADA
OFFICE OF THE STATE ENGINEER

GROUND WATER FOR INDIAN SERVICE HOSPITAL AT SCHURZ, NEVADA

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Prepared cooperatively by the
GEOLOGICAL SURVEY
UNITED STATES DEPARTMENT OF THE INTERIOR

November 1950

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INTRODUCTION

The ground-water supply for the hospital of the Walker River Sub-Agency of the Carson Indian Agency at Schurz, Nevada, has never been satisfactory from the standpoint of either quality or quantity. This condition was recognized by the Division of Public Health Engineering, Nevada State Department of Health, in a letter dated July 31, 1950, to the State Engineer's Office summarizing the water-supply situation, and requesting recommendations for the development of a reliable supply in the vicinity of the hospital. In describing the condition W. W. White, Director, Division of Public Health Engineering, wrote in part as follows:

> Over the period of the last twenty years, there has been seasonal and regular trouble with the water supply at the Schurz Hospital, this is the Walker River Agency hospital. The existing supply is inadequate, unreliable, is occasionally contaminated, and the use leads to regular and early replacement of boilers and other distribution equipment.

As the result of this letter the State Engineer requested the Ground Water Branch, United States Geological Survey, as a part of the State-wide cooperative ground-water program, to investigate the possibilities of developing a satisfactory and reliable ground-water supply in the vicinity of the hospital. Accordingly, on August 8, 1950, the writer made an examination of the area, and collected samples of water from four wells for mineral analysis.

LOCATION AND GENERAL CONDITIONS

Schurz, in Mineral County, Nevada, lies about 5 miles north of the northern end of Walker Lake, in the Walker River valley. It is served by a branch-line railroad of the Southern Pacific Co., and by U. S. Highways 95 and 95 Alternate, both of which are hard-surfaced.

The population of Schurz is estimated to be about 475. According to a survey by the Carson Indian Agency in the winter of 1950, there were 371 resident Indians and a white personnel of 80, the latter attached to the hospital or sub-agency staff. In addition, there are about 20 local residents.

The Walker River valley at the latitude of Schurz is flanked on the west by the precipitous Wassuk Range, and on the east by the foothills at the northern end of the inconspicuous Gillis Range. One of the highest peaks in the Wassuk Range, Black Mountain, about $5\frac{1}{2}$ miles directly west of Schurz, rises to an altitude of 8,136 feet. The altitude of the flood plain of the Walker River near the railroad station is about 4,120 feet. The hospital is located on the flood plain about 0.4 mile northeast of the railroad station.

The Walker River, which heads in the high Sierra Nevada to the west of the Wassuk Range, passes around the north end of the Wassuk Range and then flows southeast for approximately 25 miles to Walker Lake. Walker Lake is a present-day remnant of ancient Lake Lahontan, which at one time covered many hundred square miles of northwestern Nevada. According to a brief report in the files of the U. S. Geological Survey, entitled "Water supplies from wells near Hawthorne, Nev.," prepared by Kirk Bryan about 1925, the gravel benches along Walker Lake indicate that at one time the water level of Lake Lahontan stood at an altitude of about 4,230 feet. Thus at one time the site of Schurz was under at least 100 feet of water, and the Walker River valley for many miles upstream was also inundated.

Prior to the construction of impounding reservoirs upstream, and use of the river water for irrigation, the Walker River discharged large quantities into Walker Lake. At present the channel in the vicinity of Schurz may be dry at certain times during the year. On August 8, 1950, some water was noted in the channel but there was very little movement. The Weber Reservoir, about 7 miles upstream from Schurz, impounds the river water for the irrigation of Indian land on the flood plain of the river both above and below Schurz. The irrigation water for lands lying downstream from Schurz is conveyed past Schurz by two main ditches, one on the east and the other on the west side of the river channel.

In the vicinity of Schurz the flood plain of the Walker River is bounded on the east and west by terraces 20 to 30 feet above the flood plain. To the east the land surface rises very gently; to the west it slopes upward with a gradient of about 100 feet to the mile to the base of the Wassuk Range, 2 miles distant. At the base of the Wassuk Range the land surface is formed by many small alluvial fans and the slope is somewhat steep. Between the toes of the fans and the edge of the terrace on the west side of the flood plain the surface is mantled with talus debris ranging widely in texture. The thickness of this debris is not known.

River deposits floor the flood plain of the Walker River. In the central part of the flood plain these deposits extend to a depth of at least 190 feet, as shown by the log of the well of the Southern Pacific Railroad Co. no. 13/28-36B1. The deposits consist of alternating beds of sand, sandy clay, clay, and gravel. According to this log, sand is the predominating material and constitutes about 60 percent of the logged section. Mixed sand and clay make up about 30 percent, clay, 7 percent, and gravel, 3 percent.

GROUND-WATER CONDITIONS

Ground water occurs in the sediments beneath the detritus-mantled plain sloping toward the Walker River from the base of the Wassuk Range, and in the river deposits in the flood plain. The sediments underlying the sloping plain are recharged by water from spring runoff or local thunderstorms that discharges from the normally dry canyons of the Wassuk Range onto the alluvial fans, where it percolates downward and then moves laterally eastward toward the Walker River. The Walker River is the principal source of recharge to the river deposits beneath the flood plain. Recharge occurs by seepage from the river channel, seepage from irrigation ditches, and downward percolation of water spread for irrigation. In addition, there is some recharge from ground water moving laterally eastward from the Wassuk Range.

Several wells in the vicinity of the hospital tap water in the river deposits. Except for the 190-foot well of the Southern Pacific Co., all are relatively shallow and the water is used for domestic purposes. Water from the railroad well is used primarily for locomotives, although some is also used for domestic purposes.

During the field examination data were obtained for five representative wells in the vicinity of the hospital. Samples of water for mineral analysis were collected from four of the wells. Data for the five wells are given in Table 1, and the results of the analysis of the water of the four samples collected are shown in Table 2.

TABLE 1

Records of five representative wells in the vicinity of Schurz, Nev.

13/28-35A1. Walker River Sub-Agency. Domestic dug well, diameter 87 inches, depth 24.7 feet, corrugated-iron casing. Equipped with horizontal reciprocating pump powered by a 3-horsepower electric motor. Main supply for Walker River Sub-Agency hospital and resident dwellings. Measuring point, top of corrugated galvanized-iron casing, 0.10 foot above land surface. Depth to water, 18.45 feet below measuring point, Aug. 8, 1950.

13/28-35A2. Walker River Sub-Agency. Domestic dug well, diameter 60 inches, depth 24.5 feet, corrugated-iron casing. Located about 15 feet east of well 13/28-35A1. Equipped with turbine pump having a 3-inch discharge pipe, and powered by a 3-horsepower electric motor. Supplementary supply for Walker River Sub-Agency hospital and resident dwellings. Measuring point, top of concrete curb, 0.10 foot above land surface. Depth to water, 20.10 feet below measuring point, Aug. 8, 1950.

13/28-36B1. Southern Pacific Railroad Co. Drilled well, diameter 12 inches, depth 190 feet, steel casing to 190 feet, perforated between 120 and 140 feet and 161 and 170 feet. Equipped with 10-horsepower turbine pump. Tested April 23 and 24, 1945, at the rate of 266 gallons per minute, with a drawdown of 34 feet. Reported depth to water, 16 feet below land surface, April 1945. Record of materials penetrated from graphical log furnished by the Southern Pacific Co.

Material	Thickness (feet)	Depth (feet)
Sand	5	5
Gravel	5	10
Sand, fine	4	14
Quicksand	6	20
Sand	7	27
Sand, light	23	50
Sand, loose	15	65
Sand, coarse, and gravel	5	70
Clay and sand	10	80
Sandy clay	25	105
Sand and clay	1	106
Clay, yellow	4	110
Clay, yellow, sandy	2	112
Clay, blue, and sand	8	120
Sand, tight	4	124
Clay, blue, muddy, and sand	1	125
Sand, coarse	15	140
Sand, coarse, tight	15	155
Clay, blue	6	161
Sand, loose, muddy	4	165
Sand, coarse	3	168
Sand, hard	8	176
Clay, hard, and sand	14	190
Total depth	..	190

TABLE 1--CONTINUED

13/28-36B2. Southern Pacific Co. Unused dug well, 84 inches square, depth 16.3 feet, wood cribbing. Depth to water, 11.94 feet below measuring point, Aug. 8, 1950.

13/28-36B3. Andy Vidovich. Domestic driven well, diameter 2 inches, reported depth 45 feet. Equipped with 3/4-horsepower electrically operated pressure system, capacity 800 gallons per hour. Reported depth to water, 8 feet below land surface, 1945.

QUALITY OF WATER

The quality of the ground water in the river deposits is shown by the analyses in Table 2. The water samples were purposely collected from wells of different depths in order to determine the change in quality, if any, with depth. It is readily apparent from the analyses that the waters from the three shallow wells (13/28-35A1, 13/28-36B2, and 13/28-36B3) have a greater concentration than water in the deep well (13/28-36B1). The water from the deep well, owned by the Southern Pacific Co., according to the casing record, comes from depths of 120 to 140 feet and 161 to 170 feet. This water is relatively soft and would appear suitable for most uses. It is possible that the relatively high silica content of 58 parts per million may give some trouble in boiler use through formation of hard scale. However, the water is used regularly in locomotive boilers.

Water from two of the shallow wells, Southern Pacific Co. 13/28-36B2 and Andy Vidovich 13/28-36B3, are moderately concentrated and are classified as hard water. The sample from well 13/28-36B2 contained an appreciable amount of precipitated iron at the time of the analysis and showed a rather high phosphate concentration. Reportedly the water from this well was unsatisfactory for use in locomotive boilers.

The water from the Walker River Sub-Agency well, 13/28-35A1, which furnishes the present hospital supply, is a relatively soft water and is only moderately mineralized. It is difficult to tell from the analysis why the water should cause difficulty in boilers and distributing equipment. However, as noted in Mr. White's letter to the State Engineer, this water has not been satisfactory.

An examination of the log of the 190-foot well of the Southern Pacific Co. reveals that, between depths of 70 and 120 feet, there is 50 feet of clay and sandy clay. These materials are believed to be sufficiently impermeable to prevent any vertical movement of water through them. The difference in quality between the water above a depth of 70 feet and that below a depth of 120 feet is also indicative of lack of connection. The lateral extent of the zone of clay and sandy clay is not known. However, because the layer is of considerable thickness, and because the ground water above and below it are different in quality, it is believed to extend over a considerable area of the river deposits. If this is true, then water having a concentration similar to that of the 190-foot well may be obtained from a well tapping the water-bearing river deposits below the clay and sandy clay, at a depth of 120 feet or more.

The water from well 13/28-35A1, the present source of supply for the hospital, is believed to be ground water moving laterally east from the base of the Wassuk Range. Because of its location at the toe of the terrace on the west side of the Walker River flood plain, the well is able to intercept ground water from that source before it mixes with the water in the river deposits. The difference in quality of the water from this well from that from the other two shallow wells strongly suggests such a condition.

TABLE 2

Analyses of water from four wells at Schurz, Nev.

(Analyses by U. S. Geological Survey, Salt Lake City laboratory)

(Parts per million)

	Walker River Sub-Agency dug well 13/28-35A1 (depth 24.7 ft.)	Southern Pacific Co. drilled well 13/28-36B1 (depth 190 ft.)	Southern Pacific Co. unused dug well 13/28-36B2 (depth 16.3 ft.)	Andy Vidovich driven well 13/28-36B3 (depth 45 ft.)	Limits recommended by U. S. Public Health Service 1946
Silica (SiO_2)	49	58	42	41	
Iron (Fe)	.02	.02	* .02	.09	.3
Calcium (Ca)	18	9.2	74	99	
Magnesium (Mg)	3.2	2.3	20	24	125
Sodium and potassium (Na+K) ..	79	35	102	90	
Bicarbonate (HCO_3) .	130	94	308	336	
Sulfate (SO_4)	84	20	166	197	250
Chloride (Cl)	22	5.8	44	42	250
Fluoride (F)	2.0	.5	.4	.2	1.5
Nitrate (NO_3)	.4	.2	.7	2.0	
Phosphate (PO_4)	.1	.2	.9	0	
Boron (B)	.4	.2	.4	.6	
Dissolved solids ...	322	177	601	661	500
Hardness as $CaCO_3$:					
Noncarbonate	0	0	14	70	
Total	58	32	266	346	
Specific conductance (Micromhos)	469	203	913	987	
Percent sodium	75	70	46	36	

*Precipitated Fe 0.13.

PRESENT WATER SUPPLY

As previously noted, the present supply for the hospital is primarily from well 13/28-35A1, supplemented by water from well 13/28-35A2. According to information from L. A. Adair, administrative assistant for the hospital, the minimum need of the hospital and resident dwellings for domestic use is about 5,000 gallons a day. This does not allow any water to be used for sprinkling yards or irrigating gardens. Well 13/28-35A1 is pumped dry after 6 hours of continuous pumping. During this period it supplies about 5,000 gallons of water. Well 13/28-35A2 is pumped dry after about 20 minutes of continuous pumping. It is estimated that during this 20-minute pumping period the well will produce about 700 gallons of water. Thus, a total of about 5,700 gallons may be obtained by pumping both wells dry. The time required for the two wells to refill is not known, but it is obvious that the supply is not greatly in excess of the minimum requirement.

CONCLUSION

From the foregoing discussion it is apparent that the quality of the ground water from shallow wells on the flood plain of the Walker River in the vicinity of Schurz is not satisfactory for use at the hospital. However, ground water of satisfactory quality is present below the 50-foot-thick zone of clay and sandy clay, the bottom of which is at about 120 feet. Judging from the log and performance record of the Southern Pacific Co. well 13/28-36B1, a properly constructed well tapping the water-bearing materials from about 120 to about 170 feet should furnish an ample supply of water for the hospital. Inasmuch as the Southern Pacific Co. well is only 0.4 mile from the hospital, there is every reason to believe that the material penetrated by a well in the vicinity of the hospital would be similar to that shown in the log of that well.

Care should be taken in constructing the new well to insure that the water of low concentration below the clay and sandy clay will not be contaminated by the water of higher concentration above.