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HYDROLOGIC RECONNAISSANCE OF SKULL VALLEY, TOOELE COUNTY, UTAH

by

J. W. Hood, Hydrologist, and
K. M. Waddell, Chemist
U. S. Geological Survey

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HYDROLOGIC RECONNAISSANCE OF SKULL VALLEY, TOOELE COUNTY, UTAH

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ABSTRACT

Skull Valley is a north-trending narrow depression that extends about 50 miles from the vicinity of Lookout Pass in T. 8 S., R. 7 W., northward to the southwestern shore of Great Salt Lake. The Skull Valley drainage basin includes about 880 square miles. In the valley, the main ground-water reservoir is in unconsolidated rocks of late Tertiary and Quaternary age and underlies about 230,000 acres.

The source of all water in Skull Valley is precipitation which falls mainly on the Stansbury and Onaqui Mountains. The estimated potential long-term average annual runoff from the uplands is about 32,000 acre-feet of water, but only a small part of this amount flows out of the valley. The remainder becomes recharge or is lost by evapotranspiration within the valley.

The estimated average annual ground-water recharge and discharge is in the range of 30,000-50,000 acre-feet per year. Ground water is discharged from Skull Valley by evapotranspiration, wells, surface outflow, and underflow from the mouth of the valley. Of these, evapotranspiration accounts for 80-90 percent of the total ground-water discharge. In 1965, wells discharged only about 5,000 acre-feet of water.

The estimated perennial yield of ground water in Skull Valley is 10,000 acre-feet or less. Water in excess of this amount would have to be drawn from storage. Recoverable water in storage in the upper 100 feet of the saturated unconsolidated rocks is estimated to be about 2.3 million acre-feet, but only about 1 million acre-feet of the ground water is believed to be of a chemical quality suitable for irrigation and domestic use.

The chemical quality of water limits potential development of Skull Valley. The range of concentration of dissolved solids in the drainage basin is 98 to 17,200 ppm (parts per million). Most of the water from the area north of Iosepa and from parts of the valley south of Iosepa is saline. The freshest water is from streams and springs in the Stansbury Mountains. Water of good chemical quality underlies the alluvial apron that borders the area of greatest recharge—the Stansbury and Onaqui Mountains. Water of chemical quality suitable for irrigation, with low to moderate sodium and salinity hazards, may underlie as much as 100,000 acres.

Past and present development of water in Skull Valley has been limited mainly to irrigation and domestic use of streams, springs, and wells along the east side of the valley and to wells for public supply at Dugway. Use of ground water by stock and industry is small. In 1965, less than 600 acres of land were irrigated entirely with ground water from wells, about 450 acres were irrigated entirely from spring flow, and about 1,500 acres were irrigated with stream and spring flow that was supplemented with well water. Ground water is the main source of water for future development. Potential agricultural development of the valley may be limited to a total of perhaps 25,000 acres, considering both the quality of ground water and probable soil conditions in the valley.

INTRODUCTION

This report is the second in a series by the U.S. Geological Survey in cooperation with the Utah Department of Natural Resources, Division of Water Rights, which describes the water resources of the western basins of Utah. Its purpose is to present available hydrologic data on Skull Valley, to provide an evaluation of the potential water-resource development of the valley, and to identify needed studies that would help provide an understanding of the valley's water supply.

The investigation on which this report is based consisted largely of a study of all available data for geology, streams, wells, and water use in Skull Valley. These data were supplemented by data collected during a 1-week reconnaissance in August 1965 of land forms, vegetation, geology, and water use. Where well records were poor or not available, additional wells were inventoried. Under a cooperative program with the Utah Geological and Mineralogical Survey, most water resources in the lowlands of Skull Valley and at the edges of the mountains were sampled and the water samples were analyzed for chemical content. These analyses (Waddell, 1967) are supplemented with the few available analyses from Connor, Mitchell, and others (1958). Estimates of stream discharge, records of selected wells and springs, drillers' logs, and chemical analyses are presented in tables 3, 8, 9, 10, and 11.

Skull Valley is southwest of Salt Lake City; and Timpie, a railroad siding and a road junction on U.S. Highway 40, at the north end of the valley, is 49 road miles west of Salt Lake City. The valley extends from the vicinity of Lookout Pass in T. 8 S. to the southwestern shore of Great Salt Lake in T. 2 N. Most of the valley extends from R. 7 W. to R. 9 W. and includes an area of about 400 square miles. (See plate 1.)

Few published sources of hydrologic data for Skull Valley are available. Carpenter (1913) included Skull Valley in a reconnaissance report on northwestern Utah. Snyder (1963) included data on the valley in a reconnaissance report that dealt with the availability of water for stock grazing in the public domain of western Utah. Mahoney (1953) discussed Skull Valley as a part of his appraisal of the general disposition of precipitation in western Utah, and Bagley, Jeppson, and Milligan (1964) included data on the valley in their analysis of water yields in Utah.

Sources of geologic data are more abundant and include the work of Cohenour (1959), Teichert (1959), Young (1955) Crittenden (1963), and Rigby (1958). Stokes (1964) used all available sources in compiling the State geologic map, which is the basis for the geohydrologic map shown on plate 1. Unpublished studies include a thesis on the geology and ground water of eastern Skull Valley by K. R. Everett (written commun., 1957) and a report by L. C. Demars and others (written commun., 1954) on the valley southeast of Dugway Proving Grounds. R. E. Maurer (oral commun., 1965) supplied data on geology, local roads, and topographic conditions in the Cedar Mountains.

Wells, springs, and surface-water data sites are numbered in this report using the system of numbering wells in Utah, which is based on the cadastral land-survey system of the Federal Government. The number, in addition to designating the well, spring, or other data site, locates its position to the nearest 10-acre tract in the land net. By this system the State is divided into four quadrants by the Salt Lake base line and meridian. These quadrants are designated by the uppercase letters A, B, C, and D, thus: A, for the northeast quadrant; B, for the northwest; C, for the southwest; and D, for the southeast quadrant. Numbers designating the township and range respectively, follow the quadrant letter, and the three are enclosed in parentheses. The number after the parentheses designates the section, and the lowercase letters give the location of the well within the section. The first letter indicates the quarter section, which is generally a tract of 160 acres, the second letter indicates the 40-acre tract, and the third letter indicates the 10-acre tract. The number that follows the letters indicates the serial number of the well within the 10-acre tract. Thus, well (C-5-8)35cad-1, in Tooele County, is in the SE¼NE¼SW¼ sec. 35, T. 5 S., R. 8 W., and is the first well constructed or visited in that tract. (See figure 1.)

When the serial (final) number is preceded by an "S" the number designates a spring; if the spring is located to the nearest 40 acres or larger tract, a suffixed "S" is used without a serial number. When no serial number is suffixed to a location number for a 10-acre tract, the number designates the location of a surface-water sampling site.

PHYSIOGRAPHIC SUMMARY

Skull Valley is a part of the Great Basin, and is in that part of the basin that was once occupied by the ancient inland sea called Lake Bonneville (Gilbert, 1890). The valley is nearly 50 miles long and reaches its maximum width of about 22 miles in T. 5 S. (plate 1). The drainage divides that frame most of the basin are the crests of the Stansbury and Onaqui Mountains on the east and the Cedar Mountains on the west. The south end of the Lakeside Mountains extends along the west shore of Great Salt Lake and a short distance into the valley. The southern end of the valley is a small topographic subbasin partly separated from the main valley by the Davis Knolls.

The mountains that surround Skull Valley are typical block-faulted mountains. The Stansbury Mountains dominate the landscape, rising from an altitude of 6,000 feet in the eastern part of T. 4 S., R. 8 W., to 11,031 feet at Deseret Peak in the central part of T. 4 S., R. 7 W. The Stansbury Mountains present a steep westward slope into Skull Valley; and at the foot of the main mountain mass, an alluvial apron of coalescing alluvial fans slopes to the valley floor. The alluvial apron is pierced by subsidiary masses of consolidated rocks, as at Salt Mountain in eastern T. 3 S., R. 8 W.

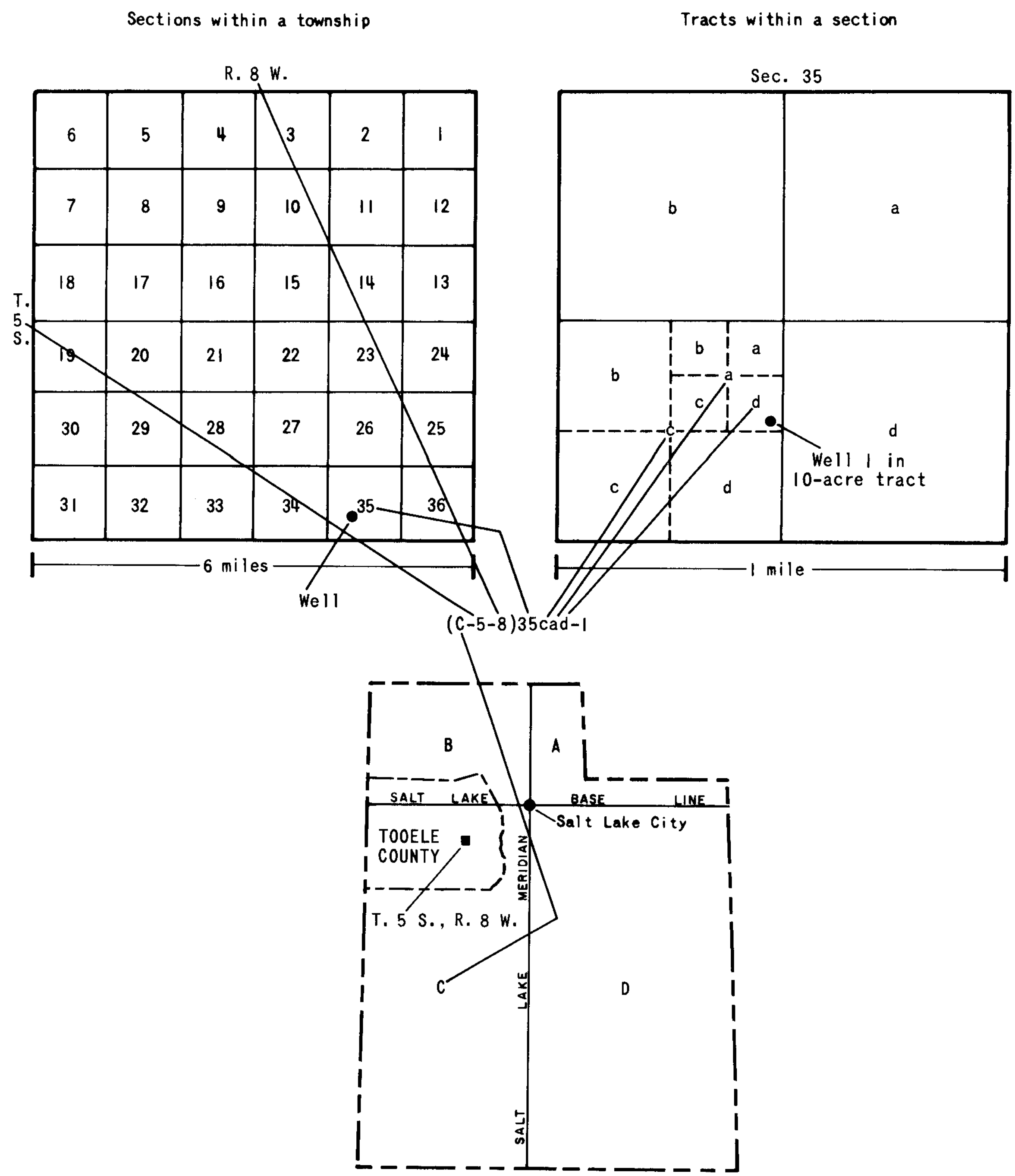


Figure 1. — Well-numbering system used in Utah.

The Onaqui Mountains rise above 9,000 feet but the range covers only about 60 square miles. The Cedar Mountains are a long and narrow range that is angular in plan because of changes in direction of geologic structural trends in the vicinity of T. 5 S., R. 10 W. The Cedar Mountains rise to an altitude of about 7,600 feet in the southern part of T. 3 S., R. 10 W., and their eastern slope has an alluvial apron which is much narrower than that along the base of the Stansbury Mountains.

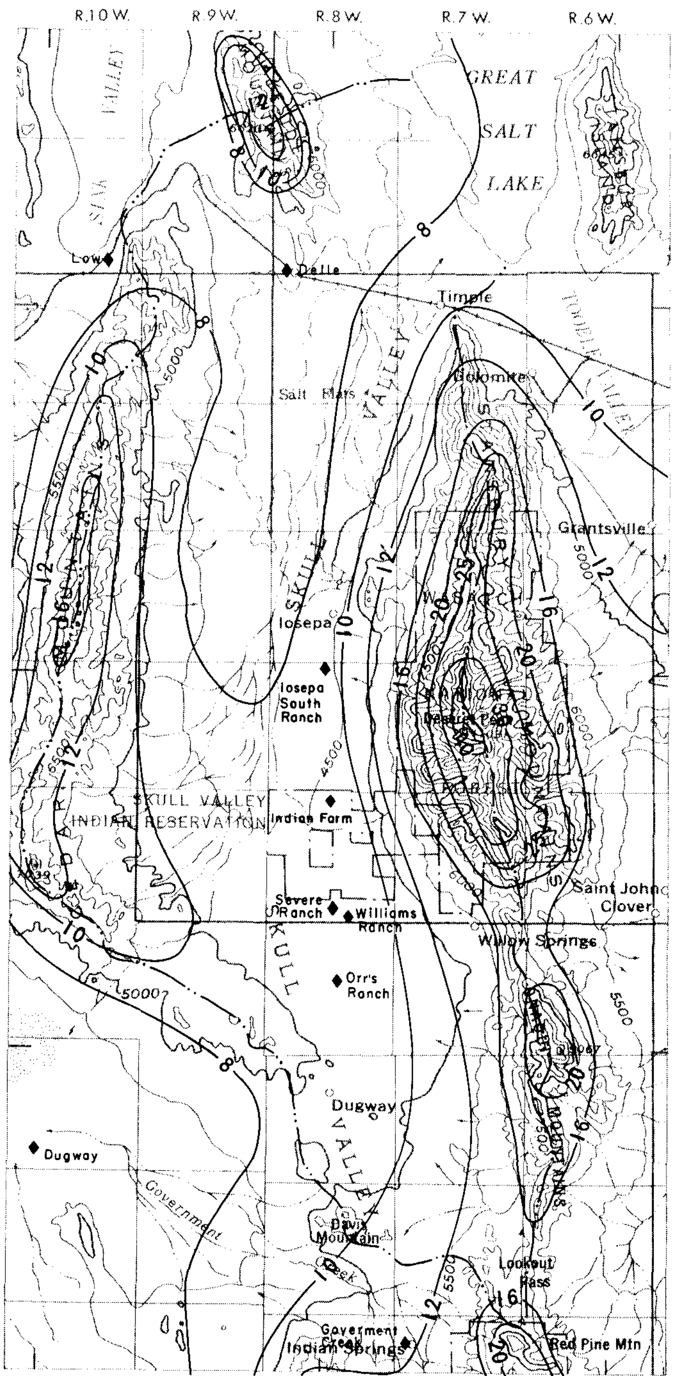
The floor of Skull Valley slopes northward from an altitude of about 5,200 feet near the pass to Government Creek valley to an altitude of about 4,200 feet near the shore of Great Salt Lake. The valley floor is pierced by a few outcrops of consolidated rocks, but as a whole it is relatively smooth. The southern two-thirds of the valley is trough shaped. Stream channels from the mountains slope almost straight down to an axial trough. Most of the northern one-third of the valley is a gently sloping flat surface that receives drainage both from the sides and the southern part of the valley and delivers surface water to Great Salt Lake through a group of braided channels. The flat is broken at places by low erosional remnants and linear sand dunes.

The lowlands and adjacent slopes of Skull Valley were modified by the action of the water in Lake Bonneville (Gilbert, 1890, p. 90). At its highest level (plate 1), the lake notched the alluvial apron, and it seems probable that wave action formed the apparent pediment along part of the eastern side of the Cedar Mountains. The lake left many other features throughout the valley, such as terraces and the multiple bay bars east of the Davis Knolls and at the pass to Government Creek valley.

CLIMATIC SUMMARY

Because of the wide range of altitude, the climate in Skull Valley is semiarid, whereas on the uppermost slopes of the Stansbury Mountains it is humid to subalpine. Climatologic data are provided in the published records of the U.S. Weather Bureau (1937, 1957, 1965, 1951-66), and the availability of these data is summarized in table 1. Useful regional interpretations of climatic data are also available, such as those described by Peck and Brown (1962) who produced the isohyetal maps of Utah (U.S. Weather Bur., 1963a and b and figure 2), evaporation maps of the United States by Kohler, Nordenson, and Baker (1959), and the tables of freezing temperature probabilities by Ashcroft and Derksen (1963).

Long-term precipitation in Skull Valley generally ranges from 7 to 12 inches per year (figure 2). However, only about one-third of the annual precipitation falls on the lowlands during the growing season. The uplands receive from 12 to more than 40 inches of precipitation annually. A small area near the center of the Cedar Mountains receives a maximum of 16-20 inches; whereas in the lofty Stansbury Mountains, large areas receive 16-30 inches of precipitation, and at Deseret Peak, the annual total exceeds 40 inches. About one-fourth of the annual precipitation falls on the uplands during the growing season.



EXPLANATION

——12——
Isohyet
Shows normal annual precipitation, 1931-60; intervals 2, 4, 5, and 10 inches

◆ Orr's Ranch
Climatologic station

——··——··——
Boundary of drainage basin

Base adapted from U.S. Geological Survey State Base Map, 1959.

0 5 10 MILES

Isohyet from U.S. Weather Bureau (1963a)

Figure 2. — Isohyetal map of Skull Valley and vicinity, showing locations of climatologic stations listed in table 1.

Table 1. — Stations at which climatologic data have been collected in and near Skull Valley

[P, precipitation, T, temperature]

Station	Location Lat.	Location Long.	Altitude (feet)	Period of record	Type of record	Remarks
Delle			4,219	6-27-19 to 6-30-27	P,T	At railroad station.
	40°46′	112°49′	4,219	9-24-40 to 4-15-41	P,T	At service station.
		112°47′	4,250	6-20-51 to 5-16-52	P,T	At cafe.
		112°48′	4,270	5-16-52 to 12-31-52	P,T	At railroad station.
Dugway	40°10′	113°00′	4,359	9- -50 to 12-31-64	P,T	In Dugway Valley.
Government Creek	40°03′	112°40′	5,320	12- 1-00 to 11- -49	P,T	In Government Creek valley. At James Ranch; also called Indian Springs Post Office. Late part of record for summers only.
Indian Farm	40°24′	112°43′	4,800	3- -15 to 8-31-18	P	
Iosepa South Ranch	40°33′	112°45′	4,356	8-30-10 to 4-30-17	P,T	At South Ranch of Deseret Livestock Co.
	40°33′	112°45′	4,415	8-31-51 to 12- -58	P,T	
Low	40°47′	112°57′	4,602	7- 8-11 to 4-30-19	P,T	In Sink Valley. At railroad station.
Orr's Ranch	40°24′	112°45′	-	1-24-19 to 6-30-20	P,T	Known as Sells through 1923. Poor record through 1920.
	40°18′	112°44′	4,700	11- 1-20 to 4- -49	P,T	
Severe Ranch	40°20′	112°43′	4,610	8- 1-49 to 2-28-51	P,T	Record intermittent.
Williams Ranch	40°20′	112°43′	4,626	6- -60 to 6- -63	P,T	Do.

Table 2 includes data on average monthly and annual precipitation at five climatologic stations in and near Skull Valley. Figure 3 shows the cumulative departure from the normal annual precipitation at three stations and indicates that precipitation in the Skull Valley area varies cyclically from periods of normal to excess to periods of normal to deficient (drought) precipitation.

Air temperature in Skull Valley has a wide annual range. The lowest temperatures of record ranged from -11° to -35°F and occurred in January or February; the highest temperatures of record ranged from 105° to 107°F and occurred during the period June-August. The average annual temperature ranges from 48° to 52°F. The available temperature records and the available records of frost-free days during midyear at four stations are summarized in figure 4.

Evaporation in Skull Valley was estimated from the records of stations to the east and west of the valley and the estimate compared with the maps by Kohler, Nordenson, and Baker

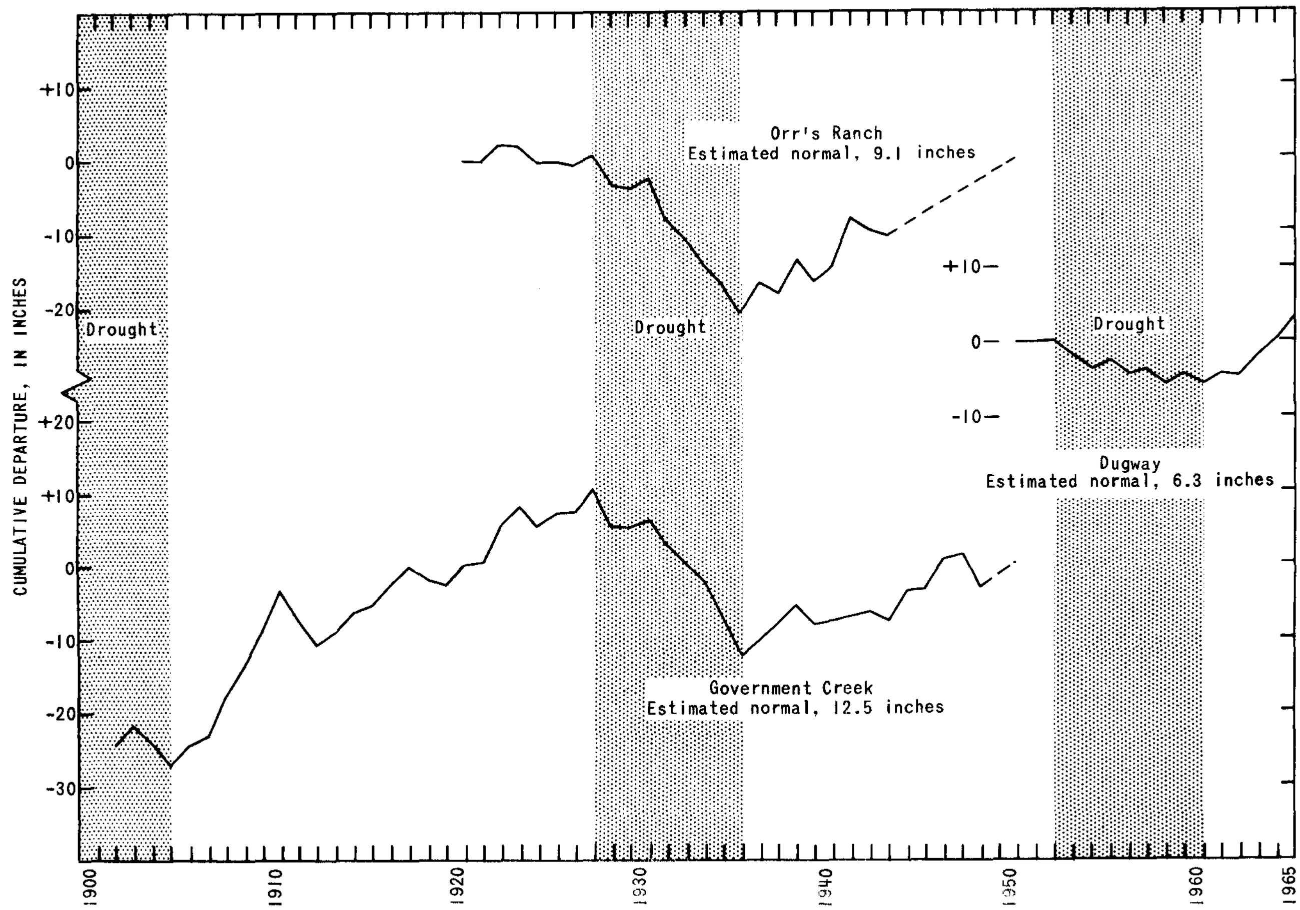
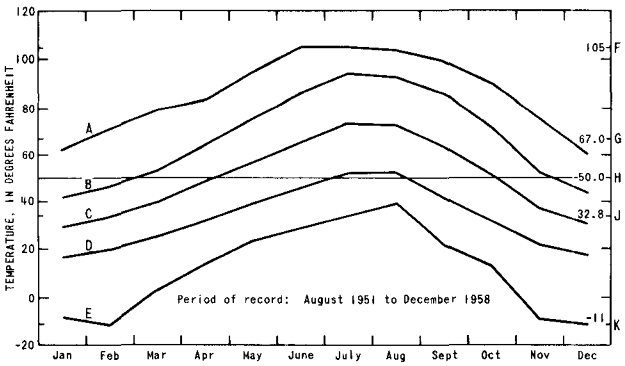


Figure 3. — Cumulative departure from 1921-50 normal annual precipitation at Government Creek, Dugway, and Orr's Ranch.

A Highest temperature of record during month
B Mean monthly maximum
C Average monthly
D Mean monthly minimum
E Lowest temperature of record during month
F Highest of record
G Mean annual maximum
H Mean annual
J Mean annual minimum
K Lowest of record

Freeze data for September 1951 through November 1958:

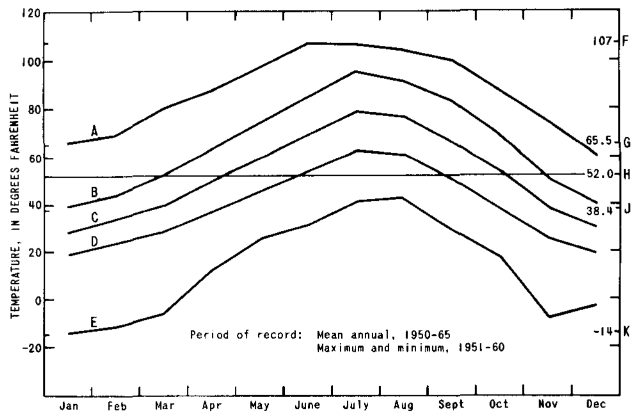
	Number of days between last spring and first fall minimum					
	32°F	Year	28°F	Year	24°F	Year
Annual average for 7 years	120	-	140	-	165	-
Longest period and year	139	1957	175	1952	192	1957
Shortest period and year	100	1953	100	1953	125	1954



Iosepa South Ranch

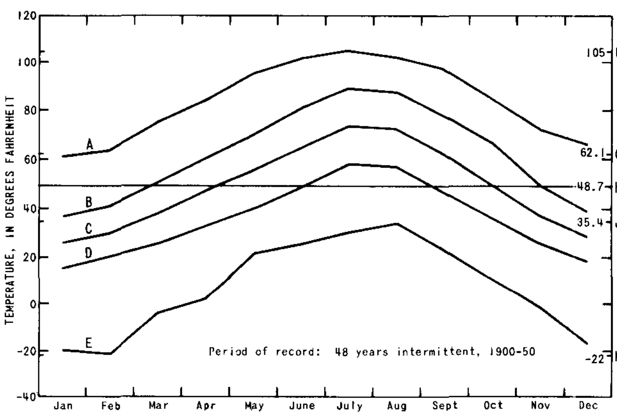
Freeze data for 1951-64 inclusive:

	Number of days between last spring and first fall minimum					
	32°F	Year	28°F	Year	24°F	Year
Annual average for 14 years	151	-	179	-	209	-
Longest period and year	187	1963	216	1957	225	1964
Shortest period and year	120	1954	146	1960	160	1960



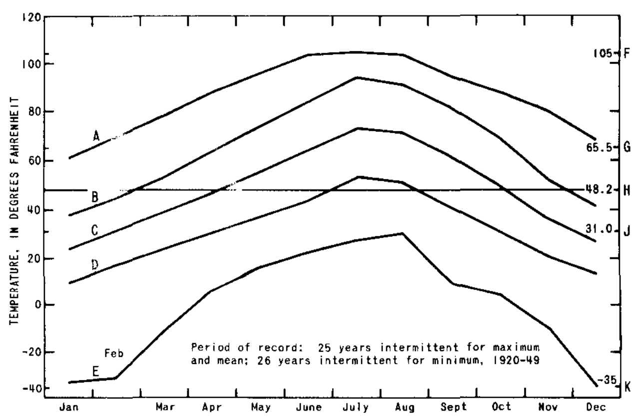
Dugway

Freeze data for 30-year period, 1901-30 inclusive: Average number of days between last spring and first fall minimum of 32°F or less - 118 days



Government Creek

Freeze data for 10-year period, 1920-30 inclusive: Average number of days between last spring and first fall minimum of 32°F or less - 92 days



Orr's Ranch

Figure 4. — Temperature and freeze data for four stations in and near Skull Valley.

(1959, pls. 1 and 2), which show the averages for the period 1946-55. In Skull Valley, the estimated average evaporation from an evaporation pan is 61 inches per year, and the evaporation from lakes, or other large bodies of open water, is in the range of 42-44 inches per year.

Table 2. — Average monthly and annual precipitation, in inches, at climatologic stations in and near Skull Valley

[For basic data, see U.S. Weather Bureau (1951-66). Numbers in parentheses show period of record, in years. Annual total is sum of monthly averages. See table 1 for station records.]

	Delle	Dugway	Government Creek	Iosepa South Ranch	Orr's Ranch
January	0.53(8)	0.53(15)	1.00(49)	1.18(14)	0.62(31)
February	.54(9)	.53(15)	1.19(49)	.85(14)	.88(30)
March	.83(9)	.55(15)	1.60(49)	1.24(14)	.87(31)
April	.77(9)	.75(15)	1.32(49)	1.39(12)	.91(30)
May	.90(9)	.74(15)	1.45(50)	1.08(12)	1.03(28)
June	.45(9)	.57(15)	.72(48)	.69(11)	.51(28)
July	.63(11)	.38(15)	.79(49)	.51(11)	.50(29)
August	.82(9)	.57(15)	1.01(49)	.47(11)	.74(29)
September	.23(9)	.37(14)	.70(49)	.35(14)	.50(29)
October	.74(9)	.42(15)	1.15(49)	1.00(15)	.99(29)
November	.64(10)	.51(15)	.97(48)	.87(15)	.69(29)
December	.56(9)	.56(15)	1.01(49)	.93(15)	.81(29)
Annual total	7.64	6.48	12.91	10.56	9.05

GEOLOGIC SETTING

The geology shown on plate 1 is based largely on the geologic map of Utah (Stokes, 1964) and the discussion of the Stansbury Mountains by Rigby (1958). The data from these sources, together with field data, are the basis for the following discussion of the relation of geology to hydrology.

The consolidated rocks in Skull Valley are the framework of the drainage basin. They crop out both in the uplands and at a few places in the valley, and they underlie all the valley at depths controlled chiefly by the geologic structure.

The oldest sedimentary rocks are exposed in the central uplands of the Stansbury Mountains and comprise the Tintic Quartzite of Early and Middle Cambrian age. The formation is shown separately on plate 1 because the quartzite has a low bulk permeability and underlies much of the area where precipitation is greatest. Thus, precipitation that falls on the outcrop area of the Tintic Quartzite mainly runs off to lower altitudes with a minimum of loss to infiltration into the mountain block.

Most of the consolidated rocks are grouped into a single unit owing to their common age and similar water-bearing characteristics. The rocks in this unit are mainly of Paleozoic age (plate 1), and they overlie the Tintic Quartzite. (See Rigby, 1958, p. 10-51.) The unit mainly contains carbonate rocks—limestone and dolomite—but includes many beds of shale, sandstone, and quartzite that individually may be as much as 350 feet thick. Most rocks in the unit have a low bulk permeability and most have low primary permeabilities. The carbonate rocks, however, have some secondary permeability, which is due in part to mechanical disruption by structural movements and in part to development of cavernous zones by solution.

Unconsolidated or semiconsolidated rocks of Tertiary and Quaternary age underlie Skull Valley. Little is known about the Tertiary rocks, but they may be similar to those described by Heylmun (1965, p. 9-26) for areas in Rush Valley and the Great Salt Lake Desert, both adjacent to Skull Valley. These rocks include basal conglomerates, lake deposits, volcanic rocks, and outwash deposits that range from Paleocene(?) to Pliocene(?) in age. The older Tertiary rocks contain few aquifers. Well (C-7-8)22adb-1 penetrated clay and tuffaceous sand between 497 and 730 feet. These deep impermeable beds, which contain volcanic glass shards, appear to be similar to those described for the zone 307-601 feet in well (C-6-8)2dcd-1. (See table 9.) Elsewhere in the valley, wells penetrated "lime" (presumably limestone), hardpan, and hard conglomerates that may be parts of the older section.

Younger Tertiary rocks and Quaternary rocks, which are mostly clastic erosional debris, comprise the main ground-water reservoir. Most of the erosional debris was laid down as outwash deposits in the alluvial fans and on the valley floor. The heads of the fans contain chaotic mixtures of grain sizes, ranging from boulders to clay, and these mixtures grade into well-sorted beds of gravel, sand, and clay beneath the middle and lower slopes of the fans. In the lowlands of the valley, the deposits mainly are fine grained. Thick beds of clay interfinger with permeable beds of sand and gravel along the edges of the fans. The north-central part of the valley contains a small amount of sand interbedded with silt and clay. (See table 9.)

The Quaternary rocks, which were deposited in Lake Bonneville, are only a small part of the unconsolidated rocks in Skull Valley. They are in part coarse-grained shore facies, but the bulk of the lake deposits are silt and clay. Within the area marked by the ancient shoreline (plate 1), most of the valley floor apparently is underlain with a layer of lacustrine clay which is 20-100 feet thick. Deposits that postdate Lake Bonneville consist of additions to the alluvial fans and of soils, sand dunes, and playa deposits of Recent age.

The total thickness of rocks of Tertiary and Quaternary age that underlie Skull Valley is not known. Johnson and Cook (1957, p. 53) infer from geophysical data that 6,000-7,000 feet of sedimentary deposits lie upon the denser and older consolidated rocks east of the Cedar Mountains. Surface resistivity surveys by Coyd Yost, Jr., and others of the Geological Survey (written commun., 1954) indicate areas between the Davis Knolls and Davis Mountain where the top of the older consolidated rocks is 1,200 feet or more beneath the land surface. A few drillers' logs (table 9) give depths to consolidated rocks along the edges of the valley.

The present position of the unconsolidated rocks partly determines their function in the hydrologic system in Skull Valley. The coarse-grained rocks near the heads of the alluvial fans are a main area of recharge, and the sand dunes at lower altitudes locally are potential areas of intermittent recharge. Lower in the fans, the sands and gravels constitute the main aquifer and yield from 200 to more than 1,000 gpm (gallons per minute) of water to large-diameter wells. (See table 8.) In contrast, the extensive lake-bottom deposits in the lower parts of the valley act as an effective deterrent to infiltration of recharge and do not yield large quantities of water to wells. In areas where the water table is close to the land surface, the fine-grained lake-bottom deposits permit a large capillary rise that delivers water to the surface where it is discharged by evaporation.

Skull Valley is a graben, or down-faulted area between elevated, subparallel mountain blocks. The elevation of the mountain blocks has had three effects on the hydrologic system. First, the structural distortion elevated the sources of the coarse-grained valley fill. Second, the elevation of the blocks created the topographic conditions that enhance the amount of precipitation within the drainage basin. Third, structural distortion disrupted the older consolidated rocks and provided access into those rocks for water. Faults and scattered zones, tension joints in folds and uplifted beds all provide entrance for water and within the formations provide routes of travel from local recharge areas to discharge points. Springs are associated with the Stansbury fault, and the lowest fault trace at the west edge of the Stansbury Mountains is inferred from the linearity of the locations of the warm saline springs between Iosepa and Timpie (plate 1).

WATER RESOURCES

The following discussion of the water resources of Skull Valley describes the source, movement, and disposition of water in the valley, and provides an approximation of the quantity of water that is available for use by man.

Surface water

Part of the precipitation within the Skull Valley drainage basin is carried from the mountains to the valley by streamflow. Much of the water in streams leaving the mountains is lost by infiltration and evapotranspiration on the alluvial slopes. Some of the streamflow reaches the valley floor where much of it is evaporated in the stream channels and saltflats and a small part flows out of the valley and into Great Salt Lake. The quantities of water lost from streams depend on the quantity of flow and the temperature of the air, and therefore on the time of the year. The larger flows in the streams are derived during the spring from snowmelt on the highest parts of the mountains, and during the summer from intense rainstorms on the mountains and the lowlands. In late summer and fall, low flow in the few perennial streams is sustained by water discharging from springs in the mountains.

Carpenter (1913, p. 82) noted that Skull Valley contained only four perennial streams—Barlow, Hickman (now called Indian Hickman), Antelope, and Lost Creeks. These streams head in the Stansbury Mountains and supply water to ranches in Tps. 3-6 S., R. 8 W., and to the Skull Valley Indian Reservation. Diversions are made where the canyons open onto the heads of the alluvial fans, and the water is carried by ditch and by pipeline to areas of use in the lower parts of the valley.

Other streams in the valley are intermittent and flow only in response to snowmelt in the spring and to runoff from rainstorms in the summer. The latter for the most part is flashy and of short duration.

The only records of streamflow in Skull Valley are from crest-stage gages on the North Fork of Muskrat Canyon at (C-2-7)21b and on a stream channel in the Cedar Mountains, 8 miles southwest of Delle, at (C-1-9)31b. Periodic observations at these gages are made of flow or lack of it. When floods occur, the peak discharge is estimated by means of indirect measurement (see stations 10-1728.3 and 10-1728.35 in U.S. Geol. Survey, 1965, p. 304). The Deseret Livestock Co. made miscellaneous measurements of the discharge of streams in the vicinity of their property in 1965. Estimates were made of the discharge of streams that were sampled during this study. The several records are compiled in table 3.

Because adequate records are not available, the total discharge of streams in Skull Valley cannot be computed. An estimate of the potential long-term average runoff was made, however, using the transparent overlays of runoff maps described by Bagley, Jeppson, and Milligan (1964, p. 56). These maps were derived by using records of precipitation and the available data on altitude, topography, geology, and plant cover to statistically analyze the basins for which runoff is gaged. The derived parameters were then applied to other ungaged parts of Utah, such as Skull Valley, based on the relation of precipitation to altitude.

Table 3. —
Discharge of streams and pipelines at miscellaneous sites in Skull Valley

Stream and site description	Location	Date	Discharge (cfs)	Remarks
Delle Springs Creek at Highway 40	(C-1-8)2cd	9- -63	0	
		4-21-64	0	Water in channel, but not moving.
		5-29-65	.2	Road shoulder damage indicates recent larger rate of runoff.
		8-27-65	0	Water in channel, but not moving.
		11-24-65	1.0-2.0	Weather: cloudy; rain in Onaqui Mountains to south.
		2- 4-66	.5	
		3- 3-66	30	Weather: storm and warm temperatures late in February. Most water probably was surface runoff.
		3- 6-66	20	
		4- 1-66	1.5	
		4-29-66	1.5	
Channel, at U.S. Highway 40, approximately 1 mile east of Delle	(C-1-8)4dc	8-27-65	0	Water in channel, but not moving.
		2- 4-66	.2	
		3- 3-66	2.5	
		4- 4-66	0	
		4-29-66	0	
Skull Valley tributary near Delle	(C-1-9)31b	8- 1-60	30.1	Indirect measurement, crest-stage gage on right bank, 300 feet upstream from road crossing and about 8 miles southwest of Delle; drainage area, 1.5 square miles.
		8- 6-61	-	Small flow on this date, but rate not determined.
		1962	0	No flow during entire year.

Table 3. — (Continued)

Discharge of streams and pipelines at miscellaneous sites in Skull Valley

Stream and site description	Location	Date	Discharge (cfs)	Remarks
Skull Valley tributary near Delle (Continued)	(C-1-9)31b	9-13-63	20	
		1964	0	No flow during entire year.
		9- 6-65	1	Indirect measurement.
North Fork of Muskrat Canyon near Timpie	(C-2-7)21b	1961-65	0	Crest-stage gage; drainage area, 1.78 square miles; no flow during entire period of record.
Pass Canyon at mouth	(C-3-7)30dac	7-31-63	2.0	Streamflow reportedly sustained by springs.
Delle Springs Creek at road to Eightmile Spring	(C-3-8)19cca	9-23-65	0	
		11-24-65	1.0	
Outlet of Deseret Livestock Co. pipeline near Iosepa	(C-3-8)28dac	3-11-65	1.3	Measurements reported by company. Flow from pipeline is gathered from several canyons and springs and is remnant after substantial losses and several bypasses.
		6- 1-65	6.3	
		7- 5-65	3.3	
		10- 6-65	.10	
		11- 1-65	.15	
Antelope Canyon near mouth	(C-4-7)30c	8- 1-63	-	Flowed, but rate not determined; reportedly runoff from precipitation.
Outlet of Deseret Livestock Co. pipeline at south ranch	(C-4-8)4dda	5-15-65	2.5	Measurements reported by company; not all available water diverted into line.
		6-10-65	5.4	
		7- 5-65	4.9	
		7-14-65	4.9	
		7-15-65	4.9	
		9- -65	.90	
		9- -65	.76	
		10- 6-65	.42	
		11- 1-65	.53	
Big Creek Canyon ditch	(C-4-8)12ad	7-31-63	1.5	
Lost Creek at Island Ranch	(C-4-8)22abd	8- 1-63	.7	
Indian Hickman Creek:				
Near mouth of canyon	(C-5-7)6aa	8- 1-63	2.0	
3 miles below mouth of canyon	(C-5-8)11acc	5-29-65	1.0	
		12-22-65	1.0	
Outlet of pipeline from Barlow Creek	(C-6-7)4aba	5-29-65	.005	
Hatch Brothers Co. pipeline	(C-6-7)10	8-14-63	.01	
Ditch at reservoirs east of Orr's Ranch	(C-6-7)18bbb	11-24-65	1.5	Ephemeral flow; weather: cool; rain in Onaqui Mountains to southeast.

The long-term average potential annual runoff from the uplands of the Skull Valley drainage basin was estimated by multiplying the area between adjacent lines of equal runoff, as shown on the transparent overlays at a scale of 1:250,000, by the average value for runoff in the area between the two lines. The total estimated potential average runoff is about 32,000 acre-feet of water per year (table 4). Most runoff comes from the uplands on the east side of the valley; only about 800 acre-feet comes from the uplands on the west side.

Table 4. — Estimated potential average annual runoff from the uplands of Skull Valley

[Calculated from isorunoff maps described by Bagley, Jeppson, and Milligan, 1964, p. 56]

Interval between lines of equal runoff (inches)	Average runoff (inches)	Area (acres)	Estimated runoff (acre-feet, rounded)
Stansbury, Onaqui, and Sheeprock Mountains			
1 - 2	1.5	11,136	1,400
2 - 4	3	12,352	3,100
4 - 8	6	13,376	6,700
8 - 12	10	10,624	8,800
12 - 16	14	4,672	5,500
16 - 20	18	3,008	4,500
More than 20	21	896	1,600
Subtotal (rounded)		56,100	31,600
Cedar Mountains			
1 - 2	1.5	5,440	680
2 - 4	3	576	144
Subtotal (rounded)		6,000	800
Total (rounded)		62,000	32,000

Ground water

Source

Ground water in Skull Valley is derived entirely from precipitation that falls on the drainage basin, mostly from snowmelt and rainfall on lands above 6,000 feet. Some of this water is lost by evapotranspiration, some infiltrates the consolidated rocks, and some collects in streams that discharge onto the adjoining permeable alluvial fans. Much of the water is lost by evapotranspiration after infiltration; some adds to the soil moisture; and a part eventually reaches the ground-water reservoir in the valley.

Only a small part of the precipitation that falls on lands at altitudes between 5,300 and 6,000 feet reaches the ground-water reservoir, because the amount of precipitation is generally small and much of it is held by the soil and subsequently discharged by evapotranspiration. Recharge to the ground-water reservoir in this altitude zone may occur where water from intense local storms falls on coarse-grained alluvium.

Little or none of the precipitation that falls on lands below 5,300 feet reaches the ground-water reservoir, because the average annual amount of precipitation is small—generally less than 8 inches—and because the surficial or near-surface deposits are silt and clay that have low permeability and inhibit downward percolation of water.

Occurrence

Ground water in Skull Valley is in both consolidated and unconsolidated rocks. The occurrence of ground water in the consolidated rocks is indicated by the large number of springs that issue from bedrock in the Stansbury Mountains (plate 1) and Redlum Spring, (C-2-9)7cb-S, and Eight-Mile Spring, (C-3-9)8cc-S, that drain limestone in the Cedar Mountains (R. E. Maurer, oral commun., 1965). Most springs in the mountains appear to be gravity springs, and some are intermittent. The alignment of the warm saline springs between Iosepa and Timpie and their proximity to exposures of consolidated rocks of Paleozoic age indicate a relation between the springs and those rocks.

Existing wells in Skull Valley obtain water from beds of gravel and sand in the unconsolidated rocks of Tertiary and Quaternary age. In and near the recharge areas the sand and gravel are in lenticular beds that are relatively discrete units, but these beds function as a hydrologic unit. The beds are sufficiently connected both vertically and laterally so that water moves from one bed to another and is unconfined under water-table conditions. Thus, during drilling, water in wells at the Dugway Proving Grounds cantonment and near Johnson Pass did not rise appreciably above the level at which it was encountered.

Downgradient, however, the water-bearing sand and gravel and the intervening clays are more differentiated and the degree of bed isolation is greater. In such areas as in the vicinity of Orr's Ranch and the lowlands north of Iosepa, part of the ground water is confined under artesian pressure and rises above the depth at which it is encountered during drilling.

Estimated average annual recharge

The average annual rate of recharge to the ground-water reservoir in Skull Valley was estimated by three methods.

Method of Eakin and others (1951, p. 79-81)

This method assumes that a fixed percentage of the average annual precipitation recharges the ground-water reservoir, and relates the quantity of recharge to the sum of quantities of water originating from precipitation in several altitude zones. In Skull Valley, the method of Eakin and others was modified by the use of an isohyetal map of Utah (U.S. Weather Bur., 1963a), and the use of altitude zones was not necessary except for judging the reasonableness of the estimate. In comparing precipitation and altitude shown on the isohyetal map with the precipitation quantities cited by Eakin and others (1951, p. 80) for areas in Nevada and by Hood and Rush (1965, p. 22) for an area along the Nevada-Utah border, it can be seen that the average annual rate of precipitation for equivalent altitude zones is considerably greater on the western slopes of the Stansbury and Onaqui Mountains than in areas farther west in Utah and Nevada. It follows, therefore, that the recharge percentage values must be adjusted for variations of topography and geology in Skull Valley. In preparing table 5, therefore, the estimates of recharge were influenced by the following considerations:

1. The west face of the Stansbury Mountains has a steep gradient that becomes very steep in some areas and thus rapidly delivers streamflow to the valley.

2. Much of the highest mountain upland in the Stansbury Mountains where precipitation is greatest is underlain by the Tintic Quartzite, which provides for a greater runoff that for most other kinds of consolidated rocks—the so-called "tin roof" effect.

3. Coarse-grained debris in the bottom of some of the mountain canyons and at the head of the alluvial apron is extremely permeable, as indicated by a few measurements of stream loss and by the lack of any flood flow of record at the crest-stage gage in Muskrat Canyon at (C-2-7)21b (plate 1 and table 3).

4. The small areas of unconsolidated rocks that receive more than 16 inches of precipitation are thought to be only a veneer on bedrock and thus function in the same manner as mountain soils on bedrock.

5. The unconsolidated rocks in zones that receive 16 inches or less of precipitation are recharged less by direct precipitation than by runoff from consolidated rocks at the same altitude.

6. The relation among precipitation, altitude, and geology in the Cedar and Lakeside Mountains is similar to that used for Snake Valley (Hood and Rush, 1965, table 5).

The estimate of recharge based on the method of Eakin and others (1951) indicates that in Skull Valley about 32,000 acre-feet of water, or 6 to 7 percent of the average annual precipitation on the drainage basin, recharges the ground-water reservoir annually.

Method of Gates (1963, 1965)

The second method of estimating the recharge to Skull Valley is taken from Gates (1963, p. K-34; 1965, p. 55-61) who estimated the quantities of water available to adjacent Tooele Valley and to one of its tributary canyons. Gates made estimates of the available water by deducting the estimated evapotranspiration losses from the precipitation in and above the recharge areas. In his study of the tributary canyon, Gates (1963, p. K-34) estimated the loss to evapotranspiration in the mountain area to be 67 percent. His estimate, which was based on the work of Croft and Monninger (1953, p. 571-573) who studied Parrish Canyon in the Wasatch Range, was deliberately made conservative. In a later study for all of Tooele Valley, Gates (1965, p. 55-61) estimated that the losses in the mountains around the entire valley amounted to 40 percent.

In Skull Valley, evapotranspiration consumes a relatively large part of the precipitation because the area in and above the recharge area includes altitude zones as low as 5,300 feet where the amount of precipitation is small, and the annual temperature is appreciably greater than in the altitude zone of 7,000-10,000 feet described by Croft and Monninger (1953).

Table 5. — Estimated average annual precipitation and ground-water recharge in Skull Valley

[Areas of precipitation zones measured from geologic and isohyetal maps]

Precipitation zone (inches)	Area (acres)	Estimated annual precipitation: Inches	Estimated annual precipitation: Acre-feet	Estimated annual recharge: Percentage of precipitation	Estimated annual recharge: Acre-feet
Stansbury and Onaqui Mountain area					
Areas of consolidated rocks					
More than 40	1,000	42	3,500		
30-40	4,200	35	12,300		
25-30	7,100	27.5	16,200		
20-25	11,300	22.5	21,200		
Subtotal			53,200	33	17,600
16-20	24,800	18	37,200	20	7,400
12-16	16,800	14	19,700	10	2,000
8-12	7,100	10	5,900	5	300
Areas of alluvial apron					
12-16	30,700	14	25,900	3	1,100
8-12	25,400	10	21,100	1	200
Subtotal	128,400		173,900		28,600
Cedar Mountain area					
Areas of consolidated rocks					
16-20	2,200	18	3,300	17	600
12-16	17,200	14	20,100	8	1,600
8-12	44,500	10	36,900	3	1,100
Areas of alluvial apron					
8-12	40,700	10	33,800	1	300
Subtotal	104,600		94,100		3,600
Lakeside Mountain area					
Areas of consolidated rocks					
12-16	1,000	14	1,200	8	100
8-12	4,500	10	3,700	3	100
Areas of alluvial apron					
8-12	1,300	10	1,100	1	0
Subtotal	6,800		6,000		200
All lowlands					
6-12	324,000	8	217,000	0	0
Total (rounded)	560,000		490,000		32,000

The following tabulation shows the range of volumes of water available for recharge in Skull Valley, depending on variations in the assumed loss by evapotranspiration, and combines these estimates with a rough estimate by Eakin (1961, p. 20) that about one-third of the available water recharges the ground-water reservoir.

Estimated volume of precipitation (acre-feet)	Assumed loss by evapotranspiration (percent)	Volume available for recharge (acre-feet)	Gross estimated recharge (acre-feet)
	40	160,000	53,000
[1] 270,000	50	140,000	47,000
	60	110,000	37,000

1 From table 5: Total estimated annual average precipitation, less that on the lowlands of Skull Valley.

Method based on loss of streamflow

The third method is based on water losses into the stream channels that cross the recharge area. Although some of the streams in the Stansbury Mountains are perennial, most contain appreciable quantities of water only during and immediately after the period of snowmelt (table 3). Thus, recharge to the ground-water reservoir occurs only during a period of 2-3 months. Runoff derived from snowmelt after this period and the low flow of the perennial streams are conveyed across the recharge area by pipeline or ditch.

The Deseret Livestock Co., provided the authors with a set of miscellaneous streamflow measurements that indicate an aggregate loss of about 4.2 cfs (cubic feet per second) in 1.7 miles of channel near Pass Canyon, or nearly 2.5 cfs per mile during a period of moderate runoff. The total channel distance across the recharge area for all streams in Skull Valley that reach any appreciable distance into the mountains is 134 miles. If the average rate of stream loss for all the streams measured is only 2 cfs per mile, the aggregate loss is 268 cfs. The duration of flow is estimated from the apparent duration of runoff from snowmelt at four gaging stations: Stations 10-1430 and 10-1450, Parrish and Mill Creeks, north of Salt Lake City; the short-term station 10-1728 on South Willow Creek, east of Deseret Peak; and station 10-1728.7, Trout Creek, in Snake Valley near the Nevada-Utah State line. (See U. S. Geol. Survey, 1965, p. 216, 219, 247, and 248 for description of station and period of record.) The estimated average snowmelt period for the four stations for 1959-65 was 9 weeks. Because of residual effects following snowmelt, however, the effective runoff period might be as long as 14 weeks. The following table shows the estimated recharge for the two periods:

Gross rate of loss (cfs)	Length of runoff period (weeks)	Recharge (acre-feet per year, rounded)
268	9	34,000
	14	52,000

Summary of recharge estimates

The three methods of estimating recharge result in the following quantities:

Method	Estimated recharge (acre-feet per year)
Eakin and others	32,000
Gates	37,000-53,000
Loss of streamflow	34,000-52,000

It is concluded that the average annual rate of ground-water recharge to Skull Valley is in the range of 30,000-50,000 acre-feet per year, or from 6 to 10 percent of the total average annual precipitation in the Skull Valley drainage basin.

Movement

Ground water in Skull Valley moves generally from the recharge areas along the edges of the mountains toward the axis of the valley and thence to a discharge area in the playas both south and north of U.S. Highway 40. (See plate 1.) Some ground water ultimately reaches the shore of Great Salt Lake. The relatively steep slopes of the water table, indicated by close contour spacing along the east side and south end of the valley reflect both the large rate of recharge in those areas and the relatively thin section of permeable material through which the water must pass. Along much of the length of the Davis-Cedar-Lakeside mountain chain, the west edge of the valley receives only small amounts of recharge, and therefore the slope of the water table is more gradual.

Estimated average annual discharge

Water leaves Skull Valley by several means that all include the discharge of ground water. The largest quantity of ground water is discharged by evapotranspiration; smaller amounts are discharged by pumpage from wells, surface outflow of effluent ground water in the lowlands, and underflow from the mouth of the valley. For the purposes of control, the discharge computations are made for the area south of U.S. Highway 40.

Evapotranspiration

Much of the ground water discharged by evapotranspiration is consumed by phreatophytic plants in the lowlands of Skull Valley where the depth to water does not exceed 40-50 feet. The principal phreatophytes are greasewood (*Sarcobatus vermiculatus*), rabbitbrush (*Chrysothamnus* sp.), and saltgrass (*Distichlis stricta*). The valley also contains significant growths of sedges (*Carex* sp.) and cattails (*Typha* sp.).

Ground water is discharged by evapotranspiration in two parts of Skull Valley. (See plate 1.) One tract is centered in T. 6 S., R. 8 W., in the vicinity of Orr's Ranch. The principal phreatophytes in the tract are greasewood and rabbitbrush which are mainly sparse, low plants, but locally are dense growths as much as 4 feet high (type 1 in table 6). The seasonal fluctuations of water levels in observation wells (C-6-7)19ccd-1, (C-6-7)19ddd-1, and (C-6-8)10caa-1 (figure 5) are interpreted as being due to evapotranspiration because these wells are not near any heavily pumped well.

The other main area of evapotranspiration in Skull Valley extends from T. 4 S. northward to U.S. Highway 40, where parts of the valley floor are covered with vegetation or the surface consists of broad, bare flats or playas. A band of vegetation characteristically occupies the zone between the flats and the steep slope of the adjacent alluvial aprons. This zone, mainly of greasewood, appears to extend from the altitude where the water table is just shallow enough to provide water to phreatophytes down to that where the soil is too saline to sustain plant growth. The zone of vegetation can be delineated rather accurately along the sides of the valley, but at its south end the limit of the zone was set arbitrarily, based on the estimated depth to water. The zone as a whole contains some small quantities of saltgrass at its lower margins (type 2 in table 6).

Considerable parts of the bare ground in the western part of the playas and flats are covered by sand dunes or erosional remnants of old lake deposits. The erosional remnants are bare, whereas the dunes characteristically have a moderate to sparse cover of plants and parts of the lowland have a sparse cover of vegetation where the level is slightly above the flats (type 3 in table 6). The eastern part of the flats (type 4 in table 6) contains more vegetation and is more moist. The densest growth of plants is in the northeastern side of the valley where springs provide water to phreatophytes and some hydrophytes that grow on saturated soils or in bodies of water (type 5 in table 6).

In the lowest part of Skull Valley, the estimates for evapotranspiration include both water discharged from the flats and water discharged from the saline springs. The rates in the western part of the flats are based almost entirely on evaporation from bare soil whereas those for the eastern part include evapotranspiration from a large marshy area.

Table 6 summarizes the data for the estimated annual evapotranspiration in Skull Valley.

Table 6. — Estimated annual evapotranspiration in Skull Valley

[Figures apply to area of valley south of U.S. Highway 40]

Type	Area (acres)	Depth to water (feet)	Evapotranspiration	
			Acre-feet per acre	Acre-feet (rounded)
1. Mixture of greasewood and rabbitbrush	14,900	0-40	0.2	3,000
2. Mixture and separate stands of greasewood and saltgrass	42,600	5-40	.2- .4	8,500-17,000
3. Bare ground with very sparse, scattered patches of miscellaneous phreatophytes	22,400	0-30	.05- .1	1,100- 2,200
4. Moist to wet bare ground	23,700	0-5	.1	2,400
5. Marshy ground, dense phreatophytes hydrophytes, and small areas of open water	2,600	0	3.0- 4.5	7,800-12,000
Total (rounded)	106,000			23,000-37,000

Wells

Because of the small population and the primary dependence on surface water for stock and irrigation supplies, the valley contains few large-diameter wells. The wells are concentrated along the east side of the valley between Timpie and the Skull Valley Indian Reservation, in the vicinity of Orr's Ranch, and at the Dugway Proving Grounds cantonment. The following estimates of well discharge are based mainly on measurements made during a reconnaissance during 1963-65, electric power consumption, acreage, and the pumpage reported by the U.S. Army.

Use	Year			
	1957 [1]	1963	1964	1965
	Acre-feet			
Public supply and domestic	760	1,450	1,520	1,460
Stock	10	10	10	10
Irrigation and some stock	2,700	—	2,600	3,500
Total (rounded)	3,500	—	4,100	5,000

[1] Estimated by K. R. Everett (written commun., 1957).

Surface outflow of effluent ground water

Ground water discharged into surface channels consists of the flow of Big Spring and the associated small springs at Timpie, and of the wintertime low flow of Delle Springs Creek and a small unnamed channel that crosses U.S. Highway 40, near Delle. All other flow from springs in the drainage basin either is above the recharge area or is consumed by evapotranspiration.

The water from Big Spring and the associated small springs is discharged through a single ditch to the north side of U.S. Highway 40. The rate of flow fluctuates and during 1961-65 ranged from 2 to 8 cfs, based on a few miscellaneous measurements. The long-term average discharge rate is estimated to range from 4 to 8 cfs, or 2,900 to 5,800 acre-feet of water per year.

The flow of Delle Springs Creek and the unnamed channel near Delle is intermittent. Based on observations and reports from local residents, both streams appear to be dry more than half of each year. The few estimates of flow (table 3) indicate a wide variation in flow when water is present, and the estimated ground-water component of flow in the two streams is in the range of 0.5 to 2.5 cfs, or 360 to 1,800 acre-feet per year.

Underflow

The north end of Skull Valley is open to the main structural depression of Great Salt Lake, the drainage terminus of the entire region. Water-level contours (plate 1) indicate that ground water moves northward, but the fill in the mouth of the valley is silt and clay for the most part, and thus the quantity of underflow probably is small. The underflow (Q) is estimated using the width (W) of the valley mouth along U.S. Highway 40, the slope of the water table (I), and the coefficient of transmissibility (T) in the formula

$$Q = 0.00112\, T\, I\, W$$

The width of the section through which underflow occurs is 7 miles, and the slope of the water table is assumed to be 5 feet per mile. Assuming a coefficient of transmissibility of 20,000 gpd per ft (gallons per day per foot), the annual volume of underflow is

$$Q = 0.00112 \times 20{,}000 \times 5 \times 7$$
$$= 784 \text{ acre-feet per year, or } 800 \text{ acre-feet per year (rounded)}$$

If the coefficient of transmissibility is assumed to be twice as great, the underflow would be about 1,600 acre-feet per year.

Ground-water budget

The average quantity of ground water recharged to and discharged from Skull Valley is estimated to be between 30,000 and 50,000 acre-feet per year. The quantities of water that are involved in the several processes are shown in table 7. Most of the figures for the natural processes are given a range of values that account for estimated maxima and minima. Ranges, rather than specific amounts, are given because the estimates are based on rather flexible considerations.

Table 7. — Ground-water budget for Skull Valley

Item	Acre-feet per year
Recharge (p. 26)	30,000-50,000
Discharge	
Evapotranspiration (table 6)	23,000-37,000
Surface outflow across U. S. Highway 40:	
Big Spring area at Timple (p. 28)	2,900- 5,800
Delle Springs Creek and unnamed creek near Delle (estimated ground-water component only, p. 28)	360- 1,800
Underflow in valley fill (p. 29)	800- 1,600
Total natural ground-water discharge (rounded)	27,000-46,000
Discharge from wells (1965, p. 28)	5,000
Total discharge (rounded)	30,000-50,000

Perennial yield

The perennial yield of a ground-water reservoir is the maximum amount of water of suitable chemical quality that can be withdrawn economically each year for an indefinite period of years. The perennial yield cannot exceed the natural discharge; moreover, the yield will be limited to the amount of natural discharge that can economically be salvaged for beneficial use.

In Skull Valley, the maximum amount of natural discharge that is available for salvage is the estimated evapotranspiration loss of 23,000-37,000 acre-feet per year (table 6) plus surface outflow of ground-water effluent. If additional wells are drilled near the areas of evapotranspiration, a part of the water now lost could be salvaged.

The salvage of natural discharge appears most feasible in the southern part of Skull Valley in the vicinity of Orr's Ranch, where about 3,000 acre-feet of ground water is wasted annually by greasewood and rabbitbrush (table 6). In the north-central part of Skull Valley, an additional amount of ground water might be salvaged by lowering water levels somewhat, but when the cones of depression of water levels around the areas of development reach the flats and the areas of saline springs, further lowering would be accompanied by the threat of saline-water encroachment.

Based on these considerations, it is estimated that 5,000-10,000 acre-feet of ground water might be diverted to beneficial use, but the recovery of even this amount would require the careful positioning of wells in order to decrease the rate of natural losses and yet avoid the threat of saline-water encroachment.

In 1965, the withdrawal of ground water through wells in Skull Valley amounted to about 5,000 acre-feet. Only a part of the water pumped is thought to have been diverted from loss by evapotranspiration, and the rest of the pumped water came from storage. If development of the valley requires quantities of water appreciably greater than the potential salvage of ground water by loss from evapotranspiration, the additional withdrawal of water would lower water levels.

Storage

Under natural conditions, a ground-water system is in dynamic equilibrium; long-term average annual natural recharge and discharge are equal, and the amount of ground water in transient storage remains nearly constant.

The change of water levels in wells indicates changes in storage. Measurements of the water levels in observation wells in Skull Valley show that as a whole the withdrawal of water from wells has not appreciably altered the natural balance. (See figure 5.) Only in the vicinity of Dugway, where water is pumped for public supply, have water levels declined appreciably in response to pumping.

Recoverable ground water in storage is that part of the stored water that will drain by gravity from the ground-water reservoir as water levels are lowered. It is the product of the specific yield of the reservoir rocks, the saturated thickness, and the area. The specific yield of the upper 100 feet of the ground-water reservoir in Skull Valley is estimated to be at least 10 percent. The reservoir underlies about 230,000 acres. Assuming a uniform lowering of water levels of 100 feet, the ground-water reservoir would yield at least 2.3 million acre-feet, or 50-80 times the estimated average annual recharge.

Not all the recoverable ground water is fresh. Most water stored in the valley north of Salt Mountain is saline. South of Salt Mountain, the estimated quantity of recoverable water in the upper 100 feet of the reservoir is about 1.4 million acre-feet, of which 1 million acre-feet or more may be of a chemical quality suitable for irrigation and domestic use.

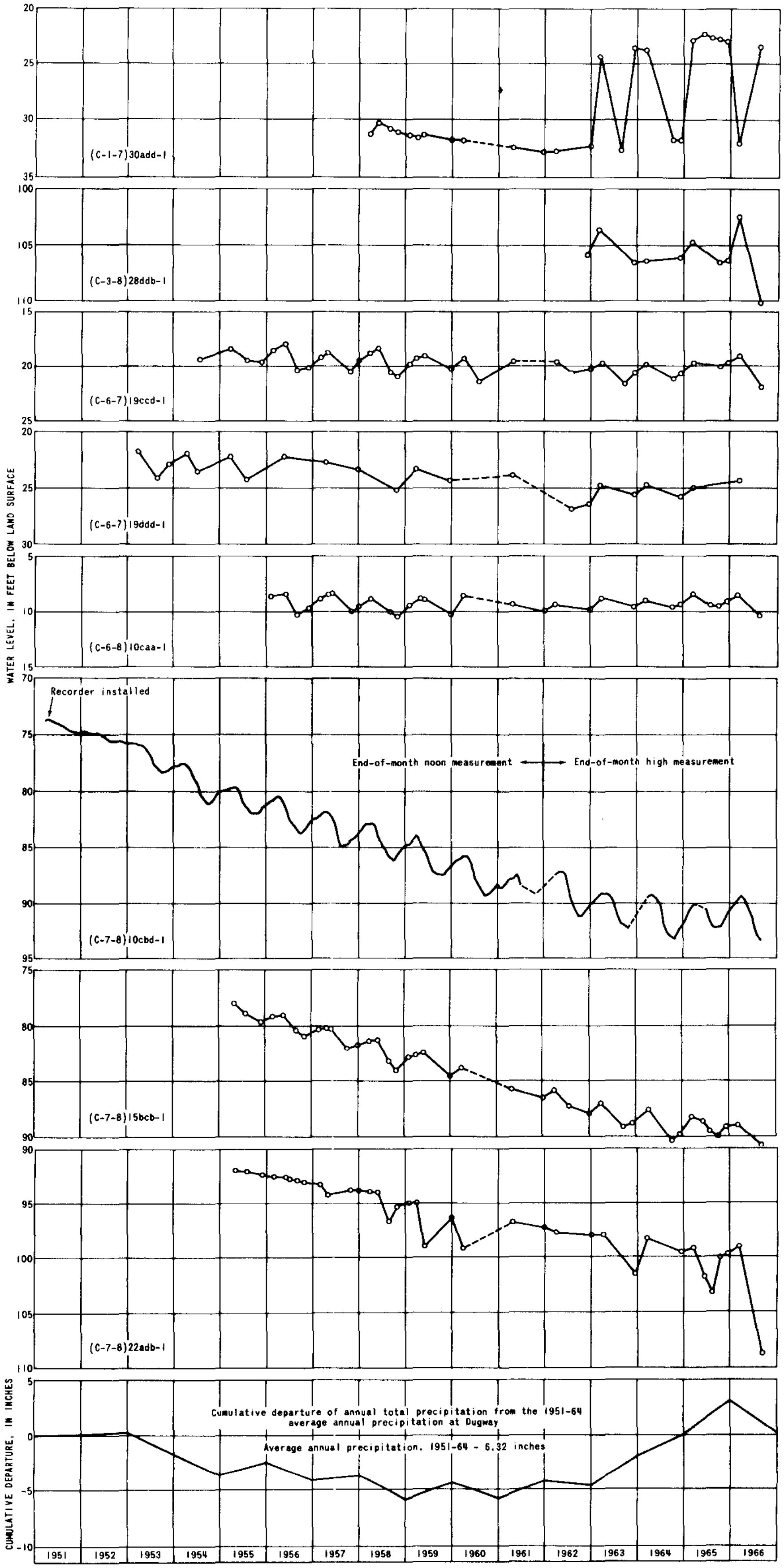


Figure 5. — Water levels in observation wells in Skull Valley and the cumulative departure from the 1951-64 average annual precipitation at Dugway.

Chemical quality of water

The dissolved-solids content of the water in the Skull Valley drainage basin ranges from 98 to 17,200 ppm (parts per million) (tables 10 and 11). Though the range is wide, there are areas in which the dissolved-solids content is relatively uniform and the water is similar in chemical composition (plate 2). The water from springs in the Stansbury Mountains generally contains lower concentrations of dissolved solids than that from springs in the Cedar Mountains, and the ground water in the southern part of the valley contains lower concentrations of dissolved solids than that in the northern part.

Mountains

The dissolved-solids content of the water from the springs and streams in the Stansbury Mountains ranges from 98 to 395 ppm, and the principal chemical constituents are generally calcium and bicarbonate. The water discharged by the streams originating at high altitudes contains the lowest concentrations of dissolved solids; the water discharged from springs at lower altitudes toward the northern and southern ends of the Stansbury Mountains contain slightly higher concentrations. From Indian Hickman Canyon, north to Chokecherry Spring, (C-3-7)29bcb-S1, the concentration of dissolved solids of the water ranges from 98 to 229 ppm, and the relative proportions of the chemical constituents are similar. North of this area, the water from spring (C-3-8)12ab-S, which discharges on the lower slopes of the mountains, has a concentration of dissolved solids of 395 ppm and contains relatively larger amounts of sodium and chloride ions. A spring at the southern end of the Stansbury Mountains and another at the northwestern slopes of the Onaqui Mountains near Johnson Pass yield water containing concentrations of dissolved solids of 241 and 374 ppm, and the principal chemical constituents are calcium and bicarbonate.

Water from three springs in the Cedar Mountains contains dissolved solids ranging from 1,940 to 2,380 ppm; the principal chemical constituents are sodium and chloride. Water from White Rock Spring, (C-6-9)6dbb-S1, however, contains only 200 ppm of dissolved solids, and sodium and bicarbonate are the principal chemical constituents. White Rock Spring is not perennial and the comparatively lower concentration of dissolved solids may be due to local recharge received during the spring runoff season.

Valley

South of Iosepa, the ground water contains dissolved solids ranging from 137 to 2,570 ppm. Most of the water, however, contains dissolved solids ranging from 500 to 1,000 ppm. Sodium and chloride are the principal chemical constituents, and the two ions generally account for 50-60 percent of the total equivalents per million of the cations and anions. There is no apparent relation between the chemical quality of the water and the depth of the source; locally the ground water from springs and from shallow and deep wells is of similar chemical composition.

From Dugway northward to Orr's Ranch, the chemical composition of the ground water is similar. Several springs immediately south of Orr's Ranch yield a sodium chloride water of uniform composition; the concentration of dissolved solids ranges from 706 to 926 ppm. Several wells north and northeast of Orr's Ranch discharge a similar type water, but there are small local areas (plate 2) in which the concentration of dissolved solids of the ground water exceeds 1,000 ppm. Well (C-5-8)34bdb-2 yields water containing the highest concentration of dissolved solids (2,570 ppm) observed in the southern part of the valley.

North of the Skull Valley Indian Reservation, the ground water in the alluvial apron on the east side of the valley contains the lowest concentrations of dissolved solids in the valley. The concentrations of dissolved solids in eight samples ranges from 137 to 839 ppm. Three wells north of the reservation discharge water which ranges in total solids from 616 to 839 ppm; the principal chemical constituents are calcium, sodium, and chloride. Four wells farther north, near Iosepa, yield water which contains less than 500 ppm of dissolved solids; the principal chemical constituents are calcium and bicarbonate.

The ground water in the valley north of Iosepa and west of Timpie contains dissolved solids ranging from 1,610 to 7,850 ppm. The discharge from Delle Springs Creek at (C-1-8) 2cd (table 11), however, which consists of effluent ground water contains 17,200 ppm of dissolved solids. The percentages of total equivalents per million of sodium and chloride increase with increasing dissolved solids (figure 6).

Much of the ground water discharged in the northern part of the valley is from the artesian springs between Iosepa and Timpie. The composition of the water discharged by wells near some of the springs is similar to that discharged by the springs. Wells (C-2-7)6caa-2 and (C-2-7)7ccc-1, for example, discharge water of almost identical chemical composition to that of Burnt Spring, (C-2-7)6cda-S1, (table 10). Most of the artesian springs are thermal (White, 1957, p. 1638). The range in annual average air temperature in Skull Valley is 48-52°F, and the artesian springs discharge water ranging in temperature from 61 to 73°F. The temperature and the chemical characteristics of the water suggest that water containing high dissolved-solids concentrations moves upward from deep aquifers and the wide range of dissolved-solids concentrations is due to mixing near the surface with water containing lower dissolved-solids concentrations.

Changes in chemical quality

Significant changes in the chemical quality of ground water have been recorded at only two wells in Skull Valley, (C-7-8)9dad-1 and (C-7-8)9dca-1. These are public-supply wells near Dugway, which have been sampled periodically during a 16-year period (table 10). The dissolved solids and the relative concentrations of the constituents in water from these wells have fluctuated during the entire sampling period, whereas the chemical composition of water from two adjacent public-supply wells, (C-7-8)15cba-1 and (C-7-8)22adb-2, has remained relatively constant when observed during the last 9 years of the sampling period.

The concentration of nitrate and the relative concentrations of calcium and sulfate increased with increasing dissolved solids (figure 7a) at wells (C-7-8)9dad-1 and (C-7-8)9dca-1. The relative concentrations (shown in figure 7a as percentage equivalents per million) of the other constituents either decreased or remained virtually the same.

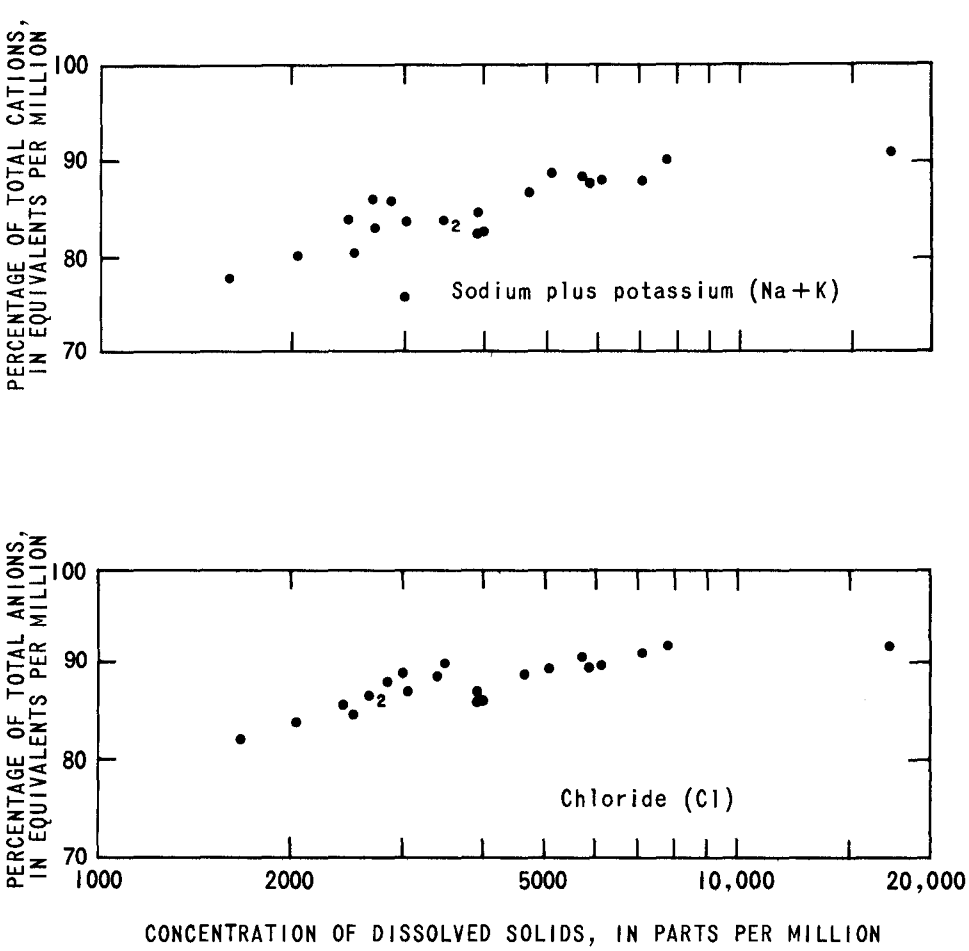


Figure 6. — Relations of sodium plus potassium and chloride concentrations to the concentration of dissolved solids in ground water in northern Skull Valley.
Number by data point indicates the number of analyses represented.

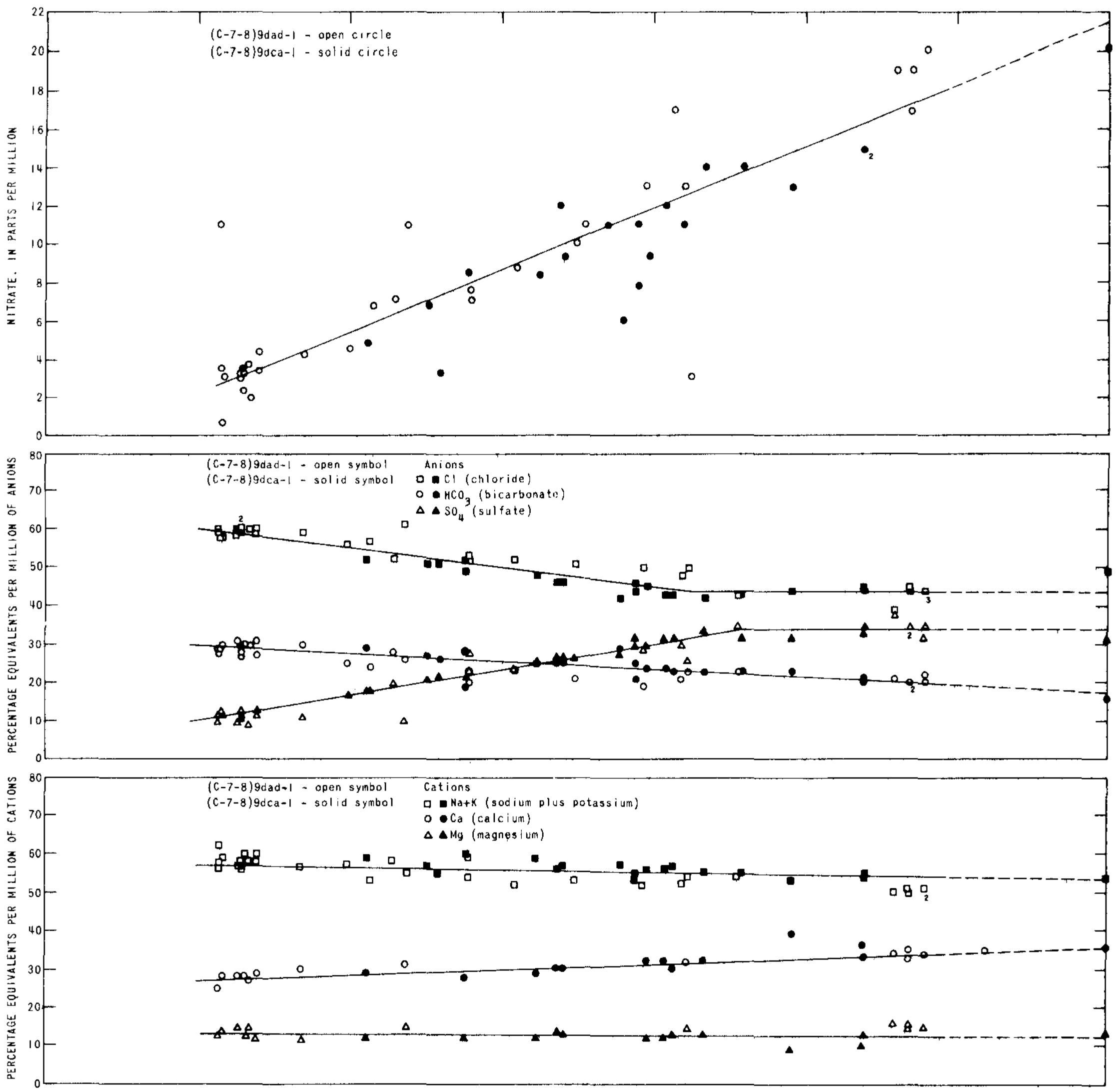


Figure 7a. — Fluctuations in chemical composition of water from wells (C-7-8)9dad-1 and (C-7-8)9dca-1, 1951-65. Number by data point indicates the number of analyses represented.

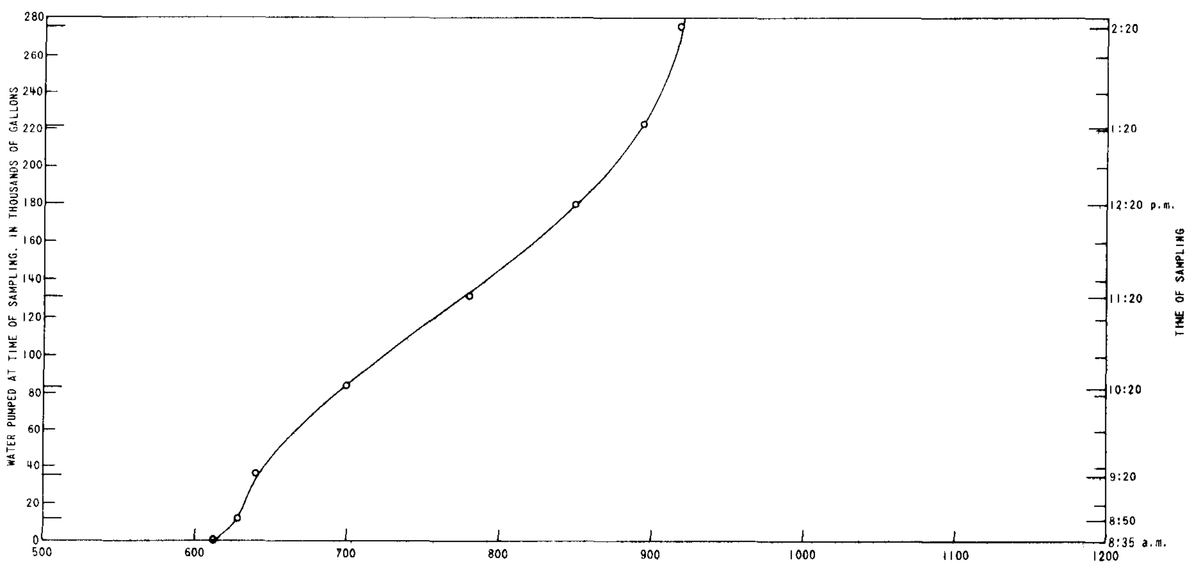


Figure 7b. — Relation of gallons of water pumped to the concentration of dissolved solids in water from well (C-7-8)9dad-1, November 15, 1956.

The increase in the concentration of dissolved solids apparently is related to the amount of water pumped continuously from wells (C-7-8)9dad-1 and (C-7-8)9dca-1. Figure 7b shows the relation between the amount of water pumped from well (C-7-8)9dad-1 on November 15, 1956, and the dissolved-solids concentration in the water. Prior to the 6-hour pumping period, neither well (C-7-8)9dad-1 nor (C-7-8)9dca-1 had been pumped for more than 24 hours. Water with low dissolved-solids concentration is most frequently obtained on days following periods of small daily demand (less than 200,000 gallons). The reasons for the fluctuations in chemical quality of the water is not known and needs further study.

Irrigation supplies

In Skull Valley, precipitation must generally be supplemented to provide adequate water for crops, which in 1965 were mainly alfalfa and wheatgrass. The streamflow that can be diverted to arable lands is mainly from the Stansbury Mountains and is generally suitable for agricultural use. Ground water used for irrigation in the valley is obtained from both springs and wells.

The chemical quality factors that determine the suitability of water for irrigation are the concentration of dissolved solids and the relative proportions of some of the ions in solution. In this report, the suitability of water for irrigation is judged by the classification developed by the U.S. Salinity Laboratory Staff (1954, p. 79-81). (See figure 8.) It must be emphasized that the classification is based on "average conditions" with respect to soil texture, climate, drainage, salt tolerance of crops, and management practices.

Most of the water in southern Skull Valley has a low-sodium hazard and a medium to high salinity hazard (figure 8). Water from one source in southern Skull Valley, and all those in northern Skull Valley have high to very high sodium and salinity hazards. Most of the field and forage crops grown in Skull Valley have medium to high salinity tolerances as indicated by the following tabulation taken from the U.S. Salinity Laboratory Staff (1954, p. 67):

High	Medium
Forage crops	
Saltgrass	Perennial ryegrass
Western wheatgrass	Sudan grass
Barley (hay)	Alfalfa
	Rye (hay)
	Wheat (hay)
	Oats (hay)
	Blue grama
Field crops	
Barley (grain)	Rye (grain)
	Wheat (grain)
	Oats (grain)
	Sorghum (grain)
	Corn (field)

Residual sodium carbonate was present in water from only one source in Skull Valley. Based on calculations from data in table 10, spring (C-3-7)7daa-S1 yields water containing

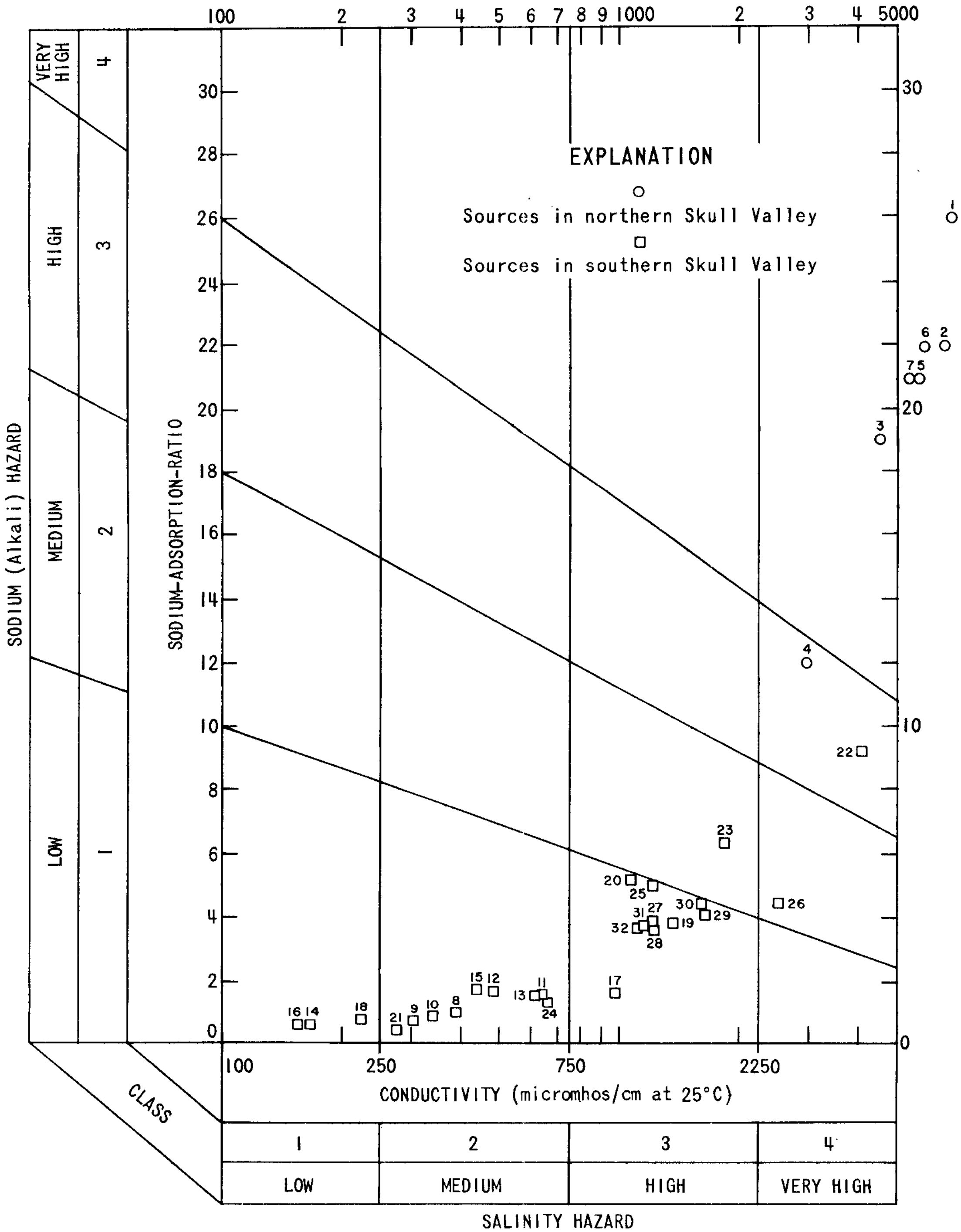


Figure 8. — Classification of water for irrigation in Skull Valley.

No.	Location of sampling site
1	(C-1-7)30add-1
2	32bd
3	(C-2-7)7ccc-1
4	(C-2-8)24bcd-1
5	24cc-S1
6	24cc-S2
7	25bbd-1
8	(C-3-7)29bcb-S1
9	30dac
10	30ddb-S1
11	(C-3-8)28adc-1
12	28bcd-1
13	28ddb-1
14	(C-4-7)30c
15	(C-4-8)3ccb-2
16	12ad
17	22baa-1
18	22abd
19	22bda-1
20	33aba-1
21	(C-5-8)11acc
22	34bdb-2
23	34ddb-5
24	(C-6-7)11cdb-S1
25	(C-6-8)2dcd-1
26	11dad-1
27	15abd-1
28	15cac-S1
29	(C-7-8)9dad-1
30	9dca-1
31	15cba-1
32	22adb-2

(See table 10 for analytical data on wells and springs; table 11 for surface-water sites.)

0.8 epm (equivalents per million) of residual sodium carbonate. According to the U.S. Salinity Laboratory Staff (1954, p. 81) water containing less than 1.25 epm probably is safe for use in irrigation. Boron concentrations exceed the limits for sensitive crops only in some of the water in the northern part of the valley.

Domestic supplies

Most of the ground water in Skull Valley contains more than 180 ppm of hardness as calcium carbonate ($CaCO_3$) and is classed as very hard (Irelan and Mendieta, 1964, p. K-5).

Much of the water contains one or more constituents in concentrations that exceed the maximum limits for drinking-water standards recommended by the U.S. Public Health Service (1962).

The recommended maximum limits are:

Substance	Concentration (ppm)
Sulfate (SO_4)	250
Chloride (Cl)	250
Flouride (F)	[1] 1.2
Nitrate (NO_3)	45
Iron plus manganese (Fe+Mn)	.30
Dissolved solids	500

[1] Maximum recommended for water used in public supplies at average annual maximum daily air temperatures prevailing in Skull Valley (U.S. Public Health Service, 1962, p. 8).

Although one or more of the constituents in most of the water in Skull Valley exceeds the limits recommended for domestic purposes, nitrate and flouride concentrations were within the limits. Continued monitoring of the nitrate content in public supplies, however, is desirable because high concentrations of nitrate can cause fatal poisoning in infants. The nitrate concentrations have ranged from 0.6 to 20 ppm and 3.3 to 20 ppm in wells (C-7-8) 9dad-1 and (C-7-8)9dca-1, respectively.

LAND USE AND DEVELOPMENT

The Skull Valley drainage basin includes about 560,000 acres of land, but the valley and alluvial slopes that border the mountain ranges cover only about 250,000 acres. Perhaps two-thirds of the alluvial slopes are sufficiently gentle to permit agricultural development if adequate water and suitable soils were present. The actual area that can be developed is considerably smaller, however, because of poor soils, insufficient water, or water of poor chemical quality.

Past and present

The drainage basin is used primarily as grazing land for livestock. Between 10 and 15 percent of the land is private—mainly in the vicinity of State Highway 108 and on the adjacent slopes of the Stansbury and Onaqui Mountains. Small parts of the valley are included in the Dugway Proving Grounds of the U.S. Army and the Skull Valley Indian Reservation. Much of the Stansbury Mountains are included in the Wasatch National Forest, and the remaining lands are public domain and State lands.

Except for use by the U.S. Army, the present (1966) land use pattern extends back at least as far as 1911 when the valley was described by Carpenter (1913, p. 82). He states that streams supplied irrigation water to about 45 acres at Condie's Ranch on Barlow Creek, the Goshuit (presently Skull Valley) Indian Reservation on Hickman Creek, about 100 acres at Brown's Ranch on Antelope Creek, and to the Livestock Co. ranch on Lost Creek. In 1911, springs supplied irrigation water to the Hatch Ranch (in sec. 9, T. 6 S., R. 7 W.), to about 80 acres on Orr's Ranch, and to the Iosepa settlement.

The Soil Conservation Service (M. W. Lewis, oral commun., 1966) estimated that in 1965, the valley contained about 2,600 acres of land used or intended for use as irrigated farmland. About 450 acres were irrigated entirely with water from springs; less than 600 acres were irrigated entirely with well water; and the remaining land was irrigated primarily with water from springs and streams. Lands in the latter category are between Iosepa and State Highway 215 and are provided with supplemental irrigation water from large-diameter wells. All actively irrigated farmland is on the lower parts of the alluvial apron that borders the Stansbury-Onaqui Mountains.

Future

Skull Valley can support some additional development based on ground-water supplies. North of Iosepa, in T. 2 S., Rs. 7 and 8 W., a relatively small area of land along State Highway 108 is known to be underlain by water suitable for agriculture, and a part of the area is being developed slowly. Future development of large irrigated tracts north of Iosepa seems unlikely.

In the valley south of Iosepa, approximately 100,000 acres are thought to be underlain by water suitable for irrigation. The lowest parts of this area, however, contain soils that may be saline or susceptible to damage by water with a large sodium-adsorption ratio. On the uppermost slopes of the alluvial aprons south of Iosepa, the depth to water indicates that pumping for irrigation would be costly. K. R. Everett (written commun., 1957) rightly points out that the most desirable areas for development of irrigated land are those on the slopes of the alluvial apron, where soils appear to be best drained and permeable. The area of the lower slopes amounts to perhaps a quarter of the area south of Iosepa and thus includes a total of about 25,000 acres.

Within the approximate 25,000 acres, withdrawal of ground water would cause a decline of water levels because pumping would not appreciably increase recharge or decrease discharge. Thus the water would be removed from storage. If 3 acre-feet per acre were applied to the land annually, the annual use would be about 75,000 acre-feet per year, or approximately 7½ percent of the estimated minimum total storage of water suitable for agricultural use in Skull Valley.

Salvage of ground water from loss by evapotranspiration might be most effective in the phreatophyte area in the vicinity of Orr's Ranch. If all water now discharged by evapotranspiration in that area were salvaged, the annual savings would be about 3,000 acre-feet.

PROPOSALS FOR ADDITIONAL STUDIES

Because Skull Valley has a potential for development, a detailed water-resources investigation is needed to refine the estimates given in this reconnaissance. Such a study should include the following considerations:

1. A comprehensive inventory of the water resources of the valley should be made to supplement the coverage of this reconnaissance. Detailed data should be obtained on the hydraulic characteristics of existing wells, the discharge characteristics of both the large saline springs in the valley and the large mountain springs, the use of water in the valley, and the availability of surface-water supply.

2. A systematic study of the unconsolidated rocks and their relation to the older rocks of Tertiary and Paleozoic age should be made to aid in the evaluation of the aquifer framework.

3. After study and analysis of existing records and surface conditions, drilling of several test holes may be justified to aid geologic and hydrologic analysis. At least one such test hole should be drilled in the west side of the valley, one in the central part of the valley axis, one near the large, warm saline springs, one in the alluvial apron west of the Stansbury Mountains, and one in the pass between Skull and Government Creek Valleys.

4. Streamflow records should be accumulated by expanding the crest-stage gage program in the valley and by installing temporary gaging stations. Such stations would have to be operated several years in order to accumulate adequate records. The flow of the perennial surface streams and the large springs should be measured, including Delle Springs Creek at U.S. Highway 40 and Big Spring.

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BASIC DATA

Table 8. — Records of selected wells and springs in Skull Valley

Location: See text for description of well- and spring-numbering system.
Altitude: Altitudes of land-surface datum above mean sea level estimated from topographic maps.
Type of well: Dr, drilled; J, jetted.
Depth of well: Measured depths given in feet and tenths below land-surface datum; reported depths given in feet.
Casing: Depth reported.
Character of material in main aquifer: C, conglomerate; G, gravel; L, limestone; S, sand.
Water level: Measured depths given in feet and tenths below or above land-surface datum; reported depths given in feet; F, flowed on date indicated.
Method of lift and type of power: C, centrifugal pump; E, electric; F, flows; G, gasoline or diesel; J, jet pump; N, none; P, cylinder (piston) and pump jack; T, turbine pump. Number in parentheses indicates horsepower.
Yield: B, bailer test; E, estimated; M, measured; R, reported.
Use of water: H, domestic, I, irrigation, N, industrial; P, public supply; S, stock; U, unused; R, wildlife refuge; Z, highway construction.
Remarks and other data available: A or C preceding number indicates application or claim in files of Utah State Engineer; C, chemical analysis listed in table 10; Dd, drawdown; L, log in table 9; Perf., casing perforated; WDR preceding number indicates driller's report in files of Utah State Engineer.

Location	Owner or name	Year drilled	Altitude above sea level (feet)	Type of well	Depth of well (feet)	Casing: Depth (feet)	Casing: Diameter of well (inches)	Character of material in main aquifer	Water level: Above (+) or below (-) land-surface datum (feet)	Water level: Date of measurement	Method of lift and type of power	Yield: Rate (gpm)	Yield: Date of measurement	Use of water	Temperature (°F)	Remarks and other data available
(B-1-8)																
31dac-1	Georgia Lynn Mining Co.	1938	4,290	Dr	128	-	10	-	-39.7	10- 7-52	N	150R	-	U	-	At Delle Smelter; water reported salty.
(B-1-9)																
3ccc-1	Marblehead Lime Co.	1956 1957	4,600	Dr Dr	450.0 543	217 543	6 8,6	- S	- -391.7	- 12-22-65	- -	<100R 30B	- 6- 6-57	- N	- -	A-28500 and A-29437. Drilled to 450 ft in 1956; deepened to 543 ft in 1957. Casing: 8-inch to 508 ft, 6-inch, 501-543 ft. Perf. 395-543 ft. Dd 15 ft. L.
9bcb-1	U.S. Bureau of Land Management Well 82	1935	4,530	Dr	395	395	8,6	S	-277.0 -277.2 -279.2 -278.1	12- 6-46 12-11-50 10-22-62 3- 5-63	-,G	20R	-	S	57	A-13071. Casing: 8-inch, 0-127 ft; 6-inch to 395 ft. Water reported slightly brackish. L.
16baa-1	M. Morrin and Son Co.	1958	4,490	Dr	825	808	12	G	-258.9	12-22-65	-	500R	7-11-58	Z	-	A-30015. Dd 138 ft reported. L.
24cdd-1	Bertagnole	1952	4,460	Dr	215	215	6	G	-175	12- -52	T,-	40R	-	S	75	A-24411. Dd 20 ft reported. C, L.
(B-2-8)																
28dcb-1	U.S. Bureau of Land Management Well 80	1935	4,260	Dr	122	122	8	G	-39.4	8-27-65	P,G (5)	20R	-	S	-	A-13071. Water reported slightly brackish. C, L.
(C-1-7)																
8dbb-1	Wayne Rowberry	1905	4,220	Dr	106	-	-	S	-	-	N	-	-	U	-	A-25215. WDR 10907. At Timpie Service Station; abandoned because water is salty. L.
9caa-S1	Utah State Fish and Game Dept.	-	4,218	-	-	-	-	L	-	-	-	30E	8-27-65	R	72	South side of U.S. Highway 40, east of Big Spring.
9cad-S1	do	-	4,219	-	-	-	-	L(?)	-	-	-	30E	8-27-65	R	72	Do.
9ccc-S1	do	-	4,215	-	-	-	-	L or C	-	-	-	2,390M	9-18-65	R	65	Issues from conglomerate(?) at base of limestone bluff. C.
15bdb-S1	Spring	-	4,218	-	-	-	-	L(?)	-	-	-	-	-	U	74	In Timpie Valley at edge of saltflats. C.
25acc-S1	do	-	4,240	-	-	-	-	-	-	-	-	-	-	U	68	Do.
25bca-S1	do	-	4,237	-	-	-	-	-	-	-	-	-	-	S	59	Do.
25dab-S1	Utah Lime Co.	-	4,240	-	-	-	-	L(?)	-	-	-	-	-	U	66	Do.
26dbb-1	do	1952	4,350	Dr	152	152	-	-	-110	-	-	20B	7-29-52	U	-	A-23905. WDR 9533. Water reported too saline for use. Dd 10 ft on 7-29-52. L.
29bdd-1	Connie Hoopiiania	1958	-	Dr	100	100	6	G	-18	5- -58	-	300R	5- -58	-	-	A-25538. Aquifer 37-63 ft salty; 71-100 ft "fair quality." Dd 54 ft. L.
30add-1	W. C. Callister	1954	4,250	Dr	132.0	-	6	S,G	-21 -31.3 -31.8 -23.0	7- 4-57 3- 7-58 3-21-60 3-22-65	T,-	220R	-	I,S	-	A-24653. WDR 10656. Drilled to 140 ft. Perf. below 35 ft. Dd 14 ft. C, L.
30add-2	V. Anderson	1956	4,244	Dr	100	-	8	G	-28	-	-	350R	-	I,S	-	A-25142. WDR 12311. Perf. below 50 ft. L.
31aad-1	L. C. Hale	1955	-	Dr	100	-	6	-	-	-	-	100M	8-30-55	I,H,S	60	
31dcd-1	A. B. Callister and L. C. Hale	1957	4,245	Dr	130	130	6	G	+2.3	3- 5-63	N	10R 1.3E	1957 7-18-63	S	62	A-28748. WDR 12789. Perf. 110-130 ft. C, L.
32bd	do	1959	4,270	Dr	130	130	12	G	-43 -30.0 -41.0	6- -59 7-18-63 12-22-65	T,G	1,800R 1,000E	6-29-59 7-18-63	I,H,S	66	A-28809. WDR 13695. Perf. below 60 ft. Dd 17 ft on 6-29-59. C, L.
(C-1-8)																
6abc-1	C. Hammond	1949	4,250	Dr	64	52	6,4	L(?)	-20	11- -49	J,E	10R	11- -49	H	80	A-21142. WDR 7293. Perf. 20-52 ft. Dd 17 ft in November 1949. Water reported too saline for any use except flushing. L.
6add-1	Utah State Road Commission	1956	4,240	Dr	150	-	6	-	-35	1- -56	N	70B	1- -56	U	-	A-27690. WDR 12160. Well abandoned and second well drilled.
6add-2	do	1956	4,240	Dr	605	605	6	G(?)	-60	5- -56	-	-	-	Z	-	A-27690. WDR 12236. L.
25caa-1	C. H. Callister	1954	4,230	Dr	306	240	6	S	-	-	N	-	-	U	-	A-25138. WDR 10906. Water reported salty. L.
(C-2-7)																
6caa-1	J. Q. Griffiths	1953	4,250	Dr	255	-	12	S,G	-12.6	12-22-65	C,G	450R 100E	7-31-53 3-16-55	I,H,S	62	A-24665. WDR 10307. Perf. below 45 ft. L.
6caa-2	do	1954	4,250	Dr	130	-	6	S,G	+7.0	4- -54	F	50E	3-16-55	I,S	60	A-24665. Perf. below 60 ft. C, L.
6cda-S1	Burnt Spring	-	4,255	-	-	-	-	-	-	-	-	Seep 26E	1955 7-18-63	S	67	C.
7bcc-1	D. Lawrence	-	4,270	Dr	170	-	16	-	-16	-	T,G	-	-	I	-	
7ccc-1	do	1954	4,287	Dr	175	173	16	G	-16 -31.8	2-11-54 12-22-65	-	- 600R	- 2- -54	I	-	A-24813. WDR 10667. Perf. 65-172 ft. Yield reported during development; Dd 24 ft reported. C.

Table 8. — (Continued)

Location	Owner or name	Year drilled	Altitude above sea level (feet)	Type of well	Depth of well (feet)	Casing		Character of material in main aquifer	Water level		Method of lift and type of power	Yield		Use of water	Temperature (°F)	Remarks and other data available
						Depth (feet)	Diameter of well (inches)		Above (+) or below (-) land-surface datum (feet)	Date of measurement		Rate (gpm)	Date of measurement			
(C-2-8)																
13dcb-S1	Muskrat Spring	-	4,275	-	-	-	-	-	-	-	-	Seep 50E	1955 7-18-63	I	66	C.
24bca-1	A. Cole	1957	4,288	Dr	136	-	10	G	-7 -4.1 -5.5	6- -57 9-13-57 10-10-57	-	-	-	-	-	A-24814. WDR 12900. L.
24bcd-1	E. R. Flinders	1954	4,290	Dr	132	-	12	S,G	-5 -25.5	5-29-54 3-16-55	C,G	350R 540M	- 7- 1-54	I	61	A-24914. Dd 13 ft. C, L.
24cc-S1	Spring	-	4,290	-	-	-	-	-	-	-	-	25E	7-18-63	I,S	64	Three-quarters of a mile north of Horseshoe Springs. C.
24cc-S2	do	-	4,290	-	-	-	-	-	-	-	-	25E	7-18-63	I,S	72	Do.
25bbd-1	M. D. Arbon	-	4,319	Dr	147	146	12	G	-	-	F C,G	45R 355M	7- 1-54 7- 1-54	I,S	64	A-26105. WDR 11203. Dd 12 ft on 7-1-54. C, L.
26dab-S1	North Horseshoe Spring	-	4,275	-	-	-	-	-	-	-	-	-	-	I	73	C.
26dbc-S1	South Horseshoe Spring	-	4,275	-	-	-	-	-	-	-	-	3-10E	1953	I	73	In 1957, Everett (1958) estimated total flow from the Horseshoe Springs at 30 cfs. C.
(C-2-9)																
7cb-S	Redlum Spring	-	4,950	-	-	-	-	L(?)	-	-	-	2E	-	S	70	Water at sampling point reportedly piped short distance from fault zone. C.
20bbd-S1	Henry's Spring	-	4,600	-	-	-	-	-	-	-	-	1-10E	-	S	-	
(C-3-7)																
7S	Delle Ranch Spring	-	-	-	-	-	-	-	-	-	-	1,000R	-	S	59	Exact location not identified.
7cba-S1	Spring	-	5,300	-	-	-	-	-	-	-	-	-	-	-	-	North of old Delle Ranch buildings.
7daa-S1	do	-	5,640	-	-	-	-	-	-	-	-	2.7M	-	S	55	Northeast of old Delle Ranch. C.
9cba-S1	do	-	6,320	-	-	-	-	-	-	-	-	-	-	S	-	In Box Canyon
16aad-S1	do	-	7,240	-	-	-	-	-	-	-	-	-	-	S	-	Head of Little Granite Canyon.
29bcb-S1	Chokecherry Spring	-	5,710	-	-	-	-	L	-	-	-	450E 1,350R	7-31-63 3-11-65	I,S	51 -	Part of irrigation supply to Deseret Ranch at Iosepa. C.
30cdb-S1	Spring	-	5,620	-	-	-	-	-	-	-	-	-	-	-	-	On alluvial slope below Pass and Little Pole Canyons.
30cdc-S1	do	-	5,620	-	-	-	-	-	-	-	-	-	-	-	-	Do.
30dac-S1	do	-	5,880	-	-	-	-	-	-	-	-	170R 110R	3-11-65 7- 1-65	I,S	-	Part of irrigation supply to Deseret Ranch at Iosepa. At mouth of Pass Canyon.
30ddb-S1	do	-	5,830	-	-	-	-	-	-	-	-	50E	7-31-63	I,S	-	Part of irrigation supply to Deseret Ranch at Iosepa. At mouth of Pass Canyon. C.
32bdd-S1	do	-	6,740	-	-	-	-	-	-	-	-	-	-	-	-	In Little Pole Canyon.
32ccd-S1	do	-	6,780	-	-	-	-	-	-	-	-	-	-	-	-	In Big Pole Canyon
(C-3-8)																
10ccc-S1	Deseret Livestock Co. South Springs	-	4,320	-	-	-	-	-	-	-	-	1,800E	7-30-63	I,S	73	Yield is combined discharge of five springs in north end of Deseret South Springs area. Springs are aligned in a northward trend. Everett (1958) estimated total discharge from Deseret Springs area to be on the order of 30-50 cfs. C.
12ab-S	Spring	-	-	-	-	-	-	-	-	-	-	4.6M	7-30-63	S	66	Spring formerly used by Western Pacific Railroad Co. C.
15b-S	Deseret Livestock Co. South Springs	-	4,320- 4,330	-	-	-	-	-	-	-	-	-	-	I,S	-	Five springs in part of Deseret South Springs area. See also (C-3-8)10ccc-S1.
15cba-S1	do	-	4,340	-	-	-	-	-	-	-	-	230E	7-30-63	I,S	71	Individual spring in Deseret South Springs area. C.
21ddb-S1	Deseret Livestock Co.	-	4,360	-	-	-	-	-	-	-	-	10E	7-23-63	S	75	C.
21dd-S	do	-	-	-	55	-	-	-	-	-	-	-	-	-	-	Water reported too brackish for culinary purposes (Carpenter, 1913, p. 82).
21ddd-1	do	1963	4,420	Dr	107	107	6	S,G	-46	5-28-63	-	-	-	H	-	A-35231. Perf. 73-83 and 88-105 ft with Mills knife. L.
25dbd-S1	do	-	5,220	-	-	-	-	-	-	-	-	29E	7-31-63	S	54	C.
28adc-1	do	1961	4,430	Dr	396	396	16	S,G,C	-90	4-25-61	T,E (150)	2,500R	4- -61	I	56	A-32795. Perf. 2 1/2 x 5/16-inch in zones at 115-170, 260-278, 290-300, 305-335, and 365-385 ft. Dd 25 ft after 12 hrs of pumping. C, L.
28bcd-1	do	1957	4,380	Dr	183	-	16	S,G	-31	1- -57	T,E (50)	1,100R 1,400M	1- -57 7-23-63	I	56	A-28673. WDR 12768. Perf. below 50 ft. C, L.
28ddb-1	do	1956	4,450	Dr	241	241	16	G	-91 -105.8 -106.5	6- -56 12- 3-62 12-16-65	T,E (75)	1,300R	6-29-56	I	56	A-27752. Perf. below 119 ft. Dd 97 ft on 6-29-56. C, L.
(C-3-9)																
8cc-S	Eight-Mile Spring	-	4,750	-	-	-	-	L	-	-	-	3.6M	7-23-63	S	58	One of several small springs that issue from limestone at edge of small syncline. Gross flow from spring area estimated to be 100 gpm. C.

Table 8. — (Continued)

Location	Owner or name	Year drilled	Altitude above sea level (feet)	Type of well	Depth of well (feet)	Casing: Depth (feet)	Casing: Diameter of well (inches)	Character of material in main aquifer	Water level: Above (+) or below (-) land-surface datum (feet)	Water level: Date of measurement	Method of lift and type of power	Yield: Rate (gpm)	Yield: Date of measurement	Use of water	Temperature (°F)	Remarks and other data available
(C-4-7)																
5ad-S	Spring	-	8,160	-	-	-	-	-	-	-	-	-	-	-	-	Upper spring in Big Pole Canyon.
5cc-S	do	-	7,080	-	-	-	-	-	-	-	-	-	-	-	-	Lower spring in Spring Canyon.
8ab-S	do	-	7,580	-	-	-	-	-	-	-	-	-	-	-	-	Upper spring in Spring Canyon.
16bb-S	do	-	8,380	-	-	-	-	-	-	-	-	-	-	-	-	In Big Creek Canyon.
17db-S	do	-	8,560	-	-	-	-	-	-	-	-	-	-	-	-	Head of Middle Lost Canyon.
20ab-S	do	-	7,920	-	-	-	-	-	-	-	-	-	-	-	-	Upper spring in South Lost Canyon.
28aca-S	do	-	8,240	-	-	-	-	-	-	-	-	-	-	-	-	In Antelope Canyon.
33ad-S	do	-	7,180	-	-	-	-	-	-	-	-	-	-	-	-	Middle spring in Indian Hickman Canyon.
33db-S	do	-	6,740	-	-	-	-	-	-	-	-	-	-	-	-	Head of perennial flow in Indian Hickman Canyon.
34ba-S	do	-	7,580	-	-	-	-	-	-	-	-	-	-	-	-	Upper spring in Indian Hickman Canyon.
(C-4-8)																
3ccb-1	Deseret Livestock Co.	1956	4,435	Dr	316	316	16	G	-93 -78.7 -58	1957 7- 2-57 1958	-	1,300R	3- -56	-	-	A-27751. WDR 12372. Replaced by ccb-2. Perf. below 93 ft. L.
3ccb-2	do	1958	4,435	Dr	331	331	16	G	-84	6- -58	T,E (75)	977M 995M	7-31-63 7-31-64	I	56	A-27751. WDR 13519. Perf. 135-139, 165-177, 201-208, 235-250, 267-287, 311-331 ft with 2 x 3/8-inch slots. Dd 75 ft estimated on 7-31-63. C, L.
13ab-S	Spring	-	5,520	-	-	-	-	-	-	-	-	-	-	-	-	At head of alluvial apron, near Stansbury Fault.
13dab-S1	do	-	5,760	-	-	-	-	-	-	-	-	-	-	-	-	In mouth of North Lost Canyon, above Stansbury Fault.
22baa-1	Island Ranching Co.	1960	4,510	Dr	325	325	12	G	-90.0	8- 1-63	T,E (75)	716M	8- 1-63	I	59	A-31275. Perf. below 168 ft. C, L.
22bda-1	do	1954	4,550	Dr	347	347	12	S,G	-90.0	8- 1-63	T,E (30)	423M	9-12-63	I,H	57	A-25525. WDR 11134. Perf. 168-347 ft. Drilled in old dug well 14 ft deep. C, L.
24add-S1	Spring	-	5,880	-	-	-	-	-	-	-	-	-	-	-	-	Lower spring in mouth of South Lost Canyon.
28dcd-1	Hatch Bros. Co.	1957	4,540	Dr	460	460	16, 10	S,G	-185 -188	9-20-57 5- 1-60	-	-	-	-	-	A-28366. Drilled to 308 ft in 1957. Deepened to 460 ft in 1960. Casing: 16-inch to 308 ft; 10-inch 300-460 ft. Perf. 207-457 ft. Dd 60 ft reported. L.
33aba-1	do	1962	4,540	Dr	500	500	12	S,G	-	-	T,E (50)	350M 340M	8- 1-63 8- 3-64	I	60	A-28366. Perf. 334-500 ft. Dd 90 ft estimated 8-1-63. C, L.
(C-4-9)																
32abb-1	Deseret Livestock Co.	1956 1965	4,620	Dr	340	340	6.5	G	-294.9	11-22-65	T,G	35R	5- -65	S	-	A-27753. Drilled to 325 ft in 1956. Deepened to 340 ft in 1965. Casing: 6-inch to 312 ft; 5-inch 312-340 ft. Perf. 290-312, 317-340 ft. Dd 5 ft after 3 hours. L.
(C-5-7)																
4c-S	Spring	-	6,600	-	-	-	-	-	-	-	-	-	-	-	-	In Dry Canyon.
21bad-S1	do	-	6,020	-	-	-	-	-	-	-	-	-	-	-	-	South slope of Spring Creek Canyon.
21ddb-S1	do	-	5,840	-	-	-	-	-	-	-	-	-	-	-	-	Head of perennial flow in Barlow Creek.
21ddc-S1	do	-	5,790	-	-	-	-	-	-	-	-	-	-	-	-	Adds to perennial flow in Barlow Creek.
22cba-S1	do	-	6,080	-	-	-	-	-	-	-	-	>100R	-	-	-	Upper spring on Barlow Creek.
23bbd-S1	Rock Spring	-	7,140	-	-	-	-	-	-	-	-	-	-	-	-	
27abc-S1	Clay Spring	-	6,020	-	-	-	-	-	-	-	-	-	-	-	-	On tributary to Barlow Creek.
35bcb-S1	Sand Spring	-	5,740	-	-	-	-	-	-	-	-	5E	8-14-63	H	63	C.
35cbb-S1	Willow Springs	-	5,660	-	-	-	-	-	-	-	-	-	-	-	-	Springs reported intermittent.
(C-5-8)																
32aab-1	Hatch Bros. Co.	1948	4,600	Dr	209	-	6	S	-150	-	-	20R	9- -48	S	-	A-20167. WDR 6596. Perf. below 155 ft. Dd. 20 ft. L.
34bdb-1	H. W. Severe	1920	-	-	60	-	6	-	-	-	-	<10R	-	-	-	C-21153.
34bdb-2	do	1954	4,605	Dr	120.0	112	6	S,G	-10	-	-	60R 30M	8- -54 8-16-63	I	50	C-21153. WDR 11276. Perf. below 20 ft. C.
34bdb-3	do	1961	4,605	Dr	105	105	12	S,G	-12.9	8-16-63	-	100R	9- -61	U	54	A-30513. Perf. 23-105 ft. Dd 40 ft after 4 hours. L.
34dad-1	A. L. Williams	1923	4,620	Dr	-	-	2	-	+1.25	12- 6-46	-	1E	12- 6-46	I,S	52	C.
34ddb-1	do	1923	4,620	J	20	-	6	-	>+5	8-16-63	-	150E	8-16-63	I,S	52	C-113. On low knoll.
34ddb-2	do	-	4,620	J	-	-	2	-	-.9	12- 6-46	-	-	-	-	-	On low knoll.
34ddb-4	do	-	4,620	J	-	-	5	-	+2.5	12- 6-46	-	-	-	-	-	Do.
34ddb-5	H. W. Severe	1957	4,620	Dr	35	-	16	-	F	8-16-63	-	150R	8-16-63	I	52	A-29405. C.
35a	-	-	-	-	-	-	-	-	-12	1911	-	-	-	-	-	
35cad-1	A. L. Williams	1961	4,640	Dr	160	153	12	S	-45	8- -61	T,E (25)	300M	8-16-63	I,S	-	A-33051. Perf. 48-153 ft with 6 x 1/4-inch slots. L.
35cbc-1	do	1896	4,620	Dr	80	-	2	-	-	-	-	3E	8-16-63	H	-	C.
35cbc-2	do	1916	4,620	J	108	-	2	-	>+5.5	12- 6-46	-	4.5M	12- 6-46	H,S	52	C-14205.
35ccc-1	do	1910	4,630	-	65	-	2	-	-	-	-	1-10R	-	I	-	C-14204.
35ccc-2	do	-	4,630	Dr	120	-	2	-	-	-	-	-	-	H,S	52	C.
(C-5-9)																
16aab-1	-	1940	4,630	Dr	292	-	6	G	-280	-	-	12R	5- -40	S	-	A-13536. WDR 1367. L.
(C-5-10)																
15dcc-S1	Spring	-	5,400	-	-	-	-	-	-	-	-	-	-	-	-	Spring probably intermittent; reported dry on 8-20-63. C.

Table 8. — (Continued)

Location	Owner or name	Year drilled	Altitude above sea level (feet)	Type of well	Depth of well (feet)	Casing: Depth (feet)	Casing: Diameter of well (inches)	Character of material in main aquifer	Water level: Above (+) or below (-) land-surface datum (feet)	Water level: Date of measurement	Method of lift and type of power	Yield: Rate (gpm)	Yield: Date of measurement	Use of water	Temperature (°F)	Remarks and other data available
(C-6-6)																
31ccd-S1	Spring	-	-	-	-	-	-	-	-	-	-	10-100R	-	-	-	
31daa-S1	do	-	8,220	-	-	-	-	-	-	-	-	-	-	-	-	At head of The Dell canyon in Onaqui Mountains.
31dac-S1	do	-	8,020	-	-	-	-	-	-	-	-	-	-	-	-	Do.
31dbb-S1	do	-	7,740	-	-	-	-	-	-	-	-	-	-	-	-	
(C-6-7)																
2bbc-S1	Pack Springs	-	5,500	-	-	-	-	-	--	-	-	10-100R	-	H,S,I	-	One of three springs.
2bbc-S2	do	-	5,530	-	-	-	-	-	-	-	-	10-100R	-	H,S,I	-	Do.
2bbd-S1	do	-	5,560	-	-	-	-	-	-	-	-	10-100R	-	H,S,I	-	Do.
3aaa-1	D. D. Williams	1957	5,520	Dr	245	-	6	S	-230	7- -57	-	6R	7- -57	H	-	A-29019. WDR 13329. Dd 15 ft reported. L.
3cbb-1	R. A. McCullough	1959	5,220	Dr	420	-	6	S	-324	1- -59	-	6R	1- -59	H	-	A-30324. WDR 13966. Perf. 327-331 ft. Driller reported "no water" below 331 ft. Dd 56 ft reported in January 1959. L.
3cbc-1	T. Frampton	1956	5,200	Dr	320	-	6	G	-295	5- -56	-	7R	5- -56	H	50	A-27709. WDR 12245. Perf. 312-320 ft. Dd 5 ft reported in May 1956.
3cca-1	S. Olson	1965	5,200	Dr	267	267	6	S,G	-215	6- -65	-	12R,B	6- -65	H	-	A-36792. Perf. 215-267 ft. Dd 6 ft reported after 2 hours of pumping in June 1965. L.
3ccb-1	O. Cox	1958	5,180	Dr	325	325	6	S	-295	11- -58	-	8R	11- -58	H	-	A-27696. WDR 13796. Perf. 312-325 ft. Dd 10 ft reported in November 1958.
3ccc-1	A. Huntsman	1956	5,150	Dr	215	-	6	S,G	-205	6- -56	-	-	-	H	-	A-28031. WDR 12312. Perf. below 208 ft.
3ccd-1	M. Southworth	1956	5,170	Dr	240	-	6	S,G	-225	6- -56	-	-	-	H	-	A-27059. WDR 12309.
3cda-1	H. S. Critchlow	1956 1963	5,240	Dr	260	-	6	S,G	-205 -218	9- -56 12- 5-63	- -	- 12R,B	- 12- -63	- H	- -	A-28470. Deepened in December 1963. Casing not perforated. Dd 0 ft.
3cdb-1	J. S. Risske	1961	5,210	Dr	256	256	6	G	-212	7- -61	-	24R,B	7- -61	H,I	-	A-32190. Perf. 212-256 ft with 6 x 1/4-inch slots.
3cdb-2	J. V. Harry	1961	5,210	Dr	262	256	6	S	-212	11- -61	-	30R,B	11- -61	H,S	-	A-32554. Perf. 212-254 ft with 6 x 1/4-inch slots. Dd 0 ft.
3cdc-1	D. S. Halladay	1962	5,190	Dr	265	265	6	S,G	-230	11- -62	-	10R,B	11- -62	H	-	A-34594. Perf. 230-260 ft with 6 x 1/2-inch slots. Dd 10 ft reported after 1 hour.
3cdc-2	M. D. Jensen	1963	5,190	Dr	271	271	6	S	-240	11- -63	-	12R,B	11- -63	H	-	A-35150. Perf. 245-267 ft. No drawdown after pumping 2 hours.
3cdd-1	M. B. Hill	1961	5,200	Dr	270	270	6	G	-212	10- -61	-	30R,B	10- -61	H	-	A-33432. Perf. 212-265 ft with 6 x 1/4-inch slots. L.
11cdb-S1	Park Spring	-	5,390	-	-	-	-	-	-	-	-	200E	8-14-63	I,S	55	C.
14ccc-S1	Caldwell Spring	-	5,275	-	-	-	-	-	-	-	-	-	-	S	-	Spring is intermittent.
18	T. S. Cochran	-	-	-	350	-	-	-	-30	1911	-	-	-	-	-	Water reported to be of inferior quality (Carpenter, 1913).
19ccd-1	C. Hymas	1952	4,730	Dr	116	103	8	S	-19.4 -18.9 -19.7	7- 1-54 3- 7-58 3-22-65	T,G	500R	12- -52	I	-	A-24145. WDR 9812. Perf. 48-103 ft. Not used often. Dd 48 ft in December 1952. L.
19ddd-1	L. Buzianis	1953	4,750	Dr	107	-	10	S,G	-21.7 -25.0	3-31-53 3-22-65	-	-	-	H,S	-	A-24461. WDR 10035. Perf. below 36 ft. L.
29acd-1	G. Buzianis and J. J. Jackson	1953	4,810	Dr	113	113	14	G	-40.7	2- -53	-	-	-	-	-	A-24623. WDR 10034. Perf. 32-113 ft. L.
(C-6-8)																
1a	Hatch Bros. Co.	1946	4,680	Dr	155	-	6	S,G	-70	9- -46	-	30R,B	9- -46	-	-	A-17932. WDR 4939. Perf. below 130 ft. Dd 10 ft reported in September 1946. L.
2dcc-1	do	1946	4,646	Dr	170	-	6	S	-10	-	-	30R,B	10- -46	-	-	A-17931. WDR 4938. L.
2dcd-1	do	1960	4,645	Dr	601	396	16	S,G	-29	7-22-60	T,E (75)	512R 390M	7-22-60 8- 3-64	I,S	57	A-31927. Perf. 335-390 ft with 2½ x 3/8-inch slots. Dd 221 ft reported after pumping 11 hours 7-22-60. C, L.
10caa-1	H. B. Rowell	1954	4,685	Dr	176	173	10	C	-7.3 -8.5	4-29-55 3-22-65	N	37R,B	7- -54	U	-	A-25252. WDR 10926. Perf. 128-170 ft with 2½ x 5/16-inch slots. L.
11dad-1	G. Hess	1954	4,650	Dr	250	250	6	S,G	-2	7- -54	T,E	300R 250E	7-28-54 5-29-65	I	57	A-25620. WDR 11277. Perf. 100-250 ft. C, L.
11dbd-1	do	1954	4,650	-	275	-	3	G	-3 -20.0	5- 2-56 8-14-63	-	25R	5- 2-56	H	54	A-28074. WDR 12537. L.
11dbd-2	do	1956	4,650	Dr	-	-	3	-	-9.0	8-14-63	-	35M	8-20-63	H	53	C.
11dca-1	do	1958	4,655	Dr	295	-	12	S	-6 -14.3	6-31-58 8-20-63	T,E (15)	90R,B 300R	6-31-58 8-20-63	U	55	A-25620. Perf. below 169 ft. L.
11ddc-1	do	Old	4,655	Dr	-	-	-	-	F	8-16-63	-	1E	8-16-63	H,S	59	C-21337.
14c-15b-S	Orr's Ranch Spring area	-	-	-	-	-	-	-	-	-	-	-	-	I,S	-	Area contains 17 or more springs in parts of secs. 14 and 15. Additional springs of related origin are at Willow Patch Springs and Scribner Spring to southeast in secs. 23 and 25. Selected springs are listed below. Springs at Orr's Ranch are oriented in two trends at right angles. One trend parallels land-surface contour and appears to relate to seepage from sand dunes. Second trend is downslope (northeast-ward) and may be related to geological structures. Temperature of water differs measurably from one spring location trend to the other.

Table 8. — (Continued)

Location	Owner or name	Year drilled	Altitude above sea level (feet)	Type of well	Depth of well (feet)	Casing: Depth (feet)	Casing: Diameter of well (inches)	Character of material in main aquifer	Water level: Above (+) or below (-) land-surface datum (feet)	Water level: Date of measurement	Method of lift and type of power	Yield: Rate (gpm)	Yield: Date of measurement	Use of water	Temperature (°F)	Remarks and other data available
(C-6-8)																
14ccd-S1	Spring	-	4,715	-	-	-	-	-	-	-	-	25E	11-24-65	S	52	Flows into small depression pond.
15abd-1	Orr's Ranch	Old	4,700	-	300	-	-	-	-	-	-	10E	9-15-65	H	55	C.
15cac-S1	Spring	-	4,735	-	-	-	-	S	-	-	-	150E 100E	8-15-63 11-24-65	I,S	60	Flows to reservoir at Orr's Ranch house. C.
15dbb-S1	do	-	4,715	-	-	-	-	S	-	-	-	50E	11-24-65	I,S	52	Flows to reservoir at Orr's Ranch house.
15dbb-S2	do	-	4,725	-	-	-	-	S	-	-	-	200E	11-24-65	I,S	58	Do.
23acb-S1	do	-	4,715	-	-	-	-	-	-	-	-	-	-	S	-	Southernmost of six or more seeps that supply pond in N½ sec. 23. C.
23bac-S2	Willow Patch Spring	-	4,725	-	-	-	-	-	-	-	-	1E	8-15-63	S	-	C.
25bbb-S1	Scribner Spring	-	4,725	-	-	-	-	-	-	-	-	-	-	S	56	Water flows into small pond. C.
(C-6-9)																
6dbb-S1	White Rock Spring	-	5,305	-	-	-	-	-	-	-	-	Seep	-	S	59	At northwest side of White Rock Spring. Appears to discharge from alluvium that lies on igneous rock of Tertiary age; water is held in small stock-watering reservoir. C.
(C-7-7)																
7aac-1	-	1946	4,900	Dr	175	-	8	G	-60	-	-	10-100R	-	-	-	A-15244. Could not be located in field.
16bcd-1	Hatch Bros. Co.	1945	5,168	Dr	448	448	6.5	S,G	-390	12- -45	P,G	-	-	S	-	A-18996. Casing: 6-inch to 165 ft; 5-inch from 0-448 ft. Perf. 408-448 ft. L.
(C-7-8)																
9dad-1	U.S. Army	1951	4,837	Dr	400	400	16	G,C	-77.5	6- 7-51	T,E	1,000R 700M	1951 9- 6-63	P	54	A-22901. Dugway Proving Grounds well 19. Casing: 16-inch California stovepipe. Perf. 85-180, 290-385 ft. Dd 13 ft. C,L.
9dca-1	do	1951	4,837	Dr	345	340	16	G,C	-79.7	1-25-51	T,E	1,000R 960M	1951 9- 6-63	P	57	A-22392. Dugway Proving Grounds well 18. Casing: 16-inch California stovepipe. Perf. 100-195, 215-320 ft. C, L.
10cbd-1	do	1942	4,835	Dr	175	175	8	G	-73.5 -89.3	11- 5-46 3- 6-63	N	15R	-	U	-	Dugway Proving Grounds well 6. Perf. 155-175 ft.
15bcb-1	do	1954	4,836	Dr	500	-	-	S,G	-78.4 -81.3 -88.2	9-24-54 3- 7-58 3-22-65	N	-	-	U	-	Test well. Dugway Proving Grounds well 20. C, L.
15cba-1	do	1957	4,838	Dr	580	437	16	G,C	-86	8- -57	T,E	1,260R 800M	- 9- 6-63	P	- 55	A-26199. Dugway Proving Grounds well 26. Casing: 20-inch to 20 ft; 16-inch 0-437 ft with concrete plug at 432 ft. Perf. 104-140, 150-220, 265-320, 405-410 ft. Dd 28 ft. C, L.
22adb-1	do	1954	4,852	Dr	730	718	8	S,G	-91.5 -93.9 -99.2	9-24-54 3- 7-58 3-22-65	N	-	-	U	-	Test well. Dugway Proving Grounds well 21. Perf. 112-125, 140-160, 280-310, 365-400, 490-497 ft. No water below 497 ft. L.
22adb-2	do	1957	4,852	Dr	550	550	16	G,C	-95	9- -57	T,E	1,200R	-	P	54	A-26199. Dugway Proving Grounds well 27. Casing: 20-inch to 20 ft; 16-inch 0-550 ft with concrete plug at 595 ft. Perf. 105-120, 140-170, 180-240, 260-290, 300-340, 345-350, 375-390, 445-450, 475-540 ft. Dd 30 ft. C, L.
36ccc-1	U.S. Bureau of Land Management	-	4,980	Dr	272	272	6	-	-31.7	3- -65	T,G	-	-	-	-	
(C-8-6)																
7c-S	Cedar Spring	-	-	-	-	-	-	-	-	-	-	2E	-	S	-	
(C-8-7)																
30dbb-1	U.S. Bureau of Land Management	1947	5,150	Dr	490 320.0	490	6	S,G	-290	8- -53	N	4R 21R	3- -47	U	-	A-18397. In Government Creek valley adjacent to divide at south end of Skull Valley. Well abandoned. Casing obstructed at 259 ft. Dd 100 ft reported. L.

Table 9. — Selected drillers' logs of wells in Skull Valley

Altitudes are in feet above mean sea level for land surface at well.
Thickness in feet.
Depth in feet below the land surface.

Material	Thickness	Depth
(B-1-9)3ccc-1. Log by Mac Exploration Co. to 450 ft; 450-543 ft. by Robinson Drilling Co. Alt. 4,600 ft.		
Sand, blow, and clay seams	5	5
Boulders	55	60
Gravel, fine to medium	10	70
Conglomerate of fine gravel and interbedded clay seams	130	200
Gravel interbedded with clays	210	410
Sand, coarse, and medium gravel	40	450
Sand, hard	15	465
Rock, hard	1	466
Sand and gravel, with clay	9	475
Sand and gravel	15	490
Gravel and rocks	53	543
(B-1-9)9bcb-1. Alt. 4,530 ft.		
Quicksand, fine	126	126
Lime shelves and clay	24	150
Clay, yellow	50	200
Clay, white, heavy	75	275
Lime shelves and sand	60	335
Sand; water	60	395
(B-1-9)16baa-1. Log by Robinson Drilling Co. Alt. 4,490 ft.		
Clay, sandy	10	10
Sand	110	120
Clay, sandy, yellow	25	145
Clay and gravel	125	270
Sand; water	4	274
Clay, sandy, brown	106	380
Gravel, fine,and clay	165	545
Gravel, fine with small amounts of clay	218	763
Clay, white	4	767
Conglomerate, limestone	34	801
Gravel, small	5	806
Limestone, solid	19	825
(B-1-9)24cdd-1. Log by L. E. Hale. Alt. 4,460 ft.		
Sand and clay	60	60
Clay and gravel	115	175
Gravel; water bearing	40	215
(B-2-8)28dcb-1. Log by H. H. Bell. Alt. 4,260 ft.		
Clay and sand	20	20
Lime, sandy	20	40
Mud, blue	20	60
Clay, green	20	80
Clay, sandy	20	100
Clay, blue	10	110
Gravel, black-lime; water	12	122
(C-1-7)8dbb-1. Log by E. Hale. Alt. 4,220 ft.		
Soil	6	6
Clay, blue, and sand	100	106
(C-1-7)26dbb-1. Log by Robinson Drilling Co. Alt. 4,350 ft.		
No record	1	1
Gravel and limestone boulders	151	152
(C-1-7)29bdd-1. Log by J. Hale.		
Soil	2	2
Gravel and clay	16	18
Clay	19	37
Gravel; salty water	26	63
Clay	6	69
Hardpan	2	71
Gravel; water, fair quality	29	100
(C-1-7)30add-1. Log by L. E. Hale. Alt. 4,250 ft.		
Gravel and sand	30	30
Sand	8	38
Clay, blue	5	43
Sand, coarse, and gravel	7	50
Clay	4	54
Sand	42	96
Sand, tight	5	101
Gravel, tight	39	140
(C-1-7)30add-2. Log by I. Hale. Alt. 4,244 ft.		
Soil	4	4
Clay	16	20
Gravel	5	25
Hardpan	5	30
Sand and gravel	32	62
Clay	6	68
Hardpan	2	70
Gravel	30	100
(C-1-7)31bd Log by J. Hale. Alt. 4,270 ft.		
Soil	4	4
Boulders in sand and clay	33	37
Clay	7	44
Hardpan	1	45
Gravel, coarse; water	20	65
Clay	4	69
Gravel, coarse	29	98
Clay, with streaks of sand and gravel	19	117
Gravel, coarse, with boulders	13	130
(C-1-7)31dcd-1. Log by I. Hale. Alt. 4,245 ft.		
Surface	8	8
Clay	16	24
Sand	1	25
Clay	8	33
Sand and gravel; water	15	48
Clay	14	62
Sand and gravel; water	27	89
Clay	20	109
Hardpan	1	110
Gravel	20	130
(C-1-8)6abc-1. Log by J. P. Feighny. Alt. 4,250 ft.		
Clay	24	24
Rock, loose, and clay	24	48
Limestone ledge; water at 52 ft; salty	16	64
(C-1-8)6add-2. Log by J. S. Lee and Sons. Alt. 4,240 ft.		
Clay, gray	22	22
Silt, mucky	268	290
Hardpan	3	293
Clay, brown, sandy	47	340
Lime rocks and silt; water	106	446
Lime rocks	105	551
Clay, gray, gumbo	5	556
Lime rocks; water	49	605
(C-1-8)25aaa-1. Log by Earl Hale. Alt. 4,230 ft.		
Soil	8	8
Clay, blue, with 2-ft. hard strata of blue sand	298	306
(C-2-7)6caa-1. Log by Robinson Drilling Co. Alt. 4,250 ft.		
Clay, red	5	5
Clay, dark blue	10	15
Clay, sandy, blue	40	55
Clay, blue, and gravel	10	65
Clay, blue	5	70
Clay, brown	42	112
Rock, hard, gray	5	117
Clay, brown	3	120
Sand and gravel	80	200
Sand, gravel,and clay	12	212
Sand and gravel	13	225
Sand, gravel, and clay	30	255
(C-2-7)6caa-2. Log by E. Hale Alt. 4,250 ft.		
Soil	5	5
Sand and gravel; shallow water	7	12
Gravel, tight	4	16
Clay	20	36
Gravel	8	44
Clay and gravel	12	56
Sand, tight	34	90
Clay	6	96
Sand and gravel	13	109
Clay	9	118
(C-2-7)6caa-2 - continued		
Sand, tight	7	125
Gravel	5	130
(C-2-8)24bca-1. Alt. 4,288 ft.		
Clay	15	15
Gravel	5	20
Sand	20	40
Sand and clay	50	90
Gravel	3	93
Clay and sand	17	110
Gravel	10	120
Clay and gravel	4	124
Gravel	12	136
(C-2-8)24bcd-1. Alt. 4,290 ft.		
Surface, clay	20	20
Sand	12	32
Clay	28	60
Sand	13	73
Gravel	4	77
Clay	6	83
Sand and gravel	11	94
Clay	3	97
Sand	5	102
Gravel	18	120
Sand and gravel	12	132
(C-2-8)25bbd-1. Log by Selby Drilling Co. Alt. 4,319 ft.		
Soil	3	3
Boulders	6	9
Gravel and clay	3	12
Gravel and boulders	135	147
(C-3-8)21ddd-1. Log by M. Church Drilling Co. Alt. 4,420 ft.		
Clay, silt, and boulders	73	73
Sand and cobbles	10	83
Silt and cobbles	5	88
Sand, gravel, and cobbles	19	107
(C-3-8)28adc-1. Log by Robinson Drilling Co. Alt. 4,430 ft.		
Gravel	22	22
Clay, yellow and hardpan	93	115
Sand gravel; water	15	130
Boulders	20	150
Sand, gravel, and boulders	10	160
Sand and gravel	10	170
Clay, yellow, and boulders	20	190
Sand and gravel, heaving	5	195
Sand and boulders	15	210
Clay, yellow, and boulders	50	260
Conglomerate	18	278
Clay and boulders	12	290
Boulders	10	300
Sand and boulders	5	305
Sand and gravel	27	332
Clay, yellow, and boulders	29	361
Clay, yellow, sand, and gravel	7	368
Boulders	17	385
Clay, yellow, and gravel	11	396
(C-3-8)28bcd-1. Log by Selby Drilling Co. Alt. 4,380 ft.		
Dirt and clay	45	45
Sand; first water	5	50
Sand and gravel	14	64
Clay	3	67
Gravel	46	113
Clay	8	121
Gravel	22	143
Clay	6	149
Gravel	34	183
(C-3-8)28ddb-1. Log by Selby Drilling Co. Alt. 4,450 ft.		
Surface fill and clay	23	23
Clay and large boulders	96	119
Gravel, large, with thin beds of clay	122	241
(C-4-8)3ccb-1. Log by Selby Drilling Co. Alt. 4,435 ft.		
Clay	18	18

Table 9. — (Continued)

Material	Thickness	Depth
(C-4-8)3ccb-1 - Continued		
Gravel, large	6	24
Clay	41	65
Gravel	5	70
Clay, sandy	59	129
Gravel	5	134
Clay	5	139
Clay and thin gravel (beds)	21	160
Clay and gravel	82	242
Gravel, large	6	248
Clay, sandy, with some gravel	17	265
Gravel, large	7	272
Clay and gravel	13	285
Gravel	13	298
Clay	3	301
Gravel	9	310
Clay	2	312
Gravel	4	316
(C-4-8)3ccb-2. Log by Selby Drilling Co. Alt. 4,435 ft.		
Clay, yellow, sandy	58	58
Gravel, pea	3	61
Clay, yellow, sandy	31	92
Gravel, coarse; water	3	95
Clay, sandy	35	130
Gravel, coarse	9	139
Clay, sandy	23	162
Gravel, coarse	15	177
Clay, sandy	18	195
Sand and fine gravel	3	198
Gravel, coarse	10	208
Clay, sandy	23	231
Gravel, coarse	19	250
Clay, sandy	14	264
Gravel, coarse	23	287
Clay, sandy	21	308
Gravel, coarse	23	331
(C-4-8)22baa-1. Log by Robinson Drilling Co. Alt. 4,510 ft.		
Clay and boulders	8	8
Boulders of hardrock	27	35
Boulders and some clay	133	168
Boulders and gravel	22	190
Boulders, gravel, and some clay	6	196
Boulders and gravel	17	213
Boulders, gravel, and some clay	33	246
Boulders and gravel	12	258
Boulders, gravel, and some clay	14	272
Boulders and gravel	3	275
Boulders, gravel, and some clay	13	288
Boulders and clay	17	305
Boulders, gravel, and some clay	9	314
Boulders and gravel	7	321
Boulders, gravel, and some clay	4	325
(C-4-8)22bda-1. Log by Robinson Drilling Co. Alt. 4,550 ft.		
Old dug well	14	14
Boulders	26	40
Conglomerate	28	68
Boulders	17	85
Conglomerate	70	155
Boulders	10	165
Conglomerate	10	175
Rocks; water	5	180
Gravel, water	3	183
Conglomerate	20	203
Gravel, water, and larger rocks	9	212
Conglomerate	20	232
Sand, coarse, and water gravel	12	244
Conglomerate	28	272
Gravel	3	275
Conglomerate	7	282
Sand and gravel	14	296
Hardpan	4	300
Gravel	3	303
Conglomerate	12	315
Sand and gravel; water	3	318
Conglomerate	29	347
(C-4-8)28dcd-1. Logs by Selby Drilling Co. to 308 ft; 308-460 ft. by Robinson Drilling Co. Alt. 4,540 ft.		
Soil	5	5
Clay and rock	39	44
Rocks, large	13	57
Clay and gravel	26	83
Clay, light gray	7	90
Clay, red, sandy	29	119
Sand, coarse, and gravel	9	128

Material	Thickness	Depth
(C-4-8)28dcd-1 - Continued		
Gravel and rocks	68	196
Hard shell; first water at 204 ft.	8	204
Gravel, with some clay	100	304
Clay	4	308
Clay, yellow and gravel	72	380
Conglomerate, hard and sharp	32	412
Sand, hard and sharp	20	432
Rock, hard and sharp	28	460
(C-4-8)33aba-1. Log by I. Hale. Alt. 4,540 ft.		
Soil	4	4
Boulders and conglomerate	34	38
Gravel and clay	257	295
Clay, soft, and sand	39	334
Sand; water	13	347
Gravel	33	380
Clay and gravel; very little water	60	440
Clay and gravel; more water	36	476
Clay	4	480
Sand; very little water	20	500
(C-4-9)32abb-1. Logs by L. Perkins to 312 ft; 312-340 ft. by Robinson Drilling Co. Alt. 4,620 ft.		
Clay, red, and cobble rocks	310	310
Gravel	15	325
Hardpan and hard limestone	2	327
Conglomerate	13	340
(C-5-8)32aab-1. Log by I. Hale. Alt. 4,600 ft.		
Soil	5	5
Clay	45	50
Sand	12	62
Clay	13	75
Sand	15	90
Clay	119	209
(C-5-8)34bdb-3. Log by I. Hale. Alt. 4,605 ft.		
Soil	1	1
Clay	14	15
Sand	8	23
Clay	4	27
Gravel	1	28
Clay	4	32
Gravel	16	48
Clay and gravel	37	85
Clay	10	95
Sand	4	99
Clay	6	105
(C-5-8)35cad-1. Log by I. Hale. Alt. 4,640 ft.		
Soil	5	5
Clay, white	43	48
Sand; water	46	94
Clay	10	104
Hardpan	6	110
Sand	20	130
Clay	5	135
Sand	20	155
Hardpan	3	158
Clay	2	160
(C-5-9)16aab-1. Log by V. J. Crocheran. Alt. 4,630 ft.		
Sand	10	10
Boulders	100	110
Gravel and boulders	182	292
(C-6-7)3aaa-1. Log by I. Hale. Alt. 5,520 ft.		
Soil, sandy top	4	4
Sand	13	17
Sand, clay, and rock	213	230
Hardpan	1	231
Sand; water	14	245
(C-6-7)3cbb-1. Log by I. Hale. Alt. 5,220 ft.		
Soil and sand	18	18
Sand	15	33
Clay	5	38
Sand	9	47
Clay	146	193
Hardpan	1	194
Clay	85	279
Hardpan	2	281
Clay	44	325
Hardpan	2	327

Material	Thickness	Depth
(C-6-7)3cbb-1 - Continued		
Sand, fine; water	4	331
Clay, brown	19	350
Sandstone, hard, black, with streaks of oil shale and carbon.	70	420
(C-6-7)3cca-1. Log by E. W. Hale. Alt. 5,200 ft.		
Sand	33	33
Hardpan, green	1	34
Clay and sand, green	108	142
Clay, green	7	149
Clay, sand, and gravel, green	63	212
Clay, green	3	215
Gravel; water	5	220
Clay, gray	14	234
Sand and gravel, gray; water	11	245
Clay, gray	13	258
Gravel, gray	7	265
Clay, gray	2	267
(C-6-7)3cdd-1. Log by I. Hale. Alt. 5,200 ft.		
Soil	2	2
Gravel	2	4
Clay	35	39
Hardpan	1	40
Clay and gravel	102	142
Clay	7	149
Clay, sand, and gravel	63	212
Clay, and gravel; water	44	256
Clay	14	270
(C-6-7)19ccd-1. Alt. 4,730 ft.		
Soil	20	20
Clay, sandy; water at about 32 ft	40	60
Soil, sandy	29	89
Hardpan	3	92
Sandy(?)	12	104
Clay, white	11	115
Hardpan	1	116
(C-6-7)19ddd-1. Log by G. F. Casey. Alt. 4,750 ft.		
Loam, sandy	5	5
Clay, white	7	12
Clay, brown	2	14
Clay, sandy	8	22
Sand, white	4	26
Clay, brown, sandy	17	43
Sand	9	52
Clay, brown	8	60
Gravel	1	61
Clay, hard, brown	27	88
Sand and gravel	2	90
Clay	17	107
(C-6-7)29acd-1. Log by G. F. Casey Alt. 4,810 ft.		
Soil	13	13
Clay	2	15
Clay,sandy	4	19
Sand, fine to coarse	10	29
Gravel	3	32
Rock	2	34
Clay, sandy	6	40
Clay, white, sand(y); water at 43 ft.	3	43
Gravel	6	49
Clay	31	80
Clay, sand	20	100
Gravel, coarse	13	113
(C-6-8)1a. Alt. 4,680 ft.		
Soil	4	4
Clay	76	80
Quicksand, heavy; water at 80 ft.	15	95
Clay	5	100
Clay and gravel strata	55	155
(C-6-8)2dcc-1. Log by L. E. Hale. Alt. 4,646 ft.		
Clay	10	10
Sand and clay strata	40	50
Sand, with chalk and hardpan; all with water	100	150
Clay	20	170
(C-6-8)2dcd-1. Log by Robinson Drilling Co. Alt. 4,645 ft.		
Soil	1	1
Clay, yellow	16	17

Table 9. — (Continued)

Material	Thickness	Depth
(C-6-8)2dcd-1 - Continued		
Sand and fine gravel; water at 14 ft.	1	18
Clay, sandy, blue	70	88
Clay, sandy, gray	18	106
Gravel, fine	4	110
Clay, yellow	47	157
Hard streak	2	159
Clay, yellow	7	166
Hard, streak	3	169
Clay, yellow	101	270
Clay and gravel	32	302
Clay, yellow	5	307
Clay, gray and yellow, mixed	23	330
Lime, broken	17	347
Clay, red and gray	13	360
Clay, white	15	375
Clay, yellow	20	395
Lime, gray, broken	13	408
Clay, gray	7	415
Clay, red	110	525
Clay, gray	33	558
Clay, blue-gray	43	601
(C-6-8)10caa-1. Log by Robinson Drilling Co. Alt. 4,685 ft.		
Clay, white	16	16
Gravel, water	1	17
Conglomerate, hard	11	28
Boulders, white; some water	2	30
Clay, hard, white	16	46
Clay, brownish-white, sticky; some bentonite	9	55
Clay, sandy; bentonite	5	60
Bentonite, with some sandy clay	15	75
Bentonite; some water	21	96
Bentonite and brown sandy clay	4	100
Clay, brown; some water	5	105
Clay, brown	23	128
Conglomerate; water	23	151
Conglomerate	15	166
Conglomerate, loose; water	6	172
Conglomerate, tight	4	176
(C-6-8)11dad-1. Log by E. Hale. Alt. 4,650 ft.		
Soil and clay	14	14
Sand and clay; shallow water	76	90
Sand, real hard	5	95
Sand and gravel	11	106
Clay, blue, and sand	58	164
Gravel, tight	6	170
Gravel and sand	14	184
Clay	36	220
Sand and gravel	30	250
(C-6-8)11dbd-1. Alt. 4,650 ft.		
Sand and clay	70	70
Gravel	10	80
Clay and hardpan. Almost as much hardpan as clay	195	275
(C-6-8)11dca-1. Log by I. Hale. Alt. 4,655 ft.		
Soil	3	3
Clay, with small streaks of sand	37	40
Sand, fine; water	12	52
Clay	117	169
Sand, coarse; water	7	176
Clay, gumbo	119	295
(C-7-7)16bcd-1. Log by L. W. Dalton. Alt. 5,168 ft.		
Gravel and boulders, clean	165	165
Shale, soft	61	226
Shale, with hard streaks and streaks of soft sand; water first noticed at 412 ft.	204	430
Gravel, stream-washed	10	440
Shale, soft	8	448
(C-7-8)9dad-1. Log by H. M. Robinson. Alt. 4,837 ft.		
Clay, sandy	3	3
Sand	3	6
Clay, sandy	47	53
Gravel; water at 40 gpm	29	82
Conglomerate; water	103	185
Clay, light, soft, sandy	100	285
Conglomerate, light	10	295
Conglomerate, dark	15	310
Conglomerate, brown	20	330
Conglomerate, dark brown	50	380
Conglomerate, light brown	10	390
Conglomerate, dark brown	10	400
Note: all gravels and conglomerates were cemented.		
(C-7-8)9dca-1. Log by H. M. Robinson. Alt. 4,837 ft.		
Clay, sandy	6	6
Sand, fine	2	8
Clay, yellow	17	25
Clay, sandy	5	30
Clay, sandy, yellow	20	50
Clay, sandy, brown	40	90
Gravel, angular, fine, red	34	124
Conglomerate, brown	76	200
Clay, soft, brown	10	210
Granite, decomposed, soft, brown and gray	25	235
Granite, decomposed, medium-hard	15	250
Conglomerate, brown, soft	10	260
Conglomerate, brown, medium-hard	20	280
Conglomerate, brown, hard	60	340
Gabbro, solid, olivine	5	345
Author's note: well was bottomed in consolidated rock that probably is igneous, but driller's specific identification of rock is open to question because rock of this type has not been identified elsewhere in the general area.		
(C-7-8)15bcb-1. Log by J. S. Lee and Sons. Alt. 4,836 ft.		
Sand, fine, and clay	20	20
Sand and gravel; water at 95 ft.	105	125
Ash, volcanic	30	155
Sand and gravel	50	205
Ash, volcanic	20	225
Sand and gravel	25	250
Clay, sandy	50	300
Sand, with pumice and glassy quartz grains	95	395
Sand, gravel, and conglomerate	80	475
Clay	5	480
Clay, sandy	5	485
Sand and gravel, clean	10	495
Clay, heavy, gray; resisted driving casing further	5	500
(C-7-8)15cba-1. Log by J. S. Lee and Sons. Alt. 4,838 ft.		
Silt and clay	10	10
Clay, light	10	20
Clay and gravel	60	80
Clay, sandy	5	85
Clay and gravel	65	150
Conglomerate	20	170
Clay and gravel	30	200
Clay, sandy, and gravel	10	210
Clay, gray, sandy	50	260
Clay and gravel	20	280
Clay, sticky, gray	40	320
Clay, sandy	80	400
Shale, blue	180	580
(C-7-8)22adb-1. Log by J. S. Lee and Sons. Alt. 4,852 ft.		
Clay, silt, and fine sand	20	20
Clay, silty, sand, and gravel	92	112
Sand, coarse, and gravel; water at 112-116	58	170
Silt and clay	25	195
Sand and gravel, with silt and clay	25	220
Silt and clay	10	230
Gravel and coarse sand	35	265
Clay	10	275
Gravel and coarse sand, with some silt and clay	140	415
Clay, light gray, sticky	20	435
Clay, tan, silty	10	445
Gravel and coarse sand, with some silt and clay	15	460
Sand, silt, clay, and some gravel	15	475
Clay, light green and sticky yellow and brown	15	490
Gravel and sand; water rose to 130 ft.	7	497
Clay, sticky, gray, silty	33	530
Sand, tuffaceous, and tuff	50	580
Clay, yellow-brown (oxidized)	5	585
Clay and sandy shale, pink, gray, green and tan	75	660
Clay, blue-gray	10	670
Sandstone, blue-gray, tuffaceous	30	700
Shale and clay, blue-gray, greasy, silty	30	730
Note: No water found below 497 ft.		
(C-7-8)22adb-2. Log by J. S. Lee and Sons. Alt. 4,852 ft.		
Clay, sandy	75	75
Clay, sandy, and gravel	155	230
Conglomerate	110	340
Clay and gravel	43	383
Conglomerate	7	390
Clay and gravel	20	410
Clay	10	420
Clay, sticky, with little gravel	11	431
Clay, sticky, sandy	39	470
Clay and gravel	80	550
(C-8-7)30dbb-1. Log by L. E. Hale. Alt. 5,150 ft.		
Clay	36	36
Gravel	2	38
Clay and sand	262	300
Hardpan; water	1	301
Clay, red, and sand, mixed; well bottomed on gravel	189	490

Table 10. — Chemical analyses of water from selected wells and springs in Skull Valley

Sodium and potassium: Where no potassium value is shown, sodium plus potassium is calculated and reported as sodium.
Dissolved solids: Residue on evaporation at 180°C unless indicated by c (sum of determined constituents) or e (estimated from specific conductance).

Location	Date (or time) of collection	Temperature (°F)	Parts per million																	Percent sodium	Sodium-adsorption ratio	Specific conductance (micromhos/cm at 25°C)	pH
			Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$	Noncarbonate hardness as $CaCO_3$				
(B-1-9)24cdd-1	12-29-65	-	24	0.93	0.02	78	102	849	39	158	0	146	1,540	0.8	11	0.46	3,070	613	483	74	15	5,190	7.3
(B-2-8)28dcb-1	4-22-64	-	17	-	-	40	55	609	33	183	0	147	990	.7	1.3	.39	2,020	328	178	78	15	3,490	8.0
(C-1-7)9ccc-S1	7-18-63	65	14	1.1	.04	134	79	2,630	93	212	0	310	4,260	.1	4.1	.79	7,850	658	484	88	45	12,900	7.7
15bdb-S1	9- 5-41	74	-	-	-	-	-	-	-	-	-	-	6.720	-	-	-	-	-	-	-	-	-	-
25acc-S1	9- 5-41	68	-	-	-	-	-	-	-	-	-	-	9,600	-	-	-	-	-	-	-	-	-	-
25bca-S1	9- 5-41	59	-	-	-	-	-	-	-	-	-	-	3,580	-	-	-	-	-	-	-	-	-	-
25dab-S1	9- 5-41	66	-	-	-	-	-	-	-	-	-	-	6,850	-	-	-	-	-	-	-	-	-	-
30add-1	1-29-54	-	36	-	-	79	64	1,300	58	277	-	177	2,040	.3	3.8	.51	3,900c	460	233	84	26	6,800	7.5
31dcd-1	7-18-63	62	29	.38	.00	62	37	859	34	212	0	118	1,380	.2	2.1	.23	2,680	308	134	84	21	4,690	7.3
32bd	7-18-63	66	31	.41	.00	107	71	1,220	45	234	0	231	1,980	.2	3.8	.57	4,010	558	366	81	22	6,540	7.2
	9- 5-63	66	31	.39	.02	106	69	1,180	46	233	0	248	1,950	.2	8.1	.38	3,910	546	355	81	22	6,320	7.3
(C-2-7)6caa-2	4-29-55	60	32	-	-	70	41	793	30	206	0	107	1,270	.2	6.0	-	2,480	343	174	82	19	4,380	7.7
6cda-S1	7-18-63	67	26	.18	.00	84	45	824	31	207	0	114	1,360	.2	7.4	.23	2,680	394	224	81	18	4,610	7.3
7ccc-1	3-16-54	63	21	-	-	78	42	820	30	190	0	95	1,350	.1	4.5	.28	2,530c	367	212	81	19	4,590	7.8
(C-2-8)13dcb-S1	7-18-63	66	22	.17	.00	85	36	639	25	218	0	87	1,050	.1	5.1	.19	2,060	360	181	78	15	3,670	7.4
24bcd-1	7- 1-54	61	22	-	-	70	31	485	16	199	-	76	825	.1	3.7	-	1,610c	302	-	77	12	2,910	-
24cc-S1	7-18-63	64	22	.78	.00	103	44	1,020	32	190	0	126	1,720	.1	3.4	.26	3,430	436	280	82	21	5,650	7.1
24cc-S2	7-18-63	72	18	.53	.00	101	46	1,060	25	183	0	133	1,790	.1	2.8	.30	3,490	440	290	83	22	5,810	7.3
25bbd-1	7- 1-54	64	22	-	-	95	46	993	34	188	-	128	1,630	.1	4.4	-	3,090c	426	-	82	21	5,350	-
26dab-S1	7-18-63	73	47	.50	.00	126	47	1,500	47	244	0	190	2,420	.2	8.7	.39	4,720	508	308	85	29	7,720	7.8
26dba-S1	7-18-63	73	29	.11	.00	123	49	1,720	59	246	0	227	2,700	.7	6.0	.40	5,120	508	306	87	33	8,570	7.3
(C-2-9)7cb-S	7-19-63	-	15	.01	.00	180	96	314	8.2	232	0	163	840	.2	3.3	.15	1,930	845	655	44	4.7	3,090	7.7
	10-27-63	59	14	-	-	180	94	315		226	0	137	845	-	1.6	-	1,940	836	651	45	4.7	3,040	7.3
(C-3-7)7daa-S1	7-30-63	55	18	.03	.00	42	7.1	53	1.2	188	0	11	57	.2	1.5	.06	273	134	0	46	2.0	507	7.4
29bcb-S1	7-31-63	51	11	.05	.00	41	11	27	1.1	169	0	14	41	.2	.3	.03	229	148	9	28	1.0	398	7.6
30ddb-S1	7-31-63	61	10	.03	.00	38	9.0	24	1.1	158	0	10	31	.1	.3	.02	199	132	2	28	.9	343	7.6
(C-3-8)10ccc-S1[1/]	7-30-63	73	17	.09	.01	152	61	1,970	66	241	0	280	3,150	.4	6.9	.47	5,980	630	432	86	34	9,820	7.3
12ab-S	7-30-63	66	21	.03	.00	63	11	60	.8	203	0	20	102	.2	1.2	.04	395	202	35	39	1.8	678	7.5
15cba-S1	7-30-63	71	16	.15	.04	138	55	1,960	66	223	0	260	3,090	.3	4.3	.44	5,770	570	387	87	36	9,590	7.2
21ddb-S1	7-23-63	75	11	1.2	.10	23	5.4	14	.9	90	0	10	26	.2	.1	.02	137	80	6	27	.7	238	7.1
25dbd-S1	7-31-63	54	11	.07	.00	37	8.8	25	1.1	156	0	15	34	.1	.0	.04	211	128	0	30	1.0	352	7.8
28adc-1	7-23-63	56	17	1.1	.00	58	11	51	4.5	149	0	12	124	.2	.5	.06	377	190	68	36	1.6	643	7.3
	7-30-63	-	19	.01	.00	64	10	53	4.2	151	0	16	130	.1	1.3	.09	415	202	78	36	1.6	655	7.8
28bcd-1	7-23-63	56	18	.64	.00	39	9.5	47	2.6	132	0	9.7	86	.3	.4	.05	276	137	29	42	1.7	493	7.1
28ddb-1	7-23-63	56	17	.25	.00	54	13	49	1.8	139	0	19	114	.2	.9	.07	354	189	75	36	1.5	613	7.0
(C-3-9)8cc-S	7-23-63	64	13	.72	.08	180	111	268	8.5	196	0	129	855	.1	3.7	.17	1,940	905	744	39	3.9	3,050	7.9
	9- 5-63	64	13	.48	.01	174	114	262	7.9	196	0	129	840	.3	2.6	.18	2,070	905	744	38	3.8	3,000	7.3
(C-4-8)3ccb-2	7-31-63	56	10	.01	.00	34	6.3	43	4.1	113	0	11	78	.1	.6	.03	253	110	17	45	1.8	441	7.2
22baa-1	8- 1-63	59	13	.59	.04	97	17	68	1.6	139	0	56	200	.1	14	.03	671	311	197	32	1.7	982	7.1
22bda-1	8- 1-63	57	13	.66	.02	96	18	160	6.2	180	0	126	265	.0	24	.10	839	316	168	52	3.9	1,380	7.3
33aba-1	8- 1-63	60	25	.09	.00	28	23	153	12	190	0	40	222	.1	12	.08	616	163	7	65	5.2	1,090	7.3
(C-4-9)32abb-1	4-27-66	-	46	-	-	36	18	371	9.9	250	0	100	470	.7	4.4	.20	1,150	162	0	82	13	2,030	7.9
(C-5-7)35bcb-S1	8-14-63	63	7.3	.30	.00	51	2.4	13	.7	270	0	11	17	.1	.2	.03	241	224	3	11	.4	453	7.7
(C-5-8)34bdb-2	8-16-63	50	38	.24	.00	166	96	604	29	378	0	377	1,000	.8	2.9	.51	2,570	810	500	61	9.2	4,060	7.7
34dad-1	8-16-63	57	24	.22	.00	75	43	208	12	301	0	79	348	.6	2.2	.22	932	362	115	55	4.8	1,650	7.7
34ddb-5	8-16-63	52	27	.19	.00	67	42	265	14	351	0	102	375	.7	3.8	.29	1,070	342	54	62	6.3	1,880	7.5
	9-27-63	52	26	.03	.00	79	36	259	14	351	0	111	380	.6	1.6	.28	1,060	348	60	61	6.0	1,850	7.8
35cbc-1	8-16-63	53	24	.60	.00	74	39	199	11	288	0	74	330	.5	1.3	.17	922	346	110	55	4.7	1,580	7.8
35ccc-2	4-29-55	52	28	-	-	70	43	190	12	282	0	74	331	.6	1.9	.19	914	352	120	53	4.4	1,560	7.5
(C-5-10)15dcc-S1	8-20-63	-	18	.11	.10	136	156	375	4.5	148	0	171	1,080	.2	2.2	.17	2,220	980	859	45	5.2	3,690	7.7
	9- 5-63	-	18	.12	-	144	157	377	4.7	142	0	167	1,080	.2	1.6	.22	2,380	1,000	889	45	5.2	3,580	7.6
(C-6-7)11cdb-S1	8-14-63	55	12	.77	.00	63	21	49	1.6	267	0	40	63	.3	1.7	.09	374	241	22	30	1.4	660	7.7
(C-6-8)2dcd-1	8-16-63	57	30	.06	.00	43	27	172	5.3	246	0	51	245	1.0	1.8	.15	700	221	19	62	5.0	1,220	7.7
11dad-1	5-29-65	57	37	.13	.15	127	77	268	9.1	209	0	98	652	.9	.4	.16	1,700	636	465	47	4.6	2,500	7.7
11dbd-2	8-20-63	53	29	.35	.0	57	32	142	6.3	235	0	49	250	.6	1.3	.14	712	272	79	52	3.8	1,230	7.7
15abd-1	9-15-65	55	18	-	-	61	31	149		236	0	50	254	-	.9	-	738	280	86	54	3.9	1,220	7.9
15cac-S1	8-15-63	60	19	.70	.00	59	32	142	7.7	238	0	49	245	.4	1.5	.12	706	278	83	52	3.7	1,220	7.4
23acb-S1	8-15-63	-	32	.48	.00	80	30	145	9.6	296	0	55	242	.7	6.2	.16	779	324	81	48	3.5	1,290	7.2
23bac-S2	8-15-63	-	32	.23	.00	79	39	187	12	334	0	54	318	.8	3.1	.24	926	360	86	52	4.3	1,570	7.4
25bbb-S1	8-15-63	56	24	.98	.01	65	33	152	8.9	254	0	64	260	.7	1.2	.15	751	298	90	52	3.8	1,290	7.8
(C-6-9)6dbb-S1	5-29-65	-	2.7	.71	.09	30	4.4	34	6.5	116	0	16	47	.3	.2	.08	200	94	0	42	1.5	358	8.1
(C-7-8)9dad-1	3- -51	-	-	-	-	-	-	184		207	0	249	225	-	-	-	957	345	176	54	4.3	1,480	7.5
	10-15-52	54	48	-	-	110	32	180	11	208	0	299	230	.2	19	-	1,060	406	236	48	3.9	1,610	7.5
	11- 4-53	54	45	-	-	57	19	129	7.1	194	0	51	210	.5	3.0	-	628	220	61	55	2.5	1,080	7.6
	10- 6-54	56	45	-	-	112	33	192	10	199	0	266	260	.3	19	-	1,070	415	252	49	4.1	1,660	7.3
	12-12-55	54	51	-	-	55	19	132	9.0	183	0	45	216	.4	2.0	-	636	215	65	56	3.9	1,060	7.3
	9-11-56	52	50	-	-	116	31	187	11	198	0	278	260	.2	17	-	1,070	418	256	48	4.0	1,650	7.5
	11-15-56																						
	(8:35am)	-	-	-	-	-	-	136	-	-	-	56	212	-	3.6	-	615e	210	-	58	4.1	1,070	-
	(8:50am)	-	-	-	-	-	-	136	-	-	-	62	215	-	3.3	-	630e	212	-	58	4.1	1,080	-
	(9:20am)	-	-	-	-	-	-	136	-	-	-	66	215	-	3.5	-	640e	216	-	58	4.0	1,100	-
	(10:20am)	-	-	-	-	-	-	143	-	-	-	92	220	-	4.6	-	700e	238	-	57	4.0	1,170	-
	(11:20am)	-	-	-	-	-	-	149	-	-	-	132	225	-	7.7	-	780e	276	-	54	3.9	1,270	-

Table 10. — (Continued)

Location	Date (or time) of collection	Temperature (°F)	Parts per million																	Percent sodium	Sodium-adsorption ratio	Specific conductance (micromhos/cm at 25°C)	pH
			Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$	Noncarbonate hardness as $CaCO_3$				
(C-7-8)9dad-1	11-15-56																						
	(12:20pm)	-	-	-	-	-	-	160	-	-	-	172	235	-	10	-	850e	308	-	53	4.0	1,360	-
	(1:20pm)	-	-	-	-	-	-	166	-	-	-	192	245	-	13	-	895e	328	-	52	4.0	1,420	-
	(2:20pm)	-	-	-	-	-	-	171	-	-	-	206	240	-	13	-	920e	340	-	52	4.0	1,450	-
	4- 8-57	52	-	-	-	-	-	168		148	0	166	228	-	7.1	-	780e	256	135	59	4.6	1,270	7.8
	4-17-57	52	-	-	-	-	-	159		202	0	112	219	-	7.2	-	730e	252	86	58	4.4	1,210	7.3
	4-29-57	52	-	-	-	-	-	131	-	-	-	56	215	-	2.4	-	630e	220	-	56	3.8	1,080	-
	5- 7-57	52	-	-	-	-	-	131	-	-	-	50	216	-	11	-	615e	224	-	56	3.8	1,070	-
	5-20-57	52	-	-	-	-	-	151	-	-	-	148	231	-	8.8	-	810e	300	-	52	3.8	1,310	-
	5-28-57	52	-	-	-	-	-	137	-	-	-	99	224	-	6.8	-	715e	260	-	53	3.7	1,190	-
	8-27-57	52	-	-	-	-	-	196	-	-	-	255	258	-	20	-	1,080e	406	-	51	4.2	1,650	-
	9-19-57	52	46	-	-	59	15	137	7.5	194	0	58	210	0.4	4.4	-	641	210	51	58	4.1	1,100	7.9
	10-18-57	-	-	-	-	-	-	-	-	-	-	-	221	-	11	-	855e	-	-	-	-	1,370	-
	12-30-57	50	39	-	-	57	17	133	7.3	186	0	58	210	.3	3.1	-	617	208	55	57	3.9	1,080	8.0
	1- -58	-	32	-	-	51	17	148		183	0	63	214	-	.6	-	616	196	46	62	4.6	1,070	7.7
	10-14-58	53	38	-	-	57	16	138	8.3	190	0	49	215	.4	3.8	-	633	209	53	58	4.1	1,090	7.5
	9-15-60	55	50	-	-	112	30	187	10	197	0	277	258	.3	14	-	1,080	405	243	49	4.0	1,640	7.5
	12- 4-62	54	45	-	-	64	16	139		190	0	55	220	.3	4.3	-	670	225	69	57	4.0	1,130	7.6
	9- 6-63	-	45	-	-	91	25	170	8.9	201	0	179	255	.2	3.1	-	924	330	165	52	4.1	1,450	7.3
	9-29-65	55	41	-	-	69	20	143		178	5	53	245	.4	11	-	738	255	101	55	3.9	1,200	8.3
(C-7-8)9dca-1	1-26-51	-	-	-	-	-	-	-	-	218	0	-	215	-	-	-	810e	-	-	-	-	1,310	-
	7-31-51	56	53	-	-	70	18	162	12	212	0	132	215	.3	8.5	-	778	248	75	57	4.5	1,290	7.8
	6- 2-53	56	50			81	23	167	12	208	0	172	220	.3	12	0.19	838	296	126	54	4.2	1,340	7.6
	10- 6-54	56	47	-	-	68	17	153	9.4	205	0	96	211	.2	4.9	-	712	240	72	57	4.3	1,190	7.4
	12-12-55	-	55	-	-	80	20	165	12	204	0	174	214	.3	9.3	-	842	282	114	55	4.3	1,340	7.3
	9-11-56	53	50	-	-	94	21	178	11	206	0	219	218	.2	12	-	909	322	153	54	4.3	1,430	7.3
	2- 7-57	56	52	-	-	77	19	171	11	202	0	160	220	.4	8.5	-	825	270	104	57	4.5	1,320	7.5
	4- 8-57	53	-	-	-	-	-	158		202	0	121	220	-	6.9	-	750e	264	98	57	4.2	1,240	7.4
	4-17-57	53	-	-	-	-	-	136		188	0	54	215	-	3.6	-	630e	220	66	57	4.0	1,080	7.7
	4-29-57	53	-	-	-	-	-	195	-	-	-	202	223	-	6.1	-	880e	324	-	57	4.7	1,400	-
	5- 7-57	-	-	-	-	-	-	151	-	-	-	128	218	-	3.3	-	760e	272	-	57	4.0	1,250	-
	5-20-57	53	-	-	-	-	-	180	-	-	-	206	220	-	7.9	-	890e	316	-	55	4.4	1,410	-
	5-28-57	53	-	-	-	-	-	167	-	-	-	206	223	-	11	-	890e	316	-	53	4.1	1,410	-
	8-27-57	53	-	-	-	-	-	189	-	-	-	229	228	-	14	-	960e	330	-	55	4.5	1,500	-
	9-19-57	53	48	-	-	93	22	176	11	206	0	236	215	.3	14	-	935	322	153	53	4.3	1,440	7.8
	10-18-57	-	-	-	-	-	-	-	-	-	-	-	225	-	11	-	870e	-	-	-	-	1,390	-
	10-14-58	54	43	-	-	89	22	185	14	206	0	219	220	.2	17	-	914	315	146	55	4.5	1,450	7.6
	9-15-60	56	50	-	-	91	21	174	10	202	0	200	225	.3	9.3	-	898	314	148	54	4.3	1,410	7.5
	10- 5-61	56	48	-	-	119	14	185	-	210	0	236	234	.2	13	-	992	356	184	53	4.3	1,520	7.5
	9- 6-63	57	46	-	-	107	25	199	11	208	0	265	255	.2	15	-	1,040	372	201	53	4.5	1,610	7.5
	10- 7-63	54	47	-	-	120	20	210		204	0	268	270	.2	15	-	1,040	384	217	54	4.6	1,610	7.4
	9-26-66	56	45	-	-	131	30	230		200	0	290	330	.5	20	-	1,200	450	286	53	4.7	1,840	7.7
15bcb-1	7-20-54	54	52	-	-	54	19	146	7.5	184	0	47	236	.5	5.2	.20	668	212	62	59	4.4	1,140	7.5
15cba-1	7-28-58	59	48	-	-	58	24	125	7.3	185	0	46	230	.6	3.4	-	675	245	93	52	3.5	1,110	7.7
	9-15-60	55	49	-	-	57	25	129	6.6	188	0	45	235	.6	1.8	-	670	244	90	53	3.6	1,110	7.7
	10- 5-61	56	48	0.07	-	73	18	134		196	0	59	228	.7	3.4	-	702	256	95	53	3.7	1,140	7.5
	9- 6-63	-	46	.10	.00	43	27	134	5.1	199	0	37	220	.3	2.0	.15	636	220	57	56	3.9	1,070	7.4
	9-29-64	55	43	.06	.03	59	25	140		194	0	48	243	.6	.7	-	696	250	91	55	3.8	1,140	7.5
22adb-2	7-28-58	59	47	-	-	38	29	136	5.4	200	0	39	220	.4	1.0	-	627	216	52	57	4.0	1,080	7.7
	10- 3-59	54	43	-	-	38	32	130	5.1	202	0	35	215	.4	1.4	-	615	226	60	55	3.8	1,100	7.8
	9-15-60	55	47	-	-	37	29	139	4.7	201	0	35	218	.5	1.3	-	614	213	48	58	4.1	1,050	7.7
	12- 4-62	54	44	-	-	46	30	127		195	0	41	222	.5	1.3	-	646	241	81	53	3.6	1,090	7.7
	9- 6-63	-	45	.50	.00	40	28	134	4.9	203	0	36	222	.4	1.6	.14	627	216	49	57	4.0	1,090	7.3
	9-29-65	54	43	-	-	37	31	135		200	0	34	220	.6	1.2	-	632	220	56	57	3.9	1,080	7.8
	1-12-66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,100	-

1/ Collected from the combined flow of five adjacent springs.

WATER CIRCULAR

No. 1. Ground water in the Jordan Valley, Salt Lake County, Utah, by Ted Arnow, U.S. Geological Survey, 1965.

BASIC-DATA REPORTS

No. 1. Records and water-level measurements of selected wells and chemical analyses of ground water, East Shore area, Davis, Weber, and Box Elder Counties, Utah, by R. E. Smith, U.S. Geological Survey, 1961.

No. 2. Records of selected wells and springs, selected drillers' logs of wells, and chemical analyses of ground and surface waters, northern Utah Valley, Utah County, Utah, by Seymour Subitzky, U.S. Geological Survey, 1962.

No. 3. Ground-water data, central Sevier Valley, parts of Sanpete, Sevier, and Piute Counties, Utah, by C. H. Carpenter and R. A. Young, U.S. Geological Survey, 1963.

No. 4. Selected hydrologic data, Jordan Valley, Salt Lake County, Utah, by I. W. Marine and Don Price, U.S. Geological Survey, 1963.

No. 5. Selected hydrologic data, Pavant Valley, Millard County, Utah, by R. W. Mower, U.S. Geological Survey, 1963.

*No. 6. Ground-water data, parts of Washington, Iron, Beaver, and Millard Counties, Utah, by G. W. Sandberg, U.S. Geological Survey, 1963.

No. 7. Selected hydrologic data, Tooele Valley, Tooele County, Utah, by J. S. Gates, U.S. Geological Survey, 1963.

No. 8. Selected hydrologic data, upper Sevier River basin, Utah, by C. H. Carpenter, G. B. Robinson, Jr., and L. J. Bjorklund, U.S. Geological Survey, 1964.

No. 9. Ground-water data, Sevier Desert, Utah, by R. W. Mower and R. D. Feltis, U.S. Geological Survey, 1964.

No. 10. Quality of surface water in the Sevier Lake basin, Utah, by D. C. Hahl and R. E. Cabell, U.S. Geological Survey, 1965.

No. 11. Hydrologic and climatologic data, collected through 1964, Salt Lake County, Utah, by W. V. Iorns, R. W. Mower, and C. A. Horr, U.S. Geological Survey, 1966.

No. 12. Hydrologic and climatologic data, 1965, Salt Lake County, Utah, by W. V. Iorns, R. W. Mower, and C. A. Horr, U.S. Geological Survey, 1966.

No. 13. Hydrologic and climatologic data, 1966, Salt Lake County, Utah, by A. G. Hely, R. W. Mower, and C. A. Horr, U.S. Geological Survey, 1967.

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*No. 1. Plan of work for the Sevier River Basin (Sec. 6, P.L. 566), U.S. Department of Agriculture, 1960.

No. 2. Water production from oil wells in Utah, by Jerry Tuttle, Utah State Engineer's Office, 1960.

No. 3. Ground water areas and well logs, central Sevier Valley, Utah, by R. A. Young, U.S. Geological Survey, 1960.

*No. 4. Ground water investigations in Utah in 1960 and reports published by the U.S. Geological Survey or the Utah State Engineer prior to 1960, by H. D. Goode, U.S. Geological Survey, 1960.

No. 5. Developing ground water in the central Sevier Valley, Utah, by R. A. Young and C. H. Carpenter, U.S. Geological Survey, 1961.

*No. 6. Work outline and report outline for Sevier River basin survey, (Sec. 6, P.L. 566), U.S. Department of Agriculture, 1961.

No. 7. Relation of the deep and shallow artesian aquifers near Lynndyl, Utah, by R. W. Mower, U.S. Geological Survey, 1961.

No. 8. Projected 1975 municipal water use requirements, Davis County, Utah, by Utah State Engineer's Office, 1962.

No. 9. Projected 1975 municipal water use requirements, Weber County, Utah, by Utah State Engineer's Office, 1962.

No. 10. Effects on the shallow artesian aquifer of withdrawing water from the deep artesian aquifer near Sugarville, Millard County, Utah, by R. W. Mower, U.S. Geological Survey, 1963.

No. 11. Amendments to plan of work and work outline for the Sevier River basin (Sec. 6, P.L. 566), U.S. Department of Agriculture, 1964.

No. 12. Test drilling in the upper Sevier River drainage basin, Garfield and Piute Counties, Utah, by R. D. Feltis and G. B. Robinson, Jr., U.S. Geological Survey, 1963.

No. 13. Water requirements of lower Jordan River, Utah, by Karl Harris, Irrigation Engineer, Agricultural Research Service, Phoenix, Arizona, prepared under informal cooperation approved by Mr. William W. Donnan, Chief, Southwest Branch (Riverside, California) Soil and Water Conservation Research Division, Agricultural Research Service, U.S.D.A. and by Wayne D. Criddle, State Engineer, State of Utah, Salt Lake City, Utah, 1964.

*No. 14. Consumptive use of water by native vegetation and irrigated crops in the Virgin River area of Utah, by Wayne D. Criddle, Jay M. Bagley, R. Keith Higginson, and David W. Hendricks, through cooperation of Utah Agricultural Experiment Station, Agricultural Research Service, Soil and Water Conservation Branch, Western Soil and Water Management Section, Utah Water and Power Board, and Utah State Engineer, Salt Lake City, Utah, 1964.

No. 15. Ground-water conditions and related water administration problems in Cedar City Valley, Iron County, Utah, February, 1966, by Jack A. Barnett and Francis T. Mayo, Utah State Engineer's Office.

No. 16. Summary of water well drilling activities in Utah, 1960 through 1965, compiled by Utah State Engineer's Office, 1966.

No. 17. Bibliography of U.S. Geological Survey Water Resources Reports for Utah, compiled by Olive A. Keller, U.S. Geological Survey, 1966.

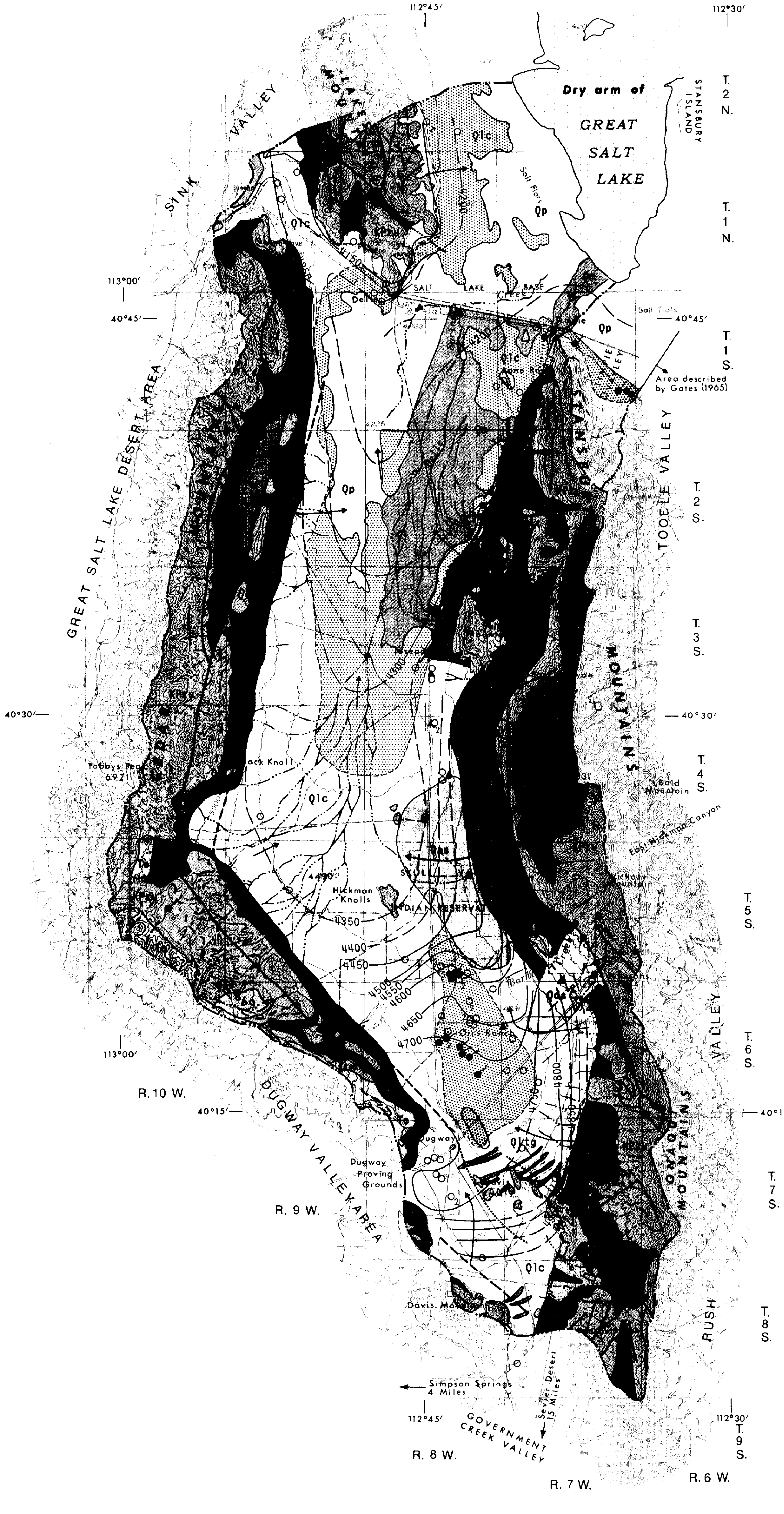
No. 18. The effect of pumping large-discharge wells on the ground-water reservoir in southern Utah Valley, Utah County, Utah, by R. M. Cordova and R. W. Mower, U.S. Geological Survey, 1967.

No. 19. Ground-water hydrology of southern Cache Valley, Utah, by L. P. Beer, 1967.

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES

TECHNICAL PUBLICATION NO. 18
PLATE I 1968



CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS
DATUM IS MEAN SEA LEVEL

Base from Army Map Service 1:250,000 series: Tooele (1962)

EXPLANATION

GEOLOGY

QUATERNARY

Qp
Playa deposits

Qm
Marshy land
Includes local small open bodies of moderately to very saline water

Qas
Alluvial surface
Mostly sloping and well-drained and generally not stony; locally may be part of recharge area; moderate permeability

Qds
Dune sand
Locally acts as recharge area; moderate to high permeability

Qltg
Gravel in constructional lakeshore features (terraces, spits, and bars)
Locally acts as recharge area; high permeability

Qlc
Lakebed sediments
Clays with low to moderate permeability, but generally tight enough to inhibit recharge

QUATERNARY / TERTIARY

Colluvium and alluvium
Mostly stony; recharge area; yields water freely to wells

TERTIARY

Te
Extrusive rocks
Volcanic flows and pyroclastics; low permeability

PALEOZOIC

MIDDLE CAMBRIAN to PERMIAN and CRETACEOUS(?)

KPzu
Sedimentary rocks
Mainly carbonate rocks, generally low in permeability, but locally high in permeability along joints, faults, and cavernous zones

LOWER and MIDDLE CAMBRIAN

Tintic Quartzite
Low in permeability

Approximate geologic contact

Fault
Solid line where exposed; dashed where inferred; dotted where concealed

Highest recognized Lake Bonneville shoreline

HYDROLOGY

4300
Water-level contour
Shows altitude of water level. Dashed where approximate. Contour interval is 50 feet. Datum is mean sea level. Arrow indicates direction of ground-water movement

●2 ○2
Flowing *Nonflowing*
Well

●2
Spring
Number indicates more than one well or spring at site

▲
Surface-water or pipeline data site

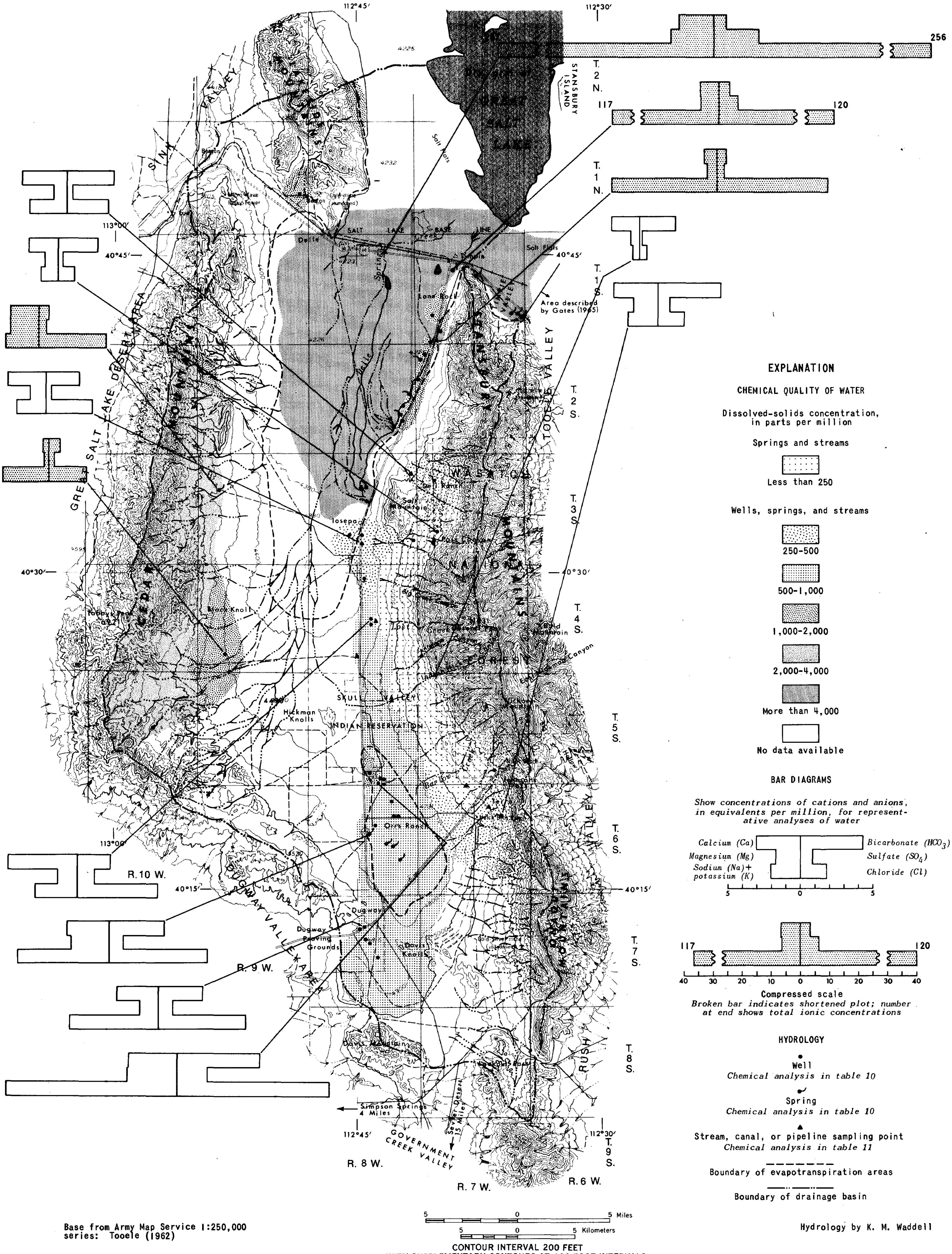
Boundary of evapotranspiration areas

Phreatophytes
Mainly greasewood and rabbitbrush in southern part of valley; mainly greasewood and saltgrass in northern part

Boundary of drainage basin

Geohydrology by J. W. Hood, 1965. Geology adapted from Stokes (1964) and Rigby (1958).

Plate 1. — GENERALIZED GEOHYDROLOGIC MAP OF SKULL VALLEY, TOOELE COUNTY, UTAH



Base from Army Map Service 1:250,000 series: Tooele (1962)

Hydrology by K. M. Waddell

Plate 2. — MAP SHOWING THE GENERALIZED DISTRIBUTION OF DISSOLVED SOLIDS IN GROUND AND SURFACE WATERS, THE CHEMICAL CHARACTER OF REPRESENTATIVE WATER SOURCES, AND THE RELATION OF QUALITY TO THE SOURCES OF RECHARGE AND THE AREAS OF DISCHARGE IN SKULL VALLEY, TOOELE COUNTY, UTAH