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TEI-804

SELECTED LOGS AND DRILLING RECORDS OF WELLS AND TEST HOLES DRILLED AT THE NEVADA TEST SITE PRIOR TO 1960

By John E. Moore

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

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John E. Moore

January 1962

Trace Elements Investigations Report

This report is preliminary and has not been edited for conformity with Geological Survey format.

*Prepared on behalf of the U.S. Atomic Energy Commission.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Washington, 25, D. C.

January 8, 1962

Mr. James E. Reeves
Assistant Manager for Test Operations
Albuquerque Operations Office
U. S. Atomic Energy Commission
P. O. Box 5400
Albuquerque, New Mexico

Dear Mr. Reeves:

Transmitted, herewith, are ten copies of TEI-804, "Selected logs and drilling records of wells and test holes drilled at the Nevada Test Site prior to 1960" by John E. Moore, January 1962.

We plan to release this report to the public in the open files.

Sincerely yours,

Edwin B. Eckel, for

V. E. McKelvey
Assistant Chief Geologist
Interagency Programs and
Supporting Activities

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SELECTED LOGS AND DRILLING RECORDS OF WELLS AND TEST HOLES DRILLED AT THE NEVADA TEST SITE PRIOR TO 1960

By

John E. Moore

INTRODUCTION

Many wells have been drilled for water at the Nevada Test Site since the Atomic Energy Commission began using the area for testing purposes. These wells afford information on the character and thickness of rocks to hundreds of feet below the land surface in a locality where such information previously was almost entirely lacking. The logs of some of these wells have been reproduced in reports issued by the U. S. Geological Survey, but the logs of others, although equally useful in planning future drilling operations in the vicinity, have been scattered in different files. The present report brings together all the logs of wells and test holes not published in previous reports.

PURPOSE AND SCOPE

This report is a compilation of lithologic logs, drillers logs, drilling records, and hydrologic data on 18 wells and test holes drilled in the Nevada Test Site and the surrounding area prior to 1960. All these holes except Gravity high 1 and 2 were drilled for hydrologic information. Seismic shot holes and core holes drilled in the tunnels in Rainier Mesa are excluded. The records were collected as part of the hydrologic and geologic studies being made at the Nevada Test Site by the U. S. Geological Survey on behalf of the Atomic Energy Commission.

Little interpretation is presented in this report, which is intended principally to supplement interpretative reports to be published later.

LOCATION OF AREA

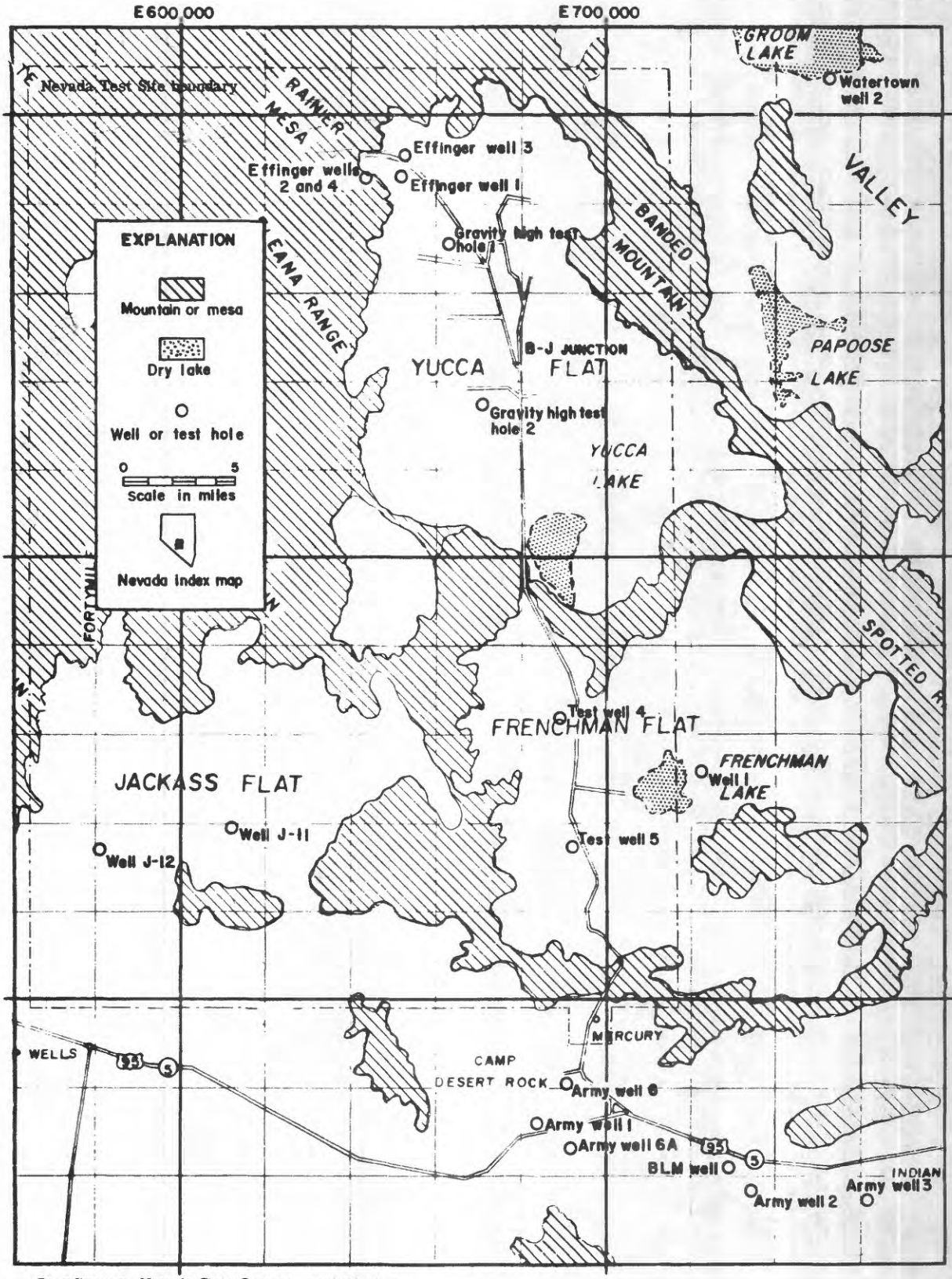
The area considered in this report includes the Nevada Test Site; Camp Desert Rock, to the south; Indian Spring Valley, to the southeast; and Emigrant Valley, to the northeast (fig. 1). It is in Nye, Clark, and Lincoln counties. The nearest large city is Las Vegas, which is about 70 miles to the southeast.

SOURCE OF INFORMATION

The logs and other data in this report were recorded by different individuals and were obtained from different sources. They therefore lack uniformity in style and content, but are believed to afford the best information available. The drillers' logs and details of well history have been obtained from the files of Reynolds Electrical and Engineering Co., Inc., and from unpublished reports of the U. S. Geological Survey. Samples from some of the wells and test holes had been preserved, and these were examined microscopically. The logs based on these samples are the most complete and detailed of those reported here.

PREVIOUS REPORTS

References to the lithologic logs of wells and test holes available in other publications are given in table 1.



Coordinates: Nevada State System, central zone

FIGURE 1.--MAP OF THE NEVADA TEST SITE AND VICINITY SHOWING LOCATIONS OF WELLS AND TEST HOLES DESCRIBED IN THIS REPORT.

Table 1.--Lithologic logs of wells and test holes at the Nevada Test Site reported in previous publications

Well or test hole no.	Other no. or name	Publication
73-70	Well 5A	Wilmarth, V. R., and others, 1959, TEI-358; Hood, J. W., 1961, TEI-788.
74-70-a	Well 5B	Wilmarth, V. R., and others, 1959, TEI-358; Hood, J. W., 1961, TEI-788.
74-70-b	Well 5C	Wilmarth, V. R., and others, 1959, TEI-358; Hood, J. W., 1961, TEI-788.
81-67	Well 3	Wilmarth, V. R., and others, 1959, TEI-358; Hood, J. W., 1961, TEI-788.
84-68	Test well 7	Wilmarth, V. R., and others, 1959, TEI-358.
88-63-a	Dolomite Hill hole	Dickey, D. D., and McKeown, F. A., 1959, TEI-755.
88-63-c	U12e M1	Schoff, S. L., and Winograd, I. J., 1961, TEI-787.
90-67-a	Marble 4 or ME4	McKeown, F. A., and Wilmarth, V. R., 1959, TEM-1036.
90-67-b	Marble 3 or ME3	Houser, F. N., and Pool, F. G., 1959, TEM-1031.
90-67-c	Marble 1 or ME1	Schoff, S. L., and Winograd, I. J., 1961, TEI-787.
90-67-d	Marble 2 or ME2	Schoff, S. L., and Winograd, I. J., 1961, TEI-787.
90-67-e	Granite hole	Houser, F. N., and Poole, F. G., 1959, TEM-836.

Chemical and radiochemical analyses of the water from test holes and wells considered here are given in a report by Moore (1961). Gamma-ray logs for 5 of these wells are shown in a report by Bunker (1961). Table 2 shows the availability of chemical and radiochemical analyses of water and gamma-ray logs of wells described in this report.

Table 2.--Availability of chemical and radiochemical analyses of water and gamma-ray logs of wells described in this report

Well or test hole no.	Other no. or name	Chemical and radiochemical analyses (Moore, 1961)	Gamma-ray logs (Bunker, 1961)
65-73	Army well 2	X	X
65-76	Army well 3	X	X
66-69	Army well 6A	X	X
66-72	Bureau of Land Management	---	---
67-68	Army well 1	---	X
68-69	Army well 6	---	---
73-58	Well J-12	X	X
73-61	Well J-11	X	---
73-69	Test well 5	---	---
75-72	Well 1	---	---
76-68	Test well 4	---	---
83-67	Gravity high 2	---	---
87-66	Gravity high 1	---	---
88-64-a	Effinger well 4	---	X
88-64-b	Effinger well 2	---	X
88-65	Effinger well 1	---	X
88-65-a	Effinger well 3	---	X
90-75	Watertown well 2	X	---

TOPOGRAPHY

The Nevada Test Site is in the Great Basin and is characterized by mountain ranges and intermontane valleys. The mountain ranges reach altitudes of 5,000 to 7,500 feet and the flat valley bottoms are at altitudes of 3,200 to 4,500 feet.

The report area includes five major valleys: Yucca, Frenchman, Jackass, Indian Spring, and Emigrant Valleys. The first three of these valleys are within the boundaries of the Nevada Test Site.

GEOLOGY

The rocks exposed in the Nevada Test Site consist of varied sedimentary rocks of Paleozoic age, volcanic and sedimentary rocks of Tertiary age, and alluvial and playa deposits of Quaternary age (Johnson and Hibbard, p. 335-336, 1957; Hansen and Lemke, 1958). The Paleozoic rocks have a total thickness of about 22,000 feet and are dominantly limestone and dolomite, together with marble, quartzite, argillite, shale, and conglomerate. The Paleozoic rocks have been intruded at a few places by a granodiorite stock and by dikes of Cretaceous or Tertiary age. The overlying Tertiary rocks consist principally of vitric and zeolitic tuff, basalt, rhyolite, and rhyodacite of the Oak Spring Formation of Miocene(?) or younger age. The Tertiary and Quaternary alluvium consists principally of detritus deposited in the intermontane basins, much of it in the form of fans. The rocks are folded and are cut by thrust faults and normal faults (Johnson and Hibbard, p. 369, 1957). The bedrock of the Nevada Test Site includes the formations listed in table 3.

Table 3.--Classification of rock formations in the Nevada Test Site (summarized from Barnes, Houser, and Pool, 1961)

Tertiary System
Miocene (?) or younger
Oak Spring Formation
Lower Pennsylvanian to Lower Permian (?)
Tippipah Limestone
Mississippian to Lower Pennsylvanian
Eleana Formation (argillite, shale, conglomerate, and quartzite)
Lower Mississippian
Mercury Limestone
Upper Devonian and Lower Mississippian
Narrow Canyon Limestone
Middle and Upper Devonian
Devils Gate(?) Limestone
Lower and Middle Devonian
Nevada Formation (dolomite, limestone, and quartzite)
Ordovician to Devonian
Dolomite, undifferentiated
Middle Ordovician
Eureka Quartzite
Lower and Middle Ordovician
Pogonip Group (limestone and some dolomite and shale)
Cambrian System
Windfall Formation
Dunderberg Shale
Bonanza King Formation
Cadiz Formation
Wood Canyon Formation

The wells and test holes included in this report penetrate the following stratigraphic units: Oak Spring Formation, Eleana Formation, Pogonip Group, Windfall Formation and Bonanza King Formation. The depths to tuff and Paleozoic rock, as indicated by test holes and wells, are shown in table 4.

Table 4.--Depth to tuff and Paleozoic rock in test holes and wells, in feet below land surface

Well or test hole no.	Other no. or name	Depth of well	Depth to tuff	Depth to Paleozoic rock	Lithology of Paleozoic rock
65-76	Army well 3	830	380	---	----
66-69	Army well 6A	1,253	---	30	Quartzite
67-68	Army well 1	620	360	610	Dolomite
73-58	Well J-12	887	515	---	----
73-61	Well J-11	1,329	1,150	---	----
87-66	Gravity high 1	145	---	130	Dolomite
88-64-a	Effinger well 4	76	65	---	----
88-64-b	Effinger well 2	80	---	40	Argillite
88-65	Effinger well 1	180	---	165	Quartzite
88-65-a	Effinger well 3	202	---	190	Argillite

EXAMINATION OF SAMPLES

Survey geologists examined the cuttings or cores collected from the following holes: Army wells 1 through 3 and 6A; wells J-11 and -12; Gravity high holes 1 and 2; Effinger wells 1 through 4. Samples from the remaining holes were not available for study.

The available cuttings first were washed free of drilling mud and then they and the cores were examined under a binocular microscope for determination of mineralogy, texture, size, roundness, and color of individual constituents. Colors of the samples were compared with the standard colors of the National Research Council rock color chart (Goddard and others, 1951).

The logs of Army wells 1, 2, and 3 describe the grain sizes in the alluvium. It should be pointed out, however, that they are at best only estimates of the natural size ranges because the materials had been altered by crushing and disaggregation by the drill bit.

LOGS AND DRILLING RECORDS

The records of the 19 wells and test holes included in this report are given on the pages that follow. A driller's log is given where a geologist's log is not available. The locations of all wells and test holes are shown in figure 1.

The location numbers that follow the name of the well or test hole are based on the Nevada State Coordinate System, central zone. Each number consists of three parts; the first two digits of the north coordinate, the first two digits of the east coordinate, and a letter to distinguish the individual well from others in the same 10,000-foot

square. The wells and test holes are arranged according to these numbers, which are given in parentheses following the name of the well.

Army well 2 (65-73)

Army well 2, also known as Army 6C, was intended for supplying water to Camp Desert Rock, an Army post. It is in the western part of Indian Spring Valley about 11 miles southeast of Mercury. The Nevada State Coordinates of the site are N 655,582 and E 735,166 and the land-surface altitude at the well is 3,813 feet.

The well was drilled in 1958 by the McKinney Drilling Co., using the cable-tool method. It is 658 feet deep and is cased from the surface to 92 feet with 10-inch blank casing. The yield was reported by the driller as only 8 to 10 gallons per minute. The well was abandoned because the yield was too little to fulfill the water needs of the camp.

The well penetrated only alluvium of Quaternary and/or Tertiary age, consisting principally of fine- to medium-grained dolomite and quartzite fragments in a calcareous-silt matrix. These materials are relatively homogeneous except in the interval from 620 to 630 feet, where abundant fragments of crystal tuff are included.

The static water level in the well in May 1961 was 501.6 feet below the land surface.

Geologist's log of Army well 2

	Thickness (feet)	Depth (feet)
Alluvium		
Sand, gravel, and silt; very pale orange and dark gray; consisting of dolomite (dark gray to light gray, fine to medium grained, subangular to round) with minor amounts of basalt (black, angular), chert (white, subangular), quartzite (rose, subangular), argillite (medium gray, subround to angular), and calcium-carbonate fragments (very pale orange); many dolomite and basalt grains covered with calcium carbonate (very pale orange); matrix, calcareous silt (very pale orange)	50	50
Similar, but with addition of minor quantities of calcite crystals and sand-sized quartz crystals	10	60
Sand and silt; very pale orange, pale purple and dark gray; composed of dolomite (dark gray to light gray, fine to medium grained) and quartzite (rose to pale purple, subangular) with minor amounts of chert (white, subangular), argillite (medium gray and		

Geologist's log of Army well 2--Continued

	Thickness (feet)	Depth (feet)
green), and basalt (black, angular); calcium-carbonate coatings sparse; matrix, calcareous silt (very pale orange)	170	230
Sand and silt; very pale orange, pale purple, and dark gray; composed of quartzite (rose to pale purple, subround) with abundant dolomite (dark gray to light gray, fine to medium grained, round to subangular) with minor amounts of chert, argillite and basalt; calcium-carbonate coatings sparse; matrix, calcareous silt (very pale orange)	110	340
Sand, gravel, and silt; very pale orange to dark gray; composed of dolomite (dark gray to light gray, fine to medium grained, round to subangular) and quartzite (rose to pale purple, subround) with minor amounts of chert, argillite, and basalt; calcium-carbonate coatings sparse; matrix, calcareous silt (very pale orange)	160	500
Similar, but with moderate quantity of calcium-carbonate fragments probably from coatings on pebbles	80	580

Geologist's log of Army well 2--Continued

	Thickness (feet)	Depth (feet)
Sand; very pale orange and dark gray; composed of dolomite (dark gray to light gray, fine to medium grained, round to subangular) and quartzite (rose to pale purple, subround to subangular) with minor amounts of crystal tuff (pinkish gray, fine to medium grained, calcareous, containing phenocrysts of quartz, and feldspar), chert, and argillite; calcium-carbonate coatings sparse	40	620
Sand and silt; pinkish gray and dark gray; composed primarily of crystal tuff (pinkish gray, calcareous, containing abundant euhedral to subhedral phenocrysts of quartz and feldspar, and scattered grains of magnetite, biotite, and amphibole), with moderate amounts of dolomite, quartzite, argillite, and chert	10	630
Gravel and sand; pinkish gray and dark dusky red to dark gray; composed primarily of limestone (grayish red to very dark dusky red, fine grained, angular to subangular) and dolomite (dark gray, fine to medium grained) with minor amounts of crystal tuff, quartzite, and chert; calcium-carbonate coatings sparse	28	658

Army well 3 (65-76)

Army well 3, also known as Army 6D, was intended for supplying water to Camp Desert Rock, an Army post. It is in the western part of Indian Spring Valley about 15 miles southeast of Mercury. The Nevada State Coordinates are N 654,163 and E 760,615 and the land-surface altitude at the well is 3,616.9 feet.

The well was drilled in 1958 by the McKinney Drilling Co., using the cable-tool method. It is 830 feet deep and is uncased. The yield as reported by the driller based on a 4-hour test was 113 gallons per minute with a drawdown of 79 feet. It was reported that the water level was drawn down to the pump (300 feet) at the end of the pumping period.

The hole penetrated alluvium from the surface to 380 feet and tuff from 380 feet to the bottom at 830 feet. The alluvium is of Quaternary and/or Tertiary age and consists primarily of fine- to medium-grained dolomite and quartzite fragments in a matrix of calcareous silt. The tuff is thought to be correlative with the Oak Spring Formation of Tertiary age. It is friable and contains numerous quartz and feldspar phenocrysts.

The static water level in the well in January 1960 was 287.3 feet below the land surface.

Geologist's log of Army well 3

	Thickness (feet)	Depth (feet)
Alluvium		
Sand, gravel, and silt; very pale orange and dark gray; consisting of dolomite (dark gray, fine to medium grained, subangular to round) and quartzite (rose, subangular) with minor amounts of argillite (medium gray to green, subround to round), and chert (white, subangular); calcium-carbonate coatings common; matrix, calcareous silt (very pale orange). . .	30	30
Similar, but with addition of a minor amount of basalt	40	70
Sand, gravel, and silt; very pale orange and dark gray; consisting of quartzite (rose to pale purple, subangular to subround) with abundant dolomite (dark gray, fine grained, subangular to round) and minor amounts of chert, argillite, and basalt; calcium-carbonate coatings sparse; matrix, calcareous silt (very pale orange)	120	190
Sand, silt, and gravel; very pale orange to dark gray; composed of quartzite (rose to pale purple, subangular to subround) with abundant dolomite (dark gray, fine grained) and minor amounts of		

Geologist's log of Army well 3--Continued

	Thickness (feet)	Depth (feet)
limestone, chert, and argillite; calcium-carbonate coatings sparse; matrix, calcareous silt (very pale orange)	130	320
Similar, but with the addition of a minor amount of basalt	30	350
Sand and gravel; very pale orange to dark gray; composed of dolomite (dark gray, fine to medium grained) with abundant quartzite (rose to pale purple, subangular to subround) and minor amounts of limestone, chert, and argillite; calcium-carbonate coatings sparse; matrix, calcareous silt (very pale orange)	30	380
Bedrock		
Tuff, crystal, friable; pinkish gray to light brownish gray; composed of quartz and feldspar crystals (medium to fine sand, euhedral to subhedral) with a moderate amount of magnetite and biotite; matrix, calcareous silt (very pale orange to pale yellowish brown)	450	830

Army well 6A (66-69)

Army well 6A, also known as the Riess well from the name of the Army's consultant for the job, was intended for supplying water for Camp Desert Rock, an Army Post. It is in the same valley as the camp, and is about 6 miles south of Mercury. The Nevada State Coordinates of the site are N 665,641 and E 690,214, and the land-surface altitude at the well is 3,445 feet.

The well was drilled to a depth of 1,253 feet in 1955 by the Allen Water Well Co. It is cased with 12-inch casing from the surface to 1,185 feet and with 10-inch casing from 1,157 to 1,228 feet. The 10-inch casing is perforated in the interval from 1,157 to 1,228 feet. The yield of the well was only 1 to 2 gallons per minute. This was too little to fulfill the needs of the camp and the well was abandoned.

The well penetrated 30 feet of alluvium underlain by quartzite, limestone, and siltstone.

The static water level in the well in January 1960 was 1,031 feet below the land surface.

Geologist's log of Army well 6A

By James Huber

	Thickness (feet)	Depth (feet)
Alluvium		
Sand, gravel, and silt; pale orange; consisting of quartz, quartzite, and fine-grained igneous rock; matrix, silt	30	30
Bedrock		
Quartzite; brownish gray and olive gray; consisting of quartzite with minor amounts of iron oxide, mica, and feldspar	510	540
Limestone; light grayish red; consisting of medium-grained limestone, some coated with iron oxide	10	550
Quartzite; medium olive gray and medium brownish gray; containing fine- to medium-grained quartzite with minor amounts of ferromagnesian minerals and mica	120	670
Sandstone; grayish red; fine-grained sandstone, metamorphosed, calcareous	20	690
Quartzite; light brownish gray; quartzite with minor amounts of magnetite, mica, and iron oxide	140	830
Siltstone; light grayish red; fine-grained siltstone, metamorphosed, laminated bedding . . .	70	900

Geologist's log of Army well 6A--Continued.

	Thickness (feet)	Depth (feet)
Quartzite and siltstone; grayish red; fine-grained quartzite and laminated siltstone . .	60	960
Limestone; very pale orange; containing oolites (1 mm) cemented with calcium carbonate . . .	20	980
Quartzite; reddish brown and greenish gray; fine-grained quartzite with minor amounts of mica and magnetite, some iron-oxide coating	200	1,180
Siltstone; light greenish gray; fine-grained siltstone, metamorphosed	40	1,220
Quartzite; light greenish gray; fine-grained quartzite	30	1,250

Bureau of Land Management well (66-72)

The Bureau of Land Management well is in the western part of Indian Spring Valley about 8 miles southeast of Mercury. The Nevada State Coordinates of the site are N 662,361 and E 728,800, and the land-surface altitude at the well is 3,647 feet.

J. L. Hogen drilled the well by the cable-tool method in 1951. The well was abandoned as a dry hole at a depth of 587 feet because of a shortage of funds.

Driller's log of the Bureau of Land Management well

	Thickness (feet)	Depth (feet)
Gravel; black, cemented	300	300
Sand and clay; yellow	4	304
Gravel; black, cemented	176	480
Lime rock; yellow, sandy	60	540
Lime rock; red, sandy	5	545

Army well 1 (67-68)

Army well 1, also known as Army 6B, was intended for supplying water to Camp Desert Rock, an Army post. It is in the same valley as the camp and is about 6 miles southwest of Mercury. The Nevada State Coordinates of the site are N 670,800 and E 683,700, and the land-surface altitude at the well is about 3,110 feet.

The well was drilled in 1958 by the McKinney Drilling Co., using the cable-tool method. It is 620 feet deep and is uncased except for a few feet of surface pipe. Drilling was stopped when dolomite was penetrated because the Army's consultant believed that the dolomite contains no water.

The hole penetrated alluvium from the surface to 360 feet, tuff from 360 to 515 feet, alluvium from 515 to 610 feet, and dolomite from 610 feet to the bottom at 620 feet.

The alluvium is of Quaternary and/or Tertiary age and consists principally of fine- to medium-grained dolomite and quartzite fragments in a matrix of calcareous silt.

The bed of tuff is thought to be correlative with the Oak Spring Formation of Tertiary age. It is friable and is composed of fragments of pumice and crystals of quartz, feldspar, and biotite.

The dolomite is dark gray and is fine- to medium-grained. It is similar in mineralogy, texture, and color to outcrop samples of dolomite of Upper Cambrian age (Windfall Formation) obtained 1 mile west of the test hole.

Geologist's log of Army well 1

	Thickness (feet)	Depth (feet)
Alluvium		
Sand, silt, and gravel; pinkish gray and pale purple; composed of quartzite (rose to purple, subangular to subround) and minor amounts of argillite (green to brown, round to subround), mica schist (sub-round), and chert (white, subangular to round); matrix, calcareous silt (very pale orange)	40	40
Similar, but many of the quartzite grains partially coated with calcium carbonate . . .	30	70
Sand, silt, and gravel; pinkish gray to yellowish gray and pale purple; composed of quartzite (rose to pale purple, angular to subround) with minor amounts of argillite, chert, basalt (black, subangular), and tuff (pinkish gray, calcareous); many quartzite grains partially covered with calcium-carbonate; matrix, calcareous silt (very pale orange) . .	35	105
Sand, silt, and gravel; pinkish gray to yellowish gray; consisting of quartzite (rose to pale purple, angular to subround) and minor amounts of dolomite (dark gray,		

Geologist's log of Army well 1--Continued

	Thickness (feet)	Depth (feet)
medium to fine grained, angular to subround), crystal tuff, calcium-carbonate fragments, mica schist, chlorite schist, and argillite; many quartzite and dolomite grains covered with calcium carbonate; matrix, calcareous silt (very pale orange)	35	140
Similar, but with calcium carbonate partially coating most dolomite and quartzite grains . .	55	195
Sand, silt, and gravel; pinkish gray to dark gray; composed of quartzite (rose to pale purple, angular to subround) and dolomite (dark gray, medium to fine grained) with minor amounts of argillite, tuff, and chert; calcium-carbonate coatings sparse; matrix, calcareous silt (very pale orange)	70	265
Sand, gravel, and silt; light gray to dark gray; unconsolidated; composed primarily of dolomite (light to dark gray, medium to fine grained) with abundant quartzite and minor amounts of chert, argillite and tuff; calcium-carbonate coatings sparse; matrix, calcareous silt (very pale orange) . .	95	360

Geologist's log of Army well 1--Continued.

	Thickness (feet)	Depth (feet)
Bedrock		
Tuff, pumiceous, friable; grayish-orange pink to pinkish gray; fine to medium grained; composed of fragments of pumice (white to grayish-orange pink, subangular to subround, 0.1 to 0.4 mm, some calcareous) with numerous crystals of quartz and feldspar (euhedral to subhedral) and moderate amounts of biotite (0.05 to 0.1 mm), amphibole, and magnetite; matrix, calcareous silt (very pale orange)	110	470
Tuff, crystal, friable; pale pink to pinkish gray, fine to medium grained; composed principally of crystals of quartz and feldspar (medium to fine sand, euhedral to subhedral), with a moderate amount of pumice fragments, biotite, magnetite, and amphibole; matrix, calcareous silt (very pale orange)	45	515
Sand, gravel, and silt; medium light gray to dark gray and pale pink; composed principally of dolomite (dark gray, medium to fine grained, subangular to angular), with		

Geologist's log of Army well 1--Continued.

	Thickness (feet)	Depth (feet)
abundant fragments of crystal tuff (pale pink), minor amounts of quartzite, chert, and argillite; calcium-carbonate coatings sparse; matrix, calcareous silt (very pale orange)	95	610
Bedrock (Upper Cambrian (?))		
Dolomite, dark gray; fine to medium grained . . .	5	615
Similar, but with minor amount of calcite (white, rhombohedral)	5	620

Army well 6 (68-69)

Army well 6 was intended for supplying water to Camp Desert Rock, an Army post. It is in the same valley as the camp and is about 3 miles southwest of Mercury. The Nevada State Coordinates of the site are N 680,800 and E 690,500 and the land-surface altitude of the well is 3,256 feet.

The well was drilled in 1951 by the McKinney Drilling Co., using the cable-tool method. It is 1,220 feet deep. The static water level in the well in October 1951 reportedly was 975 feet below the land surface. The yield reported by the driller was only 3 gallons per minute. The well was abandoned because the water was of poor chemical quality.

Drillers' log of Army well 6

	Thickness (feet)	Depth (feet)
Gravel, cemented	111	111
Clay, sand, and gravel	191	302
Sand, clay, and rhyolite	598	900
Sand and clay	320	1,220

Well J-12 (73-58)

Well J-12 was drilled to supply water for operations of the Atomic Energy Commission in Jackass Flat. It is in Jackass Flat about 23 miles northwest of Mercury. The Nevada State Coordinates of the site are N 733,509 and E 581,011 and the land-surface altitude at the well is 3,128 feet.

The well was drilled in 1957 by the Perry Drilling Co., using the cable-tool method. It is 887 feet deep and is cased from the surface to the bottom with 12 3/4-inch casing, which in the interval from 793 to 868 feet is perforated.

The yield of the well during a 2-hour pumping test was reported to be 380 gallons per minute with only 4 feet of drawdown. The specific capacity was 95 gallons per minute per foot of drawdown. The well was put in service in June 1960.

Details of construction and test pumping are given in reports prepared in 1959 and 1961 by the Burns and McDonnell Engineering Co., Kansas City, Mo.

The well penetrated alluvium from the surface to 515 feet and tuff from 515 to 887 feet. An electrical log of the well is given in figure 2.

The static water level in the well in January 1960 was 741.4 feet below the land surface.

Geologist's log of well J-12

By George E. Walker

	Thickness (feet)	Depth (feet)
Alluvium		
Sand and gravel; very pale brown to yellowish brown; consisting of sedimentary tuff (pale red to very pale orange), silicified tuff (light brown to pale yellowish brown), and crystals of quartz and feldspar (clear to pink) with minor amounts of argillite (light gray) welded tuff (brown and pale red), felsite (medium gray to light brownish gray), perlite (light gray), and glass (black) . . .	515	515
Bedrock		
Tuff, welded; pale red; consisting of flattened pumice 40 percent, crystals of quartz and feldspar 20 percent with minor amounts of black pumice, hornblende, and lithics	35	550
Tuff, welded; grayish red; consisting of flattened pumice 60 percent, and crystals of quartz and feldspar 10 percent with minor amounts of black pumice, and lithics; some manganese-oxide coatings	10	560

Geologist's log of J-12--Continued

	Thickness (feet)	Depth (feet)
Tuff, pumiceous; grayish orange; consisting of pumice (pale orange pink) 65 percent, and crystals of quartz and feldspar 30 percent with minor amounts of black pumice and lithics . . .	30	590
Tuff, vitrophyre; grayish red; consisting of pitchstone (grayish red), pumice with shards, and crystals of quartz and feldspar 30 percent with a minor amount of biotite and lithics	20	610
Tuff, vitrophyre; grayish black; consisting of obsidian (grayish black), pitchstone (pale orange, as streaks in obsidian), crystals of quartz and feldspar 30 percent, and biotite 5 percent . .	20	630
Tuff, welded (altered); pale red to pinkish gray; consisting of elongated pumice (some altered) 30 to 45 percent and crystals of quartz and feldspar 15 to 45 percent with minor amounts of biotite and lithics	100	730
Tuff, welded (altered); pinkish gray; consisting of flattened pumice (altered, some eutaxitic structure) and crystals of quartz and feldspar with minor amounts of biotite and lithics . . .	150	880
Not recorded, probably tuff	7	887

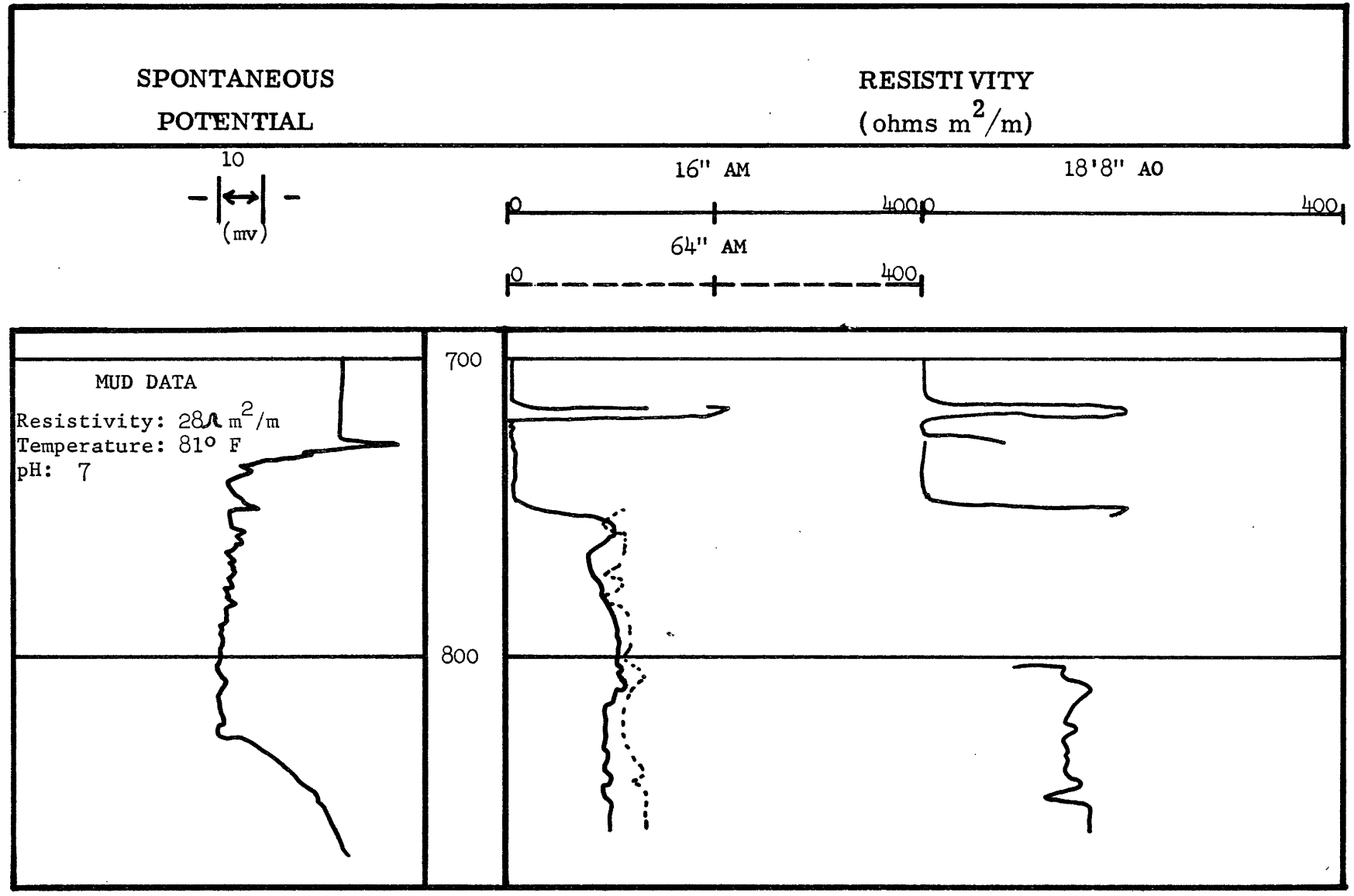


FIGURE 2. --ELECTRICAL LOG OF WELL J-12.

Well J-11 (73-61)

Well J-11 was intended for supplying water for operations of the Atomic Energy Commission in Jackass Flat. It is in Jackass Flat about 19 miles northwest of Mercury. The Nevada State Coordinates of the site are N 738,968 and E 611,764 and the land-surface altitude at the well is 3,445 feet.

The well was drilled in 1957 by the Perry Drilling Co., using the cable-tool method. It is 1,329 feet deep and is cased with 12 3/4-inch casing from the surface to 1,327 feet. Casing in the intervals from 1,077 to 1,097 and 1,244 to 1,300 feet is perforated. The yield during a 4-day pumping test was reported as 105 gallons per minute with a 40-foot drawdown. The specific yield was 2.6 gallons per minute per foot of drawdown.

The well penetrated alluvium from the surface to 1,025 feet, basalt from 1,025 to 1,150 feet, and tuff from 1,150 to 1,329 feet. An electrical log of the well is given in figure 3.

The static water level in the well in January 1958 was 1,037.5 feet below the land surface.

Geologist's log of well J-11

By George E. Walker, Isaac J. Winograd, and John E. Moore

	Thickness (feet)	Depth (feet)
Alluvium		
Sand and gravel; yellowish brown; consisting of sedimentary tuff (moderate reddish orange to pinkish gray, with calcareous cement) and quartz and feldspar crystals with minor amounts of argillite (brownish gray), chert (very pale orange), glass (black), gray perlite, biotite, and basalt	400	400
Sand and gravel; moderate yellowish brown; consisting of sedimentary tuff (very pale orange to yellowish gray) silicified tuff (moderate orange pink to grayish-orange pink), and quartz and feldspar crystals with minor amounts of argillite (pale brown and orange pink), glass (pale olive), and basalt (brownish black)	625	1,025
Bedrock		
Basalt, aphanitic; medium gray to medium dark gray; containing irregular to tubular grains (white, calcareous, hardness < 5, possible calcite amygdules) 15 to 30 percent and brown limonite 2 to 4 percent	45	1,070

Geologist's log of well J-11--Continued

	Thickness (feet)	Depth (feet)
Basalt, aphanitic; medium gray to medium dark gray; contains amygdules (some coated with a soft white mineral), limonite, olivene (translucent, greenish yellow), and crystals of calcite and quartz	80	1,150
Tuff, partially welded (porous); pinkish gray and some pale red; quartz and feldspar crystals 20 percent, and abundant glass shards (light gray) with traces of lithics embedded in a glassy matrix (altered)	105	1,255
Tuff, crystal-pumiceous, bedded; grayish orange pink; composed of quartz and feldspar crystals, lithics, and pumice with minor amounts of biotite	25	1,280
Tuff, vitrophyre; grayish black and some grayish red; consisting of obsidian (grayish black), pitchstone (pale orange, as streaks in obsidian), crystals of quartz and feldspar 30 percent, and biotite 5 percent	40	1,320
Tuff, welded; light red; composed of quartz and feldspar crystals 15 percent, pumice, and shards with minor amounts of biotite, magnetite, and hornblende	9	1,329

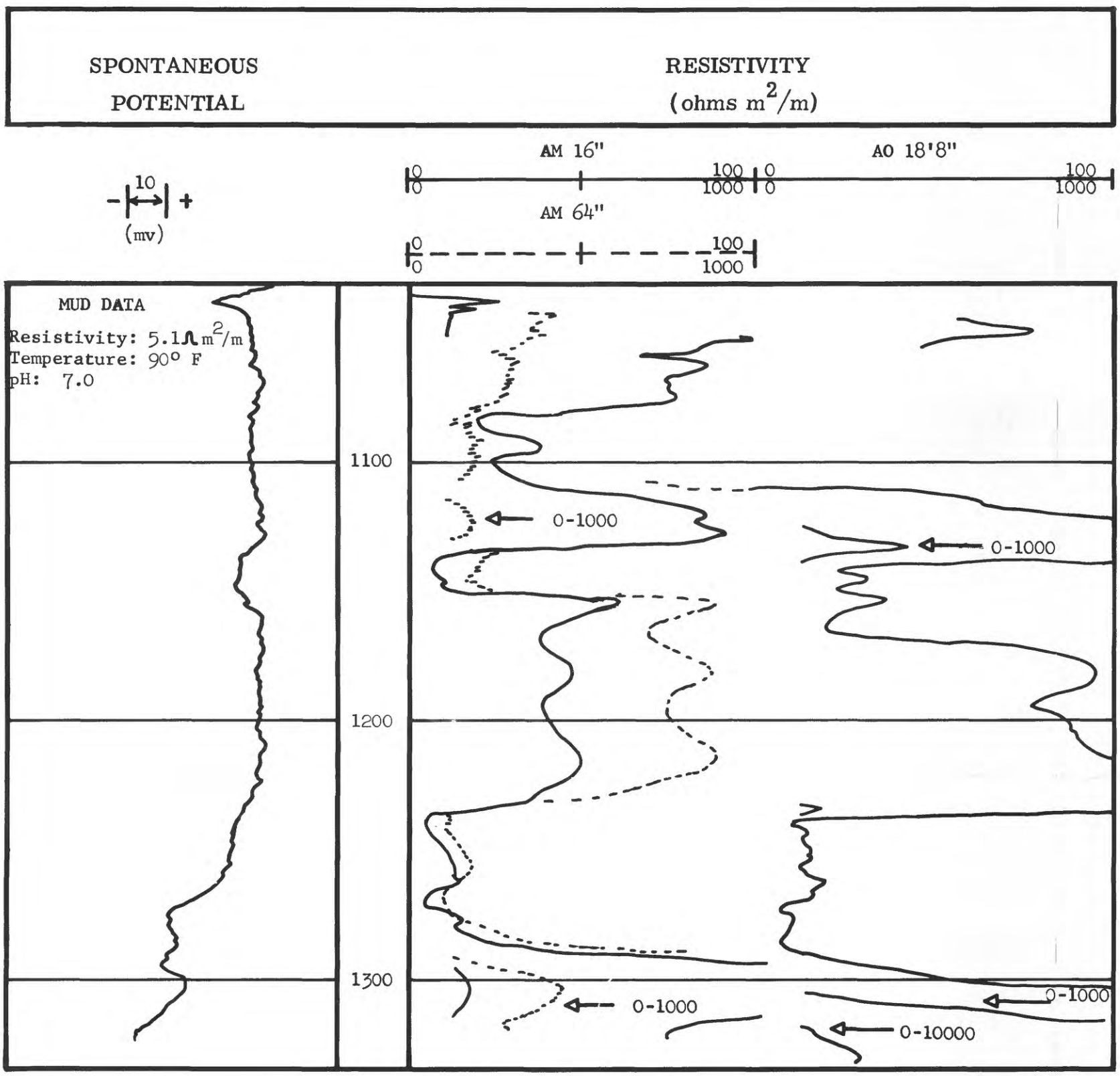


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FIGURE 3.--ELECTRICAL LOG OF WELL J-11.

Test well 5 (73-69)

Test well 5 was intended for supplying water for activities of the Atomic Energy Commission at the Nevada Test Site. It is in Frenchman Flat about 8 miles north of Mercury. The Nevada State Coordinates of the site are N 734,799 and E 690,124, and the land-surface altitude at the well is 3,233 feet.

The well was drilled in 1950 by the McKinney Drilling Co., using the cable-tool method. It is about 12 inches in diameter and is 461 feet deep, and is cased with 12-inch casing to a depth of only 8 feet. The well was abandoned as a dry hole after penetrating 134 feet of alluvium underlain by 327 feet of tuff.

A gamma-ray log run in test well 5 suggests that the alluvium-bedrock contact is at 90 feet (Winograd, personal communication).

Drillers' log of test well 5

	Thickness (feet)	Depth (feet)
Alluvium		
Gravel and sand; gray-brown	34	34
Sand and gravel; gray-brown	31	65
Sand and gravel; gray, cemented	69	134
Bedrock		
Tuff, soft; shades of red, brown, and gray . .	327	461

Well 1 (75-72)

Well 1 was intended for supplying water for activities of the Atomic Energy Commission at the Nevada Test Site. It is in Frenchman Flat about 12 miles northeast of Mercury. The Nevada State Coordinates of the site are N 751,509 and E 723,349 and the land-surface altitude at the well is 3,100 feet.

The well was drilled in 1950 by the McKinney Drilling Co., using the cable-tool method. It is 870 feet deep and is cased with 8-inch casing from the surface to 801 feet. Casing in the interval 602 to 801 feet is perforated. The yield during a 30-minute pumping test was reported as 50 gallons per minute with a 38-foot drawdown. The specific capacity was 1.3 gallons per minute per foot of drawdown. An attempt to increase the yield by dynamiting the well proved unsuccessful and the well was abandoned.

The static water level in the well in December 1950 was reported as 714 feet below the land surface.

Drillers' log of well 1

Compiled by Reynolds Electrical and Engineering Co., Inc.

	Thickness (feet)	Depth (feet)
Fine and coarse gravel with some brown silt	358	358
Silty sand with fine and medium gravel	161	519
Silty, sandy gravel	24	543
Silty sand with fine gravel	157	700
Medium to fine gravel (with lenses of coarse gravel), partly cemented	170	870

Test well 4 (76-68)

Test well 4 was intended for supplying water for activities of the Atomic Energy Commission at the Nevada Test Site. It is in Frenchman Flat about 13 miles north of Mercury. The Nevada State Coordinates of the site are N 763,910 and E 689,551 and the land-surface altitude at the well is 3,405 feet.

The well was drilled in 1950 by the McKinney Drilling Co., using the cable-tool method. It is cased with 12-inch casing to a depth of only 8 feet. The well was abandoned as a dry hole at 172 feet.

Drillers' log of test well 4

	Thickness (feet)	Depth (feet)
Silt, sand, and gravel; brown	10	10
Sand, gravel, and silt; brown	105	115
Sand and gravel; partly cemented	14	129
Andesite; gray and reddish brown; hard	43	172

Gravity high test hole 2 (83-67)

Gravity high test hole 2 was drilled in 1959 to determine the depth to bedrock where a gravity survey had indicated the bedrock to be close to the surface. It was not intended to develop a water supply. The site is in the northern part of Yucca Flat about 2 miles southwest of the B-J junction of the Mercury highway. The Nevada State Coordinates of the site are N 834,800 and E 671,650 and the land-surface altitude at the hole is about 4,120 feet.

The hole was drilled in 1959 by the Geological Survey, using the rotary-hydraulic method, to a depth of only 92 feet. It penetrated alluvium from the surface to 72 feet, and limestone and shale from 72 feet to the bottom. The limestone has been identified tentatively as belonging to the lower part of the Pogonip Group. Only rotary cuttings were available for the interval from 0 to 72 feet and these were not described in detail because the objective was the underlying bedrock. The log, therefore, consists chiefly of a description of the 20 feet of core taken from the bedrock.

Geologist's log of Gravity high test hole 2

By F. M. Byers, Jr.

	Thickness (feet)	Depth (feet)
Alluvium		
Alluvial fill, possibly with some weathered bedrock	72	72
Bedrock (Pogonip Group(?))		
Limestone, medium bluish-gray and slightly darker, (mottled and streaked with pale yellowish brown); few exposed shaly partings parallel to and within 1/2 inch of bedding surfaces (yellowish gray to pale olive); bedding surfaces make angle of 15° to 20° with horizontal; some surfaces wavy, suggestive of ripple marks; indistinct tribolite and graptolite (?) fragments . . .	15 (?)	87 (?)
Limestone, medium gray to pale yellowish-brown; finely granular; many randomly oriented white calcite-filled fractures, increasing toward base of unit.	4 (?)	91 (?)
Shale or siltstone, calcareous; pale greenish yellow with sparse dark yellowish orange; stain on broken (fracture) surface; shaly parting poor.	1 (?)	92 (?)

Gravity high test hole 1 (87-66)

Gravity high test hole 1 was drilled in 1959 to determine the depth to bedrock where a gravity survey had indicated the bedrock to be close to the surface. It was not intended to develop a water supply. The site is in the northern part of Yucca Flat about 6 miles northwest of the B-J junction of the Mercury highway. The Nevada State Coordinates of the site are N 873,000 and E 662,700 and the land surface altitude at the hole is about 4,440 feet.

The hole was drilled in 1959 by the Geological Survey, using the rotary-hydraulic method, to a depth of 145 feet. It penetrated alluvium from the surface to 130 feet and dolomite from 130 to 145 feet. Only rotary cuttings were available for the interval from 0 to 130 feet, and these were not described in detail because the objective in drilling the hole was to locate the underlying bedrock. The log, therefore, consists mainly of description of the 15 feet of bedrock core.

Geologist's log of Gravity high test hole 1

By F. M. Byers, Jr.

	Thickness (feet)	Depth (feet)
Alluvium		
Alluvial fill	130	130
Bedrock (Bonanza King Formation)		
Dolomite-pebble conglomerate; calcareous, sandy; pebbles of medium gray to medium-light gray dolomite; matrix, yellowish gray, calcareous and sandy	1	131
Dolomite; medium gray to medium-dark gray; fractured; cryptocrystalline to finely crystalline	1	132
Dolomite; light gray to medium-light gray; in fine laminations 0.5 to 2.0 mm (cryptocrystalline, dip 25° to 30°) high-angle fractures dip 60° to 70° at high angle to laminae; few vague and indistinct low-angle fractures; fractures filled with finely crystalline calcite	3	135
Dolomite; medium-light gray, in fine laminations, slightly calcareous, cryptocrystalline; fractures as above; laminae dip 35°.	3	138
Dolomitic limestone; medium-light gray, medium gray, and medium-dark gray; laminations 0.5 to 5 mm (medium to medium-dark gray laminae predominate and are less dolomitic, darker gray laminae		

Geologist's log of Gravity high test hole 1.--Continued

	Thickness (feet)	Depth (feet)
omit strong fetid odor when struck with hammer) subparallel high-angle fractures 60° to 70°; laminae somewhat irregular; dip 27° to 35°	4	142
Dolomite, light gray to medium light gray; few laminae yellowish gray; cryptocrystalline . . .	0.5	142.5
Dolomitic limestone; medium gray, highly fractured; no laminae visible	0.5	143
Dolomite; light olive gray, light yellowish gray near fractures; indistinct laminae (highly fractured, cryptocrystalline); fractures filled with finely crystalline dolomite	1	144
Dolomitic limestone; medium-light gray to medium gray, some laminae light olive gray; cryptocrystalline; laminae dip 34° to 37°	1	145

Effinger well 4 (88-64-a)

Effinger well 4 was intended for supplying water for activities of the Atomic Energy Commission at the Nevada Test Site and for determining the depth to bedrock. It is in the northern part of Yucca Flat about 11 miles northwest of the B-J junction of the Mercury highway. The Nevada State Coordinates of the site are N 886,025 and E 643,216 and the land-surface altitude at the well is 5,603 feet.

The well was drilled in 1959 by the Effinger Drilling Co., using the cable-tool method. It is cased with 5 5/8-inch casing from the surface to 70 feet. The well was abandoned as a dry hole at 76 feet.

The well penetrated alluvium from the surface to 65 feet and tuff from 65 to 76 feet.

Geologist's log of Effinger well 4

By Charles E. Price

	Thickness (feet)	Depth (feet)
Alluvium		
Sand, gravel, and silt; pale grayish orange; tuff (yellow and some red) 70 percent, colorless crystals 10 percent, quartzite (light colors) 10 percent and dolomite (medium to dark gray) 10 percent	35	35
Sand, gravel, and silt; pale grayish orange; tuff (yellow and some red) 85 percent, crystals (colorless, transparent) 5 percent, quartzite (light colors) 5 percent and dolomite (medium to dark gray) 5 percent . . .	30	65
Bedrock		
Tuff; medium yellowish orange; tuff (slightly calcareous) 95 percent and crystals (colorless, transparent) 5 percent	11	76

Effinger well 2 (88-64-b)

Effinger well 2 was intended for supplying water for activities of the Atomic Energy Commission at the Nevada Test Site and for determining the depth to bedrock. It is in the northern part of Yucca Flat about 11 miles northwest of the B-J junction of the Mercury highway. The Nevada State Coordinates of the site are N 886,283 and E 643,089 and the land-surface altitude at the well is 5,598 feet.

The well was drilled in 1959 by the Effinger Drilling Co., using the cable-tool method. It is cased with 6-inch casing from the surface to 10 feet. The well was abandoned as a dry hole at 80 feet.

The hole penetrated alluvium from the surface to 40 feet, and argillite and quartzite from 40 to 80 feet.

Geologist's log of Effinger well 2

By Charles E. Price

	Thickness (feet)	Depth (feet)
Alluvium		
Sand, silt, and gravel; pale yellowish orange grading to light yellowish gray at bottom; consisting of tuff (red and yellow hues, calcium-carbonate cement) 70 percent, crystals (transparent, colorless) 5 percent, and dolomite (medium to dark gray) 25 percent	40	40
Bedrock (Eleana Formation)		
Argillite and quartzite; yellowish gray; consisting of argillite and quartzite (fine grained, some white quartz fracture fillings) 90 percent; iron oxide stains on fracture surfaces	40	80

Effinger well 1 (88-65)

Effinger well 1 was intended for supplying water for activites at the Atomic Energy Commission at the Nevada Test Site and for determining the depth to bedrock. It is in the northern part of Yucca Flat about 10 miles northwest of the B-J junction of the Mercury highway. The Nevada State Coordinates of the site are N 888,562 and E 650,404 and the land-surface altitude at the well is 5,152 feet.

The well was drilled in 1959 by the Effinger Drilling Co., using the cable-tool method. It is cased with 6-inch casing from the surface to 10 feet. The well was abandoned as a dry hole at 180 feet.

The hole penetrated alluvium from the surface to 165 feet and quartzite from 165 to 180 feet.

Geologist's log of Effinger well 1

By Charles E. Price

	Thickness (feet)	Depth (feet)
Alluvium		
Sand, gravel, and silt; pale gray to pale orange; consisting of tuff (red and greenish yellow) 40 percent, quarzite and argillite 35 percent, dolomite (dark gray, fine grained) 20 percent and crystals (colorless, transparent, less than 2 mm) 5 percent; coatings of calcite and dolomite on some fractures. . .	135	135
Sand, gravel, and silt; very pale orange grading to dark orange pink at the bottom; consisting of quartzite and argillite 50 percent, tuff (red, white and green) 40 percent, crystals (colorless, transparent) 5 percent and dolomite (dark gray) 5 percent	30	165
Bedrock (Eleana Formation)		
Quartzite; moderate orange pink to light brown; quartzite (white and red) 90 percent; dolomite (dark gray to black) 5 percent	15	180

Effinger well 3 (89-65-a)

Effinger well 3 was intended for supplying water for activities of the Atomic Energy Commission at the Nevada Test Site and for determining the depth to bedrock. It is in the northern part of Yucca Flat about 11 miles northwest of the B-J junction of the Mercury highway. The Nevada State Coordinates of the site are N 891,026 and E 652,714 and the land-surface altitude at the well is 5,032 feet.

The well was drilled in 1959 by the Effinger Drilling Co., using the cable-tool method. It is cased with 5 5/8-inch casing from the surface to 200 feet. The well was abandoned as a dry hole at 202 feet.

The hole penetrated alluvium from the surface to 190 feet and argillite from 190 to 202 feet.

Geologist's log of Effinger well 3

By Charles E. Price

	Thickness (feet)	Depth (feet)
Alluvium		
Sand, gravel, and silt; pale grayish orange to very pale orange; consisting of tuff (yellow and red hues) 75 percent, crystals (colorless, transparent) 10 percent, argillite and quartzite 10 percent and dolomite (gray) 5 percent	190	190
Bedrock (Eleana Formation)		
Argillite; dark reddish brown	12	202

Watertown well 2 (90-75)

Watertown well 2 was intended for supplying water for activities of the Atomic Energy Commission. It is in the central part of Emigrant Valley, and the Nevada State Coordinates are N 909,062 and E 752,226. The land-surface altitude at the well is 4,437 feet.

The well was drilled in 1955 by the Allen and Failing Co., using both cable-tool and rotary equipment. It is 1,091 feet deep and is cased with 12-inch casing from the surface to 346 feet, 10-inch casing to 804 feet, and 8-inch casing to 1,091 feet. The yield during a 30-minute pumping test was reported as 15 gallons per minute with a 26-foot drawdown. The specific capacity was 0.58 gallon per minute per foot of drawdown.

The well penetrated alluvium from the surface to 370 feet and tuff from 370 to 982 feet. The static water level in the well in October 1955 was reportedly at 896 feet below the land surface.

The log was prepared from samples collected by the driller. Only three samples were collected in the depth interval from 0 to 600 feet and these are inadequate for describing so large an interval. An electrical log of the well is given in figure 4.

Geologist's log of Watertown well 2

Summary of field log by Omar J. Loeltz and Glen T. Malmberg

	Thickness (feet)	Depth (feet)
Sampling inadequate for log preparation	600	600
Tuff; tan to gray; composed of fine- to medium-grained tuff, in part glassy . . .	100	700
Tuff, agglomerate; gray to green; consisting of glass shards and tuff	70	770
Tuff, agglomerate; gray to green; consisting of fine- to coarse-grained fragments of glassy tuff and agglomerate	101	871
Tuff, rhyolitic; tan to light gray; consisting of crystals of quartz and feldspar in a fine-grained rhyolitic matrix	48	914
Tuff; friable (?); fine grained; containing angular fragments of welded tuff, quartz and biotite	68	982
Not recorded	109	1,091

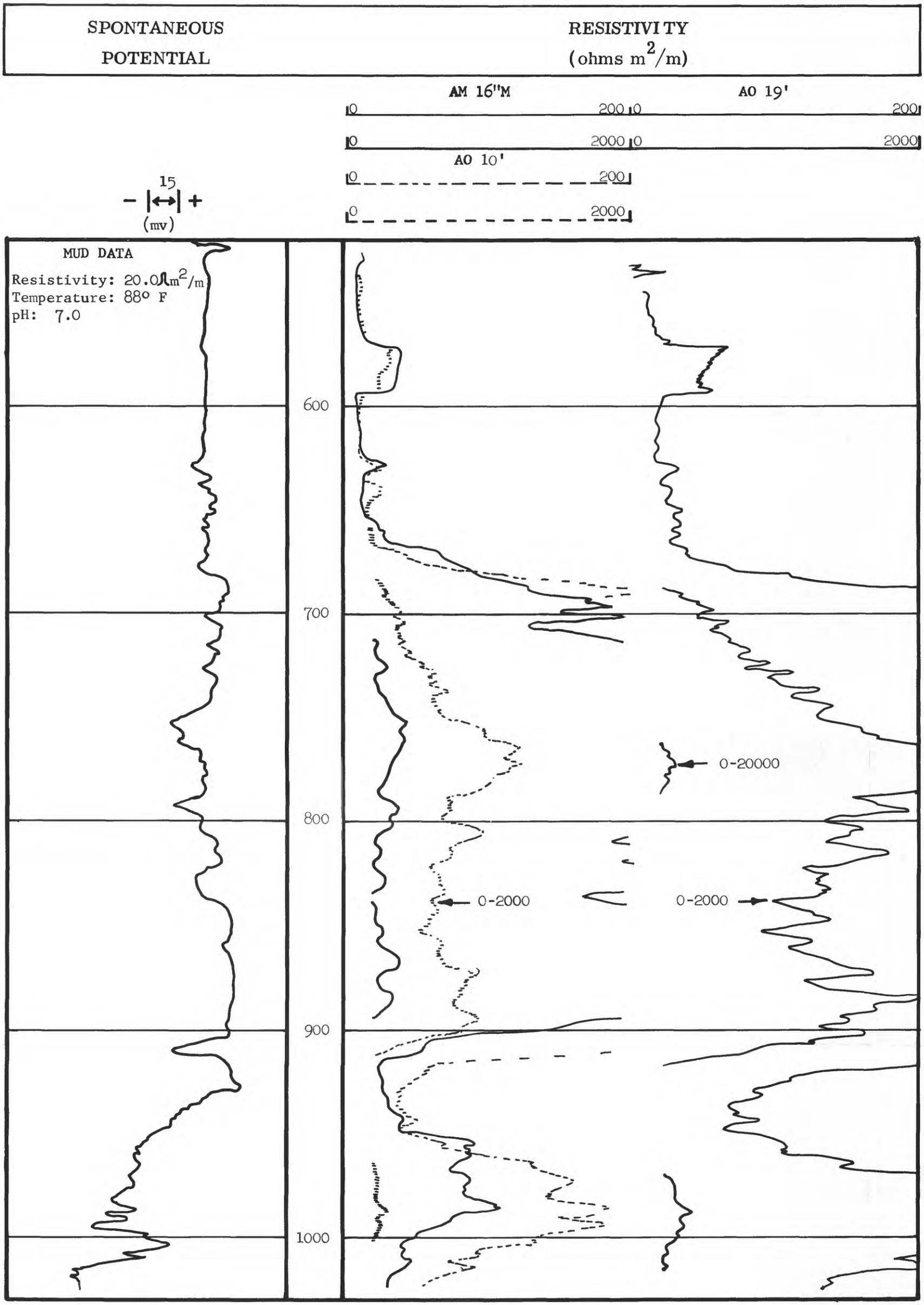

FIGURE 4. --ELECTRICAL LOG OF WATERTOWN WELL 2.

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