DATA FOR GROUND-WATER TEST HOLES IN FRESNO COUNTY, WESTERN SAN JOAQUIN VALLEY, CALIFORNIA, JUNE TO AUGUST 1985

By *Sherrill Beard* and *Julie Laudon*

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REGIONAL AQUIFER SYSTEM ANALYSIS

Prepared in cooperation with the

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CONVERSION FACTORS

In this report, some measurements are given in inch-pound units and some geophysical data are reported in International System of Units. Conversion factors from inch-pound units to International System of Units are listed below. To convert from International System of Units to inch-pound units multiply by the reciprocal of the conversion below.

Multiply	By	To obtain
acres	0.4047	square hectometers
inches (in.)	25.40	millimeters
feet (ft)	0.3048	meters
miles (mi)	1.609	kilometers

Temperature is reported in degrees Celsius (°C). To convert to degrees Fahrenheit (°F) use:

$$°F=1.8(°C)+32.$$

Sea Level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called mean sea level of 1929.

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ABSTRACT

Twenty-four test holes were drilled from June 3 to August 29, 1985, in the western San Joaquin Valley, California, to provide information about ground-water hydraulics and geochemistry. The study area is in western Fresno County, west of the San Joaquin River, and east of the Coast Range. Lithologic, hydrologic, and geophysical data were collected from test holes drilled at two cluster sites and at 13 additional sites. Both cluster sites have five cased test holes. A sixth test hole was drilled at one of the cluster sites but was destroyed. Each of the 10 cased test holes is perforated at a different 10-foot depth interval. Six of the 13 additional test holes were also cased. Lithology logs were constructed from descriptions of cuttings and cores recovered during drilling. Geophysical logs were made of the deepest hole at each cluster site. Initial water-level measurements were made at most sites.

INTRODUCTION

The presence of high selenium concentrations in shallow ground water in parts of the western San Joaquin Valley (Deverel and others, 1984) has caused concerns about the sources and distribution of selenium and its movement in the ground-water system. To address these concerns, the U.S. Geological Survey is conducting a comprehensive investigation of the hydrology and geochemistry of the San Joaquin Valley. The studies are being done in cooperation with the San Joaquin Valley Drainage Program and as part of the Regional Aquifer System Analysis Program of the U.S. Geological Survey. The studies include a test-drilling program to provide new data on geology, water levels, and ground-water chemistry.

The purpose of this report is to present a compilation of the data collected during the first part of the test-drilling program. The test drilling was done in western Fresno County in the area west of the San Joaquin River and Fresno Slough, and east of the Coast Range (fig. 1). Twenty-four test holes were drilled at 15 sites between June 3 and August 29, 1985. Data presented in this report include lithology logs, geophysical logs, and initial water-level measurements.

LOCATION AND PURPOSE OF TEST HOLES

Eleven of the 24 test holes are located at two cluster sites (fig. 1). Cluster sites are sites at which two or more wells are installed at different depths. Cluster site A has five cased test holes, plus one which was drilled but subsequently destroyed. Cluster site B has five cased test holes. The test holes at the cluster sites were drilled and cased to provide data from which to interpret vertical flow characteristics and variations in ground-water chemistry with depth. Thirteen additional test holes are single-hole sites (fig. 1). Of the 13, six were cased, one was cased but later destroyed, and six were backfilled with drill cuttings. Test holes were either cased if ground water was encountered, or backfilled with drill cuttings if the water table could not be reached. The test holes at the single-hole sites were drilled to assess geology, depth to ground water, and shallow ground-water chemistry.

WELL-NUMBERING SYSTEM

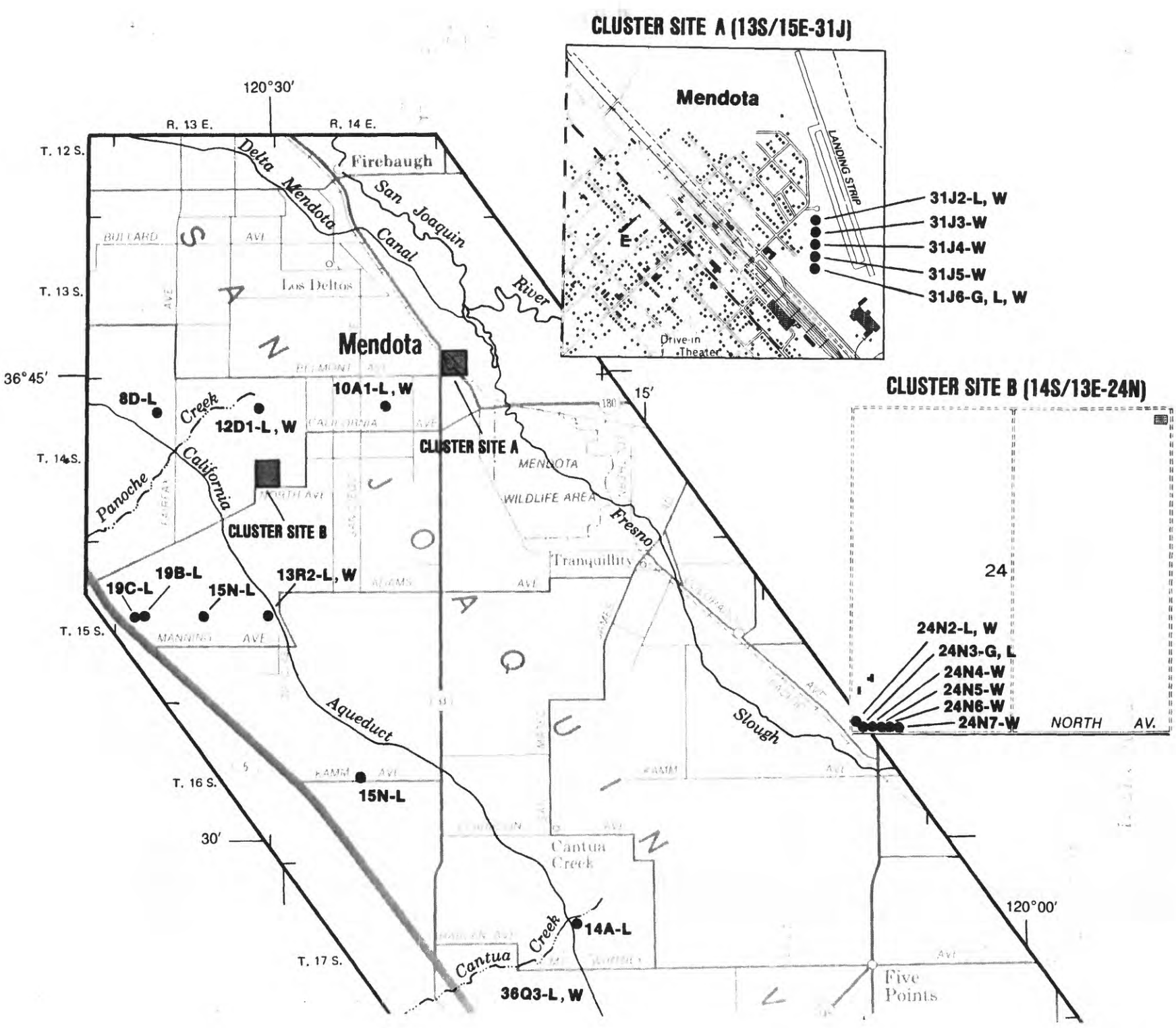
The well-numbering system used in California by the U.S. Geological Survey and the State of California indicates the location of wells according to the rectangular system for the subdivision of public lands. Their identification consists of a township number, north or south; the range number, east or west; and the section numbers. Each section is further divided into sixteen 40-acre tracts lettered consecutively (except I and O), beginning with A in the northeast corner of the section and progressing in a sinusoidal manner to R in the southwest corner. Within each 40-acre tract, wells are sequentially numbered in the order they are inventoried. The final letter in a well identification number refers to the base line and meridian. All wells in the study area are referenced to the Mount Diablo base line and Meridian (M). The following illustration shows how the well number 17S/15E-36Q3 is derived.

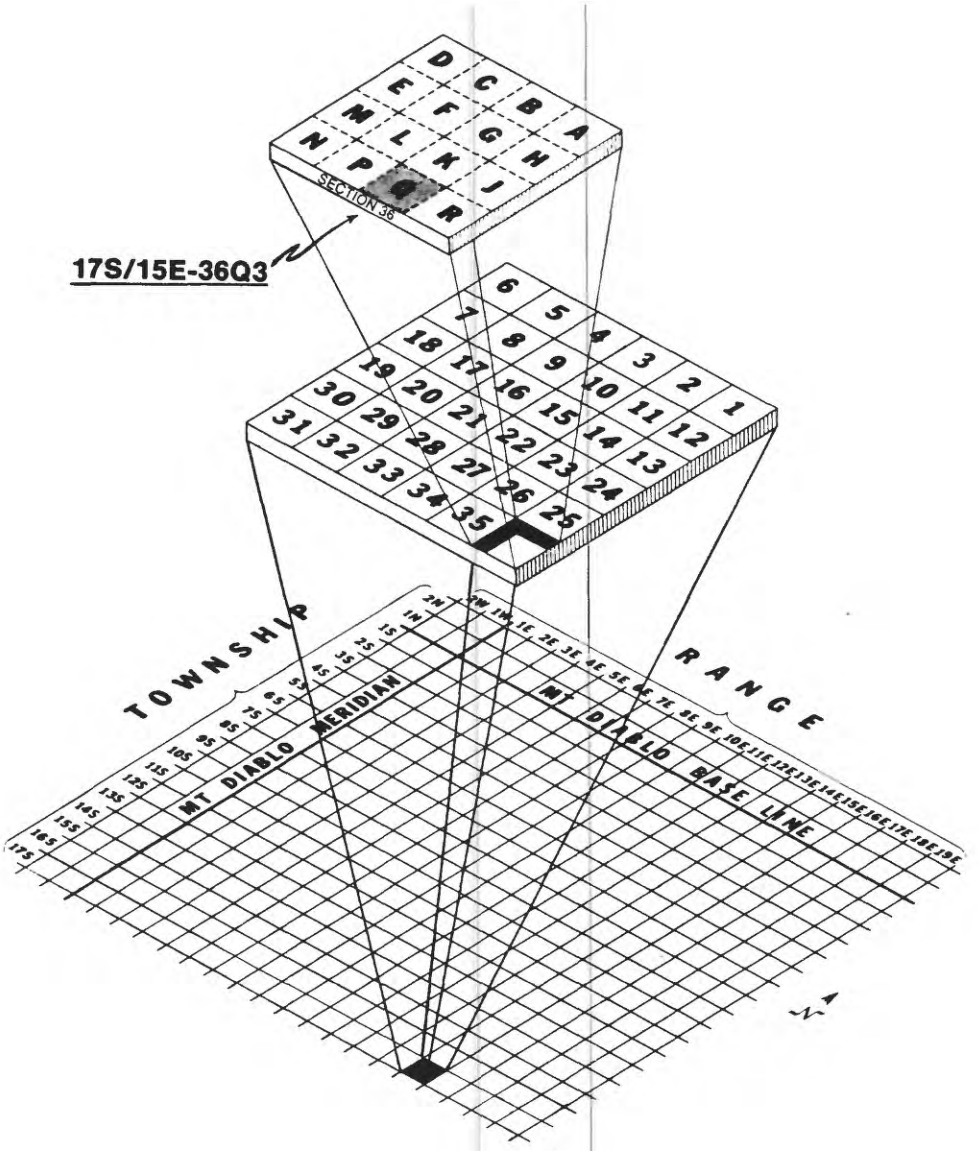
METHODS

Test-Hole Completion

Two procedures were used to drill and complete the test holes. Test holes at cluster sites were drilled by a mud rotary rig using a 12.75-inch bit. They were cased with 6-inch diameter, Certa-lok[1] polyvinyl chloride (PVC) well casing. Cluster site test holes have a

[1]The use of brand, firm, or trade names in this report is for identification purposes only and does not imply endorsement by the U.S. Geological Survey.


CLUSTER SITE A (13S/15E-31J)
Mendota
LANDING STRIP
31J2-L, W
31J3-W
31J4-W
31J5-W
31J6-G, L, W
Drive-in Theater
CLUSTER SITE B (14S/13E-24N)
24
24N2-L, W
24N3-G, L
24N4-W
24N5-W
24N6-W
24N7-W
NORTH AV.
120°30'
120°00'
36°45'
30'
15'
R. 13 E.
R. 14 E.
T. 12 S.
T. 13 S.
T. 14 S.
T. 15 S.
T. 16 S.
T. 17 S.
Firebaugh
Delta Mendota Canal
San Joaquin River
Los Deltos
Mendota
10A1-L, W
CLUSTER SITE A
8D-L
12D1-L, W
Panoche Creek
California Aqueduct
CLUSTER SITE B
MENDOTA WILDLIFE AREA
Fresno Slough
Tranquility
19B-L
19C-L
15N-L
13R2-L, W
15N-L
Cantua Creek
14A-L
Cantua Creek
36Q3-L, W
Five Points
SAN JOAQUIN VALLEY



WELL-NUMBERING SYSTEM

10-foot screened interval 5 feet above the bottom of the casing. The annulus is sand packed to the top of the screened interval and sealed with Volclay bentonite grout to land surface (see fig. 2). The test holes at single-hole sites were drilled by an auger rig using a standard 6-inch flight-auger bit. These are cased with 2-inch diameter, PVC well casing, and have a 5-foot, gravel-packed screen at the bottom. The annulus is backfilled with drill cuttings from 5 feet above the screened interval to land surface. All test holes are finished with a protective steel casing cover and locking cap, secured with a cement plug. Records of selected data and completion information for each test hole are shown in table 1, and the two types of well completion are illustrated in figure 2.

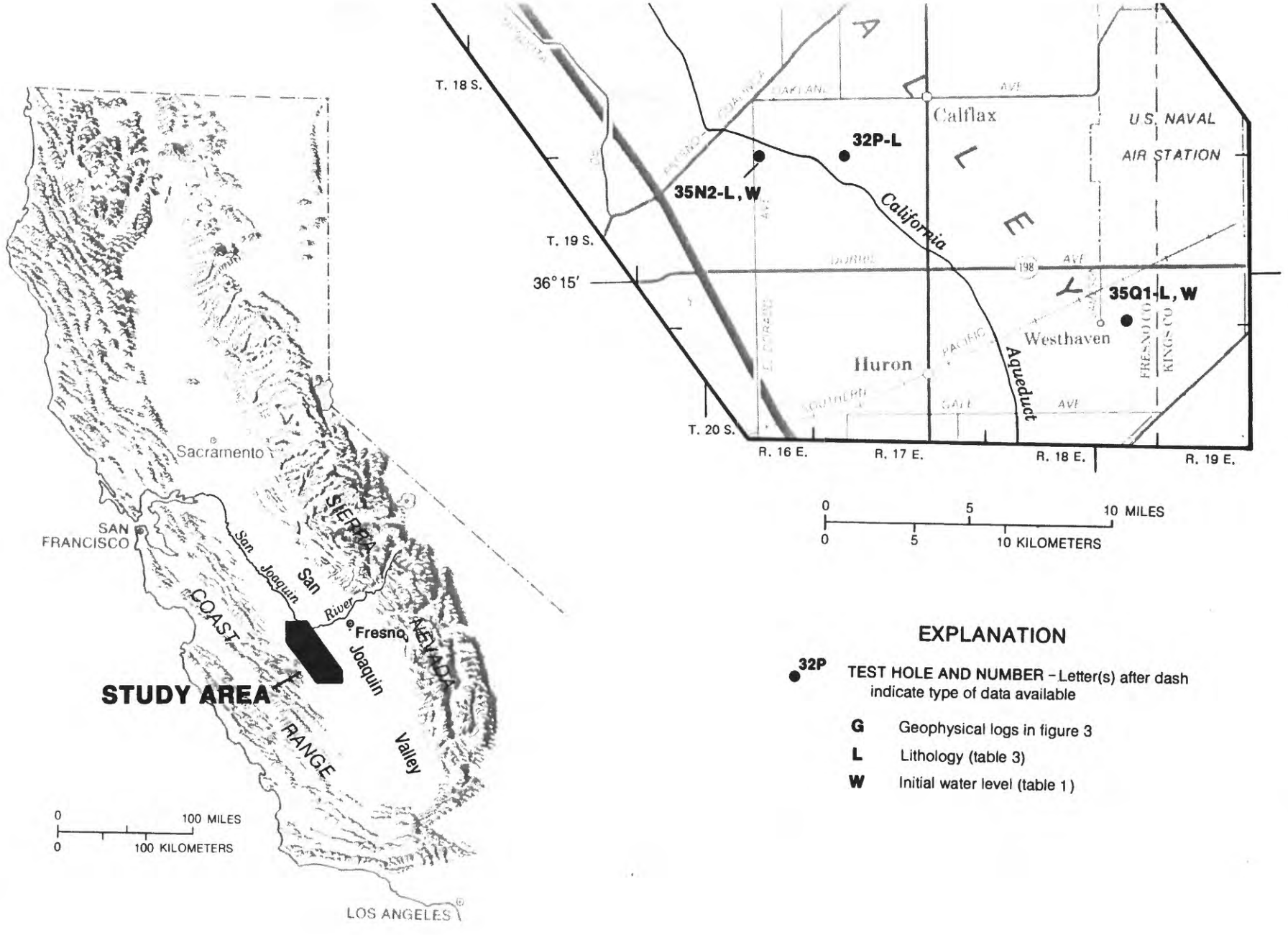


FIGURE 1. Location of the study area and ground-water test holes.

Table 1.--*Records of selected data and completion information for test holes*

[All wells were drilled in June, July, or August 1985; --, no data]

Location: See explanation of well-numbering system (page 2). Locations that end with numbers are also official State well numbers.

Drilling method: A, auger; R, rotary. Drilling mud was used in all rotary-drilled boreholes.

Total depth: Depth, in feet, below land surface.

Casing: There is 5 feet of blank casing below each screen interval in the rotary drilled holes.

Altitude of land surface: Datum is sea level. Surveyed altitudes are given in feet and decimal fractions; approximate altitudes interpolated from 7.5-minute topographic quadrangles are given in feet.

Water level: Initial water level, in feet, below land-surface datum.

Other data available: G, geophysical logs (fig. 3); L, lithology log (table 3).

Location	Drilling method	Total depth (feet)	Casing			Altitude of land surface (feet)	Date	Water level (feet)	Other data available	Comments
			Diameter (inches)	Depth (feet)	Screened interval (feet)					
13S/15E-31J2	A	27.5	2	27.5	22.5-27.5	151.3	8/22/85	21.0	L	--
-31J3	R	418	6	415	400-410	150.6	8/22/85	41.4	--	--
-31J4	R	70	6	70	55-65	151.1	8/22/85	21.9	--	--
-31J5	R	260	6	255	240-250	150.8	8/22/85	33.4	--	--
-31J6	R	500	6	495	480-490	151.7	8/22/85	90.1	G,L	--
14S/13E- 8D	A	49.0	--	--	--	315	--	--	L	Backfilled
-12D1	A	32.5	2	32.5	27.5-32.5	283	8/23/85	21.6	L	--
-24N2	A	67.0	2	67.0	62.0-67.0	279.4	8/23/85	60.2	L	--
-24N3	R	820	6	--	--	--	--	--	G,L	Destroyed
-24N4	R	845	6	812	797-807	278.8	8/23/85	261.0	--	--
-24N5	R	507	6	505	490-500	277.7	8/23/85	100.6	--	--
-24N6	R	114	6	114	99-109	277.9	8/23/85	57.2	--	--
-24N7	R	213	6	213	198-208	277.8	8/23/85	66.4	--	--
14S/14E-10A1	A	18.5	2	18.5	13.5-18.5	201	8/23/85	7.3	L	--
15S/13E-13R2	A	29.0	2	29.0	24.0-29.0	335	8/23/85	17.2	L	--
-15N	A	104.5	--	--	--	450	--	--	L	Backfilled
-19B	A	21.5	--	--	--	555	--	--	L	Backfilled
-19C	R	635	--	--	--	560	--	--	L	Destroyed
16S/14E-15N	A	71.0	--	--	--	440	--	--	L	Backfilled
17S/15E-14A	A	42.5	--	--	--	330	--	--	L	Backfilled
-36Q3	A	67.5	2	67.5	62.5-67.5	342	8/23/85	53.1	L	--
18S/16E-35N2	A	47.5	2	47.5	42.5-47.5	330	8/29/85	44.0	L	--
18S/17E-32P	A	57.5	--	--	--	312	--	--	L	Backfilled
19S/18E-35Q1	A	60.0	2	56.0	51.0-56.0	268	8/29/85	52.0	L	--

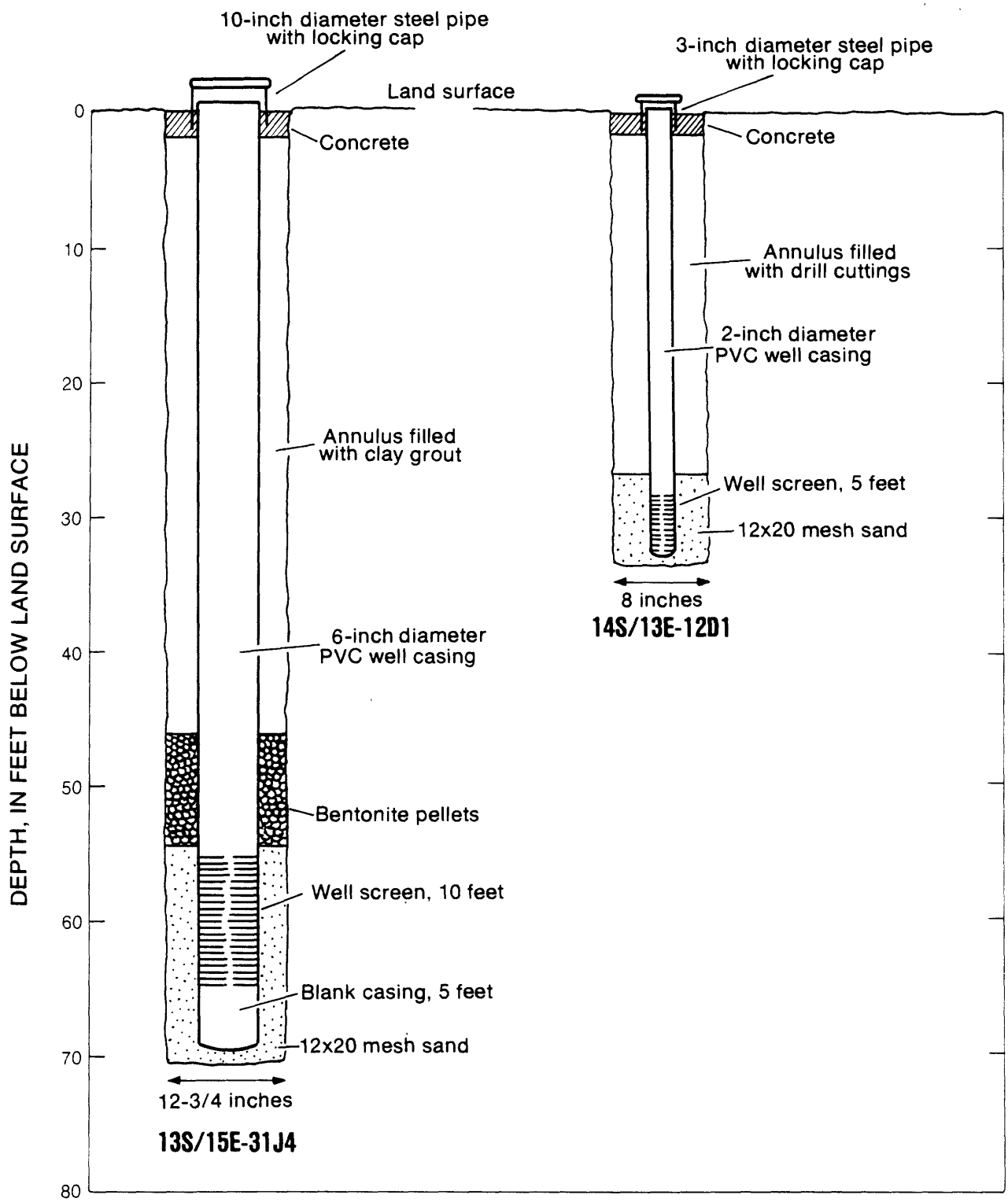


FIGURE 2. Construction of test holes 13S/15E-31J4 (rotary drilled) and 14S/13E-12D1 (augered).

Compilation of Lithology Logs

Lithologic logs were compiled from descriptions of drill cuttings and cores collected from all test holes and from observations recorded during drilling. At the deepest hole at each cluster site, drill cuttings were collected at 10-foot intervals and at distinguishable lithology changes. At all single-hole sites, cores were collected continuously for the first 10 feet and last 5 feet of the test holes, and at frequent intervals in between. Drill cuttings and cores were described by texture, color, sorting, roundness, cohesiveness, and any other significant features. Texture descriptions given in table 2 follow the National Research Council grain-size classification (National Research Council, 1947). This classification system is used so that general grain-size terms like sand and clay can be correlated to size limits in millimeters or inches. Color was determined by using moist samples following numerical color designations in the Munsell Soil Color Charts (Munsell Color, 1975). Other physical characteristics describing the drill cutting and cores were determined using Compton's Field Manual (Compton, 1985, p. 27-31, 48-51, 212-219, 238-241) and AGI Data Sheets (Dietrich and others, 1982). Salt precipitates in the samples were selectively analyzed for mineral composition using an X-ray diffractometer. The analyses show that the salts are commonly gypsum and occasionally calcite. Dolomite and thenardite ($NaSO_4$) are sometimes present in trace amounts (S.J. Deverel, U.S. Geological Survey, oral commun., 1986). Lithology logs of the drill cuttings and cores (table 3, at the end of report) are divided into intervals based on texture. The geophysical logs were used to determine lithologic boundaries more accurately.

Table 2.--*Grain-size classification*

[From National Research Council, 1947. <, actual value is less than value shown. >, actual value is greater than value shown]

Exact size limits, in millimeters	Approximate size equivalents, in inches	Name of loose aggregate
>256	>10	Boulder gravel
64-256	2.5-10	Cobble gravel
32-64	1.2-2.5	Very coarse pebble gravel
16-32	0.6-1.2	Coarse pebble
8-16	0.3-0.6	Medium pebble gravel
4-8	0.15-0.3	Fine pebble gravel
2-4	0.08-0.15	Granule (or very fine pebble gravel)
1-2	0.04-0.08	Very coarse sand
1/2-1	0.02-0.04	Coarse sand
1/4-1/2	0.01-0.02	Medium sand
1/8-1/4	0.005-0.01	Fine sand
1/16-1/8	0.002-0.005	Very fine sand
1/256-1/16	0.00015-0.002	Silt
<1/256	<0.00015	Clay (clay-size materials)

Geophysical Logs

Geophysical logs were made in test holes 13S/15E-31J6 and 14S/13E-24N3 by the U.S. Geological Survey Borehole Geophysics Service Unit, Denver, Colorado. Logs made in test hole 13S/15E-31J6 include 64-inch and 16-inch normal-resistivity, natural-gamma, neutron, compensated gamma-gamma, and single-arm caliper logs (fig. 3). Logs made in test hole 14S/13E-24N3 include 64-inch and 16-inch normal resistivity, natural-gamma, neutron, compensated gamma-gamma, and spontaneous-potential log (fig. 3). A caliper log of this hole was not made because the caliper tool was not working properly. Logs were manually digitized and computer plotted. The neutron and compensated gamma-gamma curves were smoothed by using a three-point moving average smoothing algorithm.

Normal resistivity devices measure the apparent resistivity of a volume of rock under the direct application of an electric current. These logs generally are used to determine formation resistivity, formation porosity, and fluid resistivity. Resistivity logs also can be used for geologic correlations (Keys and MacCary, 1983).

Natural-gamma devices measure the amount of natural-gamma radiation that is emitted by rocks. Natural-gamma logs are used primarily as lithology indicators, and for geologic correlations (Keys and MacCary, 1983).

Neutron devices consist of a source that emits neutrons and a detector. The neutrons travel through a fluid column and into the surrounding rock where they collide with atomic nuclei and lose some of their energy. Neutrons lose most of their energy in collisions with hydrogen atom nuclei due to their similar masses. These low-energy neutrons are not detected by the logging device; therefore, low neutron counts on the log indicate higher hydrogen content of the surrounding formation. Neutron logs are used mainly to estimate moisture content above the water table, and total porosity below the water table (Keys and MacCary, 1983).

Gamma-gamma devices record the intensity of gamma radiation from a source in the logging tool after it is backscattered and attenuated within the borehole and surrounding rocks. The gamma radiation absorbed in this process is proportional to the electron density of the surrounding material penetrated. Electron density is approximately proportional to the bulk density of most rocks (Keys and MacCary, 1983). The compensated gamma-gamma device used in this study is equipped with two detectors at different distances from the source, and a single caliper arm to force the tool against the wall of the borehole. This system minimizes the effects caused by changes in borehole diameter, and density changes in the borehole fluid. The single-arm caliper device also provides a continuous measurement of the changing borehole diameter. Gamma-gamma logs are mainly used as lithology indicators, and to measure the bulk density and porosity of rocks.

Spontaneous potential-devices measure voltage differences that exist between the borehole fluid and the surrounding rock. The spontaneous-potential log is used mainly for determining bed thickness and for geologic correlations (Keys and MacCary, 1983).

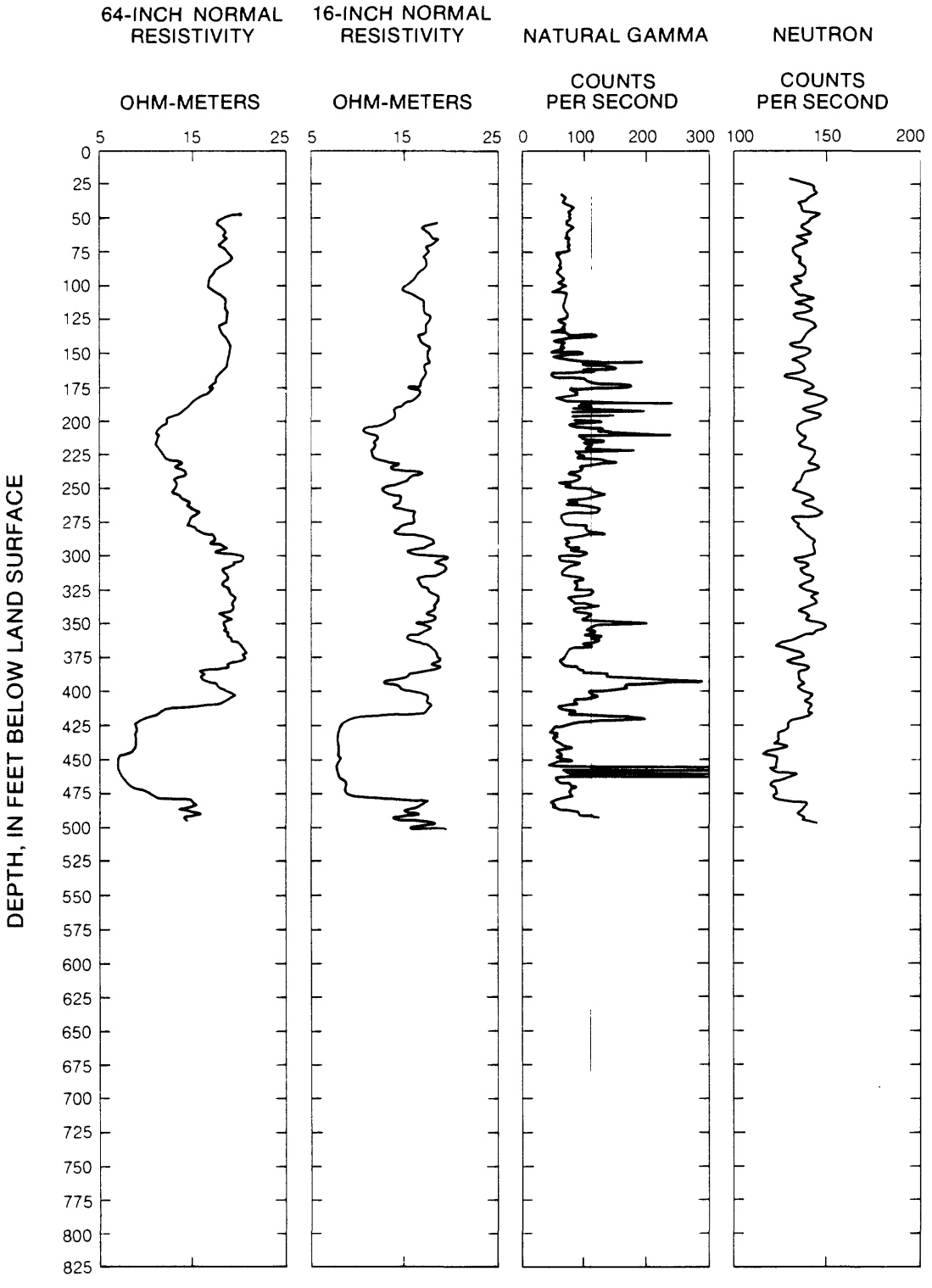
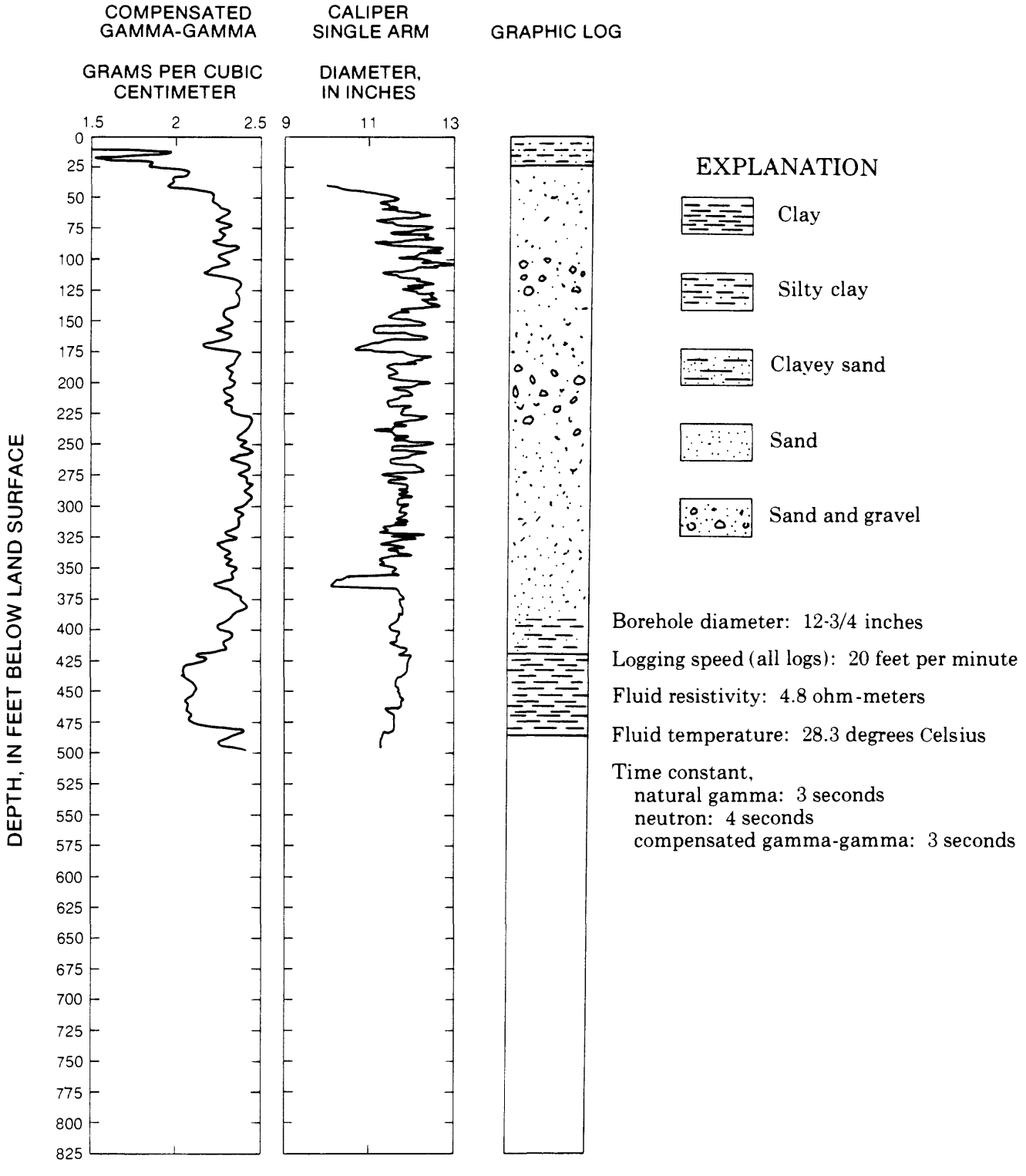


FIGURE 3. Geophysical and graphic logs for

13S/15E-31J6



Borehole diameter: 12-3/4 inches

Logging speed (all logs): 20 feet per minute

Fluid resistivity: 4.8 ohm-meters

Fluid temperature: 28.3 degrees Celsius

Time constant,
natural gamma: 3 seconds
neutron: 4 seconds
compensated gamma-gamma: 3 seconds

test holes 13S/15E-31J6 and 14S/13E-24N3.

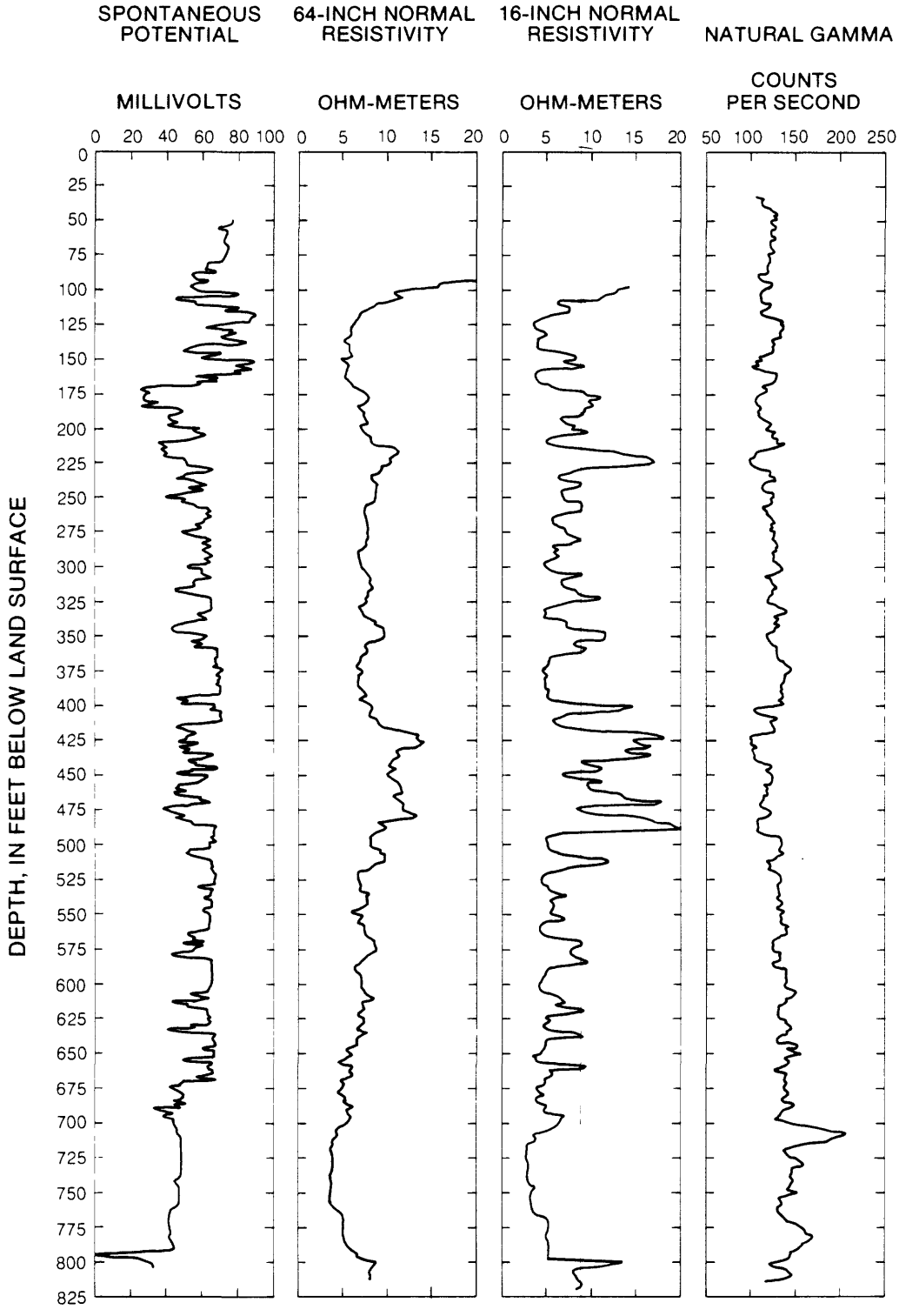
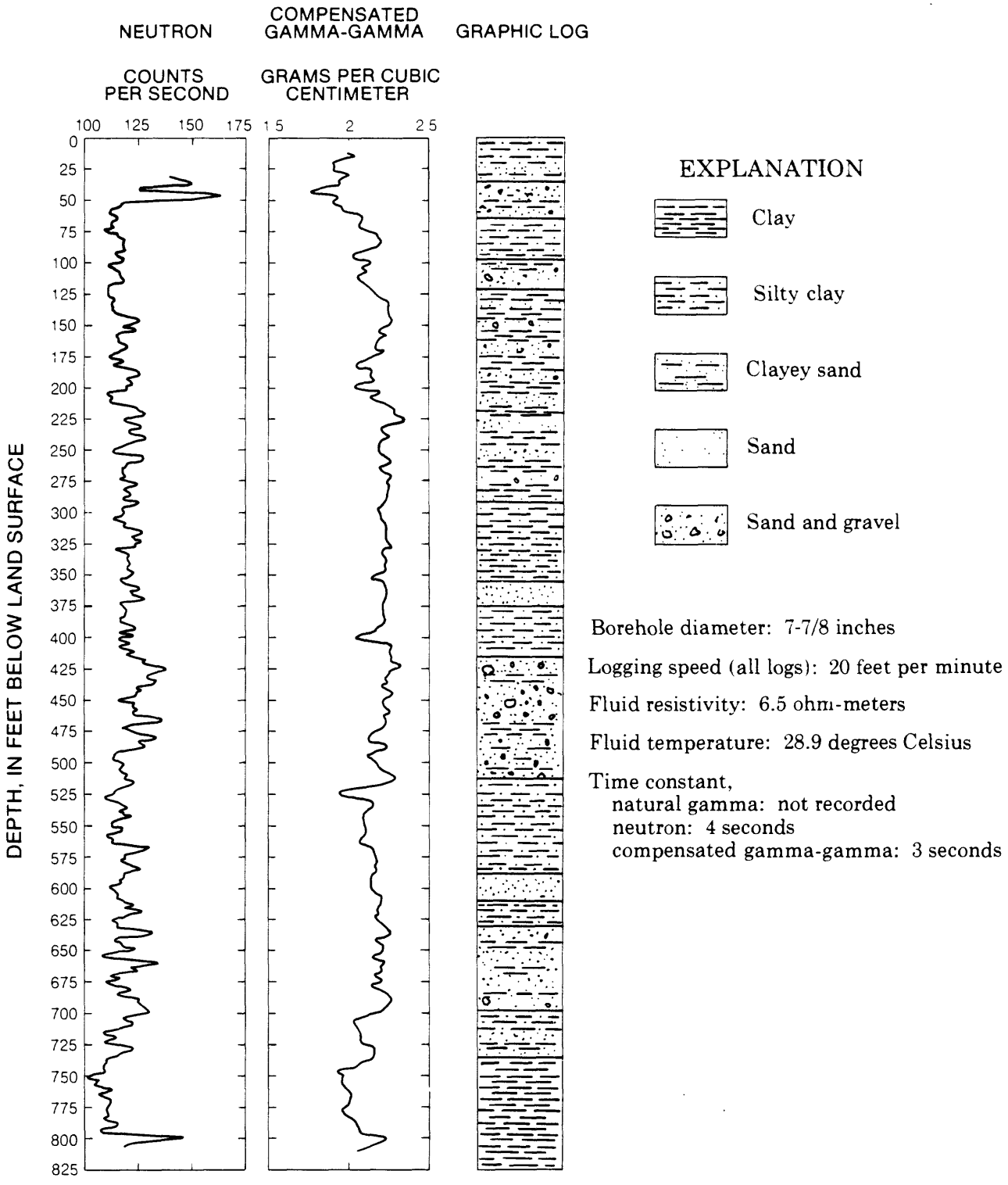


FIGURE 3. Geophysical and graphic logs for test

14S/13E-24N3



Borehole diameter: 7-7/8 inches

Logging speed (all logs): 20 feet per minute

Fluid resistivity: 6.5 ohm-meters

Fluid temperature: 28.9 degrees Celsius

Time constant,
natural gamma: not recorded
neutron: 4 seconds
compensated gamma-gamma: 3 seconds

holes 13S/15E-31J6 and 14S/13E-24N3--Continued.

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Table 3.--*Lithology logs of test holes*

Depth (ft) From	To	Description

Test holes 13S/15E-31J2 and -31J6.

Because of the close proximity, both test holes were used to compile the following log.
Test hole 13S/15E-31J2: Altitude of land surface, 151.3 ft. Drilled by a U.S. Geological Survey auger rig, August 1, 1985. Total depth, 27.5 ft. Screened interval, 22.5 to 27.5 ft.

Test hole 13S/15E-31J6: Altitude of land surface, 151.7 ft. Drilled by a U.S. Geological Survey rotary rig, July 11, 1985. Total depth, 500 ft. Screened interval, 480 to 490 ft.

From	To	Description
CORE		
0	2.5	Clay, moderately silty, moderate yellowish brown (10YR5/4), with dark brown patches; some carbon; some stringers of salt precipitates present; slight reaction to hydrochloric acid (HCl); hard and cohesive.
2.5	5.0	Clay, as above, with a few dark reddish brown (10R3/4) patches; numerous white stringers of salt precipitates; strong reaction to HCl; hard and friable.
5.0	6.3	Clay, extremely sandy (fine to very fine sand), moderate yellowish brown (10YR5/4); a few white stringers of salt precipitates; strong reaction to HCl; slightly cohesive.
6.3	7.5	Sand (medium), moderately silty, moderate yellowish brown (10YR5/4), composed of predominantly quartz grains (about 89 percent) and dark grains (about 11 percent); one thin (0.06 in.) dark brown clay laminae; no reaction to HCl; friable.
7.5	8.3	Clay, moderately silty, moderate yellowish brown (10YR5/4); a few dark reddish brown (10R3/4) stringers; strong reaction to HCl; crumbly.
8.3	12.5	Sand (medium), extremely silty, moderate yellowish brown (10YR5/4); a few clay clasts (up to 1.0 in. long) are present; strong reaction to HCl; loose.
12.5	15.0	Clay, moderately silty, dark yellowish brown (10YR4/2); light colored (10YR8/2) patches throughout; slight reaction to HCl; crumbly.
15.0	17.5	Clay, moderately silty and slightly sandy (including mica); some light bluish green mottling throughout sample; poorly sorted; cohesive.
17.5	20.0	Clay, extremely sandy, moderate brown (5YR4/4); no reaction to HCl; soft and cohesive.
20.0	22.5	Sand (fine), moderately silty, moderate brown (5YR4/4), predominantly quartz with some lithic fragments; moderately well sorted; no reaction to HCl; friable.
22.5	23.8	Sand (medium), slightly silty, moderate yellowish brown (10YR5/4), slight iron stain, composed of quartz (about 90 percent) and lithic fragments and black grains (about 10 percent); subangular to well rounded; moderately well sorted, no reaction to HCl; loose.
23.8	27.3	Sand, as above, dark yellowish brown (10YR4/2) to dusky yellowish brown (10YR2/2).
27.3	27.5	Sand (medium to coarse), moderate yellow brown (10YR5/4), composed of quartz (about 90 percent), lithic fragments (about 5 percent) and black (N1) grains including mica (about 5 percent); no reaction to HCl; loose.
CUTTINGS		
27.5	34	Sand (medium to coarse, predominantly coarse), grains are different colors, primarily white and clear, with some gray and black, overall color is medium bluish gray (5B5/1); subangular to rounded; moderately well sorted; woodchips present ranging from 0.05 to 0.3 in. long; loose.

Table 3.--*Lithology logs of test holes*--Continued

Depth (ft) From	To	Description
Test holes 13S/15E-31J2 and -31J6.--Continued		
34	45	Sand (coarse, some medium) and gravel (very fine to medium pebble); sand fraction is mainly quartz with some black and gray minerals; gravel is all lithic fragments, possibly metasedimentary rocks; rounded to well rounded; poorly sorted; cohesive.
45	78	Sand, as above, no gravel, medium bluish gray (5B5/1); at 50 ft the sand contains some clay.
78	98	Sand (medium to very coarse), medium bluish gray (5B5/1), predominantly quartz and white feldspars, subangular to well rounded, loose.
98	106	Sand (fine to medium), medium bluish gray (5B5/1), composed of quartz (about 90 percent) with lithic fragments (about 5 percent), black grains including mica (N1, about 5 percent), loose.
106	120	Sand (medium to coarse), some gravel (fine to medium pebble); sand is predominantly quartz and feldspar with some gray and black minerals; gravel consists of mostly black grains; rounded to well rounded; loose.
120	175	Sand (medium to very coarse), medium bluish gray (5B5/1), predominantly clear quartz and feldspar with some gray and black minerals, subangular to well rounded, loose.
175	178	Sand (medium to very coarse), medium bluish gray (5B5/1), predominantly quartz and feldspar; abundant wood chips (50-60 percent of sample), wood chips up to 1.3 in. long; loose.
178	230	Sand (medium to very coarse), moderately gravelly (fine to medium), medium bluish gray (5B5/1); sand is predominately quartz and feldspar, sand size appears to decrease with depth, gravel mostly black (N1); subangular to rounded; loose.
230	272	Sand (fine to medium), medium bluish gray (5B5/1), predominantly quartz and feldspar, loose.
272	281	Sand, moderately clayey, medium bluish gray (5B5/1), predominantly quartz and feldspar, cohesive.
281	298	Sand (fine to medium), medium bluish gray (5B5/1), predominantly quartz and feldspar, loose.
298	318	Sand (fine to coarse, predominately medium), medium bluish gray (5B5/1), predominantly quartz and feldspar (about 86 percent) with some gray and black grains (about 14 percent), subrounded to rounded, poorly sorted, loose.
318	357	Sand, as above, predominantly fine grained.
357	365	Sand (fine to coarse, primarily medium), medium bluish gray (5B5/1), slightly clayey, predominantly quartz and feldspar grains, subrounded to well rounded, poorly sorted, slightly cohesive.
365	386	Sand, as above, medium bluish gray (5B5/1), loose.
386	398	Sand (medium), minor coarse sand, extremely clayey, medium bluish gray (5B5/1), composition as above, loose.
398	418	Sand (fine to coarse), moderately clayey, predominantly quartz and feldspar grains, cohesive.
418	482	Clay, medium bluish gray (5B5/1), massive bedding, firm and compact, cohesive.
482	500	No sample due to loss of circulation of drilling fluid, geophysical logs indicate coarse-grained sediment.

Depth (ft) From	To	Description

Test hole 14S/13E-8D.

Altitude of land surface, approximately 315 ft. Drilled by U.S. Geological Survey auger rig, June 15, 1985. Total depth, 49.0 ft. Test hole was backfilled with drill cuttings.

CORE

0	2.5	Clay, extremely sandy and silty, olive (5Y5/3), massively bedded; moderate reaction to HCl.
2.5	5.0	Clay, as above, decreased sand content; minor charcoal fragments; a few faint bedding planes visible.
5.0	7.5	Clay, as above, slightly sandy, platy structure.
7.5	10.0	Clay, as above, extremely sandy; abundant thin stringers of sand from 0.01 in. (one grain width) to 0.25 in. in width; no platiness apparent.
10.0	14.0	No sample.
14.0	15.0	Clay, moderately silty and slightly sandy, olive gray (5Y4/2) to olive (5Y4/3), massively bedded; a few stringers of salt precipitates are present; two thin lenses of silty, fine sand are interbedded with the clay; moderate reaction to HCl.
15.0	19.0	No sample.
19.0	20.0	Clay, moderately silty, slightly sandy, olive (5Y5/4), massively bedded; one thin clayey sand interbed; moderate reaction to HCl.
20.0	29.0	No sample.
29.0	29.8	Clay, extremely silty, moderately sandy (fine), olive (5Y5/3), massively bedded; a lens of clayey, fine sand (2.0 in wide) is interbedded with the clay, visible water in the sand lens; clay has moderate reaction to HCl.
29.8	30.1	Clay, slightly silty, olive (5Y5/3 to 5Y4/3), massively bedded, indurated, moist, moderate reaction to HCl.
30.1	49.0	Clay, moderately silty and sandy, dark grayish brown (2.5Y4/2) to olive brown (2.5Y4/4), massively bedded; platy structure in places; faint laminae visible in places; abundant stringers of fine sand are unevenly distributed throughout the clay; sand and silt content of the clay varies throughout; salt precipitates are present in root pores in places; moisture content appeared to decrease with depth; clay becomes firmer with depth; very sticky when wet; moderate reaction to HCl.

Test hole 14S/13E-12D1.

Altitude of land surface, approximately 283 feet. Drilled by U.S. Geological Survey auger rig, June 4, 1985. Total depth, 32.5 ft. Screened interval, 27.5-32.5 feet.

CORE

0	1.2	Sand (very fine to medium, predominantly fine), moderately clayey, dark grayish brown (2.5Y4/2), composed of predominantly quartz, with minor dark grains and lithic fragments, subangular to subrounded, poorly sorted, weak reaction to HCl, slightly cohesive.
1.2	2.5	Sand (very fine to medium), extremely silty, light olive brown (2.5Y5/4), composed of quartz (about 90 percent) and black, red, yellow and orange grains (about 10 percent) subangular; 2 or 3 interbeds of laminated silt, 0.5 in. thick; moderately sorted; weak reaction to HCl; loose.

Table 3.--*Lithology logs of test holes*--Continued

Depth (ft) From	To	Description
Test hole 14S/13E-12D1.--Continued		
2.5	5.0	Sand (very fine to very coarse, predominantly medium), olive brown (2.5Y4/4), composed of quartz grains (about 90 percent), dark grains (about 10 percent) including garnet and serpentine, subangular to subrounded, poorly sorted, moderate reaction to HCl, loose.
5.0	6.1	Sand (very fine to fine), moderately silty, slightly sandy (medium), olive (5Y5/3), composed of quartz grains (about 90 percent) and dark grains (about 10 percent), subangular, moderately sorted, slight reaction to HCl, slightly cohesive.
6.1	10.0	Clay, slightly sandy, olive (5Y5/3), massively bedded, platy in some parts, moderate reaction to HCl, cohesive.
10.0	12.5	Clay, moderately silty, dark yellowish brown (10YR4/2), cohesive.
12.5	13.3	Sand and gravel (very fine to medium pebble gravel, predominantly fine sand), extremely clayey, olive (5Y5/3), quartz grains with some dark grains and lithic fragments, massively bedded, subangular sand with rounded gravel clasts, very poorly sorted, strong reaction to HCl; cohesive.
13.3	15.0	Sand, as above, decreased clay content, moderately cohesive.
15.0	15.6	Sand, as above, slightly clayey, loose.
15.6	17.5	Clay, olive (5Y5/3), massively bedded, with only a few thin beds, platy structure; some salt precipitates in root pores; weak reaction to HCl; cohesive.
17.5	19.8	Clay, moderately silty, olive (5Y5/3); numerous stringers of salt precipitates.
19.8	20.0	Sand (fine to medium), moderately silty, olive (5Y5/3), composed of quartz grains (about 80 percent), and black and colored grains (about 20 percent), subrounded to rounded, moderately well sorted, loose.
20.0	22.0	Clay, extremely silty, moderately sandy (fine to very fine), olive (5Y5/3).
22.0	22.3	Clay, as above, sand and silt content decreased.
22.3	23.0	Clay, as above, extremely sandy.
23.0	27.3	Sand (fine to medium), moderately clayey, olive (5Y5/3), composed of predominantly quartz grains with some dark grains and lithic fragments, subangular, very poorly sorted, weak reaction to HCl, cohesive.
27.3	28.0	Clay, slightly silty, olive (5Y5/3); some sandy lenses; thinly bedded, platy structure, no reaction to HCl.
28.0	32.5	Clay as above, massively bedded, sand lenses in parts are in different orientations; weak reaction to HCl.

Depth (ft) From	To	Description

Test holes 14S/13E-24N2 and 14S/13E-24N3.

Because of the close proximity, both test holes were used to compile the following log. Test hole 14S/13E-24N2: Altitude of land surface, 279.4 ft. Drilled by U.S. Geological Survey auger rig, June 3 and 4, 1985. Total depth, 67.0 ft. Screened interval, 62.0 - 67.0 ft.

Test hole 14S/13E-24N3: Drilled by U.S. Geological Survey rotary rig, July 27 to 30, 1985. Total depth 820 ft. Well was destroyed.

CORE

From	To	Description
0	2.5	Clay, slightly sandy, olive (5Y5/3), massively bedded; some salt precipitates present; moderate reaction to HCl; hard and cohesive.
2.5	5.8	Clay, as above, little to no salt precipitates present.
5.8	6.0	Clay, as above, thinly bedded (0.04 in. laminae); numerous root pores.
6.0	7.5	Clay, as above, not sandy, platy structure, massively bedded.
7.5	9.3	Sand (mostly fine, some medium), extremely clayey, olive (5Y5/3), moderate reaction to HCl, moderately cohesive.
9.3	11.0	Sand (mostly medium, some fine), slightly clayey, olive (5Y5/3), composed of predominantly quartz grains, with some dark grains and orange-yellow chert grains, angular to subangular, moderately well sorted, weak reaction to HCl, loose.
11.0	11.7	Clay, moderately silty, slightly sandy, olive (5Y5/3), platy, alternately thinly and massively bedded, moderate reaction to HCl.
11.7	12.3	Sand (mostly fine to medium, minor coarse), slightly clayey, olive (5Y5/3), composed of quartz grains (about 85 percent) and dark grains and orange-yellow chert (about 15 percent), angular to subangular; a few large blocky clasts of soft laminated clay; poorly sorted; moderate reaction to HCl.
12.3	12.5	Clay, moderately silty and sandy, olive (5Y5/3), thinly bedded (laminae are 0.03-0.07 in. in width and alternately light and dark), moderate reaction to HCl.
12.5	13.8	Sand (fine to medium), extremely silty, olive (5Y5/3), composed of quartz grains (about 90 percent) and dark grains (about 10 percent), angular to subrounded, poorly sorted, moderate reaction to HCl, loose.
13.8	15.0	Clay, olive (5Y5/3), platy structures, thinly bedded (breaks easily along laminae), moderate reaction to HCl, cohesive.
15.0	16.6	Sand (fine to medium), moderately silty, olive (5Y5/3), composed of quartz grains (about 90 percent), and dark grains and lithic fragments (about 10 percent), subangular to subrounded, poorly sorted, weak reaction to HCl.
16.6	17.0	Clay, olive (5Y5/3), platy, alternately massively and thinly bedded, some salt precipitates in root pores, moderate reaction to HCl.
17.0	19.3	Sand (fine to medium, trace of gravel), moderately clayey and silty, olive (5Y5/3), composed of predominantly quartz grains with some dark grains and lithic fragments, subangular to subrounded, very poorly sorted, loose.
19.3	20.0	Sand, as above, increased clay content, more reactive to HCl than above, moderately cohesive.
20.0	20.8	Sand, as above, decreased clay content, and slightly more medium to coarse sand and gravel than above, loose.
20.8	21.8	Clay, olive (5Y5/3), platy structures, massively bedded, weak reaction to HCl.

Table 3.--*Lithology logs of test holes*--Continued

Depth (ft) From	To	Description
Test holes 14S/13E-24N2 and 14S/13E-24N3.--Continued		
21.8	24.5	Sand (fine, some medium to coarse), moderately silty, slightly clayey, olive (5Y5/3), composed of predominantly quartz grains with some dark grains and lithic fragments (including chert) subangular to subrounded; abundant clasts of clay and silty clay, both laminated and massive; abundant small platy crystals in preferred orientation are present; very poorly sorted, moderate reaction to HCl.
24.5	26.1	Sand (fine), extremely silty, olive (5Y5/3), composed of quartz grains (about 90 percent), and dark grains and lithic fragments (about 10 percent) angular to subrounded; faint, thin laminae apparent; abundant silty clay clasts occur that are thinly bedded; moderately well sorted; weak reaction to HCl; slightly cohesive.
26.1	27.5	Sand, as above, some medium to coarse sand present, very poorly sorted.
27.5	31.3	Clay, olive (5Y5/3), platy structures, massively bedded; one small lens (0.4 in. wide) of fine sand present; abundant small, platy crystals are disseminated throughout the sediment; moderate reaction to HCl; cohesive.
31.3	41.2	Sand (mostly medium to coarse, some fine), minor gravel (largest clast is 1.2 in. long), clasts are mostly white to gray, with some black, green, red and orange yellow, overall color is olive (5Y5/3), composed of quartz grains (about 85 percent), with lithic fragments (chert, serpentine, metamorphics) and dark grains (about 15 percent), subrounded to rounded; some small, soft clasts of clay are present; poorly sorted; moderate reaction to HCl; loose.
41.2	42.8	Sand (fine), extremely silty, olive (5Y5/3), composed of quartz grains (about 90 percent), with lithic fragments and dark grains (about 10 percent) angular to subangular; faint laminae are apparent; moderately well sorted; moderate reaction to HCl; slightly cohesive.
42.8	45.0	Sand (fine to very coarse, predominantly medium to coarse) and gravel (fine to medium pebble), sand is mostly white to gray, composed of quartz grains (about 80 percent), and lithic fragments (including some kaolinite clasts) and dark grains (about 20 percent), sand fraction is subangular to subrounded, gravel fraction is subrounded to rounded; poorly sorted; moderate reaction to HCl; loose.
45.0	46.6	Silt and silty clay, some fine sand, olive (5Y5/3), massively bedded, moderately well sorted, moderate reaction to HCl, moderately cohesive.
46.6	47.5	Sand (very fine to fine, trace medium), slightly silty, olive (5Y5/3), composed of quartz grains (about 85 percent), and dark grains and lithic fragments (about 15 percent), subangular, poorly sorted, moderate reaction to HCl, slightly cohesive.
47.5	50.0	Sand (very fine to fine), extremely silty, olive (5Y5/3), composed of quartz grains (about 95 percent), and dark grains (about 5 percent), subangular, moderately well sorted, moderate reaction to HCl, loose to slightly cohesive.
50.0	51.7	Sand, same as above, slightly coarser grained.
51.7	52.3	Clay, silty, olive (5Y5/3), massively bedded; abundant root pores and plant material; moderate reaction to HCl; cohesive.
52.3	53.8	Sand (fine to medium), slightly silty, olive (5Y5/3), composed of quartz grains (about 97 percent), and dark grains (about 3 percent), subangular to subrounded, moderately well sorted, reacts to HCl, loose.
53.8	55.0	Clay, with a few stringers of silty fine sand; olive (5Y5/3), massively bedded, platy structures, moderate reaction to HCl.
55.0	55.7	Clay, moderately silty, olive (5Y5/3), massively bedded; some plant material, moderate reaction to HCl.

Depth (ft) From	To	Description
Test holes 14S/13E-24N2 and 14S/13E-24N3.--Continued		
55.7	56.1	Sand (fine), moderately silty, olive (5Y5/3), composed of quartz grains (about 97 percent), and dark grains (about 3 percent), subangular to subrounded, moderately well sorted, weak reaction to HCl, loose.
56.1	56.7	Clay, moderately silty, slightly sandy, olive (5Y5/3), massively bedded, moderate reaction to HCl.
56.7	57.5	Sand (very fine to medium), olive (5Y5/3), composed of quartz grains (about 93 percent), and dark grains and lithic fragments (about 7 percent), subangular, moderately well sorted, weak reaction to HCl, loose.
57.5	60.0	No sample.
60.0	61.3	Sand (fine to very coarse, predominantly medium to coarse) and gravel (very fine to coarse), grains are different colors, composed of quartz grains (about 85 percent), and dark grains and lithic fragments (about 15 percent), subangular to rounded, poorly sorted, moderate reaction to HCl, loose.
61.3	62.5	Clay, moderately silty, olive (5Y5/6), platy structures, massively bedded; some small, platy crystals disseminated throughout; weak reaction to HCl.
62.5	65.0	Clay, as above, silty content increased.
65.0	67.5	Clay, as above, slightly sandy, weak reaction to HCl.
CUTTINGS		
67.5	92.0	Clay, moderately silty, slightly sandy, dark yellowish brown (10YR4/2) to light olive brown (5Y5/6), massively bedded.
92.0	110	Sand (medium) and gravel (up to 0.4 in. in diameter), moderately clayey, primarily black, gray, and white, some red, green, and yellow; sand is quartz (about 90 percent) and lithic fragments (about 10 percent); gravel fraction is all lithic fragments of chert, serpentine, and possibly andesite and metamorphics; very poorly sorted; angular to subrounded.
110	118	Sand (fine to coarse, predominantly medium), color as above, composed of quartz grains (about 75 percent), and lithic fragments (about 25 percent), poorly sorted, angular to well rounded, predominantly subrounded.
118	127	Clay, moderately sandy and gravelly, olive (5Y5/3), massively bedded.
127	142	Sand (fine to coarse), extremely gravelly and moderately clayey, coarse fraction different colored, overall color is olive (5Y5/3); sand is 50 percent quartz grains, mostly clear, and 50 percent lithic fragments; gravel is all lithic fragments; angular to subrounded; poorly sorted.
142	146	Clay, moderately silty, olive (5Y5/3), massively bedded.
146	157	Sand (fine to coarse), extremely clayey, moderately gravelly, different colored, overall color is olive (5Y5/3), composed of lithic fragments (about 80 percent) and quartz grains (about 20 percent), very poorly sorted, angular to subrounded.
157	172	Clay, sand, and gravel, sample appears to be a heterogeneous mix of predominantly clay cuttings with some fine to very coarse sand, and fine to medium pebble gravel; clay is olive (5Y5/3), massively bedded, sand and gravel, multi-colored(?), consisting of lithic fragments (about 60 percent) and quartz grains (about 40 percent), very angular to well rounded; very poorly sorted.
172	191	Sand (fine to coarse), light gray (N8) to black (N1), composed of quartz grains (about 80 percent) and dark grains and lithic fragments (about 20 percent), angular to subangular, poorly sorted, loose.

Table 3.--*Lithology logs of test holes*--Continued

Depth (ft) From	To	Description
Test holes 14S/13E-24N2 and 14S/13E-24N3.--Continued		
191	197	Clay, sand (fine to very coarse) and gravel (very fine to medium); clay is olive (5Y5/3); coarse fraction is different colored consisting of lithic fragments and quartz; massively bedded.
197	206	Sand (medium to coarse) and gravel, moderately clayey, predominantly light gray (N8) to black (N1), with some red, yellow and green grains; sand fraction is predominantly quartz with some black magnetic grains; gravel fraction is lithic fragments of chert, serpentine, andesite, and some metamorphics; very poorly sorted; angular to subrounded; slightly cohesive.
206	216	Clay, extremely sandy (fine to coarse) and gravelly (fine pebble), olive (5Y5/3), massively bedded.
216	230	Sand (predominantly medium), slightly gravelly (fine pebble), moderately clayey, different colored grains, overall color is olive (5Y5/3), subangular to subrounded, poorly sorted.
230	238	Clay, moderately silty, olive (5Y5/3).
238	244	Gravel (very fine to medium pebble gravel) and fine to coarse sand, different colored grains, consists of lithic fragments (about 70 percent) and quartz grains (about 30 percent), poorly sorted, subrounded.
244	253	Clay, moderately silty, olive (5Y5/3).
253	262	Sand, and gravel (fine sand to fine pebble gravel), both extremely clayey, coarse fraction is different colored; clay is olive (5Y5/3); coarse fraction composed of lithic fragments (about 65 percent) and quartz grains (about 35 percent) with abundant milky quartz; very poorly sorted; angular to well rounded, predominantly subrounded.
262	271	Clay, moderately silty, slightly sandy and gravelly, olive (5Y5/3), massively bedded.
271	283	Sand (fine to coarse), moderately clayey, very light gray (N8) to white (N9), with some black grains (N1 to N2), 85 to 90 percent quartz grains (predominately clear) 10 to 15 percent dark grains and lithic fragments, poorly sorted, subangular to subrounded.
283	345	Clay, moderately silty, moderately sandy and gravelly, olive (5Y5/3); faint iron-stained streaks and laminae observed at 340 ft; otherwise massively bedded.
345	364	Sand (fine to medium, some coarse), moderately clayey, predominantly very light gray (N8) to white (N9), with some black (N1) grains, composed of quartz grains (about 82 percent) and dark grains and lithic fragments (about 18 percent), subrounded, moderately well to poorly sorted.
364	401	Clay, moderately silty, slightly sandy and gravelly, olive (5Y5/3), occasional lighter colored patches of sediment present; some blebs and stringers of earthy, white mineral are present; massively bedded.
401	414	Sand (fine to coarse), and gravel.
414	420	Clay, moderately silty, olive (5Y5/3).
420	450	Gravel (very fine pebble to medium pebble), extremely sandy (fine to coarse), slightly clayey, different colored grains, composed of lithic fragments (about 55 percent) and quartz grains (about 45 percent), very poorly sorted, angular to well rounded.
450	464	Clay, moderately silty, extremely sandy (fine to coarse) and gravelly (very fine pebble to medium pebble), olive (5Y5/3), massively bedded.

Depth (ft) From	To	Description
Test holes 14S/13E-24N2 and 14S/13E-24N3.--Continued		
464	492	Sand (fine to coarse, predominantly coarse) and gravel (very fine pebble to medium pebble gravel); clay is present in stringers and as abundant matrix material; clay imparts an overall color of olive (5Y5/3); coarse fraction is different colored and composed of quartz grains and lithic fragments; very poorly sorted; predominantly subangular.
492	510	Clay, olive (5Y5/3); massively bedded; some coarse sand and gravel present.
510	517	Sand (fine to coarse), and gravel (very fine pebble to medium pebble gravel), some clay; sand fraction is mostly clear quartz; very poorly sorted; angular to well rounded.
517	556	Clay, moderately silty, slightly sandy and gravelly, olive (5Y5/3), slightly darker than above, massively bedded, appears more compacted, and drier than overlying clays.
556	568	Clay, moderately silty, slightly sandy, olive (5Y5/3) to moderate olive brown (5Y4/4), massively bedded.
568	589	Sand (fine to medium), moderately clayey, slightly gravelly, clay imparts an overall color of olive (5Y5/3); sand is predominantly quartz grains, white to gray in color; gravel is composed of lithic fragments; poorly sorted; subangular.
589	610	Clay, moderately silty, and sand, slightly gravelly, olive (5Y5/3), massively bedded, less compacted than overlying clay.
610	623	Sand (fine to medium), and clay; sand is white to gray quartz grains (about 95 percent) and dark grains (about 5 percent), moderately well sorted, angular to subangular; clay contains some sand and gravel, light olive brown (5Y5/6) to olive gray (5Y3/2), massively bedded.
623	635	Clay, moderately silty, light olive brown (5Y5/6) to olive gray (5Y3/2), massively bedded.
635	682	Sand (fine to coarse) and clay; sand is white to gray in color and predominantly quartz, with variable clay content, poorly sorted to moderately well sorted, subangular; clay varies in color from light olive brown (5Y5/6) and light olive gray (5Y3/2) to medium bluish gray (5B5/1) with depth, massively bedded; samples taken in this interval may not be representative because of circulation problems with the drilling fluid.
682	694	Clay, light olive brown (5Y5/6), light olive gray (5Y3/2) and medium bluish gray (5B5/1), a few chips are dark yellowish brown (10YR4/2), massively bedded, moderately compacted.
694	710	Sand (fine), and some gravel, white to gray and black, approximately 85 percent quartz grains and 15 percent dark grains, poorly sorted, angular.
710	800	Clay, medium bluish gray (5B5/1), oxidizes to light olive gray (5Y3/2) to olive gray (5Y5/2), massively bedded, dense and compacted, becomes more so with depth; a few coarse grained clasts present; sample at 790 ft has a sparkly appearance in light.
800	820	No sample due to circulation problems with the drilling fluid. Geophysical logs indicate a coarse-grained sediment.

Table 3.--*Lithology logs of test holes*--Continued

Depth (ft) From	To	Description

Test hole 14S/14E-10A1.

Altitude of land surface, approximately 201 ft. Drilled by U.S. Geological Survey auger rig, June 10, 1985. Total depth, 18.5 ft. Screened interval, 13.5-18.5 ft.

Depth (ft) From	To	Description
CORE		
0	2.5	Clay, moderately sandy, between dark grayish brown (10YR4/2) and olive (5Y5/6), massively bedded.
2.5	5.0	No sample. Drilled through gravel envelope around concrete cistern.
5.0	6.8	Clay, moderately sandy, slightly gravelly (largest clast is 0.9 in. in diameter), dark grayish brown (10YR4/2) to olive (5Y5/6), massively bedded.
6.8	7.5	Sand (fine to medium), some coarse sand and gravel, extremely clayey, dark grayish brown (10YR4/2) to olive (5Y5/6), composed of quartz grains (about 85 percent), dark grains and lithic fragments (about 15 percent); subangular, very poorly sorted.
7.5	8.5	Sand, as above (predominantly medium), some clay.
8.5	9.0	Sand, as above, abundant clay.
9.0	9.8	Sand, as above, some clay.
9.8	11.0	Sand, as above, abundant clay.
11.0	13.5	No sample.
13.5	18.5	Sand (fine to coarse, predominantly medium), slightly gravelly, extremely clayey near the top of the interval to slightly clayey at the bottom; sand fraction varies from gray to white, with some dark gray to black; coarse fraction is predominantly quartz grains, some dark grains and lithic fragments; very poorly to poorly sorted; subangular.

Test hole 15S/13E-13R2.

Altitude of land surface, approximately 335 ft. Drilled by U.S. Geological Survey auger rig, June 10, 1985. Total depth, 29.0 ft. Screened interval, 24.0-29.0 ft.

Depth (ft) From	To	Description
CORE		
0	2.5	Sand (very fine to medium), moderately clayey, olive (5Y5/3), composed of quartz grains (about 87 percent) and black and colored grains (about 13 percent), massively bedded; angular to subangular; very poorly sorted; moderate reaction to HCl, cohesive.
2.5	5.0	Sand, as above, increased clay content; abundant stringers of salt precipitates.
5.0	5.5	Sand, as above, slightly more clayey, strong reaction to HCl, loose to moderately cohesive.
5.5	7.5	Clay, extremely sandy, olive (5Y5/3), massively bedded, some thin stringers of clayey sand; moderate reaction to HCl.
7.5	8.9	Sand (very fine to medium), slightly clayey, olive brown (2.5Y4/4), composed of quartz grains (about 92 percent), and black and colored grains (about 8 percent), angular to subangular, poorly sorted, strong reaction to HCl, moderately cohesive.
8.9	10.0	Sand, as above, increased clay content; cohesive.
10.0	14.0	No sample.

Depth (ft) From	To	Description
Test holes 15S/13E-13R2.--Continued		
14.0	15.0	Sand, similar to the above 8.9 to 10.0 foot interval.
15.0	17.5	No sample.
17.5	20.0	Sand (fine to medium), extremely clayey, olive (5Y5/3), composed of predominantly quartz grains, with some black and colored grains, angular to subangular; thin clay lenses and stringers of salt precipitates are abundant; very poorly sorted; moderate reaction to HCl; cohesive.
20.0	24.0	No sample.
24.0	24.7	Sand (medium to coarse), moderately gravelly (very fine), olive (5Y5/3) to light olive brown (5Y5/4), composed of quartz grains (about 90 percent), and black and colored grains, and lithic fragments (about 10 percent) subangular to rounded; thin lenses of clayey sand are abundant; very poorly sorted; weak reaction to HCl; loose to cohesive.
24.7	25.5	Sand (fine to medium), as above.
25.5	26.5	Sand (very fine to fine), extremely clayey, olive (5Y5/3), composed of quartz grains (about 90 percent), and black and colored grains (about 10 percent) angular to subangular; thin clay lenses and stringers of salt precipitates are abundant; very poorly sorted; moderate reaction to HCl; cohesive.
26.5	27.3	Sand (medium to very coarse), slightly gravelly (very fine to medium pebble), olive (5Y5/3); composed of quartz grains (about 95 percent), and colored grains and lithic fragments (about 5 percent), lithic fragments include chert and metamorphics, angular to subrounded; clayey sand lenses are abundant; very poorly sorted; weak reaction to HCl; loose to cohesive.
27.3	29.0	Clay, extremely sandy, olive (5Y5/3), massively bedded, platy; abundant stringers of salt precipitates in root pores; moderate reaction to HCl.
Test hole 15S/13E-15N.		
Altitude of land surface, approximately 450 ft. Drilled by U.S. Geological Survey auger rig, June 10-12, 1985. Total depth, 104.5 ft. Test hole was backfilled with drill cuttings.		
CORE		
0	2.5	Sand (fine to medium), extremely clayey, dark yellowish brown (10YR4/4), composed of quartz grains (about 85 percent) and dark lithic fragments (about 15 percent), massive; some salt stringers; strong reaction to HCl.
2.5	4.4	Clay, extremely sandy, dark brown (10YR3/3); abundant soft, white rounded clasts (kaolinite?) up to 0.3 inches in diameter are present; very dark brown (10YR2/2) resistant clay clasts (up to 0.5 in. in diameter) also present; platy structure; cohesive.
4.4	6.8	Sand (fine to medium), moderately silty, moderately brown (7.5YR4/4); minor white, rounded clasts as above (up to 0.1 in. in diameter) are present; minor stringers of salt precipitates and some clay rich nodules that are friable; weak reaction to HCl; loose.
6.8	8.4	Sand (fine to medium), extremely clayey, yellowish brown (10YR5/4), composed of quartz grains (about 85 percent) and lithic fragments (about 15 percent), subangular to well rounded; some soft, white clasts, as above, up to 0.1 in. in diameter and minor salt precipitates; strong reaction to HCl; slightly cohesive.

Table 3.--*Lithology logs of test holes*--Continued

Depth (ft) From	To	Description
Test hole 15S/13E-15N.--Continued		
8.4	10.0	Sand, as above, yellowish brown (10YR5/4); clasts of clayey very fine sand that are more resistant than overall sample are present; minor interbeds of resistant thin clay laminae, abundant stringers of salt precipitates, and traces of gypsum crystals up to 0.2 in. in length.
10.0	14.0	No sample.
14.0	15.0	Sand, moderately clayey, yellowish brown (10YR5/4), minor amounts of soft rounded clasts up to 0.1 in. in diameter (kaolinite?); strong reaction to HCl; slightly cohesive.
15.0	17.5	No sample.
17.5	20.0	Sand, slightly clayey and silty, yellowish brown (10YR5/4), composed of quartz grains (about 85 percent) and lithic fragments (about 15 percent; mostly black), subrounded to well rounded; trace amounts of gypsum stringers; subrounded to well rounded, loose.
20.0	24.0	No sample.
24.0	25.0	Sand (fine to medium), extremely clayey, yellowish brown (10YR5/4) with abundant amounts of very dark brown (10YR2/2) mottling well rounded clay clasts up to 0.5 in. in diameter, moderate amounts of soft, white, well rounded clasts up to 0.4 in. in diameter; strong reaction to HCl; cohesive.
25.0	27.5	No sample.
27.5	30.0	Sand, as above, with one dark brown and white clast, maximum diameter is 0.2 in.
30.0	34.0	No sample.
34.0	35.0	Sand (very fine) and clay, interbedded with beds up to 2 in. in thickness, clay and sand have strong reaction to HCl.
35.0	37.0	No sample.
37.0	38.9	Sand (fine to medium), extremely clayey, yellowish brown (10YR5/4) with some very dark brown (10YR2/2) mottling; well rounded clasts up to 0.2 in. in length are present; moderate amounts of salt precipitates; strong reaction to HCl; cohesive.
38.9	40.0	Sand (medium to coarse), yellowish brown (10YR5/4), subangular to well rounded; a 1 in. thick coarse grained sandy lens is present, in the sand lens at a preferred orientation are quartz and lithic grains, hard, platy broken clay laminae and soft, white mineral (kaolinite?); poorly sorted; weak reaction to HCl; loose.
40.0	44.0	No sample.
44.0	45.0	Clay, extremely sandy (fine to medium), yellowish brown (10YR5/4); minor amounts of salt precipitate stringers; strong reaction to HCl; cohesive.
45.0	47.5	No sample.
47.5	50.0	Sand (medium), extremely clayey, yellowish brown (10YR5/4), some dark brown clasts up to 0.2 in. in diameter and some stringers of salt precipitates are present; strong reaction to HCl; cohesive.
50.0	54.0	No sample.
54.0	55.0	Sand (very fine to medium) and clay, interbedded; one resistant thin laminae is present, only the laminae has a reaction to HCl.
55.0	57.5	No sample.

Depth (ft) From	To	Description
Test hole 15S/13E-15N.--Continued		
57.5	59.0	Sand (fine to medium), extremely clayey, light yellowish brown (10YR6/4); coarse grained lens (2.0 in.) is present, includes black pebbles up to 0.3 in. in diameter and yellow-orange, soft clasts up to 0.5 in. in diameter; abundant stringers of salt precipitates throughout sample; strong reaction to HCl; cohesive.
59.0	62.5	No sample.
62.5	64.5	Clay with some minor interbeds of fine grained, faintly laminated sand; some gypsum crystals up to 0.7 in. in length are present; strong reaction to HCl; cohesive.
64.5	67.5	No sample.
67.5	69.5	Clay, extremely sandy, three medium to coarse grained sand lenses present (0.5 to 1 in. thick); clay has some stringers of salt precipitates; both sand and clay have strong reaction to HCl; clay is cohesive, sand is loose.
69.5	72.5	No sample.
72.5	74.5	Clay, extremely sandy, yellowish brown (10YR5/6); one sandy lens is present (1.0 in. thick); sand is fine to medium, predominantly clear quartz; sample has strong reaction to HCl; clay fraction is cohesive, sand lens is loose.
74.5	77.5	No sample.
77.5	79.5	Clay, extremely sandy, yellowish brown (10YR5/6); three fine to medium sand lenses up to 0.5 in. thick are present; clay has faint laminae; abundant white, earthy salt precipitate stringers are present; reaction to HCl; clay is cohesive, sand is loose.
79.5	82.5	No sample.
82.5	84.5	Clay, extremely sandy, yellowish brown (10YR5/4); three fine grained sand lenses and abundant stringers of salt precipitates are present; strong reaction to HCl; cohesive.
84.5	87.5	No sample.
87.5	89.5	Clay, extremely sandy, yellowish brown (10YR5/5); two medium grained sand lenses up to 3 in. thick and additional minor sand lenses are present; clay is massive; stringers of salt precipitates throughout sample; all sample has strong reaction to HCl; clay is cohesive, sand is loose.
89.5	92.5	No sample.
92.5	94.5	Sand (very fine to medium), abundant clay, yellowish brown (10YR5/4), dark brown (10YR3/3) shaley clasts up to 0.3 in. in diameter and soft, white, well rounded clasts up to 0.4 in. in diameter (kaolinite?) are present; upper portion of sample has abundant gypsum crystals up to 0.5 in. in length, grading downwards to earthy salt precipitates in lower section; strong reaction to HCl throughout sample; cohesive.
94.5	97.5	No sample.
97.5	99.5	Sand, abundant clay, with interbeds of medium grained, clean sand, yellowish brown (10YR5/4); soft, white, earthy clay clasts up to 0.1 in. in diameter are present in clayey layers, some well rounded light gray (10YR7/2) resistant clasts throughout sample; some stringers of salt precipitates are present; all sample has strong reaction to HCl; cohesive.
99.5	102.5	No sample.
102.5	104.5	Sand, as above, except there are no light gray clasts.

Table 3.--*Lithology logs of test holes*--Continued

Depth (ft) From	To	Description

Test holes 15S/13E-19B and 15S/13E-19C.

Because of the close proximity, both test holes were used to compile the following log. Test hole 15S/13E-19B: Altitude of land surface, approximately 555 ft. Drilled by U.S. Geological Survey auger rig, June 6, 1985. Total depth, 21.5 ft. Backfilled with drill cuttings.

Test hole 15S/13E-19C: Altitude of land surface, approximately 560 ft. Drilled by U.S. Geological Survey rotary rig, July 27-30, 1985. Total depth, 635 ft. Well was destroyed.

CORE

From	To	Description
0	2.5	Sand (very fine to medium, predominantly fine), extremely silty, pale olive (5Y6/4); some stringers of salt precipitates; strong reaction to HCl; slightly cohesive.
2.5	7.5	Sand (fine to medium, predominantly fine), extremely silty, light olive brown (2.5Y5/6); strong reaction to HCl; slightly cohesive.
7.5	8.5	Sand (fine to medium, predominantly fine), moderately silty, composed of quartz (80 percent) and black lithic fragments (20 percent), angular to rounded, strong reaction to HCl, loose.
8.5	10.0	Sand (fine to very coarse, predominantly coarse) and gravel (fine to medium), sample is about 85 percent sand and 15 percent gravel; sand fraction is composed of white and clear quartz (about 78 percent) and black, green, gray and orange lithic fragments (about 22 percent); angular to well rounded; gravel fraction is mostly black and dark gray lithic fragments and some white quartz, subrounded to well rounded; no reaction to HCl; loose.
10.0	12.0	Sand (very fine to coarse, predominantly medium), moderately silty and clayey, light olive brown (2.5Y5/6); occasional clay-rich clasts with faint laminae are present; strong reaction to HCl; slightly cohesive.
12.0	12.5	Sand (fine to medium), light olive brown (2.5Y5/6), massively bedded; abundant stringers and blebs of salt precipitates; some very dark gray (10YR3/1) rounded clay clasts are present; strong reaction to HCl; cohesive.
12.5	15.0	Sand (fine to medium, predominantly medium), moderately silty and clayey; light olive brown (2.5Y5/6); abundant soft rounded clay rich clasts, some with numerous salt precipitate stringers; strong reaction to HCl; slightly cohesive.
15.0	16.0	Sand (fine to medium), moderately silty, light olive brown (2.5Y5/6); some slightly resistant sand layers with faint laminae are present; some dark brown clay rich layers with abundant salt precipitate stringers are present; strong reaction to HCl; slightly cohesive.
16.0	18.0	Sand (fine to medium), silty, light yellowish brown (2.5Y6/4); moderately clay rich clasts with platy appearance are present; strong reaction to HCl, slightly cohesive.
18.0	19.0	Sand, as above (very fine to fine).
19.0	20.5	Sand, as above (fine to medium).
20.5	21.5	Sand (fine to medium), extremely clayey and silty, light yellowish brown (2.5Y6/4); abundant clay stringers, massive; faint laminae; strong reaction to HCl; cohesive.

The following descriptions are for composite samples from 10 ft intervals that were collected while air-rotary drilling.

CUTTINGS

From	To	Description
20	30	Clay, moderately sandy (very fine to medium, predominantly fine), light olive brown (2.5Y5/7), strong reaction to HCl; cohesive.

Depth (ft) From	To	Description
Test holes 15S/13E-19B and 15S/13E-19C.--Continued		
30	40	Clay, moderately sandy (fine to medium, predominantly fine), light yellowish brown (2.5Y6/4); strong reaction to HCl, cohesive.
40	50	Sand (medium), moderately clayey, light olive brown (2.5Y5/6), consists of quartz (about 80 percent) and black grains (about 20 percent), moderate reaction to HCl, slightly cohesive.
50	60	Sand (fine to very coarse, predominantly medium to coarse), moderately clayey, light olive brown (2.5Y5/4), composed of quartz (about 80 percent) and black grains (about 20 percent), angular to subrounded; strong reaction to HCl, cohesive.
60	70	Sand (fine), moderately clayey, light yellowish brown (2.5Y6/4), strong reaction to HCl, moderately cohesive.
70	80	Sand (medium), moderately clayey and gravelly, olive brown (2.4Y4/4), sand is composed of predominantly quartz with some black grains; gravel is white quartz, chert, and metasedimentary fragments; some small (up to 0.1 in. long) gypsum crystals are present; strong reaction to HCl; slightly cohesive.
80	90	Sand (fine), extremely clayey and silty, light olive brown (2.5Y5/4); faint light colored laminae present; strong reaction to HCl; cohesive.
90	100	Sand (medium to coarse) and gravel (very fine to medium), olive brown (2.5Y4/4), 80 percent of sample is sand, 15 percent is gravel; numerous gypsum crystals up to 0.5 in. are present, loose.
100	110	Sand (medium to coarse), slightly clayey, olive brown (2.5Y4/4), composed of clear and white quartz (about 90 percent) and black grains and lithic fragments (about 10 percent), angular to well rounded; numerous gypsum crystals up to 0.2 in. in length; moderate reaction to HCl; loose.
110	120	Sand (medium to coarse), clay (more clay than preceeding sample), and gravel (fine to medium), light olive brown (2.5Y5/4), about 70 percent of sample is sand, about 20 percent is clay and about 10 percent is gravel, numerous gypsum crystals up to 0.5 in. long are present; strong reaction to HCl; cohesive.
120	130	Sand (fine to medium, predominantly medium), moderately clayey, light olive brown (2.5Y5/4), composed of primarily quartz grains and about 15 percent lithic fragments, subangular to rounded; moderate amount of gypsum crystals (up to 0.2 in. long) are present; strong reaction to HCl; cohesive.
130	140	Sand (fine to medium, predominantly medium), extremely clayey, light olive brown (2.5Y5/4); abundant clay clasts and some gypsum crystals (up to 0.3 in.) are present; strong reaction to HCl; cohesive.
140	150	Sand (fine to coarse, predominantly medium), moderately clayey, light olive brown (2.5Y5/4), predominantly quartz (about 82 percent) with black and different colored lithic fragments (about 18 percent), subrounded to well rounded; some gypsum crystal up to 0.1 in. long are present; strong reaction to HCl; moderately cohesive.
150	160	Sand, as above.
160	200	Sand, as above, slightly coarser grained (predominantly coarse).
200	210	No sample.
From 210 to 460 ft, the borehole was drilled using foam and no samples were collected. The 6 in. diameter air and foam drilled hole was reamed (using mud rotary technique) to 12.25 in. Samples for the interval 210 to 460 ft were collected every 10 ft while reaming.		
210		Sand (fine to medium, predominantly fine), extremely clayey, light olive brown (2.5Y5/4), primarily quartz with different colored lithic fragments, very cohesive.

Table 3.--*Lithology logs of test holes*--Continued

Depth (ft) From	To	Description
Test holes 15S/13E-19B and 15S/13E-19C.--Continued		
220		Sand, as above, slight decrease in clay content.
230		Sand (fine to coarse, predominantly fine), extremely clayey, light olive brown (2.5Y5/4); some soft, white, rounded clasts and some gypsum crystals up to 0.2 in. are present; cohesive.
240		Sand (fine to coarse, predominantly medium), slight decrease in clay content from above, slightly gravelly (very fine to fine), light olive brown (2.5Y5/4), gravel is all black, angular to subrounded, cohesive.
250		Clay, extremely sandy (fine to medium, predominantly fine), light olive brown (2.5Y5/4), cohesive.
260		Clay, as above.
270		Sand (fine to coarse), extremely clayey, slightly gravelly (predominantly medium), light olive brown (2.5Y5/4), composed of quartz (about 70 percent) and black grains (about 30 percent), angular to rounded, cohesive.
280		Clay, moderately sandy (fine to medium, predominantly fine), light olive brown (2.5Y5/4); cohesive.
280	310	No sample.
310		Clay, moderately silty, minor sandy (medium), light yellowish brown (2.5Y6/4); cohesive.
320		Sand (fine to coarse, predominantly medium), light yellowish brown (2.5Y6/4), composed of quartz grains (about 75 percent) and black and different colored lithic fragments (about 25 percent), angular to subrounded, cohesive.
330		Clay, slightly sandy, light yellowish brown (2.5Y6/4), massive with some platy structure; some salt precipitate stringers; cohesive.
340		Clay, as above.
350		Sand (fine to medium, predominantly medium), extremely clayey, light yellowish brown (2.5Y6/4), composed of clear and white quartz (about 77 percent) and black (N1) minerals and different colored lithic fragments (about 23 percent), platy and faintly laminated clay clasts are present; poorly sorted; cohesive.
360		Clay, moderately silty and slightly sandy, light yellowish brown (2.5Y6/4) to light olive brown (2.5Y5/6); gypsum crystals present up to 0.2 in. long; massive; cohesive.
370		Sand (fine to coarse, predominantly medium), extremely clayey, some silt, sand is composed of quartz (about 82 percent) and black (N1) minerals and different colored lithic fragments (about 18 percent), angular to well rounded; poorly sorted; cohesive.
380		Sand (fine to coarse, predominantly medium), extremely clayey and silty, between light yellowish brown (2.5Y6/4) and olive yellow (2.5Y6/5), poorly sorted, cohesive.
390		Sand, as above.
400		Clay and silty, some fine to medium sand, light yellowish brown (2.5Y6/4) to olive yellow (2.5Y6/5); sand is primarily quartz and lithic fragments; massive; cohesive.
410		Sand (fine to medium, predominantly fine), extremely clayey, between light yellowish brown (2.5Y6/4) and olive yellow (2.5Y6/5); angular to well rounded, predominantly subrounded; poorly sorted; cohesive.

Depth (ft) From	To	Description
Test holes 15S/13E-19B and 15S/13E-19C.--Continued		
420		Sand, as above, slightly lower clay content.
430		Sand (fine to medium, predominantly medium), extremely clayey but less than above, between light yellowish brown (2.5Y6/4) and olive yellow (2.5Y6/5), composed of quartz (about 82 percent) and black (N1) grains (about 18 percent); some clay clasts with platy appearance are present; moderately well sorted; cohesive.
440		Sand, as above.
450		Sand (fine to medium, predominantly fine), extremely clayey and silty, between light yellowish brown (2.5Y6/4) and olive yellow (2.5Y6/5), composed primarily of quartz (about 80 percent) and black and different colored grains such as green, red, and orange (about 20 percent), poorly sorted, cohesive. From 460 to 635 ft, the bore hole was drilled using mud and a 12.25 in. diameter bit.
460		Sand (fine to medium, predominantly medium), extremely clay, light olive brown (2.5Y5/4); some clay clasts with a platy appearance are present; poorly sorted; cohesive.
470		Sand (fine to medium, predominantly fine), clay content slightly decreased from above, light olive brown (2.5Y5/4), composed of quartz (about 70 percent) with black and lithic fragments (about 30 percent), angular to well rounded, poorly sorted, cohesive.
480		Sand, as above.
490		No sample.
500		Sand (fine to medium), extremely clayey and silty, light olive brown (2.5Y5/4), composed of quartz (about 75 perecent) and black and lithic fragments (about 25 percent), angular to well rounded, poorly sorted, cohesive.
510		Clay, extremely sandy (fine to medium, mostly fine), light olive brown (2.5Y5/4), massive, cohesive.
520		Gravel (very fine to medium, predominantly very fine), sand (fine to coarse, predominantly coarse), and clay; gravel and sand composed primarily of quartz (about 60 percent) and different colored lithic fragments (black, dark gray, light green, green, red, orange, yellow, and blue in order of decreasing abundance; about 40 percent), angular to subrounded (predominately subrounded); some grains are magnetic; the lithic fragments are primarily chert and metasedimentary rocks; very poorly sorted; loose.
530		Sand (very fine to coarse, predominantly coarse), extremely clayey, light yellowish brown (2.5Y6/4) to light olive brown (2.5Y5/6), composed of quartz (about 75 percent) and multicolored lithic fragments with black the most common color (about 25 percent); angular to rounded (subrounded most extremely), poorly sorted, cohesive.
540		Clay, moderately sandy (very fine to medium, predominantly fine), light yellowish brown (2.5Y6/4) to light olive brown (2.5Y5/6), cohesive.
550		No sample.
560		Sand (fine to medium, predominantly fine), extremely clayey, light olive brown (2.5Y5/4), angular to rounded, poorly sorted, cohesive.
570		Clay, moderately silty and sandy, pale yellow (2.5Y7/4) to light yellowish brown (2.5Y6/4), massive, poorly sorted, cohesive.

Table 3.--*Lithology logs of test holes*--Continued

Depth (ft) From	To	Description

Test holes 15S/13E-19B and 15S/13E-19C.--Continued

580		Gravel (fine to medium, predominantly very fine), sand (fine to coarse, predominantly coarse), and clay; gravel and sand composed of quartz (about 60 percent) and different colored lithic fragments (black, dark gray, light green, green, red, orange, yellow, and blue in order of decreasing abundance; about 40 percent of the sample is angular to well rounded (predominantly subangular); some magnetic grains; the lithic fragments are primarily chert and metasedimentary rocks; very poorly sorted; loose.
590		Sand (very fine to coarse, predominantly fine to medium), extremely clayey, composed of quartz (about 60 percent) and lithic fragments (about 40 percent), mostly black (N1), angular to rounded (predominantly subrounded), very poorly sorted, cohesive.
600		Sand (fine to very coarse), extremely clayey, slightly gravelly, light olive brown (2.5Y5/5), composed primarily of quartz (about 65 percent) and lithic fragments (about 35 percent), lithic fragments mostly black (N1), angular to rounded, poorly sorted, cohesive.
610	635	Clay, olive (5Y4/3), massively bedded, dense and compact; sparkly appearance under light; does not react to HCl, cohesive.

Test hole 16S/14E-15N.

Altitude of land surface, approximately 440 ft. Drilled by U.S. Geological Survey auger rig, June 13, 1985. Total depth, 71.0 ft. Test hole was backfilled with drill cuttings.

CORE

0	2.5	Sand (fine to medium), extremely clayey, pale yellowish brown (10YR6/2) to moderate yellowish brown (10YR6/4); some white stringers of salt precipitates and some plant material are present; cohesive.
2.5	5.0	Sand (fine), extremely clayey, moderate yellowish brown (10YR5/4), abundant salt precipitate stringers present; earthy, soft, white mineral present (kaolinite?) in rounded clasts of up to 0.25 in. long; cohesive.
5.0	10.0	Sand (fine), extremely clayey and moderately silty, yellowish gray (5Y7/2) to dusky yellow (5Y6/4); abundant stringers of salt precipitates present; strong reaction to HCl; slightly cohesive.
10.0	12.5	Sand (fine), extremely clayey, moderate yellowish brown (10YR5/4); some stringers of salt precipitates present; clasts present up to 0.40 in. long of earthy, soft, white mineral; slight reaction to HCl; cohesive.
12.5	14.0	No sample.
14.0	15.0	Sand (fine to medium), moderately clayey, dusky yellow gray (5Y5/2); some stringers of salt precipitates present; some rounded clasts present up to 0.5 in. long of soft, white, earthy mineral; slight reaction to HCl; slightly cohesive.
15.0	17.5	No sample.
17.5	19.2	Sand (fine), moderately clayey and silty, brownish yellow (10YR6/6); some rounded clasts present up to 0.25 in. long of soft, white, earthy mineral; moderately reaction to HCl; slightly cohesive.
19.2	20.0	Sand (fine), moderately clayey and silty, brownish yellow (10YR5/3); some stringers of salt precipitates present; some very dark grayish brown (10YR3/2) resistant clay clasts up to 0.5 in. long are present; slight reaction to HCl; slightly cohesive.
20.0	24.0	No sample.

Depth (ft) From	To	Description
Test hole 16S/14E-15N.--Continued		
24.0	25.0	Clay, some sand (fine), yellowish brown (10YR5/4); some rounded clay (koalinite?) clasts up to 0.3 in. long; very strong reaction to HCl; cohesive.
25.0	27.5	No sample.
27.5	30.0	Sand, slightly clayey, yellowish brown (10YR5/4); earthy, white clasts (kaolinite?) 0.25 in. long present, dark brown resistant clay clasts present; slight reaction to HCl; slightly cohesive.
30.0	34.0	No sample.
34.0	35.0	Sand (medium), yellowish brown (10YR5/4); indurated brown (7.5YR5/2) clay laminae up to 0.2 in. thick are present; clay laminae are coated with earthy, white material (kaolinite?); a few reddish yellow, rounded, indurated clasts up to 0.6 in. long are present; no reaction to HCl; loose.
35.0	37.5	No sample.
37.5	40.0	Sand, extremely clayey, olive (5Y5/3), indurated clay clasts up to 0.3 in. long and some earthy salt precipitates in blebs and stringers are present; slight reaction to HCl; cohesive.
40.0	44.0	No sample.
44.0	45.0	Sand (fine), extremely clayey, light yellowish brown (2.5Y6/4); earthy salt precipitates are present in blebs and stringers; moderate reaction to HCl; cohesive.
45.0	54.0	No sample.
54.0	55.0	Sand (fine to medium), slightly silty and clayey, olive (5Y5/3); some stringers of salt precipitates are present; slight reaction to HCl; loose.
55.0	57.4	No sample.
57.4	64.0	No sample.
64.0	65.0	Clay, moderately sandy, light olive brown (2.5Y5/4); some stringers of salt precipitates are present; moderate reaction to HCl; cohesive.
65.0	67.5	No sample.
67.5	68.3	Clay, extremely sandy, olive (5Y5/3); stringers of salt precipitates are common; white, earthy rounded clast is present (kaolinite?); slight reaction to HCl; soft and cohesive.
68.3	69.6	Sand (fine to medium), extremely clayey, olive brown (2.5Y4/4); stringers of salt precipitates are common; white, earthy clasts (kaolinite?) up to 0.25 in. long and indurated rounded clay clasts up to 0.30 in. long are present; slightly cohesive.
69.6	71.0	No sample.
Test hole 17S/15E-14A.		
Altitude of land surface, approximately 330 feet. Drilled by U.S. Geological Survey auger rig, June 6, 1985. Total depth, 42.5 ft. Test hole was backfilled with drill cuttings.		
CORE		
0	2.8	Sand (very fine to fine), moderately silty and clayey, olive (5Y5/3 to 5Y4/3), composed of mainly quartz, and abundant black and colored grains, subangular, poorly sorted, moderate reaction to HCl, moderately cohesive.

Table 3.--*Lithology logs of test holes*--Continued

Depth (ft) From	To	Description
Test hole 17S/15E-14A.--Continued		
2.8	5.0	Sand, as above; trace clay and silty; light olive brown (2.5Y5/4).
5.0	7.5	Sand (very fine), extremely silty, moderately clayey, olive (5Y5/3 to 5Y4/3), angular; massively bedded in places, thinly bedded in other places; stringers of salt precipitates and thin clay lenses present; moderately well sorted; strong reaction to HCl; slightly cohesive to loose.
7.5	8.1	Sand (very fine to fine, some medium), extremely silty, olive brown (5Y4/4), composed of quartz (about 92 percent), and black and colored grains (about 8 percent), angular to subangular, moderately well sorted, weak reaction to HCl, loose.
8.1	11.0	Sand, as above, extremely clayey in places; some thin laminated clay stringers; poorly sorted; loose to cohesive.
11.0	12.0	Sand, as above; abundant stringers of salt precipitates.
12.0	14.5	Sand, as above; faintly laminated, white, earthy, mineral is present (kaolinite?); hard and cohesive.
14.5	25.0	No sample.
25.0	32.5	Sand (very fine to coarse), moderately silty, slightly gravelly (medium pebble), light olive brown (2.5Y5/4 to 2.5Y4/4), composed of quartz grains (about 90 percent), and black and colored grains, and lithic fragments (about 10 percent) angular to subrounded; abundant buff to white clasts of soft clay are present; poorly sorted; weak reaction to HCl; loose to slightly cohesive.
32.5	35.0	No sample.
35.0	36.7	Sand (very fine to fine), moderately silty, olive (5Y4/3 to 5Y4/4), composed of quartz (about 95 percent), and black and colored grains (about 10 percent), angular, moderately well sorted, very weak reaction to HCl, loose.
36.7	37.5	Sand, as above; interbeds of clayey sand are present.
37.5	42.5	No sample.
Test hole 17S/15E-36Q3.		
Altitude of land surface, approximately 342 ft. Drilled by U.S. Geological Survey auger rig, June 6-8, 1985. Total depth, 67.5 ft. Screened interval, 62.5-67.5 ft.		
CORE		
0	5.0	Sand (fine to medium), extremely clayey, slightly gravelly, olive brown (2.5Y4/4), composed of predominantly quartz with black and colored grains (green, red, yellow), subangular to subrounded, very poorly sorted; abundant white, earthy mineral (salt precipitate) dispersed throughout; massively bedded; reacts to HCl; cohesive.
5.0	7.5	Sand, as above, no gravel; no salt precipitates; poorly sorted; less reactive to HCl.
7.5	8.3	Sand, as above, weak to no reaction to HCl.
8.3	10.0	Sand, as above, slightly clayey; reacts to HCl; slightly cohesive.
10.0	12.5	Silt, some clay and fine sandy, olive brown (2.5Y4/4); cohesive.

Depth (ft) From	To	Description
Test hole 17S/15E-36Q3.--Continued		
12.5	12.9	Sand (very fine to medium), moderately silty, slightly clayey, olive brown (2.5Y4/4), composed of predominantly quartz with some black grains and possibly some lithic fragments, subangular, poorly sorted, massively bedded; weak reaction to HCl; cohesive.
12.9	13.3	Sand, as above, no clay, moderately well sorted, no reaction to HCl; loose.
13.3	13.6	Sand, as above, increased clay content, weak reaction to HCl, slightly cohesive.
13.6	15.0	Sand and gravel, (very fine sandy to medium pebble gravel, predominantly medium sand), light yellowish brown (2.5Y6/4), composed of quartz (about 93 percent) and black and colored grains (green, red, yellow) and lithic fragments (about 7 percent) including metamorphics, chert and serpentine, subangular (sand fraction) to rounded (gravel fraction), very poorly sorted, reacts to HCl, loose. From 14.0-14.3 clay interbed, olive (5Y5/3), faintly laminated.
15.0	16.0	Sand (very fine to medium), moderately silty, clay and fine gravel, light olive brown (2.5Y5/6), composed of quartz grains (about 90 percent) and black and different colored grains (about 10 percent), subangular, very poorly sorted, weak reaction to HCl, slightly cohesive.
16.0	17.5	Sand, as above, extremely clayey, cohesive.
17.5	18.5	Sand, as above, more reactive to HCl.
18.5	19.5	Clay, moderately silty, olive (5Y5/3); minor amounts of an earthy, white mineral (salt precipitate) dispersed throughout; massively bedded; reacts to HCl.
19.5	20.5	Clay, moderately silty, olive (5Y5/3), massively bedded, platy structure, reacts to HCl.
20.5	21.0	Sand (very fine to medium), extremely silty, slightly clayey, olive brown (2.5Y4/4), composed of predominantly quartz grains, with black and different colored grains, angular to subangular, poorly sorted, no reaction to HCl, moderately cohesive.
21.0	21.5	Clay, moderately silty, slightly sandy, olive (5Y5/3), massively bedded, reacts to HCl.
21.5	22.3	Clay, as above, sand content increased.
22.3	23.0	Sand (very fine to medium), extremely silty, light olive brown (2.5Y5/4 to 2.5Y5/6), composed of quartz (about 90 percent), and black and different colored grains (about 10 percent), possibly some lithic fragments, angular to subrounded, moderately well sorted, reacts to HCl, loose.
23.0	24.0	Sand, as above, increased silty and clay content; some clasts of soft, massively bedded clay present.
24.0	25.0	Silt, extremely sandy in top portion of sample, abundant clay in bottom portion, light olive brown (2.5Y5/4 to 2.5Y5/6), massively bedded, reacts to HCl, cohesive.
25.0	26.0	Sand (fine to coarse), slightly silty, pale olive (5Y6/3) to olive (5Y5/3), composed of quartz (about 93 percent) and black and different colored grains, and lithic fragments (about 7 percent) including chert and serpentine, subangular to subrounded, moderately well sorted, weak reaction to HCl, loose.
26.0	27.0	Sand, as above, generally finer grained.
27.0	27.4	Sand, as above, very fine to medium, abundant silt, slightly cohesive.
27.4	28.3	Sand, as above, slightly coarser grained, reacts to HCl, moderately cohesive.

Table 3.--*Lithology logs of test holes*--Continued

Depth (ft) From	To	Description
Test hole 17S/15E-36Q3.--Continued		
28.3	28.6	Clay, moderately silty and sandy, light yellowish brown (2.5Y6/4) to light olive brown (2.5Y5/4); numerous thin sand lenses throughout; massively bedded, although faint laminae are present in places, breaks easily along horizontal planes; reacts to HCl.
28.6	33.0	Sand (very fine to medium), moderately silty, light olive brown (2.5Y5/4 to 2.5Y5/6), composed of quartz (about 95 percent) and black and colored grains (about 5 percent), subangular, moderately well sorted, weak reaction to HCl, loose to slightly cohesive. From 29.0 to 33.0 ft, a few small clay and clay rich layers are present.
33.0	40.0	No sample.
40.0	41.1	Sand, as above, extremely silty; numerous clasts of soft laminated clay are present; reacts to HCl, moderately cohesive.
41.1	42.5	Clay, extremely silty and sandy, olive brown (2.5Y4/4), numerous thin lenses of clayey silt and sand are present; massively bedded, although platy mineral grains (salt precipitates?) show a preferred horizontal orientation; no reaction to HCl.
42.5	45.0	No sample.
45.0	45.5	Sand (very fine to medium), extremely clayey, light olive brown (2.5Y5/4), composed of quartz grains (about 95 percent) and black grains (about 5 percent), angular to subangular, poorly sorted, reacts to HCl, moderately cohesive to cohesive.
45.5	46.0	Sand and gravel (very fine sand to medium pebble gravel, predominantly medium sand), olive brown (2.5Y4/4), composed of quartz grains (about 90 percent), and black and colored grains, and lithic fragments (about 10 percent) including buff colored shale and metamorphic fragments, angular (fine sand) to rounded (gravel), poorly sorted, weak reaction to HCl, loose.
46.0	50.0	No sample.
50.0	52.5	Sand, as above, some silt, no gravel, reacts to HCl.
52.5	55.0	No sample.
55.0	55.5	Clay, abundant silt and fine sand, olive brown (2.5Y4/4), reacts to HCl.
55.5	56.0	Sand and gravel (very fine sand to medium pebble gravel, predominantly medium sand), extremely silty, slightly clayey, light olive brown (2.5Y5/4 to 2.5Y5/6), composed of quartz (about 88 percent), and black and colored grains, and lithic fragments (about 12 percent), subangular to rounded, very poorly sorted, weak reaction to HCl, slightly to moderately cohesive.
56.0	60.0	No sample.
60.0	60.3	Sand (very fine sand to fine gravel, predominantly medium sand), light olive brown (2.5Y5/4 to 2.5Y5/6), composed of quartz grains (about 88 percent), and black and colored grains and lithic fragments (about 12 percent), subangular to subrounded, poorly sorted, reacts to HCl, loose.
60.3	62.5	Clay, abundant silt, slightly sandy, olive (5Y5/3), massively bedded, reacts to HCl.
62.5	65.0	Sand (very fine to medium), extremely clayey and silty, olive (5Y5/3 to 5Y4/3), composed of predominantly quartz with some black and colored grains, massively bedded, subangular, very poorly sorted, reacts to HCl, very cohesive.
65.0	66.5	Sand (very fine to medium), extremely silty, light olive brown (2.5Y5/4 to 2.5Y5/6), composed of quartz (about 88 percent), and black and colored grains (about 12 percent), angular to subangular, moderately well sorted, reacts to HCl, slightly cohesive.
66.5	67.5	Clay, extremely sandy and silty, light olive brown (2.5Y5/4 to 2.5Y5/6), massively bedded, very poorly sorted, reacts to HCl.

Depth (ft) From	To	Description

Test hole 18S/16E-35N2.

Altitude of land surface, approximately 330 feet. Drilled by U.S. Geological Survey auger rig, August 29, 1985. Total depth, 47.5 ft. Screened interval, 42.5 - 47.5 ft.

CORE

From	To	Description
0	2.5	Sand (fine to very fine), moderately silty, dark yellowish brown (10YR4/2), composed of predominantly clear quartz and some black (N1) grains, subangular to subrounded, moderately well sorted.
2.5	5.0	Clay and silt, dark yellowish brown (10YR4/2), one pebble (1.3 x 0.9 in. in diameter), rounded.
5.0	8.7	Sand (fine to medium), slightly silty, dark yellowish brown (10YR4/2), mostly clear quartz (about 60 percent), subangular to rounded, loose.
8.7	10.0	Sand (very fine), moderately silty, dark yellowish brown (10YR4/2), subrounded to rounded, well sorted, friable.
10.0	12.5	Clay, moderately silty, dark yellowish brown (10YR4/2), minor stringers of salt precipitates.
12.5	15.0	Clay, moderately silty, between moderate yellowish brown (10YR5/4) and dark yellowish brown (10YR4/2), minor stringers of salt precipitates towards bottom of sample, moderately cohesive.
15.0	17.5	Sand (medium to fine), moderately silty, moderate yellowish brown (10YR5/4), composed of mainly clear quartz (about 60 percent), moderately well sorted, loose and friable.
17.5	20.8	Sand (medium), composed of clear quartz (about 80 percent) and some black (N1) grains (about 20 percent), well sorted; sharp contact with underlying clay layer; loose.
20.8	27.8	Clay, moderately sandy (very fine), dark yellowish brown (10YR4/2), slightly cohesive.
27.8	30.0	Sand (medium to fine), silty and clay, between moderately yellowish brown (10YR5/4) and dark yellowish brown (10YR4/2), composed primarily of clear quartz (about 60 percent); clay clasts up to 1.5 in. long and some earthy salt precipitates are present; friable and loose.
30.0	35.0	Clay, moderately sandy (fine to very fine), dark yellowish brown (10YR4/2), slightly cohesive.
35.0	37.5	Clay, as above, some iron staining.
37.5	40.0	Clay, silty, and moderately sandy (fine to very fine), dark yellowish brown (10YR4/2); minor salt precipitates (earthy); traces of carbon; thin medium grain sand lenses in the lower portion of the sample.
40.0	42.5	Clay, moderately silty, dark yellowish brown (10YR4/2); light colored (10YR8/2) clayey clasts up to 0.7 in. long throughout sample; cohesive.
42.5	46.3	Clay, some silt, dark yellowish brown (10YR4/2), cohesive.
46.3	47.5	Sand (medium to fine), slightly silty, composed mainly of clear quartz (about 80 percent), subangular to rounded, moderately well sorted, friable and loose.

Table 3.--*Lithology logs of test holes*--Continued

Depth (ft) From	To	Description

Test hole 18S/17E-32P.

Altitude of land surface, approximately 312 feet. Drilled by U.S. Geological Survey auger rig, August 29, 1985. Total depth, 57.5 ft. Test hole was backfilled with drill cuttings.

CORE

From	To	Description
0	5.0	Sand (very fine), extremely clayey, moderate yellowish brown (10YR5/4), moderate reaction to HCl, loose.
5.0	7.5	Clay, moderately sandy (very fine), moderate yellowish brown (10YR5/4); white stringers of salt precipitates are present throughout sample; strong reaction to HCl; cohesive.
7.5	12.5	Sand (fine to very fine), extremely clayey, moderate yellowish brown (10YR5/4), moderately well sorted, very strong reaction to HCl, loose.
12.5	15.0	Clay, moderately sandy (very fine), dark yellowish brown (10YR4/2), cohesive.
15.0	17.5	Sand (very fine), moderately silty, moderate yellowish brown (10YR5/4), well sorted, no reaction to HCl, loose.
17.5	22.5	Clay, extremely silty, moderately sandy, moderate yellowish brown (10YR5/4), weak reaction to HCl; cohesive.
22.5	25.0	Sand (very fine to fine), extremely silty, moderate yellowish brown (10YR5/4), moderate reaction to HCl, slightly cohesive.
25.0	26.2	Clay, extremely silty, moderately sandy (very fine), moderate yellowish brown (10YR5/4), strong reaction to HCl, cohesive.
26.2	27.5	Sand (fine to medium), extremely clayey, moderate yellowish brown (10YR5/4); some light colored stringers (10YR8/2) that have a very strong reaction to HCl are present; hard and friable.
27.5	28.8	Clay (fine to medium), extremely sandy, moderate yellowish brown (10YR5/4); abundant light colored stringers (10YR8/2) are present that have a very strong reaction to HCl; clay fraction does not react to HCl.
28.8	32.5	Sand (fine to medium), moderately silty, dark yellowish brown (10YR4/2), composed of quartz (about 77 percent), lithic fragments (about 12 percent) and dark grains (N1, about 11 percent), strong reaction to HCl, loose.
32.5	40.0	Sand (medium to fine), slightly silty, moderate yellowish brown (10YR5/4), strong reaction to HCl, loose.
40.0	42.5	Sand (medium to very coarse) and gravel (very fine to medium pebble), poorly sorted, angular to well rounded, composed of quartz and lithic fragments such as chert, metasediments, and volcanic fragments, slight reaction to HCl, loose.
42.5	43.7	Sand (fine to medium), moderate yellowish brown (10YR5/4), scattered clasts of clay, dark yellowish brown (10YR5/2) are present; moderate reaction to HCl; loose.
43.7	45.0	Sand (medium to very coarse) and gravel (very fine to medium), composed of angular clay clasts, quartz and lithic fragments of plutonic, volcanic, metasedimentary, and chert fragments, slight reaction to HCl, loose.
45.0	46.2	Sand (fine to medium), moderately clayey, moderate yellowish brown (10YR5/4), strong reaction to HCl, loose.
46.2	50.0	Clay, some sand in places, dark yellowish brown (10YR4/2), strong reaction to HCl; some earthy white salt precipitates; soft and cohesive.
50.0	57.5	Clay, dark yellowish brown (10YR4/2), some earthy white salt precipitates; strong reaction to HCl, hard and cohesive.

Table 3.--*Lithology logs of test holes*--Continued

Depth (ft) From	To	Description

Test hole 19S/18E-35Q1.

Altitude of land surface, approximately 268 feet. Drilled by U.S. Geological Survey auguer rig, August 28, 1985. Total depth, 60.0 ft. Screened interval 51.0-56.0 ft.

CORE

From	To	Description
0	2.5	Clay, silty, and moderately sandy, light olive gray (5Y5/2) to olive gray (5Y3/2), weak reaction to HCl, hard and cohesive.
2.5	7.5	Clay, moderately silty, moderate yellowish brown (10YR5/4); light colored stringers throughout sample; strong reaction to HCl; hard and cohesive.
7.5	10.0	Clay, as above, moderate reaction to HCl, cohesive.
10.0	12.5	Clay, as above, weak reaction to HCl, hard and cohesive, friable.
12.5	17.5	Clay, moderate yellowish brown (10YR5/4) to dark yellowish brown 10YR4/2; some scattered blocky clasts of lighter colored clay, (yellowish gray 5Y8/1); weak reaction to HCl; light colored clasts have moderately reaction to HCl.
17.5	20.0	Sand (fine to medium), extremely silty, moderate yellowish brown (10YR5/4), cohesive.
20.0	22.5	Clay, moderate yellowish brown (10YR5/4); abundant white stringers; strong reaction to HCl.
22.5	26.8	Clay, as above; clear crystals (gypsum?) present up to 0.4 in. in diameter.
26.8	27.2	Sand (fine to medium), moderately clayey, composed of quartz (about 80 percent), lithic fragments (about 10 percent), dark grains (N1, about 10 percent), moderately well sorted, weak reaction to HCl, loose.
27.2	27.5	Clay, moderate yellowish brown (10YR5/4), massive, cohesive.
27.5	32.5	Sand (medium to coarse), composed of quartz (about 70 percent), dark grains (N1, about 20 percent), lithic fragments (about 10 percent), subangular to rounded, moderately well sorted, weak reaction to HCl; sharp contact with overlying clay lens; loose.
32.5	35.0	Clay, moderate yellowish brown (10YR5/4); abundant salt stringers react strongly to HCl; massive; cohesive.
35.0	37.5	Clay, extremely silty, slightly sandy (fine), moderate yellowish brown (10YR5/4), strong reaction to HCl, cohesive.
37.5	40.0	Clay, extremely silty, pale yellowish brown (10YR6/2) to moderate yellowish brown (10YR5/4), no reaction to HCl, cohesive.
40.0	40.2	Sand (medium), moderate yellowish brown (10YR5/4), no reaction to HCl, loose.
40.2	42.5	Clay, extremely silty, moderate yellowish brown (10YR5/4), no reaction to HCl, loose.
42.5	46.5	Clay, as above; abundant light colored mottling that strongly reacts to HCl; cohesive.
46.5	55.0	Sand (very fine to fine), extremely silty; moderate yellowish brown (10YR5/4), weak reaction to HCl, slightly cohesive.
55.0	55.8	Sand (medium to coarse), olive gray (5Y3/2), composed of quartz (about 80 percent), lithic fragments (about 10 percent), dark grains (N1, about 10 percent), subangular to rounded, well sorted, loose.
55.8	57.7	Clay, moderately silty, slightly sandy, moderate yellowish brown (10YR5/4), predominantly massive with some faint platyness, moderate reaction to HCl; cohesive.
57.7	60.0	Clay, moderately silty and sandy, moderate yellowish brown (10YR5/4), moderate reaction to HCl, cohesive.