Hydrogeologic and Water-Quality Data for the Main Site, Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia

By Clifton F. Bell, Thomas P. Bolles, and George E. Harlow, Jr.

U.S. GEOLOGICAL SURVEY
Open-File Report 94-301

Prepared in cooperation with the
ENVIRONMENTAL DIVISION
NAVAL SURFACE WARFARE CENTER,
DAHLGREN LABORATORY

Richmond, Virginia

1994

U.S. DEPARTMENT OF THE INTERIOR
BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY
GORDON P. EATON, Director

UNITED STATES GOVERNMENT PRINTING OFFICE: 1994

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Multiply	By	To obtain
foot (ft)	0.3048	meter
inch (in.)	25.4	millimeter (mm)
	25,4000	micron (μ)
square mile (mi^2)	2.590	square kilometer
mile (mi)	1.609	kilometer
gallon (gal)	3,785	milliliter (mL)

Water temperature is expressed in degrees Celsius (°C), which can be converted to degrees Fahrenheit (°F) by the following equation:

$$°F = 18\ (°C) + 32$$

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

Abbreviated water-quality units: Chemical concentration and specific electrical conductance in this report are expressed in metric units. Chemical concentration is expressed in milligrams per liter (mg/L) or in mocrograms per liter (μg/L). Specific electrical conductance of water is expressed in microsiemens per centimeter at 25 degrees Celsius (μS/cm). Values of the stable isotope ratios of hydrogen and oxygen (δD and $\delta^{18}O$) refer to the relative difference between the ratios $^2H/^1H$ and $^{18}O/^{16}O$, respectively, in the sample and the ratios in standard mean ocean water.

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Abstract

Hydrogeologic and water-quality data were collected at the Naval Surface Warfare Center, Dahlgren Laboratory at Dahlgren, Virginia, as part of a hydrogeologic assessment of the shallow aquifer system begun in 1992. The U.S. Geological Survey conducted this study to provide the Navy with hydrogeologic data to meet the requirements of a Spill Contingency Plan. This report describes the ground-water observation-well network, hydrogeologic, and water-quality data collected between August 1992 and September 1993. The report includes a description of the locations and construction of 35 observation wells on the Main Site. Hydrogeologic data include lithologic logs, geophysical logs, and vertical hydraulic conductivity measurements of selected core intervals. Hydrologic data include synoptic and hourly measurements of ground-water levels, observation-well slug tests to determine horizontal hydraulic conductivity, and tide data. Water-quality data include analyses of major dissolved constituents in ground water and surface water.

INTRODUCTION

The Naval Surface Warfare Center, Dahlgren Laboratory (NSWCDL) at Dahlgren, Va., was established in 1918 as a proving ground for naval ordnance (fig. 1). At present (1994), the NSWCDL is also involved in the development and application of computer models to naval warfare, missile flight, and artificial satellite motion. Various activities conducted at the NSWCDL have had the potential to contaminate ground water, soil, and (or) surface water. There are nine locations on the Main Site that have been identified by the Installation Restoration Program (IRP) as contaminated or potentially contaminated by different materials, including pesticides, PCB's, heavy metals, and several chemical and municipal wastes (Halliburton NUS, 1992). The U.S. Environmental Protection Agency placed the Main Site on the National Priority List in February 1992.

The Commonwealth of Virginia requires a Spill Contingency Plan for sites having hydrocarbon storage tanks. Sites that contain storage tanks with a capacity of more than 1 million gallons require a ground-water assessment to provide information on migration pathways from a potential hydrocarbon release. At the time this study was initiated (1992), the NSWCDL had hydrocarbon storage tanks with a combined capacity of more than 1 million gallons.

In 1992, the U. S. Geological Survey (USGS), in cooperation with the NSWCDL, began an investigation of the shallow aquifer system underlying the Main Site of the installation. The USGS conducted this study to provide the Navy with information to meet the requirements of a Spill Contingency Plan. The study was designed to provide basic hydrogeologic and water-quality data describing the natural properties and characteristics

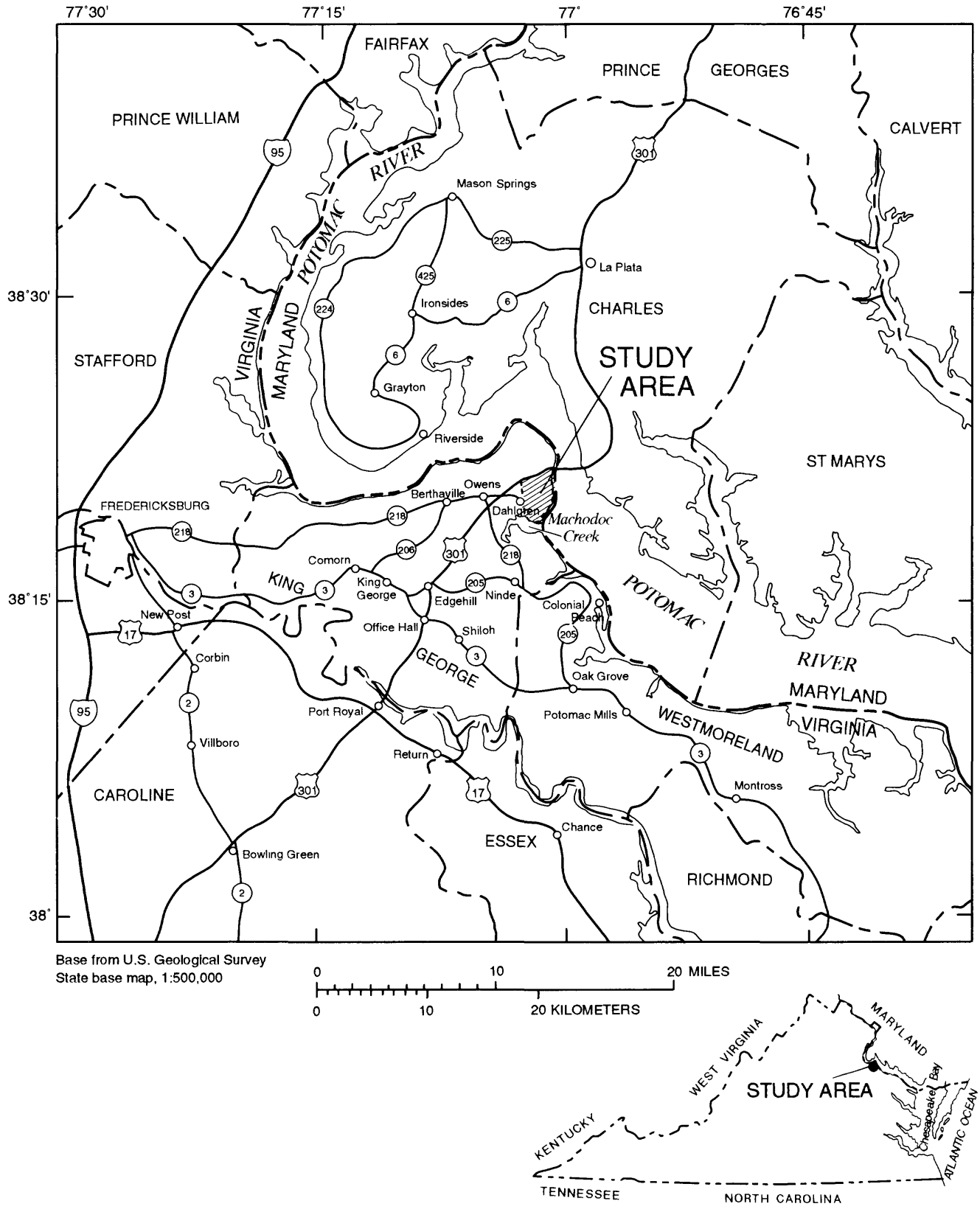

Figure 1. Location of study area at the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia.

of the shallow aquifer system. The results of this study will also be used for the ongoing National Priority List (NPL) studies at the NSWCDL.

Purpose and Scope

The purpose of this report is to present hydrogeologic and general water-quality data collected at the Main Site of the NSWCDL, Dahlgren, Va., between August 1992 and September 1993. The report includes (1) descriptions of the observation-well network, (2) hydrogeologic data, and (3) water-quality data. Most of the hydrogeologic and water-quality data are presented in figures and tables.

Thirty-five observation wells were installed at 29 locations on the Main Site of the NSWCDL. Hydrogeologic data includes lithologic logs and geophysical logs obtained from the 35 observation wells, and mineralogic characteristics and vertical conductivity data from laboratory analysis of selected core intervals. Data are presented from slug tests of 27 water-table wells to estimate horizontal hydraulic conductivity. Hydrologic data include synoptic water-level measurements in wells and hourly water-level measurements from analog-to-digital recorders (ADR's) installed on 11 wells and on a tide-gaging station. Water samples from all 35 observation wells and from 3 surface-water sampling sites were collected and analyzed for selected water-quality constituents and selected isotopes to establish background water-quality conditions.

Description of Study Area

The NSWCDL is located in King George County, Va., and is bounded on the east by the Potomac River (fig. 1). Upper Machodoc Creek divides the installation into two areas: The Main Site to the north, which is approximately 2,678 acres (pl. 1), and the Explosive Experimental Area to the south, which is approximately 1,614 acres. Other surface-water bodies present on the NSWCDL include Gambo Creek and Williams Creek, both of which flow in a north-south direction on the Main Site, and three fresh-water impoundments. The topography is generally flat, with a maximum relief of about 20 ft over most of the site. The land use on the installation is forest, open field, marsh, a small air field with landing strips, residential military housing, and military operations facilities.

Unconsolidated sedimentary deposits of the Atlantic Coastal Plain underlie the NSWCDL. These deposits consist of tabular bodies of interbedded sand, silt, and clay, and range in age from Cretaceous to Quaternary. Pleistocene deposits of the Poquoson, Lynnhaven, and Sedgefield members of the Tabb formation crop out at the surface of the installation (Mixon and others, 1989). In many locations on the Main Site, the surficial material is fill.

The shallow aquifer system underlying the NSWCDL, as defined in this report, consists of the unconfined Columbia aquifer and two confined aquifers. The Columbia aquifer is underlain by the upper confining unit, which overlies the upper confined aquifer. The upper confined aquifer is underlain by the Nanjemoy-Marlboro confining unit (unpublished data on file in the Virginia District office of the U.S. Geological Survey), which overlies the Aquia aquifer (Meng and Harsh, 1988).

Previous Investigations

An Initial Assessment Study (IAS) was performed at the NSWCDL in 1981 (Fred C. Hart Associates, 1983), which identified 29 potentially contaminated sites on the Main Site. The IAS recommended that 7 of the 29 sites be investigated under the Navy Assessment and Control of Installation Pollutants program. No wells were installed for the IAS. Confirmation studies conducted at five of the seven sites and at one additional site during 1983 and 1984 found evidence of environmental contamination. The confirmation studies included the installation of 20 shallow (10- to 25-ft total depth below land surface) monitoring wells at five of the sites (O'Brien and Gere, 1986). The Navy later concluded that nine sites on the Main Site warranted additional study. An IRP Remedial Investigation/Feasibility Study for these nine sites was proposed (Halliburton NUS, 1992) and began in December 1993.

Acknowledgments

The authors wish to thank Ann Swope, Billie Weedon, and other members of the Environmental Division, NSWCDL for providing invaluable assistance in project planning and implementation. The U.S. Army Corps of Engineers (COE) completed the drilling operations at the Main Site in a safe and efficient manner under the supervision of Charles Brown.

DESCRIPTION OF OBSERVATION-WELL NETWORK

The observation well locations at the Main Site were selected to obtain maximum areal coverage of the study area, to have drill sites accessible by drilling equipment, and to avoid areas of known or suspected contamination. Observation well locations are shown on plate 1.

Well Construction

All 35 observation wells installed at the NSWCDL for the hydrogeologic assessment were constructed of 4-in. inside-diameter polyvinyl chloride (PVC) casing. Twenty-nine wells were installed in the Columbia aquifer, of which 27 wells were augered and 2 wells (wells 4 and 10) were drilled by hydraulic rotary method. Three wells were installed in the upper confined aquifer and three wells were installed in the Aquia aquifer by hydraulic rotary methods. In order to avoid possible contamination of the confined aquifers from the Columbia aquifer, 10-in. inside-diameter PVC casing was set and grouted into the upper confining unit before drilling continued through this casing. Wells in the Columbia aquifer were constructed with either 5- or 10-ft screens, wells in the upper confined aquifer were constructed with 10-ft screens, and wells in the Aquia aquifer were constructed with 20-ft screens. A schematic diagram showing the standard well construction is shown in figure 2, and details on the construction of individual wells are presented in table 1.

Location and Numbering System of Wells

The 29 observation wells in the Columbia aquifer are each identified with a local number (1 to 30) and a unique USGS identifier. A well was not completed at the site proposed for well 26. The three wells in the upper confined aquifer are identified by a local number preceded by the letter "M" (M1, M2, and M3), and the three wells in the Aquia aquifer are identified by a local number preceded by the letter "D" (D1, D2, and D3). The locations of these wells on the installation are shown on plate 1.

A unique USGS identifier was assigned to each well for the purpose of storing well information in the Ground Water Site Inventory data base maintained by the USGS. These USGS identifiers are based on the Virginia coordinate grid number of the USGS standard series 7.5-minute topographic quadrangle in which the well is located, and the chronological order in which the well was installed. For example, the USGS number 54Q 22 corresponds to the 22d well installed by the USGS in the area covered by the Dahlgren quadrangle, which has a Virginia coordinate grid number of 54Q.

The latitudes and longitudes of observation wells were determined by a Magellan (NAV 5000 PRO) portable Global Positioning System receiver, and checked on the topographic map. Elevation of land surface and measuring point was leveled in by the USGS to an accuracy of 0.01 ft.

HYDROGEOLOGIC DATA

This section describes lithologic and geophysical logs for observation wells, mineralogic and vertical conductivity data from laboratory analysis of 35 Shelby tube samples, and hydrologic data from water-level measurements and aquifer tests.

Lithologic and Geophysical Logs

Lithologic samples were recovered with split-spoon samplers and logged during drilling operations at all 35 wells. Recorded characteristics include grain size according to the Wentworth scale

(Leeder, 1982); color; sedimentary structures; degree of moistness; and presence of features, such as organic material, shell material, indurated material, glauconite, or mica. In some intervals, no representative material could be recovered. Field descriptions of the lithologic samples are listed in table 2.

Geophysical logs were recorded at 28 of the 29 drill sites (figs. 3–6). The logging operation consisted of lowering a probe to the bottom of the borehole and recording the response as the probe was raised. Natural gamma logs were run at 25 of the 29 wells in the Columbia aquifer, and at all 3 wells in the Aquia aquifer. Spontaneous potential, single-point resistance, 16-in. normal resistivity, and 64-in. normal resistivity logs also were run at the three wells in the Aquia aquifer. Several of the electric logs were apparently affected by nearby power lines and thus are not presented in this report.

Shelby Tubes

Thirty-five Shelby tube core samples from 23 well sites were analyzed by the U.S. Army COE, Ohio River Division Laboratory, Cincinnati, Ohio, to provide measurements of vertical hydraulic conductivity (table 3), and descriptions of mineralogy (table 4). Vertical conductivity was measured by a falling-head permeameter test. Mineralogy was determined by visual inspection and x-ray diffraction. The core intervals sampled were chosen to characterize vertical and areal variations in lithology found in the study area.

Hydrologic Data

Water levels in wells were monitored by collecting synoptic and hourly measurements to determine the response of ground-water levels to precipitation, tidal influence, and evapotranspiration. Tidal fluctuations also were monitored. Precipitation data, not shown in this report, was collected by the NSWCDL.

Ground-Water Levels

Twelve synoptic water-level measurements were recorded at each of the 35 wells installed for the study (table 5). Measuring points were established for each well on the top of the casing; the elevations of these were surveyed by the USGS from a first-order bench mark to an accuracy of 0.01 ft. Water-levels in wells were measured to an accuracy of 0.01 ft by chalked steel tape. These measurements were then subtracted from the elevation of the measuring point to obtain the elevation of the water level.

In addition to the synoptic surveys, ADR's were installed on 11 wells (D1, D2, D3, M1, M2, M3, 4, 10, 11, 19, and 24) to provide periodic monitoring of water levels in those wells. The ADR's on these wells record measurements every hour. These water-level data assist in the evaluation of seasonal and short-term variations in water levels, and allow comparison of the response of water levels in wells screened in different aquifers to tidal influences, precipitation events, and other hydrologic variables. Water-level data from ADR's are presented in hydrographs, showing minimum daily water levels (relative to sea level) (figs. 7–18) from August 1992 through September 1993.

Tides

A tide gage with an ADR was installed on Upper Machodoc Creek (pl. 1) to record the stage. Tidal fluctuations were recorded at 5-minute intervals. Tide-gage data from August 1992 through September 1993 are presented in figure 19.

Aquifer Tests

Slug tests, by the volume-displacement method, were conducted on all 35 wells to determine horizontal hydraulic conductivity. An In-Situ Hermit (1000B) data logger and pressure transducer were used to record water-level recovery. Prior to the introduction of the slug, the water level was monitored for 10 minutes so that any rising or falling background trend could be subtracted from the recovery plot. A sand-filled PVC cylinder of known volume was rapidly lowered into the well, causing a temporary rise in the water level, and the data logger recorded the water level over time as it returned to equilibrium. Instantaneous water levels were

recorded at intervals that varied from every 0.2 seconds at the beginning of the test to every 30 seconds at the end of the test (table 6). An additional slug test was performed on some wells by recording the recovery of the water level after removal of the slug from the well.

WATER-QUALITY DATA

The concentrations of selected chemical constituents were measured in ground-water and surface-water samples from the NSWCDL. This water-quality data can be used to assess background geochemistry of ground water and surface water at the NSWCDL. Reporting limits for all water-quality constituents are given in table 7. Chemical analyses of surface-water and ground-water samples are listed in tables 8 and 9. Isotopic analyses for both ground-water and surface-water samples are listed table 10.

Location and Methods of Field Sampling

Water-quality samples were collected from all 35 observation wells and 3 surface-water sites in Gambo Creek (pl. 1) in May 1993. Ground-water samples were collected using a stainless steel submersible pump with a Teflon discharge line. Depth-width-integrated surface-water samples were collected with a weighted-bottle sampler. Prior to collecting water-quality samples, all equipment was cleaned thoroughly with laboratory detergent, and rinsed with tap and distilled water. The outside of the pump and Teflon tubing were rinsed with distilled water between wells, and the entire system was flushed with distilled water after each day of sampling. Each well was purged of at least three well volumes of water prior to sampling, unless the well went dry in which case the water level was allowed to recover prior to sampling.

Field parameters measured include pH, temperature, dissolved oxygen (DO), specific conductance, and alkalinity. DO and temperature were measured in ground water and surface water using a YSI (model 54A) dissolved oxygen meter with cable and submersible stirrer. Specific conductance and pH were measured on unfiltered water samples using an Orion (model 122) specific conductance meter with glass conductivity cell and Orion (SA 250) pH meter with gel-filled pH electrode, respectively. The pH meters were calibrated each day using two solutions of known pH values (usually pH 4 and 7). The calibration of the specific conductance meter was checked each day using three solutions of known conductance. Alkalinities were determined by incremental titration of 100-mL filtered water samples with sulfuric acid.

Water-quality samples collected for dissolved inorganic constituent analyses were placed in pre-cleaned bottles and filtered immediately after collection to minimize oxidation of any unstable and chemically reduced solutes. The filtering was accomplished using a peristaltic pump and a 142-mm-diameter filter-plate assembly with 0.45-µm pore-size filter membrane. The filter membranes were flushed with 200 mL of American Society of Testing and Materials Type II water before filtration of the sample. Water-quality samples for major cations and metals were acidified to pH 2 with concentrated nitric acid. Water-quality samples for isotopic analyses were unfiltered, poured slowly into bottles, and the bottle cap was tightened and secured with adhesive tape. All water-quality samples were placed in sealed plastic bags, chilled with ice, and shipped to the laboratories overnight in high-impact plastic ice chests.

Quality-control samples included duplicate samples, an equipment blank, and a distilled water blank. Duplicate samples were collected at approximately 10 percent of the sampling sites, including one duplicate surface-water sample, to determine the reproducibility of water-quality data. Results of analyses of duplicate samples are presented in tables 8, 9, and 10 with results from the other samples. A distilled water blank and an equipment blank of distilled water were passed through the pump and tubing to determine the cleanliness of equipment and sample-collection procedures.

Methods of Laboratory Analysis

All water-quality samples were sent to the USGS National Water Quality Laboratory in Arvada, Colo., for determination of inorganic constituents and organic carbon. Metals and major cations were determined using inductively coupled argon plasma. Chloride and fluoride were determined by a colorimetric method, and sulfate was determined by a turbidimetric method. Total dissolved solids were measured as residue-on-evaporation at 180°C. The analytical methods are described in Fishman and Friedman (1989) and Wershaw and others (1987). Laboratory quality-assurance procedures are described in Friedman and Erdmann (1982) and Jones (1987). Samples also were sent to the USGS Stable Isotope Laboratory in Reston, Va., for determination of hydrogen and oxygen isotopic ratios by mass spectrometry.

DATA MANAGEMENT

Data produced by field activities were recorded in bound notebooks and validated by the field personnel and a reviewer. Well-construction data and synoptic water-level measurements were entered into the USGS Ground-Water Site Inventory file, a ground-water data storage and retrieval system that is part of the USGS National Water Information System (NWIS). Ground-water-level and tide-gage data were entered into the USGS Automated Data Processing System (ADAPS), which also is part of NWIS. ADAPS consists of a collection of computer programs and files designed to provide a comprehensive system of up-to-date standardized water data processing procedures. All water-quality data from the USGS National Water Quality Laboratory were reviewed and verified by laboratory and project personnel, and entered into the USGS Quality of Water Data Base, which is part of NWIS. The original field notebooks and hard copies of all well-construction, water-level, and water-quality data are stored at the USGS, Virginia District office, Richmond, Va.

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TABLES

Table 1. Well-construction data for observation wells

[Methods of construction: hydraulic rotary (wells 4, 10, 24, M1, M2, M3, D1, D2, D3) and hollow-stem auger (all others). Depths are measured from land-surface datum, altitude is in reference to sea level. All wells have 4 inch screen/casing internal diameter. For locations of observation wells, see plate 1]

Local well no.	USGS well no.	Latitude	Longitude	Land-surface datum altitude (feet)	Date of completion	Depth of well (feet)	Depth of hole (feet)	Hydrogeologic unit	Interval of screen (feet)	Interval of sand pack (feet)	Interval of bentonite seal (feet)	Interval of grout (feet)
1	54Q25	38°20'17"	77°03'04"	20.48	09–11–92	12.5	14.5	Columbia aquifer	5.0–10.0	3 –12	1– 3	0 –1
2	54Q26	38°20'31"	77°03'01"	21.05	09–11–92	17.5	20.0	Columbia aquifer	5.0–15.0	3 –17	2– 3	0 –2
3	54Q27	38°20'55"	77°02'59"	22.15	09–10–92	22.0	22.0	Columbia aquifer	9.5–19.5	7 –20	6– 7	0 –2
4	54Q28	38°21'03"	77°02'54"	21.33	08–27–92	21.9	22.0	Columbia aquifer	9.7–19.7	5 –22	3– 5	0 –3
5	54Q29	38°21'12"	77°02'44"	19.92	08–27–92	20.5	22.0	Columbia aquifer	8.0–18.0	4 –22	3– 4	0 –3
6	54Q30	38°21'16"	77°02'35"	17.61	09–04–92	12.4	12.4	Columbia aquifer	4.9– 9.9	3 –12	2– 3	0 –2
7	54Q31	38°21'23"	77°02'05"	19.81	09–04–92	17.2	17.2	Columbia aquifer	4.7–14.7	3 –17	2– 3	0 –2
8	54Q32	38°21'27"	77°01'33"	21.02	09–03–92	30.0	30.0	Columbia aquifer	17.7–27.7	8 –30	7– 8	0 –2
9	54Q33	38°21'30"	77°01'08"	21.20	09–03–92	25.1	25.1	Columbia aquifer	12.9–22.9	8 –25	7– 8	0 –3
10	54Q34	38°21'29"	77°00'58"	20.44	08–13–92	20.0	20.0	Columbia aquifer	7.7–17.7	5 –20	3– 5	0 –3
11	54Q35	38°21'31"	77°00'55"	4.40	09–02–92	14.2	25.0	Columbia aquifer	7.0–12.0	2 –12	1– 2	0 –2
12	54Q36	38°20'55"	77°01'13"	20.24	09–15–92	18.5	20.0	Columbia aquifer	8.0–18.0	6 –18	1– 6	0 –1
13	54Q37	38°20'42"	77°01'19"	15.81	09–15–92	18.5	20.0	Columbia aquifer	8.0–18.0	5 –20	4– 5	0 –1
14	54Q38	38°20'48"	77°01'52"	17.05	09–15–92	27.0	27.5	Columbia aquifer	16.5–26.5	10 –27	7–10	0 –7
15	54Q39	38°20'54"	77°02'42"	23.43	09–10–92	17.5	22.0	Columbia aquifer	5.0–15.0	3 –17	2– 3	0 –2
16	54Q40	38°20'42"	77°02'24"	21.83	09–08–92	17.5	17.5	Columbia aquifer	5.0–15.0	3 –17	2– 3	0 –2
17	54Q41	38°20'27"	77°02'02"	13.68	09–08–92	15.5	15.5	Columbia aquifer	3.0–13.0	2 –13	1– 2	0 –1
18	54Q42	38°20'14"	77°02'01"	14.50	09–08–92	24.8	24.8	Columbia aquifer	12.3–22.3	10 –22	9–10	0 –2
19	54Q43	38°20'04"	77°01'57"	13.89	09–09–92	16.8	17.0	Columbia aquifer	9.3–14.3	7 –15	6– 7	0 –2
20	54Q44	38°19'46"	77°01'59"	16.44	09–12–92	24.5	25.0	Columbia aquifer	12.0–22.0	4 –22	1– 4	0 –1
21	54Q45	38°19'49"	77°01'31"	16.24	09–10–92	25.1	25.1	Columbia aquifer	12.6–22.6	10 –25	9–10	0 –2
22	54Q46	38°19'46"	77°01'42"	14.61	09–09–92	17.0	17.0	Columbia aquifer	4.5–14.5	2 –15	1– 2	0 –1
23	54Q47	38°20'10"	77°02'00"	3.91	09–09–92	24.5	24.5	Columbia aquifer	12.0–22.0	7 –24	6– 7	0 –2
24	54Q48	38°19'15"	77°02'03"	10.68	08–21–92	14.93	16.5	Columbia aquifer	2.7–12.7	1 –16	0– .5	.5 –1

Table 1. Well-construction data for observation wells—Continued

[Methods of construction: hydraulic rotary (wells 4, 10, 24, M1, M2, M3, D1, D2, D3) and hollow-stem auger (all others). Depths are measured from land-surface datum, altitude is in reference to sea level. All wells have 4 inch screen/casing internal diameter. For locations of observation wells, see plate 1]

Local well no.	USGS well no.	Latitude	Longitude	Land-surface datum altitude (feet)	Date of completion	Depth of well (feet)	Depth of hole (feet)	Hydrogeologic unit	Interval of screen (feet)	Interval of sand pack (feet)	Interval of bentonite seal (feet)	Interval of grout (feet)
25	54Q49	38°19'26"	77°02'32"	10.62	09–14–92	25.0	25.0	Columbia aquifer	9.5 – 19.5	4 – 20	1 – 4	0 – 1
27	54Q50	38°19'26"	77°02'17"	10.80	09–12–92	20.5	20.5	Columbia aquifer	8.0 – 18.0	6 – 20	4 – 6	0 – 1
28	54Q51	38°19'37"	77°02'48"	7.95	09–14–92	15.5	15.5	Columbia aquifer	5.0 – 15.0	3 – 15	1 – 3	0 – 1
29	54Q52	38°19'54"	77°02'49"	18.48	09–12–92	14.5	14.5	Columbia aquifer	7.0 – 12.0	5 – 14	2 – 5	0 – 2
30	54Q53	38°21'15"	77°02'41"	8.85	09–04–92	20.0	22.0	Columbia aquifer	12.5 – 17.5	9 – 20	8 – 9	0 – 2
M1	54Q20	38°21'03"	77°02'54"	21.59	08–29–92	97.25	100.0	Upper confined aquifer	85.0 – 95.0	70 – 100	66 – 70	0 – 66
M2	54Q22	38°21'29"	77°00'58"	20.52	09–01–92	58.25	60.0	Upper confined aquifer	46.0 – 56.0	39 – 60	34 – 39	0 – 34
M3	54Q24	38°19'15"	77°02'03"	10.70	08–22–92	74.2	75.0	Upper confined aquifer	61.8 – 71.8	39 – 74	34 – 39	0 – 34
D1	54Q19	38°21'03"	77°02'54"	21.60	08–26–92	202.25	220.0	Aquia aquifer	180.0 – 200.0	155 – 220	151 – 155	0 – 151
D2	54Q21	38°21'29"	77°00'58"	20.46	08–18–92	219.25	219.5	Aquia aquifer	197.0 – 217.0	184 – 219	182 – 184	0 – 182
D3	54Q23	38°19'15"	77°02'03"	10.70	08–21–92	214.7	215.0	Aquia aquifer	192.4 – 212.4	170 – 215	165 – 170	0 – 165

Table 2. Lithologic logs of observation wells

[ft, feet; in., inches; >, greater than; <, less than; depth, feet below land surface datum; for locations of observation wells see plate 1; codes in parentheses are color codes according to Munsell Color (1975), grain size is according to Wentworth scale (Leeder, 1982)]

Depth (ft)	Description
	Well D1 (54Q 19)
0 – 1.0	Clay, moderate-yellowish brown (10YR 5/4).
1.0– 5.0	Clay, dark-yellowish-orange (10YR 6/6), with pale-yellowish-brown (10YR 6/2) mottles at 4 to 5 ft.
5.0– 6.0	Clay, dark-yellowish-orange (10YR 6/6), with yellowish-gray (5Y 7/2) mottles.
6.0– 7.0	Clay, yellowish-gray (5Y 7/2), with dark-yellowish-orange (10YR 6/6) mottles.
7.0– 8.0	Clay, yellowish-gray (5Y 7/2), with pale-yellowish-brown (10YR 6/2) mottles. Contains quartz pebbles at 7 ft.
8.0– 9.5	Clay, dark-yellowish-orange (10YR 6/6), with pale-yellowish-brown (10YR 6/2) mottles.
9.5–10.0	Sandy clay, dark-yellowish-orange (10YR 6/6) to light-brown (5YR 5/6). Sand is medium grained.
10.0–11.0	Clay, mottle dark-yellowish-orange (10YR 6/6), yellowish-gray (5Y 7/2), and pale-yellowish-brown (10YR 6/2). Dry.
11.0–12.0	Sand, grayish-orange (10YR 7/4), fine-grained, rounded, well sorted, and micaceous. Wet.
12.0–14.0	Sand, grayish-orange (10YR 7/4) to pale-yellowish-brown (10YR 6/2), fine-grained, rounded, well-sorted, and micaceous.
14.0–15.0	Clay, yellowish-gray (5Y 7/2) with light-brown (5YR 5/6) mottles.
15.0–16.0	Sand, moderate-yellowish-brown (10YR 5/4) to dusky-yellow (5Y 6/4), very-fine- to fine-grained, rounded, and well-sorted. Wet. Contains some very-fine-grained glauconite.
16.0–17.0	Clay, pale-yellowish-brown (10YR 6/2) with dark-yellowish-orange (10YR 6/6) mottles.
17.0–19.0	Sand grading downward into silt, both are pale-yellowish-brown (10YR 6/2), sand is very-fine-grained, rounded, well-sorted, and micaceous. Wet. Contains some very-fine-grained glauconite.
19.0–19.5	Silty clay, yellowish-gray (5Y 7/2). Contains dark-yellowish-orange (10YR 6/6) laminae and some muscovite.
19.5–21.0	Silt, pale-yellowish brown (10YR 6/2). Contains some dark-yellowish-orange (10YR 6/6) laminae, some very-fine-grained sand, and some muscovite.
21.0–21.5	Silt, pale-yellowish brown (10YR 6/2). Contains some dark-yellowish-orange (10YR 6/6) laminae, some medium-grained sand, some quartz pebbles, and a burrow of moderate-yellowish-brown (10YR 5/4) color.
21.5–23.0	Clay, pale-yellowish brown (10YR 6/2), plastic. Wet.
23.0–25.0	No recovery. Spoon went through the interval under the weight of the hammer.
25.0–27.0	Clay, pale-yellowish brown (10YR 6/2), with some dark-yellowish-orange (10YR 6/6) mottles. Wet. Contains some dark-yellowish-orange (10YR 6/6) burrows.
27.0–27.2	Clay, pale-yellowish brown (10YR 6/2), with some medium- to coarse-grained sand.
27.2–31.0	Clay, olive-gray (5Y 4/1). Contains some silt and burrows-dark-yellowish-orange (10YR 6/6) to dark-yellowish-brown (10YR 4/2) in color.
31.0–35.0	No representative cuttings.
35.0–37.5	Silty clay, olive-gray (5Y 4/1). Contains some muscovite at 37.5 ft.
37.5–40.0	Clay, olive-gray (5Y 4/1). Contains some silt and some very-fine-grained glauconite.
40.0–50.0	Clay, brownish-gray (5YR 4/1) to light-brownish-gray (5YR 6/1). Contains some silt and some very-fine-grained glauconite.
50.0–60.0	Clay, brownish-gray (5YR 4/1) to light-brownish-gray (5YR 6/1). Contains some silt and more glauconite than in the previous interval. Glauconite is fine- to medium-grained.
60.0–66.0	Clay, brownish-gray (5YR 4/1) and light-brownish-gray (5YR 6/1). Contains some silt and the same amount of glauconite as in the previous interval. Contains some plant and wood fragments.
66.0–70.0	Sand and silt, greenish-gray (5GY 6/1), sand is very-fine-grained, glauconitic, rounded, and moderately sorted. Contains some quartz of larger grain sizes-fine-grained to granules. Drill chatter at 66 to 67 ft, and again at 70 ft.
70.0–72.5	Sand, grayish-green (5G 5/2) and dusky-yellowish-green (10GY 3/2), medium-grained, glauconitic, subrounded, and moderately sorted.

Table 2. Lithologic logs of observation wells—Continued

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Depth (ft)	Description
	Well D1 (54Q 19)—Continued
72.5–80.0	Sand and silt interlayered, grayish-green (10GY 5/2), between light-brownish-gray (5YR 6/1) and brownish-gray (5YR 4/1), and dusky-yellow-green (5GY 5/2). Sand is very-fine- to medium-grained, glauconitic, micaceous, subrounded, and moderately sorted. Contains some larger quartz grains-coarse-grained to granule in size. Drill chatter at 70, 75,76, and 80 ft.
80.0–90.0	Sand and silt interlayered. Sand is light-olive-gray (5Y 6/1), olive-gray (5Y 4/1), and dusky-yellow-green (5GY 5/2), very-fine- to medium-grained, glauconitic, subangular, and poorly sorted. Silt is grayish-green (10GY 5/2) and dusky-yellowish-green (10GY 3/2), and glauconitic (very-fine- to medium-grained). Drill chatter at 80 to 81 ft, 85 to 86 ft, and 90 to 91 ft.
90.0–96.0	Sand, gravel, and silt interlayered. Sand and gravel is multi-colored, very-coarse-grained to pebble-sized, subangular, and poorly sorted. Silt is between dark-greenish-gray (5GY 4/1) and greenish-gray (5GY 6/1) and some of the silt is grayish-green (10G 4/2) in color. The silt is glauconitic. Drill chatter at 91 to 92 ft, 93 to 94 ft, and 95 to 96 ft.
96.0–100.0	Silt, dark-greenish-gray (5GY 4/1) and glauconitic (fine- to medium-grained). Contains some muscovite.
100.0–110.0	Silt, olive gray (5Y 4/1) to dark-greenish-gray (5GY 4/1), and glauconitic (very-fine- to medium-grained). Contains some muscovite.
110.0–120.0	Silt, dark-greenish-gray (5GY 4/1), and glauconitic (very-fine- to medium-grained). Contains some muscovite and some very-fine-grained sand.
120.0–130.0	Silt, dark-greenish-gray (5GY 4/1), glauconitic (very-fine- to medium-grained), and micaceous. Contains sparse medium-grain sand and some wood fragments.
130.0–139.5	Silt at 130 ft grading downward into silty clay at 135 ft, dark-greenish-gray (5GY 4/1) to olive-gray (5Y 4/1), both silt and clay are glauconitic (very-fine- to medium-grained). Contains shell fragments and some muscovite.
139.5–155.0	Clay, pale-brown (5YR 5/2) to light-brown (5YR 6/4), plastic. No glauconite.
155.0–160.0	Silt, olive-gray (5Y 4/1), glauconitic (fine- to medium-grained). Contains some muscovite. Brownish tinge returns to drilling fluids from borehole.
160.0–170.0	Sand and silt, olive-gray (5Y 4/1). Sand is very-fine-grained, rounded, and well-sorted. Glauconitic (very-fine- to medium-grained). Contains some muscovite. Hard at 165 ft and 170 ft.
170.0–180.0	Silt, olive-gray (5Y 4/1) to olive-black (5Y 2/1), and glauconitic (fine- to medium-grained). Contains some very-fine- to fine-grained sand and some muscovite. Hard from 179 to 180 ft.
180.0–190.0	Silt, olive-gray (5Y 4/1) to olive-black (5Y 2/1), and glauconitic (very-fine- to fine-grained). Contains some very-fine-grained sand and some shell fragments. Hard at 188 ft but no drill chatter.
190.0–200.0	Silt and sand, olive-gray (5Y 4/1) to olive-black (5Y 2/1). Sand is rounded, well-sorted, and glauconitic (fine- to medium-grained). Contains abundant shell fragments and sparse fine- to medium-grained sand. Drill chatter at 190 to 192 ft, and at 198 ft.
200.0–209.6	Sand and silt, olive-gray (5Y 4/1) to dark-greenish-gray (5GY 4/1). Sand is very-fine-grained, rounded, well-sorted. Glauconitic (very-fine- to medium-grained). Contains shell fragments. Tight at 201 ft. Hard at 209.5 ft.
209.6–209.7	Sandy silt, dark-greenish-gray (5GY 4/1), well-indurated. Glauconitic (very-fine- to fine-grained). Sand is very-fine- to medium-grained. Cement is calcium carbonate. No shells.
209.7–220.0	Sand and silt, dark-greenish-gray (5GY 4/1). Sand is very-fine-grained, rounded, well-sorted, and glauconitic (very-fine- to medium-grained). Contains shell fragments and some fine- to medium-grained sand. Hard from 209 to 211 ft, at 212 ft, and from 218 to 220 ft.

Table 2. Lithologic logs of observation wells—Continued

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Depth (ft)	Description
	Well M1 (54Q 20)
0 – 1.0	Clay, moderate-yellowish-brown (10YR 5/4). Contains root matter and organic material.
1.0– 5.0	Sandy clay, dark-yellowish-orange (10YR 6/6), and clay, pale-yellowish-brown (10YR 6/2). Sand is very-fine- to medium-grained. Contains sparse glauconite (very-fine- to fine-grained).
5.0– 7.0	Clay, pale-yellowish-brown (10YR 6/2) from 5.0 to 6.2 ft, pale-yellowish-brown (10YR 6/2) with light-brown (5YR 5/6) mottles from 6.2 to 6.5 ft, and light-brown (5YR 5/6) from 6.5 to 7.0 ft. Dry near top of interval. Moist, but not wet near bottom of interval.
7.0–10.0	Clay, pale-yellowish-brown (10YR 6/2) grading downward into clay, mottled pale-yellowish-brown (10YR 6/2) and light-brown (5YR 5/6).
10.0–10.5	Clay, pale-yellowish-brown (10YR 6/2). Moist. Contains some muscovite.
10.5–11.5	Sand, dusky-yellow (5Y 6/4), very-fine- to fine-grained. Wet.
11.5–12.0	Clay, pale-yellowish-brown (10YR 6/2). Wet.
12.0–15.0	Clay, pale-yellowish-brown (10YR 6/2) to grayish-orange (10YR 7/4), and sand, pale-yellowish-brown (10YR 6/2) interbedded. Sand is fine-grained and contains some fine-grained glauconite.
15.0–17.0	Clay, pale-yellowish-brown (10YR 6/2) with light-brown (5YR 5/6) to dark-yellowish-orange (10YR 6/6) mottles(?) or horizontal burrows(?).
17.0–20.0	Clay, pale-yellowish-brown (10YR 6/2), with mottles(?) or burrows(?), dark-yellowish-orange (10YR 6/6) in color. Contains some fine-grained sand.
20.0–22.0	Silty sand, pale-yellowish-brown (10YR 6/2), very-fine-grained, grading downward into silt, pale-yellowish-brown (10YR 6/2) at 21.5 ft. Contains some muscovite and some burrows, dark-yellowish-orange (10YR 6/6) in color.
22.0–25.0	Clay, pale-yellowish-brown (10YR 6/2). Contains some burrows, dark-yellowish-orange (10YR 6/6) in color.
25.0–26.5	Clay, pale-yellowish-brown (10YR 6/2). Contains some burrows, dark-yellowish-orange in color. Contains sparse very-coarse-grained to granule-size quartz (possible channel lag).
26.5–30.0	No recovery.
30.0–40.0	Clay, olive-gray (5Y 4/1).
40.0–50.0	Sandy clay and wood fragment. Sandy clay is olive-gray (5Y 4/1) with very-fine-grained sand and sparse very-fine-grained glauconite. Contains leaf fragments.
50.0–60.0	Clay, olive-gray (5Y 4/1). Contains some glauconite.
60.0–61.0	Clay, olive-gray (5Y 4/1). Contains some mica. Contains a wood knot and bark at 61.0 ft.
61.0–61.5	Silty sand, olive-gray (5Y 4/1) to dark-greenish-gray (5GY 4/1), very-fine-grained, thin bedded, and micaceous. Each bed is 0.1 to 0.2 ft thick. Contains wood fragments and some glauconite.
61.5–62.5	Clay, olive-gray (5Y 4/1). Contains some silt and some muscovite.
62.5–63.5	Clay, olive-gray (5Y 4/1), interbedded with peat.
63.5–64.0	Sand, greenish-gray (5GY 6/1) to olive-gray (5Y 4/1), fine- to medium-grained. Contains some fine-grained glauconite. Smooth contact with overlying unit, no burrows.
64.0–66.0	Sand, light-olive-gray (5Y 6/1) to greenish-gray (5GY 6/1), and clay, olive-gray (5Y3/2 to 5Y 4/1), interbedded. Sand is medium-grained and glauconitic. Contains some coarse quartz sand. Clay is plastic and micaceous. Interbedded with peat layers from 64.0 to 65.0 ft.
66.0–66.5	Clay, olive-gray (5Y 4/1), plastic. Contains some muscovite and has a pebble lag (1.5 in pebble) at base.
66.5–67.7	Silt and sand, fining upward, greenish-gray (5GY 6/1) to dark-greenish-gray (5GY 4/1), sand is very-fine-grained at top of interval and medium grained at bottom, and glauconitic (fine-grained). Contains quartz-pebble fragment at bottom of interval
67.7–68.0	Peaty clay, olive-gray (5Y 4/1), with thin sand beds, light-olive-gray (5Y 6/1). Sand is coarse-grained.
68.0–70.0	Sandy silt and sand, fining upward, dusky-yellow-green (5GY 5/2) to greenish-gray (5GY 6/1). Sand is medium-grained and glauconitic (fine-grained). This interval does not contain clay layers.

Table 2. Lithologic logs of observation wells—Continued

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Depth (ft)	Description
	Well M1 (54Q 20)—Continued
70.0–80.0	Clay, sand, and silt, interbedded, grayish-green (10GY 5/2), olive-gray (5Y 4/1), and grayish-green (5G 5/2). Sand is predominately very-fine-grained, but poorly sorted-contains some medium- to very-coarse grains. Glauconitic (very-fine-to fine-grained). Drill chatter at 70.0 ft and from 75.0 to 80.0 ft.
80.0–90.0	Sandy clay, greenish-gray (5GY 6/1), grayish-green (10GY 5/2), and dusky-yellow-green (5GY 5/2); and gravel (multicolored); interbedded. Sand is very-fine-grained and glauconitic (fine- to medium-grained). Sandy clay contains very-fine-grained glauconite. The gravel is pebble-size and contains pebble fragments. Drill chatter from 85.0 to 90.0 ft.
90.0–94.0	Gravel, granule- to pebble-size, with pebble fragments. Drill chatter from 90.0 to 94.0 ft. Changed to an eight-inch rock bit to drill through hard zone. Gravel was cemented from 92.0 to 94.0 ft.
94.0–100.0	Clayey silt, dark-greenish-gray (5GY 4/1), glauconitic (fine- to medium-grained).
	Well D2 (54Q 21)
0 – 1.0	Clay, moderate-yellowish-brown (10YR 5/4). Contains some quartz pebbles.
1.0– 5.0	Clay, dark-yellowish-orange (10YR 6/6). Contains pelecypod shell fragments, species unknown.
5.0– 7.0	Clayey sand, dark-yellowish-orange (10YR 6/6) to grayish-orange (10YR 7/4), medium-grained, angular, and poorly sorted. Contains some muscovite.
7.0–10.0	Sandy clay, dark-yellowish-orange (10YR 6/6). Sand is medium- to very-coarse-grained, angular, and poorly sorted.
10.0–12.0	Sand, grayish orange (10YR 7/4) with dark-yellowish-orange (10YR 6/6) mottles, fine-grained, angular, and well-sorted. Contains sparse quartz granules and some very-fine-grained glauconite.
12.0–15.0	Sand, dark-yellowish-orange (10YR 6/6), fine-grained, angular, and well-sorted. Contains sparse very-coarse-grained sand, some very-fine-grained glauconite, and some muscovite. Pebbles (?) at 15 ft.
15.0–17.0	Sand, yellowish-gray (5Y 7/2), fine- to medium-grained, subangular, and poorly sorted. Contains some very-fine-grained glauconite and some muscovite.
17.0–18.0	Same as above with quartz granules at 18 ft.
18.0–20.0	Silt, light-olive-gray (5Y 5/2). Contains sparse glauconite and some muscovite.
20.0–22.0	Silt, light-olive-gray (5Y 5/2). Contains about 5 percent glauconite black to green and some muscovite.
22.0–25.0	Silt, light-olive-gray (5Y 5/2).
25.0–27.0	Silt, olive-gray (5Y 3/2). Contains some muscovite, some carbonaceous streaks, and some glauconite.
27.0–30.0	Silt, light-olive-gray (5Y 5/2).
30.0–35.0	Clay, grayish-green (5G 5/2).
35.0–37.5	Clay, olive-gray (5Y 4/1). Contains pelecypod shells.
37.5–40.0	No representative cuttings.
40.0–50.0	Clay (and sand?), light-olive-gray (5Y 5/2). Contains shell fragments. Sand layers from 43 to 50 ft indicated by geophysical logs, but not represented in the cuttings.
50.0–55.0	Silt, dusky-yellow-green (5GY 5/2), glauconitic. Contact between overlying sand and underlying silt at 54 ft on the geophysical logs but not represented in the cuttings.
55.0–57.5	Silt, olive-gray (5Y 4/1), very glauconitic. Dry.
57.5–60.0	No representative cuttings.
60.0–70.0	Silt to silty clay, dark-greenish-gray (5GY 4/1), very glauconitic.
70.0–80.0	Silt, dark-greenish-gray (5GY 4/1), very glauconitic. Contains some muscovite. Drill chatter at 75 ft.

Table 2. Lithologic logs of observation wells—Continued

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Depth (ft)	Description
	Well D2 (54Q 21)—Continued
80.0–90.0	Silt, dark-greenish-gray (5GY 4/1), very glauconitic. Contains some quartz granules. A worm tube or burrow lining found at this interval. Drill chatter from 88 to 90 ft.
90.0–92.5	Silty clay, dark-greenish-gray (5GY 4/1), very glauconitic. Hard interval at 92 ft
92.5–100.0	Silty clay, dark-greenish-gray (5GY 4/1), very glauconitic. No hard zones within this interval.
100.0–102.0	Silty clay, dark-greenish-gray (5GY 4/1), very glauconitic. Dry. Contains some muscovite and less silt than in overlying intervals.
102.0–110.0	Silty clay, dark-greenish-gray (5GY 4/1), very glauconitic. Contains some shell fragments. Drill chatter at 109 ft.
110.0–120.0	Silt, dark-greenish-gray (5GY 4/1), very glauconitic. Contains some shell fragments. Slightly harder at 113 and 115 ft.
120.0–130.0	Silty clay, dark-greenish-gray (5GY 4/1), very glauconitic. Contains some shell fragments and less silt than in overlying intervals. Soft at 128 ft.
130.0–132.0	Silty clay, olive-gray (5Y 4/1), very glauconitic. Contains many pelecypod shells.
132.0–140.0	Clay, dark-greenish-gray (5GY 4/1), very glauconitic. Contains shell fragments and some silt. Drill chatter from 135 to 136 ft, soft from 136 to 140 ft.
140.0–150.0	Clay, dark-greenish-gray (5GY 4/1), very glauconitic. Contains some shell fragments and silt. Hard below 145 ft.
150.0–160.0	Silty clay, dark-greenish-gray (5GY 4/1), very glauconitic. Contains shell fragments. Drill chatter from 151 to 152 ft, soft below 152 ft.
160.0–167.0	Silty clay, dark-greenish-gray (5GY 4/1), very glauconitic.
167.0–170.0	Clay, pale-brown (5YR 5/2), plastic. No glauconite. Soft after 167 ft and reddish tinge first noticed in the drilling fluids from borehole.
170.0–180.0	Clay, pale-brown (5YR 5/2), plastic. No glauconite.
180.0–185.0	Clay, pale-brown (5YR 5/2), plastic. No glauconite. Softer than above at 185 ft (contact).
185.0–190.0	No representative cuttings.
190.0–191.7	Sandy silt, olive-black (5Y 2/1), very glauconitic. Dry. Contains large *Turritella* shells (1-2 inches) and pelecypod shells. Sand is fine-grained.
191.7–200.0	Silty clay, olive-gray (5Y 4/1), very glauconitic. Drill chatter at 195 ft.
200.0–210.0	Silty clay, olive-gray (5Y 4/1), very glauconitic. Drill chatter throughout the interval. Changed to an eight-inch rock bit at 205 ft to drill through a hard zone.
210.0–219.5	Silt and silty clay, moderate-green (5G 5/6), dark-yellowish-green (10GY 4/4), grayish-green (10GY 5/2), and dusky-yellow-green (5GY 5/2). Interlayered soft and hard beds.
	Well M2 (54Q 22)
0 – 1.0	Clay, moderate-yellowish-brown (10YR 5/4).
1.0– 5.0	Clayey sand, dark-yellowish-orange (10YR 6/6), very-fine- to medium-grained. Contains some fine-grained glauconite.
5.0– 5.5	Clay, mottled grayish-orange (10YR 7/4) and dark-yellowish-orange (10YR 6/6). Contains quartz pebbles and oyster shell at 5.5 ft.
5.5– 6.5	Clayey sand, yellowish-gray (5Y 7/2) and dark-yellowish-orange (10YR 6/6), laminated, fine-grained. Contains fine-grained glauconite.
6.5– 7.0	Sand, dark-yellowish-orange (10YR 6/6), fine- to medium-grained. Contains some coarse-grained to granule-size quartz and some fine-grained glauconite.

Table 2. Lithologic logs of observation wells—Continued

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Depth (ft)	Description
	Well M2 (54Q 22)—Continued
7.0–10.0	Sand and sandy clay, grayish-orange (10YR 7/4). Sand is fine-grained. Contains some quartz granules and some very-fine-grained glauconite.
10.0–12.0	Sand, pale-yellowish-brown to grayish-orange (10YR 7/4), fine- to medium-grained. Contains some glauconite (very-fine- to fine-grained) and quartz pebbles (up to 2 inch diameter). Burrowed, color dark-yellowish-orange (10YR 6/6).
12.0–15.0	Sand, pale-yellowish-orange (10YR 8/6) to grayish-orange (10YR 7/4), and clay, dark-yellowish-orange (10YR 6/6). Sand is fine-grained and contains some fine-grained glauconite.
15.0–17.0	Sand, yellowish-gray (5Y 7/2), fining upward from fine- to medium-grained at the bottom to very-fine-grained at the top. Micaceous throughout the interval. Burrowed from 15.0 to 16.0 ft, dark-yellowish-orange (10YR 6/6).
17.0–20.0	No recovery. Drill chatter at 17.5 ft.
20.0–30.0	Sandy silt grading downward into clay, olive-gray (5Y 4/1). Sand in silt is very-fine-grained. Contains sparse glauconite (very-fine- to fine-grained) and wood fragments.
30.0–35.0	Clay, olive-gray (5Y 4/1), with thin clay layers from grayish-green (5G 5/2) to dark-greenish-gray (5G 4/1) in color. Contains sparse fine- to coarse-grained sand and sparse glauconite.
35.0–37.0	Clay, greenish-gray (5G 6/1) to dark-greenish-gray (5G 4/1), plastic. Moist to dry, not wet.
37.0–39.0	Clay, dark-greenish-gray (5GY 4/1). Contains oyster shells, some glauconite (fine- to medium-grained), and some muscovite. Plant fossil at 39.0 ft.
39.0–40.5	Clay and silt, dark-greenish-gray. Contains some glauconite (very-fine- to fine-grained), some muscovite, oyster shell fragments, and some very-fine- to coarse-grained sand.
40.5–41.0	Sand, dark-greenish-gray (5G 4/1), very-fine-grained, glauconite (very-fine- to fine-grained). Sharp contact with overlying unit.
41.0–43.0	No recovery.
43.0–45.0	Sand, dark-greenish-gray (5G 4/1), fine-grained, and glauconitic (fine- to medium-grained). Contains some very-fine- to medium-grained sand. Contains sparse muscovite.
45.0–47.5	Sand, dark-greenish-gray (5G 4/1), fine-grained, and glauconitic (fine- to medium-grained). Contains some muscovite. Contains sparse very-fine- to medium-grained sand.
47.5–49.0	Sand, dark-greenish-gray (5G 4/1), fine-grained, and glauconitic (fine- to medium-grained), and micaceous. Contains rounded to angular quartz pebbles 0.2 inches in diameter.
49.0–49.5	Sandy silt, dark-greenish-gray (5GY 4/1), contains angular and rounded quartz pebbles up to 2 inches in diameter. Glauconitic (fine- to medium-grained). Contains some pelecypod fragments.
49.5–51.0	Sand, dark-greenish-gray (5G 4/1), medium-grained, glauconitic (fine- to medium-grained), and micaceous. Contains some fine-grained sand.
51.0–53.0	Sand, dark-greenish-gray (5GY 4/1 to 5G 4/1), coarsening upward from very-fine- to fine-grained at 53.0 ft to medium-grained at 51.0 ft, glauconitic (fine- to medium-grained), and micaceous.
53.0–54.5	Sand, dark-greenish-gray (5G 4/1), fining upward from medium- to coarse-grained at 54.5 ft to very-fine- to fine-grained at 53.0 ft, and glauconitic. Wet. Quartz pebbles up to 1 inch in diameter from 54.0 to 54.5 ft.
54.5–55.0	Sandy clay, dark-greenish-gray (5GY 4/1), glauconitic, and micaceous. Sand in clay is fine- to medium-grained. Wet.
55.0–55.5	Sand and silt, dark-greenish-gray (5GY 4/1), fines upward from fine- to medium-grained at 55.5 ft to silt and very-fine-grain sand at 55.0 ft, glauconitic (very-fine- to medium-grained), and micaceous. Wet. Contains quartz pebbles up to 2 inches in diameter. Drill chatter.
55.5–57.0	Clayey silt, dark-greenish-gray (5GY 4/1) to olive-gray (5Y 4/1), and glauconitic (fine- to medium-grained). Dry. Contains mica and some dissolved shell material.
57.0–60.0	No recovery.

Table 2. Lithologic logs of observation wells—Continued

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Depth (ft)	Description
	Well D3 (54Q 23)
0 – 1.0	Clay, dark-yellowish-brown (10YR 4/2) to moderate-yellowish-brown (10YR 5/4)
1.0– 5.0	Sandy clay, dark-yellowish-orange (10YR 6/6), grading downward into clay, dark-yellowish-orange (10YR 6/6) with pale-yellowish-brown (10YR 6/2) mottling, plastic. Wet at 3.0 ft. Contains quartz pebbles.
5.0– 7.0	Clay, pale-yellowish-brown (10YR 6/2) with dark-yellowish-orange (10YR 6/6) mottles, plastic. Wet. Contains quartz pebble layer at 5.0 ft.
7.0–10.0	Sandy clay, pale-yellowish-brown (10YR 6/2) with dark-yellowish-orange (10YR 6/6) mottles, plastic, sand is coarse-grained.
10.0–11.5	Clay, pale-red (5R 6/2), plastic. Contains iron laminae, moderate yellowish-brown (10YR 5/4) in color.
11.5–12.0	Clayey sand grading downward into sand, grayish-orange (10YR 7/4), medium-grained, rounded, and well-sorted.
12.0–13.0	Sand, dark-yellowish-orange (10YR 6/6), medium- to coarse-grained, rounded, and well-sorted. Soft at 13 ft.
13.0–15.0	Clay, light-olive-gray (5Y 6/1), sticky.
15.0–17.0	Clay, olive-gray (5Y 4/1), plastic. Contains some silt.
17.0–20.0	Clay, light-olive-gray (5Y 6/1), plastic. Wet. Hard at 19 ft.
20.0–21.5	Sand, medium-gray (N5), fine-grained, rounded, and well-sorted. Contains some glauconite.
21.5–22.0	Sandy clay, olive-gray (5Y 4/1), plastic. Sand is fine-grained. Contains some carbonaceous material.
22.0–25.0	Silty clay, olive-gray (5Y 4/1). Contains sparse very-coarse- to granule-size quartz grains. Contains worm tubes (?) or burrow fillings (?).
25.0–27.0	Clay, greenish-gray (5GY 6/1), plastic.
27.0–30.0	No representative cuttings.
30.0–32.0	Clay, dark-greenish-gray (5GY 4/1), plastic.
32.0–35.0	Clayey sand, olive-gray (5Y 4/1), medium- to coarse-grained, sub-rounded, and moderately sorted.
35.0–37.0	Clay, dark-greenish-gray (5GY 4/1), plastic. Contains U-shaped burrows.
37.0–40.0	Wood fragments.
40.0–40.5	Clayey silt, greenish-gray (5GY 6/1), with moderate-olive-brown (5Y 4/4) mottles, micaceous.
40.5–42.0	Clay, dark-greenish-gray (5GY 4/1), plastic.
42.0–45.0	No recovery. Tight at approximately 44 ft.
45.0–46.0	Silty clay, greenish-gray (5GY 6/1), micaceous.
46.0–50.0	No recovery.
50.0–52.0	Sand and silt, interlaminated, greenish-gray (5GY 6/1) to dusky-yellow-gray (5GY 5/2) in color, glauconitic, and micaceous. Sand is fine-grained, sub-rounded, and well-sorted. Contains some clay and some silt laminae that are black (N1) in color.
52.0–55.0	No recovery.
55.0–57.0	Sand and silty to sandy clay, interbedded, dark-greenish-gray (5GY 4/1). Sand is fine- to medium-grained, sub-rounded, and well-sorted. Both sand and clay are micaceous. Sand is glauconitic. Clay contains less glauconite than the sand. Each bed is approximately 0.4 ft thick.
57.0–60.0	No recovery.
60.0–60.5	Sand, dusky-yellowish-green (10GY 3/2), fine-grained, rounded, well-sorted, glauconitic, and micaceous.
60.5–61.0	Silt, dusky-yellowish-green (10GY 3/2). Contains quartz pebbles.
61.0–62.0	Sand, dusky-yellowish-green (10GY 3/2), medium-grained, sub-rounded, well-sorted, glauconitic, and micaceous.
62.0–65.0	No recovery.
65.0–66.5	Sand, light-olive-gray (5Y 6/1), dusky-yellowish-green (5GY 5/2), and greenish-gray (5GY 6/1), medium- to coarse-grained, subangular, well-sorted, and glauconitic. Contains a quartz pebble lag at 66.5 ft.

Table 2. Lithologic logs of observation wells—Continued

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Depth (ft)	Description
	Well D3 (54Q 23)—Continued
66.5–70.0	No recovery.
70.0–71.0	Sand, light-olive-gray (5Y 5/2), medium- to very-coarse-grained, subangular, and poorly sorted. Contains rounded quartz pebbles one inch in diameter.
71.0–73.0	Sand and gravel, very-light-gray (N8) and moderate-yellowish-brown (10YR 5/4), very-coarse-grained, subangular, and moderately sorted. Drill chatter from 70 to 71 ft. Soft at 73 ft.
73.0–80.0	No recovery. Interval very soft. Glauconite grains at bottom of interval.
80.0–82.0	Clayey silt, dark-greenish-gray (5GY 4/1), glauconitic. Contains abundant shells.
82.0–90.0	Clay, dark-greenish-gray (5GY 4/1), glauconitic, and micaceous.
90.0–100.0	Clay, dark-greenish-gray (5GY 4/1), glauconitic. Contains some silt. Drill chatter at 96 ft.
100.0–101.0	Silty clay, dark-greenish-gray (5GY 4/1), glauconitic, and micaceous.
101.0–110.0	Clay, dark-greenish-gray (5GY 4/1), glauconitic (fine-grained). Contains some silt.
110.0–120.0	Clay, dark-greenish-gray (5GY 4/1), glauconitic (fine-grained). Contains some silt. Hard at 114 ft, soft at 115 ft.
120.0–130.0	Clay, dark-greenish-gray (5GY 4/1), glauconitic (fine-grained). Contains shell fragments and some silt.
130.0–140.0	Clay, dark-greenish-gray (5GY 4/1), glauconitic (fine-grained). Contains shell fragments and some silt.
140.0–149.0	Clay, dark-greenish-gray (5GY 4/1), glauconitic (fine-grained). Contains shell fragments and some silt.
149.0–160.0	Clay, light-brown (5YR 6/4) to moderate-brown (5YR 4/4).
160.0–170.0	Clay, light-brown (5YR 6/4).
170.0–180.0	No recovery. Interval very soft.
180.0–190.0	Clayey silt, olive-gray (5Y 4/1), glauconitic (fine-grained). Contains shell fragments and some muscovite. Hard at 187 ft.
190.0–194.0	No recovery. Hard at 192 and 194 ft. Changed to an eight-inch rock bit to drill through the hard zone at 194 ft.
194.0–200.0	Clay, moderate-green (5G 5/6) and dark-greenish-gray (5GY 4/1). Interlayered hard and soft beds.
200.0–215.0	No recovery.
215.0–216.2	Sandy silt, olive-gray (5Y 4/1), glauconitic (fine-grained), indurated(?). Contains fine-grained quartz sand and clay laminae.
	Well M3 (54Q 24)
0.0– 1.0	Silty clay, moderate-yellowish-brown (10YR 5/4) to dark-yellowish-orange (10YR 6/6). Contains coal fragments and rounded quartz pebbles. Probably fill.
1.0– 5.0	Silty clay, dark-yellowish-orange (10YR 6/6). Contains very-coarse-grained sand layer at 4.0 ft and coal fragments. Probably fill.
5.0– 7.0	Clay, pale-yellowish-brown (10YR 6/2), plastic. Contains burrows and laminae of dark-yellowish-orange (10YR 6/6) color from 5.0 to 6.0 ft.
7.0–10.0	Clay, pale-yellowish-brown (10YR 6/2). Contains some silt.
10.0–11.5	Clay, pale-yellowish-brown (10YR 6/2). Contains burrows, dark-yellowish-orange (10YR 6/6).
11.5–13.0	Sand, pale-yellowish-brown (10YR 6/2), medium- to coarse-grained.
13.0–15.0	Clay, olive-gray (5Y 4/1) to dark-greenish-gray (5GY 4/1), plastic. Contains worm tubes(?) or burrows(?).
15.0–17.5	Clay, dark-greenish-gray (5GY 4/1), plastic.
17.5–20.0	Sand, light-olive-gray (5Y 6/1), fine-grained. Contains wood fragments.
20.0–30.0	Silty clay, dark-greenish-gray (5GY 4/1). Contains worm tubes(?) or burrows (?), moderate-brown (5YR 4/4) in color.

Table 2. Lithologic logs of observation wells—Continued

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Depth (ft)	Description
	Well M3 (54Q 24)—Continued
30.0–40.0	Clay, olive-gray (5Y 4/1), plastic. Contains some silt. Contains worm tubes(?) or burrows(?), moderate-brown (5YR 4/4) in color. Contains some rounded quartz pebbles, up to 0.2 in. in diameter.
40.0–49.0	Silt, between dark-greenish-gray (5GY 4/1) and light-olive-gray (5GY 6/1) in color. Some plastic clay near the bottom of the interval, olive-gray (5Y 3/2) to light-olive-gray (5Y 5/2) in color. Some micaceous plastic clay, olive-gray (5Y 4/1) near the bottom. Wood fragments and fossil leaves throughout this interval.
49.0–60.0	No recovery, but the driller noticed the interval was hard beginning at 49.0 ft.
60.0–70.0	Sand, silt, and clay, interbedded, greenish-gray (5GY 6/1) and light-olive-gray (5Y 6/1). Sand is fine-grained to granule-size. All sediments are glauconitic and micaceous. Contains some quartz pebbles, up to 0.2 in diameter. Drill chatter at 60.0 and 61.0 ft.
70.0–74.0	Sand and gravel, indicated by drill chatter. No recovery.
74.0–75.0	Soft, no recovery.
	Well 1 (54Q 25)
0 – 0.3	Top soil.
.3– 4.0	Silt, light-olive-gray (5Y 5/2), some fine-grained sand.
4.0– 5.0	Sandy clay, grayish orange (10YR 7/4), some fine-grained sand.
5.0–10.0	Clayey sand, pale-yellowish-brown (10YR 6/2), fine- to medium-grained. Clay content increases at 6.5 ft. Mottling present in one discrete interval (6.3 to 6.5 ft).
10.0–12.5	Clay with some sand, pale-yellowish-brown (10YR 6/2) and light-brown (5YR 5/6), very fine- to fine-grained. Mottled. Moist.
12.5–13.0	Clay with some sand, light-gray (7N7), very-fine- to fine-grained. Mottled.
13.0–15.5	Clay, olive-gray (5Y 4/1), plastic, micaceous.
15.5–17.0	Silty sand, olive-gray (5Y 4/1), very-fine- to fine-grained, micaceous, and glauconitic.
	Well 2 (54Q 26)
0 – 0.5	Top soil.
.5– 2.0	Silty clay with sand, dark-yellowish-brown (10YR 4/2), fine grained.
2.0– 3.5	Silty sand, pale-yellowish-brown (10YR 6/2), fine-grained. Some clay.
3.5– 5.0	Sandy clay, dark-yellowish-orange (10YR 6/6), very-fine- to fine-grained.
5.0–10.0	Clayey sand, pale-yellowish-brown (10YR 6/2) and light-brown (5YR 5/6), very-fine- to fine-grained, mottled. Coarsening upward. Moist.
10.0–12.5	Same as above, except iron oxide cement in places. Wet.
12.5–15.0	Same as above, except clay content increasing.
15.0–17.5	Clay with some sand, pale-blue (5PB 7/2) from 15.0 to 16.0 ft and light-brown (5YR 5/6) from 16.0 to 17.0 ft, very-fine- to fine-grained. Some zones hard, possibly iron oxide cement. Moist.
17.5–19.5	Same as above, except sand content slightly increases.
19.5–21.0	Clay, dark-greenish-gray (5GY 4/1), plastic.
21.0–22.5	Sand with silt, dark-greenish-gray (5GY 4/1), very-fine- to fine-grained, glauconite, micaceous. Moist.

Table 2. Lithologic logs of observation wells—Continued

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Depth (ft)	Description
	Well 3 (54Q 27)
0 – 0.1	Top Soil.
.1– 3.0	Clay, pale-yellowish-brown (10YR 6/2), some fine-grained sand.
3.0– 4.0	Silty sand, moderate-yellowish-brown (10YR 5/4), fine-grained.
4.0– 5.0	Clay, dark-yellowish-orange (10YR 6/6), very little sand.
5.0– 11.0	Sandy clay, pale-yellowish-brown (10YR 6/2) and light-brown (5YR 5/6), very-fine- to fine-grained. Mottled with oxidation stains.
11.0– 12.5	Sandy silt, light-bluish-gray (5B 7/1) and light-brown (5YR 5/6), very-fine- to fine-grained. Some clay. Moist.
12.5– 14.5	Silty sand interbedded with clayey sand, light-bluish-gray (5B 7/1) and light-brown (5YR 5/6), fine-grained. Mottled. Wet.
14.5– 15.0	Silty sand interbedded with clayey sand, light-bluish-gray (5B 7/1) and light-brown (5YR 5/6), fine-grained. Mottled. Wet.
15.0– 17.5	Same as above, except very-fine- to fine-grained.
17.5– 20.0	Silty sand, pale-yellowish-brown (10YR 6/2), very-fine- to fine-grained. Fewer clayey sand interbeds than above. Mottling not as prevalent. Wet.
20.0– 21.0	Clayey sand, pale-yellowish-brown (10YR 6/2), fine-grained. Signs of oxidation at 21.0 ft. Wet.
21.0– 22.0	Clay with sand, olive-gray (5Y 4/1), very-fine- to fine-grained, plastic, micaceous.
	Well 4 (54Q 28)
0 – 1.0	Clay, moderate-yellowish-brown (10YR 5/4).
1.0– 5.0	Sand, dark-yellowish-orange (10YR 6/6), sandy clay and clay, pale-yellowish-brown (10YR 6/2), sand is fine- to medium-grained. Contains some very-fine-grained glauconite and sparse coarse-grained quartz.
5.0– 7.0	Clay, yellowish-gray (5Y 7/2) grading downward into mottled and burrowed clay, light-brown (5YR 5/6), yellowish-gray (5Y 7/2), dark-yellowish-orange (10YR 6/6), and grayish-orange-pink (5YR 7/2) to pale-brown (5YR 5/2).
7.0– 10.0	Sand, dark-yellowish-orange (10YR 6/6), and clay, yellowish-gray (5Y 7/2) to pale-yellowish-brown (10YR 6/2). Sand is medium-grained and contains some very-fine-grained glauconite.
10.0– 11.5	Clay, pale-yellowish-brown (10YR 6/2), to mottled dark-yellowish-orange (10YR 6/6) and light-olive-brown (5Y 5/6) from 10.5 to 11.0 ft. Contains burrows, light-olive-brown (5Y 5/6).
11.5– 12.0	Sand, yellowish-gray (5Y 7/2) to pale-yellowish-brown (10YR 6/2), fine-grained. Wet. Contains some very-fine-grained glauconite.
12.0– 15.0	Sand, grayish-orange (10YR 7/4), very-fine- to fine-grained. Contains some very-fine-grained glauconite.
15.0– 16.5	Clay, pale-yellowish-brown (10YR 6/2). Contains burrows, dark-yellowish-orange (10YR 6/6).
16.5– 17.0	Silt, pale-yellowish-brown (10YR 6/2)
17.0– 20.0	Sand, grayish-orange (10YR 7/4), very-fine-grained. Contains some very-fine-grained glauconite.
20.0– 21.5	Sand and silt, pale-yellowish-brown (10YR 6/2), coarsening upward from silt at 21.5 ft to very-fine-grained sand at 20.0 ft. Contains burrows, dark-yellowish-orange (10YR 6/6) to light-brown (5YR 5/6).
21.5– 22.0	Clay, light-olive-gray (5Y 6/1).
	Well 5 (54Q 29)
0 – 0.5	Top soil.
.5– 2.5	Silty sand, dark-yellowish-orange (10YR 6/6), medium-grained. Some oyster shells, possibly fill.
2.5– 5.0	Silty sand with clay, yellowish-gray (5Y 7/2), medium-grained.

Table 2. Lithologic logs of observation wells—Continued

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Depth (ft)	Description
	Well 5 (54Q 29)—Continued
5.0–10.0	Clay, light-olive-gray (5Y 6/1) and light-brown (5YR 5/6). Laminated in places and iron oxide stained. Some fine-grained sands.
10.0–12.5	Clayey sand with silt interbeds, pale-yellowish-brown (10YR 6/2) and dark-yellowish-orange (10YR 6/6), silt is moderate-yellowish-brown (10YR 5/4), very-fine- to fine-grained. Root material in the silt. Clayey sand is wet.
12.5–18.5	Clayey sand, grayish-orange (10YR 7/4), very-fine- to fine-grained. Very wet.
18.5–24.5	Clay, olive-gray (5Y 4/1), highly plastic.
	Well 6 (54Q 30)
0 – 0.5	Top soil.
.5– 3.0	Sandy silt, dark-yellowish-orange (10YR 6/6), very-fine-grained. Dry.
3.0– 4.0	Silty sand, light-brown (5YR 5/6), medium- to coarse-grained.
4.0– 5.0	Clayey sand, dark-yellowish-orange (10YR 6/6), fine- to medium-grained.
5.0– 7.0	Clayey sand, dark-yellowish-orange (10YR 6/6), fine- to medium-grained. Clay content increases downward.
7.0– 9.0	Sandy clay, pale-yellowish-brown (10YR 6/2), fine- to medium-grained. Moist.
9.0–10.0	Sandy clay, light-olive-gray (5Y 5/2), fine- to medium-grained. Moist.
10.0–12.0	Clay, light-olive-gray (5Y 6/1), plastic. Minor very-fine- to fine-grained sand. Some oxidation between 10.0 and 10.1 ft.
12.0–14.5	Clay, olive-gray (5Y 4/1), plastic.
	Well 7 (54Q 31)
0 – 4.5	Silty sand, dark-yellowish-orange (10YR 6/6), fine- to medium-grained.
4.5– 5.0	Sand with gravel, grayish-orange (10YR 7/4), coarse-grained. Some gravels as large as 5 in. Damp.
5.0– 7.0	Sand with gravel, very-pale orange (10YR 8/2), fine- to coarse-grained. Sand interbedded with gravels (0.5 - 1 in.). Some gravels are phosphate coated. Small grains in sand are black, possibly magnetite(?). Wet with signs of oxidation, dark-yellowish-orange (10YR 6/6), especially from 5.0 to 5.1 ft.
7.0– 9.0	Same as above, but wetter.
9.0–10.0	Same as above; color getting darker, grayish-orange (10YR 7/4). Gravels are smaller in diameter (<5 in.).
10.0–12.0	Sand and gravel, grayish-orange (10YR 7/4), medium- to very-coarse-grained. Gravels are getting larger (>1 in.). Saprolitic chlorite-schist clast. Wet with visible signs of oxidation.
12.0–15.0	Sand, grayish-orange (10YR 7/4), fine- to medium-grained. Wet.
15.0–15.4	Sand, very-pale-orange (10YR 8/2), fine- to medium-grained, some silt/clay. Silt/clay content increases downward. Wet.
15.4–15.5	Sandy silt with clay, light-brown (5YR 5/6), fine-grained, laminated. Highly oxidized zone.
15.5–17.0	Sandy silt, olive-gray (5Y 3/2), fine-grained, organic fragments, some mica, glauconite(?).
17.0–19.0	Sandy silt, olive-gray (5Y 3/2), fine-grained. Some mica, thin interbeds of shell fragments (<0.1 in. thick).
	Well 8 (54Q 32)
0 – 1.0	Clay, dark-yellowish-brown (10YR 4/2). Contains some rounded quartz pebbles, rootlets, and sparse medium- to coarse-grained sand.

Table 2. Lithologic logs of observation wells—Continued

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Depth (ft)	Description
	Well 8 (54Q 32)—Continued
1.0– 5.0	Clay, moderate-yellowish-brown (10YR 5/4). Moist at 2.0 ft. Drill chatter from 2.0 to 3.0 ft. Contains rounded quartz granules and pebbles from 3.5 to 5.0 ft and some medium- to coarse-grained sand.
5.0– 5.75	Clayey sand, light-olive-gray (5Y 5/2), coarse- to very-coarse-grained. Moist.
5.75–5.9	Sandy clay, pale-olive (10Y 6/2) to grayish-olive (10Y 4/2), medium-grained to granule-size sand.
5.9– 8.0	Clayey and sandy conglomerate, light-olive-gray (5Y 5/2) to pale-olive (10Y 6/2). Wet at 6.0 ft. Contains rounded quartz pebbles.
8.0– 9.0	Sand, pale-olive (10Y 6/2), coarse- to very-coarse-grained. Contains quartz granules and pebbles.
9.0– 9.5	Cobbles, with clayey sand matrix, pale-olive (10Y 6/2), coarse- to-very-coarse-grained. Wet.
9.5–10.0	Clayey sand, dark-yellowish-orange (10YR 6/6), coarse- to very-coarse-grained. Wet. Contains some quartz granules and pebbles.
10.0–10.5	Sandy clay, olive-gray (5Y 4/1), medium- to coarse-grained.
10.5–12.0	Sand, light-olive-gray (5Y 5/2) to pale-olive (10Y 6/2), very-fine- to fine-grained. Wet. Contains some fine-grained glauconite and some muscovite.
12.0–15.0	Sand, light-olive-gray (5Y 5/2) to pale-olive (10Y 6/2), very-fine- to fine-grained. Wet. Contains some fine-grained glauconite and some muscovite. Soft at 12.5 ft.
15.0–15.7	Sand, pale-yellowish-brown (10YR 6/2), fine- to medium-grained. Wet. Contains fine-grained glauconite.
15.7–16.4	Clayey sand, pale-olive (10Y 6/2), medium-grained to granule-size. Contains some muscovite.
16.4–16.8	Sand, light-olive-gray (5Y 5/2), medium-grained. Wet. Contains some fine-grained glauconite.
16.8–17.0	Sand, dark-yellowish-orange (10YR 6/6), medium-grained.
17.0–20.0	No recovery.
20.0–22.0	Sand, pale-yellowish-brown (10YR 6/2), poorly sorted, fine-grained to granule-size, predominantly medium-grained. Wet.
22.0–27.0	Sand and conglomerate, dusky-yellow (5Y 6/4) to light-olive-gray (5Y 5/2), poorly sorted, fine-grained to pebble-size, predominantly medium-grained. Pebbles are rounded. Contains some fine-grained glauconite.
27.0–30.0	No recovery. Interval soft.
30.0–32.0	Silt, olive-gray (5Y 3/2), micaceous. Moist, not wet. Contains some fine-grained sand and sparse very-coarse-grained to granule-size quartz.
	Well 9 (54Q 33)
0 – 0.1	Clay and leaf matter, grayish-brown (5YR 3/2) to moderate-brown (5YR 3/4).
.1– 2.0	Silty clay, pale-yellowish-brown (10YR 6/2) to dark-yellowish-brown (10YR 4/2), with moderate-yellowish-brown (10YR 5/4) mottling. Contains rootlets.
2.0– 5.0	Silty clay, dark-yellowish-orange (10YR 6/6). Dry. Moist at 4.5 ft.
5.0– 6.5	Clayey sand, dark-yellowish-orange (10YR 6/6) with yellowish-gray (5Y 7/2) mottles, very-fine- to fine-grained. Wet. Contains some fine-grained glauconite.
6.5– 7.0	Clay, yellowish-gray (5Y 7/2), plastic, with dark-yellowish-orange (10YR 6/6) burrows. Contains sparse fine-grained glauconite and some muscovite.
7.0–10.0	Sandy clay, color change from dusky-yellow (5Y 6/4) at 7.0 ft to dusky-yellow (5Y 6/4) to light-olive-brown (5Y 5/6) at 10.0 ft. Sand in clay is fine- to medium-grained. Contains some fine-grained glauconite and some rounded quartz granules and pebbles.
10.0–12.5	Sandy clay, mottled dark-greenish-yellow (10Y 6/6) and pale-olive (10Y 6/2), poorly sorted, very-fine- to medium-grained. Contains some fine-grained glauconite and some muscovite.
12.5–15.0	Clayey sand and sandy clay, dark-greenish-yellow (10Y 6/6) to pale-olive (10Y 6/2), very-fine- to fine-grained. Contains some fine-grained glauconite and some muscovite.

Table 2. Lithologic logs of observation wells—Continued

[ft, feet; in., inches; >, greater than; <, less than; depth, feet below land surface datum; for locations of observation wells see plate 1; codes in parentheses are color codes according to Munsell Color (1975), grain size is according to Wentworth scale (Leeder, 1982)]

Depth (ft)	Description
	Well 9 (54Q 33)—Continued
15.0–17.0	Silty clay and clayey silt, moderate-olive-brown (5Y 4/4) with light-olive-brown (5Y 5/6) laminae, micaceous. Moist to wet at 15.0 ft, dry at 17.0 ft. Contains some fine-grained glauconite and some very-fine- to fine-grained sand.
17.0–20.0	Clayey silt and clay, moderate-olive-brown (5Y 4/4). Contains some fine-grained glauconite, some muscovite, and sparse fine- to coarse-grained sand.
20.0–22.0	Silty clay, color from light-olive-gray (5Y 5/2) and light-olive (10Y 5/4) at 20.0 ft to grayish-olive (10Y 4/2) at 22.0 ft, micaceous. Contains some fine- to medium-grained sand. Gastropod mold (*Turritella*?) at 21.0 ft.
22.0–23.0	No recovery.
24.0–25.5	Silty clay, olive-gray (5Y 4/1) to dark-greenish-gray (5GY 4/1), micaceous. Moist to dry. Contains some fine-grained sand and some fine-grained glauconite. Contains pelecypod shells.
	Well 10 (54Q 34)
0 – 1.0	Clay, moderate-yellowish-brown (10YR 5/4).
1.0– 5.0	Clay, dark-yellowish-orange (10YR 6/6) with pale-yellowish-brown (10YR 6/2) mottles.
5.0– 7.0	Clayey sand, dark-yellowish-orange (10YR 6/6), medium-grained. Contains quartz pebbles, up to 2 in. in diameter.
7.0– 9.0	No recovery.
9.0– 9.5	Clayey sand, dark-yellowish-orange (10YR 6/6) with pale-yellowish-brown (10YR 6/2) mottles, fine-grained.
9.5–10.0	Sand, dusky-yellow (5Y 6/4), fine-grained.
10.0–12.5	Sand, grayish-orange (10YR 7/4), fine-grained
12.5–15.0	Sand, dark-yellowish-orange (10YR 6/6) changing to pale-yellowish-brown (10YR 6/2), fine-grained. Water at 15.0 ft.
15.0–17.0	Sand, dark-yellowish-orange (10YR 6/6) changing to pale-yellowish-brown (10YR 6/2) at 16.0 ft, very-fine-grained.
17.0–18.5	Sand, dark-yellowish-orange (10YR 6/6) changing to pale-yellowish-brown (10YR 6/2) from 18.45 to 18.5 ft, very-fine-grained.
18.5–19.0	Silt, olive-gray (5Y 4/1).
19.0–21.0	Silt, olive-gray (5Y 4/1).
	Well 11 (54Q 35)
0 – 2.5	Sandy clay, moderate-yellowish-brown (10YR 5/4) to dark-yellowish-brown (10YR 4/2), medium- to coarse-grained. Contains oyster shells and rootlets.
2.5– 5.0	Sand, dark-yellowish-orange (10YR 6/6) to dusky-yellow (5Y 6/4) to light-olive-gray (5Y 5/2) at 5.0 ft, medium- to coarse-grained. Contains some shell fragments.
5.0– 5.5	Sand, dusky-yellow (5Y 6/4) to light-olive-brown (5Y 5/6), medium-grained. Contains some coarse-grained sand.
5.5– 5.7	Silty clay, pale-yellowish-brown (10YR 6/2) to dark-yellowish-orange (10YR 6/6).
5.7– 5.9	Shell hash, olive-gray (5Y 4/1) to light-olive-gray (5Y 6/1). Contains some very-fine- to fine-grained sand.
5.9– 7.0	Sand, light-olive-gray (5Y 6/1), fine- to medium-grained. Wet. Contains some very-fine-grained glauconite.
7.0–13.0	Sand, light-olive-gray (5Y 5/2), very-fine- to fine-grained. Wet. Contains some fine-grained glauconite and some medium-grained to pebble-size quartz grains.

Table 2. Lithologic logs of observation wells—Continued

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Depth (ft)	Description
	Well 11 (54Q 35)—Continued
13.0–15.0	Sandy clay and silty sand, dusky-yellow (5Y 6/4), light-olive-brown (5Y 5/6), olive-gray (5Y 3/2), brownish-gray (5YR 4/1), and olive-gray (5Y 4/1), sand is very-fine- to medium-grained. Some shell fragments.
15.0–15.2	Silt, dusky-brown (5YR 2/2).
15.2–17.0	Clay, pale-olive (10Y 6/2) with dark-yellowish-orange (10YR 6/6) burrows. Contains some oyster shell fragments.
17.0–18.7	Sandy silt, olive-gray (5Y 4/1), very-fine- to fine-grained. Contains some oyster shell fragments. Soft at 18.7 ft.
18.7–20.5	Silt, olive-black (5Y 2/1). Contains some very-fine- to fine-grained sand.
20.5–21.3	Clay, light-olive-gray (5Y 6/1). Contains clay laminae and burrows, dark-yellowish-orange (10YR 6/6) in color.
21.3–21.8	Sand, dusky-yellow (5Y 6/4), medium- to coarse-grained. Contains quartz granules and pebbles and wood fragments.
21.8–22.0	Sand, pale-olive (10Y 6/2), very-fine-grained. Contains some fine-grained glauconite and fine-grained sand.
22.0–25.0	Clay, dark-yellowish-orange (10YR 6/6), plastic. Contains some muscovite and sparse quartz granules.
	Well 12 (54Q 36)
0 – 5.0	Silty sand, moderate-yellowish-brown (10YR 5/4). Numerous cobbles.
5.0– 7.0	Silty sand, moderate-yellowish-brown (10YR 5/4), sub-angular grains.
7.0–10.0	Silty sand, dark-yellowish-orange (10YR 6/6). Fining to a silty clay at 10.0 ft.
10.0–10.5	Sandy silt, moderate-yellowish-brown (10YR 5/4).
10.5–12.5	Mottled clay, pale-yellowish-brown (10YR 6/2), with minor amounts of organic matter.
12.5–13.0	Silty sand, moderate-yellowish-brown (10YR 5/4), fine- to very-fine-grained. Wet.
13.0–14.3	Sand, dark-yellowish-orange (10YR 6/6), coarse- to very-coarse-grained with sub-rounded to angular pebbles.
14.3–15.0	Sand, grayish-orange (10YR 7/4), medium-grained.
15.0–15.5	Silty sand, dark-yellowish-orange (10YR 6/6) to dark-yellowish-brown (10YR 4/2) at lower contact.
15.5–17.5	Sand, grayish-orange (10YR 7/4) to grayish-orange-pink (10YR 7/2), coarse- to very-coarse-grained. Some pebbles.
17.5–18.0	Silty sand, dark-yellowish-orange (10YR 6/6), coarse- to fine-grained. Some pebbles.
18.0–20.0	Silt, olive-gray (5Y 4/1), micaceous.
	Well 13 (54Q 37)
0 – 5.0	Silt, dark-yellowish-orange (10YR 6/6).
5.0– 6.0	Sand, yellowish-gray (5Y 7/2), medium- to coarse-grained. Glauconite(?).
6.0– 6.2	Clayey silt, dark-yellowish-orange (10YR 6/6).
6.2–11.0	Clay, pale-yellowish-brown (10YR 6/2). Mottled.
11.0–12.5	Sand, pale-yellowish-brown (10YR 6/2), fine-grained. Some fine-grained-glauconite(?).
12.5–15.0	Silt, pale-yellowish-brown (10YR 6/2), mottled and clayey (12.5 to 13.0 ft). Silt with some sand, dark-yellowish-orange (10YR 6/6) (14.0 to 15.0 ft). Wet.
15.0–16.5	Silty clay, pale-yellowish-brown (10YR 6/2). Mottled.
16.5–17.5	Sand, light-olive-gray (5Y 6/1), fine-grained.
17.5–18.5	Clay, dark-yellowish-orange (10YR 6/6). Mottled.

Table 2. Lithologic logs of observation wells—Continued

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Depth (ft)	Description
	Well 13 (54Q 37)—Continued
18.5–20.0	Sand, medium-light-gray (6N6), silty, fine- to medium-grained. Fining upwards. Some fine-grained glauconite.
20.0–21.0	Sandy silt, dark-yellowish-orange (10YR 6/6). Mottled.
21.0–22.0	Clay, medium-light-gray (6N6). Sticky.
	Well 14 (54Q 38)
0 – 4.0	Silt, dark-yellowish-orange (10YR 6/6). Contains some fine sand grains.
4.0– 5.0	Silty sand, dark-yellowish-orange (10YR 6/6), fine- to very-fine-grained.
5.0– 5.1	Silty clay, dark-yellowish-orange (10YR 6/6).
5.1– 7.0	Clay, pale-yellowish-brown (10YR 6/2). Mottled. Some very-fine-grained sand. Some mica. Some very-fine-grained glauconite.
7.0– 8.0	Sand, dark-yellowish-orange (10YR 6/6), medium-grained, subrounded. Contains some round quartz pebbles.
8.0–10.0	Sand, very-pale-orange (10YR 8/2), medium-grained.
10.0–11.0	Clay, dark-yellowish-orange (10YR 6/6) to pale-yellowish-brown (10YR 6/2). Silty (10.0 to 10.5 ft) to mottled (10.5 to 11.0 ft).
11.0–12.5	Sand, pale-yellowish-brown (10YR 6/2), fine-grained.
12.5–13.5	Clay, dark-yellowish-orange (10YR 6/6). Mottled.
13.5–15.0	Sand, pale-yellowish-brown (10YR 6/2), medium-grained, subrounded. Some fine-grained glauconite(?).
15.0–15.5	Clay, dark-yellowish-orange (10YR 6/6). Mottled.
15.5–17.0	Sand, pale-yellowish-brown (10YR 6/2), medium-grained, subrounded. Contains some fine-grained glauconite.
17.0–20.0	Same as above. Some quartz pebbles (17.5 to 18.7 ft).
20.0–21.5	Sand, grayish-orange (10YR 7/4), medium-grained, subrounded. Some fine-grained glauconite.
21.5–22.5	Sand, dark-gray (3N3), medium-grained. Some medium-grained glauconite. Wood fragments (21.5 to 21.75 ft).
22.5–24.5	Sand, pale-yellowish-brown (10YR 6/2), medium-grained. Some glauconite.
24.5–28.0	No recovery. Sand running up in augers.
28.0–28.2	Clay, brownish-gray (5Y5 4/1), sticky, glauconitic on bottom of auger. At 28.0 ft drilling change (softer) noted by driller.
	Well 15 (54Q 39)
0 – 0.5	Top soil.
.5– 1.0	Clayey silt with sand, moderate-yellow (5Y 7/6), fine-grained.
1.0– 5.0	Sandy silt with thin clay layers, dark-yellowish-orange (10YR 6/6), fine-grained.
5.0– 6.0	Silty sand, dark-yellowish-orange (10YR 6/6), fine-grained. Damp.
6.0– 9.0	Clayey sand, very-pale-orange (10YR 8/2) and dark-yellowish-orange (10YR 6/6), very-fine-grained. Visible signs of oxidation. Wet.
9.0–10.0	Sandy clay, grayish-orange (10YR 7/4), fine-grained.
10.0–11.0	Sand, very-pale-orange (10YR 8/2), fine-grained. Wet
11.0–12.0	Sand, very-pale-orange (10YR 8/2), medium- to very-coarse-grained. Clay absent.Glauconite(?) grains. Fining upward. Wet.

Table 2. Lithologic logs of observation wells—Continued

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Depth (ft)	Description
	Well 15 (54Q 39)—Continued
12.0–12.5	Sand, very-pale-orange (10YR 8/2), medium- to very-coarse-grained. Clay absent. Wet.
12.5–14.5	Sand and gravel, very-pale-orange (10YR 8/2), very-coarse-grained, subangular pebbles. Clay absent. Wet.
14.5–15.0	Sand, dark-yellowish-orange (10YR 6/6), fine- to medium-grained. Oxidation stains visible. Wet.
15.0–16.5	Sand, dark-yellowish-orange (10YR 6/6), fine- to medium-grained. Thin clay layers (0.2 ft thick).
16.5–17.5	Clayey sand, greenish-gray (5GY 6/1), very-fine- to fine-grained, micaceous, glauconite. Wet.
17.5–19.5	Clayey sand, greenish-gray (5GY 6/1), very-fine- to fine-grained, micaceous, glauconite(?).
19.5–22.0	Sandy clay, dark-greenish-gray (5G Y4/1), very-fine- to fine-grained, micaceous, wood fragments.
22.0–24.5	Clay, olive-gray (5Y 4/1), plastic, micaceous, glauconite(?), plant fragments.
	Well 16 (54Q 40)
0 – 0.6	Top soil.
.6– 2.0	Clay, moderate-olive-brown (5Y 4/4), minor fine-grained sand. Laminated with oxidation stains.
2.0– 4.0	Sandy silt, dark-yellowish-orange (10YR 6/6), fine- to medium-grained.
4.0– 5.0	Sandy silt, light-olive-gray (5Y 5/2), fine- to medium-grained, some gravels.
5.0– 7.5	Silty sand, grayish-orange (10YR 7/4), fine- to medium-grained. Oxidation of pyrite grains. Moist.
7.5–10.0	Same as above.
10.0–12.0	Clay with sand interbeds, dark-yellowish-orange (10YR 6/6) and pale-yellowish-brown (10YR 6/2), fine-grained. Moist.
12.0–14.0	Clay with sand interbeds, dark-yellowish-orange (10YR 6/6) and pale-yellowish-brown (10YR 6/2), fine-grained. Sand content increases downwards. Moist.
14.0–15.0	Sandy clay, light-brown (5YR 5/6), fine-grained. Laminated with oxidation stains.
15.0–17.5	Clay with sand, olive-gray (5Y 4/1), fine-grained. Wood fragments, micaceous, and glauconite(?).
	Well 17 (54Q 41)
0 – 1.0	Top soil.
1.0– 3.0	Sandy clay, moderate-yellowish-orange (10YR 7/6), fine- to medium-grained.
3.0– 4.0	Same as above.
4.0– 5.0	Silty sand, dark-yellowish-orange (10YR 6/6), medium-grained.
5.0– 6.5	Clay, light-olive-gray (5Y 6/1), dark-yellowish-orange (10YR 6/6), and moderate-yellowish-brown (10YR 5/4), laminated. Oxidation along vertical direction, possible fracture(?). Auger chatter at 6.0 ft, possible gravels.
6.5–10.0	Sandy clay, light-brown (5YR 5/6) and pale-yellowish-brown (10YR 6/2), fine-grained. Wet
10.0–12.5	Sand with minor silt, light-olive-gray (5Y 6/2) and dark-yellowish-orange (10YR 6/6), medium- to coarse-grained, some pebbles (<0.5 in.). Oxidation of iron-bearing minerals is prominent. Wet.
12.5–12.8	Clay, pale-yellowish-brown (10YR 6/2), laminated.
12.8–13.5	Sand, dark-yellowish-orange (10YR 6/6), medium- to coarse-grained with quartz pebbles (<0.5 in.).
13.5–14.5	Clay, light-olive-gray (5Y 5/2), plastic with wood fragments and some shell material.
14.5–17.0	Clay, light-olive-gray (5Y 5/2), plastic with lignitic wood fragments.

Table 2. Lithologic logs of observation wells—Continued

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Depth (ft)	Description
	Well 18 (54Q 42)
0 – 0.5	Top soil.
.5– 4.0	Silty sand with minor clay, moderate-yellowish-brown (10YR 5/4), medium-grained.
4.0– 5.0	Clay with some sand, moderate-yellowish-orange (10YR 7/6).
5.0– 6.0	Clayey sand, dark-yellowish-brown (10YR 5/2), medium-grained. Moist.
6.0–10.0	Clay, pale-yellowish-brown (10YR 6/2) and light-brown (5YR 5/6), laminated. Minor fine-grained sands.
10.0–12.5	Silty sand and gravel, grayish-orange (10YR 7/4), medium- to coarse-grained. Some fine-grained layers (0.4 ft thick). Ironstone in the upper part. Wet.
12.5–14.0	Sand, moderate-yellow (5Y 7/6), fine- to coarse-grained. Ironstone present.
14.0–16.0	Sand, dark-yellowish-orange (10YR 6/6) changing to pale-yellowish-brown (10YR 6/2) at 15.0 ft, fine- to medium-grained. Clay absent. Wet
16.0–18.0	Sand, grayish-orange (10YR 7/4), fine- to coarse-grained. Clay absent. Wet.
18.0–20.0	Sand, grayish-orange (10YR 7/4), fine- to medium-grained. Clay absent. Some ironstone. Wet.
20.0–22.0	Sand, grayish-orange (10YR 7/4), medium- to coarse-grained. Ironstone layer from 21.8 to 21.9 ft. Wet.
22.0–22.7	Sand, grayish-orange (10YR 7/4), fine- to coarse-grained. Clay absent. Some pebbles (<0.5 in.).
22.7–26.5	Clay, olive-gray (5Y 4/1), plastic, micaceous. Some plant fragments.
	Well 19 (54Q 43)
0 – 0.2	Top soil.
.2– 2.0	Silt with some sand, dark-yellowish-brown (10YR 4/2), fine-grained.
2.0– 5.0	Silty sand with thin clay layers, dark-yellowish-orange (10YR 6/6), clay layers are pale-yellowish-brown (10YR 6/2), fine- to medium-grained. Gravel layer at 3.0 ft.
5.0– 7.5	Clay, light-olive-gray (5Y 6/1) and some dark-yellowish-orange (10YR 6/6), mottled. Fractured in upper part.
7.5–10.0	Same as above, except fractures are absent.
10.0–11.0	Clay, light-olive-gray (5Y 6/1), laminated, mottled in places.
11.0–14.5	Silty sand, dark-yellowish-orange (10YR 6/6), fine-grained. Some mica. Wet.
14.5–17.0	Sandy clay, dark-greenish-gray (5GY 4/1), very-fine- to fine-grained. Very thin fine-grained sand interbeds (0.1 in. thick). Wet.
17.0–19.5	Sandy clay, olive-gray (5Y 4/1), very-fine- to fine-grained. Wet.
	Well 20 (54Q 44)
0 – 0.5	Top soil.
.5– 3.5	Sandy clay, pale-yellowish-brown (10YR 6/2), fine-grained, roots, moist.
3.5– 5.0	Silty sand, pale-yellowish-brown (10YR 6/2), fine- to medium-grained. Moist.
5.0– 5.2	Silty sand, dark-yellowish-orange (10YR 6/6) and light-brown (5YR 5/6), fine- to medium-grained, mottled. Auger chatter, possible gravels.
5.2– 8.0	Clay, pale-yellowish-brown (10YR 6/2) and light-brown (5YR 5/6), mottled, ironstone. Some medium-grained sand.
8.0–10.2	Clayey sand, dark-yellowish-orange (10YR 6/6), very-fine- to fine-grained. Wet.
10.2–11.0	Clay, pale-yellowish-brown (10YR 6/2) and light-brown (5YR 5/6), mottled. Some medium-grained sand. Moist.

Table 2. Lithologic logs of observation wells—Continued

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Depth (ft)	Description
	Well 20 (54Q 44)—Continued
11.0–12.5	Sand and gravel, grayish-orange-pink (5YR 7/2), very-fine to very-coarse-grained, coarsening upward, fine-grained glauconite(?). Extremely wet.
12.5–12.8	Clayey sand, light-brown (5YR 5/6), very-fine- to fine-grained. Mottled. Wet.
12.8–15.0	Sand, grayish-orange-pink (5YR 7/2), medium- to very-coarse-grained. Very little clay. Extremely wet.
15.0–17.5	Sand, grayish-orange-pink (5YR 7/2), medium- to very-coarse-grained, very little clay. Thin plastic clay interbeds (<0.2 ft thick). Very wet.
17.5–18.8	Sand, grayish-orange-pink (5YR 7/2), medium- to very-coarse-grained. Very wet.
18.8–18.9	Clay, pale-yellowish-brown (10YR 6/2), plastic, mottled.
18.9–19.5	Sand and gravel, light-brown (5YR 5/6), medium- to very-coarse-grained. Very wet.
19.5–20.0	Same as above. Auger chatter at 20.0 ft.
20.0–21.8	Sand and gravel, grayish-orange-pink (5YR 7/2), medium- to very-coarse-grained. Medium-grained glauconite(?). Very wet.
21.8–22.0	Clay, pale-yellowish-brown (10YR 6/2), plastic, mottled.
22.0–22.5	Sand and gravel, grayish-orange-pink (5YR 7/2), medium- to very-coarse-grained. Very wet.
22.5–22.7	Sand and gravel, grayish-orange-pink (5YR 7/2), medium- to very-coarse-grained, fine-grained glauconite. Very thin mottled clay layers (<1.5 in. thick). Very wet.
22.7–25.0	Sandy silt, dusky-yellowish-green (10GY 3/2), very-fine- to fine-grained, glauconitic.
25.0–27.5	Same as above, except sand content increases and is medium-grained.
	Well 21 (54Q 45)
0 – 0.1	Fill material-gravel road.
.1– 2.0	Silty sand and pebbles (<0.5 in.), light-brown (5YR 5/6), medium- to coarse-grained. Fill material(?).
2.0– 4.5	Sandy silt with clay, dark-yellowish-orange (10YR 6/6), fine- to medium-grained. Some pebbles.
4.5– 5.0	Sand with pebbles, dark-yellowish-orange (10YR 6/6), fine-grained.
5.0– 6.0	Sand, dark-yellowish-orange (10YR 6/6) to grayish-orange (10YR 7/4), fine-grained. Pebble layer and ironstone at 6.0 ft.
6.0– 7.5	Clay with sand interbeds, light-olive-gray(5Y 6/1) and dark-yellowish-orange (10YR 6/6), fine-grained. Plastic, mottled. Damp.
7.5– 8.5	Sand with some clay, dark-yellowish-orange (10YR 6/6), fine-grained. Some pebbles. Wet.
8.5– 9.5	Clay, light-olive-gray (5Y 6/1) and dark-yellowish-orange (10YR 6/6), plastic, laminated. Bedding is curvilinear.
9.5–11.0	Clay, light-olive-gray (5Y 6/1) and dark-yellowish-orange (10YR 6/6), plastic, laminated. Bedding is curvilinear.
11.0–12.5	Sand and gravel, dark-yellowish-orange (10YR 6/6) and grayish-orange (10YR 7/4), coarse-grained. Abundant ironstone. Wet.
12.5–12.7	Clay, light-olive-gray (5Y 6/1), plastic, laminated.
12.7–15.0	Sand with some gravel, light-olive-gray (5Y 6/1), light-brown (5YR 5/6), and dark-yellowish-orange (10YR 6/6), coarse-grained. Very little clay. Wet.
15.0–15.7	Clay, light-olive-gray (5Y 6/1), plastic, laminated. Some ironstone-coated pebbles.
15.7–17.0	Sand with gravel, light-olive-gray (5Y 6/1), light-brown (5YR 5/6), and dark-yellowish-orange (10YR 6/6), coarse-grained. Very little clay. Gravels less than 3 in. Wet.
17.0–17.5	Sand and gravel, light-olive-gray (5Y 6/1), light-brown (5YR 5/6), and dark-yellowish-orange (10YR 6/6), coarse-grained. Very little clay. Wet.

Table 2. Lithologic logs of observation wells—Continued

[ft, feet; in., inches; >, greater than; <, less than; depth, feet below land surface datum; for locations of observation wells see plate 1; codes in parentheses are color codes according to Munsell Color (1975), grain size is according to Wentworth scale (Leeder, 1982)]

Depth (ft)	Description
	Well 21 (54Q 45)—Continued
17.5–17.7	Clay, light-olive-gray (5Y 6/1), laminated.
17.7–18.1	Sand, light-brown (5YR 5/6), fine- to medium-grained.
18.1–20.0	Sand and gravel, light-brown (5YR 5/6), coarse-grained.
20.0–22.5	Sand and gravel, light-brown (5YR 5/6), coarse-grained. Gravel layer at 21.5 ft. Clay content increase between 20.0 and 21.5 ft. Visible oxidation stains and ironstone. Wet.
22.5–23.8	Sand and gravel, pale-yellowish-brown (10YR 6/2), coarse-grained. Wet
23.8–24.5	Silt with some sand, greenish-black (5GY 2/1), fine-grained, well-sorted. Glauconite(?). Damp to dry.
24.5–25.0	Silt with some sand, greenish-black (5GY 2/1), fine-grained, well-sorted. Glauconite(?).
25.0–25.8	Silt with some sand, greenish-black (5GY 2/1), fine-grained, micaceous, glauconite(?). Possible burrows(?).
	Well 22 (54Q 46)
0 – 0.4	Top soil.
.4– 4.0	Silty clay, grayish-orange (10YR 7/4), some small pebbles (< 0.5 in.).
4.0– 5.0	Silty sand, dark-yellowish-orange (10YR 6/6), medium-grained. Mottled in places.
5.0– 6.0	Sand, pale-yellowish-brown (10YR 6/2) and dark-yellowish -orange (10YR 6/6), fine- to medium-grained. Some pebbles.
6.0– 7.0	Clay, light-olive-gray (5Y 6/1) and dark-yellowish-orange (10YR 6/6), plastic, mottled. Oxidation stains.
7.0–12.0	Clayey sand, dark-yellowish-brown (10YR 4/2), medium-grained with some gravels. Moist.
12.0–14.0	Sand and gravel, grayish-orange (10YR 7/4), medium- to coarse-grained. Wet.
14.0–15.4	Clay, pale-yellowish-brown (10YR 6/2) and dark-yellowish-orange (10YR 6/6), laminated. Ironstone formation along bedding and vertical, fracture(?).
15.4–17.0	Clay, olive-gray (5Y 4/1), plastic, wood fragments, glauconite. Some very thin very-fine-grained sand layers (< 0.1 in. thick).
17.0–19.5	Clay, olive-black (5Y 2/1), plastic, wood fragments, glauconite(?).
	Well 23 (54Q 47)
0 – 0.2	Top soil.
.2– 6.5	Sandy clay, moderate-yellowish-brown (10YR 5/4), fine to medium grain.
6.5– 7.3	Sand, dark-yellowish-orange (10YR 5/4), fine- to medium-grained. Small pebbles (< 0.5 in.). Wet.
7.3–15.0	Sand with clayey sand interbeds, dark-yellowish-orange (10YR 6/6), interbeds are light-bluish-gray (5B 7/1), fine- to medium-grained. Laminated in places. Small pebbles (< 0.5 in.) in interbeds. Very wet.
15.0–17.0	Sand, grayish-orange (10YR 7/4), medium- to course-grained. Thin laminated clay interbeds (0.1 ft thick). Very wet.
17.0–19.0	Sand, grayish-orange (10YR 7/4), medium- to coarse-grained. Some ironstone, mottled clay clasts, and small pebbles (< 0.5 in.). Very wet.
19.0–20.0	Sand, grayish-orange (10YR 7/4), medium- to coarse-grained. Some ironstone, mottled clay clasts, and small pebbles (< 0.5 in.). Very wet.
20.0–21.5	Sand, dark-yellowish-orange (10 YR 6/6), medium- to coarse-grained. Very wet.
21.5–21.9	Sand with pebbles, moderate-brown (5YR 5/4), medium- to coarse-grained, pebbles (< 1 in.). Very wet.
21.9–22.0	Clay, olive-gray (5Y 4/1), plastic.
22.0–23.7	Clay, olive-gray (5Y 4/1), plastic. Bivalve cast.

Table 2. Lithologic logs of observation wells—Continued

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Depth (ft)	Description
	Well 24 (54Q 48)
0 – 3.0	No sample.
3.0– 5.0	Sandy silt, dark-yellowish-orange (10YR 6/6) to moderate-yellowish-brown (10YR 5/4). Sand is medium-grained. Contains some coal fragments. Fill(?).
5.0– 10.0	Silty clay, pale-yellowish-brown (10YR 6/2) and dark-yellowish-orange (10YR 6/6). Contains some fine- to medium-grained sand and quartz pebbles. Fill(?).
10.0– 11.5	Clay, pale-yellowish-brown (10YR 6/2) with moderate-brown (5YR 4/4) mottles, sticky.
11.5– 12.0	Sand, moderate-yellowish-brown (10YR 5/4), medium-grained.
12.0– 15.0	Sandy silt, grayish-orange (10YR 7/4). Contains quartz pebbles and some clay.
15.0– 18.5	Clay, olive-gray (5Y 4/1).
18.5– 19.0	Sand, olive-gray (5Y 4/1), fine-grained. Contains sparse very-fine to fine-grained glauconite.
	Well 25 (54Q 49)
0 – 0.5	Top soil.
.5– 4.0	Sandy clay, dark-yellowish-orange (10YR 6/6). A few shell fragments. Some approximately 0.25 in., well-rounded quartz pebbles.
4.0– 5.0	Clay, pale-yellowish-brown (10YR 6/2) to dark-yellowish-orange (10YR 6/6), mottled.
5.0– 7.0	Clay, pale-yellowish-brown (10YR 6/2), mottled, moderate-brown (5YR 4/4). Roots present. Increased mottling from 6.0 to 7.0 ft, mottles approximately 45 degrees to clay layering.
7.0– 10.0	Same as above, dark-yellowish-orange (10YR 6/6).
10.0– 10.5	Clay, moderate-yellowish-brown (10YR 5/4). Mottled, pale-yellowish-brown (10YR 6/2) to light-brown (5YR 5/6).
10.5– 11.0	Silty sand, grayish-orange (10YR 7/4), fine-grained. Some mica.
11.0– 15.0	Sand, pale-yellowish-brown (10YR 6/2), very-fine- to fine-grained. Some mottling (11.0 to 12.0 ft). Wet (12.0 to 14.5 ft).
15.0– 16.0	Clay, pale-yellowish-brown (10YR 6/2). Mottled, light-brown (5YR 5/6).
16.0– 16.1	Sand, pale-yellowish-brown (10YR 6/2). A few 0.1 in., well-rounded quartz grains.
16.1– 17.5	Clay, pale-yellowish-brown (10YR 6/2). Mottled, light-brown (5YR 5/6).
17.5– 18.5	Sandy clay, pale-yellowish-orange (10YR 8/6). Mottled, burrowed(?).
18.5– 19.0	Clay, grayish-orange (10YR 7/4), sticky.
19.0– 20.0	Clayey sand, pale-yellowish-brown (10YR 6/2), fine-grained.
20.0– 21.0	Same as above, slightly glauconitic(?).
21.0– 26.0	Clayey sand, medium-light-gray (6N6), very-fine- to fine-grained. Glauconitic.
26.0– 27.0	Mottled clay, light-olive-gray (5Y 6/1).
27.0– 28.0	Clay, dark-greenish-gray (5GY 4/1). Slightly glauconitic.
	Well 27 (54Q 50)
0 – 2.5	Silty sand, dark-yellowish-brown (10YR 4/2), fine-grained.
2.5– 3.5	Silty sand, dark-yellowish-brown (10YR 4/2), fine-grained. Some clay and pebbles.
3.5– 5.0	Silty sand, moderate-yellowish-brown (10YR 5/4), fine-grained. Some clay and pebbles.
5.0– 11.0	Clay, light-olive-gray (5Y 6/1), greenish-gray (5GY 6/1), and pale-brown (5YR 5/2), plastic, mottled. Some fine-grained sand, pebbles, and rootlets. Dry and hard.

Table 2. Lithologic logs of observation wells—Continued

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Depth (ft)	Description
	Well 27 (54Q 50)—Continued
11.0–12.5	Clayey sand, light-gray (7N7), fine- to medium-grained, mottled. Some rootlets and pebbles. Clay content decreases at 11.5 ft. Wet at 11.5 ft.
12.5–13.5	Sand, pale-yellowish-brown (10YR 6/2), fine- to medium-grained, mottled. Some clay. Wet.
13.5–15.0	Clayey sand, pale-yellowish-brown (10YR 6/2), very-fine- to fine-grained. Mottling not as pronounced. Wet.
15.0–17.5	Clayey sand with sand interbeds, pale-yellowish-brown (10YR 6/2), very-fine-grained, and mottled for the clayey sand. Pale-brown (5YR 5/2), very-fine- to medium-grained, glauconite or magnetite, shell fragments(?), some mica for sand. Very wet at 15.5 ft.
17.5–17.7	Sand, dark-yellowish-orange (10YR 6/6), very-fine- to fine-grained, glauconite(?). Very wet.
17.7–18.0	Sandy clay, dark-yellowish-orange (10YR 6/6), very-fine- to fine-grained, mottled ironstone at basal contact.
18.0–18.3	Sandy clay, light-olive-gray (5Y 6/1), very-fine-grained, mica, glauconite, mottled.
18.3–20.0	Clay, light-olive-gray (5Y 6/1), plastic, micaceous, glauconite(?). Some very-fine-grained interbeds, wet.
20.0–22.5	Clay, dark-greenish-gray (5GY 4/1), very plastic, micaceous, glauconite.
	Well 28 (54Q 51)
0 – 3.0	Silt, dark-yellowish-brown (10YR 4/2), clayey.
3.0– 4.5	Sandy silt, dark-yellowish-orange (10YR 6/6). Some quartz grains.
4.5– 5.0	Silty clay, dark-yellowish-orange (10YR 6/6).
5.0– 5.5	Silty sand, dark-yellowish-orange (10YR 6/6) to moderate-yellowish-brown (10YR 5/4), medium- to coarse-grained. Dry.
5.5– 6.5	Sand, pale-yellowish-orange (10YR 8/6), with silt, light-brown (5YR 5/6). Dry.
6.5– 7.0	Clayey sand, pale-yellowish-brown (10YR 6/2) to dark-yellowish-orange (10YR 6/6), very-fine- to fine-grained.
7.0– 8.0	Silty sand, moderate-yellowish-brown (10YR 5/4) to grayish-orange (10YR 7/4), very-coarse grained. Softer at 7.5 ft.
8.0–10.0	Silty sand, dark-yellowish-orange (10YR 6/6), medium- to very-coarse-grained. Moist.
10.0–12.5	Sand, dark-yellowish-orange (10YR 6/6). Quartz pebbles at 10.0 ft.
12.5–14.0	Silty sand, moderate-brown (5YR 3/4), with mottled reddish areas. Contained a 1.5 in. quartz pebble, pale-yellowish-brown (10YR 6/2).
14.0– 14.5	Sand, dark-yellowish-orange (10YR 6/6), fine- to medium-grained, with a little clay.
14.5–17.0	Clay, olive-gray (5Y 4/1), sticky. Contained wood fragments, some mica, some very-fine-grained glauconite.
	Well 29 (54Q 52)
0 – 0.5	Top soil.
.5– 5.0	Sandy clay, dark-yellowish-orange (10YR 6/6), fine-grained, mottled.
5.0– 7.0	Silty sand, dark-yellowish-orange (10YR 6/6) and light-brown (5Y 5/6), medium-grained. Clay content increases at 6.0 ft.
7.0–10.0	Clayey sand, moderate-yellowish-brown (10YR 5/4) and yellowish-gray (5Y 8/1), very-fine- to fine-grained. Wet.
10.0–11.7	Clayey sand, moderate-yellowish-brown (10YR 5/4) and yellowish-gray (5Y 8/1), very-fine- to fine-grained. Some pebbles and wet zones of very-fine-grained sand with very little clay. Glauconite (?).
11.7–12.0	Sandy silt, olive-gray (5Y 4/1), very-fine-grained. Micaceous, glauconite(?). Some clay. Wet.
12.0– ?	Sandy clay, pale-yellowish-orange (10YR 8/6), very-fine- to fine-grained.

Table 2. Lithologic logs of observation wells—Continued

[ft, feet; in., inches; >, greater than; <, less than; depth, feet below land surface datum; for locations of observation wells see plate 1; codes in parentheses are color codes according to Munsell Color (1975), grain size is according to Wentworth scale (Leeder, 1982)]

Depth (ft)	Description
	Well 29 (54Q 52)—Continued
? – 14.2	Silty sand, dark-greenish-gray (5GY 4/1) and grayish-blue-green (5BG 5/2), very-fine- to coarse-grained, fine- to medium-grained glauconite. Some pebbles. Wet.
14.2– 14.5	No recovery.
14.5– 15.0	Silty sand, pale-yellowish-orange (10YR 8/6), pale-yellowish-brown (10YR 6/2), and olive-gray (5Y 4/1), very-fine- to fine-grained. Some clay.
15.0– 16.5	Silty sand, dark-greenish-gray (5GY 4/1) and grayish-blue-green (5BG 5/2), very-fine- to coarse-grained, fine- to medium-grained glauconite. Some pebbles. Wet.
	Well 30 (54Q 53)
0 – 0.2	Top soil.
.2– 3.0	Silt, dark-yellowish-orange (10YR 6/6). Some very-fine-grained sand and minor clay.
3.0– 4.8	Sandy clay, pale-yellowish-brown (10YR 6/2), medium-grained. Organic material with odor like decaying material.
4.8– 5.0	Sandy clay, pale-yellowish-brown (10YR 6/2), medium-grained. Organic material.
5.0– 7.0	Sandy clay, dark-yellowish-orange (10YR 6/6) and light-brown (5YR 5/6), medium-grained. Mottled.
7.0– 8.0	Clayey silt with sand, dark-yellowish-brown (10YR 4/2), fine- to medium-grained. Some pebbles and root material.
8.0– 11.0	Clayey silt, olive-gray (5Y 3/2), organic material. Rootlets appear fairly recent.
11.0– 15.0	Clayey sand and gravel, moderate-brown (5YR 4/4), medium- to coarse-grained. Mottled with ironstone(?). Wet.
15.0– 16.9	Sandy clay and gravel, moderate-brown (5YR 4/4), medium- to coarse-grained. Mottled with ironstone. Wet at 15.0 ft.
16.9– 17.5	Clayey sand and gravel, moderate-brown (5YR 4/4), medium- to coarse-grained. Mottled with abundant ironstone. Wet.
17.5– 17.6	Same as above, except abundant ironstone at base.
17.6– 19.5	Silty clay with sand, olive-gray (5Y 4/1) and pale-olive (10Y 6/2), fine-grained. Mottled with abundant oxidation stains. Ironstone formation along vertical direction, possibly fracture (?). Some laminations.
19.5– 20.7	Silty clay, moderate-brown (5YR 4/4) and pale-olive (10YR 6/2). Laminated with abundant oxidation stains.
20.7– 22.0	Silty clay, with sand interbeds, olive-gray (5Y 4/1), very-fine- to fine-grained. Interbeds 0.05 to 0.1 in. thick. Micaceous in places.
22.0– 24.0	Silty clay, olive-gray (5Y 4/1). Abundant lignitic wood fragments. Some shell material. Micaceous in places.

Table 3. Depth, lithology, and vertical hydraulic conductivity of selected core intervals

[Datum is sea level; (-) indicates below sea level; ft-BLS, feet below land surface; ft/d, feet per day]

Locall well no.	Sample no.	Depth to top of interval (ft-BLS)	Depth to bottom of interval (ft-BLS)	Altitude of top of interval (feet)	Hydrogeologic unit of sample	Lithology	Vertical hydraulic conductivity (ft/d)
1	ST-35A	14.5	15.1	6.0	Upper confining unit	Clay	8.79×10^{-5}
1	ST-35B	15.1	15.3	6.0	Upper confining unit	Gravelly clayey sand	1.42×10^{-2}
1	ST-35C	15.3	17.0	6.0	Upper confining unit	Sandy organic clay	8.19×10^{-5}
2	ST-33B	20.0	22.5	1.0	Nanjemoy-Marlboro confining unit	Silty sand	1.55×10^{-1}
3	ST-32	10.0	12.5	12.1	Columbia aquifer	Sandy clay	4.34×10^{-2}
5	ST-15	22.0	24.5	-2.1	Upper confining unit	Organic clay	8.16×10^{-4}
6	ST-12	12.0	14.5	5.6	Upper confining unit	Clay	1.25×10^{-4}
9	ST-11	25.0	27.5	-3.8	Upper confining unit	Clayey sand	5.33×10^{-2}
10	ST-01	10.0	12.5	10.4	Columbia aquifer	Silty sand	4.08×10^{0}
15	ST-30	10.0	12.0	13.4	Columbia aquifer	Sand	6.80×10^{-3}
16	ST-16	5.0	7.5	16.8	Columbia aquifer	Clay	2.83×10^{-3}
16	ST-17	15.0	17.5	6.8	Upper confining unit	Clay	7.54×10^{-4}
17	ST-19	10.0	12.5	3.7	Columbia aquifer	Sandy clay	1.14×10^{0}
17	ST-20	14.5	17.0	-.8	Upper confining unit	Sandy organic clay	4.14×10^{-5}
18	ST-21	12.5	14.0	2.0	Columbia aquifer	Sand	5.10×10^{0}
18	ST-22	24.0	26.5	-9.5	Upper confining unit	Silty sand	2.23×10^{-1}
19	ST-25	5.0	7.5	8.9	Columbia aquifer	Clay	1.75×10^{-3}
19	ST-26	17.0	19.5	-3.1	Upper confining unit	Clay	2.65×10^{-6}
20	ST-38A	25.0	27.5	-8.6	Upper confining unit	Clayey sand	6.77×10^{-2}
21	ST-29	10.0	12.5	6.2	Columbia aquifer	Clay	3.63×10^{-5}
22	ST-27	10.0	12.5	4.6	Columbia aquifer	Clay	1.43×10^{-4}
22	ST-28	17.0	19.5	-2.4	Upper confining unit	Organic Clay	4.48×10^{-4}
23	ST-23A	5.0	5.9	-1.1	Columbia aquifer	Clay	5.95×10^{-3}
23	ST-23B	5.9	6.6	-1.1	Columbia aquifer	Sandy clay	9.92×10^{-5}
23	ST-24	22.0	24.5	-18.1	Upper confining unit	Clay	2.50×10^{-4}
25	ST-39	12.0	14.5	-1.4	Columbia aquifer	Sandy clay	7.09×10^{-3}
27	ST-37	20.0	22.5	-9.2	Upper confining unit	Sandy clay	9.24×10^{-5}
30	ST-14	14.5	17.0	-5.6	Columbia aquifer	Silty clay	1.37×10^{-4}
M2	ST-09	46.0	47.5	-25.5	Upper confined aquifer	Silty sand	5.67×10^{-3}
M3	ST-06	15.0	17.5	-4.3	Upper confining unit	Sandy clay	1.15×10^{-4}
D1	ST-07	35.0	37.5	-13.4	Upper confining unit	Clay	2.16×10^{-5}
D1	ST-08	70.0	72.0	-48.4	Upper confined aquifer	Silty sand	7.80×10^{-5}
D2	ST-02	35.0	37.5	-14.5	Upper confining unit	Sandy organic clay	3.83×10^{-5}
D2	ST-03	55.0	57.5	-34.5	Nanjemoy-Marlboro confining unit	Clayey sand	1.59×10^{-3}
D2	ST-04	100.0	101.5	-79.5	Nanjemoy-Marlboro confining unit	Silty sand	6.72×10^{-4}

Table 4. Relative percentage abundance of minerals in selected core intervals

[values given in weight percent; --, mineral not found; depth of samples can be found on table 3]

Sample	Local well number	Quartz	Orthoclase	Plagioclase	Illite	Chlorite	Pyrite	Siderite
ST-35A	1	91.8	2.5	2.5	3.2	(2)	--	(2)
ST-35B	1	99.9	(2)	(2)	(2)	--	--	--
ST-35C	1	95.4	(2)	2.3	2.3	--	--	--
ST-33B	2	98.1	1.9	(2)	--	--	--	--
ST-32	3	94.4	1.8	1.6	2.2	--	--	--
ST-15	5	89.0	(2)	5.0	3.4	2.6	--	--
ST-12	6	86.8	2.6	2.2	4.0	4.5	(2)	--
ST-11	9	92.6	2.4	--	3.0	--	2.0	--
ST-1	10	98.4	1.5	--	--	--	--	--
ST-30B	15	98.9	1.1	--	--	--	--	--
ST-16	16	90.8	(2)	2.4	3.6	3.2	--	(2)
ST-17	16	92.2	1.4	1.3	2.4	2.6	--	--
ST-19	17	89.4	3.5	3.5	3.6	(2)	--	--
ST-20	17	87.3	(2)	2.4	3.8	3.8	--	2.7
ST-21	18	99.9	(2)	--	--	--	--	--
ST-22B	18	99.9	(2)	--	--	--	--	--
ST-25	19	95.3	(2)	--	4.7	(2)	--	--
ST-26	19	85.9	2.1	4.2	3.2	2.8	--	1.8
ST-38A	20	96.9	(2)	--	2.5	--	(2)	--
ST-38B	20	92.5	(2)	--	4.1	(2)	3.4	(2)
ST-29	21	92.2	(2)	3.6	4.2	(2)	--	--
ST-27	22	85.6	2.0	2.6	6.0	3.7	--	--
ST-28A	22	99.9	(2)	(2)	--	--	--	--
ST-28B	22	78.4	3.6	3.7	5.0	4.2	5.1	--
ST-23A[1]	23	89.5	1.6	1.9	2.6	2.2	--	--
ST-23B	23	94.8	(2)	2.1	3.1	--	--	--
ST-24	23	90.4	(2)	2.7	3.1	3.7	(2)	--
ST-39	25	95.9	1.4	1.1	1.6	--	--	--
ST-37	27	94.9	2.6	2.6	(2)	--	--	--
ST-14	30	84.9	2.3	3.9	5.5	3.4	--	(2)
ST-9	M2	99.3	--	--	(2)	--	(2)	--
ST-6	M3	87.7	4.1	4.4	3.8	(2)	(2)	--
ST-7	D1	84.1	5.1	2.9	4.6	3.3	--	--
ST-8	D1	93.0	2.7	--	4.3	(2)	--	--
ST-2	D2	83.7	--	6.5	5.0	4.8	--	--
ST-3	D2	90.9	2.3	2.7	4.0	(2)	--	(2)
ST-4	D2	93.6	2.2	--	4.2	--	(2)	--

[1] Sample also contains 2.3 percent Dolomite

[2] Trace amounts (less than one percent)

Table 5. Periodic measurements of ground-water levels at the Main Site, Naval Surface Warfare Center, Dahlgren Laboratory, October 1992 through September 1993—Continued

[Land-surface datum elevation is in feet above sea level; water levels are in feet above or below (-) sea level]

Local well number: 1
USGS well number: 54Q25
Land-surface datum elevation: 20.48

Date	Water level	Date	Water level
1992			
Oct. 28	15.38	Apr. 28	19.58
Dec. 1	17.66	June 2	17.86
1993		June 29	15.26
Jan. 5	19.37	July 28	11.68
Jan. 26	19.38	Aug. 25	10.68
Feb. 23	19.79	Sept. 29	10.31
Mar. 30	20.20		

Local well number: 2
USGS well number: 54Q26
Land-surface datum elevation: 21.05

Date	Water level	Date	Water level
1992			
Oct. 28	14.59	Apr. 28	19.55
Dec. 1	15.48	June 2	18.39
1993		June 29	16.05
Jan. 5	17.99	July 28	11.58
Jan. 26	18.38	Aug. 25	10.84
Feb. 23	19.07	Sept. 29	10.77
Mar. 30	20.08		

Local well number: 3
USGS well number: 54Q27
Land-surface datum elevation: 22.15

Date	Water level	Date	Water level
1992			
Oct. 29	18.33	Apr. 28	21.46
Dec. 1	20.22	June 2	20.98
1993		June 29	19.30
Jan. 5	21.51	July 28	16.57
Jan. 26	21.15	Aug. 25	15.12
Feb. 23	21.56	Sept. 29	14.56
Mar. 30	22.04		

Local well number: 4
USGS well number: 54Q28
Land-surface datum elevation: 19.92

Date	Water level	Date	Water level
1992			
Oct. 28	17.16	Apr. 28	20.77
Dec. 2	18.29	June 2	19.95
1993		June 29	17.88
Jan. 6	20.24	July 28	14.42
Jan. 27	20.83	Aug. 25	13.61
Feb. 24	20.56	Sept. 29	13.66
Mar. 30	21.43		

Local well number: 5
USGS well number: 54Q29
Land-surface datum elevation: 19.92

Date	Water level	Date	Water level
1992			
Oct. 28	11.22	Apr. 28	15.78
Dec. 1	12.50	June 2	13.87
1993		June 29	11.68
Jan. 5	14.27	July 28	9.66
Jan. 26	14.48	Aug. 25	8.97
Feb. 23	15.33	Sept. 29	9.58
Mar. 30	16.42		

Local well number: 6
USGS well number: 54Q30
Land-surface datum elevation: 17.61

Date	Water level	Date	Water level
1992			
Oct. 28	9.72	Apr. 28	16.21
Dec. 1	10.92	June 2	14.78
1993		June 29	12.74
Jan. 5	12.89	July 28	10.80
Jan. 26	14.31	Aug. 25	9.12
Feb. 23	15.02	Sept. 29	7.54
Mar. 30	16.59		

Table 5. Periodic measurements of ground-water levels at the Main Site, Naval Surface Warfare Center, Dahlgren Laboratory, October 1992 through September 1993—Continued

[Land-surface datum elevation is in feet above sea level; water levels are in feet above or below (-) sea level]

Local well number: 7
USGS well number: 54Q31
Land-surface datum elevation: 19.81

Date	Water level	Date	Water level
1992			
Oct. 28	15.05	Apr. 28	18.74
Dec. 1	15.66	June 2	17.09
1993		June 29	15.59
Jan. 5	17.50	July 28	14.42
Jan. 26	17.83	Aug. 25	13.95
Feb. 23	18.10	Sept. 29	14.38
Mar. 30	19.64		

Local well number: 8
USGS well number: 54Q32
Land-surface datum elevation: 21.02

Date	Water level	Date	Water level
1992			
Oct. 28	14.41	Apr. 28	17.64
Dec. 1	15.16	June 2	16.47
1993		June 29	15.11
Jan. 5	16.54	July 28	13.85
Jan. 26	16.93	Aug. 25	13.54
Feb. 23	17.63	Sept. 29	14.42
Mar. 30	18.08		

Local well number: 9
USGS well number: 54Q33
Land-surface datum elevation: 21.20

Date	Water level	Date	Water level
1992			
Oct. 28	14.55	Apr. 28	20.60
Dec. 1	15.86	June 2	18.52
1993		June 29	15.62
Jan. 5	18.41	July 28	13.40
Jan. 26	19.89	Aug. 25	12.40
Feb. 23	20.65	Sept. 29	13.84
Mar. 30	21.22		

Local well number: 10
USGS well number: 54Q34
Land-surface datum elevation: 20.44

Date	Water level	Date	Water level
1992			
Oct. 28	5.22	Apr. 28	8.80
Dec. 1	5.28	June 2	7.67
1993		June 29	6.90
Jan. 6	6.08	July 28	6.21
Jan. 27	7.18	Aug. 25	5.81
Feb. 24	7.06	Sept. 29	5.52
Mar. 30	9.07		

Local well number: 11
USGS well number: 54Q35
Land-surface datum elevation: 4.40

Date	Water level	Date	Water level
1992			
Oct. 28	2.14	Apr. 28	2.43
Dec. 1	2.24	June 2	1.99
1993		June 29	1.69
Jan. 6	2.86	July 28	1.75
Jan. 27	2.32	Aug. 25	1.85
Feb. 24	2.65	Sept. 29	1.99
Mar. 30	3.06		

Local well number: 12
USGS well number: 54Q36
Land-surface datum elevation: 20.24

Date	Water level	Date	Water level
1992			
Oct. 28	11.19	Apr. 28	16.34
Dec. 1	12.23	June 2	14.36
1993		June 29	12.08
Jan. 5	14.59	July 28	10.28
Jan. 26	15.41	Aug. 25	9.48
Feb. 23	16.30	Sept. 29	9.57
Mar. 30	17.42		

Table 5. Periodic measurements of ground-water levels at the Main Site, Naval Surface Warfare Center, Dahlgren Laboratory, October 1992 through September 1993—Continued

[Land-surface datum elevation is in feet above sea level; water levels are in feet above or below (-) sea level]

Local well number: 13
USGS well number: 54Q37
Land-surface datum elevation: 15.81

Date	Water level	Date	Water level
1992			
Oct. 28	7.48	Apr. 28	11.60
Dec. 1	8.98	June 2	9.91
1993		June 29	7.73
Jan. 5	11.24	July 28	6.05
Jan. 26	11.22	Aug. 25	5.57
Feb. 23	11.81	Sept. 29	5.65
Mar. 30	12.51		

Local well number: 14
USGS well number: 54Q38
Land-surface datum elevation: 17.05

Date	Water level	Date	Water level
1992			
Oct. 28	5.66	Apr. 28	9.93
Dec. 1	6.01	June 2	8.96
1993		June 29	8.17
Jan. 5	6.15	July 28	7.24
Jan. 26	7.98	Aug. 25	6.52
Feb. 23	8.35	Sept. 29	5.81
Mar. 30	10.18		

Local well number: 15
USGS well number: 54Q39
Land-surface datum elevation: 23.43

Date	Water level	Date	Water level
1992			
Oct. 28	18.26	Apr. 28	21.78
Dec. 1	19.69	June 2	20.27
1993		June 29	18.16
Jan. 5	21.91	July 28	16.38
Jan. 26	22.48	Aug. 25	15.43
Feb. 23	22.00	Sept. 29	15.14
Mar. 30	22.18		

Local well number: 16
USGS well number: 54Q40
Land-surface datum elevation: 21.83

Date	Water level	Date	Water level
1992			
Oct. 28	18.22	Apr. 28	20.95
Dec. 1	19.35	June 2	20.10
1993		June 29	17.11
Jan. 5	21.19	July 28	14.45
Jan. 26	20.00	Aug. 25	13.93
Feb. 23	21.02	Sept. 29	14.92
Mar. 30	21.24		

Local well number: 17
USGS well number: 54Q41
Land-surface datum elevation: 13.68

Date	Water level	Date	Water level
1992			
Oct. 28	8.25	Apr. 28	12.19
Dec. 1	11.22	June 2	9.92
1993		June 29	7.53
Jan. 5	13.22	July 28	5.28
Jan. 26	12.11	Aug. 25	4.93
Feb. 23	12.91	Sept. 29	5.89
Mar. 30	13.68		

Local well number: 18
USGS well number: 54Q42
Land-surface datum elevation: 14.50

Date	Water level	Date	Water level
1992			
Oct. 28	2.02	Apr. 28	3.22
Dec. 1	2.17	June 2	2.96
1993		June 29	2.56
Jan. 5	2.52	July 28	2.23
Jan. 26	3.13	Aug. 25	2.05
Feb. 23	2.78	Sept. 29	1.85
Mar. 30	3.52		

Table 5. Periodic measurements of ground-water levels at the Main Site, Naval Surface Warfare Center, Dahlgren Laboratory, October 1992 through September 1993—Continued

[Land-surface datum elevation is in feet above sea level; water levels are in feet above or below (-) sea level]

Local well number: 19
USGS well number: 54Q43
Land-surface datum elevation: 13.89

Date	Water level	Date	Water level
1992			
Oct. 29	6.47	Apr. 28	11.69
Dec. 2	8.76	June 2	9.91
1993		June 29	6.60
Jan. 6	10.79	July 28	3.67
Jan. 27	11.32	Aug. 25	3.32
Feb. 24	11.64	Sept. 29	3.92
Mar. 30	12.40		

Local well number: 20
USGS well number: 54Q44
Land-surface datum elevation: 16.44

Date	Water level	Date	Water level
1992			
Oct. 29	9.76	Apr. 28	12.29
Dec. 1	10.91	June 2	11.03
1993		June 29	9.69
Jan. 5	11.99	July 28	8.57
Jan. 26	11.94	Aug. 25	8.51
Feb. 23	12.51	Sept. 29	9.63
Mar. 30	13.94		

Local well number: 21
USGS well number: 54Q45
Land-surface datum elevation: 16.24

Date	Water level	Date	Water level
1992			
Oct. 29	3.69	Apr. 28	4.76
Dec. 1	4.14	June 2	4.13
1993		June 29	3.67
Jan. 5	4.59	July 28	3.25
Jan. 26	4.47	Aug. 25	3.10
Feb. 23	4.51	Sept. 29	3.00
Mar. 30	5.67		

Local well number: 22
USGS well number: 54Q46
Land-surface datum elevation: 14.61

Date	Water level	Date	Water level
1992			
Oct. 29	8.59	Apr. 28	12.43
Dec. 1	9.82	June 2	9.96
1993		June 29	8.22
Jan. 5	12.00	July 28	6.66
Jan. 26	11.43	Aug. 25	6.57
Feb. 23	12.56	Sept. 29	7.89
Mar. 30	13.56		

Local well number: 23
USGS well number: 54Q47
Land-surface datum elevation: 3.91

Date	Water level	Date	Water level
1992			
Oct. 28	1.98	Apr. 28	3.14
Dec. 1	2.21	June 2	2.81
1993		June 29	1.38
Jan. 5	2.63	July 28	2.06
Jan. 26	2.73	Aug. 25	1.92
Feb. 23	2.74	Sept. 29	1.75
Mar. 30	3.44		

Local well number: 24
USGS well number: 54Q48
Land-surface datum elevation: 10.68

Date	Water level	Date	Water level
1992			
Oct. 29	4.56	Apr. 28	8.47
Dec. 2	6.54	June 2	6.70
1993		June 29	4.43
Jan. 6	8.88	July 28	3.11
Jan. 27	7.71	Aug. 25	3.38
Feb. 24	8.48	Sept. 29	5.61
Mar. 30	10.21		

Table 5. Periodic measurements of ground-water levels at the Main Site, Naval Surface Warfare Center, Dahlgren Laboratory, October 1992 through September 1993—Continued

[Land-surface datum elevation is in feet above sea level; water levels are in feet above or below (-) sea level]

Local well number: 25
USGS well number: 54Q49
Land-surface datum elevation: 10.62

Date	Water level	Date	Water level
1992			
Oct. 29	3.77	Apr. 28	5.64
Dec. 1	4.72	June 2	4.85
1993		June 29	3.68
Jan. 5	5.72	July 28	3.03
Jan. 26	5.35	Aug. 25	2.80
Feb. 23	5.83	Sept. 29	2.70
Mar. 30	6.76		

Local well number: 27
USGS well number: 54Q50
Land-surface datum elevation: 10.80

Date	Water level	Date	Water level
1992			
Oct. 29	4.13	Apr. 28	8.12
Dec. 1	5.82	June 2	6.50
1993		June 29	3.96
Jan. 5	7.71	July 28	1.61
Jan. 26	8.06	Aug. 25	1.36
Feb. 23	8.50	Sept. 29	2.02
Mar. 30	9.32		

Local well number: 28
USGS well number: 54Q51
Land-surface datum elevation: 7.95

Date	Water level	Date	Water level
1992			
Oct. 29	0.41	Apr. 28	4.38
Dec. 1	1.45	June 2	2.75
1993		June 29	.96
Jan. 5	4.45	July 28	-.44
Jan. 26	4.00	Aug. 25	-.73
Feb. 23	4.62	Sept. 29	-.75
Mar. 30	5.29		

Local well number: 29
USGS well number: 54Q52
Land-surface datum elevation: 18.48

Date	Water level	Date	Water level
1992			
Oct. 29	12.12	Apr. 28	14.15
Dec. 1	12.90	June 2	13.33
1993		June 29	12.00
Jan. 5	15.15	July 28	10.59
Jan. 26	13.88	Aug. 25	10.03
Feb. 23	14.52	Sept. 29	10.56
Mar. 30	15.47		

Local well number: 30
USGS well number: 54Q53
Land-surface datum elevation: 8.85

Date	Water level	Date	Water level
1992			
Oct. 28	4.12	Apr. 28	4.84
Dec. 1	4.60	June 2	4.71
1993		June 29	4.68
Jan. 5	4.68	July 28	4.03
Jan. 26	4.38	Aug. 25	3.60
Feb. 23	4.51	Sept. 29	3.63
Mar. 30	4.94		

Local well number: M1
USGS well number: 54Q20
Land-surface datum elevation: 21.59

Date	Water level	Date	Water level
1992			
Oct. 28	4.89	Apr. 28	5.54
Dec. 2	5.02	June 2	5.54
1993		June 29	5.31
Jan. 6	5.15	July 28	5.01
Jan. 27	5.28	Aug. 25	4.86
Feb. 24	5.41	Sept. 29	4.70
Mar. 30	5.58		

Table 5. Periodic measurements of ground-water levels at the Main Site, Naval Surface Warfare Center, Dahlgren Laboratory, October 1992 through September 1993—Continued

[Land-surface datum elevation is in feet above sea level; water levels are in feet above or below (-) sea level]

Local well number: M2
USGS well number: 54Q22
Land-surface datum elevation:20.52

Date	Water level	Date	Water level
1992			
Oct. 28	4.97	Apr. 28	6.63
Dec. 1	5.17	June 2	6.08
1993		June 29	5.60
Jan. 6	5.45	July 28	4.88
Jan. 27	5.93	Aug. 25	4.78
Feb. 24	5.83	Sept. 29	4.92
Mar. 30	6.57		

Local well number: M3
USGS well number: 54Q24
Land-surface datum elevation: 10.70

Date	Water level	Date	Water level
1992			
Oct. 29	2.41	Apr. 28	3.23
Dec. 2	2.63	June 2	2.98
1993		June 29	3.02
Jan. 6	2.47	July 28	2.68
Jan. 27	2.61	Aug. 25	2.80
Feb. 24	2.31	Sept. 29	2.20
Mar. 30	3.10		

Local well number: D1
USGS well number: 54Q19
Land-surface datum elevation: 21.60

Date	Water level	Date	Water level
1992			
Oct. 28	-2.53	Apr. 28	-2.50
Dec. 2	-2.34	June 2	-3.49
1993		June 29	-3.57
Jan. 6	-2.39	July 28	-3.91
Jan. 27	-2.29	Aug. 25	-4.14
Feb. 24	-2.38	Sept. 29	-4.17
Mar. 30	-2.32		

Local well number: D2
USGS well number: 54Q21
Land-surface datum elevation: 20.46

Date	Water level	Date	Water level
1992			
Oct. 28	-9.97	Apr. 28	-9.33
Dec. 1	-9.67	June 2	-9.92
1993		June 29	-9.75
Jan. 6	-10.00	July 28	-10.10
Jan. 27	-9.69	Aug. 25	-10.07
Feb. 24	-10.06	Sept. 29	-10.81
Mar. 30	-9.23		

Local well number: D3
USGS well number: 54Q23
Land-surface datum elevation: 10.70

Date	Water level	Date	Water level
1992			
Oct. 29	-12.20	Apr. 28	-12.39
Dec. 2	-12.01	June 2	-11.97
1993		June 29	-12.04
Jan. 6	-12.36	July 28	-12.37
Jan. 27	-12.38	Aug. 25	-12.51
Feb. 24	-12.60	Sept. 29	-13.00
Mar. 30	-12.39		

Table 6. Slug-test data for observation wells—Continued

[Depth refers to distance from measuring point to static water level; data are from falling-head slug tests except for well 10 data, which are from a rising-head slug test; for locations of observation wells see plate 1]

Well 1
Equilibrium water level: 3.95 feet
Date: March 16, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	2.04
.0167	2.39
.0334	2.24
.0500	2.28
.0667	2.23
.0834	2.24
.1000	2.24
.1167	2.25
.1334	2.25
.1500	2.23
.1667	2.24
.1834	2.27
.2000	2.33
.2167	2.25
.3001	2.11
.3834	2.26
.4667	2.27
.5501	2.27
.6334	2.28
.7167	2.28
.8001	2.29
.8834	2.29
.9667	2.29
1.0501	2.29
1.1334	2.30
1.2167	2.30
1.3000	2.30
1.3834	2.31
1.4667	2.31
1.5501	2.31
1.6334	2.31
1.7167	2.31
1.8001	2.32
1.8834	2.32
2.3834	2.33
2.8834	2.34
3.3834	2.35
3.8834	2.36
4.3834	2.37
4.8834	2.38
5.3834	2.39
5.8834	2.40
6.3834	2.41
6.8834	2.41
7.3834	2.42
7.8834	2.43
8.3834	2.44
8.8834	2.45
9.3834	2.46
9.8834	2.46
11.8834	2.49
13.8834	2.52
15.8834	2.55
17.8834	2.57
19.8834	2.60
21.8834	2.62
23.8834	2.64
25.8834	2.66
27.8834	2.69
29.8834	2.70
31.8834	2.73
33.8834	2.74

Well 2
Equilibrium water level: 4.71 feet
Date: March 16, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	2.90
.0666	3.11
.0833	3.12
.1000	3.13
.1166	3.14
.1333	3.15
.1500	3.16
.1666	3.17
.1833	3.17
.2000	3.18
.2166	3.19
.2333	3.20
.2500	3.20
.2666	3.21
.2833	3.21
.3667	3.24
.4500	3.27
.5333	3.29
.6167	3.31
.7000	3.33
.7833	3.36
.8667	3.38
.9500	3.40
1.0333	3.41
1.1167	3.43
1.2000	3.44
1.2833	3.46
1.3666	3.48
1.4500	3.49
1.5333	3.50
1.6167	3.52
1.7000	3.54
1.7833	3.55
1.8667	3.56
1.9500	3.57
2.4500	3.65
2.9500	3.71
3.4500	3.77
3.9500	3.82
4.4500	3.87
4.9500	3.91
5.4500	3.96
5.9500	3.99
6.4500	4.03
6.9500	4.06
7.4500	4.09
7.9500	4.12
8.4500	4.14
8.9500	4.17
9.4500	4.19
9.9500	4.21
11.9500	4.29
13.9500	4.35
15.9500	4.40
17.9500	4.44
19.9500	4.47
21.9500	4.49
23.9500	4.51
25.9500	4.53
27.9500	4.55
29.9500	4.56
31.9500	4.57
33.9500	4.58

Table 6. Slug-test data for observation wells—Continued

[Depth refers to distance from measuring point to static water level; data are from falling-head slug tests except for well 10 data, which are from a rising-head slug test; for locations of observation wells see plate 1]

Well 3
Equilibrium water level: 3.21 feet
Date: March 16, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	1.29
.0167	1.48
.0500	1.49
.0667	1.48
.0833	1.50
.1000	1.50
.1167	1.51
.1333	1.52
.1500	1.53
.1667	1.54
.1833	1.54
.2000	1.54
.2834	1.57
.3667	1.60
.4500	1.62
.5334	1.64
.6167	1.65
.7000	1.67
.7834	1.69
.8667	1.71
.9500	1.72
1.0334	1.73
1.1167	1.75
1.2000	1.76
1.2833	1.77
1.3667	1.78
1.4500	1.79
1.5334	1.81
1.6167	1.82
1.7000	1.83
1.7834	1.84
1.8667	1.85
2.3667	1.90
2.8667	1.97
3.3667	2.03
3.8667	2.08
4.3667	2.12
4.8667	2.16
5.3667	2.19
5.8667	2.23
6.3667	2.25
6.8667	2.28
7.3667	2.31
7.8667	2.34
8.3667	2.36
8.8667	2.38
9.3667	2.40
9.8667	2.42
11.8667	2.50
13.8667	2.56
15.8667	2.61
17.8667	2.66
19.8667	2.70
21.8667	2.74
23.8667	2.77
25.8667	2.80
27.8667	2.83
29.8667	2.86
31.8667	2.88
33.8667	2.91
35.8667	2.93
37.8667	2.94
39.8667	2.96
41.8667	2.97
43.8667	2.98
45.8667	2.99

Well 4
Equilibrium water level: 2.67 feet
Date: March 24, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	0.70
.0666	0.95
.0833	0.96
.1000	0.97
.1166	0.97
.1333	0.98
.1500	0.98
.1666	0.99
.1833	0.99
.2000	0.99
.2166	1.00
.2333	1.00
.3167	1.02
.4000	1.03
.4833	1.05
.5667	1.06
.6500	1.07
.7333	1.09
.8167	1.10
1.9000	1.11
1.9833	1.12
1.0667	1.13
1.1500	1.14
1.2333	1.15
1.3166	1.16
1.4000	1.17
1.4833	1.18
1.5667	1.18
1.6500	1.19
1.7333	1.20
1.8167	1.21
1.9000	1.22
2.4000	1.26
2.9000	1.30
3.4000	1.34
3.9000	1.37
4.4000	1.40
4.9000	1.43
5.4000	1.46
5.9000	1.49
6.4000	1.52
6.9000	1.54
7.4000	1.57
7.9000	1.59
8.4000	1.61
8.9000	1.63
9.4000	1.66
9.9000	1.68
11.9000	1.75
13.9000	1.81
15.9000	1.87
17.9000	1.92
19.9000	1.97
21.9000	2.01
23.9000	2.05
25.9000	2.08
27.9000	2.12
29.9000	2.15
31.9000	2.18

Table 6. Slug-test data for observation wells—Continued

[Depth refers to distance from measuring point to static water level; data are from falling-head slug tests except for well 10 data, which are from a rising-head slug test; for locations of observation wells see plate 1]

Well 5
Equilibrium water level: 6.09 feet
Date: March 16, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	4.16
.0500	4.48
.0667	4.48
.0833	4.50
.1000	4.50
.1167	4.51
.1333	4.51
.1500	4.52
.1667	4.52
.1833	4.52
.2000	4.53
.2167	4.53
.2333	4.53
.2500	4.54
.3334	4.55
.4167	4.57
.5000	4.58
.5834	4.59
.6667	4.61
.7500	4.62
.8334	4.63
.9167	4.65
1.0000	4.66
1.0834	4.67
1.1667	4.68
1.2500	4.69
1.3333	4.70
1.4167	4.72
1.5000	4.73
1.5834	4.73
1.6667	4.74
1.7500	4.75
1.8334	4.76
1.9167	4.77
2.4167	4.83
2.9167	4.88
3.4167	4.93
3.9167	4.98
4.4167	5.02
4.9167	5.07
5.4167	5.11
5.9167	5.14
6.4167	5.18
6.9167	5.21
7.4167	5.24
7.9167	5.27
8.4167	5.30
8.9167	5.33
9.4167	5.36
9.9167	5.38
11.9167	5.48
13.9167	5.56
15.9167	5.62
17.9167	5.68
19.9167	5.73
21.9167	5.77
23.9167	5.81
25.9167	5.83
27.9167	5.86
29.9167	5.89
31.9167	5.91
33.9167	5.93
35.9167	5.93
37.9167	5.95
39.9167	5.96
41.9167	5.97

Well 6
Equilibrium water level: 5.92 feet
Date: March 16, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	4.01
.0500	4.29
.0667	4.35
.0833	4.35
.1000	4.37
.1167	4.37
.1333	4.37
.1500	4.37
.1667	4.37
.1833	4.37
.2000	4.37
.2167	4.37
.2333	4.37
.2500	4.37
.2667	4.37
.2833	4.37
.3000	4.37
.3834	4.37
.4667	4.37
.5500	4.37
.6334	4.36
.7167	4.37
.8000	4.37
.8834	4.37
.9667	4.37
1.0500	4.37
1.1334	4.37
1.2167	4.37
1.3000	4.37
1.3833	4.37
1.4667	4.37
1.5500	4.37
1.6334	4.37
1.7167	4.37
1.8000	4.38
1.8834	4.38
1.9667	4.38
2.4667	4.38
2.9667	4.38
3.4667	4.39
3.9667	4.39
4.4667	4.39
4.9667	4.40
5.4667	4.40
5.9667	4.40
6.4667	4.40
6.9667	4.40
7.4667	4.41
7.9667	4.41
8.4667	4.41
8.9667	4.41
9.4667	4.41
9.9667	4.42
11.9667	4.43
13.9667	4.43
15.9667	4.44
17.9667	4.45
19.9667	4.46
21.9667	4.46
23.9667	4.47
25.9667	4.48
27.9667	4.49

Table 6. Slug-test data for observation wells—Continued

[Depth refers to distance from measuring point to static water level; data are from falling-head slug tests except for well 10 data, which are from a rising-head slug test; for locations of observation wells see plate 1]

Well 7
Equilibrium water level: 2.42 feet
Date: March 15, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	0.58
.0167	1.02
.0500	1.06
.0667	1.11
.0834	1.15
.1000	1.19
.1167	1.23
.1334	1.27
.1500	1.30
.1667	1.34
.1834	1.37
.2000	1.40
.2167	1.43
.3001	1.56
.3834	1.67
.4667	1.76
.5501	1.84
.6334	1.91
.7167	1.97
.8001	2.02
.8834	2.06
.9667	2.09
1.0501	2.13
1.1334	2.15
1.2167	2.18
1.3000	2.20
1.3834	2.21
1.4667	2.23
1.5501	2.25
1.6334	2.26
1.7167	2.27
1.8001	2.28
1.8834	2.29
2.3834	2.33
2.8834	2.36
3.3834	2.37
3.8834	2.38
4.3834	2.38
4.8834	2.39
5.3834	2.39
5.8834	2.39
6.3834	2.39
6.8834	2.40
7.3834	2.40
7.8834	2.40
8.3834	2.40
8.8834	2.40
9.3834	2.40
9.8834	2.40
11.8834	2.40

Well 8
Equilibrium water level: 5.34 feet
Date: March 15, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	3.44
.0166	3.77
.0333	3.66
.0500	3.68
.0666	3.70
.0833	3.71
.1000	3.73
.1166	3.74
.1333	3.75
.1500	3.77
.1666	3.79
.1833	3.80
.2000	3.81
.2166	3.82
.2333	3.84
.3167	3.87
.4000	3.87
.4833	3.95
.5667	4.06
.6500	4.11
.7333	4.15
.8167	4.19
.9000	4.23
.9833	4.27
1.0667	4.30
1.1500	4.34
1.2333	4.37
1.3166	4.40
1.4000	4.43
1.4833	4.46
1.5667	4.49
1.6500	4.51
1.7333	4.54
1.8167	4.56
1.9000	4.59
2.4000	4.71
2.9000	4.81
3.4000	4.90
3.9000	4.96
4.4000	5.01
4.9000	5.06
5.4000	5.09
5.9000	5.12
6.4000	5.15
6.9000	5.17
7.4000	5.18
7.9000	5.20
8.4000	5.21
8.9000	5.22
9.4000	5.23
9.9000	5.23
11.9000	5.26
13.9000	5.28

Table 6. Slug-test data for observation wells—Continued

[Depth refers to distance from measuring point to static water level; data are from falling-head slug tests except for well 10 data, which are from a rising-head slug test; for locations of observation wells see plate 1]

Well 9
Equilibrium water level: 3.04 feet
Date: March 15, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	1.14
.0167	1.29
.0333	1.31
.0500	1.32
.0667	1.33
.0833	1.34
.1000	1.35
.1167	1.36
.1333	1.37
.1500	1.38
.1667	1.38
.1833	1.39
.2000	1.40
.2834	1.44
.3667	1.48
.4500	1.51
.5334	1.54
.6167	1.57
.7000	1.61
.7834	1.63
.8667	1.66
.9500	1.69
1.0334	1.71
1.1167	1.74
1.2000	1.76
1.2833	1.79
1.3667	1.81
1.4500	1.84
1.5334	1.86
1.6167	1.88
1.7000	1.90
1.7834	1.92
1.8667	1.94
2.3667	2.05
2.8667	2.15
3.3667	2.24
3.8667	2.31
4.3667	2.38
4.8667	2.44
5.3667	2.49
5.8667	2.53
6.3667	2.58
6.8667	2.61
7.3667	2.64
7.8667	2.68
8.3667	2.70
8.8667	2.73
9.3667	2.75
9.8667	2.77
11.8667	2.84
13.8667	2.88
15.8667	2.91
17.8667	2.93
19.8667	2.95
21.8667	2.96
23.8667	2.97
25.8667	2.98
27.8667	2.98

Well 10
Equilibrium water level: 14.18 feet
Date: March 23, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	16.08
.0033	16.00
.0066	15.95
.0100	15.92
.0133	15.84
.0300	15.87
.0466	15.84
.0633	15.80
.0800	15.75
.0966	15.72
.1133	15.69
.1300	15.67
.1466	15.64
.1633	15.61
.1800	15.59
.1966	15.56
.2133	15.54
.2300	15.51
.2466	15.49
.2633	15.47
.2800	15.45
.2966	15.44
.3133	15.40
.3967	15.31
.4800	15.23
.5633	15.18
.6467	15.13
.7300	15.09
.8133	15.05
.8967	15.03
.9800	15.00
1.0633	14.98
1.1467	14.96
1.2300	14.94
1.3133	14.92
1.3966	14.91
1.4800	14.89
1.5633	14.88
1.6467	14.86
1.7300	14.85
1.8133	14.84
1.8967	14.83
1.9800	14.81
2.4800	14.75
2.9800	14.70
3.4800	14.65
3.9800	14.60
4.4800	14.56
4.9800	14.53
5.4800	14.50
5.9800	14.47
6.4800	14.44
6.9800	14.42
7.4800	14.40
7.9800	14.38
8.4800	14.36
8.9800	14.35
9.4800	14.33
9.9800	14.32
11.9800	14.27

Table 6. Slug-test data for observation wells—Continued

[Depth refers to distance from measuring point to static water level; data are from falling-head slug tests except for well 10 data, which are from a rising-head slug test; for locations of observation wells see plate 1]

Well 11
Equilibrium water level: 4.46 feet
Date: March 23, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	2.60
.0334	2.63
.0500	2.71
.0667	2.71
.0834	2.72
.1000	2.73
.1167	2.74
.1334	2.75
.1500	2.76
.1667	2.76
.1834	2.77
.2000	2.78
.2167	2.79
.2334	2.80
.2500	2.80
.2667	2.81
.3501	2.85
.4334	2.88
.5167	2.91
.6001	2.94
.6834	2.97
.7667	3.01
.8501	3.04
.9334	3.07
1.0167	3.09
1.1001	3.13
1.1834	3.15
1.2667	3.18
1.3500	3.21
1.4334	3.23
1.5167	3.26
1.6001	3.28
1.6834	3.31
1.7667	3.34
1.8501	3.36
1.9334	3.38
2.4334	3.51
2.9334	3.63
3.4334	3.72
3.9334	3.82
4.4334	3.89
4.9334	3.96
5.4334	4.03
5.9334	4.08
6.4334	4.13
6.9334	4.17
7.4334	4.21
7.9334	4.24
8.4334	4.27
8.9334	4.30
9.4334	4.32
9.9334	4.35
11.9334	4.41
13.9334	4.45

Well 12
Equilibrium water level: 4.72 feet
Date: March 15, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	2.92
.0333	3.33
.0500	3.42
.0667	3.48
.0833	3.67
.1000	3.66
.1167	3.68
.1333	3.71
.1500	3.73
.1667	3.76
.1833	3.78
.2000	3.81
.2167	3.83
.2333	3.86
.2500	3.88
.2667	3.90
.2833	3.92
.3000	3.94
.3834	4.04
.4667	4.14
.5500	4.23
.6334	4.31
.7167	4.38
.8000	4.44
.8834	4.50
.9667	4.54
1.0500	4.59
1.1334	4.63
1.2167	4.66
1.3000	4.69
1.3833	4.71
1.4667	4.74
1.5500	4.76
1.6334	4.78
1.7167	4.79
1.8000	4.81
1.8834	4.82
1.9667	4.83
2.4667	4.89
2.9667	4.92
3.4667	4.93
3.9667	4.95
4.4667	4.95
4.9667	4.96
5.4667	4.96
5.9667	4.97
6.4667	4.96
6.9667	4.97
7.4667	4.97
7.9667	4.97
8.4667	4.97
8.9667	4.97
9.4667	4.97
9.9667	4.97
11.9667	4.97
13.9667	5.20

Table 6. Slug-test data for observation wells—Continued

[Depth refers to distance from measuring point to static water level; data are from falling-head slug tests except for well 10 data, which are from a rising-head slug test; for locations of observation wells see plate 1]

Well 13
Equilibrium water level: 5.56 feet
Date: March 15, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	3.86
.0167	4.02
.0334	4.03
.0500	4.04
.0667	4.05
.0834	4.05
.1000	4.06
.1167	4.06
.1334	4.06
.1500	4.07
.1667	4.07
.2501	4.09
.3334	4.10
.4167	4.11
.5001	4.13
.5834	4.15
.6667	4.16
.7501	4.18
.8334	4.19
.9167	4.20
1.0001	4.21
1.0834	4.23
1.1667	4.24
1.2500	4.25
1.3334	4.26
1.4167	4.28
1.5001	4.29
1.5834	4.30
1.6667	4.31
1.7501	4.32
1.8334	4.33
2.3334	4.39
2.8334	4.44
3.3334	4.49
3.8334	4.54
4.3334	4.58
4.8334	4.62
5.3334	4.66
5.8334	4.69
6.3334	4.73
6.8334	4.76
7.3334	4.79
7.8334	4.83
8.3334	4.86
8.8334	4.88
9.3334	4.91
9.8334	4.93
11.8334	5.01
13.8334	5.10
15.8334	5.15
17.8334	5.20
19.8334	5.24
21.8334	5.29
23.8334	5.32
25.8334	5.35
27.8334	5.36
29.8334	5.39
31.8334	5.40
33.8334	5.42
35.8334	5.44
37.8334	5.45
39.8334	5.46
41.8334	5.47
43.8334	5.47

Well 14
Equilibrium water level: 7.11 feet
Date: March 15, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	5.63
.0167	5.89
.0334	5.84
.0500	6.26
.0667	5.87
.0834	6.04
.1000	6.23
.1167	6.38
.2001	6.47
.2834	6.64
.3667	6.74
.4501	6.81
.5334	6.88
.6167	6.92
.7001	6.96
.7834	6.98
.8667	7.00
.9501	7.02
1.0334	7.02
1.1167	7.03
1.2000	7.04
1.2834	7.05
1.3667	7.05
1.4501	7.05
1.5334	7.05
1.6167	7.06
1.7001	7.06
1.7834	7.06
2.2834	7.07
2.7834	7.07
3.2834	7.07
3.7834	7.07
4.2834	7.07
4.7834	7.07
5.2834	7.07
5.7834	7.07
6.2834	7.07
6.7834	7.08
7.2834	7.08
7.7834	7.07
8.2834	7.08
8.7834	7.07
9.2834	7.07
10.7834	7.07
11.7834	7.07

Table 6. Slug-test data for observation wells—Continued

[Depth refers to distance from measuring point to static water level; data are from falling-head slug tests except for well 10 data, which are from a rising-head slug test; for locations of observation wells see plate 1]

Well 15
Equilibrium water level: 2.94 feet
Date: March 17, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	1.30
.0167	1.42
.0334	1.39
.0500	1.37
.0667	1.56
.0834	1.59
.1000	1.61
.1167	1.63
.1334	1.62
.1500	1.66
.1667	1.68
.1834	1.69
.2000	1.71
.2167	1.72
.2334	1.73
.2500	1.74
.2667	1.75
.3501	1.81
.4334	1.85
.5167	1.88
.6001	1.92
.6834	1.95
.7667	1.98
.8501	2.01
.9334	2.04
1.0167	2.06
1.1001	2.09
1.1834	2.11
1.2667	2.14
1.3500	2.16
1.4334	2.18
1.5167	2.21
1.6001	2.23
1.6834	2.25
1.7667	2.27
1.8501	2.29
1.9334	2.31
2.4334	2.40
2.9334	2.49
3.4334	2.56
3.9334	2.62
4.4334	2.67
4.9334	2.72
5.4334	2.75
5.9334	2.79
6.4334	2.82
6.9334	2.84
7.4334	2.86
7.9334	2.88
8.4334	2.90
8.9334	2.92
9.4334	2.93
9.9334	2.94
11.9334	2.99

Well 16
Equilibrium water level: 2.39 feet
Date: March 17, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	0.64
.0334	0.85
.0500	0.86
.0667	0.87
.0834	0.88
.1000	0.89
.1167	0.90
.1334	0.91
.1500	0.91
.1667	0.92
.1834	0.93
.2000	0.94
.2167	0.94
.3001	0.98
.3834	1.01
.4667	1.04
.5501	1.06
.6334	1.09
.7167	1.11
.8001	1.14
.8834	1.16
.9667	1.18
1.0501	1.21
1.1334	1.22
1.2167	1.25
1.3000	1.27
1.3834	1.28
1.4667	1.30
1.5501	1.32
1.6334	1.33
1.7167	1.35
1.8001	1.37
1.8834	1.38
2.3834	1.46
2.8834	1.53
3.3834	1.60
3.8834	1.65
4.3834	1.70
4.8834	1.75
5.3834	1.79
5.8834	1.82
6.3834	1.86
6.8834	1.89
7.3834	1.91
7.8834	1.94
8.3834	1.96
8.8834	1.98
9.3834	2.00
9.8834	2.02
11.8834	2.09
13.8834	2.13
15.8834	2.17
17.8834	2.20
19.8834	2.23
21.8834	2.25
23.8834	2.26
25.8834	2.28
27.8834	2.29
29.8834	2.30
31.8834	2.31

Table 6. Slug-test data for observation wells—Continued

[Depth refers to distance from measuring point to static water level; data are from falling-head slug tests except for well 10 data, which are from a rising-head slug test; for locations of observation wells see plate 1]

Well 17
Equilibrium water level: 1.87 feet
Date: March 17, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	0.01
.0333	0.14
.0500	0.14
.1167	0.15
.1333	0.16
.1500	0.16
.1833	0.17
.2000	0.17
.2500	0.17
.4167	0.18
.5000	0.19
.5834	0.19
.6667	0.20
.7500	0.20
.8334	0.21
.9167	0.22
1.0000	0.22
1.0834	0.23
1.1667	0.23
1.2500	0.24
1.3333	0.24
1.4167	0.24
1.5000	0.25
1.5834	0.25
1.6667	0.26
1.7500	0.26
1.8334	0.27
1.9167	0.27
2.4167	0.30
2.9167	0.33
3.4167	0.36
3.9167	0.39
4.4167	0.42
4.9167	0.45
5.4167	0.48
5.9167	0.50
6.4167	0.53
6.9167	0.56
7.4167	0.58
7.9167	0.60
8.4167	0.63
8.9167	0.65
9.4167	0.68
9.9167	0.70
11.9167	0.78
13.9167	0.85
15.9167	0.93
17.9167	0.99
19.9167	1.06
21.9167	1.12
23.9167	1.17
25.9167	1.22
27.9167	1.27
29.9167	1.32
31.9167	1.35
33.9167	1.39
35.9167	1.43
37.9167	1.46

Well 18
Equilibrium water level: 13.77 feet
Date: March 18, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	12.43
.0167	12.64
.0333	12.78
.0500	12.83
.0667	12.92
.0833	12.99
.1000	13.05
.1167	13.11
.1333	13.16
.1500	13.21
.1667	13.25
.1833	13.29
.2000	13.33
.2167	13.36
.2333	13.39
.2500	13.41
.3334	13.52
.4167	13.59
.5000	13.63
.5834	13.67
.6667	13.69
.7500	13.71
.8334	13.72
.9167	13.73
1.0000	13.73
1.0834	13.73
1.1667	13.74
1.2500	13.74
1.3333	13.75
1.4167	13.75
1.5000	13.75
1.5834	13.75
1.6667	13.75
1.7500	13.75
1.8334	13.75
1.9167	13.75
2.4167	13.74
2.9167	13.76
3.4167	13.76
3.9167	13.75
4.4167	13.75
4.9167	13.76
5.4167	13.76
5.9167	13.76
6.4167	13.76
6.9167	13.76
7.4167	13.76
7.9167	13.76
8.4167	13.76
8.9167	13.76
9.4167	13.76
10.9167	13.76
11.9167	13.75
13.9167	13.76

Table 6. Slug-test data for observation wells—Continued

[Depth refers to distance from measuring point to static water level; data are from falling-head slug tests except for well 10 data, which are from a rising-head slug test; for locations of observation wells see plate 1]

Well 19
Equilibrium water level: 4.87 feet
Date: March 22, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	2.96
.0500	3.01
.1000	3.04
.1166	3.04
.1333	3.04
.1500	3.03
.1666	3.04
.1833	3.04
.2667	3.04
.4333	3.04
.5167	3.04
.6000	3.04
.6833	3.05
.7667	3.05
.8500	3.05
.9333	3.05
1.0167	3.05
1.1000	3.06
1.1833	3.06
1.2666	3.06
1.3500	3.06
1.4333	3.06
1.5167	3.06
1.6000	3.06
1.6833	3.07
1.7667	3.07
1.8500	3.07
2.3500	3.08
2.8500	3.09
3.3500	3.10
3.8500	3.12
4.3500	3.13
4.8500	3.14
5.3500	3.15
5.8500	3.17
6.3500	3.18
6.8500	3.19
7.3500	3.20
7.8500	3.21
8.3500	3.22
8.8500	3.23
9.3500	3.24
9.8500	3.26
11.8500	3.30
13.8500	3.34
15.8500	3.37
17.8500	3.41
19.8500	3.44
21.8500	3.47
23.8500	3.51
25.8500	3.54
27.8500	3.56
29.8500	3.60
31.8500	3.63
33.8500	3.66
35.8500	3.69
37.8500	3.72
39.8500	3.74
41.8500	3.77
43.8500	3.79
45.8500	3.82
47.8500	3.84
49.8500	3.87
51.8500	3.89
53.8500	3.91

Well 20
Equilibrium water level: 1.77 feet
Date: March 18, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	0.05
.0334	0.29
.0500	0.34
.0667	0.37
.0834	0.40
.1000	0.42
.1167	0.45
.1334	0.47
.1500	0.49
.1667	0.51
.1834	0.53
.2000	0.55
.2167	0.57
.3001	0.66
.3834	0.74
.4667	0.81
.5501	0.84
.6334	0.95
.7167	0.99
.8001	1.04
.8834	1.09
.9667	1.14
1.0501	1.18
1.1334	1.21
1.2167	1.25
1.3000	1.28
1.3834	1.31
1.4667	1.34
1.5501	1.36
1.6334	1.39
1.7167	1.41
1.8001	1.43
1.8834	1.45
2.3834	1.55
2.8834	1.62
3.3834	1.66
3.8834	1.70
4.3834	1.72
4.8834	1.73
5.3834	1.74
5.8834	1.75
6.3834	1.76
6.8834	1.77
7.3834	1.77
7.8834	1.76
8.3834	1.76
8.8834	1.76
9.3834	1.77
9.8834	1.77

Table 6. Slug-test data for observation wells—Continued

[Depth refers to distance from measuring point to static water level; data are from falling-head slug tests except for well 10 data, which are from a rising-head slug test; for locations of observation wells see plate 1]

Well 21
Equilibrium water level: 13.14 feet
Date: March 18, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	11.16
.0333	11.51
.0666	11.54
.0833	11.56
.1000	11.59
.1166	11.61
.1333	11.63
.1500	11.65
.1666	11.66
.1833	11.68
.2000	11.69
.2166	11.71
.2333	11.72
.3167	11.78
.4000	11.83
.4833	11.88
.5667	11.92
.6500	11.95
.7333	11.99
.8167	12.02
.9000	12.05
.9833	12.07
1.0667	12.10
1.1500	12.12
1.2333	12.14
1.3166	12.16
1.4000	12.18
1.4833	12.21
1.5667	12.22
1.6500	12.24
1.7333	12.26
1.8167	12.28
1.9000	12.30
2.4000	12.39
2.9000	12.47
3.4000	12.54
3.9000	12.60
4.4000	12.65
4.9000	12.70
5.4000	12.74
5.9000	12.79
6.4000	12.82
6.9000	12.85
7.4000	12.88
7.9000	12.91
8.4000	12.93
8.9000	12.96
9.4000	12.97
9.9000	12.99
11.9000	13.05
13.9000	13.09
15.9000	13.12

Well 22
Equilibrium water level: 3.73 feet
Date: March 18, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	1.85
.0334	2.06
.0667	2.06
.1000	2.06
.1167	2.07
.1334	2.08
.1500	2.08
.1667	2.09
.1834	2.10
.2000	2.10
.2167	2.11
.2334	2.11
.2500	2.12
.2667	2.12
.3501	2.15
.4334	2.17
.5167	2.20
.6001	2.21
.6834	2.23
.7667	2.26
.8501	2.27
.9334	2.29
1.0167	2.31
1.1001	2.32
1.1834	2.35
1.2667	2.36
1.3500	2.38
1.4334	2.39
1.5167	2.41
1.6001	2.42
1.6834	2.43
1.7667	2.45
1.8501	2.46
1.9334	2.49
2.4334	2.56
2.9334	2.63
3.4334	2.71
3.9334	2.77
4.4334	2.84
4.9334	2.89
5.4334	2.94
5.9334	2.99
6.4334	3.04
6.9334	3.08
7.4334	3.12
7.9334	3.16
8.4334	3.18
8.9334	3.23
9.4334	3.26
9.9334	3.29
11.9334	3.39
13.9334	3.47
15.9334	3.52
17.9334	3.57
19.9334	3.60
21.9334	3.63
23.9334	3.65
25.9334	3.67
27.9334	3.69
29.9334	3.70

Table 6. Slug-test data for observation wells—Continued

[Depth refers to distance from measuring point to static water level; data are from falling-head slug tests except for well 10 data, which are from a rising-head slug test; for locations of observation wells see plate 1]

Well 23
Equilibrium water level: 3.34 feet
Date: March 18, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	1.36
.0333	1.61
.0500	1.83
.0666	1.87
.0833	1.91
.1000	1.95
.1166	1.99
.1333	2.03
.1500	2.07
.1666	2.10
.1833	2.14
.2000	2.17
.2166	2.20
.2333	2.23
.2500	2.26
.2666	2.29
.2833	2.32
.3667	2.45
.4500	2.56
.5333	2.65
.6167	2.74
.7000	2.81
.7833	2.87
.8667	2.93
.9500	2.98
1.0333	3.02
1.1167	3.05
1.2000	3.08
1.2833	3.11
1.3666	3.13
1.4500	3.15
1.5333	3.17
1.6167	3.19
1.7000	3.21
1.7833	3.22
1.8667	3.23
1.9500	3.24
2.4500	3.28
2.9500	3.30
3.4500	3.31
3.9500	3.32
4.4500	3.32
4.9500	3.32
5.4500	3.32
5.9500	3.32
6.4500	3.32
6.9500	3.32
7.4500	3.32
7.9500	3.32
8.4500	3.32
8.9500	3.32
9.4500	3.32
9.9500	3.32

Well 24
Equilibrium water level: 4.43 feet
Date: March 22, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	3.32
.0167	3.31
.0334	3.32
.0500	3.32
.0667	3.32
.0834	3.31
.1000	3.31
.1167	3.31
.1334	3.31
.1500	3.31
.1667	3.31
.2501	3.30
.3334	3.30
.4167	3.30
.5001	3.31
.5834	3.31
.6667	3.31
.7501	3.31
.8334	3.32
.9167	3.32
1.0001	3.32
1.0834	3.32
1.1667	3.32
1.2500	3.32
1.3334	3.33
1.4167	3.33
1.5001	3.33
1.5834	3.33
1.6667	3.33
1.7501	3.34
1.8334	3.34
2.3334	3.35
2.8334	3.36
3.3334	3.37
3.8334	3.38
4.3334	3.39
4.8334	3.40
5.3334	3.40
5.8334	3.42
6.3334	3.43
6.8334	3.44
7.3334	3.45
7.8334	3.45
8.3334	3.46
8.8334	3.47
9.3334	3.47
9.8334	3.48
11.8334	3.51
13.8334	3.55
15.8334	3.58
17.8334	3.61
19.8334	3.64

Table 6. Slug-test data for observation wells—Continued

[Depth refers to distance from measuring point to static water level; data are from falling-head slug tests except for well 10 data, which are from a rising-head slug test; for locations of observation wells see plate 1]

Well 25
Equilibrium water level: 6.44 feet
Date: March 19, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	4.52
.0333	4.63
.0500	4.61
.0667	4.66
.0833	4.66
.1000	4.66
.1167	4.66
.1333	4.67
.1500	4.67
.1667	4.67
.1833	4.67
.2000	4.67
.2834	4.67
.3667	4.68
.4500	4.69
.5334	4.69
.6167	4.70
.7000	4.70
.7834	4.71
.8667	4.71
.9500	4.72
1.0334	4.72
1.1167	4.73
1.2000	4.73
1.2833	4.74
1.3667	4.74
1.4500	4.75
1.5334	4.75
1.6167	4.76
1.7000	4.76
1.7834	4.76
1.8667	4.77
2.3667	4.79
2.8667	4.81
3.3667	4.84
3.8667	4.86
4.3667	4.87
4.8667	4.90
5.3667	4.91
5.8667	4.93
6.3667	4.95
6.8667	4.96
7.3667	4.98
7.8667	4.99
8.3667	5.01
8.8667	5.03
9.3667	5.04
9.8667	5.06
11.8667	5.11
13.8667	5.17
15.8667	5.22
17.8667	5.26
19.8667	5.30
21.8667	5.35
23.8667	5.39
25.8667	5.42
27.8667	5.46
29.8667	5.49
31.8667	5.53
33.8667	5.56
35.8667	5.59
37.8667	5.62
39.8667	5.65
41.8667	5.68
43.8667	5.70
45.8667	5.73

Well 27
Equilibrium water level: 3.69 feet
Date: March 18, 1993

Elapsed time (minutes	Depth (feet)
0.0000	1.83
.0166	1.94
.0333	1.95
.0500	1.95
.0666	1.96
.0833	1.96
.1000	1.97
.1166	1.98
.1333	1.98
.1500	1.99
.1666	1.99
.1833	2.00
.2000	2.00
.2166	2.01
.2333	2.01
.3167	2.04
.4000	2.06
.4833	2.08
.5667	2.10
.6500	2.12
.7333	2.13
.8167	2.15
.9000	2.17
.9833	2.18
1.0667	2.20
1.1500	2.21
1.2333	2.23
1.3166	2.24
1.4000	2.25
1.4833	2.27
1.5667	2.28
1.6500	2.29
1.7333	2.30
1.8167	2.32
1.9000	2.33
2.4000	2.40
2.9000	2.46
3.4000	2.52
3.9000	2.57
4.4000	2.62
4.9000	2.67
5.4000	2.71
5.9000	2.75
6.4000	2.79
6.9000	2.83
7.4000	2.87
7.9000	2.90
8.4000	2.93
8.9000	2.96
9.4000	2.99
9.9000	3.02
11.9000	3.12
13.9000	3.20
15.9000	3.26
17.9000	3.32
19.9000	3.37
21.9000	3.41
23.9000	3.44
25.9000	3.47
27.9000	3.50
29.9000	3.51
31.9000	3.54

Table 6. Slug-test data for observation wells—Continued

[Depth refers to distance from measuring point to static water level; data are from falling-head slug tests except for well 10 data, which are from a rising-head slug test; for locations of observation wells see plate 1]

Well 28
Equilibrium water level: 5.38 feet
Date: March 19, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	3.72
.0166	3.72
.0333	3.72
.0500	3.73
.0666	3.72
.0833	3.73
.1667	3.74
.2500	3.75
.3333	3.77
.4167	3.78
.5000	3.79
.5833	3.80
.6667	3.81
.7500	3.82
.8333	3.83
.9167	3.84
1.0000	3.85
1.0833	3.86
1.1666	3.87
1.2500	3.88
1.3333	3.89
1.4167	3.90
1.5000	3.91
1.5833	3.92
1.6667	3.92
1.7500	3.93
2.2500	3.98
2.7500	4.02
3.2500	4.06
3.7500	4.10
4.2500	4.14
4.7500	4.17
5.2500	4.20
5.7500	4.24
6.2500	4.27
6.7500	4.30
7.2500	4.33
7.7500	4.36
8.2500	4.39
8.7500	4.41
9.2500	4.44
9.7500	4.47
11.7500	4.56
13.7500	4.65
15.7500	4.72
17.7500	4.79
19.7500	4.84
21.7500	4.90
23.7500	4.95
25.7500	5.00
27.7500	5.03
29.7500	5.07
31.7500	5.10
33.7500	5.13
35.7500	5.16

Well 29
Equilibrium water level: 5.88 feet
Date: March 19, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	4.12
.0334	4.19
.0500	4.20
.0667	4.21
.0834	4.23
.1000	4.24
.1167	4.26
.1334	4.26
.1500	4.28
.1667	4.29
.1834	4.30
.2000	4.32
.2167	4.33
.2334	4.34
.2500	4.35
.2667	4.36
.3501	4.41
.4334	4.45
.5167	4.50
.6001	4.54
.6834	4.58
.7667	4.62
.8501	4.66
.9334	4.70
1.0167	4.73
1.1001	4.77
1.1834	4.80
1.2667	4.83
1.3500	4.86
1.4334	4.89
1.5167	4.92
1.6001	4.95
1.6834	4.98
1.7667	5.00
1.8501	5.03
1.9334	5.06
2.4334	5.20
2.9334	5.31
3.4334	5.40
3.9334	5.48
4.4334	5.55
4.9334	5.60
5.4334	5.64
5.9334	5.68
6.4334	5.71
6.9334	5.74
7.4334	5.75
7.9334	5.77
8.4334	5.79
8.9334	5.80
9.4334	5.81
9.9334	5.82
11.9334	5.84

Table 6. Slug-test data for observation wells—Continued

[Depth refers to distance from measuring point to static water level; data are from falling-head slug tests except for well 10 data, which are from a rising-head slug test; for locations of observation wells see plate 1]

Well 30
Equilibrium water level: 6.58 feet
Date: March 16, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	3.96
.0167	4.37
.0334	4.46
.0500	4.42
.0667	4.43
.0834	4.44
.1000	4.44
.1167	4.45
.1334	4.46
.1500	4.46
.1667	4.46
.1834	4.46
.2000	4.47
.2167	4.47
.2334	4.47
.2500	4.48
.2667	4.48
.3501	4.49
.4334	4.51
.5167	4.51
.6001	4.53
.6834	4.54
.7667	4.55
.8501	4.56
.9334	4.57
1.0167	4.58
1.1001	4.59
1.1834	4.60
1.2667	4.61
1.3500	4.62
1.4334	4.63
1.5167	4.64
1.6001	4.65
1.6834	4.66
1.7667	4.67
1.8501	4.67
1.9334	4.68
2.4334	4.72
2.9334	4.75
3.4334	4.79
3.9334	4.81
4.4334	4.83
4.9334	4.83
5.4334	4.84
5.9334	4.85
6.4334	4.85
6.9334	4.85
7.4334	4.86
7.9334	4.86
8.4334	4.86
8.9334	4.87
9.4334	4.87
9.9334	4.87
11.9334	4.89
13.9334	4.90
15.9334	4.91
17.9334	4.92
19.9334	4.93
21.9334	4.94
23.9334	4.95
25.9334	4.96
27.9334	4.96
29.9334	4.97

Well 30
Equilibrium water level: 6.58 feet
Date: March 16, 1993

Elapsed time (minutes)	Depth (feet)
31.9334	4.98
33.9334	4.99
35.9334	4.99
37.9334	5.00
39.9334	5.01
41.9334	5.01
43.9334	5.02
45.9334	5.03
47.9334	5.03
49.9334	5.03

Well M1
Equilibrium water level: 18.50 feet
Date: March 24, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	16.61
.0166	16.69
.0333	16.69
.0500	16.71
.0666	16.73
.0833	16.73
.1000	16.73
.1166	16.74
.1333	16.76
.1500	16.76
.1666	16.76
.1833	16.77
.2000	16.79
.2166	16.79
.2333	16.80
.3167	16.84
.4000	16.87
.4833	16.90
.5667	16.94
.6500	16.97
.7333	17.00
.8167	17.03
.9000	17.07
.9833	17.09
1.0667	17.12
1.1500	17.15
1.2333	17.18
1.3166	17.21
1.4000	17.23
1.4833	17.26
1.5667	17.28
1.6500	17.31
1.7333	17.33
1.8167	17.36
1.9000	17.38
2.4000	17.51
2.9000	17.62
3.4000	17.72
3.9000	17.81
4.4000	17.89
4.9000	17.96
5.4000	18.02
5.9000	18.08

Table 6. Slug-test data for observation wells—Continued

[Depth refers to distance from measuring point to static water level; data are from falling-head slug tests except for well 10 data, which are from a rising-head slug test; for locations of observation wells see plate 1]

Well M1
Equilibrium water level: 18.50 feet
Date: March 24, 1993

Elapsed time (minutes)	Depth (feet)
6.4000	18.13
6.9000	18.17
7.4000	18.21
7.9000	18.25
8.4000	18.28
8.9000	18.31
9.4000	18.33
9.9000	18.36
11.9000	18.43
13.9000	18.47
15.9000	18.50
17.9000	18.52
19.9000	18.53

Well M2
Equilibrium water level: 16.86 feet
Date: March 23, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	15.01
.0167	15.04
.0500	15.04
.1000	15.05
.1167	15.05
.1333	15.06
.1500	15.06
.1667	15.06
.1833	15.06
.2000	15.06
.2167	15.06
.2333	15.06
.2500	15.06
.3334	15.07
.4167	15.07
.5000	15.07
.5834	15.07
.6667	15.08
.7500	15.08
.8334	15.08
.9167	15.08
1.0000	15.08
1.0834	15.08
1.1667	15.09
1.2500	15.09
1.3333	15.10
1.4167	15.10
1.5000	15.10
1.5834	15.10
1.6667	15.11
1.7500	15.11
1.8334	15.11
1.9167	15.11
2.4167	15.12
2.9167	15.14
3.4167	15.15
3.9167	15.16
4.4167	15.17

Well M2
Equilibrium water level: 16.86 feet
Date: March 23, 1993

Elapsed time (minutes)	Depth (feet)
4.9167	15.18
5.4167	15.19
5.9167	15.20
6.4167	15.21
6.9167	15.22
7.4167	15.23
7.9167	15.24
8.4167	15.25
8.9167	15.26
9.4167	15.27
9.9167	15.28
11.9167	15.32
13.9167	15.36
15.9167	15.39
17.9167	15.42
19.9167	15.45
21.9167	15.48
23.9167	15.51
25.9167	15.54
27.9167	15.57
29.9167	15.60
31.9167	15.63
33.9167	15.65
35.9167	15.68
37.9167	15.70
39.9167	15.72
41.9167	15.75
43.9167	15.76
45.9167	15.79
47.9167	15.81
49.9167	15.83
51.9167	15.85
53.9167	15.87
55.9167	15.89
57.9167	15.90
59.9167	15.92

Table 6. Slug-test data for observation wells—Continued

[Depth refers to distance from measuring point to static water level; data are from falling-head slug tests except for well 10 data, which are from a rising-head slug test; for locations of observation wells see plate 1]

Well M3
Equilibrium water level: 10.82 feet
Date: March 22, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	8.91
.0334	9.23
.0500	9.22
.0667	9.26
.0834	9.30
.1000	9.34
.1167	9.37
.1334	9.41
.1500	9.45
.1667	9.48
.1834	9.52
.2000	9.55
.2167	9.58
.2334	9.61
.2500	9.64
.2667	9.67
.3501	9.80
.4334	9.91
.5167	10.01
.6001	10.09
.6834	10.17
.7667	10.23
.8501	10.29
.9334	10.34
1.0167	10.39
1.1001	10.43
1.1834	10.46
1.2667	10.50
1.3500	10.52
1.4334	10.55
1.5167	10.57
1.6001	10.59
1.6834	10.61
1.7667	10.63
1.8501	10.64
1.9334	10.65
2.4334	10.71
2.9334	10.74
3.4334	10.76
3.9334	10.77
4.4334	10.78
4.9334	10.78
5.4334	10.79
5.9334	10.79
6.4334	10.79
6.9334	10.79
7.4334	10.79
7.9334	10.79
8.4334	10.79
8.9334	10.79
9.4334	10.79
9.9334	10.79
11.9334	10.79

Well D1
Equilibrium water level: 26.47 feet
Date: March 24, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	24.56
.0167	24.66
.0333	24.65
.0500	24.63
.0667	24.62
.0833	24.63
.1000	24.63
.1167	24.62
.1333	24.63
.1500	24.63
.1667	24.63
.1833	24.63
.2000	24.63
.2167	24.62
.2333	24.63
.2500	24.63
.3334	24.63
.4167	24.62
.5000	24.63
.5834	24.63
.6667	24.63
.7500	24.63
.8334	24.63
.9167	24.63
1.0000	24.63
1.0834	24.63
1.1667	24.63
1.2500	24.63
1.3333	24.63
1.4167	24.63
1.5000	24.63
1.5834	24.63
1.6667	24.63
1.7500	24.63
1.8334	24.63
1.9167	24.63
2.4167	24.63
2.9167	24.64
3.4167	24.64
3.9167	24.64
4.4167	24.64
4.9167	24.64
5.4167	24.64
5.9167	24.65
6.4167	24.65
6.9167	24.65
7.4167	24.65
7.9167	24.65
8.4167	24.66
8.9167	24.66
9.4167	24.66
9.9167	24.66
11.9167	24.66
13.9167	24.67
15.9167	24.67
17.9167	24.68
19.9167	24.69
21.9167	24.70
23.9167	24.70
25.9167	24.71
27.9167	24.71

Table 6. Slug-test data for observation wells—Continued

[Depth refers to distance from measuring point to static water level; data are from falling-head slug tests except for well 10 data, which are from a rising-head slug test; for locations of observation wells see plate 1]

Well D2
Equilibrium water level: 32.74 feet
Date: March 23, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	30.83
.0333	30.92
.0500	30.92
.0667	30.92
.0833	30.93
.1000	30.94
.1167	30.94
.1333	30.95
.1500	30.95
.1667	30.95
.1833	30.96
.2000	30.96
.2167	30.96
.2333	30.96
.2500	30.97
.3334	30.99
.4167	31.01
.5000	31.02
.5834	31.04
.6667	31.05
.7500	31.07
.8334	31.08
.9167	31.10
1.0000	31.11
1.0834	31.13
1.1667	31.14
1.2500	31.15
1.3333	31.17
1.4167	31.18
1.5000	31.19
1.5834	31.20
1.6667	31.22
1.7500	31.23
1.8334	31.24
1.9167	31.25
2.4167	31.32
2.9167	31.39
3.4167	31.45
3.9167	31.50
4.4167	31.56
4.9167	31.61
5.4167	31.65
5.9167	31.70
6.4167	31.75
6.9167	31.79
7.4167	31.82
7.9167	31.86
8.4167	31.90
8.9167	31.93
9.4167	31.96
9.9167	31.99
11.9167	32.11
13.9167	32.20
15.9167	32.26
17.9167	32.33
19.9167	32.37

Well D3
Equilibrium water level: 26.06 feet
Date: March 22, 1993

Elapsed time (minutes)	Depth (feet)
0.0000	24.18
.0834	24.21
.2500	24.23
.3334	24.23
.4167	24.23
.5000	24.24
.5834	24.24
.6667	24.24
.7500	24.24
.8334	24.24
.9167	24.25
1.0000	24.25
1.0833	24.25
1.1667	24.26
1.2500	24.26
1.3334	24.26
1.4167	24.26
1.5000	24.26
1.5834	24.26
1.6667	24.27
2.1667	24.28
2.6667	24.28
3.1667	24.30
3.6667	24.31
4.1667	24.32
4.6667	24.33
5.1667	24.34
5.6667	24.35
6.1667	24.36
6.6667	24.38
7.1667	24.39
7.6667	24.39
8.1667	24.40
8.6667	24.42
9.1667	24.43
9.6667	24.44
11.6667	24.48
13.6667	24.51
15.6667	24.55
17.6667	24.58
19.6667	24.62
21.6667	24.65
23.6667	24.68
25.6667	24.71
27.6667	24.74
29.6667	24.77
31.6667	24.80
33.6667	24.83
35.6667	24.86
37.6667	24.89
39.6667	24.91
41.6667	24.94
43.6667	24.96
45.6667	24.98
47.6667	25.01

Table 7. Reporting units and limits for selected water-quality constituents

[°C, degrees Celsius; µg/L, micrograms per liter; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter at 25°C]

Constituent	Reporting units	Reporting limit
Specific conductance, field	µS/cm	1
pH, field	standard pH units	.1
Temperature, field	°C	.1
Dissolved oxygen, field	mg/L, as O_2	.1
Alkalinity, field	mg/L, as $CaCO_3$	1
Calcium	mg/L, as Ca	.1
Magnesium	mg/L, as Mg	.1
Sodium	mg/L, as Na	.1
Potassium	mg/L, as K	.1
Sulfate	mg/L, as SO_4	.1
Chloride	mg/L, as Cl	.1
Fluoride	mg/L, as F	.1
Silica	mg/L, as SiO_2	.1
Dissolved solids, residue at 180° C	mg/L	1
Aluminum	µg/L, as Al	10
Iron	µg/L, as Fe	10
Manganese	µg/L, as Mn	10
Dissolved organic carbon	mg/L, as C	.1
Suspended organic carbon	mg/L, as C	.1

Table 8. Major dissolved constituents in surface water from the Main Site, Naval Surface Warfare Center, Dahlgren Laboratory

[°C, degrees Celsius; µg/L, micrograms per liter; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter at 25 °C; >, greater than; <, less than; for surface-water sample locations, see plate 1]

Location number	Date	Specific conductance, field (µS/cm)	pH, field	Temperature, field (°C)	Oxygen, dissolved, field (mg/L)	Calcium (mg/L, as Ca)	Magnesium (mg/L, as Mg)	Sodium (mg/L, as Na)	Potassium (mg/L, as K)	Alkalinity field (mg/L, as $CaCO_3$)
SW1	05-17-93	83	6.1	19.0	3.4	3.7	1.7	4.9	1.9	22
[1] SW1-D	05-17-93	68	6.1	19.0	3.4	3.8	1.7	4.9	1.9	22
SW2	05-17-93	648	6.9	22.0	3.9	9.4	12	88	5.8	24
SW3	05-17-93	1,287	7.1	23.4	3.4	18	23	180	10	51

Location number	Sulfate (mg/L, as SO_4)	Chloride (mg/L, as Cl)	Fluoride (mg/L, as F)	Sillca (mg/L, as SiO_2)	Solids, dissolved, (residue at 180° C)	Aluminum (µg/L, as Al)	Iron (µg/L, as Fe)	Manganese (µg/L, as Mn)	Carbon, organic, dissolved (mg/L, as C)	Carbon, organic, suspended (mg/L, as C)
SW1	2.5	9.9	<0.10	3.4	110	460	9,800	700	24	11
[1] SW1-D	2.5	9.9	<.10	3.5	48	430	9,800	740	22	9
SW2	25	160	.20	1.8	381	150	2,100	320	17	4.2
SW3	50	330	.20	1.3	712	50	700	280	11	1.8

[1]Duplicate sample.

Table 9. Major dissolved constituents in ground water from the Main Site , Naval Surface Warfare Center, Dahlgren Laboratory

[°C, degrees Celsius; µg/L, micrograms per liter; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter at 25 °C; --, data not collected; >, greater than; <, less than; for locations of observation wells see plate 1]

Well no.	USGS well number	Date	Specific conductance field (µS/cm)	pH field (standard units)	Temperature field (°C)	Dissolved oxygen field (mg/L)	Calcium (mg/L, as Ca)	Magnesium (mg/L, as Mg)	Sodium (mg/L, as Na)	Potassium (mg/L, as K)
1	54Q25	05-25-93	137	4.9	13.0	3.0	1.7	1.8	18	0.70
2	54Q26	05-25-93	165	4.9	16.0	2.3	.77	.95	26	.30
3	54Q27	05-24-93	840	5.1	14.8	5.3	6.3	2.3	150	1.4
4	54Q28	05-21-93	100	5.3	12.2	3.8	.18	.08	18	.30
5	54Q29	05-19-93	186	4.8	12.0	7.8	3.2	4.1	19	.40
6	54Q30	05-19-93	159	5.0	12.5	.9	4.8	4.5	15	.70
7	54Q31	05-18-93	137	5.1	16.0	4.3	6.7	2.4	11	.90
[1]7	54Q31	05-18-93	137	5.1	16.0	4.3	6.9	2.5	11	.90
8	54Q32	05-18-93	450	6.1	13.9	.5	17	5.8	47	4.8
9	54Q33	05-24-93	1,480	4.7	13.3	.6	94	17	130	3.5
10	54Q34	05-18-93	455	6.9	13.0	7.4	80	1.6	11	.30
11	54Q35	05-18-93	375	6.7	14.0	.5	47	6.9	14	1.6
12	54Q36	05-17-93	69	5.2	13.2	.7	4.7	1.1	8.2	.90
13	54Q37	05-24-93	53	5.6	13.3	4.6	3.6	.63	5.1	.30
14	54Q38	05-17-93	142	6.1	13.5	.9	5.5	1.7	6.1	17
15	54Q39	05-21-93	69	5.1	13.8	2.0	2.8	2.1	4.2	.90
16	54Q40	05-20-93	80	5.3	13.8	1.6	1.0	1.2	9.9	.40
17	54Q41	05-20-93	77	5.1	13.5	2.8	1.8	1.4	8.0	.70
18	54Q42	05-20-93	79	6.3	13.0	2.4	8.2	1.3	4.0	.60
19	54Q43	05-21-93	50	5.6	13.8	9.4	.82	.50	5.4	.80
20	54Q44	05-20-93	62	5.7	13.9	.5	1.6	.75	7.1	1.6
21	54Q45	05-21-93	166	6.0	15.2	7.2	19	.82	11	.30
22	54Q46	05-21-93	121	5.1	13.7	1.5	2.8	.90	16	.70
23	54Q47	05-19-93	197	6.9	13.8	.6	9.1	2.5	5.0	1.0
[1]23	54Q47	05-19-93	197	6.9	13.8	.6	9.0	2.5	5.1	1.0
24	54Q48	05-25-93	146	5.6	16.8	2.2	9.6	1.6	12	2.4
[1]24	54Q48	05-25-93	146	5.6	16.8	2.2	10	1.7	14	2.5
25	54Q49	05-25-93	200	6.0	14.7	2.1	15	1.7	20	1.2
27	54Q50	05-25-93	535	6.3	15.6	1.5	81	2.7	18	.50
28	54Q51	05-24-93	62	5.0	16.8	1.3	.43	.38	9.1	.40
29	54Q52	05-24-93	58	4.7	16.4	5.0	.30	.88	5.9	1.2
30	54Q53	05-19-93	2,190	6.4	13.8	2.5	27	39	320	5.5
M1	54Q20	05-26-93	180	6.5	15.2	.4	7.3	2.1	14	6.2
M2	54Q22	05-26-93	515	7.6	16.2	1.0	39	12	34	32
M3	54Q24	05-26-93	430	7.1	16.9	.4	24	8.6	37	20
[1]M3	54Q24	05-26-93	430	7.1	16.9	.4	24	8.7	38	20
[2]D1	54Q19	05-27-93	7,140	12.5	--	--	390	<.10	100	230
[2]D2	54Q21	05-27-93	521	10.0	17.7	--	4.0	.48	90	28
[2]D3	54Q23	05-27-93	1,535	11.6	--	--	15	.07	140	120

[1] Duplicate sample.

[2] Water from these wells may not be representative of formation water due to possible grout contamination.

Table 9.—Continued

Alkalinity, field (mg/L, as $CaCO_3$)	Sulfate (mg/L, as SO_4)	Chloride (mg/L, as Cl)	Fluoride (mg/L, as F)	Silica (mg/L, as SiO_2)	Solids, dissolved (residue at 180°C)	Aluminum (µg/L, as Al)	Iron (µg/L, as Fe)	Manganese (µg/L, as Mn)	Carbon, organic, dissolved (mg/L, as C)	Carbon, organic, suspended (mg/L, as C)	Well no.
4	5.7	29	<0.10	53	124	70	220	95	1.7	0.5	1
9	47	9.0	<.10	34	130	70	120	41	3.2	1.1	2
13	85	180	.10	76	546	80	200	280	18	.4	3
10	3.3	19	.10	50	117	240	52	2	2.7	2.1	4
2	26	31	.10	35	137	290	200	160	2.4	4.0	5
13	10	28	<.10	23	125	170	5,000	330	.2	.1	6
7	21	19	<.10	9.1	82	30	93	28	1.6	.1	7
5	21	20	<.10	9.1	75	30	59	28	1.7	.1	7
86	15	74	.10	29	261	10	14,000	200	3.9	.3	8
1	2.3	420	.10	41	964	630	2,700	170	1.1	.1	9
173	31	11	.10	8.4	281	10	21	3	.9	1.7	10
151	29	5.0	.10	20	224	20	3,100	420	.9	.1	11
17	10	3.1	<.10	18	60	20	36	31	5.0	.8	12
10	5.9	4.7	<.10	22	62	50	84	14	.3	1.4	13
35	14	7.5	<.10	12	89	40	420	42	.8	.3	14
7	14	5.5	.20	16	64	140	87	99	2.3	.3	15
6	9.5	12	.20	31	74	120	190	40	1.3	2.1	16
6	14	9.2	.10	17	55	60	160	17	.7	.3	17
35	3.1	3.9	<.10	24	63	30	950	500	.3	.4	18
5	11	2.2	<.10	32	67	20	160	100	<.1	.9	19
18	2.2	5.6	<.10	19	49	30	1,700	120	.5	.1	20
31	26	8.6	<.10	19	110	150	26	46	.8	.2	21
6	17	16	.10	30	100	70	17	80	1.1	.4	22
82	<.10	3.3	.30	23	110	<10	30,000	400	1.3	.2	23
82	<.10	3.2	.10	22	114	10	30,000	410	6.3	.5	23
16	36	7.3	<.10	14	92	60	1,700	110	2.1	4.0	24
15	36	6.9	<.10	12	100	40	1,800	120	2.0	3.2	24
47	33	6.0	<.10	18	129	20	48	53	1.2	2.1	25
168	31	50	<.10	19	306	80	140	140	1.2	.3	27
3	1.5	13	<.10	29	57	40	130	31	.6	.2	28
1	6.5	5.2	<.10	21	54	120	7	9	.7	.1	29
291	55	480	.20	22	1,190	70	30,000	7,000	11	>4.0	30
85	.60	4.5	.10	39	131	90	14,000	200	1.6	.6	M1
252	3.7	6.6	.20	30	311	530	290	240	4.8	4.1	M2
197	1.2	6.5	.30	43	272	20	7,400	130	3.0	.3	M3
196	1.2	6.9	.30	43	266	20	7400	130	2.8	.3	M3
1,360	4.5	1.5	1.6	.80	2050	600	<10	10	6.2	.4	D1
176	12	2.9	.70	8.9	302	100	90	<1	5.2	>17	D2
327	13	2.6	1.0	9.3	618	180	99	<1	4.8	.8	D3

Table 10. Hydrogen and oxygen stable isotope ratios in ground water and surface water from the Main Site, Naval Surface Warfare Center, Dahlgren Laboratory

[δD and $\delta^{18}O$ refer to the relative difference between the ratios ($^2H/^1H$) and ($^{18}O/^{16}O$), respectively, in the sample and the ratios in standard mean ocean water, expressed in parts per thousand (per mil); for locations of observation wells and surface-water-sample sites, see plate 1]

Well number	δ D (per mil)	$\delta^{18}O$ (per mil)	Well number	δ D (per mil)	$\delta^{18}O$ (per mil)
1	-39.6	-6.74	24	-34.6	-6.22
2	-39.9	-7.01	[1]24	-34.4	-6.22
3	-38.0	-6.64	25	-37.9	-6.66
4	-41.7	-6.97	27	-39.4	-6.64
5	-36.6	-6.35	28	-38.2	-6.95
			29	-39.2	-6.76
6	-37.0	-6.55	30	-37.2	-6.21
7	-43.7	-7.31			
[1]7	-44.7	-7.23	M1	-39.9	-6.78
8	-37.0	-6.56	M2	-40.8	-7.09
9	-36.2	-6.14	M3	-40.0	-6.83
			[1]M3	-39.2	-6.89
10	-39.5	-6.61			
11	-41.6	-7.13	D1	-37.2	-6.38
12	-38.2	-6.69	D2	-40.4	-6.87
13	-36.9	-6.66	D3	-38.7	-6.49
14	-37.7	-6.47	**Surface-water sample site number**	**δ D (per mil)**	**$\delta^{18}O$ (per mil)**
15	-41.8	-7.04			
16	-37.2	-6.50	SW1	-32.7	-5.49
17	-36.6	-6.38	[1]SW1-D	-33.3	-5.43
18	-42.0	-6.96	SW2	-30.8	-4.84
19	-38.5	-6.44	SW3	-39.2	-6.18
20	-37.3	-6.49			
21	-38.4	-6.46			
22	-38.9	-6.60			
23	-39.8	-6.88			
[1]23	-39.9	-6.90			

[1] Duplicate sample

ILLUSTRATIONS

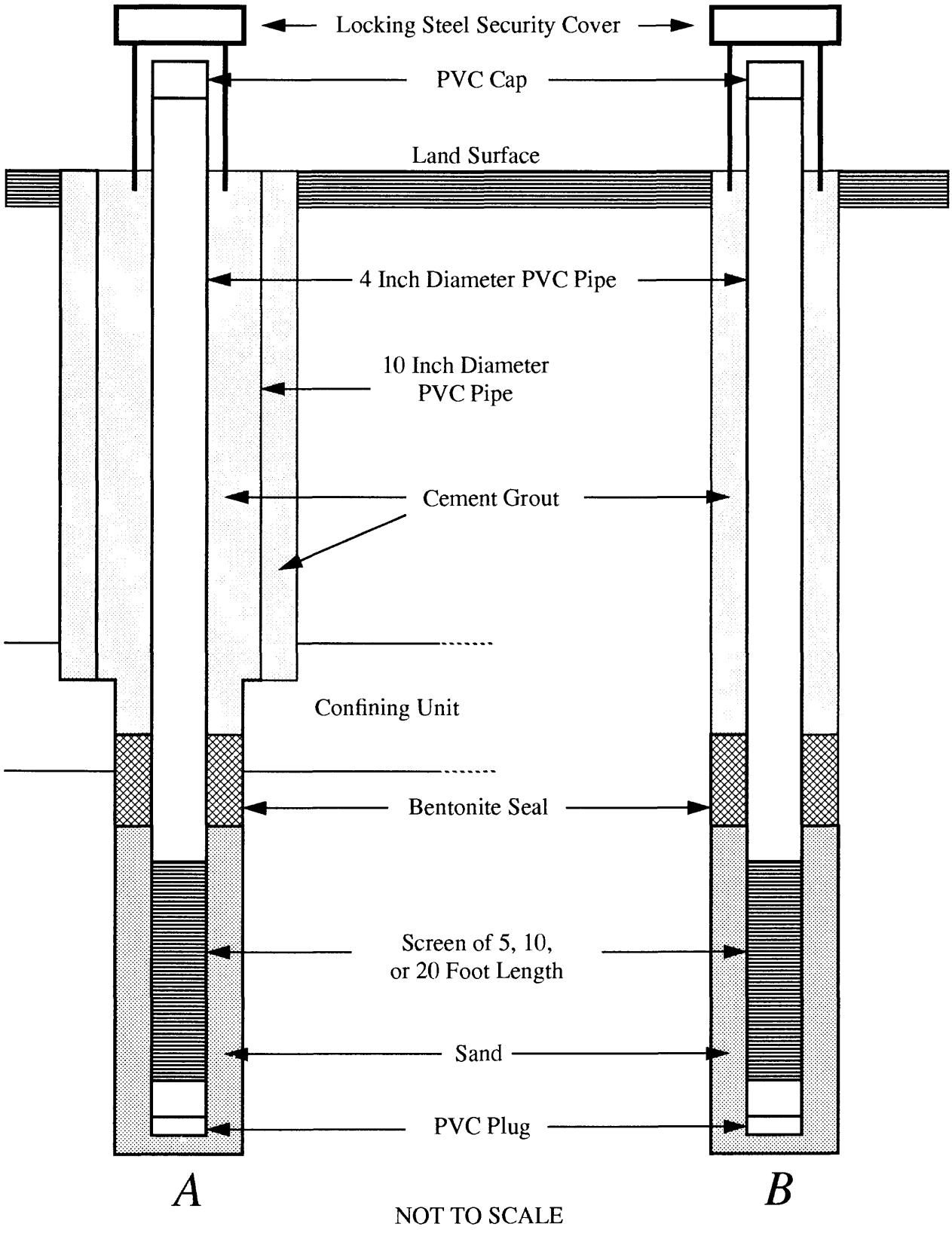

Figure 2. Standard construction of wells completed in (*A*) confined aquifer and (*B*) unconfined aquifer.

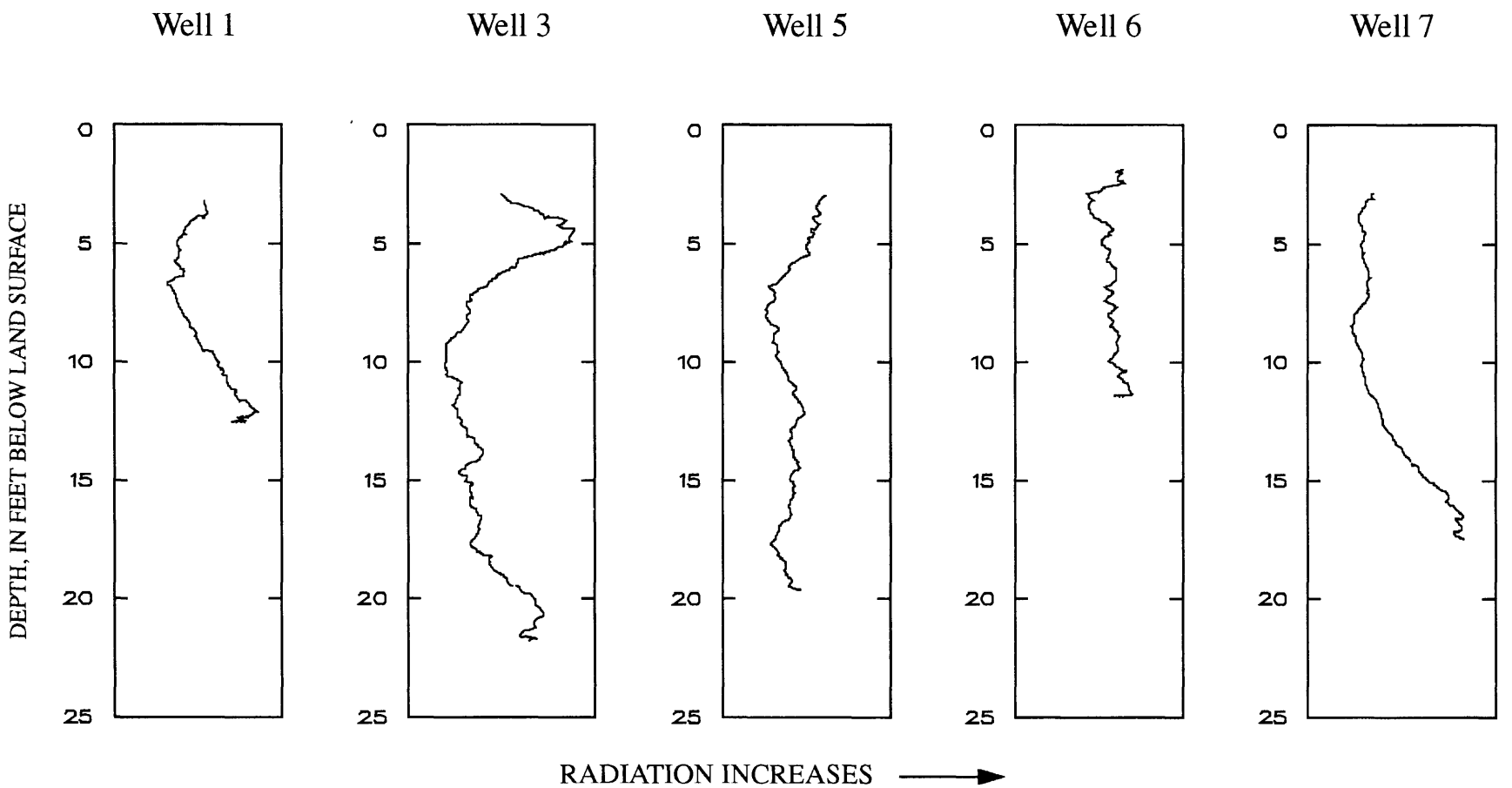

Figure 3. Natural gamma logs of wells in the Columbia aquifer.

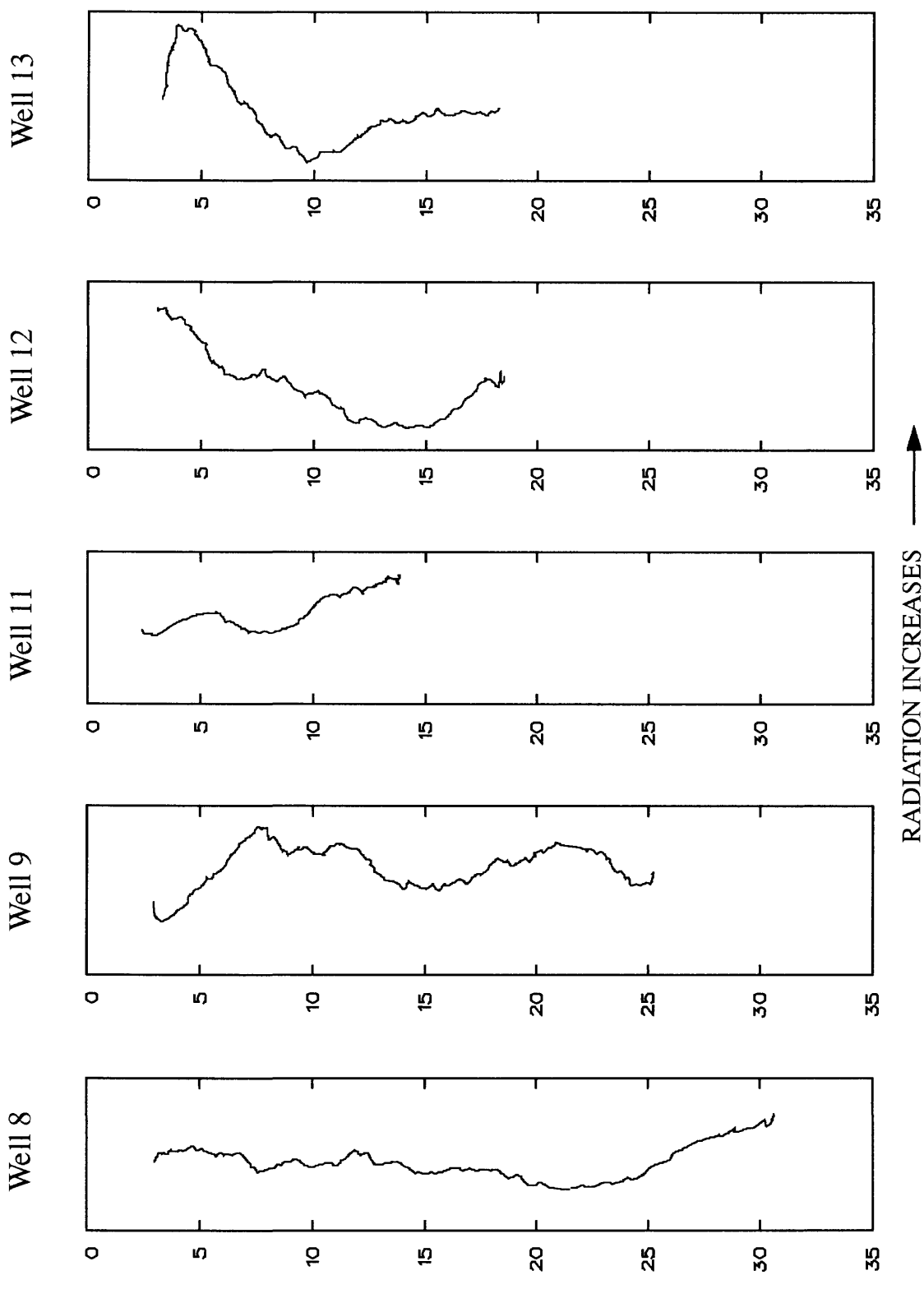

Figure 3. Natural gamma logs of wells in the Columbia aquifer—Continued.

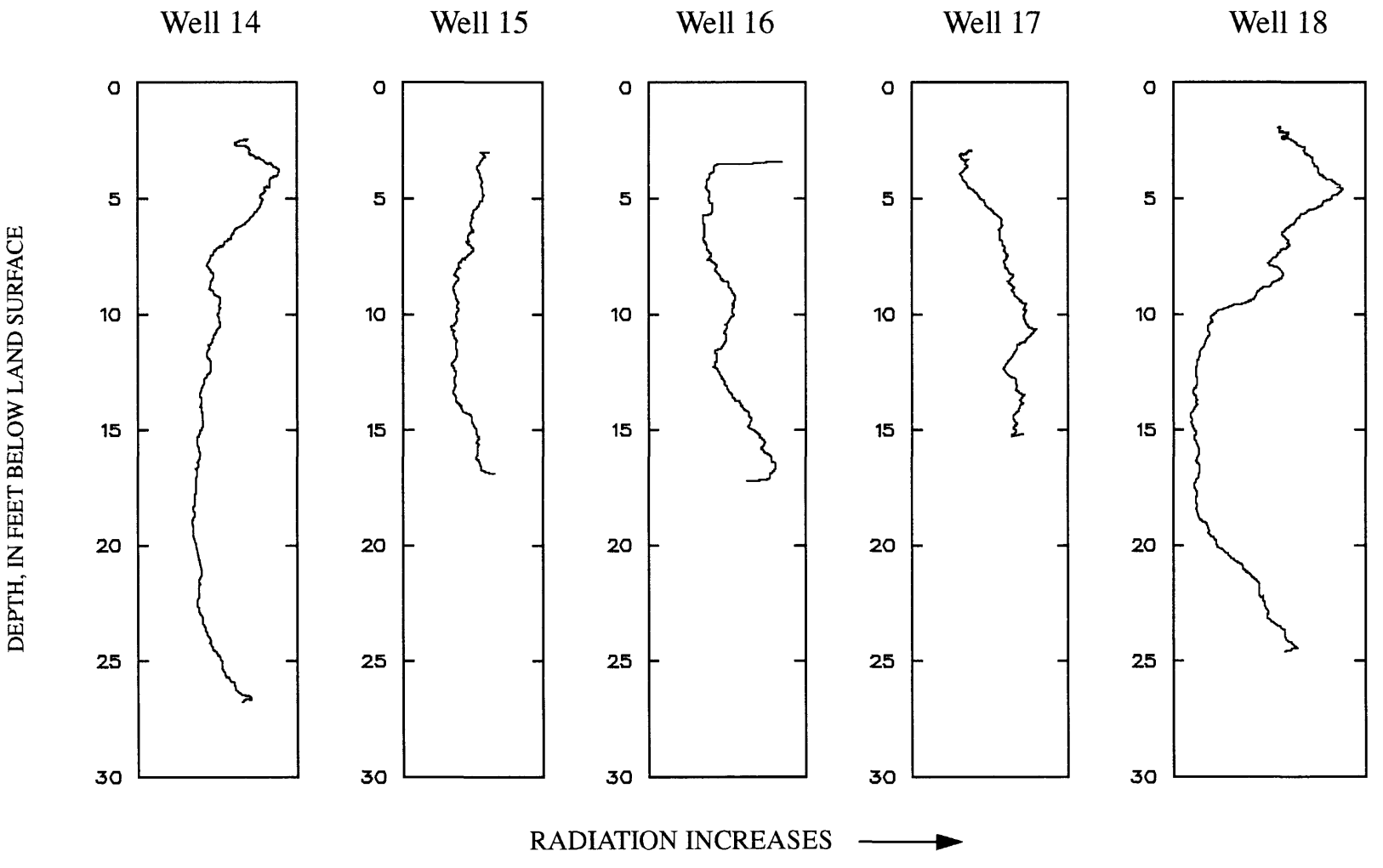

Figure 3. Natural gamma logs of wells in the Columbia aquifer—Continued.

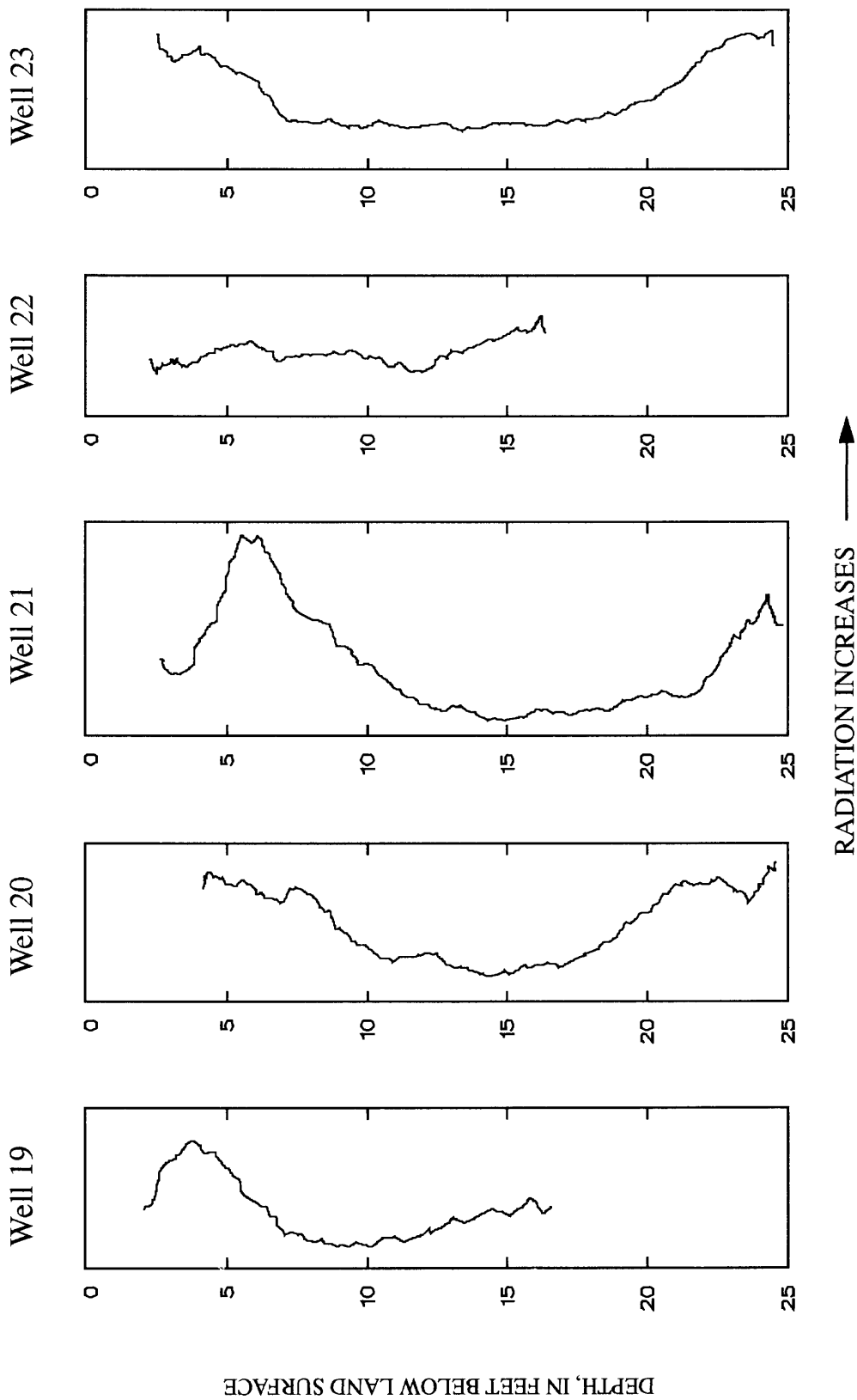

Figure 3. Natural gamma logs of wells in the Columbia aquifer—Continued.

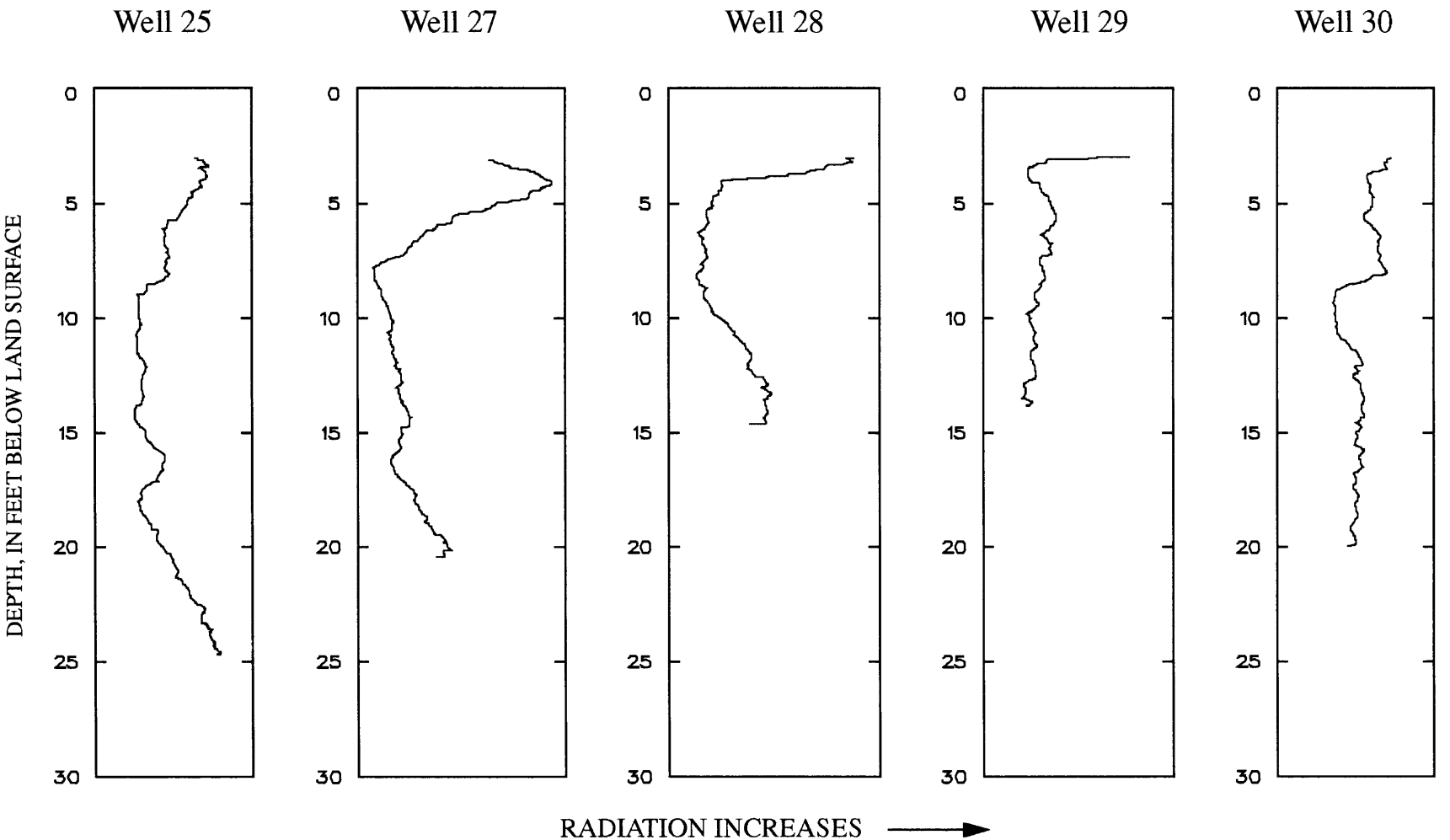

Figure 3. Natural gamma logs of wells in the Columbia aquifer—Continued.

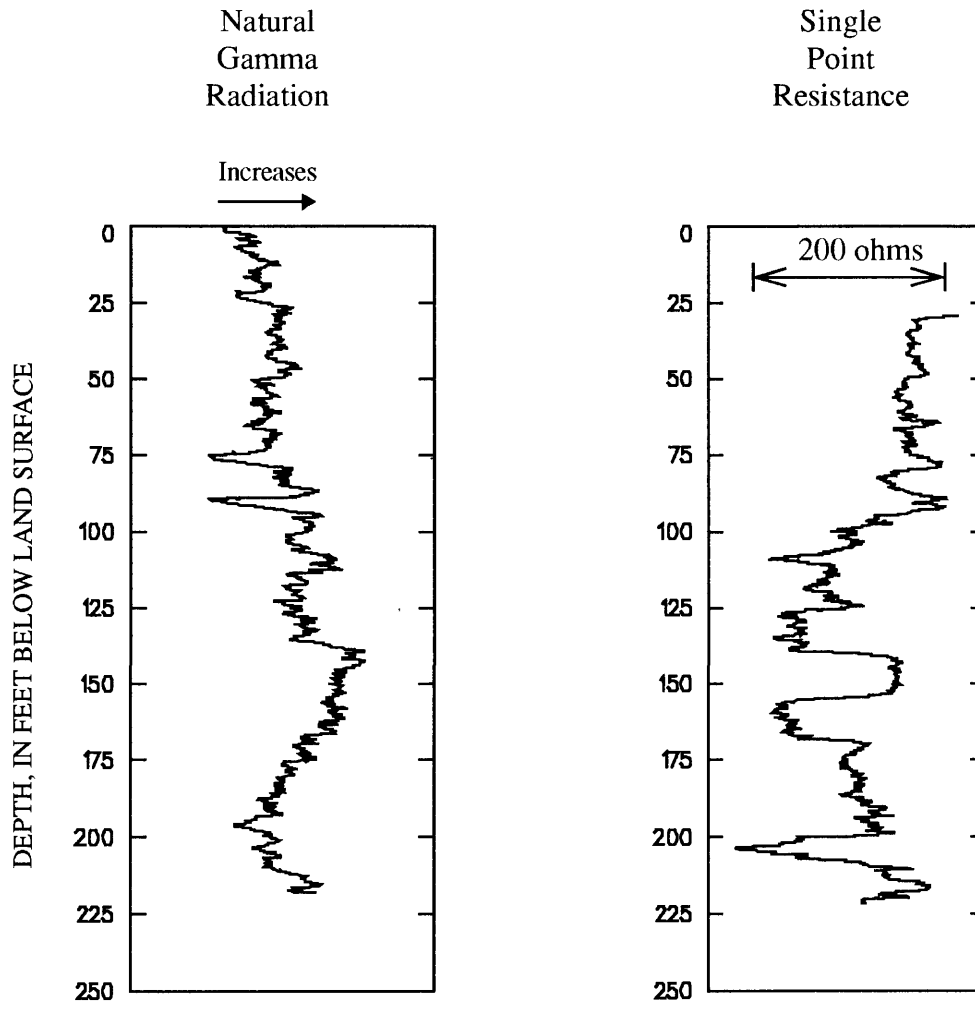

Figure 4. Selected geophysical logs of well D-1.

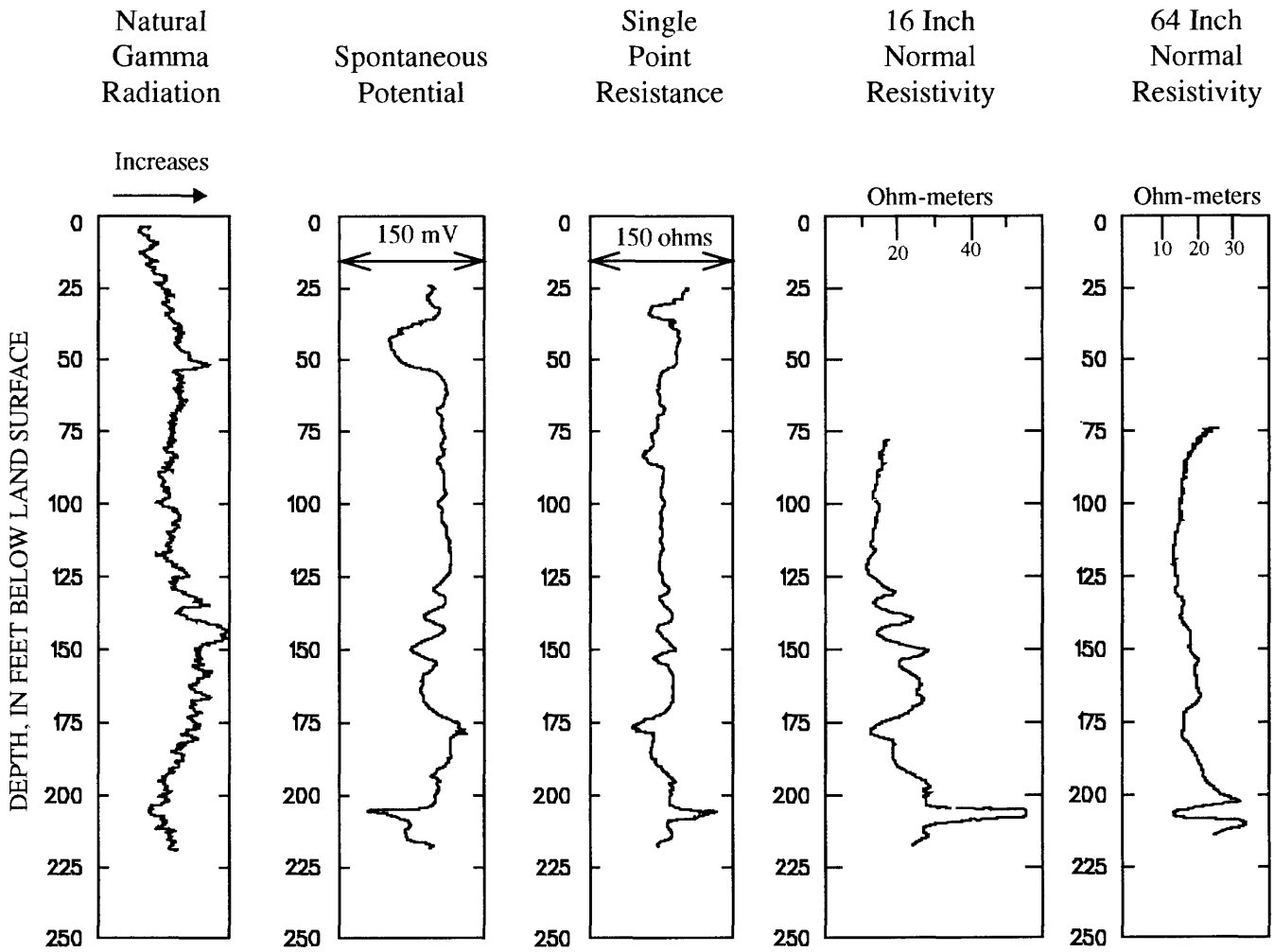

Figure 5. Selected geophysical logs of well D-2.

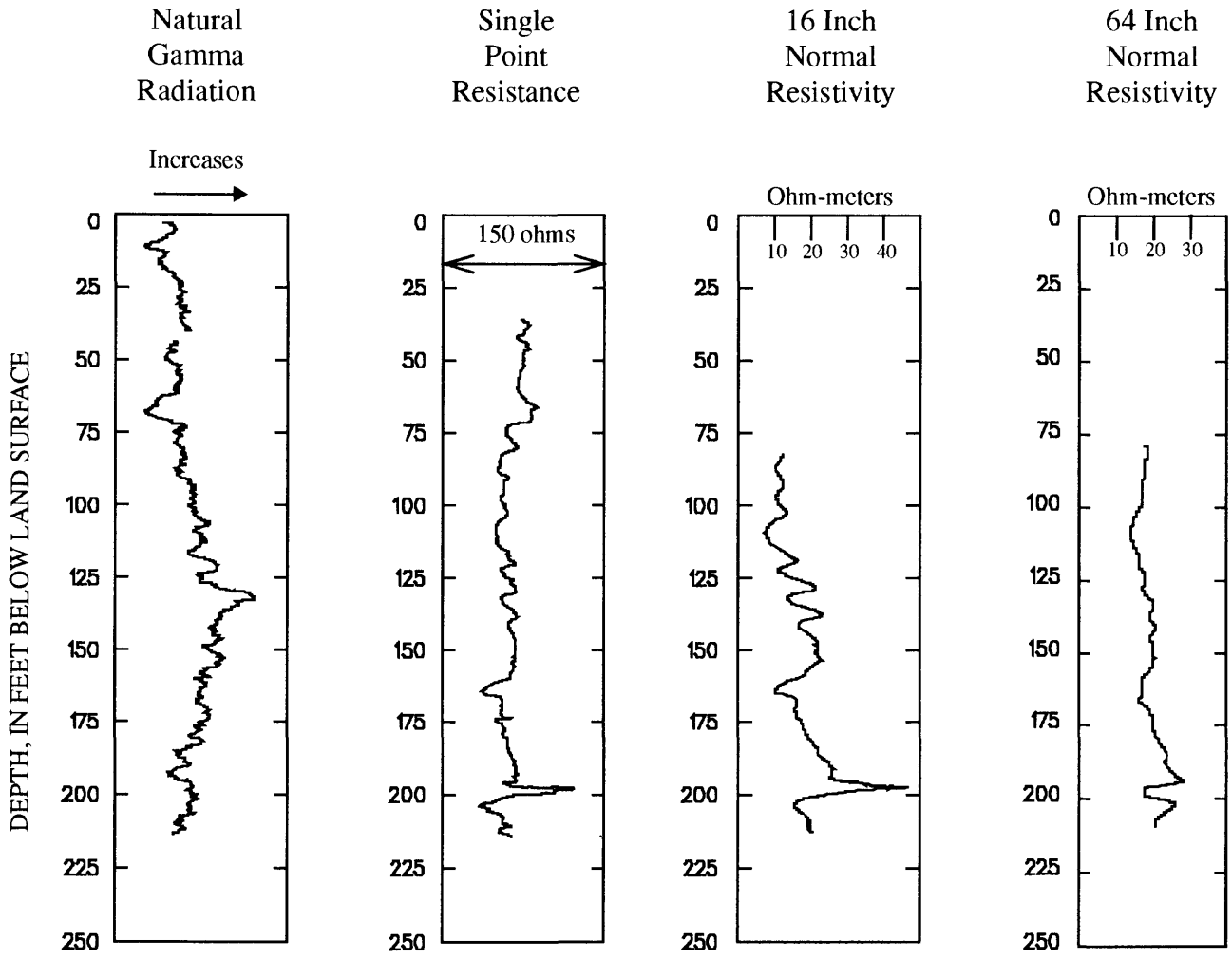

Figure 6. Selected geophysical logs of well D-3.

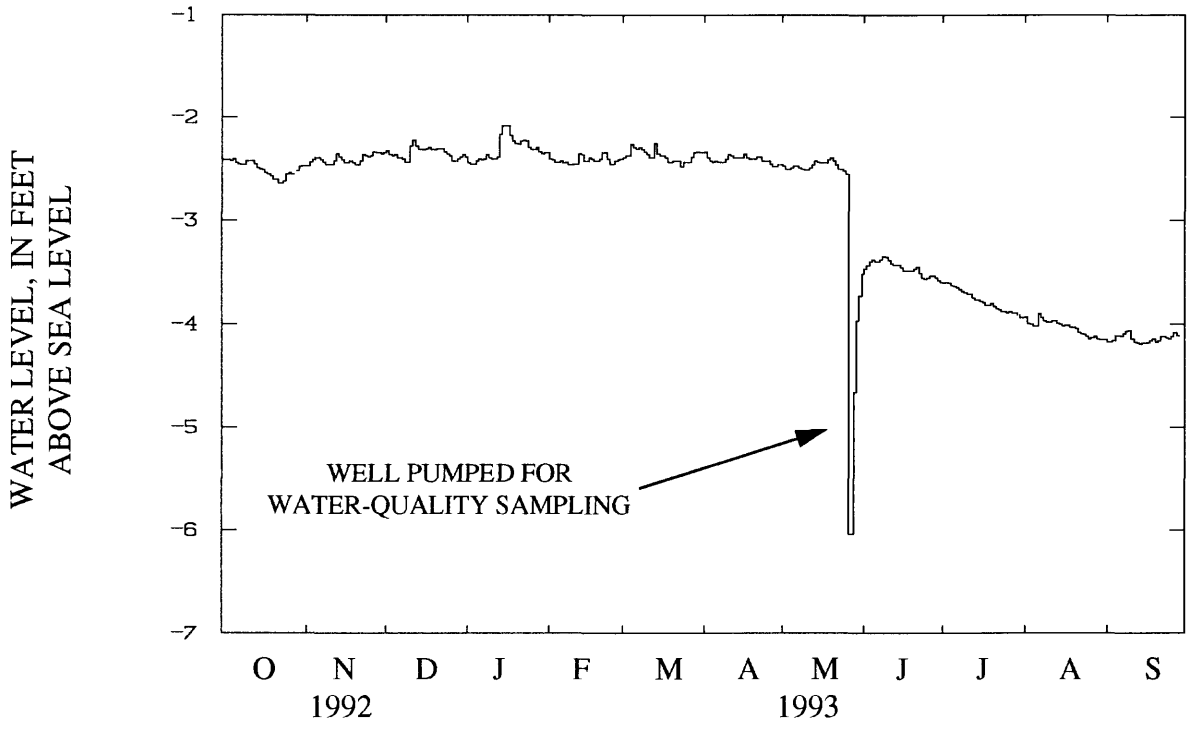

Figure 7. Hydrograph for well D1, showing minimum daily water level relative to sea level.

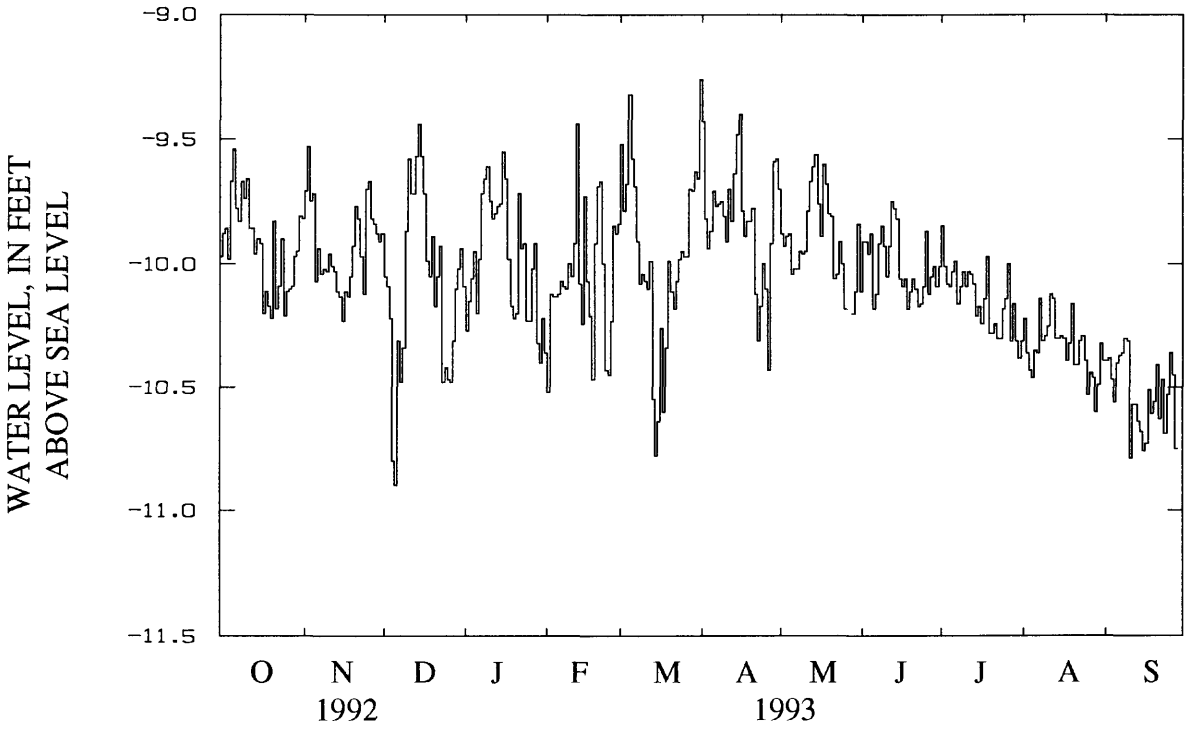

Figure 8. Hydrograph for well D2, showing minimum daily water level relative to sea level.

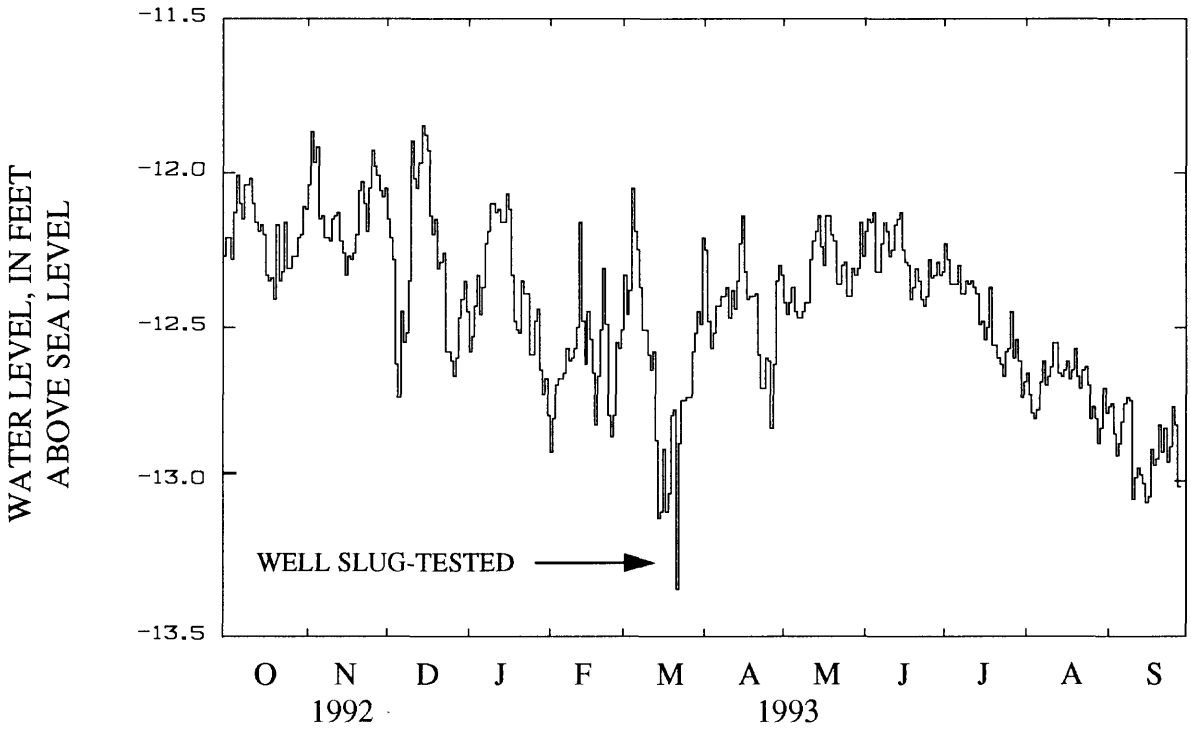

Figure 9. Hydrograph for well D3, showing minimum daily water level relative to sea level.

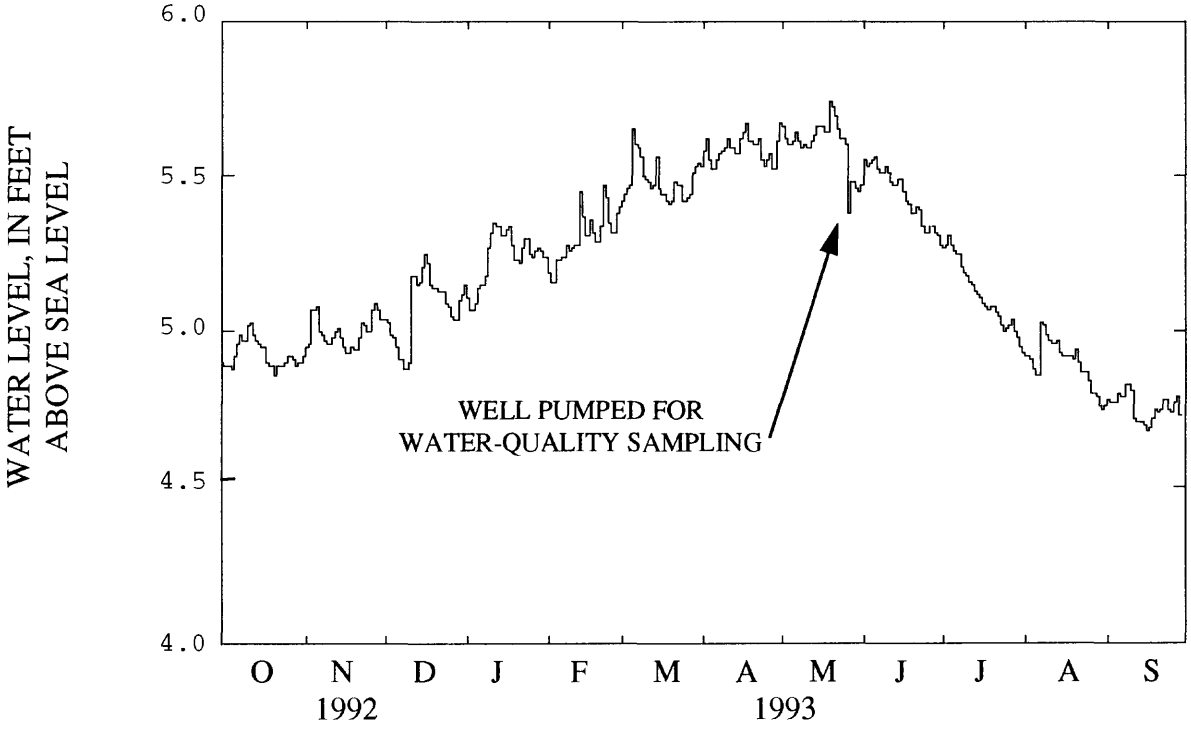

Figure 10. Hydrograph for well M1, showing minimum daily water level relative to sea level.

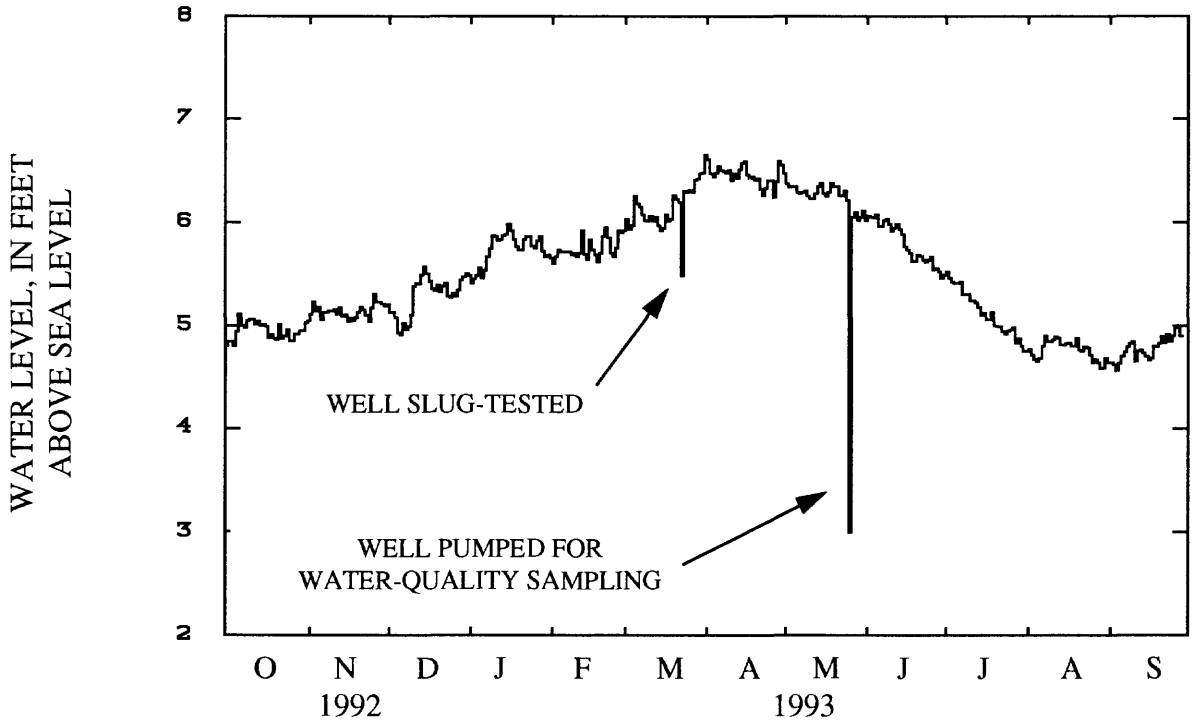

Figure 11. Hydrograph for well M2, showing minimum daily water level relative to sea level.

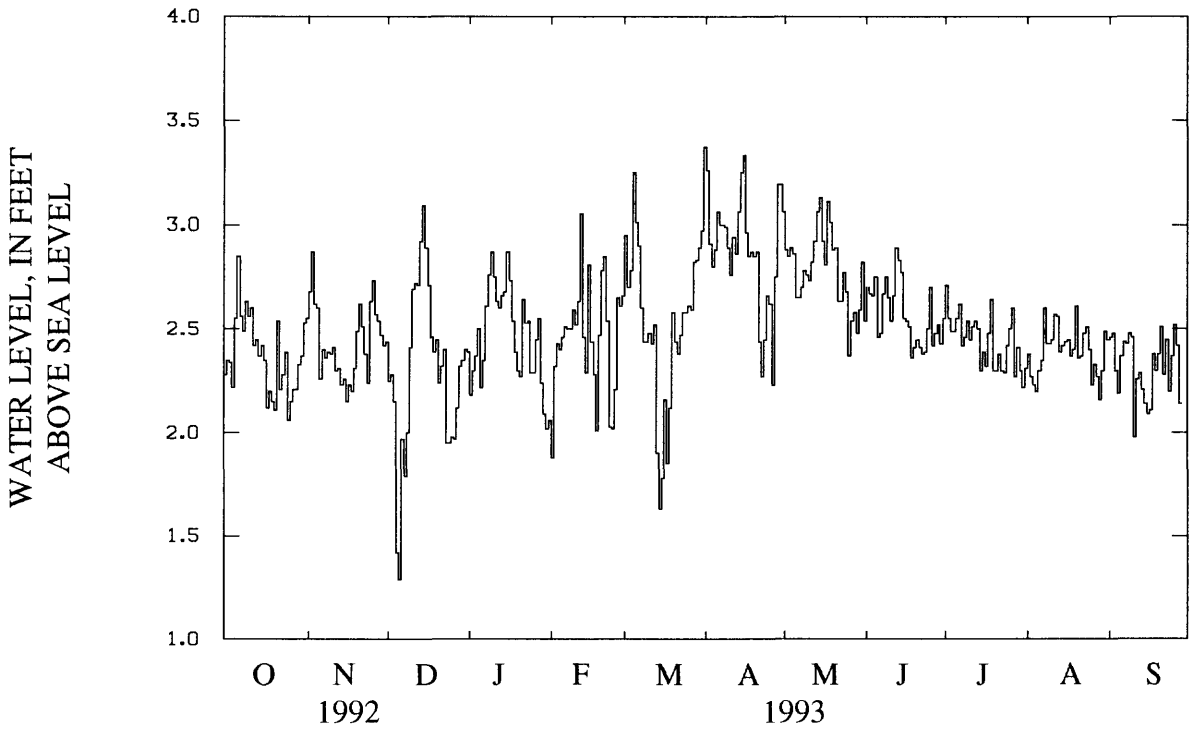

Figure 12. Hydrograph for well M3, showing minimum daily water level relative to sea level.

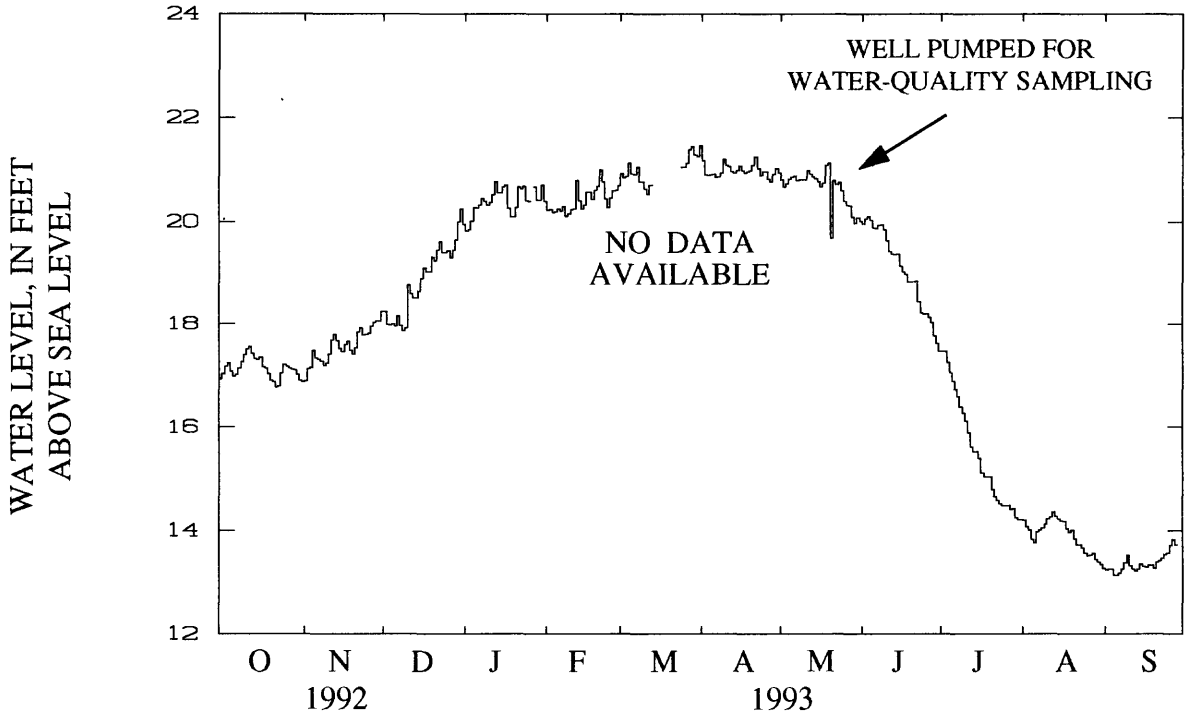

Figure 13. Hydrograph for well 4, showing minimum daily water level relative to sea level.

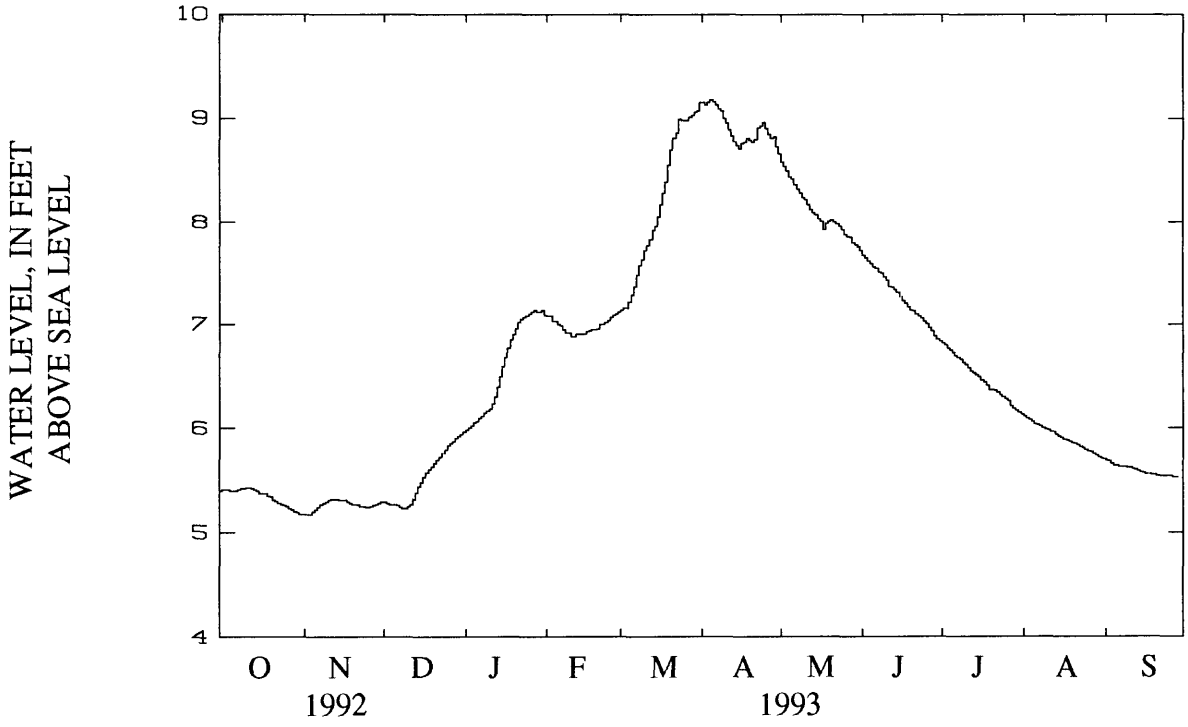

Figure 14. Hydrograph for well 10, showing minimum daily water level relative to sea level.

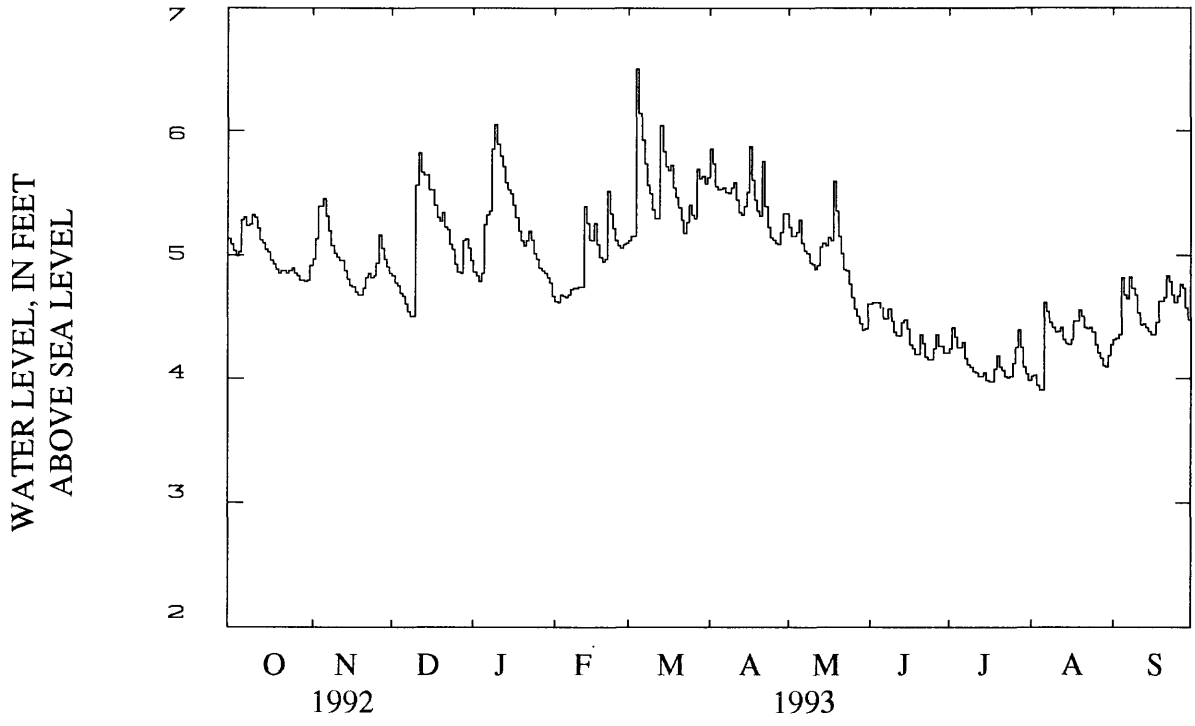

Figure 15. Hydrograph for well 11, showing minimum daily water level relative to sea level.

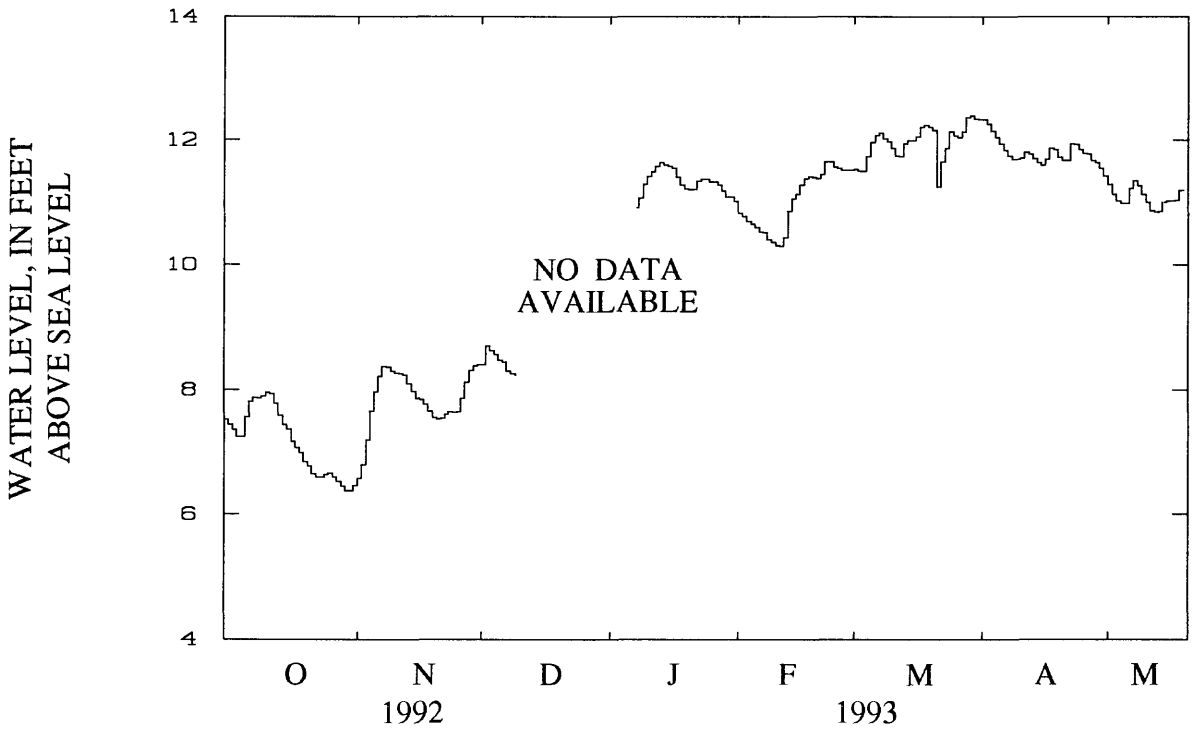

Figure 16. Hydrograph for well 19, showing minimum daily water level relative to sea level.

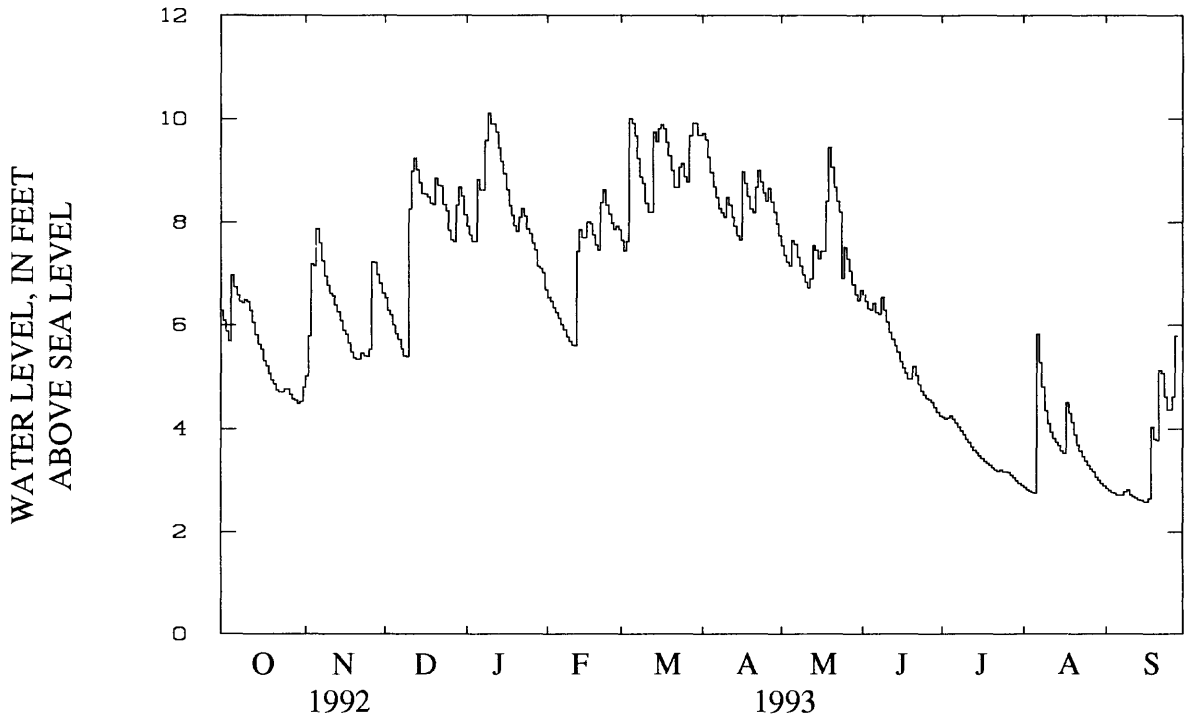

Figure 17. Hydrograph for well 24, showing minimum daily water level relative to sea level.

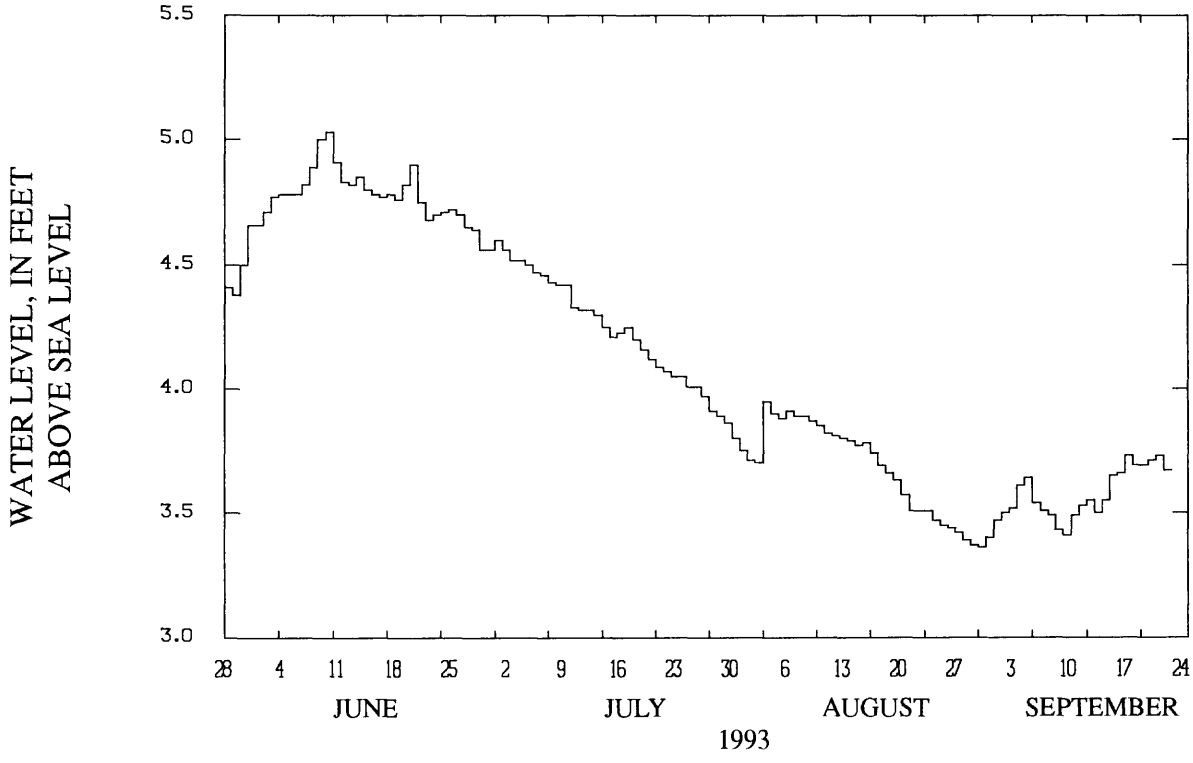

Figure 18. Hydrograph for well 30, showing minimum daily water level relative to sea level.

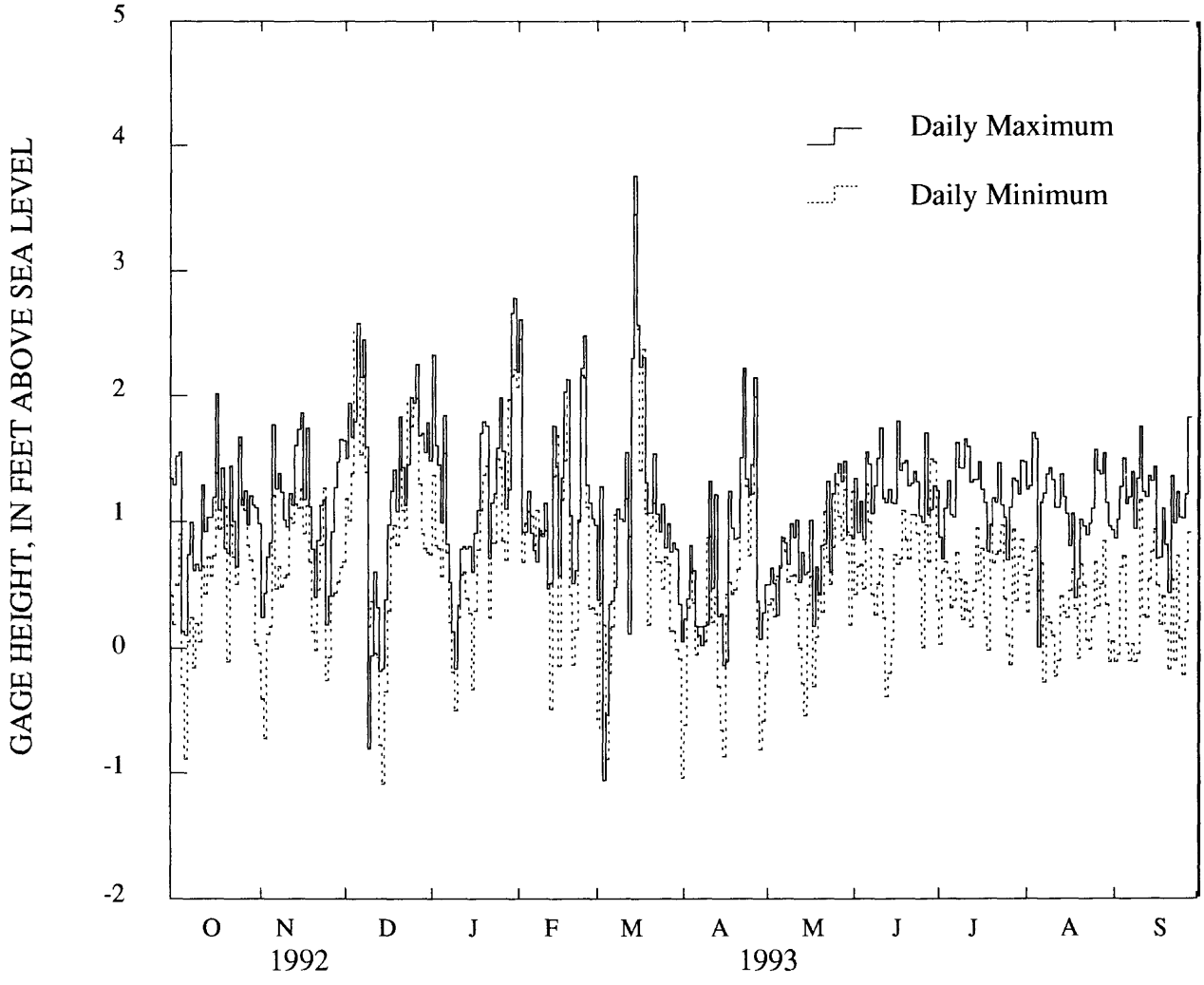

Figure 19. Daily maximum and minimum stage at Upper Machodoc Creek.