GROUND-WATER DATA

for

TOWNER COUNTY, NORTH DAKOTA

By

Ronald L. Kuzniar
and
P. G. Randich

U.S. Geological Survey

COUNTY GROUND-WATER STUDIES 36 — PART II
North Dakota State Water Commission
Vernon Fahy, *State Engineer*

BULLETIN 79 — PART II
North Dakota Geological Survey
Don L. Halvorson, *State Geologist*

Prepared by the U.S. Geological Survey in cooperation
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Bismarck, North Dakota

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INCH-POUND UNITS TO THE INTERNATIONAL SYSTEM (SI)

OF METRIC UNITS

A dual system of measurements--inch-pound units and the International System (SI) of metric units--is given in this report. SI is an organized system of units adopted by the 11th General Conference of Weights and Measures in 1960. Selected factors for converting inch-pound units to SI units are given below.

Multiply inch-pound unit	By	To obtain SI unit
Acre	0.4047	hectare (ha)
Foot (ft)	0.3048	meter (m)
Inch (in.)	25.4	millimeter (mm)

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INTRODUCTION

The investigation of the geology and occurrence of ground water in Towner County (fig. 1) was made cooperatively by the U.S. Geological Survey, North Dakota State Water Commission, North Dakota Geological Survey, and Towner County Board of Commissioners. The results of the investigation will be published in three separate parts. Part I is an interpretive report describing the geology of the study area, part II is a compilation of the ground-water data, and part III is an interpretive report describing the ground-water resources. Part II (this report) makes available geologic and hydrologic data collected during the county investigation and functions as a reference for the other reports.

Purpose

The purpose of the investigation was to provide detailed geologic and hydrologic information needed for the orderly development of water supplies for municipal, domestic, livestock, irrigation, industrial, and similar uses. Specifically, the objectives were to (1) determine the location, extent, and nature of the major aquifers; (2) evaluate the occurrence and movement of ground water, including the sources of recharge and discharge; (3) estimate the quantities of water stored in the glacial aquifers; (4) estimate the potential yields to wells tapping the major aquifers; (5) determine the chemical quality of the ground water; and (6) identify current and potential use of the ground water.

Location-Numbering System

The location-numbering system used in this report is based on the public land classification system used by the U.S. Bureau of Land Management. The system is illustrated in figure 2. The first numeral

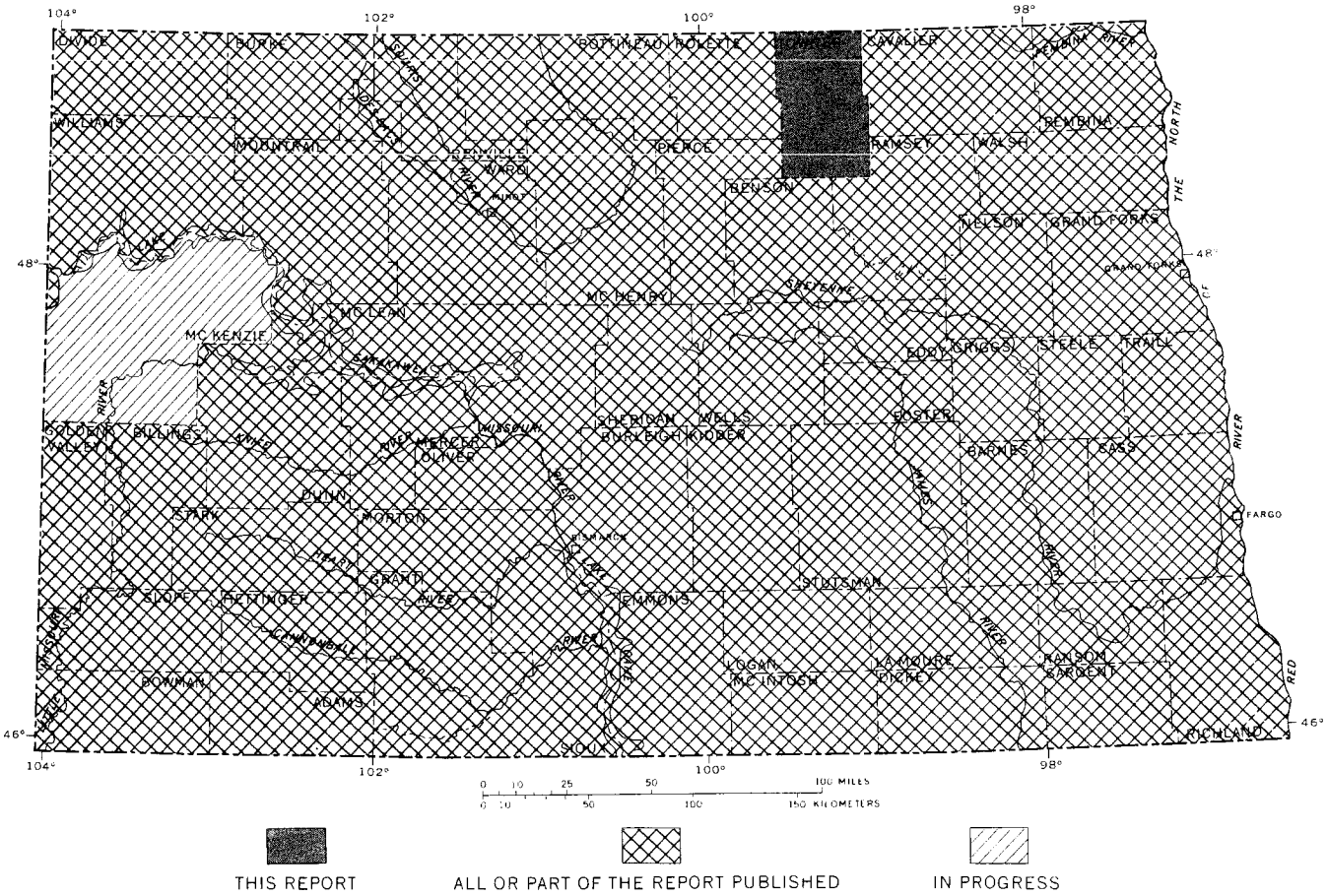

FIGURE 1.—County ground-water studies in North Dakota.

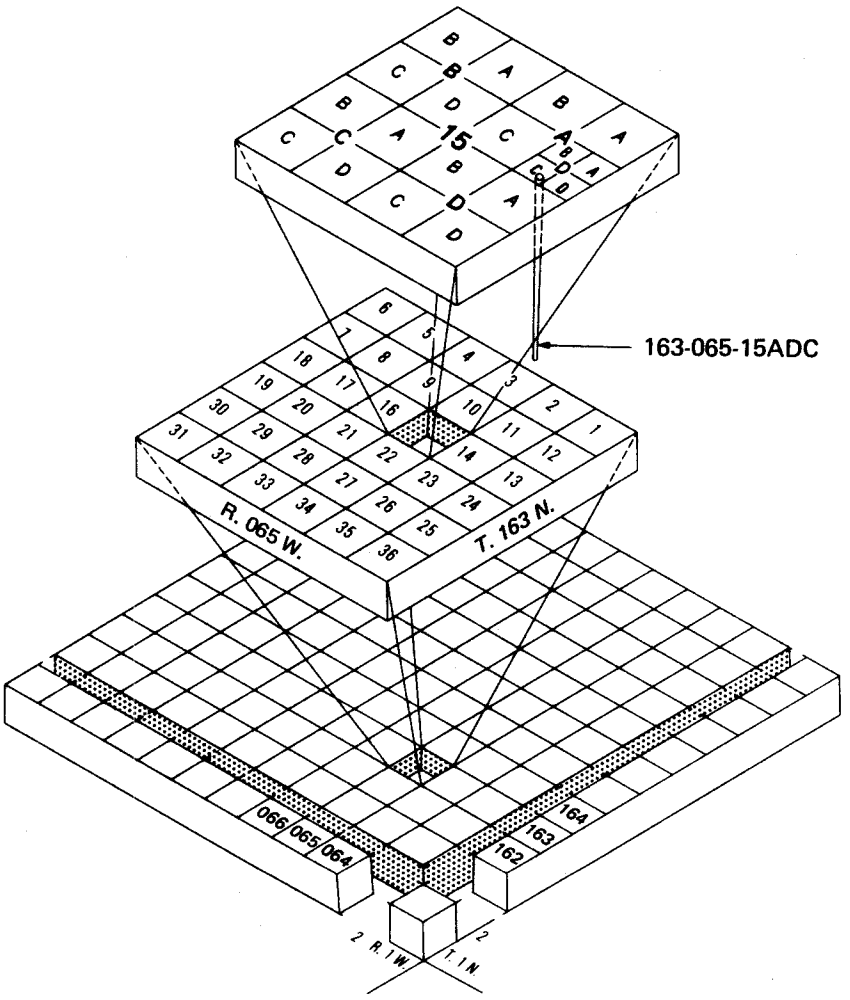

FIGURE 2.—Location-numbering system.

denotes the township north of a base line, the second numeral denotes the range west of the fifth principal meridian, and the third numeral denotes the section in which the well is located. The letters A, B, C, and D designate, respectively, the northeast, northwest, southwest, and southeast quarter section, quarter-quarter section, and quarter-quarter-quarter section (10-acre or 4-ha tract). For example, well 163-065-15ADC is in the SW1/4SE1/4NE1/4 sec. 15, T. 163 N., R. 065 W. Consecutive terminal numerals are added if more than one well or test hole is recorded within a 10-acre (4-ha) tract. The location of each well and test hole in the tables is shown on plate 1 (in pocket).

Acknowledgments

The collection of data for this report was made possible by the cooperation of residents and officials of Towner County, who furnished essential information on wells and permitted water-level measurements and the collection of water samples. Particular recognition is due to the following personnel of the North Dakota State Water Commission: A. E. Comeskey for logging of test holes and contributing to the understanding of the stratigraphy, G. O. Muri for chemical analyses of water samples, and M. O. Lindvig for scheduling of drilling activities. Thanks are due to the private well drillers and drilling companies that furnished drillers' logs and other information in this report.

EXPLANATION OF TABLES AND METHODS OF DATA COLLECTION

The data in this report, which were collected chiefly between 1980 and 1981, are listed in tables 1-5. The points of collection are shown on plate 1. The data consist of the following: (1) Geologic and hydrologic records of wells and test holes, (2) water-level measurements in observation wells, (3) lithologic and geophysical logs of test holes and wells, (4) chemical analyses of ground water for major constituents, and (5) chemical analyses of ground water for trace elements from selected wells. The data provided are useful for evaluating geologic and ground-water conditions in Towner County. For example, a person considering the construction of a new well can

locate the proposed site on plate 1. Depths, water quality, lithologies, and water levels of nearby wells and test holes tapping the different aquifers can be determined from the tables. However, use of the data as a guide to conditions at different sites should be made with caution because of the lenticular character of the water-bearing rocks and varying water quality in some aquifers.

Records of Wells and Test Holes

Records of selected wells and test holes are given in table 1. Well depth is the depth of casing for open-bottom wells or the base of the deepest well screen for screened wells. Many test holes were converted to observation wells for periodic water-level measurements and water-quality sampling. At some sites two or three observation wells were drilled in order to obtain water levels and water samples from several aquifers. The observation wells were constructed of 1¼-inch (32-mm) plastic casing with 3-, 5-, or 6-foot (0.9-, 1.5-, or 1.8-m) screens or 2-inch (51-mm) steel casing with 3-, 5-, 6-, 9-, 10-, or 12-foot (0.9-, 1.5-, 1.8-, 2.7-, 3-, or 3.7-m) screens. The observation wells were developed by backwashing and, in some cases, jetting the screened interval and were pumped a minimum of 10 hours for development before water samples were collected for analysis.

Water Levels in Selected Wells

Table 2 lists the monthly and intermittent water levels in selected wells, in feet below or above (+) land surface, that tap major aquifers in Towner County. Water-level measurements began in 1980 and extended through December 1981. Measurements will continue to be made in several wells as part of the statewide observation-well network to monitor changes in water levels as the ground-water resources of the area are developed.

Logs of Wells and Test Holes

Logs collected from water-well drillers and other sources and logs of test holes drilled as part of this project are included in table 3. Minor changes in word order have been made on some of the drillers'

logs and logs from test holes drilled during previous investigations. However, geologic interpretations shown on commercial and private well logs are those of the drillers. Most test holes drilled during this project and some municipal, industrial, and private wells have geophysical logs in addition to a description of the materials penetrated. The geophysical logs are extremely useful for correlation of geologic units. Grain-size determinations refer to the Wentworth (1922) size scale. The color descriptions were determined by comparing fresh samples with the Geological Society of America's rock color chart (1963).

Water Quality

The chemical composition and physical properties of water are reported in the tables of analyses (tables 4 and 5). Water for samples was obtained from privately owned wells by using the existing pumps and from the North Dakota State Water Commission observation wells by airlift. Generally enough water was pumped to clear the well column and plumbing, then the sample was collected in a polyethylene bottle. For those metals considered unstable, a separate sample was filtered and acidified before transport to the laboratory. Most of the samples were analyzed by the North Dakota State Water Commission, Bismarck, N. Dak. Methods of analyses were generally those described by Brown and others (1970) and Skougstad and others (1979). The results are expressed in milligrams per liter (mg/L) or micrograms per liter (ug/L). A microgram per liter is one-thousandth of a milligram per liter.

Drinking-water standards have been recommended by the National Academy of Sciences-National Academy of Engineering (1972) at the request of the Environmental Protection Agency. Standards for public drinking-water supplies were established by the U.S. Environmental Protection Agency (1976). These standards include the following recommended limits: iron (Fe), 300 ug/L; manganese (Mn), 50 ug/L; sulfate (SO_4), 250 mg/L; and chloride (Cl), 250 mg/L.

The following summation for farmstead use is modified from the Federal Water Pollution Control Administration (1968) and the National Academy of Sciences-National Academy of Engineering (1972).

KEY WATER QUALITY CRITERIA FOR FARMSTEAD USES

Characteristic	Recommendations (at point of use) General farmstead uses	Additional special-use requirements
Taste and odor	Substantially free	
Odor	Substantially free	
pH	6.0 to 8.5	6.8 to 8.5 dairy sanitation
Total dissolved inorganic solids	500 mg/L (under certain circumstances, higher levels are acceptable)	
Turbidity	Substantially free	
Hazardous trace elements	Levels in excess of those shown are grounds for rejection of supply:	
	Substances	
	Arsenic (ug/L)---[a]/50	
	Barium (ug/L)---[a]/1000	
	Cadmium (ug/L)---[a]/10	
	Chromium (ug/L)---[a]/50	
	Cyanide (mg/L)---0.2	
	Lead (ug/L)---[a]/50	
	Selenium (ug/L)---[a]/10	
	Silver (ug/)---[a]/50	
Other trace elements	Levels shown below should not be exceeded if alternate sources are available:	
	Substances	
	Manganese (ug/L)---50	In dairy sanitation, water should contain <20 mg/L potassium and <0.1 mg/L iron and copper.
	Iron (ug/L)---300	
	Copper (ug/L)---1000	
	Zinc (ug/L)---5000	
	Fluoride (mg/L)--0.7-1.2 ([a]/2.4)	
	Nitrate (as N) (mg/L)---[a]/10	

[a]/*Maximum permitted levels of inoryanic chemicals in public water systems of North Dakota; set by the North Dakota State Department of Health (1977).*

Chemical Constituents in Solution

Silica (SiO_2)

Weathering processes dissolve silica from practically all rocks. Silica affects the usefulness of water because it can contribute to the formation of scale in pipes, water heaters, and boilers in the presence of calcium and magnesium.

Iron (Fe)

Iron compounds are common in rocks and may be leached by acidic water. Water containing more than 300 ug/L of iron, after exposure to air, may become discolored. Reddish-brown stains on porcelain or enamelware and fixtures and on fabrics washed in the water result from the iron.

Manganese (Mn)

Manganese in concentrations as low as 200 ug/L may cause a dark-brown or black stain on fabrics and porcelain fixtures. Ground water that contains high concentrations of iron may also have considerable amounts of manganese.

Calcium and Magnesium (Ca and Mg)

Limestone and similar rocks are the principal source of calcium and magnesium in natural water. Calcium and magnesium cause water hardness and, with anions, can form scale on utensils and in water heaters, boilers, and pipes.

Sodium and Potassium (Na and K)

Sodium and potassium are present in many igneous and sedimentary rocks. Sodium dissolves readily and when brought into solution it tends to remain in solution. Potassium is dissolved with greater difficulty and exhibits a stronger tendency to be reincorporated into solid weathering products, especially clay minerals. In most natural water the concentration of potassium is much lower than the concentration of sodium. Water that contains a large proportion of sodium salts is generally unsatisfactory for irrigation. The presence of several hundred milligrams per liter of sodium in water can make it unsuitable for use in sodium-restricted diets (North Dakota State Department of Health, 1962).

Bicarbonate and Carbonate (HCO_3 and CO_3)

Bicarbonate and carbonate ions are the major cause of alkalinity in most water. The significance of alkalinity to the domestic,

agricultural, and industrial user is usually dependent upon the nature of the cations (Ca, Mg, Na, and K) associated with it. However, moderate amounts of alkalinity do not adversely affect most uses.

Alkalinity can be calculated from the analyses by using the formula:

$$\text{Alkalinity (As } CaCO_3) = 0.82(HCO_3)+1.67(CO_3)$$

Sulfate (SO_4)

Metallic sulfide minerals in both sedimentary and igneous rocks are converted to sulfates by weathering. Sulfate may also be dissolved from beds of gypsum and deposits of sodium sulfate.

Chloride (Cl)

Chloride is present in all natural waters, but the concentrations usually are not great. Chloride may be leached from sedimentary rocks that were deposited under marine conditions. Chloride concentrations of 400 mg/L impart a noticeable salty taste for most people.

Fluoride (F)

Fluoride in ground water is probably derived from solution of fluorite, apatite, and hornblende minerals. High fluoride content (depending on annual average maximum daily air temperature) may cause mottling of tooth enamel in children's teeth during calcification.

Nitrate (NO_3)

The occurrence of high nitrate concentrations in shallow ground water has been attributed to leaching in feedlots or to fertilizer from irrigated fields where nitrogen compounds have been applied. High nitrate content is undesirable in drinking water because of its bitter taste and it has been reported to cause methemoglobinemia (blue babies) in infants (Comly, 1945).

Boron (B)

Boron is a constituent of the mineral tourmaline and may be present in biotite and amphiboles. In small quantities boron is essential for plant growth. Excessive concentrations in soil and in irrigation water are harmful for some plants.

Dissolved Solids

The concentration of dissolved solids is calculated from the weight of residue on evaporation at 180°C from a known quantity of water.

Properties and Characteristics of Water

Hardness

Calcium and magnesium are the principal cause of hardness. Hardness exhibits the characteristics of requiring greater quantities of soap to produce a lather as the hardness increases. Hard water also can contribute to the formation of scale in boilers, water heaters, radiators, and pipes, with a resultant decrease in the rate of water flow and(or) heat transfer.

The hardness that is equivalent to the alkalinity is called carbonate hardness, and any excess is called noncarbonate hardness. The carbonate hardness is the quantity that will contribute scale on heating, and the noncarbonate hardness is the quantity of hardness that will remain after precipitation of the carbonate hardness. As a general reference, the U.S. Geological Survey often uses the following classification of water hardness.

Calcium and magnesium hardness, as $CaCO_3$ (milligrams per liter)	Hardness description
0-60	Soft
61-120	Moderately hard
121-180	Hard
More than 180	Very hard

Percent Sodium and Sodium-Adsorption Ratio (SAR)

The percent sodium is the percentage of sodium to all other major cations, expressed in milliequivalents per liter. The displacement of calcium and magnesium by sodium in soils is slight unless the percent sodium is considerably higher than 50.

The term SAR (sodium-adsorption ratio) was introduced by the U.S. Salinity Laboratory Staff (1954). Their experiments show that the SAR relates to the degree water enters into cation-exchange reactions with soil. Sodium-adsorption ratio is expressed by the equation:

$$SAR = \frac{Na^{+}}{\sqrt{\frac{[Ca^{++}]+[Mg^{++}]}{2}}}$$

where the concentrations of the ions are expressed in milliequivalents per liter. The U.S. Salinity Laboratory Staff (1954) divided water into 16 classes, depending upon the SAR and specific conductance. The classifications indicate the usefulness of water for irrigation of different crops on different types of soil.

Specific Conductance (micromhos per centimeter at 25°C)

Specific conductance is a measure of the ability of water to conduct an electric current. Approximately 65 to 70 percent of the specific conductance (in micromhos) is an estimate of the amount of dissolved solids (in milligrams per liter) in water; however, this relation is not constant and will vary with the chemical composition of the water (Hem, 1970).

Hydrogen-Ion Concentration (pH)

Hydrogen-ion concentration (activity) is expressed in terms of pH units. The values of pH often are used as one measure of the solvent capacity of water.

The hydrogen-ion concentrations affect the corrosiveness of water. A pH of 7.0 indicates that the water is neutral, neither acidic nor basic. Readings progressively lower than 7.0 denote increasing acidity, and those progressively higher than 7.0 denote increasing alkalinity.

Temperature

Temperature is an important factor in evaluating the usefulness of water. For example, high temperature precludes its use as an industrial coolant. Temperature is also important for its influence upon concentrations of dissolved gases and mineral matter in water. Water temperatures given in the tables are expressed in degrees Celsius (Centigrade). Degrees Celsius and the equivalent temperature in degrees Fahrenheit are given in the following table.

Degrees Celsius (°C)	Degrees Fahrenheit (°F)	Degrees Celsius (°C)	Degrees Fahrenheit (°F)	Degrees Celsius (°C)	Degrees Fahrenheit (°F)
3.5	38	12.5	54	21.5	71
4.0	39	13.0	55	22.0	72
4.5	40	13.5	56	22.5	72
5.0	41	14.0	57	23.0	73
5.5	42	14.5	58	23.5	74
6.0	43	15.0	59	24.0	75
6.5	44	15.5	60	24.5	76
7.0	45	16.0	61	25.0	77
7.5	45	16.5	62	25.5	78
8.0	46	17.0	63	26.0	79
8.5	47	17.5	63	26.5	80
9.0	48	18.0	64	27.0	81
9.5	49	18.5	65	27.5	81
10.0	50	19.0	66	28.0	82
10.5	51	19.5	67	28.5	83
11.0	52	20.0	68	29.0	84
11.5	53	20.5	69	29.5	85
12.0	54	21.0	70	30.0	86

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TABLE 1.--Records of wells and test holes

Owner

NDSWC 5986, North Dakota State Water Commission, test hole number 5986

Water level (feet)

Water level, in feet below or above (+) land surface

D, dry
P, pumping
R, recently pumped
Z, other

Use of water

C, commercial
H, domestic
I, irrigation
N, industrial
P, public supply
S, stock
U, unused

Principal aquifer

112, Pleistocene
211, Upper Cretaceous

BGFV, buried glaciofluvial deposits
OTSH, outwash deposits
PIRR, Pierre Shale
ROLL, Rolla aquifer
SPRD, Spiritwood aquifer

Specific conductance

Value shown is the field specific conductance measured at the well at the time of inventory.

Altitude of land surface (feet)

Altitude of land surface is reported with respect to the National Geodetic Vertical Datum of 1929 (NGVD). NGVD is a geodetic datum derived from a general adjustment of the first order level nets of both the United States and Canada. It was formerly called "Sea Level Datum of 1929" or "mean sea level" in this series of reports. Although the datum was derived from the average sea level over a period of many years at 26 tide stations along the Atlantic, Gulf of Mexico, and Pacific Coasts, it does not necessarily represent local mean sea level at any particular place.

LOCAL NUMBER	OWNER	DEPTH DRILLED (FEET)	DEPTH OF WELL (FEET)	DEPTH TO FIRST OPENING (FEET)	CASING DIAM-ETER (INCHES)	DATE COMPLETED	WATER LEVEL (FEET)		DATE WATER LEVEL MEASURED	USE OF WATER	PRINCIPAL AQUIFER	SPECIFIC CONDUCTANCE (µMHO/CM AT 25°C)	TEMPERATURE (DEGREES C)	ALTITUDE OF LAND SURFACE (FEET)
157-065-02CCC	CURRIE, JACK	116	116	115	4	10/28/1963	25.00		10/28/1963	S	--	--	--	1465
157-065-04CCB	CANDO, ND	41	--	--	--	07/24/1977	--		--	--	--	--	--	1468
157-065-05DAA	SIMPSON, FRED	40	--	--	--	06/28/1977		D	--	--	--	--	--	1468
157-065-09BCB	CANDO, ND	40	--	--	--	06/29/1977	--		--	--	--	--	--	1465
157-065-10CCC	NDSWC 5986	101	--	--	--	09/17/1981	--		--	--	--	--	--	1460
157-065-17ABB	ABRAHAMSON, CLAYTON	140	--	--	--	12/18/1974		D	--	--	--	--	--	1470
157-065-17DC	RHODES-LANGENFELD	3765	--	--	--	10/27/1952	--		--	--	--	--	--	1493
157-065-19BAB	BERANEK, ROBERT	35	35	27	24	05/14/1976	16.00	R	05/14/1976	H	112UTSH	1000	7.5	1465
157-065-21DDD	NDSWC 5987	81	--	--	--	09/17/1981	--		--	--	--	--	--	1455
157-065-29BBD	CANDO, ND	40	--	--	--	07/02/1977	--		--	--	--	--	--	1473
157-065-31BBB	NDSWC 5706	102	46	43	1.25	06/10/1980	1.11		09/11/1980	U	112BGFV	840	7.0	1450
157-066-03CCC	NDSWC 5981	161	--	--	--	09/16/1981	--		--	--	--	--	--	1463
157-066-04BBB	NDSWC 5982	201	160	157	1.25	09/16/1981	11.00		10/14/1981	U	112SPRD	2420	6.5	1465
157-066-09BBB	NDSWC 5980	201	130	127	1.25	09/16/1981	9.08		10/14/1981	U	112SPRD	3000	6.5	1463
157-066-09CDC	NDSWC 5979	201	--	--	--	09/15/1981	--		--	--	--	--	--	1465
157-066-10BBA	MILLER, HENRY	57	57	52	4	05/12/1976	9.00	R	05/12/1976	N	112BGFV	1500	8.0	1461
157-066-15DCC	NDSWC 5977	121	--	--	--	09/15/1981	--		--	--	--	--	--	1455
157-066-16BBB	NDSWC 5978	70	46	43	1.25	09/15/1981	5.78		10/14/1981	U	112SPRD	1100	7.0	1460
157-066-17DAC	PANKER, REUBEN	78	78	73	4	06/24/1970	7.00	R	06/24/1970	H	112SPRD	3500	7.5	1460
157-066-18DDD1	NDSWC 5970	341	262	252	2	09/03/1981	10.32		10/14/1981	U	112SPRD	2680	7.0	1470
157-066-18DDD2	NDSWC 5970A	162	161	158	1.25	09/03/1981	10.86		10/14/1981	U	112SPRD	2600	7.0	1470
157-066-20CDD	NDSWC 5972	420	--	--	--	09/10/1981	--		--	--	--	--	--	1462
157-066-21ABB	NDSWC 5976	101	--	--	--	09/15/1981	--		--	--	--	--	--	1455
157-066-21CBB	NDSWC 5975	201	41	38	1.25	09/15/1981	6.90		10/14/1981	U	112SPRD	3100	6.5	1455
157-066-26DDD1	NDSWC 5705	90	--	--	--	06/10/1980	--		--	--	--	--	--	1449
157-066-26DDD2	NDSWC 5705A	122	--	--	--	06/10/1980	--		--	--	--	--	--	1449
157-066-27DCC	NDSWC 5707	122	98	95	1.25	06/10/1980	3.20		10/16/1980	U	112SPRD	2400	6.5	1451
157-066-28CBB	NDSWC 5974	221	115	112	1.25	09/14/1981	5.14		10/14/1981	U	112SPRD	2200	6.5	1455
157-066-28CBC	NDSWC 5973	61	52	49	1.25	09/11/1981	6.15		10/14/1981	U	112SPRD	2700	7.0	1455
157-066-28DCC	NDSWC 5708	182	44	38	1.25	06/11/1980	1.84		09/11/1980	U	112BGFV	660	6.5	1450
157-066-30AAA	NDSWC 5709	242	129	123	1.25	06/11/1980	.60+		10/16/1980	U	112SPRD	2400	6.5	1460
157-066-30ABB	NDSWC 5711	282	43	37	1.25	06/12/1980	12.97		10/16/1980	U	112UTSH	1100	7.5	1470
157-066-32AAB	NDSWC 5702	142	83	81	1.25	06/09/1980	5.60		10/16/1980	U	112SPRD	2300	7.0	1460
157-066-32DCA1	GULF WESTERN, GW81-1	141	--	--	--	07/27/1981	--		--	--	--	--	--	1457
157-066-32DCA2	GULF WESTERN, GW81-2	122	--	--	--	07/29/1981	--		--	--	--	--	--	1457
157-066-32DCA3	GULF WESTERN, GW81-3	81	--	--	--	07/27/1981	--		--	--	--	--	--	1457
157-066-33AAA	NDSWC 5703	162	--	--	--	06/10/1980	--		--	--	--	--	--	1448
157-066-33CDD	ELSPERGER, JOHN	23	23	15	24	08/01/1975	11.00	R	08/01/1975	H	112UTSH	1350	9.0	1455
157-066-34AAD	NDSWC 5704	122	--	--	--	06/10/1980	--		--	--	--	--	--	1455
157-067-01DDD	NDSWC 5962	200	120	117	1.25	08/27/1981	8.67		10/14/1981	U	112SPRD	2220	6.0	1475

LOCAL NUMBER	OWNER	DEPTH DRILLED (FEET)	DEPTH OF WELL (FEET)	DEPTH TO FIRST OPENING (FEET)	CASING DIAMETER (INCHES)	DATE COMPLETED	WATER LEVEL (FEET)		DATE WATER LEVEL MEASURED	USE OF WATER	PRINCIPAL AQUIFER	SPECIFIC CONDUCTANCE (µMHO/CM AT 25°C)	TEMPERATURE (DEGREES C)	ALTITUDE OF LAND SURFACE (FEET)
157-067-03BCC	NDBWC 5965	300	--	--	--	09/01/1981	--		--	--	--	--	--	1480
157-067-03DDD	NDBWC 5964	150	--	--	--	08/31/1981	--		--	--	--	--	--	1485
157-067-05ADD	THOMPSON, F.	205	205	152	4	08/18/1965	35.00		08/18/1965	H	--	--	--	1490
157-067-08AAA	NDBWC 5966	160	--	--	--	09/02/1981	--		--	--	--	--	--	1480
157-067-11AAA	NDBWC 5963	180	141	138	1.25	08/28/1981	22.34		10/14/1981	U	112BPRD	2400	6.5	1485
157-067-12CDD	NDBWC 5971	180	128	125	1.25	09/10/1981	9.07		10/14/1981	U	112BPRD	2400	8.0	1478
157-067-14CAA	MARTZ, D.	78	75	74	6	04/24/1978	32.00	P	04/24/1978	H,S	112BPRD	1900	7.0	1501
157-067-17CDD	FARBU, JEFF	83	83	82	6	07/20/1979	5.00	P	07/20/1979	H	112BGFV	2400	7.5	1490
157-067-20BCA	FARBU, DALE	117	117	112	4	11/20/1970	20.00	R	11/20/1970	H	112BGFV	1900	7.5	1505
157-067-22CCC	NDBWC 5780	162	--	--	--	07/24/1980	--		--	--	--	--	--	1489
157-067-24AAA	NDBWC 5969	180	--	--	--	09/02/1981	--		--	--	--	--	--	1478
157-067-25AAA	NDBWC 5710	222	144	138	1.25	06/11/1980	8.25		10/16/1980	U	112BPRD	2000	8.0	1473
157-067-25BBB	NDBWC 5712	202	151	148	1.25	06/12/1980	1.08		09/11/1980	U	112BPRD	2150	7.0	1474
157-067-27AAA	NDBWC 5779	182	128	125	1.25	07/24/1980	18.15		10/16/1980	U	112BPRD	2400	7.0	1498
157-067-29AAA	NDBWC 5967	140	--	--	--	09/02/1981	--		--	--	--	--	--	1493
157-068-01DBB	ANDERSON, RICHARD	153	153	125	6	07/16/1979	60.00	R	07/16/1979	H	211PINR	4900	11.5	1512
157-068-03DAA	BRATLEE, DON	226	226	127	4	1963	30.00	R	1963	H	211PIRR	6000	11.0	1520
157-068-16DDD	NDBWC 5713	162	--	--	--	06/13/1980	--		--	--	--	--	--	1522
157-068-17CCC	NDBWC 5715	222	--	--	--	06/13/1980	--		--	--	--	--	--	1572
157-068-20AAA	NDBWC 5714	182	--	--	--	06/13/1980	--		--	--	--	--	--	1538
157-068-23CCC	CLARK, ALFRED	277	277	210	4	01/24/1973	40.00		01/24/1973	H	--	--	--	1511
157-068-29DDC	MESTEGARD, ARNOLD	137	137	132	4	06/ /1975	25.00	R	06/ /1975	H,S	112BGFV	1500	9.5	1581
157-068-33CBA	STAVE, ERNEST	85	85	81	24	07/01/1977	25.00	R	07/01/1977	H	112BGFV	2800	7.5	1578
157-068-35DDC	STAVE, LAWRENCE	66	66	50	4	05/15/1967	--		--	H	--	--	--	1510
157-068-36AAA	NDBWC 5968	160	--	--	--	09/02/1981	--		--	--	--	--	--	1505
158-065-07BBB	NDBWC 5725	62	--	--	--	06/20/1980	--		--	--	--	--	--	1490
158-065-12CCC	NDBWC 5775	82	38	35	1.25	07/24/1980	6.45		10/16/1980	--	112BGFV	5000	8.0	1493
158-065-14ADD	NDBWC 5991	81	49	46	1.25	09/18/1981	6.85		10/14/1981	--	112BGFV	3000	6.0	1487
158-065-15AAA	NDBWC 5776	162	--	--	--	07/24/1980	--		--	--	--	--	--	1488
158-065-15BAA	NDBWC 5992	121	--	--	--	09/18/1981	--		--	--	--	--	--	1490
158-065-16AAA	NDBWC 5777	102	--	--	--	07/24/1980	--		--	--	--	--	--	1493
158-065-16DDD	NDBWC 5993	61	--	--	--	09/18/1981	--		--	--	--	--	--	1485
158-065-17AAA	NDBWC 5778	82	--	--	--	07/24/1980	--		--	--	--	--	--	1483
158-065-23AAA	NDBWC 5990	281	--	--	--	09/17/1981	--		--	--	--	--	--	1487
158-065-23DAA	NDBWC 5989	221	--	--	--	09/17/1981	--		--	--	--	--	--	1475
158-065-23DDD	NDBWC 5988	220	--	--	--	09/17/1981	--		--	--	--	--	--	1480
158-065-28DCA	MCPICK, OR.	220	220	--	4	09/10/1964	40.00		09/10/1964	H	--	--	--	1473
158-065-30BBB	NDBWC 5985	81	--	--	--	09/17/1981	--		--	--	--	--	--	1475
158-065-34CDD	CURRIE, JACK	124	124	118	5	08/08/1971	16.00		08/08/1971	S	112BGFV	3350	7.0	1470
158-066-04ABA	FREUND, GEORGE	90	90	69	6	07/25/1979	30.00	R	07/25/1979	H	112QTSH	760	9.0	1505

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158-066-05CBB	DEPLAZES, PHILLIP	163	163	158	5	05/22/1979	0.00	R	05/22/1980	H	112SPRD	2600	7.0	1483
158-066-07DDD	SLUSSER, LLOYD	127	127	123	5	04/05/1973	20.00	R	04/05/1973	S	112SPRD	2380	8.0	1482
158-066-11DA	MANN BROS.	2236	--	--	--	1977	--		--	U	--	--	--	1471
158-066-13AAA	NDSWC 5724	62	--	--	--	06/20/1980	--		--	--	--	--	--	1480
158-066-20ACC	HORSEMANS, ASS., TURNER CO.	160	160	150	4	11/23/1970	20.00	R	11/23/1970	S,H	--	--	--	1480
158-066-20CAA	CANDO, ND	73	73	58	8	12/01/1980	26.20		12/01/1980	P	--	--	--	1480
158-066-20CAB	FARM EQUIP., ROBERTS	162	160	156	5	01/01/1979	23.00	R	01/01/1979	C	112SPRD	1500	8.0	1470
158-066-20CCB	GREENHOUSE, MORRIS	111	111	106	5	03/10/1977	20.00	R	03/10/1977	I	112SPRD	1300	8.0	1472
158-066-20DDA	NDSWC 5721	202	--	--	--	06/19/1980	--		--	--	--	--	--	1480
158-066-24AAD	NDSWC 5723	82	--	--	--	06/20/1980	--		--	--	--	--	--	1474
158-066-28AAA	NDSWC 5722	242	--	--	--	06/20/1980	--		--	--	--	--	--	1480
158-066-28CBD	JOHNSTON, HARVEY	184	184	179	5	04/23/1979	25.00	R	04/23/1979	H	112SPRD	2200	8.0	1473
158-066-30BBB	NDSWC 5716	322	213	208	5	06/16/1980	10.25		10/15/1980	--	112SPRD	2500	6.5	1481
158-066-31CD	NATNL BULK	4498	--	--	--	12/13/1952	--		--	U	--	--	--	1459
158-066-33BAB	NDSWC 5983	240	150	147	1.25	09/16/1981	9.85		10/14/1981	U	112SPRD	2400	10.0	1468
158-066-34AAA	NDSWC 5984	101	30	27	1.25	09/16/1981	10.80		10/14/1981	U	112DTSH	1090	6.0	1475
158-067-01BBB	NDSWC 5960	240	171	168	1.25	08/26/1981	2.80		10/14/1981	U	112SPRD	2380	6.3	1500
158-067-03AAA	NDSWC 5959	300	211	208	1.25	08/26/1981	2.19		10/14/1981	U	112SPRD	2400	7.0	1505
158-067-04AAA	NDSWC 5958	420	--	--	--	08/25/1981	--		--	--	--	--	--	1510
158-067-05CCD	MCINTYRE, LOYD	157	157	128	4	07/25/1970	25.00		07/25/1970	H	211PIRR	3500	12.0	1515
158-067-06AAA	NDSWC 5957	120	--	--	--	08/25/1981	--		--	--	--	--	--	1518
158-067-13BAA	JOHNSON, REUBEN	103	103	83	5	09/06/1978	8.00	R	09/06/1978	--	112SPRD	2200	8.0	1487
158-067-13CDD	OLSON, ELMER	89	89	85	4	10/17/1972	2.00	R	10/17/1972	H,S	112SPRD	2400	8.0	1485
158-067-19CCB	NDSWC 5719	162	--	--	--	06/19/1980	--		--	--	--	--	--	1500
158-067-25ADC	CANDO, ND	124	124	--	--	06/28/1969	--		--	P	112SPRD	2590	9.0	1477
158-067-25BBB	NDSWC 5717	242	155	149	1.25	06/17/1980	1.78+		10/16/1980	U	112SPRD	2200	7.0	1480
158-067-27BBC	NDSWC 5718	402	321	315	2	06/18/1980	6.10+		10/16/1980	U	112SPRD	2400	7.0	1490
158-067-28BBC	NDSWC 5720	150	--	--	--	06/19/1980	--		--	--	--	--	--	1487
158-067-28CBB	PULSI, CLARENCE	126	126	121	4	08/18/1975	1.00+		08/18/1975	H,S	112SPRD	2200	9.0	1482
158-068-11DDD	JOHNSON, GARY	80	80	79	6	07/18/1979	41.00	R	07/18/1979	H,S	112BGFV	2800	8.0	1524
158-068-21AAA	NDSWC 5955	160	--	--	--	08/24/1981	--		--	--	--	--	--	1548
158-068-27DAA	TRAYNOR, HENRY	171	171	125	4	04/29/1964	60.00	L	04/29/1964	H,S	--	--	--	1530
158-068-29BAA	LARSON, GARY	174	174	153	4	09/16/1974	25.00		09/16/1974	H	211PIRR	5500	7.0	1546
158-068-31BAB	NELSON, STANLEY	79	79	71	24	08/11/1976	18.60	L	08/11/1976	H	--	--	--	1565
158-068-34BBB	WESTLIND, SALMER	81	81	75	5	1965	15.00	R	1965	H	112BGFV	1900	12.0	1545
158-068-35AAD	OLSEN, JR, JOHN	168	168	137	5	08/25/1975	34.00	R	08/25/1975	H,S	211PIRR	2450	7.0	1510
159-065-04CCC	RASMUSSEN, RALPH	105	105	80	4	09/15/1972	36.00	R	09/15/1972	H,S	211PIRR	2550	7.0	1525
159-065-06BB	SCHOOL DISTRICT, E. CENTRAL	112	112	92	5	11/24/1972	38.00	R	11/24/1972	--	211PIRR	2250	11.0	1515
159-065-06BBB	ELEVATOR CO., EGELAND	133	133	101	4	09/02/1972	30.00	R	09/02/1972	H	211PIRR	3000	7.0	1515
159-065-06BBC	RINAS, ERVIN	149	149	113	4	07/12/1971	50.00	R	07/12/1971	H	211PIRR	2900	8.0	1515

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159-065-06BBD	ODEGAARD, PETER	153	153	101	4	07/09/1966	40.00	R	07/09/1966	H	211PIRR	4000	11.0	1520
159-065-06BCA	JACOBSON, ORLO	194	194	122	5	06/24/1978	53.00	R	06/24/1978	H	211PIRR	3000	8.5	1520
159-065-06BCC	SCHOOL DISTRICT, E.CENTRAL	52	--	--	--	11/ /1972	--		--	--	--	--	--	1516
159-065-08CCC	NDSWC 6009	61	--	--	--	09/25/1981	--		--	--	--	--	--	1515
159-065-17CCC	NDSWC 6004	81	--	--	--	09/25/1981	--		--	--	--	--	--	1504
159-065-18BAA	NDSWC 6005	81	--	--	--	09/25/1981	--		--	--	--	--	--	1500
159-065-20CBC	NDSWC 6003	442	--	--	--	09/24/1981	--		--	--	--	--	--	1490
159-065-21CCC	NDSWC 6002	221	70	67	1.25	09/24/1981	--		--	U	112BGFV	3500	6.0	1509
159-065-22AAA	NDSWC 5774	42	--	--	--	07/24/1980	--		--	--	--	--	--	1512
159-065-29CCC	NDSWC 6008	81	--	--	--	09/25/1981	--		--	--	--	--	--	1490
159-065-30CCC	NDSWC 6006	61	--	--	--	09/25/1981	--		--	--	--	--	--	1490
159-065-36DDD	NDSWC 6007	81	--	--	--	09/25/1981	--		--	--	--	--	--	1490
159-066-05ADA	NDSWC 6001	201	58	55	1.25	09/23/1981	12.80		10/14/1981	U	112BPRD	1800	7.0	1508
159-066-05CCC	CAMPBELL, HAROLD	228	228	192	5	08/12/1978	.00	R	08/12/1978	H,S	211PIRR	2450	14.0	1510
159-066-08CCC	KOESTER, VERNON	227	227	216	5	10/10/1979	2.00+	R	10/10/1980	H,S	211PIRR	3000	10.0	1512
159-066-14CAA	NIKOLAISEN, TOM	73	73	67	24	09/06/1979	7.00	Z	09/06/1979	S	--	--	--	1500
159-066-15CCC	WELLMAN, DR, ROSS	134	134	89	4	08/13/1975	10.00	R	08/13/1975	H	211PIRR	2500	8.0	1505
159-066-18DDD	NIKOLAISEN, TOM	65	65	54	5	04/10/1973	.50+	Z	04/10/1973	H,S	--	--	--	1500
159-066-20CCC	NDSWC 5731	242	--	--	--	06/24/1980	--		--	--	--	--	--	1495
159-066-26DDD	NDSWC 5728	82	--	--	--	06/23/1980	--		--	--	--	--	--	1492
159-066-27CCD	NDSWC 5726	202	--	--	--	06/23/1980	--		--	--	--	--	--	1485
159-066-27DDD	NDSWC 5727	142	--	--	--	06/23/1980	--		--	--	--	--	--	1485
159-066-29CDD	FREUND, JACK	150	150	144	4	09/17/1963	5.00	R	09/17/1963	H,S	112BPRD	2250	8.0	1490
159-066-29DDD	NDSWC 5729	182	113	110	1.25	06/23/1980	7.40+		09/11/1980	--	112BPRD	1600	6.5	1490
159-066-30DDD	NDSWC 5730	222	--	--	--	06/24/1980	--		--	--	--	--	--	1495
159-067-01AAD	NDSWC 5732	262	151	148	1.25	06/24/1980	1.71		10/16/1980	--	112BPRD	2150	6.0	1526
159-067-01BBB1	NDSWC 5733	242	216	210	1.25	06/25/1980	14.20		10/16/1980	--	112BPRD	2400	6.0	1530
159-067-01BBB2	NDSWC 5734	115	109	104	5	06/25/1980	9.03		10/15/1980	--	112BPRD	2000	6.0	1530
159-067-04AAD	NDSWC 5736	342	69	66	1.25	06/26/1980	9.20		10/16/1980	--	112BPRD	2300	7.5	1545
159-067-04DDD1	NDSWC 5739	102	83	77	1.25	07/02/1980	3.20		10/16/1980	--	112BPRD	2400	6.0	1535
159-067-04DDD2	NDSWC 5740	60	--	--	--	07/02/1980	--		--	--	--	--	--	1538
159-067-16BAB	CHRISTOPHERSON, RAY	415	415	355	4	11/ /1976	55.00	R	11/ /1976	H,S	211PIRR	2550	12.0	1550
159-067-28DCD	NDSWC 5741	402	284	278	1.25	07/03/1980	7.35		10/16/1980	--	112BPRD	2420	10.5	1510
159-067-33CCC	NDSWC 5956	280	153	150	1.25	08/25/1981	10.84		10/14/1981	--	112BPRD	2300	7.5	1510
159-067-36DDD	NDSWC 5961	230	--	--	--	08/26/1981	--		--	--	--	--	--	1482
159-068-01BAA	CHRISTOPHERSON, MORRIS	237	237	180	4	07/08/1964	130.00		07/08/1964	H	211PIRR	2900	14.0	1595
159-068-01BAB	WESTEMEIER, LYLE	230	230	212	4	11/06/1965	130.00	Z	11/06/1965	H	--	--	--	1602
159-068-01BDA	LYSTER, OLE	260	260	211	4	11/21/1963	130.00	K	11/21/1963	H	211PIRR	2600	13.0	1600
159-068-11DAA	BRYSON, MIKE	169	169	133	4	12/05/1974	37.00	R	12/05/1974	S	211PIRR	1650	7.0	1584
159-068-16DDD	NDSWC 5953	200	--	--	--	08/24/1981	--		--	--	--	--	--	1590

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159-068-25CCC	NDSWC 5954	140	--	--	--	08/24/1981	--		--	--	--	--	--	1530
159-068-27AAA	BERG, ARTHUR	141	141	134	5	10/31/1977	40.00	R	10/31/1977	H,S	211PIRR	4000	9.0	1560
160-065-03DDC	KOEHN, A. J.	150	150	0	4	06/05/1975	21.00		06/05/1975	H,S	211PIRR	4000	--	1554
160-065-20CCC	RANCE, VERN	130	130	83	4	07/14/1966	30.00	R	07/14/1966	H	211PIRR	3450	7.0	1527
160-065-23BCC	NDSWC 5773	42	--	--	--	07/24/1980	--		--	--	--	--	--	1550
160-065-28BBB	NDSWC 6010	81	--	--	--	09/25/1981	--		--	--	--	--	--	1530
160-065-32BBB	SIELER, HERB	186	186	112	4	05/09/1978	40.00	R	05/09/1978	H	211PIRR	3900	6.5	1525
160-066-03BBA	LINDENBERG, BROS.	114	114	54	5	10/23/1976	12.00		10/23/1976	H,S	211PIRR	5000	7.0	1525
160-066-04DDD	NDSWC 6012	181	--	--	--	09/25/1981	--		--	--	--	--	--	1528
160-066-18AC	PARK BOARD, TOWNER CO	86	86	83	4	05/12/1966	17.00	R	05/12/1966	P	112SPRD	710	7.0	1524
160-066-27AAA	NDSWC 6011	51	--	--	--	09/25/1981	--		--	--	--	--	--	1520
160-066-32CCC	AUSEY, JAMES	230	230	167	4	07/17/1970	40.00	R	07/17/1970	H	211PIRR	2650	8.5	1510
160-067-04CCC	NDSWC 5997	281	162	157	1.25	09/22/1981	48.32		10/14/1981	U	112SPRD	2800	5.5	1585
160-067-04DBC	GRANDE, EINAR	474	474	473	5	09/08/1976	48.00	R	09/08/1976	H	211PIRR	3200	7.5	1585
160-067-07AAA	NDSWC 5996	221	122	117	1.25	09/22/1981	61.75		10/14/1981	U	112SPRD	2800	6.0	1600
160-067-10AAA1	NDSWC 5998A	441	251	242	2	09/22/1981	34.44		10/14/1981	U	112SPRD	2190	6.5	1568
160-067-10AAA2	NDSWC 5998B	441	101	98	1.25	09/22/1981	43.15		10/14/1981	U	112SPRD	1850	5.8	1568
160-067-10BBB1	NDSWC 5742	402	362	356	2	07/07/1980	41.55		10/16/1980	U	112SPRD	2200	7.0	1570
160-067-10BBB2	NDSWC 5743	62	60	57	1.25	07/08/1980	33.25		10/16/1980	U	112SPRD	2250	7.0	1570
160-067-11AAA	NDSWC 5999	241	202	197	1.25	09/23/1981	17.58		10/14/1981	U	112SPRD	2180	6.5	1550
160-067-13BBC	HELD, ROBERT	42	41	37	24	12/04/1976	21.00	R	12/04/1976	H	112BGFV	2400	6.0	1550
160-067-22CCC	JOHNSON, DORIS	283	283	--	4	07/29/1969	55.00		07/29/1969	H	211PIRR	5850	8.0	1566
160-067-24DC	MIDWEST EXPLOR.	4074	--	--	--	08/29/1953	--		--	--	--	--	--	1535
160-067-32CBB	NDSWC 5737	282	190	184	1.25	06/26/1980	48.29		10/16/1980	U	112SPRD	2300	8.0	1590
160-067-33CCC	NDSWC 5738	342	--	--	--	06/30/1980	--		--	--	--	--	--	1550
160-067-34DDA	NDSWC 5735	262	75	72	1.25	06/25/1980	9.70		10/16/1980	U	112SPRD	2450	6.5	1535
160-067-36AAA	NDSWC 6000	221	155	150	1.25	09/23/1981	8.27		10/14/1981	U	112SPRD	2190	6.0	1530
160-068-05ABC	PERTH, ND	113	113	--	--	09/09/1972	--		--	P	112BGFV	2400	6.0	1720
160-068-07CBB	BOE, SIDNEY	233	233	223	4	11/27/1974	90.00	R	11/27/1974	H,S	112BGFV	2000	9.0	1740
160-068-11DAA	GALOW, ED	159	159	154	4	10/14/1974	120.00	R	10/14/1974	H,S	112BGFV	2620	5.0	1651
160-068-11DCC	GALOW, BILL	82	82	77	4	09/21/1972	32.00	R	09/21/1972	H,S	112BGFV	3950	7.0	1660
160-068-12AAA	NDSWC 5995	221	175	170	1.25	09/21/1981	89.73		10/14/1981	--	112SPRD	2800	6.5	1632
160-068-15AAB	NDSWC 5994	201	--	--	--	09/21/1981	--		--	--	--	--	--	1660
160-068-22ACA	STRAND, EDMUND	293	293	242	5	07/11/1974	140.00	R	07/11/1974	S	211PIRR	5500	7.0	1677
160-068-23ADA	GALOW, ALVIN	133	133	128	4	12/17/1965	110.00		12/17/1965	H	112BGFV	2400	9.0	1640
160-068-33BAB	WIBE, MERVIN	219	219	216	4	11/29/1974	72.00	R	11/29/1974	U,S	211PIRR	--	11.0	1640
160-068-36DAD	PARK BOARD, TOWNER CO.	167	167	164	4	10/23/1969	85.00		10/23/1969	--	112BGFV	1800	6.5	1600
160-068-36DBD1	KELLER, ROBERT	150	150	145	4	10/08/1973	90.00		10/08/1973	U	--	--	--	1600
160-068-36DBD2	KELLER, ROBERT	205	205	200	4	09/10/1974	100.00	R	09/10/1974	H,S	211PIRR	3050	14.0	1600
161-065-04DAD	NDSWC 6027	81	--	--	--	10/12/1981	--		--	--	--	--	--	1610

LOCAL NUMBER	OWNER	DEPTH DRILLED (FEET)	DEPTH OF WELL (FEET)	DEPTH TO FIRST OPENING (FEET)	CASING DIAM-ETER (INCHES)	DATE COMPLETED	WATER LEVEL (FEET)		DATE WATER LEVEL MEASURED	USE OF WATER	PRINCIPAL AQUIFER	SPECIFIC CONDUCTANCE (µMHO/CM AT 25°C)	TEMPERATURE (DEGREES C)	ALTITUDE OF LAND SURFACE (FEET)
161-065-06CDD	SANTMAN, EDWARD	128	128	123	4	11/25/1966	20.00	R	11/25/1966	H	112BGFV	1400	8.0	1550
161-065-15BBB	CAMPBELL, RICHARD	165	165	102	4	12/02/1965	25.00	Z	12/02/1965	H,S	--	--	--	1565
161-065-17BBB	NDSWC 5772	182	--	--	--	07/23/1980	--		--	--	--	--	--	1550
161-065-29DDD	NDSWC 6026	161	--	--	--	10/12/1981	--		--	--	--	--	--	1545
161-065-34CCC	STEBLETON, LEROY	113	113	100	4	10/15/1969	12.00	R	10/15/1969	H	211PIRR	3500	9.0	1550
161-065-35AAD	TRENT, HAROLD	110	110	100	4	07/02/1965	20.00	R	07/02/1965	H,S	211PIRR	1500	5.0	1574
161-065-35CDC	CAMPBELL, CECIL	180	180	129	4	06/26/1975		R	--	H	--	--	--	1570
161-066-06AAD	NDSWC 1364-12	32	--	--	--	10/06/1964	--		--	--	--	--	--	1550
161-066-06BDC	NDSWC 1364-4	74	50	47	1.25	09/25/1964	--		--	--	112DTSH	1040	--	1536
161-066-06CAD	ROCK LAKE, ND	125	125	120	5	--	20.00		--	P	112BPRD	1050	7.0	1530
161-066-07AAD	NDSWC 1364-2	179	--	--	--	09/24/1964	--		--	--	--	--	--	1545
161-066-07ABC	NDSWC 1364-3	53	--	--	--	09/25/1964	--		--	--	--	--	--	1550
161-066-07CAA	NDSWC 1364-1	63	50	47	1.25	09/24/1964	--		--	--	112DTSH	1720	--	1532
161-066-08AAA	NDSWC 1364-5	158	--	--	--	09/28/1964	--		--	--	--	--	--	1540
161-066-08DDC	NDSWC 1364-11	210	--	--	--	10/05/1964	--		--	--	--	--	--	1538
161-066-19AAA	GINGERICH, VERNON	207	207	169	4	11/10/1972	20.00	R	11/10/1972	H,S	211PIRR	5800	7.0	1540
161-066-17DDB	BRANT, ROLAND	162	162	161	4	07/06/1965	20.00	Z	07/06/1965	U,S	211PIRR	--	--	1539
161-066-18CDC	NDSWC 1364-6	200	190	--	1.25	09/24/1964	--		--	--	112BPRD	2370	--	1550
161-066-29ABB	CARTER, JIMMY	191	191	127	5	12/17/1979	14.00	R	12/17/1979	S	211PIRR	5900	6.8	1548
161-066-29CCC	KNUTT, RON	145	145	126	4	04/20/1972	16.00	R	04/20/1972	H,S	211PIRR	3500	6.5	1525
161-067-01BBB	NDSWC 1364-9	315	--	--	--	09/30/1964	--		--	--	--	--	--	1575
161-067-07DDD	NDSWC 5748	342	240	231	2	07/09/1980	124.13		09/11/1980	U	112BPRD	2500	7.0	1675
161-067-11CCC1	NDSWC 5744	382	288	282	1.25	07/08/1980	51.98		10/16/1980	U	112BPRD	1900	--	1595
161-067-11CCC2	NDSWC 5745	102	101	98	1.25	07/08/1980	47.68		10/16/1980	U	112BPRD	1950	7.0	1593
161-067-14AAA	NDSWC 1364-10	410	376	--	1.25	10/01/1964	--		--	--	112BPRD	2210	--	1575
161-067-15BBB	NDSWC 5746	562	146	140	1.25	07/08/1980	57.03		10/16/1980	U	112BPRD	2400	7.0	1602
161-067-17AAA	NDSWC 5747	442	203	197	1.25	07/09/1980	94.60		10/16/1980	U	112BPRD	--	--	1640
161-067-17DD	PETERSON, ALVIN	379	379	355	5	10/17/1978	110.00	R	10/17/1978	H,S	211PIRR	3600	7.0	1645
161-067-19DCC	PETERS, CARL	400	400	330	4	11/09/1966	135.00	R	11/09/1966	H	211PIRR	--	9.0	1662
161-067-22BAA	BRANDT, KENT	340	340	296	4	08/27/1964	85.00	R	08/27/1964	H,S	211PIRR	2400	5.0	1600
161-067-22DDA	HAUBCHULZ, DUANE	107	107	101	5	05/09/1978	60.00		05/09/1978	H	112BPRD	2400	7.5	1588
161-067-28BB	SIMPSON, FRED	180	142	--	--	1978	67.00		--	U	--	--	--	1630
161-067-30DDA	PETERS, CHARLES	165	165	160	4	05/07/1970	115.00	R	05/07/1970	S	112BPRD	3050	6.0	1650
161-068-04AAA	NDSWC 5750	302	--	--	--	07/10/1980	--		--	--	--	--	--	1730
161-068-07CCB	AGRABRIGHT, ROBERT	153	143	140	4	06/11/1974	18.00	P	06/11/1974	H	112BGFV	2350	6.0	1770
161-068-08DDD	NDSWC 6013	261	--	--	--	09/29/1981	--		--	--	--	--	--	1750
161-068-12BDD	EGGL, ALVIN	196	196	191	4	08/14/1964	166.00	R	08/14/1964	H,S	112BPRD	2900	7.0	1706
161-068-14AAA	NDSWC 5749	222	--	--	--	07/10/1980	--		--	--	--	--	--	1708
161-068-21CCB	JOHNSON, OSCAR	265	265	260	4	07/29/1975	70.00	R	07/29/1975	H	112BGFV	1400	6.0	1740
161-068-26BBB	SARRI, JAMES	408	348	285	4	04/09/1974	180.00		04/09/1974	S	211PIRR	4100	--	1721

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161-068-35DC	UNION OIL	4499	--	--	--	06/30/1952		D	--	U	--	--	--	1710
162-065-16DDD	NDSWC 6029	281	--	--	--	10/13/1981	--		--	--	--	--	--	1580
162-065-20BBB	NDSWC 5771	142	72	69	1.25	07/23/1980	3.98		10/16/1980	U	112BGFV	3400	--	1555
162-065-23ABB	NDSWC 6026	351	--	--	--	10/12/1981	--		--	--	--	--	--	1605
162-065-32BBB	NDSWC 6030	241	117	112	1.25	10/13/1981	4.63		10/21/1981	U	112BGFV	1700	6.0	1550
162-066-14DDD	NDSWC 6031	141	--	--	--	10/13/1981	--		--	--	--	--	--	1530
162-066-17BBB	OAKLAND, OLAF	145	90	34	5	12/08/1976	14.00		12/08/1976	S	211PIRR	1690	5.0	1535
162-066-21AAA	NDSWC 6032	81	--	--	--	10/13/1981	--		--	--	--	--	--	1530
162-066-28ACD	NDSWC 1364-15	63	--	--	--	10/07/1964	--		--	--	--	--	--	1532
162-066-28DAA	NDSWC 1364-14	95	--	--	--	10/06/1964	--		--	--	--	--	--	1528
162-066-28DCB	NORHEIM, BESSIE	27	27	19	24	09/01/1977	8.50	R	05/01/1980	H	112BGFV	2700	8.0	1535
162-066-30CCC	NDSWC 1364-8	21	--	--	--	09/30/1962	--		--	--	--	--	--	1551
162-066-30DCC	NDSWC 1364-7	32	--	--	--	09/30/1964	--		--	--	--	--	--	1536
162-066-32DDD	NDSWC 1364-13	126	--	--	--	10/06/1964	--		--	U	--	--	--	1533
162-067-01BCB	NDSWC 6025	261	--	--	--	10/09/1981	--		--	U	--	--	--	1535
162-067-02BBC1	NDSWC 6020A	401	237	231	2	10/05/1981	19.99		10/13/1981	U	112SPRD	2120	6.0	1555
162-067-02BBC2	NDSWC 6020B	401	105	100	1.25	10/05/1981	17.14		10/13/1981	U	112SPRD	1330	5.5	1555
162-067-04AAA	NDSWC 6021	281	243	238	1.25	10/07/1981	36.01		10/13/1981	U	112SPRD	2800	6.5	1572
162-067-05AAA	NDSWC 6022	241	98	93	1.25	10/07/1981	44.70		10/13/1981	U	112SPRD	2200	5.5	1595
162-067-06ABA	MATTSUN, RUSSELL	314	314	280	4	04/29/1969	90.00		04/29/1969	H	211PIRR	6100	7.0	1620
162-067-11DAA1	NDSWC 5757	262	201	198	1.25	07/16/1980	.60+		10/16/1980	U	112SPRD	3000	9.0	1544
162-067-11DAA2	NDSWC 5756	74	65	62	1.25	07/16/1980	1.90+		10/16/1980	U	112SPRD	2250	6.0	1544
162-067-14BBB	NDSWC 5756	382	141	138	1.25	07/15/1980	9.69		10/16/1980	U	112SPRD	1900	7.5	1560
162-067-16AAA	NDSWC 6019	281	128	123	1.25	10/05/1981	26.74		10/13/1981	U	112SPRD	1520	6.0	1575
162-067-16CCC	NDSWC 5755	302	204	201	1.25	07/15/1980	65.11		10/16/1980	U	112SPRD	2000	7.0	1608
162-067-17BBA	HENDRICKSUN, WILLARD	146	146	142	4	05/20/1970	90.00	R	05/20/1970	H,S	112SPRD	1200	5.5	1636
162-067-22AAA	NDSWC 6018	301	175	170	1.25	10/01/1981	28.20		10/13/1981	--	112SPRD	2600	5.5	1575
162-068-01AAA	NDSWC 6023	221	148	143	1.25	10/08/1981	87.14		10/13/1981	--	112SPRD	2800	5.5	1640
162-068-02BBB	NDSWC 6024	301	--	--	--	10/08/1981	--		--	--	--	--	--	1695
162-068-07CD	NAT. ASSOC. PET.	4587	--	--	--	1965	--		--	U	--	--	--	1751
162-068-07DCC	DUNLUP, DAVID	185	185	180	5	07/11/1975	65.00	R	07/11/1975	H,S	112ROLL	1600	5.0	1760
162-068-10BBB	NDSWC 6017	181	--	--	--	09/30/1981	--		--	--	--	--	--	1730
162-068-10CCD	JUHNSUN, ELMER	300	300	299	6	1970	90.00	R	1970	H	211PIRR	2600	5.5	1725
162-068-13CCC	JUNTUNEN, WESLEY	381	381	312	5	10/05/1978	150.00	R	10/05/1978	H,S	211PIRR	--	6.0	1695
162-068-16DDD	NDSWC 5754	262	--	--	--	07/15/1980	--		--	--	--	--	--	1727
162-068-17ADA	NDSWC 6016	281	140	135	1.25	09/30/1981	35.04		10/13/1981	--	112ROLL	2190	5.5	1740
162-068-21ADC	JUNTUNEN, CURTIS	153	153	148	4	07/07/1966	43.00	R	07/07/1966	H	112ROLL	2250	8.0	1740
162-068-21DDC1	NDSWC 5753	322	--	--	--	07/14/1980	--		--	--	--	--	--	1733
162-068-21DDC2	NDSWC 5752	82	--	--	--	07/11/1980	--		--	--	--	--	--	1735
162-068-22BCC	ALEXANDER, BRUCE	138	138	137	4	04/16/1964	36.00		04/16/1964	H	--	--	--	1732

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162-068-24DDD	NDSWC 5759	282	--	--	--	07/16/1980	--		--	--	--	--	--	1677
162-068-27CCC	NDSWC 5751	402	--	--	--	07/10/1980	--		--	--	--	--	--	1740
162-068-28CCC	NDSWC 6014	361	--	--	--	09/29/1981	--		--	--	--	--	--	1740
162-068-33DAA	KANGAS, HELEN	176	176	171	4	10/18/1973	--		--	H	112SPRD	1750	6.0	1738
162-068-34BAC	HEMMING, LARRY	459	459	454	4	01/16/1973	117.00	R	01/16/1973	S	112SPRD	2400	5.0	1740
163-065-10CCC	NDSWC 5770	82	--	--	--	07/23/1980	--		--	--	--	--	--	1615
163-065-12CCC	NDSWC 6039	81	--	--	--	10/15/1981	--		--	--	--	--	--	1600
163-065-13ADB	STATES, GENE	135	135	82	4	09/14/1966	27.00	P	09/14/1966	S	211PIRR	3500	8.0	1585
163-065-18AAA	NDSWC 6038	61	--	--	--	10/15/1981	--		--	--	--	--	--	1590
163-065-18BA	RHODES-LANGENFELD	3789	--	--	--	1952	--		--	U	--	--	--	1591
163-066-06AAD	KLEIN, JAMES	103	103	98	4	02/18/1972	13.00		02/18/1972	S	112SPRD	2600	6.0	1525
163-066-07BCC	NDSWC 6034	221	160	155	1.25	10/14/1981	1.50+		10/21/1981	U	112SPRD	2400	6.0	1530
163-066-07DDD	NDSWC 5768	262	--	--	--	07/22/1980	--		--	--	--	--	--	1530
163-066-10CCC	NDSWC 5769	62	--	--	--	07/23/1980	--		--	--	--	--	--	1535
163-066-11DCD	NDSWC 6037	61	--	--	--	10/14/1981	--		--	--	--	--	--	1560
163-066-17AAA	NDSWC 6036	141	--	--	--	10/14/1981	--		--	--	--	--	--	1530
163-066-31DCC	NDSWC 6033	101	--	--	--	10/13/1981	--		--	--	--	--	--	1528
163-067-01DDD	MANNING, VIRG	92	92	85	4	08/07/1969	10.00	P	08/07/1969	H,S	112SPRD	1900	6.0	1532
163-067-05CDC	KAKELA, WESLEY	62	62	59	4	03/27/1968	14.00		03/27/1968	H	112SPRD	595	7.0	1552
163-067-07DCB	HANSBORO, ND	--	110	--	--	--	--		--	P	112SPRD	900	5.0	1595
163-067-07DD	HUOVINEN, RICHARD	104	104	101	4	07/09/1970	35.00		07/09/1970	P	112SPRD	2450	10.0	1588
163-067-09CCC	NDSWC 6040	211	95	90	1.25	10/15/1981	4.49		10/21/1981	--	112SPRD	725	6.5	1543
163-067-10CCC1	NDSWC 5765	222	189	183	1.25	07/18/1980	8.07		10/16/1980	--	112SPRD	2600	7.0	1539
163-067-10CCC2	NDSWC 5766	62	53	50	1.25	07/11/1980	2.25		10/16/1980	--	112SPRD	1900	6.0	1539
163-067-10CCC3	HENDERSON, ALFRED	60	60	50	5	12/02/1974	6.00		12/02/1974	S	--	--	--	1540
163-067-10DDD	NDSWC 6035	261	185	180	1.25	10/14/1981	7.55		10/21/1981	U	112SPRD	2350	6.0	1535
163-067-12CCC	NDSWC 5767	222	82	76	1.25	07/22/1980	.72+		10/16/1980	--	112SPRD	1450	7.0	1530
163-067-15DDB	THOMAS, DARL	27	27	19	18	08/30/1977	8.50	P	04/29/1980	S	112QTSH	1750	4.0	1540
163-067-18AAA1	NDSWC 5763	282	258	252	2	07/18/1980	40.30		10/16/1980	--	112SPRD	3000	8.5	1582
163-067-18AAA2	NDSWC 5764	142	121	118	1.25	07/18/1980	39.13		10/16/1980	--	112SPRD	2250	7.0	1582
163-067-18BBB1	NDSWC 6041A	461	303	294	2	10/15/1981	29.75		10/21/1981	--	112SPRD	--	--	1610
163-067-18BBB2	NDSWC 6041B	461	125	120	1.25	10/15/1981	24.40		10/21/1981	--	112SPRD	3000	6.0	1610
163-067-24CC	NAMBLEY, J. T.	2454	--	--	--	1970	--		--	U	--	--	--	1534
163-067-28BCC	PARSLOW, EARL	233	233	232	4	10/18/1965	70.00		10/18/1965	H,S	--	--	--	1590
163-067-34CDD	OLSON, GLENN	46	46	38	24	07/15/1975	32.50	P	04/30/1980	H	112SPRD	2100	8.5	1575
163-068-06DD	KENNEDY, CHAMBERS &	1639	--	--	--	1968	--		--	--	--	--	--	1730
163-068-12CCC	NDSWC 5762	262	--	--	--	07/17/1980	--		--	--	--	--	--	1625
163-068-16AAA	NDSWC 5761	122	--	--	--	07/17/1980	--		--	--	--	--	--	1688
163-068-17BBB	NDSWC 5760	262	--	--	--	07/17/1980	--		--	--	--	--	--	1735
163-068-27BB	MIDWEST EXPLOR.	4436	--	--	--	09/16/1953	--		--	U	--	--	--	1729

LOCAL NUMBER	OWNER	DEPTH DRILLED (FEET)	DEPTH OF WELL (FEET)	DEPTH TO FIRST OPENING (FEET)	CASING DIAMETER (INCHES)	DATE COMPLETED	WATER LEVEL (FEET)		DATE WATER LEVEL MEASURED	USE OF WATER	PRINCIPAL AQUIFER	SPECIFIC CONDUCTANCE (µMHO/CM AT 25°C)	TEMPERATURE (DEGREES C)	ALTITUDE OF LAND SURFACE (FEET)
163-068-32CCC	NDSWC 6015	381	--	--	--	09/29/1981	--		--	--	--	--	--	1755
164-065-29CCB	ESTENSON, LEROY	135	135	134	4	05/25/1967	20.00	R	05/25/1967	H	--	--	--	1590
164-067-28CBD	US CUSTOMS	196	117	112	5	03/10/1972	18.00	P	03/10/1972	P	112SPRD	2800	12.0	1540

TABLE 2.--Water levels in selected wells

EXPLANATION

Water levels shown have been adjusted to feet below or above (+) land surface

MP, measuring point lsd, land surface datum

Depth to water, in feet below or above (+) land surface

157-065-31BBB MP is top of 1-1/4-inch plastic pipe 2.50 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
June 18, 1980...	1.63	Oct. 16.....	+0.20	Aug. 10.....	+0.95
July 21.....	1.80	Nov. 17.....	+1.00	Sept. 9.....	+.78
Aug. 13.....	1.76	May 12, 1981...	+.50	Oct. 14.....	+.85
Sept. 11.....	1.11	July 15.....	+1.16		

Highest water level--+1.16 ft; July 15, 1981
Lowest water level--1.80 ft; July 21, 1980

157-066-18DDD1 MP is top of 2-inch steel pipe 2.50 ft above lsd.

Sept. 9, 1981...	10.20	Oct. 14.....	10.32	Dec. 2.....	10.14

Highest water level--10.14 ft; Dec. 2, 1981
Lowest water level--10.32 ft; Oct. 14, 1981

157-066-27DCC MP is top of 1-1/4-inch plastic pipe 3.00 ft above lsd.

June 18, 1980...	4.38	Dec. 15.....	2.21	Aug. 10.....	1.92
July 1.....	4.38	Feb. 17, 1981...	2.49	Sept. 9.....	2.13
Aug. 13.....	4.36	Mar. 12.....	2.45	Oct. 14.....	2.30
Sept. 11.....	4.10	Apr. 7.....	2.79	Dec. 2.....	2.14
Oct. 16.....	3.20	May 19.....	2.54		
Nov. 17.....	2.49	July 15.....	1.69		

Highest water level--1.69 ft; July 15, 1981
Lowest water level--4.38 ft; June 18, 1980, and July 1, 1980

157-066-28CBC MP is top of 1-1/4-inch plastic pipe 3.00 ft above lsd.

Oct. 14, 1981...	6.15	Nov. 30.....	6.19	Dec. 2.....	5.98

Highest water level--5.98 ft; Dec. 2, 1981
Lowest water level--6.19 ft; Nov. 30, 1981

Depth to water, in feet below or above (+) land surface

157-066-28DCC MP is top of 1-1/4-inch plastic pipe 2.50 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
June 18, 1980...	1.66	Oct. 16.....	0.50	Aug. 10.....	0.14
July 21.....	2.30	Nov. 17.....	+.20	Sept. 9.....	.46
Aug. 13.....	2.38	May 19, 1981...	.06	Oct. 14.....	.50
Sept. 11.....	1.84	July 15.....	+.59	Dec. 2.....	.45

Highest water level--+0.59 ft; July 15, 1981
Lowest water level--2.38 ft; Aug. 13, 1980

157-066-30AAA MP is top of 1-1/4-inch plastic pipe 2.50 ft above lsd.

June 18, 1980...	0.90	Oct. 16.....	+0.60	Aug. 11.....	+1.20
July 21.....	.47	Nov. 17.....	+1.07	Sept. 9.....	+1.06
Aug. 13.....	.46	Apr. 7, 1981...	+.85	Oct. 14.....	+.96
Sept. 11.....	.16	May 19.....	+.96		

Highest water level--+1.20 ft; Aug. 11, 1981
Lowest water level--0.90 ft; June 18, 1980

157-066-30ABB MP is top of 1-1/4-inch plastic pipe 2.00 ft above lsd.

June 18, 1980...	13.21	Dec. 15.....	12.74	Aug. 11.....	12.59
July 2.....	13.29	Feb. 17, 1981...	12.80	Sept. 9.....	12.81
Aug. 13.....	13.53	Mar. 12.....	12.90	Oct. 14.....	12.89
Sept. 11.....	13.44	Apr. 7.....	12.60	Dec. 2.....	12.95
Oct. 16.....	12.97	May 12.....	12.69		
Nov. 17.....	12.83	July 15.....	12.45		

Highest water level--12.45 ft; July 15, 1981
Lowest water level--13.53 ft; Aug. 13, 1980

157-066-32AAB MP is top of 1-1/4-inch plastic pipe 3.00 ft above lsd.

June 18, 1980...	8.35	Dec. 15.....	5.52	Aug. 10.....	5.52
July 21.....	8.33	Feb. 17, 1981...	7.30	Sept. 9.....	5.99
Aug. 13.....	8.25	Mar. 12.....	7.40	Oct. 14.....	6.08
Sept. 11.....	7.33	Apr. 7.....	6.91	Dec. 2.....	5.98
Oct. 16.....	5.60	May 12.....	5.52		
Nov. 17.....	4.96	July 15.....	4.70		

Highest water level--4.70 ft; July 15, 1981
Lowest water level--8.35 ft; June 18, 1980

157-067-01DDD MP is top of 1-1/4-inch plastic pipe 1.50 ft above lsd.

Sept. 10, 1981...	8.58	Oct. 14.....	8.67	Dec. 2.....	8.62

Highest water level--8.58 ft; Sept. 10, 1981
Lowest water level--8.67 ft; Oct. 14, 1981

Depth to water, in feet below or above (+) land surface

157-067-11AAA MP is top of 1-1/4-inch plastic pipe 2.50 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Sept. 10, 1981...	22.27	Oct. 14.....	22.34	Dec. 2.....	22.27

Highest water level--22.27 ft; Sept. 10, 1981, and Dec. 2, 1981
Lowest water level--22.34 ft; Oct. 14, 1981

157-067-25AAA MP is top of 1-1/4-inch plastic pipe 2.00 ft above lsd.

June 18, 1980...	8.71	Dec. 15.....	7.39	Aug. 11.....	6.46
July 21.....	8.69	Feb. 17, 1981...	7.02	Sept. 9.....	6.30
Aug. 13.....	8.79	Mar. 12.....	7.10	Oct. 14.....	6.30
Sept. 11.....	8.60	Apr. 7.....	6.79	Dec. 2.....	6.30
Oct. 16.....	8.25	May 19.....	6.95		
Nov. 17.....	7.80	July 15.....	6.50		

Highest water level--6.30 ft; Sept. 9, 1981, Oct. 14, 1981, and Dec. 2, 1981
Lowest water level--8.79 ft; Aug. 13, 1980

157-067-25BBB MP is top of 1-1/4-inch plastic pipe 3.00 ft above lsd.

June 18, 1980...	1.16	Oct. 16.....	0.70	Aug. 11.....	+0.79
July 21.....	1.20	Nov. 17.....	.30	Sept. 9.....	+.81
Aug. 13.....	1.21	May 19, 1981...	+.35	Oct. 14.....	+.77
Sept. 11.....	1.08	July 15.....	+.74		

Highest water level--+0.81 ft; Sept. 9, 1981
Lowest water level--1.21 ft; Aug. 13, 1980

157-067-27AAA MP is top of 1-1/4-inch plastic pipe 2.50 ft above lsd.

Aug. 13, 1980...	18.58	Feb. 17, 1981...	18.15	Aug. 11.....	17.05
Sept. 11.....	18.35	Mar. 12.....	17.19	Sept. 9.....	16.95
Oct. 16.....	18.15	Apr. 7.....	17.03	Oct. 14.....	17.00
Nov. 17.....	17.94	May 19.....	17.20	Dec. 2.....	16.69
Dec. 15.....	17.70	July 15.....	17.05		

Highest water level--16.69 ft; Dec. 2, 1981
Lowest water level--18.58 ft; Aug. 13, 1980

158-065-12CCC MP is top of 1-1/4-inch plastic pipe 1.50 ft above lsd.

Aug. 14, 1980...	9.60	Mar. 12, 1981...	8.84	Sept. 9.....	9.20
Sept. 11.....	8.57	Apr. 7.....	9.12	Oct. 14.....	8.67
Oct. 16.....	6.45	May 19.....	8.60	Dec. 2.....	8.31
Nov. 17.....	5.70	July 15.....	7.54		
Dec. 15.....	5.55	Aug. 10.....	9.32		

Highest water level--5.55 ft; Dec. 15, 1980
Lowest water level--9.60 ft; Aug. 14, 1980

Depth to water, in feet below or above (+) land surface

158-066-30BBB MP is top of 5-inch steel pipe 1.40 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Aug. 15, 1980...	11.25	Jan. 20.....	9.71	Aug. 15.....	9.69
Aug. 20.....	10.97	Jan. 25.....	9.65	Aug. 20.....	9.73
Aug. 25.....	10.98	Jan. 30.....	9.75	Aug. 25.....	9.73
Aug. 30.....	10.96	Feb. 5.....	9.78	Aug. 30.....	9.76
Sept. 5.....	10.93	Feb. 10.....	9.78	Sept. 5.....	9.81
Sept. 10.....	10.91	Feb. 15.....	9.88	Sept. 10.....	9.55
Sept. 15.....	10.68	Feb. 20.....	9.97	Sept. 15.....	9.65
Sept. 20.....	10.60	Mar. 15.....	8.83	Sept. 20.....	9.67
Sept. 25.....	10.54	Mar. 20.....	8.85	Sept. 25.....	9.63
Sept. 30.....	10.40	Mar. 25.....	8.87	Sept. 30.....	9.68
Oct. 5.....	10.38	Mar. 30.....	8.77	Oct. 5.....	9.65
Oct. 10.....	10.27	Apr. 5.....	8.78	Oct. 10.....	9.65
Oct. 15.....	10.25	May 15.....	10.04	Oct. 15.....	9.87
Oct. 20.....	10.05	May 20.....	10.02	Oct. 20.....	9.86
Oct. 25.....	10.02	May 25.....	9.95	Oct. 25.....	9.81
Oct. 30.....	9.91	May 30.....	9.94	Oct. 30.....	9.82
Nov. 5.....	9.80	June 5.....	9.83	Nov. 5.....	9.86
Nov. 10.....	9.72	June 10.....	9.80	Nov. 10.....	9.88
Nov. 15.....	9.72	June 15.....	9.71	Nov. 15.....	9.86
Nov. 20.....	9.60	June 20.....	9.64	Nov. 20.....	9.88
Nov. 25.....	9.54	June 25.....	9.56	Nov. 25.....	9.85
Nov. 30.....	9.46	June 30.....	9.55	Nov. 30.....	9.84
Dec. 5.....	9.51	July 5.....	9.55	Dec. 5.....	9.80
Dec. 10.....	9.52	July 10.....	9.58	Dec. 10.....	9.85
Dec. 20.....	9.61	July 15.....	9.57	Dec. 15.....	9.85
Dec. 25.....	9.58	July 20.....	9.57	Dec. 20.....	9.80
Dec. 30.....	9.59	July 25.....	9.59	Dec. 25.....	9.86
Jan. 5, 1981...	9.62	July 30.....	9.62	Dec. 30.....	9.92
Jan. 10.....	9.68	Aug. 5.....	9.63	Jan. 5, 1982...	9.90
Jan. 15.....	9.68	Aug. 10.....	9.66		

Highest water level--8.77 ft; Mar. 30, 1981
Lowest water level--11.25 ft; Aug. 15, 1980

158-067-01BBB MP is top of 1-1/4-inch plastic pipe 2.00 ft above lsd.

Sept. 10, 1981...	2.85	Oct. 14.....	2.80	Dec. 2.....	2.57

Highest water level--2.57 ft; Dec. 2, 1981
Lowest water level--2.85 ft; Sept. 10, 1981

158-067-03AAA MP is top of 1-1/4-inch plastic pipe 2.00 ft above lsd.

Sept. 10, 1981...	2.08	Oct. 14.....	2.19	Dec. 2.....	2.00

Highest water level--2.00 ft; Dec. 2, 1981
Lowest water level--2.19 ft; Oct. 14, 1981

Depth to water, in feet below or above (+) land surface

158-067-25BBB MP is top of 1-1/4-inch plastic pipe 2.00 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
July 21, 1980...	+1.04	Mar. 12, 1981...	+2.05	Aug. 11.....	+2.05
Aug. 13.....	+1.11	Apr. 7.....	+2.05	Sept. 9.....	+2.05
Sept. 11.....	+1.33	May 12.....	+2.10	Oct. 14.....	+2.05
Oct. 16.....	+1.78	July 15.....	+2.00		

Highest water level--+2.10 ft; May 12, 1981
Lowest water level--+1.04 ft; July 21, 1980

158-067-27BBC MP is top of 2-inch steel pipe 4.00 ft above lsd.

July 8, 1980...	+6.00	Dec. 15.....	+11.41	July 15.....	+11.10
Aug. 13.....	+6.40	Feb. 17, 1981...	+10.95	Aug. 11.....	+7.50
Sept. 11.....	+6.30	Mar. 12.....	+10.50	Sept. 9.....	+8.00
Oct. 16.....	+6.10	Apr. 7.....	+11.00	Oct. 14.....	+7.25
Nov. 17.....	+11.45	May 12.....	+10.60		

Highest water level--+11.45 ft; Nov. 17, 1980
Lowest water level--+6.00 ft; July 8, 1980

159-066-29DDD MP is top of 1-1/4-inch plastic pipe 3.60 ft above lsd.

July 8, 1980...	+7.00	Dec. 15.....	+13.60	July 15.....	+13.60
Aug. 13.....	+7.20	Feb. 17, 1981...	+13.60	Aug. 11.....	+13.60
Sept. 11.....	+7.40	Mar. 12.....	+13.49	Sept. 10.....	+13.60
Oct. 16.....	+13.00	Apr. 7.....	+13.15	Oct. 14.....	+13.55
Nov. 17.....	+13.65	May 12.....	+13.40		

Highest water level--+13.65 ft; Nov. 17, 1980
Lowest water level--+7.00 ft; July 8, 1980

159-067-01AAD MP is top of 1-1/4-inch plastic pipe 2.00 ft above lsd.

June 27, 1980...	2.84	Oct. 16.....	1.71	Aug. 11.....	0.28
July 21.....	2.50	Nov. 17.....	1.17	Sept. 10.....	.26
Aug. 13.....	2.37	May 12, 1981...	.65	Oct. 14.....	+.01
Sept. 11.....	2.28	July 15.....	.30		

Highest water level--+0.01 ft; Oct. 14, 1981
Lowest water level--2.84 ft; June 27, 1980

159-067-01BBB1 MP is top of 1-1/4-inch plastic pipe 0.00 ft above lsd.

June 27, 1980...	15.01	Dec. 15.....	13.37	Aug. 11.....	12.99
July 21.....	14.98	Feb. 17, 1981...	13.09	Sept. 10.....	12.81
Aug. 13.....	14.91	Mar. 12.....	13.20	Oct. 14.....	12.74
Sept. 11.....	14.68	Apr. 7.....	13.22	Dec. 1.....	12.51
Oct. 16.....	14.20	May 12.....	13.27		
Nov. 17.....	13.75	July 15.....	12.96		

Highest water level--12.51 ft; Dec. 1, 1981
Lowest water level--15.01 ft; June 27, 1980

Depth to water, in feet below or above (+) land surface

159-067-01BBB2 MP is top of 5-inch steel pipe 1.00 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Aug. 15, 1980...	9.67	Feb. 28.....	7.65	July 25.....	7.59
Aug. 20.....	9.41	Mar. 15.....	7.72	July 30.....	7.55
Aug. 25.....	9.47	Mar. 20.....	7.76	Aug. 5.....	7.46
Aug. 30.....	9.49	Mar. 25.....	7.78	Aug. 10.....	7.47
Sept. 5.....	9.49	Mar. 30.....	7.72	Aug. 15.....	7.47
Sept. 10.....	9.50	Apr. 5.....	7.76	Aug. 20.....	7.51
Sept. 15.....	9.32	Apr. 10.....	7.77	Aug. 25.....	7.41
Sept. 20.....	9.23	Apr. 15.....	7.86	Aug. 30.....	7.36
Sept. 25.....	9.16	Apr. 20.....	7.86	Sept. 5.....	7.38
Sept. 30.....	9.10	Apr. 25.....	7.85	Sept. 10.....	7.29
Oct. 5.....	9.11	Apr. 30.....	7.81	Sept. 15.....	7.36
Oct. 10.....	9.03	May 5.....	7.83	Sept. 20.....	7.33
Oct. 15.....	9.03	May 10.....	7.85	Sept. 25.....	7.24
Oct. 20.....	8.84	May 15.....	7.89	Sept. 30.....	7.24
Oct. 25.....	8.81	May 20.....	7.89	Oct. 5.....	7.21
Oct. 30.....	8.72	May 25.....	7.84	Oct. 10.....	7.19
Nov. 5.....	8.64	May 30.....	7.82	Oct. 15.....	7.20
Nov. 10.....	8.49	June 5.....	7.70	Oct. 20.....	7.16
Nov. 15.....	8.50	June 10.....	7.71	Oct. 25.....	7.14
Nov. 20.....	8.37	June 15.....	7.65	Oct. 30.....	7.13
Nov. 25.....	8.27	June 20.....	7.65	Nov. 5.....	7.14
Nov. 30.....	8.11	June 25.....	7.57	Nov. 10.....	7.14
Dec. 5.....	8.11	June 30.....	7.60	Nov. 15.....	7.09
Dec. 10.....	8.11	July 5.....	7.61	Nov. 20.....	7.12
Dec. 15.....	8.03	July 10.....	7.63	Nov. 25.....	7.04
Feb. 20, 1981...	7.63	July 15.....	7.61	Nov. 30.....	7.02
Feb. 25.....	7.63	July 20.....	7.59		

Highest water level--7.02 ft; Nov. 30, 1981
Lowest water level--9.67 ft; Aug. 15, 1980

159-067-04AAD MP is top of 1-1/4-inch plastic pipe 2.30 ft above lsd.

July 21, 1980...	9.80	Dec. 15.....	8.59	July 15.....	8.14
Aug. 13.....	9.70	Feb. 17, 1981...	8.30	Aug. 11.....	8.02
Sept. 11.....	9.70	Mar. 12.....	8.44	Sept. 10.....	7.82
Oct. 16.....	9.20	Apr. 7.....	8.40	Oct. 14.....	7.81
Nov. 17.....	8.89	May 20.....	8.49	Dec. 2.....	7.65

Highest water level--7.65 ft; Dec. 2, 1981
Lowest water level--9.80 ft; July 21, 1980

159-067-04DDD1 MP is top of 1-1/4-inch plastic pipe 3.00 ft above lsd.

July 21, 1980...	3.80	Dec. 15.....	2.46	July 15.....	2.03
Aug. 13.....	3.71	Feb. 17, 1981...	2.15	Aug. 11.....	1.99
Sept. 11.....	3.60	Mar. 12.....	2.20	Sept. 10.....	1.85
Oct. 16.....	3.20	Apr. 7.....	2.30	Oct. 14.....	1.81
Nov. 17.....	2.77	May 19.....	2.37	Dec. 2.....	1.59

Highest water level--1.59 ft; Dec. 2, 1981
Lowest water level--3.80 ft; July 21, 1980

Depth to water, in feet below or above (+) land surface

159-067-28DCD MP is top of 1-1/4-inch plastic pipe 2.00 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
July 21, 1980...	7.64	Dec. 15.....	7.18	July 15.....	6.73
Aug. 13.....	7.63	Feb. 17, 1981...	6.72	Aug. 10.....	6.96
Sept. 11.....	7.45	Mar. 12.....	6.79	Sept. 10.....	6.62
Oct. 16.....	7.35	Apr. 7.....	6.63	Oct. 14.....	6.58
Nov. 17.....	7.20	May 19.....	6.74	Dec. 2.....	6.36

Highest water level--6.36 ft; Dec. 2, 1981
Lowest water level--7.64 ft; July 21, 1980

159-067-33CCC MP is top of 1-1/4-inch plastic pipe 2.50 ft above lsd.

Aug. 27, 1981...	11.04	Oct. 14.....	10.84	Dec. 2.....	10.46
Sept. 10.....	10.90				

Highest water level--10.46 ft; Dec. 2, 1981
Lowest water level--11.04 ft; Aug. 27, 1981

160-067-10BBB1 MP is top of 2-inch steel pipe 4.00 ft above lsd.

July 21, 1980...	42.33	Dec. 15.....	41.27	July 15.....	39.57
Aug. 13.....	42.07	Feb. 17, 1981...	39.54	Aug. 11.....	39.52
Sept. 11.....	41.99	Mar. 12.....	39.59	Sept. 10.....	38.94
Oct. 16.....	41.55	Apr. 7.....	39.76	Oct. 14.....	38.95
Nov. 17.....	41.04	May 12.....	39.89	Dec. 1.....	38.59

Highest water level--38.59 ft; Dec. 1, 1981
Lowest water level--42.33 ft; July 21, 1980

160-067-10BBB2 MP is top of 1-1/4-inch plastic pipe 1.00 ft above lsd.

July 21, 1980...	33.34	Dec. 15.....	32.50	July 15.....	31.90
Aug. 13.....	33.49	Feb. 17, 1981...	31.98	Aug. 11.....	31.76
Sept. 11.....	33.50	Mar. 12.....	32.15	Sept. 10.....	31.52
Oct. 16.....	33.25	Apr. 7.....	32.01	Oct. 14.....	31.46
Nov. 17.....	32.98	May 12.....	31.94	Dec. 1.....	31.23

Highest water level--31.23 ft; Dec. 1, 1981
Lowest water level--33.50 ft; Sept. 11, 1980

160-067-32CBB MP is top of 1-1/4-inch plastic pipe 3.00 ft above lsd.

July 21, 1980...	48.87	Dec. 15.....	48.01	July 15.....	47.48
Aug. 13.....	48.80	Feb. 17, 1981...	47.60	Aug. 11.....	47.40
Sept. 11.....	48.70	Mar. 12.....	47.60	Sept. 10.....	47.31
Oct. 16.....	48.29	Apr. 7.....	47.61	Oct. 14.....	47.28
Nov. 17.....	48.10	May 12.....	47.64	Dec. 2.....	47.29

Highest water level--47.28 ft; Oct. 14, 1981
Lowest water level--48.87 ft; July 21, 1980

Depth to water, in feet below or above (+) land surface

160-067-34DDA MP is top of 1-1/4-inch plastic pipe 2.00 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
June 27, 1980...	10.65	Dec. 15.....	8.64	Aug. 11.....	7.91
July 21.....	9.26	Feb. 17, 1981...	8.18	Sept. 10.....	7.70
Aug. 13.....	10.22	Mar. 12.....	8.34	Oct. 14.....	7.60
Sept. 11.....	10.05	Apr. 7.....	8.30	Dec. 2.....	7.42
Oct. 16.....	9.70	May 12.....	8.70		
Nov. 17.....	9.08	July 15.....	7.04		

Highest water level--7.04 ft; July 15, 1981
Lowest water level--10.65 ft; June 27, 1980

161-067-07DDD MP is top of 2-inch steel pipe 3.30 ft above lsd.

July 21, 1980...	124.95	Dec. 15.....	123.82	July 15.....	124.08
Aug. 13.....	124.29	Feb. 17, 1981...	123.75	Aug. 12.....	124.10
Sept. 11.....	124.13	Mar. 12.....	123.69	Sept. 10.....	123.79
Oct. 16.....	124.47	Apr. 7.....	123.74	Oct. 13.....	123.70
Nov. 17.....	123.87	May 12.....	124.27	Dec. 1.....	123.32

Highest water level--123.32 ft; Dec. 1, 1981
Lowest water level--124.95 ft; July 21, 1980

161-067-11CCC1 MP is top of 1-1/4-inch plastic pipe 2.00 ft above lsd.

July 21, 1980...	51.27	Dec. 15.....	50.85	July 15.....	50.60
Aug. 13.....	51.13	Feb. 17, 1981...	50.57	Aug. 12.....	50.59
Sept. 11.....	51.21	Mar. 12.....	50.62	Sept. 10.....	50.40
Oct. 16.....	51.98	Apr. 7.....	50.52	Oct. 13.....	50.38
Nov. 17.....	50.97	May 12.....	50.68	Dec. 1.....	50.05

Highest water level--50.05 ft; Dec. 1, 1981
Lowest water level--51.98 ft; Oct. 16, 1980

161-067-11CCC2 MP is top of 1-1/4-inch plastic pipe 2.50 ft above lsd.

July 21, 1980...	47.80	Dec. 15.....	47.57	July 15.....	47.36
Aug. 13.....	47.77	Feb. 17, 1981...	47.25	Aug. 12.....	47.35
Sept. 11.....	47.81	Mar. 12.....	47.31	Sept. 10.....	47.14
Oct. 16.....	47.68	Apr. 7.....	47.22	Oct. 13.....	47.10
Nov. 17.....	47.80	May 12.....	47.41	Dec. 1.....	46.89

Highest water level--46.89 ft; Dec. 1, 1981
Lowest water level--47.81 ft; Sept. 11, 1980

Depth to water, in feet below or above (+) land surface

161-067-15BBB MP is top of 1-1/4-inch plastic pipe 2.50 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
July 21, 1980...	57.30	Dec. 15.....	57.90	July 15.....	56.69
Aug. 13.....	57.17	Feb. 17, 1981...	56.65	Aug. 12.....	56.67
Sept. 11.....	57.17	Mar. 12.....	57.02	Sept. 10.....	56.47
Oct. 16.....	57.03	Apr. 7.....	56.61	Oct. 13.....	56.49
Nov. 17.....	57.30	May 12.....	56.95	Dec. 1.....	56.18

Highest water level--56.18 ft; Dec. 1, 1981
Lowest water level--57.90 ft; Dec. 15, 1980

161-067-17AAA MP is top of 1-1/4-inch plastic pipe 2.50 ft above lsd.

July 21, 1980...	95.30	Dec. 15.....	94.79	July 15.....	94.76
Aug. 13.....	95.10	Feb. 17, 1981...	94.42	Aug. 12.....	94.72
Sept. 11.....	95.01	Mar. 12.....	94.38	Sept. 10.....	94.44
Oct. 16.....	94.60	Apr. 7.....	94.50	Oct. 13.....	94.39
Nov. 17.....	95.14	May 12.....	94.98	Dec. 1.....	94.04

Highest water level--94.04 ft; Dec. 1, 1981
Lowest water level--95.30 ft; July 21, 1980

162-065-20BBB MP is top of 1-1/4-inch plastic pipe 3.00 ft above lsd.

Aug. 13, 1980...	4.77	Feb. 17, 1981...	3.66	Aug. 12.....	3.47
Sept. 11.....	4.20	Mar. 12.....	3.74	Sept. 10.....	3.35
Oct. 16.....	3.98	Apr. 7.....	4.20	Oct. 13.....	3.28
Nov. 17.....	3.08	May 20.....	3.66	Dec. 1.....	3.18
Dec. 15.....	2.76	July 15.....	3.30		

Highest water level--2.76 ft; Dec. 15, 1980
Lowest water level--4.77 ft; Aug. 13, 1980

162-067-11DAA1 MP is top of 1-1/4-inch plastic pipe 3.00 ft above lsd.

July 24, 1980...	+0.45	Nov. 17.....	+0.70	Aug. 12.....	+0.88
Aug. 13.....	+.25	Apr. 7, 1981...	+1.02	Sept. 10.....	+1.07
Sept. 11.....	+.24	May 12.....	+1.02	Oct. 13.....	+1.10
Oct. 16.....	+.60	July 15.....	+.96		

Highest water level--+1.10 ft; Oct. 13, 1981
Lowest water level--+0.24 ft; Sept. 11, 1980

162-067-11DAA2 MP is top of 1-1/4-inch plastic pipe 2.50 ft above lsd.

July 24, 1980...	+0.74	Apr. 7, 1981...	+2.41	Sept. 10.....	+1.93
Aug. 13.....	+1.06	May 12.....	+2.08	Oct. 13.....	+2.19
Sept. 11.....	+1.25	July 15.....	+1.59		
Oct. 16.....	+1.90	Aug. 12.....	+1.43		

Highest water level--+2.41 ft; Apr. 7, 1981
Lowest water level--+0.74 ft; July 24, 1980

Depth to water, in feet below or above (+) land surface

162-067-14BBB MP is top of 1-1/4-inch plastic pipe 2.30 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
July 24, 1980...	10.55	Dec. 15.....	9.61	July 15.....	9.64
Aug. 13.....	10.60	Feb. 17, 1981...	9.63	Aug. 12.....	9.74
Sept. 11.....	10.30	Mar. 12.....	9.59	Sept. 10.....	9.28
Oct. 16.....	9.69	Apr. 7.....	9.29	Oct. 13.....	9.30
Nov. 17.....	9.63	May 12.....	9.50	Dec. 1.....	9.17

Highest water level--9.17 ft; Dec. 1, 1981
Lowest water level--10.60 ft; Aug. 13, 1980

162-067-16CCC MP is top of 1-1/4-inch plastic pipe 3.00 ft above lsd.

July 24, 1980...	65.64	Dec. 15.....	65.95	July 15.....	65.05
Aug. 13.....	65.80	Feb. 17, 1981...	64.82	Aug. 12.....	64.92
Sept. 11.....	65.60	Mar. 12.....	65.10	Sept. 10.....	64.49
Oct. 16.....	65.11	Apr. 7.....	64.81	Oct. 13.....	64.27
Nov. 17.....	65.29	May 12.....	65.16	Dec. 1.....	64.20

Highest water level--64.20 ft; Dec. 1, 1981
Lowest water level--65.95 ft; Dec. 15, 1980

163-067-10CCC1 MP is top of 1-1/4-inch plastic pipe 2.00 ft above lsd.

July 30, 1980...	9.05	Dec. 15.....	7.63	July 15.....	7.60
Aug. 13.....	8.99	Feb. 17, 1981...	7.73	Aug. 12.....	7.85
Sept. 11.....	8.65	Mar. 12.....	7.61	Sept. 10.....	7.61
Oct. 16.....	8.07	Apr. 7.....	7.99	Oct. 13.....	7.55
Nov. 18.....	7.76	May 12.....	7.72	Dec. 1.....	7.33

Highest water level--7.33 ft; Dec. 1, 1981
Lowest water level--9.05 ft; July 30, 1980

163-067-10CCC2 MP is top of 1-1/4-inch plastic pipe 2.50 ft above lsd.

July 30, 1980...	4.39	Dec. 15.....	3.61	July 15.....	3.75
Aug. 13.....	4.35	Feb. 17, 1981...	4.00	Aug. 12.....	3.92
Sept. 11.....	3.21	Mar. 12.....	3.88	Sept. 10.....	2.60
Oct. 16.....	2.25	Apr. 7.....	2.10	Oct. 13.....	2.65
Nov. 18.....	2.35	May 12.....	2.20	Dec. 1.....	2.93

Highest water level--2.10 ft; Apr. 7, 1981
Lowest water level--4.39 ft; July 30, 1980

163-067-12CCC MP is top of 1-1/4-inch plastic pipe 2.50 ft above lsd.

July 30, 1980...	0.88	Apr. 7, 1981...	+0.13	Sept. 10.....	+0.76
Aug. 13.....	.73	May 12.....	+.77	Oct. 13.....	+.94
Sept. 11.....	.10	July 15.....	+.77		
Oct. 16.....	+.72	Aug. 12.....	+.34		

Highest water level--+0.94 ft; Oct. 13, 1981
Lowest water level--0.88 ft; July 30, 1980

Depth to water, in feet below or above (+) land surface

163-067-18AAA1 MP is top of 2-inch steel pipe 3.30 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
July 24, 1980...	42.50	Dec. 15.....	40.10	July 14.....	40.45
Aug. 13.....	42.64	Feb. 17, 1981...	41.20	Aug. 12.....	40.50
Sept. 11.....	40.96	Mar. 12.....	41.37	Sept. 10.....	40.56
Oct. 16.....	40.30	Apr. 7.....	40.45	Oct. 13.....	40.43
Nov. 18.....	39.91	May 12.....	40.40	Dec. 1.....	40.96

Highest water level--39.91 ft; Nov. 18, 1980
Lowest water level-42.64 ft; Aug. 13, 1980

163-067-18AAA2 MP is top of 1-1/4-inch plastic pipe 2.80 ft above lsd.

July 24, 1980...	41.18	Dec. 15.....	38.56	July 14.....	39.25
Aug. 13.....	41.40	Feb. 17, 1981...	39.95	Aug. 12.....	39.68
Sept. 11.....	40.38	Mar. 12.....	39.74	Sept. 10.....	39.23
Oct. 16.....	39.13	Apr. 7.....	39.20	Oct. 13.....	39.70
Nov. 18.....	38.57	May 12.....	38.91	Dec. 1.....	39.63

Highest water level--38.56 ft; Dec. 15, 1980
Lowest water level--41.40 ft; Aug. 13, 1980

TABLE 3.--Logs of selected wells and test holes

Depths are shown in feet below land surface.

Gamma-ray logs are in API GR units (American Petroleum Institute gamma-ray units).

Neutron logs are in API N units (American Petroleum Institute neutron units).

Spontaneous potential (SP) logs are in mV (millivolts).

Resistivity logs are in ohm-m (ohm-meters; 16-inch short normal and 64-inch long normal.

Resistance logs (single point) are in ohms and are shown in the resistivity column.

157-065-02CCC
(Log modified from C. A. Simpson & Son)

Altitude: 1465 feet — Date drilled: 10/28/63

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow	19	20
	Clay, blue, sandy, hard	25	45
	Clay, sandy, soft	47	92
	Sand, mushy	5	97
	Sand, fine to coarse	19	116

157-065-04CCB
(Log modified from C. A. Simpson & Son)

Altitude: 1468 feet — Date drilled: 7/24/77

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Soil, black	1	1
	Clay, light-gray	4	5
	Clay, blue; with a very few pebbles	13	18
	Clay, yellow, slightly sandy	3	21
	Clay or shale, blue, slightly sandy, hard	2	23
Pierre Shale:			
	Shale, blue, hard; with slate chips	18	41

157-065-05DAA
(Log modified from C. A. Simpson & Son)

Altitude: 1468 feet — Date drilled: 6/28/77

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Soil, black	3	3
	Clay, light-tan, slightly sandy	2	5
	Clay, yellow; with gray clay, red particles, and a few pebbles	4	9
	Clay, yellow; with a few pebbles; damp	6	15
	Clay, blue; with red material in seams; tough; rock at 39 feet	25	40

157-065-09BCB
(Log modified from C. A. Simpson & Son)

Altitude: 1465 feet — Date drilled: 6/29/77

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Soil, black	1	1
	Clay, light-tan; with rust stains and some gray clay	6	7
	Clay, yellow; with rust stains and some small gravel	7	14
	Clay, blue; a few pebbles; seams with black and gray coating and roots	8	22
	Sand, clayey	1	23
	Clay, blue; with a few pebbles	10	33
Pierre Shale:			
	Shale, gray; becoming harder with slate chips after 38 feet	7	40

157-065-10CCC
NDSWC 5986

Altitude: 1460 feet — Date drilled: 9/17/81

Glacial drift:			
	Topsoil	1	1
	Clay, dark-yellowish-orange, silty, oxidized	14	15
	Clay, olive-gray, pebbly (till)	6	21
	Clay, dark-gray, pebbly (till)	15	36
	Clay, dark-gray, sandy, pebbly (till)	42	78
Pierre Shale:			
	Shale, grayish-black, siliceous, fractured	23	101

157-065-17ABB
(Log modified from C. A. Simpson & Son)

Altitude: 1470 feet — Date drilled: 12/18/74

Glacial drift:			
	Fill	3	3
	Topsoil	1	4
	Clay, yellow	26	30
	Clay, blue	9	39
	Gravel	3	42
Pierre Shale:			
	Shale	98	140

157-065-17DC
(Log modified from Smith, 1954)

Altitude: 1493 feet — Date drilled: 10/27/52

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
CRETACEOUS SYSTEM:			
Niobrara Formation (top):			596
Greenhorn Formation (top):			995
Muddy Sandstone (top):			1,287
Dakota Formation (top):			1,394
JURASSIC SYSTEM:			
Sundance Formation (top):			1,580
Piper Formation (top):			1,835
Red Beds (top):			1,907
DEVONIAN SYSTEM:			
Nisku Formation (top):			1,952
Duperow Formation (top):			2,000
Souris River Formation (top):			2,310
Dawson Bay Formation (top):			2,380
Ashern (top):			2,590
SILURIAN SYSTEM:			
Interlake Formation (top):			2,620
ORDOVICIAN SYSTEM:			
Upper Stony Mountain Formation (top):			2,853
Lower Stony Mountain Formation (top):			2,937
Red River Formation (top):			3,022
Winnipeg Formation (top):			3,567
Winnipeg Sand (top):			3,745
PRECAMBRIAN			3,757

157-065-19BAB
(Log modified from Church Well Boring)

Altitude: 1465 feet — Date drilled: 5/14/76

Glacial drift:			
	Topsoil, black	1	1
	Sand, yellow	4	5
	Clay, yellow	10	15
	Clay, blue	13	28
	Sand, coarse, wet	2	30
	Sand, coarse; shale; and small rocks	5	35

157-065-21DDD
NDSWC 5987

Altitude: 1455 feet — Date drilled: 9/17/81

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, pebbly, oxidized (till)	14	15
	Clay, olive-gray, pebbly (till)	21	36
	Clay, dark-gray, pebbly, sandy (till)	4	40
	Silt, dark-gray, clayey	2	42
	Clay, olive-gray, silty, pebbly (till)	10	52
Pierre Shale:			
	Shale, grayish-black, siliceous, fractured	29	81

157-065-29BBD
(Log modified from C. A. Simpson & Son)

Altitude: 1473 feet — Date drilled: 7/02/77

Glacial drift:			
	Soil, black	6	6
	Clay, sandy to very sandy, damp	9	15
	Clay, dark-gray to black; with a few pebbles	3	18
	Sand, very clayey, very soft	13	31
	Sand to small gravel; some fairly clean; some clayey	3	34
	Clay, gray; with some gravel and pebbles	6	40

157-065-31BBB
NDSWC 5706

Altitude: 1450 feet — Date drilled: 6/10/80

Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, oxidized	9	10
	Clay, brownish-gray, very sandy (till); interbedded lenses of gravel	10	20
	Sand, medium, gravelly, subrounded to rounded; about 70 percent shale and 30 percent carbonate grains	35	55
Pierre Shale:			
	Shale, dusky-brown, siliceous, fractured	23	78
	Shale, brownish-gray, siliceous, well-indurated	24	102

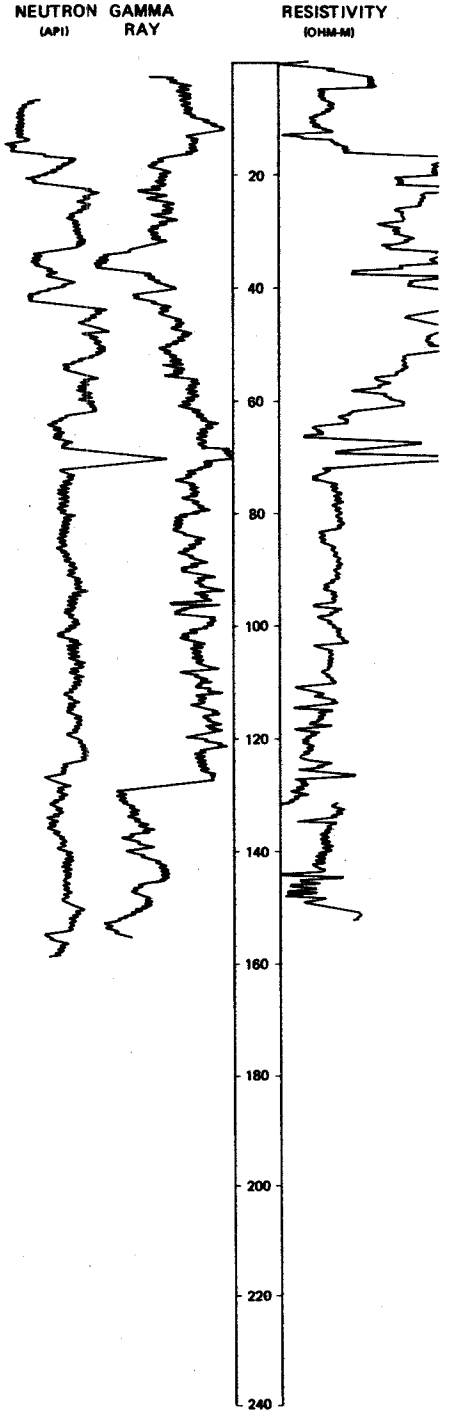
NDSWC 5981

LOCATION: 157-066-03CCC

DATE DRILLED: 9/16/81

ALTITUDE: 1463
(FT, NGVD)

DEPTH: 161
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-14	Silt, dark-yellowish-orange, clayey, oxidized.
14-17	Silt, olive-gray, clayey.
17-33	Clay, olive-gray, pebbly (till).
33-37	Sand, fine to coarse, clayey.
37-68	Clay, olive-gray, silty (till).
68-72	Gravel, coarse, sandy; cobbles.
72-128	Clay, dark-gray, pebbly (till).

PIERRE SHALE

128-161	Shale, grayish-black, siliceous, fractured.

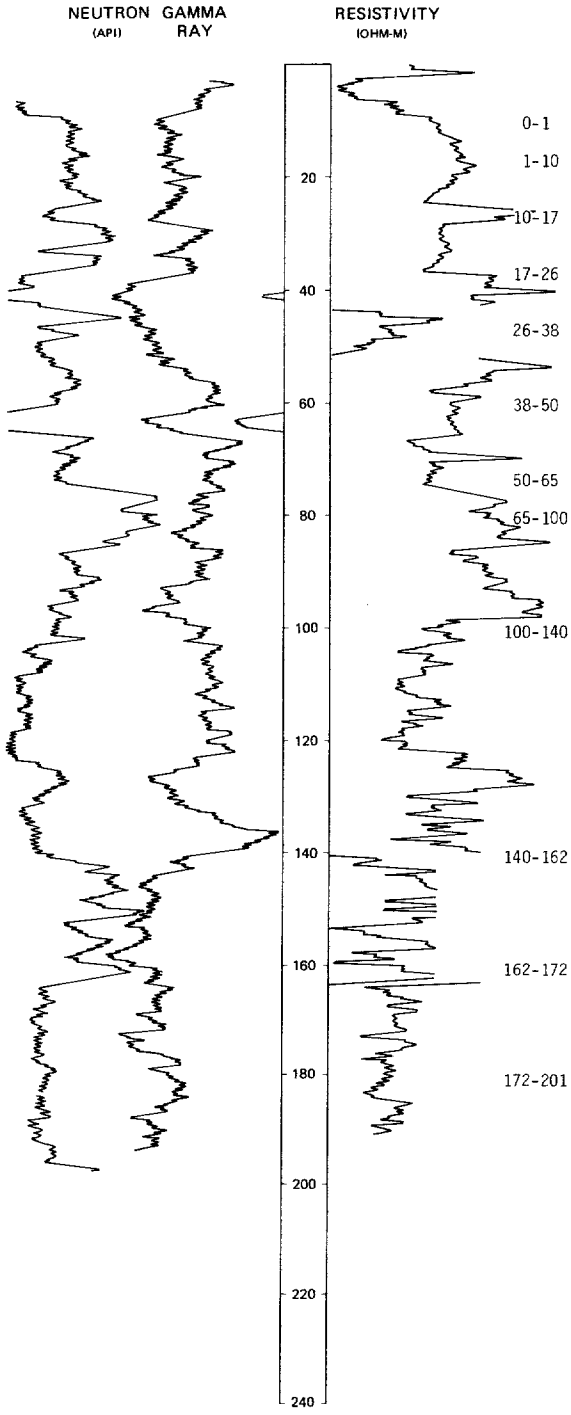
NDSWC 5982

LOCATION: 157-066-04BBB

DATE DRILLED: 9/16/81

ALTITUDE: 1465
(FT, NGVD)

DEPTH: 201
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-10	Silt, yellowish-orange, clayey, oxidized.
10-17	Clay, yellowish-brown, pebbly, oxidized (till).
17-26	Clay, olive-gray, pebbly (till).
26-38	Clay, olive-gray (till); interbedded with lenses of fine sand.
38-50	Gravel, fine to coarse; interbedded with coarse subangular sand.
50-65	Silt, olive-gray, clayey.
65-100	Clay, dark-gray (till); interbedded with fine to medium gravel.
100-140	Silt, dark-gray, clayey; interbedded with sand from 122 to 130 feet.
140-162	Sand, coarse; interbedded with fine to coarse sub-angular gravel.
162-172	Gravel, fine to coarse, subrounded; all detrital shale.

PIERRE SHALE

172-201	Shale, grayish-black, siliceous, fractured.

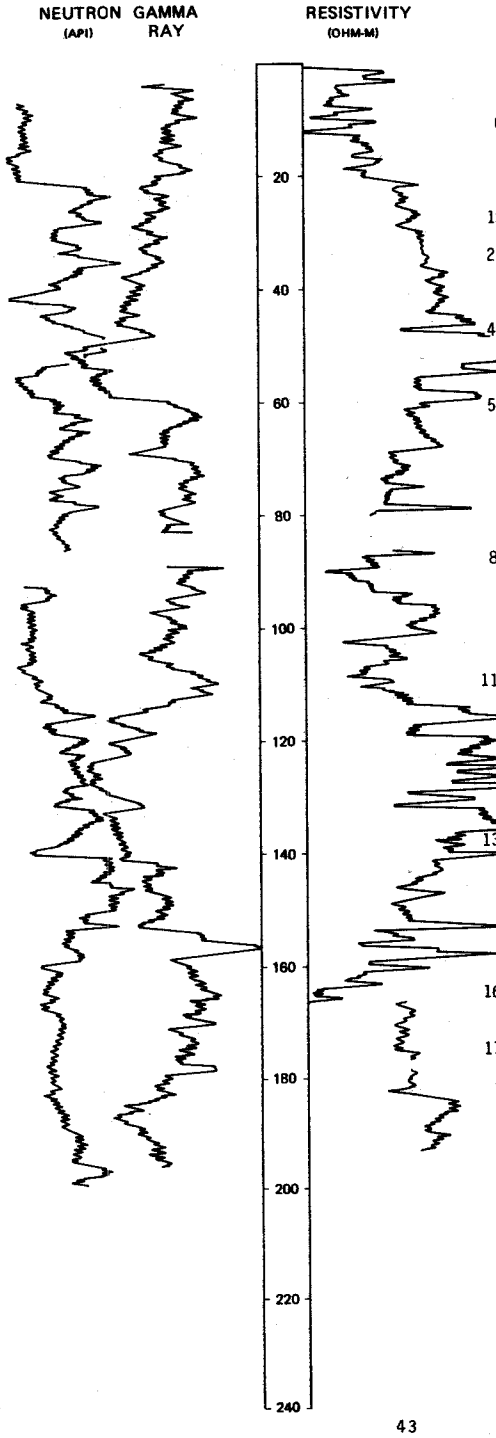
NDSWC 5980

LOCATION: 157-066-09BBB

DATE DRILLED: 9/16/81

ALTITUDE: 1463
(FT, NGVD)

DEPTH: 201
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-15	Silt, yellowish-orange, clayey, oxidized.
15-21	Silt, olive-gray, clayey.
21-48	Clay, olive-gray (till); interbedded with thin lenses of sand and gravel.
48-55	Sand, coarse; interbedded with fine to coarse sub-angular gravel.
55-88	Clay, olive-gray, silty (till); interbedded with lenses of sand and gravel.
88-110	Silt, dark-gray, clayey.
110-137	Sand, very fine to coarse; interbedded with fine to medium gravel; some lenses of clay.
137-164	Clay, dark-gray (till); interbedded with lenses of gravel.

PIERRE SHALE

164-174	Shale, dark-gray, macerated.
174-201	Shale, grayish-black, fractured; some interstitial clay.

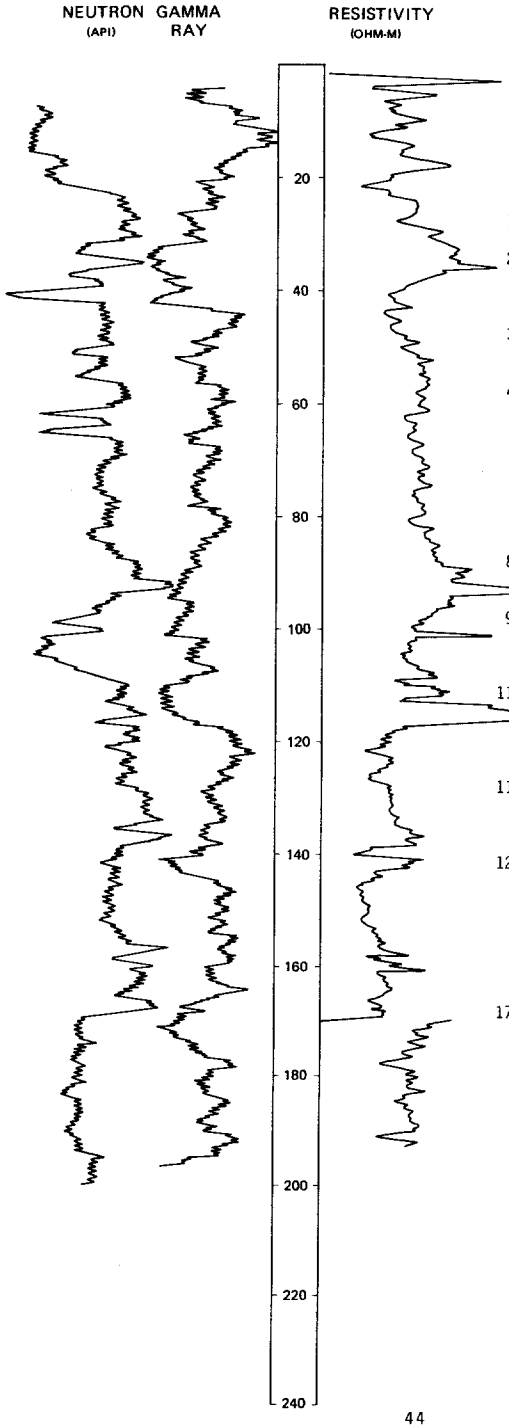
NDSWC 5979

LOCATION: 157-066-09CDC

DATE DRILLED: 9/15/81

ALTITUDE: 1465
(FT, NGVD)

DEPTH: 201
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-18	Silt, yellowish-orange, clayey, oxidized.
18-29	Till, olive-gray, pebbly.
29-36	Sand, coarse; interbedded with lenses of fine to coarse subangular gravel.
36-42	Clay, olive-gray, very sandy (till).
42-87	Clay, olive-gray, gravelly (till).
87-95	Sand, fine to coarse, mostly medium, subrounded.
95-110	Clay, dark-gray, silty to sandy.
110-118	Sand, coarse to very coarse; interbedded with fine to medium subangular gravel.
118-129	Clay, brownish-gray, sandy, pebbly, oxidized (till).
129-170	Clay, dark-gray, pebbly (till).

PIERRE SHALE

170-201	Shale, grayish-black, siliceous, fractured.

157-066-10BBA
(Log modified from C. A. Simpson & Son)

Altitude: 1461 feet

Date drilled: 5/12/76

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow	14	15
	Clay, yellow, sandy	10	25
	Clay, blue, very gravelly	25	50
	Clay, blue	4	54
	Sand	2	56
	Clay, blue	1	57

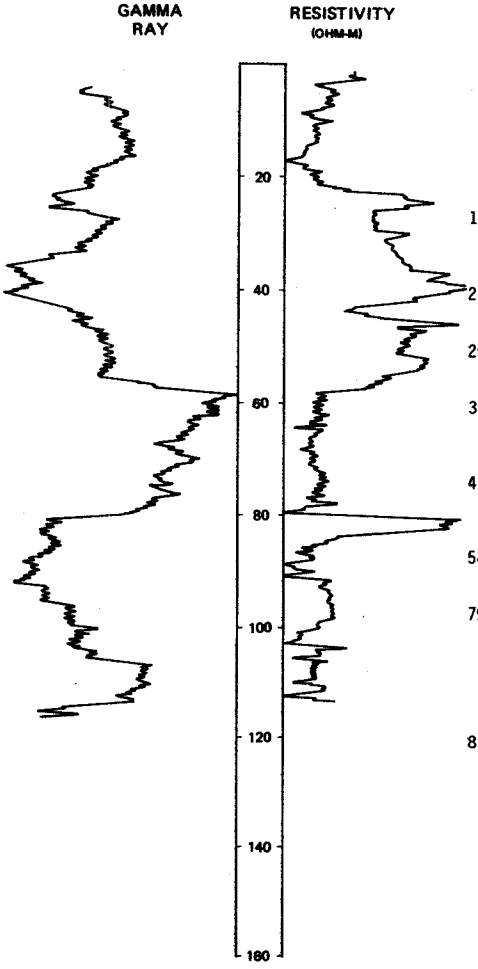
NDSWC 5977

LOCATION: 157-066-15DCC

DATE DRILLED: 9/15/81

ALTITUDE: 1455
(FT, NGVD)

DEPTH: 121
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-15	Clay, yellowish-orange, silty, oxidized.
15-22	Clay, olive-gray; interbedded with brownish-gray slightly carbonaceous silt.
22-25	Sand, fine to coarse, gravelly, subrounded.
25-35	Clay, olive-gray, pebbly (till).
35-41	Sand, coarse; interbedded with fine to coarse angular to rounded gravel.
41-58	Clay, olive-gray to brownish-gray, very silty; carbonaceous streaks.
58-79	Clay, olive-gray, pebbly (till).
79-81	Sand, fine, well-sorted, subrounded; predominantly quartz grains.

PIERRE SHALE

81-121	Shale, grayish-black, siliceous, fractured.

157-066-16BBB
NDSWC 5978

Altitude: 1460 feet — Date drilled: 9/15/81

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Silt, yellowish-orange, clayey, oxidized	11	12
	Silt, olive-gray, clayey	10	22
	Sand, coarse; interbedded with lenses of fine to coarse subangular gravel	13	35
	Clay, olive-gray, pebbly (till)	6	41
	Sand, coarse to very coarse; interbedded with fine to coarse angular to well-rounded gravel	29	70

157-066-17DAC
(Log modified from C. A. Simpson & Son)

Altitude: 1460 feet — Date drilled: 6/24/70

Glacial drift:			
	Topsoil and fill	3	3
	Clay, yellow	9	12
	Clay, gray, sandy; caves	36	48
	Sand and gravel	2	50
	Clay, sandy	8	58
	Sand and gravel; with some fines	20	78

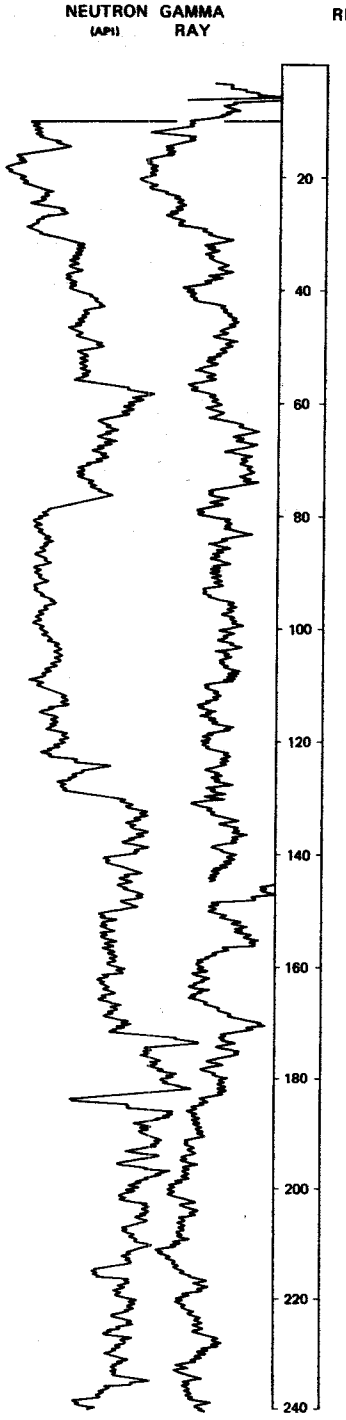
NDSWC 5970, 5970A

LOCATION: 157-066-18DDD1, 2

DATE DRILLED: 9/03/81

ALTITUDE: 1470
(FT, NGVD)

DEPTH: 341
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

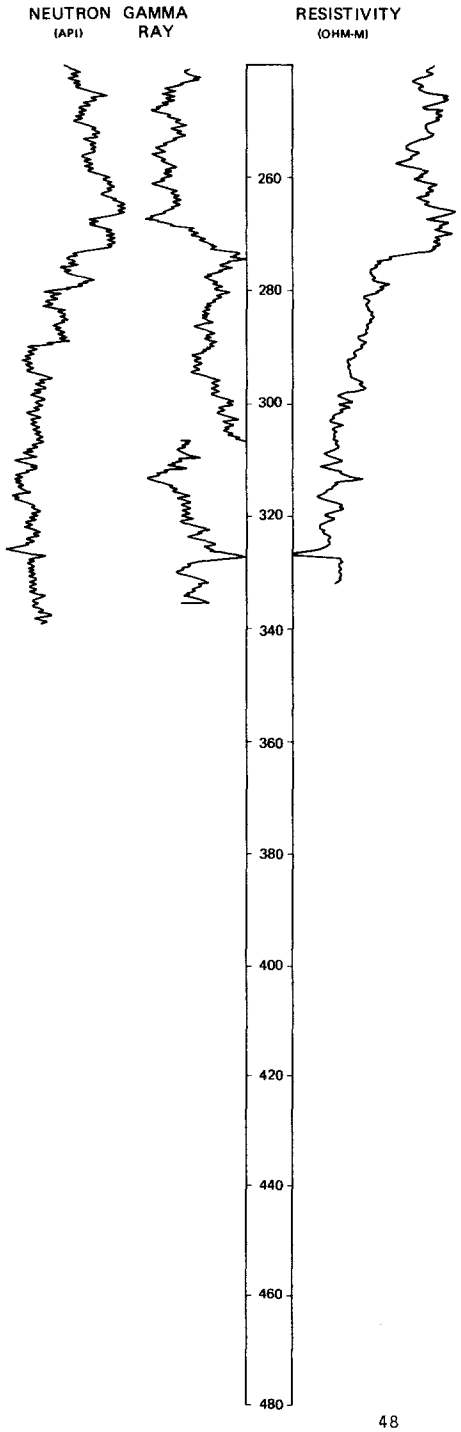
0-1	Topsoil.
1-18	Silt, yellowish-orange, clayey, oxidized.
18-20	Silt, olive-gray, clayey.
20-31	Sand, very fine, rounded; interbedded with silt and clay.
31-56	Clay, olive-gray, pebbly (till).
56-77	Clay, olive-gray, very sandy (till).
77-130	Silt, olive-gray; interbedded with thin lenses of very fine sand.
130-150	Clay, olive-gray (till); interbedded with lenses of fine to medium gravel.
150-170	Sand, fine; interbedded with lenses of fine gravel; abundant detrital lignite.
170-215	Gravel, fine to coarse; interbedded with very coarse angular to rounded sand.
215-272	Sand, very coarse; interbedded with lenses of fine to coarse subrounded gravel; abundant detrital shale and lignite.

LOCATION: 157-066-18DDD1, 2

DATE DRILLED: 9/03/81

ALTITUDE: 1470
(FT, NGVD)

DEPTH: 341
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

272-290 Gravel, fine to very coarse, subangular to rounded; predominately detrital shale.

290-305 Clay, dark-gray; with yellowish-orange oxidation streaks; predominately detrital shale.

PIERRE SHALE

305-341 Shale, grayish-black, bentonitic, moderately indurated, slightly fractured.

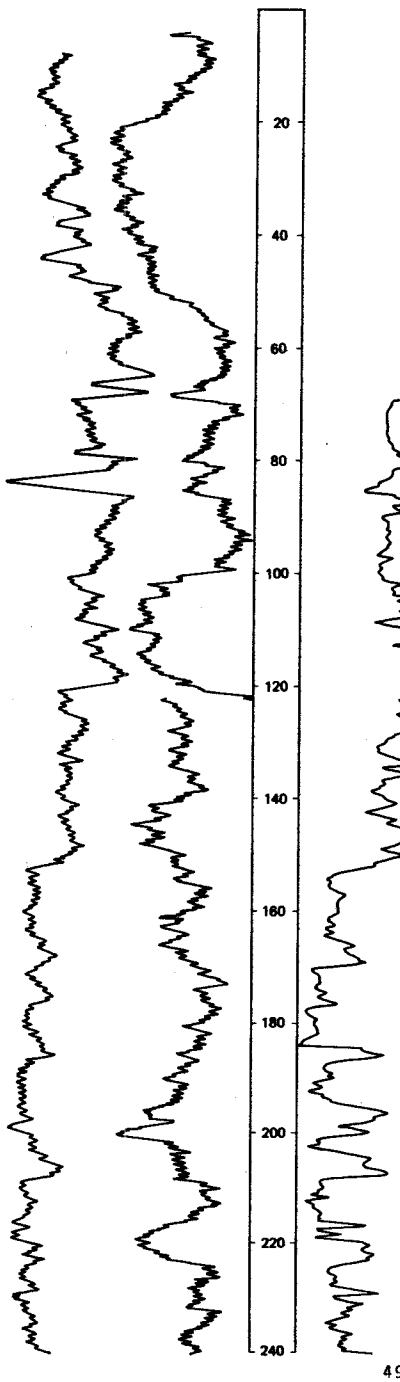
NDSWC 5972

LOCATION: 157-066-20CDD

DATE DRILLED: 9/10/81

ALTITUDE: 1462
(FT, NGVD)

DEPTH: 420
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-10	Silt, yellowish-brown, clayey, oxidized.
10-15	Silt, olive-gray, clayey.
15-44	Sand, fine to medium, rounded.
44-50	Gravel, coarse to very coarse, subrounded; cobbles; predominantly detrital shale.
50-64	Clay, olive-gray, sandy, pebbly (till).
64-110	Clay, brownish-gray, sandy, partially oxidized (till).
110-120	Sand, fine to very coarse, subrounded to rounded.
120-150	Clay, brownish-gray; interbedded with lenses of carbonaceous silt.
150-184	Silt, olive-gray; interbedded with clay; carbonaceous streaks.
184-274	Clay, olive-gray; interbedded with lenses of silt and sand.

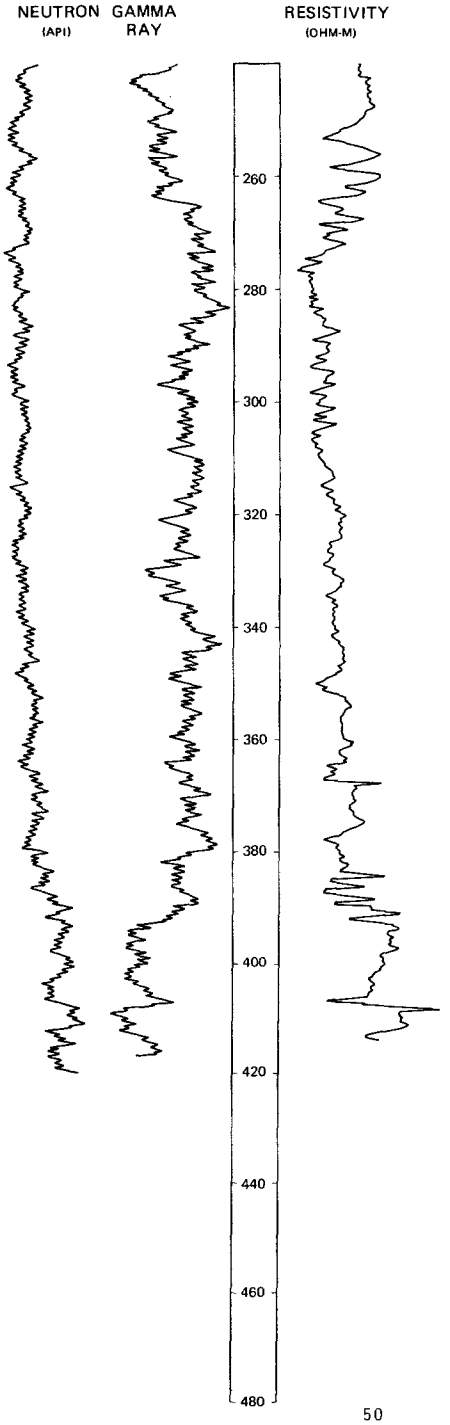
NDSWC 5972, Continued

LOCATION: 157-066-20CDD

DATE DRILLED: 9/10/81

ALTITUDE: (FT, NGVD) 1462

DEPTH: (FT) 420



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

274-368	Clay, olive-gray, silty.
368-390	Clay, olive-gray, sandy; carbonaceous streaks.
390-420	Claystone, dark-greenish-gray; interbedded with siltstone.

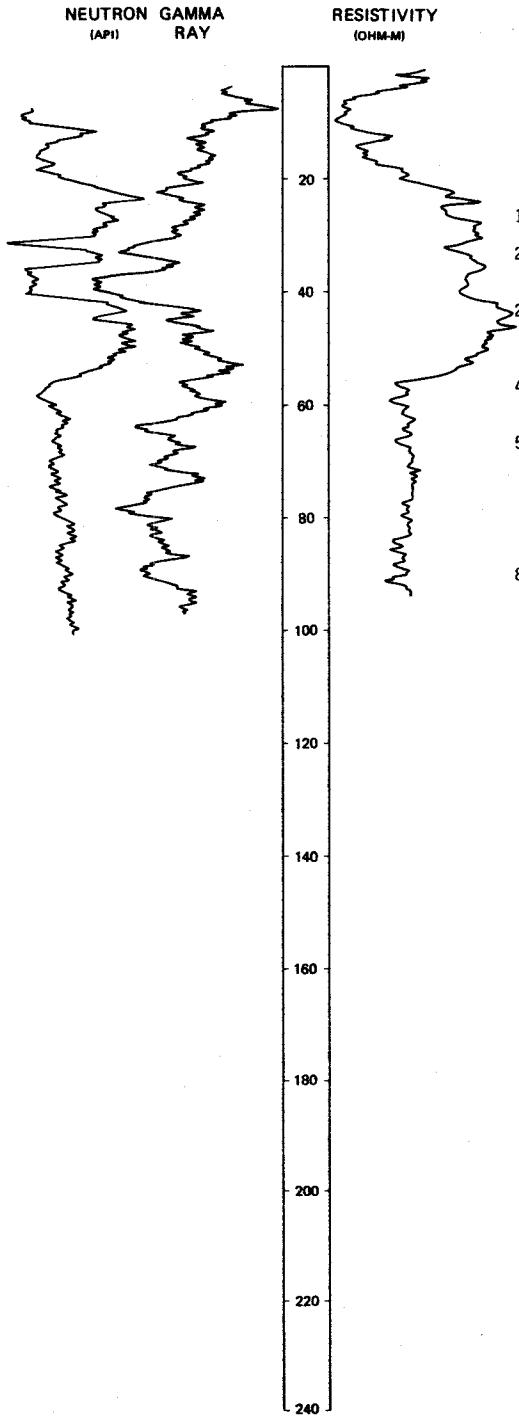
NDSWC 5976

LOCATION: 157-066-21ABB

DATE DRILLED: 9/15/81

ALTITUDE: 1455
(FT, NGVD)

DEPTH: 101
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-11	Silt, yellowish-orange, clayey, oxidized.
11-20	Silt, olive-gray, clayey.
20-28	Clay, olive-gray, pebbly (till).
28-40	Sand, coarse; interbedded with lenses of fine sub-angular gravel.
40-56	Clay, olive-gray, pebbly (till).
56-84	Shale, dark-gray, macerated; inclusions of clayey rounded siliceous shale pebbles.

PIERRE SHALE

84-101	Shale, grayish-black, siliceous, fractured.

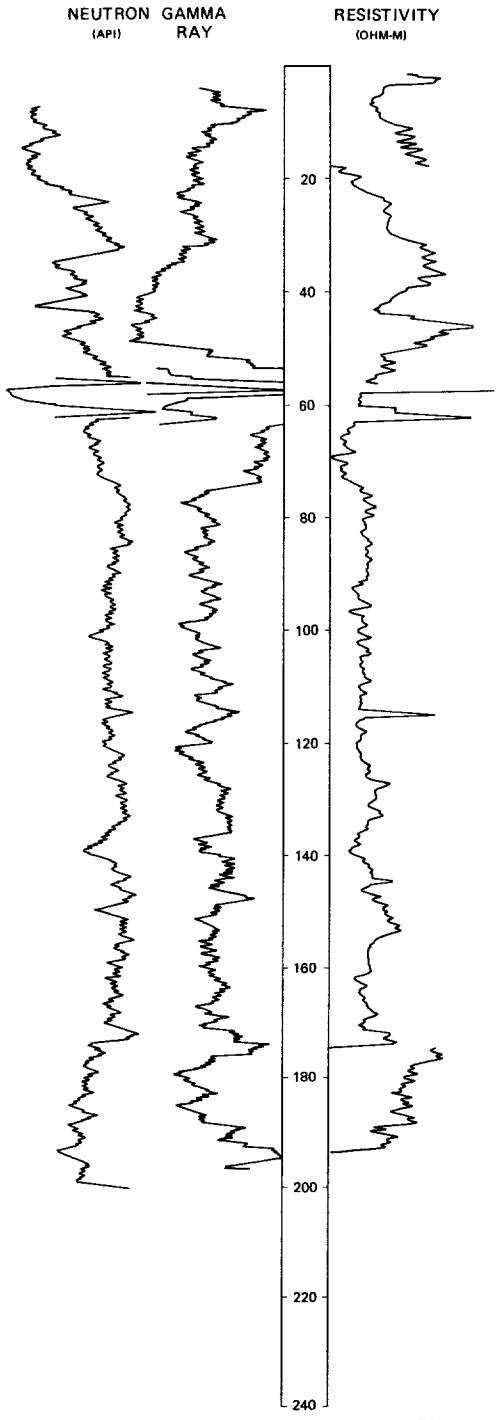
NDSWC 5975

LOCATION: 157-066-21CBB

DATE DRILLED: 9/15/81

ALTITUDE: 1455
(FT, NGVD)

DEPTH: 201
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-13	Silt, yellowish-orange, clayey, oxidized.
13-18	Silt, olive-gray, clayey.
18-30	Clay, olive-gray, very silty, pebbly (till).
30-48	Sand, very coarse; interbedded with fine to coarse angular to rounded gravel.
48-74	Clay, olive-gray, pebbly (till).
74-128	Clay, dark-gray, pebbly (till).
128-172	Clay, olive-gray, very sandy (till).

PIERRE SHALE

172-201	Shale, grayish-black, siliceous, fractured.

157-066-26DDD1
NDSWC 5705

Altitude: 1449 feet

Date drilled: 6/10/80

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, oxidized	9	10
	Clay, olive-gray, very plastic	5	15
	Clay, olive-gray, sandy to gravelly (till)	15	30
	Clay, olive-gray (till); interbedded with lenses of sand and gravel	30	60
	Silt, olive-gray, clayey	11	71
	Clay, olive-gray, silty, gravelly (till)	18	89
	Boulder, granite	1	90

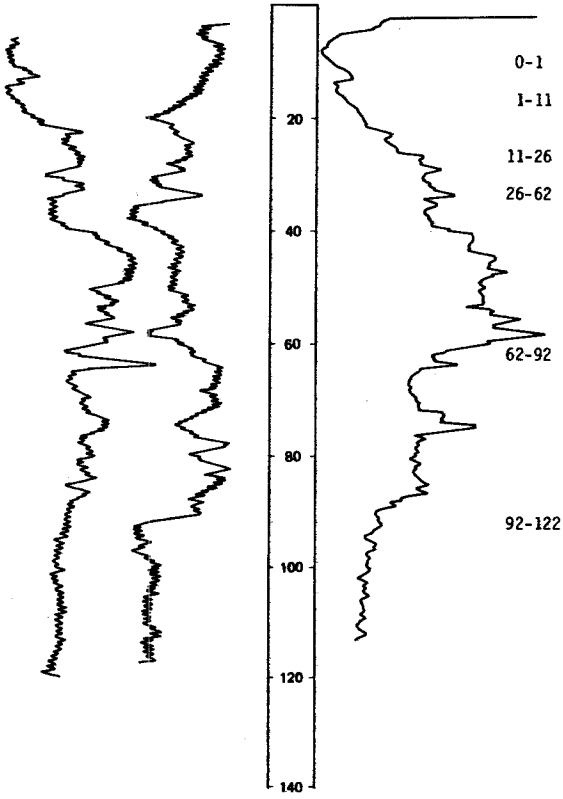
NDSWC 5705A

LOCATION: 157-066-26DDD2

DATE DRILLED: 6/10/80

ALTITUDE: 1449 (FT, NGVD)

DEPTH: 122 (FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-11	Clay, yellowish-brown, cohesive, oxidized.
11-26	Clay, olive-gray, cohesive.
26-62	Clay, olive-gray, very sandy to gravelly (till).
62-92	Clay, dark-gray (till); abundant detrital shale pebbles.

PIERRE SHALE

92-122	Shale, dusky-yellowish-brown, fractured.

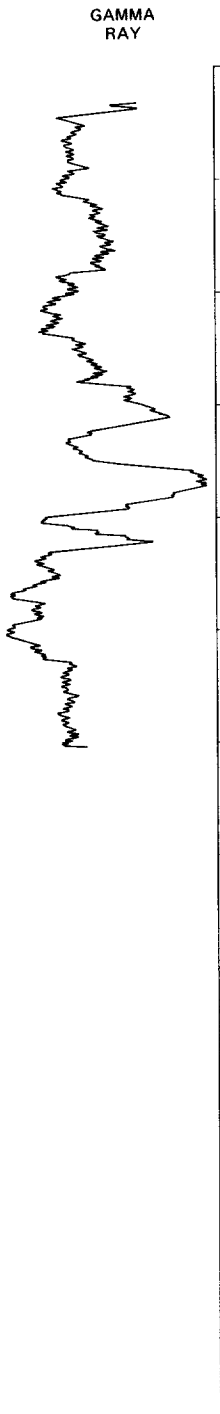
NDSWC 5707

LOCATION: 157-066-27DCC

DATE DRILLED: 6/10/80

ALTITUDE: 1451
(FT, NGVD)

DEPTH: 122
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-8	Clay, yellowish-brown, sandy, pebbly, oxidized (till).
8-78	Clay, brownish-gray (till); interbedded with thin lenses of sand and gravel.
78-106	Sand, fine to coarse, gravelly, subrounded to rounded; interbedded with thin lenses of clay; about 75 percent detrital lignite; abundant detrital shale.

PIERRE SHALE

106-122	Shale, dusky-yellowish-brown, fissile, very fractured.

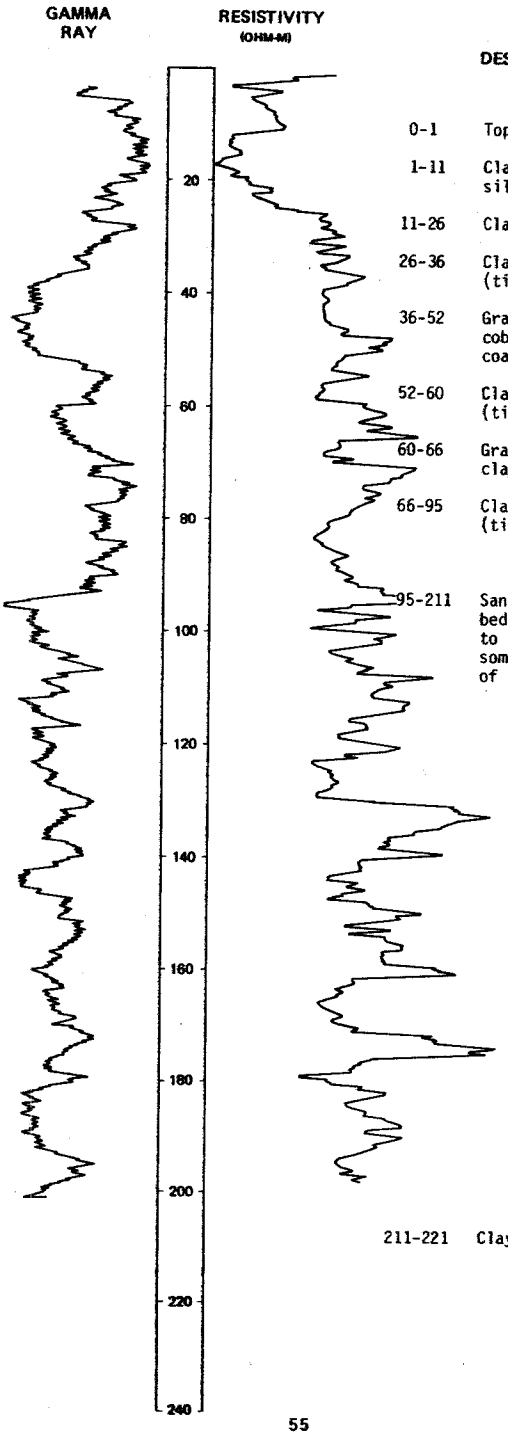
NDSWC 5974

LOCATION: 157-066-28CBB

DATE DRILLED: 9/14/81

ALTITUDE: 1455
(FT, NGVD)

DEPTH: 221
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-11	Clay, yellowish-brown, silty, oxidized.
11-26	Clay, olive-gray, silty.
26-36	Clay, olive-gray, silty (till).
36-52	Gravel, medium to coarse; cobbles; interbedded with coarse subrounded sand.
52-60	Clay, olive-gray, pebbly (till).
60-66	Gravel, fine to medium, clayey, subrounded.
66-95	Clay, dark-gray, pebbly (till).
95-211	Sand, very coarse; interbedded with fine angular to rounded gravel; with some interbedded lenses of silt and clay.
211-221	Clay, dark-gray, sandy.

157-066-28CBC
NDSWC 5973

Altitude: 1455 feet

Date drilled: 9/11/81

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil----------	1	1
	Silt, yellowish-brown, clayey, oxidized----------	9	10
	Silt, olive-gray, clayey----------	7	17
	Sand, medium to very coarse, well-rounded; predominantly quartz and carbonate grains----------	18	35
	Gravel, fine to medium, angular to rounded; with some lenses of clay----------	26	61

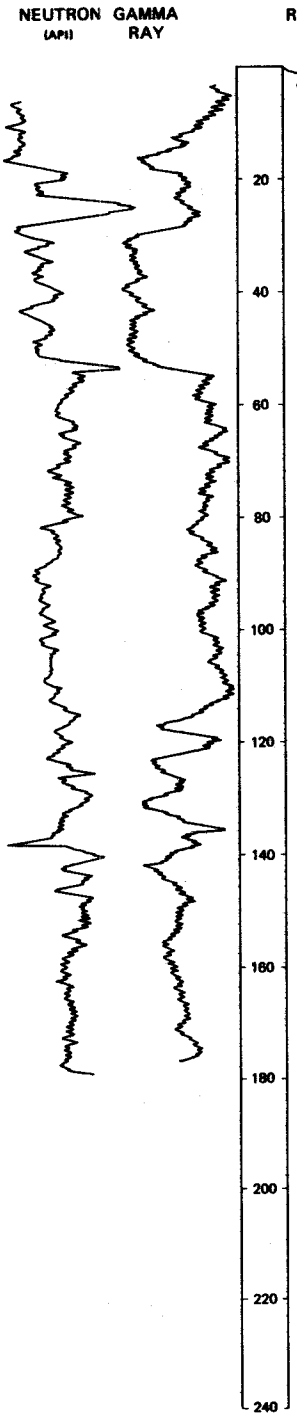
NDSWC 5708

LOCATION: 157-066-28DCC

DATE DRILLED: 6/11/80

ALTITUDE: 1450
(FT, NGVD)

DEPTH: 182
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-9	Clay, yellowish-brown, oxidized.
9-29	Clay, olive-gray.
29-54	Gravel, fine to coarse; about 30 percent fine to coarse subrounded to rounded sand.
54-92	Clay, olive-gray, sandy, pebbly (till).
92-113	Silt, olive-gray, clayey.
113-154	Silt, dark-gray; sandy lenses; gravelly from 149 to 154 feet.

PIERRE SHALE

154-182	Shale, dusky-yellowish-brown, fissile, very fractured.

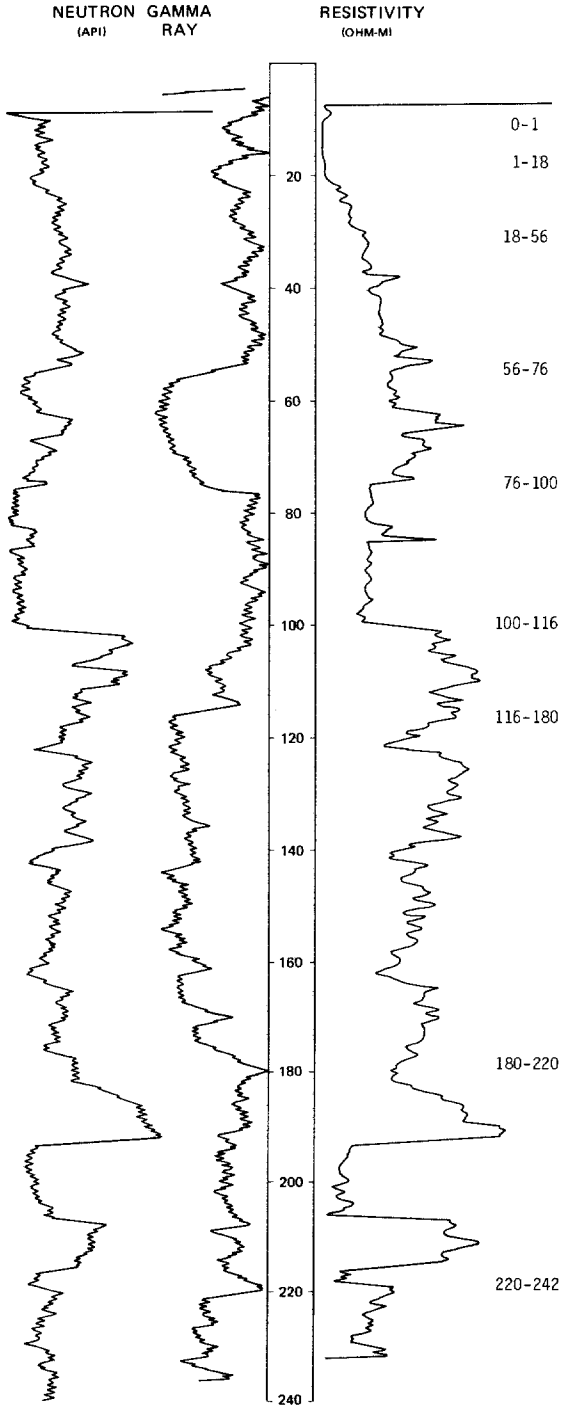
NDSWC 5709

LOCATION: 157-066-30AAA

DATE DRILLED: 6/11/80

ALTITUDE: 1460
(FT, NGVD)

DEPTH: 242
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-18	Clay, yellowish-brown, sandy, pebbly, oxidized (till).
18-56	Clay, olive-gray, very sandy, gravelly (till).
56-76	Sand, fine to coarse, gravelly, subrounded to rounded; predominately quartz, carbonate, and detrital shale grains.
76-100	Silt, olive-gray, clayey.
100-116	Clay, olive-gray, pebbly, sandy (till).
116-180	Gravel, fine to coarse; interbedded with thin lenses of silty clay; about 30 percent coarse angular to rounded sand; mostly igneous and carbonate pebbles.
180-220	Clay, brownish-gray (till); gravelly from 180 to 192 and 206 to 216 feet.

PIERRE SHALE

220-242	Shale, dusky-yellowish-brown, indurated, fissile, fractured.

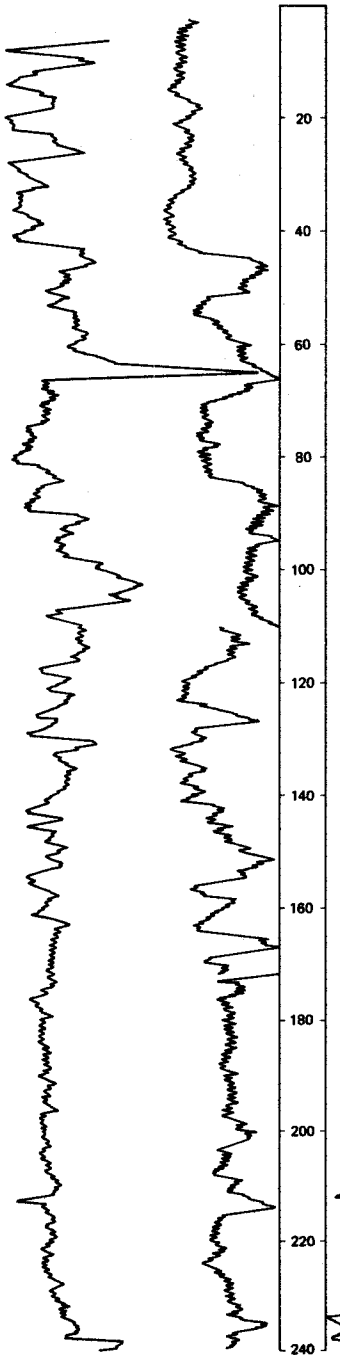
NDSWC 5711

LOCATION: 157-066-30ABB

DATE DRILLED: 6/12/80

ALTITUDE: 1470
(FT, NGVD)

DEPTH: 282
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-44	Sand, fine to coarse, gravelly, subrounded to rounded; about 70 percent quartz, 15 percent carbonate, and 15 percent detrital shale and lignite grains.
44-66	Clay, olive-gray, silty, gravelly (till).
66-108	Silt, brownish-gray, clayey.
108-125	Clay, brownish-gray, very sandy (till).
125-144	Silt, brownish-black, clayey, carbonaceous.
144-172	Clay, olive-gray, sandy (till).
172-262	Clay, brownish-gray (till); abundant detrital shale.

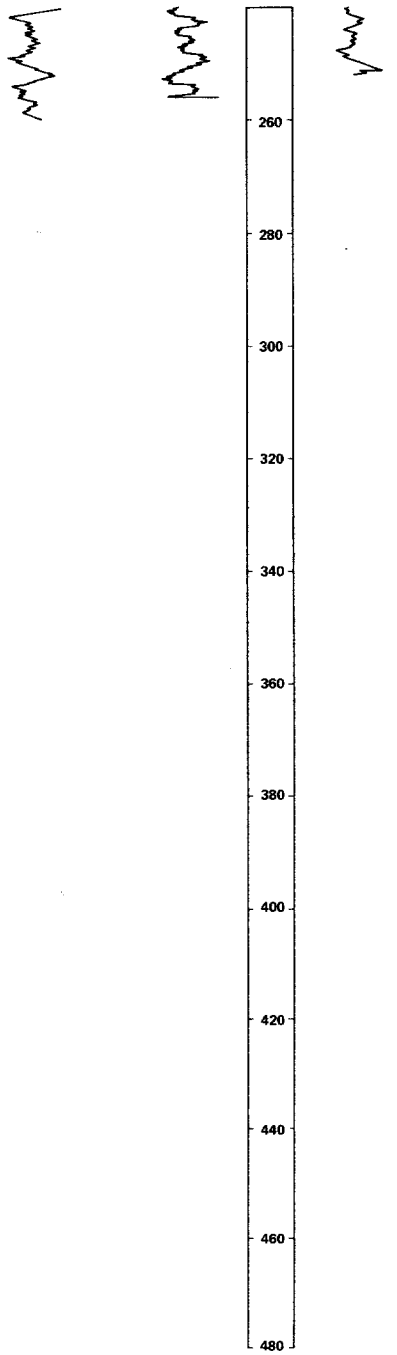
LOCATION: 157-066-30ABB

DATE DRILLED: 6/12/80

ALTITUDE: 1470
(FT, NGVD)

DEPTH: 282
(FT)

NEUTRON (API) GAMMA RAY RESISTIVITY (OHM-M)



DESCRIPTION OF DEPOSITS

PIERRE SHALE

262-282 Shale, dusky-yellowish-brown, siliceous, bentonitic, fissile.

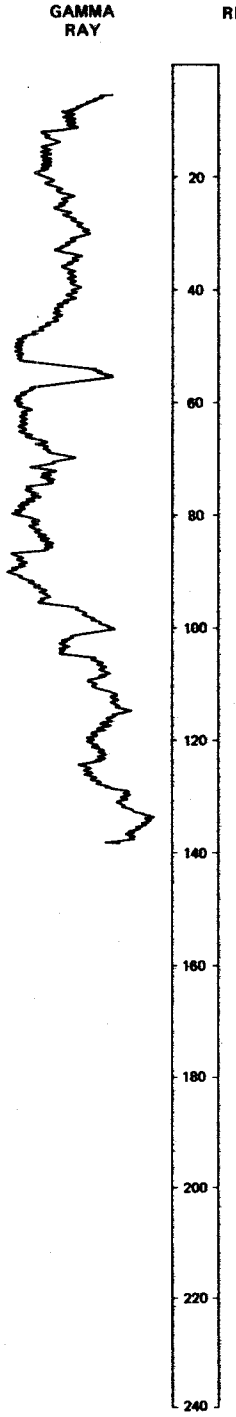
NDSWC 5702

LOCATION: 157-066-32AAB

DATE DRILLED: 6/09/80

ALTITUDE: 1460
(FT, NGVD)

DEPTH: 142
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-19	Clay, yellowish-brown, sandy, oxidized.
19-67	Clay, olive-gray, pebbly, very sandy (till).
67-96	Gravel, fine to coarse; about 30 percent fine to coarse subangular to rounded sand.
96-112	Silt, brownish-gray, clayey.
112-128	Shale, brownish-gray; interbedded with clayey silt.

PIERRE SHALE

128-142	Shale, dusky-yellowish-brown, siliceous, well-indurated.

157-066-32DCA1
(Log modified from C. A. Simpson & Son)

Altitude: 1457 feet — Date drilled: 7/27/81

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Fill	2	2
	Topsoil	1	3
	Clay, gray	1	4
	Clay, yellow	11	15
	Clay, blue, soft	2	17
	Clay, blue	4	21
	Sand, medium	6	27
	Clay, blue	4	31
	Sand, medium	3	34
	Clay, blue	8	42
	Sand; with clay layers	18	60
	Clay, blue	41	101
	Clay, blue, soft	34	135
	Clay, gray, soft	6	141

157-066-32DCA2
(Log modified from C. A. Simpson & Son)

Altitude: 1457 feet — Date drilled: 7/29/81

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	13	14
	Clay, blue	14	28
	Gravel	3	31
	Clay, blue	3	34
	Gravel	2	36
	Clay, blue	9	45
	Gravel, medium	5	50
	Clay, blue	10	60
	Sand, medium	5	65
	Clay, blue	3	68
	Rock, hard	1	69
	Clay, blue	17	86
	Rock	1	87
	Clay, blue	17	104
	Clay, blue, soft	18	122

157-066-320CA3
(Log modified from C. A. Simpson & Son)

Altitude: 1457 feet — Date drilled: 7/27/81

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow	12	13
	Clay, blue, soft	5	18
	Clay, blue	8	26
	Sand	1	27
	Clay, blue	2	29
	Sand	1	30
	Sand, very clayey	6	36
	Clay, blue	6	42
	Gravel, very clayey, and clay	12	54
	Gravel, coarse	2	56
	Clay, blue	2	58
	Sand, medium to fine	1	59
	Clay, blue	3	62
	Sand, medium	5	67
	Clay, blue; with stones	14	81

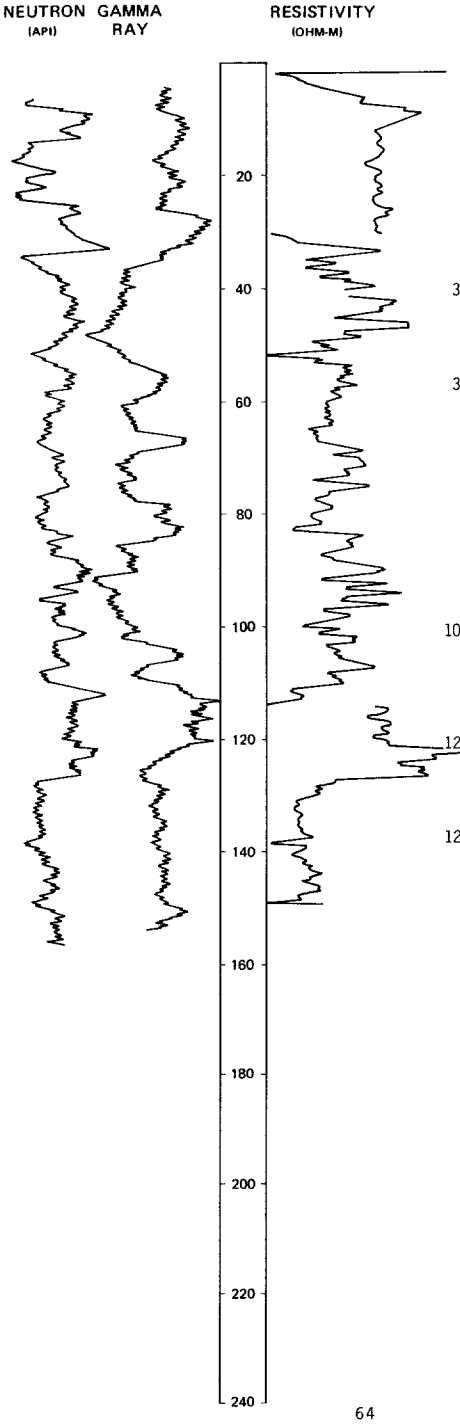
NDSWC 5703

LOCATION: 157-066-33AAA

DATE DRILLED: 6/10/80

ALTITUDE: 1448
(FT, NGVD)

DEPTH: 162
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-9	Clay, yellowish-brown, silty to sandy, oxidized (till).
9-33	Clay, olive-gray, sandy to gravelly (till).
33-37	Sand, medium to coarse, subangular to rounded; predominantly detrital shale.
37-100	Clay, olive-gray (till); interbedded with about 50 percent sand and gravel.
100-121	Clay, olive-gray, silty, sandy (till).
121-127	Silt, brownish-gray; abundant detrital shale.

PIERRE SHALE

127-162	Shale, dark-gray, bentonitic, indurated.

157-066-33CDD
(Log modified from Church Well Boring)

Altitude: 1455 feet

Date drilled: 8/01/75

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil, black	1	1
	Clay, yellow, sandy	2	3
	Sand, coarse, yellow	7	10
	Sand, coarse, yellow, wet	2	12
	Sand, fine, yellow	11	23

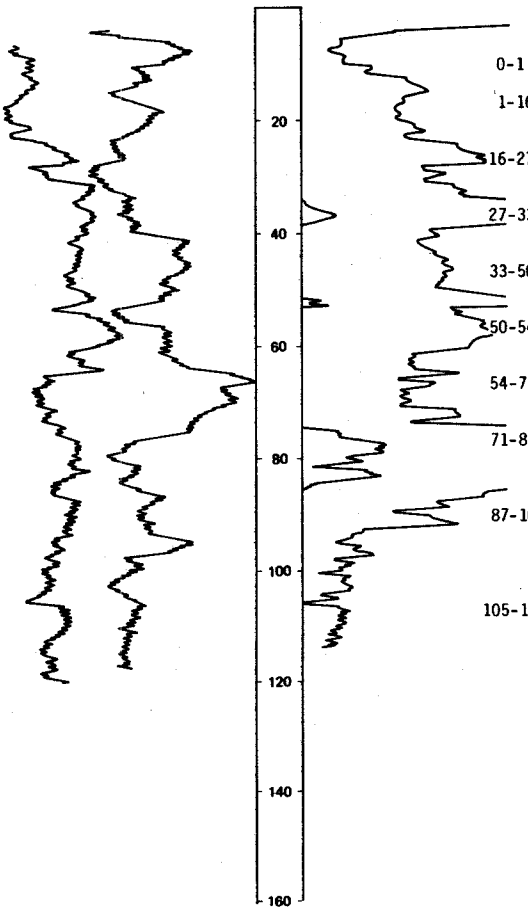
NDSWC 5704

LOCATION: 157-066-34AAD

DATE DRILLED: 6/10/80

ALTITUDE: 1455 (FT, NGVD)

DEPTH: 122 (FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-16	Clay, yellowish-brown, oxidized.
16-27	Clay, olive-gray, sandy, gravelly (till).
27-33	Gravel, fine to medium, sandy, subrounded.
33-50	Clay, olive-gray, sandy, pebbly (till).
50-54	Gravel, fine to coarse, sandy.
54-71	Clay, olive-gray, sandy, gravelly.
71-87	Silt, greenish-gray, clayey.
87-105	Clay, dark-gray (till); abundant detrital shale.

PIERRE SHALE

105-122	Shale, dark-brownish-gray, well-indurated.

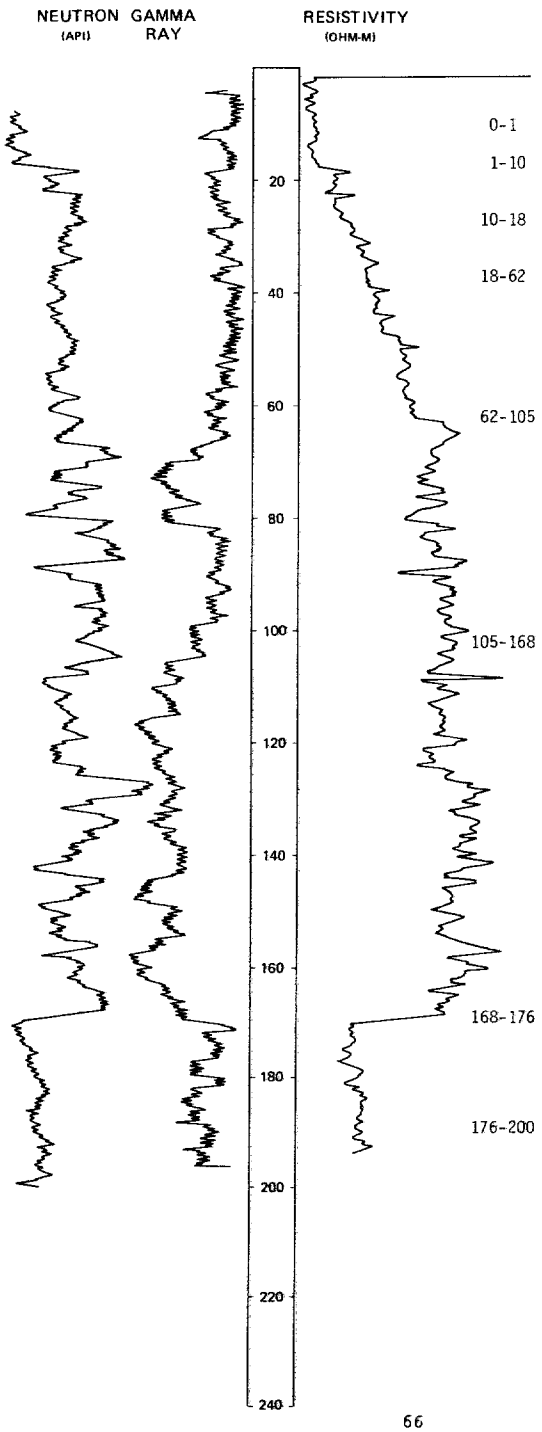
NDSWC 5962

LOCATION: 157-067-01DDD

DATE DRILLED: 8/27/81

ALTITUDE: 1475
(FT, NGVD)

DEPTH: 200
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-10	Clay, yellowish-brown, silty, oxidized.
10-18	Silt, yellowish-brown, clayey, oxidized.
18-62	Clay, olive-gray, pebbly (till).
62-105	Clay, brownish-gray (till); interbedded with lenses of medium gravel.
105-168	Sand, fine to very coarse; interbedded with fine to coarse subrounded gravel; occasionally thin lenses of interbedded clay.
168-176	Shale, dark-greenish-gray, macerated; inclusions of rounded shale pebbles.

PIERRE SHALE

176-200	Shale, dark-gray, poorly indurated, fissile, tight.

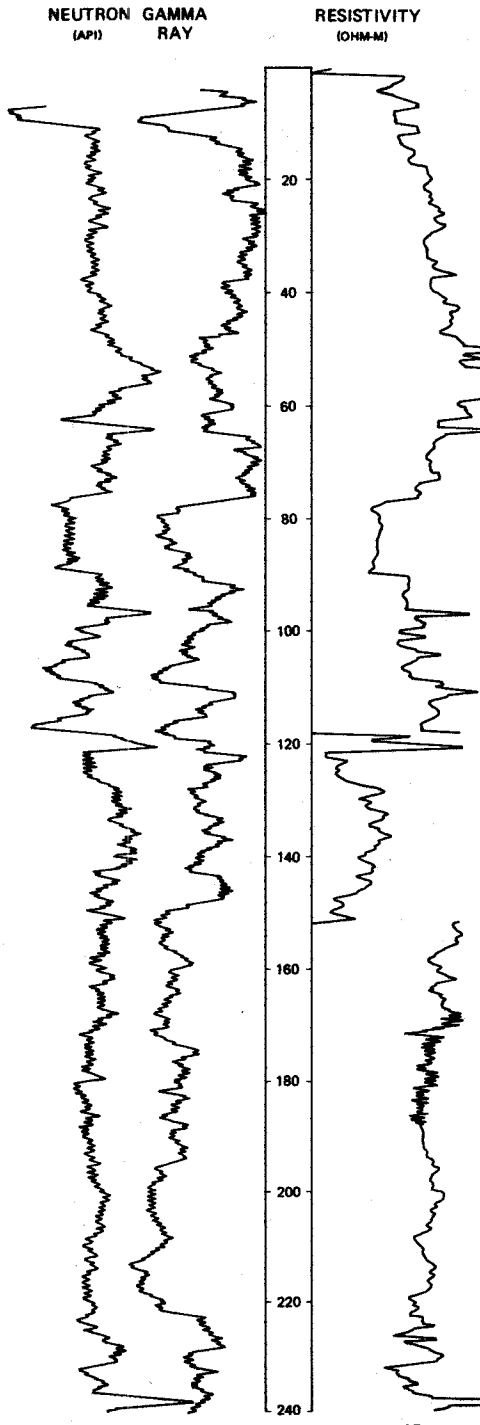
NDSWC 5965

LOCATION: 157-067-03BCC

DATE DRILLED: 9/01/81

ALTITUDE: 1480
(FT, NGVD)

DEPTH: 300
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-18	Clay, yellowish-brown, pebbly, oxidized (till).
18-48	Clay, olive-gray, gravelly (till).
48-76	Clay, olive-gray (till); interbedded with thin lenses of sand and gravel.
76-90	Shale, greenish-black, indurated, fractured.
90-97	Clay, olive-gray, pebbly (till).
97-110	Sand, very coarse; interbedded with fine to coarse subrounded clayey gravel.
110-118	Silt, olive-gray, sandy.
118-122	Sand, medium to coarse; interbedded with fine subrounded gravel; predominantly quartz grains.
122-142	Silt, dark-gray, clayey.
142-150	Shale, dark-gray, pebbly, macerated.
150-190	Clay, dark-gray, sandy, pebbly (till).
190-210	Shale, greenish-black, indurated, fractured, macerated.
210-244	Clay, dark-gray, sandy (till); abundant detrital shale pebbles.

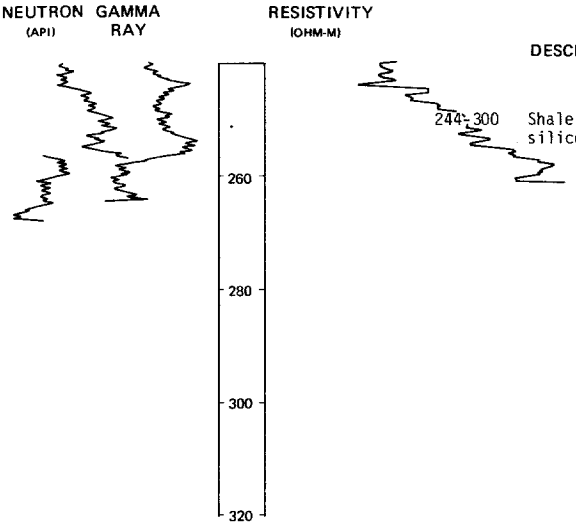
NDSWC 5965, Continued

LOCATION: 157-067-03BCC

DATE DRILLED: 9/01/81

ALTITUDE: 1480
(FT, NGVD)

DEPTH: 300
(FT)



DESCRIPTION OF DEPOSITS

PIERRE SHALE

244-300 Shale, grayish-black, siliceous, fractured.

157-067-03DDD
NDSWC 5964

Altitude: 1485 feet

Date drilled: 8/31/81

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, pebbly, oxidized (till)	19	20
	Clay, olive-gray, pebbly (till)	43	63
	Gravel, fine to coarse, subrounded	7	70
	Clay, olive-gray, very sandy (till)	3	73
	Sand, fine to coarse; interbedded with coarse angular to rounded gravel	7	80
	Clay, olive-gray, sandy, pebbly (till)	25	105
	Gravel, fine to coarse, sandy; predominantly detrital shale and lignite	7	112
	Clay, olive-gray, gravelly (till); boulders	18	130
Pierre Shale:			
	Shale, dark-grayish-black, siliceous	20	150

157-067-05ADD
(Log modified from C. A. Simpson & Son)

Altitude: 1490 feet

Date drilled: 8/18/65

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	21	22
	Clay, blue	23	45
	Clay, blue, sandy	18	63
	Clay, blue, gravelly	7	70
	Clay, blue	28	98
Pierre Shale:			
	Shale	107	205

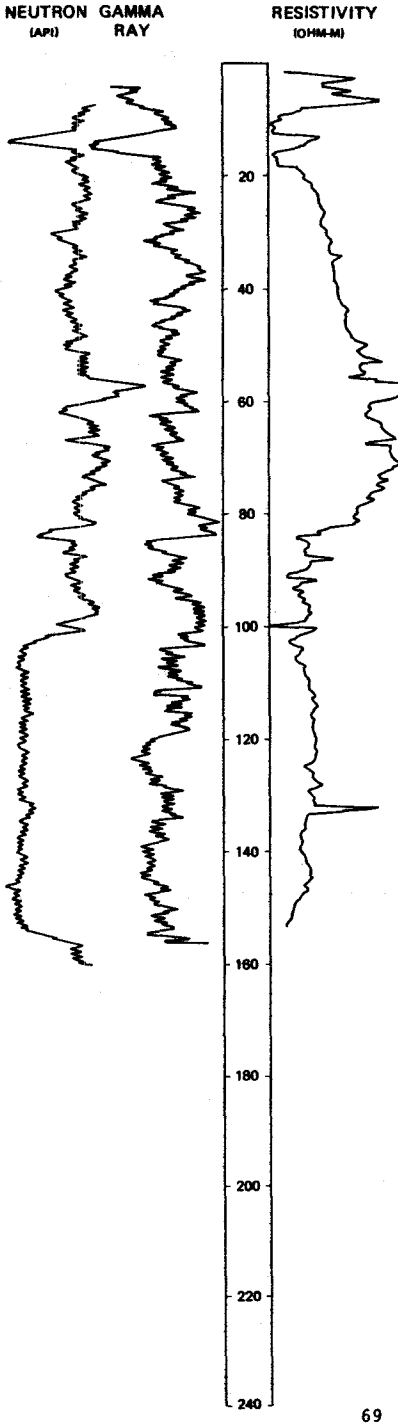
NDSWC 5966

LOCATION: 157-067-08AAB

DATE DRILLED: 9/02/81

ALTITUDE: 1480
(FT, NGVD)

DEPTH: 160
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-19	Clay, yellowish-brown, oxidized (till); interbedded with lenses of sand and gravel.
19-52	Clay, olive-gray, pebbly (till).
52-82	Clay, olive-gray, sandy (till).
82-85	Clay, dark-gray, shaly (till).
85-102	Clay, greenish-gray, silty; mixed with detrital shale fragments.

FOX HILLS SANDSTONE

102-153	Shale, greenish-gray; interbedded with siltstone and thin lenses of bentonite.

PIERRE SHALE

153-160	Shale, grayish-black, siliceous, fractured.

NDSWC 5963

LOCATION: 157-067-11AAA

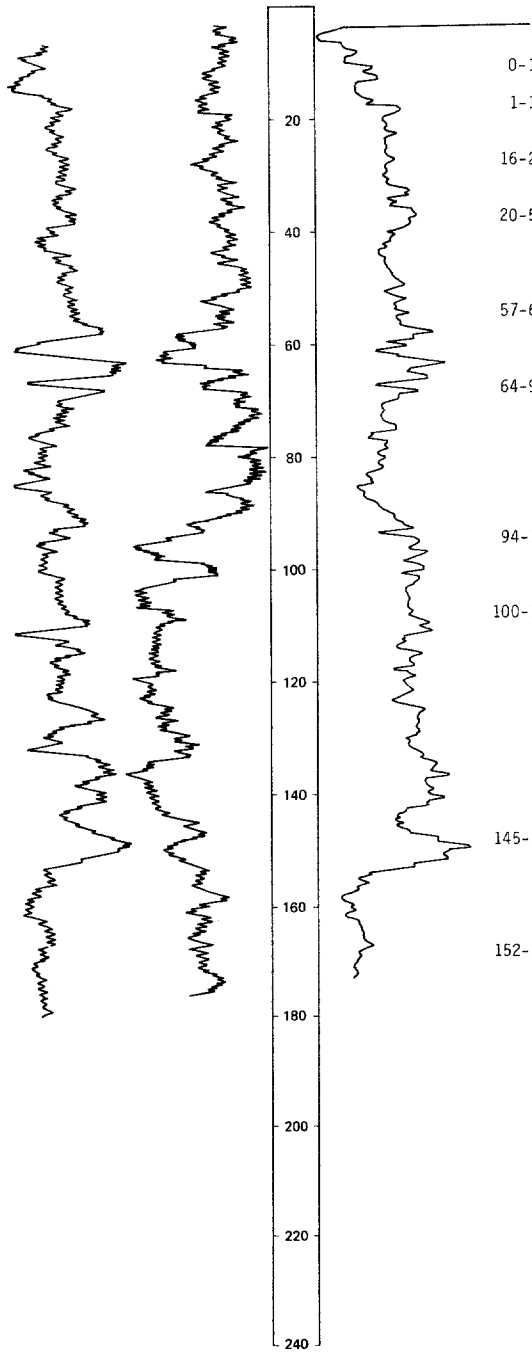
DATE DRILLED: 8/28/81

ALTITUDE: 1485
(FT, NGVD)

DEPTH: 180
(FT)

NEUTRON (API) GAMMA RAY

RESISTIVITY (OHM-M)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-16	Silt, yellowish-brown, clayey, oxidized.
16-20	Clay, yellowish-brown, pebbly (till).
20-57	Clay, olive-gray, pebbly (till).
57-64	Sand, fine to coarse; interbedded with fine gravel and clay.
64-94	Clay, olive-gray, sandy to gravelly (till).
94-100	Sand, fine; interbedded with lenses of carbonaceous clay and detrital lignite.
100-145	Sand, fine to coarse; interbedded with lenses of fine subrounded gravel.
145-152	Gravel, fine to coarse, sandy, subangular to rounded.

PIERRE SHALE

152-180	Shale, grayish-black, siliceous, fractured.

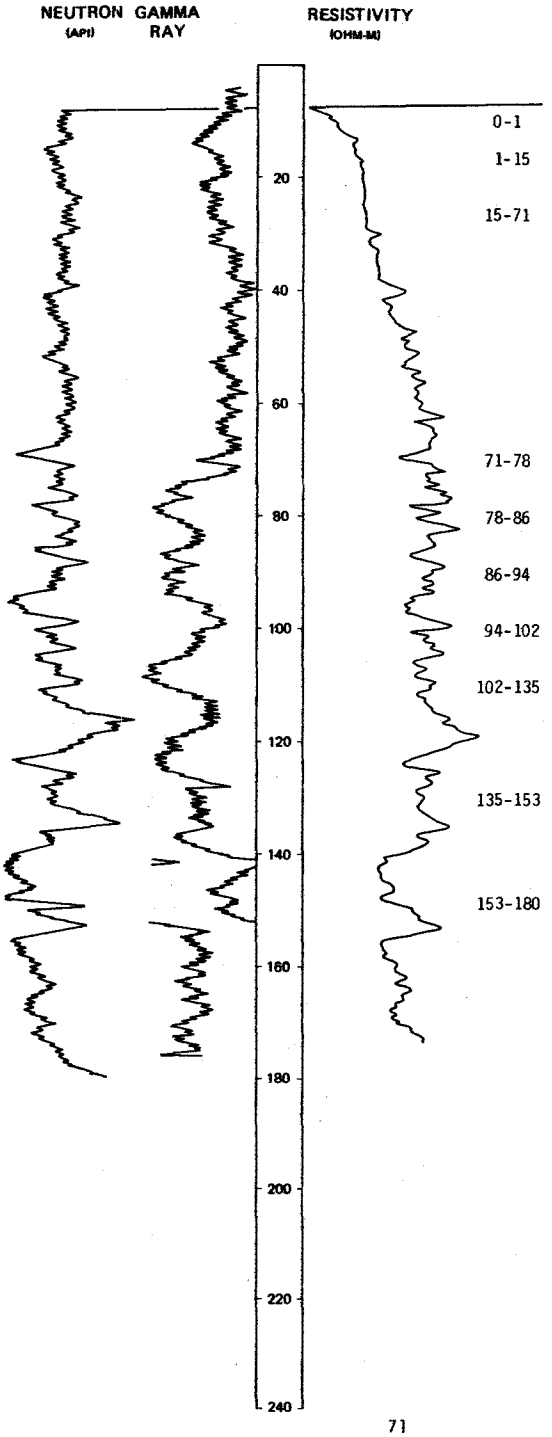
NDSWC 5971

LOCATION: 157-067-12CDD

DATE DRILLED: 9/10/81

ALTITUDE: 1478
(FT, NGVD)

DEPTH: 180
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-15	Clay, yellowish-brown, pebbly, oxidized (till).
15-71	Clay, olive-gray, pebbly (till).
71-78	Gravel, fine to coarse, clayey, subrounded.
78-86	Clay, olive-gray to brownish-gray, sandy (till).
86-94	Sand, fine to coarse, angular to rounded.
94-102	Clay, olive-gray to brown, sandy (till).
102-135	Sand, fine to very coarse; interbedded with coarse subangular gravel; lenses of silty clay.
135-153	Clay, olive-gray, sandy to gravelly (till).

PIERRE SHALE

153-180	Shale, grayish-black, moderately indurated, fissile.

157-067-14CAA
(Log modified from Marchus Drilling)

Altitude: 1501 feet — Date drilled: 4/24/78

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Dirt, black	1	1
	Till, yellow	12	13
	Till, yellow, and gravel	15	28
	Till, gray, and gravel	44	72
	Gravel and sand	4	76
	Till, gray	2	78

157-067-17CDD
(Log modified from Marchus Drilling)

Altitude: 1490 feet — Date drilled: 7/20/79

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	22	23
	Clay, gray	14	37
	Rock	1	38
	Clay, gray	25	63
	Gravel, sand, and shale	20	83

157-067-20BCA
(Log modified from C. A. Simpson & Son)

Altitude: 1505 feet — Date drilled: 11/28/70

Glacial drift:			
	Clay, yellow	25	25
	Gravel	8	33
	Clay, blue, sandy	37	70
	Sand, hard	5	75
	Sand, clayey, hard	36	111
	Sand	6	117

157-067-22CCC
NDSWC 5780

Altitude: 1489 feet — Date drilled: 7/24/80

Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, very silty, oxidized (till)	24	25
	Clay, olive-gray, very silty to sandy (till)	45	70
	Gravel, fine; about 40 percent fine to very coarse angular to rounded sand	11	81
	Clay, dark-gray, very sandy (till)	19	100
	Clay, olive-gray (till); interbedded with thin lenses of sand and gravel	41	141
Pierre Shale:			
	Shale, dark-gray, siliceous, well-indurated	21	162

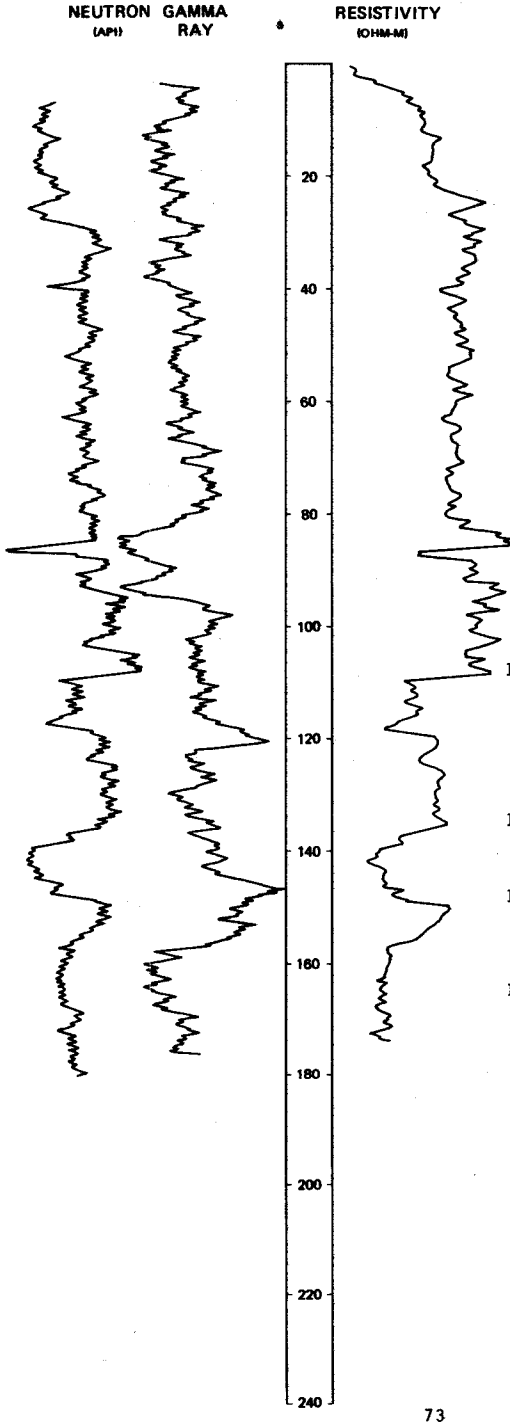
NDSWC 5969

LOCATION: 157-067-24AAA

DATE DRILLED: 9/02/81

ALTITUDE: 1478
(FT, NGVD)

DEPTH: 180
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-20	Silt, yellowish-orange, oxidized.
20-24	Silt, olive-gray, clayey.
24-40	Clay, olive-gray, pebbly (till).
40-60	Clay, brownish-gray (till); interbedded with lenses of fine silty sand.
60-80	Clay, olive-gray, pebbly (till).
80-93	Sand, fine; interbedded with medium very clayey angular to rounded gravel.
93-109	Clay, olive-gray; interbedded with fine to coarse gravelly sand.
109-136	Clay, brownish-gray, sandy (till); cobbles.
136-148	Clay, olive-gray, pebbly (till).
148-156	Clay, olive-gray, sandy to gravelly (till).

PIERRE SHALE

156-180	Shale, grayish-black, fissile, well-indurated, tight.

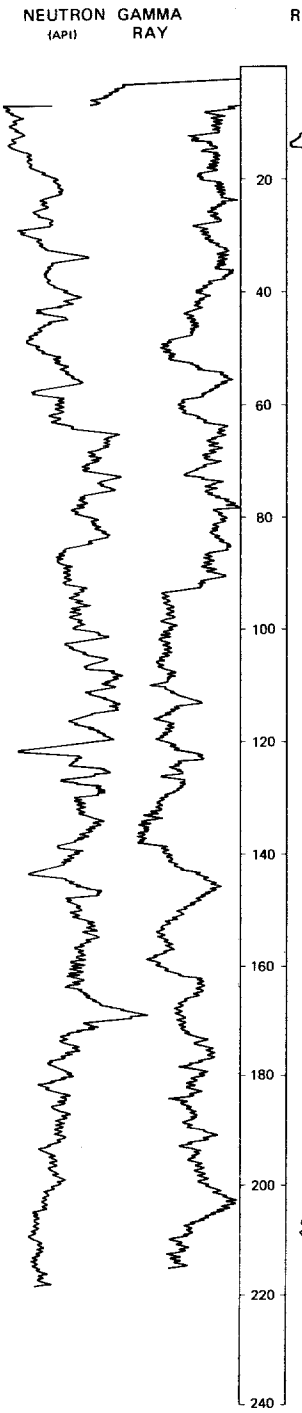
NDSWC 5710

LOCATION: 157-067-25AAA

DATE DRILLED: 6/11/80

ALTITUDE: 1473
(FT, NGVD)

DEPTH: 222
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-14	Clay, yellowish-brown, silty, pebbly, oxidized (till).
14-30	Silt, olive-gray, clayey.
30-94	Clay, olive-gray, silty, gravelly (till).
94-144	Sand, fine to coarse, gravelly, subangular to rounded.
144-203	Gravel, medium to coarse, sandy, subangular to rounded; interbedded with thin lenses of silt; abundant detrital shale.

PIERRE SHALE

203-222	Shale, dusky-brownish-gray, siliceous, fissile, fractured.

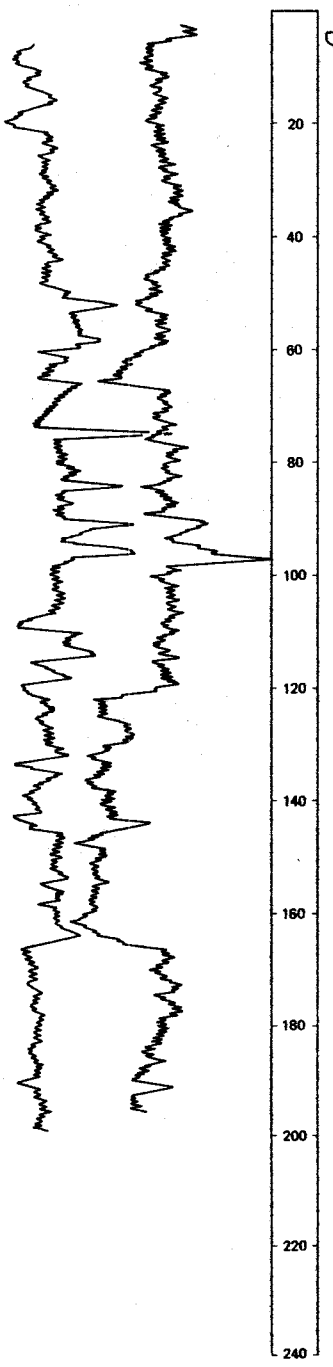
NDSWC 5712

LOCATION: 157-067-25BBB

DATE DRILLED: 6/12/80

ALTITUDE: 1474
(FT, NGVD)

DEPTH: 202
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-14	Clay, yellowish-brown, sandy, oxidized (till).
14-49	Clay, olive-gray, sandy (till).
49-122	Clay, medium-gray, sandy (till); occasional boulders; interbedded with thin lenses of gravel.
122-166	Sand, fine to coarse; about 20 percent medium to coarse angular to rounded gravel.

PIERRE SHALE

166-202	Shale, dark-gray, indurated; interbedded with brownish-gray bentonitic siltstone.

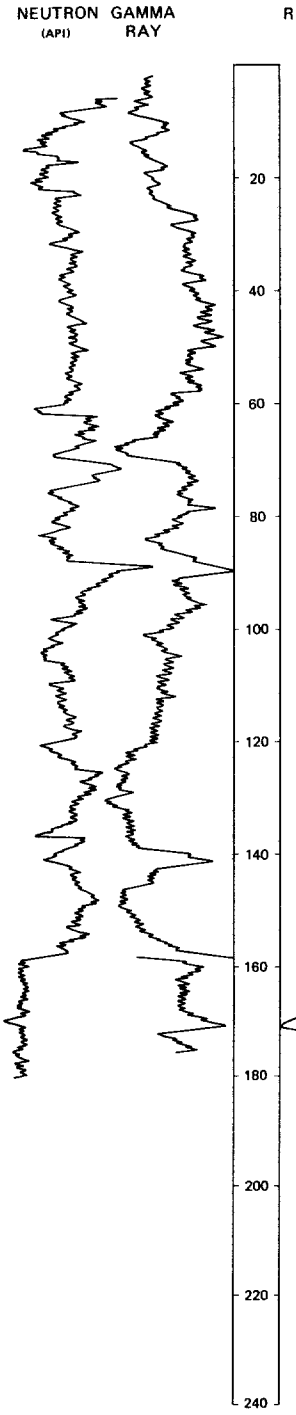
NDSWC 5779

LOCATION: 157-067-27AAA

DATE DRILLED: 7/24/80

ALTITUDE: 1498
(FT, NGVD)

DEPTH: 182
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-6	Clay, yellowish-brown, sandy, oxidized (till).
6-9	Sand, fine to coarse, gravelly, angular to rounded, oxidized.
9-29	Clay, yellowish-brown, very silty, gravelly, oxidized (till).
29-62	Clay, olive-gray, very silty, pebbly (till).
62-120	Clay, olive-gray, silty (till); interbedded with thin lenses of gravel; abundant detrital shale.
120-141	Sand, fine to coarse; about 40 percent fine to coarse poorly sorted angular to rounded gravel.
141-160	Sand, fine to coarse, gravelly, predominately rounded; with thin lenses of silt.

PIERRE SHALE(?)

160-182	Shale, dark-gray, very silty, argillaceous, bentonitic, moderately indurated.

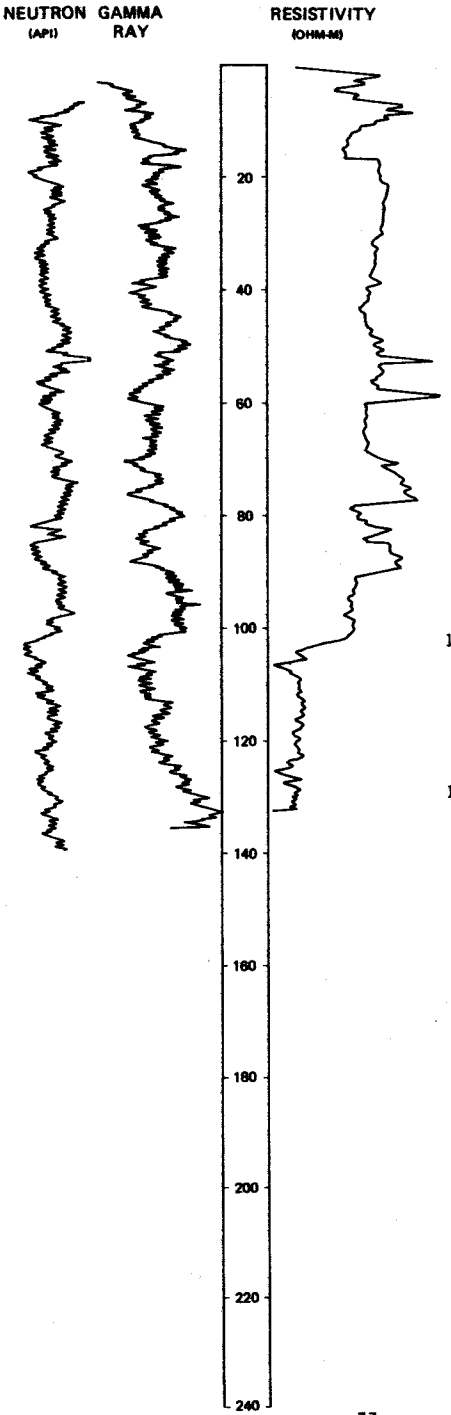
NDSWC 5967

LOCATION: 157-067-29AAA

DATE DRILLED: 9/02/81

ALTITUDE: 1493
(FT, NGVD)

DEPTH: 140
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-15	Clay, yellowish-brown, pebbly (till).
15-52	Clay, olive-gray, pebbly (till).
52-90	Clay, dark-gray (till); interbedded with lenses of sand and gravel.
90-102	Clay, dark-gray, pebbly, tight (till).
102-130	Clay, dark-gray, silty (till); predominantly detrital shale.

PIERRE SHALE

130-140	Shale, dark-grayish-black, silty, indurated; thin lenses of limestone.

157-068-01DBB
(Log modified from Marchus Drilling)

Altitude: 1512 feet — Date drilled: 7/16/79

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow	33	34
	Clay, gray	17	51
	Sand and gravel	1	52
	Clay, gray	18	70
	Sand, fine, black	25	95
Pierre Shale(?):			
	Shale	50	145
	Shale; water	3	148
	Shale	5	153

157-068-03DAA
(Log modified from C. A. Simpson & Son)

Altitude: 1520 feet — Date drilled: 1963

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	21	22
	Clay, blue	23	45
	Clay, blue, sandy	20	65
	Clay, blue	45	110
	Sand, clayey	9	119
Pierre Shale:			
	Shale, blue	9	128
	Shale	100	228

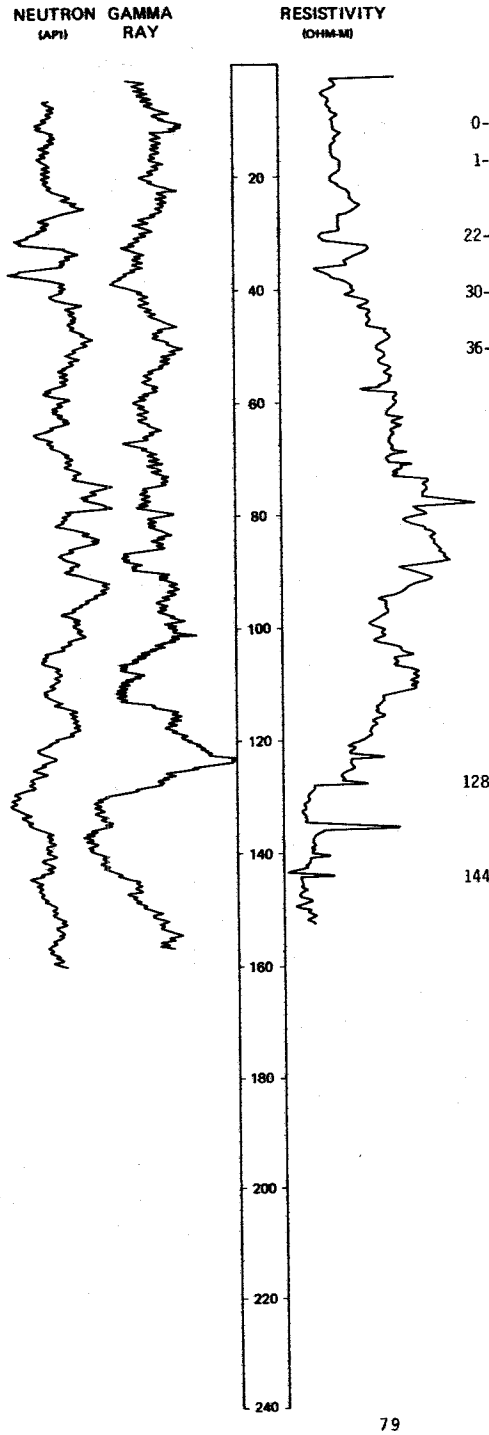
NDSWC 5713

LOCATION: 157-068-16DDD

DATE DRILLED: 6/13/80

ALTITUDE: 1522
(FT, NGVD)

DEPTH: 162
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-22	Clay, yellowish-brown, silty, pebbly, oxidized (till).
22-30	Clay, olive-gray, silty, pebbly (till).
30-36	Sand, medium, gravelly, angular to rounded.
36-128	Clay, olive-gray, silty (till); occasional thin lenses of sand and gravel.

PIERRE SHALE

128-144	Shale, dark-gray, indurated, fractured.
144-162	Shale, dark-gray, well-indurated, fissile.

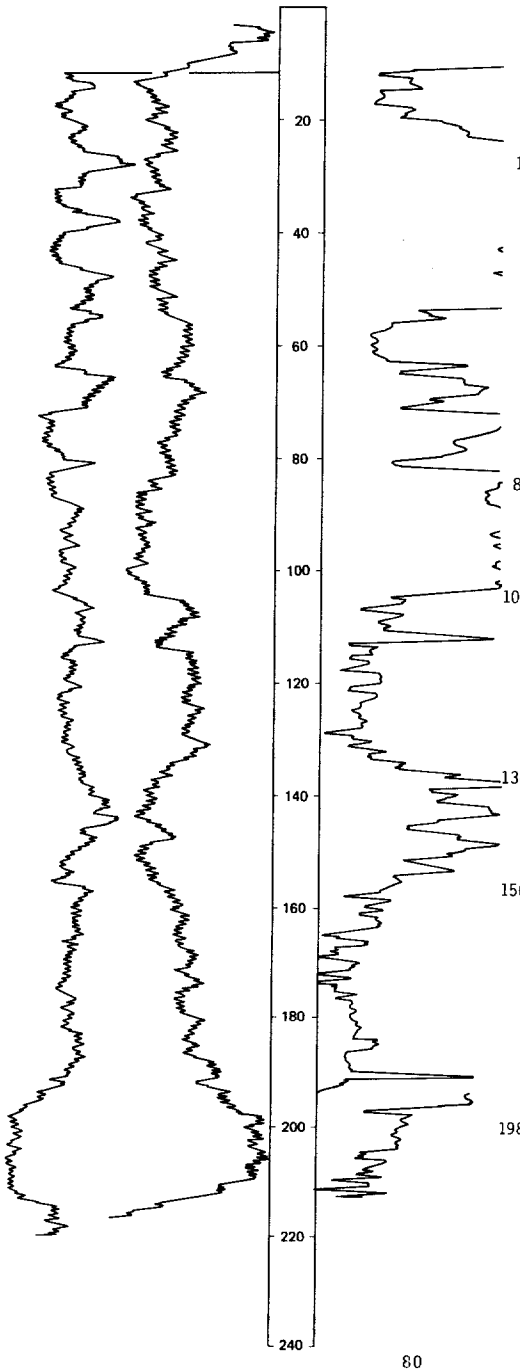
NDSWC 5715

LOCATION: 157-068-17CCC

DATE DRILLED: 6/13/80

ALTITUDE: (FT, NGVD) 1572

DEPTH: (FT) 222



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-14	Clay, yellowish-brown, sandy, oxidized (till).
14-82	Clay, olive-gray, very silty, gravelly (till).
82-104	Sand, very fine to fine, silty, subrounded to rounded.
104-134	Silt, dark-gray, clayey.
134-156	Clay, olive-gray, silty (till); interbedded with lenses of sand and gravel.
156-198	Clay, dark-gray, silty, gravelly (till).

PIERRE SHALE

198-222	Shale, dark-gray, fissile; interbedded with dark-gray moderately indurated siltstone.

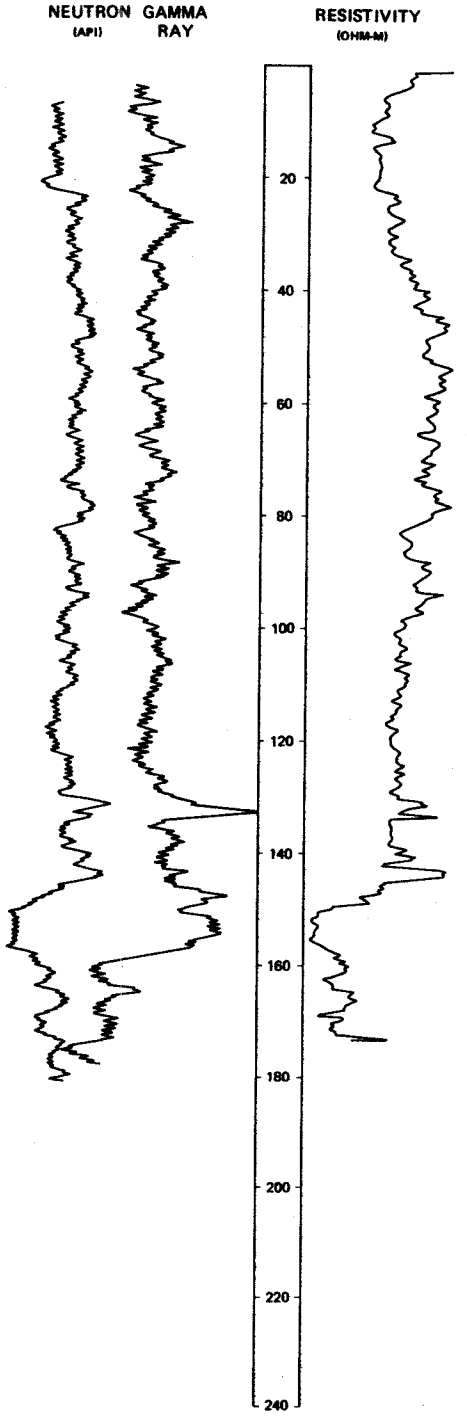
NDSWC 5714

LOCATION: 157-068-20AAA

DATE DRILLED: 6/13/80

ALTITUDE: 1538
(FT, NGVD)

DEPTH: 182
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-22	Clay, yellowish-brown, silty, pebbly, oxidized (till).
22-150	Clay, olive-gray, sandy to gravelly (till).
150-158	Clay, dark-gray (till); mostly detrital shale.

PIERRE SHALE

158-182	Shale, dark-gray, fissile, fractured.

157-068-23CCC
(Log modified from C. A. Simpson & Son)

Altitude: 1511 feet — Date drilled: 1/24/73

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow, sandy	21	22
	Clay, blue	28	50
	Clay, blue, gravelly	10	60
	Clay, blue	18	78
	Sand, dry	7	85
	Clay, blue, rocky	10	95
	Sand, clayey; cleaner at bottom	17	112
	Clay, blue; with small rocks	34	146
	Gravel, clayey	9	155
Pierre Shale:			
	Shale; started getting water at 247 feet	122	277

157-068-29DDC
(Log modified from C. A. Simpson & Son)

Altitude: 1581 feet — Date drilled: 6/ /75

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	34	35
	Clay, blue	30	65
	Sand, fine, soupy	15	80
	Clay, blue, very gravelly	25	105
	Gravel, dirty	18	123
	Sand, fine, blue, clayey	14	137

157-068-33CBA
(Log modified from Church Well Boring)

Altitude: 1578 feet — Date drilled: 7/01/77

Glacial drift:			
	Topsoil, black	1	1
	Clay, yellow	23	24
	Clay, yellow and blue	8	32
	Clay, blue, sandy	2	34
	Clay, blue, pebbly	20	54
	Clay, blue, hard	10	64
	Clay, blue, pebbly	19	83
	Gravel, coarse, and large rocks	2	85

157-068-35DDC
(Log modified from Jacobson Drilling)

Altitude: 1510 feet — Date drilled: 5/15/67

Glacial drift:			
	Topsoil	2	2
	Clay, yellow	13	15
	Clay, gray	24	39
	Sand, fine to medium to coarse	6	45
	Clay, gray	5	50
	Gravel, fine to medium to coarse	16	66

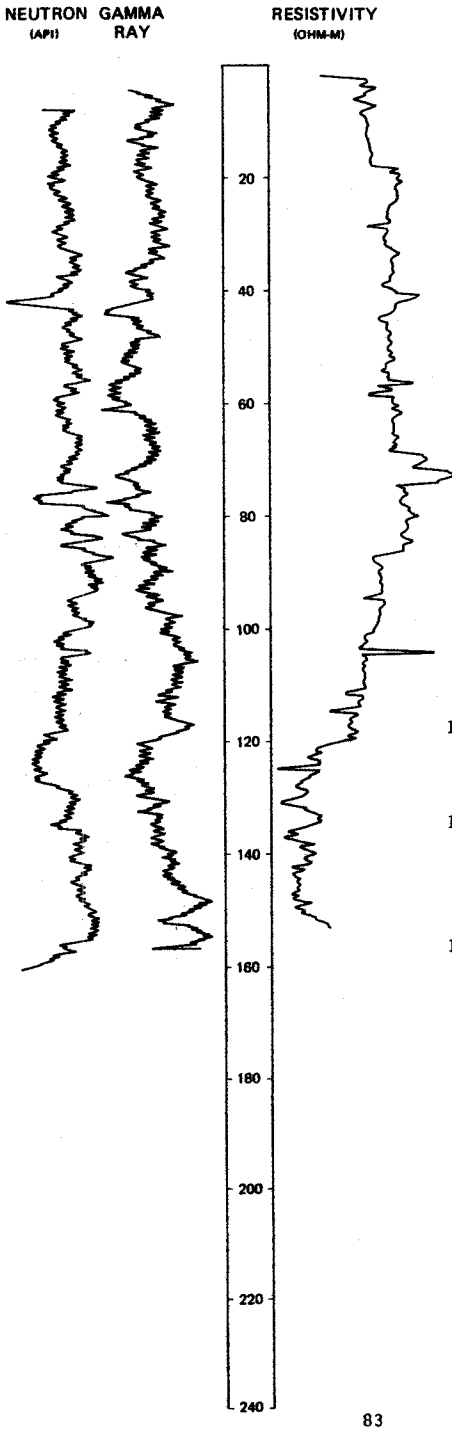
NDSWC 5968

LOCATION: 157-068-36AAA

DATE DRILLED: 9/02/81

ALTITUDE: 1505
(FT, NGVD)

DEPTH: 160
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-18	Clay, yellowish-brown, pebbly, oxidized (till).
18-70	Clay, olive-gray, pebbly (till).
70-75	Sand, very fine, clayey, well-sorted.
75-88	Clay, brownish-gray, very sandy (till).
88-118	Clay, olive-gray, pebbly (till).
118-128	Clay, dark-gray, gravelly; abundant detrital shale.

PIERRE SHALE

128-157	Shale, grayish-black, siliceous, well-indurated, fractured.
157-160	Shale, grayish-black, fissile, tight.

158-065-07BBB
NDSWC 5725

Altitude: 1490 feet — Date drilled: 6/20/80

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, silty, oxidized	19	20
	Clay, olive-gray, silty, cohesive	2	22
	Sand and gravel; coarse sand to medium gravel; poorly sorted; subrounded to rounded	5	27
	Clay, brownish-gray, sandy, pebbly, slightly oxidized (till)	17	44
	Clay, dark-gray, silty to gravelly (till); abundant detrital shale pebbles	6	50
Pierre Shale:			
	Shale, dark-gray, siliceous, indurated, fractured	12	62

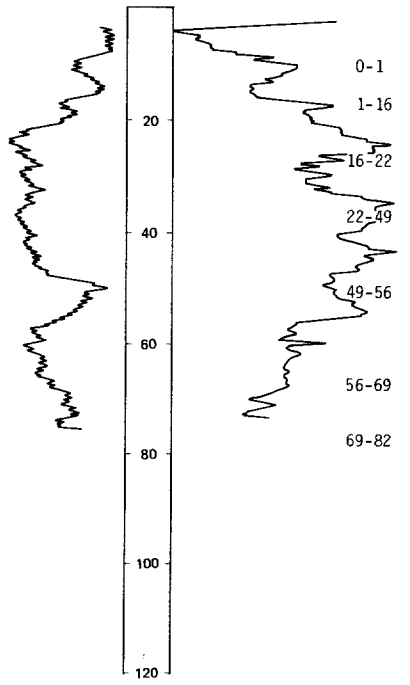
NDSWC 5775

LOCATION: 158-065-12CCC

DATE DRILLED: 7/24/80

ALTITUDE: 1493 (FT, NGVD)

DEPTH: 82 (FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-16	Clay, yellowish-brown, silty, cohesive, oxidized.
16-22	Clay, olive-gray, sandy to gravelly (till).
22-49	Sand and gravel; fine sand to coarse gravel; poorly sorted; angular to subangular.
49-56	Clay, olive-gray, very sandy, pebbly (till).

PIERRE SHALE

56-69	Shale, dark-gray, bentonitic, indurated.
69-82	Shale, dark-gray, siliceous, well-indurated, fissile.

158-065-14ADD
NDSWC 5991

Altitude: 1487 feet | Date drilled: 9/18/81

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, pebbly, oxidized (till)	17	18
	Clay, olive-gray, pebbly (till)	4	22
	Gravel, coarse; cobbles; interbedded with coarse subrounded to rounded sand; about 80 percent detrital shale and carbonate and 20 percent silicate pebbles	14	36
	Clay, dark-gray	4	40
	Gravel, coarse to very coarse, sandy; predominantly detrital shale	14	54
	Clay, dark-gray, silty	6	60
	Gravel, fine to very coarse, rounded; with abundant cobbles; predominantly detrital shale, carbonate, and silicate pebbles	14	74
	Clay, dark-gray, sandy	7	81

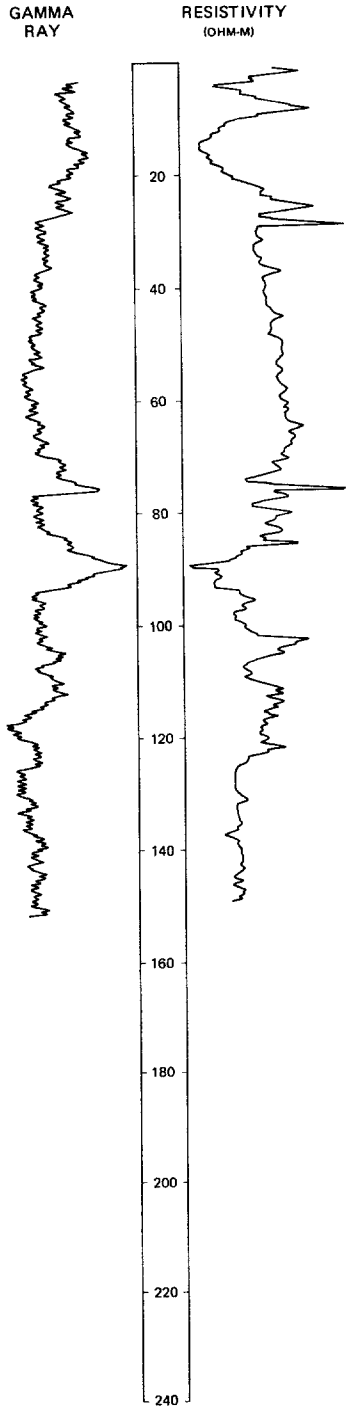
NDSWC 5776

LOCATION: 158-065-15AAA

DATE DRILLED: 7/24/80

ALTITUDE: 1480
(FT, NGVD)

DEPTH: 162
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-16	Clay, yellowish-brown, very silty to gravelly, oxidized.
16-28	Clay, olive-gray, very silty to sandy (till); with thin lenses of gravel from 20 to 30 feet.
28-70	Clay, olive-gray, very sandy to gravelly (till).
70-126	Clay, dark-gray, very sandy, pebbly (till); abundant detrital shale and bentonite; coarse gravel lens from 98 to 102 feet.

PIERRE SHALE

126-162	Shale, dark-gray, siliceous, well-indurated, fissile.

NDSWC 5992

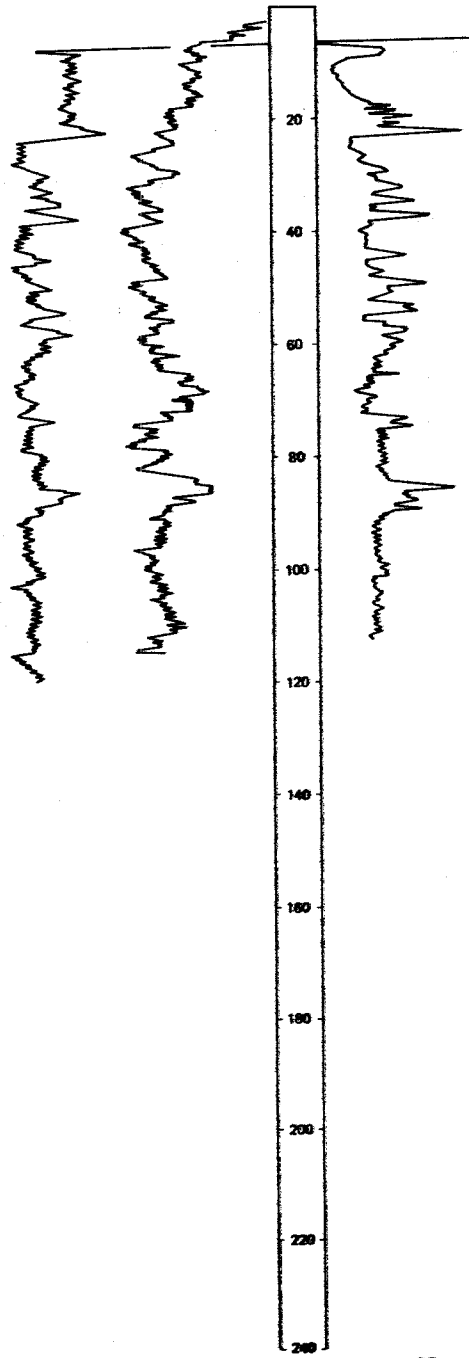
LOCATION: 158-065-15BAA

DATE DRILLED: 9/18/81

ALTITUDE: 1490
(FT, NGVD)

DEPTH: 121
(FT)

NEUTRON (API) GAMMA RAY RESISTIVITY (OHM-M)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-10	Silt, dark-yellowish-orange, clayey, oxidized.
10-17	Clay, yellowish-brown, pebbly, oxidized (till).
17-20	Clay, olive-gray, gravelly (till).
20-80	Clay, dark-gray; interbedded with thin lenses of gravel; predominantly detrital shale.
80-90	Gravel, fine to medium, rounded; interbedded with lenses of clay; predominantly detrital shale.

PIERRE SHALE

90-121	Shale, grayish-black, siliceous, fractured.

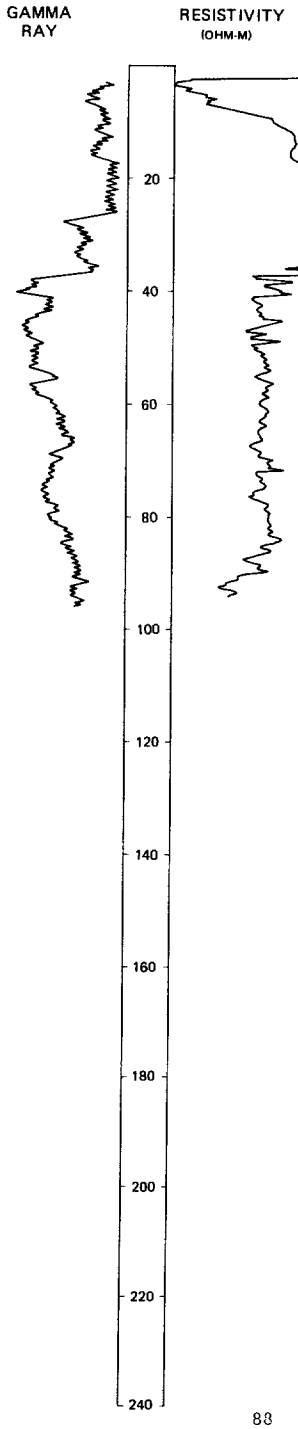
NDSWC 5777

LOCATION: 158-065-16AAA

DATE DRILLED: 7/24/80

ALTITUDE: 1493
(FT, NGVD)

DEPTH: 102
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-17	Clay, pale-yellowish-brown, very silty, pebbly, oxidized (till).
17-27	Clay, olive-gray, very silty, gravelly (till).
27-38	Clay, dark-gray (till); abundant detrital shale.
38-82	Gravel, fine to coarse, poorly sorted, angular to rounded; interbedded with lenses of till from 58 to 82 feet.

PIERRE SHALE

82-102	Shale, dark-gray, siliceous, well-indurated, fissile.

158-065-16DDD
NDSWC 5993

Altitude: 1485 feet — Date drilled: 9/18/81

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil----------	1	1
	Silt, yellowish-brown, clayey, oxidized----------	8	9
	Clay, yellowish-brown, pebbly, oxidized (till)---------	8	17
	Clay, olive-gray, gravelly (till)----------	3	20
	Gravel, fine to coarse, subrounded, oxidized----------	3	23
	Clay, olive-gray, gravelly (till)----------	9	32
Pierre Shale:			
	Shale, dark-bluish-gray, siliceous, fractured----------	29	61

158-065-17AAA
NDSWC 5778

Altitude: 1483 feet — Date drilled: 7/24/80

Glacial drift:			
	Clay, yellowish-brown, sandy, oxidized (till)----------	20	20
	Clay, brownish-gray, very silty, gravelly (till)-------	30	50
Pierre Shale:			
	Shale, dark-gray, siliceous, bentonitic, well-indurated, fissile----------	32	82

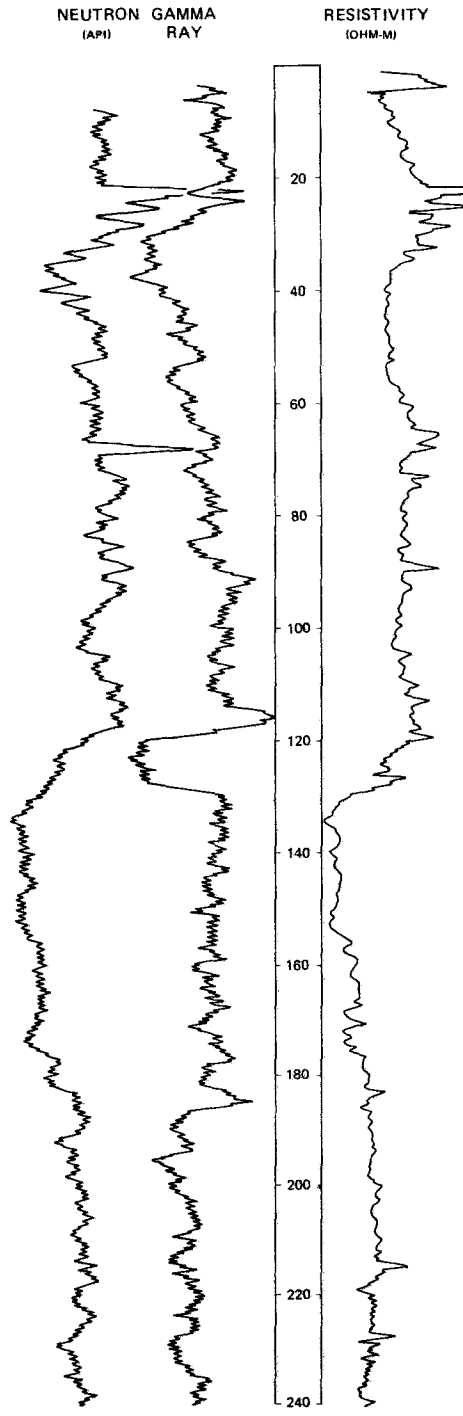
NDSWC 5990

LOCATION: 158-065-23AAA

DATE DRILLED: 9/17/81

ALTITUDE: 1487
(FT, NGVD)

DEPTH: 281
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

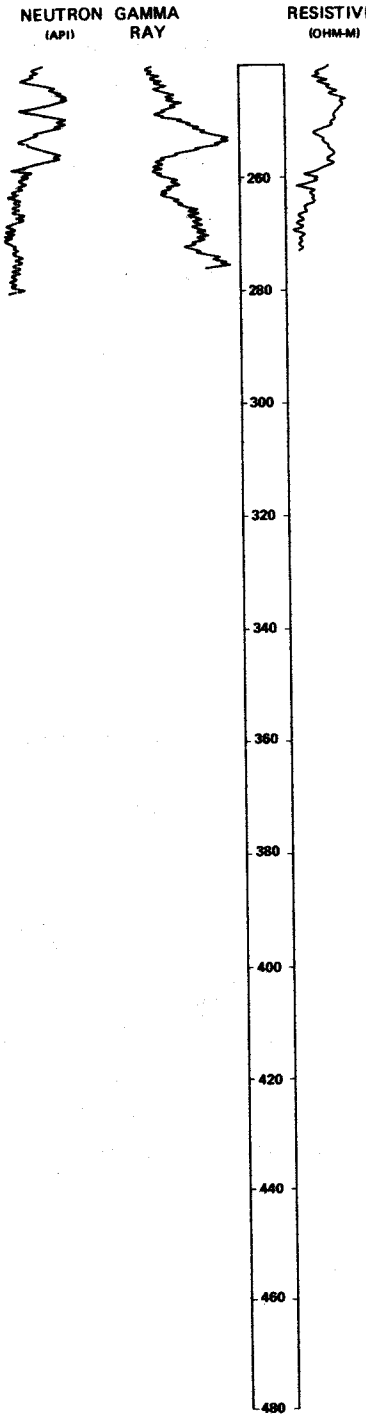
0-1	Topsoil.
1-20	Clay, yellowish-orange, pebbly, oxidized (till).
20-22	Boulders.
22-26	Clay, olive-gray, silty, pebbly (till).
26-33	Sand, coarse to very coarse; interbedded with fine to coarse subangular gravel.
33-117	Clay, olive-gray, pebbly; some boulders (till).
117-121	Sand, coarse; interbedded with fine subangular gravel.
121-182	Clay, olive-gray, silty.
182-256	Clay, olive-gray, silty; interbedded with thin lenses of gravel and cobbles.

LOCATION: 158-065-23AAA

DATE DRILLED: 9/17/81

ALTITUDE: 1487
(FT, NGVD)

DEPTH: 281
(FT)



DESCRIPTION OF DEPOSITS

PIERRE SHALE

256-281 Shale, dark-greenish-gray, fissile, poorly indurated, massive.

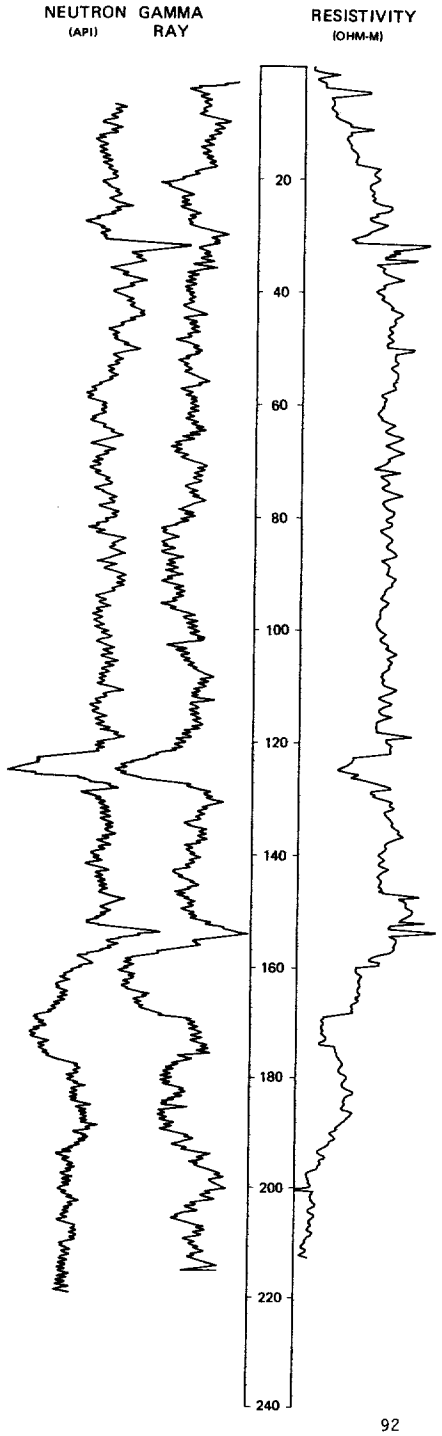
NDSWC 5989

LOCATION: 158-065-23DAA

DATE DRILLED: 9/17/81

ALTITUDE: 1475
(FT, NGVD)

DEPTH: 221
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-5	Silt, yellowish-brown, clayey, oxidized.
5-18	Clay, yellowish-brown, pebbly, oxidized (till).
18-32	Clay, olive-gray, silty, pebbly (till).
32-120	Clay, olive-gray (till); interbedded with thin lenses of gravel.
120-124	Sand, coarse; interbedded with fine to very coarse subangular gravel.
124-157	Clay, olive-gray, gravelly (till).
157-161	Sand, coarse; interbedded with fine subrounded gravel.
161-193	Clay, olive-gray to dark-gray, silty.

PIERRE SHALE

193-221	Shale, grayish-black, moderately indurated, fissile.

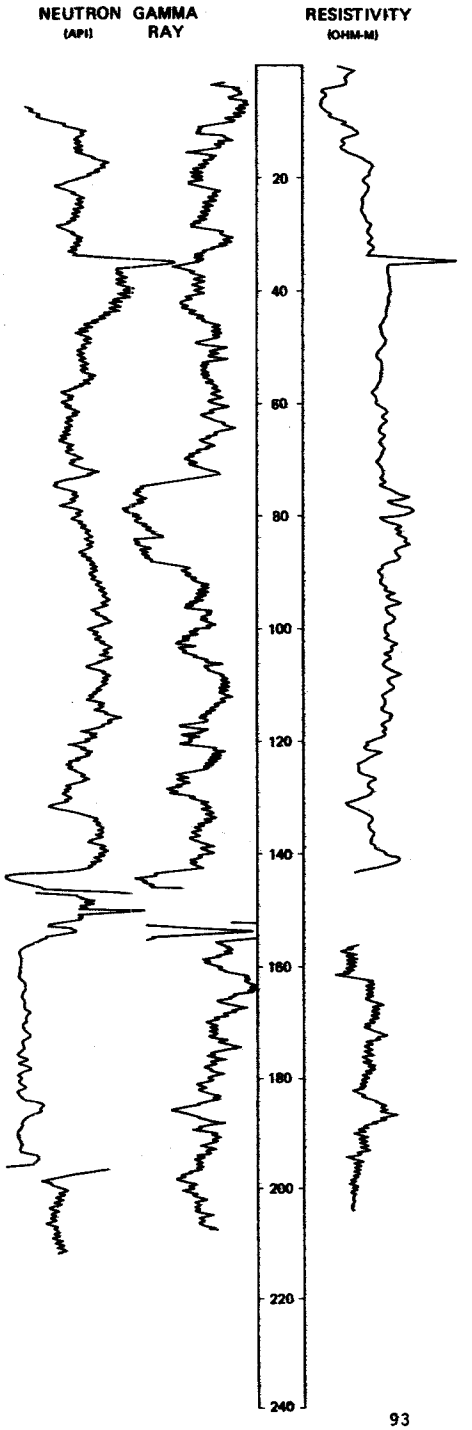
NDSWC 5988

LOCATION: 158-065-23DDD

DATE DRILLED: 9/17/81

ALTITUDE: 1480
(FT, NGVD)

DEPTH: 220
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-10	Silt, yellowish-orange, clayey, oxidized.
10-22	Clay, yellowish-brown, pebbly (till).
22-34	Clay, dark-gray, pebbly (till).
34-44	Clay, olive-gray to brownish-gray, sandy (till).
44-74	Silt, brownish-gray, very clayey.
74-89	Sand, coarse; interbedded with fine subrounded gravel; about 80 percent detrital shale and carbonate and 20 percent silicate grains.
89-143	Clay, olive-gray, pebbly (till).
143-154	Gravel, fine to coarse, sandy, subangular; some cobbles.
154-196	Clay, olive-gray, pebbly (till).

PIERRE SHALE

196-220	Shale, grayish-black, siliceous, fractured.

158-065-28DCA
(Log modified from C. A. Simpson & Son)

Altitude: 1473 feet — Date drilled: 9/10/64

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow	21	22
	Clay, blue	38	60
Pierre Shale:			
	Shale, blue	160	220

158-065-30BBB
NDSWC 5985

Altitude: 1475 feet — Date drilled: 9/17/81

Glacial drift:			
	Topsoil	1	1
	Silt, yellowish-orange, clayey, oxidized	9	10
	Clay, yellowish-brown, pebbly, oxidized (till)	4	14
	Clay, olive-gray, pebbly (till)	3	17
	Sand, fine to coarse, gravelly, subrounded	2	19
	Clay, olive-gray, silty, pebbly (till)	31	50
Pierre Shale:			
	Shale, grayish-black, very siliceous, very fractured	31	81

158-065-34CDD
(Log modified from C. A. Simpson & Son)

Altitude: 1470 feet — Date drilled: 8/08/71

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	24	25
	Clay, blue, sandy, hard	20	45
	Clay, blue, sandy	55	100
	Sand, clayey, soft	19	119
	Gravel; mostly shale	5	124

158-066-04ABA
(Log modified from Marchus Drilling)

Altitude: 1505 feet — Date drilled: 7/25/79

Glacial drift:			
	Topsoil	1	1
	Sand and gravel	47	48
	Clay, gray	19	67
	Sand and gravel	3	70
	Clay, gray	20	90

158-066-05CBB
(Log modified from C. A. Simpson & Son)

Altitude: 1483 feet — Date drilled: 5/22/79

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow	9	10
	Clay, blue	92	102
	Clay, blue, sandy	36	138
	Shale gravel	25	163

158-066-07DDD
(Log modified from C. A. Simpson & Son)

Altitude: 1482 feet — Date drilled: 4/05/73

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	11	12
	Clay, yellow, soupy	8	20
	Clay, blue, soupy	10	30
	Clay, blue, sandy	22	52
	Clay, blue, very gravelly	3	55
	Clay, blue, gravelly	10	65
	Clay, blue	11	76
	Clay, gray	9	85
	Clay, blue	32	117
	Gravel, clayey	5	122
	Gravel, coarse	5	127

158-066-13AAA
NDSWC 5724

Altitude: 1480 feet — Date drilled: 6/20/80

Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, very silty, oxidized	14	15
	Sand, fine; 50 percent coarse poorly sorted angular to rounded gravel	8	23
	Clay, olive-gray, very silty to sandy (till)	18	41
	Clay, dark-gray, sandy (till); abundant detrital shale pebbles	9	50
Pierre Shale:			
	Shale, dark-gray, siliceous, well-indurated, fissile, fractured	12	62

158-066-20ACC
(Log modified from C. A. Simpson & Son)

Altitude: 1480 feet — Date drilled: 11/23/70

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Clay, yellow	20	20
	Sand, blue	22	42
	Sandstone(?), blue, soft	17	59
	Gravel	15	74
	Clay, blue	2	76
	Gravel, dry, hard	16	92
	Clay, gravelly	10	102
	Clay, yellow	20	122
	Clay, blue, sandy	28	150
	Sand, clayey	10	160

158-066-20CAA
(Log modified from C. A. Simpson & Son)

Altitude: 1480 feet — Date drilled: 12/01/80

Glacial drift:			
	Topsoil	1	1
	Clay, yellow, sandy, soft	5	6
	Sand, fine, yellow	20	26
	Sand, fine, blue	9	35
	Gravel, shale, and mostly fine sand	10	45
	Sand, medium	10	55
	Gravel and sand, coarse	5	60
	Gravel, very coarse; with some fine sand	13	73
	Clay, blue	--	73

158-066-20CAB
(Log modified from C. A. Simpson & Son)

Altitude: 1470 feet — Date drilled: 1/01/79

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	15	16
	Clay, blue, soft	51	67
	Clay, blue	11	78
	Sand; a little water	1	79
	Clay, blue	35	114
	Sand, dry	1	115
	Clay, blue	28	143
	Sand, fine, clayey; a little water	4	147
	Sand and gravel, very clayey	9	156
	Gravel; with clay layers	4	160
	Clay, blue	2	162

158-066-20CCB
(Log modified from C. A. Simpson & Son)

Altitude: 1472 feet — Date drilled: 3/10/77

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	19	20
	Clay, blue, sandy	25	45
	Clay, blue, very gravelly	30	75
	Clay, blue	30	105
	Sand, fine	6	111

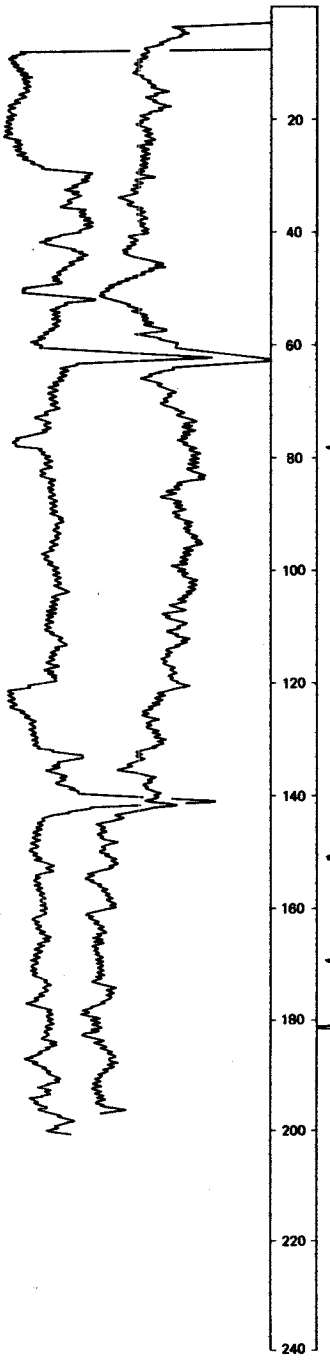
NDSWC 5721

LOCATION: 158-066-20DDA

DATE DRILLED: 6/19/80

ALTITUDE: 1480 (FT, NGVD)

DEPTH: 202 (FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-14	Clay, pale-yellowish-brown, oxidized.
14-24	Silt, yellowish-brown, clayey, oxidized.
24-30	Silt, olive-gray, clayey.
30-54	Clay, olive-gray, silty, pebbly (till); gravel lenses from 49 to 52 feet.
54-60	Clay, dark-brownish-gray, sandy, pebbly (till).
60-64	Gravel, very coarse, well-rounded; about 60 percent carbonate and 40 percent detrital shale pebbles.
64-79	Clay, brown, silty, pebbly (till).
79-122	Clay, brownish-gray, silty (till); abundant detrital shale pebbles.
122-132	Silt, brownish-gray, very clayey.
132-142	Clay, brownish-gray, silty, pebbly (till).
142-180	Clay, brownish-gray (till); abundant detrital shale pebbles.

PIERRE SHALE

180-202	Shale, grayish-black, siliceous, highly fractured.

158-066-24AAD
NDSWC 5723

Altitude: 1474 feet — Date drilled: 6/20/80

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, very silty, oxidized	17	18
	Clay, yellowish-brown, silty to sandy (till)	2	20
	Sand, fine, well-sorted, angular to rounded; about 50 percent quartz and 50 percent detrital shale grains	4	24
	Clay, olive-gray, silty to sandy (till); some thin lenses of gravel	28	52
Pierre Shale:			
	Shale, dark-gray, siliceous, very fractured	30	82

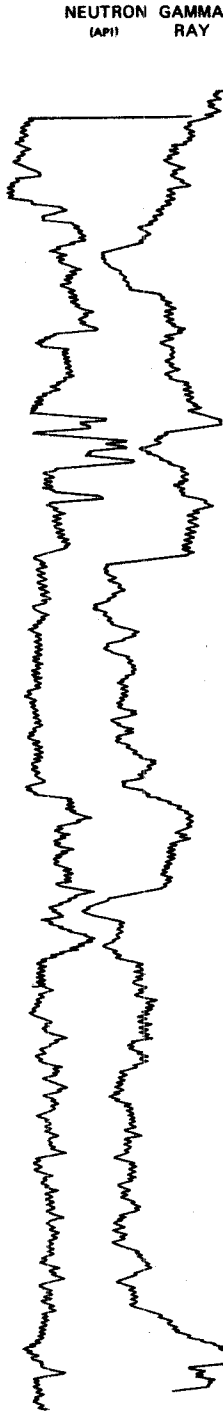
NDSWC 5722

LOCATION: 158-066-28AAA

DATE DRILLED: 6/20/80

ALTITUDE: 1480
(FT, NGVD)

DEPTH: 242
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-5	Silt, yellowish-brown, clayey, oxidized.
5-10	Clay, yellowish-brown, silty, oxidized.
10-14	Clay, olive-gray, very silty.
14-88	Clay, olive-gray, silty to sandy (till); interbedded with lenses of gravel from 32 to 38 and 64 to 71 feet.
88-130	Clay, dark-gray (till); abundant detrital shale.
130-146	Clay, dark-gray (till); reworked shale.
146-158	Sand, fine to coarse, silty to clayey.
158-174	Clay, dark-gray (till); reworked shale.

PIERRE SHALE

174-222	Shale, dark-gray, siliceous, fractured.
222-242	Shale, grayish-black, siliceous, fissile.

158-066-28CBD
(Log modified from C. A. Simpson & Son)

Altitude: 1473 feet — Date drilled: 4/23/79

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow	27	28
	Clay, blue, sandy	28	56
	Gravel, coarse, dry	4	60
	Clay, blue	17	77
	Gravel	2	79
	Clay, blue	56	135
	Clay, blue, gravelly, hard	16	151
	Gravel	6	157
	Clay, blue	18	175
	Sand, coarse	9	184

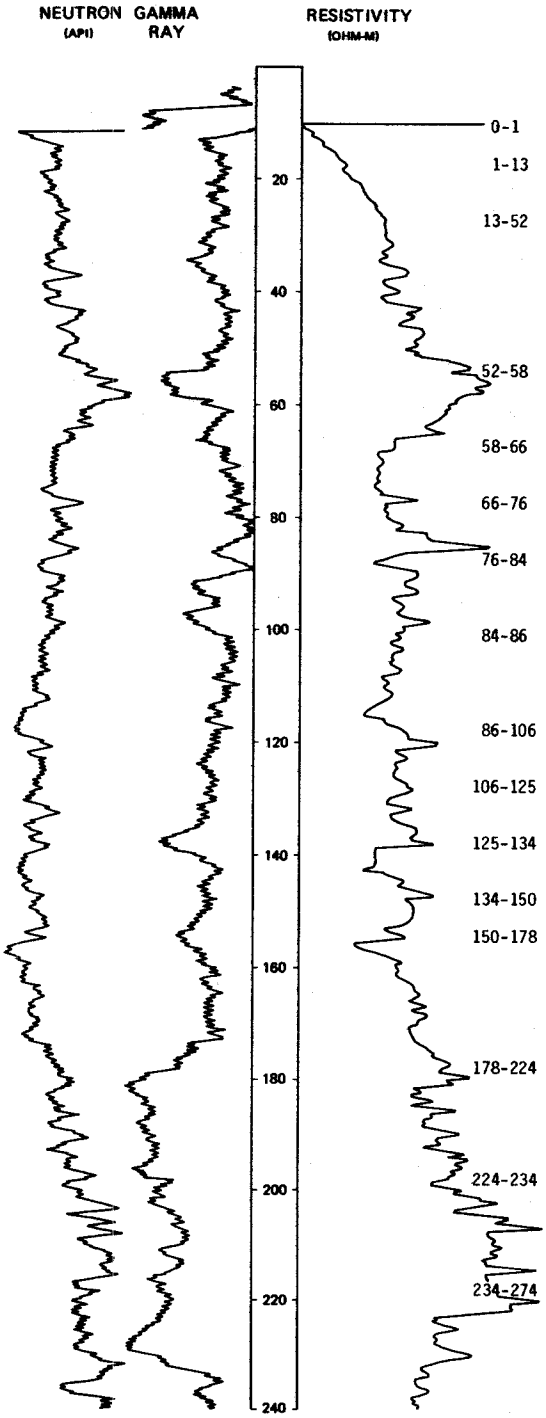
NDSWC 5716

LOCATION: 158-066-30BBB

DATE DRILLED: 6/16/80

ALTITUDE: 1481
(FT, NGVD)

DEPTH: 322
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-13	Clay, yellowish-brown, cohesive, oxidized.
13-52	Clay, dark-gray, silty, gravelly (till).
52-58	Gravel, fine to coarse, subrounded; predominately carbonate pebbles.
58-66	Clay, dark-gray, silty to sandy (till).
66-76	Clay, dark-gray; with very thin lenses of gravel (till).
76-84	Clay, grayish-black (till); abundant detrital shale pebbles.
84-86	Gravel, fine to coarse, angular to rounded; predominately carbonate and detrital shale pebbles.
86-106	Clay, grayish-black, silty (till).
106-125	Silt, dark-gray, very clayey.
125-134	Clay, grayish-black, silty, pebbly (till).
134-150	Silt, dark-gray, sandy.
150-178	Clay, grayish-black, silty, sandy.
178-224	Sand, very fine to coarse, very silty, subrounded to rounded.
224-234	Gravel, fine to coarse; about 30 percent coarse angular to rounded sand; predominately carbonate pebbles.
234-274	Clay, brownish-gray, very sandy (till); some thin lenses of gravel.

LOCATION: 158-066-30BBB

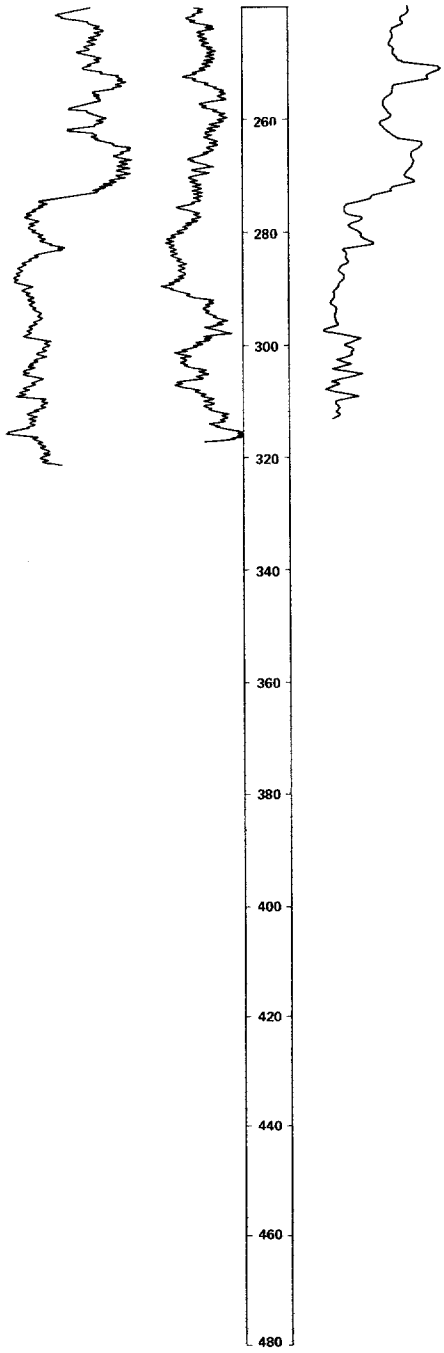
DATE DRILLED: 6/16/80

ALTITUDE: 1481
(FT, NGVD)

DEPTH: 322
(FT)

NEUTRON (API) GAMMA RAY

RESISTIVITY (OHM-M)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

274-290 Clay, brownish-gray to grayish-black (till); redeposited bedrock shale.

PIERRE SHALE

290-322 Shale, grayish-black, clayey; interbedded with brownish-gray siltstone.

158-066-31CD
(Log modified from Smith, 1953)

Altitude: 1459 feet | Date drilled: 12/13/52

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Niobrara Formation (top):			655
Greenhorn Formation (top):			1,040
Dakota Formation (top):			1,436
Sundance Formation (top):			1,630
Piper Formation (top):			1,861
Red Beds (top)			1,950
Mission Canyon Limestone (top):			2,030
Nisku Formation (top):			2,142
Duperow Formation (top):			2,193
Souris River Formation (top):			2,485
Dawson Bay Formation (top):			2,585
Ashern (top):			2,808
Interlake Formation (top):			2,845
Upper Stony Mountain Formation (top):			3,107
Lower Stony Mountain Formation (top):			3,188
Red River Formation (top):			3,273
Winnipeg Shale (top):			3,868
Winnipeg Sand (top):			3,995
Precambrian (top):			4,498

NDSWC 5983

LOCATION: 158-066-33BBB

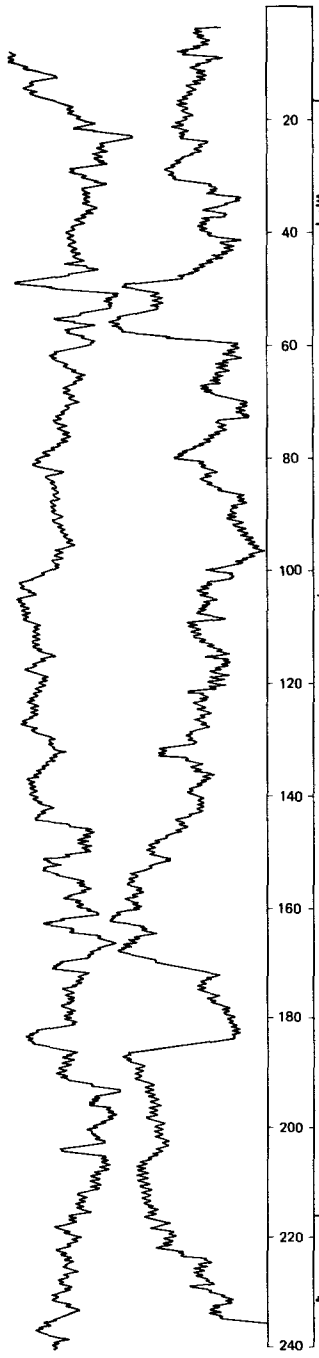
DATE DRILLED: 9/16/81

ALTITUDE: 1468
(FT, NGVD)

DEPTH: 240
(FT)

NEUTRON (API) GAMMA RAY

RESISTIVITY (OHM-M)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-15	Silt, yellowish-orange, clayey, oxidized.
15-25	Clay, yellowish-brown, pebbly, oxidized (till).
25-46	Clay, olive-gray, gravelly (till).
46-57	Sand, coarse; interbedded with fine to medium sub-angular gravel; predominately quartz and carbonate grains.
57-70	Clay, olive-gray, silty (till).
70-94	Clay, dark-greenish-gray, pebbly (till).
94-144	Clay, olive-gray, very silty to sandy.
144-168	Sand, fine to coarse; interbedded with medium subrounded gravel.
168-186	Silt, olive-gray, sandy.
186-216	Sand, fine to coarse, gravelly; interbedded with lenses of clay.

PIERRE SHALE

216-240	Shale, grayish-black, siliceous, slightly fractured.

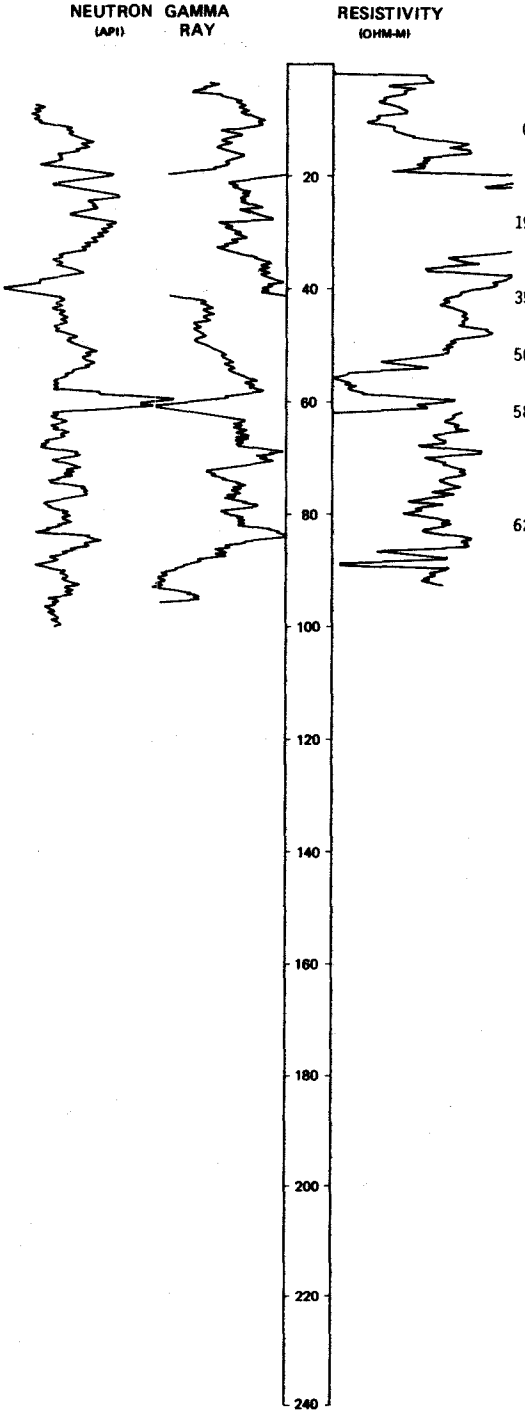
NDSWC 5984

LOCATION: 158-066-34AAA

ALTITUDE: 1475
(FT, NGVD)

DATE DRILLED: 9/16/81

DEPTH: 101
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-19	Silt, yellowish-orange, clayey, oxidized.
19-35	Sand, very coarse; interbedded with lenses of fine to coarse subrounded gravel.
35-50	Silt, olive-gray, clayey.
50-58	Clay, olive-gray, silty, pebbly (till).
58-62	Clay, dark-gray, macerated (till); abundant detrital shale.

PIERRE SHALE

62-101	Shale, grayish-black, fractured; with interstitial clay fillings; occasional thin lenses of bentonite.

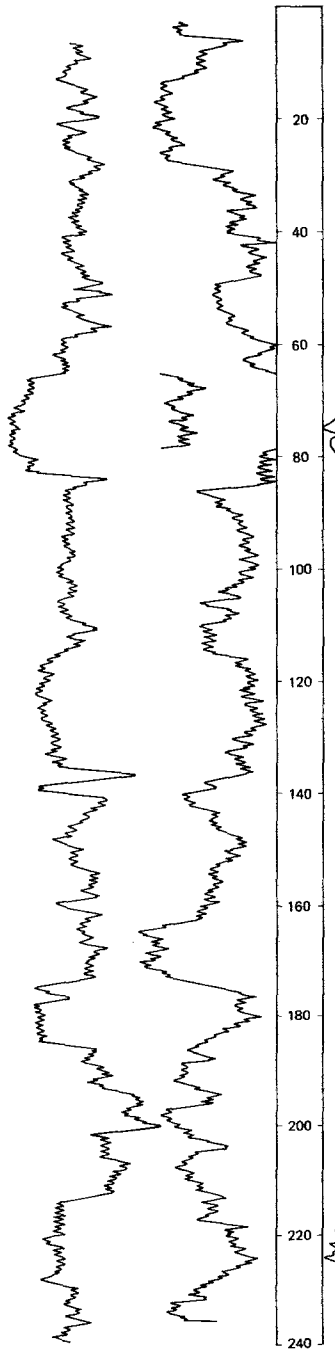
NDSWC 5960

LOCATION: 158-067-01BBB

DATE DRILLED: 8/26/81

ALTITUDE: 1500 (FT. NGVD)

DEPTH: 240 (FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-9	Silt, yellowish-brown, oxidized.
9-12	Clay, yellowish-brown, pebbly, oxidized.
12-28	Sand, fine, gravelly, subangular, oxidized; interbedded with silt.
28-60	Clay, olive-gray, pebbly (till).
60-83	Clay, olive-gray, cohesive.
83-112	Clay, dark-brownish-gray, partially oxidized (till); interbedded with lenses of sand.
112-115	Clay, yellowish-brown, sandy, oxidized (till).
115-136	Silt, olive-gray, clayey.
136-157	Clay, olive-gray, silty to sandy (till).
157-174	Sand, very coarse; interbedded with fine subrounded gravel.
174-185	Clay, olive-gray, silty.
185-194	Sand, very coarse, gravelly, rounded; interbedded with clay.
194-202	Gravel, fine to very coarse, sandy, rounded.
202-214	Clay, brownish-gray (till); interbedded with fine sandy gravel.

PIERRE SHALE

214-240	Shale, grayish-black, siliceous, fractured.

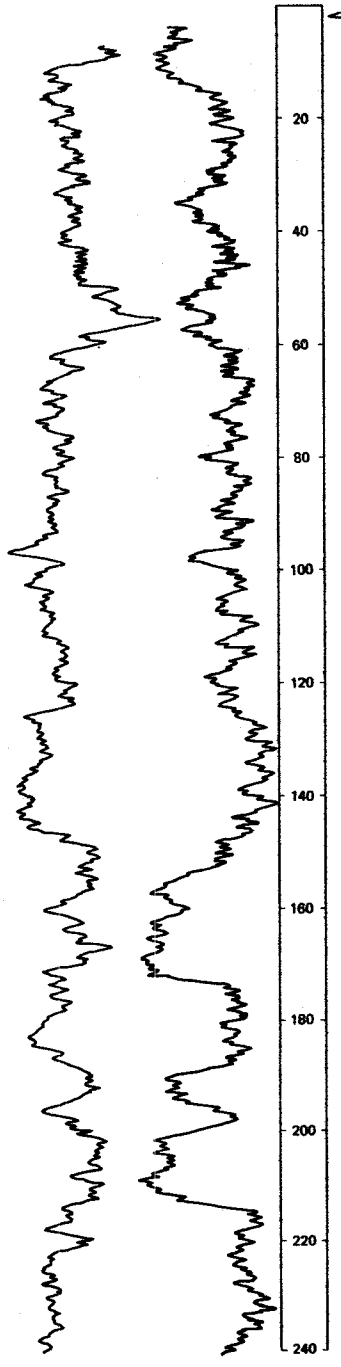
NDSWC 5959

LOCATION: 158-067-03AAA

DATE DRILLED: 8/26/81

ALTITUDE: 1505
(FT, NGVD)

DEPTH: 300
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

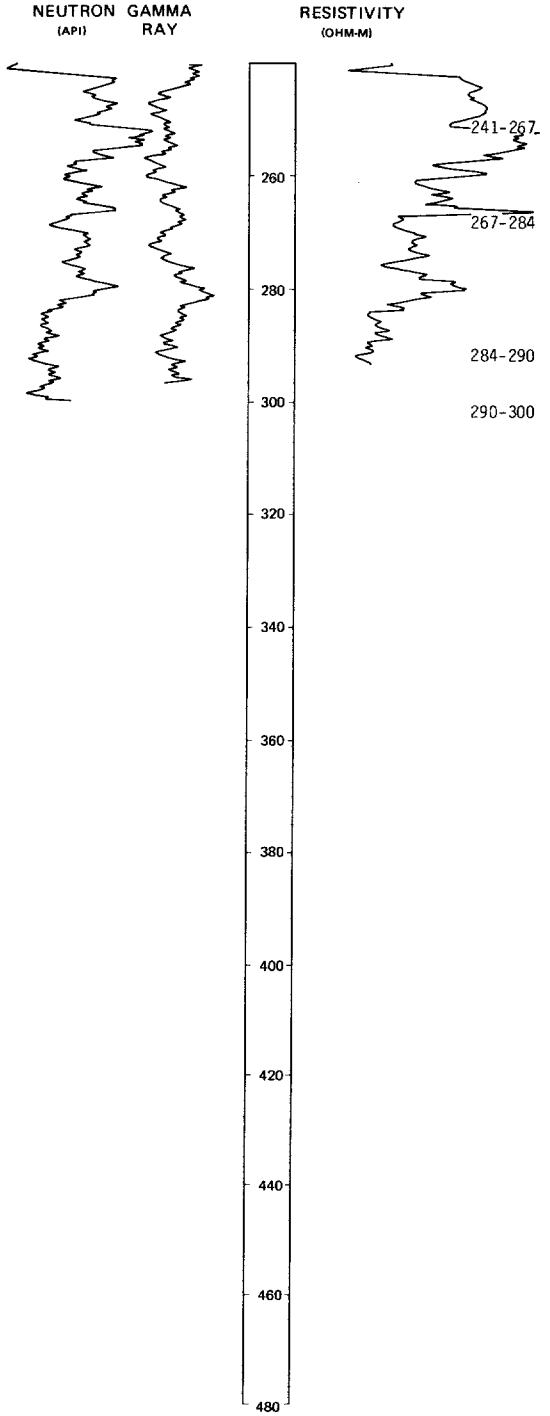
0-1	Topsoil.
1-12	Sand, fine to coarse, angular to rounded, oxidized.
12-18	Clay, yellowish-brown, pebbly, oxidized (till).
18-50	Clay, olive-gray, sandy to gravelly (till).
50-60	Clay, olive-gray (till); interbedded with gravel.
60-71	Clay, olive-gray, silty.
71-124	Silt, olive-gray, sandy.
124-147	Clay, dark-gray; interbedded with lenses of silt.
147-172	Sand, medium to very coarse; interbedded with fine angular to rounded gravel; predominately carbonate and detrital shale grains; some interbedded lenses of clay.
172-180	Silt, olive-gray, very clayey.
180-186	Silt, olive-gray; interbedded with lenses of detrital lignite.
186-214	Sand, very fine to medium, subangular to subrounded; predominately detrital shale and quartz grains; clayey from 196 to 200 feet.
214-241	Silt, olive-gray, clayey.

LOCATION: 158-067-03AAA

DATE DRILLED: 8/26/81

ALTITUDE: 1505
(FT, NGVD)

DEPTH: 300
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

241-267 Sand, very coarse; interbedded with fine angular to rounded gravel; with lenses of silt.

267-284 Gravel, coarse; interbedded with coarse subrounded sand; predominately detrital shale and carbonate pebbles.

PIERRE SHALE

284-290 Shale, dark-gray, siliceous, fractured.

290-300 Shale, dark-greenish-gray, fissile, tight.

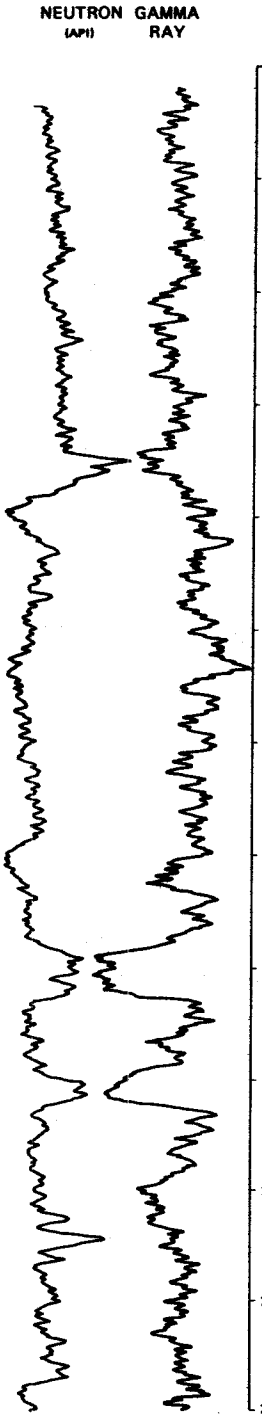
NDSWC 5958

LOCATION: 158-067-04AAA

DATE DRILLED: 8/25/81

ALTITUDE: 1510
(FT, NGVD)

DEPTH: 420
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

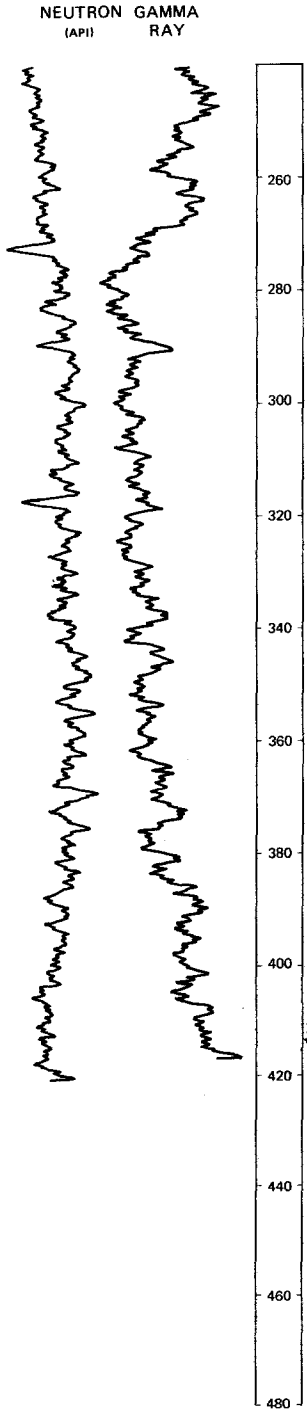
0-1	Topsoil.
1-18	Clay, yellowish-brown, pebbly, oxidized (till).
18-68	Clay, olive-gray, gravelly (till).
68-75	Sand, medium, gravelly, subrounded.
75-140	Clay, olive-gray, pebbly (till).
140-144	Silt, olive-gray, clayey.
144-156	Silt, olive-gray, sandy.
156-165	Sand, fine to coarse, clayey; interbedded with fine to coarse angular to rounded gravel.
165-180	Silt, olive-gray, clayey.
180-184	Sand, fine to medium, gravelly, subrounded.
184-215	Clay, olive-gray, silty to sandy (till).
215-235	Silt, olive-gray, clayey.
235-268	Silt, olive-gray; interbedded with detrital lignite.

LOCATION: 158-067-04AAA

DATE DRILLED: 8/25/81

ALTITUDE: 1510
(FT, NGVD)

DEPTH: 420
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

268-285	Sand, fine to medium, clayey; interbedded with lenses of fine gravel; predominately detrital shale.
285-306	Gravel, fine to coarse, clayey; interbedded with coarse rounded sand; predominately detrital shale.
306-340	Clay, dark-gray; abundant detrital shale and lignite.
340-376	Gravel, fine to coarse, subrounded; interbedded with lenses of silty clay.
376-388	Clay, dark-gray, sandy (till); interbedded with lenses of medium gravel.
388-403	Clay, dark-gray (till); predominately macerated detrital shale.

PIERRE SHALE

403-420	Shale, dark-greenish-gray, poorly indurated, fissile, tight.

158-067-05CCD
(Log modified from C. A. Simpson & Son)

Altitude: 1515 feet — Date drilled: 7/25/70

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow, sandy	25	26
	Clay, blue, sandy	94	120
Pierre Shale:			
	Shale	37	157

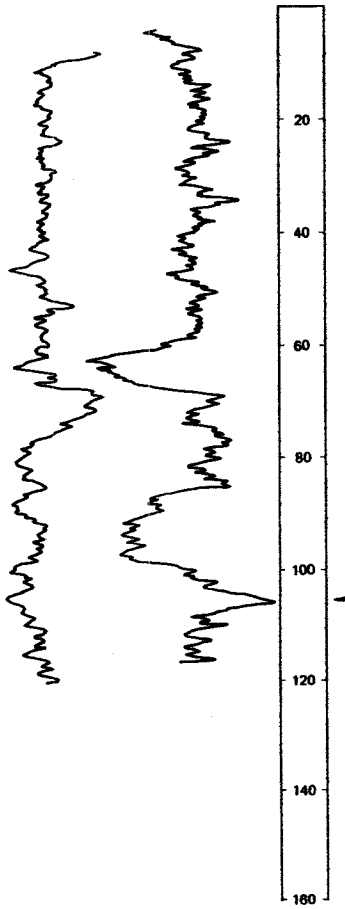
NDSWC 5957

LOCATION: 158-067-06AAA

DATE DRILLED: 8/25/81

ALTITUDE (FT, NGVD): 1518

DEPTH (FT): 120



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-18	Clay, yellowish-brown, pebbly, oxidized (till).
18-58	Clay, olive-gray (till), interbedded with thin lenses of sand and gravel.
58-64	Gravel, coarse; interbedded with medium to very coarse angular to rounded sand.
64-77	Clay, olive-gray, sandy (till).
77-85	Clay, dark-gray, very silty to sandy (till).

PIERRE SHALE

85-98	Shale, grayish-black, siliceous, fractured.
98-120	Shale, greenish-black, fissile, massive, tight.

158-067-13BAA
(Log modified from Holbeck Water-Well Service Inc.)

Altitude: 1487 feet — Date drilled: 9/06/78

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow	17	18
	Clay, blue; gravel pebbles	14	32
	Clay, blue	39	71
	Soapstone	19	90
	Sand, fine	2	92
	Shale, soft	11	103

158-067-13CDD
(Log modified from C. A. Simpson & Son)

Altitude: 1485 feet — Date drilled: 10/17/72

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	19	20
	Clay, blue	5	25
	Clay, blue, gravelly	39	64
	Gravel	11	75
	Clay, blue	5	80
	Sand	9	89

NDSWC 5719

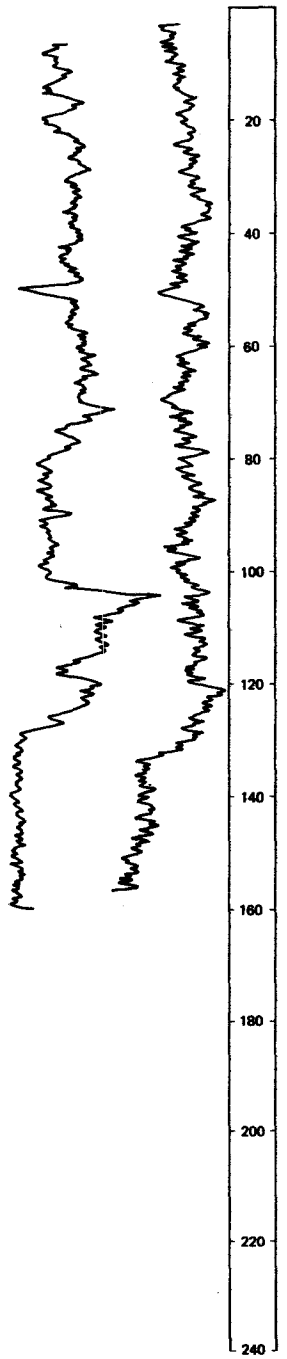
LOCATION: 158-067-19CCB

ALTITUDE: 1500
(FT, NGVD)

DATE DRILLED: 6/19/80

DEPTH: 162
(FT)

NEUTRON (API) GAMMA RAY



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-23	Clay, yellowish-brown, silty, pebbly, oxidized (till).
23-51	Clay, olive-gray, silty, pebbly (till).
51-54	Gravel, medium; interbedded with coarse angular to rounded sand.
54-80	Clay, olive-gray, silty, gravelly (till).
80-134	Clay, olive-gray, silty to sandy (till); with lenses of gravel from 90 to 92 and 104 to 106 feet.

PIERRE SHALE

134-162	Shale, dark-gray, siliceous, fractured; interbedded with thin lenses of argillaceous siltstone and bentonite.

158-067-25ADC
(Log modified from C. A. Simpson & Son)

Altitude: 1477 feet — Date drilled: 6/28/69

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow, sandy	16	17
	Gravel; pumped 6 gallons per minute; salty	48	65
	Clay, blue, sandy	54	119
	Sand, fine	5	124

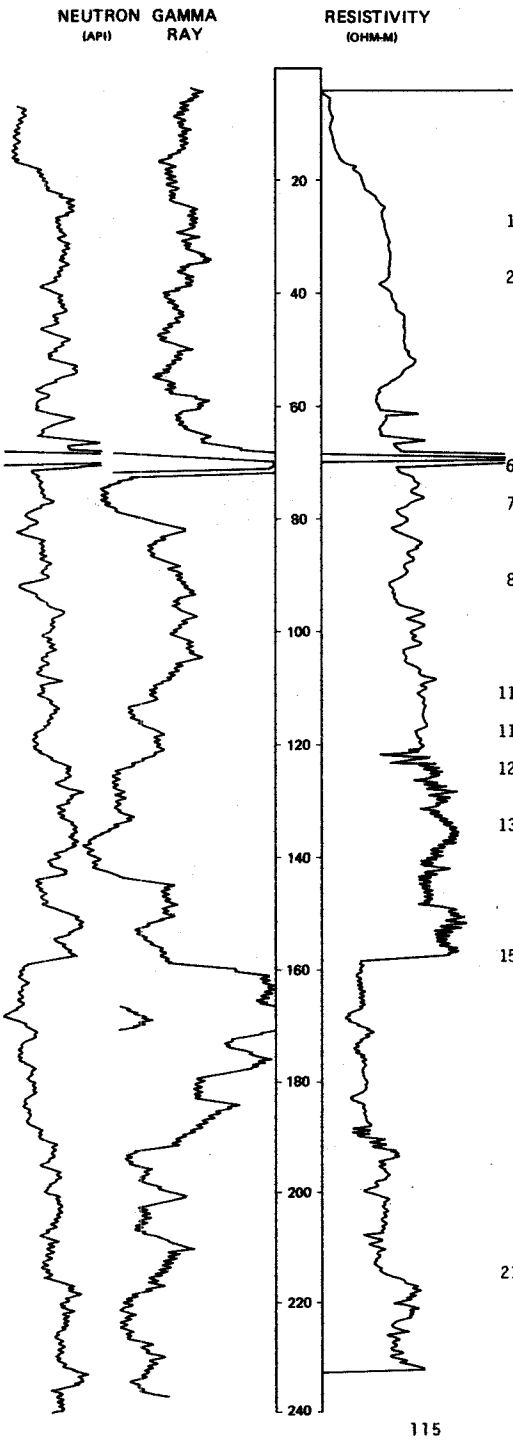
NDSWC 5717

LOCATION: 158-067-25BBB

DATE DRILLED: 6/17/80

ALTITUDE: 1480
(FT, NGVD)

DEPTH: 242
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-18	Clay, yellowish-brown, oxidized.
18-24	Clay, olive-gray, very sandy (till).
24-68	Clay, olive-gray, silty, pebbly (till).
68-72	Cobbles and boulders.
72-88	Sand, very fine, rounded; predominately quartz and detrital lignite grains.
88-113	Silt, olive-gray, clayey.
113-115	Sand, very fine, silty.
115-122	Silt, olive-gray, clayey.
122-134	Sand, very fine, silty; abundant detrital lignite.
134-159	Sand, fine to coarse, angular to rounded; predominately quartz.
159-217	Clay, brownish-gray (till); reworked bedrock shale.

PIERRE SHALE

217-242	Shale, grayish-black, siliceous, well-indurated, fissile.

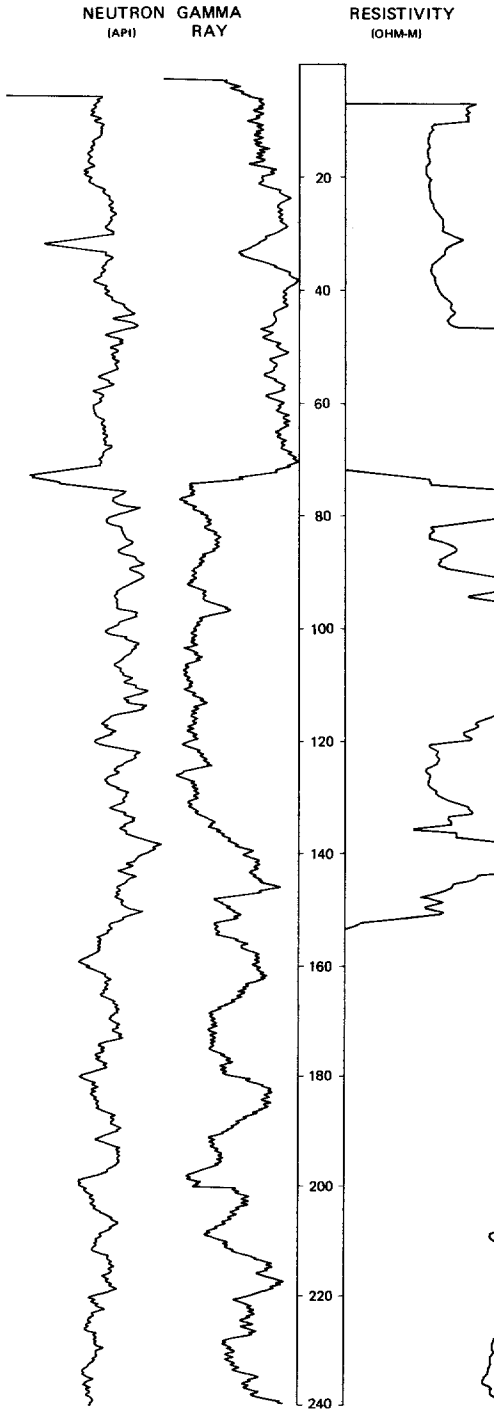
NDSWC 5718

LOCATION: 158-067-27BBC

DATE DRILLED: 6/18/80

ALTITUDE: 1490
(FT, NGVD)

DEPTH: 402
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-8	Clay, yellowish-brown, sandy, oxidized (till).
8-74	Clay, olive-gray, silty (till); interbedded with sand and gravel from 46 to 61 feet.
74-152	Sand, fine to coarse, sub-angular to rounded; becomes coarser with depth; some fine gravel.
152-246	Sand, fine, rounded; inter-bedded with lenses of silt; abundant detrital shale; gravel intervals.

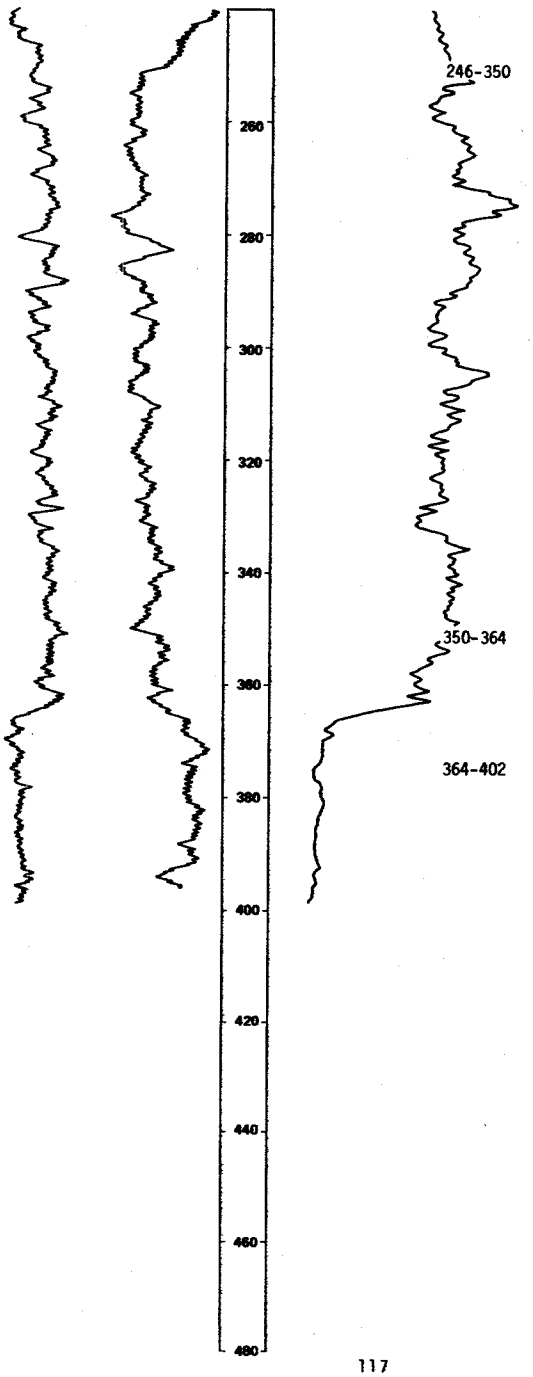
NDSWC 5718, Continued

LOCATION: 158-067-27BBC

DATE DRILLED: 6/18/80

ALTITUDE: 1490
(FT, NGVD)

DEPTH: 402
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

246-350 Gravel, fine to coarse, angular to rounded; predominately detrital shale; occasional lenses of sandy clay.

350-364 Clay, brownish-gray (till); about 50 percent coarse gravel; abundant detrital shale.

PIERRE SHALE

364-402 Shale, dark-gray, siliceous, well-indurated, fissile.

158-067-28BBC
NDSWC 5720

Altitude: 1487 feet — Date drilled: 6/19/80

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, silty, gravelly, oxidized (till)	24	25
	Clay, olive-gray, very silty (till); numerous lenses of gravel	95	120
	Sand, fine to coarse; about 50 percent coarse angular to rounded gravel; about 50 percent detrital shale, 30 percent carbonate, and 20 percent quartz grains	30	150

158-067-28CBB
(Log modified from C. A. Simpson & Son)

Altitude: 1482 feet — Date drilled: 8/18/75

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	24	25
	Clay, blue	15	40
	Gravel	4	44
	Clay, blue	77	121
	Sand, fine, and gravel; mostly shale	5	126

158-068-11DDD
(Log modified from Marchus Drilling)

Altitude: 1524 feet — Date drilled: 7/18/79

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	30	31
	Sand and gravel	7	38
	Clay, gray	41	79
	Sand and gravel	1	80

158-068-21AAA
NDSWC 5955

Altitude: 1548 feet — Date drilled: 8/24/81

Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, silty, oxidized (till)	16	17
	Clay, olive-gray, pebbly (till)	46	63
	Gravel, coarse, subangular	1	64
	Clay, olive-gray, sandy; interbedded with lenses of medium gravel	61	125
Pierre Shale:			
	Shale, grayish-black, siliceous, fractured	15	140
	Shale, dark-gray, moderately indurated, slightly fractured	20	160

158-068-27DAA
(Log modified from C. A. Simpson & Son)

Altitude: 1530 feet — Date drilled: 4/29/64

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow	17	18
	Clay, blue	67	85
	Clay, gray, slightly sandy	30	115
Pierre Shale:			
	Shale	56	171

158-068-29BAA
(Log modified from C. A. Simpson & Son)

Altitude: 1546 feet — Date drilled: 9/16/74

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	24	25
	Clay, blue	35	60
	Sand	4	64
	Clay, blue, soupy	81	145
Pierre Shale:			
	Shale	29	174

158-068-31BAB
(Log modified from Church Well Boring)

Altitude: 1565 feet — Date drilled: 8/11/76

Glacial drift:			
	Topsoil, black	1	1
	Clay, yellow	9	10
	Clay, yellow, hard	16	26
	Clay, blue	29	55
	Clay, blue, sandy	5	60
	Clay, blue	12	72
	Sand, blue, and blue clay	7	79

158-068-34BBB
(Log modified from C. A. Simpson & Son)

Altitude: 1545 feet — Date drilled: 1965

Glacial drift:			
	Topsoil	1	1
	Clay, yellow; rocks	14	15
	Clay, gravelly, hard; rocks	37	52
	Clay, gray, sandy	22	74
	Gravel, clayey	7	81

158-068-35AAD
(Log modified from C. A. Simpson & Son)

Altitude: 1510 feet — Date drilled: 8/25/75

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow	34	35
	Clay, blue, sandy	74	109
	Clay, yellow, gravelly	3	112
	Clay, blue, gravelly	15	127
Pierre Shale:			
	Shale, hard	13	140
	Shale, blue, sandy	28	168

159-065-04CCC
(Log modified from C. A. Simpson & Son)

Altitude: 1525 feet — Date drilled: 9/15/72

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	9	10
	Clay, yellow, gravelly	25	35
	Clay, blue, gravelly	20	55
Pierre Shale:			
	Shale	50	105

159-065-06BB
(Log modified from C. A. Simpson & Son)

Altitude: 1515 feet — Date drilled: 11/24/72

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	24	25
	Clay, blue, sandy	12	37
	Gravel and rocks	17	54
	Clay, blue	16	70
	Shale, crumbly; some hard gravel	5	75
	Clay, blue, or shale	15	90
Pierre Shale:			
	Shale	22	112

159-065-06BBB
(Log modified from C. A. Simpson & Son)

Altitude: 1515 feet — Date drilled: 9/02/72

Glacial drift:			
	Clay, yellow, sandy	18	18
	Clay, blue, sandy; with rocks	40	58
	Clay, blue, sandy	2	60
	Clay, gray; with rocks	20	80
	Clay, blue	18	98
Pierre Shale:			
	Shale	35	133

159-065-06BBC
(Log modified from C. A. Simpson & Son)

Altitude: 1515 feet — Date drilled: 7/12/71

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Clay, yellow, sandy	32	32
	Clay, blue; big rock at 37 feet	33	65
Pierre Shale:			
	Shale, blue	84	149

159-065-06BBD
(Log modified from C. A. Simpson & Son)

Altitude: 1520 feet — Date drilled: 7/09/66

Glacial drift:			
	Topsoil	1	1
	Clay, yellow; rocks	14	15
	Clay, blue; rocks	33	48
	Clay, blue, sandy	19	67
Pierre Shale:			
	Shale	86	153

159-065-06BCA
(Log modified from C. A. Simpson & Son)

Altitude: 1520 feet — Date drilled: 6/24/78

Glacial drift:			
	Topsoil	1	1
	Clay, yellow; rocks	15	16
	Gravel, clayey; rocks	4	20
	Clay, blue	18	38
Pierre Shale:			
	Shale	156	194

159-065-06BCC
(Log modified from C. A. Simpson & Son)

Altitude: 1516 feet — Date drilled: 11/ /72

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	24	25
	Clay, blue, sandy	12	37
	Gravel and rocks	15	52

159-065-08CCC
NDSWC 6009

Altitude: 1515 feet — Date drilled: 9/25/81

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Silt, yellowish-brown, oxidized	4	5
	Clay, yellowish-brown, pebbly, oxidized (till)	13	18
	Clay, olive-gray, silty, pebbly (till)	1	19
	Sand, fine, clayey	1	20
	Clay, olive-gray, silty to sandy (till)	5	25
	Clay, dark-gray (till); predominantly detrital shale	7	32
Pierre Shale:			
	Shale, dark-gray, indurated, fractured	29	61

159-065-17CCC
NDSWC 6004

Altitude: 1504 feet — Date drilled: 9/25/81

Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, pebbly, oxidized (till)	14	15
	Clay, olive-gray, pebbly (till)	16	31
	Clay, olive-gray, sandy (till); interbedded with lenses of fine gravel	29	60
Pierre Shale:			
	Shale, dark-gray, bentonitic, fractured	21	81

159-065-18BAA
NDSWC 6005

Altitude: 1500 feet — Date drilled: 9/25/81

Glacial drift:			
	Topsoil	1	1
	Gravel, fine, subrounded, oxidized	1	2
	Clay, yellowish-brown, very silty, oxidized (till)	16	18
	Clay, olive-gray, pebbly (till)	4	22
	Clay, yellowish-orange, very sandy, oxidized (till)	2	24
	Clay, olive-gray, sandy to gravelly (till)	16	40
	Clay, olive-gray, very silty, pebbly (till)	20	60
	Clay, dark-gray (till); predominantly detrital shale	3	63
Pierre Shale:			
	Shale, dark-grayish-black, bentonitic, indurated	18	81

NDSWC 6003

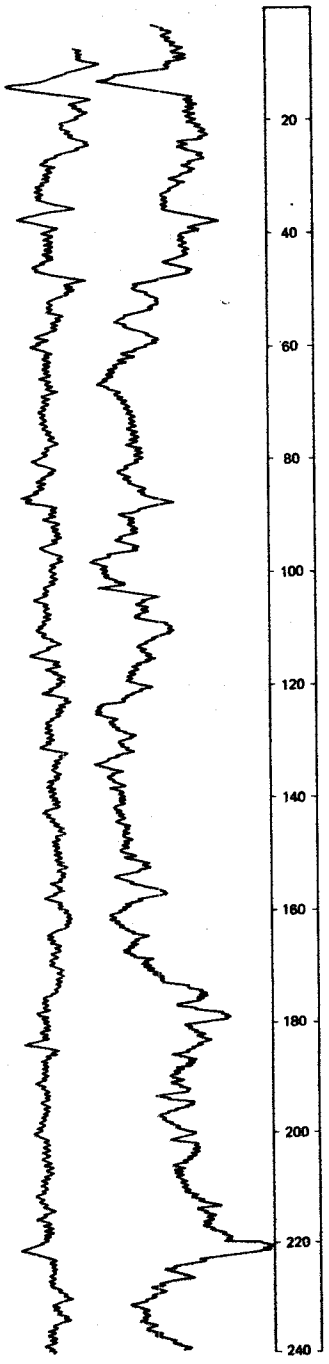
LOCATION: 159-065-20CBC

DATE DRILLED: 9/24/81

ALTITUDE: 1490
(FT, NGVD)

DEPTH: 442
(FT)

NEUTRON (API) GAMMA RAY



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-10	Clay, yellowish-brown, pebbly, oxidized (till).
10-15	Gravel, fine to coarse, subangular, oxidized.
15-17	Clay, yellowish-brown, sandy, oxidized (till).
17-20	Clay, olive-gray, pebbly (till).
20-47	Clay, dark-gray (till); interbedded with fine to coarse gravel.

PIERRE SHALE

47-175	Shale, dark-greenish-gray to black, siliceous, very fractured; interbedded with thin lenses of bentonite; some silty shale intervals.
175-220	Shale, dark-grayish-black, siliceous, fractured; abundant thin lenses of bentonite; some aragonite fragments.
220-280	Shale, dark-grayish-black, siliceous, bentonitic, fractured.

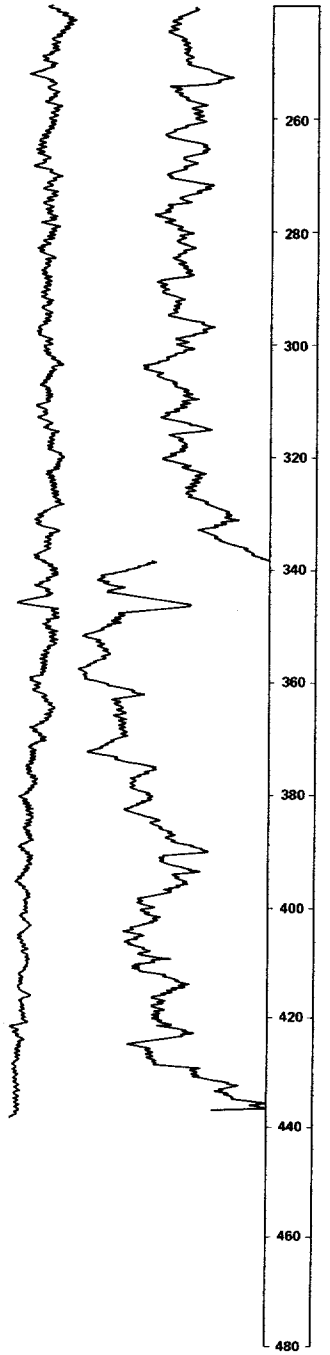
LOCATION: 159-065-20CBC

DATE DRILLED: 9/24/81

ALTITUDE: 1490
(FT, NGVD)

DEPTH: 442
(FT)

NEUTRON (API) GAMMA RAY



DESCRIPTION OF DEPOSITS

PIERRE SHALE

280-360 Shale, dark-grayish-black, siliceous, fractured; interbedded with thin lenses of light-brown limestone.

360-442 Shale, grayish-black, poorly indurated, fissile; numerous thin lenses of bentonite.

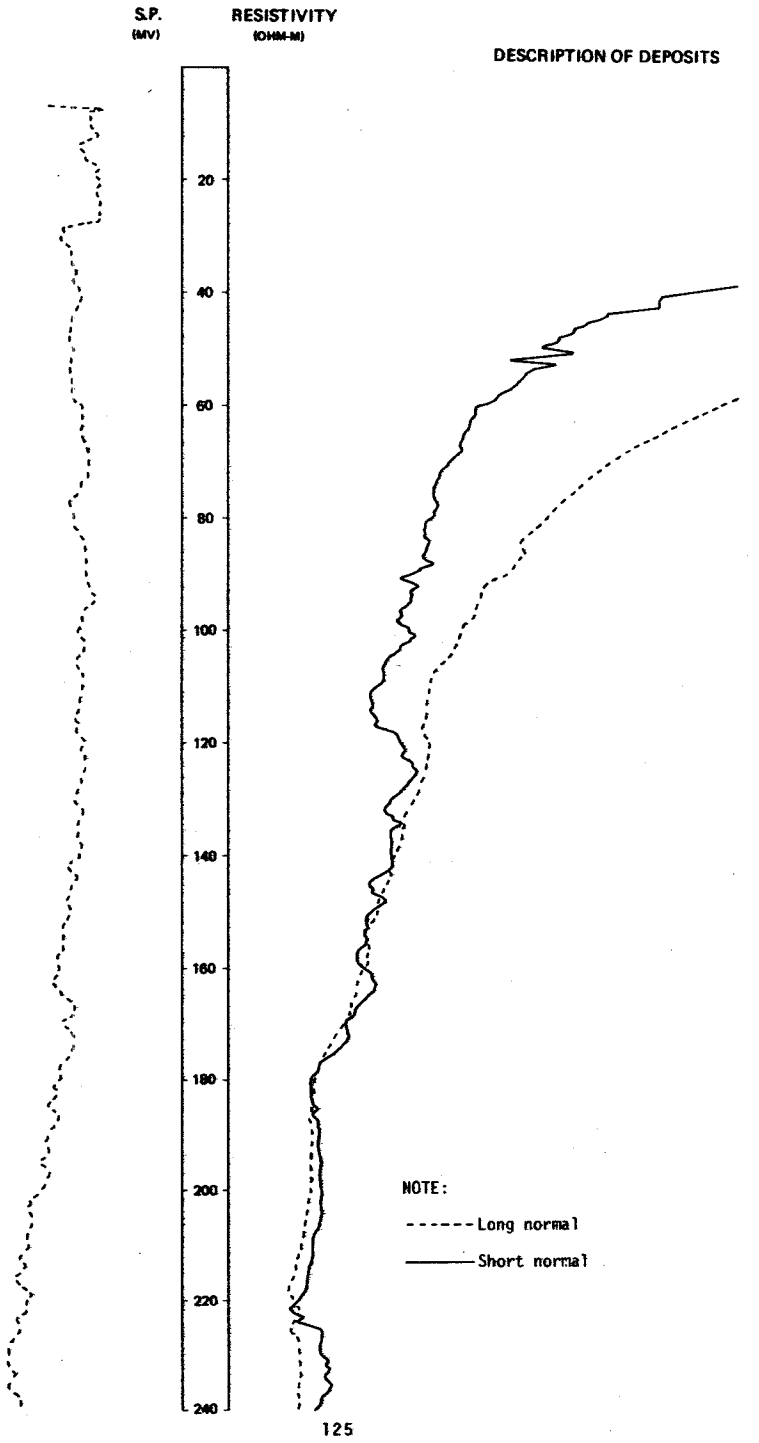
NDSWC 6003, Continued

LOCATION: 159-065-20CBC

DATE DRILLED: 9/24/81

ALTITUDE: 1490
(FT, NGVD)

DEPTH: 442
(FT)

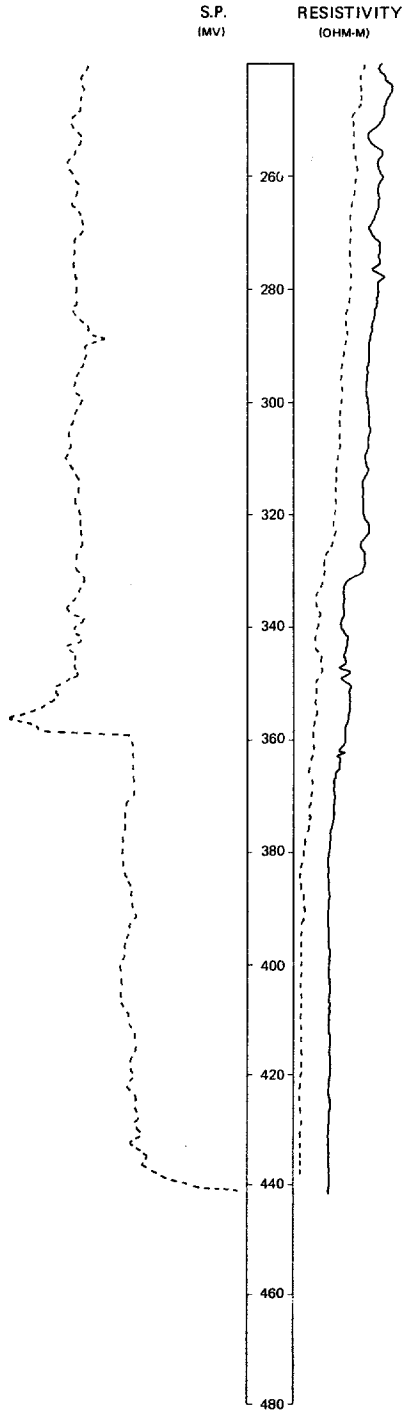


LOCATION: 159-065-20CBC

DATE DRILLED: 9/24/81

ALTITUDE: 1490
(FT, NGVD)

DEPTH: 442
(FT)



DESCRIPTION OF DEPOSITS

NOTE:

------Long normal

———Short normal

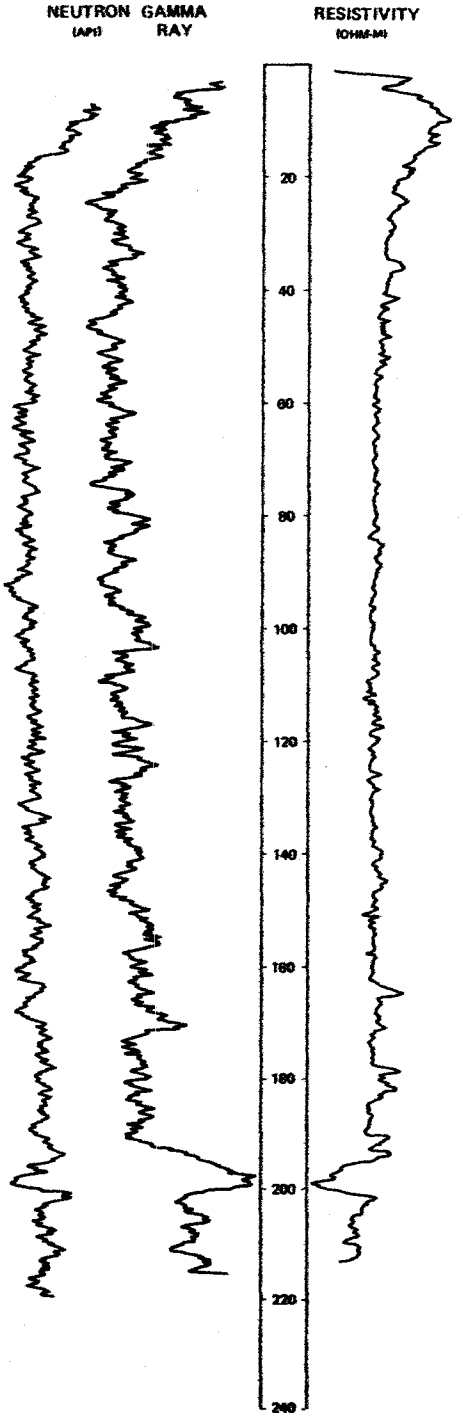
NDSWC 6002

LOCATION: 159-065-21CCC

DATE DRILLED: 9/24/81

ALTITUDE: 1500
(FT, NGVD)

DEPTH: 221
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-12	Clay, yellowish-brown, pebbly, oxidized (till).
12-16	Clay, olive-gray, gravelly (till).
16-22	Clay, olive-gray, sandy (till).
22-190	Gravel, fine to very coarse, angular to rounded; some cobbles; about 90 percent detrital shale with 10 percent carbonate and silicate pebbles.

PIERRE SHALE

190-221	Shale, grayish-black, very bentonitic, poorly indurated.

159-065-22AAA
NDSWC 5774

Altitude: 1512 feet — Date drilled: 7/24/80

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, very silty to sandy, oxidized (till)	16	17
	Clay, olive-gray, silty to sandy, gravelly (till)	16	33
Pierre Shale:			
	Shale, dark-gray, siliceous, indurated, fractured	9	42

159-065-29CCC
NDSWC 6008

Altitude: 1490 feet — Date drilled: 9/25/81

Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, silty, oxidized (till)	11	12
	Clay, olive-gray, very silty (till)	8	20
	Silt, greenish-gray, clayey	32	52
Pierre Shale:			
	Shale, dark-gray, bentonitic, fractured	29	81

159-065-30CCC
NDSWC 6006

Altitude: 1490 feet — Date drilled: 9/25/81

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Sand, fine to coarse, oxidized; interbedded with fine to medium gravel	11	12
	Clay, yellowish-brown, silty, oxidized (till)	3	15
	Clay, olive-gray, pebbly (till)	5	20
	Silt, olive-gray, clayey	4	24
	Sand, coarse; interbedded with lenses of fine to medium rounded gravel	4	28
	Clay, olive-gray, sandy	7	35
Pierre Shale:			
	Shale, greenish-black, fractured; thin lenses of bentonite and limestone	26	61

159-065-36DDD
NDSWC 6007

Altitude: 1490 feet — Date drilled: 9/25/81

Glacial drift:			
	Topsoil	1	1
	Silt, pale-yellowish-brown, clayey, oxidized	4	5
	Silt, yellowish-brown, clayey, oxidized	10	15
	Clay, olive-gray, gravelly, sandy (till)	19	34
	Silt, greenish-gray, clayey	6	40
	Clay, olive-gray (till); abundant detrital shale	15	55
	Silt, dark-gray, clayey	4	59
Pierre Shale:			
	Shale, dark-grayish-black, fractured; bentonitic lenses	22	81

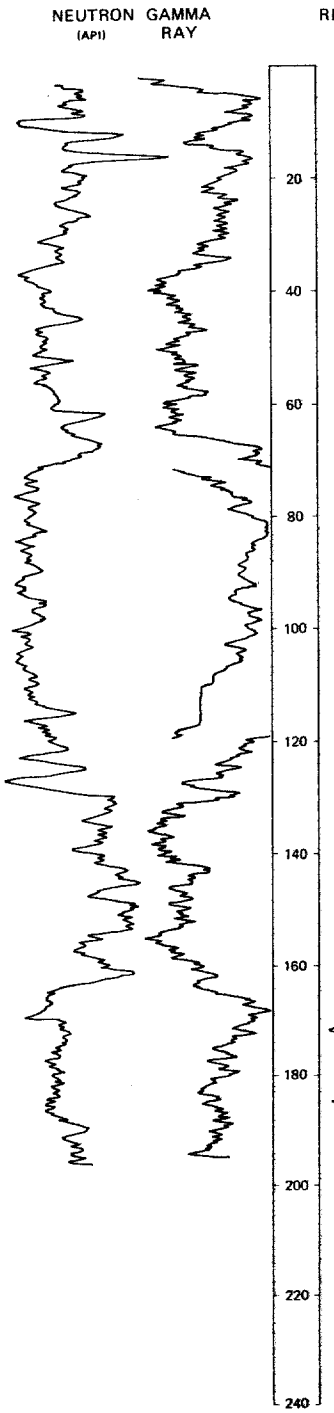
NDSWC 6001

LOCATION: 159-066-05ADA

DATE DRILLED: 9/23/81

ALTITUDE: 1508
(FT, NGVD)

DEPTH: 201
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-4	Gravel, fine to coarse, subrounded, oxidized.
4-12	Clay, yellowish-brown, pebbly, oxidized (till).
12-17	Clay, olive-gray, gravelly (till).
17-35	Silt, brownish-gray, clayey.
35-41	Sand, coarse; interbedded with medium subrounded gravel.
41-65	Gravel, fine to coarse, angular; about 70 percent detrital shale and 30 percent silicate and carbonate pebbles.
65-70	Clay, olive-gray, sandy (till).
70-118	Silt, brownish-gray, clayey.
118-165	Sand, fine to coarse; interbedded with fine subangular gravel; abundant detrital shale.
165-190	Clay, medium-gray (till); predominantly macerated shale.

PIERRE SHALE

190-201	Shale, greenish-black, siliceous, fractured.

159-066-05CCC
(Log modified from C. A. Simpson & Son)

Altitude: 1510 feet — Date drilled: 8/12/78

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Sand, fine, yellow	11	12
	Clay, yellow, gravelly	4	16
	Clay, blue, gravelly	86	102
	Gravel; with water	50	152
	Clay, blue, gravelly	6	158
	Sand, fine	4	162
	Clay, blue	14	176
	Gravel; with clay layers	13	189
Pierre Shale:			
	Shale	39	228

159-066-08CCC
(Log modified from C. A. Simpson & Son)

Altitude: 1512 feet — Date drilled: 10/10/79

Glacial drift:			
	Topsoil	2	2
	Shale gravel	9	11
	Clay, blue	119	130
	Gravel	9	139
	Clay, blue; with gravel layers	12	151
	Gravel, medium to coarse	3	154
	Clay, blue; with gravel layers	31	185
	Gravel, coarse	1	186
	Clay, blue	8	194
	Clay, blue, shaly	20	214
Pierre Shale:			
	Shale, hard	13	227

159-066-14CAA
(Log modified from Church Well Boring)

Altitude: 1500 feet — Date drilled: 9/06/79

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil, black	1	1
	Clay, yellow, sandy, wet	6	7
	Clay, yellow, pebbly	1	8
	Sand, yellow	4	12
	Clay, yellow, pebbly	4	16
	Clay, blue, sandy, hard	2	18
	Clay, blue, and sand layers; water	11	29
	Clay, blue, pebbly	10	39
Pierre Shale:			
	Shale	6	45
	Clay, blue, sandy, hard	25	70
	Shale	3	73

159-066-15CCC
(Log modified from C. A. Simpson & Son)

Altitude: 1505 feet — Date drilled: 8/13/75

Glacial drift:			
	Topsoil	1	1
	Clay, yellow, sandy	19	20
	Clay, blue, shaly	15	35
Pierre Shale:			
	Shale, blue	99	134

159-066-18DDD
(Log modified from C. A. Simpson & Son)

Altitude: 1500 feet — Date drilled: 4/10/73

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	14	15
	Clay, blue	17	32
	Sand; mostly shale	33	65

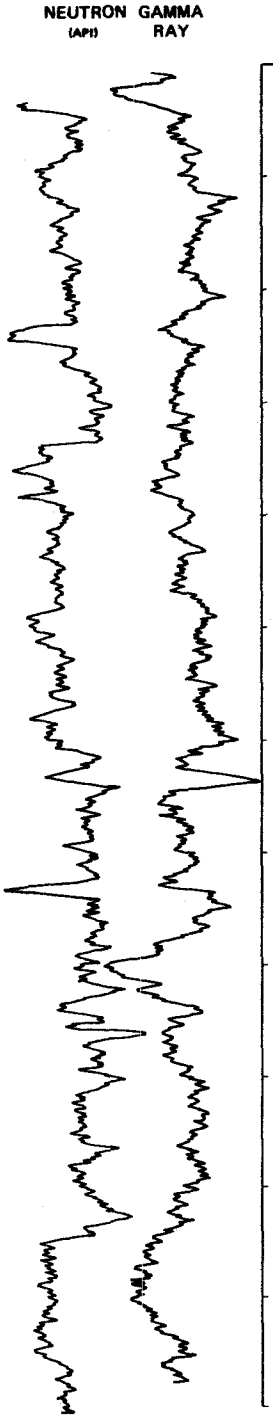
NDSWC 5731

LOCATION: 159-066-20CCC

DATE DRILLED: 6/24/80

ALTITUDE: 1495
(FT, NGVD)

DEPTH: 242
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-10	Clay, yellowish-brown, very sandy, gravelly, oxidized (till).
10-16	Clay, olive-gray, sandy, gravelly (till).
16-68	Clay, olive-gray, sandy, very gravelly (till).
68-128	Clay, olive-gray, silty to sandy (till).
128-160	Clay, brownish-gray, very sandy, pebbly (till).
160-164	Sand, fine to coarse, gravelly, subangular to rounded; predominately quartz grains.
164-210	Clay, brownish-gray, very sandy (till).
210-232	Clay, dark-gray (till); abundant detrital shale.

PIERRE SHALE

232-242	Shale, grayish-black, siliceous, indurated, fractured.

159-066-26DDD
NDSWC 5728

Altitude: 1492 feet

Date drilled: 6/23/80

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Sand, fine to coarse, gravelly, subrounded to rounded, oxidized	10	11
	Clay, olive-gray, very sandy, gravelly (till)	9	20
	Silt, brownish-gray, clayey	10	30
Pierre Shale:			
	Shale, dark-gray, siliceous, fractured	17	47
	Shale, dark-gray, bentonitic, indurated; interbedded with brownish-gray siltstone	18	65
	Shale, dark-gray, siliceous, bentonitic, well-indurated, fissile	17	82

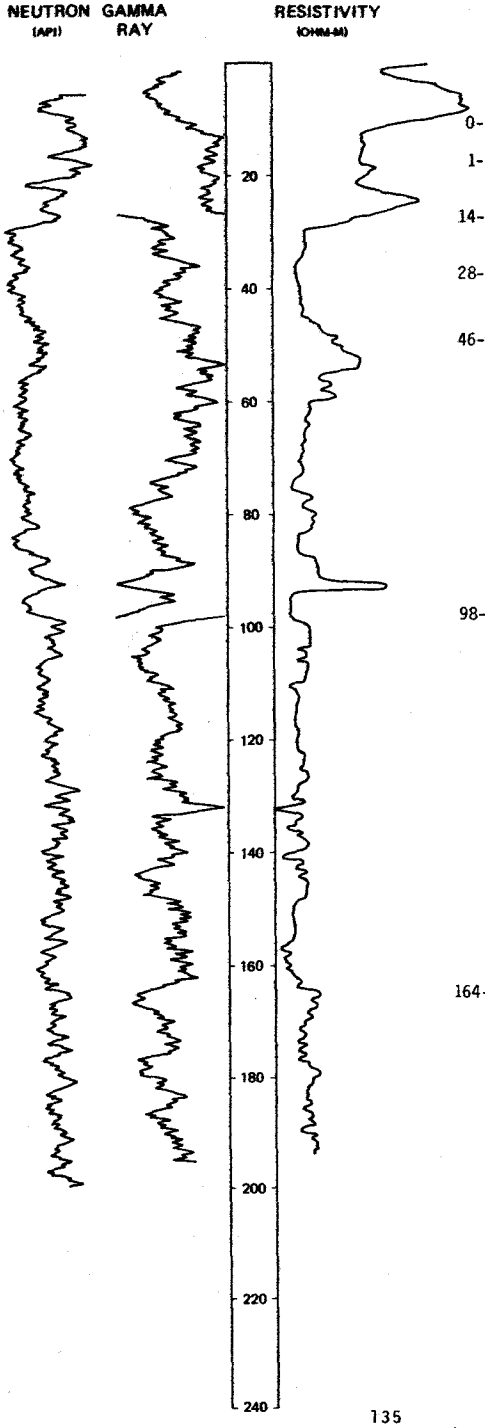
NDSWC 5726

LOCATION: 159-066-27CCD

DATE DRILLED: 6/23/80

ALTITUDE: 1485
(FT, NGVD)

DEPTH: 202
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-14	Clay, yellowish-brown, very silty, oxidized (till).
14-28	Clay, olive-gray, very silty to sandy (till).
28-46	Clay, olive-gray, very cohesive.
46-98	Clay, dark-gray, silty.
98-164	Clay, dark-gray, silty; abundant detrital shale.

PIERRE SHALE

164-202	Shale, dark-gray, siliceous, indurated, fractured.

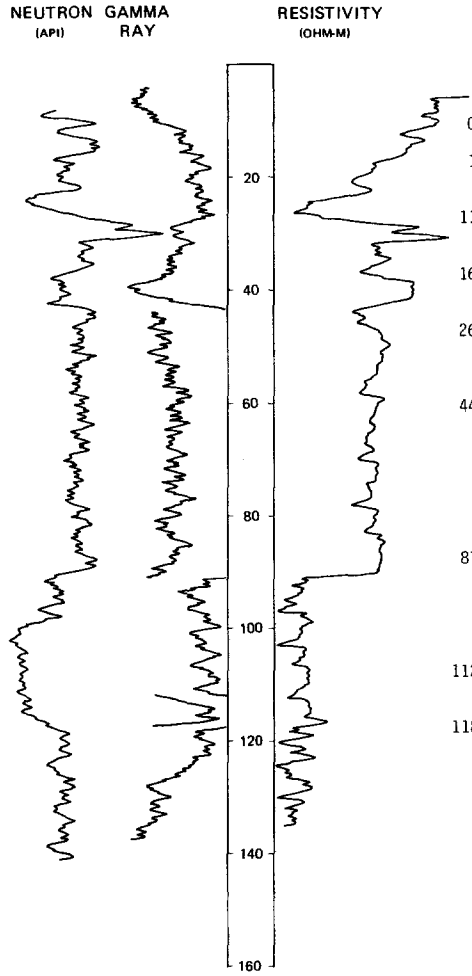
NDSWC 5727

LOCATION: 159-066-27DDD

DATE DRILLED: 6/23/80

ALTITUDE: 1485
(FT, NGVD)

DEPTH: 142
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-11	Sand, very fine, rounded, oxidized.
11-16	Clay, yellowish-brown, very silty, oxidized (till).
16-26	Clay, olive-gray, very silty to sandy (till).
26-44	Clay, dark-gray, gravelly (till); abundant detrital shale.
44-87	Clay, dark-brownish-gray, very silty to sandy (till).
87-112	Siltstone and shale, brownish-gray; bedrock shove block.

PIERRE SHALE

112-118	Shale, dark-gray, silty, siliceous, well-indurated.
118-142	Shale, dark-gray, siliceous, well-indurated, fissile.

159-066-29CDD
(Log modified from C. A. Simpson & Son)

Altitude: 1490 feet

Date drilled: 9/17/63

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow	19	20
	Clay, blue	60	80
	Clay, blue, sandy	55	135
	Sand	15	150

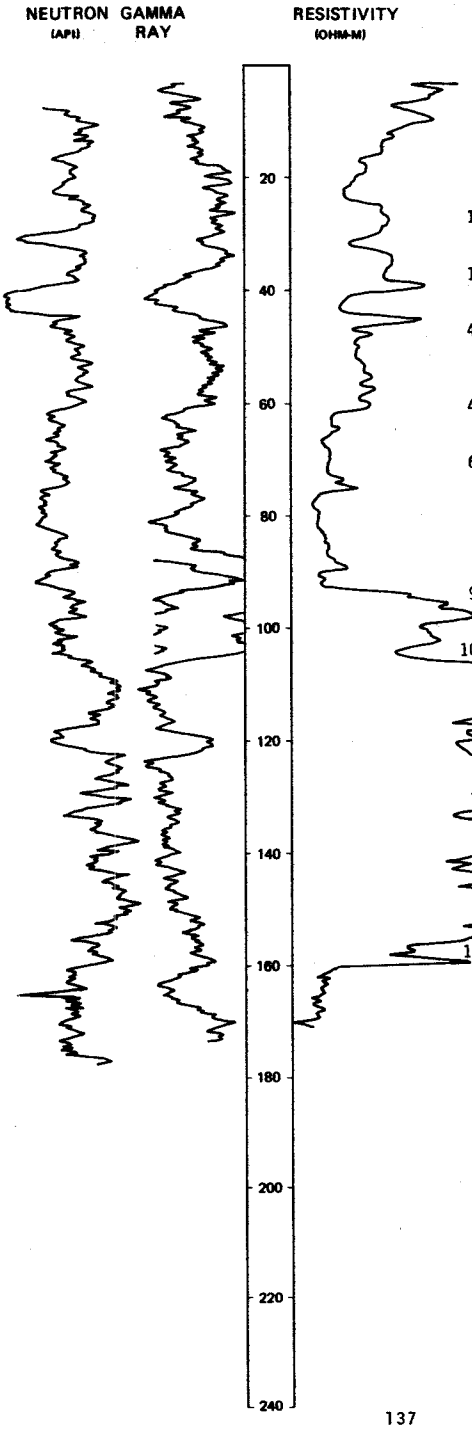
NDSWC 5729

LOCATION: 159-066-29DDD

DATE DRILLED: 6/23/80

ALTITUDE: 1490
(FT, NGVD)

DEPTH: 182
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-10	Sand, fine, gravelly, sub-rounded to rounded, oxidized.
10-18	Clay, yellowish-brown, silty to sandy, oxidized (till).
18-40	Clay, olive-gray, very silty and sandy, gravelly (till).
40-46	Sand, fine, gravelly, rounded; abundant detrital shale and lignite.
46-62	Clay, brownish-gray, very sandy to gravelly (till).
62-94	Clay, dark-gray (till); reworked bedrock shale.
94-106	Sand, coarse, gravelly, angular to rounded.
106-160	Gravel, fine; about 30 percent medium to coarse angular to rounded sand; predominately quartz, carbonate, and detrital shale pebbles.

PIERRE SHALE

160-182	Shale, dark-gray, siliceous, well-indurated, partially fractured.

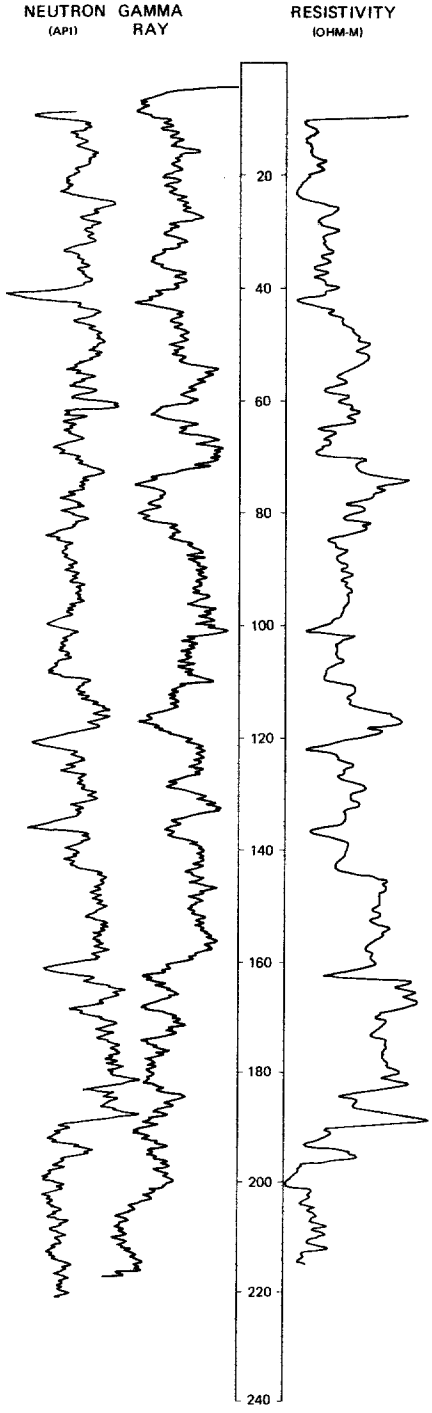
NDSWC 5730

LOCATION: 159-066-30DDD

DATE DRILLED: 6/24/80

ALTITUDE: 1495
(FT, NGVD)

DEPTH: 222
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-10	Clay, yellowish-brown, silty to sandy, oxidized (till).
10-86	Clay, olive-gray, silty to sandy (till); lenses of sand and gravel from 28 to 29, 40 to 41, and 60 to 62 feet.
86-144	Clay, olive-gray, silty, sandy (till); occasional thin lenses of gravel.
144-160	Clay, brownish-gray, very silty (till); interbedded with thin lenses of sand and gravel.
160-200	Clay, dark-gray, very sandy (till); abundant detrital shale gravel.

PIERRE SHALE

200-222	Shale, dark-gray, siliceous, fractured.

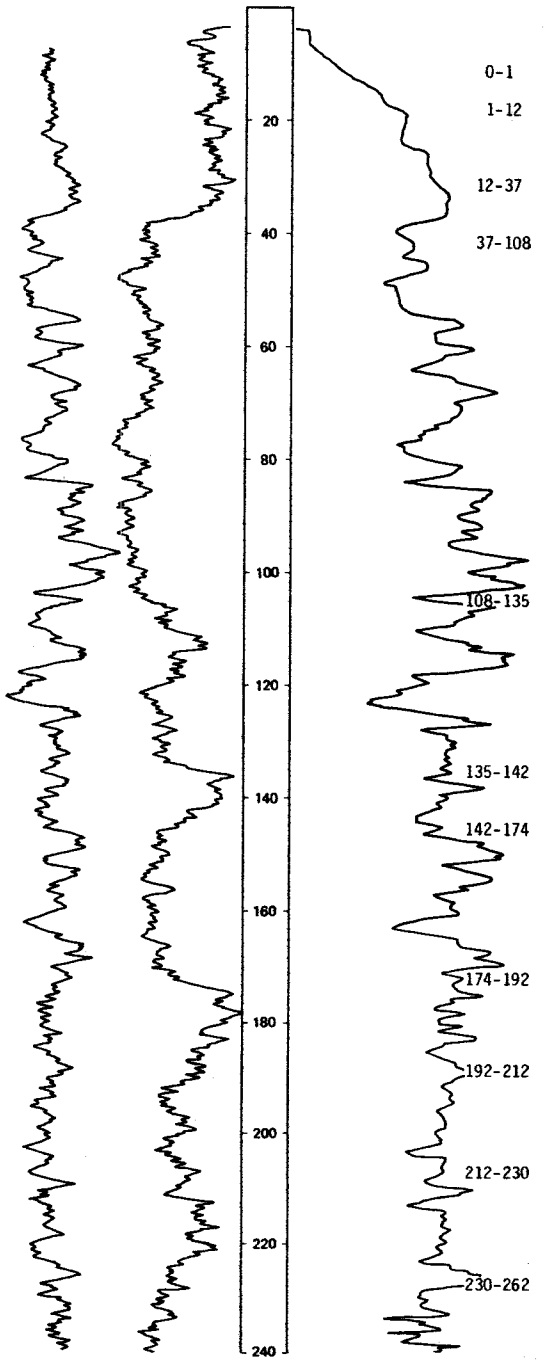
NDSWC 5732

LOCATION: 159-067-01AAD

DATE DRILLED: 6/24/80

ALTITUDE: 1526
(FT, NGVD)

DEPTH: 262
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-12	Clay, yellowish-brown, very silty to sandy, oxidized (till).
12-37	Clay, olive-gray, very silty, sandy (till).
37-108	Sand, fine to very coarse, gravelly, angular to rounded, mostly rounded.
108-135	Gravel, fine to coarse, sandy, subangular to rounded; predominately quartz, carbonate, and detrital shale pebbles.
135-142	Silt, dark-gray, clayey.
142-174	Gravel, fine to coarse, sandy, subangular to rounded; predominately detrital shale and lignite pebbles.
174-192	Silt, brownish-gray, clayey; abundant detrital lignite.
192-212	Clay, brownish-gray, very silty, pebbly (till).
212-230	Clay, dark-gray, very sandy (till); abundant detrital shale.

PIERRE SHALE

230-262	Shale, grayish-black, siliceous, well-indurated, fissile.

LOCATION: 159-067-01AAD

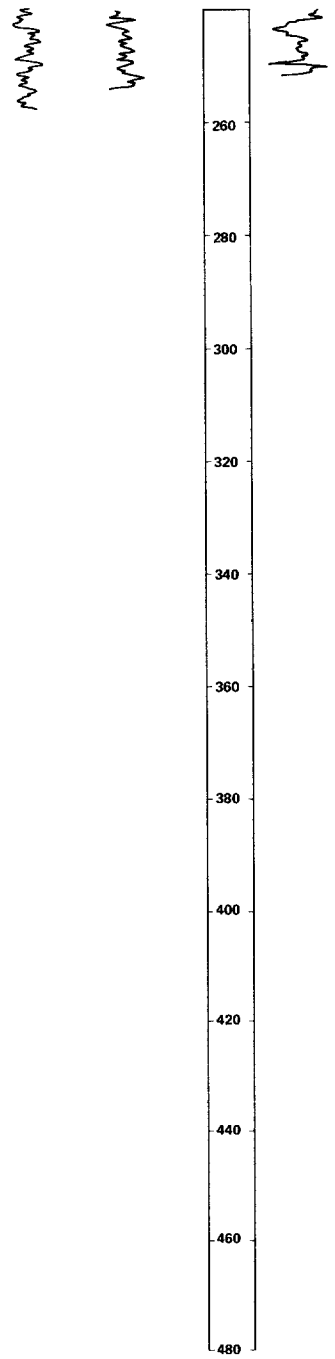
DATE DRILLED: 6/24/80

ALTITUDE: 1526
(FT, NGVD)

DEPTH: 262
(FT)

NEUTRON (API) | GAMMA RAY | RESISTIVITY (OHM-M)

DESCRIPTION OF DEPOSITS



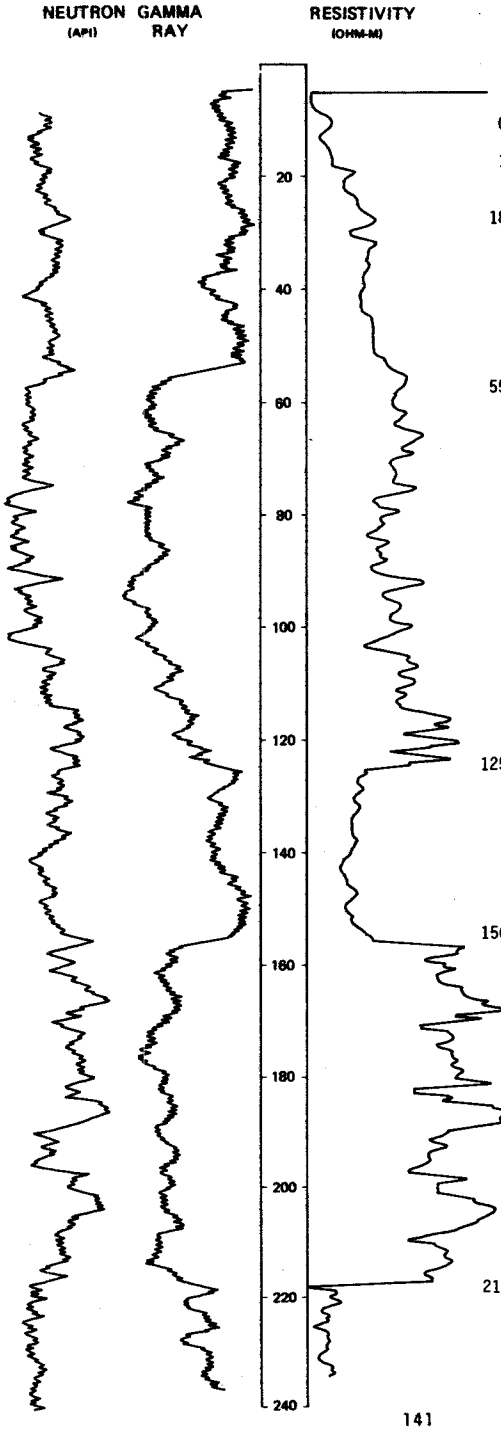
NDSWC 5733

LOCATION: 159-067-01BBB1

DATE DRILLED: 6/25/80

ALTITUDE: 1530
(FT, NGVD)

DEPTH: 242
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-18	Clay, yellowish-brown, very silty, sandy, oxidized (till).
18-55	Clay, olive-gray, very sandy (till).
55-125	Sand, medium to coarse; about 30 percent fine to coarse angular to rounded gravel.
125-156	Clay, brownish-gray, very sandy (till).
156-218	Gravel, fine to coarse; about 40 percent fine to very coarse angular to rounded sand; abundant detrital shale.

PIERRE SHALE

218-242	Shale, dark-gray, silty, bentonitic, indurated.

159-067-01BBB2
NDSWC 5734

Altitude: 1530 feet — Date drilled: 6/25/80

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, very silty, sandy, oxidized (till)	17	18
	Clay, olive-gray, very silty to sandy, pebbly (till)	37	55
	Sand, fine to very coarse; about 30 percent fine to coarse angular to rounded gravel; mostly rounded	60	115

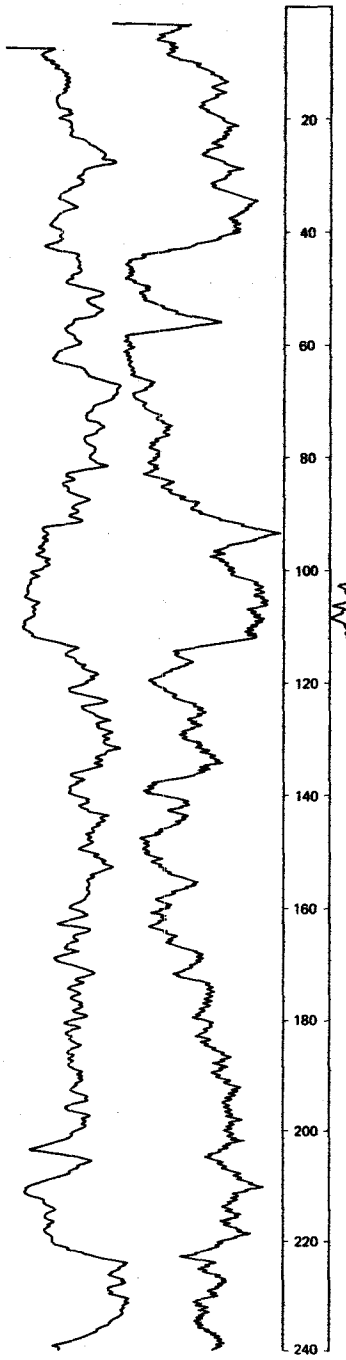
NDSWC 5736

LOCATION: 159-067-04AAD

DATE DRILLED: 6/26/80

ALTITUDE: 1545
(FT, NGVD)

DEPTH: 342
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

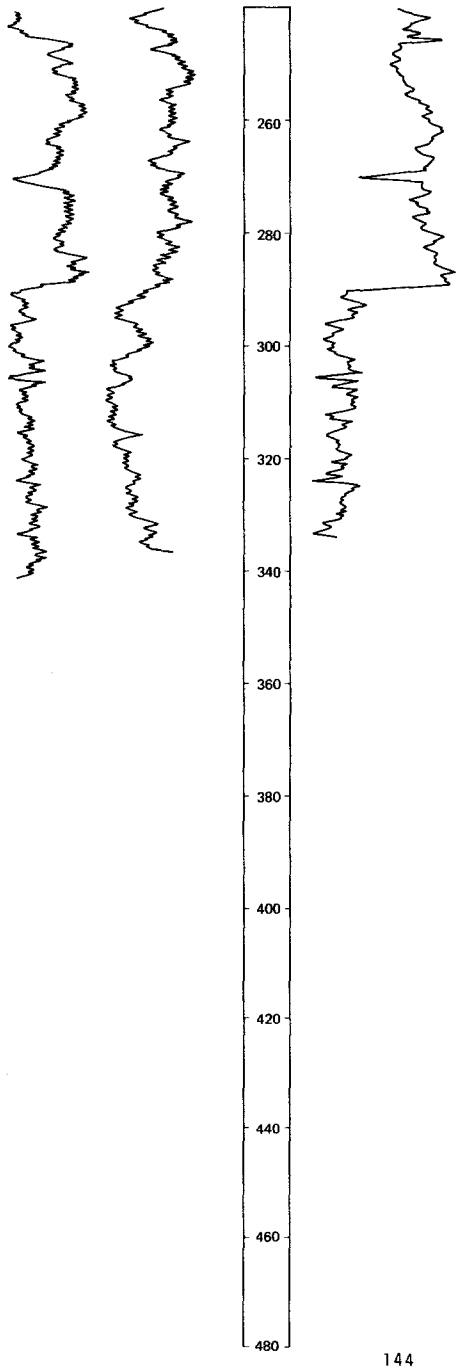
0-1	Topsoil.
1-9	Gravel, fine, oxidized; about 30 percent coarse angular to rounded sand.
9-14	Clay, yellowish-brown, very silty, oxidized (till).
14-66	Clay, olive-gray, very silty (till); interbedded with sand and gravel from 43 to 55 feet.
66-92	Sand, fine to coarse; about 30 percent fine subangular to rounded gravel; predominantly quartz grains.
92-101	Silt, greenish-gray to yellowish-brown, very clayey, carbonaceous.
101-114	Clay, brownish-gray, sandy, pebbly (till).
114-174	Sand, fine to coarse, gravelly; interbedded with silty till.
174-220	Clay, olive-gray, very silty (till).
220-290	Clay, olive-gray, very sandy, pebbly (till).

LOCATION: 159-067-04AAD

DATE DRILLED: 6/26/80

ALTITUDE: 1545
(FT, NGVD)

DEPTH: 342
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

290-300 Clay, dark-gray (till); abundant detrital shale.

PIERRE SHALE

300-342 Shale, dark-gray, siliceous, fissile, fractured.

159-067-04DDD1
NDSWC 5739

Altitude: 1535 feet — Date drilled: 7/02/80

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, very silty to sandy, oxidized (till)	9	10
	Clay, olive-gray, very silty, gravelly (till)	40	50
	Clay, brownish-gray, silty, bentonitic	18	68
	Sand, fine to very coarse, gravelly; angular to rounded cobbles	22	90
	Clay, dark-gray, silty to sandy	12	102

159-067-04DDD2
NDSWC 5740

Altitude: 1538 feet — Date drilled: 7/02/80

Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, very silty, gravelly, oxidized (till)	16	17
	Clay, olive-gray, very silty to sandy (till)	7	24
	Sand, fine to very coarse; about 40 percent coarse gravel; some cobbles; predominantly rounded	36	60

159-067-16BAB
(Log modified from C. A. Simpson & Son)

Altitude: 1550 feet — Date drilled: 11/ /76

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	29	30
	Clay, blue	10	40
	Sand, coarse	2	42
	Clay, blue, sandy	10	52
	Gravel, dry	8	60
	Clay, blue	12	72
	Sand, dirty	12	84
	Clay, blue	106	190
	Sand, fine, soupy	10	200
	Clay, blue	23	223
	Sand, fine to coarse; with water	112	335
	Sand, dirty	15	350
Pierre Shale:			
	Shale	65	415

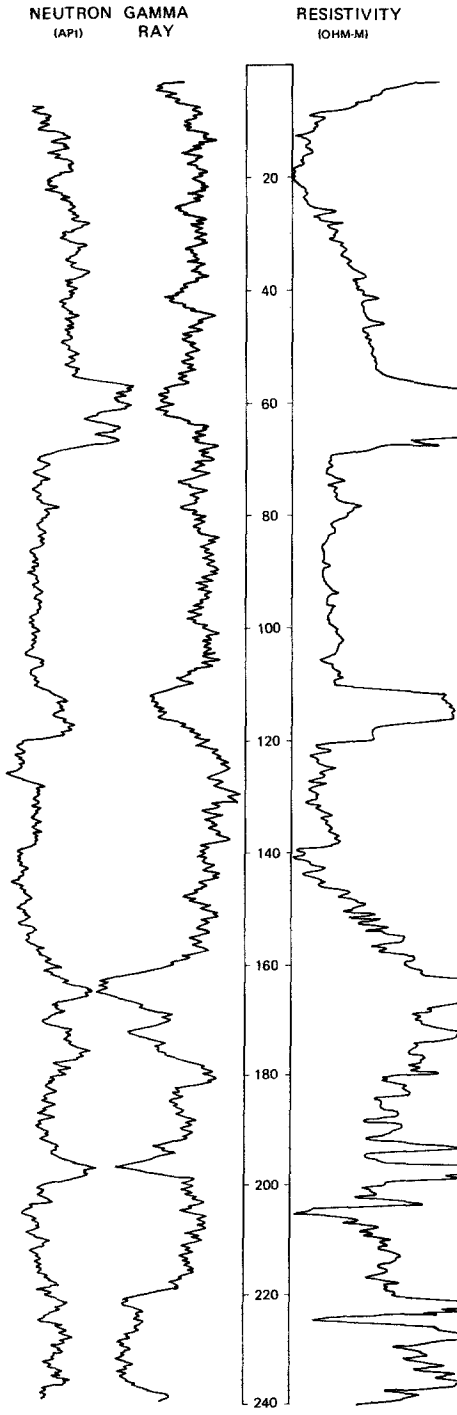
NDSWC 5741

LOCATION: 159-067-28DCD

DATE DRILLED: 7/03/80

ALTITUDE: 1510
(FT, NGVD)

DEPTH: 402
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-12	Clay, yellowish-brown, silty, oxidized (till).
12-56	Clay, olive-gray, very silty to sandy, pebbly (till).
56-65	Silt, dark-gray, clayey.
65-112	Clay, olive-gray, very silty (till).
112-120	Sand, fine to medium, subrounded, silty.
120-140	Clay, olive-gray, very silty, pebbly (till).
140-200	Clay, olive-gray, very silty (till); becoming increasingly sandy with depth.
200-220	Clay, olive-gray, very silty, sandy (till).
220-290	Sand, fine to very coarse, gravelly, angular to rounded.

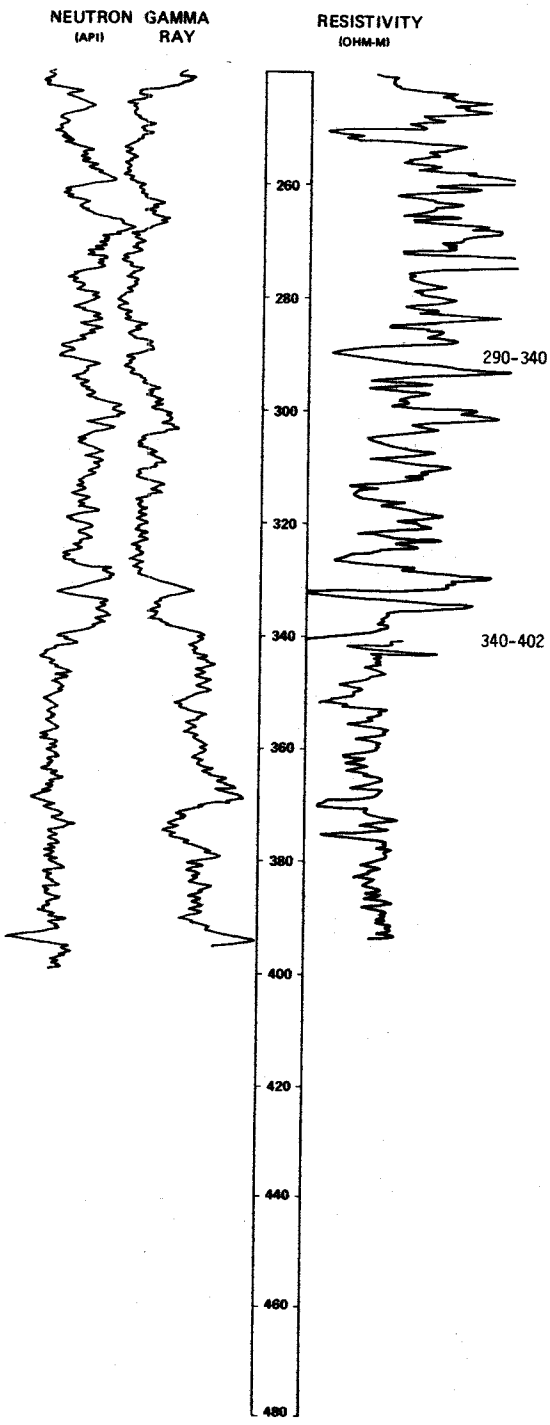
NDSWC 5741, Continued

LOCATION: 159-067-28DCD

DATE DRILLED: 7/03/80

ALTITUDE: 1510
(FT, NGVD)

DEPTH: 402
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

290-340 Sand, fine to coarse; about 30 percent detrital shale; angular to rounded gravel.

PIERRE SHALE

340-402 Shale, dark-gray, siliceous, well-indurated, fissile.

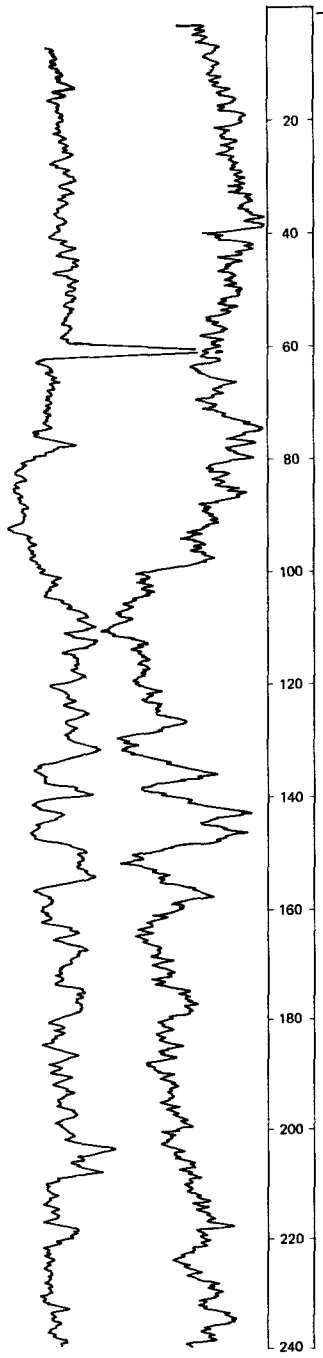
NDSWC 5956

LOCATION: 159-067-33CCC

DATE DRILLED: 8/25/81

ALTITUDE: 1510
(FT, NGVD)

DEPTH: 280
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

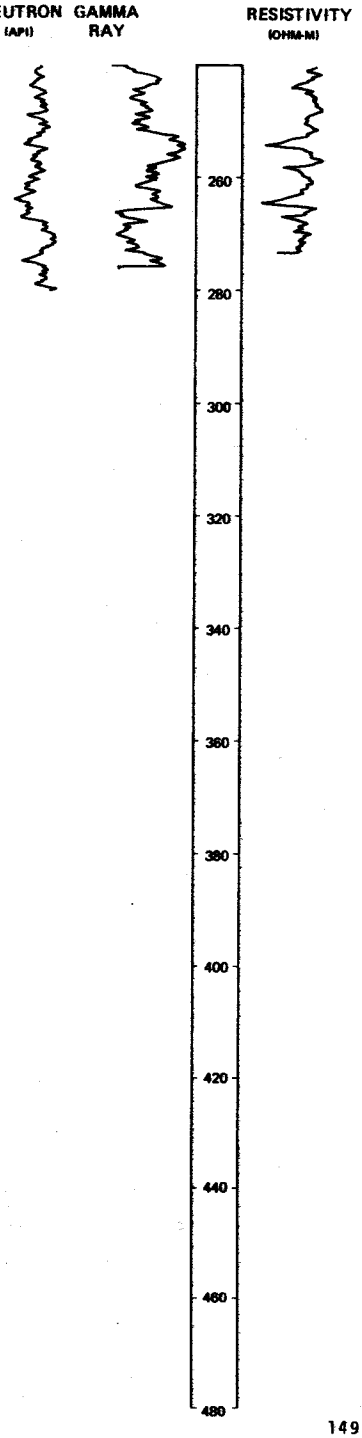
0-1	Topsoil.
1-17	Clay, yellowish-brown, pebbly, oxidized (till).
17-60	Clay, olive-gray, gravelly (till).
60-71	Clay, olive-gray, sandy (till); boulders.
71-86	Clay, dark-gray, pebbly (till).
86-90	Silt, dark-gray, clayey.
90-112	Sand, fine, silty, angular; predominantly quartz, carbonate, and detrital lignite grains.
112-124	Gravel, fine to medium; interbedded with coarse sand; predominantly detrital shale.
124-149	Sand, coarse; interbedded with fine to coarse angular to rounded gravel; about 50 percent quartz and 50 percent carbonate and detrital shale.
149-205	Gravel, medium to coarse, rounded; predominantly detrital shale.
205-220	Clay, greenish-gray, very sandy, pebbly (till).
220-240	Shale, greenish-gray, pebbly, macerated (till).

LOCATION: 159-067-33CCC

DATE DRILLED: 8/25/81

ALTITUDE: 1510
(FT, NGVD)

DEPTH: 280
(FT)



DESCRIPTION OF DEPOSITS

PIERRE SHALE

240-266	Shale, dark-gray, fissile, tight.
266-280	Shale, grayish-black, siliceous, fractured.

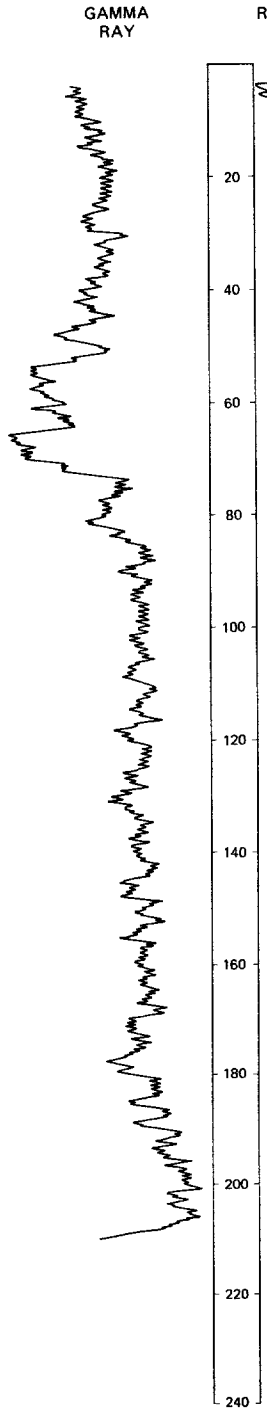
NDSWC 5961

LOCATION: 159-067-36DDD

DATE DRILLED: 8/26/81

ALTITUDE: 1482
(FT, NGVD)

DEPTH: 230
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-12	Clay, yellowish-brown, sandy, oxidized (till).
12-50	Clay, olive-gray, sandy to gravelly (till).
50-54	Gravel, very coarse, subrounded.
54-56	Clay, olive-gray, very sandy (till).
56-64	Sand, very coarse; interbedded with fine to medium subangular gravel.
64-65	Clay, dark-gray, silty.
65-72	Boulder, quartzite.
72-194	Clay, brownish-gray, pebbly (till); partially oxidized to 84 feet.
194-205	Clay, brownish-gray, silty.
205-210	Gravel, fine to coarse, subrounded; predominantly detrital shale pebbles.
210-221	Clay, dark-gray, pebbly (till); abundant detrital shale.

PIERRE SHALE

221-230	Shale, greenish-black, siliceous, fractured.

159-068-01BAA
(Log modified from C. A. Simpson & Son)

Altitude: 1595 feet — Date drilled: 7/08/64

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow	17	18
	Clay, blue	37	55
	Gravel, clayey	5	60
	Sand, clayey	25	85
	Clay, sandy	10	95
	Clay, blue	60	155
	Clay, slightly sandy	20	175
	Clay, blue	5	180
Pierre Shale:			
	Shale	57	237

159-068-01BAB
(Log modified from C. A. Simpson & Son)

Altitude: 1602 feet — Date drilled: 11/06/65

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	24	25
	Clay, blue	33	58
	Sand, clayey	12	70
	Clay, blue	22	92
	Clay, blue, sandy; rocks	23	115
	Clay, blue	34	149
	Sand, fine, clayey	32	181
Pierre Shale:			
	Shale	16	197
	Shale gravel	14	211
	Shale	19	230

159-068-01BDA
(Log modified from C. A. Simpson & Son)

Altitude: 1600 feet — Date drilled: 11/21/63

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Clay, yellow	26	26
	Clay, blue, gravelly; rocks	28	54
	Sand, clayey	4	58
	Clay, blue, gravelly; rocks	30	88
	Sand and gravel	1	89
	Hardpan, sandy	5	94
	Hardpan, gravelly	10	104
	Clay, blue, gravelly; rocks	13	117
	Sand, fine, clayey	6	123
	Clay, sandy	6	129
	Sand, clayey	4	133
	Clay, gray	12	145
	Sand, clayey	37	182
Pierre Shale(?):			
	Shale	13	195
	Sand	1	196
	Shale	9	205
	Sand	1	206
	Shale	2	208
	Sand	1	209
	Shale	51	260

159-068-11DAA
(Log modified from C. A. Simpson & Son)

Altitude: 1584 feet — Date drilled: 12/05/74

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	19	20
	Clay, blue, sandy	55	75
	Gravel	10	85
	Clay, blue, gravelly	35	120
Pierre Shale:			
	Shale	49	169

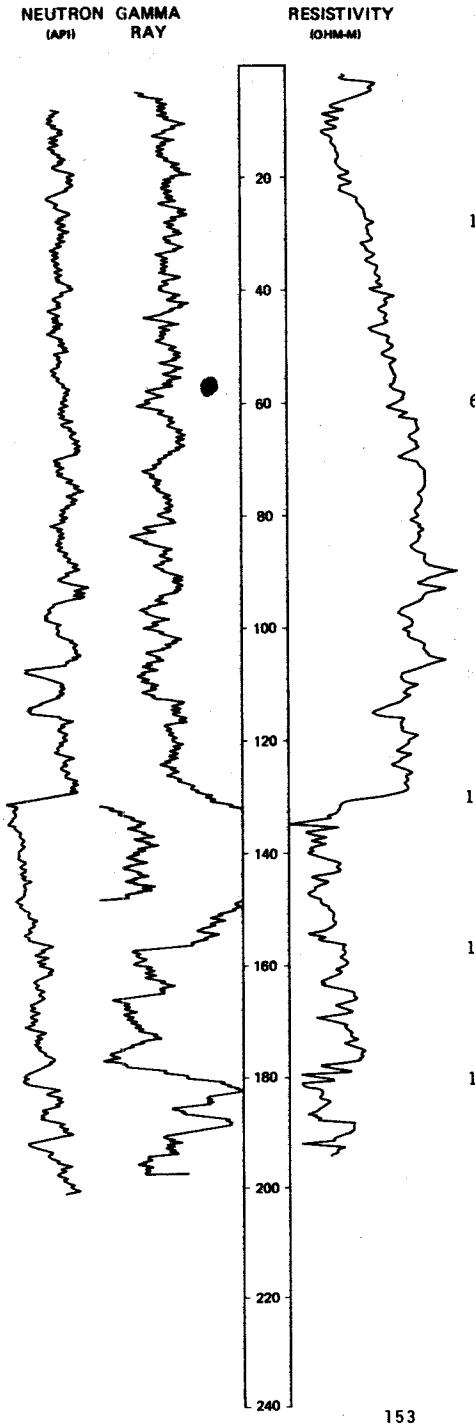
NDSWC 5953

LOCATION: 159-068-16DDD

DATE DRILLED: 8/24/81

ALTITUDE: 1590
(FT, NGVD)

DEPTH: 200
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-13	Clay, yellowish-brown, pebbly, oxidized (till).
13-60	Clay, olive-gray, pebbly (till).
60-130	Clay, olive-gray, gravelly (till).

PIERRE SHALE

130-156	Shale, dark-gray, fractured; with many fractures filled with silt and clay.
156-180	Shale, dark-gray, siliceous, fractured.
180-200	Shale, grayish-black, poorly indurated to moderately indurated.

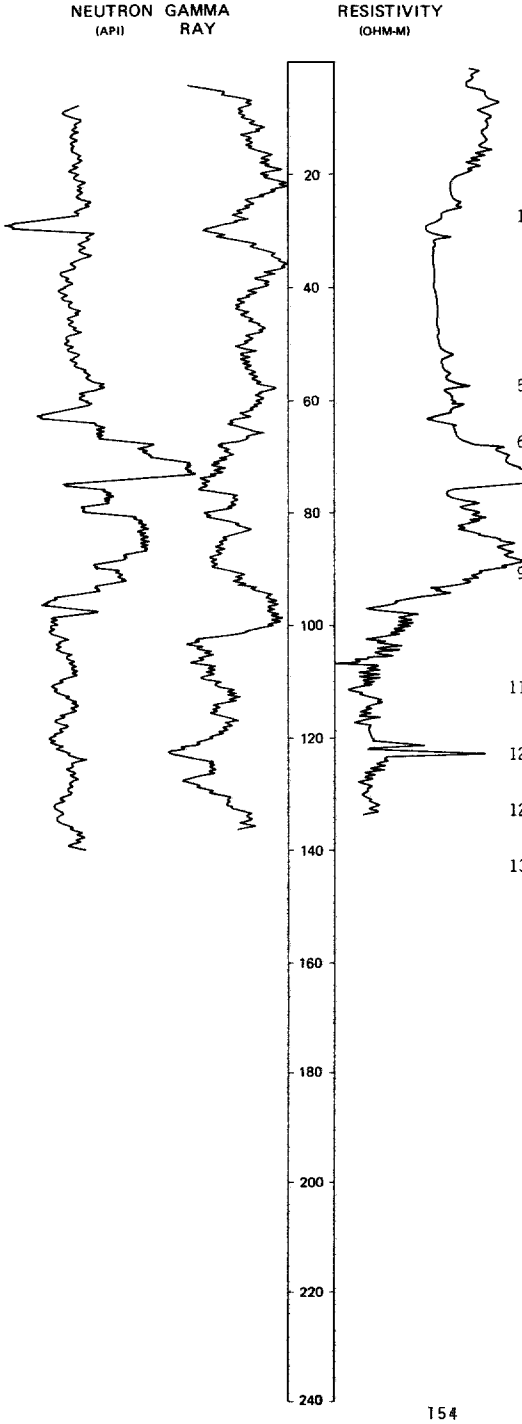
NDSWC 5954

LOCATION: 159-068-25CCC

DATE DRILLED: 8/24/81

ALTITUDE: 1530
(FT, NGVD)

DEPTH: 140
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-13	Clay, yellowish-brown, pebbly, oxidized (till).
13-58	Clay, olive-gray, pebbly (till).
58-62	Gravel, fine to coarse, angular to rounded.
62-94	Clay, olive-gray (till); interbedded with lenses of sand and gravel.

PIERRE SHALE

94-110	Shale, brownish-black, siliceous, fractured.
110-122	Shale, grayish-black, fractured.
122-123	Limestone, brownish-gray, indurated.
123-130	Shale, grayish-black, siliceous, fractured.
130-140	Shale, greenish-black, poorly indurated, tight.

159-068-27AAA
(Log modified from C. A. Simpson & Son)

Altitude: 1560 feet — Date drilled: 10/31/77

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow	19	20
	Clay, yellow, very sandy	18	38
	Clay, blue	7	45
	Clay, blue, sandy	17	62
	Clay, blue	18	80
	Sand, clayey	16	96
	Clay, blue	28	124
Pierre Shale:			
	Shale	17	141

160-065-03DDC
(Log modified from L. A. Gjerdevig)

Altitude: 1554 feet — Date drilled: 6/05/75

Glacial drift:			
	Topsoil	2	2
	Clay, gray	3	5
	Clay, yellow, sandy	15	20
	Clay, gray, sandy	10	30
	Clay, gray	30	60
	Clay, gray; trace of shale	40	100
Pierre Shale:			
	Shale	50	150

160-065-20CCC
(Log modified from C. A. Simpson & Son)

Altitude: 1527 feet — Date drilled: 7/14/66

Glacial drift:			
	Topsoil	1	1
	Clay, yellow, sandy; rocks	26	27
	Clay, blue, sandy; rocks	27	54
Pierre Shale:			
	Shale	76	130

160-065-23BCC
NDSWC 5773

Altitude: 1550 feet — Date drilled: 7/24/80

Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, silty, oxidized (till)	17	18
	Clay, olive-gray, silty, gravelly (till)	5	23
Pierre Shale:			
	Shale, dark-gray, siliceous, indurated, fractured	19	42

160-065-28BBB
NDSWC 6010

Altitude: 1530 feet — Date drilled: 9/25/81

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, silty, oxidized (till)	18	19
	Clay, olive-gray, gravelly (till)	11	30
	Clay, olive-gray, silty to sandy (till)	9	39
	Sand, fine to medium, subangular	1	40
	Clay, olive-gray, silty to sandy (till)	21	61
	Clay, dark-gray (till); predominantly detrital shale	9	70
Pierre Shale:			
	Shale, dark-gray, siliceous, fractured	11	81

160-065-32BBB
(Log modified from Peterson Well Co.)

Altitude: 1525 feet — Date drilled: 5/09/78

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	24	25
	Gravel and clay	5	30
	Clay, gray	40	70
Pierre Shale:			
	Shale, blue, soft	100	170
	Shale, blue	16	186

160-066-03BBA
(Log modified from C. A. Simpson & Son)

Altitude: 1525 feet — Date drilled: 10/23/76

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	14	15
	Rock, big	1	16
	Clay, blue	4	20
Pierre Shale:			
	Shale	94	114

160-066-04DDD
NDSWC 6012

Altitude: 1528 feet — Date drilled: 9/25/81

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, pebbly, sandy, oxidized (till)	16	17
	Clay, olive-gray, partially oxidized (till); boulders	2	19
	Clay, dark-gray, pebbly (till)	59	78
	Clay, medium-gray, pebbly (till)	58	136
	Sand, medium to coarse, angular to subrounded	1	137
	Clay, dark-gray, silty to sandy (till)	13	150
Pierre Shale:			
	Shale, black, siliceous, fractured	31	181

160-066-18AC
(Log modified from C. A. Simpson & Son)

Altitude: 1524 feet — Date drilled: 5/12/66

Glacial drift:			
	Topsoil	1	1
	Clay, yellow, gravelly; rocks	13	14
	Clay, blue, sandy	23	37
	Clay, blue, gravelly, hard	29	66
	Clay, blue, sandy	7	73
	Clay, gravelly	11	84
	Gravel, coarse	2	86

160-066-27AAA
NDSWC 6011

Altitude: 1520 feet — Date drilled: 9/25/81

Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, silty, oxidized (till)	12	13
	Sand, fine to coarse; interbedded with medium gravel; abundant angular to subangular cobbles	11	24
	Clay, olive-gray, silty, pebbly (till)	18	42
Pierre Shale:			
	Shale, grayish-black, siliceous, fractured	9	51

160-066-32CCC
(Log modified from C. A. Simpson & Son)

Altitude: 1510 feet — Date drilled: 7/17/70

Glacial drift:			
	Topsoil	1	1
	Clay, yellow, sandy	17	18
	Clay, blue, sandy	72	90
	Sand, coarse; rocks; lots of water	75	165
Pierre Shale:			
	Shale	65	230

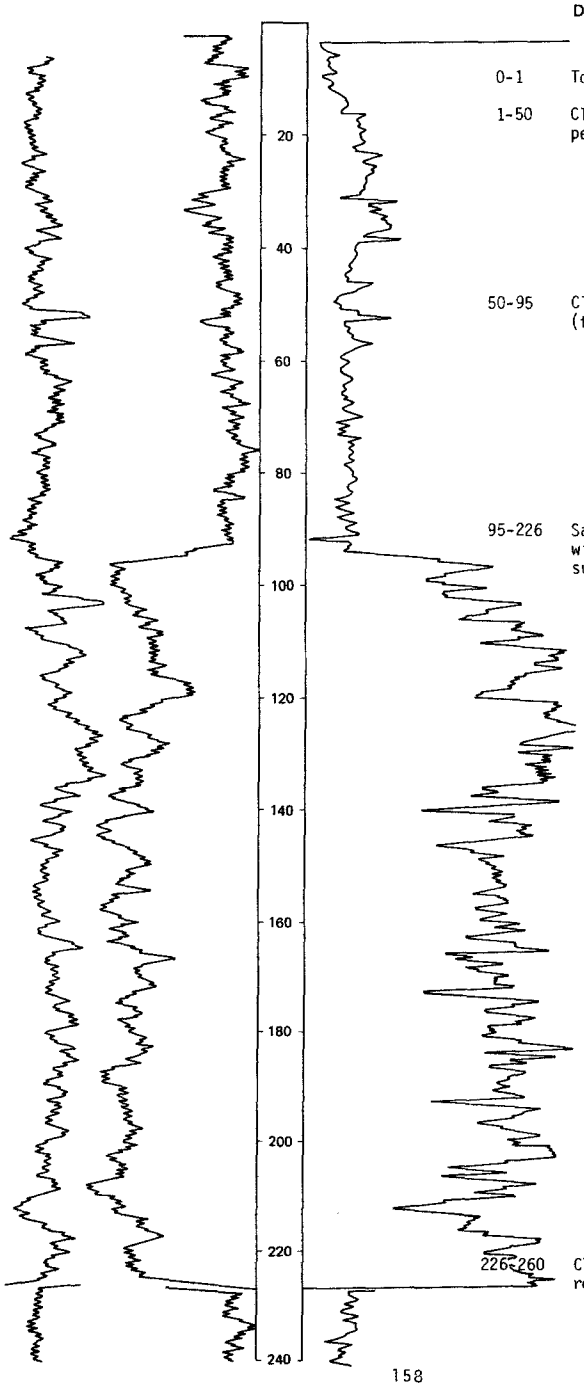
NDSWC 5997

LOCATION: 160-067-04CCC

DATE DRILLED: 9/22/81

ALTITUDE: 1585
(FT, NGVD)

DEPTH: 281
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-50	Clay, yellowish-brown, pebbly, oxidized (till).
50-95	Clay, olive-gray, pebbly (till).
95-226	Sand, coarse; interbedded with thin lenses of fine subangular gravel.
226-260	Clay, dark-greenish-gray; redeposited local bedrock.

NDSWC 5997, Continued

LOCATION: 160-067-04CCC

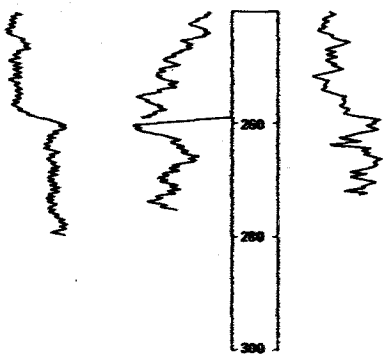
DATE DRILLED: 9/22/81

ALTITUDE: 1585
(FT. NGVD)

DEPTH: 281
(FT)

NEUTRON (API) GAMMA RAY

RESISTIVITY (OHM-M)



DESCRIPTION OF DEPOSITS

PIERRE SHALE

260-281 Shale, grayish-black, fissile, partially fractured.

160-067-04DBC
(Log modified from C. A. Simpson & Son)

Altitude: 1585 feet

Date drilled: 9/08/76

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil, black, silty	1	1
	Clay, yellowish-brown, silty (till)	29	30
	Gravel, fine to medium to coarse; about 20 percent sand	10	40
	Clay, olive, silty (till); with lots of rock	75	115
	Gravel, fine to medium to coarse; about 20 percent sand	15	130
	Clay, olive, silty (till); about 40 percent gravel and sand	14	144
	Sand, fine to medium to coarse; about 20 percent gravel with clay	57	201
	Clay, olive-gray, silty (till)	19	220
	Sand, fine to medium to coarse; with clay layers	62	282
	Clay, olive-gray to bluish-gray, silty	15	297
	Sand, fine to medium to coarse	10	307
	Clay, olive-gray, silty	18	325
	Clay, olive, silty; 50 percent gravel and shale gravel	65	390
	Sand and gravel; with clay layers	45	435
	Clay, blue, shaly, hard; with stones	4	439
	Shale, coarse; big chunks with sand	7	446
	Clay, blue, hard; with stones	6	452
	Sand, fine, shaly	3	455
	Clay, blue, hard; with stones	3	458
	Shale, fine, sandy	2	460
Pierre Shale:			
	Shale	14	474

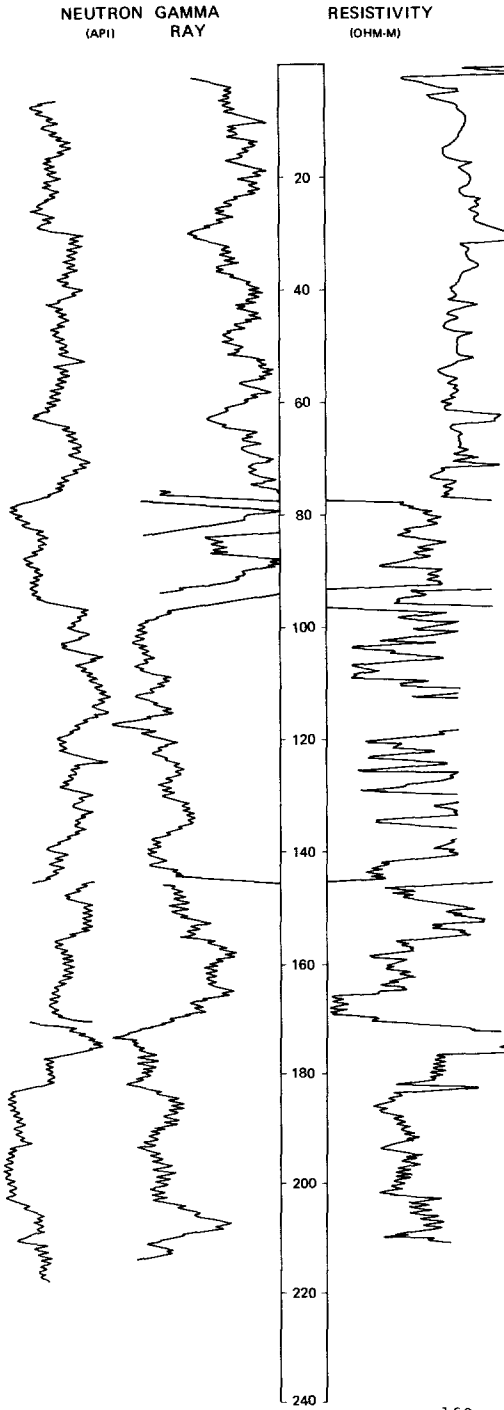
NDSWC 5996

LOCATION: 160-067-07AAA

DATE DRILLED: 9/22/81

ALTITUDE: 1600
(FT, NGVD)

DEPTH: 221
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-6	Clay, pale-yellowish-brown, oxidized (till).
6-30	Clay, yellowish-brown to reddish-brown, oxidized (till).
30-40	Clay, brownish-gray, partially oxidized (till).
40-77	Clay, olive-gray, gravelly (till).
77-92	Sand, fine, well-sorted, angular to rounded; about 70 percent quartz and 30 percent detrital shale.
92-97	Clay, olive-gray, sandy.
97-145	Gravel, fine; interbedded with medium to very coarse subrounded to rounded sand.
145-171	Clay, dark-gray, silty.
171-176	Gravel, fine, sandy, subrounded.
176-182	Clay, olive-gray, sandy.
182-203	Clay, dark-brownish-gray, silty.

PIERRE SHALE

203-221	Shale, grayish-black, poorly indurated, fissile.

NDSWC 5998A, 5998B

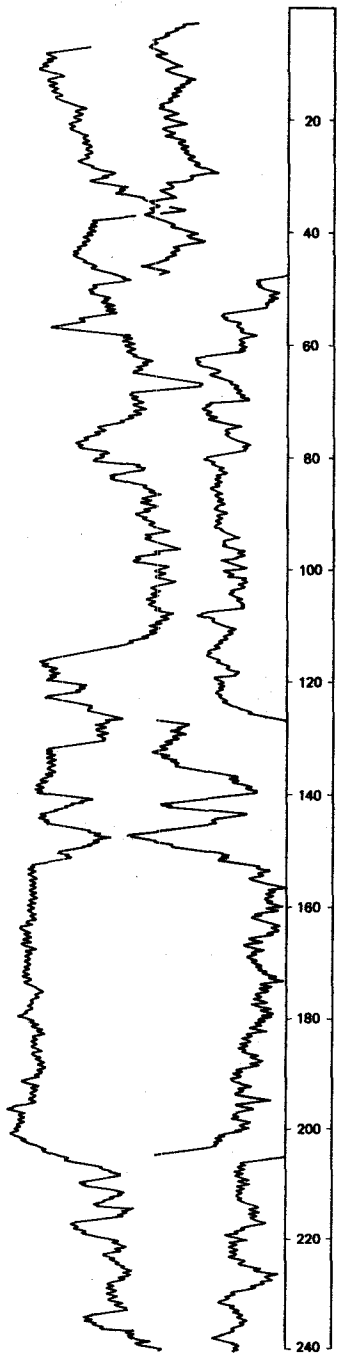
LOCATION: 160-067-10AAA1, 2

DATE DRILLED: 9/22/81

ALTITUDE: 1568
(FT, NGVD)

DEPTH: 441
(FT)

NEUTRON (API) GAMMA RAY



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-17	Clay, yellowish-brown, pebbly, oxidized (till).
17-22	Clay, dark-yellowish-orange, pebbly, oxidized (till).
22-30	Clay, dark-brownish-gray, partially oxidized (till).
30-47	Clay, olive-gray (till); interbedded with sandy gravel.
47-67	Sand, fine, subangular; interbedded with clay.
67-124	Sand, coarse, poorly sorted; interbedded with lenses of coarse subangular gravel; predominantly quartz.
124-128	Clay, olive-gray, silty (till).
128-135	Clay, dark-gray (till); abundant detrital shale.
135-139	Clay, olive-gray, pebbly (till).
139-141	Sand, fine to coarse, subrounded.
141-145	Clay, dark-gray, silty.
145-152	Sand, coarse, well-sorted, subangular.
152-204	Clay, dark-gray, cohesive, plastic.
204-220	Sand, coarse; interbedded with fine to coarse subangular gravel.
220-360	Gravel, fine to coarse; interbedded with fine to coarse subrounded sand.

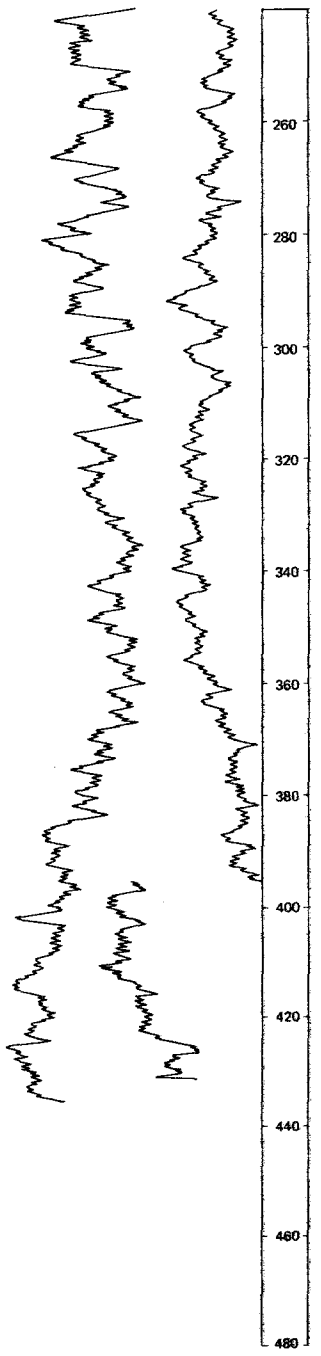
LOCATION: 160-067-10AAA1, 2

DATE DRILLED: 9/22/81

ALTITUDE: 1568
(FT, NGVD)

DEPTH: 441
(FT)

NEUTRON (API) GAMMA RAY



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

360-384 Gravel, fine to coarse, sandy, rounded; predominantly detrital shale.

384-407 Gravel, fine to coarse; interbedded with lenses of sandy clay.

407-415 Clay, dark-gray (till); abundant detrital shale.

PIERRE SHALE

415-424 Shale, dark-gray, macerated.

424-441 Shale, grayish-black, siliceous, indurated.

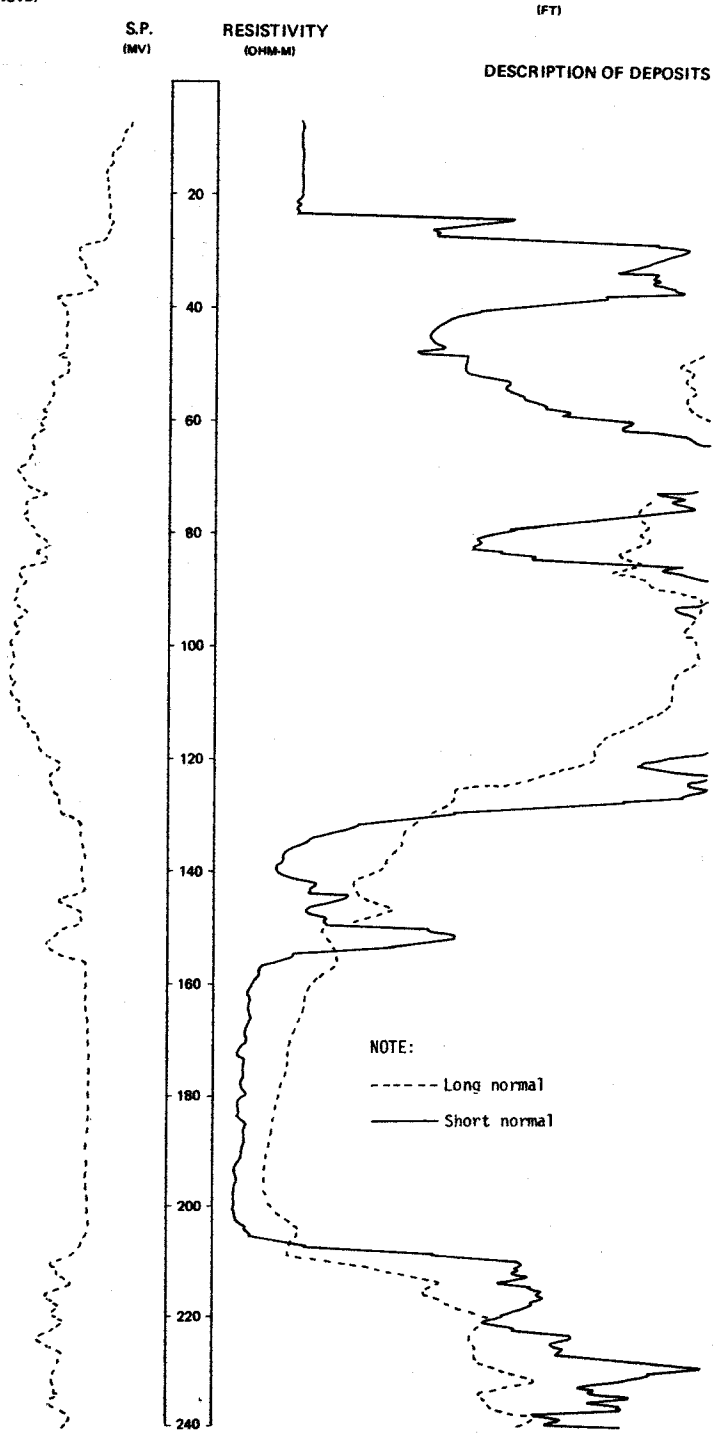
NDSWC 5998A, 5998B, Continued

LOCATION: 160-067-10AAA1, 2

DATE DRILLED: 9/22/81

ALTITUDE: 1568
(FT, NGVD)

DEPTH: 441
(FT)

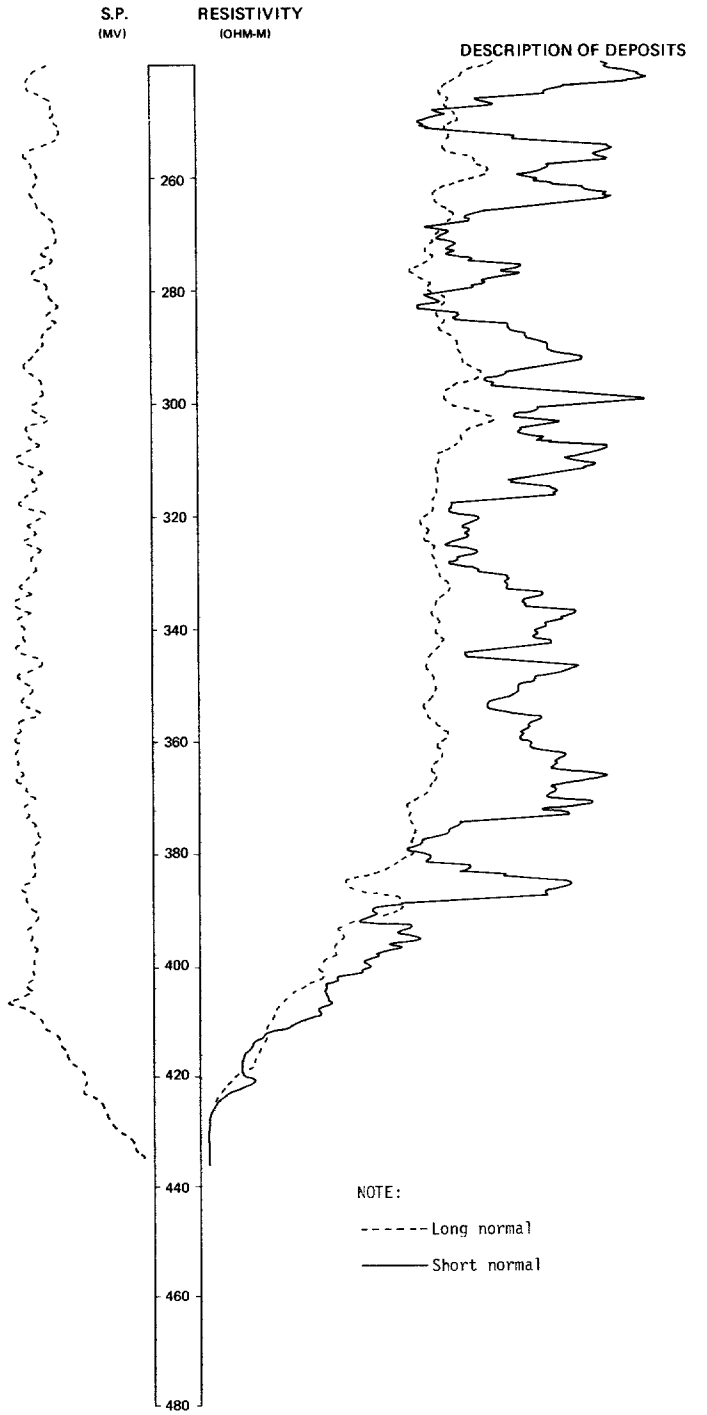


LOCATION: 160-067-10AAA1, 2

DATE DRILLED: 9/22/81

ALTITUDE: 1568
(FT, NGVD)

DEPTH: 441
(FT)



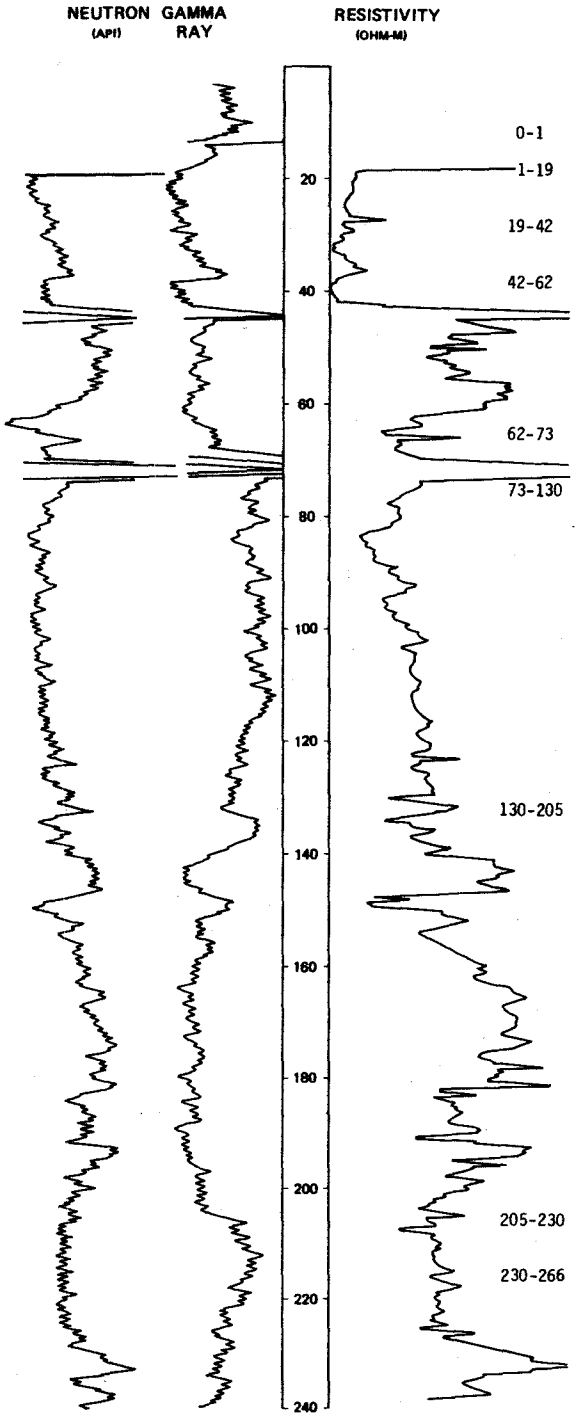
NDSWC 5742

LOCATION: 160-067-10BBB1

DATE DRILLED: 7/07/80

ALTITUDE: 1570
(FT, NGVD)

DEPTH: 402
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

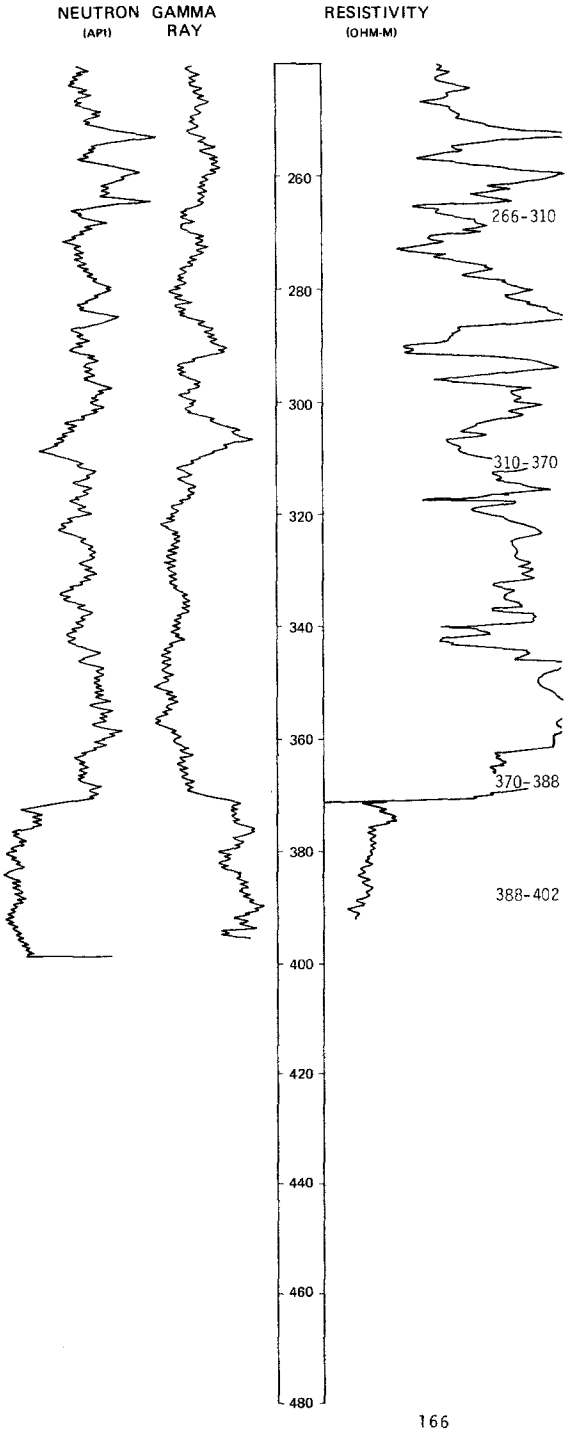
0-1	Topsoil.
1-19	Clay, yellowish-brown, very sandy, oxidized (till).
19-42	Clay, olive-gray, very silty to sandy (till).
42-62	Sand, fine to coarse; about 30 percent medium to coarse rounded gravel; about 60 percent carbonate, 30 percent quartz, and 10 percent detrital shale grains.
62-73	Clay, olive-gray (till); cobbles and boulders.
73-130	Silt, olive-gray, clayey.
130-205	Clay, olive-gray, very silty to sandy.
205-230	Silt, dark-gray, clayey.
230-266	Gravel, fine to medium, silty to clayey, angular to rounded; about 50 percent carbonate, 30 percent detrital shale, and 20 percent quartz and igneous pebbles.

LOCATION: 160-067-10BBB1

DATE DRILLED: 7/07/80

ALTITUDE: 1570
(FT, NGVD)

DEPTH: 402
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

266-310 Clay, brownish-gray, very silty to sandy, gravelly (till).

310-370 Sand, fine to very coarse, gravelly, angular to rounded; interbedded with clay from 310 to 340 feet.

PIERRE SHALE

370-388 Shale, dark-gray, silty, macerated.

388-402 Shale, dark-gray, siliceous, indurated, fissile.

160-067-10BB82
NDSWC 5743

Altitude: 1570 feet

Date drilled: 7/08/80

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil----------	1	1
	Clay, yellowish-brown, very sandy, oxidized (till)----------	18	19
	Clay, olive-gray, very silty to sandy (till)----------	23	42
	Sand, fine to coarse; about 30 percent fine to coarse rounded gravel; about 60 percent carbonate, 30 percent quartz, and 10 percent detrital shale grains----------	20	62

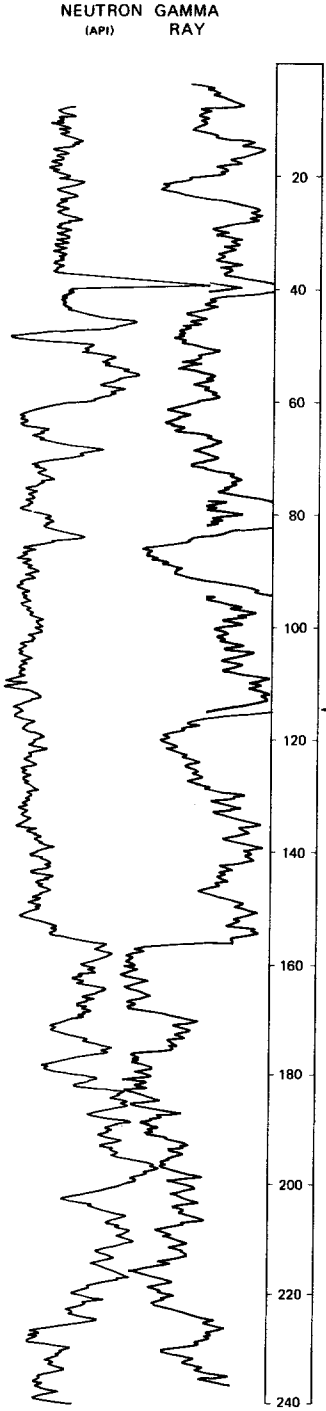
NDSWC 5999

LOCATION: 160-067-11AAA

DATE DRILLED: 9/23/81

ALTITUDE: 1550
(FT, NGVD)

DEPTH: 241
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-10	Clay, yellowish-brown, pebbly, oxidized (till).
10-20	Clay, brownish-gray, gravelly, oxidized (till).
20-36	Clay, olive-gray, gravelly (till); cobbles.
36-60	Clay, olive-gray, sandy to gravelly (till).
60-70	Clay, olive-gray, silty (till).
70-77	Clay, dark-gray, silty.
77-83	Clay, yellowish-brown, oxidized (till); highly radioactive.
83-92	Clay, dark-gray (till); predominantly detrital shale.
92-115	Clay, dark-gray, silty; highly radioactive.
115-129	Clay, dark-gray (till); predominantly detrital shale.
129-156	Silt, dark-gray; predominantly detrital shale.
156-180	Sand, medium to coarse, gravelly, subrounded to rounded; interbedded with lenses of clay.
180-226	Sand, coarse; interbedded with medium to coarse subrounded to rounded gravel.

PIERRE SHALE

226-241	Shale, dark-greenish-gray, bentonitic, indurated, fissile.

160-067-13BBC
(Log modified from Church Well Boring)

Altitude: 1550 feet — Date drilled: 12/04/76

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow	29	30
	Sand, yellow	1	31
	Clay, yellow	10	41
	Clay, blue; with large rocks	1	42

160-067-22CCC
(Log modified from C. A. Simpson & Son)

Altitude: 1566 feet — Date drilled: 7/29/69

Glacial drift:			
	Topsoil	1	1
	Clay, yellow, sandy	14	15
	Clay, blue, sandy	62	77
	Sand	56	133
	Clay, blue, sandy	27	160
	Clay, blue, sandy, mushy	23	183
	Clay, blue, sandy, hard	35	218
	Sand, coarse, clean	6	224
	Shale, sandy	48	272
Pierre Shale:			
	Shale, crumbly	11	283

160-067-24DC
(Log modified from Smith, 1954)

Altitude: 1535 feet — Date drilled: 8/29/53

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
CRETACEOUS SYSTEM:			
Niobrara Formation (top):			718
Greenhorn Formation (top):			1,100
Muddy Sandstone (top):			1,380
Dakota Formation (top):			1,480
JURASSIC SYSTEM:			
Sundance Formation(?) (top):			1,600
Piper Formation (top):			1,655
Red Beds (top):			2,118
DEVONIAN SYSTEM:			
Duperow Formation (top):			2,222
Souris River Formation (top):			2,415
Dawson Bay Formation (top):			2,480
Ashern (top):			2,818
SILURIAN SYSTEM:			
Interlake Formation (top):			2,850
ORDOVICIAN SYSTEM:			
Upper Stony Mountain Formation (top):			3,160
Lower Stony Mountain Formation (top):			3,240
Red River Formation (top):			3,325
Winnipeg Shale (top):			3,915
Winnipeg Sand (top):			4,040
Granite (top):			4,064

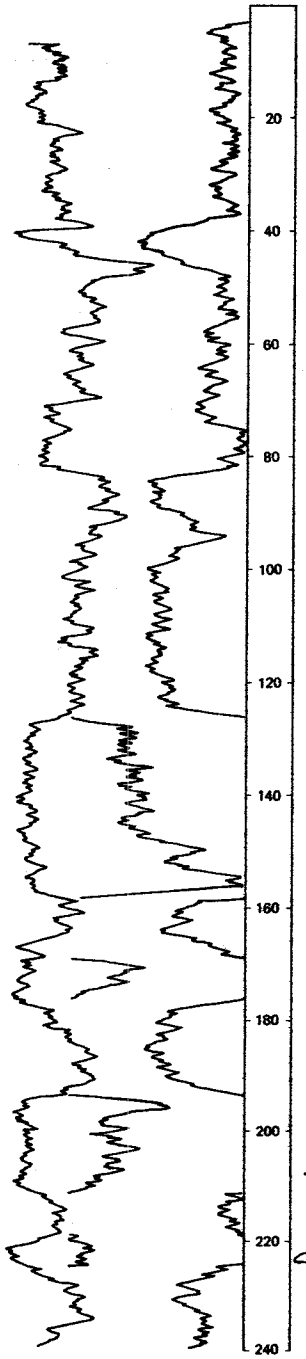
NDSWC 5737

LOCATION: 160-067-32CBB

DATE DRILLED: 6/26/80

ALTITUDE: 1590
(FT, NGVD)

DEPTH: 282
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

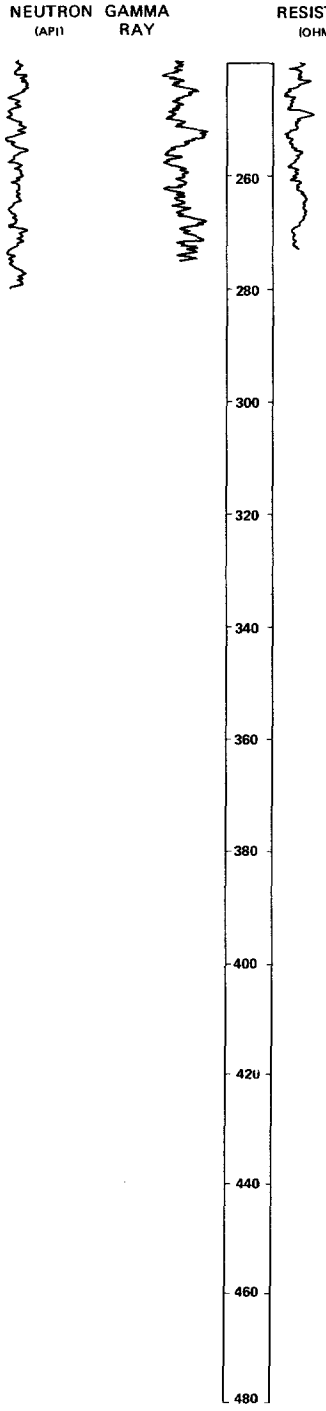
0-1	Topsoil.
1-12	Clay, yellowish-brown, very silty, oxidized (till).
12-20	Clay, yellowish-brown, very silty to sandy (till).
20-47	Clay, yellowish-brown, silty to sandy, gravelly (till).
47-83	Clay, olive-gray, very silty to sandy (till).
83-128	Sand, fine to coarse, gravelly, rounded.
128-150	Silt, brownish-gray, clayey.
150-168	Sand, fine, well-sorted, subrounded.
168-178	Clay, olive-gray, sandy.
178-196	Sand, fine to medium, subrounded to rounded.
196-212	Silt, brownish-gray, clayey.
212-220	Gravel, fine to coarse, sandy, angular to rounded.
220-224	Clay, gray, silty.
224-236	Gravel, fine to coarse, angular to rounded; abundant detrital shale.

LOCATION: 160-067-32CBB

DATE DRILLED: 6/26/80

ALTITUDE: 1590
(FT, NGVD)

DEPTH: 282
(FT)



DESCRIPTION OF DEPOSITS

PIERRE SHALE

236-282 Shale, dark-gray, siliceous, well-indurated, fissile.

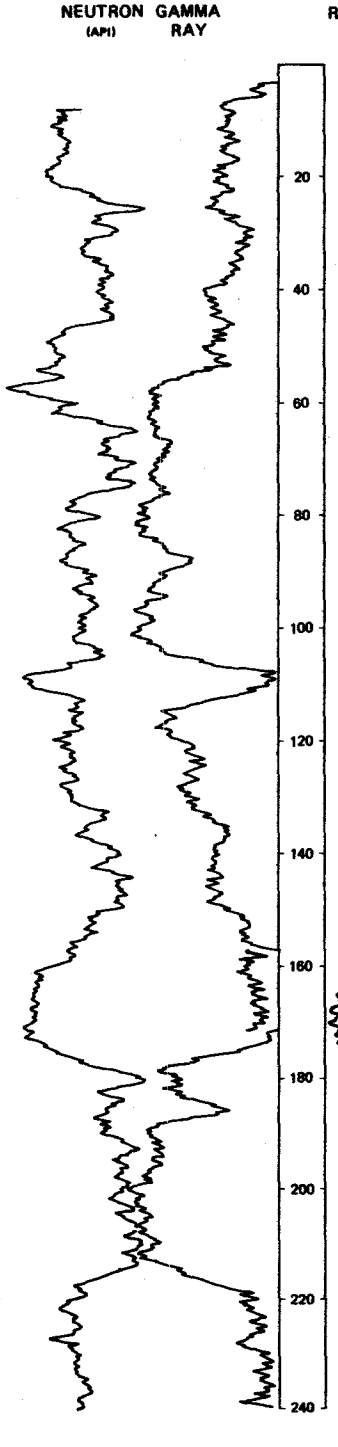
NDSWC 5738

LOCATION: 160-067-33CCC

DATE DRILLED: 6/30/80

ALTITUDE: 1550
(FT, NGVD)

DEPTH: 342
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

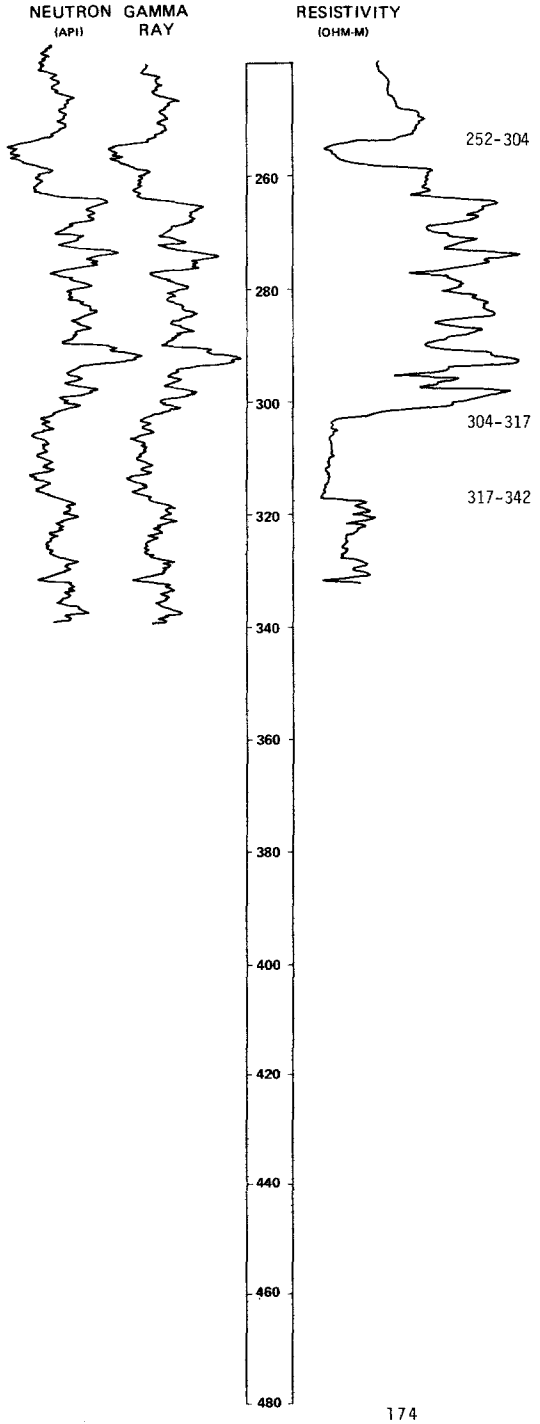
0-1	Topsoil.
1-25	Clay, yellowish-brown, very silty and sandy, pebbly, oxidized (till).
25-30	Clay, yellowish-brown, very sandy, gravelly, oxidized (till).
30-56	Clay, olive-gray, sandy, gravelly (till).
56-76	Sand, fine to coarse, gravelly, predominantly rounded; about 50 percent quartz with 50 percent carbonate and detrital shale grains.
76-108	Gravel, fine to coarse, subrounded; interbedded with lenses of silty to clayey sand.
108-133	Clay, brownish-gray, silty to sandy.
133-156	Clay, light-brownish-gray, sandy (till); interbedded with lenses of sand and gravel.
156-178	Clay, dark-brownish-gray, silty.
178-218	Silt, dark-brownish-gray; interbedded with lenses of sand and clay.
218-252	Clay, dark-gray, silty to sandy (till); abundant detrital shale.

LOCATION: 160-067-33CCC

DATE DRILLED: 6/30/80

ALTITUDE: 1550
(FT, NGVD)

DEPTH: 342
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

252-304 Clay, brownish-gray, very silty to sandy (till); interbedded with thin lenses of gravel.

PIERRE SHALE

304-317 Shale, dark-gray, indurated; interbedded with brownish-gray siltstone.

317-342 Shale, dark-gray, siliceous, well-indurated, fissile.

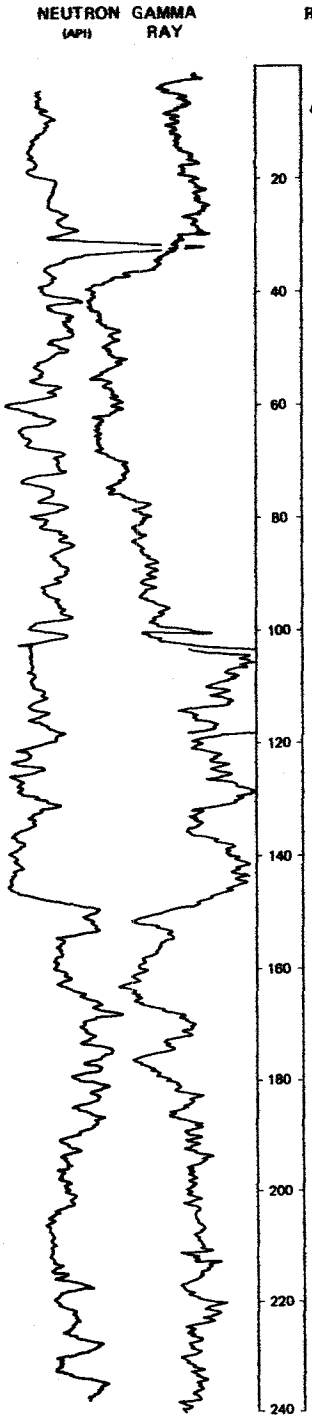
NDSWC 5735

LOCATION: 160-067-34DDA

DATE DRILLED: 6/25/80

ALTITUDE: 1535
(FT, NGVD)

DEPTH: 262
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-6	Clay, pale-yellowish-brown, very silty, oxidized (till).
6-14	Clay, yellowish-brown, silty, pebbly, oxidized (till).
14-34	Clay, olive-gray, very silty, sandy, gravelly (till).
34-38	Silt, dark-brownish-gray, clayey.
38-77	Sand, fine to coarse, rounded; interbedded with lenses of fine subangular gravel; predominantly detrital shale.
77-100	Clay, dark-gray, pebbly (till); interbedded with thin lenses of sand and gravel.
100-120	Clay, brownish-gray, very sandy (till); interbedded with lenses of gravel.
120-150	Silt, brownish-gray, argillaceous, bentonitic; shove block.
150-190	Clay, olive-gray, pebbly (till); interbedded with lenses of sand and gravel.
190-246	Clay, dark-gray, very silty (till); abundant detrital shale.

LOCATION: 160-067-34DDA

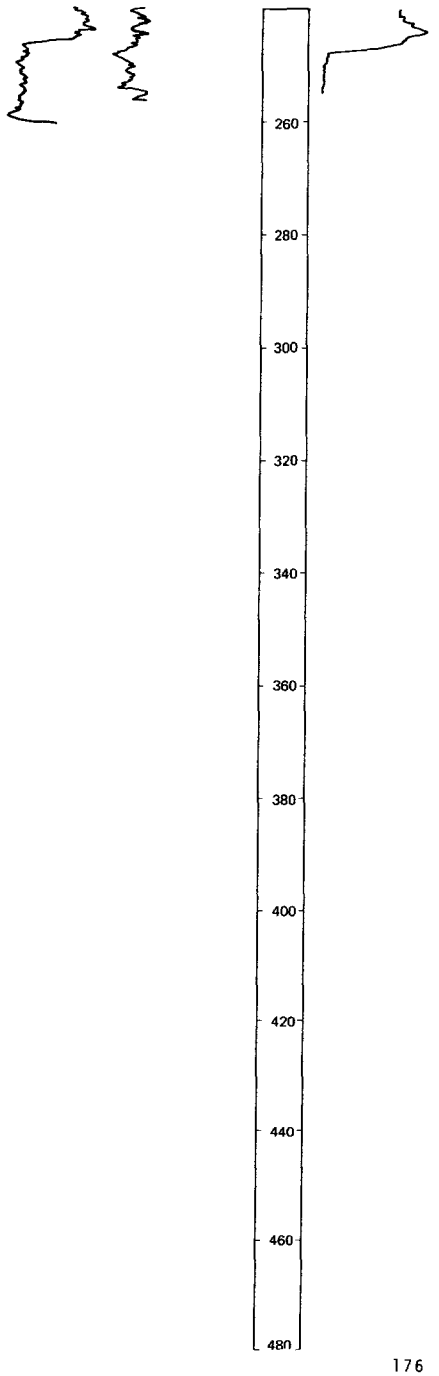
DATE DRILLED: 6/25/80

ALTITUDE: 1535
(FT, NGVD)

DEPTH: 262
(FT)

NEUTRON (API) GAMMA RAY

RESISTIVITY (OHM-M)



DESCRIPTION OF DEPOSITS

PIERRE SHALE

246-262 Shale, dark-gray, siliceous, well-indurated, fissile.

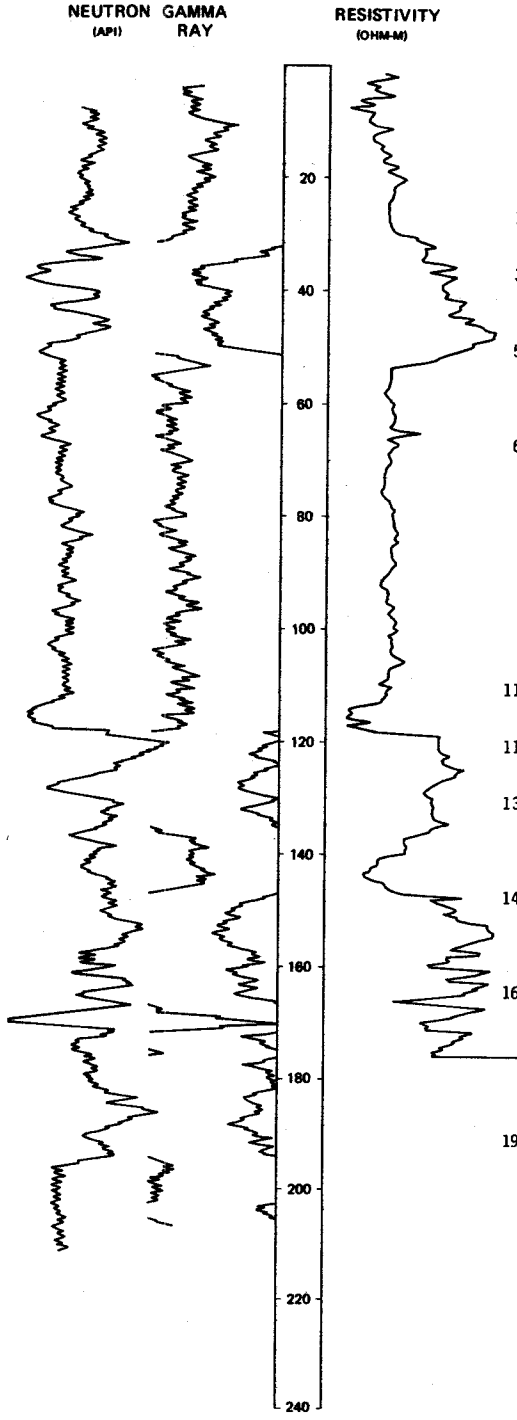
NDSWC 6000

LOCATION: 160-067-36AAA

DATE DRILLED: 9/23/81

ALTITUDE: 1530
(FT, NGVD)

DEPTH: 221
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-18	Clay, yellowish-brown, pebbly, oxidized (till).
18-32	Clay, olive-gray, pebbly (till).
32-51	Sand, fine to coarse; interbedded with fine subrounded gravel.
51-67	Clay, brownish-gray, silty, partially oxidized (till).
67-113	Clay, olive-gray, silty, pebbly (till).
113-118	Silt, brownish-gray; abundant detrital lignite.
118-135	Gravel, fine; interbedded with fine clayey sand.
135-147	Clay, brownish-gray, silty (till); cobbles.
147-168	Sand, fine to coarse, rounded; interbedded with coarse gravel; abundant detrital lignite.
168-196	Sand, fine to very coarse, gravelly, rounded; interbedded with lenses of clay.

PIERRE SHALE

196-221	Shale, grayish-black, siliceous, bentonitic, indurated.

160-068-05ABC
(Log modified from C. A. Simpson & Son)

Altitude: 1720 feet — Date drilled: 9/09/72

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow	11	12
	Clay, yellow, gravelly	6	18
	Clay, blue, sandy	27	45
	Clay, blue	45	90
	Sand and rocks	1	91
	Clay, blue, gravelly	17	108
	Sand	5	113

160-068-07CBB
(Log modified from C. A. Simpson & Son)

Altitude: 1740 feet — Date drilled: 11/27/74

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	19	20
	Clay, blue	40	60
	Clay, blue, gravelly	81	141
	Gravel	9	150
	Clay, blue, gravelly	20	170
	Sand, fine	9	179
	Clay, blue	43	222
	Shale gravel; with clay layers	11	233

160-068-11DAA
(Log modified from C. A. Simpson & Son)

Altitude: 1651 feet — Date drilled: 10/14/74

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	24	25
	Clay, blue	47	72
	Clay, blue, sandy	38	110
	Clay, blue, very sandy	10	120
	Sand, clayey, soupy	27	147
	Sand	12	159

160-068-11DCC
(Log modified from C. A. Simpson & Son)

Altitude: 1660 feet — Date drilled: 9/21/72

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	34	35
	Clay, blue	44	79
	Sand	3	82

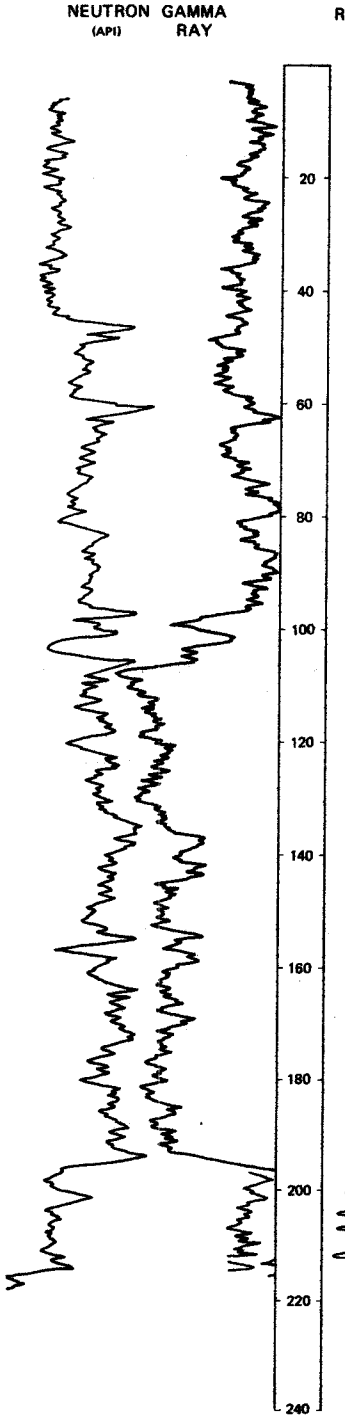
NDSWC 5995

LOCATION: 160-068-12AAA

DATE DRILLED: 9/21/81

ALTITUDE: 1632
(FT, NGVD)

DEPTH: 221
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-30	Clay, yellowish-orange, pebbly, oxidized (till).
30-45	Clay, light-olive-gray, pebbly (till).
45-47	Clay, olive-gray, tight (till).
47-50	Sand, coarse; interbedded with coarse subangular gravel.
50-98	Clay, yellowish-gray, partially oxidized (till); some thin lenses of gravel.
98-103	Sand, medium, gravelly, rounded; predominately quartz.
103-106	Clay, olive-gray, sandy.
106-132	Sand, coarse; interbedded with fine gravel and lenses of clay; predominantly detrital shale and carbonate grains.
132-165	Gravel, medium; interbedded with coarse subrounded sand; predominantly detrital shale.
165-193	Sand, coarse, well-rounded; predominantly quartz.
193-203	Clay, dark-gray, sandy, pebbly (till); boulders.

PIERRE SHALE

203-221	Shale, grayish-black, moderately indurated, fissile.

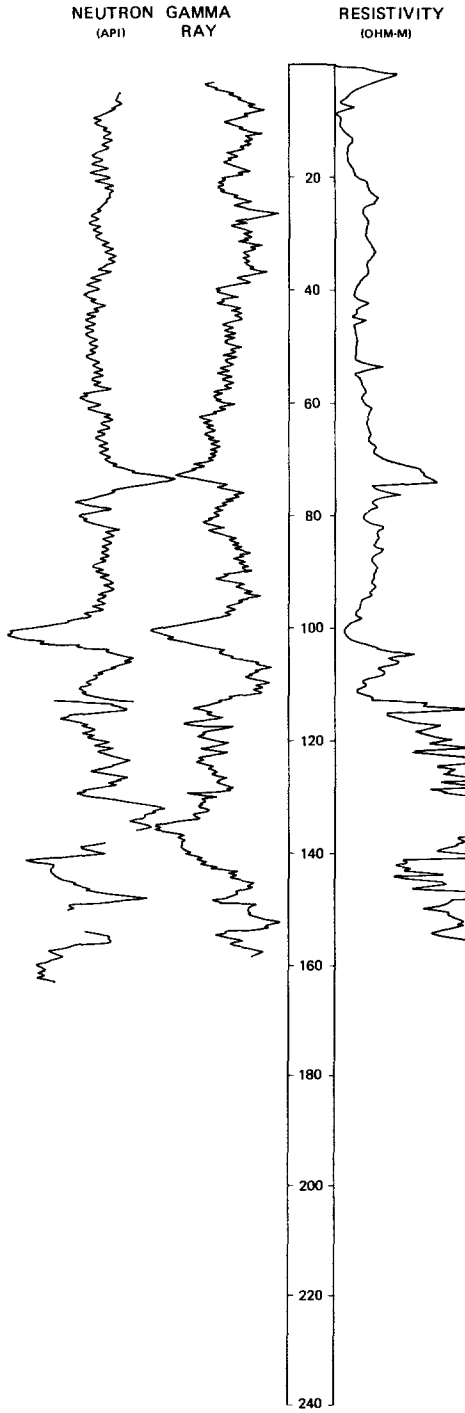
NDSWC 5994

LOCATION: 160-068-15AAB

DATE DRILLED: 9/21/81

ALTITUDE: 1660 (FT, NGVD)

DEPTH: 201 (FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-35	Clay, yellowish-brown, pebbly, oxidized (till).
35-70	Clay, olive-gray, pebbly (till).
70-97	Clay, olive-gray, gravelly, silty (till).
97-104	Gravel, coarse, sandy; cobbles; detrital shale.
104-120	Clay, brownish-gray, silty, partially oxidized.
120-154	Gravel, fine to coarse, subangular; interbedded with silty clay.
154-160	Clay, dark-gray; abundant detrital lignite.
160-180	Sand, fine, well-sorted, angular; interbedded with silty clay.

PIERRE SHALE

180-201	Shale, dark-gray, moderately indurated, fissile.

160-068-22ACA
(Log modified from C. A. Simpson & Son)

Altitude: 1677 feet — Date drilled: 7/11/74

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, gray	5	6
	Clay, yellow	24	30
	Clay, blue	70	100
	Clay, blue, sandy, soupy	2	102
	Clay, blue; some rocks	118	220
Pierre Shale:			
	Shale	73	293

160-068-23ADA
(Log modified from C. A. Simpson & Son)

Altitude: 1640 feet — Date drilled: 12/17/65

Glacial drift:			
	Topsoil	1	1
	Clay, yellow, sandy	21	22
	Clay, blue, sandy	41	63
	Clay, blue, gravelly, hard	24	87
	Clay, blue, sandy	9	96
	Clay, blue, gravelly, hard	33	129
	Sand, fine	4	133

160-068-33BAB
(Log modified from C. A. Simpson & Son)

Altitude: 1640 feet — Date drilled: 11/29/74

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	34	35
	Clay, blue	10	45
	Clay, blue, very sandy	20	65
	Clay, blue	27	92
	Clay, blue, very sandy	33	125
	Clay, dark-blue	85	210
Pierre Shale:			
	Shale	9	219

160-068-36DAD
(Log modified from C. A. Simpson & Son)

Altitude: 1600 feet — Date drilled: 10/23/69

Glacial drift:			
	Topsoil	1	1
	Clay, yellow, sandy	41	42
	Rock	6	48
	Clay, blue, sandy, hard	25	73
	Clay, blue, sandy	32	105
	Clay, sandy, mushy	55	160
	Sand, coarse	6	166
	Clay, blue	1	167

160-068-36DBD1
(Log modified from C. A. Simpson & Son)

Altitude: 1600 feet — Date drilled: 10/08/73

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow	49	50
	Clay, blue, sandy	10	60
	Clay, blue, very sandy	7	67
	Gravel, coarse, clayey	7	74
	Clay, blue, gravelly	9	83
	Clay, blue	35	118
	Clay, blue, silty	25	143
	Sand, fine to medium	7	150

160-068-36DBD2
(Log modified from C. A. Simpson & Son)

Altitude: 1600 feet — Date drilled: 9/10/74

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	49	50
	Clay, blue, sandy	10	60
	Clay, blue, very sandy	7	67
	Gravel, coarse, clayey	7	74
	Clay, blue, gravelly	9	83
	Clay, blue	35	118
	Clay, blue, silty	25	143
	Sand, fine to medium	7	150
	Clay, blue	8	158
	Sand, clayey, soupy	12	170
	Clay, blue	16	186
	Sand; with water	4	190
	Clay, blue	10	200
Pierre Shale(?):			
	Shale, fractured, or shale gravel	5	205

161-065-04DAD
NDSWC 6027

Altitude: 1610 feet — Date drilled: 10/12/81

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, pebbly, oxidized (till)	9	10
	Clay, brownish-gray, pebbly, oxidized (till)	8	18
Pierre Shale:			
	Shale, dark-gray, fractured; oxidized along fractures to about 40 feet	63	81

161-065-06CDD
(Log modified from C. A. Simpson & Son)

Altitude: 1550 feet — Date drilled: 11/25/66

Glacial drift:			
	Clay, yellow	20	20
	Rock	2	22
	Clay, blue, gravelly; rocks	36	58
	Sand, very clayey	7	65
	Clay, blue	35	100
	Clay, blue, very sandy	12	112
	Sand and gravel	1	113
	Sand, clayey	11	124
	Sand and gravel	4	128

161-065-15BBB
(Log modified from C. A. Simpson & Son)

Altitude: 1565 feet — Date drilled: 12/02/65

Glacial drift:			
	Topsoil	1	1
	Clay, yellow, sandy	26	27
	Clay, blue, hard	15	42
Pierre Shale:			
	Shale	123	165

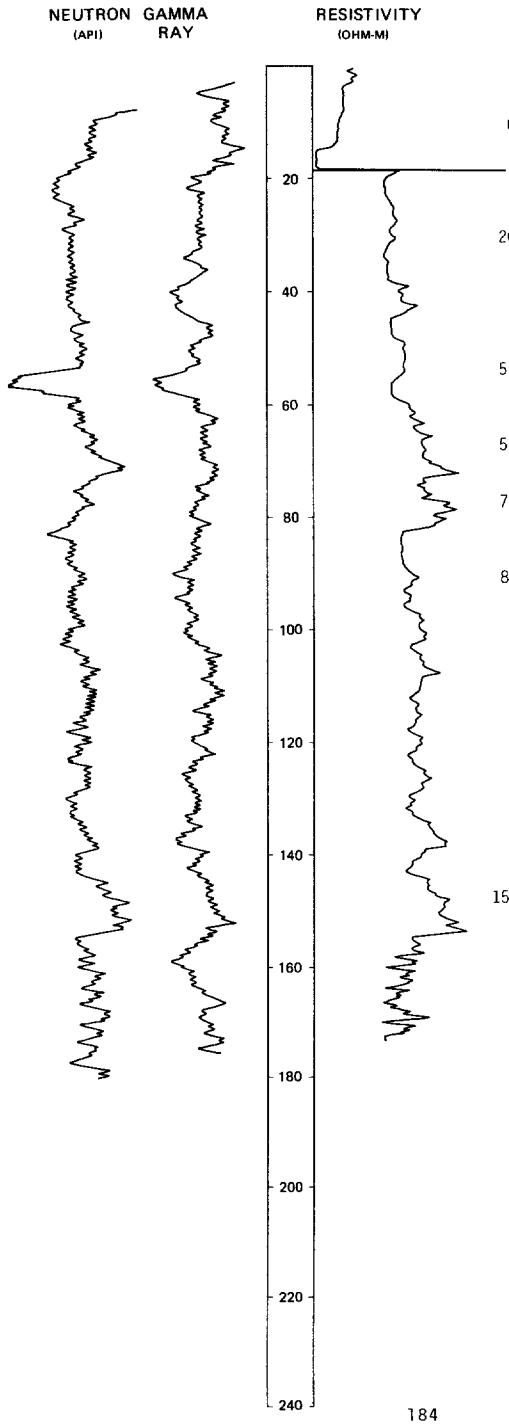
NDSWC 5772

LOCATION: 161-065-17BBB

DATE DRILLED: 7/23/80

ALTITUDE: 1550
(FT, NGVD)

DEPTH: 182
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-20	Clay, yellowish-brown, silty, pebbly, oxidized (till).
20-54	Clay, olive-gray, silty to gravelly (till).
54-58	Gravel, fine to coarse, sandy, angular; predominantly detrital shale.
58-78	Clay, olive-gray, silty to gravelly (till).
78-82	Gravel, fine to coarse, sandy, clayey; predominantly detrital shale.
82-155	Clay, brownish-gray, gravelly (till).

PIERRE SHALE

155-182	Shale, dark-gray, siliceous, well-indurated, fissile.

161-065-29DDD
NDSWC 6026

Altitude: 1545 feet — Date drilled: 10/12/81

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Sand, coarse; interbedded with coarse poorly sorted angular to rounded oxidized gravel	4	5
	Clay, yellowish-brown, sandy, oxidized (till)	5	10
	Clay, dark-brown, sandy, partially oxidized (till)	6	16
	Clay, dark-gray (till); predominantly detrital shale	124	140
Pierre Shale:			
	Shale, light-brown; interbedded with limestone and bentonite	10	150
	Shale, dark-gray, siliceous, bentonitic, fractured	11	161

161-065-34CCC
(Log modified from C. A. Simpson & Son)

Altitude: 1550 feet — Date drilled: 10/15/69

Glacial drift:			
	Clay, yellow	15	15
	Clay, blue, sandy; with many rocks	45	60
Pierre Shale:			
	Shale	53	113

161-065-35AAD
(Log modified from C. A. Simpson & Son)

Altitude: 1576 feet — Date drilled: 7/02/65

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	21	22
	Clay, blue	11	33
	Clay, sandy, hard	9	42
Pierre Shale:			
	Shale; drills slow	68	110

161-065-35CDC
(Log modified from C. A. Simpson & Son)

Altitude: 1570 feet — Date drilled: 6/26/75

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	29	30
	Clay, blue, gravelly	10	40
Pierre Shale:			
	Shale	140	180

161-066-06AAD
NDSWC 1364-12
(Log modified from Kahil, 1965)

Altitude: 1550 feet — Date drilled: 10/06/64

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
	Topsoil	1	1
Pierre Shale:			
	Shale, olive-gray to dark-greenish-gray; interbedded with bentonitic(?) clay layers; slightly sandy at places	22	23
	Shale, olive-black; interbedded with bentonitic(?) clay layers	9	32

161-066-06BDC
NDSWC 1364-4
(Log modified from Kahil, 1965)

Altitude: 1536 feet — Date drilled: 9/25/64

Glacial drift:			
	Topsoil	1	1
	Sand, fairly well sorted to well-sorted, predominantly angular; predominant size is one-fourth millimeter	39	40
	Gravel, fairly well sorted, subrounded to well-rounded; between 5 and 30 millimeters in size; interbedded with sand layers; poorly sorted; average size is 1 millimeter	21	61
Pierre Shale:			
	Shale, olive-black; interbedded with clayey bentonitic(?) layers	13	74

161-066-07AAD
NDSWC 1364-2
(Log modified from Kahil, 1965)

Altitude: 1545 feet — Date drilled: 9/24/64

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, very pale orange, sandy, noncohesive, very soft, oxidized	1	2
	Till, very fine, light-olive-gray, sandy, highly calcareous, cohesive	8	10
	Sand, fairly well sorted, angular to well-rounded; average size is about 1 millimeter; oxidized	4	14
	Clay (till?); silty matrix with shale fragments; noncalcareous; cohesive; soft; top slightly oxidized; interbedded with clay; dark greenish gray; highly calcareous	19	33
	Gravel, sandy, poorly sorted, angular to well-rounded; average size is 2 millimeters; oxidized	8	41
	Till, dusky-yellowish-green, silty, cohesive, hard	10	51
	Gravel, sandy, poorly sorted, subangular to well-rounded; average size is 2 millimeters	11	62
	Till, olive-gray, gravelly and bouldery, cohesive	22	84
	Boulder, granite	1	85
	Silt, greenish-gray, gravelly, cohesive, soft, brittle; silt grades downward to a fine sand	37	122
	Sand; grading into till	43	165
Pierre Shale:			
	Shale, olive-black, cohesive, very hard	14	179

161-066-07ABC
NDSWC 1364-3
(Log modified from Kahil, 1965)

Altitude: 1550 feet — Date drilled: 9/25/64

	Topsoil	1	1
Pierre Shale:			
	Shale, olive-black, cohesive, very hard; interbedded with bentonitic(?) clay layers; cohesive; soft	52	53

161-066-07CAB
NDSWC 1364-1
(Log modified from Kahil, 1965)

Altitude: 1532 feet — Date drilled: 9/24/64

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Sand, pale-yellowish-orange, clayey, fairly poorly sorted, mostly angular; predominant size is one-half millimeter; oxidized	2	3
	Sand, fairly well sorted, subangular to subrounded; predominant size is three-fourths millimeter	27	30
	Gravel, slightly sandy, fairly well sorted; between 5 and 25 millimeters in size	20	50
Pierre Shale(?):			
	Shale(?), greenish-gray, noncalcareous, cohesive, soft, unoxidized	13	63

161-066-08ABA
NDSWC 1364-5
(Log modified from Kahil, 1965)

Altitude: 1540 feet — Date drilled: 9/28/64

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Boulder, dolomite	1	2
	Till, predominantly grayish-orange to dark-yellowish-orange, highly calcareous, cohesive, fairly soft, oxidized	9	11
	Till, olive-gray to dark-greenish gray, silty, cohesive, fairly hard, unoxidized; dolomite boulders	14	25
	Till(?), dark-greenish-gray, noncalcareous to very slightly calcareous, bentonitic(?), cohesive, soft; clay matrix with shale fragments	2	27
	Till, dark-greenish-gray to olive-gray, highly calcareous, cohesive, hard	27	54
	Till, dark-greenish-gray to olive-gray, highly calcareous, cohesive, hard; interbedded with gravel; mostly rounded to subrounded	23	77
	Sand, poorly sorted, mostly angular; average size is 1½ millimeters; interbedded with gravel	9	86
	Till, olive-gray, gravelly, highly calcareous	56	142
Pierre Shale:			
	Shale, olive-black; interbedded with clayey bentonitic(?) layers; lenses of sand; very fine; white; noncalcareous to very slightly calcareous	16	158

161-066-08DDC
NDSWC 1364-11
(Log modified from Kahil, 1965)

Altitude: 1538 feet — Date drilled: 10/05/64

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Till, light-brownish-gray to light-olive-gray, extremely calcareous, soft, oxidized, laminated	1	2
	Till, very pale orange to pale-yellowish-orange, highly calcareous, soft, oxidized	2	4
	Till, very pale orange to light-olive-gray, extremely calcareous, soft, oxidized, laminated	2	6
	Gravel, poorly sorted, oxidized	2	8
	Till, dark-yellowish-orange to greenish-gray, calcareous, soft, oxidized	6	14
	Silt, olive-gray, sandy, slightly calcareous	49	63
	Till, olive-gray, calcareous, cohesive, hard, unoxidized	64	127
	Clay, olive-gray, highly calcareous; contains sulfides; interbedded with silt; highly calcareous; cohesive; soft; contains sulfides	8	135
	Sand, gravelly, poorly sorted	6	141
	Clay, olive-gray, sandy, highly calcareous; contains sulfides	8	149
	Till, olive-black; interbedded with bentonitic(?) clay layers	7	156
	Gravel, fairly poorly sorted, angular to subrounded; average size is 4 millimeters	18	174
	Till(?), olive-green and dark-greenish-gray, noncalcareous; interbedded with gravel	12	186
Pierre Shale:			
	Shale, olive-black and olive-gray; interbedded with bentonitic(?) clay layers	24	210

161-066-10AAA
(Log modified from C. A. Simpson & Son)

Altitude: 1540 feet — Date drilled: 11/18/72

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	24	25
	Clay, blue, sandy	10	35
	Shale, blue, sandy	15	50
Pierre Shale:			
	Shale	157	207

161-066-17DDB
(Log modified from C. A. Simpson & Son)

Altitude: 1539 feet — Date drilled: 7/06/65

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow; rocks	17	18
	Clay, blue, sandy; rocks	72	90
	Clay, blue; rocks	69	159
Pierre Shale:			
	Shale	3	162

161-066-18CDC
NDSWC 1364-6
(Log modified from Kahil, 1965)

Altitude: 1550 feet — Date drilled: 9/24/64

Glacial drift:			
	Topsoil	1	1
	Till, dark-yellowish-orange, highly calcareous, cohesive, hard, oxidized	16	17
	Till, olive-gray to dark-greenish-gray, highly calcareous, cohesive	23	40
	Till, olive-gray, highly calcareous, cohesive	76	116
	Gravel, clayey, very poorly sorted	9	125
	Till, dark-olive-green, sandy, slightly calcareous, cohesive, brittle	3	128
	Till, olive-gray to dark-greenish-gray, cohesive, soft; contains sulfides; sand laminations; fine; white	17	145
	Sand, poorly sorted, angular to rounded	21	166
	Sand, fairly well sorted, angular to well-rounded; between one-fourth to one-half millimeter in size	10	176
	Gravel, poorly sorted; maximum size is 20 millimeters	11	187
Pierre Shale:			
	Shale; interbedded with clayey bentonitic(?) layers	13	200

161-066-29ABB
(Log modified from C. A. Simpson & Son)

Altitude: 1540 feet — Date drilled: 12/17/79

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	14	15
	Clay, blue	22	37
	Sand; add mud	50	87
	Clay, blue	8	95
Pierre Shale:			
	Shale	96	191

161-066-29CCC
(Log modified from C. A. Simpson & Son)

Altitude: 1525 feet — Date drilled: 4/20/72

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow	17	18
	Clay, blue, sandy	10	28
	Sand, hard	22	50
	Sand; water	45	95
Pierre Shale:			
	Shale	50	145

161-067-01BBB
NDSWC 1364-9
(Log from Kahil, 1965)

Altitude: 1575 feet — Date drilled: 9/30/64

Glacial drift:			
	Topsoil	1	1
	Till, very pale orange to light-olive-green, silty, highly calcareous, cohesive, soft, oxidized	4	5
	Till, olive-gray, calcareous, cohesive, fairly hard	12	17
	Till, dark-greenish-gray, highly calcareous, cohesive, fairly hard; sand in parts	3	20
	Sand, fairly well sorted, mostly angular; average grain size is three-fourths millimeter	3	23
	Till, dark-greenish-gray to olive-gray, slightly calcareous, cohesive, fairly hard	109	132
	Silt, dark-greenish-gray to olive-gray, highly calcareous, cohesive, soft, laminated	42	174
	Silt, olive-gray to dark-greenish-gray, sandy	12	186
	Till, olive-gray to dark-greenish-gray, highly calcareous, cohesive, soft	11	197
	Silt, olive-gray; interbedded with sandy silt; calcareous, cohesive; hard; contains sulfides; sand lenses; fine; white	43	240
	Shale(?), dark-greenish-gray, silty, highly calcareous, cohesive, weathered(?)	13	253
	Till, dark-greenish-gray, bouldery, highly calcareous, cohesive, very hard	15	268
	Shale(?), dark-greenish-gray, highly calcareous, cohesive	15	283
	Clay, dark-greenish-gray, silty, slightly calcareous to noncalcareous, cohesive, hard, extremely compact	2	285
Pierre Shale:			
	Shale, olive-black; interbedded with clayey bentonitic(?) layers	30	315

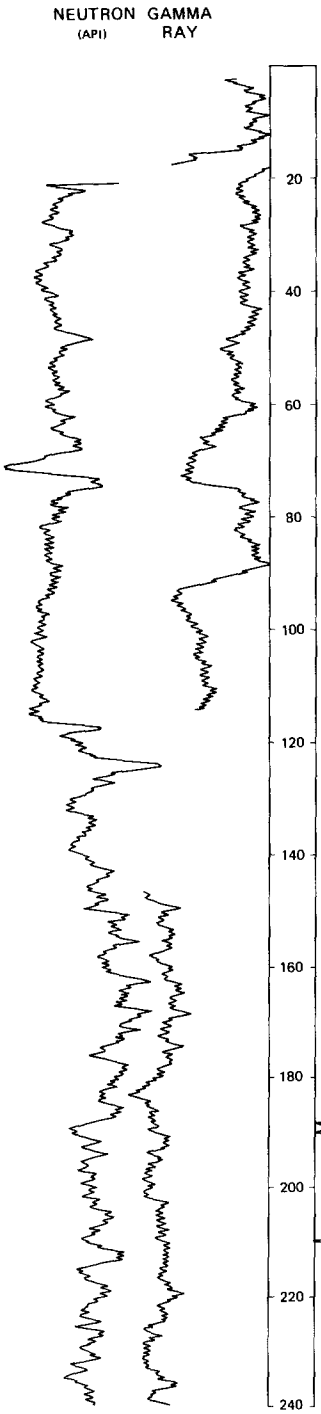
NDSWC 5748

LOCATION: 161-067-07DDD

DATE DRILLED: 7/09/80

ALTITUDE: 1675
(FT, NGVD)

DEPTH: 342
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

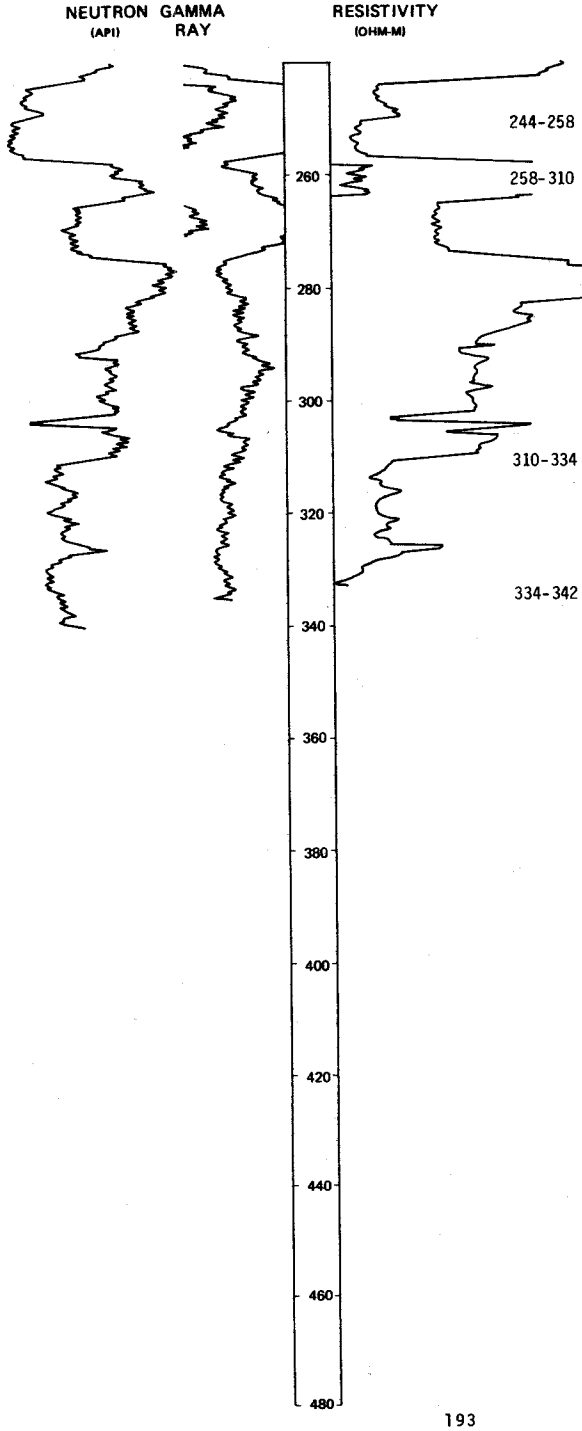
0-1	Topsoil.
1-15	Clay, yellowish-brown, very silty, pebbly, oxidized (till).
15-42	Clay, dark-yellowish-brown, very silty and sandy (till).
42-66	Clay, olive-gray, very silty, pebbly (till).
66-75	Gravel, medium; about 30 percent fine to coarse angular sand; predominantly detrital shale and some carbonate pebbles.
75-122	Clay, olive-gray, silty, pebbly (till).
122-192	Sand, fine to coarse, oxidized; about 40 percent fine to medium gravel.
192-210	Clay, light-brownish-gray, sandy (till).
210-244	Sand, fine to coarse, gravelly, rounded.

LOCATION: 161-067-07DDD

DATE DRILLED: 7/09/80

ALTITUDE: 1675
(FT, NGVD)

DEPTH: 342
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

244-258 Silt, dark-greenish-gray, clayey.

258-310 Clay, dark-brownish-gray, very silty, sandy (till).

310-334 Clay, dark-gray, pebbly (till); abundant detrital shale.

PIERRE SHALE

334-342 Shale, dark-gray, indurated.

NDSWC 5744

LOCATION: 161-067-11CCC1

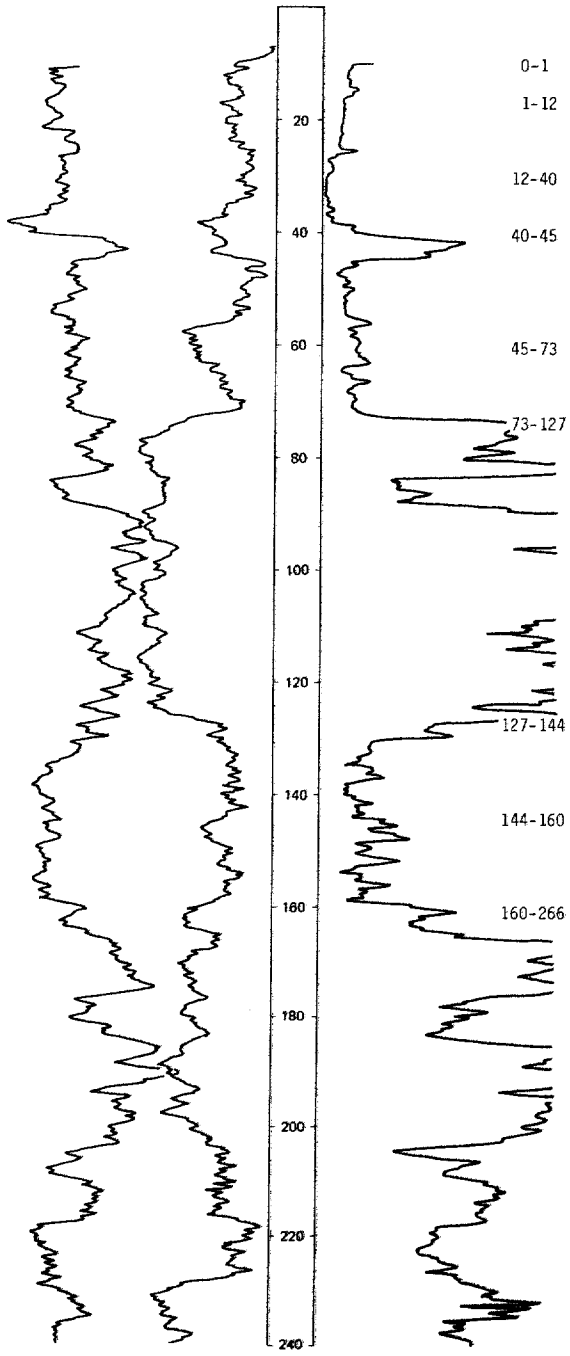
DATE DRILLED: 7/08/80

ALTITUDE: 1595
(FT, NGVD)

DEPTH: 382
(FT)

NEUTRON (API) GAMMA RAY

RESISTIVITY (OHM-M)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

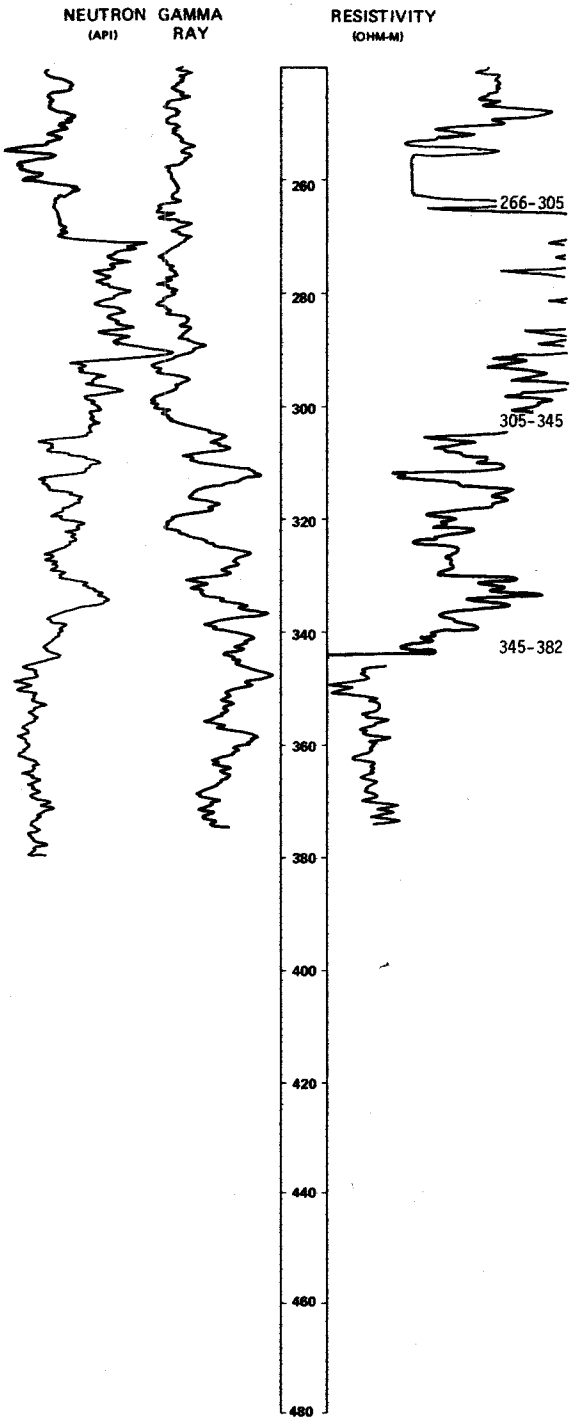
0-1	Topsoil.
1-12	Clay, yellowish-brown, silty, sandy, gravelly, oxidized (till).
12-40	Clay, olive-gray, silty, sandy, pebbly (till).
40-45	Sand, fine to coarse, sub-rounded; predominantly 50 percent detrital shale, 40 percent quartz, and 10 percent carbonate grains.
45-73	Clay, olive-gray, silty, sandy, pebbly (till).
73-127	Sand, fine to coarse, gravelly, rounded; some thin lenses of silt.
127-144	Clay, olive-gray, very silty, pebbly (till).
144-160	Silt, olive-gray, clayey.
160-266	Clay, dark-brownish-gray, silty (till); interbedded with lenses of gravel from 160 to 205 feet.

LOCATION: 161-067-11CCC1

DATE DRILLED: 7/08/80

ALTITUDE: 1595
(FT, NGVD)

DEPTH: 382
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

266-305 Sand, fine to coarse, rounded; interbedded with fine to medium gravel.

305-345 Silt, dark-gray, clayey; interbedded with lenses of sand and gravel.

PIERRE SHALE

345-382 Shale, dark-gray, siliceous, well-indurated, fissile.

161-067-11CCC2
NDSWC 5745

Altitude: 1595 feet | Date drilled: 7/08/80

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil----------	1	1
	Clay, yellowish-brown, very silty and sandy, pebbly, oxidized (till)----------	11	12
	Clay, olive-gray, very silty, sandy, gravelly (till)----------	28	40
	Sand, fine to coarse, angular to rounded; about 50 percent detrital shale, 40 percent quartz, and 10 percent carbonate grains----------	5	45
	Clay, olive-gray, silty, pebbly (till)----------	37	82
	Sand, fine to coarse, gravelly, predominantly rounded; occasional thin lenses of silt----------	20	102

161-067-14AAA
NDSWC 1364-10
(Log modified from Kahil, 1965)

Altitude: 1575 feet — Date drilled: 10/01/64

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Till, yellowish-gray and light-olive-gray, highly calcareous, cohesive, soft, oxidized	2	3
	Till, grayish-orange to light-olive-gray, silty, highly calcareous, cohesive, soft, oxidized	1	4
	Till, very fine, dark-yellowish-brown to moderate-yellowish-brown, silty, sandy, noncalcareous, cohesive, soft, oxidized	7	11
	Till, dark-yellowish-orange to olive-gray, highly calcareous, cohesive, oxidized	3	14
	Sand, fairly well sorted, mostly angular; predominant size is one-half millimeter	4	18
	Till, olive-gray to dark-greenish-gray, bouldery, highly calcareous, cohesive, very hard	37	55
	Till, olive-gray to dark-greenish-gray, bouldery, highly calcareous, cohesive, very hard; contains gravel; subrounded to subangular; average size is 5 millimeters	5	60
	Till, dark-greenish-gray, calcareous, cohesive	37	97
	Till, olive-gray, silty, calcareous, cohesive, fairly hard	50	147
	Gravel, very poorly sorted, angular to rounded; size ranges from 2 to 20 millimeters	7	154
	Till, olive-gray, gravelly, calcareous, cohesive, fairly hard	22	176
	Silt, olive-gray, highly calcareous, cohesive, hard; contains sulfides	17	193
	Gravel, fairly well sorted, mostly subangular to subrounded	4	197
	Silt, olive-gray, bouldery, highly calcareous, cohesive, hard; contains sulfides	6	203
	Gravel, clayey	5	208
	Silt, olive-gray, bouldery, highly calcareous, cohesive, hard; contains sulfides; interbedded with shale; olive black; cohesive; hard	3	211
	Silt, olive-gray, bouldery, calcareous, cohesive, hard; interbedded with lignite	4	215
	Clay, olive-gray to dark-greenish-gray, sandy, slightly calcareous; interbedded with lignite	66	281
	Sand, poorly sorted, mostly angular to subangular; grades into gravel	37	318
	Gravel, sandy, very poorly sorted, angular to rounded; between 1 and 5 millimeters in size	61	379
Pierre Shale:			
	Shale, dark-greenish-gray, noncalcareous, cohesive, very hard; interbedded with bentonitic(?) clay layers	31	410

NDSWC 5746

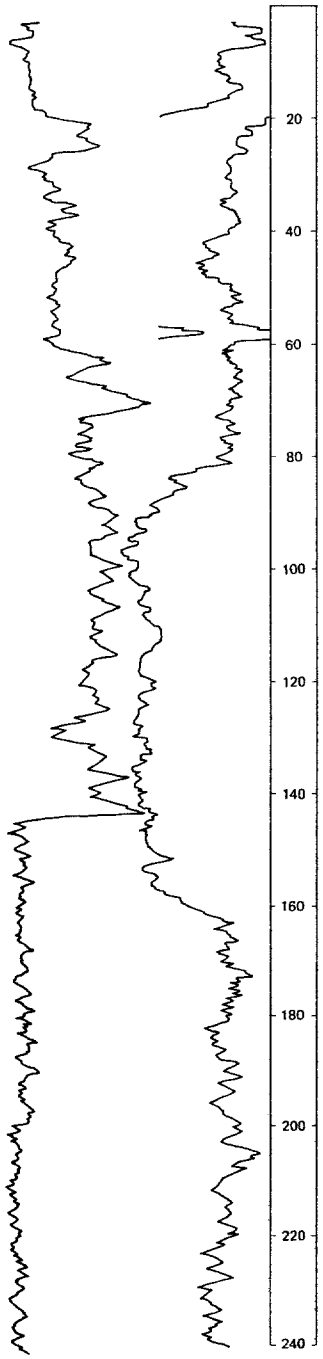
LOCATION: 161-067-15BBB

DATE DRILLED: 7/08/80

ALTITUDE: 1602
(FT, NGVD)

DEPTH: 562
(FT)

NEUTRON (API) GAMMA RAY



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-26	Clay, yellowish-brown, very silty to sandy, oxidized (till).
26-84	Clay, olive-gray, silty, pebbly (till).
84-166	Sand, fine to coarse, predominantly fine, subrounded to rounded; gravelly from 91 to 96 feet; interbedded with fine to coarse gravel from 140 to 166 feet; about 60 percent quartz, 20 percent carbonate, and 20 percent detrital shale grains.
166-270	Silt, dark-gray, very clayey.

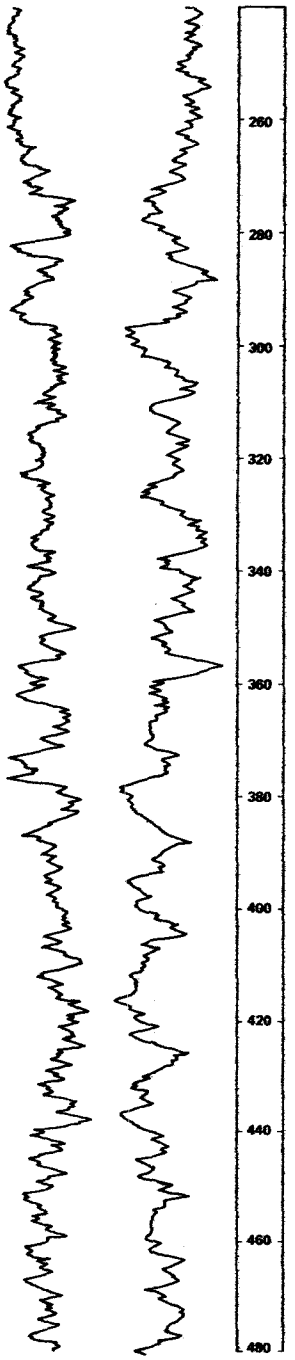
LOCATION: 161-067-15BBB

DATE DRILLED: 7/08/80

ALTITUDE: 1602
(FT, MGVD)

DEPTH: 562
(FT)

NEUTRON (API) GAMMA RAY



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

270-440 Clay, dark-gray, very silty to sandy, pebbly (till).

440-562 Clay, dark-gray, sandy, pebbly (till); abundant detrital shale.

LOCATION: 161-067-15BBB

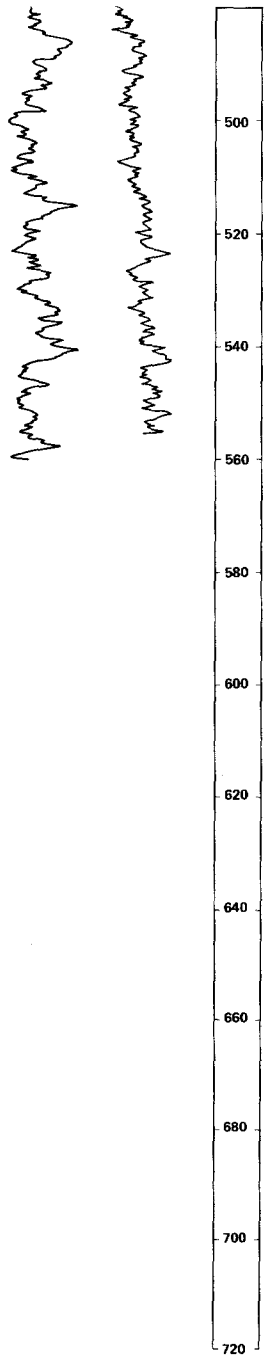
DATE DRILLED: 7/08/80

ALTITUDE: 1602
(FT, NGVD)

DEPTH: 562
(FT)

NEUTRON (API) GAMMA RAY

DESCRIPTION OF DEPOSITS



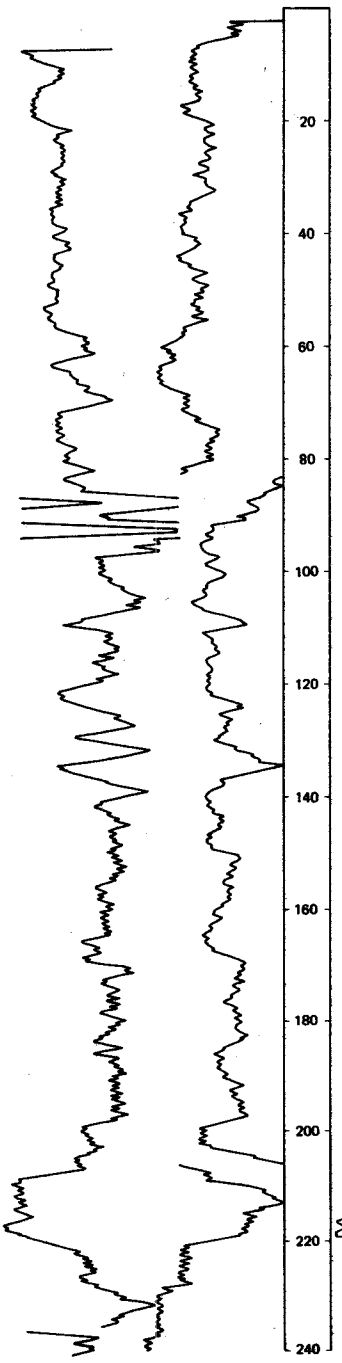
NDSWC 5747

LOCATION: 161-067-17AAA

DATE DRILLED: 7/09/80

ALTITUDE: 1640
(FT, NGVD)

DEPTH: 442
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-72	Clay, yellowish-brown, very silty, oxidized (till).
72-86	Clay, olive-gray, silty, pebbly (till).
86-138	Sand, fine to coarse, rounded; interbedded with clayey silt.
138-207	Gravel, fine to coarse; about 40 percent fine to very coarse sand; predominantly rounded; oxidized from 138 to 160 feet.
207-230	Clay, olive-gray, silty, pebbly (till).
230-248	Sand, fine, rounded; interbedded with silty carbonaceous clay.

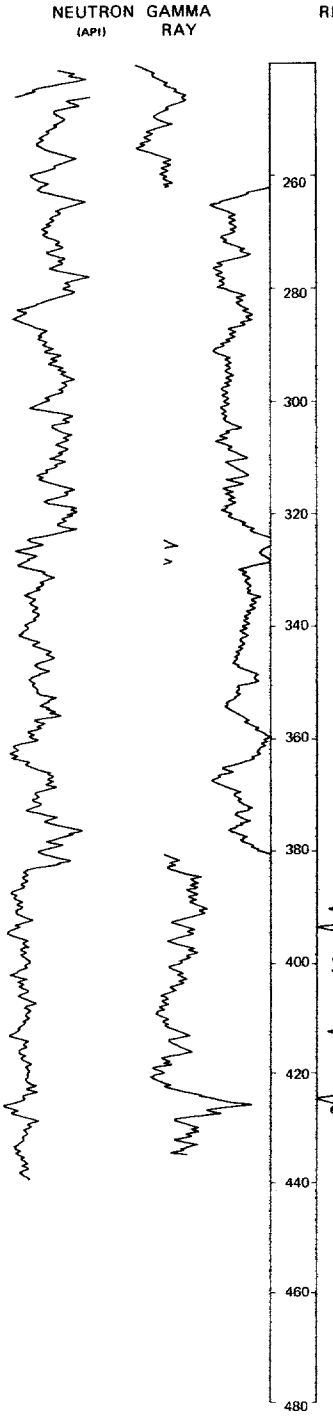
NDSWC 5747, Continued

LOCATION: 161-067-17AAA

DATE DRILLED: 7/09/80

ALTITUDE: 1640
(FT, NGVD)

DEPTH: 442
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

248-324 Gravel, fine to medium; interbedded with silt; about 30 percent fine to coarse angular to rounded sand; predominantly detrital shale.

324-383 Silt, brownish-gray, sandy, carbonaceous.

PIERRE SHALE

383-424 Shale, medium-gray, silty, bentonitic, macerated.

424-442 Shale, dark-gray, siliceous, well-indurated, fissile.

161-067-17DD
(Log modified from C. A. Simpson & Son)

Altitude: 1645 feet — Date drilled: 10/17/78

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow	22	23
	Clay, blue	103	126
	Sand	36	162
	Clay, blue, gravelly	50	212
	Hardpan	10	222
	Sand, fine to medium	128	350
Pierre Shale:			
	Shale	29	379

161-067-19DCC
(Log modified from C. A. Simpson & Son)

Altitude: 1662 feet — Date drilled: 11/09/66

Glacial drift:			
	Topsoil	1	1
	Clay, blue; rocks	71	72
	Hard layer	1	73
	Clay, sandy, hard	58	131
	Clay, blue	13	144
	Sand	103	247
	Sand, coarse	12	259
	Clay, very sandy	24	283
	Sand	2	285
	Clay, sandy	3	288
Pierre Shale:			
	Shale	112	400

161-067-22BAA
(Log modified from C. A. Simpson & Son)

Altitude: 1600 feet — Date drilled: 8/27/64

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	14	15
	Clay, blue	94	109
	Clay, blue, sandy	16	125
	Sand, clayey	10	135
	Clay, blue, sticky	57	192
	Sand, clayey	3	195
	Clay, blue	45	240
	Sand, clayey	30	270
	Sand and gravel	16	286
Pierre Shale:			
	Shale	54	340

161-067-22DDA
(Log modified from C. A. Simpson & Son)

Altitude: 1588 feet — Date drilled: 5/09/78

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow	39	40
	Clay, yellow, gravelly	5	45
	Clay, yellow	15	60
	Clay, blue	33	93
	Sand, fine	14	107

161-067-28BB
(Log modified from C. A. Simpson & Son)

Altitude: 1630 feet — Date drilled: 1978

Glacial drift:			
	Topsoil, black, silty	1	1
	Clay, yellowish-brown, silty (till)	33	34
	Clay, olive-gray, silty (till); with lots of rocks	70	104
	Sand, fine to medium to coarse; about 30 percent gravel	7	111
	Clay, olive-gray, silty	3	114
	Gravel, fine to medium to coarse; about 25 percent sand with small clay layers	26	140
	Gravel and rocks; rough drilling; rock bit	6	146
	Gravel, fine to medium; about 15 percent shale	12	158
	Clay, olive-gray, silty	2	160
	Gravel and rock; about 50 percent clay	15	175
	Clay, olive, silty	5	180

161-067-30DDA
(Log modified from C. A. Simpson & Son)

Altitude: 1650 feet — Date drilled: 5/07/70

Glacial drift:			
	Topsoil	1	1
	Clay, yellow, sandy	19	20
	Clay, blue, sandy	60	80
	Boulders and gravel	15	95
	Clay, blue, hard	40	135
	Gravel, coarse, dry	10	145
	Sand	20	165

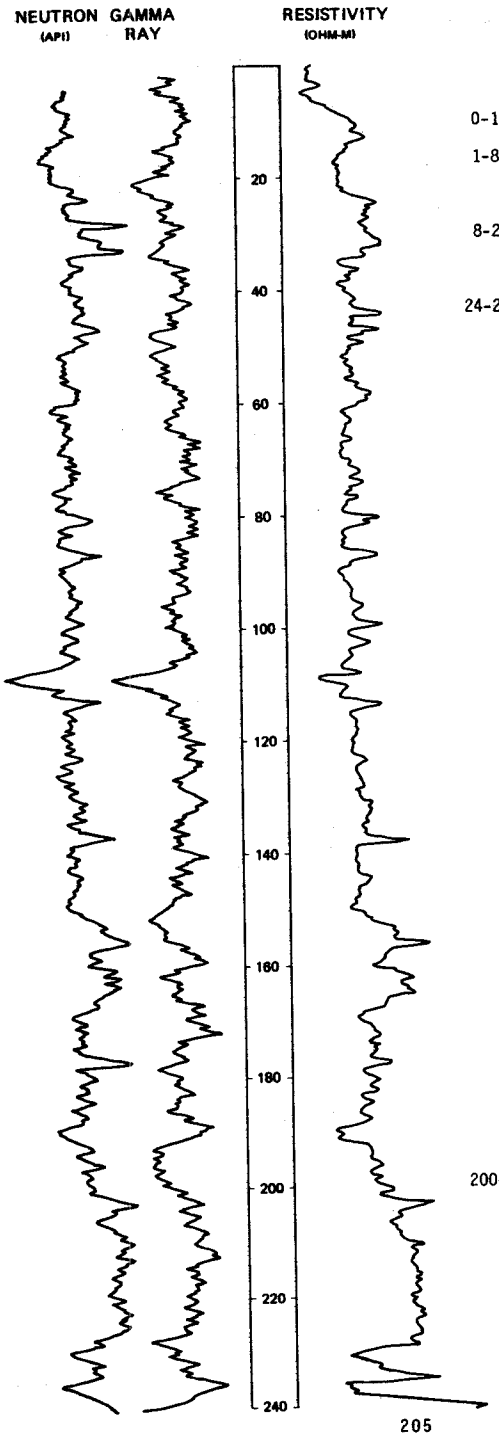
NDSWC 5750

LOCATION: 161-068-04AAA

DATE DRILLED: 7/10/80

ALTITUDE: 1730
(FT, NGVD)

DEPTH: 302
(FT)



205

DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-8	Clay, yellowish-brown, very silty, pebbly, oxidized (till).
8-24	Clay, yellowish-brown, very silty, sandy, oxidized (till).
24-200	Clay, olive-gray, silty, sandy, gravelly (till).
200-264	Clay, olive-gray, sandy to gravelly (till).

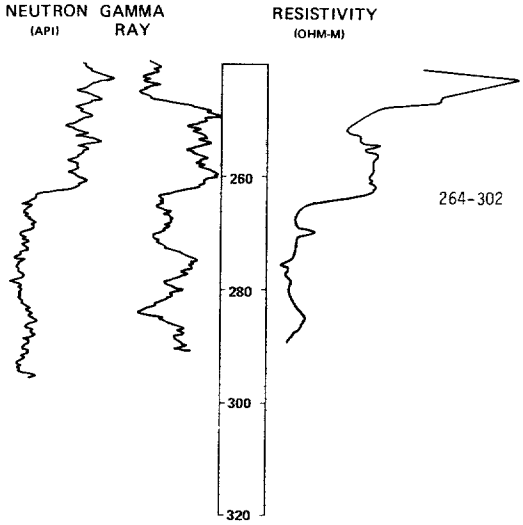
NDSWC 5750, Continued

LOCATION: 161-068-04AAA

DATE DRILLED: 7/10/80

ALTITUDE: 1730
(FT, NGVD)

DEPTH: 302
(FT)



DESCRIPTION OF DEPOSITS

PIERRE SHALE

264-302 Shale, dark-gray, siliceous, well-indurated, fissile.

161-068-07CCB
(Log modified from C. A. Simpson & Son)

Altitude: 1770 feet

Date drilled: 6/11/74

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow	27	28
	Clay, blue, sandy	12	40
	Clay, blue, very sandy	5	45
	Clay, blue, sandy	63	108
	Sand, soupy; some water	12	120
	Clay, blue, sandy	21	141
	Sand, fine to coarse	12	153

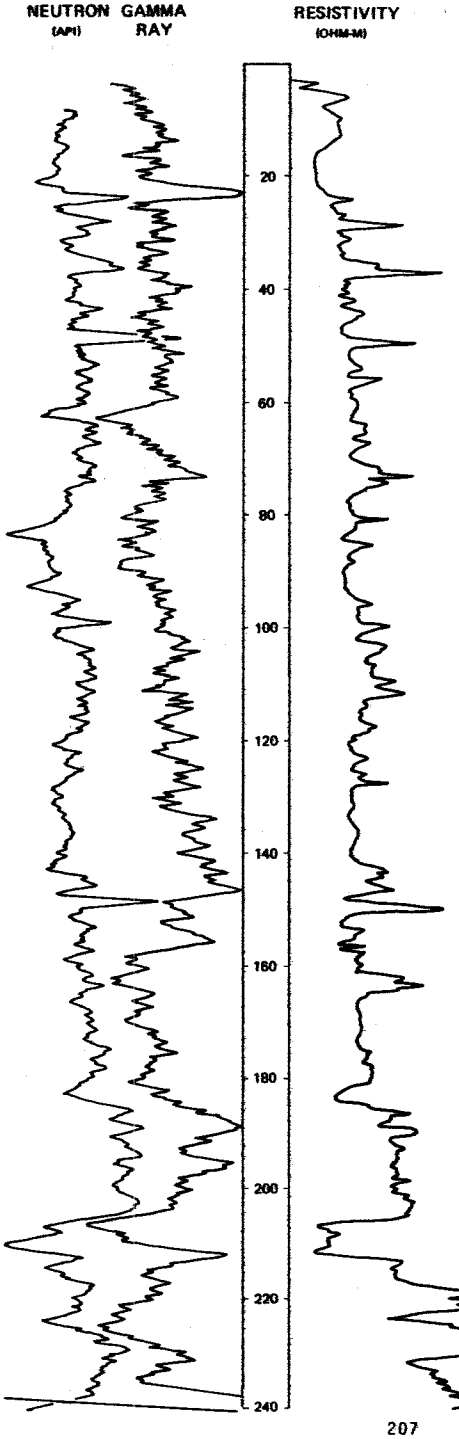
NDSWC 6013

LOCATION: 161-068-08DDD

DATE DRILLED: 9/29/81

ALTITUDE: 1750
(FT, NGVD)

DEPTH: 261
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-12	Clay, yellowish-brown, silty, oxidized (till).
12-25	Clay, brownish-gray, pebbly, oxidized (till).
25-185	Clay, olive-gray (till); interbedded with occasional lenses of sand and gravel.
185-205	Clay, olive-gray, gravelly (till).
205-213	Clay, dark-gray.
213-238	Sand, fine to coarse; interbedded with clay; about 30 percent fine to medium gravel.

PIERRE SHALE

238-261	Shale, dark-gray, siliceous, indurated.

NDSWC 6013, Continued

LOCATION: 161-068-08DDD

DATE DRILLED: 9/29/81

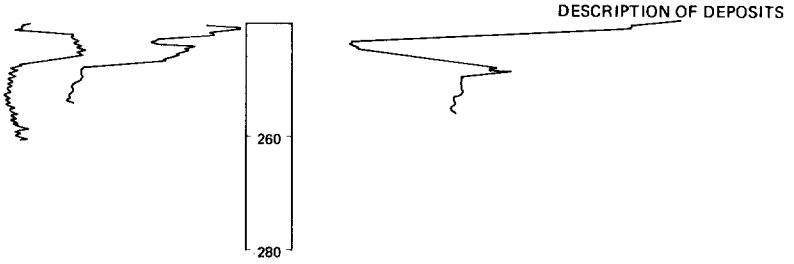
ALTITUDE: 1750
(FT, NGVD)

DEPTH: 261
(FT)

NEUTRON (API) GAMMA RAY

RESISTIVITY (OHM-M)

DESCRIPTION OF DEPOSITS



161-068-12BDD
(Log modified from C. A. Simpson & Son)

Altitude: 1706 feet

Date drilled: 8/14/64

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Soil, black	2	2
	Clay, yellow, sandy	48	50
	Clay, blue	5	55
	Clay, coarse, sandy	5	60
	Clay, blue	35	95
	Clay, blue, sandy	94	189
	Sand	7	196

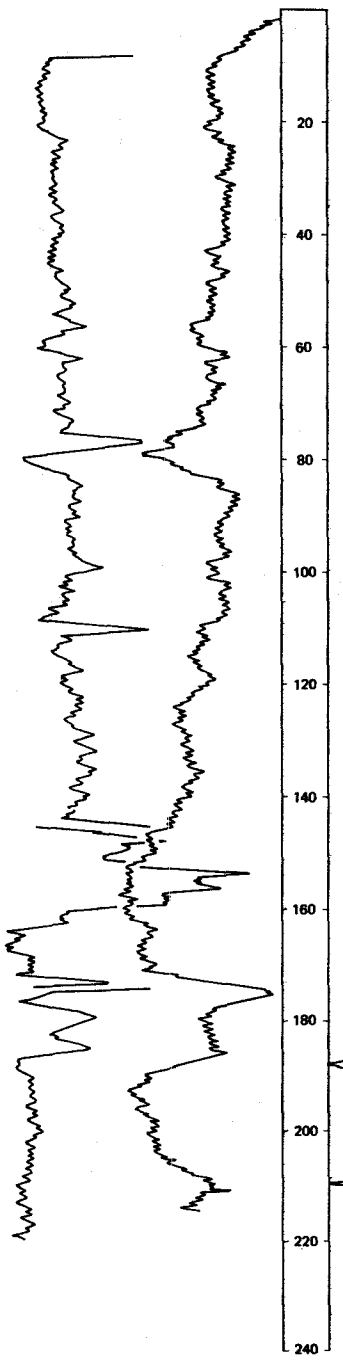
NDSWC 5749

LOCATION: 161-068-14AAA

DATE DRILLED: 7/10/80

ALTITUDE: 1708
(FT, NGVD)

DEPTH: 222
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-10	Clay, yellowish-brown, very silty, oxidized (till).
10-24	Clay, dark-yellowish-brown, very silty, oxidized (till).
24-146	Clay, olive-gray, silty, pebbly (till); cobbles and boulders from 46 to 83 feet.
146-174	Sand, fine to coarse, poorly sorted, angular to rounded.
174-180	Clay, olive-gray, pebbly, very sandy (till).
180-189	Clay, dark-gray, very silty to sandy, gravelly (till).

PIERRE SHALE

189-222	Shale, dark-gray, siliceous, well-indurated.

161-068-21CCB
(Log modified from C. A. Simpson & Son)

Altitude: 1740 feet — Date drilled: 7/29/75

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow	14	15
	Gravel	8	23
	Clay, blue, rocky	40	63
	Sand	1	64
	Clay, blue; rocks	10	74
	Sand	1	75
	Clay, blue, sandy	45	120
	Clay, blue, very gravelly	39	159
	Sand, dirty	2	161
	Clay, blue, sandy	26	187
	Gravel, coarse	2	189
	Clay, blue, sandy	71	260
	Sand	5	265

161-068-26BBB
(Log modified from C. A. Simpson & Son)

Altitude: 1721 feet — Date drilled: 4/09/74

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	19	20
	Clay, blue	40	60
	Clay, blue, sandy	100	160
	Clay, blue, gravelly	100	260
	Clay, blue, or shale; caves	20	280
Pierre Shale:			
	Shale	128	408

161-068-35DC
(Log modified from Hansen, 1957)

Altitude: 1710 feet — Date drilled: 6/30/52

GEOLOGIC SOURCE MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
CRETACEOUS SYSTEM:		
Niobrara Formation (top):		940
Greenhorn Formation (top):		1,330
Dakota Formation (top):		1,708
JURASSIC SYSTEM:		
Piper Formation(?) (top):		2,153
TRIASSIC SYSTEM:		
Spearfish Formation (top):		2,370
DEVONIAN SYSTEM:		
Nisku Formation (top):		2,488
Duperow Formation (top):		2,563
Souris River Formation (top):		2,890
Dawson Bay Formation (top):		3,197
Winnipegosis Formation (top):		3,289
Ashern Formation (top):		3,390
SILURIAN SYSTEM:		
Interlake Formation (top):		3,436
ORDOVICIAN SYSTEM:		
Upper Stony Mountain Formation (top):		3,608
Lower Stony Mountain Formation (top):		3,691
Red River Formation (top):		3,772
Winnipeg Shale (top):		4,355
Winnipeg Sand (top):		4,460

NDSWC 6029

LOCATION: 162-065-16DDD

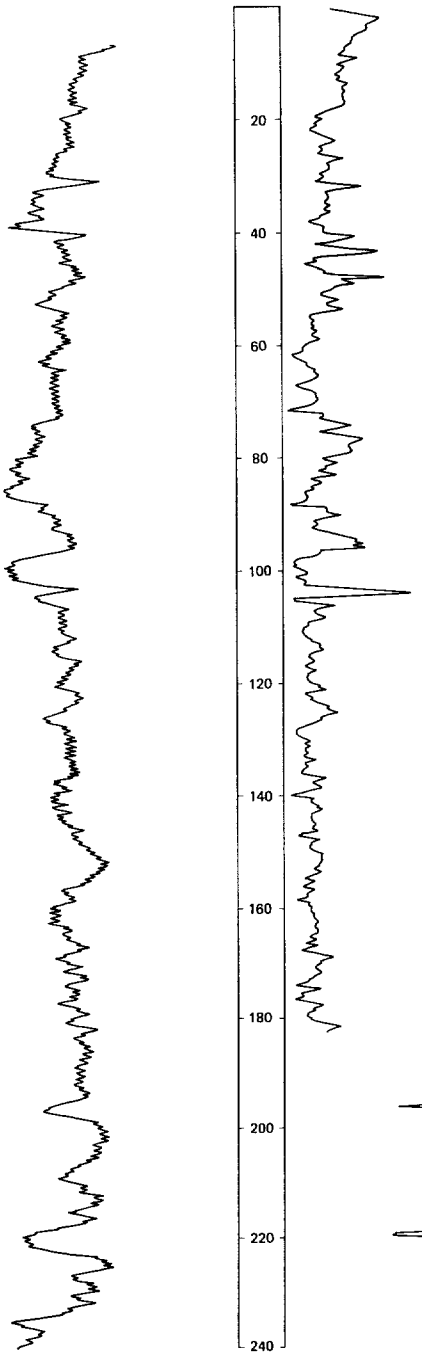
DATE DRILLED: 10/13/81

ALTITUDE: 1580
(FT, NGVD)

DEPTH: 281
(FT)

NEUTRON
(API)

RESISTIVITY
(OHM-M)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

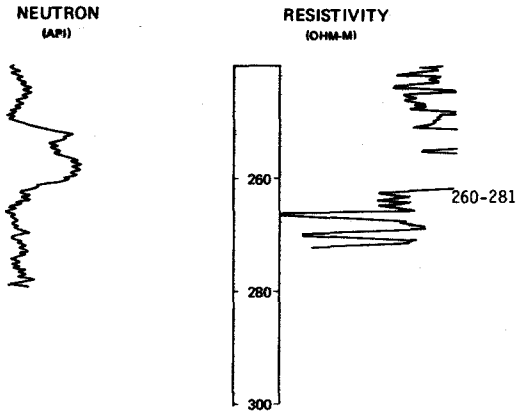
0-1	Topsoil.
1-23	Clay, yellowish-brown, pebbly, oxidized (till).
23-40	Clay, olive-gray, pebbly (till).
40-49	Sand, coarse; interbedded with medium gravel and lenses of clay.
49-54	Silt, olive-gray, clayey.
54-80	Clay, olive-gray, sandy (till).
80-90	Silt, olive-gray, clayey.
90-92	Gravel, fine, subrounded.
92-102	Clay, dark-gray, silty.
102-105	Sand, coarse, gravelly, subrounded.
105-194	Clay, olive-gray, sandy to gravelly (till).
194-210	Sand, fine, subangular; interbedded with clay.
210-218	Silt, olive-gray.
218-228	Gravel, fine to medium, rounded.
228-260	Clay, brownish-gray, pebbly (till).

LOCATION: 162-065-16DDD

DATE DRILLED: 10/13/81

ALTITUDE: 1580
(FT, NGVD)

DEPTH: 281
(FT)



DESCRIPTION OF DEPOSITS

PIERRE SHALE

260-281 Shale, dark-gray, silty, argillaceous, moderately indurated, partially fractured.

162-065-20BBB
NDSWC 5771

Altitude: 1555 feet

Date drilled: 7/23/80

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, very silty to sandy, oxidized (till)	9	10
	Clay, olive-gray, silty, sandy, pebbly (till)	48	58
	Gravel, fine to coarse, sandy, subangular; predominantly carbonate pebbles	14	72
	Clay, olive-gray, very gravelly (till)	38	110
	Clay, olive-gray (till); abundant cobbles and boulders	20	130
	Sand, fine to coarse, gravelly, subrounded to rounded, oxidized; interbedded with lenses of clay	12	142

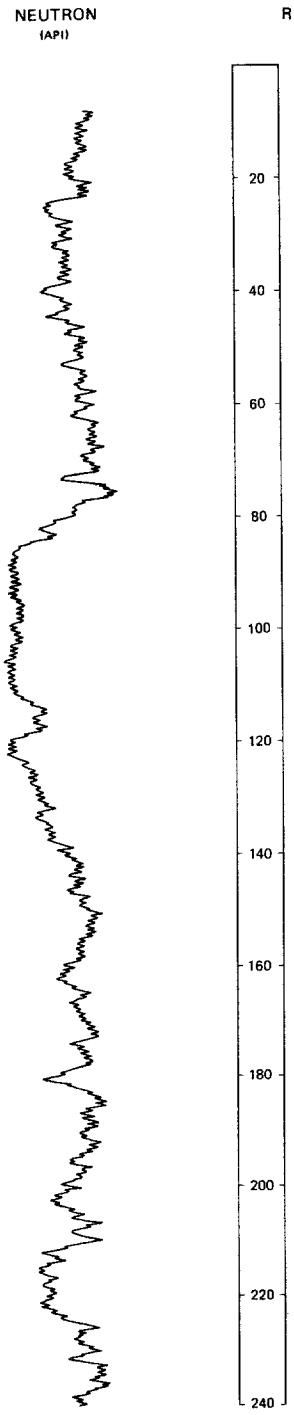
NDSWC 6028

LOCATION: 162-065-23ABB

DATE DRILLED: 10/12/81

ALTITUDE: 1605
(FT, NGVD)

DEPTH: 351
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-20	Clay, yellowish-brown, pebbly, oxidized (till).
20-27	Clay, olive-gray, pebbly (till).
27-84	Clay, olive-gray, pebbly, sandy (till).
84-125	Clay, olive-gray, silty.
125-155	Clay, olive-gray, pebbly, sandy (till).
155-195	Gravel, fine to coarse; interbedded with lenses of coarse and clayey sand; predominantly detrital shale.
195-200	Clay, olive-gray, sandy.
200-214	Sand, coarse, gravelly; interbedded with lenses of clay.
214-222	Clay, olive-gray, silty.
222-278	Clay, olive-gray, pebbly (till).

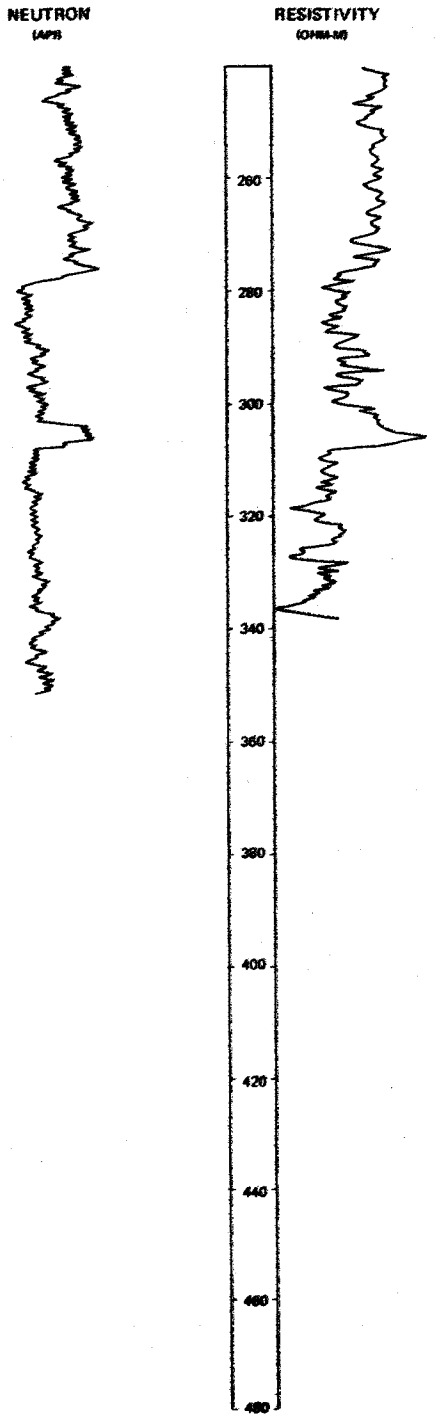
214

LOCATION: 162-065-23ABB

DATE DRILLED: 10/12/81

ALTITUDE: 1605
(FT, NGVD)

DEPTH: 351
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

278-304 Clay, olive-gray, silty.

304-338 Silt, olive-gray to greenish-gray, clayey, macerated.

PIERRE SHALE

338-351 Shale, dark-gray, siliceous, moderately indurated.

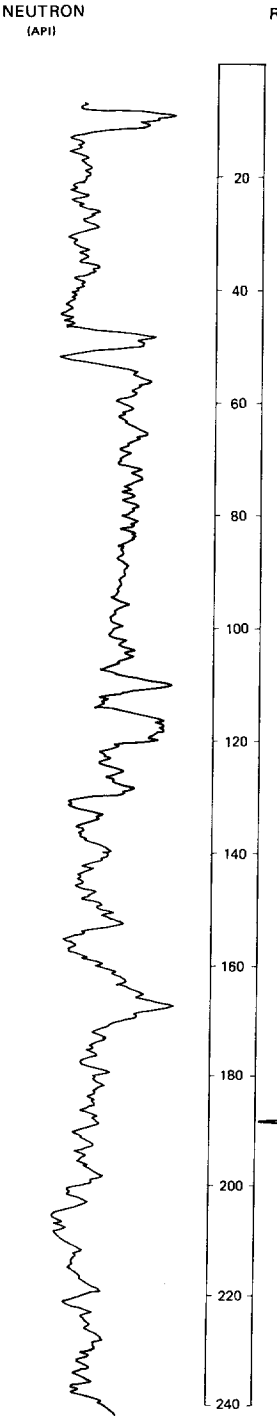
NDSWC 6030

LOCATION: 162-065-32BBB

DATE DRILLED: 10/13/81

ALTITUDE: 1550
(FT, NGVD)

DEPTH: 241
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-7	Silt, yellowish-brown, clayey, oxidized.
7-13	Clay, yellowish-brown, pebbly, oxidized (till).
13-16	Clay, dark-brown, pebbly, partially oxidized (till).
16-42	Shale, dark-gray, fractured.
42-102	Clay, olive-gray, pebbly, sandy (till).
102-130	Sand, coarse; interbedded with coarse to very coarse gravel; predominantly detrital shale.
130-158	Clay, olive-gray, silty; fine sand from 150 to 152 feet.
158-171	Clay, brownish-gray, pebbly, sandy (till).
171-185	Shale, dark-gray, fractured; fractures filled with clay.
185-218	Shale, dark-gray, bentonitic; interbedded with silty clay.

PIERRE SHALE

218-241	Shale, dark-gray, siliceous, indurated, fissile.

162-066-14DDD
NDSWC 6031

Altitude: 1530 feet — Date drilled: 10/13/81

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, silty, oxidized (till)	11	12
	Clay, brownish-gray, sandy, oxidized (till)	3	15
	Clay, olive-gray, gravelly; abundant detrital shale	25	40
	Clay, dark-gray	7	47
	Clay, olive-gray, sandy (till)	57	104
Pierre Shale:			
	Shale, dark-gray, siliceous, fractured	37	141

162-066-17BBB
(Log modified from C. A. Simpson & Son)

Altitude: 1535 feet — Date drilled: 12/08/76

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	13	14
	Shale, gravelly	11	25
Pierre Shale:			
	Shale	120	145

162-066-21AAA
NDSWC 6032

Altitude: 1530 feet — Date drilled: 10/13/81

Glacial drift:			
	Topsoil	1	1
	Silt, yellowish-brown, oxidized	4	5
	Clay, yellowish-brown, pebbly (till)	10	15
	Clay, olive-gray, sandy (till)	15	30
Pierre Shale:			
	Shale, dark-gray, moderately indurated, fractured	51	81

162-066-28ACD
NDSWC 1364-15
(Log modified from Kahil, 1965)

Altitude: 1532 feet — Date drilled: 10/07/64

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Dam filling	8	8
	Sand, fairly well sorted, mostly angular; predominant size is one-half millimeter; oxidized	1	9
	Till, yellowish-gray, clayey, highly calcareous, fairly cohesive, soft, oxidized	2	11
	Clay, dark-greenish-gray, sandy, calcareous, fairly cohesive, soft	3	14
	Sand, fairly well sorted, angular to rounded; predominant size is one-half millimeter	17	31
	Gravel, poorly sorted; gradational contact with above sand	10	41
Pierre Shale:			
	Shale, olive-black, cohesive, hard; interbedded with bentonitic(?) clay	22	63

162-066-28DAA
NDSWC 1364-14
(Log modified from Kahil, 1965)

Altitude: 1528 feet — Date drilled: 10/06/64

Glacial drift:			
	Topsoil	1	1
	Sand, well-sorted, mostly angular; predominant size is one-half millimeter; oxidized	3	4
	Till, grayish-orange to pale-yellowish-orange, silty, highly calcareous, oxidized	7	11
	Silt, light-olive-gray, clayey, sandy, calcareous, oxidized	23	34
	Till, dark-greenish-gray, calcareous	5	39
	Silt, dark-greenish-gray; interbedded with sandy silt	2	41
	Sand, well-sorted; average size is one-fourth millimeter	4	45
	Till, dark-greenish-gray, silty, calcareous, cohesive	6	51
	Gravel, poorly sorted	11	62
	Till, dark-greenish-gray, cohesive, crumbly	4	66
Pierre Shale:			
	Shale; interbedded with bentonitic(?) clay layers	29	95

162-066-28DCB
(Log modified from Church Well Boring)

Altitude: 1535 feet — Date drilled: 9/01/77

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil, black	2	2
	Clay, yellow, rocky	14	16
	Clay, blue, rocky, hard	4	20
	Sand, coarse, yellow; water	7	27

162-066-30CCC
NDSWC 1364-8
(Log modified from Kahil, 1965)

Altitude: 1551 feet — Date drilled: 9/30/62

Glacial drift:			
	Topsoil	1	1
	Till, dusky-yellow to light-olive-gray, noncalcareous, cohesive, oxidized	6	7
Pierre Shale:			
	Shale, olive-gray, cohesive, hard, massive, oxidized	3	10
	Shale, dusky-blue and dark-gray, cohesive, hard, massive; interbedded with bentonitic(?) clay layers; sand laminae; white; noncalcareous	11	21

162-066-30DCC
NDSWC 1364-7
(Log modified from Kahil, 1965)

Altitude: 1536 feet — Date drilled: 9/30/64

Glacial drift:			
	Topsoil	1	1
	Till, predominantly olive-gray, calcareous, cohesive, oxidized	2	3
	Sand, poorly sorted, rounded to subrounded, oxidized	5	8
	Silt, moderate-yellowish-brown to dark-yellowish-brown, highly calcareous	2	10
Pierre Shale:			
	Shale	22	32

162-066-32DDD
NDSWC 1364-13
(Log modified from Kahil, 1965)

Altitude: 1533 feet — Date drilled: 10/06/64

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Till, pinkish-gray, silty, highly calcareous, noncohesive, soft, oxidized	2	3
	Till, grayish-orange to dark-greenish-gray, calcareous, cohesive, soft, oxidized	9	12
	Till, mostly dark-greenish-gray, calcareous, cohesive, hard; contains small lenses of white sand	93	105
Pierre Shale:			
	Shale, dark-greenish-gray to medium-bluish-gray, noncalcareous, cohesive, soft	21	126

162-067-01BCB
NDSWC 6025

Altitude: 1535 feet — Date drilled: 10/09/81

Glacial drift:			
	Topsoil	1	1
	Sand, fine; interbedded with fine to medium rounded oxidized gravel	6	7
	Clay, yellowish-brown, silty, pebbly, oxidized (till)	3	10
	Clay, olive-gray, silty, pebbly (till)	13	23
	Sand, fine to coarse; interbedded with fine to medium rounded gravel	32	55
	Clay, olive-gray, silty, pebbly (till)	5	60
	Silt, olive-gray; interbedded with clay	94	154
	Gravel, medium, angular; interbedded with clay	7	161
	Clay, medium-gray, pebbly (till); medium sand from 175 to 177 feet	79	240
Pierre Shale:			
	Shale, dark-gray, siliceous	21	261

NDSWC 6020A, 6020B

LOCATION: 162-067-02BBC1, 2

DATE DRILLED: 10/05/81

ALTITUDE: 1555
(FT. NGVD)

DEPTH: 401
(FT)

DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

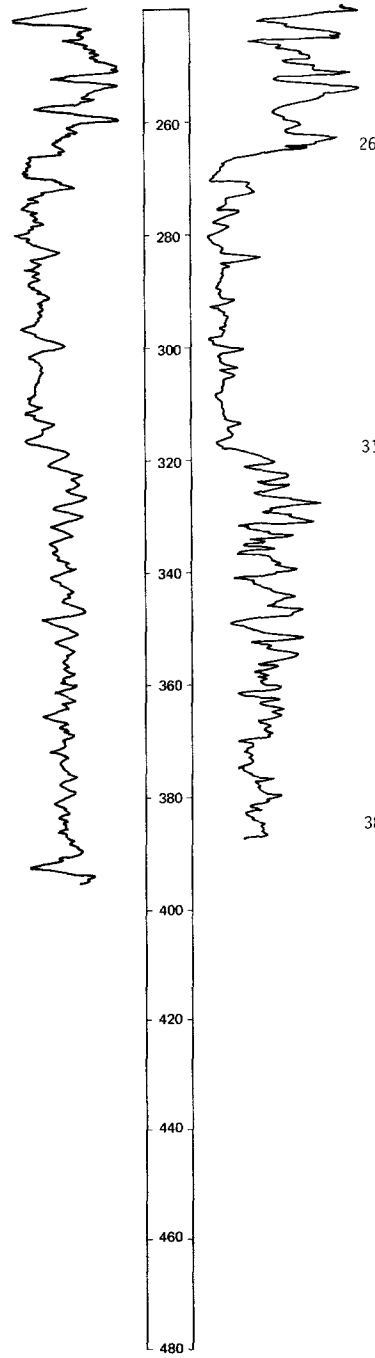
0-1	Topsoil.
1-17	Clay, yellowish-brown, pebbly, oxidized (till).
17-26	Clay, olive-gray, pebbly (till).
26-36	Clay, olive-gray, sandy (till).
36-60	Sand, fine, well-sorted, subrounded to rounded; about 80 percent quartz and 20 percent carbonate grains.
60-113	Sand, coarse; interbedded with fine to medium subrounded to rounded gravel.
113-150	Gravel, fine to coarse, angular to rounded; about 85 percent detrital shale and 15 percent silicate and carbonate pebbles.
150-189	Clay, dark-gray, pebbly (till).
189-266	Sand, coarse; interbedded with coarse subrounded gravel; thin lenses of clay from 240 to 260 feet.

LOCATION: 162-067-02BBC1, 2

DATE DRILLED: 10/05/81

ALTITUDE: 1555
(FT, NGVD)

DEPTH: 401
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

266-318 Clay, dark-gray, silty.

318-382 Clay, dark-gray, sandy, macerated; oxidation streaks; abundant detrital shale.

PIERRE SHALE

382-401 Shale, dark-gray, bentonitic, tight.

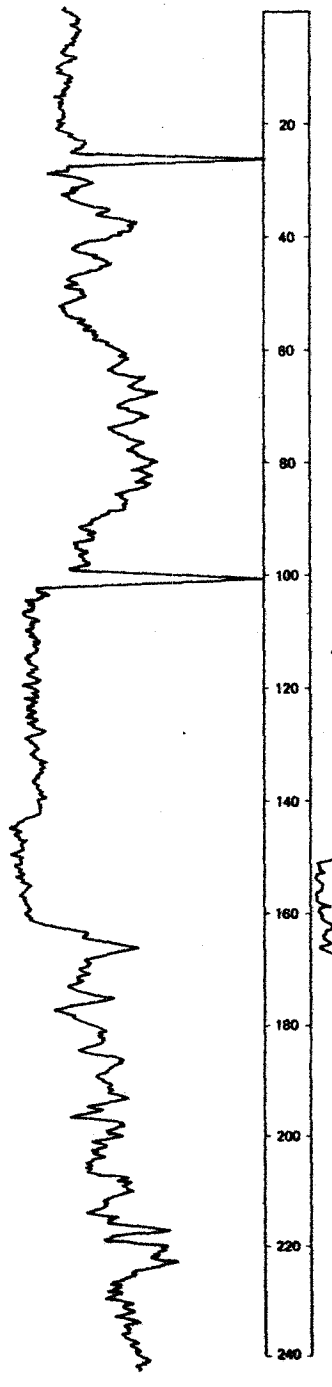
NDSWC 6021

LOCATION: 162-067-04AAA

DATE DRILLED: 10/07/81

ALTITUDE: 1572
(FT, NGVD)

DEPTH: 281
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-19	Clay, yellowish-brown, pebbly, oxidized (till).
19-34	Clay, olive-gray, pebbly (till); boulders.
34-36	Clay, olive-gray, sandy.
36-62	Sand, fine to medium, sub-rounded to rounded.
62-107	Sand, coarse; interbedded with fine to medium rounded gravel.
107-150	Silt, olive-gray, clayey.
150-170	Clay, dark-gray, cohesive.
170-224	Clay, dark-gray, sandy (till); interbedded with thin lenses of gravel.
224-255	Sand, coarse; interbedded with fine angular to rounded gravel; becomes coarse at 240 feet.

NDSWC 6021, Continued

LOCATION: 162-067-04AAA

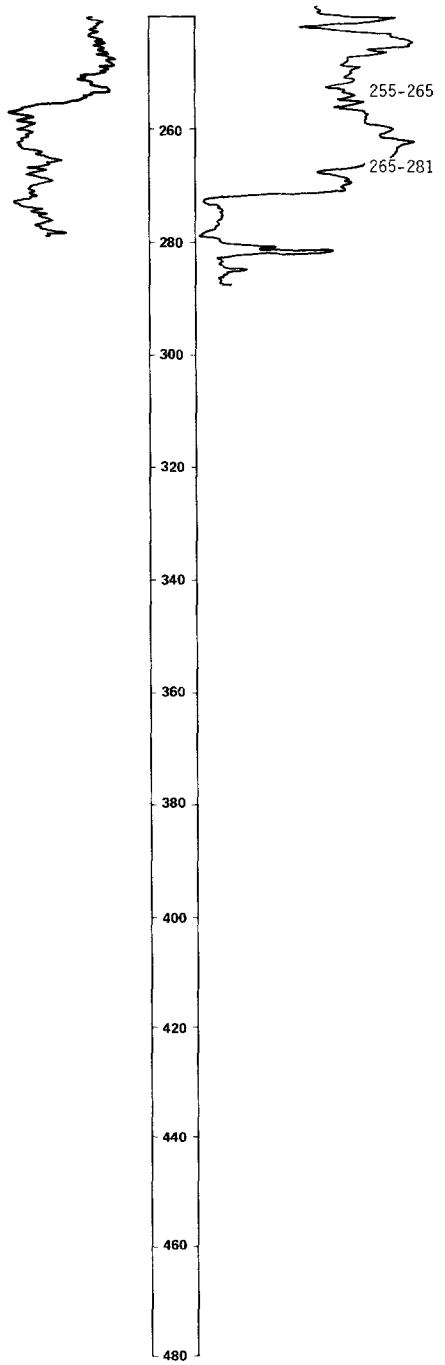
DATE DRILLED: 10/07/81

ALTITUDE: 1572
(FT, NGVD)

DEPTH: 281
(FT)

NEUTRON
(API)

RESISTIVITY
(OHM-M)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

255-265 Silt, medium-gray, clayey.

PIERRE SHALE

265-281 Shale, dark-gray, fissile.

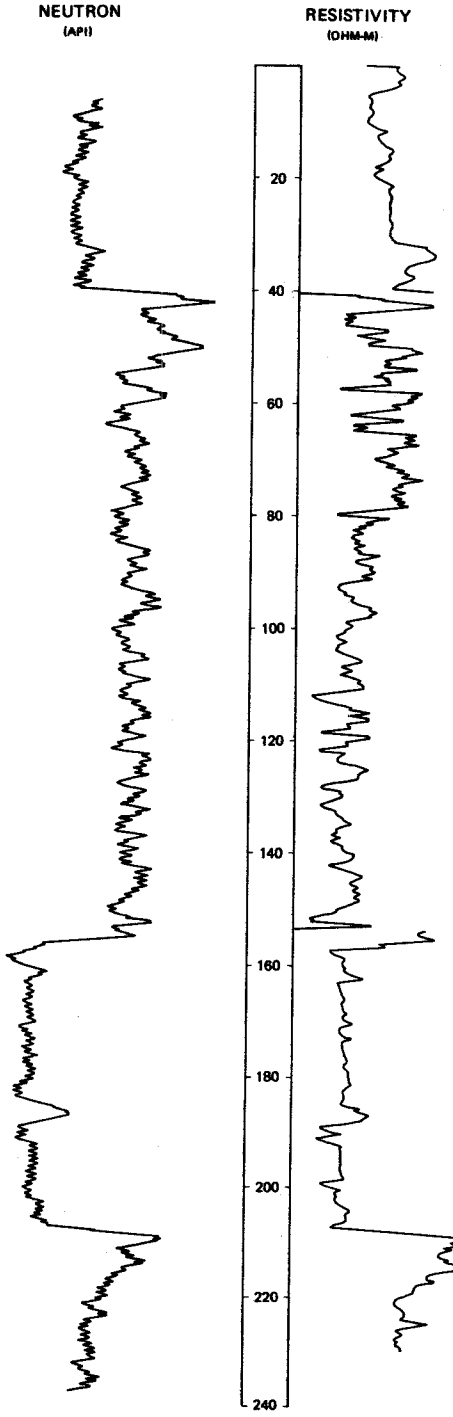
NDSWC 6022

LOCATION: 162-067-05AAA

DATE DRILLED: 10/07/81

ALTITUDE: 1595
(FT, NGVD)

DEPTH: 241
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-11	Clay, yellowish-brown, silty, oxidized (till).
11-32	Clay, brownish-gray, pebbly, oxidized (till).
32-36	Sand, fine, oxidized.
36-40	Clay, olive-gray, sandy (till).
40-80	Sand, coarse; interbedded with fine subrounded to rounded gravel.
80-155	Sand, coarse to very coarse; interbedded with fine sub-rounded to rounded gravel.
155-170	Clay, olive-gray, silty.
170-207	Clay, dark-gray, cohesive.
207-215	Gravel, fine to medium, subrounded.

PIERRE SHALE

215-241	Shale, dark-gray, siliceous, indurated.

162-067-06ABA
(Log modified from C. A. Simpson & Son)

Altitude: 1620 feet — Date drilled: 4/29/69

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow; some rocks	20	21
	Clay, gray; rocks	39	60
	Hardpan, yellow, gravelly	7	67
	Sand, clayey	12	79
	Sand and gravel; little water	7	86
	Sand; somewhat clayey	13	99
	Clay, sandy	6	105
	Sand, blue, very clayey	8	113
	Gravel, clayey	7	120
	Sand, fine, gray, clayey	30	150
	Sand and gravel	5	155
	Clay, fine, sandy	6	161
	Clay, blue, sandy	5	166
	Shale, blue	70	236
	Shale gravel; with limestone pebbles	4	240
Pierre Shale:			
	Shale, broken; caves; no water	14	254
	Shale and limestone gravel; dry	1	255
	Shale, sandy	24	279
	Shale, broken	1	280
	Shale, blue, hard	34	314

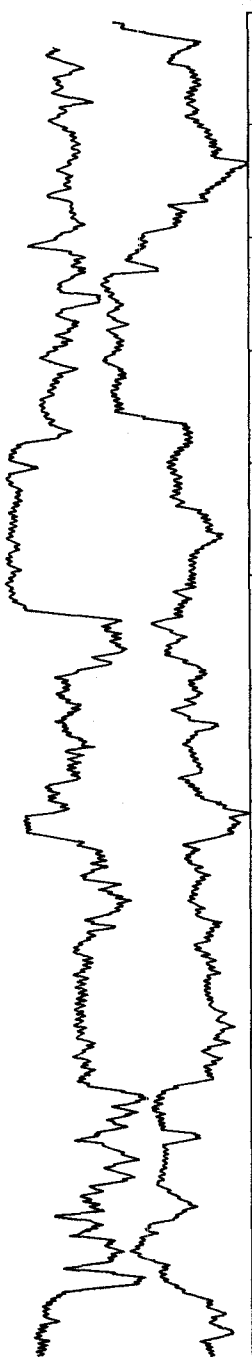
NDSWC 5757

LOCATION: 162-067-11DAA1

DATE DRILLED: 7/16/80

ALTITUDE: 1544
(FT, NGVD)

DEPTH: 262
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-5	Gravel, fine, sandy, rounded, oxidized.
5-14	Clay, yellowish-brown, silty, oxidized (till).
14-34	Clay, olive-gray, silty, pebbly (till).
34-76	Sand, fine to coarse, rounded; interbedded with coarse gravel from 56 to 76 feet.
76-106	Silt, dark-gray, clayey.
106-191	Clay, brownish-gray, very silty to sandy (till).
191-228	Sand, fine to very coarse, gravelly, rounded; interbedded with lenses of clay.

PIERRE SHALE

228-240	Shale, dark-gray, macerated.

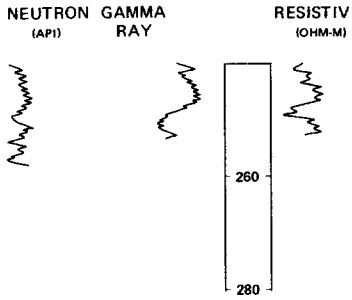
NDSWC 5757, Continued

LOCATION: 162-067-11DAA1

DATE DRILLED: 7/16/80

ALTITUDE: 1544 (FT, NGVD)

DEPTH: 262 (FT)



DESCRIPTION OF DEPOSITS

PIERRE SHALE, Continued

240-262 Shale, dark-gray, well-indurated.

162-067-11DAA2
NDSWC 5758

Altitude: 1544 feet

Date drilled: 7/16/80

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Gravel, fine, sandy, rounded, oxidized	4	5
	Clay, yellowish-brown, very silty, oxidized (till)	9	14
	Clay, olive-gray, silty, sandy (till)	20	34
	Sand, fine to coarse, rounded; interbedded with coarse gravel from 56 to 74 feet	40	74

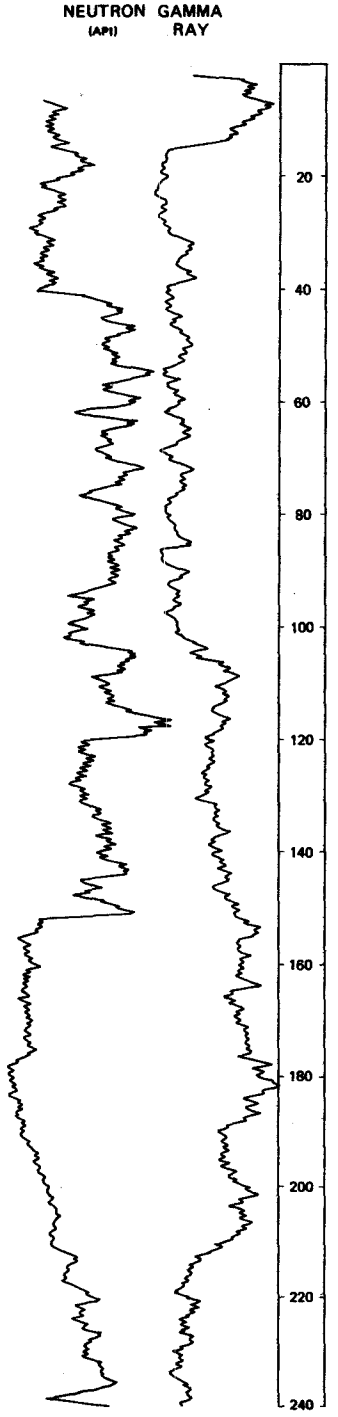
NDSWC 5756

LOCATION: 162-067-14BBB

ALTITUDE: 1560
(FT, NGVD)

DATE DRILLED: 7/15/80

DEPTH: 382
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

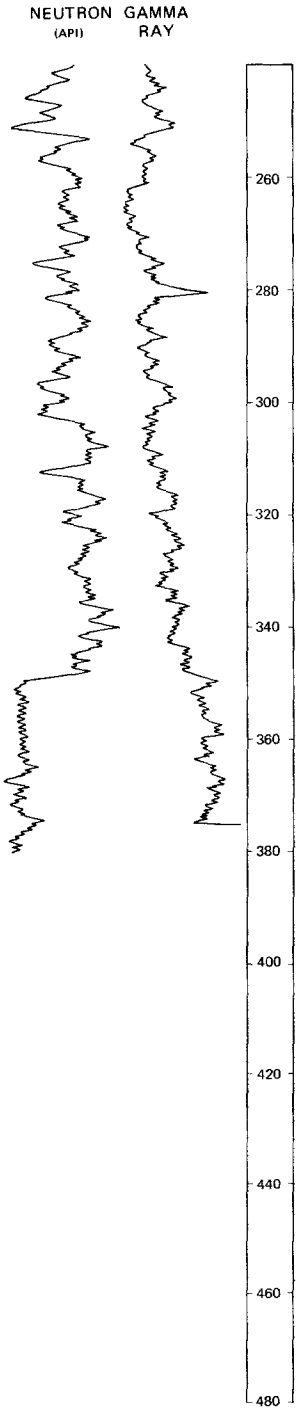
0-1	Topsoil.
1-8	Gravel, fine to coarse, sandy, angular, oxidized.
8-15	Clay, yellowish-brown, gravelly, oxidized (till).
15-31	Sand, fine to coarse, gravelly, poorly sorted, rounded, oxidized.
31-100	Sand, fine, well-sorted, rounded; gravelly from 80 to 100 feet.
100-151	Gravel, coarse, sandy, sub-angular; predominantly detrital shale.
151-300	Silt, dark-gray, clayey; interbedded with lenses of sand and gravel from 220 to 300 feet.

LOCATION: 162-067-14BBB

DATE DRILLED: 7/15/80

ALTITUDE: 1560
(FT, NGVD)

DEPTH: 382
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

300-350 Sand, fine to very coarse, gravelly, poorly sorted, rounded; interbedded with lenses of silt.

PIERRE SHALE

350-382 Shale, dark-gray, well-indurated, fissile.

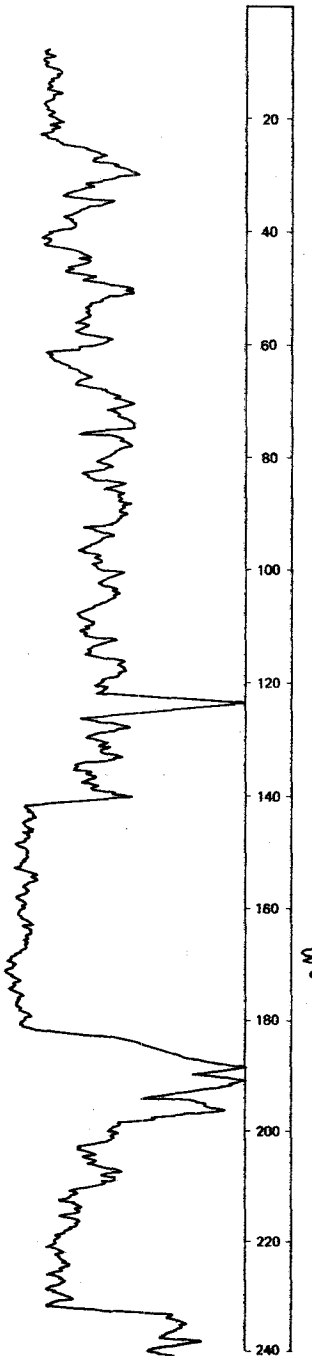
NDSWC 6019

LOCATION: 162-067-16AAA

DATE DRILLED: 10/05/81

ALTITUDE: 1575
(FT, NGVD)

DEPTH: 281
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-14	Clay, yellowish-brown, pebbly, oxidized (till).
14-18	Clay, brownish-gray, pebbly (till).
18-27	Clay, olive-gray, pebbly (till).
27-33	Sand, fine to coarse, gravelly, oxidized.
33-36	Clay, yellowish-brown, gravelly, oxidized (till).
36-43	Clay, olive-gray, pebbly (till).
43-70	Sand, fine to medium, subrounded to rounded; interbedded with thin lenses of silt.
70-84	Sand, medium to coarse; interbedded with fine to medium subrounded to rounded gravel.
84-92	Gravel, fine to medium; about 40 percent fine to coarse subangular to rounded sand.
92-127	Gravel, medium; interbedded with fine to coarse subangular to rounded sand.
127-140	Gravel, coarse to very coarse, subangular to rounded; cobbles; predominantly detrital shale and carbonate pebbles.
140-168	Clay, dark-gray, silty.
168-181	Clay, dark-gray, cohesive.
181-198	Gravel, fine to medium; interbedded with lenses of clay; about 30 percent medium to coarse sand.
198-232	Clay, dark-gray, silty to sandy.
232-250	Clay, dark-gray; interbedded with sand and gravel.

LOCATION: 162-067-16AAA

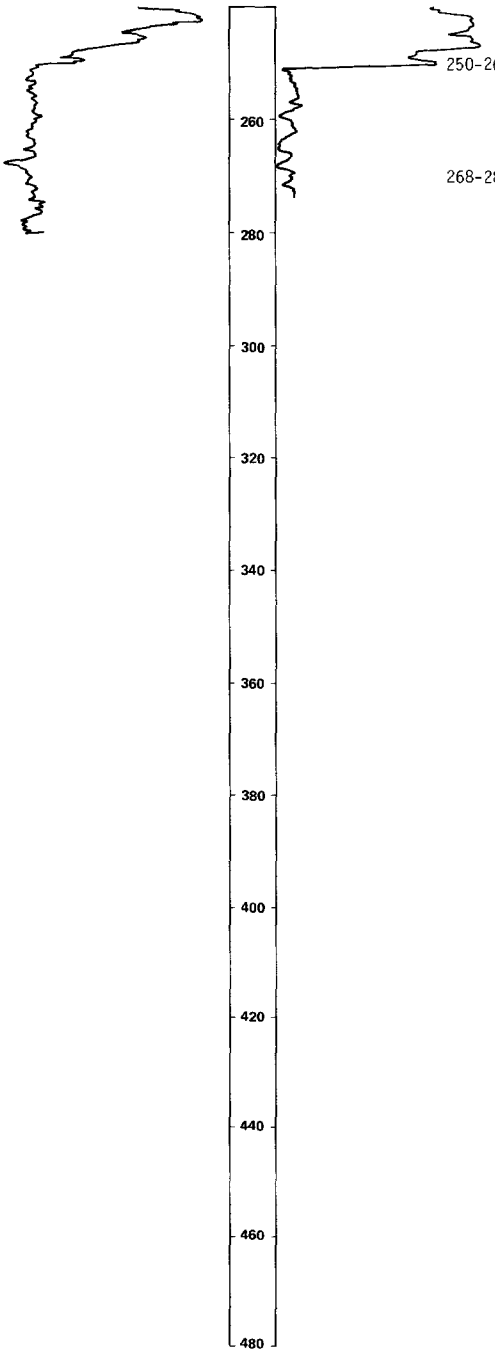
DATE DRILLED: 10/05/81

ALTITUDE: 1575
(FT, NGVD)

DEPTH: 281
(FT)

NEUTRON
(API)

RESISTIVITY
(OHM-M)



DESCRIPTION OF DEPOSITS

PIERRE SHALE

250-268 Shale, grayish-black, indurated, fissile.

268-281 Shale, grayish-black, siliceous.

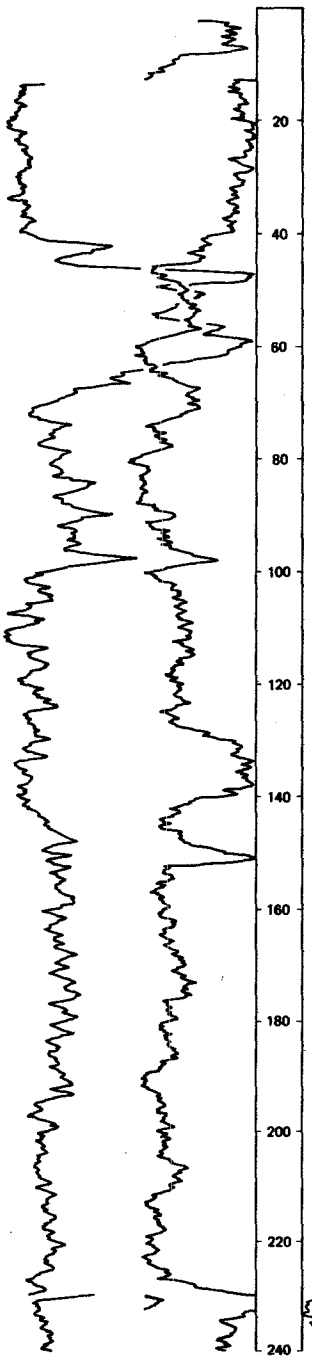
NDSWC 5755

LOCATION: 162-067-16CCC

DATE DRILLED: 7/15/80

ALTITUDE: 1608
(FT, NGVD)

DEPTH: 302
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

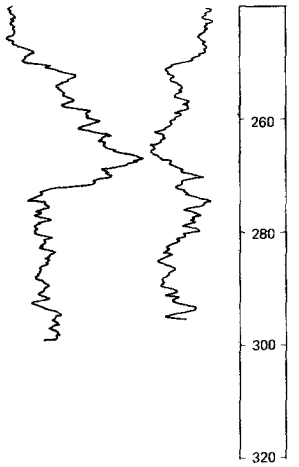
0-1	Topsoil.
1-46	Clay, yellowish-brown, gravelly, oxidized (till).
46-90	Sand, fine to coarse, clayey, rounded; about 90 percent quartz and 10 percent carbonate grains.
90-100	Gravel, coarse, sandy, subrounded; about 50 percent detrital shale and 50 percent igneous pebbles.
100-130	Silt, olive-gray, clayey.
130-150	Silt, gray; interbedded with lenses of sand and gravel.
150-230	Sand, fine to coarse, gravelly, rounded.
230-260	Clay, dark-gray; brown carbonaceous lenses.

LOCATION: 162-067-16CCC

DATE DRILLED: 7/15/80

ALTITUDE: 1608
(FT, NGVD)

DEPTH: 302
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

260-273 Sand, fine to coarse, gravelly, poorly sorted, rounded.

PIERRE SHALE

273-302 Shale, dark-gray, siliceous, well-indurated, fractured.

162-067-17BBA
(Log modified from C. A. Simpson & Son)

Altitude: 1636 feet

Date drilled: 5/20/70

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow, sandy	16	17
	Clay, blue, sandy	78	95
	Sand, blue, clayey	20	115
	Sand, fine	27	142
	Sand, coarse	4	146

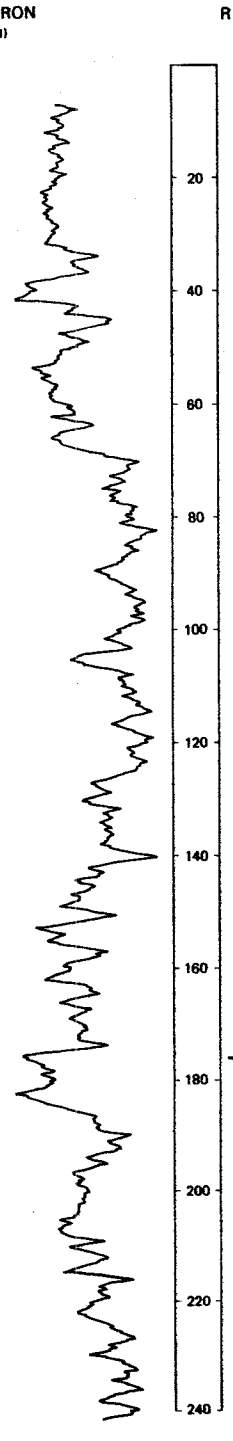
NDSWC 6018

LOCATION: 162-067-22AAA

DATE DRILLED: 10/01/81

ALTITUDE: 1575
(FT, NGVD)

DEPTH: 301
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

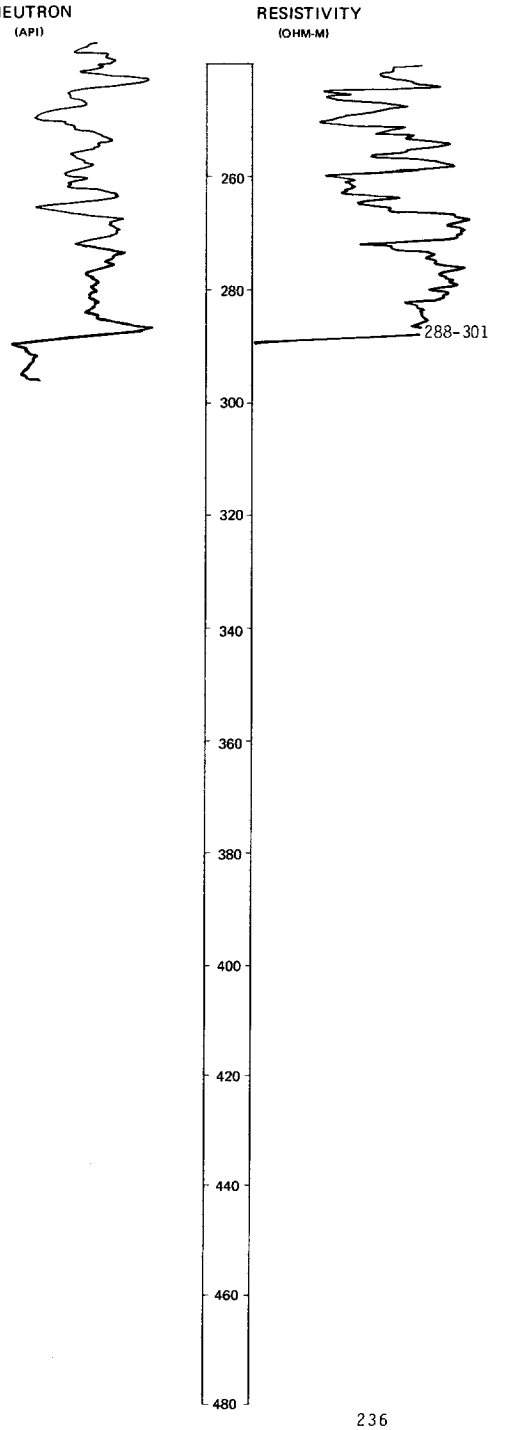
0-1	Topsoil.
1-11	Clay, yellowish-brown, pebbly, oxidized (till).
11-32	Clay, dark-yellowish-brown, pebbly, partially oxidized (till).
32-36	Clay, olive-gray, pebbly (till).
36-38	Clay, greenish-gray, very sandy.
38-70	Sand, dark-green, fine.
70-125	Sand, coarse; interbedded with fine to medium sub-rounded gravel; predominately quartz, carbonate, and detrital shale grains.
125-195	Gravel, medium to coarse, sandy; cobbles; interbedded with clay.
195-210	Clay, dark-gray, sandy, gravelly (till).
210-288	Gravel, coarse; interbedded with clay; predominately detrital shale.

LOCATION: 162-067-22AAA

DATE DRILLED: 10/01/81

ALTITUDE: 1575
(FT, NGVD)

DEPTH: 301
(FT)



DESCRIPTION OF DEPOSITS

PIERRE SHALE

Shale, dark-gray, silty; oxidized along bedding planes from 288 to 295 feet.

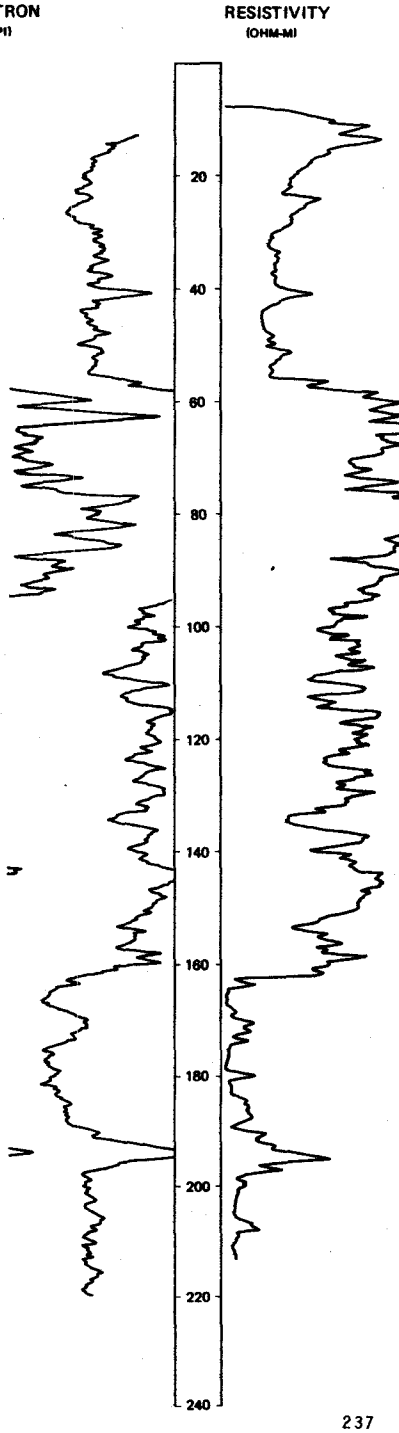
NDSWC 6023

LOCATION: 162-068-01AAA

DATE DRILLED: 10/08/81

ALTITUDE: 1640
(FT, NGVD)

DEPTH: 221
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-20	Clay, yellowish-brown, gravelly, oxidized (till).
20-50	Clay, yellowish-brown, sandy, oxidized (till).
50-55	Clay, yellowish-brown, very gravelly, oxidized (till).
55-65	Gravel, fine to coarse, poorly sorted, angular to rounded, oxidized.
65-75	Clay, dark-yellowish-brown, very sandy, oxidized.
75-95	Sand, fine to medium, rounded, oxidized.
95-130	Sand, fine to coarse; interbedded with coarse subrounded to rounded gravel.
130-135	Clay, dark-gray, silty.
135-162	Gravel, fine to very coarse, angular to rounded; abundant cobbles from 157 to 162 feet.
162-196	Clay, dark-gray, silty.

PIERRE SHALE

196-221	Shale, dark-grayish-black, siliceous, indurated.

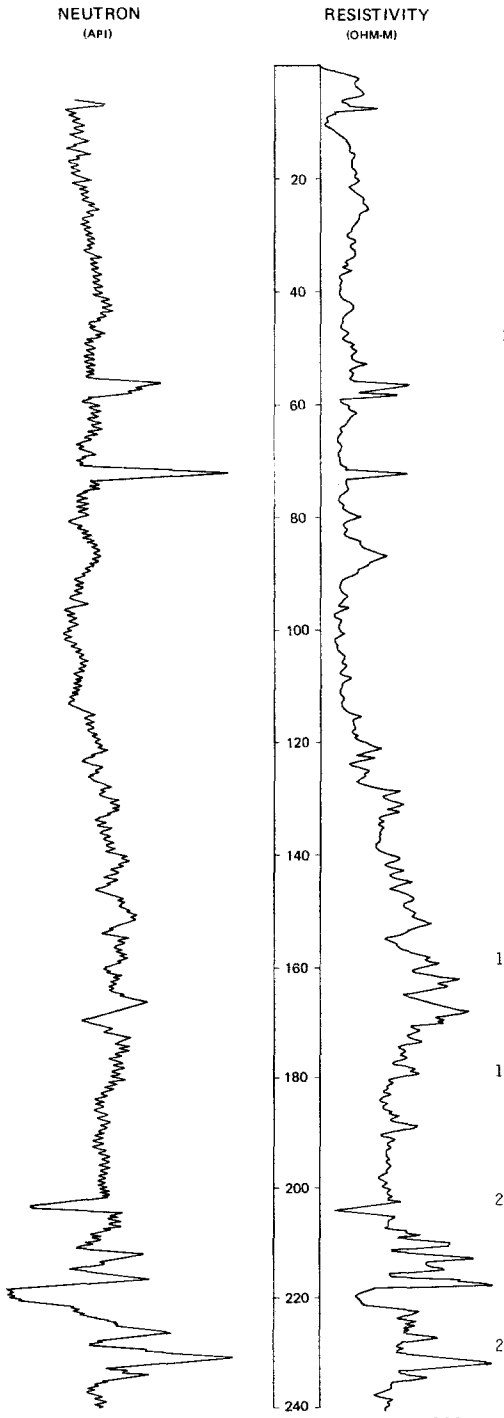
NDSWC 6024

LOCATION: 162-068-02BBB

DATE DRILLED: 10/08/81

ALTITUDE: 1695
(FT, NGVD)

DEPTH: 301
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-4	Clay, pale-yellowish-brown, silty, oxidized (till).
4-7	Clay, yellowish-brown, pebbly, oxidized (till).
7-33	Clay, brownish-gray, pebbly, oxidized (till).
33-158	Clay, olive-gray, pebbly (till); boulders.
158-172	Sand, very coarse; interbedded with fine to medium gravel; predominately detrital shale and carbonate grains.
172-205	Clay, olive-gray, pebbly (till).
205-232	Gravel, fine to very coarse, angular to rounded; interbedded with lenses of clay.
232-285	Clay, dark-gray, gravelly (till).

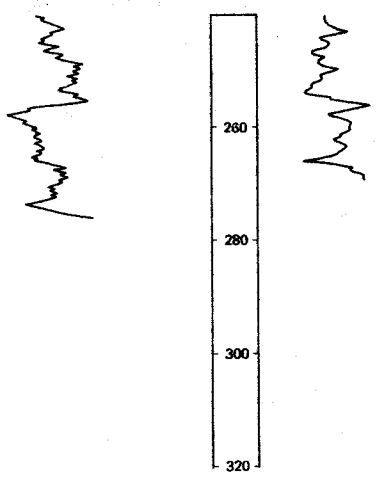
NDSWC 6024, Continued

LOCATION: 162-068-02BBB

DATE DRILLED: 10/08/81

ALTITUDE: 1695 (FT, NGVD)

DEPTH: 301 (FT)



DESCRIPTION OF DEPOSITS

PIERRE SHALE

285-301 Shale, dark-gray, siliceous, indurated, fissile.

162-068-07DCC
(Log modified from C. A. Simpson & Son)

Altitude: 1760 feet

Date drilled: 7/11/75

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow, very gravelly	34	35
	Clay, blue	25	60
	Clay, blue, very sandy	10	70
	Clay, sandy, soupy	5	75
	Clay, blue	69	144
	Sand, dirty	5	149
	Clay, blue, sandy	6	155
	Sand	13	168
	Sand, fine, clayey, soupy	10	178
	Sand	7	185

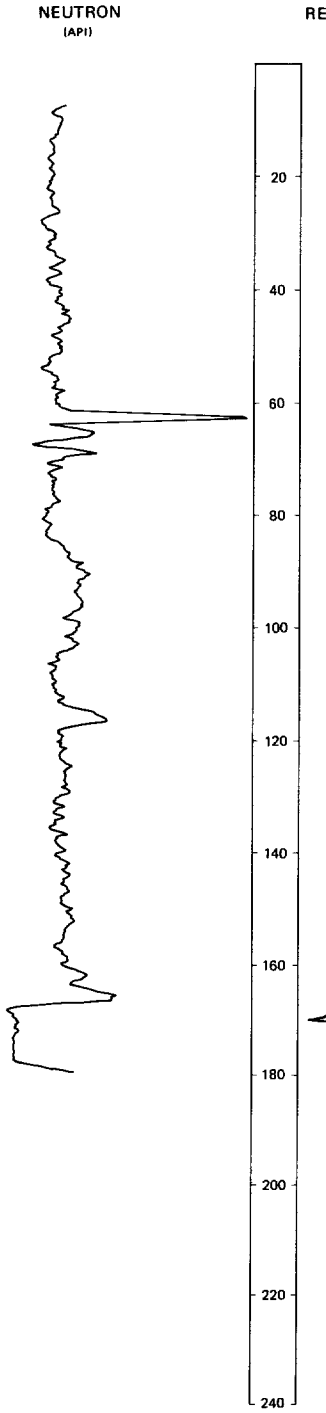
NDSWC 6017

LOCATION: 162-068-10BBB

DATE DRILLED: 9/30/81

ALTITUDE: 1730
(FT, NGVD)

DEPTH: 181
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-20	Clay, yellowish-brown, silty, oxidized (till).
20-30	Clay, brownish-gray, pebbly, partially oxidized (till).
30-62	Clay, olive-gray, gravelly (till); cobbles.
62-70	Clay, olive-gray (till); interbedded with lenses of sand.
70-86	Clay, dark-gray, silty (till).
86-168	Clay, olive-gray, gravelly (till).

PIERRE SHALE

168-181	Shale, dark-gray, very bentonitic, poorly indurated, fissile.

162-068-13CCC
(Log modified from C. A. Simpson & Son)

Altitude: 1695 feet

Date drilled: 10/05/78

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow	17	18
	Clay, blue, gravelly	107	125
	Gravel	27	152
	Clay, blue	75	227
	Clay, blue, gravelly	33	260
Pierre Shale:			
	Shale	121	381

NDSWC 5754

LOCATION: 162-068-16DDD

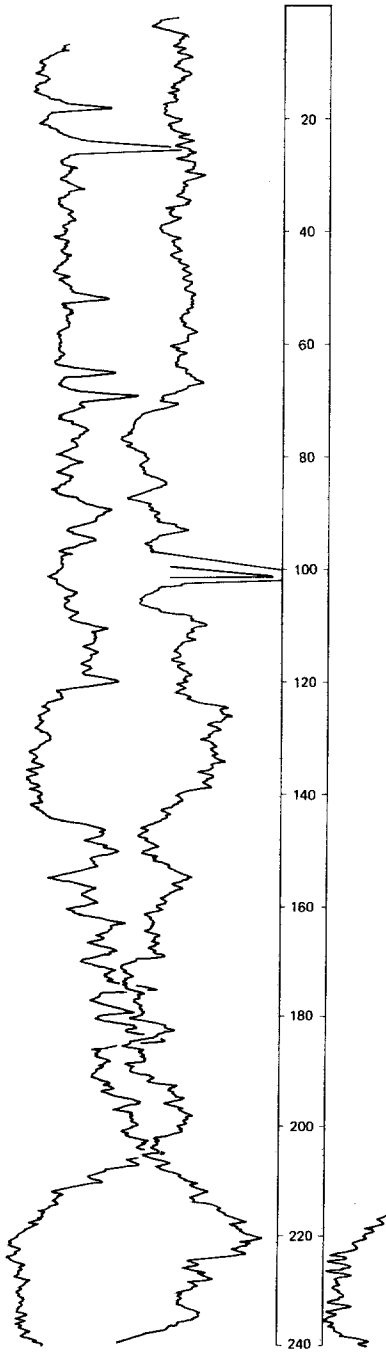
DATE DRILLED: 7/15/80

ALTITUDE: 1727
(FT, NGVD)

DEPTH: 262
(FT)

NEUTRON (API) GAMMA RAY

RESISTIVITY (OHM-M)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1 Topsoil.

1-46 Clay, yellowish-brown, silty, pebbly, oxidized (till).

46-73 Clay, olive-gray, very silty, gravelly (till).

73-110 Sand, fine to coarse; interbedded with silty clay; about 30 percent fine to medium rounded gravel.

110-122 Clay, olive-gray, very gravelly (till).

122-146 Silt, dark-gray, clayey; interbedded with thin lenses of fine sandy gravel.

146-186 Clay, brownish-gray, very sandy (till); interbedded with sand and gravel.

186-222 Clay, olive-gray, very gravelly; abundant detrital shale.

PIERRE SHALE

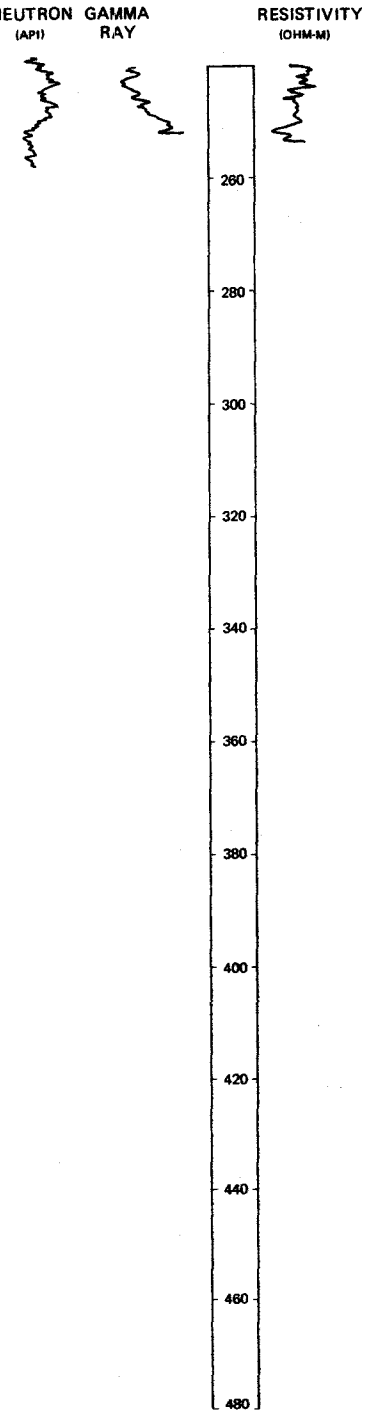
222-240 Shale, medium-gray to dark-gray, silty, argillaceous, bentonitic.

LOCATION: 162-068-16DDD

DATE DRILLED: 7/15/80

ALTITUDE: 1727
(FT, NGVD)

DEPTH: 262
(FT)



DESCRIPTION OF DEPOSITS

PIERRE SHALE, Continued

240-262 Shale, dark-gray, siliceous, well-indurated, fissile; some fractures.

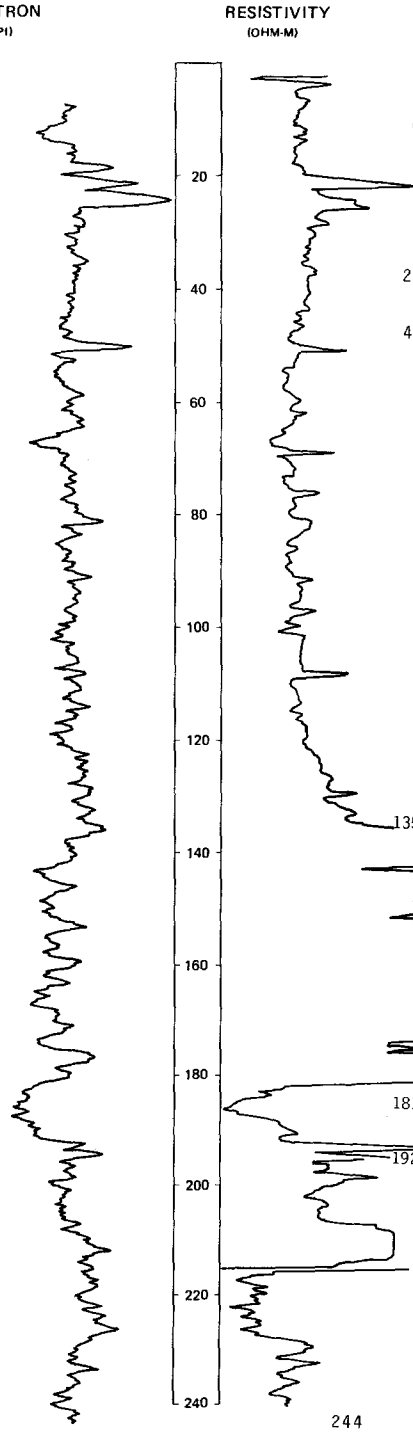
NDSWC 6016

LOCATION: 162-068-17ADA

DATE DRILLED: 9/30/81

ALTITUDE: 1740
(FT, NGVD)

DEPTH: 281
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-7	Clay, yellowish-brown, pebbly, oxidized (till).
7-21	Clay, dark-brown, pebbly, oxidized (till).
21-41	Clay, olive-gray, pebbly (till).
41-135	Clay, olive-gray (till); interbedded with lenses of gravel.
135-181	Sand, fine, well-sorted, subangular; interbedded with thin lenses of clay.
181-192	Clay, olive-gray.
192-258	Clay, olive-gray, gravelly (till).

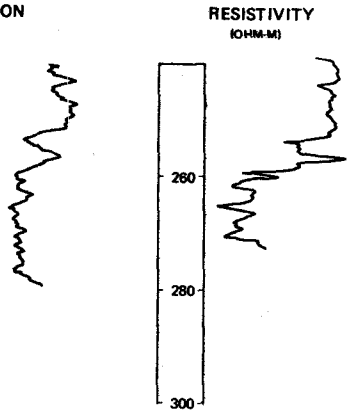
244

LOCATION: 162-068-17ADA

DATE DRILLED: 9/30/81

ALTITUDE: 1740
(FT, NGVD)

DEPTH: 281
(FT)



DESCRIPTION OF DEPOSITS

PIERRE SHALE

258-281 Shale, dark-gray, siliceous, fissile.

162-068-21ADC
(Log modified from C. A. Simpson & Son)

Altitude: 1740 feet

Date drilled: 7/07/66

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow; rocks	44	45
	Clay, gray; rocks	100	145
	Sand	8	153

NDSWC 5753

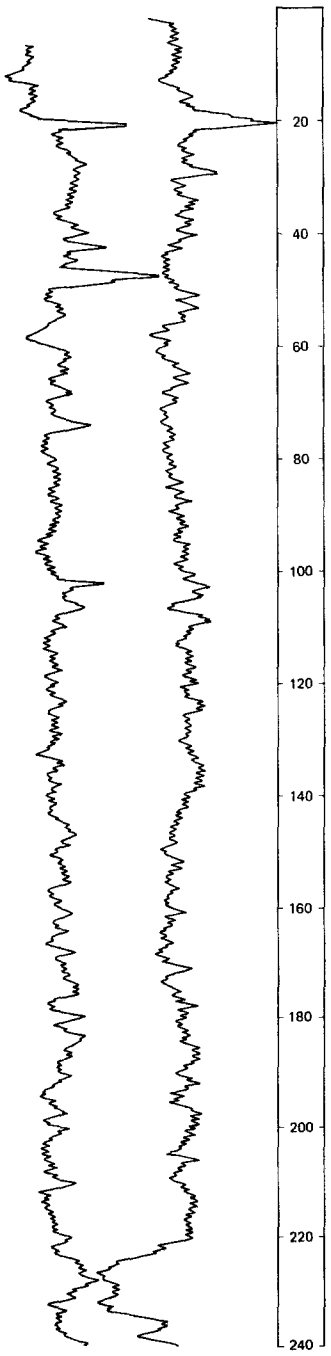
LOCATION: 162-068-21DDC1

DATE DRILLED: 7/14/80

ALTITUDE: 1733
(FT, NGVD)

DEPTH: 322
(FT)

NEUTRON (API) GAMMA RAY



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

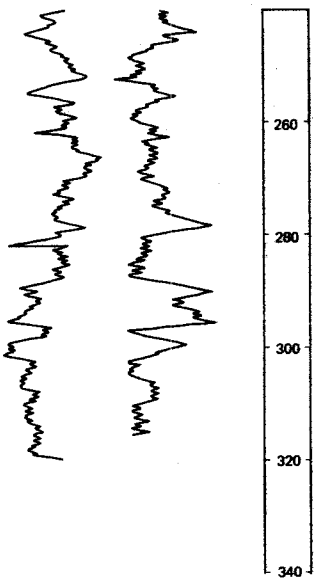
0-1	Topsoil.
1-22	Clay, yellowish-brown, very silty to sandy, oxidized (till).
22-50	Clay, brownish-gray, very silty, sandy to gravelly (till).
50-220	Clay, olive-gray, very silty, sandy, pebbly (till).
220-240	Sand, fine to coarse, gravelly; interbedded with lenses of clay; predominantly rounded carbonate grains.

LOCATION: 162-068-21DDC1

DATE DRILLED: 7/14/80

ALTITUDE: 1733 (FT, NGVD)

DEPTH: 322 (FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

240-310 Clay, brownish-gray, very silty to sandy (till); interbedded with sand and gravel from 284 to 300 feet; predominantly detrital shale.

PIERRE SHALE

310-322 Shale, dark-gray, siliceous, well-indurated, fissile.

162-068-21DDC2
NDSWC 5752

Altitude: 1735 feet — Date drilled: 7/11/80

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, very sandy, oxidized (till)	9	10
	Clay, olive-gray, very silty to sandy, pebbly (till)	50	60
	Sand, fine to very coarse; about 40 percent fine to coarse gravel; abundant cobbles from 78 to 82 feet	22	82

162-068-22BCC
(Log modified from C. A. Simpson & Son)

Altitude: 1732 feet — Date drilled: 4/16/64

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	11	12
	Clay	58	70
	Clay, blue	56	126
	Sand	11	137
	Gravel	1	138

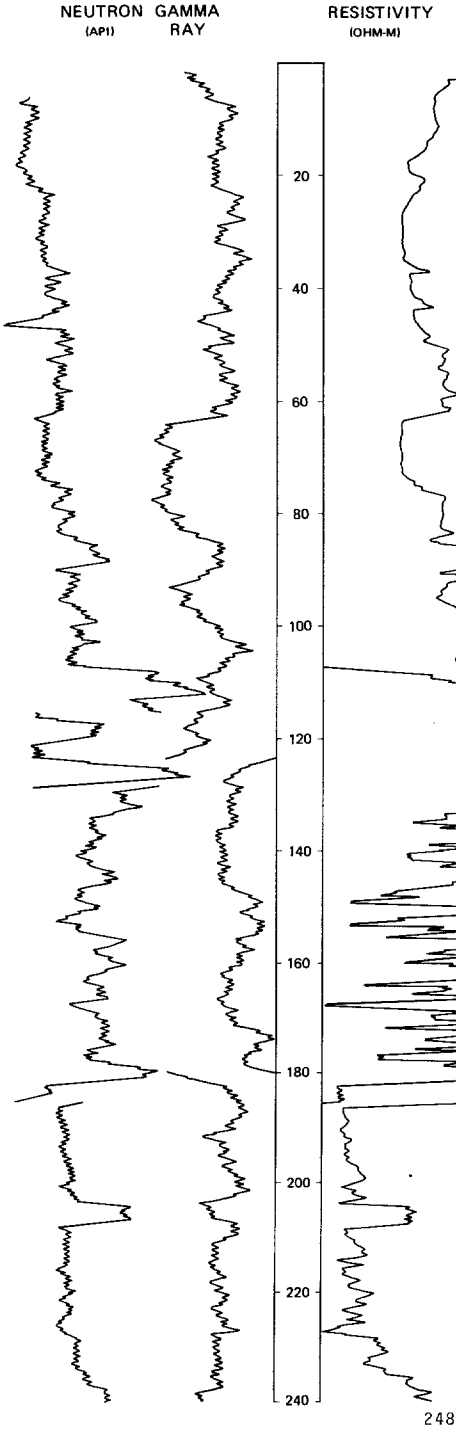
NDSWC 5759

LOCATION: 162-068-24DDD

DATE DRILLED: 7/16/80

ALTITUDE: 1677
(FT, NGVD)

DEPTH: 282
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-8	Clay, pale-yellowish-brown, very silty, pebbly, oxidized (till).
8-23	Clay, yellowish-brown, very silty, pebbly (till).
23-84	Clay, olive-gray, very silty, gravelly (till).
84-108	Clay, brownish-gray, silty, pebbly (till).
108-186	Sand, fine to coarse, angular to rounded; interbedded with about 50 percent clay.
186-252	Silt, dark-gray, very clayey; abundant detrital shale from 245 to 252 feet.

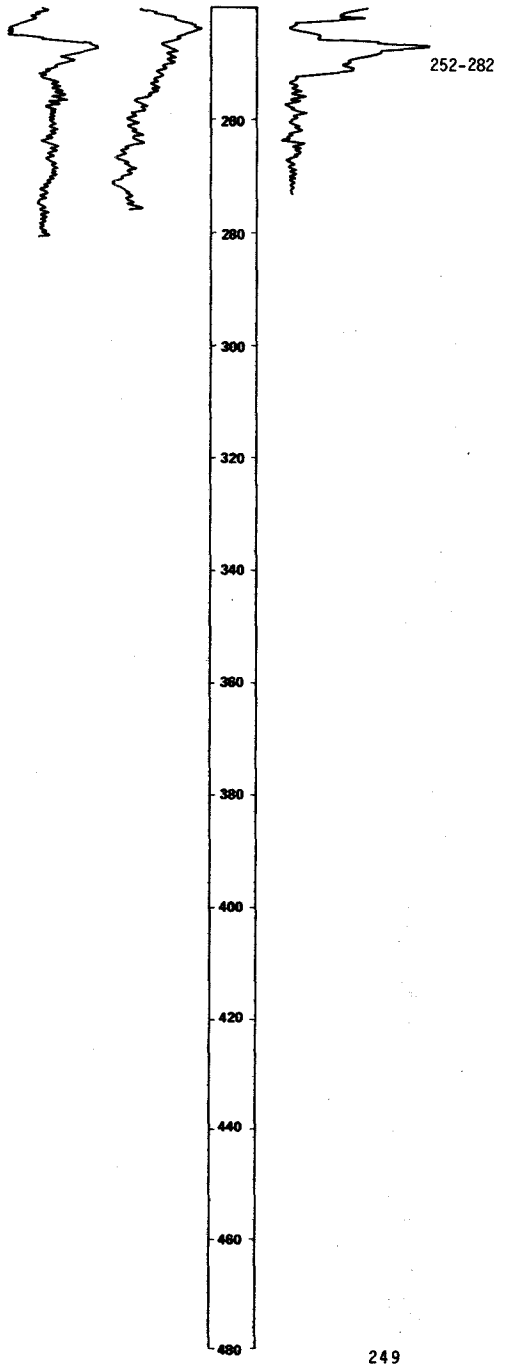
NDSWC 5759, Continued

LOCATION: 162-068-24DDD

DATE DRILLED: 7/16/80

ALTITUDE: 1677
(FT, NGVD)

DEPTH: 282
(FT)



DESCRIPTION OF DEPOSITS

PIERRE SHALE

252-282 Shale, dark-gray, well-indurated, fissile.

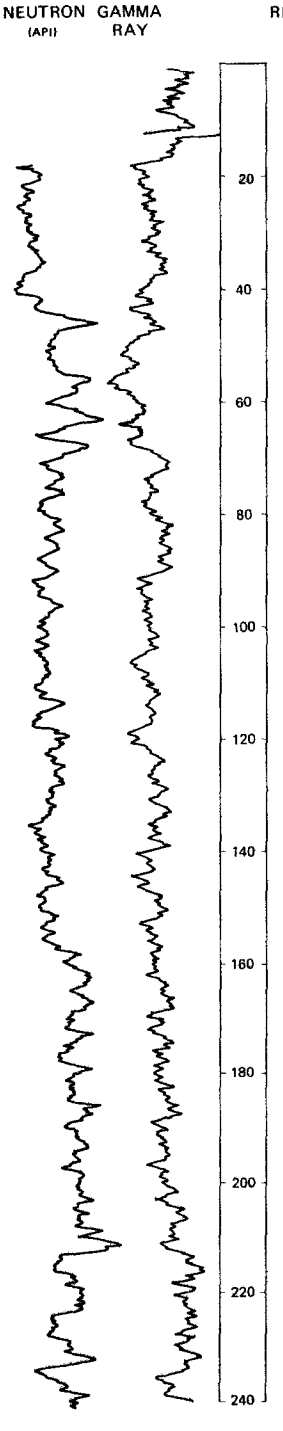
NDSWC 5751

LOCATION: 162-068-27CCC

DATE DRILLED: 7/10/80

ALTITUDE: 1740
(FT, NGVD)

DEPTH: 402
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-55	Clay, yellowish-brown, silty, oxidized (till).
55-69	Sand, fine to coarse, gravelly, subangular; interbedded with lenses of clay.
69-158	Clay, olive-gray, pebbly, very silty (till).
158-210	Clay, olive-gray, very sandy (till).
210-310	Clay, olive-gray, very sandy to very gravelly (till).

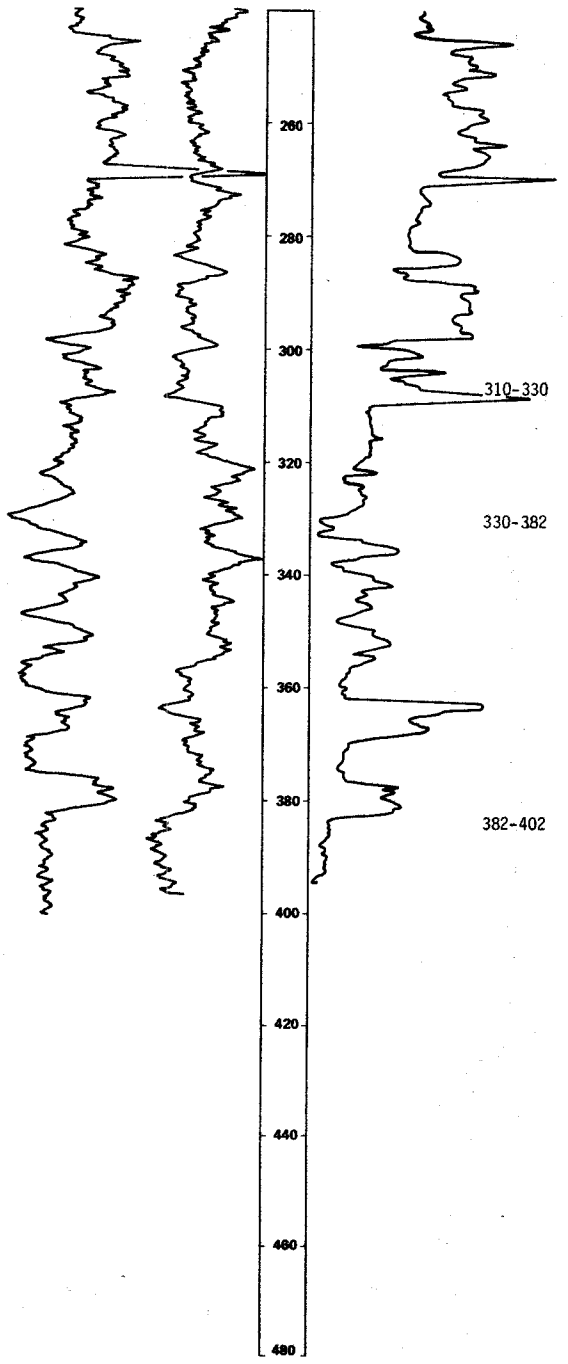
NDSWC 5751, Continued

LOCATION: 162-068-27CCC

DATE DRILLED: 7/10/80

ALTITUDE: 1740
(FT, NGVD)

DEPTH: 402
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

310-330 Clay, brownish-gray, very silty, pebbly (till).

330-382 Clay, dark-gray to greenish-gray; interbedded with brownish-gray silt.

PIERRE SHALE

382-402 Shale, dark-gray, siliceous, well-indurated, fissile.

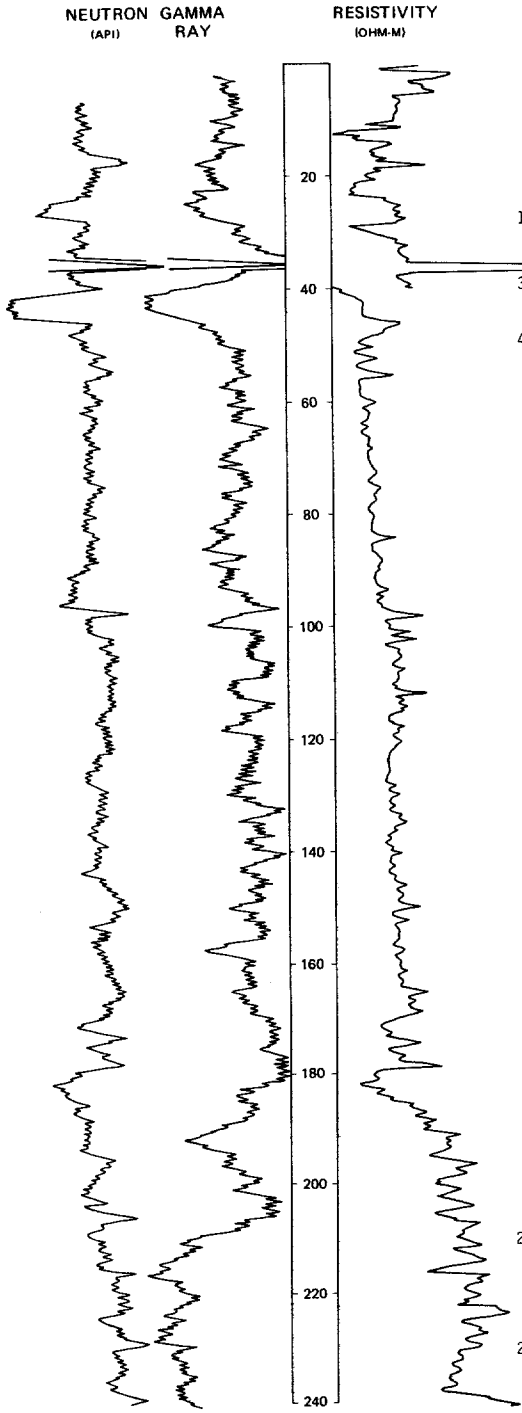
NDSWC 6014

LOCATION: 162-068-28CCC

DATE DRILLED: 9/29/81

ALTITUDE: 1740
(FT, NGVD)

DEPTH: 361
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

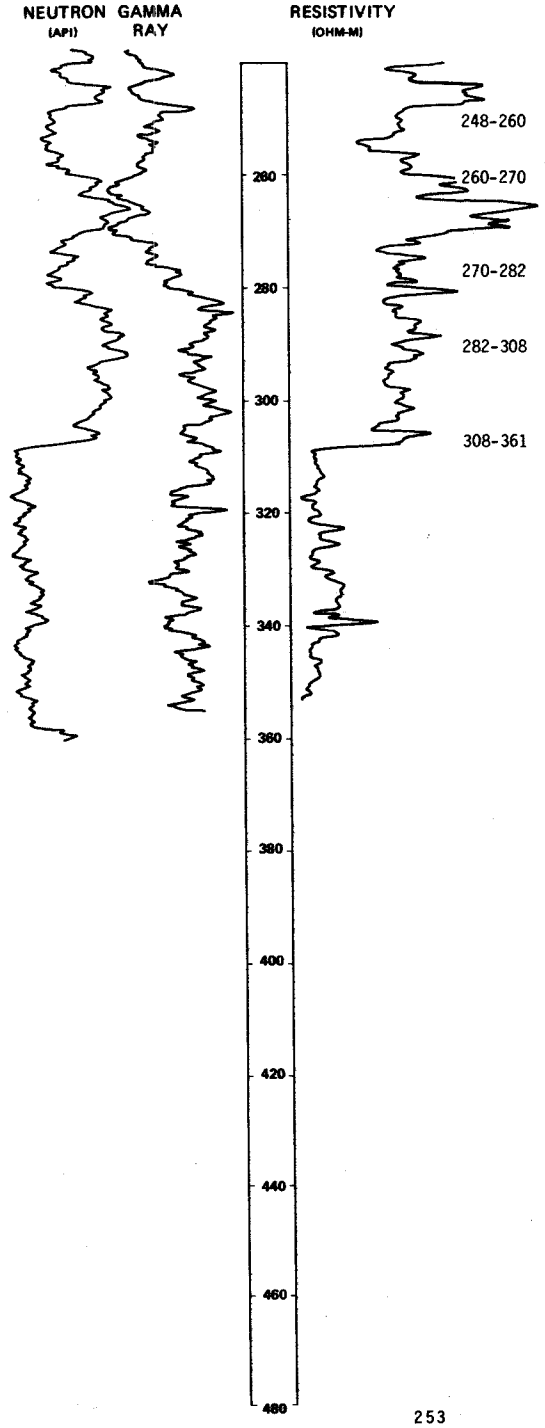
0-1	Topsoil.
1-15	Clay, yellowish-brown, pebbly, oxidized (till).
15-39	Clay, olive-gray, silty (till).
39-45	Sand, fine to medium, gravelly; cobbles.
45-210	Clay, olive-gray, sandy (till).
210-238	Clay, olive-gray, gravelly (till).
238-248	Sand, fine, yellowish-green, clayey, oxidized.

LOCATION: 162-068-28CCC

DATE DRILLED: 9/29/81

ALTITUDE: 1740
(FT, NGVD)

DEPTH: 361
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

248-260	Clay, yellowish-green, sandy (till).
260-270	Sand, fine to coarse; interbedded with subrounded gravel; predominantly detrital shale.
270-282	Clay, dark-gray (till); interbedded with lenses of sandy gravel.
282-308	Silt, dark-gray, clayey.

PIERRE SHALE

308-361	Shale, dark-gray, moderately indurated, fissile.

162-068-33DAA
(Log modified from C. A. Simpson & Son)

Altitude: 1738 feet — Date drilled: 10/18/73

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow, gravelly	17	18
	Clay, blue, gravelly	72	90
	Clay, blue, very sandy	25	115
	Clay, blue, sandy	54	169
	Sand	7	176

162-068-34BAC
(Log modified from C. A. Simpson & Son)

Altitude: 1740 feet — Date drilled: 1/16/73

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	49	50
	Clay, blue, sandy	25	75
	Clay, blue	115	190
	Gravel, coarse, clayey	5	195
	Sand, fine, clayey	40	235
	Sand	5	240
	Clay, blue	2	242
	Gravel, dry	13	255
	Clay, blue	10	265
	Gravel; mostly shale	10	275
	Clay, blue, sandy	50	325
	Sand, clayey; with rocks	13	338
	Sand, clayey	37	375
	Clay, blue, sandy	8	383
	Sand, dirty	7	390
	Sand, very fine, clayey	10	400
	Sand, fine, clayey; some water	55	455
	Sand	4	459

163-065-10CCC
NDSWC 5770

Altitude: 1615 feet — Date drilled: 7/23/80

Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, silty, very sandy, oxidized (till)	9	10
	Clay, olive-gray, very silty to sandy (till)	45	55
Pierre Shale:			
	Shale, dark-gray, siliceous, fissile, fractured	27	82

163-065-12CCC
NDSWC 6039

Altitude: 1600 feet — Date drilled: 10/15/81

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Roadfill	2	2
	Clay, yellowish-brown, silty, oxidized	5	7
Pierre Shale:			
	Shale, brownish-gray, fractured, oxidized	6	13
	Shale, dark-gray, clayey, cohesive	7	20
	Shale, grayish-black, siliceous, fractured	10	30
	Shale, greenish-gray to black, clayey, silty	5	35
	Shale, grayish-black, siliceous, fractured	25	60
	Shale, grayish-green to black, clayey, pliable	10	70
	Shale, grayish-black, siliceous, very fractured	11	81

163-065-13ADB
(Log modified from C. A. Simpson & Son)

Altitude: 1585 feet — Date drilled: 9/14/66

Glacial drift:			
	Topsoil	1	1
	Clay, yellow, sandy	13	14
	Clay, blue, sandy; rocks	14	28
Pierre Shale:			
	Shale, sandy	53	81
	Shale, fractured	54	135

163-065-18AAA
NDSWC 6038

Altitude: 1590 feet — Date drilled: 10/15/81

Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, silty, sandy, oxidized (till)	11	12
	Clay, brown, oxidized (till); predominantly detrital shale	3	15
	Clay, dark-gray (till); predominantly detrital shale	5	20
Pierre Shale:			
	Shale, dark-gray, siliceous, bentonitic, fractured	41	61

163-066-06AAD
(Log modified from C. A. Simpson & Son)

Altitude: 1525 feet — Date drilled: 2/18/72

Glacial drift:			
	Topsoil	1	1
	Sand, yellow	27	28
	Sand, blue, fine	75	103

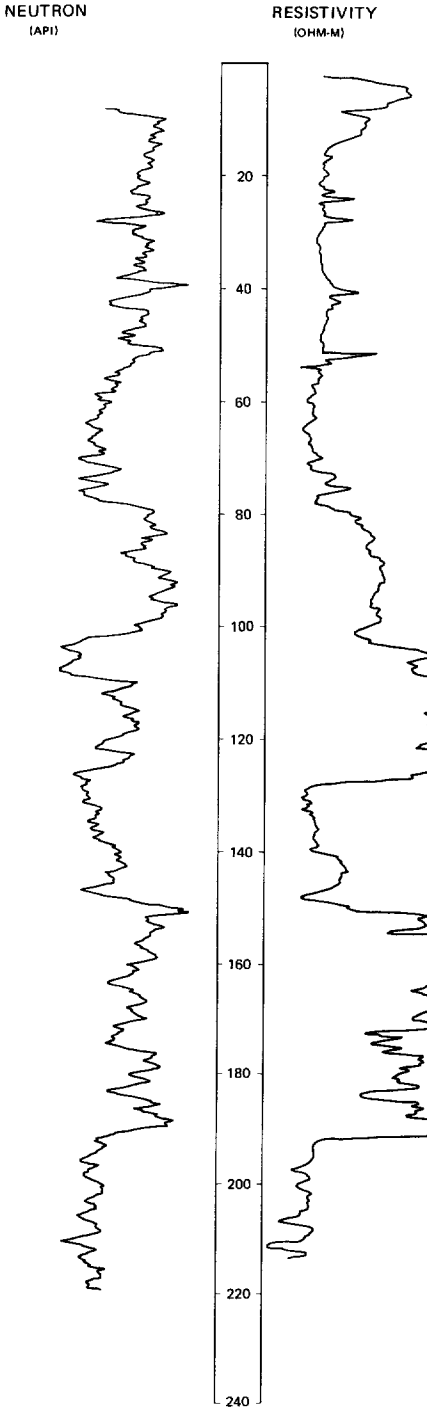
NDSWC 6034

LOCATION: 163-066-07BCC

DATE DRILLED: 10/14/81

ALTITUDE: 1530
(FT, NGVD)

DEPTH: 221
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-10	Clay, yellowish-brown, sandy, pebbly, oxidized (till).
10-50	Clay, olive-gray, sandy (till); numerous cobbles.
50-76	Clay, olive-gray, silty.
76-102	Clay, olive-gray, sandy, pebbly (till).
102-126	Sand, medium to coarse, subrounded; about 50 percent detrital lignite grains.
126-140	Shale, grayish-black; shove block.
140-148	Clay, dark-gray, sandy, pebbly (till).
148-190	Gravel, fine to coarse, sandy, angular to rounded.

PIERRE SHALE

190-221	Shale, dark-gray, silty, bentonitic.

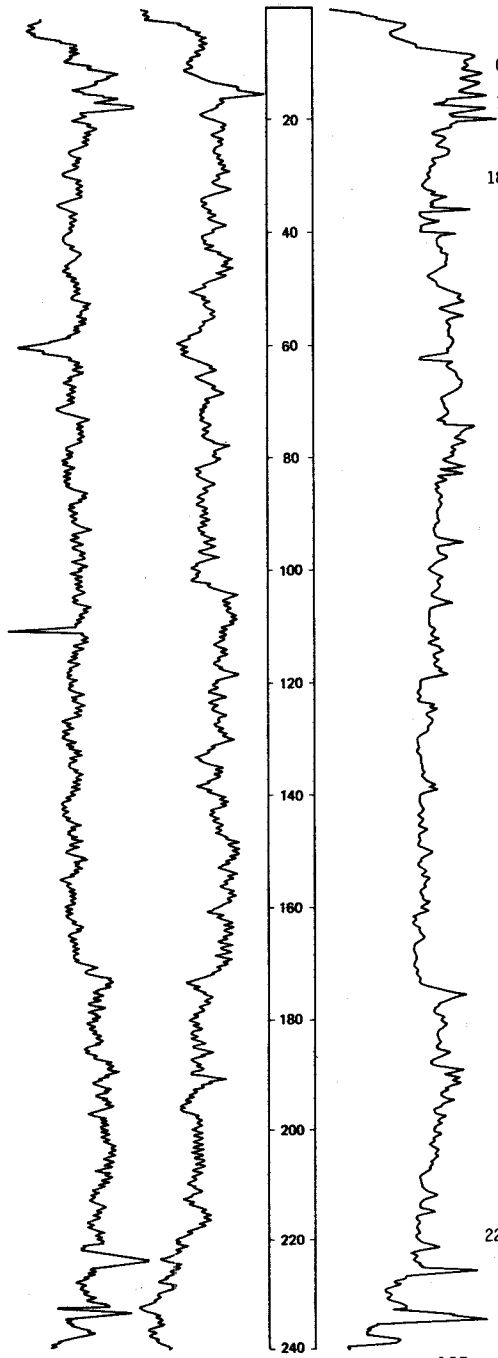
NDSWC 5768

LOCATION: 163-066-07DDD

DATE DRILLED: 7/22/80

ALTITUDE: 1530
(FT, NGVD)

DEPTH: 262
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-18	Clay, yellowish-brown, very silty, gravelly, oxidized (till).
18-220	Clay, olive-gray, very silty to sandy, pebbly (till).
220-241	Clay, olive-gray, silty, very gravelly (till).

NDSWC 5768, Continued

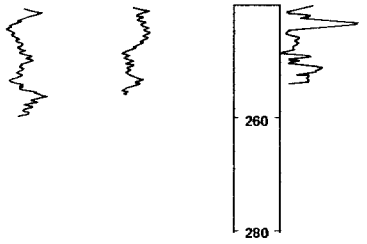
LOCATION: 163-066-07DDD

DATE DRILLED: 7/22/80

ALTITUDE: 1530 (FT, NGVD)

DEPTH: 262 (FT)

NEUTRON (API) GAMMA RAY RESISTIVITY (OHM-M)



DESCRIPTION OF DEPOSITS

PIERRE SHALE

241-262 Shale, dark-gray, siliceous, well-indurated.

163-066-10CCC
NDSWC 5769

Altitude: 1535 feet Date drilled: 7/23/80

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Sand, fine, well-sorted, rounded, oxidized	9	10
	Clay, yellowish-brown, silty, gravelly (till)	10	20
Pierre Shale:			
	Shale, dark-gray, siliceous, indurated, fractured	42	62

163-066-11DCD
NDSWC 6037

Altitude: 1560 feet Date drilled: 10/14/81

Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, silty, sandy, oxidized (till); boulder at 15 feet	15	16
Pierre Shale:			
	Shale, dark-gray, moderately indurated, fractured	45	61

163-066-17AAA
NDSWC 6036

Altitude: 1530 feet Date drilled: 10/14/81

Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, sandy, pebbly, oxidized (till)	11	12
	Clay, olive-gray, sandy, pebbly (till)	3	15
	Sand, coarse, gravelly, subrounded	2	17
	Clay, olive-gray (till); some boulders; interbedded with detrital shale gravel from 80 to 100 feet	83	100
Pierre Shale:			
	Shale, dark-gray, siliceous, fractured	41	141

163-066-31DCC
NDSWC 6033

Altitude: 1528 feet — Date drilled: 10/13/81

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Silt, yellowish-brown, oxidized	6	7
	Clay, yellowish-brown, silty, oxidized (till)	3	10
	Clay, brown, sandy, oxidized (till)	3	13
Pierre Shale:			
	Shale, brownish-gray, fractured, oxidized	4	17
	Shale, dark-gray, fractured; silty laminations	84	101

163-067-01DDD
(Log modified from C. A. Simpson & Son)

Altitude: 1532 feet — Date drilled: 8/07/69

Glacial drift:			
	Clay, yellow, sandy	23	23
	Clay, blue, sandy	62	85
	Sand, clayey; coal	7	92

163-067-05CDC
(Log modified from C. A. Simpson & Son)

Altitude: 1552 feet — Date drilled: 3/27/68

Glacial drift:			
	Topsoil	1	1
	Clay, yellow, gravelly	18	19
	Clay, blue, sandy, hard	29	48
	Sand, coarse	14	62

163-067-07DD
(Log modified from C. A. Simpson & Son)

Altitude: 1588 feet — Date drilled: 7/09/70

Glacial drift:			
	Topsoil	1	1
	Clay, yellow, sandy	17	18
	Clay, blue, gravelly	82	100
	Sand, coarse	4	104

163-067-09CCC
NDSWC 6040

Altitude: 1543 feet — Date drilled: 10/15/81

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Gravel, fine to coarse, rounded, oxidized	10	10
	Clay, olive-gray, sandy (till)	12	22
	Gravel, fine to coarse; interbedded with silt from 22 to 54 feet; about 40 percent coarse rounded sand	81	103
	Clay, olive-gray, very sandy (till)	15	118
	Gravel, fine, sandy; interbedded with clay	12	130
	Clay, olive-gray, sandy to gravelly (till)	22	152
	Gravel, fine to coarse; interbedded with lenses of clay; predominantly detrital lignite and carbonate pebbles	42	194
Pierre Shale:			
	Shale, dark-gray, silty	17	211

163-067-10CCC1
NDSWC 5765

Altitude: 1539 feet — Date drilled: 7/18/80

Glacial drift:			
	Clay, yellowish-brown, very gravelly, oxidized (till)	10	10
	Sand, fine to medium, yellowish-brown, oxidized	5	15
	Sand, fine to medium	25	40
	Sand, fine to coarse, angular to subrounded	20	60
	Clay, olive-gray, silty, pebbly (till)	100	160
	Sand, fine to coarse; interbedded with lenses of clay; about 30 percent fine gravel	10	170
	Sand, fine to very coarse, gravelly, angular to subrounded	25	195
Pierre Shale:			
	Shale, dark-gray, siliceous, indurated, fissile	27	222

163-067-10CCC2
NDSWC 5766

Altitude: 1539 feet — Date drilled: 7/11/80

Glacial drift:			
	Clay, yellowish-brown, very gravelly, oxidized (till)	10	10
	Sand, fine to medium, yellowish-brown, oxidized	5	15
	Sand, fine to medium	25	40
	Sand, fine to coarse, angular to subrounded	22	62

163-067-10CCC3
(Log modified from Lee's Well Drilling)

Altitude: 1540 feet — Date drilled: 12/02/74

Glacial drift:			
	Topsoil	1	1
	Clay, yellow	11	12
	Sand	48	60

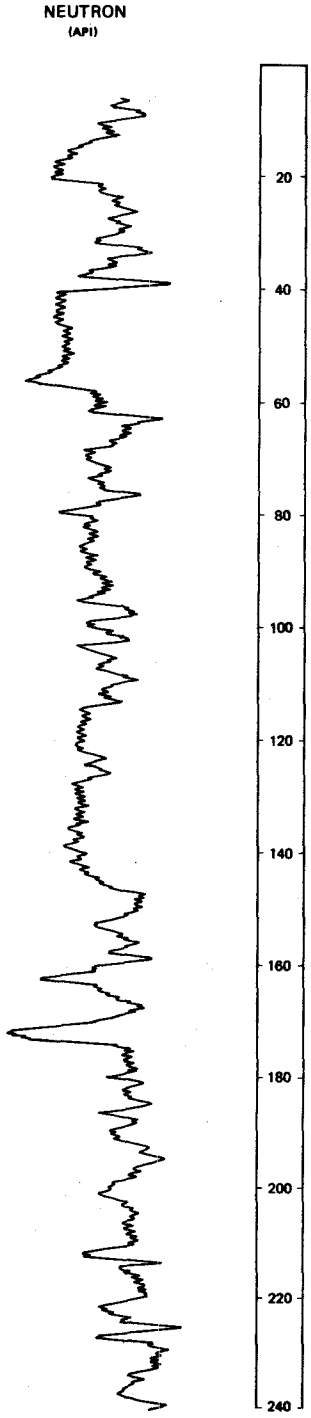
NDSWC 6035

LOCATION: 163-067-10DDD

DATE DRILLED: 10/14/81

ALTITUDE: 1535
(FT, NGVD)

DEPTH: 261
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-12	Clay, yellowish-brown, sandy, oxidized (till).
12-15	Clay, olive-gray, sandy, pebbly (till).
15-35	Sand, medium to coarse; about 40 percent fine to medium subrounded gravel.
35-40	Gravel, fine to coarse, sandy, subrounded.
40-58	Silt, dark-gray, clayey.
58-105	Clay, olive-gray, pebbly (till); gravelly from 95 to 105 feet.
105-114	Gravel, fine, rounded.
114-146	Clay, olive-gray, pebbly (till).
146-215	Sand, medium; interbedded with detrital lignite and fine to coarse gravel.
215-246	Gravel, fine to coarse, rounded.

261

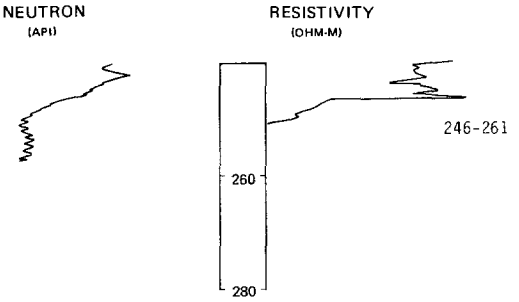
NDSWC 6035, Continued

LOCATION: 163-067-10DDD

DATE DRILLED: 10/14/81

ALTITUDE: 1535
(FT, NGVD)

DEPTH: 261
(FT)



DESCRIPTION OF DEPOSITS

PIERRE SHALE

246-261 Shale, dark-gray, silty, poorly indurated.

163-067-12CCC
NDSWC 5767

Altitude: 1530 feet

Date drilled: 7/22/80

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Gravel, fine to coarse, sandy, oxidized	10	10
	Clay, dark-gray, pebbly, silty to sandy (till)	53	63
	Sand, fine to medium, subrounded	9	72
	Sand, medium, well-sorted, subrounded	10	82
	Sand, fine to coarse; interbedded with lenses of silty clay	20	102
	Silt, dark-gray, clayey, pebbly (till); abundant detrital lignite	48	150
	Silt, brownish-black, carbonaceous	3	153
	Silt, olive-gray, sandy	11	164
	Silt, dark-gray, clayey, pebbly (till)	33	197
	Boulder, granite	1	198
Pierre Shale:			
	Shale, dark-grayish-black, siliceous, indurated, brittle	24	222

163-067-15DDB
(Log from Turtle Mountain Well Drillers)

Altitude: 1540 feet

Date drilled: 8/30/77

Glacial drift:			
	Topsoil	1	1
	Gravel	26	27

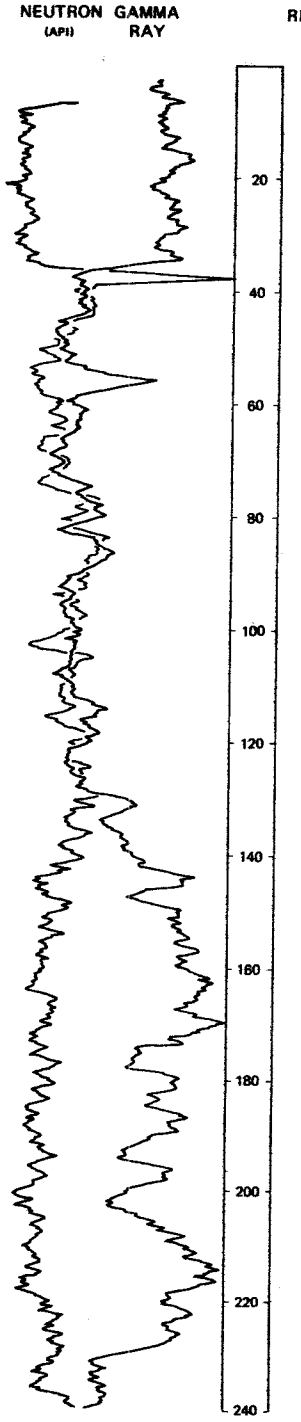
NDSWC 5763

LOCATION: 163-067-18AAA1

DATE DRILLED: 7/18/80

ALTITUDE: 1582
(FT, NGVD)

DEPTH: 282
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-36	Clay, yellowish-brown, silty to gravelly, oxidized (till).
36-80	Sand, fine to coarse, angular to rounded; oxidized to 50 feet.
80-130	Sand, coarse, subangular; interbedded with fine gravel.
130-144	Clay, brownish-gray, very silty and sandy, pebbly (till).
144-230	Clay, dark-gray, very sandy (till); occasional thin lenses of fine to coarse gravel.
230-261	Sand, fine to coarse, gravelly, angular to rounded.

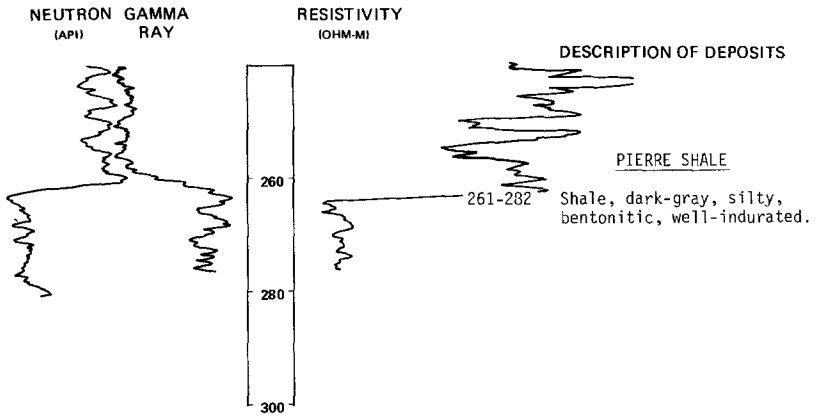
NDSWC 5763, Continued

LOCATION: 163-067-18AAA1

DATE DRILLED: 7/18/80

ALTITUDE: 1582 (FT, NGVD)

DEPTH: 282 (FT)



163-067-18AAA2
NDSWC 5764

Altitude: 1582 feet

Date drilled: 7/18/80

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellowish-brown, silty to gravelly, oxidized (till)	35	36
	Sand, fine to coarse, angular to rounded; oxidized to 50 feet	44	80
	Sand, coarse, subangular; interbedded with fine gravel	50	130
	Clay, brownish-gray, very silty and sandy, pebbly (till)	12	142

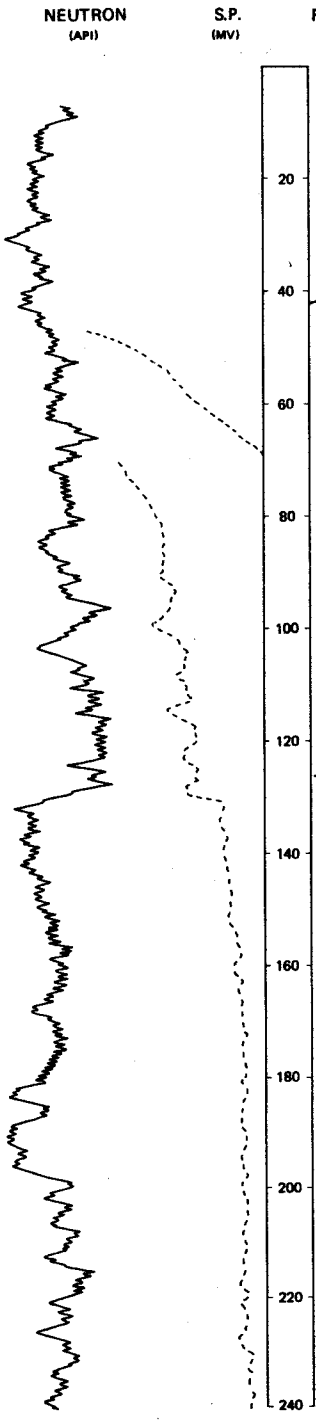
NDSWC 6041A, 6041B

LOCATION: 163-067-18BBB1, 2

DATE DRILLED: 10/15/81

ALTITUDE: 1610 (FT, NGVD)

DEPTH: 461 (FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-18	Clay, yellowish-brown, pebbly, oxidized (till).
18-34	Clay, dark-yellowish-brown, pebbly, oxidized (till).
34-52	Clay, olive-gray, pebbly (till).
52-58	Sand, medium to very coarse; about 40 percent fine angular gravel; predominantly detrital shale.
58-82	Clay, olive-gray, pebbly (till).
82-100	Sand, fine, well-sorted, subangular; predominantly quartz and about 10 percent detrital lignite grains.
100-128	Sand, coarse; interbedded with fine rounded gravel.
128-134	Silt, yellowish-brown, clayey, oxidized.
134-169	Silt, olive-gray, clayey.
169-198	Clay, medium-gray, very silty, pebbly (till).
198-272	Clay, olive-gray (till); interbedded with lenses of sand and gravel.

NOTE:

------Long normal

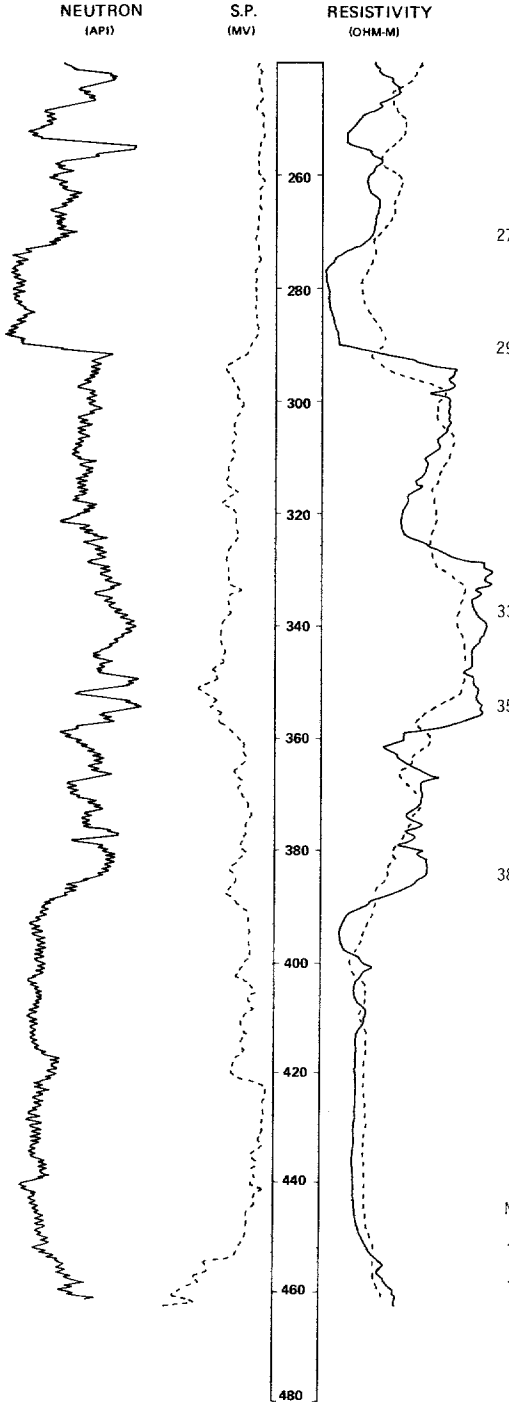
———Short normal

LOCATION: 163-067-18BBB1, 2

DATE DRILLED: 10/15/81

ALTITUDE: 1610
(FT, NGVD)

DEPTH: 461
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

272-290	Clay, dark-gray, pebbly (till).
290-338	Sand, very coarse; interbedded with coarse gravel.
338-356	Clay, olive-gray (till); interbedded with lenses of sand and gravel; abundant detrital shale.
356-386	Clay, dark-gray, silty to sandy (till).
386-461	Clay, greenish-gray, silty.

NOTE:

------Long normal

———Short normal

163-067-28BCC
(Log modified from C. A. Simpson & Son)

Altitude: 1590 feet — Date drilled: 10/18/65

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Topsoil	1	1
	Clay, yellow; rock	21	22
	Clay, blue	28	50
	Clay, blue, gravelly	5	55
	Clay, blue	55	110
	Clay, blue, sandy	80	190
	Sand, slightly clayey	27	217
	Sand, clayey, and gravel	13	230
	Sand	2	232
	Gravel	1	233

163-067-34CDD
(Log modified from Church Well Boring)

Altitude: 1575 feet — Date drilled: 7/15/75

Glacial drift:			
	Topsoil, black	2	2
	Clay, yellow, sandy	2	4
	Clay, yellow	17	21
	Clay, dark-yellow	6	27
	Clay, dark-yellow and blue	11	38
	Sand, coarse	8	46

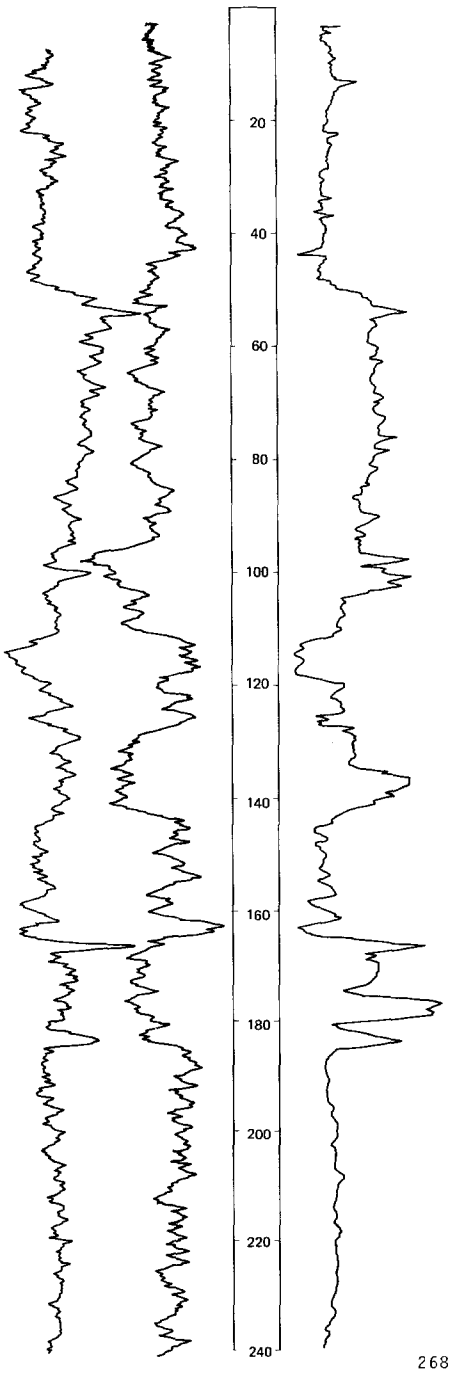
NDSWC 5762

LOCATION: 163-068-12CCC

DATE DRILLED: 7/17/80

ALTITUDE: 1625
(FT, NGVD)

DEPTH: 262
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-8	Clay, pale-yellowish-brown, very silty, pebbly, oxidized (till).
8-23	Clay, yellowish-brown, silty, sandy, gravelly, oxidized (till).
23-50	Clay, olive-gray, very silty, pebbly (till).
50-110	Clay, olive-gray, very silty, gravelly (till).
110-158	Clay, dark-gray, silty, sandy (till); gravelly from 136 to 143 feet.
158-185	Clay, olive-gray, very silty (till); interbedded with dark-gray silt.
185-254	Clay, brownish-gray to dark-gray, very silty to sandy, pebbly (till).

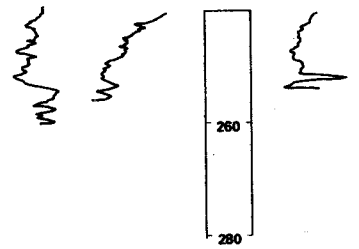
NDSWC 5762, Continued

LOCATION: 163-068-12CCC

DATE DRILLED: 7/17/80

ALTITUDE: 1625
(FT, NGVD)

DEPTH: 262
(FT)



DESCRIPTION OF DEPOSITS

PIERRE SHALE

254-262 Shale, dark-gray, siliceous, well-indurated, fissile.

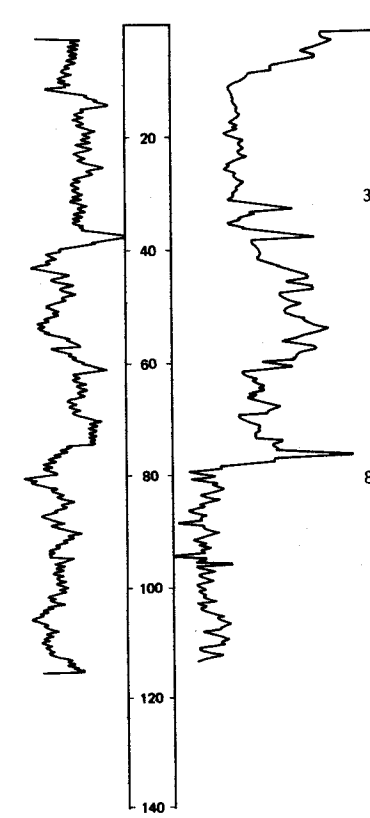
NDSWC 5761

LOCATION: 163-068-16AAA

DATE DRILLED: 7/17/80

ALTITUDE: 1688
(FT, NGVD)

DEPTH: 122
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1 Topsoil.

1-32 Clay, yellowish-brown, silty, pebbly, oxidized (till).

32-80 Clay, olive-gray, silty, pebbly (till); interbedded with lenses of gravel.

PIERRE SHALE

80-122 Shale, dark-gray, siliceous, fissile, fractured.

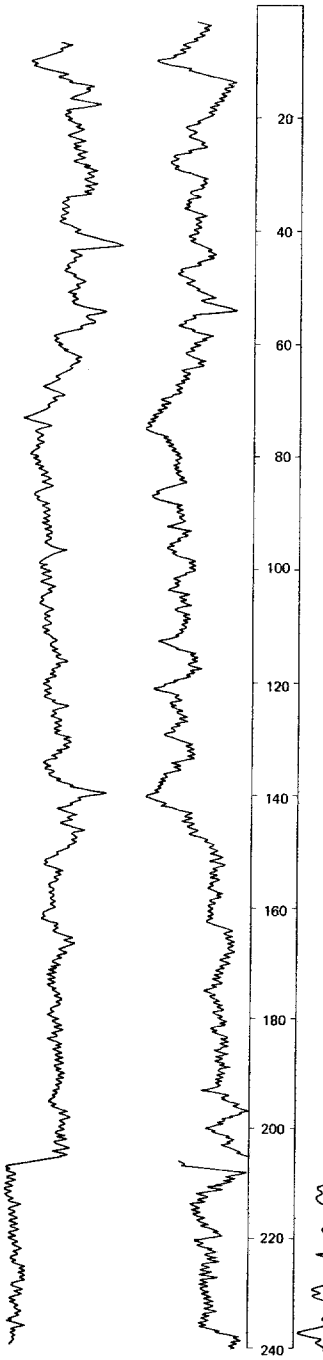
NDSWC 5760

LOCATION: 163-068-17BBB

DATE DRILLED: 7/17/80

ALTITUDE: 1735
(FT, NGVD)

DEPTH: 262
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-2	Gravel, fine to coarse, sandy, rounded, oxidized.
2-12	Clay, pale-yellowish-brown, sandy to gravelly, oxidized (till).
12-58	Clay, olive-gray, very silty, gravelly (till).
58-130	Silt, olive-gray, clayey.
130-148	Clay, olive-gray, very silty, very gravelly (till).
148-208	Clay, dark-gray (till); predominantly detrital shale.

PIERRE SHALE

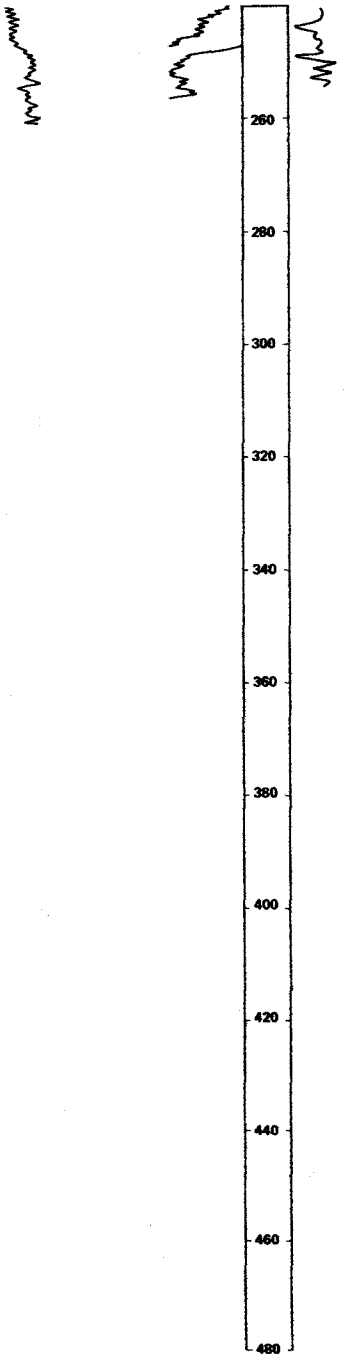
208-248	Shale, dark-greenish-gray, silty, indurated.

LOCATION: 163-068-17BBB

DATE DRILLED: 7/17/80

ALTITUDE: 1735
(FT, NGVD)

DEPTH: 262
(FT)



DESCRIPTION OF DEPOSITS

PIERRE SHALE, Continued

248-262	Shale, dark-gray, siliceous, well-indurated, fissile.

163-068-27BB
(Log modified from Strassberg, 1954)

Altitude: 1729 feet — Date drilled: 9/16/53

GEOLOGIC SOURCE / MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
CRETACEOUS SYSTEM:		
Niobrara Formation (top):		845
Greenhorn Formation (top):		1,228
Dakota Formation (top):		1,610
JURASSIC SYSTEM:		
Morrison Formation (top):		1,764
Sundance Formation (top):		1,790
Piper Formation (top):		2,035
MISSISSIPPIAN SYSTEM:		
Lodgepole Limestone (top):		2,126
Englewood Limestone (top):		2,277
DEVONIAN SYSTEM:		
Lyleton Formation (top):		2,310
Nisku Formation (top):		2,338
Duperow Formation (top):		2,411
Souris River Formation (top):		2,778
Dawson Bay Formation (top):		2,894
Ashern Formation (top):		3,151
SILURIAN SYSTEM:		
Interlake Formation (top):		3,182
ORDOVICIAN SYSTEM:		
Upper Stony Mountain Formation (top):		3,521
Lower Stony Mountain Formation (top):		3,617
Red River Formation (top):		3,695
Winnipeg Shale (top):		4,274
Winnipeg Sandstone (top):		4,404
Granite (top):		4,425

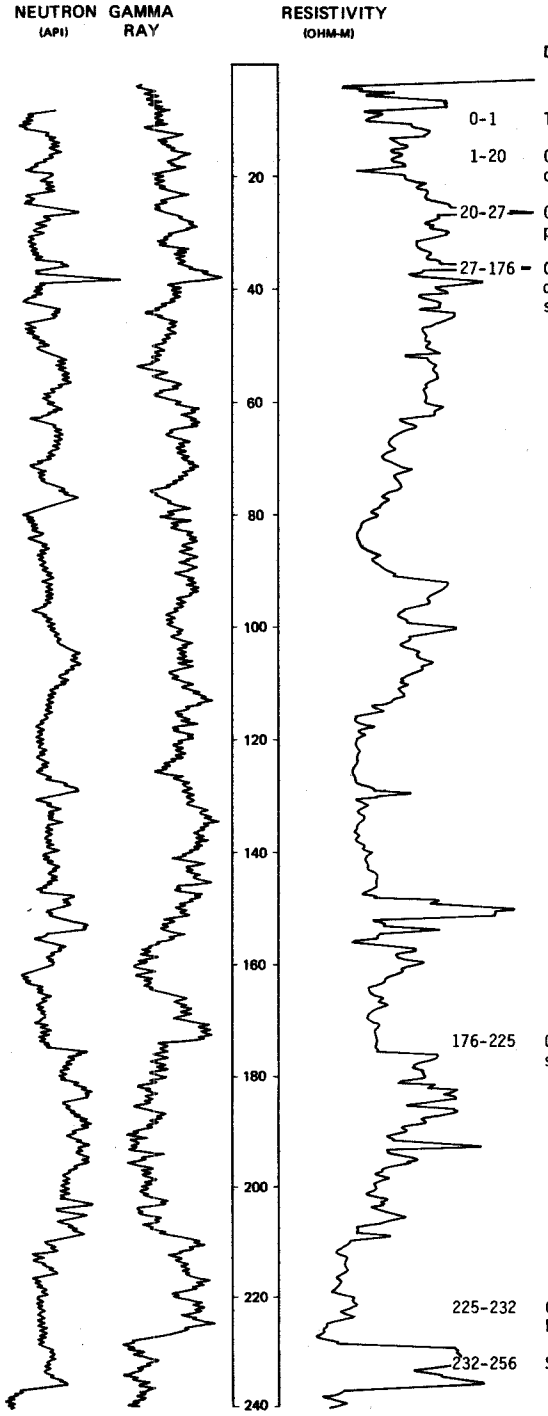
NDSWC 6015

LOCATION: 163-068-32CCC

DATE DRILLED: 9/29/81

ALTITUDE: 1755
(FT, NGVD)

DEPTH: 381
(FT)



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Topsoil.
1-20	Clay, yellowish-brown, silty, oxidized (till).
20-27	Clay, dark-yellowish-brown, pebbly, oxidized (till).
27-176	Clay, olive-gray, silty (till); occasional thin lenses of sandy gravel and cobbles.
176-225	Clay, olive-gray, silty to sandy (till).
225-232	Gravel, fine, sandy; interbedded with clay.
232-256	Silt, dark-gray, clayey.

LOCATION: 163-068-32CCC

DATE DRILLED: 9/29/81

ALTITUDE: (FT, NGVD) 1755

DEPTH: (FT) 381

DESCRIPTION OF DEPOSITS

GLACIAL DRIFT, Continued

256-277 Clay, dark-gray; interbedded with silty lenses of detrital lignite.

277-366 Clay, dark-gray (till?); predominantly detrital shale.

PIERRE SHALE

366-381 Shale, dark-gray, indurated, fissile.

164-065-29CCB
(Log modified from Peterson Well Co.)

Altitude: 1590 feet — Date drilled: 5/25/67

GEOLOGIC SOURCE	MATERIAL	THICKNESS (FEET)	DEPTH (FEET)
Glacial drift:			
	Clay, yellow	18	18
	Clay, gray	22	40
Pierre Shale:			
	Shale	20	60
	Shale, crumbly	5	65
	Shale	70	135

164-067-28CBD
(Log modified from C. A. Simpson & Son)

Altitude: 1540 feet — Date drilled: 3/10/72

Glacial drift:			
	Roadfill	7	7
	Clay, yellow	13	20
	Clay, blue	90	110
	Sand	7	117
	Clay, blue, slightly sandy	33	150
	Clay, blue, gravelly	30	180
	Clay, blue, sandy	10	190
	Clay, blue, very sandy	6	196

TABLE 4.--Chemical analyses of ground water for major constituents

[Chemical analyses of ground water for major constituents are grouped according to aquifer.]

Principal aquifer	Specific conductance
112, Pleistocene 211, Upper Cretaceous BGFV, buried glaciofluvial deposits OTSH, outwash deposits PIRR, Pierre Shale ROLL, Rolla aquifer SPRD, Spiritwood aquifer	Value shown is the field specific conductance measured at the well at the time of inventory.

LOCAL IDENTIFIER	GEOLOGIC UNIT	DEPTH OF WELL, TOTAL (FEET)	DATE OF SAMPLE	SPECIFIC CONDUCTANCE (UMHO/CM AT 25°C)	PH (UNITS)	TEMPERATURE (DEG C)	HARDNESS (MG/L AS CACO3)	NONCARBONATE HARDNESS (MG/L CACO3)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	PERCENT SODIUM	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE FET-FLU (MG/L AS HCO3)	CARBONATE FET-FLU (MG/L AS CO3)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	NITROGEN, NITRATE DISSOLVED (MG/L AS N)	BORON, DISSOLVED (UG/L AS B)	IRON, DISSOLVED (UG/L AS FE)	MANGANESE, DISSOLVED (UG/L AS MN)
157-065-31BBB	112BBFV	46	80-07-01	660	6.8	7.0	220	0	62	16	120	53	3.5	5.7	424	0	110	17	0.2	30	367	0.23	0	90	530
157-066-10BBA	112BGFV	57	80-06-12	1500	6.3	8.0	714	320	160	63	98	23	1.6	7.0	489	0	510	31	.3	29	1180	.23	130	650	1200
157-066-26DCC	112BGFV	44	80-07-02	660	6.1	6.5	340	85	95	25	16	9	.4	3.1	311	0	98	19	.1	29	499	.23	0	60	920
157-067-17CDD	112BGFV	83	80-06-25	2400	6.1	7.5	310	0	83	25	440	75	11	9.6	495	0	560	280	.3	34	1680	.23	550	700	180
157-067-26BCA	112BGFV	117	80-06-25	1900	6.4	7.5	230	0	59	20	360	77	11	8.7	484	0	210	300	.4	32	1250	.23	580	710	240
157-068-29DDC	112BGFV	137	80-06-24	1500	6.1	9.5	140	0	37	12	340	83	12	6.3	665	0	280	37	.2	27	1020	.02	420	1900	220
157-068-33CBA	112BGFV	65	80-06-20	2800	8.0	7.5	930	510	190	110	390	47	5.6	13	514	0	1100	150	.2	27	2340	15	650	20	320
158-065-12CCC	112BGFV	38	80-07-30	5000	8.1	8.0	2100	1800	540	190	510	34	4.8	23	368	0	2300	420	.1	31	4450	.23	170	130	3600
158-065-14ADD	112BGFV	49	81-09-22	3000	7.7	6.0	1100	750	310	79	260	33	3.4	25	421	0	580	440	.1	25	2800	.23	50	200	2200
158-065-34CDD	112BGFV	124	80-06-12	3350	8.0	7.0	1940	730	290	67	390	39	4.1	17	324	0	230	840	.1	33	2280	.23	440	3700	3600
158-066-11DDD	112BGFV	80	80-06-17	2800	8.2	8.0	320	0	93	21	540	78	13	12	484	0	270	590	.3	26	1810	.23	760	420	310
158-066-24DBA	112BGFV	81	80-06-17	1900	8.1	12.0	440	52	120	34	320	61	6.6	11	472	0	700	34	.3	24	1480	.23	530	4000	380
159-065-21CCC	112BGFV	70	81-09-30	3500	8.0	6.0	810	600	230	57	500	56	7.7	25	505	0	710	470	.9	27	2230	.23	1300	30	2000
160-067-13BBC	112BGFV	41	80-05-22	2400	7.3	8.0	1390	790	290	140	110	15	1.3	15	625	0	960	70	.3	26	2080	2.3	70	20	600
160-068-05ABC	112BGFV	113	81-05-14	2400	8.0	6.0	580	280	140	44	360	57	6.5	14	367	0	960	26	.2	21	1720	.01	580	230	750
160-068-07CBB	112BGFV	113	81-05-14	2400	8.0	6.0	590	300	160	45	310	53	5.6	13	--	--	970	23	.2	19	--	--	940	280	700
160-068-11DAA	112BGFV	233	80-06-03	2000	7.3	9.0	510	42	130	45	260	52	5.0	15	570	0	270	270	.4	25	1310	.23	530	7100	900
160-068-11DAA	112BGFV	159	80-06-03	2620	7.2	5.0	920	630	240	78	320	43	4.7	19	595	0	990	140	.4	27	2130	.23	560	14000	1900
160-068-11DCC	112BGFV	82	80-06-03	3950	7.1	7.0	1800	1100	460	150	420	33	4.3	18	465	0	2000	33	.2	25	3740	.23	890	19000	1900
160-068-23ADA	112BGFV	133	80-06-03	2400	7.3	9.0	700	230	180	61	370	53	6.1	14	574	0	1000	55	.6	35	1910	.23	490	13000	940
160-068-36DAD	112BGFV	167	80-05-22	1800	7.5	6.5	320	0	65	38	290	65	7.1	14	379	0	410	180	.2	9.4	1160	.23	230	5900	300
161-065-06CDD	112BGFV	128	80-05-20	1400	7.6	8.0	670	120	120	41	140	34	2.6	7.9	426	0	480	28	.2	27	956	.23	0	4700	720
161-068-21CCD	112BGFV	265	80-05-08	1400	6.6	6.0	620	320	180	64	66	23	1.5	8.6	381	0	420	67	.2	30	1100	.36	480	720	1100
162-065-28BBB	112BGFV	72	80-07-31	3000	8.4	--	420	52	110	35	550	73	12	16	467	0	320	620	.6	27	1940	.23	1200	10	1200
162-065-32BBB	112BGFV	117	81-10-15	1700	--	8.0	400	0	100	36	270	58	6.9	19	585	0	390	71	.5	22	1560	.23	490	400	290
162-066-28DCB	112BGFV	27	80-05-01	2700	7.8	8.0	780	250	170	86	400	52	6.2	16	641	0	1080	56	.8	26	2190	4.7	230	50	370
157-065-19BAB	112DTBH	35	80-06-18	1080	8.3	7.5	600	290	140	61	12	4	.2	3.2	376	0	250	44	.3	28	768	.43	180	20	530
157-066-30ABB	112DTBH	43	80-07-02	1100	8.0	7.5	590	280	160	46	25	6	.4	3.6	319	0	350	32	.1	30	850	.23	170	340	720
157-066-32CDD	112DTBH	23	80-06-16	1350	8.4	9.0	780	440	170	79	27	7	.4	8.0	373	0	370	56	.1	29	1120	10	130	10	190
158-066-04ABA	112DTBH	90	80-06-05	760	7.6	9.0	250	0	68	20	84	41	2.3	5.1	348	0	85	51	.3	25	490	.23	390	1700	280
158-066-34AAA	112DTBH	30	81-09-21	1990	7.6	6.0	570	220	140	54	45	14	.8	7.5	427	0	280	21	.2	26	836	2.7	180	20	590
161-066-06BDC	112DTBH	50	80-09-25	1060	7.5	--	520	51	120	50	40	14	.8	11	564	0	130	9.8	.5	25	673	.68	0	7200	--
161-066-07CAB	112DTBH	50	80-09-24	1720	7.6	--	730	120	190	66	190	24	1.6	--	624	0	390	19	.5	--	1230	.08	--	2400	--
163-067-19DDB	112DTBH	27	80-06-29	1750	7.2	6.0	970	340	260	98	70	13	1.9	4.4	503	0	680	23	.2	26	1460	.23	190	8300	2400
162-068-07DCC	112HULL	185	80-05-05	1600	7.8	5.0	790	230	230	52	150	29	2.3	9.9	483	0	620	70	.3	23	1440	.05	190	2400	310
162-068-17ADA	112HULL	140	81-10-01	2190	7.5	5.5	710	350	190	57	280	42	3.9	21	431	0	630	150	.5	36	1440	.23	800	690	1700
162-068-21ADC	112HULL	153	80-05-05	2250	7.7	8.0	960	380	160	27	250	48	4.6	15	315	0	800	150	.5	26	1960	.23	550	6400	1400
157-066-08BBB	112HPRD	160	81-09-21	2420	8.4	6.5	66	0	18	10	526	91	24	16	698	0	200	35	.4	30	1470	.23	680	490	40
157-066-19BBB	112HPRD	130	81-09-17	3000	8.2	9.5	170	0	42	16	940	87	29	23	614	0	130	660	.3	31	1620	.23	650	440	50
157-066-19BBB	112HPRD	46	81-09-17	1190	8.2	7.0	410	0	120	27	120	36	2.6	15	360	0	190	18	.2	24	777	.23	380	50	220
157-066-17BAC	112HPRD	78	80-06-16	3500	8.4	7.5	220	0	68	17	650	86	19	13	598	0	77	780	.5	28	1990	.23	990	1000	50
157-066-18DDD1	112HPRD	262	81-09-10	2660	7.8	7.0	710	230	180	63	390	53	6.4	23	590	0	980	150	.1	28	1940	.23	280	4300	150
157-066-18DDD2	112HPRD	161	81-09-11	2660	8.2	7.0	680	250	190	58	370	53	6.2	24	547	0	860	120	.1	29	1940	.23	280	700	240
157-066-21CBB	112HPRD	41	81-09-16	3180	8.2	6.5	380	V	110	26	580	75	13	22	581	0	200	690	.4	25	1960	.23	630	670	590
157-066-27DCC	112HPRD	98	80-07-02	2400	8.0	6.5	340	0	81	33	460	74	11	16	518	0	350	370	.3	32	1670	.23	750	540	60
157-066-28CBB	112HPRD	115	81-09-15	2200	8.0	6.5	540	140	140	46	340	57	6.4	16	484	0	660	170	.2	29	1620	.23	150	680	280
157-066-29CBC	112HPRD	32	81-09-15	2700	7.8	7.0	730	320	200	56	410	54	6.6	22	494	0	950	140	.2	27	2020	.23	350	2300	460
157-066-34AAA	112HPRD	129	80-07-07	2400	7.9	6.5	670	190	170	66	400	56	6.7	16	590	0	870	140	.1	27	2000	.23	410	690	250
157-066-32AAB	112HPRD	83	80-06-11	2380	8.2	7.0	620	230	170	48	310	51	5.8	13	474	0	780	150	.2	29	1640	.23	490	4900	940
157-067-01DDD	112HPRD	120	81-08-31	2220	7.8	6.0	590	32	130	43	420	63	8.2	19	571	0	710	140	.2	30	1690	.23	630	1200	140
157-067-11AAA	112HPRD	141	81-08-31	2400	7.9	6.5	480	27	120	44	420	65	8.3	17	552	0	730	120	.2	31	1740	.23	730	850	210
157-067-12CDD	112HPRD	128	81-09-14	2400	8.2	8.0	570	170	160	41	380	58	6.9	22	467	0	880	110	.2	26	1690	.23	350	140	240
157-067-14CAA	112HPRD	79	80-06-25	1900	8.2	7.0	650	250	190	43	250	45	4.3	11	469	0	760	48	.2	28	1530	.02	580	1400	410
157-067-25AAA	112HPRD	144	80-07-02	2900	8.3	8.0	70	0	17	7.7	680	93	24	7.8	487	0	420	210	.4	30	1370	.23	1200	140	40
157-067-29DDB	112HPRD	151	80-07-02	2150	8.0	7.0	470	71	120	41	350	61	7.0	11	485	0	690	240	.3	33	1520	.23	530	410	240
157-067-27AAA	112HPRD	128	80-07-29	2400	8.1	7.0	460	60	120	39	350	62	7.1	13	488	0	570	160	.2	33	1530	.23	270	2800	200
158-066-05CBB	112HPRU	163	80-06-12	2600	8.2	7.0	280	0	78	23	550	86	14	9.9	663	0	750	150	.4	33	1900	.23	890	320	310
158-066-07DDB	112HPRU	127	80-06-12	2580	8.2	6.0	220	0	62	16	450	88	13	13	582	0	140	440	.6	31	1620	.23	690	2100	190
158-066-26CAB	112HPRU	160	80-06-12	1580	8.4	6.0	57	0	15	6.7	370	92	21	6.7	705	0	57	170	1.2	35	983	.23	690	210	50
158-066-29CCB	112HPRU	111	80-06-13	1300	8.5	8.0	790	510	150	100	20	7	.4	4.6	334	0	540	19	.3	31	1130	.23	230	700	830

LOCAL IDENTIFIER	GEOLOGIC UNIT	DEPTH OF WELL, TOTAL (FEET)	DATE OF SAMPLE	SPECIFIC CONDUCTANCE (UMHO/CM AT 25°C)	PH (UNITS)	TEMPERATURE (DEG C)	HARDNESS (MG/L AS CACO3)	NONCARBONATE HARDNESS (MG/L CACO3)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	PERCENT SODIUM	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE FET-FLD (MG/L AS HCO3)	CARBONATE FET-FLD (MG/L AS CO3)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	NITROGEN, NITRATE DISSOLVED (MG/L AS N)	BORON, DISSOLVED (UG/L AS B)	IRON, DISSOLVED (UG/L AS FE)	MANGANESE, DISSOLVED (UG/L AS MN)
158-066-28CBU	112SPRD	184	80-06-12	2200	8.3	8.0	150	0	36	15	500	87	18	13	553	0	360	510	0.6	33	1530	0.23	850	660	80
158-066-30BBB	112SPRD	213	80-06-26	2500	8.1	6.5	500	44	130	43	480	67	9.5	16	558	0	880	140	.1	32	1920	.23	550	220	220
158-066-33BBB	112SPRD	150	81-09-21	2400	8.6	10.0	130	0	30	13	430	86	17	19	617	8	99	320	.8	31	1200	.23	580	80	70
158-067-01BBB	112SPRD	171	81-08-27	2380	7.8	6.1	690	360	230	77	270	39	3.9	19	651	0	810	57	.2	30	1020	.23	330	1800	920
158-067-03AAA	111SPRD	211	81-08-27	2400	8.0	7.0	500	20	130	43	410	63	8.0	21	585	0	720	110	.3	30	1860	.23	430	1900	180
158-067-13AAA	112SPRD	103	80-06-13	2200	8.2	8.0	890	370	240	71	280	40	4.1	16	635	0	870	91	.2	32	1960	.23	190	4100	700
158-067-13CDD	112SPRD	89	80-06-13	2400	8.1	8.0	930	440	230	86	280	39	4.0	14	602	0	840	110	.3	34	2000	.23	460	3500	600
158-067-25ADC	112SPRD	124	81-05-14	2590	7.5	9.0	880	420	230	74	300	42	4.4	17	562	0	890	110	.2	34	1920	.00	450	3600	390
158-067-25BBB	112SPRD	124	81-05-14	2590	7.5	9.0	910	430	240	76	280	40	4.0	12	--	--	950	100	.2	28	--	--	590	3600	360
158-067-27BBB	112SPRD	155	80-07-08	2200	8.0	7.0	834	370	220	68	300	43	4.5	15	563	0	830	86	.2	32	1860	.23	530	450	380
158-067-27BDC	112SPRD	321	80-07-08	2400	7.7	7.0	590	120	150	52	380	58	6.8	16	571	0	730	130	.3	31	1750	.23	660	3900	190
158-067-28CDD	112SPRD	321	81-05-13	2200	7.2	6.5	550	140	140	49	360	58	6.7	16	--	--	760	130	.2	28	1740	.00	750	4000	140
159-066-05ADA	112SPRD	58	81-09-29	1600	7.9	7.0	930	590	230	86	140	24	2.0	19	416	0	620	29	.3	25	1490	.25	330	750	190
159-066-29CDD	112SPRD	150	80-06-05	2250	7.7	8.0	290	0	66	30	470	77	12	13	525	0	720	140	.2	28	1650	.23	660	1100	110
159-066-29DDD	112SPRD	113	80-07-03	1600	8.1	6.5	140	0	35	13	360	63	13	11	488	7	410	90	.5	33	1170	.23	1100	250	40
159-067-01AAD	112SPRD	151	80-07-08	2150	7.7	6.0	860	320	230	69	220	35	3.3	13	652	0	760	50	.2	30	1750	.23	360	2100	640
159-067-01BBB1	112SPRD	216	80-07-08	2400	8.0	6.0	840	450	220	71	280	42	4.2	13	716	0	770	49	.2	29	1720	.23	560	1000	480
159-067-01BHH2	112SPRD	109	81-08-19	2000	7.3	6.0	940	310	250	77	250	36	3.5	15	775	0	780	39	.2	30	1050	.23	460	7900	430
159-067-04AAU	112SPRD	69	80-07-09	2300	7.9	7.5	980	500	250	86	260	36	3.6	13	588	0	690	120	.3	31	1960	.23	360	1100	900
159-067-04DDD1	112SPRD	83	80-07-03	2400	7.7	6.0	1000	490	260	85	270	37	3.7	14	623	0	940	99	.3	31	2100	.23	690	2200	880
159-067-28DCU	112SPRD	284	80-07-29	2400	8.3	10.5	660	260	170	62	340	51	5.7	17	518	0	830	80	.2	33	1750	.23	410	60	490
159-067-33CCC	112SPRD	153	81-06-26	2300	8.0	7.5	550	74	140	49	420	61	7.4	19	581	0	710	160	.3	30	1780	.23	530	370	160
160-066-18AC	112SPRD	86	80-05-21	710	7.7	7.0	300	20	68	32	33	19	.6	5.9	343	0	79	15	.3	13	426	.23	30	2900	410
160-067-04CCC	112SPRD	102	81-09-23	2800	7.7	5.5	1100	510	300	85	270	34	3.5	19	714	0	1000	79	.1	25	2220	.23	350	6100	820
160-067-07AAA	112SPRD	122	81-09-23	2600	7.7	6.0	1000	520	260	85	330	41	4.5	24	589	0	1000	130	.2	27	2270	.23	250	3600	1700
160-067-10AAA1	112SPRU	251	81-09-24	2190	7.8	6.5	790	280	200	71	240	39	3.7	18	621	0	680	56	.1	28	1590	.23	130	2400	520
160-067-10AAA2	112SPRU	101	81-09-24	1850	7.9	5.8	610	300	210	69	190	33	2.9	17	647	0	610	36	.2	30	1500	.23	200	1300	1300
160-067-10BBB1	112SPRU	362	80-07-15	2200	7.8	7.0	980	380	250	86	260	36	3.6	14	726	0	800	56	.2	31	1830	.25	790	1400	620
160-067-10BBB2	112SPRU	60	80-07-15	2250	8.9	7.0	1000	480	280	73	200	30	2.8	12	634	0	640	52	.2	30	1820	.23	550	750	620
160-067-11AAA	112SPRD	202	81-09-24	2180	7.8	6.5	780	290	200	66	250	40	3.9	16	597	0	720	46	.1	29	1650	.23	180	2800	220
160-067-12CBB	112SPRD	190	80-07-09	2390	8.0	8.0	820	330	190	64	290	43	4.4	16	602	0	870	58	.1	41	1820	.23	440	220	430
160-067-34DDA	112SPRD	75	80-07-09	2450	7.9	6.5	1000	500	270	79	230	33	3.2	16	610	0	930	56	.2	33	1980	.23	270	1600	900
160-067-36AAA	112SPRD	195	81-09-24	2190	7.8	6.0	780	260	200	68	250	40	3.9	19	636	0	680	65	.2	29	1680	.23	200	5600	530
160-068-12AAA	112SPRD	175	81-09-22	2800	7.5	6.5	1100	620	310	74	350	40	4.6	24	580	0	1200	130	.2	27	2560	.23	330	6300	2100
161-066-08CAD	112SPRD	125	81-05-13	1050	7.5	7.0	470	12	120	41	52	19	1.0	8.0	556	0	160	14	.4	33	644	.23	30	50	1200
161-067-01BBB	112SPRD	125	81-05-13	1050	7.5	7.0	460	1	120	39	46	17	.9	12	--	--	130	14	.4	31	--	--	70	40	1100
161-067-18CDC	112SPRD	190	64-09-30	2370	7.9	--	540	120	180	45	350	57	6.6	27	514	0	690	140	.8	23	1660	.68	1	700	--
161-067-19DDD	112SPRU	440	80-07-11	2500	7.7	7.0	1300	800	330	120	290	32	3.5	15	635	0	1200	92	.1	29	2950	.25	510	2100	1190
161-067-11CCC1	112SPRD	268	80-07-16	1900	7.8	--	840	400	230	64	130	25	2.0	11	533	0	610	15	.1	31	1330	.25	380	70	370
161-067-11CCC2	112SPRD	101	80-07-16	1950	7.6	7.0	880	410	240	68	170	29	2.5	10	567	0	740	13	.1	28	1520	.23	650	3300	710
161-067-14AAA	112SPRD	376	64-10-07	2210	7.8	--	850	380	210	78	220	36	3.3	18	568	0	750	65	.6	21	1440	.68	0	820	--
161-067-15BBB	112SPRD	146	80-07-16	2400	7.6	7.0	1400	880	370	120	41	8	.7	11	651	0	1000	17	.1	29	2010	.25	270	4400	930
161-067-22DDA	112SPRD	107	80-05-14	2400	7.6	7.5	860	260	240	63	280	41	4.2	13	753	0	840	18	.2	24	1790	.23	490	16000	770
161-067-39DDA	112SPRD	165	80-05-14	3050	7.6	6.0	1100	650	300	85	340	40	4.5	16	553	0	1100	160	.1	26	2420	.23	460	7200	2400
161-068-12DDD	112SPRD	196	80-05-07	2900	7.3	7.0	1100	710	290	91	320	38	4.2	14	477	0	1300	93	.3	25	2420	.07	420	1400	3900
162-067-02BBC1	112SPRD	237	81-10-08	2120	8.1	6.0	1000	520	280	73	140	23	1.9	12	598	0	720	40	.1	24	1490	.23	640	7700	1700
162-067-02BBC2	112SPRD	105	81-10-08	1330	8.0	5.5	730	290	200	56	55	14	.9	7.5	533	0	350	17	.1	26	898	.23	250	4600	1800
162-067-04AAA	112SPRD	243	81-10-08	2800	8.2	6.5	910	430	240	75	340	44	4.9	20	586	0	880	180	.1	27	2050	.23	800	1100	160
162-067-05AAA	112SPRU	98	81-10-13	2200	--	5.5	1400	960	380	110	40	6	.5	9.6	536	0	920	24	.1	19	1670	.23	130	4700	2500
162-067-11VAA1	112SPRD	201	80-07-23	3000	8.3	9.0	390	0	110	28	550	74	12	20	498	0	130	750	.4	31	1800	.25	750	50	180
162-067-11DAA2	112SPRD	65	80-07-23	2250	7.8	6.0	1300	710	360	97	90	13	1.1	10	714	0	880	24	.1	26	1940	.23	270	9100	1900
162-067-14BBB	112SPRD	141	80-07-30	1900	7.7	7.5	900	550	280	49	66	14	1.0	7.9	628	0	660	15	.2	27	1400	.23	0	7600	2000
162-067-16AAA	112SPRU	128	81-10-05	1520	7.5	6.0	810	490	220	63	38	9	.6	9.1	391	0	470	32	.0	20	952	.23	230	5400	1500
162-067-16CCC	112SPND	204	80-07-22	2000	7.9	7.0	1000	520	300	61	110	19	1.5	9.7	588	0	730	26	.1	28	1610	.23	660	7400	2100
162-067-17BBA	112SPRU	146	80-05-05	1200	6.5	5.5	780	320	210	62	41	10	.6	3.9	561	0	390	16	.2	25	1090	.23	30	5600	2100
162-067-22AAA	112SPRU	175	81-10-05	2600	7.6	5.5	1200	610	340	85	210	27	2.6	19	718	0	1000	33	.1	24	2120	.23	350	7300	1600
162-068-01AAA	112SPRU	148	81-10-13	2600	--	5.5	1100	680	310	79	290	36	3.8	17	599	0	1200	64	.2	19	2260	.23	670	490	3800
162-068-33DAA	112SPRU	176	80-05-05	1750	7.8	6.0	800	540	230	55	120	24	1.8	10	322	0	730	36	.4	29	1510	.07	480	2500	1600
162-068-34BAC	112SPRU	459	80-05-07	2400	7.8	5.0	400	3	110	30	410	68	8.9	11	482	0	600	230	.4	22	1630	.23	840	4300	920

LOCAL IDENT-I-FIER	GEO-LOGIC UNIT	DEPTH OF WELL, TOTAL (FEET)	DATE OF SAMPLE	SPE-CIFIC CON-DUCT-ANCE (µMHO/CM AT 25°C)	PH (UNITS)	TEMPER-ATURE (DEG C)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	PERCENT SODIUM	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE FET-FLD (MG/L AS HCO3)	CAR-BONATE FET-FLD (MG/L AS CO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	NITRO-GEN, NITRATE DIS-SOLVED (MG/L AS N)	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)
163-066-06AAD	112SPRD	183	80-04-29	2600	7.2	6.0	1200	710	280	120	200	26	2.5	17	591	0	990	100	0.3	31	2050	2.0	260	4800	720
163-066-07BCC	112SPRD	100	81-10-15	2400	--	6.0	630	240	170	50	320	52	5.5	20	401	0	660	160	.3	29	1650	.23	300	1900	790
163-067-01DDD	112SPRD	92	80-04-30	1900	7.6	6.0	880	410	230	74	110	21	1.6	15	560	0	570	76	.2	29	1360	.05	300	6100	400
163-067-05CDC	112SPRD	62	80-04-29	595	8.0	7.0	300	74	77	26	6.7	5	.2	2.1	279	0	88	.0	.1	26	396	.00	0	730	790
163-067-07DCD	112SPRD	110	81-05-12	900	7.5	5.0	470	150	100	54	20	9	.5	21	392	0	100	12	.2	27	613	.23	290	60	10
163-067-07DD	112SPRD	106	80-04-30	2490	7.5	10.0	1500	990	350	150	53	7	.6	6.3	617	0	950	110	.1	23	2080	.23	230	33000	2400
163-067-09CCC	112SPRD	95	81-10-16	725	--	6.5	320	66	89	24	39	21	.9	6.1	310	0	130	25	.1	20	475	.23	0	680	740
163-067-10CCC1	112SPRD	189	80-07-24	2680	8.0	7.0	1300	770	330	120	270	31	3.2	15	670	0	1200	64	.1	28	2340	.23	440	3500	580
163-067-10CCC2	112SPRD	53	80-07-24	1900	8.2	6.0	660	260	180	51	220	42	3.7	11	491	0	620	91	.2	30	1460	.23	400	1400	1200
163-067-10DDD	112SPRD	105	81-10-15	2350	--	6.0	1100	560	300	85	170	25	2.2	17	630	0	820	94	.1	23	1640	.23	800	8500	360
163-067-12DCC	112SPRD	82	80-07-24	1480	7.8	7.0	550	180	170	31	130	33	2.4	9.0	449	0	380	36	.3	33	1000	.23	70	630	210
163-067-18AAA1	112SPRD	250	80-07-23	3000	8.2	8.5	460	95	120	39	600	73	18	18	445	0	990	290	.3	31	2320	.23	890	480	220
163-067-18AAA2	112SPRD	121	80-07-23	2250	8.0	7.0	1200	790	290	120	130	19	1.6	9.4	526	0	950	23	.2	30	1950	.23	380	1700	1800
163-067-18BBB2	112SPRD	125	81-10-16	3000	--	6.0	1300	1000	360	97	300	33	3.6	18	334	0	1400	130	.1	18	2470	.23	540	90	3300
163-067-34CDD	112SPRD	66	80-04-30	2100	7.1	8.5	1400	910	350	130	39	6	.5	6.2	608	0	980	22	.1	27	1920	2.9	230	40	4600
157-066-01DDD	211PIRR	133	80-06-24	4900	8.1	11.5	70	0	20	6.8	1000	96	49	13	714	0	.0	1200	.6	39	2670	.23	2200	10	60
157-066-03DAA	211PIRR	220	80-06-26	6000	8.2	11.0	250	0	50	26	1500	92	41	20	460	0	960	1500	.2	21	4200	.23	1700	40	290
158-067-09DDD	211PIRR	157	80-06-11	3500	8.5	12.0	47	0	11	4.7	860	97	55	10	829	10	120	820	.8	31	2160	.32	2200	70	50
158-068-29DAA	211PIRR	174	80-06-17	5500	8.4	7.0	110	0	23	13	1300	96	56	14	580	0	110	1700	.4	29	3400	.23	1300	30	140
158-068-31AAD	211PIRR	168	80-06-17	2450	7.3	7.0	110	0	23	13	580	91	24	10	779	0	25	540	.5	52	1710	.23	2300	250	120
159-065-04CCC	211PIRR	105	80-06-10	2550	8.3	7.0	100	0	25	9.1	540	91	24	9.4	825	0	280	360	.3	32	1510	.11	1500	190	190
159-065-08DD	211PIRR	112	80-06-10	2250	8.0	11.0	250	0	65	21	440	78	12	11	670	0	460	140	.4	30	1480	.23	850	960	560
159-065-08DDA	211PIRR	133	80-06-10	3000	8.0	7.0	83	0	21	7.4	680	94	33	9.3	770	25	410	350	.6	28	1880	.23	2100	20	110
159-065-08DDC	211PIRR	149	80-06-10	2900	8.1	8.0	40	0	9.4	4.0	690	97	48	8.0	951	0	93	500	.7	30	1790	.23	2300	60	50
159-065-08DDD	211PIRR	153	80-06-10	4000	8.4	11.0	64	0	15	6.4	900	96	49	11	893	0	.0	960	.6	29	2380	.11	2600	40	40
159-065-08DCA	211PIRR	194	80-06-18	3000	8.1	8.5	42	0	10	4.1	710	97	48	8.6	918	0	68	550	.7	27	1810	.23	2400	110	40
159-066-03CCC	211PIRR	228	80-06-05	2450	8.0	14.0	140	0	34	13	560	89	21	12	630	0	610	100	.6	24	1750	.23	1200	40	100
159-066-08CCC	211PIRR	227	80-06-05	3000	7.9	10.0	120	0	28	12	720	92	29	12	679	0	49	700	.5	26	1880	.23	2200	30	90
159-066-15CCC	211PIRR	134	80-06-05	2500	8.1	8.0	61	0	19	8.8	640	95	36	8.5	853	0	56	500	.8	27	1530	.26	2700	30	60
159-067-16AAB	211PIRR	415	80-06-04	2550	7.1	12.0	550	30	130	55	420	62	7.8	16	635	0	810	120	.2	27	1920	.23	800	8100	430
159-068-01AAA	211PIRR	237	80-06-04	2900	8.0	14.0	83	0	21	7.4	660	94	32	9.5	963	0	100	400	.6	29	1730	.23	1700	170	40
159-068-01ADA	211PIRR	260	80-06-04	2600	8.3	15.0	110	0	26	11	610	92	25	9.3	851	0	170	400	.5	29	1610	.18	1190	890	40
159-068-11DAA	211PIRR	169	80-06-04	1650	8.7	7.0	56	0	14	5.1	380	93	22	7.3	673	0	270	67	.4	24	1030	.23	720	350	140
159-068-27AAA	211PIRR	141	80-06-04	8000	7.5	9.0	210	0	49	21	1700	94	51	20	666	11	31	2300	.3	28	4319	.23	3200	1200	130
160-065-20CCC	211PIRR	130	80-05-21	3450	7.9	7.0	79	0	20	7.1	740	95	36	10	765	0	200	630	.4	26	2030	.45	1700	90	90
160-065-32DDD	211PIRR	186	80-05-21	3900	8.0	6.5	65	0	16	6.1	830	96	45	11	164	0	16	880	.5	26	2170	2.0	2400	80	40
	211PIRR	186	61-05-13	3700	8.1	7.0	79	0	17	6.5	810	95	42	11	--	--	20	930	.4	25	--	--	2900	40	50
160-066-03DDA	211PIRR	114	80-05-21	5000	8.1	7.0	240	0	62	21	980	89	27	16	404	0	1700	180	.4	30	3140	.23	990	1500	220
160-066-32CCC	211PIRR	230	80-05-21	2650	8.5	8.5	79	0	16	9.5	510	92	25	9.3	646	13	240	310	.4	22	1460	.23	1090	90	20
160-067-04DBC	211PIRR	474	80-05-22	3200	7.4	7.5	400	0	100	36	650	77	14	19	924	0	810	140	.3	26	2200	.23	950	660	300
160-067-22BCC	211PIRR	263	80-05-22	5850	8.0	8.0	150	0	34	13	930	92	33	17	641	0	25	1200	.5	24	2160	.23	1900	70	100
160-068-24ACA	211PIRR	293	80-06-03	5500	8.0	7.0	180	0	45	16	1200	93	39	18	927	0	3.3	1500	.6	29	3300	.23	3000	600	150
160-068-33BAB	211PIRR	219	80-06-03	--	8.0	11.0	380	0	92	36	2000	91	54	22	513	0	70	3700	.2	27	6000	.23	3000	4100	170
160-068-36DDDA	211PIRR	205	80-06-03	3050	8.0	14.0	190	0	42	21	650	87	20	13	707	0	830	570	.3	24	1770	.23	1200	110	80
161-065-30CCC	211PIRR	113	80-05-20	3500	8.1	9.0	66	0	14	7.5	820	96	44	8.5	673	0	400	630	.6	26	2270	.23	2900	220	60
161-065-35AAD	211PIRR	110	80-05-20	1500	7.8	5.0	180	0	45	16	310	78	10	7.2	629	0	310	37	.2	25	976	.14	360	1800	540
161-066-16AAA	211PIRR	207	80-05-20	5800	7.7	7.0	400	0	96	39	1200	86	26	23	615	0	100	1700	.2	23	3160	.23	1600	4000	430
161-066-29AAB	211PIRR	191	80-05-20	5900	7.8	6.0	530	150	130	50	980	78	17	21	459	0	1000	870	.1	24	3140	.23	530	1400	1000
161-068-29CCC	211PIRR	105	80-05-20	3500	7.9	6.5	350	0	82	35	690	80	16	13	484	0	540	640	.1	26	2290	.11	480	660	950
161-065-11DD	211PIRR	379	80-05-16	3600	7.9	7.0	140	0	32	12	730	92	28	14	482	0	310	800	.2	26	1970	.23	360	330	110
161-067-19DCC	211PIRR	400	80-05-14	--	7.8	9.6	600	200	150	55	2400	89	43	24	491	0	60	4000	.2	21	6590	.23	3100	7400	330
161-067-20DAA	211PIRR	300	80-05-14	3400	7.8	5.0	540	0	130	52	300	60	7.1	19	661	0	750	78	.3	19	1690	.23	300	4300	320
161-068-26DBB	211PIRR	300	80-05-08	4100	8.7	--	53	0	13	5.0	890	97	53	12	727	0	44	1000	.5	18	2230	.00	2600	30	10
162-066-17DDD	211PIRR	90	80-05-01	1090	7.6	5.0	780	320	190	74	100	22	1.6	5.2	565	0	330	62	.1	32	1310	32	230	10	60
162-063-04ADA	211PIRR	314	80-05-05	6100	7.9	7.0	390	0	92	39	1200	87	28	29	492	0	9.1	1900	.2	26	3460	.00	2100	1400	210
162-066-10CCD	211PIRR	300	80-05-07	2600	8.2	5.5	86	0	20	8.8	560	93	26	8.0	848	0	130	380	.4	27	1680	.27	2400	300	40
162-066-13CCC	211PIRR	381	80-05-07	--	7.7	6.0	340	0	80	34	1900	92	45	21	548	0	23	2800	.3	25	4660	.23	3700	2700	190
162-065-13ADD	211PIRR	136	80-04-29	3500	8.0	6.0	134	0	30	11	810	92	31	12	493	0	1400	76	.4	27	2960	.14	1400	40	230

TABLE 5.--Chemical analyses of ground water from selected wells for trace elements[1/]

[Analyses reported in ug/L]

Location	158-067-25ADC	158-067-27BBC	160-065-32BBB	160-068-05ADC	161-066-06CAD
Well depth (ft)	124	321	186	113	125
Date of collection	5/14/81	5/13/81	5/13/81	5/14/81	5/13/81
Aluminum (Al)	0	0	0	5	0
Arsenic (As)	7	2	1	7	1
Barium (Ba)	100	0	200	0	200
Beryllium (Be)	0	0	0	0	1
Cadmium (Cd)	4	0	1	0	1
Chromium (Cr)	10	0	10	10	10
Cobalt (Co)	0	1	0	0	3
Copper (Cu)	1	0	1	1	5
Lead (Pb)	0	1	1	1	2
Lithium (Li)	220	200	250	230	50
Mercury (Hg)	.1	.1	.2	.0	.1
Molybdenum (Mo)	5	3	0	17	10
Nickel (Ni)	2	2	2	2	0
Selenium (Se)	0	0	--	0	0
Strontium (Sr)	1400	100	330	1300	470
Vanadium (V)	1.0	4.0	21	1.0	1.0
Zinc (Zn)	230	110	830	790	20

[1/]Analyses by the U.S. Geological Survey Hydrologic Laboratory, Lakewood, Colo.