GROUND-WATER DATA

for

BILLINGS, GOLDEN VALLEY AND SLOPE COUNTIES, NORTH DAKOTA

by

Lawrence O. Anna

U.S. Geological Survey

COUNTY GROUND-WATER STUDIES 29 — PART II
North Dakota State Water Commission
Vernon Fahy, *State Engineer*

BULLETIN 76 — PART II
North Dakota Geological Survey
Lee Gerhard, *Acting State Geologist*

Prepared by the U.S. Geological Survey
in cooperation with the North Dakota State
Water Commission, North Dakota Geological
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Bismarck, North Dakota

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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)	.3048	meter (m)
Inch (in)	25.4	millimeter (mm)

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INTRODUCTION

The ground-water investigation in Billings, Golden Valley, and Slope Counties (fig. 1) was made cooperatively by the U.S. Geological Survey (USGS), North Dakota State Water Commission (NDSWC), North Dakota Geological Survey (NDGS), U.S. Forest Service (USFS), U.S. National Park Service (USNPS), and the Billings, Golden Valley, and Slope Counties Water Management Districts. The results of the investigation will be published in three parts. Part I is an interpretive report describing the surface 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 the 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 determine the availability and quality of ground water for municipal, domestic, industrial, and irrigation uses. Specifically, the objectives were to: (1) determine the location, extent, and nature of the major aquifers and confining beds; (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 aquifers; (4) estimate the potential yields of wells tapping the major aquifers; (5) determine the chemical quality of the ground water; and (6) estimate the water use.

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

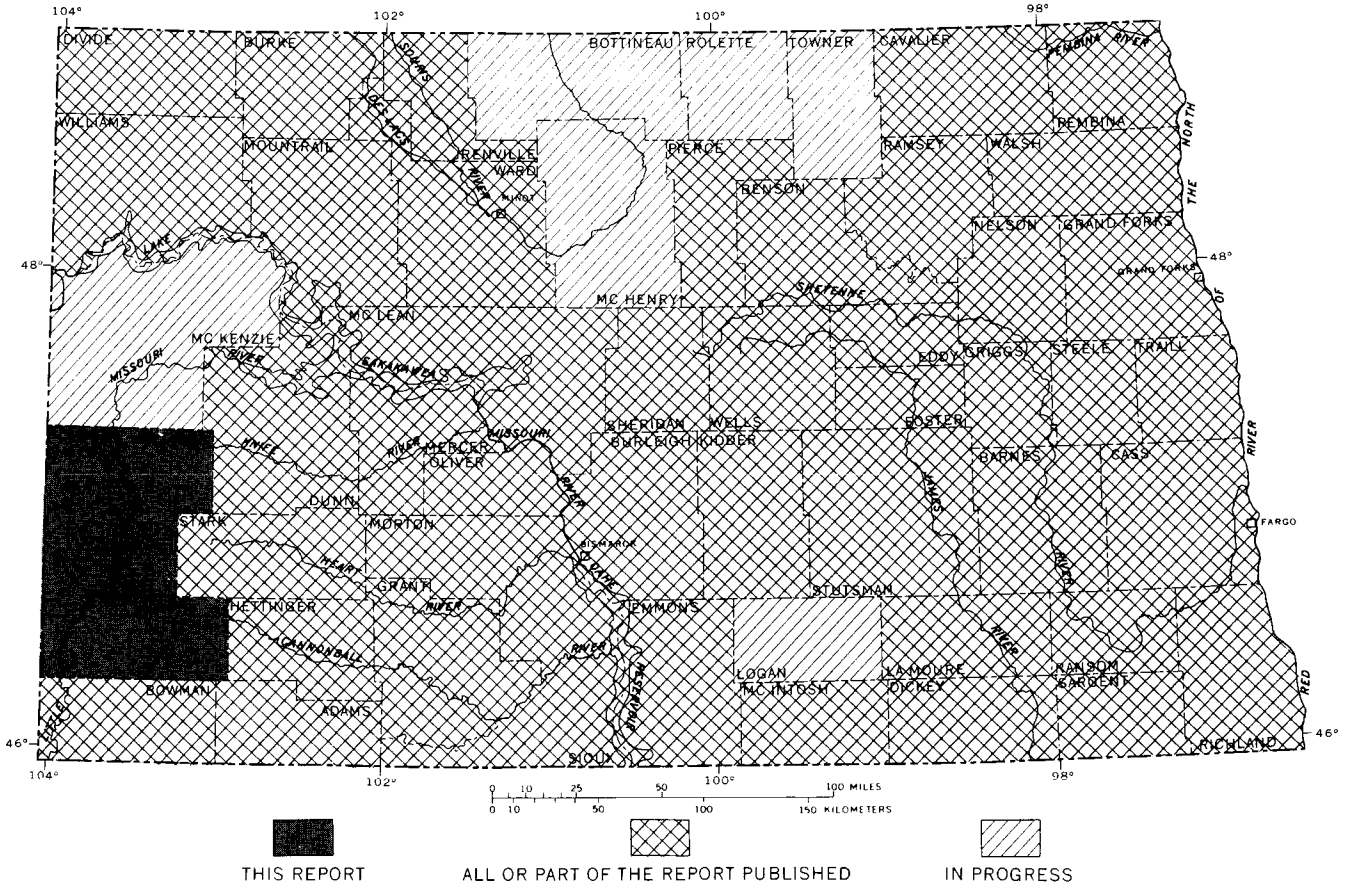

FIGURE 1.—County ground-water studies in North Dakota.

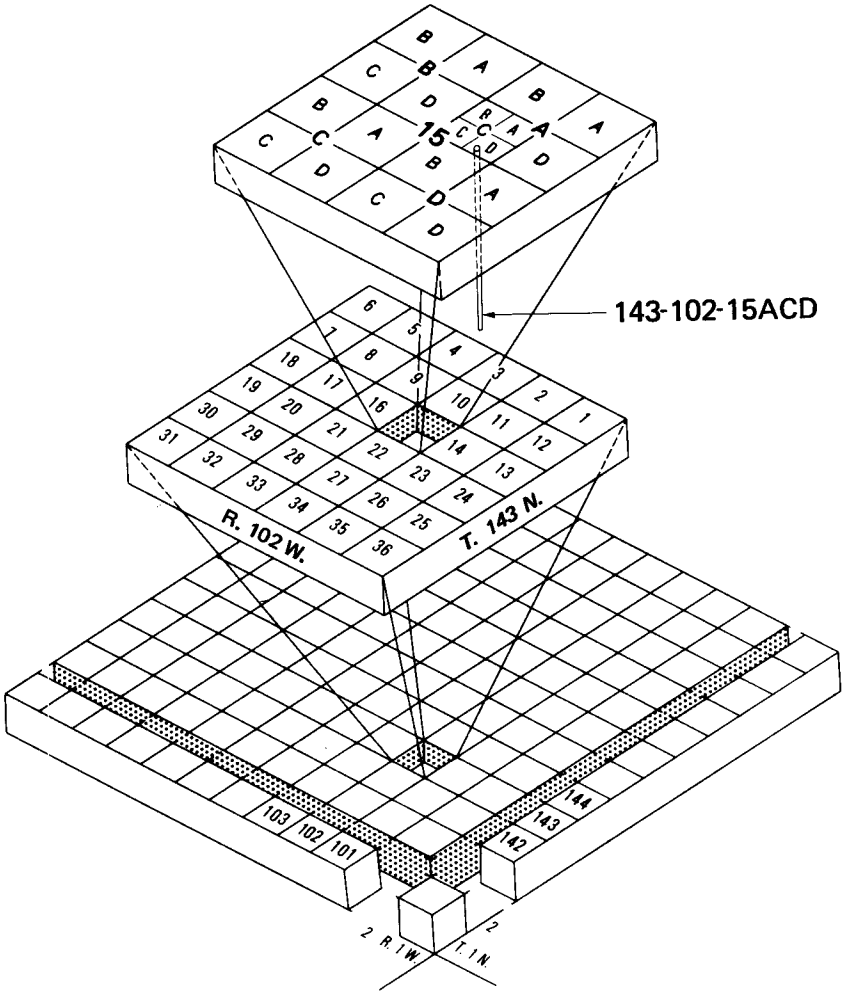

FIGURE 2.—Location-numbering system.

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 143-102-15ACD is in the SE¼SE¼NE¼ sec. 15, T. 143 N., R. 102 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 the residents and officials of Billings, Golden Valley, and Slope Counties who furnished 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: L. D. Smith and G. L. Sunderland for logging test holes, providing lithologic descriptions of hole cuttings, and contributing to the understanding of the local stratigraphy; G. O. Muri for chemical analyses of water samples; and M. O. Lindvig for scheduling of drilling activities. Thanks are due to the various 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 between 1974 and 1977, are listed in tables 1-9. The points of collection are shown on plate 1. The data consist of the following: (1) Geologic and hydrologic records for 723 wells, test holes, springs, and miscellaneous data-collection sites; (2) water-level measurements in 48 observation wells; (3) lithologic and geophysical logs of 367 test holes and wells; (4) 273 chemical analyses of ground water; (5) 33 chemical analyses of surface water during low flow; (6) 18 chemical analyses of ground water for trace constituents; (7) 9 chemical analyses of ground water for

dissolved gases; (8) 62 analyses of core samples for hydraulic parameters and particle-size distribution; and (9) 29 analyses of core samples for heavy mineral content. The data are useful for evaluating geologic and ground-water conditions in Billings, Golden Valley, and Slope Counties. 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, Test Holes, Springs, and Miscellaneous Data-Collection Sites

Records of selected wells, test holes, springs, and miscellaneous data-collection sites are given in table 1. Well depth is the depth of casing for open-bottom wells or the base of the well screen. Most 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 installed in order to obtain water levels and water samples from superimposed aquifers. The observation wells were constructed of 1¼-inch (32-mm) plastic casing with 3- or 6-foot (1- or 2-m) screens, 2-inch (51-mm) steel casing with 6-, 12-, or 18-foot (2-, 4-, or 5-m) screens, 4-inch (102-mm) steel casing with open-bottom completion, or 4-inch (102-mm) plastic casing with a 10-foot (3-m) screen. The observation wells were developed by backwashing with the deflocculent trisodium phosphate and were pumped a minimum of 8 hours for development before collection of water samples for analysis.

Water Levels in Selected Wells

Table 2 gives monthly and intermittent water levels in selected wells, in feet below or (+) above land surface, that tap the major aquifers in Billings, Golden Valley, and Slope Counties. Water-level measurements were made beginning in the fall of 1975 and extending through February 1978. Measurements will continue to be made in some

wells as part of the statewide observation-well network to monitor changes in water levels as the ground-water resources are developed.

Logs of Wells and Test Holes

Logs collected from water-well drillers, North Dakota State Water Commission, 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. Most test holes drilled during this project and some municipal, industrial, and private wells have geophysical logs in addition to a description of the material penetrated. The geophysical logs are extremely useful for geologic correlation purposes. 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 mineral constituents and physical properties of water are reported in tables 4-7. Water for samples was secured from privately owned wells by using the existing pumps and from the North Dakota State Water Commission observation wells by airlift or a submersible pump. Generally enough water to clear the well column and plumbing was pumped; 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. The analyses of minor elements (table 6) were made by the U.S. Geological Survey, Salt Lake City, Utah. Methods of analyses were generally those described by Brown and others (1970). 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 were established by the National Academy of Sciences-National Academy of Engineering (1972) at the request of the Environmental Protection Agency and are generally accepted as applicable to public water supplies. 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, p. 116).

KEY WATER QUALITY CRITERIA FOR FARMSTEAD USES

	Recommendations (at point of use)	
Characteristic	*General farmstead uses*	*Additional special-use requirements*
Taste and odor	*Substantially free*	
Color	*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 a supply:*	
	Substances	
	Arsenic (ug/L)	[1]*50*
	Barium (ug/L)	[1]*1000*
	Cadmium (ug/L)	[1]*10*
	Chromium (ug/L)	[1]*50*
	Cyanides (mg/L)	*0.2*
	Lead (ug/L)	[1]*50*
	Selenium (ug/L)	[1]*10*
	Silver (ug/L)	[1]*50*
Other trace elements	*Levels shown below should not be exceeded if alternate sources are available:*	
	Substances	
	Manganese (ug/L)	*50*
	Iron (ug/L)	*300*
	Copper (ug/L)	*1000*
	Zinc (ug/L)	*5000*
	Fluoride (mg/L)	*0.7-1.2 ([1]2.4)*
	Nitrate (as N) (mg/L)	[1]*10*
		In dairy sanitation, water should contain <20 mg/L potassium and <0.1 mg/L iron and copper.

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

Mineral 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 is a widespread constituent in rocks and is easily leached by ground water under reducing conditions or in 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-imparted turbidity.

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 may be unsatisfactory for irrigation on certain types of poorly drained soils. 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, upon weathering or with bacterial action, are converted to sulfates. 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 low. Important sources of chloride are sedimentary rocks that were deposited under marine conditions.

Fluoride (F)

Fluoride in the ground water is probably derived from solution of fluorite, apatite, and hornblende minerals.

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 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.

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 many times 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 cations, with the cations 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 0.65 to 0.70 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 power 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. This is evident for such a direct use as an industrial coolant. Temperature is also important, but perhaps not so evident, 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

Trace Constituents

Trace elements are relatively insoluble in water and hence are generally found in low concentrations (<1.0 mg/L). Trace-constituent data (table 6) are used to gain information about circulation and distribution of minerals in the rocks and water and to establish relationships between water composition and public health, either related to water pollution or to natural conditions.

Chemical Analyses of Ground Water for Dissolved Gases and Sulfide

The dissolved gases in water from selected wells are reported in table 7. Samples were collected in evacuated flasks and were analyzed by the U.S. Geological Survey in the geochemical laboratory in Reston, Va. Methods of analyses were generally those described by Hobba and others (1977).

Particle-Size Distribution Data

Particle-size distributions were determined by the sieve and hydrometer method for 62 core samples representing eight principal aquifers. Table 8 shows the percentage of clay, silt, and sand in the samples along with hydrologic parameters and statistical measures of textures from several cores.

Heavy Mineral Analyses

Heavy mineral analyses from 29 cores from bedrock formations are in table 9. These analyses may be useful for correlation of geohydrologic units throughout the Williston basin and surrounding areas.

SELECTED REFERENCES

Abbott, G. A., and Voedisch, F. W., 1938, The municipal ground water supplies of North Dakota: North Dakota Geological Survey Bulletin 11, 99 p.

Alger, R. P., 1966, Interpretation of electric logs in fresh water wells in unconsolidated formations: Society of Professional Well Log Analysts Transactions, 7th Annual Logging Symposium, section cc, p. 1-25.

Brown, Eugene, Skougstad, M. W., and Fishman, M. J., 1970, Methods for collection and analysis of water samples for dissolved minerals and gases: Techniques of Water-Resources Investigations of the U.S. Geological Survey, book 5, chapter A1, 160 p.

Croft, M. G., 1974, Water supply at Painted Canyon Overlook, Theodore Roosevelt National Memorial Park (South Unit), southwestern North Dakota: U.S. Geological Survey Open-File Report 74-136, 35 p.

Comly, H. H., 1945, Cyanosis in infants caused by nitrates in well water: American Medical Association Journal, v. 129, no. 2, p. 112-116.

Durfor, C. N., and Becker, Edith, 1964, Public water supplies of the 100 largest cities in the United States, 1962: U.S. Geological Survey Water-Supply Paper 1812, 364 p.

Federal Water Pollution Control Administration, 1968, Report of the committee on the water-quality criteria: Washington, U.S. Government Printing Office, 234 p.

Geological Society of America, 1963, Rock-color chart: New York, Geological Society of America.

Hamilton, T. M., 1970, Groundwater flow in part of the Little Missouri River basin, North Dakota: Unpublished Doctor of Philosophy thesis, University of North Dakota, 179 p.

Hem, J. D., 1970, Study and interpretation of the chemical characteristics of natural water (2d ed.): U.S. Geological Survey Water-Supply Paper 1473, 363 p.

Hobba, W. A., Jr., and others, 1977, Geochemical and hydrologic data for wells and springs in thermal spring areas of the Appalachians: U.S. Geological Survey Water-Resources Investigations 7725.

Johnson, A. I., 1963, Application of laboratory permeability data: U.S. Geological Survey Open-File Report, 33 p.

Maxey, K. F., 1950, Report on the relation of nitrate concentration in well waters to the occurrence of methemoglobinemia: National Research Council Bulletin, Sanitary Engineering and Environment, p. 265-271, appendix D.

National Academy of Sciences-National Academy of Engineering, 1972 (1973), Water quality criteria 1972: U.S. Environmental Protection Agency, Ecological Research Series, Report EPA R3-073-033, March 1973, 594 p.

North Dakota State Department of Health, 1962, The low sodium diet in cardiovascular and renal disease: Sodium content of municipal waters in North Dakota: 12 p.

_____1964, Chemical analyses of municipal waters in North Dakota: 25 p.

_____1970, Water quality standards for surface waters of North Dakota: 45 p.

_____1977, Regulations for public water supply systems of the State of North Dakota: Regulation 61-28.1-02, 18 p.

Riggs, H. C., 1972, Low-flow investigations: Techniques of Water-Resources Investigations of the U.S. Geological Survey, book 4, chapter B1, 18 p.

Robinove, C. J., Langford, R. H., and Brookhart, J. W., 1958, Saline-water resources of North Dakota: U.S. Geological Survey Water-Supply Paper 1428, 72 p.

Schroer, F. W., 1970, A study of the effect of water quality and management on the physical and chemical properties of selected soils under irrigation: North Dakota Water Resources Research Institute Report no. WI-221-007-70, FCST:III-C, 48 p.

Simpson, H. E., 1929, Geology and ground-water resources of North Dakota, with a discussion of the chemical character of the water, by H. B. Riffenburg: U.S. Geological Survey Water-Supply Paper 598, 312 p.

U.S. Public Health Service, 1962, Public Health Service drinking water standards, 1962: U.S. Public Health Service Publication 956, 61 p.

U.S. Salinity Laboratory Staff, 1954, Diagnosis and improvement of saline and alkali soils: U.S. Department of Agriculture, Agriculture Handbook no. 60, 160 p.

Wentworth, C. K., 1922, A scale of grade and class terms for clastic sediments: Journal of Geology, v. 30, p. 377-392.

TABLE 1.--Records of wells, test holes, springs, and miscellaneous data-collection sites

Owner

Arneson, 1-57, Oil and gas test holes are included that may provide data for the understanding of shallow aquifer systems. Logs are available from the North Dakota Geological Survey.

HCGA, Horse Creek Grazing Association

NDSHD, North Dakota State Highway Department

NDSHS, North Dakota State Historical Society

NDSWC 4905, North Dakota State Water Commission, test hole number 4905

USFS, United States Forest Service

USGS, United States Geological Survey auger hole

USNPS, United States National Park Service

Water level (feet)

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

D, dry
F, well flows
R, recently pumped

Use of water

H, domestic
P, public supply
S, stock supply
T, institutional
U, unused

Principal aquifer

110, Quaternary
125, Paleocene
211, Upper Cretaceous

HCFH, lower Hell Creek and Fox Hills aquifer
LHCK, lower Ludlow and upper Hell Creek aquifer
QRNR, alluvium
SNLB, Sentinel Butte aquifer
TRVL, lower Tongue River and upper Ludlow aquifer

Specific conductance

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

Altitude of land surface (feet)

National Geodetic Vertical Datum of 1929 (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 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)
133-098-05BD	ARNESON, 1-57	5316	--	--	--	10/28/1968	--		--	U	--	--	--	2765
133-098-06CA	ARNESUN, 1-58	5365	--	--	--	11/07/1968	--		--	U	--	--	--	2761
133-098-06DCC	EVANS, CHARLES	340	338	--	4	05/15/1968	--		--	S	125TRVL	2280	14.0	--
133-098-14AAA	MEGNEN, ART	--	860	--	--	--	190.00		07/22/1975	S,H	125LMCK	2200	16.0	2790
133-098-18DDD	SCHAAR, ROY	95	95	--	4	10/ /1955	50.00		10/ /1955	S	125TRVL	2600	7.0	--
133-098-19DDB	MEKVOLD, OSCAR	65	60	--	5.18	05/29/1946	50.00		05/29/1946	S,H	125TRVL	2700	10.0	--
133-098-20CBC	SCHAAR, ROBERT	94	91	--	6	06/23/1950	54.00		06/23/1950	S	125TRVL	1870	14.0	--
133-098-29BAC	K.SCHAAR, 1	5107	--	--	--	07/23/1968	--		--	U	--	--	--	2736
133-098-32BCA	SCHAAR, FREDRICK	108	106	--	5	07/23/1949	76.00		07/23/1949	S	125TRVL	2800	11.0	--
133-099-02CBB	PIENCE, FLOYD	1404	1404	1364	4.50	07/29/1974	251.00		07/29/1974	S,H	211MCFH	1920	13.0	--
133-099-04BCB	MISTLEBERGER, LEO	95	--	--	--	01/01/1930	--		--	--	125TRVL	--	--	--
133-099-05DCA	PICHLER, ANNA	55	55	--	5	--	36.00		--	U	125TRVL	--	--	--
133-099-06CC	SWANSON, 1-54	5415	--	--	--	10/11/1968	--		--	U	--	--	--	--
133-099-11DD	TESKE, 1-14-11	5340	--	--	--	08/12/1968	--		--	U	--	--	--	2802
133-099-12AC	OBERFOELL, 1-60	5310	--	--	--	12/06/1968	--		--	--	--	--	--	2713
133-099-19DD	DILSE, 1-45	5370	--	--	--	09/22/1968	--		--	U	--	--	--	3150
133-099-20ADA	FLAIZ, HAZEL	215	210	--	4	1963	91.00		1963	S,H	125TRVL	2290	10.5	--
133-099-30CA	DILSE, 1-50	5360	--	--	--	10/13/1968	--		--	U	--	--	--	2862
133-099-32BBA	DILSE, FRANK	1252	1252	--	--	06/30/1972	251.00		08/24/1974	S,H	211MCFH	1830	--	2871
133-100-08ADA	OLSON, RUSSEL	103	74	--	4.50	09/ /1973	65.00		09/ /1973	S,H	125TRVL	2510	13.0	3003
133-100-19AD	BRAUN, 1-16-15	5479	--	--	--	08/03/1968	--		--	--	--	--	--	2970
133-101-06CBA	BROOKS, EUGENE	80	45	25	4	1974	20.00		1974	S	125TRVL	600	9.0	--
133-101-09CDD	USGS	82	64	--	--	06/04/1976	--		--	--	125TRVL	510	14.0	2915
133-101-11DCC	NDSWC 4905	220	--	--	--	05/18/1976	--		--	--	--	--	--	2980
133-101-15BAA	USGS	112	--	--	--	06/04/1976	--		--	--	--	--	--	2933
133-101-15DCD	USGS	112	104	98	2	06/07/1976	44.66	R	11/09/1976	U	--	--	--	2920
133-101-16BBC	BROOKS, HAROLD	105	94	72	4.50	06/01/1972	35.00		06/01/1972	S	125TRVL	--	--	--
133-101-17ABB	USGS	77	65	53	2	06/08/1976	25.84	R	11/09/1976	U	125TRVL	2300	9.0	2897
133-101-19DCC	USGS	112	101	--	--	06/03/1976	--		--	--	125TRVL	4000	13.0	2940
133-101-28ABB	USGS	77	--	--	--	06/03/1976	--		--	--	--	--	--	2925
133-101-29ABB	USGS	52	--	--	--	06/03/1976	--		--	--	--	--	--	2890
133-101-30BBB	FULSKE, ROBERT	280	260	--	4	05/17/1973	90.00		05/17/1973	S	125TRVL	--	--	--
133-101-32AD	CONSOLIDATED COAL, 1-32	5425	--	--	--	09/03/1968	--		--	--	--	--	--	2961
133-101-34DAA	FREITAG, GERALD	420	407	365	1.25	01/29/1974	70.00		01/29/1974	S	125TRVL	1900	13.0	--
133-101-35DDB	FREITAG, GERALD	640	599	--	4.50	10/05/1972	190.00		10/05/1972	S	125LMCK	--	--	2965
133-103-17DCA	FISCHER, EUGENE	300	268	220	4.50	05/11/1974	120.00		05/11/1974	S	125TRVL	--	--	2970
133-103-17DCC	FISCHER, EUGENE	512	--	--	--	06/28/1960	--		--	U	--	--	--	3000
133-103-23BDC	GETZ, JOHN	671	671	634	4	07/30/1961	140.00		07/30/1961	S	211MCFH	1600	11.0	2910
133-103-26BC	SILBERNAGEL, 1-17-23	5223	--	--	--	07/31/1968	--		--	--	--	--	--	2980
133-103-29ACC	LONG, BURTON	240	240	220	4	04/10/1974	--		--	S	125TRVL	--	--	3040

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133-104-10BCC	SUNDEN, ARTHUR	199	137	--	4	09/15/1961	100.00	09/15/1961	S	125TRVL	650	9.0	3065
133-104-15CBB	HENDRY, HARRY	144	110	--	4	08/30/1961	80.00	08/30/1961	U	125TRVL	--	--	3140
133-104-18AA	GUV'T J. COLE, 1-18-25	5168	--	--	--	08/22/1968	--	--	--	--	--	--	3080
133-104-22BDC	SWENSON, JOEL	280	278	188	4	11/27/1972	120.00	11/27/1972	S	--	--	--	2950
133-104-24BBB	HANDE, DALE	270	270	255	4	11/17/1972	190.00	11/17/1972	S	--	2600	11.0	3130
133-105-07ADC	USGS LM-42	28	--	--	--	04/20/1956	--	--	U	--	--	--	2686
133-105-07DBD	USGS LM-41	33	--	--	--	04/20/1956	--	--	U	--	--	--	2688
133-105-07DCA	USGS LM-40	33	--	--	--	04/20/1956	--	--	U	--	--	--	2688
133-105-30CCC	MARMARTH	--	215	--	--	--	--	--	P	211MCFH	2570	14.0	2710
133-105-31BAA	MARMARTH	--	270	--	--	--	--	--	P	211MCFH	--	--	2708
133-106-13AUB1	NDSWC 5139	382	--	--	--	07/06/1977	--	--	U	--	--	--	2750
133-106-13AUB2	NDSWC 5139A	230	229	223	1.25	07/06/1977	42.04	10/13/1977	U	211MCFH	2400	11.0	2750
133-106-13AUB3	NDSWC 5139B	96	94	88	1.25	07/06/1977	63.94	10/13/1977	U	211MCFH	--	--	2750
133-106-23DC	LYDIA FOREMAN, 1	9416	--	--	--	06/22/1963	--	--	--	--	--	--	--
133-106-25CBB	RANKIN, GEORGE	237	237	--	--	--	130.00	--	S	211MCFH	3500	10.5	2755
133-106-29DD	FLUR, 1	4550	--	--	--	10/30/1968	--	--	--	--	--	--	2840
133-106-34AAA	SUNSALLA, JOSEPH	--	120	--	1.25	--		F --	S	--	2200	11.0	2750
133-106-34BAA	NDSWC 4809	280	104	98	1.25	07/08/1975	3.00+	07/08/1975	U	211MCFH	1950	8.5	2750
134-098-06DDA1	GUSSEY, WILLIAM	33	33	--	5	04/09/1951	17.00	04/09/1951	--	125TRVL	--	--	--
134-098-06DDA2	GUSSEY, WILLIAM	230	230	--	4	12/23/1959	90.00	--	S,H	125TRVL	2090	9.0	--
134-098-10BAA	OLSON, CHARLES	220	220	168	4	01/17/1973	120.00	01/17/1973	H,S	125SNLB	1450	12.0	2805
134-098-11AA	BAKKE, 1-42	5450	--	--	--	10/22/1968	--	--	--	--	--	--	2727
134-098-13ADD	ERICKSON, ORLIN	201	--	--	--	--	--	--	--	--	--	--	--
134-098-14BBC	BRATTEN, KNUTE	161	160	140	4	07/17/1972	54.00	--	H,S	125SNLB	2000	22.0	2772
134-098-17BA	WILLIAM GRAETZ, 1	5275	--	--	--	08/13/1968	--	--	--	--	--	--	2774
134-098-18BAA	MING, RAY	58	58	--	5	07/11/1940	28.00	07/11/1940	--	125SNLB	--	--	--
134-098-22AD	RUSTAN, 1-19-13	5400	--	--	--	08/08/1968	--	--	--	--	--	--	2746
134-098-26DAD	GATZKE, ALMA	72	72	--	5	1935	57.00	1935	S	125TRVL	--	--	--
134-098-26DAC	KLEIN, JOHN	101	101	--	4	01/01/1936	40.00	--	U	125TRVL	--	--	--
134-098-29DAD	CHRISTIANSON, GLENN	200	200	128	4	01/01/1960	45.00	--	S	125TRVL	--	--	--
134-098-30CA	WELLSANDT, 1-52	5395	--	--	--	10/04/1968	--	--	--	--	--	--	2732
134-098-31DA	OVERBO, 1-51	5350	--	--	--	10/16/1968	--	--	--	--	--	--	2778
134-098-33BCC	CHRISTIANSON, GLENN	200	200	--	4	01/01/1971	--	--	S	125TRVL	2190	10.0	--
134-099-02AA	STUCKERT, 1-34	5550	--	--	--	09/11/1968	--	--	--	--	--	--	--
134-099-08AAD	HANSON, HAROLD	155	155	--	5	12/ /1936	--	--	U	125SNLB	--	--	--
134-099-10DDD	STAFFORD, LAWRENCE	180	180	170	5	07/28/1973	63.00	07/28/1973	H	125SNLB	1500	14.0	2830
134-099-12AAA	GUSSEY, WILLIAM	36	36	--	4.50	01/01/1936	19.00	01/01/1936	--	125SNLB	--	--	2805
134-099-14BAD	FABER, ELMER	205	200	200	5	11/04/1949	180.00	11/04/1949	U	125SNLB	--	--	2805
134-099-18DDC	POWELL, GLENN	880	880	796	1.25	11/29/1972	350.00	11/29/1972	S	125LMCK	--	--	2900
134-099-21DCC	NDSWC 4946	560	411	399	2	08/06/1976	158.20	01/13/1977	U	125TRVL	1850	11.5	2885

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134-099-22CC	STUCKERT, 1-20-14	5500	--	--	--	08/19/1968	--	--	--	--	--	--	2814
134-099-27DAA	OLSON, GORDON	157	150	--	5	07/03/1952	107.00	07/03/1952	S,H	125TRVL	1450	13.5	2832
134-099-33ADD	OLSON, GERALD	123	123	--	5	01/01/1940	88.00	--	S,H	125TRVL	--	--	2825
134-099-35CC	PIERCE, 1-44	5450	--	--	--	09/12/1968	--	--	--	--	--	--	2743
134-100-07ADD1	NDSWC 5142	391	--	--	--	07/08/1977	--	--	U	--	--	--	2935
134-100-07ADD2	NDSWC 5142A	313	304	298	--	07/08/1977	--	--	U	125TRVL	1900	10.0	2935
134-100-10AAD	JACOBS, WALLACE	251	251	218	4	12/23/1960	110.00	12/23/1960	S,H	125SNLB	1700	12.0	2855
134-101-04DDD	NDSWC 4906	220	--	--	--	05/19/1976	--	--	--	--	--	--	2905
134-101-17DDD	NDSWC 4907	180	160	--	--	05/19/1976	--	--	--	125TRVL	975	10.0	2900
134-101-18ABB	USGS	77	75	--	--	06/08/1976	--	--	--	125TRVL	2100	10.0	2850
134-101-26AAA	RUEN, CHRISS	472	472	394	4	08/03/1961	--	--	U	125TRVL	--	--	--
134-101-35BCC	RUEN, CHRISS	184	184	142	4	10/15/1964	134.00	10/15/1964	S	125SNLB	690	11.5	--
134-101-35DD	RUEN, 1-13-12	5800	--	--	--	09/24/1968	--	--	--	--	--	--	3150
134-102-04CBC	SPETHMAN, CLARK	80	80	40	4.50	08/01/1972	22.00	08/01/1972	U	125TRVL	--	--	2700
134-102-12DDA	NDSWC 4947	292	286	280	1.25	08/06/1976	164.55	01/13/1977	U	125TRVL	5200	11.0	2845
134-102-27ACC	STUBER, URVILLE	222	222	--	--	05/07/1971	--	--	S	125TRVL	4500	11.0	2851
134-103-08AAA	NDSWC 4942	400	366	354	2	07/30/1976	163.30	01/13/1977	U	125TRVL	2200	12.0	2960
134-103-08BBC	NDSWC 4942A	40	--	--	--	07/30/1976	--	--	U	--	--	--	3030
134-103-23ABB	ATKINSON, ETHEL	341	341	317	5	06/19/1974	175.00	06/19/1974	S	125TRVL	1300	10.5	2940
134-103-25CCC	STUBER, ROBERT	230	230	209	4	08/28/1969	--	--	S	125TRVL	--	--	2870
134-103-28BDA	MEGGERS, DONALD	168	168	138	4	06/16/1960	--	--	H	125TRVL	2700	11.0	2950
134-103-30BB	USFS	--	500	--	--	--	--	--	S	125LMCK	2800	--	3100
134-103-34DB	GUY'T FUE, 1-37	5336	--	--	--	09/02/1968	--	--	--	--	--	--	2918
134-103-35ADD	MARTIAN, MICHAEL	144	117	--	4	06/30/1961	100.00	06/30/1961	U	125TRVL	--	--	2870
134-104-09ADD	ENGESSER, BERNARD	180	180	130	4	06/29/1966	--	--	S,H	125TRVL	1600	13.0	2885
134-104-24DDD1	NDSWC 4810	1300	1300	1260	4	07/21/1975	406.17	02/11/1976	U	211MCFM	1800	20.0	3090
134-104-24DDD2	NDSWC 4810A	60	--	--	--	--	--	--	--	--	--	--	3085
134-104-24DDD3	NDSWC 4810B	850	831	831	2	07/12/1977	396.20	09/07/1977	--	125LMCK	--	--	3087
134-104-24DDD4	NDSWC 4810C	196	196	190	1.25	07/12/1977	156.84	08/30/1977	U	125TRVL	--	--	3087
134-104-28DAA	NELSON, DUANE	203	151	147	4	08/31/1961	97.00	08/31/1961	U	125TRVL	--	--	3045
134-104-28DAC	NELSON, DUANE	157	118	--	4	05/16/1961	105.00	05/16/1961	U	125TRVL	--	--	3030
134-104-36AB	MEGGERS, 1-43	5510	--	--	--	09/09/1968	--	--	--	--	--	--	--
134-105-05AAA	CLARK, ELMER	--	98	--	1.25	1905	--	--	S,H	125LMCK	1690	14.0	2640
134-105-05BBB	USGS LM-47	48	--	--	--	04/22/1956	--	--	U	--	--	--	2636
134-105-07AAD	USGS LM-43	23	--	--	--	04/21/1956	--	--	U	--	--	--	2633
134-105-07ABC	USGS LM-45	28	--	--	--	04/21/1956	--	--	U	--	--	--	2635
134-105-07ABD	USGS LM-44	23	--	--	--	04/21/1956	--	--	U	--	--	--	2633
134-105-07BAC	USGS LM-46	23	--	--	--	04/21/1956	--	--	U	--	--	--	2638
134-105-09BAA	USFS	1336	463	--	4.50	06/22/1970	15.00	06/22/1970	S	211MCFM	1420	12.5	--
134-105-20AA	LUNG, 1-28-26	5273	--	--	--	07/17/1968	--	--	--	--	--	--	--

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134-105-21DD	GREEN FEDERAL, 1	10125	--	--	--	07/06/1964	--		--	--	--	--	--	2880
134-105-25ADD	RUE, GARY	95	95	44	4.50	12/20/1973	45.00		12/20/1973	S	125LMCK	3500	10.5	2950
134-105-26BAA	MENKE, ALLAN	536	536	445	4	01/17/1961	175.00		01/17/1961	H	211MCFH	1480	14.0	2650
134-106-01CCC	NDSWC 4929	220	--	--	--	07/15/1976	--		--	--	--	--	--	2852
134-106-04BB	GUY'T, 40	4962	--	--	--	08/24/1968	--		--	--	--	--	--	2850
134-106-27DBD	BRADAC, HENRY	100	100	60	4	07/05/1966	--		--	S	125LMCK	2800	10.5	2800
135-098-02DD	KIRSCHMAN, 1	8499	--	--	--	08/08/1971	--		--	--	--	--	--	2643
135-098-04CC	BRUSICH, 1	8665	--	--	--	10/17/1970	--		--	--	--	--	--	2700
135-098-08DD	BRUSICH, 1	11522	--	--	--	12/19/1952	--		--	--	--	--	--	2792
135-098-13ADD	ERICKSON, JAY	201	201	161	4	05/24/1972	48.00		05/24/1972	S,H	125SNLB	1700	12.0	--
135-098-14CBC	MAIXNER, WILLIAM	140	140	110	4	09/01/1972	68.00		--	H	125TRVL	1410	16.0	2765
135-098-20AC	BENZ, 1	8974	--	--	--	11/01/1953	--		--	--	--	--	--	--
135-098-22BDA	MAIXNER, RICHARD	141	141	125	4	02/20/1970	115.00		--	H	125SNLB	2000	20.0	2798
135-098-32DAD1	SCHNEIDER, FRANK	--	62	--	--	1907	--		--	S,H	125SNLB	4010	8.0	2885
135-098-32DAD2	SCHNEIDER, FRANK	270	177	160	4	1951	--		--	U	125SNLB	--	--	2885
135-099-01DDD1	LENHARDT, NICK	430	430	418	4	05/23/1972	--		--	S	125TRVL	2400	15.0	2820
135-099-01DDD2	LENHARDT, NICK	1104	902	837	4	02/28/1973	395.00		02/28/1973	S	125TRVL	2390	--	2820
135-099-07CC	GATZKE, 1-36	5530	--	--	--	09/22/1968	--		--	--	--	--	--	2734
135-099-14DAD	BUCK, RICHARD	110	110	80	4	07/18/1973	40.00		07/18/1973	S	125SNLB	1800	10.0	2915
135-099-15CDA	HOFFAKER, HENRY	554	546	--	4	11/04/1968	192.00		11/04/1968	U	--	--	--	2810
135-099-32AA	HAAGENSTAD, 1-35	5477	--	--	--	08/31/1968	--		--	--	--	--	--	2784
135-100-16CC	BISMARCK, 1-A	9024	--	--	--	08/11/1957	--		--	--	--	--	--	2796
135-101-09DD	HAMANN ESTATE, 1	8763	--	--	--	01/09/1961	--		--	--	--	--	--	2782
135-101-15ACC	JJJ RANCH	300	298	208	4.50	07/28/1972	120.00		07/26/1972	S	--	--	--	--
135-101-16CBA	JJJ RANCH	180	167	98	4.50	07/26/1972	80.00		07/26/1972	S	125SNLB	2050	11.0	--
135-101-26BAA	KATHREIN, JACK	1280	1082	--	4	10/18/1966	342.00		10/18/1966	S,H	125LMCK	2000	--	2929
135-101-32BAA	USGS	92	--	--	--	05/19/1976	--		--	--	--	--	--	2775
135-101-33CBC	USGS	97	--	--	--	06/07/1976	--		--	--	--	--	--	2780
135-102-03CDB	KLEWIN, ALFRED	955	945	905	1.25	05/15/1964	23.20+		09/22/1976	S	211MCFH	1780	17.5	2560
135-102-07BDD	M T ENTERPRISES	390	390	--	--	07/15/1975	--		--	S	125TRVL	--	--	2694
135-102-08DAA	USFS	245	245	--	4	06/20/1967	--		--	S	125TRVL	2630	12.0	2736
135-102-16CBA	M T ENTERPRISES	220	220	--	4	08/08/1968	--		--	U	125TRVL	--	--	2700
135-102-19CCC	M T ENTERPRISES	280	263	248	2	09/19/1967	120.00		09/19/1967	S	125TRVL	1500	12.0	2740
135-102-19DAA	M T ENTERPRISES	1080	1080	1040	2	04/15/1975	3.20+		09/22/1976	H	211MCFH	1910	20.0	2620
135-102-19DCC	M T ENTERPRISES	320	302	--	1.25	10/24/1966		F	--	S	125LMCK	1300	11.0	2650
135-102-22CCC	LAMBOURN, BRUCE	220	217	196	--	06/21/1973	80.00		06/21/1973	S	125TRVL	2900	12.5	2745
135-102-27ACC	HILL, WILLIAM	240	185	--	4.50	07/01/1972	--		--	S	125TRVL	1850	12.0	2745
135-102-27BBB	HILL, WILLIAM	240	185	175	4	07/28/1973	128.00		07/28/1973	U	125TRVL	--	--	2760
135-102-29BCA	M T ENTERPRISES	320	320	--	--	10/13/1966		F	--	S	125LMCK	1430	11.0	--
135-103-12AA	GUY'T & WYCKOFF, 1-29-24	5360	--	--	--	08/07/1968	--		--	--	--	--	--	2680

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135-103-17DDB	WOLFGNAM, ALDEN	425	386	--	4	09/03/1961	--		--	U	125TRVL	--	--	2880
135-103-26DD	BERQUIST, 1-38	5330	--	--	--	09/19/1968	--		--	--	--	--	--	2750
135-104-06BDD1	NDSWC 5137	105	102	96	1.25	07/05/1977	11.35		10/13/1977	U	125TRVL	1530	10.0	2565
135-104-06BDD2	NDSWC 5137A	22	19	16	1.25	07/05/1977	--		--	U	110URNR	--	--	2565
135-104-06CAC	USGS LM-5	43	--	--	--	03/07/1956	--		--	U	--	--	--	2555
135-104-06CAD	NDSWC 5138	22	20	17	1.25	07/05/1977	--		--	U	110URNR	--	--	2565
135-104-19CDD	STRUM, GLENN	740	740	713	4	07/16/1975	200.00		--	S	211MCFM	1500	14.0	2820
135-104-20CC	DAVIS, 1-39	5350	--	--	--	09/02/1968	--		--	--	--	--	--	2838
135-105-15AAB	USGS LM-51	28	--	--	--	04/24/1956	--		--	U	--	--	--	2585
135-105-15AAD	USGS LM-52	23	--	--	--	04/24/1956	--		--	U	--	--	--	2585
135-105-21CC	GOV'T, 1-21-27	4974	--	--	--	07/26/1968	--		--	--	--	--	--	2657
135-105-28AAB	USGS LM-48	38	--	--	--	04/23/1956	--		--	U	--	--	--	2602
135-105-28ABD	USGS LM-49	18	--	--	--	04/23/1956	--		--	U	--	--	--	2602
135-105-28BAD	USGS LM-50	23	--	--	--	04/23/1956	--		--	U	--	--	--	2604
135-105-33ACB	NDSWC 5134	33	--	--	--	06/30/1977	--		--	--	--	--	--	2610
135-106-07ABC	MCGA	140	140	110	4	06/14/1974	65.00		06/14/1974	S	125LMCK	--	--	--
136-098-01BAA	NDSWC 4950	280	220	208	2	08/11/1976	134.53	R	11/09/1976	U	--	--	--	2765
136-098-05AAA	NDSWC 4951	220	207	195	2	08/11/1976	120.72	R	08/11/1976	U	--	--	--	2715
136-098-15AAA	NDSWC 4949	180	151	145	2	08/10/1976	77.85	R	11/09/1976	U	--	--	--	2670
136-098-15CBB	NDSWC 4946	120	--	--	--	08/10/1976	--		--	--	--	--	--	2610
136-098-23AAB	ZENKEN, WILMER	202	202	164	4	11/05/1970	60.00		11/05/1970	S	125TRVL	1600	11.0	2460
136-098-26CDC	O'CONNELL, MAURICE	140	140	98	5	09/11/1972	63.00		09/11/1972	S,H	125TRVL	3000	8.5	2625
136-098-31ABB	HEICK, JOSEPH	--	960	--	--	--	--		--	S,H	125LMCK	2070	14.0	--
136-098-33CCD	RANDICH, JOHN	120	120	75	4	05/24/1973	63.00		05/24/1973	S	125SNLB	2390	11.0	--
136-099-05AAD	GOV'T, 41-5	8044	--	--	--	10/22/1970	--		--	--	--	--	--	2706
136-099-07BC	SCHAEFFER-HECK, 1	8030	--	--	--	01/15/1973	--		--	--	--	--	--	2772
136-099-08ABB	SCHATZ, 8-2	7910	--	--	--	03/19/1973	--		--	--	--	--	--	2700
136-099-09AA	GARDNER, 41-9	7981	--	--	--	01/12/1970	--		--	--	--	--	--	2709
136-099-15ADD	NDSWC 4952	180	88	82	2	08/12/1976	40.03	R	11/09/1976	U	--	--	--	2700
136-099-18BA	GOV'T, 21-18	7966	--	--	--	12/15/1969	--		--	--	--	--	--	2700
136-099-20DDD	NDSWC 4953	180	116	110	2	08/12/1976	42.28	R	11/09/1976	U	--	--	--	2700
136-099-25AA	J P HEICK, 1	5338	--	--	--	08/07/1968	--		--	--	--	--	--	2667
136-099-26DAD	NDSWC 4945	600	534	523	2	08/05/1976	135.20		01/13/1977	U	125TRVL	2000	12.0	2640
136-099-31BCC	NDSWC 4956	160	135	129	2	08/13/1976	46.69	R	11/09/1976	U	--	--	--	2760
136-099-33DAA	NDSWC 4955	200	--	--	--	08/13/1976	--		--	--	--	--	--	2705
136-099-36CCC	NDSWC 4957	160	144	138	2	08/16/1976	57.30	R	11/09/1976	U	--	--	--	2705
136-100-02BB	HUNIE, 11X-2	8130	--	--	--	11/13/1970	--		--	--	--	--	--	2800
136-100-09CAD	--	415	--	--	--	--	--		--	--	--	--	--	--
136-100-12BB	SCHATZ, 1	7975	--	--	--	03/09/1972	--		--	--	--	--	--	2765
136-100-13AA	PETERSON, 41-13	7998	--	--	--	10/02/1970	--		--	--	--	--	--	2707

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136-100-17AAA	PETERSON, HOWARD	85	85	60	4	12/18/1972	43.00		12/18/1972	S	125SNLB	--	--	--
136-100-20CDC	USFS	80	80	55	4	09/16/1972	32.00		09/16/1972	S	125SNLB	1000	8.0	--
136-100-28BCB	SCHAEFFER, JOSEPH	1500	1394	1330	2	04/08/1971	230.00		06/06/1975	U	211MCFM	--	--	2820
136-100-31DDC1	NDSWC 4811	1725	1725	1388	4	07/22/1975	299.51		04/09/1976	U	211MCFM	1920	21.0	2870
136-100-31DDC2	NDSWC 4811A	650	642	630	2	07/11/1977	--		--	U	125LMCK	2950	10.0	2870
136-101-02ABC	PETRI, ROBERT	--	600	--	--	01/01/1969	18.50		07/02/1969	U	125TRVL	--	12.5	--
136-101-09CAD	USFS	415	415	410	5	03/20/1972	325.00		03/20/1972	S	125TRVL	1680	12.5	--
136-101-25ACC	AUSTIN, WILLIAM	515	515	512	4	02/18/1965	--		--	S	125TRVL	1550	13.5	--
136-101-29CBB	GERBIG, MORRIS	220	220	199	4	09/15/1972	122.00		09/15/1972	S	125TRVL	1450	12.0	--
136-101-32CCA	GERBIG, MORRIS	330	329	324	4	09/22/1972	197.00		09/22/1972	S	125TRVL	1600	13.5	--
136-102-05DBB	HANSON, ROBERT	--	960	--	--	1969	150.00		07/28/1969	S	125LMCK	1600	19.0	2671
136-102-07ABB	USFS	--	250	--	--	1969	7.80+		07/28/1969	S	125TRVL	1500	12.0	2455
136-102-08ACC	USFS	--	500	--	--	1969	23.10+		07/28/1969	S	125LMCK	1500	11.6	2428
136-102-08CAD	USGS LM-61	33	--	--	--	05/04/1956	--		--	U	--	--	--	2425
136-102-08CBD	HANSON, ROBERT	--	270	--	--	1969	8.10+		07/03/1969	S	125TRVL	1600	11.0	2431
136-102-08CDA	USGS LM-60	28	--	--	--	05/04/1956	--		--	U	--	--	--	2425
136-102-09DCC	HANSON, ROBERT	100	81	61	4.50	04/13/1973	15.00		04/13/1973	S	125TRVL	2750	8.5	2460
136-102-11BBB	HANSON, ROBERT	--	1060	--	--	--		F	--	S	211MCFM	1700	15.0	2410
136-102-11BCB	HANSON, ROBERT	--	300	--	--	--		F	--	S	125TRVL	1600	13.0	2430
136-102-11DAC	HANSON, ROBERT	--	1120	--	--	1969	40.60+		07/02/1969	S	211MCFM	1600	17.8	2460
136-102-12CCA	USFS	96	86	66	4	04/10/1964	43.79		08/20/1974	H	125TRVL	--	15.5	2460
136-102-12DAD	USFS	--	1100	--	--	1974		F	--	S	211MCFM	1790	20.0	2520
136-102-15ACC	USFS	1400	1091	1061	2.38	04/18/1973	1.15+		04/18/1973	S	211MCFM	1700	15.5	2560
136-102-16AB	STATE OF ND, 1-22-30	5223	--	--	--	08/26/1968	--		--	--	--	--	--	2490
136-102-17BDD	HANSON, ROBERT	--	500	--	--	1969	23.10+		07/03/1969	S,H	125LMCK	1410	20.0	2425
136-102-20BBD	HANSON, ROBERT	--	1120	--	--	1969	40.40+		11/06/1975	S	211MCFM	1550	18.0	2510
136-102-21DBD	HANSON, ROBERT	--	1100	--	--	1969	63.00+		07/03/1969	S	211MCFM	1610	17.0	2470
136-103-05CAC	USGS LM-58	22	--	--	--	04/26/1956	--		--	U	--	--	--	2478
136-103-05DAB	USGS LM-59	21	--	--	--	04/26/1956	--		--	U	--	--	--	2474
136-103-05DBC	USGS LM-57	28	--	--	--	04/26/1956	--		--	U	--	--	--	2476
136-103-09BBB	VAN DAELE, GEORGE	--	775	--	--	--		F	--	S,H	125LMCK	1500	15.0	2520
136-103-14ADA	HAFELE, KENNETH	--	840	--	--	1969	27.70+		07/03/1969	S	211MCFM	1650	15.5	2500
136-103-15CC	B. FAUST, 1-23-29	5449	--	--	--	08/15/1968	--		--	--	--	--	--	2600
136-103-18CDD	HAFELE, LOUIS	900	840	--	4.50	03/31/1973	80.00		03/31/1973	S	125LMCK	--	--	--
136-103-19CDC	JACOBSON, VERN	--	425	--	--	--	9.20+		07/03/1969	S	125LMCK	1600	13.0	2700
136-103-22BCB	KEMPENICH, CLARENCE	377	337	--	4	09/10/1961	--		--	S,H	125TRVL	1900	15.0	2720
136-103-22BCC	NDSWC 4943	400	316	310	1.25	08/03/1976	--		--	U	125TRVL	--	--	2775
136-103-23ADB	JACOBSON, VERN	1010	850	--	1.25	1969	11.50+		07/03/1969	S	211MCFM	1600	13.5	2570
136-103-24ABD	HAFELE, KENNETH	840	840	800	1.25	1969	40.40+		07/03/1969	S	211MCFM	1600	13.5	2494
136-103-24DAA	NDSWC 5144	132	132	126	1.25	07/15/1977	18.89		10/13/1977	U	125TRVL	1340	10.0	2460

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136-103-24DBA	NDSWC 5143	22	15	5	4	07/15/1977	9.39	10/15/1977	U	110WMNR	--	--	2460
136-103-24DCD	JACOBSON, VERN	--	310	--	--	1969	8.10+	07/03/1969	S	125TRVL	1490	10.5	2480
136-103-33CB	WOLFGRAM, 1-33	5626	--	--	--	09/27/1968	--	--	--	--	--	--	2885
136-104-08AA	JOHNSON, 1-24-16	5364	--	--	--	08/03/1968	--	--	--	--	--	--	2605
136-104-09AAB	USGS LM-56	23	--	--	--	04/25/1956	--	--	U	--	--	--	2500
136-104-09AAC	USGS LM-55	28	--	--	--	04/25/1956	--	--	U	--	--	--	2501
136-104-09ADB	USGS LM-54	33	--	--	--	04/25/1956	--	--	U	--	--	--	2504
136-104-09ADC	USGS LM-53	13	--	--	--	04/25/1956	--	--	U	--	--	--	2506
136-104-12BAD	WOJOHN, EDITH	1000	987	945	1.25	07/18/1972	27.10+	09/23/1976	S	211MCFH	1670	18.0	2550
136-104-26AB	DAVIS, 1-30-26	5530	--	--	--	09/09/1968	--	--	--	--	--	--	2850
136-104-30CAD	USGS LM-8	40	--	--	--	03/08/1956	--	--	U	--	--	--	2530
136-104-30CDD	USGS LM-14	28	--	--	--	03/09/1956	9.30	03/09/1956	U	--	--	--	2540
136-104-30DBD	USGS LM-7	28	--	--	--	03/08/1956	9.97	03/08/1956	U	--	--	--	2530
136-104-31AAA	USGS LM-9	28	--	--	--	03/09/1956	10.90	03/09/1956	U	--	--	--	2540
136-104-31ACC	USGS LM-12	28	--	--	--	03/09/1956	--	--	U	--	--	--	2540
136-104-31BAA	USGS LM-15	28	--	--	--	03/09/1956	--	--	U	--	--	--	2540
136-104-31BBU	USGS LM-13	18	--	--	--	03/09/1956	12.60	03/09/1956	U	--	--	--	2540
136-104-31DBC	USGS LM-11	33	--	--	--	03/09/1956	24.95	03/09/1956	U	--	--	--	2550
136-104-32DAA	USGS LM-10	33	--	--	--	03/09/1956	26.65	03/09/1956	S	--	--	--	2550
136-105-01AAD	REMILLONG, ROLAND	440	440	375	4	06/12/1973	180.00	06/12/1973	S	125LMCK	1550	12.5	2765
136-105-01BCC	REMILLONG, ROLAND	190	190	163	5.50	06/01/1964	--	--	S	125TRVL	5000	11.0	2765
136-105-02ADA	REMILLONG, ROLAND	300	300	258	4	06/28/1964	--	--	S,H	125TRVL	1760	11.5	2755
136-105-26ACA	NDSWC 4941	600	570	564	2	07/19/1976	68.04	01/13/1977	U	125LMCK	1800	12.0	2620
136-105-30AAC	NORTHRUP, MAX	151	150	100	4	09/01/1965	F	--	S	125LMCK	2400	13.0	2800
136-105-32CBB	NORTHRUP, MAX	130	130	90	1.25	09/09/1964	F	--	S	125LMCK	2000	10.0	2860
136-106-13AAC	USFS	180	180	150	4.50	07/09/1964	90.00	07/09/1964	S	125LMCK	--	--	2875
137-100-08ADD	GEARY, CECIL	--	35	--	18	01/01/1945	24.00	--	S,H	125SNLB	850	7.5	--
137-100-09DD	GOV'T-MCCAULEY, 2	8282	--	--	--	01/08/1962	--	--	--	--	--	--	2914
137-100-10CD	GOV'T-MCCAULEY, 1	8243	--	--	--	11/04/1961	--	--	--	--	--	--	2884
137-100-14CB	E.A.SMITH, 1	6362	--	--	--	03/12/1957	--	--	--	--	--	--	2821
137-100-15AB	LUCY FRITZ, 5	8215	--	--	--	07/18/1961	--	--	--	--	--	--	2882
137-100-15AD	FRITZ, 7	8150	--	--	--	09/23/1965	--	--	--	--	--	--	2841
137-100-15BB	LUCY FRITZ, 4	8278	--	--	--	06/27/1961	--	--	--	--	--	--	2898
137-100-15BD	FRITZ, 3	8275	--	--	--	12/26/1957	--	--	--	--	--	--	2900
137-100-15CB1	E.A.SMITH, 1	6363	--	--	--	03/12/1957	--	--	--	--	--	--	2821
137-100-15CB2	FRITZ, 6	8410	--	--	--	02/20/1963	--	--	--	--	--	--	2907
137-100-15DB	FRITZ, 2	8178	--	--	--	09/23/1957	--	--	--	--	--	--	2848
137-100-15DD	FRITZ, 1	9382	--	--	--	01/01/1957	--	--	--	--	--	--	2841
137-100-16AD	STATE, 1	8300	--	--	--	02/01/1958	--	--	--	--	--	--	2886
137-100-22AB	FRITZ, 1	8189	--	--	--	04/15/1958	--	--	--	--	--	--	2841

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137-100-22AD	FRITZ, 2-4222	8250	--	--	--	09/15/1965	--		--	--	--	--	--	2843
137-100-22CCC1	NDSWC 5141	342	--	--	--	07/07/1977	--		--	U	--	--	--	2945
137-100-22CCC2	NDSWC 5141A	302	302	296	2	07/07/1977	289.49		09/17/1977	U	125TRVL	--	--	2945
137-100-22CD	GOV'T-MCCAULEY, 1	8258	--	--	--	11/16/1958	--		--	--	--	--	--	2894
137-100-22DD	FRITZ, 3-4422	8312	--	--	--	06/21/1967	--		--	--	--	--	--	2882
137-100-23BB	GUST NDG, 1	8379	--	--	--	09/29/1957	--		--	--	--	--	--	2838
137-100-25DC	GUST NDG, 34-25	8170	--	--	--	11/16/1969	--		--	--	--	--	--	2824
137-100-27AB	AM LUTH CHURCH, 2-27	8250	--	--	--	04/07/1971	--		--	--	--	--	--	2898
137-100-35AA	AM LUTH CHURCH, 1-4135	8315	--	--	--	05/26/1970	--		--	--	--	--	--	2839
137-100-36AAC	STATE, 41X-36	8155	--	--	--	10/19/1969	--		--	--	--	--	--	2822
137-100-36BA	STATE, 21-36	8233	--	--	--	02/26/1970	--		--	--	--	--	--	2814
137-101-19BBD	USFS	--	580	--	--	1969	33.20+		09/09/1976	S	125LMCK	1800	14.5	2420
137-101-29CCA	GERBIG, MORRIS	--	865	--	--	1969	37.60+		09/10/1976	S	211MCFM	1600	17.5	2450
137-101-30ABC	GERBIG, MORRIS	1020	925	883	1.25	09/03/1966	112.00+		06/24/1969	S,H	211MCFM	1520	18.0	2415
137-101-30BBC	GERBIG, MORRIS	820	807	--	1.25	06/29/1967		F	--	S	211MCFM	1590	16.0	2393
137-101-30BBD	GERBIG, MORRIS	--	352	--	--	1969	11.50+		06/24/1969	S	125TRVL	1650	14.5	2392
137-101-32CCB	GERBIG, JOHN	--	585	--	--	1943	41.60+		07/02/1969	H	125LMCK	1600	14.0	2405
137-101-33CCA	GERBIG, JOHN	--	600	--	--	--	3.20+		09/10/1976	S	125LMCK	1600	11.0	2455
137-101-34ABA1	NDSWC 4944	360	355	343	2	08/04/1976	173.55		01/13/1977	U	125TRVL	1620	11.0	2600
137-101-34ABA2	NDSWC 5140	165	164	158	1.25	07/07/1977		U	09/15/1977	U	125TRVL	--	--	2600
137-101-34ABA3	NDSWC 5140A	130	128	122	1.25	07/07/1977	94.68		09/15/1977	U	125TRVL	--	--	2600
137-101-34CCA	HENDERS, W	--	685	--	--	--	5.80+		07/02/1969	S	125LMCK	1550	17.0	2480
137-102-03ACC	USGS LM-66	31	--	--	--	05/08/1956	--		--	U	--	--	--	2367
137-102-03BDA	USGS LM-67	43	--	--	--	05/08/1956	--		--	U	--	--	--	2367
137-102-03DBA	USGS LM-65	33	--	--	--	05/08/1956	--		--	U	--	--	--	2361
137-102-04DBA	PAASCH, DAVID	340	336	315	1.25	12/23/1972	32.20+		12/23/1972	S,H	125LMCK	1600	15.0	2362
137-102-06CBD	DRYBREAD, CHARLES	940	940	--	--	--		F	--	S	211MCFM	1600	18.5	2395
137-102-20BAA	GOV'T, 1	9125	--	--	--	07/27/1959	--		--	--	--	--	--	2707
137-102-24B	--	--	--	--	--	--	60.30+		09/09/1976	U	--	--	--	2440
137-102-25DAB	USGS LM-62	23	--	--	--	05/07/1956	--		--	U	--	--	--	2393
137-102-25DBA	USGS LM-63	28	--	--	--	05/07/1956	--		--	U	--	--	--	2392
137-102-25DBB	USGS LM-64	28	--	--	--	05/07/1956	--		--	U	--	--	--	2392
137-103-01ACA	MOSEPKA, ALBERT	--	550	--	--	--	5.40+		09/21/1976	S	125LMCK	1700	13.5	2395
137-103-09CCB	SCHMELING, LOUIS	90	90	40	1.25	06/05/1964		F	--	S	125TRVL	1550	10.0	2495
137-103-12BAB	MOSEPKA, ALBERT	--	950	--	--	--	97.40+		09/21/1976	S,H	211MCFM	1600	20.0	2415
137-104-02BCC	BABCOCK, HARVARD	135	135	100	4	11/22/1966	60.00		11/22/1966	U	125TRVL	--	--	2580
137-104-10ABB	SCHMELING, VULMET	230	230	--	1.25	05/15/1964	0.00		06/01/1976	S	125TRVL	1000	9.5	2610
137-104-27BAA	SCHERMAN, CHARLES	225	225	213	4	03/31/1964	--		--	S,H	125TRVL	2380	12.0	2765
137-104-29ADA	KNOPP, RICHARD	400	400	350	4.50	10/05/1964	170.00		10/05/1964	S,H	125LMCK	2050	12.0	2795
137-104-29CAC	--	120	--	--	--	--	--		--	--	--	--	--	--

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137-104-29DCB	KNOPP, RICHARD	120	120	90	4	11/05/1972	70.00		11/05/1972	S	--	--	--	2803
137-105-05DDD	NULL, GERALD	125	123	--	--	11/25/1966	60.00		11/25/1966	S	125TRVL	--	--	--
137-105-10ABB	BUSSERMAN, MEL	940	940	880	4	06/24/1974	160.00		06/24/1974	S,H	211MCFH	2020	17.0	2757
137-105-22DCB	BARTHEL, PAUL	140	140	55	4	05/01/1964	--		--	S	125TRVL	--	--	--
137-105-31BBB	HAMMOND, DONALD	63	63	40	4.50	12/01/1963	--		--	U	125TRVL	--	--	--
137-105-34AAB	WEINREIS, LLOYD	205	205	165	5	12/29/1972	80.00		12/29/1972	S	125TRVL	1730	10.0	--
137-105-36BBD	WISE, VIRGINIA	180	180	80	4	08/10/1965	70.00		08/10/1965	S	125TRVL	2300	11.0	2860
137-106-13AAA	HAMMOND, KIENZI	240	240	209	4.50	12/04/1963	--		--	S	125TRVL	--	--	--
137-106-14ACC	SCHULTE, JOHN	60	60	15	4	01/01/1900	9.00		01/01/1900	S	125TRVL	5000	8.5	--
138-100-03ABB	SMYPKOSKI, WILLIAM	520	470	--	4	01/18/1974	310.00		01/18/1974	S,H	125TRVL	1600	14.5	2710
138-100-06CAA	BANNMARI, RALPH	--	160	--	4	01/01/1970	17.00		--	S	125SNLB	7000	7.5	--
138-100-07AAA1	NUSMC 4921	1100	980	960	2	07/08/1976	141.70		01/13/1977	U	125LMCK	2250	13.0	2610
138-100-07AAA2	NUSMC 4921A	240	240	234	1.25	07/18/1977	176.22		11/16/1977	U	125TRVL	2080	10.0	2610
138-100-10CC	KEVIN-FEDERAL, 1	12272	--	--	--	02/04/1965	--		--	--	--	--	--	2801
138-100-28AAB	PAASCH, 1	9300	--	--	--	01/22/1971	--		--	--	--	--	--	2724
138-100-28ADD	FRITZ, JAMES	--	310	--	4	01/01/1960	--		--	S,H	125SNLB	1500	17.0	--
138-100-31DA	USA BLAYLOCK, 1	9300	--	--	--	11/19/1971	--		--	--	--	--	--	2852
138-100-34DD	SCHWARTZ, 1	9410	--	--	--	06/12/1955	--		--	--	--	--	--	2818
138-101-02BAC	NUSMC 4922	440	343	315	2	07/15/1976	159.87		01/13/1977	U	125TRVL	1700	12.0	2510
138-101-11DAB	USFS	105	105	--	4	06/02/1963	--		--	S	125TRVL	8000	10.5	--
138-101-19ACC	USFS	1450	1450	1408	1.25	09/26/1973	58.00		09/26/1973	S	211MCFH	1690	13.0	2560
138-101-24AA	FEDERAL, 1-24	9210	--	--	--	12/05/1964	--		--	--	--	--	--	2661
138-101-34AAB	GUNKEL, KARL	--	14	--	48	01/01/1911	--		--	S	125SNLB	--	--	--
138-101-34DDB	GRIFFIN, MEL	--	18	--	--	--	--		--	H	125SNLB	900	13.0	--
138-102-03BBC	STODE, AL	--	650	--	--	--	11.10+		07/02/1969	S	125LMCK	1850	12.5	2370
138-102-06ADD	MC CUICHAN, CHARLES	--	455	--	--	--		F	--	S,H	125LMCK	1900	15.0	2325
138-102-07CAC	CUNNELL, SID	--	500	--	--	--	19.90+		06/20/1969	S	125LMCK	1800	13.0	2345
138-102-08BBC	USFS	--	425	--	--	--		F	--	S	125LMCK	1900	15.0	2315
138-102-10AD	NU FEDERAL, A1	9302	--	--	--	07/20/1966	--		--	--	--	--	--	2517
138-102-18CBB	CUNNELL, SID	--	480	--	--	--	30.70+		06/20/1969	S,H	125LMCK	1900	14.5	2335
138-102-19ACD	VANVIG, MILFORD	--	478	--	--	--		F	--	S,H	125LMCK	1850	14.0	2340
138-102-19BAD	USGS LM-68	18	--	--	--	--	--		--	--	--	--	--	2331
138-102-19BDC	USGS LM-69	23	--	--	--	05/09/1956	--		--	U	--	--	--	2236
138-102-20ADA	USFS	--	777	--	--	--	28.90+		06/24/1969	S	125LMCK	--	15.0	2388
138-102-30CAB	RIPLEY, STANLEY	--	365	--	--	--	18.50+		06/20/1969	S,H	125TRVL	1650	14.0	2335
138-102-34CCB	PAASCH, KAY	1020	997	955	1.25	07/07/1972	89.80+		09/09/1976	S	211MCFH	--	--	2400
138-102-34DDA	PAASCH, KAY	1000	988	968	2	10/01/1961	69.00+		09/09/1976	S	211MCFH	1600	18.0	2435
138-103-04AAA	ULSTAD, HARMON	436	436	340	2	06/17/1968		F	--	S	125TRVL	1610	12.0	2455
138-103-08DCD	DIETZ, JOSEPH	325	325	290	4.50	05/08/1964	--		--	U	125TRVL	--	--	2675
138-103-13BAA	CUNNELL, SID	--	880	--	--	--	92.50+		09/20/1976	--	211MCFH	1620	--	2370

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138-103-25DBA	RIPLEY, STANLEY	--	405	--	--	--	4.00+		09/21/1976	S	125LMCK	--	14.0	2390
138-104-06DDC	CLARIN, ROBERT	102	102	70	5	06/30/1967	15.00		06/30/1967	U	125TRVL	--	--	2700
138-104-12BAD	DIETZ, JOSEPH	125	125	80	4.50	05/02/1964	--		--	U	125TRVL	--	--	2590
138-104-16CD	ND KANNENBERG, 1	9250	--	--	--	09/30/1968	--		--	--	--	--	--	2816
138-105-07CCD	NDSWC 4939	380	306	288	2	07/28/1976	118.53		01/13/1977	U	125TRVL	1900	12.0	2926
138-105-09CCC	AMERADA	197	197	140	7	08/04/1966	90.00		08/04/1966	--	125LMCK	--	--	--
138-105-33CAB	CURLY, GERALD	--	60	--	--	--	20.20+		09/04/1976	--	125TRVL	2640	9.0	2770
138-106-11AAA	NDSWC 4933	60	50	38	2	07/16/1976	28.48	R	11/08/1976	U	--	--	--	2887
138-106-25DDA	GULVA	1450	967	942	4	06/01/1970	315.00		--	P	211HCFH	1780	13.5	2819
139-100-02AB	KNUPIK-KEIS, 1	8384	--	--	--	10/04/1959	--		--	--	--	--	--	2658
139-100-04CD	LUGAN, 1	9455	--	--	--	10/09/1953	--		--	--	--	--	--	2775
139-100-04DD	JUUBERT, 1	9422	--	--	--	05/11/1954	--		--	--	--	--	--	2761
139-100-05DC	AMERADA-HPRR, 1L	--	--	--	--	02/07/1964	--		--	--	--	--	--	2839
139-100-06BB	GAMMYLUK UNIT, 1	--	--	--	--	01/09/1966	--		--	--	--	--	--	2747
139-100-07DB	LUGAN, 1	8310	--	--	--	06/02/1959	--		--	--	--	--	--	2708
139-100-08BB	LUGAN EATON, 1	8369	--	--	--	10/25/1963	--		--	--	--	--	--	2775
139-100-08DB	AMERADA EATON, 1	8435	--	--	--	11/02/1959	--		--	--	--	--	--	2816
139-100-09AB	MAY, 1	13333	--	--	--	09/14/1953	--		--	--	--	--	--	2761
139-100-09DB	MAY, 3	9435	--	--	--	04/14/1955	--		--	--	--	--	--	2778
139-100-10CB	FRANCHUK, 1	9407	--	--	--	12/17/1953	--		--	--	--	--	--	2747
139-100-12AD	DULETSKI, 1	8328	--	--	--	02/12/1967	--		--	--	--	--	--	2665
139-100-13BAA	WALTER, JOSEPH	--	40	--	--	--	--		--	H,S	125BNLB	3500	12.0	--
139-100-14CCC	NDSWC 5145	522	504	492	2	07/19/1977	298.55		09/22/1977	U	125TRVL	--	--	2695
139-100-15CB	SYMINUK, 1A	9356	--	--	--	11/24/1954	--		--	--	--	--	--	2732
139-100-16AB	MATIESON, 2	9393	--	--	--	03/05/1955	--		--	--	--	--	--	2742
139-100-16ABB	FRYBURG SCHOOL	--	480	--	7	01/01/1954	280.00		--	T	125TRVL	2000	23.0	2750
139-100-20ABB	HUNU, FLOYD	--	48	--	18	01/01/1972	32.00		--	H,S	125BNLB	3050	8.0	2740
139-100-22BBA	SYMINUK, 1	9476	--	--	--	03/15/1965	--		--	--	--	--	--	2755
139-101-01CB	UNIT, 7	8162	--	--	--	06/19/1962	--		--	--	--	--	--	2604
139-101-01CCB	USFS	580	--	--	--	1973	--		--	--	--	--	--	--
139-101-02A	UNIT, 9	9452	--	--	--	08/12/1964	--		--	--	--	--	--	2759
139-101-02CC	SCONIA UNIT, 2	9257	--	--	--	01/18/1958	--		--	--	--	--	--	2662
139-101-10AA	SCONIA UNIT, 1	9480	--	--	--	10/02/1957	--		--	--	--	--	--	2615
139-101-11CBA	USFS	560	550	520	5	10/02/1973	316.00		10/02/1973	U	125TRVL	--	--	--
139-101-12BB	USA-TUCKER, 2	8145	--	--	--	09/04/1964	--		--	--	--	--	--	2584
139-101-14BA	USA LOOMIS, 1	9461	--	--	--	05/04/1958	--		--	--	--	--	--	2545
139-101-14BDC1	O'CONNELL, MAURICE	--	300	--	--	--	97.00		07/12/1969	S	125TRVL	4000	10.0	2510
139-101-14BDC2	O'CONNELL, MAURICE	1555	1555	1513	2	08/25/1975	70.00		08/25/1975	S,H	211HCFH	--	--	2530
139-101-15CC	MURTON, 1	9144	--	--	--	01/26/1966	--		--	--	--	--	--	2515
139-101-16A	AMERADA ND-U, 1	9186	--	--	--	03/29/1964	--		--	--	--	--	--	2501

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139-101-17CAC	USA-17, 2	9152	--	--	--	08/17/1966	--		--	--	--	--	--	2538
139-101-17CDA	USFS	1290	1290	1255	2	09/01/1973	74.00		09/01/1973	S	125LHCK	1550	12.0	2520
139-101-18BB	USA, 1	9277	--	--	--	08/30/1964	--		--	--	--	--	--	2604
139-101-22BC	MARATHON-FED, 1	9224	--	--	--	05/15/1966	--		--	--	--	--	--	2601
139-101-31B	ND-FEDERAL, 1	9307	--	--	--	06/12/1966	--		--	--	--	--	--	2659
139-102-02DCA	HELLICKSON, LEON	--	1100	--	--	--	115.50+		06/23/1969	S,H	211MCFH	1650	17.0	2330
139-102-02DD	USA-HELLICKSON, 1	8935	--	--	--	12/24/1964	--		--	--	--	--	--	2344
139-102-03BAC	NDSWC 5123	35	22	19	1.25	06/22/1977	13.47		10/13/1977	U	110QRNR	1900	11.0	2300
139-102-03BCB1	NDSWC 5122	102	99	93	1.25	06/22/1977	4.81		10/13/1977	U	125TRVL	2100	10.5	2300
139-102-03BCB2	NDSWC 5122A	42	29	24	4	06/22/1977	15.52		10/15/1977	U	110QRNR	1500	9.0	2300
139-102-03BD	SCHAFER, 2	8960	--	--	--	04/21/1966	--		--	--	--	--	--	2293
139-102-04DAA	NDSWC 5121	60	--	--	--	06/21/1977	--		--	U	--	--	--	2300
139-102-10CAD	USGS LM-72	33	--	--	--	05/10/1956	--		--	U	--	--	--	2290
139-102-10DBD1	LUCHSINGER, FRED	460	460	420	1.25	10/18/1967	13.10+		09/08/1976	S	125LHCK	2000	12.5	2295
139-102-10DBD2	LUCHSINGER, FRED	--	600	--	--	--	22.60+		09/07/1968	H	125LHCK	1700	16.5	2335
139-102-10DD	FUCHS-LUCHSINGER, T	8910	--	--	--	01/26/1965	--		--	--	--	--	--	2306
139-102-11DD	AMERADA-NPRR, 1	9326	--	--	--	06/21/1964	--		--	--	--	--	--	2508
139-102-12CBD	MHMU, 241	7923	--	--	--	08/26/1972	--		--	--	--	--	--	2500
139-102-13BD	NP M TRACT 2, 1	9012	--	--	--	12/15/1964	--		--	--	--	--	--	2423
139-102-14DBD	USFS	--	1096	--	--	--	145.50+		06/23/1969	S	211MCFH	--	29.0	2340
139-102-17CAC1	BURKHARDT, ADOLPH	--	655	--	--	--	20.80+		06/18/1969	U	125LHCK	--	--	2365
139-102-17CAC2	BURKHARDT, ADOLPH	1125	1125	1054	1.25	07/25/1973	92.00+		07/25/1973	S,H	211MCFH	1700	17.0	2365
139-102-18ACA	BURKHARDT, ADOLPH	1200	1180	1120	1.25	08/15/1973	2.50+		11/06/1975	S	211MCFH	1690	16.5	2465
139-102-20ABB	MADZU, STEPHEN	460	460	420	5	09/13/1968	17.10+		09/20/1976	S	125LHCK	2160	14.0	2328
139-102-21CAB	HILD, JOSEPH	--	438	--	--	1935	34.60+		07/02/1969	S,H	125LHCK	1900	14.0	2302
139-102-22BA	ROBERTS, 1	8862	--	--	--	01/24/1966	--		--	--	--	--	--	2292
139-102-23DB	NP M TRACT, 2	9028	--	--	--	05/26/1965	--		--	--	--	--	--	2434
139-102-25BB	NP M TRACT, 1	9200	--	--	--	04/05/1966	--		--	--	--	--	--	2627
139-102-27BA	NP M TRACT, 1	9014	--	--	--	06/17/1966	--		--	--	--	--	--	2445
139-102-28BBB1	ROBERTS, LEO	--	274	--	--	--	17.30+		07/02/1969	S,H	125TRVL	--	13.0	2305
139-102-28BBB2	ROBERTS, LEO	--	170	--	--	--	9.20+		07/02/1969	S,H	125TRVL	2400	14.0	2303
139-102-28CBB	HILD, JOSEPH	--	170	--	--	--		F	--	S	125TRVL	2400	13.0	2313
139-102-29CAA	USGS LM-70	23	--	--	--	05/10/1956	--		--	U	--	--	--	2310
139-102-29DCC	USGS LM-71	28	--	--	--	05/10/1956	--		--	U	--	--	--	2310
139-102-32ADD	STUDE, AL	--	190	--	--	--	9.20+		07/02/1969	H	125TRVL	2400	18.0	2309
139-102-32DAB	STUDE, AL	--	200	--	--	--	11.50+		07/02/1969	S	125TRVL	2550	11.0	2305
139-102-33AAA	STUDE, AL	1320	720	--	1.25	--	30.50+		09/08/1976	S	125LHCK	1750	15.5	2370
139-102-33CBB	STUDE, AL	--	400	--	--	--	27.80+		09/08/1976	S	125LHCK	1950	12.5	2316
139-103-13ABB	USFS	--	1260	--	--	10/01/1974		F	--	S	--	1700	19.0	--
139-103-20ABB	KLEIN, GEORGE	--	240	--	--	--	--		--	S	125TRVL	4000	13.5	2720

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139-103-32DBB	NDSWC 4940	400	285	273	2	07/28/1976	64.03		01/13/1977	U	125TRVL	2700	10.0	2535
139-103-35AAC	NPRR, 41-35	9090	--	--	--	08/08/1958	--		--	--	--	--	--	2489
139-104-22ACA	DIETZ, JUSEPH	260	260	180	3.50	07/16/1964	160.00		07/16/1964	S	125TRVL	--	--	2800
139-104-22CDD	DIETZ, JUSEPH	220	220	190	5.50	07/13/1964	--		--	S,H	125TRVL	2920	11.0	2740
139-104-23BD	REINHOLZ, 1	9420	--	--	--	09/12/1967	--		--	--	--	--	--	2754
139-104-28BAB	THESTEN, BOYD	640	640	590	5	10/12/1972	250.00		10/12/1972	S,H	125TRVL	1700	13.5	2730
139-104-28BBA	THESTER, BOYD	--	535	--	--	--	--		--	S,H	125TRVL	2400	14.0	2730
139-104-31BDD	BUHN, TED	180	180	95	4.50	07/17/1965	90.00		07/17/1965	S	125TRVL	--	--	2840
139-105-01AAB	UECKERT, ALBERT	280	280	262	4	12/08/1966	190.00		12/08/1966	U	125TRVL	--	--	--
139-105-04AAC	SMITH, TERRY	150	150	135	5	09/13/1966	70.00		09/13/1966	H,S	125TRVL	2370	10.5	2790
139-105-13BBC	UECKERT, DARRELL	1200	1200	1020	3	05/10/1973	380.00		05/10/1973	S,H	211MCFM	1840	14.0	2831
139-105-19CBB	ORSTAD, OLAF	202	202	175	5	08/17/1967	100.00		08/17/1967	S,H	125TRVL	2900	7.0	--
139-105-29BBB	UECH, DARREL	134	134	110	6	11/27/1963	--		--	--	125TRVL	--	--	--
139-105-30CCD	NDSWC 4930	200	166	154	2	07/16/1976	42.37	R	11/08/1976	U	--	--	--	2879
139-105-30DDD	NDSWC 4938	780	728	716	2	07/27/1976	189.53		01/13/1977	U	125LMCK	5000	9.0	2870
139-106-01CCD	USGS	220	204	198	2	07/15/1976	63.37	R	11/08/1976	U	--	--	--	2852
139-106-27AAB	USGS	32	29	23	2	07/16/1976	13.45	R	11/08/1976	U	--	--	--	2833
140-100-04UD	USA, 1	9987	--	--	--	11/27/1960	--		--	--	--	--	--	2724
140-100-22C8	FEDERAL, 22-12	9655	--	--	--	10/17/1968	--		--	--	--	--	--	2754
140-100-28CAB	REDMOND, JERRY	1770	1770	--	2	01/07/1967	--		--	S	211MCFM	1670	12.0	2740
140-100-36AD	ND-LUFFELMACHER, 1	8601	--	--	--	12/26/1969	--		--	--	--	--	--	2711
140-101-32BCC	USFS	1320	1320	1300	1.25	10/15/1973		F	--	S	211MCFM	--	--	2420
140-101-32DAB	USFS	1490	1490	1440	1.25	12/17/1973	122.00		--	S	211MCFM	--	--	--
140-101-35DAD	USNPS	1930	1870	1800	7	06/ /1973	336.00		06/ /1973	H	211MCFM	1590	28.0	2770
140-102-01DBD1	NDSWC 1-1326	42	--	--	--	05/26/1963	--		--	U	--	--	--	2239
140-102-01DBD2	NDSWC 2-1326	42	--	--	--	05/26/1963	--		--	U	--	--	--	2238
140-102-06DCC	MEYERS, ROGER	--	1250	--	--	--	49.70+		08/29/1968	S,H	211MCFM	1750	14.0	2590
140-102-10DDA	USNPS	1233	1196	782	2.50	--	28.50+		07/01/1976	H	211MCFM	--	18.0	2345
140-102-11ADD	USNPS	425	424	--	--	--	21.00+		08/31/1976	H	125TRVL	--	14.5	2252
140-102-13AAD	USNPS	--	420	--	--	--	16.90+		08/28/1968	S,H	125TRVL	1800	11.5	2251
140-102-16DAA	USNPS	--	364	--	--	--		F	--	S	125TRVL	1750	14.0	2260
140-102-17CCA	USNPS	--	600	--	--	--	9.20+		06/16/1976	S	125LMCK	2050	12.5	2350
140-102-18DCC	USFS	--	1200	--	2	09/27/1968	42.92+		06/16/1976	S	211MCFM	1800	14.0	2380
140-102-19DDB	NDSWC 4923	337	190	172	2	07/14/1976	108.22		01/12/1977	U	125TRVL	1780	6.5	2380
140-102-22DBD	GOLD SEAL	1080	1050	1000	2.50	11/13/1976	124.80+		11/17/1976	P	211MCFM	1700	19.5	2260
140-102-22DCD	BACKMAN, DAHL	1045	1045	1002	3	05/01/1973	128.80+		05/01/1973	H	211MCFM	1720	22.0	2260
140-102-26ACC	MEDORA	--	1190	--	--	--	23.10+		09/18/1967	P	211MCFM	--	--	2387
140-102-26BBB	USNPS	1109	1040	--	8	1957	131.60+		--	P	211MCFM	--	--	2290
140-102-26BCA	MEDORA	1084	1080	960	4	05/14/1966	132.80+		09/06/1968	P	211MCFM	--	--	2285
140-102-26CAA	REDTAIL CAMPGROUND	660	660	639	1.25	06/27/1972	43.70+		06/27/1972	H	125LMCK	--	--	2290

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140-102-27ACB1	NDSHS	--	1120	--	--	--	110.90+		08/01/1969	H	211HCFH	1700	19.0	2275
140-102-27ACB2	NDSHS	--	950	--	--	--	127.00+		07/24/1969	H	125LHCK	--	14.5	2270
140-102-27BAD	BURKHARDT, ADOLPH	1060	1060	1000	1.25	08/27/1976	2.00+		08/27/1976	H	125LHCK	--	--	2350
140-102-28DDD	ANDERSON, BUD	500	500	440	1.25	09/26/1973	29.90+		09/26/1973	H,S	125TRVL	1840	14.0	2270
140-102-30CC	USA MELVIN, 1	9434	--	--	--	03/17/1969	--		--	--	--	--	--	2571
140-102-34AAD	HELLICKSON, H	--	1100	--	--	--	59.90+		07/02/1976	S	211HCFH	1700	20.0	2355
140-102-35CCC	USFS	--	450	--	--	--	10.70+		06/17/1976	S	125TRVL	1930	12.5	2300
140-103-02CDC	MEYERS, ROBERT	1455	1455	1415	1.25	07/11/1973	59.00		07/11/1973	S,H	211HCFH	1790	13.0	2505
140-103-05CCC	GEOPHYSICAL, WESTERN	200	--	--	--	--	--		--	U	125TRVL	--	--	2700
140-103-09DAB	USFS	1462	1445	1290	4	07/17/1967	185.00		07/17/1967	H	211HCFH	1780	17.5	2600
140-103-13AD	FEDERAL, 1	9436	--	--	--	12/16/1967	--		--	--	--	--	--	2545
140-103-16C	SHELL STATE, 1	9285	--	--	--	08/18/1969	--		--	--	--	--	--	2606
140-103-20CC	SHELL-USA, 14-20	9290	--	--	--	10/22/1967	--		--	--	--	--	--	2639
140-103-23BCB	OSTERHOUT, JERRY	175	174	150	4	11/18/1966	90.00		11/18/1966	S	125TRVL	2000	11.0	2458
140-103-24CB	OSTERHOUT, 1	9125	--	--	--	10/09/1971	--		--	--	--	--	--	2439
140-103-26AB	USA A, 1	9100	--	--	--	05/31/1972	--		--	--	--	--	--	2431
140-103-29DDD	USFS	142	142	120	5	09/27/1967	--		--	S	125TRVL	4800	10.0	2620
140-104-06BAA	UECKERT, DARREL	550	550	480	5	09/06/1966	310.00		09/06/1966	S	125TRVL	--	--	--
140-104-07DDA	LARDY, DONALD	260	260	120	5	05/24/1968	90.00		05/24/1968	U	125TRVL	--	--	--
140-104-12ADB	NDSHD	1400	1350	1268	--	05/02/1969	--		--	H	211HCFH	1670	13.5	2668
140-104-13DBA	KOJIC, WALTER	270	270	200	5	07/28/1964	160.00		07/28/1964	--	125TRVL	--	--	2690
140-104-15BBD	NDSHD	1400	1400	1351	4	05/01/1969	360.00		05/01/1969	H	211HCFH	1820	13.0	2742
140-104-18AAD	SMITH, HARRY	345	345	317	5	05/10/1968	150.00		05/10/1968	S	125TRVL	3600	9.0	--
140-104-19DDC	DIETZ, ED	230	230	170	5	09/12/1964	110.00		09/12/1964	S,H	125TRVL	2900	14.0	--
140-104-20CAB	DIETZ, DENNIS	280	280	215	5	06/27/1973	160.00		06/27/1973	S	125TRVL	2910	11.5	--
140-104-20CCD	WALDAHL, EINAR	165	165	134	4	04/11/1964	--		--	H	125TRVL	2900	9.0	--
140-104-27CBD	BUHN, OLIVE	190	190	150	4.50	07/24/1965	90.00		07/24/1965	S	125TRVL	4000	14.0	--
140-104-30ADD	DIETZ, HERMAN	295	295	230	5	09/05/1964	60.00		09/05/1964	H	125TRVL	--	--	--
140-104-32AAD	BUHN, TED	150	150	130	4.50	11/01/1963	--		--	S	125TRVL	--	--	--
140-105-07AAB	KUKOWSKI, ED	70	70	45	4	05/16/1968	25.00		05/16/1968	S	125TRVL	1500	8.5	2735
140-105-14ABA	HUME ON RANGE	1553	1553	1494	4	07/01/1975	417.00		07/01/1975	I	211HCFH	1890	22.0	2910
140-105-15DA	--	6750	--	--	--	--	--		--	--	--	--	--	--
140-105-25BBA	MUEN, PEARL	75	75	35	4	10/18/1966	15.00		10/18/1966	U	125TRVL	--	--	2770
140-105-30CCB	WAGNER, DUANE	80	80	50	4	11/21/1973	0.00		11/21/1973	S	125TRVL	4600	10.0	2760
140-105-30CCC1	NDSWC 5146	1400	1251	1239	2	07/22/1977	262.80		11/15/1977	U	211HCFH	2060	10.0	2770
140-105-30CCC2	NDSWC 5146A	700	684	672	2	07/22/1977	164.98		11/15/1977	U	125LHCK	--	--	2770
140-105-30CCC3	NDSWC 5146B	114	114	108	1.25	07/22/1977	2.05+		11/15/1977	U	125TRVL	1850	8.0	2770
140-106-01AAA	NDSWC 4934	440	354	336	2	07/20/1976	125.55		01/12/1977	U	125TRVL	2190	11.0	2710
140-106-14BAA	KUSS, ORVAL	240	240	202	5	03/26/1968	130.00		03/26/1968	S,H	125TRVL	--	--	--
140-106-14BBB	NDSWC 4924	260	207	195	2	07/14/1976	13.45	R	11/08/1976	U	--	--	--	2774

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140-106-15DDD	NDSHD	270	--	--	--	--	--	--	U	125TRVL	--	--	--
140-106-22AAA	NDSHD	240	--	--	--	--	--	--	U	125TRVL	--	--	--
140-106-23CDD	MATHAWAY, DONALD	185	120	100	5	04/15/1967	50.00	04/15/1967	H	125TRVL	--	--	--
140-106-24BCB	CARLSON, ROBERT	100	100	93	5	10/31/1964	60.00	10/31/1964	S	125TRVL	--	--	2780
140-106-25BCA	BEACH	150	150	126	8	01/16/1928	41.00	09/23/1945	P	125TRVL	--	--	2770
140-106-25BDD	BEACH	--	108	--	--	--	--	--	P	125TRVL	2090	11.5	2800
140-106-25CAC	BEACH	--	130	--	--	--	--	--	P	125TRVL	--	--	2810
140-106-25CBB1	BEACH	1380	1259	1157	6	09/ /1961	351.90	02/ /1962	P	211MCFM	--	--	2810
140-106-25CBB2	BEACH	--	94	--	--	--	--	--	P	125TRVL	--	--	2810
140-106-25CBB3	BEACH	120	110	90	10	08/28/1948	33.50	08/28/1948	P	125TRVL	--	--	2810
140-106-26ADC	WAGNER, DUANE	150	150	142	--	03/21/1966	80.00	03/21/1966	--	125TRVL	--	--	--
140-106-26DCD	BEACH	133	130	110	12	11/18/1958	27.00	11/18/1958	P	125TRVL	--	--	--
140-106-26DDC	BEACH	125	120	100	12	08/12/1958	41.00	08/12/1958	P	125TRVL	--	--	--
141-098-10BAC	BURESH, LUDWIG	30	30	--	4	07/16/1965	--	--	H	125SNLB	1550	9.0	2545
141-098-15AAA	NDSWC 4915	960	744	722	2	06/29/1976	289.12	01/12/1977	U	125TRVL	--	--	2560
141-098-23ADA	VOLESKY, ROBERT	580	580	560	5	03/18/1970	--	--	S,H	125TRVL	1900	14.5	2542
141-098-23ADD	VOLESKY, ROBERT	151	151	--	4	10/30/1964	--	--	U	125SNLB	--	--	2545
141-098-34BAA	VOLESKY, FLORIAN	--	30	--	--	01/01/1940	20.00	--	H	125SNLB	925	11.0	2610
141-099-04BAA	KLYM, JOHN	54	54	--	4	08/23/1965	--	--	H	125SNLB	860	13.0	2632
141-099-10DDD	WANNER, THURWALD	--	90	--	--	01/01/1962	--	--	H	125SNLB	1010	15.0	2640
141-099-18CDC	DEMANIUM, WILLIAM	--	14	--	--	01/01/1936	9.00	--	H	125SNLB	1650	17.0	2700
141-099-21DAA	DUERMANN, HAROLD	380	380	340	5	09/11/1972	247.00	09/11/1972	S,H	125TRVL	1770	14.0	2600
141-099-26DDC	REPETOWSKI, KENNETH	--	48	--	--	01/01/1965	--	--	S,H	125SNLB	3200	12.0	--
141-100-01DA	BURLINGTON RR, 1	10046	--	--	--	07/29/1972	--	--	--	--	--	--	2729
141-100-21AD	NPRR, 42-21	9720	--	--	--	06/15/1959	--	--	--	--	--	--	2652
141-100-30ACA	THOMPSON, VERN	--	1365	--	--	--		F --	S	211MCFM	1600	19.0	2380
141-100-34BA	MESA-FED-FUCE, 1-34	12635	--	--	--	02/07/1970	--	--	--	--	--	--	2580
141-100-34CBC	NDSWC 4913	660	508	490	2	06/21/1976	195.88	11/17/1976	U	125TRVL	1650	12.0	2475
141-101-02AAC	MESCHKE, DOROTHY	--	1300	--	--	--	34.60+	08/30/1969	S	211MCFM	1700	16.5	2355
141-101-02BBB	OMYUS, FLOYD	--	980	--	--	--	32.30+	08/30/1969	S	125LHCK	2020	19.0	2315
141-101-02BCA	OMYUS, FLOYD	--	300	--	--	--	105.10	08/30/1969	S	125TRVL	1700	16.5	2340
141-101-03AAB	OMYUS, FLOYD	--	--	--	--	--	71.50+	06/01/1976	--	211MCFM	--	--	2322
141-101-08AAD	TALKINGTON, HAROLD	1260	880	--	1.25	08/25/1970		F --	S	125TRVL	1600	21.0	--
141-101-21BCB	NORTH DAKOTA	--	1280	--	--	--	94.70+	09/20/1967	S	211MCFM	1700	11.0	2252
141-101-21CAC	MOSSEN, RALPH	1200	1200	1130	4	07/31/1963	59.40+	09/01/1976	S	211MCFM	1680	20.0	2270
141-101-26ACB	--	--	--	--	--	--	22.90+	09/01/1976	--	211MCFM	--	--	2370
141-102-02DDB	TESCHER, TED	1280	1280	1150	6	07/05/1973	66.50+	09/02/1976	S	211MCFM	1700	17.0	2260
141-103-17BBA	NDSWC 4937	510	414	402	2	07/22/1976	--	--	U	125TRVL	--	--	2595
141-104-05BBB1	NDSWC 5136	202	202	199	1.25	06/30/1977	--	--	U	125TRVL	2600	9.0	2655
141-104-05BBB2	NDSWC 5136A	47	40	--	1.25	06/30/1977	6.35	09/22/1977	U	125TRVL	--	--	2655

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141-104-31AAA	DAVIDSON, CHARLES	62	62	32	5	11/08/1972	17.00	11/08/1972	S	125TRVL	3010	9.0	--
141-105-05ADA	ROSS, ORVAL	34	34	10	4	11/07/1964	11.00	11/07/1964	U	125TRVL	--	--	2660
141-105-06DCC	ROSS, ORVAL	260	260	200	5.50	03/08/1968	140.00	03/08/1968	U	125TRVL	--	--	2750
141-105-26ADA	NISTLER, VINCENT	315	315	275	5	07/30/1973	170.00	07/30/1973	S,H	125TRVL	2590	10.5	2560
141-105-34CCC	LECHLER, GERALD	180	180	155	5	05/06/1967	60.00	05/06/1967	H	125TRVL	2450	15.5	2700
141-105-35CCC	LECHLER, FRANK	210	210	190	5	05/03/1967	110.00	05/03/1967	H,S	125TRVL	1910	10.0	2755
142-098-08CCC	SKURUPEY, ANTON	--	55	--	4	1965	37.00	--	H	125SNLB	540	8.0	2650
142-098-14DCC	HECKER, ANDREW	--	207	--	--	01/01/1957	70.00	--	S,H	125SNLB	2800	15.0	2525
142-098-33ADC1	OBRIGEWITCH, BEN	240	230	--	5	11/27/1971	--	--	U	125TRVL	--	--	2585
142-098-33ADC2	OBRIGEWITCH, BEN	38	38	--	24	11/10/1972	15.00	11/10/1972	U	125SNLB	--	--	2585
142-099-03DCC	BARANKO, EMIL	80	80	--	18	09/23/1973	44.00	09/23/1973	S	125SNLB	680	12.0	2535
142-099-10DDD	BARANKO, MICHAEL	54	54	--	18	07/30/1972	30.00	07/30/1972	H	125SNLB	565	15.0	2690
142-099-25ADD	ARMBRUST, JOSEPH	--	27	--	--	01/01/1950	3.00	--	S,H	125SNLB	1650	11.0	2645
142-099-30BAB	EVONIUK, STEVE	--	40	--	--	01/01/1959	15.00	--	S,H	125SNLB	2100	13.0	2662
142-100-01BDC	LOBOSZ, MATT	115	115	--	18	10/02/1972	90.00	10/02/1972	H	125SNLB	5230	12.0	2730
142-100-25DDA	NDSWC 4911	1500	1374	1344	2	06/11/1976	270.72	11/17/1976	U	125LMCK	2180	16.5	2650
142-101-01BDB1	KESSEL, PAUL	2000	1860	1818	--	02/07/1967	385.00	02/07/1967	S,H	211MCFH	1690	11.0	2720
142-101-01BDB2	KESSEL, PAUL	905	905	875	4	10/20/1964	--	--	U	125TRVL	--	--	2710
142-101-18BCC	NDSWC 4914	380	146	140	1.25	06/22/1976	--	--	U	125TRVL	--	--	2253
142-101-18CBB	NDSWC 5124	42	--	--	--	--	--	--	U	--	--	--	2250
142-101-18CBD1	NDSWC 5125	270	--	--	--	06/23/1977	--	--	U	--	--	--	2270
142-101-18CBD2	NDSWC 5125A	236	235	229	1.25	06/23/1977	68.22	11/15/1977	U	125TRVL	--	--	2270
142-101-31CDA	MESCHKE, GUS	--	444	--	--	--	28.90+	09/22/1967	S	125TRVL	--	12.5	2230
142-101-31DDA	MESCHKE, GUS	--	570	--	--	--	20.50+	06/31/1976	S	125TRVL	--	12.5	2230
142-101-33DBA	USFS	--	1333	--	--	--	2.30+	08/31/1976	S	211MCFH	2400	19.0	2320
142-102-04BCB	USFS	--	817	--	--	--	130.50+	08/30/1968	S	211MCFH	--	14.5	2230
142-102-12CCA	WOLF, GEORGE	--	430	--	--	--	F	--	S	125TRVL	2100	14.0	2189
142-102-25ADB	MYERS, WARREN	--	350	--	--	--	6.90+	09/23/1967	S	125TRVL	2150	12.0	2280
142-103-17DD	NPRR, 6	5891	--	--	--	10/19/1969	--	--	--	--	--	--	2587
142-103-24AA	SHELL-BROWN, 41-24-1	9830	--	--	--	06/05/1961	--	--	--	--	--	--	2675
142-103-25CAC	LUHMANN, MANULO	440	440	410	4	08/18/1973	300.00	08/18/1973	S	125TRVL	2300	12.5	2540
142-103-30ABC	BROWN, LLOYD	476	470	444	5	08/21/1972	295.00	08/21/1972	H	--	1950	12.5	2610
142-103-34ACA	NDSWC 5135	400	390	378	2	06/29/1977	159.35	09/22/1977	U	125TRVL	--	--	2480
142-104-04ADA	USFS	735	735	693	4	09/19/1972	262.00	09/19/1972	S	125TRVL	1850	13.5	2640
142-104-10ACC	NDSWC	1660	--	--	--	08/28/1974	--	--	U	211MCFH	--	--	2620
142-104-11CAC	HUDSON CO	250	250	190	4.50	--	80.00	--	S	125TRVL	--	--	--
142-104-22DD	DAILEY, 1	9610	--	--	--	08/05/1968	--	--	--	--	--	--	2582
142-105-07AAD	ABERNETHY, ROBERT	124	124	90	6	05/28/1967	60.00	05/28/1967	U	125TRVL	--	--	2540
142-105-12CAA	STEDMAN, EDMOND	120	120	102	5	05/26/1972	58.00	05/26/1972	S	125TRVL	--	--	2540
142-105-31AAB	FELDMANN, PAUL	225	225	204	4.50	11/06/1963	--	--	U	125TRVL	--	--	2640

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143-098-02DDD	SHYPKOSKI, MARY	67	67	--	4	09/23/1964	--		--	S	125SNLB	5500	8.0	2477
143-098-21DDB	KADRMAS, ALFRED	--	18	--	4	--	--		--	H	--	1470	16.5	2655
143-098-33CDC	GNESZ, FRANK	--	60	--	4	1965	--		--	H	--	1600	13.0	2675
143-099-01ADD	PALANIUK, BENARD	300	294	257	4.50	07/18/1975	180.00		07/18/1975	S	125TRVL	--	--	2510
143-099-08AAA	THOMPSON, ALLAN	220	141	--	4	09/15/1969	--		--	S	125SNLB	--	--	--
143-099-15BBA	NDSWC 5130	310	--	--	--	06/27/1977	--		--	U	--	--	--	2720
143-099-26BBD	MALKOWSKI, M.	--	40	--	--	01/01/1950	25.00		--	H	125SNLB	1220	11.0	2725
143-100-17DD	NW IMPROVEMENT, 1	6718	--	--	--	05/15/1954	--		--	--	--	--	--	2798
143-100-23BBC	CHURNUK, MARTHA	--	16	--	--	--	--		--	S,H	125SNLB	1650	8.5	--
143-100-25BBB	NDSWC 5129	220	--	--	--	06/27/1977	--		--	U	--	--	--	2650
143-100-26CCC	KANSKI, SAMUEL	--	104	--	4	01/01/1958	--		--	S,H	--	1650	10.0	2735
143-101-18ACC	GUV'T, 41X-18	9550	--	--	--	08/04/1968	--		--	--	--	--	--	2456
143-102-01BBD	CUNNELL, JACK	--	1250	--	--	--	50.80+		09/23/1967	S	211MCFH	1700	18.0	2235
143-102-09BCB	NDSWC 5128	20	15	12	1.25	06/24/1977	5.47		09/27/1977	U	110URNK	--	--	2125
143-102-09BCC1	NDSWC 5127	157	--	--	--	06/22/1977	--		--	U	125TRVL	--	--	2135
143-102-09BCC2	NDSWC 5127A	25	22	19	1.25	06/22/1977	18.18		09/27/1977	U	110URNK	2100	9.0	2135
143-102-09BCC3	NDSWC 5127B	90	88	82	1.25	06/22/1977	6.02		09/27/1977	U	125TRVL	--	--	2135
143-102-09CBB1	MUNSON, ELMER	--	525	--	--	--	27.70+		09/23/1967	S	125LMCK	2000	11.0	2150
143-102-09CBB2	NDSWC 5126	60	--	--	--	06/24/1977	--		--	--	--	--	--	2150
143-102-15ACD	USFS	--	400	--	--	--	34.00+		08/31/1976	S	125TRVL	2100	12.5	2160
143-102-21DDD	SHORT, CON	--	770	--	--	--	143.20+		08/30/1968	S	125LMCK	2300	15.0	2155
143-102-22BBA	MUSSER, DOUGLAS	--	400	--	--	--	10.40+		09/23/1968	S,H	125TRVL	2000	13.5	2150
143-102-24CCA	USFS	1370	1280	1240	1.25	--		F	--	S	211MCFH	2000	13.5	2220
143-102-26CCD	SHORT, CON	--	380	--	--	--	21.90+		08/30/1968	S,H	125TRVL	2200	11.5	2158
143-102-29AAD	USFS	--	1200	--	--	--	138.60+		08/30/1968	S	211MCFH	--	16.5	2195
143-102-34BBA	SHORT, CON	1120	1120	1040	6	09/27/1973	175.00+		09/02/1976	S	211MCFH	1800	12.0	2160
143-103-03AB	FEDERAL, 1	9328	--	--	--	06/20/1954	--		--	--	--	--	--	2353
143-103-14DBC	NDSWC 4936	640	446	434	2	07/22/1976	312.40		01/12/1977	U	125TRVL	2200	10.0	2540
143-103-22DD	BADLANDS, 1	9488	--	--	--	02/25/1958	--		--	--	--	--	--	2468
143-103-24CA	GOV'T-DOROUGH, 1	13374	--	--	--	03/03/1954	--		--	--	--	--	--	2502
143-104-15BCC	HUDSON CO	630	630	565	1.25	08/25/1964		F	--	S	125TRVL	--	--	--
143-104-21BB	JONES, 1	5490	--	--	--	03/04/1969	--		--	--	--	--	--	2446
143-104-23BBB	HUDSON CO	290	290	190	4	09/22/1966	60.00		09/22/1966	S	125TRVL	--	--	--
143-104-27CDC	HUDSON CO	350	350	296	5	09/26/1966	220.00		09/26/1966	S,H	125TRVL	1850	11.5	--
143-104-30ACC	HUDSON CO	122	122	--	4	08/03/1967	60.00		08/03/1967	S	125TRVL	2670	11.0	2425
143-105-08CBA	HULLAH, FRANCIS	830	820	716	1.25	1968	280.00		1968	S,H	125TRVL	1800	7.0	2670
143-105-17AA	NPRR, 8	6000	--	--	--	10/30/1969	--		--	--	--	--	--	2657
143-105-18BBA	HOLLAR, RONALD	415	415	385	4	03/28/1966	300.00		03/28/1966	S,H	125TRVL	1760	12.5	2710
143-105-26DD	UNION-JONES, 2-P-26	5500	--	--	--	02/26/1970	--		--	--	--	--	--	2510
143-105-33ACA1	NDSWC 5133	195	179	173	1.25	06/28/1977	9.79		11/14/1977	U	125TRVL	--	--	2395

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)
143-105-33ACA2	NDSWC 5133A	28	24	14	4	06/28/1977	17.39	09/20/1977	U	110QRNR	--	--	2395
143-105-33AC8	NDSWC 5134	33	27	24	1.25	06/29/1977	17.02	11/14/1977	U	110QRNR	--	--	2395
143-105-33BAA	NDSWC 4813	705	695	680	2	08/25/1975	42.92	10/08/1975	U	125LMCK	--	--	2385
143-105-33BAB	NDSWC 4812	1480	1177	1153	2	08/25/1975	45.48	02/10/1976	U	211MCFH	2050	16.5	2385
144-098-14DBA	KULISH, ERNEST	--	14	--	4	1960	10.00	--	S,H	125SNLB	1750	16.5	2500
144-098-34BBB	NDSWC 5131	180	--	--	--	06/27/1977	--	--	U	--	--	--	2450
144-099-10CCA1	PALANUK, WILLIAM	400	390	380	5	09/23/1969	270.00	09/23/1969	S,H	125TRVL	2800	12.0	2593
144-099-10CCA2	PALANUK, WILLIAM	2100	2065	2025	2.50	09/24/1966	378.00	09/24/1966	U	211MCFH	--	--	2568
144-099-14ABB	TACHENKO, S.C.	--	2106	2046	2.50	1967	300.00	--	S,H	211MCFH	1550	5.0	2690
144-099-15CA	PALANUK, 1	10121	--	--	--	10/08/1960	--	--	--	--	--	--	2715
144-099-21AA	HAAG, 1	10259	--	--	--	07/26/1960	--	--	--	--	--	--	2709
144-099-29AD	THOMPSON, 1	5012	--	--	--	02/06/1966	--	--	--	--	--	--	--
144-099-30AAB	TACHENKO RANCH, L.	--	100	--	--	--	--	--	S,H	125SNLB	3800	15.5	--
144-099-33AA	THOMPSON, 1	10219	--	--	--	01/07/1961	--	--	--	--	--	--	2704
144-100-09BC	NPRR, 1	10140	--	--	--	01/12/1961	--	--	--	--	--	--	2570
144-100-13DBD	LILLIBRIDGE, ROBERT	165	105	--	--	--	--	--	H	125SNLB	2950	9.5	2750
144-100-24BAC1	NDSWC 4912	930	800	782	2	06/16/1976	--	--	U	125TRVL	--	--	2670
144-100-24BAC2	NDSWC 5132	263	260	250	4	06/28/1977	--	--	U	125SNLB	--	--	2665
144-100-24BBD1	NDSWC 4814	2160	2160	1986	4	09/05/1975	395.56	04/07/1976	U	211MCFH	1720	20.5	2670
144-100-24BBD2	NDSWC 4815	1627	1624	1612	2	09/05/1975	400.30	02/10/1976	U	125LMCK	2400	10.0	2670
144-100-31AC	GOV'T-PACE, 1	9938	--	--	--	07/23/1955	--	--	--	--	--	--	2452
144-100-36DD	STATE, 1	10000	--	--	--	04/02/1966	--	--	--	--	--	--	2586
144-101-15BCC	NORTHRUP, WILLIS	1540	1540	1440	1.25	04/25/1968	--	--	S,H	211MCFH	1590	11.0	--
144-102-01BBC	USFS	1335	1335	1300	5	12/30/1971	--	--	S	211MCFH	--	--	2180
144-102-05CCB	GOLDSBERRY, HARRIS	760	760	700	1.25	07/21/1967		F --	S	125LMCK	2030	14.0	2116
144-102-05DBA	GOLDSBERRY, HARRIS	--	600	--	--	--	27.70+	07/09/1969	S,H	125LMCK	2050	14.5	2101
144-102-14DDD	SHELL-NP-GOV'T, 44-14	9550	--	--	--	06/28/1968	--	--	--	--	--	--	2329
144-102-16BBB	MOORE, RICHARD	--	600	--	--	--	26.00+	09/01/1976	S	125LMCK	1720	11.0	2118
144-102-16CCC	MOORE, RICHARD	--	500	--	--	--	18.50+	07/09/1969	S	125TRVL	2050	10.5	2240
144-102-24DDD	CONNELL, LES	820	820	--	1.25	--	87.00+	11/04/1975	S	125LMCK	1620	16.5	2200
144-102-27DCC	CONNELL, LES	1385	1280	--	1.25	09/11/1964	103.90+	09/23/1967	S,H	211MCFH	1800	17.0	2200
144-102-28ADC1	TESCHER, JAMES	--	375	--	--	--	13.90+	08/30/1968	S,H	125TRVL	2000	11.0	2142
144-102-28ADC2	TESCHER, JAMES	628	626	480	4	10/01/1960	73.90+	08/30/1968	H	125TRVL	1590	12.5	2142
144-102-28BBB	USFS	--	820	--	--	10/01/1960	--	--	S	125LMCK	1800	10.0	2411
144-102-29BBA	TESCHER, JAMES	--	1200	--	--	10/01/1960	39.30+	08/30/1968	S	211MCFH	--	18.5	2240
144-102-35CCB	CONNELL, LES	140	140	--	--	09/08/1964	35.80+	08/30/1968	S	211MCFH	--	--	2205
144-103-03BDA	HALL BROS	133	133	116	4	08/28/1968	--	--	S	125TRVL	2500	9.5	--
144-103-06DCC	HALL, DONALD	145	145	135	4	08/01/1968	22.00	08/01/1968	S	125TRVL	--	--	--
144-103-15DDC	HALL, WALLACE	45	45	--	4	08/30/1968	--	--	H	--	1750	10.0	2150

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)
144-103-17DD	NPRR, 3	5800	--	--	--	11/27/1969	--		--	--	--	--	--	2379
144-103-21BBB	HALL, DONALD	280	280	251	4	07/12/1960	142.00		07/12/1960	S	125TRVL	--	--	--
144-103-22CCD	HALL BROS	1280	1280	1239	4	--	89.40+		06/01/1976	S	211MCFH	1800	13.5	2220
144-103-22DBA	HALL BROS	596	596	--	4	--		F	--	S	125TRVL	1900	12.0	2220
144-103-23ABA	HALL, LORENA	785	764	739	4	07/22/1968	126.00		07/22/1968	S	125LMCK	2100	13.0	2360
144-104-06BCB	HALL, LEONARD	410	220	--	4	1962	171.00		--	H	125TRVL	4100	12.0	2425
144-104-07BBC	GASHO, ALLEN	475	475	402	4	09/24/1967	175.00		09/24/1967	U	125TRVL	--	--	--
144-104-10CCC	MUSSER, RICHARD	590	590	558	4	12/27/1967	--		--	S	125TRVL	1800	11.5	2575
144-104-19AA	NPRR, 9	5975	--	--	--	12/05/1969	--		--	--	--	--	--	2598
144-105-02CAA	SPERRY, KYLE	120	120	98	4	10/05/1961	83.00		10/05/1961	H,S	125TRVL	--	--	2330
144-105-03AAA	METCALF, DONALD	105	105	85	4	04/20/1966	60.00		04/20/1966	S	125TRVL	3500	9.5	2305
144-105-03BC	NPRR, 5	5773	--	--	--	11/18/1969	--		--	--	--	--	--	2330
144-105-07DBB	BRUNGARD, CONRAD	248	248	223	4	12/07/1965	150.00		12/07/1965	S	125TRVL	2000	11.0	2379
144-105-08DDD	TIBUR, ANDREW	350	350	300	4.50	07/23/1964	210.00		07/23/1964	S	125TRVL	2000	11.5	2447
144-105-25ADD	SCHIEFFER, HERMAN	480	480	420	5	10/10/1973	310.00		10/10/1973	S,H	125TRVL	1960	7.0	2590
144-105-29DD	NPRR, 2	5745	--	--	--	11/10/1969	--		--	--	--	--	--	2387
144-105-32CCA	EKKE, ALLEN	120	120	70	5	05/09/1974	60.00		05/09/1974	S	125TRVL	5010	9.5	2400
144-105-33BBB	NDSWC 4935A	60	--	--	--	07/20/1976	--		--	U	--	--	--	2405
144-105-33BBC	NDSWC 4935	500	374	368	2	07/21/1976	77.91		01/12/1977	U	125TRVL	1770	--	2360

LOCAL SPRING 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 @ 25°C)	TEMPERATURE (DEGREES C)	ALTITUDE OF LAND SURFACE (FEET)
138-102-23BBC	--	--	--	--	--	--	F	--	U	125TRVL	--	--	--
139-102-18DBD	--	--	--	--	--	--	F	--	U	125TRVL	--	--	--
139-102-19DDB	--	--	--	--	--	--	F	--	U	125TRVL	--	--	--
141-101-08BBD	--	--	--	--	--	--	F	--	U	125TRVL	--	--	--
141-101-19ACD	--	--	--	--	--	--	F	--	U	125TRVL	--	--	--
141-101-21BBC	--	--	--	--	--	--	F	--	U	125TRVL	--	--	--
144-100-16CD	--	--	--	--	--	--	F	--	S	125SNLB	4050	11.0	--
144-100-17CDD	--	--	--	--	--	--	F	--	U	125SNLB	1900	14.0	--
144-100-24BCD	--	--	--	--	--	--	F	--	U	125SNLB	799	9.0	--
MISCELLANEOUS DATA-COLLECTION SITES													
132-106-07A (Bowman Co.)	--	--	Surface water	--	--	--	--	--	--	--	--	--	--
133-098-21BAA	--	--	Surface water	--	--	--	--	--	--	--	--	--	--
133-105-30CDA	--	--	Surface water	--	--	--	--	--	--	--	--	--	--
135-097-03BAC (Hettinger Co.)	--	--	Surface water	--	--	--	--	--	--	--	--	--	--
135-100-24AAA	--	--	Surface water	--	--	--	--	--	--	--	--	--	--
136-100-14DDD	--	--	Surface water	--	--	--	--	--	--	--	--	--	--
136-102-16BDD	--	--	Surface water	--	--	--	--	--	--	--	--	--	--
136-103-24DDA	--	--	Surface water	--	--	--	--	--	--	--	--	--	--
140-102-01ACC	--	--	Surface water	--	--	--	--	--	--	--	--	--	--
140-102-11BDD	--	--	Surface water	--	--	--	--	--	--	--	--	--	--
140-102-15ACC	--	--	Surface water	--	--	--	--	--	--	--	--	--	--
140-102-27ABB	--	--	Surface water	--	--	--	--	--	--	--	--	--	--
141-098-13C	--	--	Surface water	--	--	--	--	--	--	--	--	--	--
141-101-06DAA	--	--	Surface water	--	--	--	--	--	--	--	--	--	--
142-102-12CDC	--	--	Surface water	--	--	--	--	--	--	--	--	--	--
144-102-05CBC	--	--	Surface water	--	--	--	--	--	--	--	--	--	--

TABLE 2.—Water levels in selected wells

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

133-106-13ADB2 MP is top of 1¼-inch plastic pipe 2.00 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Oct. 13, 1977.....	42.04	Dec. 6.....	41.94	Feb. 16, 1978.....	41.51

133-106-13ADB3 MP is top of 1¼-inch plastic pipe 1.50 ft above lsd.

Oct.	13, 1977.....	63.94	Dec.	5.....	63.71	Feb.	16, 1978.....	63.42

134-099-21DCC MP is top of 2-inch steel pipe 3.00 ft above lsd.

Jan.	13, 1977.....	158.20	Apr.	20.....	156.91	Aug.	10.....	158.02
Feb.	17.....	158.12						

134-102-12DDA MP is top of 1¼-inch plastic pipe 2.60 ft above lsd.

Jan.	13, 1977.....	164.55	Mar.	28.....	163.09	Aug.	10.....	163.54
Feb.	17.....	163.53	Apr.	20.....	163.58			

134-103-08AAA MP is top of 2-inch steel pipe 3.60 ft above lsd.

Jan.	13, 1977.....	163.30	Apr.	20.....	163.31	Aug.	10.....	163.33
Feb.	17.....	163.35						

134-104-24DDD1 MP is top of 4-inch steel pipe 2.00 ft above lsd.

Oct.	1, 1975.....	406.50	Mar.	9.....	406.16	Apr.	9.....	406.21
Feb.	11, 1976.....	406.17						

134-104-24DDD3 MP is top of 2-inch steel pipe 2.00 ft above lsd.

Sept.	7, 1977.....	396.20

135-104-06BDD1 MP is top of 1¼-inch plastic pipe 1.50 ft above lsd.

Oct.	13, 1977.....	11.35

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

136-099-26DAD MP is top of 2-inch steel pipe 3.60 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Jan. 13, 1977	135.20	Apr. 20	135.45	Aug. 10	135.43
Feb. 17	135.43				

136-100-31DDC1 MP is top of 4-inch steel pipe 1.00 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Feb. 11, 1976	298.80	Apr. 9	299.51	May 4	299.50
Mar. 9	299.60				

136-103-24DAA MP is top of 1¼-inch plastic pipe 1.50 ft above lsd.

Date	Water level	Date	Water level
Oct. 13, 1977	18.89	Dec. 5	18.63

136-103-24DBA MP is top of 4-inch plastic pipe 1.00 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Aug. 1, 1977	10.30	Sept. 15	10.08	Oct. 31	9.37
Aug. 5	10.31	Sept. 20	10.04	Nov. 5	9.33
Aug. 10	10.32	Sept. 25	9.86	Nov. 10	9.32
Aug. 15	10.31	Sept. 30	9.74	Nov. 15	9.29
Aug. 20	10.33	Oct. 5	9.55	Nov. 20	9.27
Aug. 25	10.28	Oct. 10	9.42	Nov. 25	9.26
Aug. 31	10.21	Oct. 15	9.39	Nov. 30	9.24
Sept. 5	10.17	Oct. 20	9.41	Dec. 5	9.23
Sept. 10	10.11	Oct. 25	9.39		

136-105-26ACA MP is top of 2-inch steel pipe 3.40 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Nov. 18, 1976	68.07	Feb. 17	68.05	Aug. 10	68.09
Jan. 13, 1977	68.04	Apr. 20	68.17	Oct. 16	68.45

137-100-22CCC2 MP is top of 2-inch steel pipe 2.00 ft above lsd.

Date	Water level	Date	Water level
Sept. 17, 1977	289.49	Feb. 16, 1978	289.10

137-101-34ABA1 MP is top of 2-inch steel pipe 3.00 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Jan. 13, 1977	173.55	Apr. 20	176.70	Aug. 10	173.00

137-101-34ABA3 MP is top of 1¼-inch plastic pipe 2.00 ft above lsd.

Date	Water level
Sept. 15, 1977	94.68

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

138-100-07AAA1 MP is top of 2-inch steel pipe 3.60 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Nov. 17, 1976	141.71	Apr. 21	141.44	Nov. 16	141.32
Jan. 13, 1977	141.70	Aug. 10	141.53		

138-100-07AAA2 MP is top of 1¼-inch plastic pipe 0.00 ft above lsd.

Date	Water level
Nov. 16, 1977	176.22

138-101-02BAC MP is top of 2-inch steel pipe 3.60 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Nov. 16, 1976	159.93	Apr. 21	159.88	Nov. 16	159.72
Jan. 13, 1977	159.87	Aug. 10	159.88		

138-105-07CCD MP is top of 2-inch steel pipe 2.60 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Nov. 18, 1976	118.52	Feb. 17	118.52	Apr. 20	118.57
Jan. 13, 1977	118.53	Mar. 29	118.48	Aug. 10	118.60

139-100-14CCC MP is top of 2-inch steel pipe 0.00 ft above lsd.

Date	Water level	Date	Water level
Sept. 22, 1977	298.55	Nov. 16	298.76

139-102-03BAC MP is top of 1¼-inch plastic pipe 1.50 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Oct. 13, 1977	13.47	Nov. 14	13.31	Dec. 6	12.06

139-102-03BCB1 MP is top of 1¼-inch plastic pipe 1.50 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Oct. 13, 1977	4.81	Nov. 15	5.05	Dec. 6	5.10

139-102-03BCB2 MP is top of 4-inch plastic pipe 1.00 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Aug. 2, 1977	16.33	Sept. 15	16.33	Oct. 31	15.57
Aug. 5	16.37	Sept. 20	16.39	Nov. 5	15.69
Aug. 10	16.44	Sept. 25	16.33	Nov. 10	15.80
Aug. 15	16.51	Sept. 30	16.26	Nov. 15	15.88
Aug. 20	16.53	Oct. 5	16.14	Nov. 20	15.95
Aug. 25	16.50	Oct. 10	15.88	Nov. 25	16.00
Aug. 31	16.48	Oct. 15	15.52	Nov. 30	16.03
Sept. 5	16.44	Oct. 20	15.36	Dec. 5	16.04
Sept. 10	16.37	Oct. 25	15.42		

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

139-103-32DBB MP is top of 2-inch steel pipe 3.60 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Jan. 13, 1977	64.03	Apr. 20	64.05	Aug. 10	64.06
Feb. 17	64.02				

139-105-30DDD MP is top of 2-inch steel pipe 2.10 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Nov. 18, 1976	207.48	Feb. 17	166.06	Apr. 20	130.01
Jan. 13, 1977	189.53	Mar. 29	131.62	July 21	116.42

140-102-19DDB MP is top of 2-inch steel pipe 3.60 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Nov. 17, 1976	108.25	Feb. 16	108.38	July 27	108.30
Jan. 12, 1977	108.22	Apr. 19	108.34	Nov. 15	108.40

140-105-30CCC1 MP is top of 2-inch steel pipe 2.50 ft above lsd.

Date	Water level	Date	Water level
Nov. 15, 1977	262.80	Feb. 16, 1978	262.12

140-105-30CCC2 MP is top of 2-inch steel pipe 2.50 ft above lsd.

Date	Water level	Date	Water level
Nov. 15, 1977	164.98	Feb. 16, 1978	164.22

140-105-30CCC3 MP is top of 1¼-inch plastic pipe 2.50 ft above lsd.

Date	Water level	Date	Water level
Nov. 15, 1977	+2.05	Dec. 5	+1.68

140-106-01AAA MP is top of 2-inch steel pipe 3.60 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Nov. 18, 1976	125.75	Feb. 17	125.57	July 21	125.93
Jan. 12, 1977	125.55	Apr. 20	125.56	Aug. 10	125.62

141-098-15AAA MP is top of 2-inch steel pipe 3.60 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Nov. 18, 1976	296.19	July 21	289.15	Aug. 11	289.17
Jan. 12, 1977	289.12				

141-100-34CBC MP is top of 2-inch steel pipe 3.00 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Nov. 17, 1976	195.88	July 28	196.19	Aug. 11	196.11
Apr. 19, 1977	196.04				

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

142-100-25DDA MP is top of 2-inch steel pipe 4.00 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Nov. 17, 1976	270.72	July 28	270.53	Aug. 12	270.55
Apr. 19, 1977	270.58				

142-101-18CBD2 MP is top of 1¼-inch plastic pipe 1.50 ft above lsd.

Sept. 10, 1977	68.20	Nov. 15	68.22		

142-103-34ACA MP is top of 2-inch steel pipe 0.00 ft above lsd.

Sept. 22, 1977	159.35	Nov. 14	159.20		

143-102-09BCB MP is top of 1¼-inch plastic pipe 2.00 ft above lsd.

Sept. 27, 1977	5.47	Nov. 15	6.33		

143-102-09BCC2 MP is top of 1¼-inch plastic pipe 1.50 ft above lsd.

Sept. 27, 1977	18.18	Nov. 16	17.89		

143-102-09BCC3 MP is top of 1¼-inch plastic pipe 1.00 ft above lsd.

Sept. 27, 1977	6.02	Nov. 15	5.84		

143-103-14DBC MP is top of 2-inch steel pipe 3.60 ft above lsd.

Jan. 12, 1977	312.40	Apr. 19	309.94	Nov. 15	310.50
Feb. 16	309.88				

143-105-33ACA1 MP is top of 1¼-inch plastic pipe 2.00 ft above lsd.

Nov. 14, 1977	9.79	Dec. 5	9.57		

143-105-33ACA2 MP is top of 4-inch plastic pipe 1.00 ft above lsd.

Aug. 2, 1977	17.12	Sept. 5	17.36	Oct. 10	17.40		
Aug. 5	17.14	Sept. 10	17.37	Oct. 15	17.40		
Aug. 10	17.19	Sept. 15	17.38	Oct. 20	17.39		
Aug. 15	17.22	Sept. 20	17.39	Oct. 25	17.39		
Aug. 20	17.28	Sept. 25	17.39	Oct. 31	17.38		
Aug. 25	17.31	Sept. 30	17.41	Nov. 5	17.38		
Aug. 31	17.34	Oct. 5	17.41	Nov. 10	17.38		

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

143-105-33ACB MP is top of 1¼-inch plastic pipe 2.50 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Nov. 14, 1977.....	17.02	Dec. 5.....	16.79		

143-105-33BAA MP is top of 2-inch steel pipe 2.50 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Aug. 25, 1975.....	42.22	July 20.....	42.76	Aug. 8.....	44.11
Oct. 8.....	42.92	Jan. 12, 1977.....	44.26	Oct. 18.....	44.20
Mar. 9, 1976.....	42.97	Feb. 16.....	44.23	Nov. 15.....	44.19
Apr. 8.....	42.81	Mar. 28.....	44.12		
May 4.....	42.60	Apr. 19.....	44.14		

143-105-33BAB MP is top of 2-inch steel pipe 3.00 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Aug. 25, 1975.....	43.90	July 20.....	46.18	Aug. 8.....	46.88
Feb. 10, 1976.....	45.48	Jan. 12, 1977.....	46.50	Oct. 8.....	46.90
Mar. 9.....	45.51	Feb. 16.....	46.49	Nov. 15.....	46.77
Apr. 8.....	45.81	Mar. 28.....	46.48		
May 4.....	45.78	Apr. 19.....	46.62		

144-100-24BBD1 MP is top of 4-inch steel pipe 1.00 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Feb. 10, 1976.....	385.90	Apr. 7.....	395.56	May 4.....	395.21
Mar. 9.....	386.97				

144-100-24BBD2 MP is top of 2-inch steel pipe 3.00 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Feb. 10, 1976.....	400.30	May 3.....	402.84	Aug. 9.....	401.47
Mar. 9.....	401.05	Feb. 16, 1977.....	401.36		
Apr. 7.....	401.98	Apr. 19.....	401.52		

144-105-33BBC MP is top of 2-inch steel pipe 3.60 ft above lsd.

Date	Water level	Date	Water level	Date	Water level
Jan. 12, 1977.....	77.91	Apr. 19.....	77.92	Nov. 15.....	77.95
Feb. 16.....	77.87	Aug. 10.....	77.90		

TABLE 3.--Logs of wells and test holes

All gamma-ray logs have Time Constant 4.

Depths are shown in feet below land surface.

Descriptions of deposits are by NDSWC personnel.

Electric logs are uncalibrated.

Formation contacts are by the author.

Neutron logs are in API units or cps (counts per second).

NDSWC resistivity logs are 16 inch normal. Resistance given in ohms or ohms per meter.

RM (resistivity of mud) is given in ohms per meter.

Specific potential given in millivolts (mV).

133-098-06DCC
(Log modified from Dependable Drilling)

Date drilled: 5/15/68

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Surface sand	2	2
Rock, soft	2	4
Sand, fine	14	18
Sandstone, blue, hard	8	26
Clay, brown	2	28
Clay, blue, fine, sandy	19	47
Coal, water-bearing	17	64
Coal	4	68
Clay, gray	6	74
Rock	1	75
Clay, gray	5	80
Coal; with clay stringers	9	89
Clay, gray	12	101
Rock	1	102
Clay, gray	5	107
Coal stringers	3	110
Clay, gray	27	137
Rock	2	139
Clay, gray; with fine sand	27	166
Coal; with fine sand	6	172
Coal	8	180
Clay, gray	35	215
Coal stringers	3	218
Clay, gray	23	241
Coal	9	250
Clay, gray	53	303
Rock	6	309
Sand, gray	29	338
Clay	2	340

133-098-18DDD
(Log modified from Iver Sander & Son)

Date drilled: 10/ /55

Surface soil, dark	2	2
Sand, gray	29	31
Coal, black	15	46
Clay, gray	26	72
Sand, gray	23	95

133-098-19DDB
(Log modified from Iver Sander & Son)

Date drilled: 5/29/46

Surface soil, dark	2	2
Clay, gray	60	62
Sand, gray	3	65

133-098-20CBC
(Log modified from Iver Sander & Son)

Date drilled: 6/23/50

Surface soil, dark	2	2
Gravel, red, sandy	10	12
Clay, yellow	20	32
Clay, gray	61	93
Coal, black	1	94

133-098-32BCA
(Log modified from Iver Sander & Son)

Date drilled: 7/23/49

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Surface soil, dark	1	1
Clay, light	29	30
Clay, dark	6	36
Coal, black	3	39
Clay, light	23	62
Rock, gray	1	63
Clay, light	42	105
Clay, dark, sandy, and sand	3	108

133-099-02CBB
(Log modified from H & H Service Co.)

Date drilled: 7/29/74

Surface soil to sand and shale	16	16
Coal	8	24
Shale	11	35
Coal	6	41
Shale	4	45
Coal	13	58
Shale; with fine sand sections and occasional ledge	1,168	1,226
Ledge	1	1,227
Shale to sandy shale and soft sand	95	1,322
Shale to sandy shale	18	1,340
Sand, soft; returns with ledge at 1,342 feet	39	1,379
Ledge	2	1,381
Sand, soft	9	1,390
Shale, firm (?)	14	1,404

133-099-04BCB
(Log modified from Iver Sander & Son)

Date drilled: 1/01/30

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Surface soil, black	4	4
Clay, dark	31	35
Coal, black	3	38
Clay, light-gray	18	56
Rock, gray	1	57
Clay, light-gray	16	73
Rock, gray	1	74
Clay, dark	18	92
Coal, black	3	95

133-099-05DCA
(Log modified from Iver Sander & Son)

Surface soil, gray	5	5
Clay, dark, sandy	41	46
Coal, black	3	49
Clay, gray	6	55

133-099-20ADA
(Log modified from Iver Sander & Son)

Date drilled: 1963

Surface gravel, gray	5	5
Clay, gray	32	37
Coal, black	6	43
Clay, gray	37	80
Coal, black, water-bearing	4	84
Clay, gray	126	210
Sand, gray, water-bearing	5	215

(Log from H & H Service Co.)

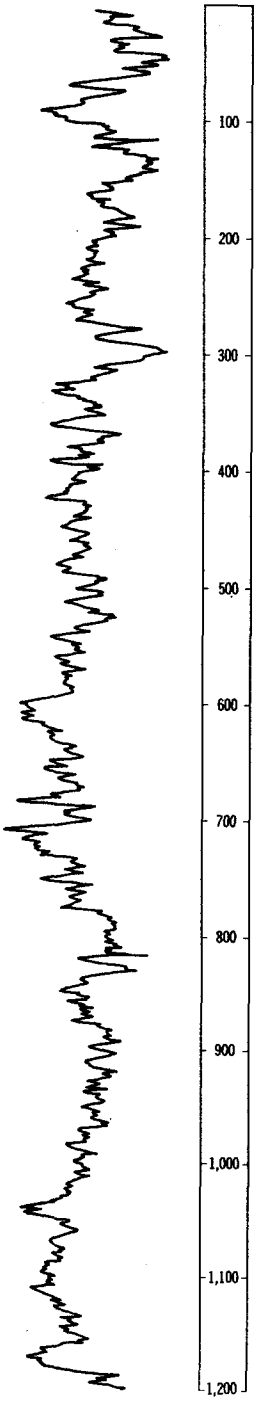
LOCATION: 133-099-32BBA

ALTITUDE: 2871
(FT, NGVD)

DATE DRILLED: 6/30/72

DEPTH: 1252
(FT, LSD)

GAMMA RAY



DESCRIPTION OF DEPOSITS

NOTE: No lithology available.

(Log from H & H Service Co.), Continued

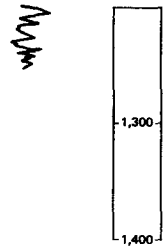
LOCATION: 133-099-32BBA

DATE DRILLED: 6/30/72

ALTITUDE: 2871
(FT, NGVD)

DEPTH: 1252
(FT, LSD)

GAMMA RAY



DESCRIPTION OF DEPOSITS

133-100-08ADA
(Log modified from Dependable Drilling)

Altitude: 3003 feet

Date drilled: 9/ /73

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Surface clay	24	24
Sand, brown	8	32
Sand, dark, coarse	18	50
Clay, hard	4	54
Sand, dark, coarse	20	74
Sand to coal	6	80
Clay, brown	4	84
Clay, blue	19	103

133-101-08CBA
(Log modified from H & H Service Co.)

Date drilled: 1974

Sand	13	13
Sandstone	2	15
Shale, yellow to gray	10	25
Sand, very fine	5	30
Sand	7	37
Coal	29	66
Shale	14	80

USGS

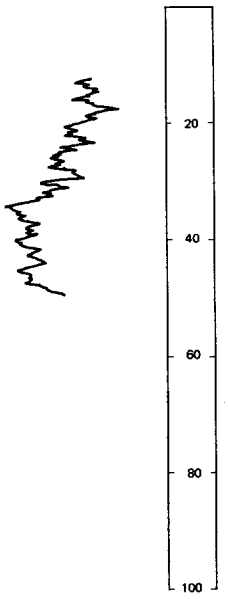
LOCATION: 133-101-09CDD

ALTITUDE: 2915
(FT, NGVD)

DATE DRILLED: 6/04/76

DEPTH: 82
(FT, LSD)

GAMMA RAY



DESCRIPTION OF DEPOSITS

NOTE: No lithology available.

NDSWC 4905

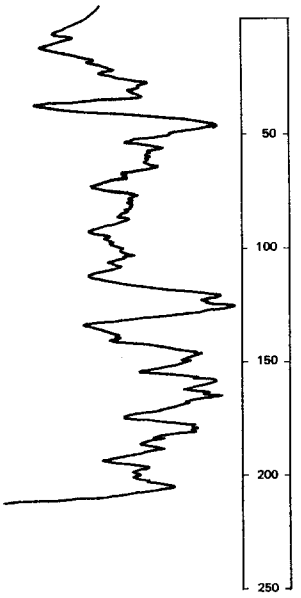
LOCATION: 133-101-11DCC

ALTITUDE: 2980
(FT, NGVD)

DATE DRILLED: 5/18/76

DEPTH: 220
(FT, LSD)

GAMMA RAY



DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-28	Sandstone, light-yellowish-brown, very fine to medium; oxidized to 10 feet.
28-37	Claystone, gray, silty, tight.
37-43	Lignite.
43-52	Claystone, greenish-gray, sandy, tight.
52-116	Sandstone, greenish-gray, very fine to fine.
116-220	Claystone, gray; interbedded sandstone and thin lignite.

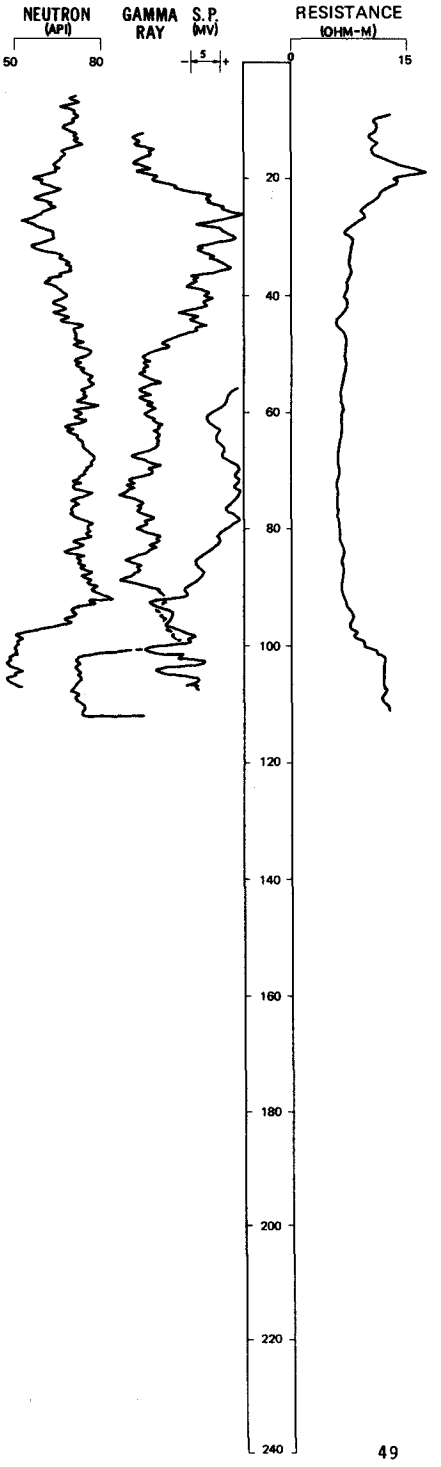
USGS

LOCATION: 133-101-15BAA

ALTITUDE: 2933
(FT, NGVD)

DATE DRILLED: 6/04/76

DEPTH: 112
(FT, LSD)



DESCRIPTION OF DEPOSITS

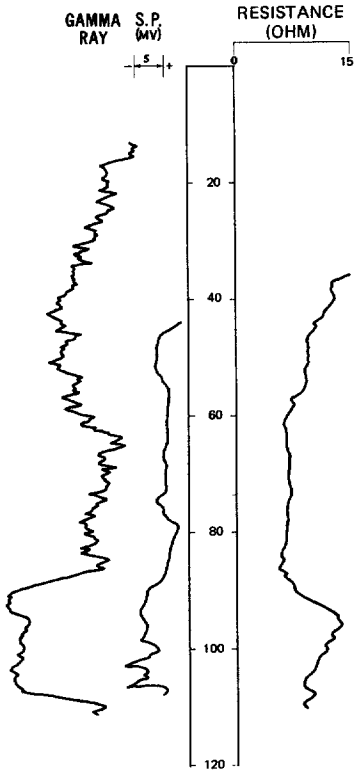
NOTE: No lithology available.

LOCATION: 133-101-15DCD

ALTITUDE: 2920
(FT, NGVD)

DATE DRILLED: 6/07/76

DEPTH: 112
(FT, LSD)



DESCRIPTION OF DEPOSITS

NOTE: No lithology available.

133-101-16BBC
(Log modified from H & H Service Co.)

Date drilled: 6/01/72

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Surface sand	20	20
Sand, brown	50	70
Shale	7	77
Sand, brown	13	90
Coal	9	99
Shale	6	105

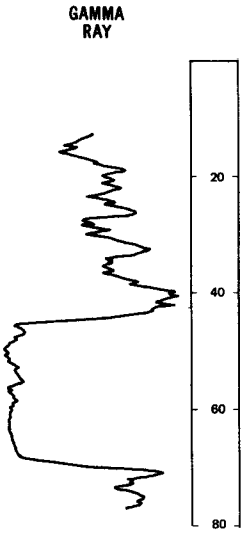
USGS

LOCATION: 133-101-17ABB

ALTITUDE: 2897
(FT, NGVD)

DATE DRILLED: 6/08/76

DEPTH: 77
(FT, LSD)



DESCRIPTION OF DEPOSITS

NOTE: No lithology available.

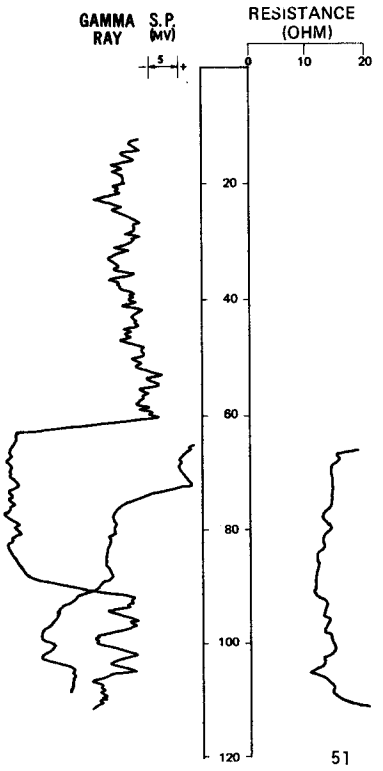
USGS

LOCATION: 133-101-19DCC

ALTITUDE: 2940
(FT, NGVD)

DATE DRILLED: 6/03/76

DEPTH: 112
(FT, LSD)



DESCRIPTION OF DEPOSITS

NOTE: No lithology available.

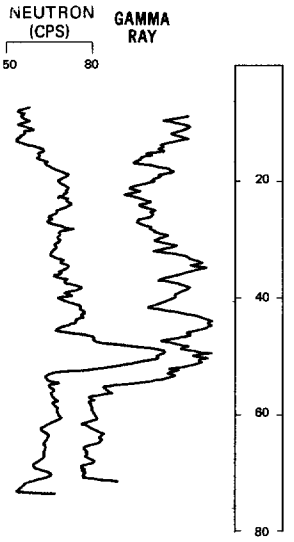
USGS

LOCATION: 133-101-28ABB

ALTITUDE: 2925
(FT, NGVD)

DATE DRILLED: 6/03/76

DEPTH: 77
(FT, LSD)



DESCRIPTION OF DEPOSITS

NOTE: No lithology available.

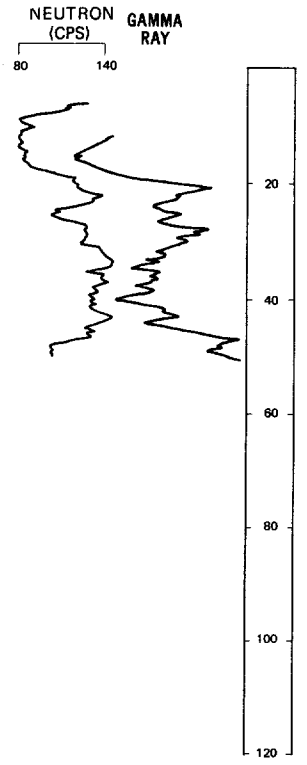
USGS

LOCATION: 133-101-29ABB

ALTITUDE: 2890
(FT, NGVD)

DATE DRILLED: 6/03/76

DEPTH: 52
(FT, LSD)



DESCRIPTION OF DEPOSITS

NOTE: No lithology available.

133-101-30BBB
(Log modified from Darel Peters)

Date drilled: 5/17/73

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay, brown	16	16
Rock stringers	1	17
Clay, brown	18	35
Coal	41	76
Clay, brown	14	90
Clay, gray, hard	14	104
Coal; with sand stringers	4	108
Sand	5	113
Clay, soft	12	125
Clay, sandy	5	130
Clay, brown, hard	20	150
Clay	28	178
Clay, blue	22	200
Clay, soft	30	230
Coal, hard	7	237
Clay, soft	13	250
Clay, sandy, soft; stringers	9	259
Clay, blue, hard	2	261
Sand, blue	19	280

133-101-34DAA
(Log modified from H & H Service Co.)

Date drilled: 1/29/74

Surface soil	25	25
Coal	10	35
Shale	17	52
Coal	5	57
Shale to sandy shale	95	152
Sand, very fine	8	160
Shale to sandy shale; with occasional ledge	200	360
Sand, fine	30	390
Shale	30	420

133-101-35DDB
(Log modified from H & H Service Co.)

Altitude: 2965 feet — Date drilled: 10/05/72

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Surface sand to shale	30	30
Coal	6	36
Shale	19	55
Coal	1	56
Shale	1	57
Coal	4	61
Shale; with occasional stringers	84	145
Coal	10	155
Shale to sandy shale	145	300
Sand, very fine	20	320
Shale	50	370
Shale, sandy, to sand	45	415
Shale; with occasional ledges	175	590
Sand	20	610
Coal ledge	5	615
Shale, soft	3	618
Ledge	1	619
Shale	5	624
Ledge	1	625
Shale	2	627
Coal ledge	1	628
Shale	9	637
Ledge	1	638
Shale	2	640

133-103-17DCA
(Log modified from H & H Service Co.)

Altitude: 2970 feet — Date drilled: 5/11/74

Shale	7	7
Coal stringer	1	8
Sand	2	10
Shale; with occasional stringers	92	102
Sand, very fine	10	112
Shale	13	125
Sand, very fine	10	135
Shale, sandy	25	160
Shale	27	187
Sandstone ledge	1	188
Shale	22	210
Sand, fine	30	240
Sand, bluish, very fine	27	267
Coal	1	268
Sand to sandy shale	4	272
Rock ledge	1	273
Shale	12	285
Coal	5	290
Shale; with ledge at 293 feet	10	300

133-103-17DCC
(Log modified from Dependable Drilling)

Altitude: 3000 feet — Date drilled: 6/28/60

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay, brown, sandy	15	15
Clay, blue	4	19
Coal	3	22
Clay, brown	11	33
Coal	1	34
Clay, blue	26	60
Rock ledge	1	61
Clay, blue	1	62
Coal	1	63
Clay, blue	2	65
Sand, blue, fine	2	67
Coal	6	73
Clay, blue	25	98
Sand, blue, fine	2	100
Coal	1	101
Clay, blue, sandy	3	104
Rock	1	105
Clay, blue	20	125
Sand, blue, fine	20	145
Sand, blue, medium	38	183
Clay, brown	3	186
Clay, blue	20	206
Rock ledge	1	207
Clay, blue	13	220
Coal	12	232
Clay, blue	4	236
Coal	6	242
Clay, blue	5	247
Sand, blue, fine	17	264
No lithologic description	----	512

133-103-23BDC
(Log modified from Dependable Drilling)

Altitude: 2910 feet

Date drilled: 7/30/61

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Surface soil	6	6
Riverwash	23	29
Shale	6	35
Shale, gray	29	64
Coal	13	77
Shale, gray	24	101
Shale, green, sandy	31	132
Sandy streaks	50	182
Shale, sandy	25	207
Sand rock	1	208
Shale	22	230
Coal stringers	1	231
Shale	60	291
Shale, sandy	40	331
Shale	1	332
Sand	45	377
Shale	21	398
Coal	4	402
Shale	58	460
Rock	2	462
Shale, white	9	471
Shale	47	518
Coal	3	521
Shale	10	531
Ledge	1	532
Shale	23	555
Rock	2	557
Shale, gray, sandy	32	589
Shale, gray	33	622
Coal	1	623
Shale	4	627
Rock, hard	1	628
Shale, sandy	10	638
Sand, gray	33	671

133-103-29ACC
(Log modified from H & H Service Co.)

Altitude: 3040 feet — Date drilled: 4/10/74

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Surface scoria and sand	5	5
Shale; with ledge at 47 feet	67	72
Shale	20	92
Coal	3	95
Shale to sandy shale	17	112
Coal	10	122
Shale	6	128
Sand, fine	3	131
Shale	11	142
Sand, gray, fine	8	150
Shale, green, sandy	30	180
Rock ledge	2	182
Shale, green	18	200
Shale	7	207
Sand, blue, fine	12	219
Shale, sandy	2	221
Sand, very fine	14	235
Shale, sandy	5	240

133-104-10BCC
(Log modified from Dependable Drilling)

Altitude: 3065 feet — Date drilled: 9/15/61

Surface soil	5	5
Sand rock	3	8
Shale	13	21
Sand	8	29
Shale	32	61
Coal	7	68
Shale, gray	7	75
Coal	5	80
Shale	1	81
Sand, gray	6	87
Shale, gray	10	97
Sand	3	100
Coal	2	102
Shale, blue	14	116
Sand, sharp	83	199

133-104-15CBB
(Log modified from Dependable Drilling)

Altitude: 3140 feet — Date drilled: 8/30/61

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Surface sand	10	10
Shale, sandy	11	21
Coal	1	22
Sand	19	41
Coal	1	42
Sand	.5	42.5
Coal	1	43.5
Shale, blue	2.5	46
Shale, white	12	58
Shale, blue	8	66
Shale, blue, sandy	36	102
Rock	1	103
Sand	23	126
Rock	3	129
Sand	5	134
Coal	2	136
Shale, sandy	8	144

133-104-22BDC
(Log modified from H & H Service Co.)

Altitude: 2950 feet — Date drilled: 11/27/72

Surface soil	15	15
Coal	2	17
Shale	6	23
Coal	7	30
Shale to sandy shale	78	108
Shale and coal	7	115
Shale, white, soft, bentonitic	65	180
Sand	7	187
Sandstone ledge	1	188
Sand, very fine to medium	57	245
Sand, fine	25	270
Shale, sandy, to shale	10	280

133-104-24BBB
(Log modified from Knutson Well Drilling)

Altitude: 3130 feet — Date drilled: 11/17/72

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand	4	4
Clay	35	39
Clay, sandy	3	42
Coal, soft	1	43
Clay	4	47
Coal	1	48
Clay	26	74
Rock	1	75
Clay	9	84
Rock	1	85
Clay	30	115
Coal	1	116
Clay	14	130
Rock	1	131
Clay	39	170
Coal	9	179
Clay, sandy, and coal	11	190
Clay, sandy	62	252
Sand	8	260
Clay, sandy	7	267
Clay, dark	3	270

133-105-07ADC
USGS LM-42

Altitude: 2686 feet — Date drilled: 4/20/56

Sand, very fine to fine	12	12
Clay, brown, lumpy	3	15
Gravel, wet; mixed with chips of lignite and scoria	7	22
Sand, blue, hard, lumpy	3	25
Clay, blue, hard	3	28

133-105-07DBD
USGS LM-41

Altitude: 2688 feet — Date drilled: 4/20/56

Sand, very fine	6	6
Sand, fine	6	12
Gravel; wet at 20 feet	11	23
Sand, blue, lumpy, sticky, wet	10	33

133-105-07DCA
USGS LM-40

Altitude: 2688 feet — Date drilled: 4/20/56

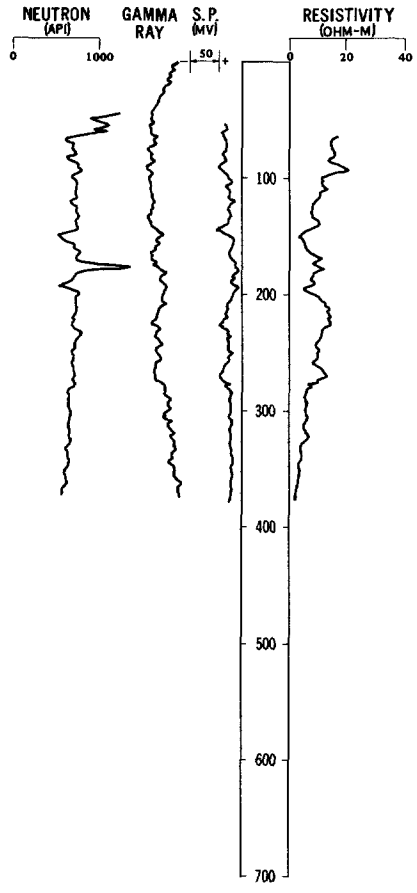
Sand, very fine	15	15
Sand, fine, damp; chips of scoria; large rock	10	25
Sand, fine, and blue wet clay	8	33

LOCATION: 133-106-13ADB1, 2, 3

DATE DRILLED: 7/06/77

ALTITUDE: 2750 (FT, NGVD)

DEPTH: 382 (FT, LSD)



DESCRIPTION OF DEPOSITS

ALLUVIUM

0-13	Clay, brownish-gray; intermingled klinker pebbles.
13-16	Gravel, fine to medium, moderately argillaceous, poorly sorted; klinker chips.

HELL CREEK FORMATION

16-52	Claystone, light-yellowish-brown; sandy near base.
52-144	Sandstone, dark-olive-gray, very argillaceous; interbedded claystone and siltstone.
144-163	Claystone, dark-olive-gray, silty.
163-178	Sandstone, light-gray, fine, moderately argillaceous.
178-198	Claystone, dark-olive-gray; silty near top.

FOX HILLS SANDSTONE

198-280	Sandstone, very light gray, very fine to fine, slightly argillaceous.

PIERRE SHALE

280-336	Shale, dark-gray, silty, tight.
336-382	Shale, very dark gray.

133-106-25CBB
(Log modified from Dependable Drilling)

Altitude: 2755 feet

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay, black	12	12
Coal	6	18
Clay, black	20	38
Coal	16	54
Clay, brown	14	68
Sand, blue, and clay	20	88
Clay, blue	38	126
Coal	7	133
Clay, blue	55	188
Sandstone	4	192
Sand, blue	30	222
Clay, blue	4	226
Sand, blue	11	237

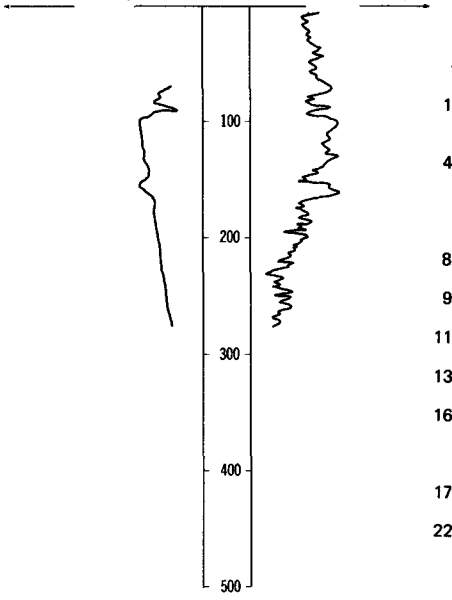
NDSWC 4809

LOCATION: 133-106-34BAA

DATE DRILLED: 7/08/75

ALTITUDE: 2750
(FT, NGVD)

DEPTH: 280
(FT)



	DESCRIPTION OF DEPOSITS
	HELL CREEK FORMATION
0-16	Claystone, dark-brown.
16-40	Claystone, greenish-gray, carbonaceous.
40-80	Sandstone, gray, very fine to medium, very silty.
	FOX HILLS SANDSTONE
80-90	Sandstone, light-gray, fine to coarse.
90-110	Claystone, gray.
110-130	Sandstone, gray, very fine to medium.
130-160	Claystone, dark-gray, silty.
160-175	Sandstone, gray, very silty.
	PIERRE SHALE
175-220	Shale, dark-gray.
220-280	Shale, dark-gray, waxy.

134-098-06DDA1
(Log modified from Iver Sander & Son)

Date drilled: 4/09/51

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Topsoil	2	2
Clay, gray, sandy	10	12
Clay, yellow	5	17
Clay, yellow, sandy	4	21
Sand, gray	12	33

134-098-06DDA2
(Log modified from Iver Sander & Son)

Date drilled: 12/23/59

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand and clay	5	5
Sand and gravel	5	10
Clay	8	18
Coal	3	21
Clay	7	28
Sand; seep vein	6	34
Coal	1	35
Clay	16	51
Coal	2	53
Clay and coal	5	58
Clay	20	78
Clay and coal	4	82
Clay	28	110
Rock	.5	110.5
Clay	31.5	142
Sand rock, white	4	146
Rock ledges and clay	3	149
Clay	39	188
Coal	2	190
Clay and sand	10	200
Water sand	30	230

134-098-10BAA
(Log modified from B & M Drilling)

Altitude: 2805 feet

Date drilled: 1/17/73

Surface soil	1	1
Sand, yellowish-brown	40	41
Sandstone	3	44
Sand, gray	21	65
Clay, gray	3	68
Lignite	4	72
Clay, brown	2	74
Clay, green	4.5	78.5
Sand, gray	6.5	85
Sand, white, water-bearing	75	160
Clay, gray	10	170
Sand, grayish-blue	50	220

134-098-13ADD
(Log modified from Moe Drilling Co.)

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand, yellow	39	39
Sandstone, gray, medium-hard	2.5	41.5
Sand, yellow	8.5	50
Sand, blue	12	62
Rock, soft	4	66
Coal	1.5	67.5
Clay, gray	5.5	73
Coal	4.5	77.5
Clay, green	7.5	85
Clay, gray, silty	9	94
Clay, gray	7	101
Coal	3	104
Clay, gray	14	118
Sand, gray, very fine, silty	16	134
Rock, gray, hard	1	135
Sand, gray, medium-coarse	60	195
Sand, gray, chunky	6	201

134-098-14BBC
(Log modified from B & M Drilling)

Altitude: 2772 feet Date drilled: 7/17/72

Surface soil	2.5	2.5
Clay, gray	7.5	10
Clay, yellow	2	12
Clay, gray	6	18
Rock, soft	1	19
Clay, yellow	1	20
Lignite, soft	1	21
Clay, silty	13	34
Clay	8	42
Sand, brown	9	51
Sandstone, very hard	2.5	53.5
Sand, brown	29.5	83
Lignite	.5	83.5
Sand, gray	26.5	110
Sandstone, soft	2	112
Silt, white	27.5	139.5
Lignite	.5	140
Clay	2	142
Sand	19	161

134-098-18BAA
(Log modified from Iver Sander & Son)

Date drilled: 7/11/40

Topsoil	2	2
Sand, gray	9	11
Rock, gray	1	12
Sand, yellow	18	30
Clay, gray	5	35
Coal, black	2	37
Clay, gray	21	58

134-098-26DAD
(Log modified from Iver Sander & Son)

Date drilled: 1935

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Topsoil	4	4
Clay, gray, sandy	16	20
Sand, brown	10	30
Sand, gray	35	65
Sand, blue	7	72

134-098-28DAC
(Log modified from Iver Sander & Son)

Date drilled: 1/01/36

Topsoil	1	1
Sand, gray	16	17
Sandstone, gray	3.5	20.5
Sand, gray	8	28.5
Rock, gray	2	30.5
Sand, gray	70.5	101

134-098-29DAD
(Log modified from Iver Sander & Son)

Date drilled: 1/01/60

Clay, gray	31	31
Clay, blue, and sand	34	65
Clay, gray	30	95
Clay and coal; mixed	2	97
Clay and sand; mixed	27	124
Rock	2	126
Sand, hard	6	132
Clay, sandy	13	145
Sand	55	200

134-098-33BCC
(Log modified from Iver Sander & Son)

Date drilled: 1/01/71

Topsoil	3	3
Sand, yellow	32	35
Clay, gray, sandy	7	42
Rock, gray	3	45
Clay, gray, sandy	69	114
Rock, gray	2	116
Shale, gray	42	158
Rock, gray	1	159
Sand, gray	5	164
No lithologic description	----	200

134-099-08AAD
(Log modified from Iver Sander & Son)

Date drilled: 12/ /36

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Topsoil	2	2
Sand, gray	30	32
Clay, gray	22	54
Rock, gray	2	56
Clay, gray	83	139
Sand, gray, water-bearing	3	142
Clay, gray, sandy	7	149
Sand, blue	6	155

134-099-10DDD
(Log modified from Kruger Drilling Co.)

Altitude: 2830 feet

Date drilled: 7/28/73

Clay	15	15
Coal	12	27
Clay	143	170
Sand	10	180

134-099-12AAA
(Log modified from Iver Sander & Son)

Altitude: 2805 feet

Date drilled: 1/01/36

Sand, dark	15	15
Clay, blue	4	19
Sand, gray	15	34
Coal, black	2	36

134-099-14BAD
(Log modified from Iver Sander & Son)

Altitude: 2805 feet

Date drilled: 11/04/49

Topsoil	1	1
Clay, light, sandy	23	24
Clay, gray	131	155
Clay, gray, sandy	24	179
Clay, gray, hard	20	199
Sand, gray	6	205

134-099-18DDC
(Log modified from H & H Service Co.)

Altitude: 2900 feet

Date drilled: 11/29/72

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Topsoil	1	1
Sand, oxidized	6	7
Shale, brown, sandy	9	16
Shale, gray	4	20
Lignite	7	27
Siltstone, blue	36	63
Lignite	12	75
Sandstone	1	76
Shale, green	24	100
Sandstone	1	101
Shale	14	115
Ledge	1	116
Shale, soft	7	123
Lignite	1	124
Shale	6	130
Ledge	1	131
Shale, gray, soft	79	210
Lignite	1	211
Sandstone, grayish-white, very fine	4	215
Ledge	1	216
Sand	3	219
Shale	5	224
Lignite	1	225
Shale to sandy shale	55	280
Shale, sandy	6	286
Sandstone, grayish-white, very fine	24	310
Ledge	1	311
Sand	15	326
Ledge	1	327
Shale	33	360
Shale, gray, sandy	39	399
Sandstone	1	400
Shale; with lignite stringers	25	425
Lignite	5	430
Sandstone	5	435
Limestone	2	437
Shale, soft	13	450
Ledge	1	451
Shale, soft	56	507
Lignite	2	509
Shale	21	530
Sandstone, very fine	10	540
Shale	10	550
Sandstone, cemented	1	551
Shale; with ledges at 556, 583, 630, 675, and 695 feet	205	756
Sandstone, cemented	3	759
Shale, soft	11	770
Lignite(?)	1	771
Shale, sandy, to sand	49	820
Sandstone, light-blue, very fine to medium; lots of quartz	28	848
Ledge	1	849
Sandstone	8	857
Ledge	1	858
Sand	2	860
Shale	20	880

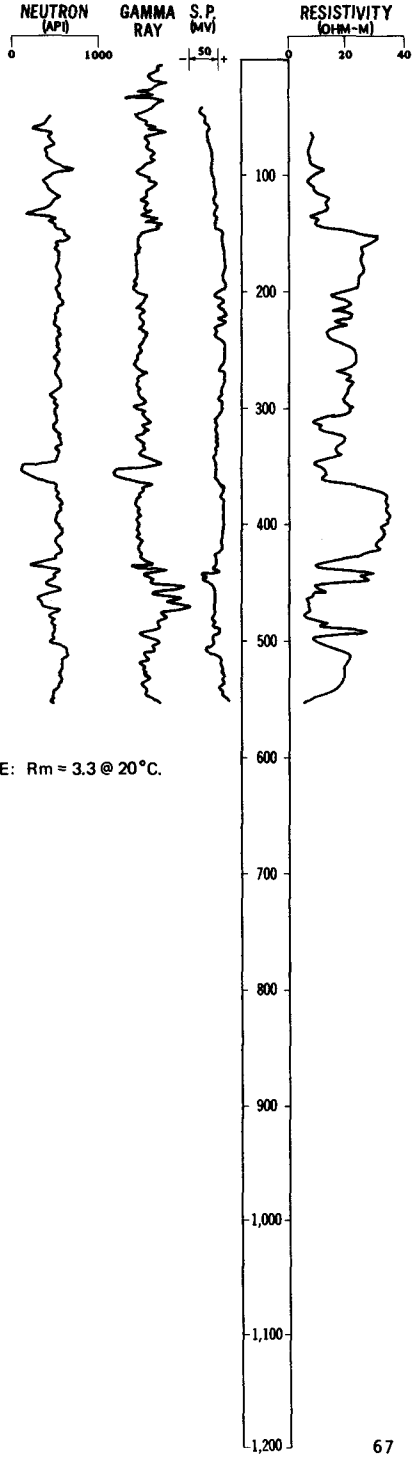
NDSWC 4946

LOCATION: 134-099-21DCC

DATE DRILLED: 8/06/76

ALTITUDE: 2885
(FT, NGVD)

DEPTH: 560
(FT, LSD)



NOTE: Rm = 3.3 @ 20°C.

DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-17	Claystone, yellowish-brown, silty, plastic.
17-22	Lignite.
22-120	Claystone, bluish-gray; interbedded thin sandstone and lignites.
120-149	Claystone, brownish-gray.
149-201	Sandstone, greenish-gray, very fine, slightly argillaceous; carbonaceous trash.
201-244	Claystone, greenish-gray, sandy.
244-308	Sandstone, greenish-gray, very fine to fine, medium- to well-sorted, subrounded; carbonaceous trash.
308-348	Claystone, dark-greenish-gray, carbonaceous; minor sand.
348-362	Lignite.
362-366	Claystone, dark-greenish-gray, very silty.
366-434	Sandstone, greenish-gray, very fine to fine, lignitic.
434-438	Lignite.
438-460	Sandstone, gray, fine; interbedded claystone and siltstone.

LUDLOW MEMBER

460-508	Claystone, light-greenish-gray, very silty, carbonaceous, bentonitic.
508-550	Sandstone, gray, very fine to fine, argillaceous.
550-560	Claystone, greenish-gray, carbonaceous.

134-099-27DAA
(Log modified from Iver Sander & Son)

Altitude: 2832 feet — Date drilled: 7/03/52

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Topsoil	1	1
Sand, light	12	13
Coal, black	8	21
Clay, gray	7	28
Rock, gray	2	30
Clay, light	106	136
Coal and clay	5	141
Clay, light, sandy	13	154
Sand, blue	3	157

134-099-33ADD
(Log modified from Iver Sander & Son)

Altitude: 2825 feet — Date drilled: 1/01/40

Gravel, gray	5	5
Clay, yellow	23	28
Rock, gray	2	30
Clay, blue	8	38
Rock, gray	2	40
Clay, blue	66	106
Coal, black	3	109
Clay, gray, sandy	10	119
Sand, gray	4	123

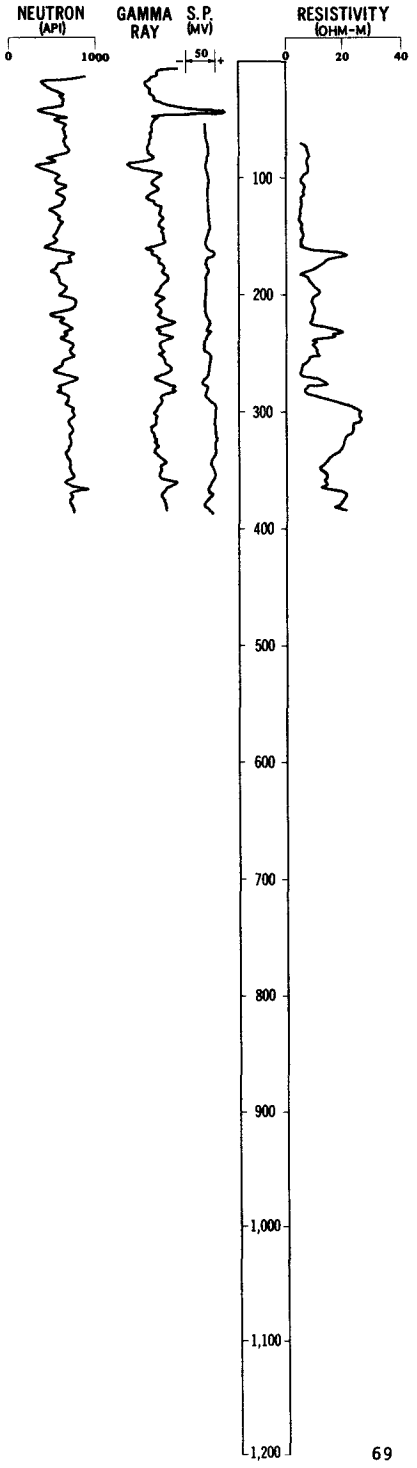
NDSWC 5142, 5142A

LOCATION: 134-100-07ADD1, 2

DATE DRILLED: 7/08/77

ALTITUDE: 2935
(FT, NGVD)

DEPTH: 391
(FT, LSD)



DESCRIPTION OF DEPOSITS

ALLUVIUM

0-16	Sand, light-yellowish-brown, very fine to fine, friable.
16-22	Gravel, medium to coarse, argillaceous, angular to subrounded.

SENTINEL BUTTE MEMBER

22-39	Sandstone, light-gray, very fine to fine; abundant micaceous minerals.
39-44	Lignite.
44-50	Claystone, light-gray, very silty, tight, bentonitic.
50-86	Sand, light-gray, very fine to fine, argillaceous.

TONGUE RIVER MEMBER

86-92	Lignite.
92-227	Claystone, light-gray, silty; interbedded thin sandstone and lignite.
227-255	Sandstone, light-gray, very fine, very argillaceous.
255-270	Claystone, light-olive-gray, silty.
270-277	Sandstone, light-gray, very fine to fine, argillaceous.
277-286	Claystone, light-olive-gray, silty.
286-336	Sandstone; no sample return.
336-388	Claystone, light-gray, tight, bentonitic; sandy near base.
388-391	Sandstone, indurated.

134-100-10AAD
(Log modified from Dependable Drilling)

Altitude: 2855 feet

Date drilled: 12/23/60

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay, brown; with coal streaks	33	33
Sand, blue	12	45
Clay, blue	5	50
Coal, hard	1	51
Clay, blue	39	90
Rock	1	91
Clay, blue	14	105
Rock	1	106
Clay, blue	17	123
Coal	2	125
Clay, blue	30	155
Clay, blue, sandy	6	161
Sand, gray, fine	2	163
Clay, gray	31	194
Clay, gray, sandy	6	200
Sand, gray, fine	17	217
Rock	3	220
Sand, gray, medium	30	250
Clay, gray	1	251

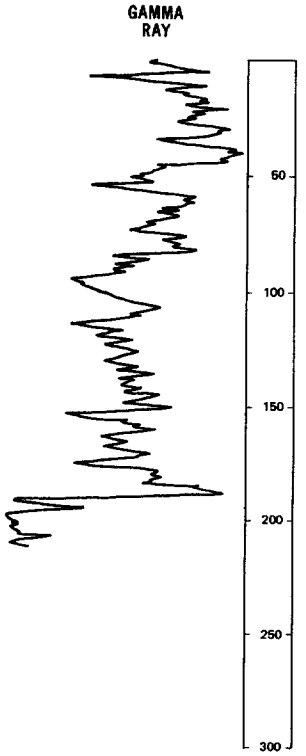
NDSWC 4906

LOCATION: 134-101-04DDD

DATE DRILLED: 5/19/76

ALTITUDE: 2905
(FT, NGVD)

DEPTH: 220
(FT, LSD)



DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-15	Sandstone, yellowish-brown, very fine to fine, argillaceous.
15-45	Claystone, yellowish-brown, silty, tight.
45-115	Sandstone, gray, very fine to fine, argillaceous.
115-191	Claystone, gray, very sandy, tight, carbonaceous.
191-215	Lignite.
215-220	Claystone, greenish-gray, carbonaceous.

NDSWC 4907

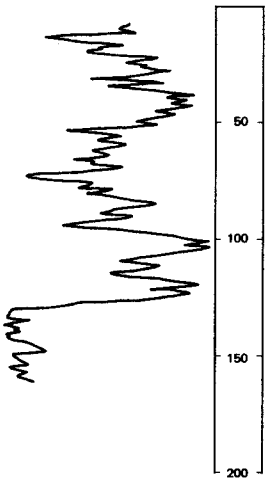
LOCATION: 134-101-17DDD

ALTITUDE: 2900
(FT, NGVD)

DATE DRILLED: 5/19/76

DEPTH: 180
(FT, LSD)

GAMMA RAY



DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-30	Sandstone, yellowish-brown, fine to coarse; minor pebbles.
30-35	Claystone, yellowish-brown, silty, tight.
35-76	Claystone, gray, silty, tight, carbonaceous.
76-130	Sandstone, gray, very fine to coarse; argillaceous near base.
130-164	Lignite.
164-180	Sandstone, gray, medium to coarse; thin argillaceous zones.

USGS

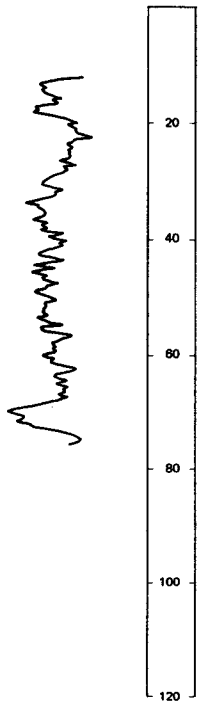
LOCATION: 134-101-18ABB

ALTITUDE: 2850
(FT, NGVD)

DATE DRILLED: 6/08/76

DEPTH: 77
(FT, LSD)

GAMMA RAY



DESCRIPTION OF DEPOSITS

NOTE: No lithology available.

134-101-26AAA
(Log modified from Dependable Drilling)

Date drilled: 8/03/61

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Surface soil and bentonite	4	4
Sandstone	1	5
Sand, yellow	11	16
Clay, yellow	23	39
Sand, gray, and bentonite	18	57
Clay, gray	24	81
Sand, gray	4	85
Coal	1	86
Clay, brown	11	97
Coal	1	98
Shale, sandy	24	122
Coal	1	123
Clay, brown	1	124
Coal	4	128
Shale	16	144
Sand	3	147
Shale, gray	6	153
Coal	2	155
Shale	17	172
Coal	2	174
Shale	11	185
Coal	1	186
Sand, gray	18	204
Rock	2	206
Sand, sharp; blue specks	78	284
Shale	19	303
Coal	1	304
Shale	2	306
Coal	1	307
Shale	20	327
Clay, gray, sandy	48	375
Coal	1	376
Clay, gray, sandy	19	395
Sand, gray	71	466
Shale	6	472

134-101-35BCC
(Log modified from Kruger Drilling Co.)

Date drilled: 10/15/64

Sand and white rock	10	10
Clay, light-gray	20	30
Lignite streaks	5	35
Clay	25	60
Sand	20	80
Lignite	4	84
Sand	100	184

134-102-04CBC
(Log modified from H & H Service Co.)

Altitude: 2700 feet

Date drilled: 8/01/72

Surface soil	20	20
Gravel	7	27
Sand	40	67
Sand to shale	13	80

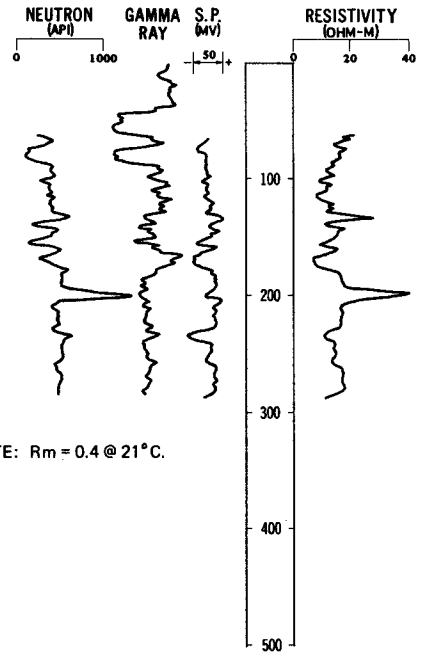
NDSWC 4947

LOCATION: 134-102-12DDA

DATE DRILLED: 8/06/76

ALTITUDE: 2845
(FT, NGVD)

DEPTH: 292
(FT, LSD)



NOTE: Rm = 0.4 @ 21°C.

DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-10	Sandstone, yellowish-brown, very fine to fine, argillaceous.
10-42	Claystone, yellowish-brown.
42-64	Lignite.
64-74	Claystone, light-gray, silty, carbonaceous.
74-87	Lignite.
87-179	Interbedded sandstone, siltstone, claystone, and lignite.
179-232	Sandstone, greenish-gray, very fine to fine; carbonaceous trash.

LUDLOW MEMBER

232-260	Claystone, gray, very silty.
260-287	Sandstone, greenish-gray, very fine to fine, argillaceous.
287-292	Claystone, gray.

134-102-27ACC
(Log modified from Kruger Drilling Co.)

Altitude: 2851 feet

Date drilled: 5/07/71

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Surface soil	10	10
Shale, soft	22	32
Lignite	1	33
Shale	33	66
Sand, gray, fine	13	79
Lignite	2	81
Shale	7	88
Lignite	3	91
Shale, gray, soft	9	100
Lignite	1	101
Shale	23	124
Lignite	1	125
Shale	13	138
Lignite	1	139
Shale	61	200
Ledge	1	201
Sand, fine	6	207
Shale; with ledge at 217 and 218 feet	15	222

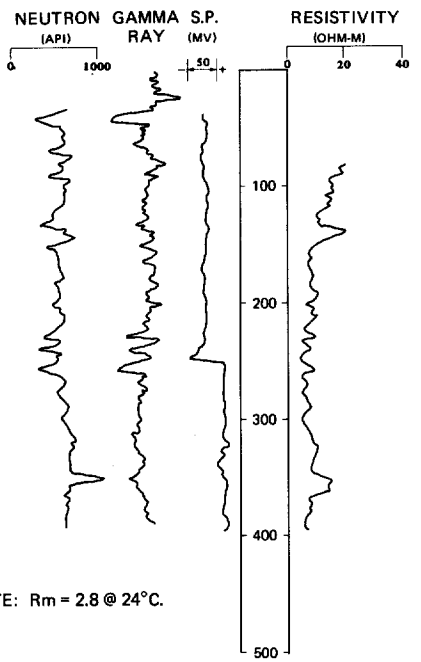
NDSWC 4942

LOCATION: 134-103-08AAA

DATE DRILLED: 7/30/76

ALTITUDE: 2960
(FT, NGVD)

DEPTH: 400
(FT)



NOTE: Rm = 2.8 @ 24°C.

DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-5	Claystone, pale-yellowish-brown, very sandy.
5-15	Klinker.
15-38	Claystone, light-greenish-gray, very silty.
38-47	Lignite.
47-150	Claystone, gray; interbedded siltstone, thin sandstone, and lignite.

LUDLOW MEMBER

150-310	Claystone, gray; interbedded siltstone, sandstone, and lignite.
310-370	Sandstone, gray, silty, slightly argillaceous.

LEBO SHALE MEMBER

370-400	Claystone, gray, silty.

134-103-08BBC
NDSWC 4942A

Altitude: 3030 feet

Date drilled: 7/30/76

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand, fine to coarse, well-sorted, angular to subrounded	5	5
Gravel, fine to very coarse, angular to subangular; quartz; sandstone; and oxidized carbonates	35	40

134-103-23ABB
(Log modified from H & H Service Co.)

Altitude: 2940 feet

Date drilled: 6/19/74

Surface soil	18	18
Clay	37	55
Lignite	1	56
Clay	14	70
Lignite	5	75
Clay, sandy, to sand	84	159
Sand	6	165
Clay; with occasional ledge	17	182
Clay; with rock streaks to sand	113	295
Sand	22	317
Sand; with ledge at 317 feet	21	338
Clay, sandy	3	341

134-103-25CCC
(Log modified from H & H Service Co.)

Altitude: 2870 feet — Date drilled: 8/28/69

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Surface shale	10	10
Lignite	2	12
Shale	20	32
Lignite	5	37
Shale	33	70
Lignite, hard	2	72
Shale	41	113
Ledge	1	114
Sand, brown, fine	26	140
Lignite	2	142
Sand, brown to blue	35	177
Lignite	2	179
Sand, bluish-gray	30	209
Shale, blue	4	213
Lignite	11	224
Sand, fine	6	230

134-103-28BDA
(Log modified from Dependable Drilling)

Altitude: 2950 feet — Date drilled: 6/16/60

Clay, brown	20	20
Sand, brown, fine	6	26
Lignite	1	27
Clay, blue	10	37
Rock	2	39
Clay, blue	4	43
Lignite	2	45
Sand, blue	3	48
Clay, blue	37	85
Clay, blue, sandy	7	92
Clay, blue	28	120
Sand, blue, fine to medium	48	168

134-103-35ADD
(Log modified from Dependable Drilling)

Altitude: 2870 feet — Date drilled: 6/30/61

Sand, brown	10	10
Clay, brown	14	24
Lignite	1	25
Clay, brown, sandy	42	67
Rock	1	68
Sand, brown	27	95
Sandstone, brown	1	96
Sand, brown	20	116
Sand, gray	12	128
Lignite	2	130
Clay, gray	14	144

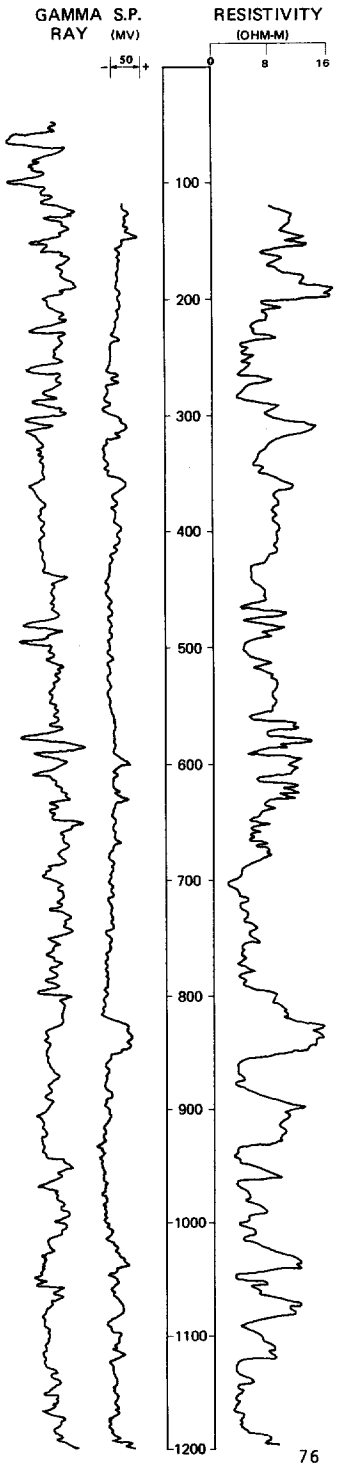
NDSWC 4810
(Log modified from Schlumberger)

LOCATION: 134-104-24DDD1

DATE DRILLED: 7/21/75

ALTITUDE: 3090
(FT, NGVD)

DEPTH: 1300
(FT)



DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-48	Sandstone, dark-yellowish-brown, fine to coarse.
48-53	Lignite.
53-87	Claystone, light-olive-gray.
87-94	Lignite.
94-128	Claystone, greenish-gray; interbedded thin lignite.
128-200	Siltstone, gray; interbedded thin lignite.

LUDLOW MEMBER

200-300	Siltstone, gray, argillaceous; interbedded thin lignite.
300-415	Siltstone, gray, sandy, moderately well sorted; interbedded thin claystone; very sandy near top.

LEBO SHALE MEMBER

415-560	Claystone, siltstone, and lignite; interbedded.

LUDLOW MEMBER

560-685	Sandstone, siltstone, lignite, and claystone; interbedded.
685-795	Claystone, greenish-gray, carbonaceous; interbedded thin lignite.
795-820	Siltstone.
820-853	Sandstone, olive-gray, very fine to medium; carbonaceous trash.

HELL CREEK FORMATION

853-882	Claystone, greenish-gray, bentonitic.
882-932	Sandstone, gray, very argillaceous.
932-1015	Claystone, gray; interbedded thin sandstone.
1015-1120	Sandstone, gray.
1120-1235	Siltstone, gray, very argillaceous.

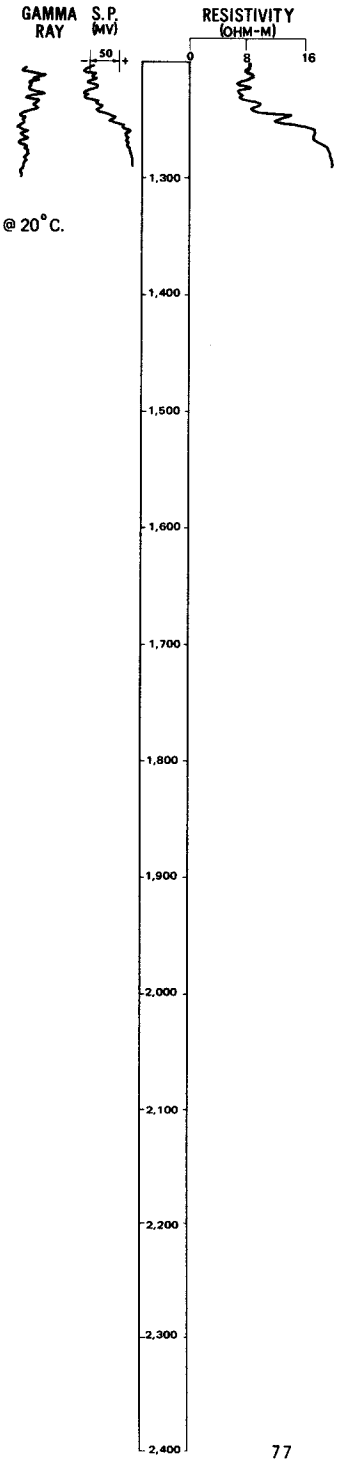
NDSWC 4810, Continued
(Log modified from Schlumberger)

LOCATION: 134-104-24DDD1

DATE DRILLED: 7/21/75

ALTITUDE: 3090
(FT, NGVD)

DEPTH: 1300
(FT, LSD)



NOTE: Rm = 1.0 @ 20°C.

DESCRIPTION OF DEPOSITS

FOX HILLS SANDSTONE

1235-1300 Sandstone, light-gray, very fine to coarse, slightly argillaceous.

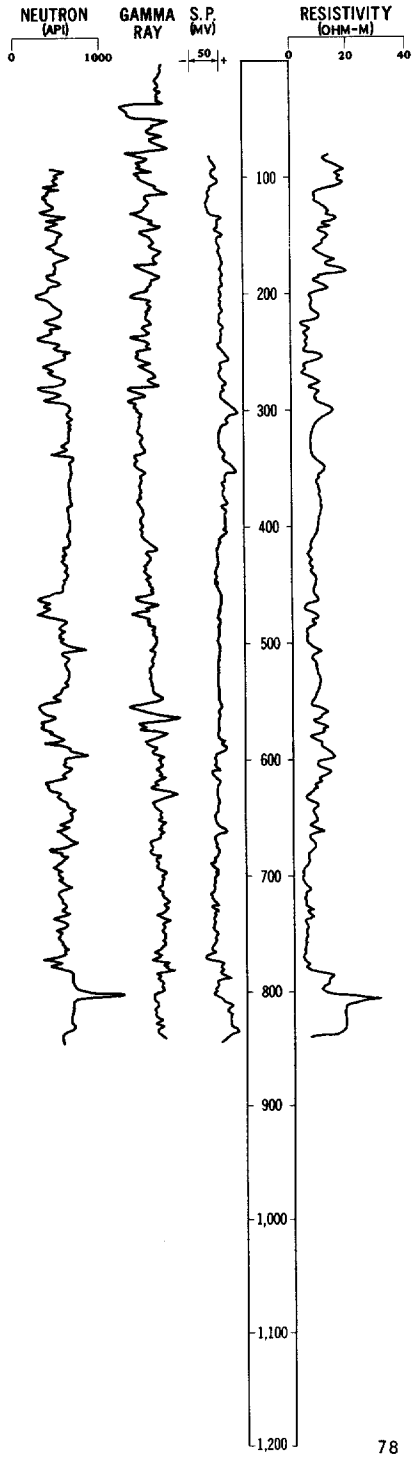
NDSWC 4810B, 4810C

LOCATION: 134-104-24DDD3, 4

DATE DRILLED: 7/12/77

ALTITUDE: 3087
(FT, NGVD)

DEPTH: 850
(FT, LSD)



DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-48	Sandstone, dark-yellowish-brown, fine to coarse.
48-53	Lignite.
53-87	Claystone, light-olive-gray.
87-94	Lignite.
94-128	Claystone, greenish-gray; interbedded thin lignite.
128-200	Siltstone, gray; interbedded thin lignite.

LUDLOW MEMBER

200-300	Siltstone, gray, argillaceous; interbedded thin lignite.
300-464	Siltstone, gray, sandy, moderately well sorted; interbedded thin claystone; very sandy near top.
464-685	Siltstone, gray; interbedded sandstone, lignite, and claystone.
685-795	Claystone, greenish-gray, carbonaceous; interbedded thin lignite.
795-820	Siltstone.
820-850	Sandstone, olive-gray, very fine to medium; carbonaceous trash.

134-104-28DAA
(Log modified from Dependable Drilling)

Altitude: 3045 feet — Date drilled: 8/31/61

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Surface soil	4	4
Shale	23	27
Ledge	1	28
Shale, blue	30	58
Shale, blue; with ledge	4	62
Shale, blue	6	68
Shale, blue, sandy	4	72
Shale, brown	3	75
Shale, gray	2	77
Lignite	1	78
Shale	1	79
Lignite, brown; with shale	2	81
Sand, gray, fine	14	95
Rock	.5	95.5
Shale, gray	5.5	101
Lignite	2	103
Shale, sandy	16	119
Sand	32	151
Shale	8	159
Lignite	4	163
Shale	17	180
Rock	.5	180.5
Lignite	4.5	185
Sand, gray, fine	18	203

134-104-28DAC
(Log modified from Dependable Drilling)

Altitude: 3030 feet — Date drilled: 5/16/61

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay, brown	12	12
Lignite	2	14
Clay, brown; with rock ledges	6	20
Lignite	3	23
Clay, blue	18	41
Lignite	1	42
Clay, blue	11	53
Lignite	3	56
Clay, blue	8	64
Lignite	3	67
Clay, gray	52	119
Clay, gray, sandy	3	122
Sand, gray, fine	33	155
Lignite	2	157

134-105-05BBB
USGS LM-47

Altitude: 2636 feet — Date drilled: 4/22/56

Sand, fine	20	20
Gravel; wet at 20 feet	5	25
Sand, coarse, wet	23	48

134-105-07AAD
USGS LM-43

Altitude: 2633 feet — Date drilled: 4/21/56

Sand, very fine	10	10
Gravel	9	19
Clay, blue, lumpy, very sticky	4	23

134-105-07ABC
USGS LM-45

Altitude: 2635 feet — Date drilled: 4/21/56

Clay, hard	3	3
Sand, fine	7	10
Sand, medium	2	12
Gravel	6	18
Gravel and blue clay	5	23
Sand, blue, sticky, wet; minor blue clay	5	28

134-105-07ABD
USGS LM-44

Altitude: 2633 feet — Date drilled: 4/21/56

Clay, hard	2	2
Sand, fine	11	13
Gravel; wet at 15 feet	7	20
Clay, blue	3	23

134-105-07BAC
USGS LM-46

Altitude: 2638 feet — Date drilled: 4/21/56

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay, hard	3	3
Sand, fine	17	20
Clay, blue, lumpy; minor fine sand	3	23

134-105-09BAA
(Log modified from H & H Service Co.)

Date drilled: 6/22/70

Surface soil	94	94
Lignite	3	97
Shale; with lignite stringers	46	143
Sand, blue, fine	3	146
Shale to sandy shale	80	226
Sand	3	229
Shale to sandy shale	19	248
Lignite	6	254
Shale to sandy shale	48	302
Sand, fine	15	317
Rock ledge	1	318
Sand, fine, to sandy shale	21	339
Shale stringer	1	340
Sand and sandy shale	28	368
Rock ledge	1	369
Shale to sandy shale	47	416
Ledge	1	417
Shale	35	452
Ledge	2	454
Shale, soft	6	460
Ledge	1	461
Sand	30	491
Sand, soft, to sandy shale	25	516
Ledge	1	517
Shale, sandy, soft	4	521
Sand, blue, fine	27	548
Shale, sandy, soft	10	558
Rock ledge	1	559
Shale; with soft shale streaks	674	1,233
Sandstone ledge	5	1,238
Sand	36	1,274
Sand to hard shale	62	1,336

134-105-25ADD
(Log modified from H & H Service Co.)

Altitude: 2950 feet — Date drilled: 12/20/73

Surface soil	25	25
Lignite	10	35
Shale	10	45
Sand	3	48
Lignite	4	52
Shale, soft	8	60
Lignite	6	66
Shale, sandy	6	72
Shale, sandy, to shale	23	95

134-105-26BAA
(Log modified from Dependable Drilling)

Altitude: 2850 feet

Date drilled: 1/17/61

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay, brown, sandy	16	16
Clay, brown	4	20
Clay, blue	5	25
Lignite	1	26
Clay, blue	9	35
Rock	1	36
Clay, blue	4	40
Lignite	3	43
Clay, blue	9	52
Rock	1	53
Clay, blue	17	70
Sand, gray	7	77
Clay, gray	4	81
Rock	1	82
Clay, gray; with sand streaks	12	94
Rock	1	95
Clay, gray	27	122
Rock	1	123
Clay, gray	4	127
Lignite	1	128
Clay, gray	7	135
Clay, blue, sandy	8	143
Clay, gray	61	204
Rock	1	205
Clay, blue	2	207
Sand, blue, coarse	18	225
Clay, blue, sandy	4	229
Clay, blue	38	267
Rock	2	269
Clay, blue, sandy	11	280
Rock	1	281
Sand, gray, fine	51	332
Rock ledge	1	333
Clay, blue, sandy; with lignite streaks	10	343
Clay, blue, hard	12	355
Rock ledge	1	356
Clay, blue	25	381
Clay, blue, hard	4	385
Rock ledge	1	386
Clay, blue, soft	3	389
Clay, blue	36	425
Sand, blue	14	439
Clay, blue	4	443
Rock	2	445
Sand, blue	7	452
Rock ledge	1	453
Sand, blue	4	457
Rock	1	458
Sand, blue	52	510
Rock	1	511
Sand, blue	3	514
Shale	22	536

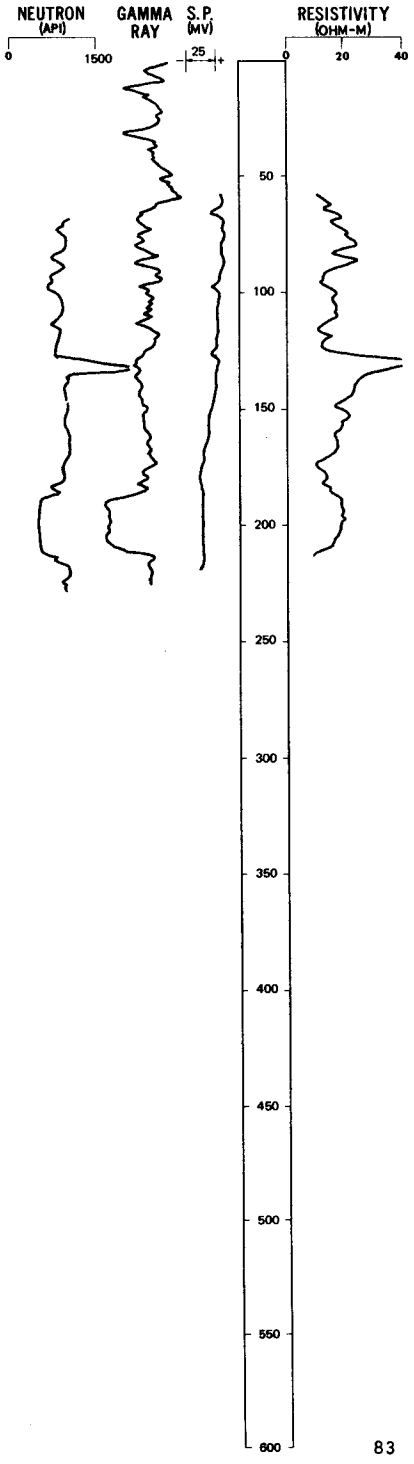
NDSWC 4929

LOCATION: 134-106-01CCC

DATE DRILLED: 7/15/76

ALTITUDE: 2852
(FT, NGVD)

DEPTH: 220
(FT, LSD)



DESCRIPTION OF DEPOSITS

LUDLOW MEMBER

0-5	Sandstone, brown, very fine to fine.
5-8	Lignite.
8-16	Sandstone, brownish-gray, very fine to fine.
16-30	Claystone, gray, tight, carbonaceous.
30-33	Lignite.
33-45	Sandstone, gray, very fine to fine, silty, micaceous.
45-187	Claystone, gray; interbedded thin lignite, sandstone, and siltstone.
187-212	Lignite.
212-220	Claystone, dark-bluish-gray, silty.

134-106-27DBD
(Log modified from Kruger Drilling Co.)

Altitude: 2800 feet — Date drilled: 7/05/66

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand	5	5
Gravel	10	15
Clay, dark-gray	50	65
Sand	10	75
Sand, hard	10	85
Clay; with sand streaks	15	100

135-098-13ADD
(Log modified from Moe Drilling Co.)

Date drilled: 5/24/72

Sand, yellow	39	39
Sandstone, gray	2.5	41.5
Sand, yellow	8.5	50
Sand, blue	12	62
Rock, soft	4	66
Lignite	1.5	67.5
Clay, gray	5.5	73
Lignite	4.5	77.5
Clay, green	7.5	85
Clay, gray, silty	9	94
Clay, gray	7	101
Lignite	3	104
Clay, gray	14	118
Sand, gray, very fine to silty	16	134
Rock, gray, hard	1	135
Sand, gray, medium-coarse	60	195
Sand, gray, chunky	6	201

135-098-14CBC
(Log modified from B & M Drilling)

Altitude: 2765 feet — Date drilled: 9/01/72

Surface soil	3.5	3.5
Sand, brown	10.5	14
Gravel, fine to medium	2.5	16.5
Sand	20.5	37
Lignite	.5	37.5
Sand, gray	16.5	54
Rock, very hard	2.5	56.5
Sand, bluish-gray	73.5	130
Clay; with lignite streaks	10	140

135-098-22BDA
(Log modified from Moe Drilling Co.)

Altitude: 2798 feet — Date drilled: 2/20/70

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand, yellow	27	27
Clay, gray	3	30
Sand, gray	11	41
Lignite	16	57
Clay, gray	2	59
Clay, green	42	101
Rock	1	102
Sand, green	8	110
Sandstone, gray	2	112
Sand, gray	28	140
Clay, gray	1	141

135-098-32DAD2
(Log modified from Iver Sander & Son)

Altitude: 2885 feet — Date drilled: 1951

Clay	8	8
Sand and lignite	2	10
Clay, brown; with lignite ledges	55	65
Clay, blue	22	87
Lignite, brown	6	93
Clay, blue	4	97
Rock	.5	97.5
Clay, gray	7.5	105
Rock	4	109
Clay	6	115
Sand	52	167
Lignite	3	170
Clay	44	214
Rock	2	216
Clay	7	223
Clay and sand	17	240
Rock	2	242
Clay	28	270

135-099-01DDD1
(Log modified from Moe Drilling Co.)

Altitude: 2820 feet — Date drilled: 5/23/72

Sand and gravel	3	3
Clay; with bentonite	21	24
Rock, gray, soft	3	27
Clay, gray	25	52
Sand, very fine	5	57
Clay, gray	30	87
Lignite	6	93
Clay, gray	44	137
Lignite	2	139
Clay, gray	12	151
Lignite	1.5	152.5
Clay, gray	20.5	173
Sand, gray, silty	13.5	186.5
Lignite	4.5	191
Clay, gray	10	201
Sand, gray; with black specks	22	223
Sandstone, gray	2	225
Sand, gray	47	272
Lignite	3	275
Clay, gray	6	281
No lithologic description	----	430

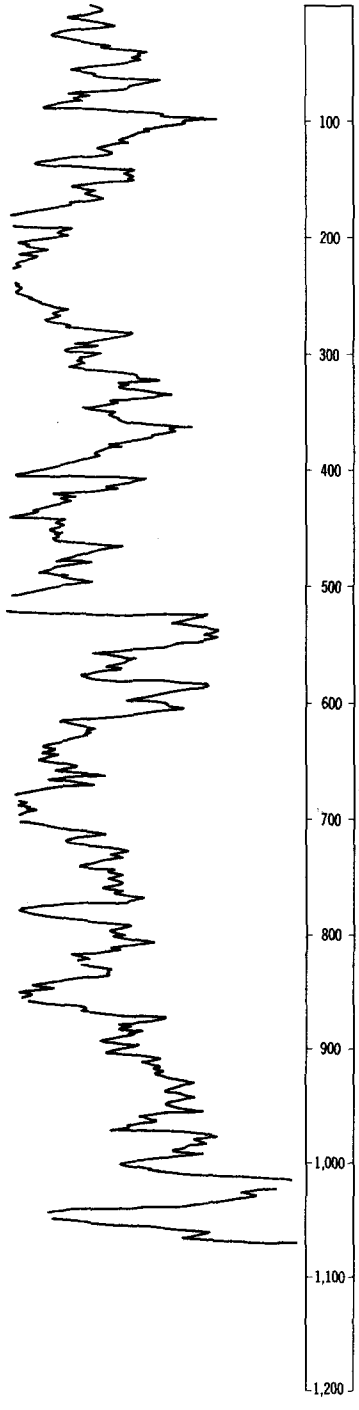
(Log modified from Moe Drilling Co.)

LOCATION: 135-099-01DDD2

DATE DRILLED: 2/28/73

ALTITUDE: 2820
(FT, NGVD)

DEPTH: 1104
(FT, LSD)



	DESCRIPTION OF DEPOSITS
0-74	Clay, yellow, sandy.
74-78	Lignite.
78-84	Clay, gray, sandy.
84-88.5	Lignite.
88.5-128	Clay, gray, sandy.
128-129	Rock.
129-133	Clay, gray.
133-136.5	Lignite.
136.5-185	Clay, gray.
185-275	Sand, gray, chunky.
275-385	Clay, gray.
385-505	Clay, gray, silty.
505-522	Lignite.
522-672	Clay, light-gray.
672-690	Sand, gray, very fine.
690-770	Clay, gray, silty.
770-813	Sand, gray, very fine, chunky.
813-817	Sandstone, gray, hard.
817-949	Clay, gray, sandy.
949-989	Clay, brown.
989-991	Lignite.
991-1013	Clay, gray.
1013-1015	Rock, gray, medium-hard.
1015-1028	Clay, gray.
1028-1029	Rock.
1029-1064	Sand, light-green, chunky.
1064-1066	Rock, hard.
1066-1104	Clay, gray.

135-099-14DAD
(Log modified from Kruger Drilling Co.)

Altitude: 2915 feet — Date drilled: 7/18/73

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay	20	20
Clay, sandy	20	40
Lignite	10	50
Clay	40	90
Sand	20	110

135-099-15CDA
(Log modified from Moe Drilling Co.)

Altitude: 2810 feet — Date drilled: 11/04/68

Topsoil	1	1
Clay, yellow, silty	23	24
Clay, green	5	29
Lignite	2	31
Clay, green	26	57
Clay, gray	58	115
Lignite	4	119
Sand, gray, chunky	7	126
Clay, gray	56	182
Sand, green, chunky	15	197
Lignite	6	203
Clay, gray	20	223
Sand, gray, chunky	147	370
Sand, gray, silty	21	391
Rock, gray, medium-hard	1	392
Sand, gray, very fine	13	405
Clay, light-green	90	495
Sand, gray, very fine	59	554

135-101-15ACC
(Log modified from H & H Service Co.)

Date drilled: 7/28/72

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Surface sand to shale	37	37
Lignite	2	39
Shale	36	75
Lignite	1	76
Shale	14	90
Lignite	2	92
Shale	2	94
Lignite	4	98
Shale	62	160
Siltstone	15	175
Sand, fine to very fine	45	220
Sand, fine	20	240
Shale, sandy	10	250
Lignite	8	258
Shale	9	267
Lignite	10	277
Shale	10	287
Lignite	3	290
Shale, sandy, soft	4	294
Ledge	1	295
Shale	5	300

135-101-16CBA
(Log modified from H & H Service Co.)

Date drilled: 7/26/72

Surface sand to shale	35	35
Lignite	1	36
Shale	48	84
Ledge	1	85
Shale, sandy, to sand	30	115
Lignite	1	116
Sand, fine	11	127
Lignite	1	128
Shale, sandy, to sand	12	140
Lignite	10	150
Shale	5	155
Lignite	2	157
Sand to sandy shale	3	160
Shale	20	180

USGS

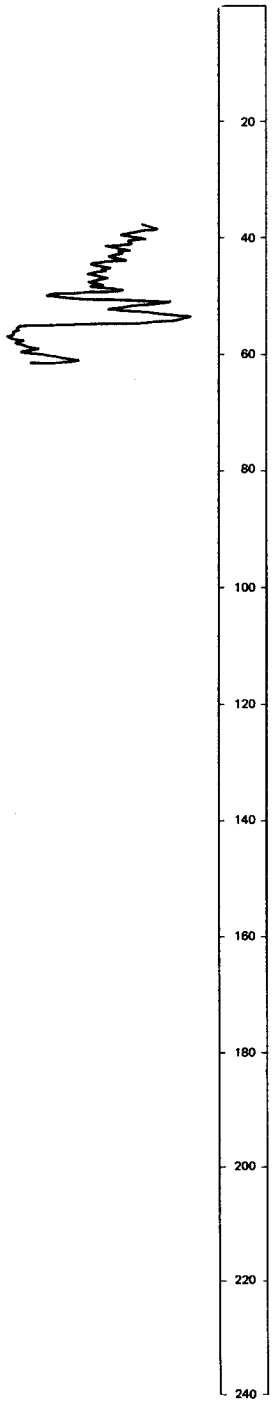
LOCATION: 135-101-32BAA

ALTITUDE: 2775
(FT, NGVD)

DATE DRILLED: 5/19/76

DEPTH: 92
(FT, LSD)

GAMMA RAY



DESCRIPTION OF DEPOSITS

NOTE: No lithology available.

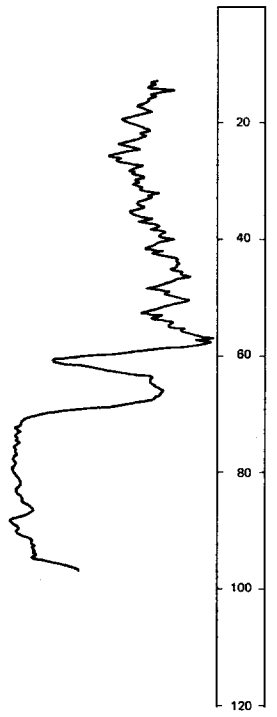
LOCATION: 135-101-33CBC

DATE DRILLED: 6/07/76

ALTITUDE: 2780
(FT, NGVD)

DEPTH: 97
(FT, LSD)

GAMMA RAY



DESCRIPTION OF DEPOSITS

NOTE: No lithology available.

135-102-07BDD
(Log modified from Kruger Drilling Co.)

Altitude: 2694 feet

Date drilled: 7/15/75

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Surface soil and yellow sand	40	40
Rock	2	42
Sand, fine, hard	18	60
Rock	1	61
Shale, sandy	49	110
Clay, sandy	20	130
Sand, blue	5	135
Clay, brown	25	160
Sand	30	190
Lignite	10	200
Clay, sandy	35	235
Sand	40	275
Sand, fine, hard	40	315
Sand, blue, fine; with clay streaks	20	335
Clay, hard	25	360
Sandstone	20	380
Sandstone to clay	10	390

135-102-08DAA
(Log modified from Kruger Drilling Co.)

Altitude: 2736 feet — Date drilled: 6/24/67

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand, yellow	18	18
Lignite	3	21
Clay, light-gray	29	50
Lignite	30	80
Clay	28	108
Lignite	15	123
Clay, whitish	27	150
Clay, greenish, sandy	10	160
Clay, sandy	30	190
Clay, sandy; with rocky spots	10	200
Clay, sandy	20	220
Clay, sandy; with lignite	20	240
Sand, blue	5	245

135-102-16CBA
(Log modified from Kruger Drilling Co.)

Altitude: 2700 feet — Date drilled: 8/08/68

Clay; streak of lignite at 80 feet	100	100
Clay, sandy	10	110
Clay	20	130
Lignite	10	140
Clay	50	190
Sand, dark, coarse, sticky	30	220

135-102-19DAA
(Log modified from Kruger Drilling Co.)

Altitude: 2620 feet — Date drilled: 4/15/75

Sand and gravel	15	15
Clay	135	150
Sand, fine	30	180
Clay	95	275
Lignite	5	280
Clay	80	360
Rock	20	380
Clay	120	500
Sand	40	540
Clay	300	840
Sand	20	860
Sand and rock	15	875
Clay	10	885
Sand	30	915
Clay	105	1,020
Sand	60	1,080

135-102-22CCC
(Log modified from H & H Service Co.)

Altitude: 2745 feet — Date drilled: 6/21/73

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Surface soil to shale	20	20
Sand, brown	7	27
Shale	5	32
Lignite	1	33
Shale	114	147
Ledge	1	148
Sand and sandy shale	6	154
Shale	6	160
Ledge, soft	3	163
Sand, brown to blue	32	195
Ledge	1	196
Sand	14	210
Sand; with shale streaks	10	220

135-102-27ACC
(Log modified from H & H Service Co.)

Altitude: 2745 feet — Date drilled: 7/01/72

Surface soil	10	10
Lignite	1	11
Shale	4	15
Ledge, hard	2	17
Shale	8	25
Lignite	5	30
Shale, blue	25	55
Sand, blue, fine	4	59
Shale	1	60
Sand, blue, fine	10	70
Shale	37	107
Sand, fine	10	117
Lignite	2	119
Shale to sandy shale	21	140
Sand, fine	10	150
Lignite	4	154
Shale	2	156
Sand, brown	9	165
Sandstone, bluish	15	180
Sand, blue	36	216
Shale	3	219
Ledge, hard	1	220
Shale, sandy	20	240

135-102-27BBB
(Log modified from H & H Service Co.)

Altitude: 2760 feet — Date drilled: 7/28/73

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Surface soil	10	10
Lignite	1	11
Shale	14	25
Lignite	5	30
Shale, blue	25	55
Sand; with shale stringers	62	117
Lignite	2	119
Shale to sandy shale	21	140
Sand, fine	10	150
Lignite	4	154
Shale	2	156
Sand, brown	9	165
Sand, bluish	51	216
Shale	3	219
Ledge, hard	1	220
Shale, sandy	20	240

135-103-17DDB
(Log modified from Dependable Drilling)

Altitude: 2880 feet — Date drilled: 9/03/61

Surface soil	2	2
Clay	13	15
Gravel	2	17
Shale	3	20
Lignite, soft	1	21
Shale	1	22
Sandstone	1	23
Shale, gray	34	57
Shale, sandy	5	62
Shale, green	15	77
Shale, hard	5	82
Shale	4	86
Lignite	2	88
Shale, sandy	32	120
Lignite	2	122
Shale	2	124
Lignite	2	126
Shale	10	136
Lignite	24	160
Shale, green	6	166
Shale, sandy	30	196
Lignite	6	202
Shale, gray	59	261
Rock	2	263
Shale	2	265
Rock	1	266
Shale	2	268
Rock	1	269
Shale, green	26	295
Lignite	4	299
Shale	11	310
Lignite	14	324
Shale, sandy	2	326
Sand, blue	22	348
Limestone, white	.5	348.5
Shale, blue, sandy	42.5	391
Rock	1	392
Shale, blue, sandy	12	404
Shale, blue	21	425

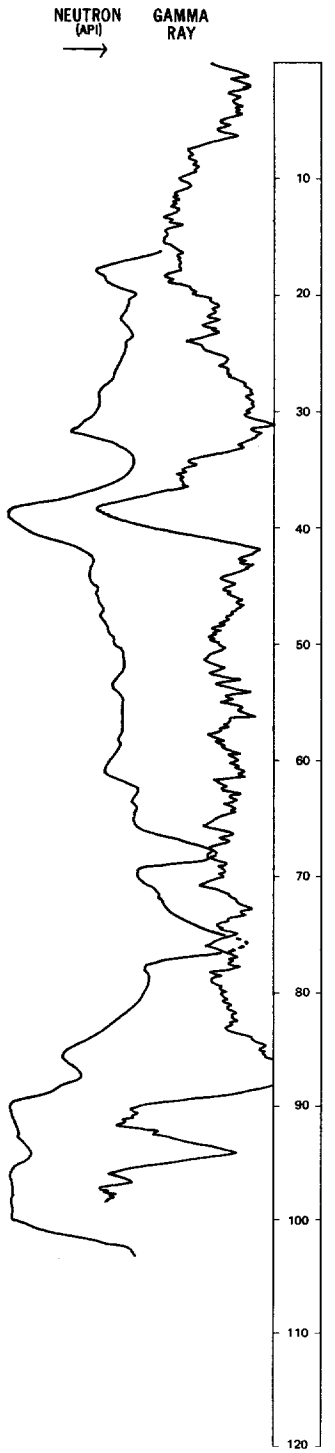
NDSWC 5137, 5137A

LOCATION: 135-104-06BDD1, 2

DATE DRILLED: 7/05/77

ALTITUDE: 2565
(FT, NGVD)

DEPTH: 105
(FT, LSD)



DESCRIPTION OF DEPOSITS

ALLUVIUM

0-7	Clay, yellowish-brown, slightly sandy.
7-19	Gravel, fine to coarse; few klinker and lignite chips.

LUDLOW MEMBER

19-37	Claystone, light-gray; minor carbonaceous trash.
37-41	Lignite.
41-90	Claystone, dark-brownish-gray, silty, slightly sandy, carbonaceous.
90-102	Lignite.
102-105	Claystone.

135-104-06CAC
USGS LM-5

Altitude: 2555 feet

Date drilled: 3/07/56

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand, fine	13	13
Sand, fine, wet; mixed with scoria	12	25
Sand, gravel, and scoria	1	26
Gravel, wet; minor sand	10	36
Clay, blue, sticky, wet	7	43

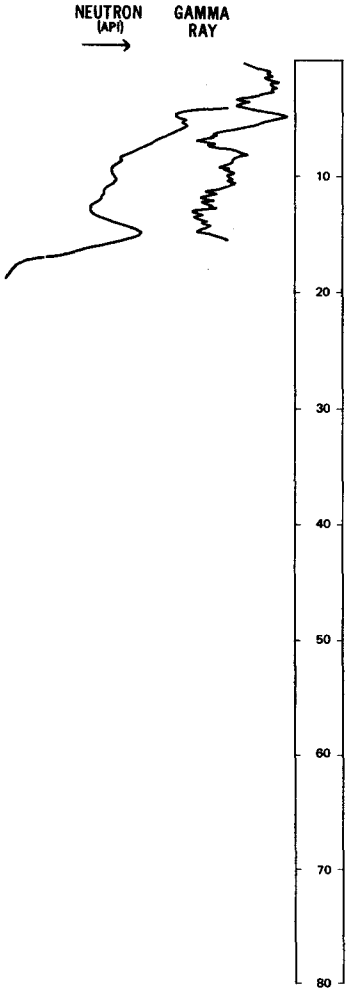
NDSWC 5138

LOCATION: 135-104-06CAD

DATE DRILLED: 7/05/77

ALTITUDE: 2565
(FT, NGVD)

DEPTH: 22
(FT, LSD)



DESCRIPTION OF DEPOSITS

ALLUVIUM

0-12 Clay, light-brownish-gray, very silty.

12-21 Gravel, fine to coarse, angular to subrounded; abundant lignite and klinker chips.

LUDLOW MEMBER

21-22 Claystone, light-gray, silty, bentonitic.

135-105-15AAB
USGS LM-51

Altitude: 2585 feet — Date drilled: 4/24/56

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand, very fine	11	11
Sand, fine	5	16
Gravel; minor scoria	6	22
Sand, medium, wet; minor clay	3	25
Clay, blue, lumpy, very sticky; minor sand	3	28

135-105-15AAD
USGS LM-52

Altitude: 2585 feet — Date drilled: 4/24/56

Sand, very fine	8	8
Sand, medium	7	15
Sand, medium to coarse; chips of scoria	6	21
Clay, blue, very hard; minor sand	2	23

135-105-28AAB
USGS LM-48

Altitude: 2602 feet — Date drilled: 4/23/56

Sand, very fine	11	11
Sand, dark, fine; specks of lignite and scoria	2	13
Sand, very fine	2	15
Sand, medium to coarse	10	25
Sand, coarse	5	30
Gravel, wet	7	37
Clay, blue, very hard	1	38

135-105-28ABD
USGS LM-49

Altitude: 2602 feet — Date drilled: 4/23/56

Sand, fine, lumpy; minor clay	5	5
Clay, brown, lumpy, very sticky; moist at 10 feet	11	16
Clay, blue, sticky	2	18

135-105-28BAD
USGS LM-50

Altitude: 2604 feet — Date drilled: 4/23/56

Sand, fine; minor clay	5	5
Clay, brown, hard, lumpy	10	15
Sand, very fine	2	17
Clay, brown, lumpy; large rock; minor sand	2	19
Clay, brown, lumpy	1	20
Clay, blue, very hard	3	23

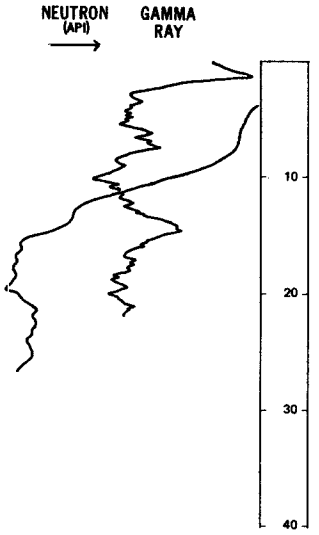
NDSWC 5134

LOCATION: 135-105-33ACB

DATE DRILLED: 6/30/77

ALTITUDE: 2610
(FT, NGVD)

DEPTH: 33
(FT, LSD)



DESCRIPTION OF DEPOSITS

ALLUVIUM

0-15 Clay, light-yellowish-brown, silty.

15-27 Gravel, fine to coarse, flat to subrounded; abundant lignite chips.

LUDLOW MEMBER

27-33 Claystone, light-greenish-gray, silty.

135-106-07ABC
(Log modified from Harold Goodale)

Date drilled: 6/14/74

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sandfill	25	25
Lignite	20	45
Shale	13	58
Lignite	4	62
Shale	48	110
Sand	30	140

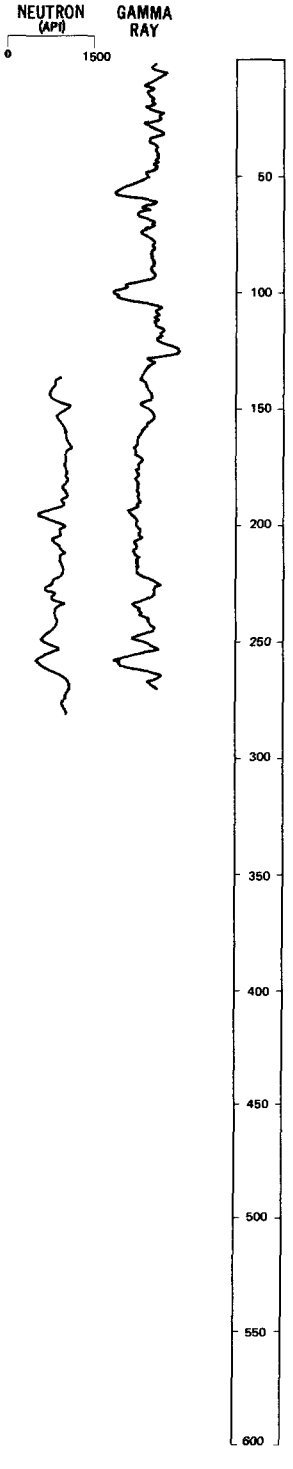
NDSWC 4950

LOCATION: 136-098-01BAA

DATE DRILLED: 8/11/76

ALTITUDE: 2765
(FT, NGVD)

DEPTH: 280
(FT, LSD)



DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-15	Claystone, yellowish-brown, tight.
15-22	Sandstone, reddish-brown, slightly argillaceous.
22-54	Claystone, light-olive-gray, silty, bentonitic.
54-60	Lignite.
60-96	Claystone, gray, silty, tight; sandy from 75 to 80 feet.
96-104	Lignite.
104-114	Sandstone, light-gray, very fine, silty.
114-160	Claystone, gray; silty near base.
160-222	Sandstone.
222-247	Claystone, greenish-gray, silty.
247-250	Lignite.
250-256	Claystone, dark-gray, carbonaceous.
256-262	Lignite.
262-280	Claystone, gray, silty, carbonaceous.

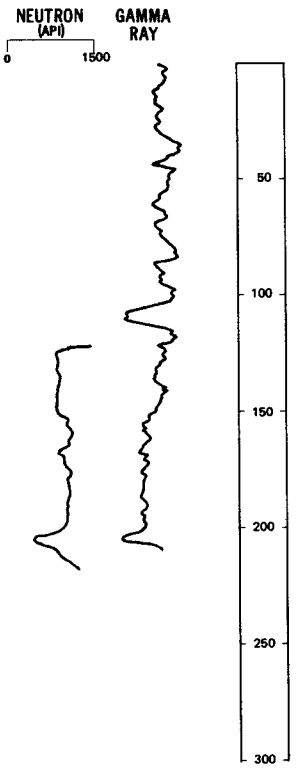
NDSWC 4951

LOCATION: 136-098-05AAA

ALTITUDE: 2715
(FT, NGVD)

DATE DRILLED: 8/11/76

DEPTH: 220
(FT, LSD)



DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-5	Claystone, light-yellowish-brown, silty.
5-12	Claystone, gray, silty, tight.
12-16	Sandstone, yellowish-brown, very fine, argillaceous.
16-42	Claystone, yellowish-brown; oxidized to 35 feet.
42-45	Lignite.
45-105	Claystone, gray, silty; interbedded thin lignite and siltstone.
105-113	Lignite.
113-156	Claystone, dark-bluish-gray, tight, slightly carbonaceous.
156-203	Sandstone, gray, very fine to fine, argillaceous.
203-207	Lignite.
207-220	Claystone, greenish-gray, silty, tight.

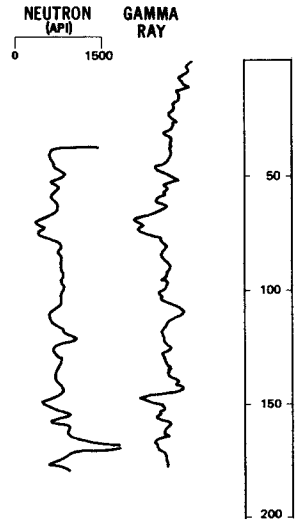
NDSWC 4949

LOCATION: 136-098-15AAA

ALTITUDE: 2670
(FT, NGVD)

DATE DRILLED: 8/10/76

DEPTH: 180
(FT, LSD)



DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-5	Claystone, dark-reddish-brown, soft.
5-10	Claystone, yellowish-brown, tight.
10-17	Claystone, light-olive-gray, sandy.
17-34	Siltstone, light-brown.
34-68	Claystone, dark-gray, silty, tight.
68-76	Lignite.
76-146	Claystone, gray, silty, carbonaceous; bentonitic near base.
146-157	Lignite.
157-180	Claystone, dark-greenish-gray, tight.

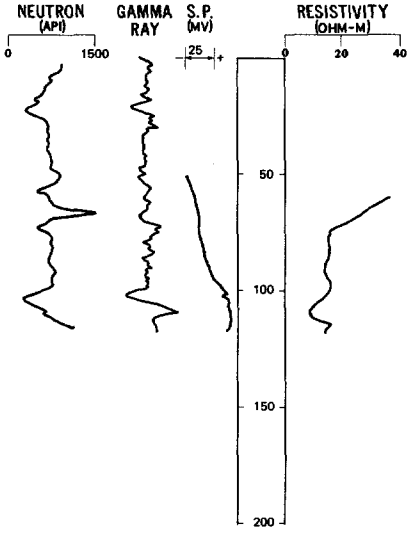
NDSWC 4948

LOCATION: 136-098-15CBB

DATE DRILLED: 8/10/76

ALTITUDE: 2610
(FT, NGVD)

DEPTH: 120
(FT, LSD)



DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-15	Claystone, brown, sandy, soft.
15-21	Claystone, gray, silty.
21-24	Lignite.
24-58	Sandstone, gray, very fine, silty, micaceous, slightly argillaceous.
58-78	Claystone, gray, tight.
78-100	Sandstone, gray, very fine to fine, silty.
100-105	Lignite.
105-116	Claystone, gray, silty, tight.
116-120	Sandstone, light-gray, very fine to fine.

136-098-23AAB
(Log modified from Moe Drilling Co.)

Altitude: 2460 feet

Date drilled: 11/05/70

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand to yellow gravel	16	16
Clay, red	2	18
Clay, gray	7	25
Lignite	1.5	26.5
Clay	118.5	145
Clay, white	48	193
Sand, gray, medium-coarse	2	195
Clay	7	202

136-098-33CCD
(Log modified from H & H Service Co.)

Date drilled: 5/24/73

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Surface soil	22	22
Shale	10	32
Lignite	3	35
Shale	3	38
Lignite	1	39
Sand	8	47
Lignite	1	48
Sand; with ledges	19	67
Rock ledge	1	68
Shale	7	75
Ledge	1	76
Sand	22	98
Lignite	4	102
Shale	18	120

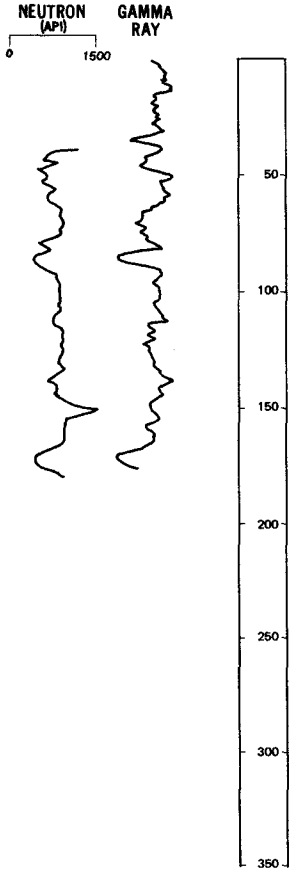
NDSWC 4952

LOCATION: 136-099-15ADD

DATE DRILLED: 8/12/76

ALTITUDE: 2700
(FT, NGVD)

DEPTH: 180
(FT, LSD)



DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-26	Claystone, light-yellowish-brown, silty, soft.
26-33	Claystone, gray, silty.
33-36	Lignite.
36-82	Claystone, gray; interbedded thin sandstone and lignite.
82-88	Lignite.
88-112	Claystone, dark-gray, carbonaceous.
112-156	Siltstone, gray, argillaceous.
156-167	Sandstone, gray, very fine, argillaceous.
167-175	Lignite.
175-180	Claystone, olive-gray.

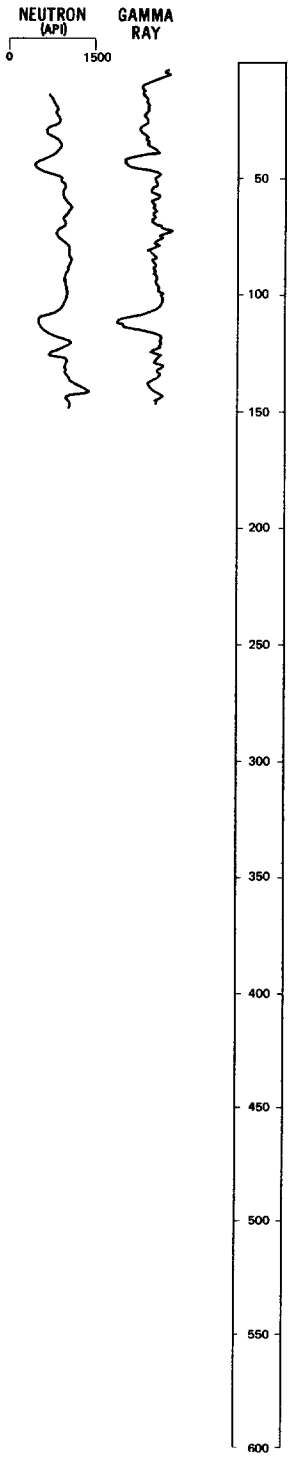
NDSWC 4953

LOCATION: 136-099-20DDD

ALTITUDE: 2700
(FT, NGVD)

DATE DRILLED: 8/12/76

DEPTH: 180
(FT, LSD)



DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

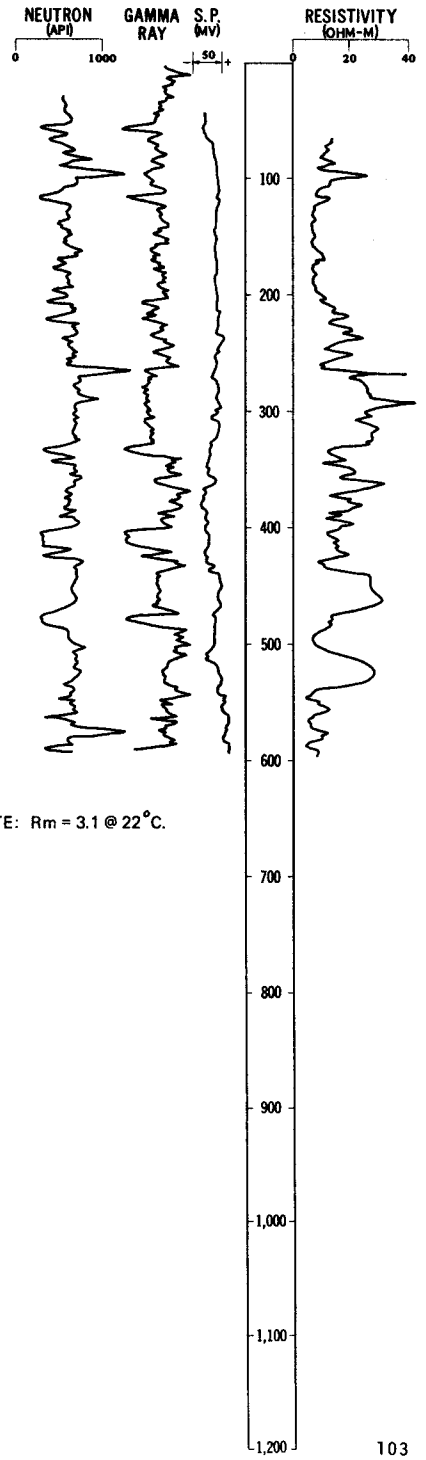
0-35	Sandstone, fine; oxidized to 20 feet.
35-41	Claystone, light-gray, silty, tight.
41-46	Lignite.
46-108	Claystone, gray, silty; interbedded thin lignite.
108-116	Lignite.
116-160	Claystone, gray, silty, carbonaceous; interbedded thin lignite.
160-180	No lithologic description.

LOCATION: 136-099-26DAD

DATE DRILLED: 8/05/76

ALTITUDE: 2640
(FT, NGVD)

DEPTH: 600
(FT, LSD)



NOTE: Rm = 3.1 @ 22°C.

DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-10	Sandstone, yellowish-brown, very fine to fine, very argillaceous.
10-25	Claystone, yellowish-brown, silty.
25-57	Claystone, dark-gray; interbedded thin sandstone.
57-62	Lignite.
62-94	Claystone, gray, silty; interbedded thin sandstone.
94-110	Sandstone, bluish-gray, very fine to fine, slightly argillaceous.
110-116	Claystone, gray, silty.

TONGUE RIVER MEMBER

116-121	Lignite.
121-220	Claystone, greenish-gray, very silty; minor carbonaceous trash; with interbedded bentonites.
220-225	Lignite.
225-274	Claystone, greenish-gray, very silty; bentonitic.
274-330	Sandstone, light-gray, very fine; interbedded siltstone.
330-340	Sandstone, light-gray, very fine; fossiliferous.
340-350	Sandstone, light-gray, very fine; interbedded siltstone.
350-404	Claystone, gray, very silty, slightly carbonaceous, slightly bentonitic; minor sand.
404-421	Lignite.
421-426	Claystone, greenish-gray, very silty.
426-428	Lignite.
428-440	Claystone, greenish-gray, very silty.
440-478	Sandstone, bluish-green, fine, medium- to well-sorted.
478-489	Lignite.
489-508	Claystone, light-gray, bentonitic.
508-538	Sandstone, greenish-gray, very fine, argillaceous.

LUDLOW MEMBER

538-600	Claystone, gray, silty, carbonaceous; interbedded sandstone.

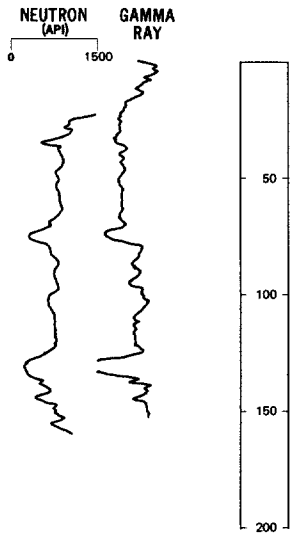
NDSWC 4956

LOCATION: 136-099-31BCC

ALTITUDE: 2760
(FT, NGVD)

DATE DRILLED: 8/13/76

DEPTH: 160
(FT, LSD)



DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-35	Sandstone, yellowish-brown.
35-72	Sandstone, gray, fine to medium, micaceous.
72-77	Lignite.
77-128	Claystone, light-gray, silty, tight.
128-135	Lignite.
135-160	Claystone, light-gray, tight, slightly carbonaceous.

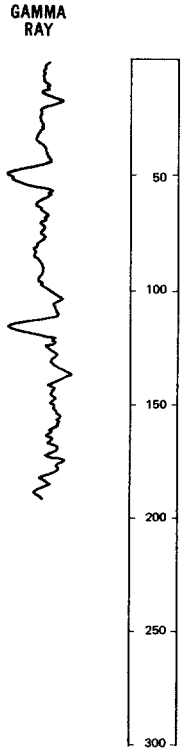
NDSWC 4955

LOCATION: 136-099-33DAA

ALTITUDE: 2705
(FT, NGVD)

DATE DRILLED: 8/13/76

DEPTH: 200
(FT, LSD)



DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-5	Sandstone, yellowish-gray, very fine, silty.
5-17	Claystone, yellowish-brown, silty, tight.
17-21	Claystone, gray.
21-36	Sandstone, gray, very fine, silty, argillaceous.
36-47	Claystone, gray, silty, tight.
47-55	Lignite.
55-114	Claystone, gray, silty, tight, carbonaceous.
114-119	Lignite.
119-200	Claystone, gray; interbedded thin lignite and siltstone.

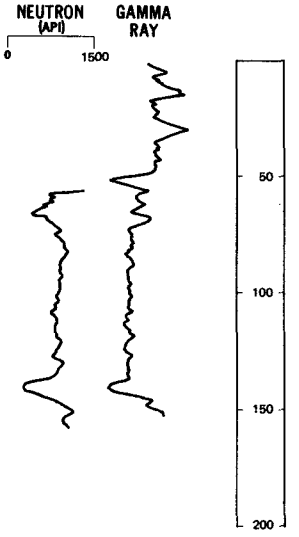
NDSWC 4957

LOCATION: 136-099-36CCC

DATE DRILLED: 8/16/76

ALTITUDE: 2705
(FT, NGVD)

DEPTH: 160
(FT, LSD)



DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-7	Claystone, yellowish-brown, tight.
7-30	Claystone, gray, silty.
30-36	Lignite.
36-51	Claystone, gray, silty, tight.
51-55	Lignite.
55-73	Claystone, gray, silty, carbonaceous.
73-138	Sandstone, light-olive-gray, very fine, micaceous, slightly argillaceous.
138-145	Lignite.
145-160	Claystone, gray, silty, bentonitic.

136-100-09CAD
(Log modified from Kruger Drilling Co.)

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay	60	60
Lignite	10	70
Clay	80	150
Lignite	5	155
Clay	65	220
Clay, sandy	30	250
Clay	60	310
Lignite	30	340
Clay	25	365
Sand, fine	35	400
Sandstone	10	410
Sand	5	415

136-100-20CDC
(Log modified from Kruger Drilling Co.)

Date drilled: 9/16/72

Sand	42	42
Rock	1	43
Sand	11	54
Lignite	6	60
Sand	20	80

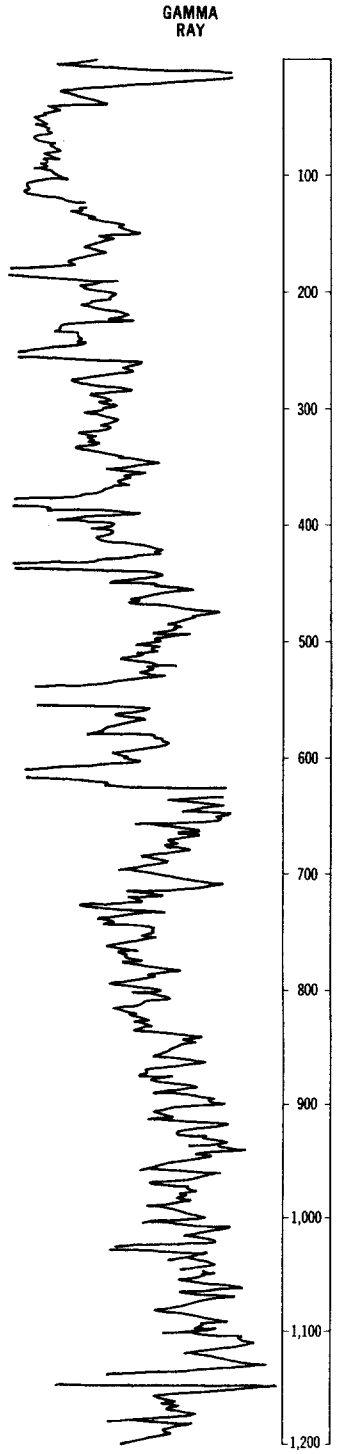
(Log modified from Moe Drilling Co.)

LOCATION: 136-100-26BCB

DATE DRILLED: 4/08/71

ALTITUDE: 2820
(FT, NGVD)

DEPTH: 1500
(FT, LSD)



	DESCRIPTION OF DEPOSITS
0-2	Topsoil.
2-52	Clay.
52-118	Sand, gray.
118-123	Lignite.
123-280	Clay, gray.
280-377	Clay, white.
377-383	Lignite.
383-400	Clay, white.
400-401	Rock.
401-405	Sand, gray, very fine.
405-432	Clay, white.
432-438	Lignite.
438-535	Clay, white, silty.
535-538	Lignite.
538-564	Clay, white, silty.
564-611	Sand, silty, very fine.
611-628	Lignite.
628-650	Sand, silty, very fine.
650-685	Sand, gray, very fine to silty.
685-758	Sand, gray, medium-fine.
758-761	Sandstone, gray, soft.
761-817	Clay, silty.
817-890	Sand, green.
890-893	Limestone, tannish-yellow.
893-901	Clay, dark-gray.
901-1194	Clay, silty.
1194-1228	Sand, gray, very dirty; with black specks.

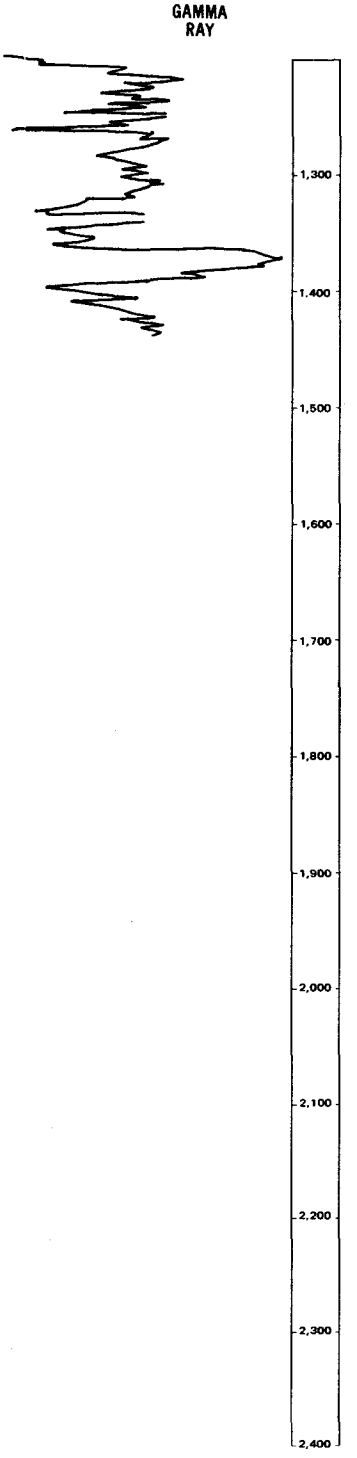
(Log modified from Moe Drilling Co.), Continued

LOCATION: 136-100-26BCB

DATE DRILLED: 4/08/71

ALTITUDE: 2820
(FT, NGVD)

DEPTH: 1500
(FT, LSD)



DESCRIPTION OF DEPOSITS

1228-1229	Rock, hard.
1229-1238	Sand, gray, very dirty.
1238-1242	Lignite.
1242-1354	Sand, gray, very dirty.
1354-1364	Sand, gray, medium, well-sorted.
1364-1400	Clay, sandy, tight.
1400-1450	Sand, gray, medium-fine.
1450-1500	Clay; with some sand.

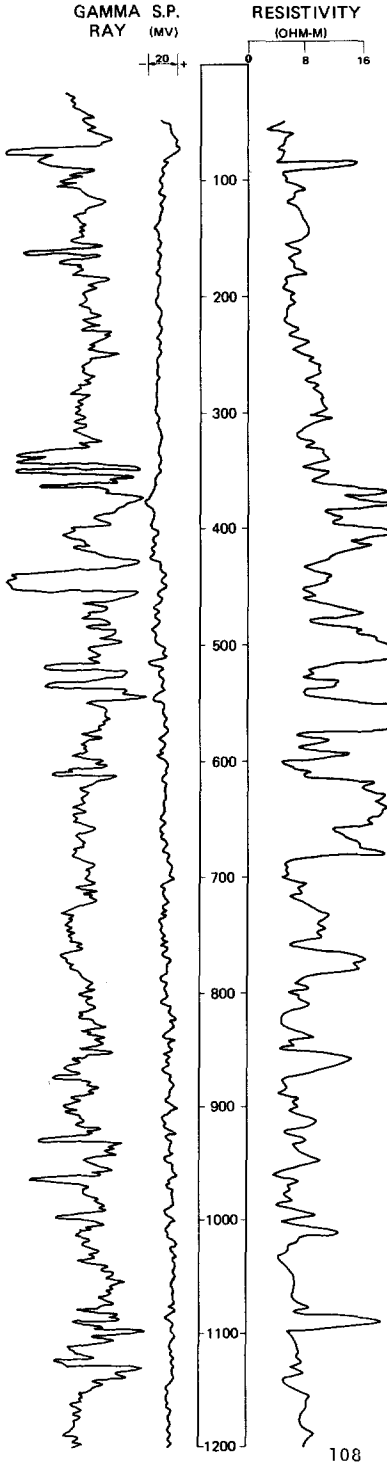
NDSWC 4811
(Log modified from Schlumberger)

LOCATION: 136-100-31DDC1

DATE DRILLED: 7/22/75

ALTITUDE: 2870
(FT, NGVD)

DEPTH: 1725
(FT)



DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-8	Sandstone, pale-yellowish-brown.
8-15	Sandstone, gray.
15-20	Sandstone, dark-yellowish-brown.
20-48	Sandstone, gray, fine to medium, bentonitic.
48-73	Claystone, dark-gray.

TONGUE RIVER MEMBER

73-87	Lignite.
87-248	Claystone, olive-gray, very silty; numerous interbedded thin lignite.
248-330	Siltstone, light-greenish-gray.
330-362	Lignite; thin claystone partings.
362-398	Siltstone, light-greenish-gray.
398-408	Sandstone.
408-435	Claystone, light-gray, silty.
435-452	Lignite.
452-468	Claystone.
468-517	Sandstone, gray, silty, argillaceous.
517-550	Claystone, gray; interbedded lignite.
550-574	Sandstone, gray, light-bluish-gray, very silty.
574-600	Siltstone, gray; interbedded thin lignite.

LUDLOW MEMBER

600-615	Claystone, dark-gray; interbedded lignite.
615-683	Sandstone, light-greenish-gray, very fine to fine, silty; fresh iron sulfide.

CANNONBALL MEMBER

683-722	Claystone, light-greenish-gray, silty.

LUDLOW MEMBER

722-782	Sandstone, gray, very fine, silty.
782-852	Siltstone, olive-gray; numerous interbedded lignite near base.
852-870	Sandstone, gray, very fine, silty.
870-1035	Siltstone, gray; interbedded claystone, lignite, and thin sandstone.
1035-1145	Siltstone, gray.
1145-1219	Sandstone, light-gray, very silty.

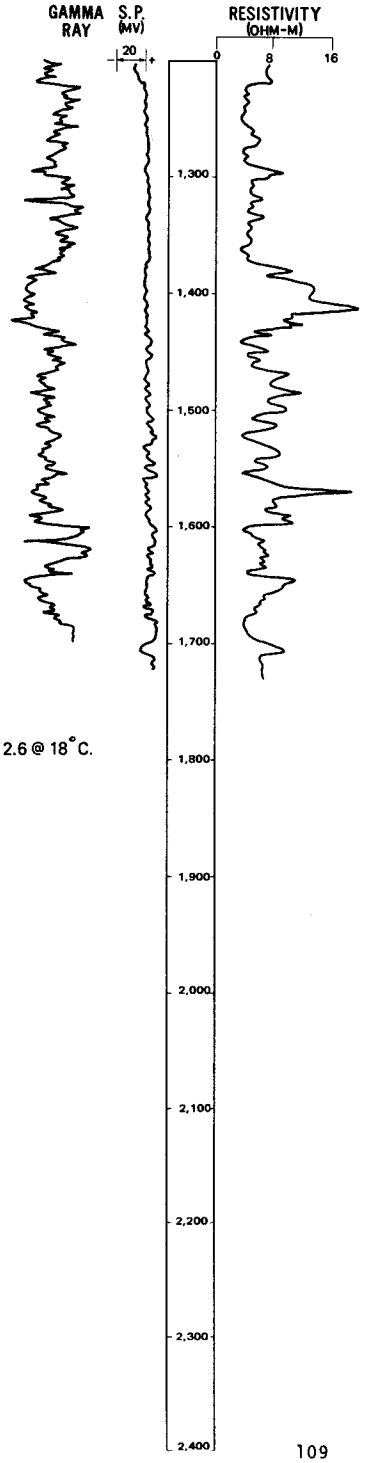
NDSWC 4811, Continued
(Log modified from Schlumberger)

LOCATION: 136-100-31DDC1

DATE DRILLED: 7/22/75

ALTITUDE: 2870
(FT, NGVD)

DEPTH: 1725
(FT, LSD)



NOTE: Rm = 2.6 @ 18°C.

DESCRIPTION OF DEPOSITS

HELL CREEK FORMATION

1219-1375 Claystone, dark-gray, carbonaceous; interbedded thin lignite.

1375-1435 Sandstone, bluish-gray, slightly silty.

1435-1468 Claystone, gray, carbonaceous.

FOX HILLS SANDSTONE

1468-1725 Sandstone, light-bluish-gray, very fine to fine; numerous interbedded siltstone; few interbedded claystone.

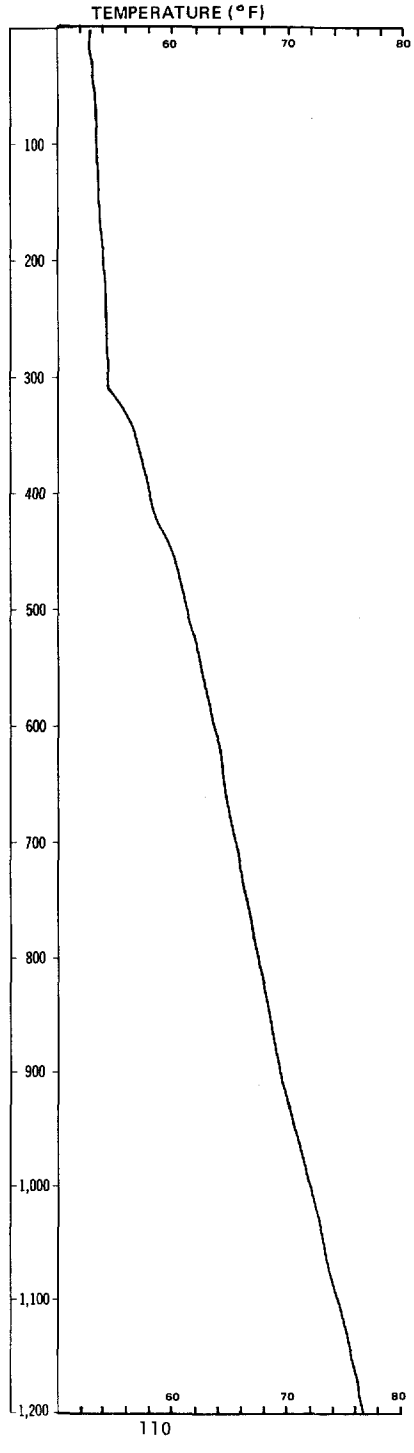
NDSWC 4811, Continued
(Log modified from Schlumberger)

LOCATION: 136-100-31DDC1

DATE DRILLED: 7/22/75

ALTITUDE: 2870
(FT, NGVD)

DEPTH: 1725
(FT, LSD)



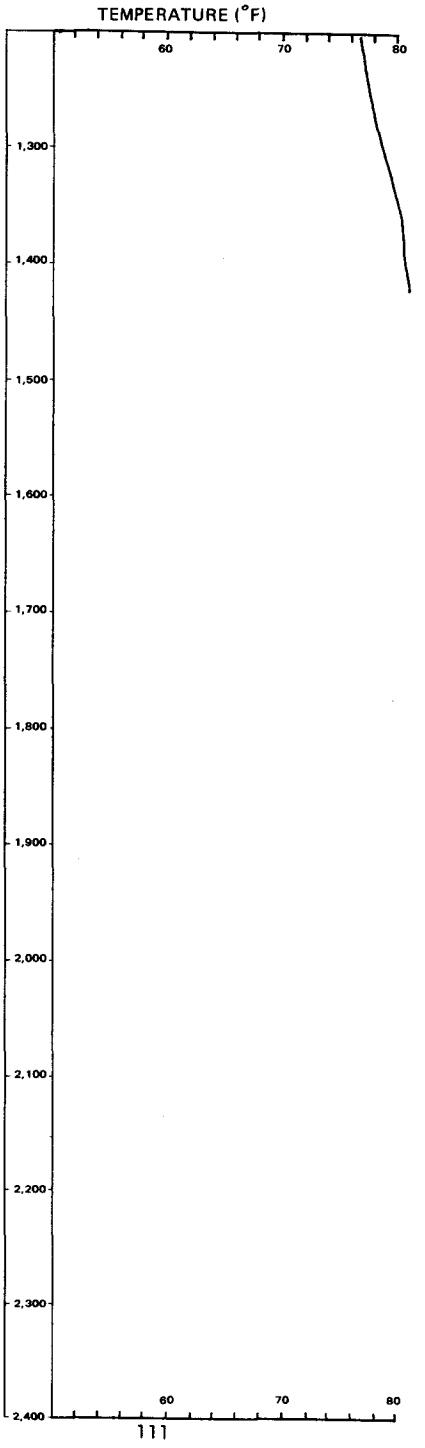
NDSWC 4811, Continued
(Log modified from Schlumberger)

LOCATION: 136-100-31DDC1

DATE DRILLED: 7/22/75

ALTITUDE: 2870
(FT, NGVD)

DEPTH: 1725
(FT, LSD)



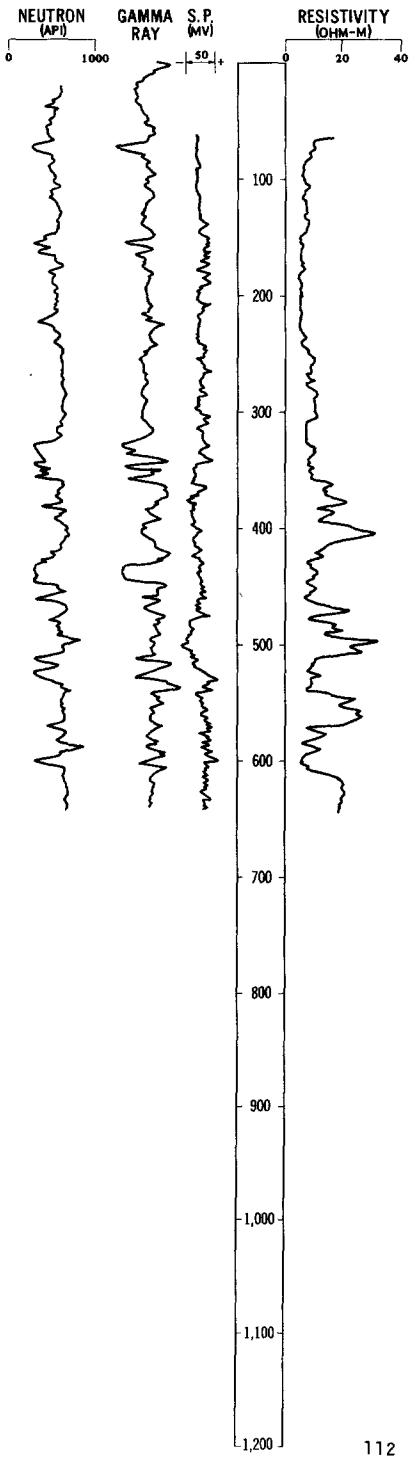
NDSWC 4811A

LOCATION: 136-100-31DDC2

DATE DRILLED: 7/11/77

ALTITUDE: 2870
(FT, NGVD)

DEPTH: 650
(FT, LSD)



DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-8	Sandstone, pale-yellowish-brown.
8-15	Sandstone, gray.
15-20	Sandstone, dark-yellowish-brown.
20-48	Sandstone, gray, fine to medium, bentonitic.
48-73	Claystone, dark-gray.

TONGUE RIVER MEMBER

73-87	Lignite.
87-248	Claystone, olive-gray, very silty; numerous interbedded thin lignite.
248-330	Siltstone, light-greenish-gray.
330-362	Lignite; thin claystone partings.
362-398	Siltstone, light-greenish-gray.
398-408	Sandstone.
408-435	Claystone, light-gray, silty.
435-452	Lignite.
452-468	Claystone.
468-517	Sandstone, gray, silty, argillaceous.
517-550	Claystone, gray; interbedded lignite.
550-574	Sandstone, gray to light-bluish-gray, very silty.
574-600	Siltstone, gray; interbedded thin lignite.

LUDLOW MEMBER

600-615	Claystone, dark-gray; interbedded lignite.
615-650	Sandstone, light-greenish-gray, very fine to fine, silty; fresh iron sulfide.

136-101-25ACC
(Log modified from Kruger Drilling Co.)

Date drilled: 2/18/65

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill	10	10
Clay	30	40
Lignite, hard	10	50
Clay, gray, hard	10	60
Clay, gray	40	100
Clay, bluish	20	120
Lignite	10	130
Sand, white	5	135
Clay, gray	25	160
Lignite	10	170
Clay, sandy	20	190
Clay, light-gray	20	210
Rock	2	212
Clay, light-gray, sandy	8	220
Clay, grayish-blue	53	273
Rock, gray, hard	2	275
Clay, gray	105	380
Clay, brownish	40	420
Lignite, soft	15	435
Clay, bluish	20	455
Clay, gray	10	465
Clay, gray; coarse texture	10	475
Clay, light-gray, sandy	20	495
Sand, clayey; many white specks	10	505
Sand, gray, fine; many white specks	5	510
Sand, gray, fine	5	515

136-101-29CBB
(Log modified from Kruger Drilling Co.)

Date drilled: 9/15/72

Sand	20	20
Sand, fine	10	30
Lignite	10	40
Clay	85	125
Lignite	10	135
Clay	65	200
Sand	20	220

136-101-32CCA
(Log modified from Kruger Drilling Co.)

Date drilled: 9/22/72

Sand, yellow	20	20
Lignite	12	32
Sand, brown	8	40
Clay	170	210
Lignite	10	220
Sand, clayey	95	315
Sand	15	330

136-102-08CAD
USGS LM-61

Altitude: 2425 feet — Date drilled: 5/04/56

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Topsoil	1	1
Clay, fine, dry	1	2
Sand, medium to coarse; chips of scoria and lignite; wet at 20 feet	22	24
Gravel, wet	7	31
Sand, blue, sticky; minor clay	2	33

136-102-08CDA
USGS LM-60

Altitude: 2425 feet — Date drilled: 5/04/56

Topsoil	1	1
Sand, medium to coarse; heavy deposit of scoria mixed in	5	6
Sand, very fine	8	14
Sand, medium; wet at 21 feet	10	24
Sand, blue, sticky, wet; minor clay	4	28

136-102-09DCC
(Log modified from H & H Service Co.)

Altitude: 2460 feet — Date drilled: 4/13/73

Surface sand	10	10
Scoria and gravel	35	45
Sand to sandy shale; with sandstone	33	78
Shale, sandy, to shale with sand streaks to gray firm shale	22	100

136-102-12CCA
(Log modified from Kruger Drilling Co.)

Altitude: 2460 feet — Date drilled: 4/10/64

Clay, light-gray, soft	12	12
Gravel, gray and yellow	1	13
Clay, gray, soft	17	30
Lignite, soft	18	48
Clay, dark-gray	12	60
Lignite, soft	20	80
Clay, light-gray	16	96

136-102-15ACC
(Log modified from H & H Service Co.)

Altitude: 2560 feet — Date drilled: 4/18/73

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Surface sand	10	10
Shale	8	18
Scoria	2	20
Shale	10	30
Lignite	7	37
Shale	56	93
Lignite	1	94
Shale	4	98
Lignite	2	100
Shale	22	122
Sand, gray, fine to very fine	63	185
Shale, sandy	7	192
Rock ledge	2	194
Shale; with ledges, sand streaks, and sandy shale streaks	538	732
Sandstone	2	734
Sand, medium-blue	40	774
Shale	1	775
Sand; with shale streaks	21	796
Rock ledge, hard	1	797
Sand; with lignite at 808 feet	18	815
Shale to sandy shale	49	864
Sand, medium-blue	56	920
Sand to sandy shale	25	945
Shale, sandy; with sand streaks and soft sandy shale	53	998
Shale, very hard	2	1,000
Shale, sandy, to shale	60	1,060
Shale, firm	1	1,061
Sand	39	1,100
Ledge, firm	1	1,101
Sand	29	1,130
Sand and sandy shale	15	1,145
Rock ledge	1	1,146
Soft sand returns; with firm streaks	21	1,167
Rock ledge	2	1,169
Shale, sandy	13	1,182
Rock ledge	1	1,183
Shale, sandy, soft, to shale; with occasional hard streaks	217	1,400

136-103-05CAC
USGS LM-58

Altitude: 2478 feet — Date drilled: 4/26/56

Sand, very fine	9	9
Sand, medium to coarse; chips of scoria	9	18
Gravel, wet; large rocks	2	20
Sand, blue	2	22

136-103-05DAB
USGS LM-59

Altitude: 2474 feet — Date drilled: 4/26/56

Topsoil	1	1
Sand, very fine	5	6
Gravel; chips of scoria	15	21

136-103-05DBC
USGS LM-57

Altitude: 2476 feet — Date drilled: 4/26/56

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand, very fine	9	9
Sand, medium; very large rocks; chips of scoria	10	19
Sand, blue, medium to coarse, sticky, wet	6	25
Sand, blue, and wet clay	3	28

136-103-18CDD
(Log modified from H & H Service Co.)

Date drilled: 3/31/73

Surface sand and gravel	40	40
Shale; with sand and clay	81	121
Sand	36	157
Shale	25	182
Lignite	15	197
Shale; with occasional ledge	598	795
Shale, sandy, to sand	5	800
Sand	80	880
Shale, sandy, to shale	20	900

136-103-22BCB
(Log modified from Dependable Drilling)

Altitude: 2720 feet — Date drilled: 9/10/61

Surface soil	3	3
Clay, yellow	3	6
Scoria	1	7
Shale, yellow	23	30
Lignite	1	31
Clay, gray	31	62
Shale, soft	1	63
Clay, gray	17	80
Rock	1	81
Clay, gray	1	82
Sand, gray, fine	11	93
Shale, gray	26	119
Lignite	14	133
Clay, gray	35	168
Lignite	1	169
Clay	3	172
Lignite	2	174
Shale	10	184
Lignite	7	191
Shale, sandy	53	244
Shale	3	247
Sandstone	49	296
Rock	1	297
Shale, gray	7	304
Clay, gray	16	320
Lignite	4	324
Shale	5	329
Shale, sandy	39	368
Sand	7	375
Shale, brown	2	377

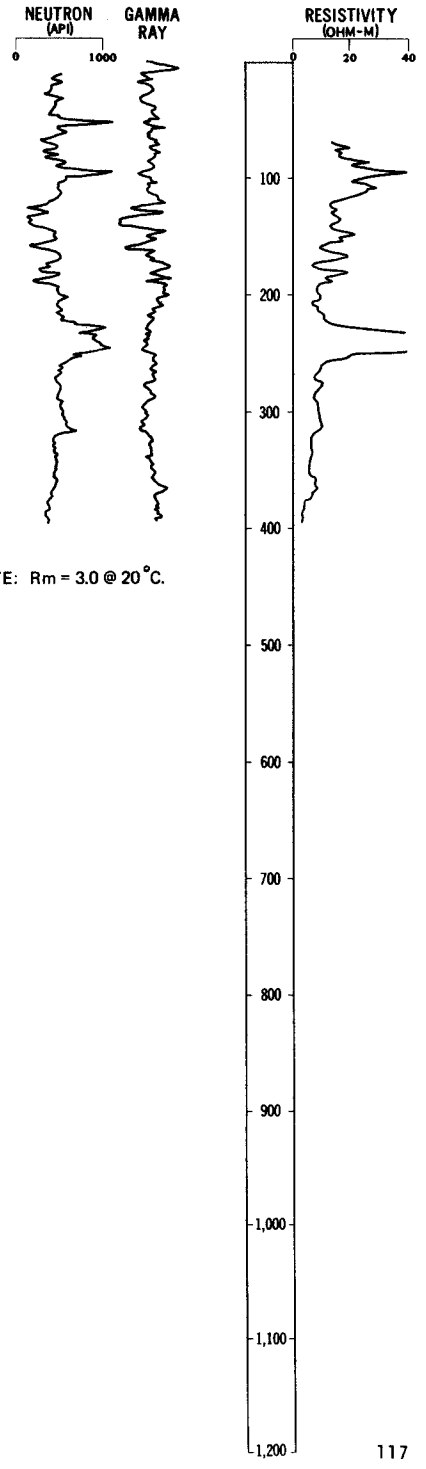
NDSWC 4943

LOCATION: 136-103-22BCC

ALTITUDE: 2775
(FT, NGVD)

DATE DRILLED: 8/03/76

DEPTH: 400
(FT, LSD)



NOTE: Rm = 3.0 @ 20°C.

DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-5	Claystone, pale-yellowish-brown.
5-7	Klinker.
7-15	Claystone, pale-yellowish-brown.
15-45	Claystone, gray, tight.
45-68	Claystone, greenish-gray, tight.
68-84	Thin interbedded lignite.
84-124	Claystone, light-gray, sandy, bentonitic.
124-143	Lignite; thin clay parting.
143-156	Claystone, brownish-gray, silty.
156-162	Lignite.
162-186	Claystone, brownish-gray, silty.
186-191	Lignite.
191-223	Claystone, greenish-gray, very silty.
223-254	Sandstone, greenish-gray, very fine, micaceous, argillaceous, calcareous.
254-290	Claystone, brownish-gray, very sandy.
290-319	Sandstone, gray, very fine to fine, very argillaceous.

LUDLOW MEMBER

319-400	Claystone, greenish-gray, carbonaceous.

136-103-23ADB
(Log modified from Kruger Drilling Co.)

Altitude: 2570 feet — Date drilled: 1969

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand, brown	40	40
Scoria and silt	10	50
Clay	10	60
Clay, gray	80	140
Lignite and brown clay	30	170
Rock	1	171
Clay, brown	109	280
Rock	1	281
Clays	39	320
Sand	35	355
Clay, brown	35	390
Rock	2	392
Sand and rock	8	400
Lignite, hard	20	420
Clay	10	430
Sand	10	440
Rock	5	445
Lignite	15	460
Clay	10	470
Clay, sandy, and clay	30	500
Rocks	30	530
Sand	30	560
Clay	160	720
Sand	5	725
Clay to shale	35	760
Clay	40	800
Sand	20	820
Clay	80	900
Silt	10	910
Rock	2	912
Clay	13	925
Sand	25	950
Rock	4	954
Sand	56	1,010

136-103-24ABD
(Log modified from Kruger Drilling Co.)

Altitude: 2494 feet

Date drilled: 1969

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Surface silt and rock	15	15
Sand, yellow	45	60
Gumbo, blue	20	80
Sand, blue	10	90
Clay, green	10	100
Clay, gray, sandy	20	120
Clay, white	20	140
Clay, sandy; with lignite streaks	20	160
Sand, green	20	180
Clay, dark, sandy	20	200
Clay	40	240
Clay, sandy	20	260
Clay	20	280
Sand	30	310
Clay	10	320
No log from 320 to 460 feet	140	460
Clay and lignite	40	500
Clay; with sand streaks	30	530
Clay; with lignite streaks	95	625
Sand	35	660
Clay	40	700
Sand	10	710
Clay	60	770
Shale	20	790
Sand	50	840

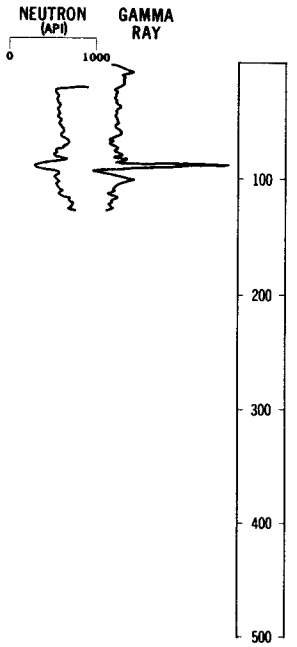
NDSWC 5144

LOCATION: 136-103-24DAA

DATE DRILLED: 7/15/77

ALTITUDE: 2460
(FT, NGVD)

DEPTH: 132
(FT, LSD)



DESCRIPTION OF DEPOSITS

ALLUVIUM

0-18	Clay, yellowish-brown, silty, soft; slightly mottled.
18-20	Gravel, medium to coarse, poorly sorted; abundant klinker.

TONGUE RIVER MEMBER

20-86	Claystone, dark-gray, very silty, slightly carbonaceous.
86-93	Lignite.
93-105	Claystone, dark-brownish-gray, carbonaceous.
105-113	Sandstone, light-gray, very fine to fine, moderately sorted; minor carbonaceous trash.
113-117	Claystone, dark-gray.
117-132	Sandstone, light-gray, fine, slightly bentonitic.

136-104-09AAB
USGS LM-56

Altitude: 2500 feet — Date drilled: 4/25/56

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand, fine	7	7
Sand, medium; some rock	9	16
Gravel, wet; some rock	5	21
Clay, blue; minor coarse sand	2	23

136-104-09AAC
USGS LM-55

Altitude: 2501 feet — Date drilled: 4/25/56

Sand, fine	10	10
Gravel; wet at 18 feet	11	21
Gravel; with blue lumpy sand	7	28

136-104-09ADB
USGS LM-54

Altitude: 2504 feet — Date drilled: 4/25/56

Sand, very fine	14	14
Sand, fine	6	20
Sand, coarse, and blue lumpy clay; small rocks; wet at 22 feet	5	25
Sand, coarse; with blue sticky wet sand	6	31
Sand, blue, sticky	2	33

136-104-09ADC
USGS LM-53

Altitude: 2506 feet — Date drilled: 4/25/56

Sand, very fine	10	10
Clay, brown, lumpy, very sticky	3	13

136-104-12BAD
(Log modified from Kruger Drilling Co.)

Altitude: 2550 — Date drilled: 7/18/72

Clay	20	20
Gravel	18	38
Clay	42	80
Lignite	20	100
Clay	360	460
Sand	50	510
Clay	270	780
Sand	50	830
Clay	40	870
Sand	30	900
Clay	15	915
Sand	85	1,000

136-104-30CAD
USGS LM-8

Altitude: 2530 feet — Date drilled: 3/08/56

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand, fine	5	5
Sand, medium to coarse; minor gravel; wet at 13 feet	11	16
Clay, gray, dense	9	25
Sand and clay; wet; soupy	10	35
No sample recovery from 35 to 40 feet	5	40

136-104-30CDD
USGS LM-14

Altitude: 2540 feet — Date drilled: 3/09/56

Sand, fine	7	7
Sand, moist; chips of lignite	4	11
Sand, coarse; small rock; chips of lignite	4	15
No recovery	8	23
Clay, sandy, wet, soupy	5	28

136-104-30DBD
USGS LM-7

Altitude: 2530 feet — Date drilled: 3/08/56

Sand, fine	3	3
Sand, medium to coarse; chips of lignite and scoria; wet at 13 feet	16	19
Clay, sandy, wet	7	26
Clay, black, hard, wet	2	28

136-104-31AAA
USGS LM-9

Altitude: 2540 feet — Date drilled: 3/09/56

Sand, fine, moist	3	3
Sand, medium to coarse; wet at 9 feet	15	18
Clay, gray, sandy, wet	9	27
Clay, blue, sticky, wet	1	28

136-104-31ACC
USGS LM-12

Altitude: 2540 feet — Date drilled: 3/09/56

Sand, fine	11	11
Sand, medium to coarse; chips of lignite; wet at 18 feet	8	19
Clay, blue, hard	8	27
Clay, sandy, wet, very soupy	1	28

136-104-31BAA
USGS LM-15

Altitude: 2540 feet — Date drilled: 3/09/56

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay, fine	6	6
Sand, coarse, moist; chips of scoria and lignite; rock mixed in at 12 feet	9	15
Clay, blue, lumpy, very sticky; some scoria and lignite	13	28

136-104-31BBD
USGS LM-13

Altitude: 2540 feet — Date drilled: 3/09/56

Sand, lumpy, moist	5	5
Sand, fine, moist	2	7
Sand, coarse, moist; small rock; chips of scoria and lignite	8	15
Gravel, wet	3	18

136-104-31DBC
USGS LM-11

Altitude: 2550 feet — Date drilled: 3/09/56

Sand, medium to coarse, moist	6	6
Sand, coarse; small rock; chips of scoria and lignite	9	15
Gravel, moist; large rock; chips of scoria and lignite	8	23
Gravel, scoria, and lumps of hard clay	10	33

136-104-32DAA
USGS LM-10

Altitude: 2550 feet — Date drilled: 3/09/56

Sand, fine	18	18
Sand, coarse, moist; chips of scoria mixed with gravel	10	28
Sand, coarse, and wet gravel	3	31
Clay, sandy	2	33

136-105-01AAD
(Log modified from Harold Goodale)

Altitude: 2765 feet — Date drilled: 6/12/73

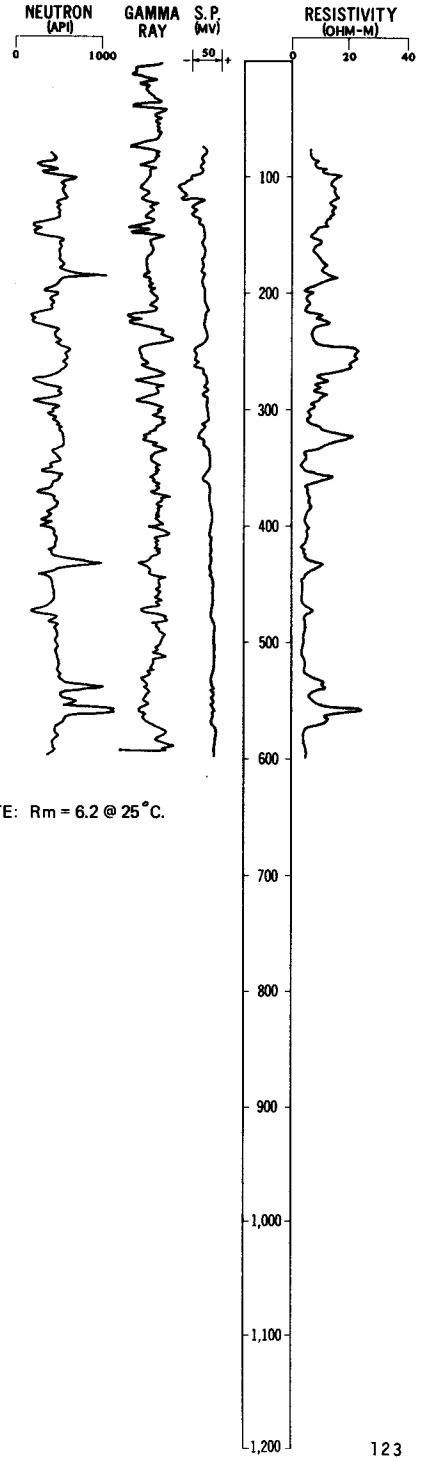
Sand	30	30
Lignite	1	31
Shale	11	42
Lignite	8	50
Shale	50	100
Lignite	8	108
Shale	147	255
Lignite	8	263
Shale	117	380
Sand	60	440

LOCATION: 136-105-26ACA

ALTITUDE: 2620
(FT, NGVD)

DATE DRILLED: 7/19/76

DEPTH: 600
(FT, LSD)



NOTE: Rm = 6.2 @ 25°C.

DESCRIPTION OF DEPOSITS

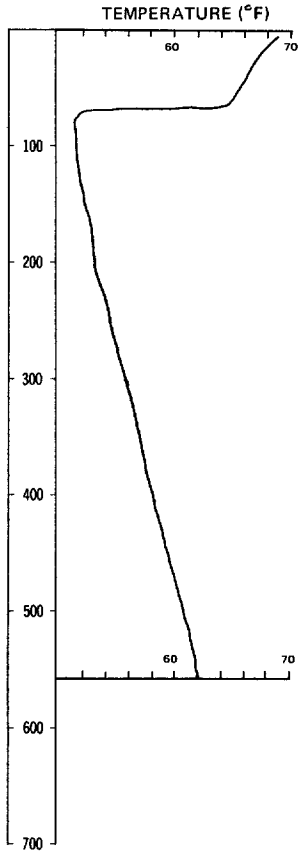
LUDLOW MEMBER

0-4	Claystone, yellowish-brown, sandy.
4-14	Lignite.
14-30	Sandstone, gray, fine to coarse, argillaceous.
30-98	Claystone, gray, silty, carbonaceous; interbedded thin lignite.
98-120	Sandstone, light-greenish-gray, very fine to fine; biotite flakes.
120-141	Siltstone, gray.
141-150	Lignite; thin claystone parting.
150-218	Claystone, gray, silty; interbedded siltstone.
218-230	Lignite; thin claystone parting.
230-245	Claystone, gray, silty.
245-268	Sandstone, greenish-gray, fine to medium; biotite flakes.
268-443	Siltstone, gray, very argillaceous; numerous interbedded thin lignite.
443-532	Claystone, bentonitic.
532-572	Sandstone, light-bluish-gray, very fine to fine, slightly argillaceous.

HELL CREEK FORMATION

572-600	Claystone, silty.

LOCATION: 136-105-26ACA
DATE DRILLED: 7/19/76
ALTITUDE: 2620 (FT, NGVD)
DEPTH: 600 (FT, LSD)



136-105-30AAC
(Log modified from Harold Goodale)

Altitude: 2800 feet
Date drilled: 9/01/65

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill	16	16
Gravel	4	20
Clay	125	145
Lignite, water-bearing	6	151

136-105-32CBB
(Log modified from Harold Goodale)

Altitude: 2860 feet
Date drilled: 9/09/64

Fill	8	8
Scoria	10	18
Clay	37	55
Lignite	7	62
Clay	28	90
Sand	40	130

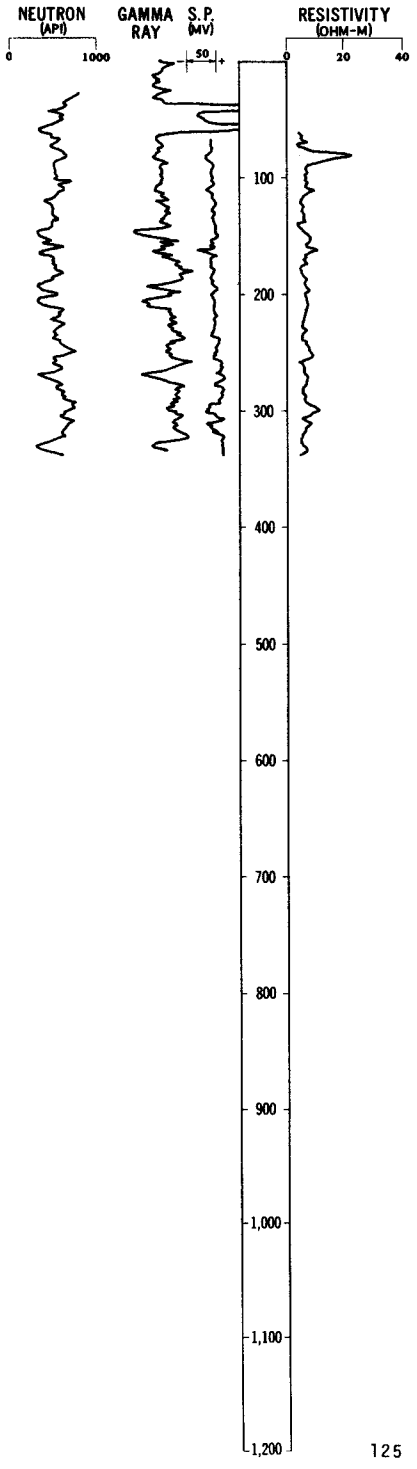
NDSWC 5141, 5141A

LOCATION: 137-100-22CCC1, 2

DATE DRILLED: 7/07/77

ALTITUDE: 2945
(FT, NGVD)

DEPTH: 342
(FT, LSD)



DESCRIPTION OF DEPOSITS

0-34	Sandstone, yellowish-brown, medium; abundant micaceous minerals.
34-41	Claystone, yellowish-brown, silty, tight.
41-43	Lignite.
43-55	Claystone, light-gray, silty, slightly carbonaceous.
55-62	Lignite.
62-118	Claystone, light-olive-gray, silty, carbonaceous.
118-120	Lignite.
120-145	Claystone, light-olive-gray, silty, bentonitic.
145-152	Lignite.
152-190	Claystone, gray, silty; interbedded thin lignite; very tight near base.
190-196	Lignite.
196-246	Claystone, gray; interbedded carbonaceous beds.
246-254	Sandstone, light-gray, very fine, argillaceous.
254-267	Claystone, gray, silty, carbonaceous.
267-273	Lignite.
273-294	Claystone, light-olive-gray, silty, tight, carbonaceous, bentonitic.
294-318	Sandstone, light-gray, very fine, silty, argillaceous.
318-328	Claystone, gray, silty.
	TONGUE RIVER MEMBER
328-337	Lignite.
337-342	Claystone, gray, silty, carbonaceous.

137-101-30BBC
(Log modified from Kruger Drilling Co.)

Altitude: 2393 feet

Date drilled: 6/29/67

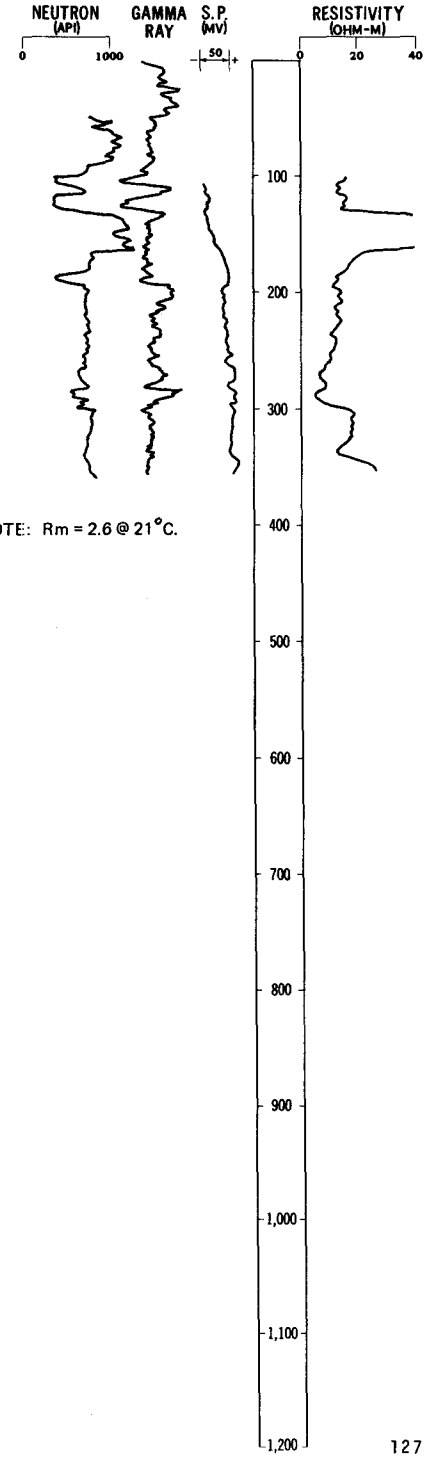
LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand	25	25
Gravel, flat, cemented	5	30
Clay, gray, sandy	50	80
Sand	40	120
Clay	120	240
Sand	60	300
Clay	80	380
Lignite	10	390
Clay	20	410
Lignite, hard	20	430
Lignite; with clay streaks	20	450
Clay, sandy	30	480
Sand; with rock spots	10	490
Clay, sandy	10	500
Clay	20	520
Clay, blackish-gray	40	560
Clay, gray	20	580
Lignite	10	590
Clay	10	600
Clay, dark-gray	30	630
Rock	1	631
Clay	16	647
Rock	2	649
Clay, gray, sandy	31	680
Shale, gray	50	730
Lignite and shale	10	740
Shale	6	746
Rock, hard	1	747
Shale, blackish-gray	13	760
Lignite	5	765
Shale	10	775
Sand	45	820

LOCATION: 137-101-34ABA1

DATE DRILLED: 8/04/76

ALTITUDE: 2600
(FT, NGVD)

DEPTH: 360
(FT, LSD)



NOTE: Rm = 2.6 @ 21°C.

DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-25	Sandstone, yellowish-brown, very fine, argillaceous.
25-30	Claystone, yellowish-brown; minor sand and silt.
30-58	Claystone, bluish-gray, lignitic.
58-98	Sandstone, light-gray, very fine, well-sorted, well-rounded; minor biotite.
98-109	Lignite, brittle.
109-117	Claystone, light-gray, carbonaceous.
117-129	Lignite, brittle.
129-134	Claystone, medium- to brownish-gray, carbonaceous; minor sand and silt.
134-184	Sandstone, very fine, argillaceous.
184-192	Lignite, brittle.
192-264	Siltstone, greenish-gray, carbonaceous, argillaceous.

LUDLOW MEMBER

264-283	Claystone, brownish-gray, carbonaceous; minor silt.
283-290	Lignite.
290-298	Claystone, brownish-gray, carbonaceous.
298-360	Sandstone, greenish-gray, very fine to fine, micaceous, argillaceous, subrounded.

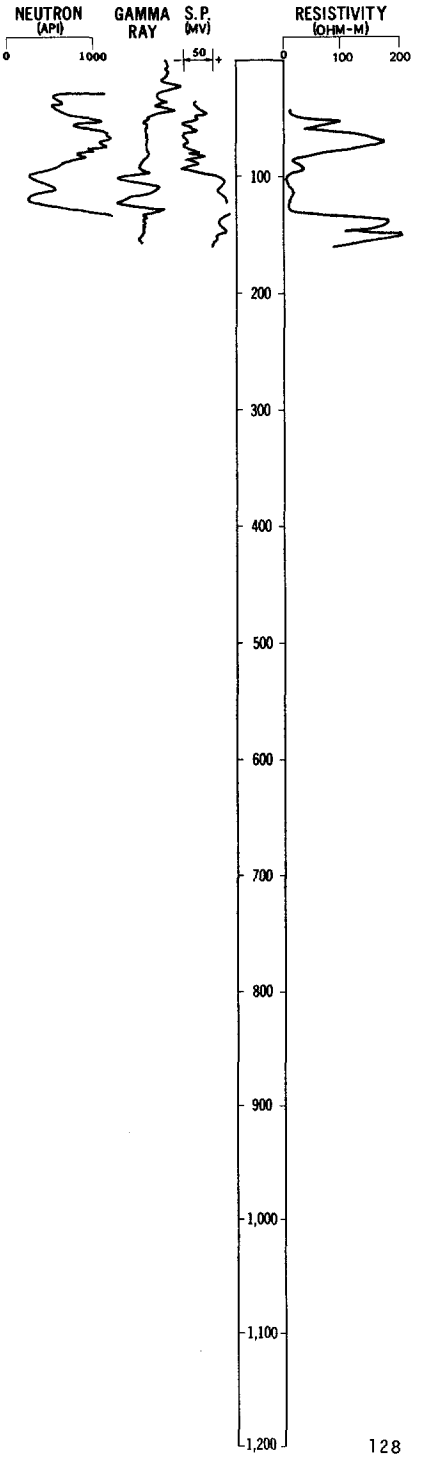
NDSWC 5140, 5140A

LOCATION: 137-101-34ABA2, 3

DATE DRILLED: 7/07/77

ALTITUDE: 2600
(FT, NGVD)

DEPTH: 165
(FT, LSD)



DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-17	Claystone, light-brownish-gray, very silty; may be colluvium.
17-46	Claystone, light-gray, silty, tight.
46-98	Sandstone, light-olive-gray, fine to very coarse; minor pebbles.
98-107	Lignite.
107-116	Claystone, gray, silty, bentonitic.
116-127	Lignite.
127-132	Claystone, gray, silty, bentonitic.
132-165	Sandstone, light-gray, very fine to fine, silty.

137-102-03ACC
USGS LM-66

Altitude: 2367 feet — Date drilled: 5/08/56

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand, very fine	10	10
Sand, fine; chips of scoria; some large rocks	13	23
No return	8	31

137-102-03BDA
USGS LM-67

Altitude: 2367 feet — Date drilled: 5/08/56

Topsoil	1	1
Sand, very fine	9	10
Sand, fine; chips of scoria; wet at 25 feet	15	25
Sand, coarse; large rock	18	43

137-102-03DBA
USGS LM-65

Altitude: 2361 feet — Date drilled: 5/08/56

Topsoil	1	1
Sand, very fine	2	3
Sand, medium to coarse; chips of scoria; small rock	10	13
Gravel; chips of scoria; wet at 19 feet	7	20
Sand, blue, very sticky; minor clay	13	33

137-102-04DBA
(Log modified from Kruger Drilling Co.)

Altitude: 2362 feet — Date drilled: 12/23/72

Gravel	40	40
Sand, blue	40	80
Clay	30	110
Lignite	10	120
Clay	100	220
Sand	40	260
Clay	52	312
Sand	28	340

137-102-06CBD
(Log modified from Kruger Drilling Co.)

Altitude: 2395 feet

Scoria and gravel	30	30
Clay; with some lignite	210	240
Sand	40	280
Clay	280	560
Sand	40	600
Clay	100	700
Lignite	10	710
Sand	10	720
Clay	30	750
Sand	30	780
Clay	40	820
Sand	10	830
Clay	10	840
Sand	20	860
Shale	40	900
Sand	40	940

137-102-25DAB
USGS LM-62

Altitude: 2393 feet — Date drilled: 5/07/56

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Topsoil	1	1
Sand, very fine to fine	11	12
Sand, medium, wet; chips of scoria	10	22
Clay, blue, very hard	1	23

137-102-25DBA
USGS LM-63

Altitude: 2392 feet — Date drilled: 5/07/56

Topsoil	1	1
Sand, very fine	10	11
Sand, medium; chips of scoria; small rock	3	14
Sand, medium to coarse, wet; chips of scoria; small rock	13	27
Clay, blue	1	28

137-102-25DBB
USGS LM-64

Altitude: 2392 feet — Date drilled: 5/07/56

Sand, very fine	7	7
Sand, medium; chips of scoria; small rock; wet at 15 feet	14	21
Clay, blue, very sticky	7	28

137-103-09CCB
(Log modified from Harold Goodale)

Altitude: 2495 feet — Date drilled: 6/05/64

Fill	12	12
Clay	3	15
Gravel	15	30
Clay	10	40
Sand	50	90

137-104-02BCC
(Log modified from Harold Goodale)

Altitude: 2580 feet — Date drilled: 11/22/66

Fill, sandy	8	8
Lignite	4	12
Clay	13	25
Lignite	5	30
Clay	50	80
Lignite	10	90
Clay	10	100
Sand	35	135

137-104-10ABB
(Log modified from Harold Goodale)

Altitude: 2610 feet — Date drilled: 5/15/64

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill	12	12
Gravel	4	16
Shale	24	40
Sand	95	135
Shale	10	145
Sand	85	230

137-104-27BAA
(Log modified from Harold Goodale)

Altitude: 2765 feet — Date drilled: 3/31/64

Silt	16	16
Clay	37	53
Lignite	5	58
Clay	22	80
Rock	2	82
Clay	8	90
Lignite	5	95
Clay	27	122
Rock	2	124
Clay	64	188
Rock	2	190
Clay	25	215
Sand	10	225

137-104-29CAC
(Log modified from Harold Goodale)

Sandfill	20	20
Shale	23	43
Lignite	10	53
Shale	37	90
Sand	30	120

137-105-05DDD
(Log modified from Harold Goodale)

Date drilled: 11/25/66

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill	10	10
Gravel	8	18
Lignite	2	20
Clay	23	43
Lignite	7	50
Clay	50	100
Sand	25	125

137-105-10ABB
(Log modified from Harold Goodale)

Altitude: 2757 feet

Date drilled: 6/24/74

Fill	30	30
Lignite	10	40
Shale	10	50
Lignite	8	58
Shale	227	285
Rock	2	287
Shale	87	374
Rock	1	375
Shale	8	383
Lignite	12	395
Shale	415	810
Rock	2	812
Shale	76	888
Rock	2	890
Sand	50	940

137-105-22DCB
(Log modified from Harold Goodale)

Date drilled: 5/01/64

Fill	12	12
Shale	33	45
Sand	95	140

137-105-31BBB
(Log modified from Harold Goodale)

Date drilled: 12/01/63

Fill	12	12
Shale	10	22
Sand	10	32
Shale	13	45
Sand	18	63

137-105-34AAB
(Log modified from Harold Goodale)

Date drilled: 12/29/72

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill	5	5
Shale	25	30
Rock	3	33
Sand	47	80
Shale	13	93
Lignite	2	95
Shale	79	174
Rock	2	176
Sand	29	205

137-105-36BBD
(Log modified from Harold Goodale)

Altitude: 2860 feet — Date drilled: 8/10/65

Fill	7	7
Clay	35	42
Lignite	6	48
Clay	42	90
Rock	2	92
Clay	18	110
Sand	70	180

137-106-14ACC
(Log modified from Harold Goodale)

Date drilled: 1/01/1900

Fill	15	15
Clay	19	34
Rock	2	36
Sand	24	60

138-100-03ABB
(Log modified from Mann Drilling Co.)

Altitude: 2710 feet — Date drilled: 1/18/74

Clay, sandy	6	6
Clay, gray	13	19
Lignite	12	31
Clay, gray	83	114
Lignite	4	118
Clay, gray, with lignite stringers	352	470
Sand	11	481
Clay	21	502
Lignite	8	510
Clay	10	520

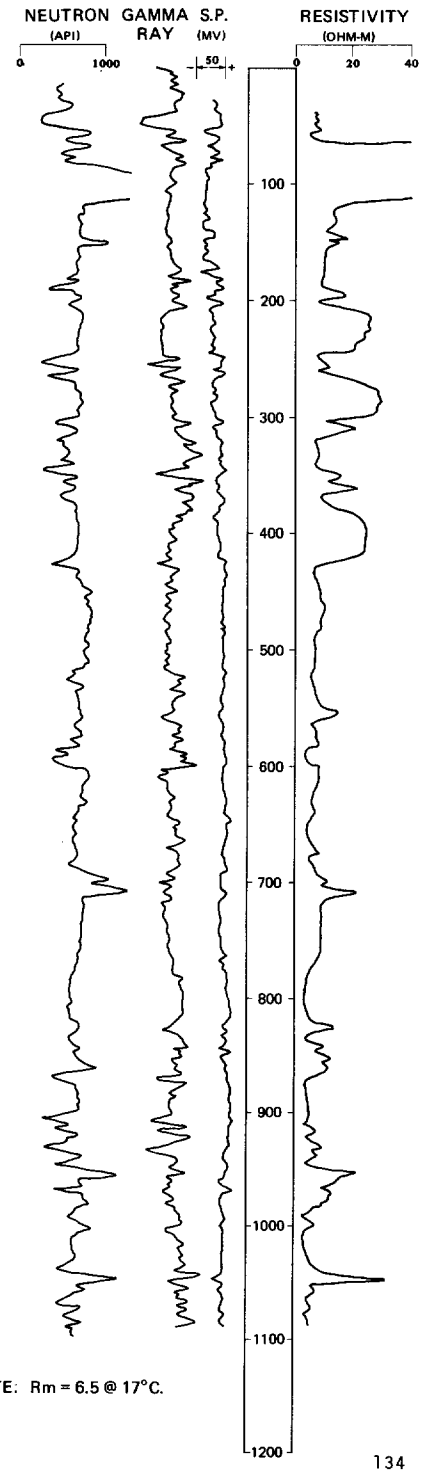
NDSWC 4921

LOCATION: 138-100-07AAA1

DATE DRILLED: 7/08/76

ALTITUDE: 2610
(FT, NGVD)

DEPTH: 1100
(FT)



NOTE: Rm = 6.5 @ 17°C.

DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-20	Claystone, yellowish-brown, silty.
20-39	Claystone, light-gray, silty.

TONGUE RIVER MEMBER

39-51	Lignite.
51-83	Claystone, light-olive-gray, silty, tight.
83-116	Sandstone, light-gray, very fine to fine, argillaceous, highly calcareous; carbonaceous trash.
116-164	Sandstone, light-gray, very fine to fine, argillaceous.
164-206	Claystone, gray, silty.
206-246	Sandstone, gray, fine, very argillaceous.
246-268	Claystone, gray, very silty; interbedded thin lignites.
268-304	Sandstone, greenish-gray, fine; minor carbonaceous trash.
304-344	Claystone, brownish-gray, carbonaceous.
344-350	Lignite.
350-375	Claystone, brownish-gray, carbonaceous.
375-380	Claystone, greenish-gray.
380-422	Sandstone, light-greenish-gray, very fine to fine; minor carbonaceous trash.
422-480	Siltstone.

LUDLOW MEMBER

480-521	Sandstone, greenish-gray, very argillaceous.
521-603	Claystone, gray, silty, carbonaceous.
603-646	Sandstone, light-greenish-gray, very fine to fine, argillaceous; minor carbonaceous trash.

CANNONBALL MEMBER

646-690	Claystone, greenish-gray; interbedded siltstone.

LUDLOW MEMBER

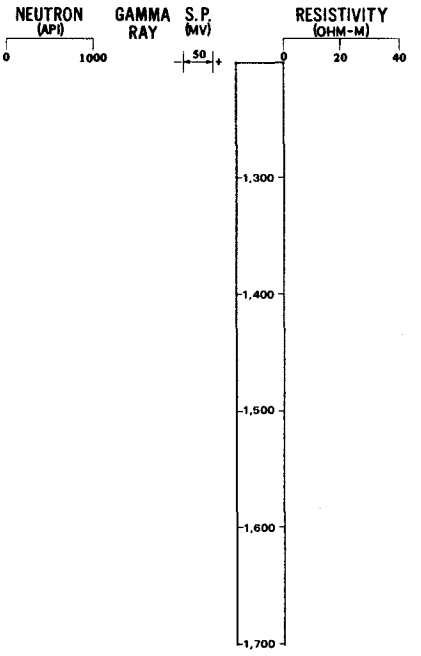
690-715	Siltstone, gray, slightly argillaceous.

LOCATION: 138-100-07AAA1

DATE DRILLED: 7/08/76

ALTITUDE: 2610
(FT, NGVD)

DEPTH: 1100
(FT, LSD)



DESCRIPTION OF DEPOSITS

CANNONBALL MEMBER

715-820	Claystone, greenish-gray, tight.

LUDLOW MEMBER

820-823	Siltstone.
823-828	Sandstone.
828-843	Claystone.
843-870	Sandstone, gray, very fine to fine, argillaceous; interbedded siltstone.
870-952	Claystone, gray, slightly silty; interbedded thin lignite.
952-985	Sandstone, gray, very fine to fine; argillaceous near base.
985-1100	Claystone, gray; interbedded thin sandstone.

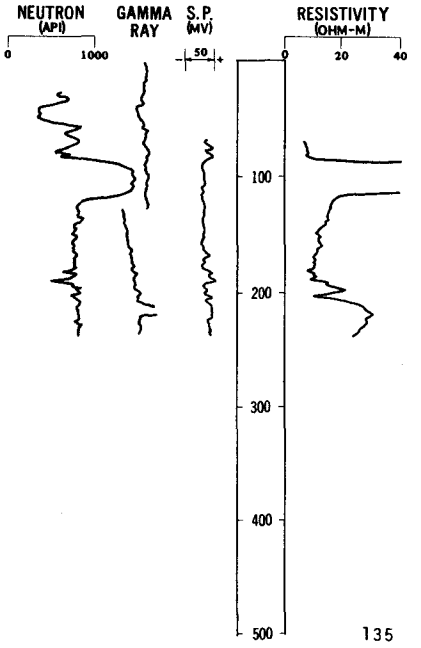
NDSWC 4921A

LOCATION: 138-100-07AAA2

DATE DRILLED: 7/18/77

ALTITUDE: 2610
(FT, NGVD)

DEPTH: 240
(FT, LSD)



DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-20	Claystone, yellowish-brown, silty.
20-39	Claystone, light-gray, silty.

TONGUE RIVER MEMBER

39-51	Lignite.
51-83	Claystone, light-olive-gray, silty, tight.
83-116	Sandstone, light-gray, very fine to fine, argillaceous, highly calcareous; carbonaceous trash.
116-164	Sandstone, light-gray, very fine to fine, argillaceous.
164-206	Claystone, gray, silty.
206-240	Sandstone, gray, fine, very argillaceous.

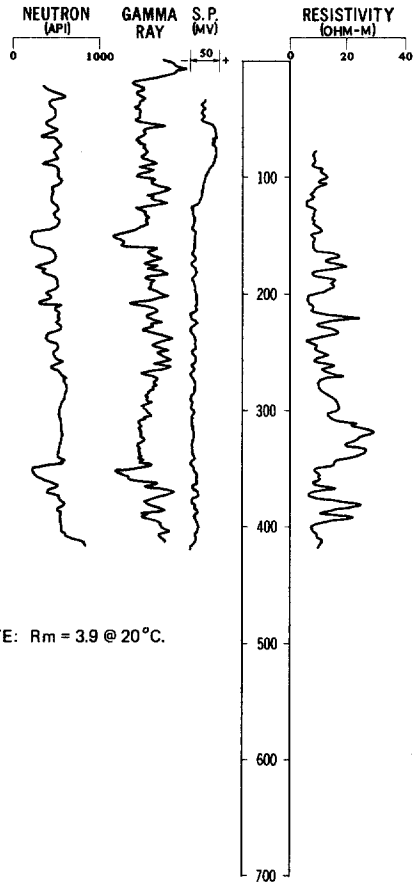
NDSWC 4922

LOCATION: 138-101-02BAC

DATE DRILLED: 7/15/76

ALTITUDE: 2510
(FT, NGVD)

DEPTH: 440
(FT, LSD)



NOTE: Rm = 3.9 @ 20°C.

DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-10	Sandstone, yellowish-brown, very fine to medium.
10-30	Klinker, red, gravelly, angular to subangular.
30-52	Sandstone, yellowish-brown, very fine to medium; interbedded thin lignite.
52-147	Claystone, light-olive-gray, silty; interbedded thin lignite.
147-161	Lignite.
161-309	Interbedded sandstone, siltstone, claystone, and lignite.
309-348	Sandstone, olive-gray, fine, slightly argillaceous.
348-361	Lignite.
361-376	Claystone, gray.
376-384	Sandstone, olive-gray, fine to coarse, predominantly fine.
384-390	Claystone, gray, tight.
390-395	Sandstone, olive-gray, fine to coarse, predominantly fine.

LUDLOW MEMBER

395-440	Claystone, gray, tight; slightly sandy near base.

138-101-11DAB
(Log modified from Mann Drilling Co.)

Date drilled: 6/02/63

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand	21	21
Sandstone	.5	21.5
Clay	4.5	26
Lignite	1	27
Clay	23	50
Sand	55	105

138-101-19ACC
(Log modified from Kruger Drilling Co.)

Altitude: 2560 feet — Date drilled: 9/26/73

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay	100	100
Sand	50	150
Clay	260	410
Sand	20	430
Clay	10	440
Sand	60	500
Clay	180	680
Lignite	10	690
Sand	10	700
Clay	140	840
Sand	25	865
Clay	145	1,010
Sand	30	1,040
Sand and clay	130	1,170
Sand	20	1,190
Clay	83	1,273
Sand	47	1,320
Shale	25	1,345
Sand	45	1,390
Shale	10	1,400
Sand	50	1,450

138-102-19BAD
USGS LM-68

Altitude: 2331 feet

Topsoil	1	1
Sand, very fine	9	10
Gravel, blue, sandy, lumpy; chips of scoria	5	15
Clay, blue, hard	3	18

138-102-19BDC
USGS LM-69

Altitude: 2236 feet — Date drilled: 5/09/56

Topsoil	1	1
Sand, very fine	9	10
Clay, brown, lumpy, very sticky	3	13
Sand, fine, and brown lumpy clay	1	14
Gravel; chips of scoria	7	21
Clay, brown, sticky	2	23

138-102-34CCB
(Log modified from Kruger Drilling Co.)

Altitude: 2400 feet — Date drilled: 7/07/72

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay	18	18
Gravel	7	25
Clay	55	80
Sand	45	125
Clay	235	360
Sand	40	400
Clay	80	480
Lignite	20	500
Clay	40	540
Sand	20	560
Clay	190	750
Sand	30	780
Clay	160	940
Sand	80	1,020

138-103-04AAA
(Log modified from McDanold Well Drilling)

Altitude: 2455 feet — Date drilled: 6/17/68

Silt	19	19
Scoria	9	28
Clay, blue	9	37
Lignite	6	43
Clay, gray	42	85
Clay, sandy	153	238
Lignite	2	240
Clay, gray	6	246
Lignite	4	250
Clay, gray	65	315
Clay, sandy	99	414
Rock	3	417
Sand	19	436

138-103-08DCD
(Log modified from Harold Goodale)

Altitude: 2675 feet — Date drilled: 5/08/64

Fill	12	12
Clay	6	18
Scoria	3	21
Clay	59	80
Lignite	3	83
Clay	32	115
Lignite	5	120
Clay	68	188
Lignite	6	194
Clay	56	250
Lignite	10	260
Clay	20	280
Sand	45	325

138-104-06DDC
(Log modified from Harold Goodale)

Altitude: 2700 feet

Date drilled: 6/30/67

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill	8	8
Clay	22	30
Lignite	5	35
Clay	15	50
Lignite	5	55
Clay	15	70
Sand	32	102

138-104-12BAD
(Log modified from Harold Goodale)

Altitude: 2590 feet

Date drilled: 5/02/64

Fill	12	12
Shale	63	75
Sand	50	125

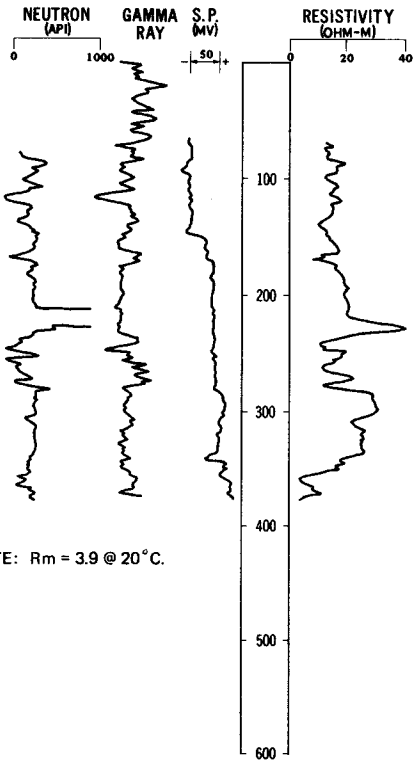
NDSWC 4939

LOCATION: 138-105-07CCD

DATE DRILLED: 7/28/76

ALTITUDE: 2926
(FT, NGVD)

DEPTH: 380
(FT, LSD)



NOTE: Rm = 3.9 @ 20°C.

DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-45	Claystone, pale-yellowish-brown, very silty.
45-85	Claystone, light-gray; interbedded thin lignite.
85-95	Sandstone, light-gray, argillaceous.
95-113	Claystone, gray, silty, carbonaceous, bentonitic.
113-121	Lignite.
121-150	Claystone, gray.
150-164	Sandstone, gray, silty, argillaceous.
164-172	Claystone, gray.
172-237	Sandstone, gray, very fine, silty.
237-283	Claystone, gray, silty; interbedded lignite.
283-352	Sandstone, gray, very fine to fine.

LUDLOW MEMBER

352-380	Claystone, light-greenish-gray, silty.

138-105-09CCC
(Log modified from Harold Goodale)

Date drilled: 8/04/66

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill	4	4
Clay	13	17
Lignite	1	18
Clay	37	55
Sand	3	58
Lignite	4	62
Sand	3	65
Clay	60	125
Lignite	6	131
Clay	19	150
Sand	47	197

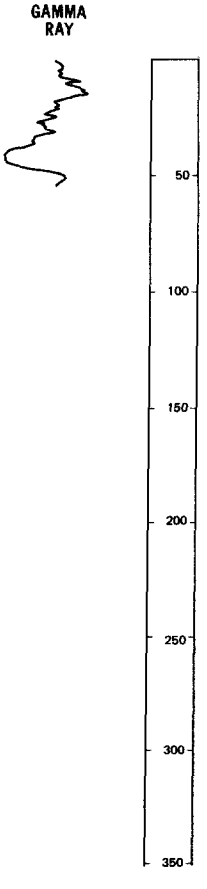
NDSWC 4933

LOCATION: 138-106-11AAA

DATE DRILLED: 7/16/76

ALTITUDE: 2887
(FT, NGVD)

DEPTH: 60
(FT, LSD)



DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-25	Claystone, yellowish-brown, silty, tight.
25-38	Claystone, dark-gray, slightly sandy.
38-49	Lignite.
49-60	Claystone, gray, silty, carbonaceous.

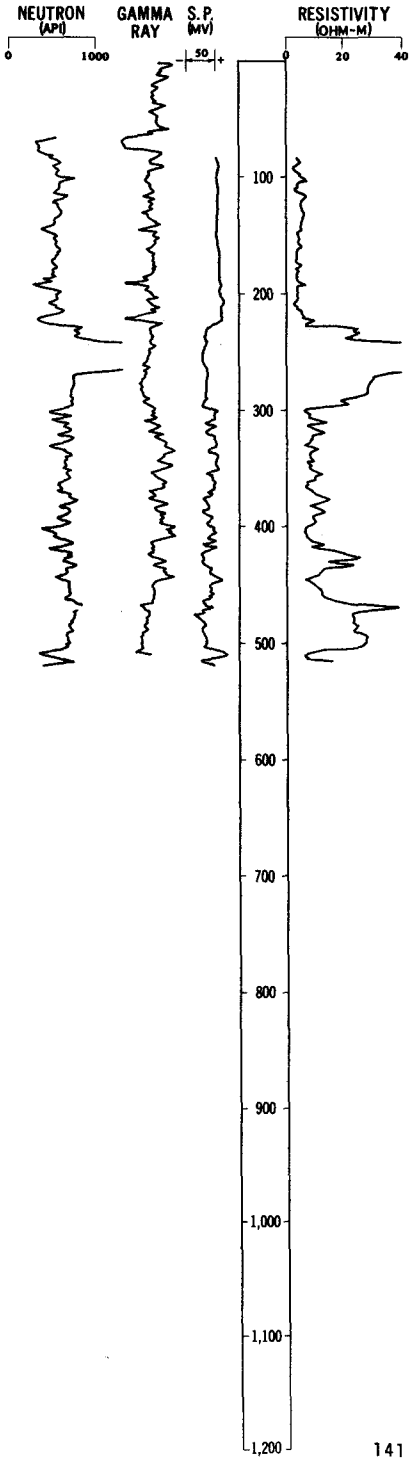
NDSWC 5145

LOCATION: 139-100-14CCC

DATE DRILLED: 7/19/77

ALTITUDE: 2695
(FT, NGVD)

DEPTH: 522
(FT, LSD)



DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-5	Claystone, reddish-brown, sandy.
5-10	Claystone, light-yellowish-gray, sandy.
10-15	Claystone, light-yellowish-gray.
15-64	Claystone, light-olive-gray.
64-76	Lignite.
76-186	Claystone, light-gray, silty, carbonaceous; bentonitic near base.
186-194	Lignite.
194-218	Claystone, light-gray, silty, carbonaceous, tight.

TONGUE RIVER MEMBER

218-224	Lignite.
224-299	Sandstone, light-gray, very fine to fine, silty, bentonitic.
299-414	Claystone, gray, silty; interbedded thin sandstone and lignite.
414-436	Sandstone, light-gray, very fine to fine, silty.
436-468	Claystone, gray, silty to slightly sandy, tight.
468-507	Sandstone, light-gray, very fine to fine.
507-513	Lignite.
513-519	Claystone, light-gray, silty, tight, bentonitic.
519-522	Lignite.

139-101-01CCB
(Log modified from Kruger Drilling Co.)

Date drilled: 1973

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay	80	80
Lignite	10	90
Sand	10	100
Clay	35	135
Lignite	10	145
Clay	55	200
Sand, fine	20	220
Clay	20	240
Sand, fine	20	260
Clay	80	340
Lignite	10	350
Clay	170	520
Sand, very fine	20	540
Lignite	20	560
Clay	20	580

139-101-11CBA
(Log modified from Kruger Drilling Co.)

Date drilled: 10/02/73

Clay	90	90
Coal	20	110
Clay	40	150
Clay, sandy	10	160
Clay	193	353
Rock	9	362
Clay	48	410
Coal	10	420
Sand, fine	30	450
Clay	30	480
Sand, fine	20	500
Coal	10	510
Clay	10	520
Sand, coarse	40	560

139-101-14BDC2
(Log modified from Kruger Drilling Co.)

Altitude: 2530 feet

Date drilled: 8/25/75

Clay	8	8
Scoria	24	32
Clay	178	210
Sand	30	240
Clay	200	440
Sand	20	460
Clay	180	640
Sand	20	660
Clay	80	740
Sand	55	795
Clay	45	840
Sand	40	880
Clay	370	1,250
Sand	120	1,370
Clay	70	1,440
Sand	40	1,480
Clay, brown	10	1,490
Sand	65	1,555

139-101-17CDA
(Log modified from Kruger Drilling Co.)

Altitude: 2520 feet — Date drilled: 9/01/73

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand	10	10
Scoria	33	43
Clay	37	80
Lignite	5	85
Clay	95	180
Clay, sandy	20	200
Clay	20	220
Lignite	15	235
Clay	125	360
Lignite	10	370
Clay	50	420
Lignite	20	440
Clay	20	460
Sand, very fine	30	490
Clay	30	520
Clay and rock	20	540
Clay	10	550
Sand, white, medium, and rock	30	580
Clay	140	720
Sand	20	740
Clay	40	780
Sand	20	800
Clay	10	810
Sand, coarse	10	820
Rock	20	840
Clay and thin lignite	130	970
Sand	10	980
Sand, fine	20	1,000
Clay	35	1,035
Sand	5	1,040
Clay and rocks	15	1,055
Sand	5	1,060
Sand and clay streaks	20	1,080
Clay	60	1,140
Sand	20	1,160
Lignite and clay	15	1,175
Sand	8	1,183
Clay	12	1,195
Sand	25	1,220
Shale	35	1,255
Sand	35	1,290

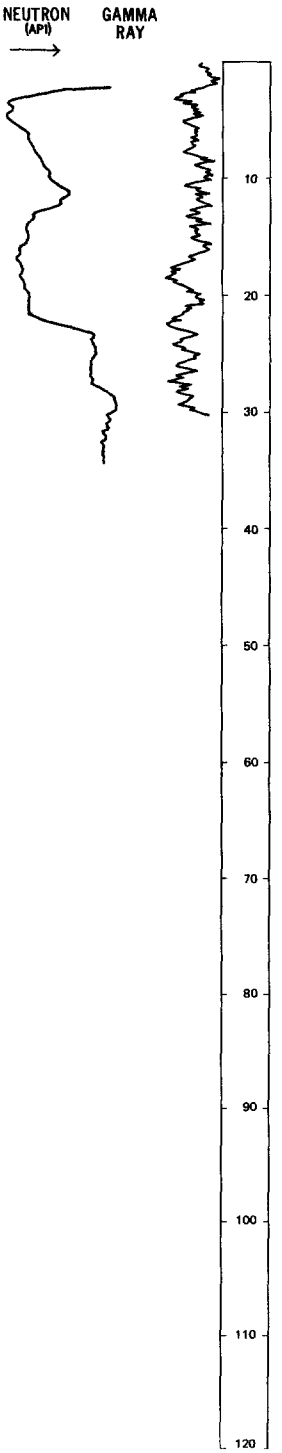
NDSWC 5123

LOCATION: 139-102-03BAC

DATE DRILLED: 6/22/77

ALTITUDE: 2300
(FT, NGVD)

DEPTH: 35
(FT, LSD)



DESCRIPTION OF DEPOSITS

ALLUVIUM

0-5	Sand, yellowish-brown, very fine to medium, silty.
5-23	Gravel, medium to coarse, sandy, poorly sorted, angular to sub-rounded; klinker and lignite chips.

TONGUE RIVER MEMBER

23-35	Claystone, light-gray, very sandy and silty.

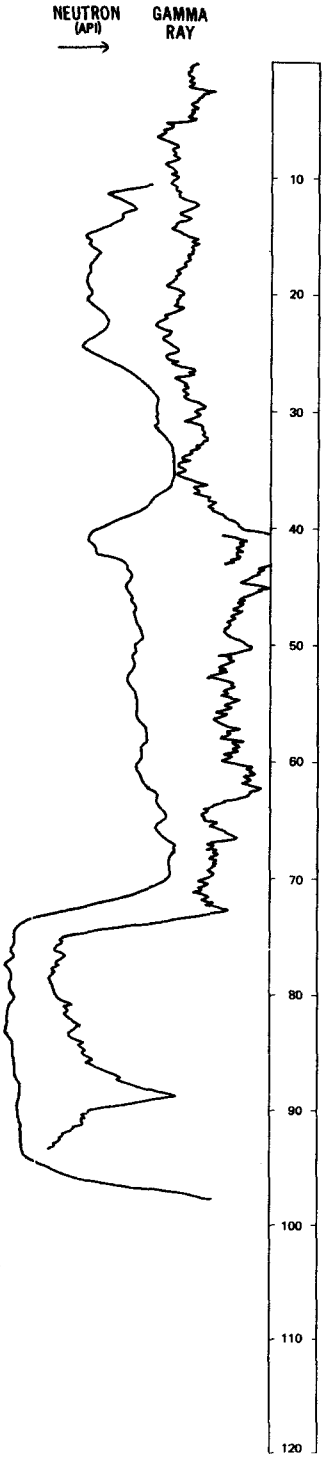
NDSWC 5122, 5122A

LOCATION: 139-102-03BCB1, 2

ALTITUDE: 2300
(FT, NGVD)

DATE DRILLED: 6/22/77

DEPTH: 102
(FT, LSD)



DESCRIPTION OF DEPOSITS

ALLUVIUM

0-11	Silt, yellowish-brown.
11-29	Gravel, very sandy; abundant klinker and lignite chips.

TONGUE RIVER MEMBER

29-40	Sandstone, very fine to fine, silty, argillaceous.
40-74	Claystone, light-gray, bentonitic; silty near base.
74-98	Lignite.
98-102	Claystone, light-gray, silty, bentonitic.

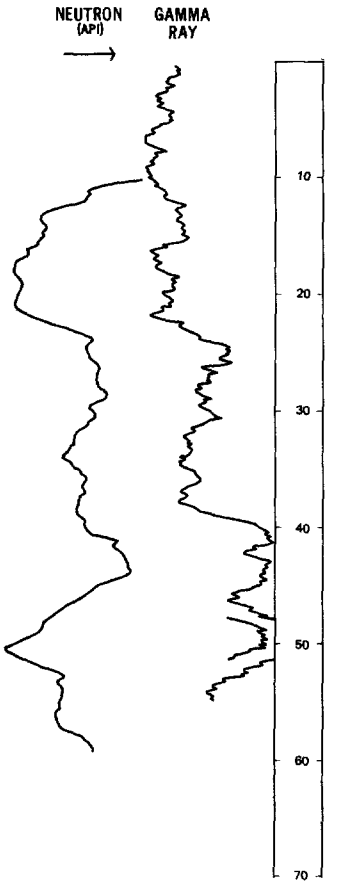
NDSWC 5121

LOCATION: 139-102-04DAA

DATE DRILLED: 6/21/77

ALTITUDE: 2300
(FT, NGVD)

DEPTH: 60
(FT, LSD)



DESCRIPTION OF DEPOSITS

ALLUVIUM

0-16 Clay, light-yellowish-gray, silty, sandy; with abundant lignite chips.

16-23 Gravel, fine to coarse; abundant klinker chips.

TONGUE RIVER MEMBER

23-40 Sandstone, silty.

40-60 Claystone, light-greenish-gray, silty.

139-102-10CAD
USGS LM-72

Altitude: 2290 feet

Date drilled: 5/10/56

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Topsoil	1	1
Clay, hard	9	10
Sand, fine, chips of scoria	5	15
Sand, coarse, moist; chips of scoria	17	32
Clay, black, sticky	1	33

139-102-10DBD1
(Log modified from Harold Goodale)

Altitude: 2295 feet — Date drilled: 10/18/67

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill	12	12
Gravel	28	40
Clay	50	90
Lignite	7	97
Clay	13	110
Sand	45	155
Clay	95	250
Sand	40	290
Rock	2	292
Clay	16	308
Rock	2	310
Clay	15	325
Rock	2	327
Clay	98	425
Rock	4	429
Sand	31	460

139-102-17CAC2
(Log modified from K. D. Thompson)

Altitude: 2365 feet — Date drilled: 7/25/73

Topsoil	1	1
Clay, yellow, sandy	34	35
Lignite, scoria, and sand	10	45
Clay, yellow	25	70
Sand, fine, and scoria	10	80
Clay, blue	50	130
Sand, fine	5	135
Shale; with lignite layers	315	450
Clay, fine, sandy	80	530
Shale; with layers of lignite and rock	180	710
Sand, fine	15	725
Shale	205	930
Sand, fine	20	950
Shale	40	990
Sandstone, brown	40	1,030
Shale	45	1,075
Sand	25	1,100
Shale	25	1,125

139-102-18ACA
(Log modified from K. D. Thompson)

Altitude: 2465 feet — Date drilled: 8/15/73

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay, yellow, sandy	50	50
Sand and scoria	25	75
Clay, blue	65	140
Silt, fine, sandy	15	155
Shale; with lignite streaks	320	475
Clay, fine, sandy	15	490
Sandstone	15	505
Shale; with lignite streaks	225	730
Sand, fine; with clay	55	785
Shale	185	970
Sand, fine	30	1,000
Shale	20	1,020
Sandstone, brown	40	1,060
Shale	60	1,120
Sand and thin rock	60	1,180
Shale	20	1,200

139-102-20ABB
(Log modified from McDanold Well Drilling)

Altitude: 2328 feet — Date drilled: 9/13/68

Silt and scoria	20	20
Gravel and scoria	38	58
Lignite	23	81
Clay, gray; with thin sand streaks	132	213
Lignite	7	220
Sand	46	266
Rock	1	267
Clay, gray	77	344
Rock	1	345
Clay, gray	53	398
Rock	1	399
Clay, gray	21	420
Lignite	4	424
Sand	11	435
Rock	1	436
Sand	13	449
Rock	2	451
Clay	9	460

139-102-29CAA
USGS LM-70

Altitude: 2310 feet — Date drilled: 5/10/56

Sand, very fine	9	9
Sand, fine; small rock	4	13
Gravel	6	19
Clay, blue, very hard	4	23

139-102-29DCC
USGS LM-71

Altitude: 2310 feet

Date drilled: 5/10/56

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand, very fine; chips of scoria at 7 feet	11	11
Gravel, wet; chips of scoria	12	23
Clay, black, very sticky	5	28

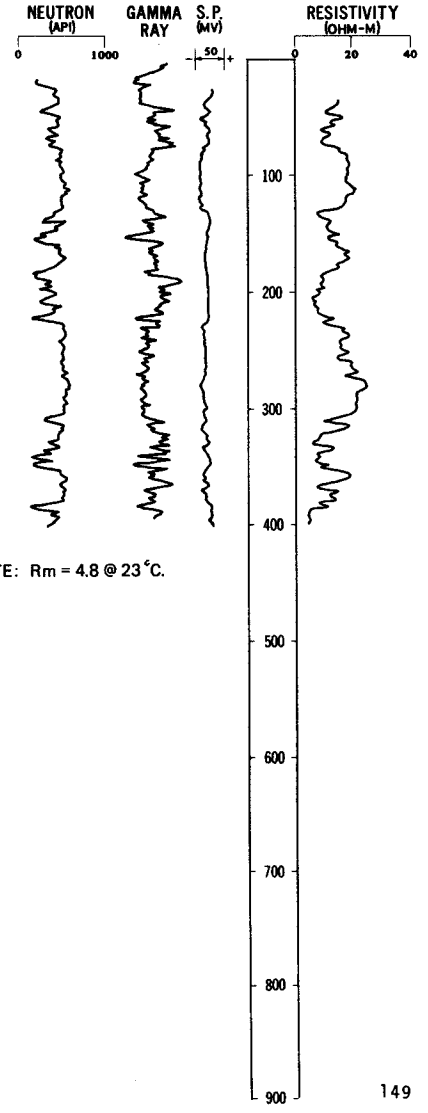
NDSWC 4940

LOCATION: 139-103-32DBB

DATE DRILLED: 7/28/76

ALTITUDE: 2535 (FT, NGVD)

DEPTH: 400 (FT, LSD)



NOTE: Rm = 4.8 @ 23 °C.

DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-12	Sandstone, yellowish-brown, very fine to fine, slightly argillaceous.
12-25	Claystone, yellowish-brown, soft.
25-35	Sandstone, dark-yellowish-gray.
35-75	Claystone, light-greenish-gray, bentonitic.
75-130	Sandstone, light-bluish-gray, very fine to fine.
130-135	Claystone, gray.
135-138	Lignite.
138-151	Claystone, light-greenish-gray.
151-154	Lignite.
154-180	Siltstone, gray.
180-220	Claystone, highly carbonaceous.
220-224	Lignite.
224-230	Claystone, light-greenish-gray.
230-260	Sandstone, gray, very argillaceous; interbedded siltstone.
260-320	Sandstone, gray, argillaceous.
320-400	Claystone, gray; interbedded thin sandstone, siltstone, and lignite.

139-104-22ACA
(Log modified from Harold Goodale)

Altitude: 2800 feet — Date drilled: 7/16/64

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand	30	30
Lignite	5	35
Clay	132	167
Rock	3	170
Clay	10	180
Sand	80	260

139-104-22CDD
(Log modified from Harold Goodale)

Altitude: 2740 feet — Date drilled: 7/13/64

Fill	17	17
Clay	73	90
Lignite	7	97
Clay	93	190
Rock	5	195
Sand	25	220

139-104-28BAB
(Log modified from Harold Goodale)

Altitude: 2730 feet — Date drilled: 10/12/72

Sand	16	16
Shale	109	125
Lignite	10	135
Shale	15	150
Lignite	5	155
Shale	147	302
Rock	5	307
Shale	263	570
Rock	3	573
Shale	27	600
Sand	40	640

139-104-31BDD
(Log modified from Harold Goodale)

Altitude: 2840 feet — Date drilled: 7/17/65

Fill	12	12
Scoria and shale	33	45
Clay	40	85
Lignite	10	95
Clay	15	110
Lignite	5	115
Clay	60	175
Lignite	5	180

139-105-01AAB
(Log modified from Harold Goodale)

Date drilled: 12/08/66

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill	11	11
Clay	87	98
Lignite	6	104
Clay	56	160
Lignite	10	170
Clay	80	250
Lignite	5	255
Clay	5	260
Sand	20	280

139-105-04AAC
(Log modified from Harold Goodale)

Altitude: 2790 feet

Date drilled: 9/13/66

Fill	7	7
Clay	25	32
Lignite	4	36
Clay	27	63
Lignite	7	70
Clay	70	140
Sand	10	150

139-105-13BBC
(Log modified from Harold Goodale)

Altitude: 2831 feet

Date drilled: 5/10/73

Fill	8	8
Clay	7	15
Lignite	2	17
Shale	131	148
Lignite	5	153
Shale	25	178
Lignite	4	182
Shale	18	200
Sand	20	220
Shale	50	270
Sand	30	300
Shale	36	336
Rock	2	338
Shale	102	440
Lignite	10	450
Shale	270	720
Sand	30	750
Shale	55	805
Lignite	10	815
Shale	165	980
Lignite	15	995
Shale	70	1,065
Rock	12	1,077
Sand	123	1,200

139-105-19CBB
(Log modified from Harold Goodale)

Date drilled: 8/17/67

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill	3	3
Clay	21	24
Lignite	6	30
Clay	19	49
Lignite	4	53
Clay	52	105
Sand	10	115
Clay	40	155
Rock	1	156
Clay	14	170
Rock	1	171
Sand	31	202

139-105-29BBB
(Log modified from Harold Goodale)

Date drilled: 11/27/63

Fill	12	12
Clay	8	20
Lignite	5	25
Clay	35	60
Lignite	4	64
Clay	46	110
Sand	24	134

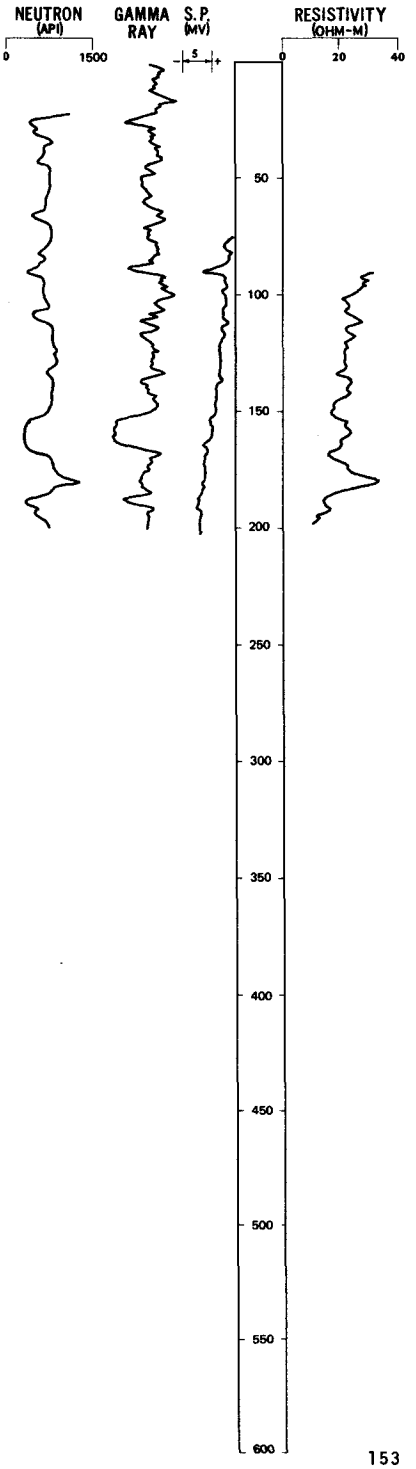
NDSWC 4930

LOCATION: 139-105-30CCD

DATE DRILLED: 7/16/76

ALTITUDE: 2879
(FT, NGVD)

DEPTH: 200
(FT, LSD)



DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-4	Claystone, pale-yellowish-brown, silty, tight.
4-14	Sandstone, yellowish-brown, very fine.
14-24	Claystone, light-yellowish-brown, carbonaceous.
24-27	Lignite.
27-88	Claystone, greenish-gray, silty; interbedded sandstone.
88-91	Lignite.
91-153	Claystone, greenish-gray, carbonaceous; interbedded thin lignite and sandstone.
153-166	Lignite.
166-187	Claystone, gray, silty, tight, carbonaceous.
187-191	Lignite.
191-200	Claystone, gray, silty, tight, carbonaceous.

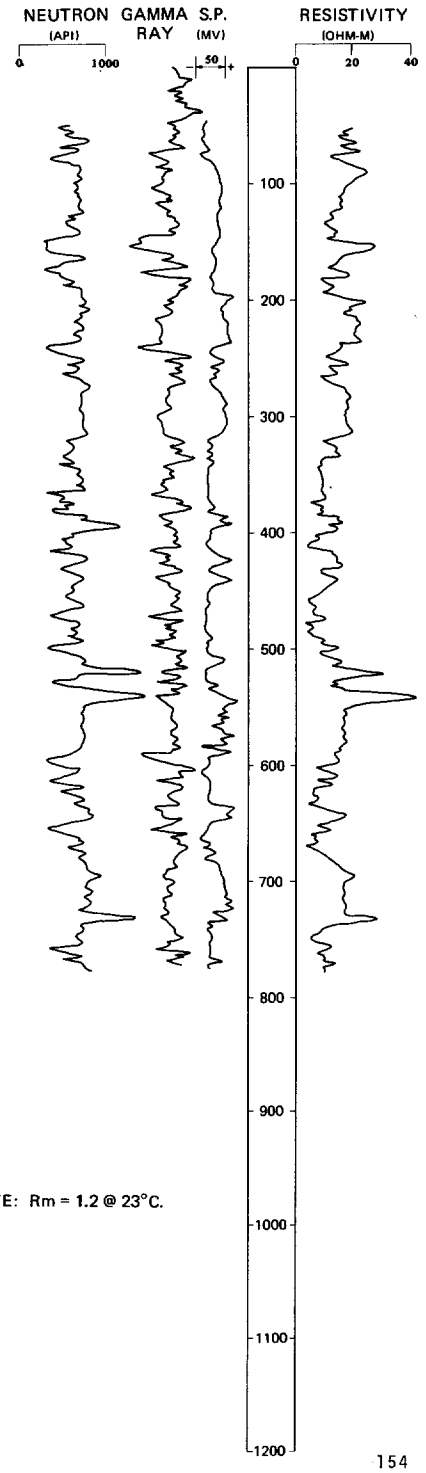
NDSWC 4938

LOCATION: 139-105-30DDD

DATE DRILLED: 7/27/76

ALTITUDE: 2870
(FT, NGVD)

DEPTH: 780
(FT)



NOTE: Rm = 1.2 @ 23°C.

DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-18	Claystone, pale-yellowish-brown, very silty.
18-20	Lignite.
20-80	Claystone, dark-gray; interbedded thin lignite.
80-105	Sandstone, light-gray, very fine to fine.
105-148	Claystone, light-olive-gray, silty.
148-161	Lignite.
161-174	Claystone.
174-180	Lignite.
180-196	Claystone, light-greenish-gray.
196-240	Sandstone, gray, fine.
240-246	Lignite.
246-277	Claystone, gray, silty.
277-321	Sandstone, light-greenish-gray, fine.
321-338	Siltstone.

LUDLOW MEMBER

338-386	Claystone, gray, silty.
386-393	Sandstone.
393-418	Interbedded siltstone, claystone, and lignite.
418-450	Sandstone, gray, argillaceous.

LEBO MEMBER

450-507	Claystone, gray; interbedded lignite.
507-580	Sandstone, gray, silty; numerous interbedded thin siltstone.

LUDLOW MEMBER

580-600	Lignite.
600-637	Claystone, gray; interbedded lignite.
637-650	Sandstone, gray, very fine to fine.
650-687	Claystone, gray; interbedded lignite.
687-736	Sandstone, gray, very fine to fine.
736-780	Claystone, gray; interbedded lignite.

140-101-32BCC
(Log modified from Kruger Drilling Co.)

Altitude: 2420 feet

Date drilled: 10/15/73

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Scoria and clay	20	20
Clay	60	80
Lignite	5	85
Clay	355	440
Sand	60	500
Clay	60	560
Sand	40	600
Clay	140	740
Sand	40	780
Clay	30	810
Sand	30	840
Clay	60	900
Sand	30	930
Clay	160	1,090
Sand	10	1,100
Clay	100	1,200
Sand	40	1,240
Clay	50	1,290
Sand	30	1,320

140-101-32DAB
(Log modified from Kruger Drilling Co.)

Date drilled: 12/17/73

Clay	80	80
Lignite	20	100
Clay	20	120
Sand	20	140
Clay	340	480
Sand	40	520
Clay	220	740
Sand	20	760
Clay	50	810
Sand	30	840
Clay	113	953
Sand	27	980
Clay	40	1,020
Sand	30	1,050
Clay	270	1,320
Sand	60	1,380
Clay	40	1,420
Clay, sandy	30	1,450
Sand	40	1,490

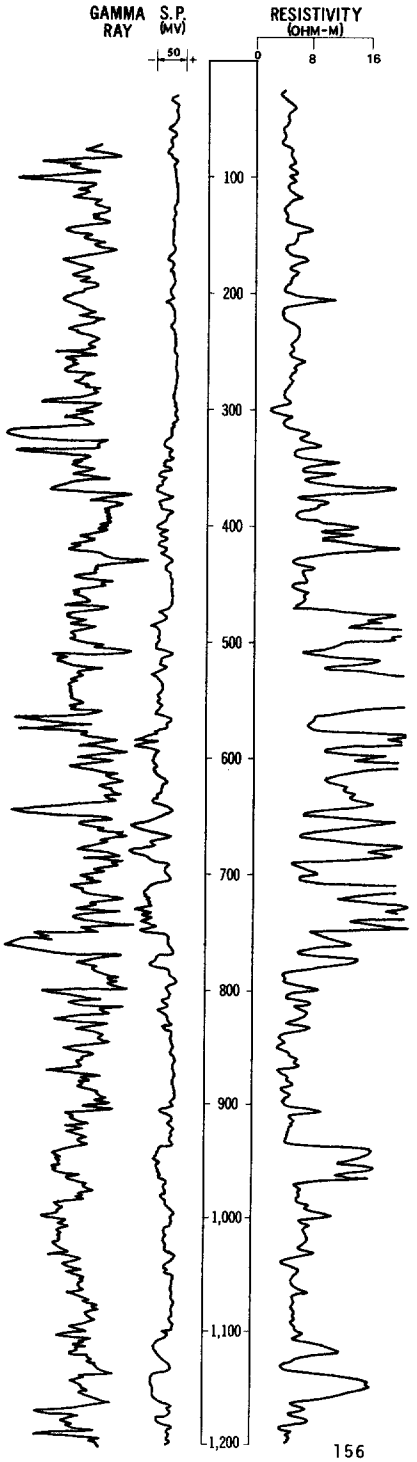
USDI
(Log modified from Schlumberger)

LOCATION: 140-101-35DAD

DATE DRILLED: 6/ /73

ALTITUDE: 2770
(FT, NGVD)

DEPTH: 1930
(FT, LSD)



DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-30	Claystone and sandstone, light-olive-gray, silty.
30-35	Claystone, silty, lignitic.
35-40	Claystone and sandstone.
40-45	Siltstone and claystone.
45-70	Siltstone, sandy.
70-84	Claystone, lignitic.
84-96	Lignite.
96-100	Claystone, silty.
100-108	Lignite.
108-116	Claystone, silty.
116-120	Limestone.
120-207	Claystone, silty, sandy, carbonaceous.
207-211	Limestone.
211-250	Claystone, silty, sandy, carbonaceous.
250-254	Lignite.
254-292	Claystone, silty; thin bed of limestone at 260 feet.
292-304	Lignite and shale, carbonaceous.

TONGUE RIVER MEMBER

304-316	Claystone, silty.
316-328	Lignite.
328-336	Sandstone, silty, clayey.
336-342	Lignite.
342-429	Sandstone and claystone.
429-434	Lignite.
434-484	Claystone, sandy, carbonaceous.
484-510	Sandstone.
510-514	Claystone, carbonaceous.
514-564	Sandstone.
564-578	Lignite.
578-642	Sandstone and claystone.
642-652	Lignite.
652-716	Sandstone and claystone.

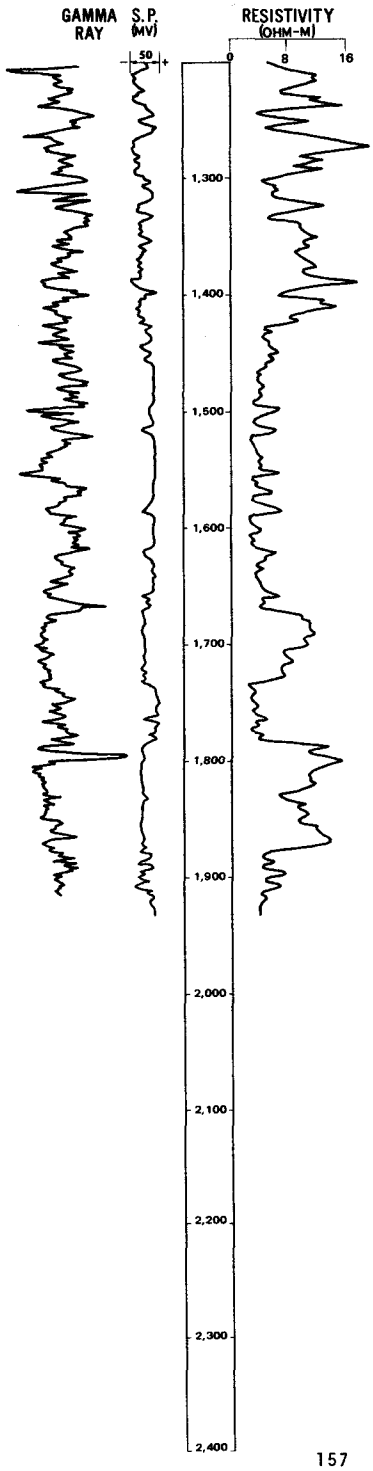
USDI, Continued
(Log modified from Schlumberger)

LOCATION: 140-101-35DAD

DATE DRILLED: 6/ /73

ALTITUDE: 2770
(FT, NGVD)

DEPTH: 1930
(FT, LSD)



DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER, Continued

716-720	Limestone.
720-750	Sandstone.
750-770	Lignite.
770-785	Sandstone.
785-798	Claystone.
798-804	Lignite.
804-834	Lignite and claystone.

LUDLOW MEMBER

834-866	Lignite and claystone.
866-878	Lignite.
878-896	Claystone.
896-913	Lignite and claystone.
913-940	Claystone, silty.
940-963	Sandstone.
963-968	Limestone.

CANNONBALL MEMBER

968-994	Siltstone, sandy.
994-998	Limestone.
998-1030	Siltstone, sandy.
1030-1034	Limestone.
1034-1064	Claystone, sandy.
1064-1066	Limestone.
1066-1102	Claystone.

LUDLOW MEMBER

1102-1106	Limestone.
1106-1168	Sandstone and claystone.
1168-1172	Lignite.
1172-1202	Claystone and lignite.
1202-1208	Lignite.
1208-1234	Sandstone, silty.
1234-1238	Limestone.
1238-1256	Siltstone and sandstone.
1256-1263	Lignite.

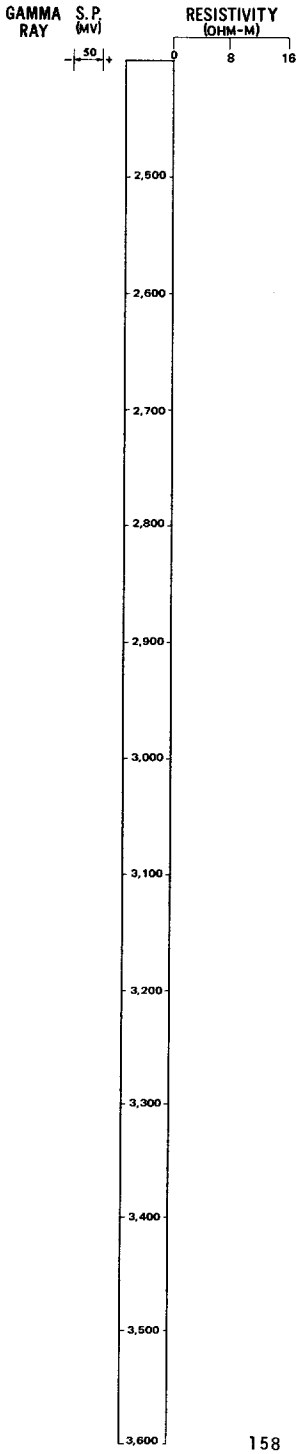
USDI, Continued
(Log modified from Schlumberger)

LOCATION: 140-101-35DAD

DATE DRILLED: 6/ /73

ALTITUDE: 2770
(FT, NGVD)

DEPTH: 1930
(FT, LSD)



DESCRIPTION OF DEPOSITS

LUDLOW MEMBER, Continued

1263-1306	Sandstone.
1306-1320	Lignite and claystone.
1320-1350	Sandstone and siltstone.
1350-1354	Limestone.
1354-1392	Sandstone.
1392-1398	Limestone.
1398-1430	Sandstone.

HELL CREEK FORMATION

1430-1448	Claystone, carbonaceous.
1448-1450	Limestone.
1450-1494	Claystone, carbonaceous.
1494-1503	Lignite.
1503-1550	Claystone.
1550-1554	Limestone.
1554-1674	Claystone, silty.
1674-1732	Sandstone.
1732-1735	Limestone.
1735-1785	Claystone and siltstone.

FOX HILLS SANDSTONE

1785-1875	Sandstone.
1875-1930	Claystone, silty, sandy.

140-102-01DBD1
(Log modified from S.W.C.C. Project No. 1326)
Test hole program
Test hole 1-1326

Altitude: 2239 feet — Date drilled: 5/26/63

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand, fine to very coarse, some gravel. Poorly to moderately sorted, but may be in stratified well-sorted layers. Subangular to subrounded. Predominately quartz with high scoria and lignite content, also some shale and limestone. The shale, scoria, and lignite grains and pebbles are tabular, rounded, and smooth. Taking water and appears to be very permeable. Medium gravel about 17 to 20 feet	21	21
Clay, light-olive-gray, smooth, soft, plastic, cohesive, sticky, very tight, calcareous. Water in mud pit milky. Poor sample return	21	42

140-102-01DBD2
(Log modified from S.W.C.C. Project No. 1326)
Test hole program
Test hole 2-1326

Altitude: 2238 feet — Date drilled: 5/26/63

Sand, fine to medium, well-sorted	2	2
Sand, very clayey, grayish-brown, loosely to moderately consolidated	3	5
Sand, fine to coarse, some gravel, poorly to moderately sorted, saturated	10	15
Lignite, black, fissile	4	19
Clay, smooth, light-olive-gray	18	37
Clay, smooth, light-olive-gray to light-brown	5	42

140-102-10DDA
(Log modified from K. D. Thompson)

Altitude: 2345 feet

Clay, yellow	15	15
Shale, blue	50	65
Lignite	10	75
Shale	105	180
Shale, sandy	50	230
Shale, brown	5	235
Sandstone	20	255
Lignite	10	265
Shale	5	270
Lignite	20	290
Shale	31	321
Sand and shale	12	333
Shale; with thin lignite streaks	174	507
Sandstone, hard	3	510
Shale, hard	244	754
Lignite	12	766
Shale, hard	22	788
Sand	8	796
Shale	4	800
Rock	1	801
Shale	24	825
Sandstone	5	830
Shale; with lignite streaks	59	889
Sandstone	14	903
Shale, dark	142	1,045
Sandstone	10	1,055
Shale, dark	90	1,145
Shale, sandy	32	1,177
Sand layers	11	1,188
Sand	8	1,196
Shale, dark	37	1,233

140-102-11ADD
(Log modified from George Askins)

Altitude: 2252 feet

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay, sandy	15	15
Gravel	10	25
Clay, sandy	30	55
Coal	5	60
Clay, sandy	10	70
Limestone	3	73
Clay, gray	82	155
Rock	.5	155.5
Streaks of sand	49.5	205
Shale	35	240
Coal	18	258
Shale	4	262
Coal	1	263
Shale, gray	2	265
Coal	1	266
Shale, sandy	9	275
Coal, soft	6	281
Shale; streaks of sand	19	300
Hard shell	1	301
Shale	6	307
Hard shell	.5	307.5
Shale, light-gray	16.5	324
Coal	4	328
Shale, greenish	12	340
Hard shell	.5	340.5
Sand	3.5	344
Shale	3	347
Sand	3	350
Shale	15	365
Coal	3	368
Shale	7	375
Sand	45	420
Shale, sandy	5	425

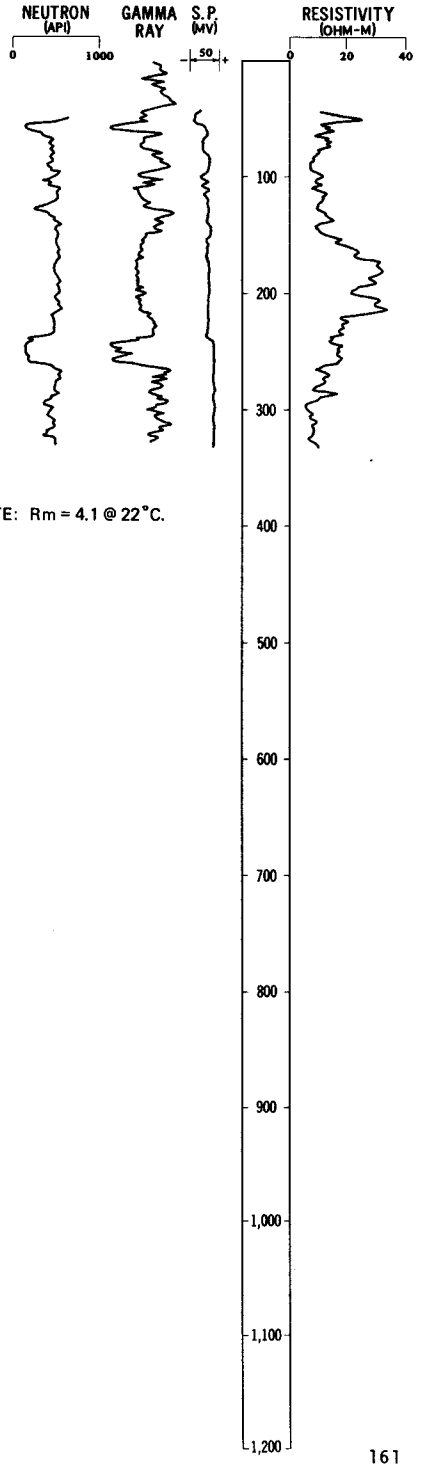
NDSWC 4923

LOCATION: 140-102-19DDB

DATE DRILLED: 7/14/76

ALTITUDE: 2380
(FT, NGVD)

DEPTH: 337
(FT, LSD)



NOTE: Rm = 4.1 @ 22°C.

DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-10	Claystone, yellowish-brown.
10-16	Claystone, gray.
16-18	Lignite.
18-30	Claystone, gray.
30-40	Claystone, pale-yellowish-gray.
40-52	Claystone, light-gray.
52-61	Lignite.
61-152	Claystone, gray, very silty, carbonaceous.
152-218	Sandstone, gray, argillaceous; carbonaceous trash.
218-238	Siltstone, gray, argillaceous.
238-261	Lignite.
261-337	Claystone, dark-brownish-gray, silty.

140-102-22DBD
(Log modified from Kruger Drilling Co.)

Altitude: 2260 feet — Date drilled: 11/13/76

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Gravel	25	25
Rock	2	27
Clay	31	58
Sand	42	100
Coal	35	135
Clay	68	203
Rock	2	205
Clay	75	280
Sand	85	365
Clay	151	516
Rock	2	518
Sand	22	540
Clay	130	670
Sand	20	690
Clay	60	750
Clay, sandy	230	980
Clay	30	1,010
Sandrock	2	1,012
Sand	68	1,080

140-102-22DCD
(Log modified from Kruger Drilling Co.)

Altitude: 2260 feet — Date drilled: 5/01/73

Sand and gravel	30	30
Rock	4	34
Sand	46	80
Clay	20	100
Sand	30	130
Clay	10	140
Lignite	20	160
Clay	160	320
Sand	20	340
Clay, sandy	40	380
Clay	150	530
Sand	40	570
Clay	90	660
Sand	27	687
Clay	173	860
Lignite	10	870
Clay	25	895
Rock	.5	895.5
Clay	44.5	940
Sand	40	980
Clay, brownish-gray	30	1,010
Sand	32	1,042
Clay	3	1,045

140-102-26BBB
(Log modified from Midwest Well and Pipe Co.)

Altitude: 2290 feet — Date drilled: 1957

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Topsoil	3	3
Clay, gray	11	14
Clay, yellow	4	18
Sand and gravel	15	33
Clay, yellow	1	34
Lignite	.6	34.6
Sand, white	3.4	38
Sandstone, hard	2	40
Clay, white	11	51
Lignite	1	52
Shale, carbonaceous	2	54
Sand, gray	86	140
Clay, sandy	8	148
Clay, dark	4	152
Lignite, hard	30	182
Soapstone, white	26	208
Clay, dark	11	219
Stone, hard	.6	219.6
Clay, light-gray	18.4	238
Stone	.6	238.6
Clay, blue	55.4	294
Sand, blue, fine, loose	26	320
Clay, fine, sandy, silty	10	330
Clay	5	335
Clay, sandy	15	350
Clay, blue	11	361
Clay, sandy	25.6	386.6
Sandstone	.4	387
Clay, blue	15	402
Sandstone, hard	1.6	403.6
Clay, blue	41.4	445
Clay, blue, sandy	11	456
Clay, blue, hard	18	474
Clay, sandy	4	478
Sandstone	2.4	480.4
Clay, white, fine, sandy	9.6	490
Sand, fine, very silty	31	521
Clay, blue	2	523
Clay, dark, hard	7	530
Soapstone	8	538
Lignite	2	540
Sand, fine, hard	31	571
Clay, fine, sandy	35	606
Lignite	7	613
Sandstone	1.6	614.6
Clay, gray	2.4	617
Soapstone, hard	53	670
Sand	16	686
Stone, hard	3	689
Sand, fine	26	715
Lignite	2	717
Soapstone	9	726
Lignite	4	730
Clay, blue	10	740
Lignite	4	744
Clay, dark	26	770
Lignite	4	774
Clay, blue	30	804
Lignite	5	809
Clay, blue	5	814
Lignite	8	822
Soapstone, hard	38	860
Lignite	4	864

140-102-26BBB, Continued
(Log modified from Midwest Well and Pipe Co.)

Altitude: 2290 feet — Date drilled: 1957

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Shale, dark, hard	16	880
Lignite	10	890
Clay, dark, hard	50	940
Sand, fine	9	949
Sandstone	.6	949.6
Sand, fine	1.4	951
Sandstone	11	962
Clay, blue	5	967
Shale, brown, carbonaceous	8	975
Lignite	2	977
Shale, soft	41	1,018
Shale, hard	22	1,040
Sand, fine, silty, soft	69	1,109

140-102-26BCA
(Log modified from K. D. Thompson)

Altitude: 2285 feet — Date drilled: 5/14/66

Clay and silt	18	18
Sand, gravel, and scoria	12	30
Clay	90	120
Lignite	25	145
Clay and shale	135	280
Sand, fine	30	310
Shale	110	420
Sand	20	440
Shale	185	625
Sand, fine	20	645
Shale	320	965
Sand	30	995
Rock, hard	4	999
Shale	36	1,035
Sand	45	1,080
Shale, hard	4	1,084

140-102-26CAA
(Log modified from Kruger Drilling Co.)

Altitude: 2290 feet — Date drilled: 6/27/72

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay	15	15
Gravel	13	28
Clay, sandy	32	60
Sand	50	110
Lignite	30	140
Clay	120	260
Sand	40	300
Clay	70	370
Sand	10	380
Clay	130	510
Sand	10	520
Clay	100	620
Lignite	20	640
Sand	20	660

140-102-27BAD
(Log modified from Kruger Drilling Co.)

Altitude: 2350 feet — Date drilled: 8/27/76

Clay	6	6
Lignite	6	12
Clay	48	60
Lignite	10	70
Clay	90	160
Sand	60	220
Lignite	30	250
Clay	120	370
Sand, greenish, fine	70	440
Clay	25	465
Sand, fine	10	475
Clay	45	520
Sand, sticky	40	560
Clay	170	730
Sand	50	780
Clay	220	1,000
Sand	60	1,060

140-102-28DDD
(Log modified from Harold Goodale)

Altitude: 2270 feet — Date drilled: 9/26/73

Scoria, sand, and gravel	38	38
Lignite	17	55
Shale	10	65
Sand	35	100
Lignite	30	130
Shale	130	260
Sand	40	300
Shale	15	315
Rock	4	319
Shale	121	440
Sand	60	500

140-103-02CDC
(Log modified from K. D. Thompson)

Altitude: 2505 feet — Date drilled: 7/11/73

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay, yellow, sandy	5	5
Lignite	3	8
Clay, yellow, and scoria	62	70
Clay, fine, sandy	10	80
Clay, blue	245	325
Sand, fine, silty	10	335
Shale, blue	5	340
Lignite	40	380
Shale	130	510
Sand, fine	5	515
Shale; with lignite streaks	310	825
Sand, fine, silty	10	835
Shale	405	1,240
Rock, hard	10	1,250
Shale	110	1,360
Sandstone, brown	40	1,400
Shale, dark	15	1,415
Sand	40	1,455

140-103-09DAB
(Log modified from K. D. Thompson)

Altitude: 2600 feet — Date drilled: 7/17/67

Shale, yellow	40	40
Shale rock	1	41
Shale	19	60
Lignite	3	63
Shale	17	80
Lignite	5	85
Shale	200	285
Lignite	15	300
Shale	5	305
Sandstone	5	310
Shale	50	360
Sandstone	20	380
Shale	145	525
Sandstone	5	530
Shale; with very thin lignite streaks	120	650
Shale, sandy	50	700
Shale, brown, very hard	30	730
Clay, white, sandy	20	750
Shale, dark	350	1,100
Shale, very hard	20	1,120
Shale, brown, hard	50	1,170
Shale	110	1,280
Sandstone	10	1,290
Sand	30	1,320
Shale, sand, and lignite; thin layers	85	1,405
Sand	40	1,445
No lithologic description	---	1,462

140-103-23BCB
(Log modified from Harold Goodale)

Altitude: 2458 feet — Date drilled: 11/18/66

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill, sandy	43	43
Lignite	1	44
Clay	6	50
Lignite	12	62
Clay	38	100
Lignite	8	108
Clay	42	150
Sand	2	152
Clay	16	168
Sand	7	175

140-103-29DDD
(Log modified from Harold Goodale)

Altitude: 2620 feet — Date drilled: 9/27/67

Fill	15	15
Clay	50	65
Lignite	2	67
Clay	43	110
Lignite	15	125
Sand	17	142

140-104-06BAA
(Log modified from Harold Goodale)

Date drilled: 9/06/66

Scoria	15	15
Clay	23	38
Rock	2	40
Clay	70	110
Lignite	25	135
Clay	30	165
Lignite	5	170
Clay	17	187
Lignite	3	190
Clay	30	220
Sand	10	230
Clay	30	260
Lignite	10	270
Clay	40	310
Lignite	5	315
Clay	155	470
Rock	2	472
Clay	18	490
Sand	60	550

140-104-07DDA
(Log modified from Harold Goodale)

Date drilled: 5/24/68

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill	11	11
Clay	21	32
Lignite	3	35
Clay	50	85
Lignite	5	90
Clay	15	105
Lignite	5	110
Clay	50	160
Sand	20	180
Lignite	5	185
Clay	15	200
Lignite	12	212
No lithologic description	----	260

140-104-12ADB
(Log modified from Moe Drilling Co.)

Altitude: 2668 feet — Date drilled: 5/02/69

Clay, yellow	18	18
Clay, gray	45	63
Sand, green, chunky	12	75
Sandstone, gray, medium-hard	4.5	79.5
Sand, green, chunky	16.5	96
Lignite	2	98
Clay, gray	247	345
Sand, fine	13	358
Lignite	6	364
Clay, brown	116	480
Clay, gray	25	505
Sand, gray, silty	40	545
Sandstone, hard	9	554
Clay, gray, silty	23	577
Clay, brownish-gray	83	660
Sand, silty	20	680
Clay, gray	47	727
Sand, gray	30	757
Clay, gray	188	945
Sand, gray, medium	25	970
Clay, brown	108	1,078
Rock, white, very hard	5	1,083
Clay, grayish-brown	49	1,132
No lithologic description	----	1,400

140-104-13DBA
(Log modified from Harold Goodale)

Altitude: 2690 feet — Date drilled: 7/28/64

Scoria and shale	18	18
Clay	117	135
Rock	2	137
Clay	18	155
Sand	10	165
Clay	35	200
Sand; with lignite ledges	70	270

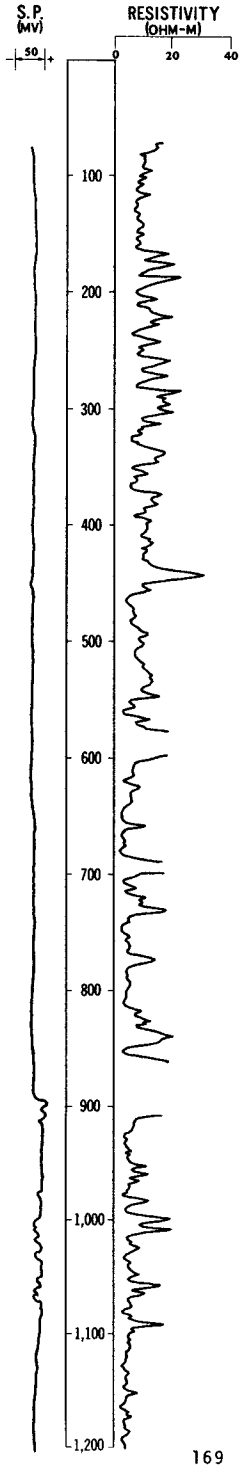
NDSHD (Camel Hump Rest Area)
(Geophysical log from Schlumberger; lithologic log modified from Moe Drilling Co.)

LOCATION: 140-104-15BBD

DATE DRILLED: 5/01/69

ALTITUDE: 2742
(FT, NGVD)

DEPTH: 1400
(FT, LSD)

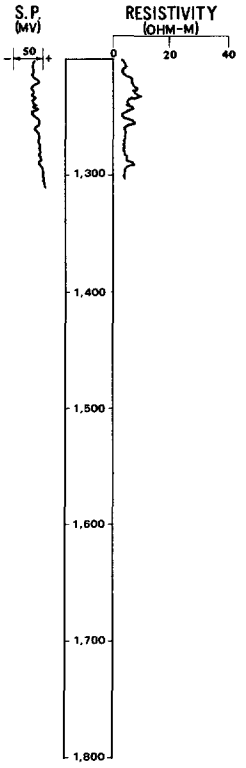


	DESCRIPTION OF DEPOSITS
0-1	Topsoil.
1-18	Clay, yellow.
18-36	Clay, gray.
36-38	Lignite.
38-80	Clay, yellow.
80-94	Clay, gray.
94-95	Lignite.
95-105	Clay, green.
105-105.5	Lignite.
105.5-114	Clay, gray.
114-115	Clay, brown.
115-135	Clay, gray.
135-138	Lignite.
138-159	Clay, gray.
159-160.5	Lignite.
160.5-186	Clay, gray.
186-190	Sand, silty.
190-210	Clay, gray; with lignite streaks.
210-212	Sand, silty.
212-286	Clay, gray.
286-293	Sandstone.
293-483	Clay, gray.
483-548	Sand, green, chunky.
548-560	Clay, brown.
560-580	Sand.
580-596	Lignite.
596-650	Clay, brown, sandy.
650-678	Sand, gray, silty.
678-680	Rock.
680-696	Clay, gray.
696-698	Rock.
698-731	Clay, gray.
731-736.5	Rock, hard.
736.5-750	Clay, gray.
750-754	Lignite.

NDSHD (Camel Hump Rest Area), Continued
(Geophysical log from Schlumberger; lithologic log modified from Moe Drilling Co.)

LOCATION: 140-104-15BBD DATE DRILLED: 5/01/69

ALTITUDE: 2742 (FT, NGVD) DEPTH: 1400 (FT, LSD)



	DESCRIPTION OF DEPOSITS
754-777	Clay, gray.
777-902	Clay.
902-905	Rock, gray, hard.
905-925	Sand.
925-952	Rock.
952-974	Clay, gray.
974-975	Rock.
975-1042	Clay, gray.
1042-1045	Rock, medium-hard.
1045-1185	Clay, brown.
1185-1188	Rock, medium-hard.
1188-1250	Clay, gray.
1250-1330	Sand.
1330-1340	Clay.
1340-1400	Sand.

140-104-18AAD
(Log modified from Harold Goodale)

Date drilled: 5/10/68

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay	68	68
Rock	2	70
Clay	10	80
Lignite	10	90
Clay	65	155
Lignite	10	165
Clay	54	219
Rock	3	222
Clay	58	280
Lignite	5	285
Clay	33	318
Sand	27	345

140-104-19DDC
(Log modified from Harold Goodale)

Date drilled: 9/12/64

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill	8	8
Clay	17	25
Lignite	10	35
Clay	70	105
Lignite	8	113
Clay	27	140
Sand	5	145
Clay	25	170
Sand	60	230

140-104-20CAB
(Log modified from Harold Goodale)

Date drilled: 6/27/73

Fill	4	4
Shale	66	70
Lignite	9	79
Shale	136	215
Sand	65	280

140-104-20CCD
(Log modified from Harold Goodale)

Date drilled: 4/11/64

Fill	12	12
Clay	23	35
Rock	4	39
Clay	26	65
Lignite	4	69
Clay	6	75
Sandstone	10	85
Clay	45	130
Sand	35	165

140-104-27CBD
(Log modified from Harold Goodale)

Date drilled: 7/24/65

Fill	9	9
Clay	71	80
Lignite	10	90
Clay	65	155
Sand	35	190

140-104-30ADD
(Log modified from Harold Goodale)

Date drilled: 9/05/64

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill	12	12
Clay	53	65
Sand	7	72
Lignite	5	77
Clay	41	118
Rock	1	119
Clay	84	203
Lignite	2	205
Clay	10	215
Lignite	5	220
Clay	8	228
Lignite	7	235
Sand	60	295

140-104-32AAD
(Log modified from Harold Goodale)

Date drilled: 11/01/63

Fill	9	9
Shale	51	60
Rock	1	61
Clay	9	70
Lignite	10	80
Clay	55	135
Sand	15	150

140-105-07AAB
(Log modified from Harold Goodale)

Altitude: 2735 feet

Date drilled: 5/16/68

Fill	8	8
Clay	34	42
Sandstone	5	47
Clay	3	50
Lignite	6	56
Clay	3	59
Lignite	3	62
Sand	8	70

140-105-14ABA
(Log modified from Kruger Drilling Co.)

Altitude: 2910 feet — Date drilled: 7/01/75

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay	160	160
Sand, white	20	180
Clay	160	340
Rock	15	355
Clay	131	486
Lignite	49	535
Clay	240	775
Sand	50	825
Clay	185	1,010
Sand	20	1,030
Clay	170	1,200
Sand	40	1,240
Clay	100	1,340
Sand	90	1,430
Clay	10	1,440
Sand	60	1,500
Rock	2	1,502
Sand	51	1,553

140-105-25BBA
(Log modified from Harold Goodale)

Altitude: 2770 feet — Date drilled: 10/18/66

Fill	9	9
Clay	11	20
Lignite	8	28
Clay	4	32
Sand	2	34
Clay	6	40
Lignite	2	42
Clay	5	47
Sand	2	49
Clay	4	53
Sand	22	75

140-105-30CCB
(Log modified from Harold Goodale)

Altitude: 2760 feet — Date drilled: 11/21/73

Shale	18	18
Sand	8	26
Lignite	4	30
Shale	25	55
Sand	25	80

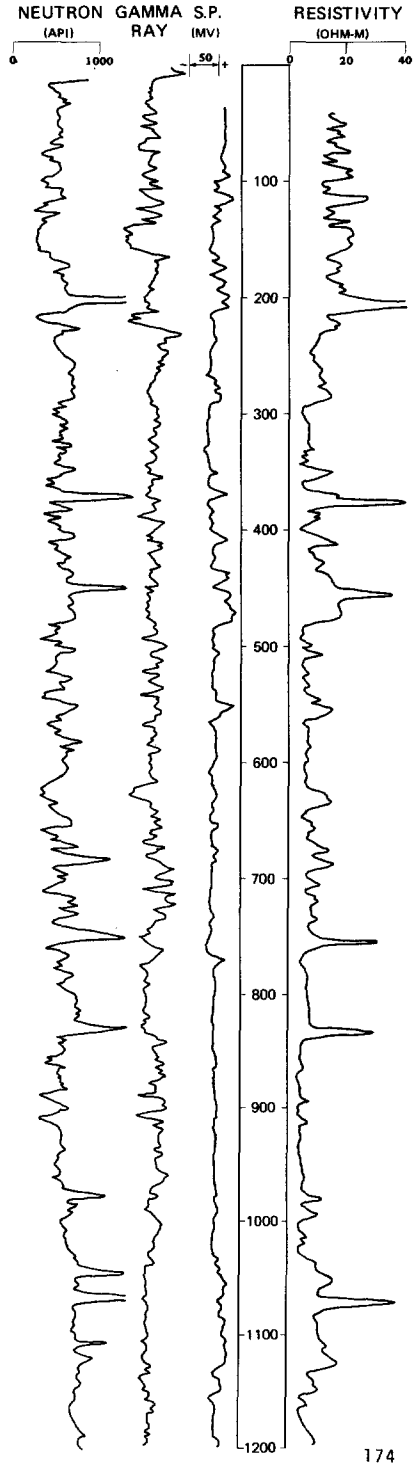
NDSWC 5146, 5146A, 5146B

LOCATION: 140-105-30CCC1, 2, 3

DATE DRILLED: 7/22/77

ALTITUDE: 2770
(FT, NGVD)

DEPTH: 1400
(FT)



DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-5	Claystone, light-yellowish-brown, soft.
5-20	Claystone, light-yellowish-gray.
20-134	Claystone, light-gray; interbedded sandstone, siltstone, and lignite.
134-158	Lignite.
158-208	Sandstone, light-gray, very fine, micaceous.
208-212	Claystone.
212-222	Lignite.
222-265	Claystone, gray; silty near base.
265-288	Sandstone, light-gray, fine, micaceous.

LUDLOW MEMBER

288-432	Claystone, light-olive-gray, silty, tight; interbedded sandstone.
432-478	Sandstone, light-gray, very fine to fine; thin indurated bed.

LEBO SHALE MEMBER

478-620	Claystone, dark-gray, silty, tight, carbonaceous; interbedded thin sandstone and siltstone.

LUDLOW MEMBER

620-642	Lignite.
642-688	Sandstone, gray, very fine to fine, argillaceous; interbedded claystone.
688-760	Siltstone, dark-gray, carbonaceous; interbedded thin lignite, sandstone, and claystone.

HELL CREEK FORMATION

760-840	Claystone, gray, very silty; sandy near base.
840-978	Claystone, dark-gray, tight; interbedded thin lignite.
978-998	Sandstone, gray, very fine to fine.
998-1032	Claystone, dark-olive-gray, silty, slightly carbonaceous.

FOX HILLS SANDSTONE

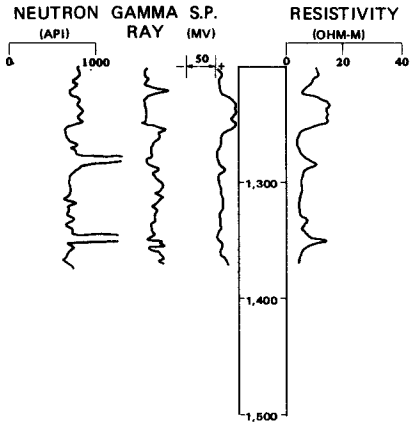
1032-1154	Sandstone, light-gray, very fine to fine, slightly argillaceous; thin indurated beds.
1154-1192	Claystone, gray, very silty.
1192-1252	Sandstone, light-gray, very fine to fine; very silty near top.

LOCATION: 140-105-30CCC1, 2, 3

DATE DRILLED: 7/22/77

ALTITUDE: 2770
(FT, NGVD)

DEPTH: 1400
(FT)



DESCRIPTION OF DEPOSITS

FOX HILLS SANDSTONE, Continued

1252-1282	Claystone, gray, silty.
1282-1290	Sandstone, gray, very fine, very silty.

PIERRE SHALE

1290-1360	Siltstone.
1360-1400	Shale, very dark gray, silty, tight.

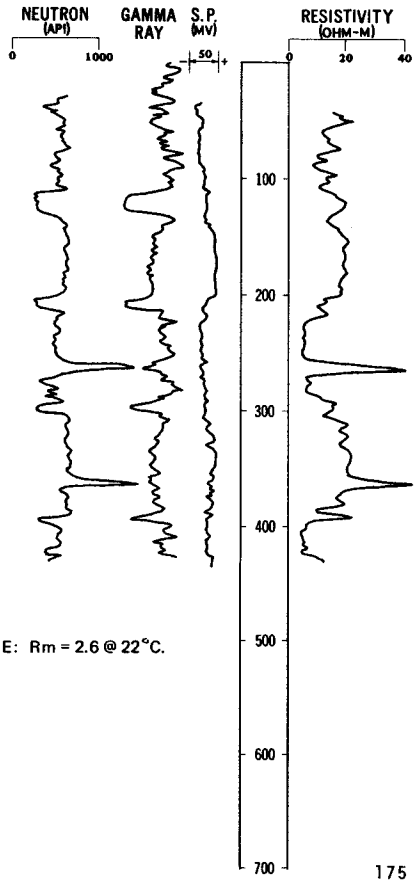
NDSWC 4934

LOCATION: 140-106-01AAA

DATE DRILLED: 7/20/76

ALTITUDE: 2710
(FT, NGVD)

DEPTH: 440
(FT, LSD)



NOTE: Rm = 2.6 @ 22°C.

DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-22	Claystone, pale-yellowish-brown; gravelly near top.
22-30	Sandstone, pale-yellowish-brown, very fine to medium.
30-50	Claystone, gray, silty.
50-57	Sandstone, gray, very fine to fine.
57-113	Claystone, gray, carbonaceous; interbedded siltstone.
113-131	Lignite.
131-144	Claystone, dark-brownish-gray.
144-204	Sandstone, gray.
204-214	Lignite.
214-222	Siltstone.

LUDLOW MEMBER

222-274	Claystone, gray.
274-310	Claystone, gray; numerous interbedded thin lignite.
310-394	Sandstone, gray, very fine to fine; argillaceous in places.
394-440	Claystone, gray, carbonaceous.

140-106-14BAA
(Log modified from Harold Goodale)

Date drilled: 3/26/68

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Shale	30	30
Lignite	5	35
Clay	8	43
Lignite	7	50
Clay	50	100
Lignite	4	104
Clay	66	170
Lignite	30	200
Sand	40	240

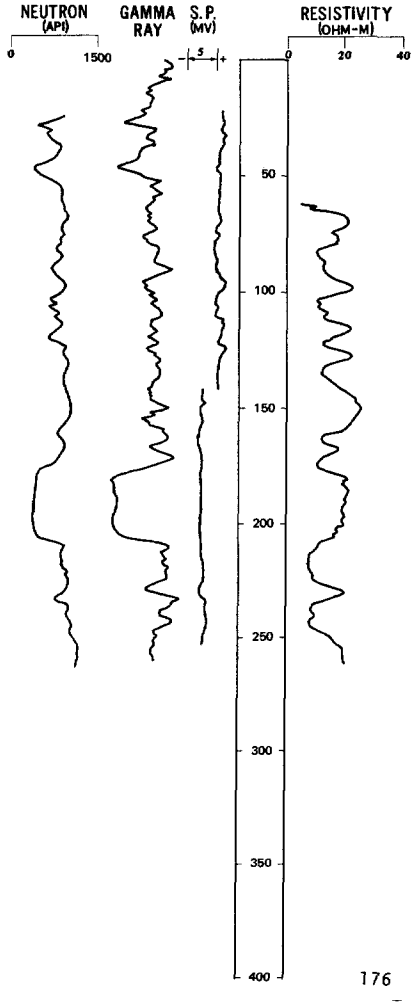
NDSWC 4924

LOCATION: 140-106-14BBB

ALTITUDE: 2774
(FT, NGVD)

DATE DRILLED: 7/14/76

DEPTH: 260
(FT, LSD)



DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-22	Claystone, yellowish-brown, soft.
22-26	Claystone, dark-gray, silty, tight.
26-35	Sandstone, fine, argillaceous.
35-138	*Claystone, gray, silty; interbedded* lignite and thin siltstone.
138-158	Sandstone, gray, very fine, silty.
158-177	Claystone, bluish-gray, silty, carbonaceous.
177-208	Lignite.
208-260	Claystone, gray, silty; interbedded thin lignite and siltstone.

140-106-15DDD
(Log modified from Moe Drilling Co.)

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill	6	6
Sand, yellow	14	20
Clay, gray	3	23
Lignite	2	25
Clay, brown	43	68
Lignite	4	72
Clay, gray	62	134
Lignite	2	136
Clay, gray	69	205
Sand, gray	63	268
Clay, gray	2	270

140-106-22AAA
(Log modified from Moe Drilling Co.)

Fill	27	27
Clay, gray	2	29
Lignite	1	30
Clay, gray, silty	75	105
Lignite	4	109
Clay, gray	2	111
Lignite	7	118
Clay, green	12	130
Clay, gray	45	175
Sand, silty	2	177
Limestone, brown	1	178
Clay, sandy	7	185
Sand, gray, fine to coarse	53	238
Clay, gray	2	240

140-106-23CDD
(Log modified from Harold Goodale)

Date drilled: 4/15/67

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill	4	4
Clay	26	30
Lignite	5	35
Clay	7	42
Lignite	3	45
Clay	2	47
Lignite	4	51
Clay	5	56
Lignite	2	58
Clay	2	60
Sand	5	65
Clay	10	75
Sand	15	90
Rock	1	91
Sand	8	99
Clay	4	103
Sand	7	110
Lignite	1	111
Clay	8	119
Lignite	2	121
Sand, fine	14	135
Shale	50	185

140-106-24BCB
(Log modified from Harold Goodale)

Altitude: 2780 feet

Date drilled: 10/31/64

Fill	8	8
Clay	52	60
Sand	5	65
Lignite	10	75
Clay	18	93
Sand	7	100

140-106-25BCA
City of Beach

Altitude: 2770 feet

Date drilled: 1/16/28

Clay, yellow	15	15
Clay, yellow and blue	10	25
Clay, blue	21	46
Clay, brown	1	47
Clay, white	3	50
Clay, blue	59	109
Sand, fine	9	118
Clay	2	120
Sand, fine	28	148
Lignite	2	150

140-106-25CBB1
(Log modified from Layne-Minnesota Co.)

Altitude: 2810 feet

Date drilled: 9/ /61

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sandstone	110	110
Clay	10	120
Lignite	45	165
Sand	70	235
Lignite	4	239
Clay	109	348
Lignite	3	351
Clay	22	373
Sandstone	3	376
Clay	44	420
Sand	23	443
Shale	64	507
Lignite	4	511
Rock	2	513
Clay	19	532
Lignite	5	537
Clay	43	580
Rock	4	584
Clay	40	624
Lignite	9	633
Clay	9	642
Sandstone	1	643
Clay	4	647
Clay, soft	28	675
Clay	20	695
Clay, soft, and lignite	10	705
Sand and rock	90	795
Clay	82	877
Lignite	3	880
Clay	12	892
Lignite	4	896
Clay	33	929
Clay, hard	25	954
Rock, hard	3	957
Clay	5	962
Rock, hard	3	965
Clay	42	1,007
Rock	1	1,008
Clay	20	1,028
Rock, hard	1	1,029
Clay	6	1,035
Rock, hard	2	1,037
Clay	33	1,070
Clay, sandy	5	1,075
Shale	75	1,150
Sand	100	1,250
Shale	130	1,380

140-106-25CBB3
(Log modified from Layne-Minnesota Co.)

Altitude: 2810 feet — Date drilled: 8/28/48

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay, sandy, and sand streaks	20	20
Sand, hard	7	27
Clay, yellow, and sandstone streaks	8	35
Sandstone, gray, fine	75	110
Clay, blue, and lignite	10	120

140-106-26DCD
(Log modified from Layne-Minnesota Co.)

Date drilled: 11/18/58

Topsoil	2	2
Sand	11	13
Clay, sandy	4	17
Clay and sand	2	19
Clay, blue	9	28
Clay, blue, hard; with lignite streaks	15	43
Clay, blue	15	58
Sand, clay, and shale	40	98
Sand; with some clay	17	115
Sand	16	131
Clay and sand	1	132
Clay, lignite, and some sand	1	133

140-106-26DDC
(Log modified from Layne-Minnesota Co.)

Date drilled: 8/12/58

Topsoil	3	3
Clay, sandy	12	15
Clay, sandy, hard	6	21
Clay, red	6	27
Clay and lignite streaks	15	42
Clay, sand, and lignite	20	62
Sand; with some clay	20	82
Sand and lignite	5	87
Sandstone and lignite	6	93
Sand, hard	24	117
Sand and clay	3	120
Clay	5	125

141-098-10BAC
(Log modified from Mann Drilling Co.)

Altitude: 2545 feet — Date drilled: 7/16/65

Sand	6	6
Sand and gravel	15	21
Lignite	9	30

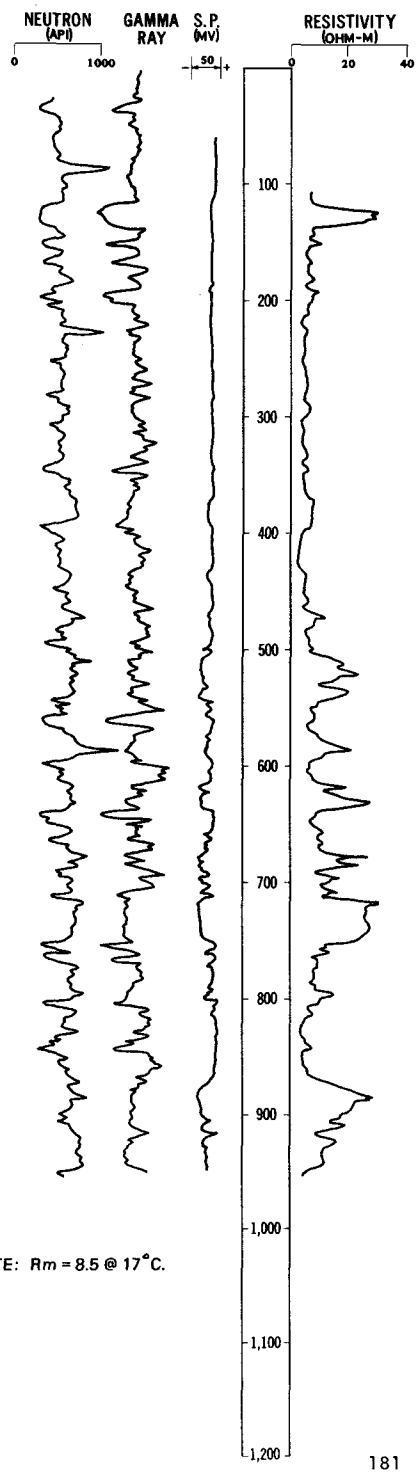
NDSWC 4915

LOCATION: 141-098-15AAA

ALTITUDE: 2560
(FT, NGVD)

DATE DRILLED: 6/29/76

DEPTH: 960
(FT, LSD)



NOTE: Rm = 8.5 @ 17°C.

DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-25	Sandstone, yellowish-brown, fine to medium.
25-27	Claystone, yellowish-brown, silty, tight.
27-30	Claystone, gray.
30-40	Lignite.
40-86	Claystone, light-gray, silty.
86-90	Sandstone, light-gray, very fine to fine.
90-118	Claystone, gray, silty.
118-138	Lignite.
138-149	Claystone, gray, very silty.
149-156	Lignite.
156-192	Claystone, gray, silty; interbedded thin lignite.

TONGUE RIVER MEMBER

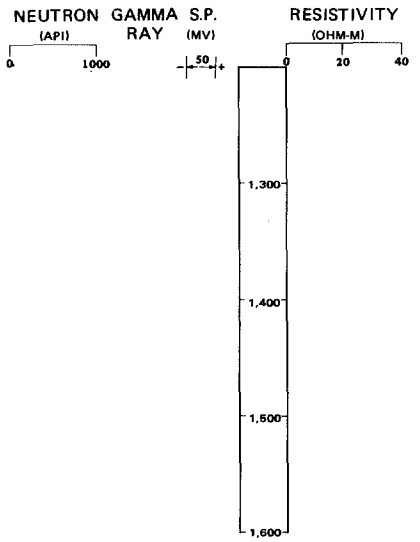
192-203	Lignite.
203-350	Claystone, dark-brownish-gray, silty; interbedded thin sandstone; minor carbonaceous trash.
350-372	Claystone, greenish-gray, sandy.
372-396	Sandstone, greenish-gray, very fine to fine, argillaceous.
396-520	Claystone, dark-brownish-gray, silty; interbedded thin sandstone; becoming bentonitic near base.
520-545	Sandstone, gray, very fine, very argillaceous; interbedded thin claystone.
545-558	Claystone, brownish-gray, silty, carbonaceous.
558-566	Lignite.
566-575	Claystone, brownish-gray, silty, carbonaceous.
575-595	Sandstone, gray, very fine to fine.
595-616	Claystone, gray, silty.
616-640	Sandstone, gray, very fine to fine, argillaceous.
640-654	Lignite.
654-717	Claystone, gray, silty; interbedded thin lignite and sandstone.

LOCATION: 141-098-15AAA

DATE DRILLED: 6/29/76

ALTITUDE: 2560
(FT, NGVD)

DEPTH: 960
(FT)



DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER, Continued

717-752	Sandstone, gray, fine to medium; carbonaceous trash.
752-818	Siltstone; lignite at 774 feet.

LUDLOW MEMBER

818-869	Claystone.
869-951	Sandstone, gray, very fine to fine, argillaceous; interbedded thin lignite and claystone.
951-960	Claystone, gray, silty.

141-098-23ADA
(Log modified from Mann Drilling Co.)

Altitude: 2542 feet

Date drilled: 3/18/70

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay, tan	12	12
Clay, gray	45	57
Lignite	3	60
Clay, gray	194	254
Sand	26	280
Clay, gray	140	420
Silt	20	440
Clay, sandy	120	560
Sand	20	580

141-098-23ADD
(Log modified from Mann Drilling Co.)

Altitude: 2545 feet — Date drilled: 10/30/64

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay	14	14
Lignite	5	19
Clay	20	39
Sandstone	2	41
Clay, sandy	23	64
Clay	6	70
Lignite	14	84
Clay	38	122
Lignite	4	126
Clay, sandy, and sand	25	151

141-099-04BAA
(Log modified from Mann Drilling Co.)

Altitude: 2632 feet — Date drilled: 8/23/65

Sand, brown	28	28
Sandstone	2	30
Sand, brown	2	32
Sand, blue	22	54

141-099-21DAA
(Log modified from Kruger Drilling Co.)

Altitude: 2600 feet — Date drilled: 9/11/72

Sand, yellow	20	20
Lignite	10	30
Clay	30	60
Rock	3	63
Clay	187	250
Lignite	4	254
Clay	36	290
Clay, sandy	50	340
Sand	20	360
Clay	20	380

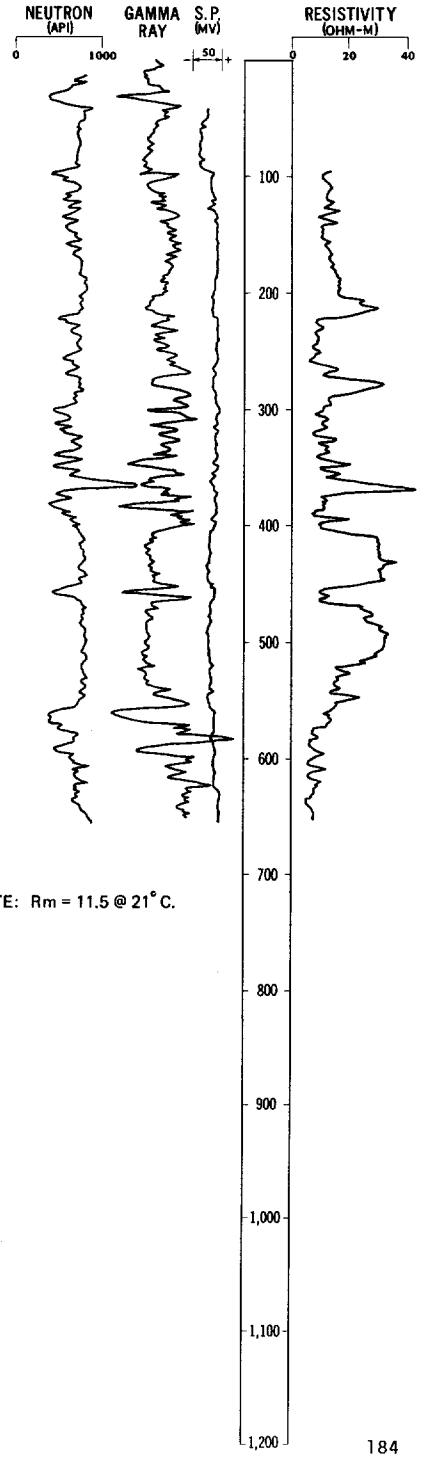
NDSWC 4913

LOCATION: 141-100-34CBC

DATE DRILLED: 6/21/76

ALTITUDE: 2475
(FT, NGVD)

DEPTH: 660
(FT, LSD)



NOTE: Rm = 11.5 @ 21° C.

DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-25	Sandstone, yellowish-brown, fine to medium, subangular; some klinker.
25-30	Claystone, light-gray, silty.

TONGUE RIVER MEMBER

30-38	Lignite.
38-52	Claystone, light-gray, sandy.
52-96	Sandstone, gray, very fine to fine, silty; thin indurated beds.
96-100	Lignite.
100-203	Claystone, brownish-gray; interbedded thin lignites, sandstones, and siltstones.
203-222	Sandstone, gray, very fine to fine; minor silt.
222-260	Claystone, gray.
260-406	Claystone, gray, silty, bentonitic; sandier near base.
406-453	Sandstone, greenish-gray, very fine to medium.
453-457	Claystone, gray, silty, brittle.
457-462	Lignite.
462-468	Claystone, gray, soft.
468-520	Sandstone, gray, very fine to medium; minor carbonaceous trash.
520-545	Claystone, light-gray, silty.
545-558	Sandstone, gray, fine to medium; carbonaceous trash.
558-630	Claystone, gray; interbedded thin lignites and siltstones.

LUDLOW MEMBER

630-660	Claystone, gray, tight.

141-101-08AAD
(Log modified from Kruger Drilling Co.)

Date drilled: 8/25/70

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay	100	100
Lignite	35	135
Clay	50	185
Sand	115	300
Clay	50	350
Lignite	10	360
Sand	85	445
Clay, sandy	35	480
Clay	60	540
Sand	50	590
Clay	100	690
Sand	10	700
Clay	120	820
Sand	74	894
No lithologic description	----	1,260

141-101-21CAC
(Log modified from Francis Boyce & Sons)

Altitude: 2270 feet

Date drilled: 7/31/63

Topsoil, sand, and scoria	40	40
Clay, gray	130	170
Sandstone, gray, soft	120	290
Shale, gray	30	320
Sandstone	50	370
Rock	4	374
Shale	28	402
Rock	2	404
Shale	176	580
Rock	2	582
Shale	80	662
Lignite	6	668
Shale	6	674
Rock	2	676
Shale	166	842
Lignite and black soft shale	19	861
Rock	3	864
Shale, hard	161	1,025
Rock	1	1,026
Shale, hard	69	1,095
Rock	1	1,096
Shale, hard	32	1,128
Rock	1	1,129
Shale, crumbly	26	1,155
Sandstone, gray, soft	45	1,200

141-102-02DDB
(Log modified from Francis Boyce & Sons)

Altitude: 2260 feet

Date drilled: 7/05/73

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand, brown, and clay	35	35
Clay, gray	45	80
Sandstone	1	81
Shale, gray	54	135
Lignite	5	140
Shale, gray	360	500
Sandstone	2	502
Shale, gray; with thin lignite layers	268	770
Shale, gray; with thin sand layers	160	930
Shale, gray; with thin sandstone layers	240	1,170
Sand, gray	10	1,180
Shale, gray	70	1,250
Sand, gray	20	1,270
Shale, gray	10	1,280

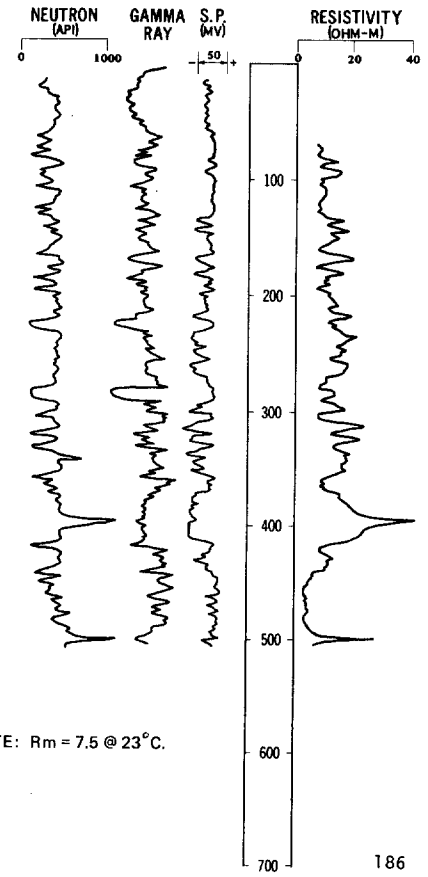
NDSWC 4937

LOCATION: 141-103-17BBA

DATE DRILLED: 7/22/76

ALTITUDE: 2595
(FT, NGVD)

DEPTH: 510
(FT, LSD)



NOTE: Rm = 7.5 @ 23°C.

DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-25	Claystone, light-yellowish-brown; thin interbedded sand lenses.
25-45	Claystone, dark-gray, sandy.
45-76	Claystone, olive-gray, tight.
76-79	Lignite.
79-136	Claystone, gray; interbedded thin lignite.
136-146	Sandstone, gray, very fine.
146-221	Interbedded sandstone, siltstone, claystone, and lignite; dark gray.
221-229	Lignite.
229-281	Siltstone, light-gray, argillaceous.
281-290	Lignite.
290-372	Interbedded sandstone, siltstone, claystone, and lignite.
372-416	Sandstone, gray, very fine to fine, argillaceous.
416-420	Lignite.
420-442	Siltstone, gray; interbedded lignite.

LUDLOW MEMBER

442-510	Claystone, gray, carbonaceous; thin sandstone lenses.

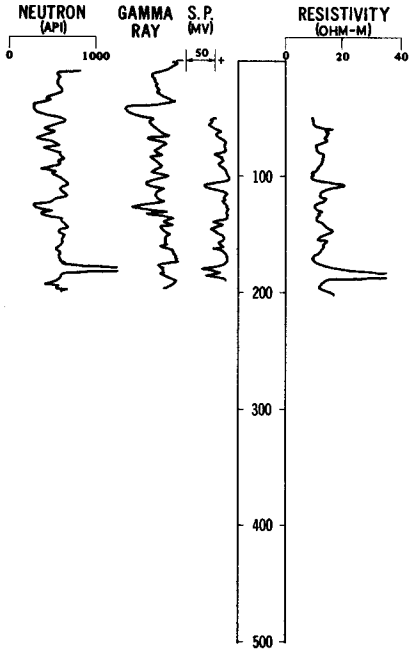
NDSWC 5136, 5136A

LOCATION: 141-104-05BBB1, 2

DATE DRILLED: 6/30/77

ALTITUDE: 2655
(FT, NGVD)

DEPTH: 202
(FT, LSD)



DESCRIPTION OF DEPOSITS

ALLUVIUM

0-10	Clay, dark-brownish-gray, very silty, reworked.

TONGUE RIVER MEMBER

10-18	Claystone, yellowish-brown.
18-38	Claystone, light-gray.
38-48	Lignite.
48-125	Claystone, light-olive-gray, carbonaceous; thin interbedded lignite.
125-130	Lignite.
130-180	Claystone, light-olive-gray, carbonaceous.
180-184	Sandstone, indurated.
184-202	Sandstone, light-gray, very fine to fine; becoming argillaceous near base.

141-104-31AAA
(Log modified from Harold Goodale)

Date drilled: 11/08/72

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand	6	6
Shale	19	25
Lignite and scoria	2	27
Shale	33	60
Lignite and sand	2	62

141-105-05ADA
(Log modified from Harold Goodale)

Altitude: 2660 feet

Date drilled: 11/07/64

Fill	4	4
Shale	8	12
Sand	18	30
Lignite	4	34

141-105-06DCC
(Log modified from Harold Goodale)

Altitude: 2750 feet — Date drilled: 3/08/68

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill	8	8
Clay	22	30
Lignite	12	42
Clay	3	45
Rock	2	47
Clay	8	55
Lignite	3	58
Clay	92	150
Lignite	5	155
Clay	60	215
Rock	5	220
Clay	20	240
Sand	20	260

141-105-26ADA
(Log modified from Harold Goodale)

Altitude: 2560 feet — Date drilled: 7/30/73

Fill	10	10
Lignite	8	18
Shale	18	36
Lignite	3	39
Shale	48	87
Rock	3	90
Shale	34	124
Lignite	4	128
Shale	67	195
Lignite	9	204
Shale	51	255
Lignite	23	278
Sand	37	315

141-105-34CCC
(Log modified from Harold Goodale)

Altitude: 2700 feet — Date drilled: 5/06/67

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Scoria	9	9
Clay	31	40
Lignite	8	48
Clay	18	66
Rock	4	70
Clay	45	115
Lignite	17	132
Clay	23	155
Sand	25	180

141-105-35CCC
(Log modified from Harold Goodale)

Altitude: 2753 feet — Date drilled: 5/03/67

Fill	6	6
Clay	24	30
Lignite	5	35
Clay	15	50
Lignite	5	55
Clay	45	100
Sand	10	110
Clay	46	156
Lignite	1	157
Clay	21	178
Rock	2	180
Clay	10	190
Rock	1	191
Sand	19	210

142-098-33ADC1
(Log modified from Mann Drilling Co.)

Altitude: 2585 feet — Date drilled: 11/27/71

Clay, tan, sandy	17	17
Lignite	2	19
Clay, sandy	92	111
Lignite	5	116
Clay	44	160
Sand, fine	20	180
Clay	10	190
Lignite	40	230
Clay	10	240

142-098-33ADC2
(Log modified from Opp Well Drilling)

Altitude: 2585 feet — Date drilled: 11/10/72

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay, dark	2	2
Sand, light	13	15
Sand, green	15	30
Sand, greenish-blue	7	37
Rock	1	38

142-099-03DCC
(Log modified from Casmier Kytoichuk)

Altitude: 2535 feet — Date drilled: 9/23/73

Gravel, coarse	6	6
Sand, brown	32	38
Clay	6	44
Lignite	5	49
Clay	31	80

142-099-10DDD
(Log modified from Casmier Kytoichuk)

Altitude: 2690 feet — Date drilled: 7/30/72

Sand, brown	30	30
Sand, gray	24	54

142-100-01BDC
(Log modified from Casmier Kytoichuk)

Altitude: 2730 feet — Date drilled: 10/02/72

Topsoil	1	1
Clay	31	32
Sand, brown	28	60
Clay	26	86
Sand, gray	12	98
Clay	17	115

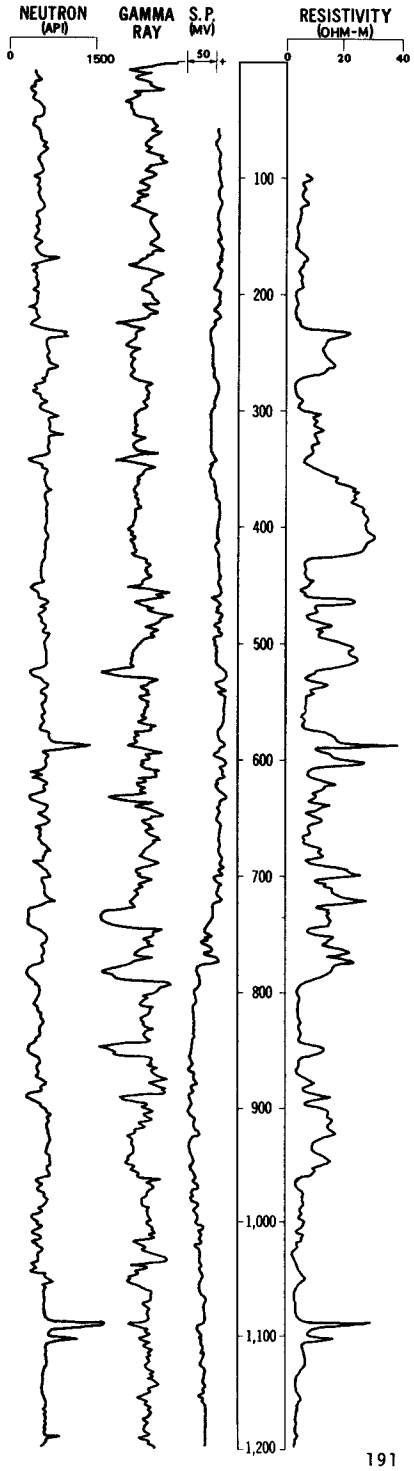
NDSWC 4911

LOCATION: 142-100-25DDA

ALTITUDE: 2650
(FT, NGVD)

DATE DRILLED: 6/11/76

DEPTH: 1500
(FT, LSD)



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DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-10	Sandstone, yellowish-brown, very fine to medium.
10-56	Claystone, brownish-gray, silty; interbedded thin lignite.
56-78	Sandstone, bluish-gray, fine to medium, silty.
78-115	Claystone, dark-brownish-gray, silty.
115-224	Claystone, light-greenish-gray, slightly bentonitic.

TONGUE RIVER MEMBER

224-227	Lignite.
227-230	Claystone, light-greenish-gray.
230-271	Sandstone, greenish-gray, very fine to medium, slightly silty.
271-340	Claystone, light-greenish-gray, silty.
340-344	Lignite.
344-425	Sandstone, greenish-gray, silty.
425-495	Claystone, light-gray, sandy.
495-523	Sandstone, gray, very fine to fine, slightly argillaceous.
523-529	Lignite.
529-576	Claystone, light-gray, slightly silty.
576-729	Interbedded claystone, siltstone, and sandstone; gray.
729-745	Lignite.
745-779	Siltstone, light-greenish-gray; carbonaceous trash.
779-790	Lignite.
790-812	Claystone, gray, silty.

LUDLOW MEMBER

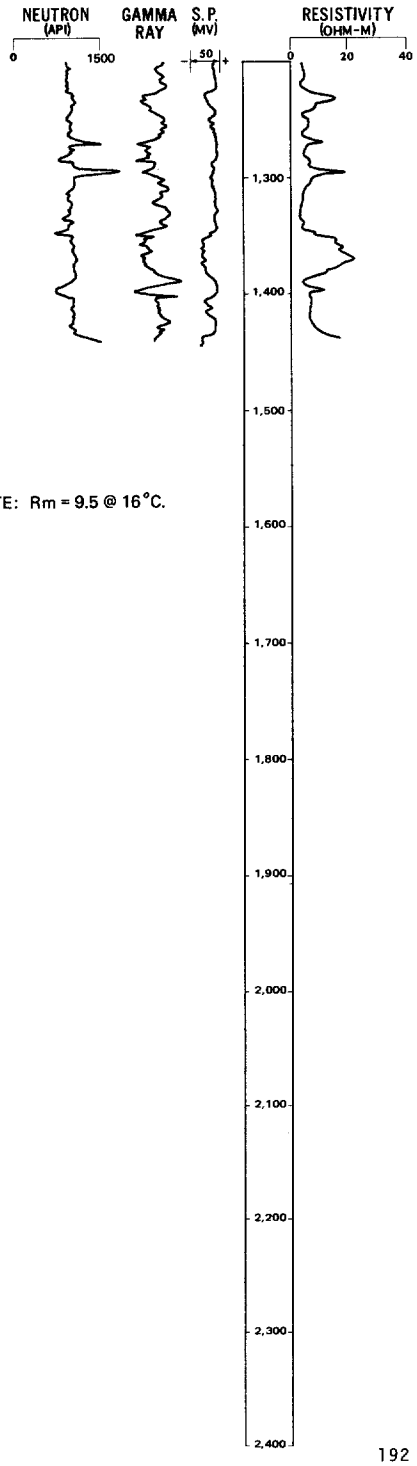
812-846	Claystone, gray, tight.
846-856	Lignite.
856-890	Claystone, gray, slightly silty.
890-896	Lignite.
896-900	Claystone, gray, silty.
900-961	Sandstone, greenish-gray, fine to medium; some interbedded coarse claystone.
961-1060	Claystone, greenish-gray, silty, tight, carbonaceous; interbedded thin sandstone.

LOCATION: 142-100-25DDA

ALTITUDE: 2650
(FT, NGVD)

DATE DRILLED: 6/11/76

DEPTH: 1500
(FT, LSD)



NOTE: Rm = 9.5 @ 16°C.

DESCRIPTION OF DEPOSITS

CANNONBALL MEMBER

1060-1227 Claystone, greenish-gray, tight; sandy in places.

LUDLOW MEMBER

1227-1235 Sandstone, greenish-gray, very fine to fine, silty.

1235-1352 Claystone, gray, very silty; thin interbedded lignite.

1352-1385 Sandstone, greenish-gray, very fine to fine, slightly argillaceous.

HELL CREEK FORMATION

1385-1500 Claystone, gray, sandy.

142-101-01BDB1
(Log modified from Mann Drilling Co.)

Altitude: 2720 feet

Date drilled: 2/07/67

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand, brown	8	8
Clay, gray, sandy	22	30
Lignite	3	33
Clay, gray	54	87
Sandstone	2	89
Clay, gray	60	149
Sandstone	1	150
Clay, gray	46	196
Lignite	3	199
Clay, gray	284	483
Lignite	6	489
Clay, gray	162	651
Lignite	12	663
Clay, gray	158	821
Lignite	11	832
Clay, gray	46	878
Sand	23	901
Sandstone	5	906
Sand	17	923
Sandstone	4	927
Lignite	7	934
Clay, sandy	87	1,021
Sandstone	8	1,029
Clay, dark-gray	73	1,102
Sandstone	5	1,107
Clay, dark-gray	188	1,295
Clay, brown	243	1,538
Sandstone	3	1,541
Clay, brown, hard	139	1,680
Clay, sandy, to fine sand	30	1,710
Clay, dark-brown	108	1,818
Sandstone	3	1,821
Sand	99	1,920
Shale	80	2,000

142-101-01BDB2
(Log modified from Mann Drilling Co.)

Altitude: 2710 feet

Date drilled: 10/20/64

Sand	19	19
Lignite	2	21
Clay	80	101
Lignite	3	104
Clay	94	198
Lignite	3	201
Clay	24	225
Sandstone	1	226
Clay	381	607
Sandstone	3	610
Clay	93	703
Lignite	4	707
Clay	85	792
Lignite	6	798
Clay	67	865
Sand	17	882
Sandstone	7	889
Sand	2	891
No lithologic description	---	905

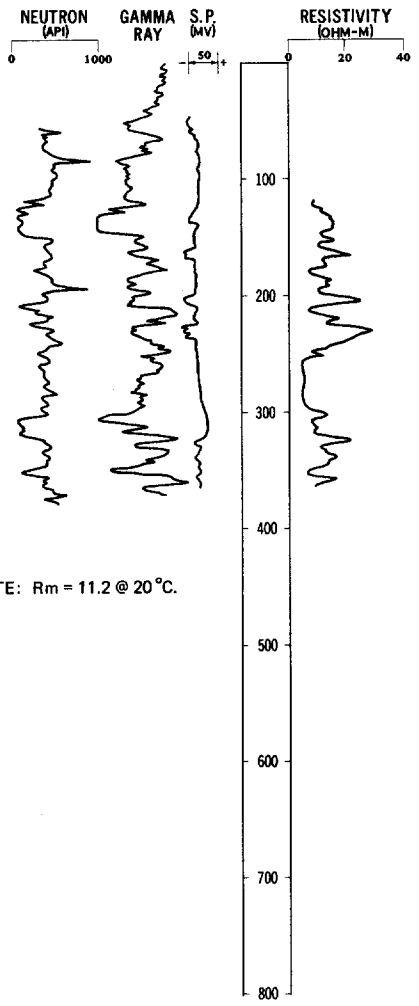
NDSWC 4914

LOCATION: 142-101-18BCC

ALTITUDE: 2253
(FT, NGVD)

DATE DRILLED: 6/22/76

DEPTH: 380
(FT, LSD)



NOTE: Rm = 11.2 @ 20 °C.

DESCRIPTION OF DEPOSITS

ALLUVIUM

0-41	Claystone, light-yellowish-brown.
41-43	Claystone, light-gray.
43-57	Gravel, gray, red, fine to medium; consists of shale, quartzite, and klinker.

TONGUE RIVER MEMBER

57-100	Siltstone, very argillaceous.
100-124	Claystone, gray; sandy near base.
124-148	Lignite; thin claystone parting.
148-200	Claystone, gray, silty.
200-206	Sandstone, gray, very fine to fine.
206-210	Lignite.
210-225	Claystone, gray, silty.
225-254	Sandstone, light-gray, fine to medium.

LUDLOW MEMBER

254-304	Claystone, gray, silty.
304-321	Lignite; claystone parting.
321-328	Sandstone.
328-348	Claystone, gray, silty, carbonaceous.
348-354	Lignite.
354-363	Sandstone.
363-380	Claystone.

142-101-18CBB
NDSWC 5124

Altitude: 2250 feet

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay, yellowish-brown, very silty	18	18
Gravel, fine to coarse, poorly sorted; abundant klinker and lignite	24	42

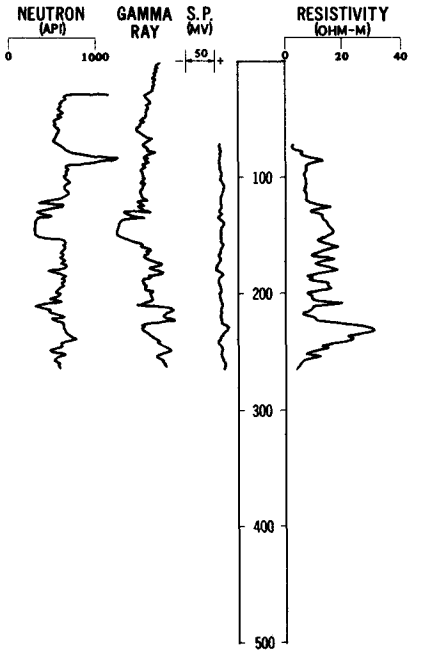
NDSWC 5125, 5125A

LOCATION: 142-101-18CBD1, 2

DATE DRILLED: 6/23/77

ALTITUDE: 2270
(FT, NGVD)

DEPTH: 270
(FT, LSD)



DESCRIPTION OF DEPOSITS

ALLUVIUM

0-45	Clay, light-yellowish-brown, silty, mottled; lignite chips.

TONGUE RIVER MEMBER

45-84	Claystone, light-olive-gray, tight.
84-117	Sandstone, light-gray, very fine to fine, silty.
117-130	Claystone, light-gray, silty, slightly sandy, tight, bentonitic.
130-154	Lignite.
154-226	Claystone, light-gray; carbonaceous streaks; interbedded thin sandstone and lignite.
226-238	Sandstone, light-gray, very fine to fine, slightly argillaceous.
238-270	Claystone, dark-gray, silty, sandy, slightly carbonaceous.

142-103-25CAC
(Log modified from Francis Boyce & Sons)

Altitude: 2540 feet

Date drilled: 8/18/73

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand, brown, and clay	50	50
Clay, gray	15	65
Sand, gray, fine	35	100
Clay, gray; interbedded with lignite	78	178
Sandstone	1	179
Shale, gray; interbedded with lignite	121	300
Lignite	6	306
Shale, gray	104	410
Sandstone	1	411
Sand, gray	29	440

142-103-30ABC
(Log modified from Francis Boyce & Sons)

Altitude: 2610 feet

Date drilled: 8/21/72

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand, brown, and clay	18	18
Lignite	12	30
Clay, gray; interbedded with lignite	145	175
Sand, white, fine	15	190
Clay, gray; interbedded with lignite and sandstone	234	424
Sandstone	1	425
Sand, gray	51	476

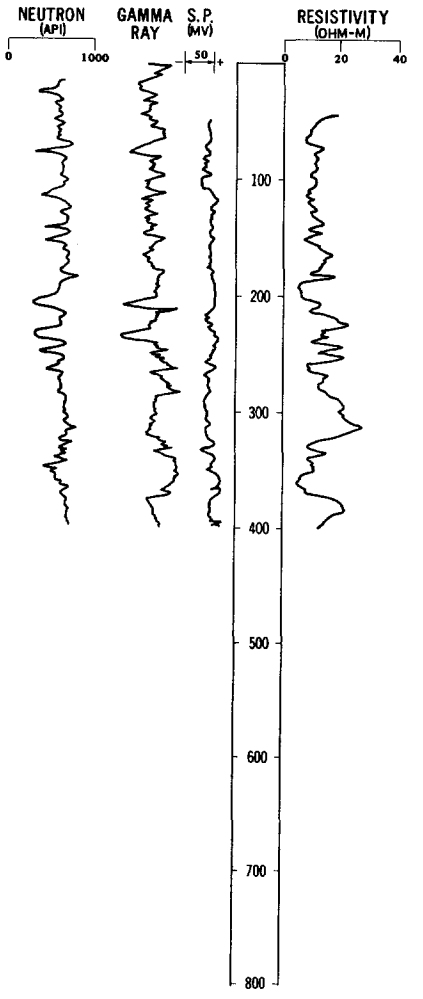
NDSWC 5135

LOCATION: 142-103-34ACA

DATE DRILLED: 6/29/77

ALTITUDE: 2480
(FT, NGVD)

DEPTH: 400
(FT, LSD)



DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-25	Claystone, light-yellowish-brown, silty, soft.
25-27	Lignite.
27-74	Claystone, light-olive-gray, tight.
74-77	Lignite.
77-204	Claystone, gray, silty; interbedded lignite and thin sandstone.
204-211	Lignite.
211-230	Claystone, dark-olive-gray, silty, carbonaceous.
230-239	Lignite.
239-286	Claystone, dark-olive-gray; interbedded thin lignite.
286-326	Sandstone, gray, very fine to fine, argillaceous.
326-355	Claystone, dark-olive-gray; interbedded thin lignite and siltstone.

LUDLOW MEMBER

355-374	Claystone, dark-gray.
374-392	Sandstone, light-olive-gray, very fine to fine, well-sorted.
392-400	Claystone, dark-olive-gray, silty, tight.

142-104-04ADA
(Log modified from McDanold Well Drilling)

Altitude: 2640 feet

Date drilled: 9/19/72

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Silt	7	7
Silt and gravel	5	12
Clay, yellow	12	24
Lignite	1	25
Clay, gray	18	43
Lignite	2	45
Clay, blue	9	54
Lignite	3	57
Clay, gray	2	59
Sand	3	62
Clay, gray	52	114
Lignite	2	116
Clay, gray	20	136
Lignite	5	141
Clay, gray	5	146
Sand	5	151
Lignite	1	152
Clay, gray	10	162
Sand	14	176
Lignite	1	177
Clay, gray	55	232
Lignite	6	238
Clay, gray	6	244
Lignite	3	247
Clay, gray	14	261
Lignite	6	267
Clay, gray, sandy	29	296
Lignite	4	300
Clay, gray	21	321
Lignite	9	330
Clay, gray	43	373
Lignite	4	377
Clay, gray	28	405
Clay, sandy	10	415
Clay, gray	30	445
Lignite	1	446
Clay, gray	37	483
Lignite	3	486
Clay, blue	13	499
Lignite	1	500
Clay, gray	10	510
Lignite	6	516
Clay, gray	9	525
Rock	2	527
Clay, gray	51	578
Lignite	11	589
Clay, gray	25	614
Lignite	7	621
Clay, gray	9	630
Lignite	11	641
Clay, gray	9	650
Lignite	1	651
Clay, sandy	4	655
Lignite	3	658
Clay, gray	17	675
Sand	60	735

NDSWC

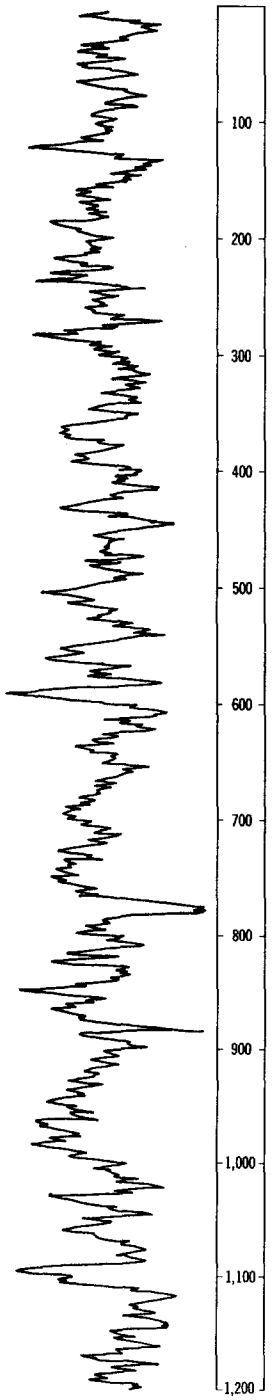
LOCATION: 142-104-10ACC

DATE DRILLED: 8/28/74

ALTITUDE: 2620
(FT, NGVD)

DEPTH: 1660
(FT, LSD)

GAMMA RAY



DESCRIPTION OF DEPOSITS

NOTE: No lithology available.

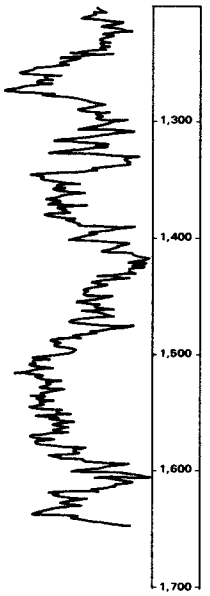
LOCATION: 142-104-10ACC

DATE DRILLED: 8/28/74

ALTITUDE: 2620
(FT, NGVD)

DEPTH: 1660
(FT, LSD)

GAMMA RAY



DESCRIPTION OF DEPOSITS

142-104-11CAC
(Log modified from Harold Goodale)

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill	18	18
Clay	44	62
Lignite	2	64
Clay	54	118
Lignite	7	125
Clay	38	163
Lignite	5	168
Clay	17	185
Sand	65	250

142-105-07AAD
(Log modified from Harold Goodale)

Altitude: 2540 feet — Date drilled: 5/28/67

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill	11	11
Clay	19	30
Lignite	5	35
Clay	23	58
Rock	4	62
Clay	3	65
Lignite	5	70
Clay	20	90
Sand	34	124

142-105-12CAA
(Log modified from McDanold Well Drilling)

Altitude: 2540 feet — Date drilled: 5/26/72

Silt	5	5
Clay, yellow	10	15
Lignite	5	20
Clay, gray	9	29
Rock	2	31
Sand	7	38
Clay, gray	31	69
Lignite	3	72
Clay, gray	9	81
Sand	3	84
Lignite	2	86
Clay, blue	22	108
Sand	6	114
Clay, gray	6	120

142-105-31AAB
(Log modified from Harold Goodale)

Altitude: 2640 feet — Date drilled: 11/06/63

Fill	12	12
Clay	23	35
Lignite	1	36
Clay	29	65
Lignite	3	68
Clay	30	98
Lignite	19	117
Clay	8	125
Lignite	11	136
Clay	54	190
Lignite	5	195
Clay	10	205
Sand	20	225

143-098-02DDD
(Log modified from Mann Drilling Co.)

Altitude: 2477 feet — Date drilled: 9/23/64

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay	27	27
Lignite	1	28
Clay	6	34
Clay, sandy	4	38
Clay	14	52
Sand	15	67

143-099-01ADD
(Log modified from Gregory Drilling Co.)

Altitude: 2510 feet — Date drilled: 7/18/75

Clay, brown, sandy	8	8
Clay, gray	11	19
Sand	3	22
Clay, gray	3	25
Clay, dark-brown	9	34
Lignite	1	35
Rock	2	37
Clay, gray	46	83
Clay, blue	5	88
Clay, gray	4	92
Rock	2	94
Clay, gray	5	99
Lignite	4	103
Clay, gray	17	120
Clay, blue	14	134
Lignite	3	137
Clay, dark-brown	3	140
Clay	5	145
Clay, gray; with lignite layers	11	156
Clay, blue	19	175
Sand, gray	10	185
Lignite	1	186
Clay, blue	71	257
Sand, blue	37	294
Clay, sandy, blue	6	300

143-099-08AAA
(Log modified from Kruger Drilling Co.)

Date drilled: 9/15/69

Scoria, lignite, and clay	20	20
Clay	20	40
Sand, coarse, sticky	20	60
Sand, blue; with lignite streaks	20	80
Clay	40	120
Sand	60	180
Clay, gray; with lignite streaks	10	190
Clay, green	10	200
Clay	20	220

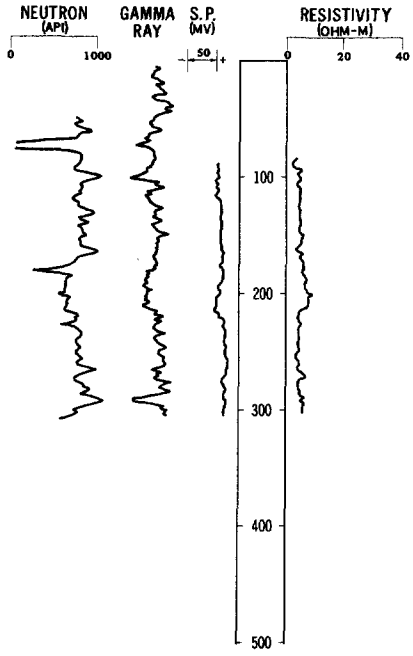
NDSWC 5130

LOCATION: 143-099-15BBA

ALTITUDE: 2720
(FT, NGVD)

DATE DRILLED: 6/27/77

DEPTH: 310
(FT, LSD)



DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-10	Claystone, light-yellowish-brown, very sandy.
10-20	Claystone, light-gray.
20-96	Claystone, light-olive-gray, silty, bentonitic; calcareous streaks near base.
96-101	Lignite.
101-184	Claystone, light-gray; silty near base.
184-214	Sandstone, dark-gray, very fine to fine, argillaceous.
214-289	Claystone, dark-gray, very silty; interbedded thin lignite.
289-294	Lignite.
294-310	Claystone, light-gray, very silty, tight, bentonitic.

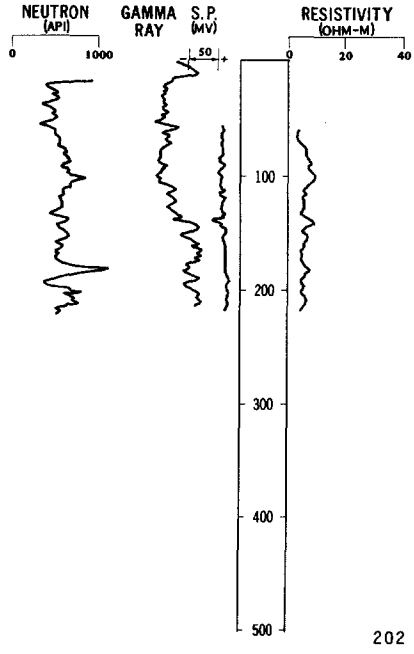
NDSWC 5129

LOCATION: 143-100-25BBB

ALTITUDE: 2650
(FT, NGVD)

DATE DRILLED: 6/27/77

DEPTH: 220
(FT, LSD)



DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-18	Claystone, light-yellowish-brown.
18-52	Claystone, light-gray; with thin lignite beds.
52-54	Lignite.
54-76	Claystone, gray, very silty; sandy near base.
76-108	Sandstone, light-olive-gray, very fine to fine, silty, argillaceous; thin bentonitic beds.
108-220	Claystone, gray, silty; thin lignite beds.

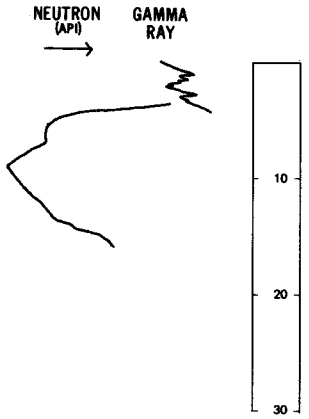
NDSWC 5128

LOCATION: 143-102-09BCB

ALTITUDE: 2125
(FT, NGVD)

DATE DRILLED: 6/24/77

DEPTH: 20
(FT, LSD)



DESCRIPTION OF DEPOSITS

ALLUVIUM

0-5	Clay, yellowish-brown, very silty.
5-17	Gravel, fine to coarse; with very coarse sand; abundant lignite and klinker chips.

TONGUE RIVER MEMBER

17-20	Claystone, light-olive-gray, silty.

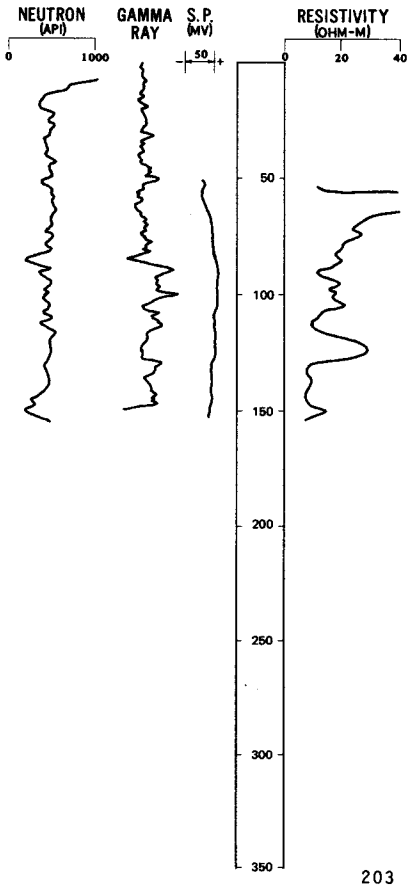
NDSWC 5127, 5127A, 5127B

LOCATION: 143-102-09BCC1, 2, 3

ALTITUDE: 2135
(FT, NGVD)

DATE DRILLED: 6/22/77

DEPTH: 157
(FT, LSD)



DESCRIPTION OF DEPOSITS

ALLUVIUM

0-6	Clay, yellowish-brown, very silty, soft.
6-22	Gravel, fine to coarse, flat to sub-rounded; abundant klinker and lignite chips.

TONGUE RIVER MEMBER

22-83	Claystone, light-gray, silty, slightly carbonaceous.
83-86	Lignite.
86-94	Claystone, light-gray; thin lignite near base.
94-121	Claystone, light-olive-gray.
121-128	Sandstone, gray, very fine to fine, clean.
128-148	Claystone, light-gray, silty, carbonaceous.
148-152	Lignite.
152-157	Claystone, gray, silty, very carbonaceous.

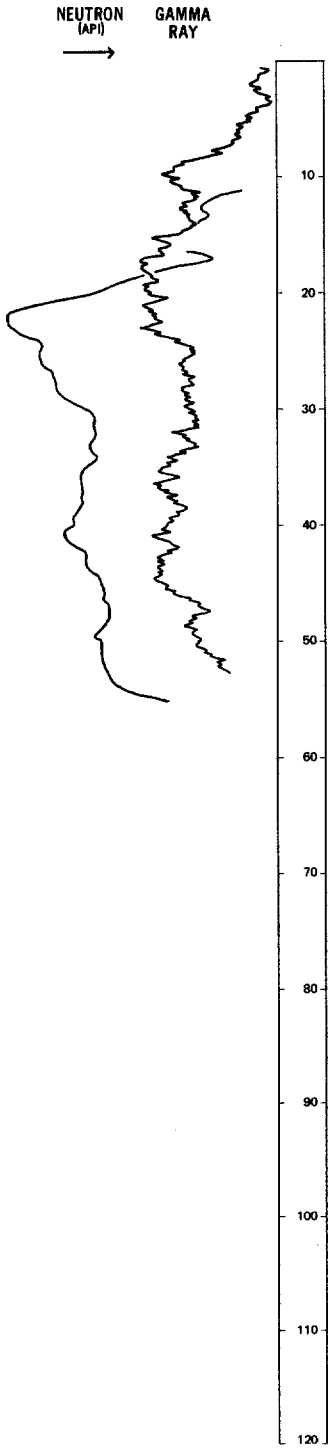
NDSWC 5126

LOCATION: 143-102-09CBB2

DATE DRILLED: 6/24/77

ALTITUDE: 2150
(FT, NGVD)

DEPTH: 60
(FT, LSD)



DESCRIPTION OF DEPOSITS

ALLUVIUM

0-17 Clay, light-yellowish-gray, silty, slightly sandy.

17-24 Gravel, fine to coarse, angular to subrounded; abundant klinker and lignite chips.

TONGUE RIVER MEMBER

24-60 Claystone, light-bluish-gray, silty; thin indurated silt layers.

143-102-34BBA
(Log modified from Boyce Drilling Inc.)

Altitude: 2160 feet — Date drilled: 9/27/73

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay, brown	8	8
Sand and gravel	9	17
Lignite	2	19
Clay, gray	19	38
Lignite	1	39
Clay, gray	26	65
Sandstone	1	66
Sand, gray, fine	49	115
Shale, gray	80	195
Lignite	7	202
Shale, gray	58	260
Sand, gray, fine	30	290
Shale, gray	197	487
Sandstone	1	488
Shale, gray; with lignite layers	262	750
Sand, gray, fine	20	770
Shale, gray, and sandy clay	290	1,060
Sand, dark-gray	60	1,120

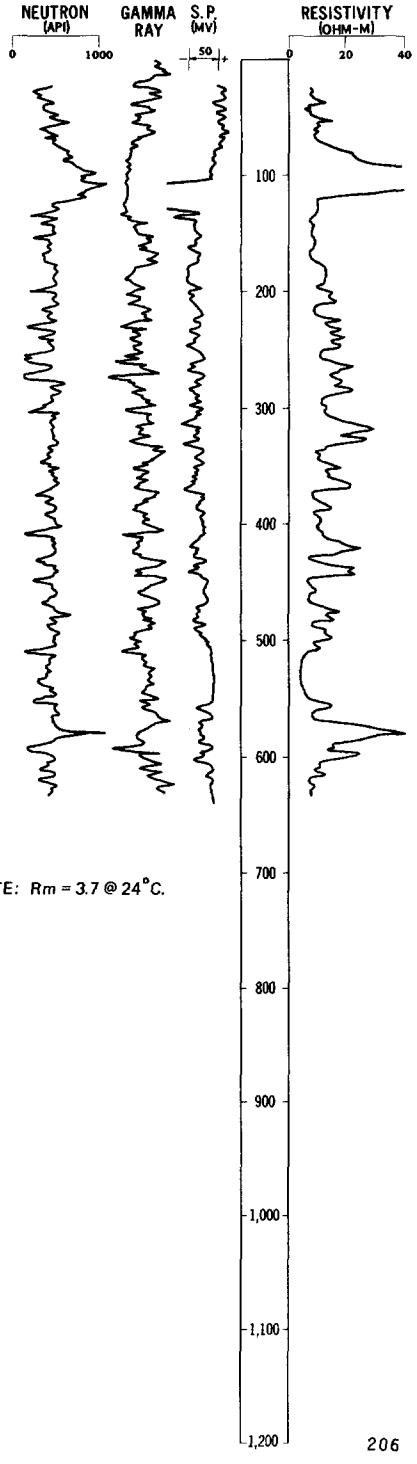
NDSWC 4936

LOCATION: 143-103-14DBC

DATE DRILLED: 7/22/76

ALTITUDE: 2540
(FT, NGVD)

DEPTH: 640
(FT, LSD)



NOTE: R_m = 3.7 @ 24°C.

DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-25	Claystone, yellowish-brown, silty.
25-84	Claystone, light-gray; sandier near base.
84-120	Sandstone, gray, very fine, argillaceous; minor carbonaceous trash.
120-134	Claystone, gray.
134-136	Lignite.
136-178	Claystone, dark-brownish-gray, tight.
178-212	Sandstone, greenish-gray, very fine, argillaceous.
212-259	Claystone, brownish-gray, carbonaceous.
259-261	Lignite.
261-271	Claystone, brownish-gray, carbonaceous.
271-276	Lignite.
276-436	Interbedded siltstone, claystone, lignite, and thin sandstone; gray to greenish gray.
436-447	Sandstone, gray, fine, argillaceous.
447-510	Claystone, gray; interbedded siltstone and lignite.

LUDLOW MEMBER

510-552	Claystone, gray, tight.
552-570	Claystone, gray, silty.
570-592	Sandstone, gray, silty, argillaceous.
592-596	Lignite.
596-640	Claystone, gray; interbedded siltstone.

143-104-15BCC
(Log modified from Harold Goodale)

Date drilled: 8/25/64

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill	13	13
Scoria and gravel	15	28
Clay	5	33
Lignite	3	36
Clay	24	60
Sand	10	70
Clay	36	106
Rock	1	107
Sand	103	210
Rock	2	212
Clay	18	230
Rock	15	245
Clay	35	280
Lignite	5	285
Clay	15	300
Sand	45	345
Clay	110	455
Lignite	5	460
Clay	20	480
Rock	3	483
Clay	15	498
Rock	3	501
Clay	49	550
Lignite	15	565
Sand	65	630

143-104-23BBB
(Log modified from Harold Goodale)

Date drilled: 9/22/66

Clay	15	15
Lignite	2	17
Gravel	2	19
Clay	18	37
Lignite	6	43
Clay	25	68
Lignite	2	70
Clay	30	100
Lignite	5	105
Clay	40	145
Rock	2	147
Clay	43	190
Sand	100	290

143-104-27CDC
(Log modified from Harold Goodale)

Date drilled: 9/26/66

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill	23	23
Clay	2	25
Lignite	5	30
Clay	13	43
Lignite	12	55
Clay	28	83
Rock	4	87
Clay	41	128
Lignite	12	140
Clay	8	148
Rock	2	150
Clay	65	215
Lignite	10	225
Clay	15	240
Rock	4	244
Clay	41	285
Lignite	5	290
Clay	5	295
Sand	55	350

143-104-30ACC
(Log modified from Harold Goodale)

Altitude: 2425 feet

Date drilled: 8/03/67

Fill	15	15
Scoria	3	18
Lignite	3	21
Clay	11	32
Rock	3	35
Clay	20	55
Lignite	8	63
Clay	17	80
Sand	42	122

143-105-08CBA
(Log modified from Harold Goodale)

Altitude: 2670 feet — Date drilled: 1968

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill	30	30
Clay	70	100
Rock	3	103
Clay	11	114
Lignite	6	120
Clay	10	130
Lignite	5	135
Clay	37	172
Rock	3	175
Clay	3	178
Lignite	7	185
Clay	157	342
Rock	3	345
Clay	40	385
Lignite	5	390
Clay	120	510
Rock	2	512
Clay	28	540
Lignite	10	550
Clay	80	630
Lignite	20	650
Clay	25	675
Lignite	10	685
Clay	10	695
Lignite	10	705
Clay	12	717
Lignite	5	722
Sand	28	750
Shale	21	771
Sand	6	777
Shale	8	785
Sand	35	820
Lignite	10	830

143-105-18BBA
(Log modified from Harold Goodale)

Altitude: 2710 feet — Date drilled: 3/28/66

Fill	12	12
Clay	23	35
Lignite	5	40
Clay	32	72
Rock	4	76
Clay	34	110
Lignite	10	120
Clay	140	260
Sandstone	4	264
Clay	11	275
Lignite	8	283
Clay	57	340
Sand	30	370
Lignite	5	375
Clay	10	385
Sand	30	415

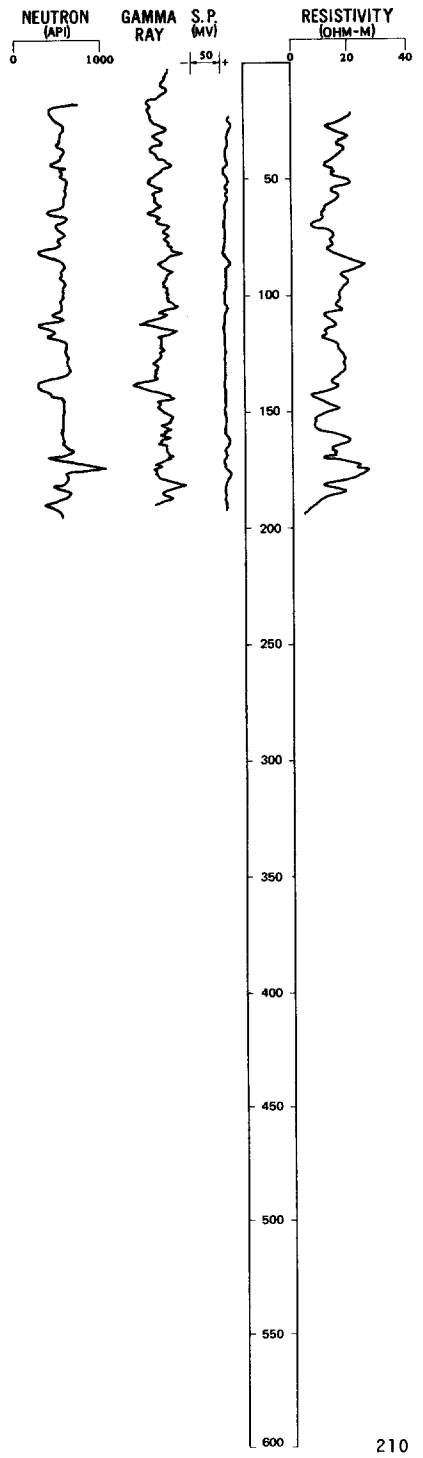
NDSWC 5133, 5133A

LOCATION: 143-105-33ACA1, 2

ALTITUDE: 2395
(FT, NGVD)

DATE DRILLED: 6/28/77

DEPTH: 195
(FT, LSD)



DESCRIPTION OF DEPOSITS

ALLUVIUM

0-15	Clay, light-yellowish-brown, silty, slightly sandy, soft.
15-29	Gravel, fine to coarse, angular, flat to subrounded; abundant lignite chips.

TONGUE RIVER MEMBER

29-61	Claystone, light-olive-gray, tight, bentonitic.
61-64	Lignite.
64-79	Claystone, light-olive-gray, silty, carbonaceous.
79-83	Lignite.
83-110	Claystone, gray.
110-113	Lignite.
113-138	Claystone, gray.
138-141	Lignite.
141-171	Claystone, gray.
171-180	Sandstone, light-gray, very fine to fine, well-sorted, rounded.
180-195	Claystone, gray, silty, tight, bentonitic.

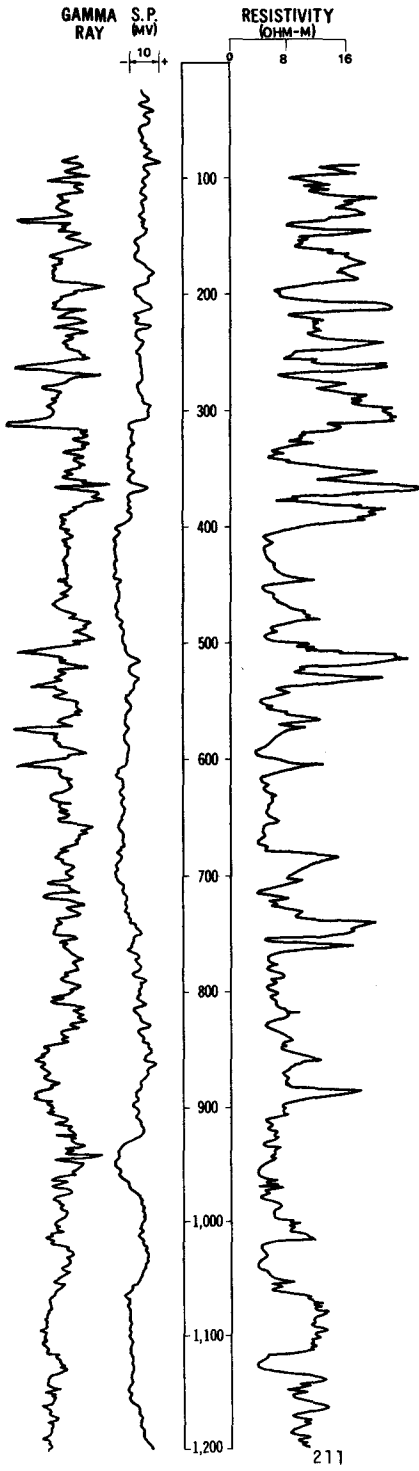
NDSWC 4812
(Log modified from Schlumberger)

LOCATION: 143-105-33BAB

DATE DRILLED: 8/25/75

ALTITUDE: 2385
(FT, NGVD)

DEPTH: 1480
(FT, LSD)



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DESCRIPTION OF DEPOSITS

ALLUVIUM

0-16	Sand, yellowish-brown, very fine to fine.
16-25	Sand, dark-gray, very fine to fine.
25-35	Gravel, dark, fine to medium, sub-rounded; klinker fragments.
35-50	Clay, gray.
50-60	Gravel, dark, fine to medium, sub-rounded; klinker fragments.

TONGUE RIVER MEMBER

60-67	Claystone, gray, bentonitic.
67-70	Lignite.
70-155	Claystone, light-olive-gray, very silty; numerous interbedded thin lignite.
155-190	Sandstone, pale-bluish-gray, very fine to medium, silty.
190-198	Claystone, gray, silty.
198-255	Claystone, gray; interbedded siltstone and lignite.
255-265	Sandstone, gray, very fine to medium, silty.
265-270	Claystone, light-olive-gray.
270-310	Sandstone, gray, very fine to medium, silty.
310-315	Lignite.
315-400	Interbedded sandstone, siltstone, and claystone.

LUDLOW MEMBER

400-678	Interbedded claystone, siltstone, sandstone, and lignite.
678-712	Sandstone, greenish-gray, very fine to medium.
712-738	Claystone, dark-greenish-gray, silty.
738-752	Sandstone, light-bluish-gray, very fine to medium, silty.
752-785	Claystone, light-olive-gray.
785-835	Claystone, gray; interbedded siltstone and lignite.
835-862	Sandstone, gray, silty.
862-945	Claystone, gray; interbedded siltstone and lignite.

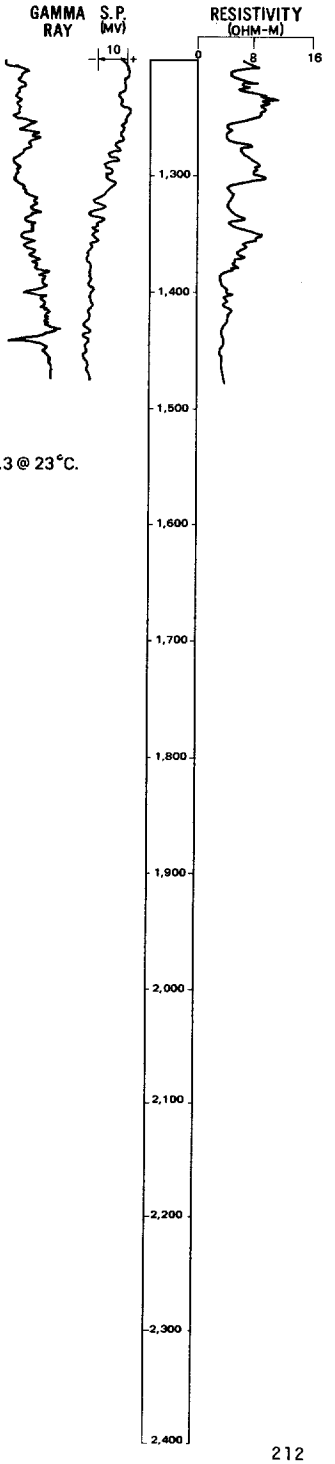
NDSWC 4812, Continued
(Log modified from Schlumberger)

LOCATION: 143-105-33BAB

DATE DRILLED: 8/25/75

ALTITUDE: 2385
(FT, NGVD)

DEPTH: 1480
(FT, LSD)



NOTE: Rm = 2.3 @ 23°C.

DESCRIPTION OF DEPOSITS

HELL CREEK FORMATION

945-997	Interbedded claystone and siltstone; dark-greenish-gray; carbonaceous.
997-1020	Sandstone, light-greenish-gray.
1020-1065	Claystone, dark-gray.
1065-1115	Sandstone, dark-bluish-gray.
1115-1130	Claystone, dark-brownish-gray, carbonaceous.

FOX HILLS SANDSTONE

1130-1208	Sandstone, light-gray, very fine to medium.
1208-1385	Siltstone, gray, sandy.

PIERRE SHALE

1385-1480	Shale, dark-gray.

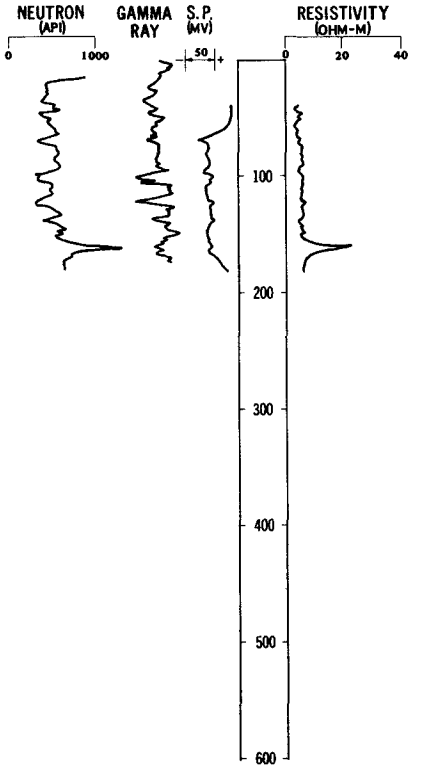
NDSWC 5131

LOCATION: 144-098-34BBB

ALTITUDE: 2450
(FT, NGVD)

DATE DRILLED: 6/27/77

DEPTH: 180
(FT, LSD)



DESCRIPTION OF DEPOSITS

ALLUVIUM

0-15	Clay, light-brown, slightly mottled.
15-30	Clay, light-gray, reworked.

SENTINEL BUTTE MEMBER

30-44	Claystone, gray, silty.
44-48	Lignite.
48-67	Claystone, light-bluish-gray, very silty, slightly sandy.
67-70	Lignite.
70-98	Claystone, light-gray, carbonaceous.
98-106	Lignite.
106-118	Claystone, gray, carbonaceous.
118-124	Lignite.
124-136	Claystone, light-olive-gray, bentonitic.
136-138	Lignite.
138-180	Claystone, gray, very silty, tight.

144-099-10CCA1
(Log modified from Kruger Drilling Co.)

Altitude: 2593 feet

Date drilled: 9/23/69

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay, gray	38	38
Lignite, soft	8	46
Clay	27	73
Lignite	17	90
Clay	30	120
Clay, sandy	20	140
Clay	7	147
Rock	3	150
Clay, light-gray	50	200
Clay	40	240
Clay; with lignite streaks	15	255
Clay	50	305
Clay, sandy	40	345
Clay	27	372
Rock	4	376
Clay, sandy	4	380
Sand	10	390
Clay, fine, sandy	10	400

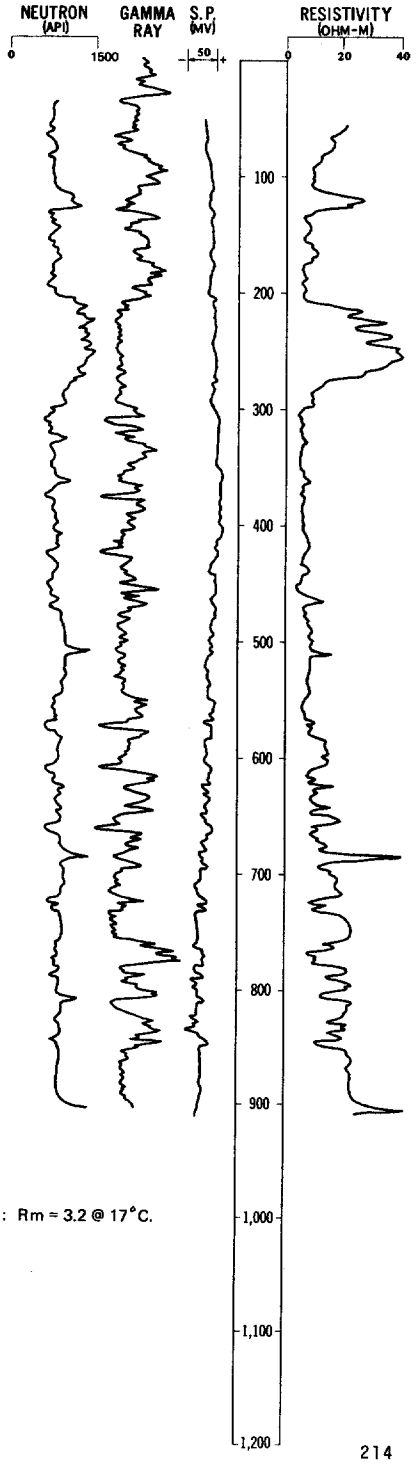
NDSWC 4912

LOCATION: 144-100-24BAC1

ALTITUDE: 2670
(FT, NGVD)

DATE DRILLED: 6/16/76

DEPTH: 930
(FT, LSD)



NOTE: Rm = 3.2 @ 17°C.

DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-23	Sandstone, yellowish-brown, very fine to medium.
23-30	Claystone, light-brownish-gray, silty.
30-90	Claystone, light-gray, silty, carbonaceous.
90-128	Claystone, greenish-gray, slightly carbonaceous.
128-208	Claystone, gray, silty; interbedded thin lignite.
208-275	Sandstone, light-gray, very fine to medium; fresh iron sulfide.
275-286	Claystone, gray.
286-300	Sandstone, light-greenish-gray, fine to medium.
300-423	Claystone, gray; with interbedded greenish-gray and dark-brownish-gray claystone; thin lignite.

TONGUE RIVER MEMBER

423-427	Lignite.
427-572	Claystone, gray, silty; interbedded thin lignite.
572-578	Lignite.
578-608	Sandstone, gray, fine to medium, argillaceous.
608-613	Lignite.
613-660	Interbedded sandstone, siltstone, and claystone; gray.
660-666	Lignite.
666-698	Siltstone, gray; thin indurated sandstone.
698-724	Sandstone, gray, argillaceous.
724-782	Claystone, gray.
782-828	Sandstone, light-gray, fine; interbedded thin claystone.
828-852	Siltstone; interbedded claystone.
852-930	Sandstone, very argillaceous.

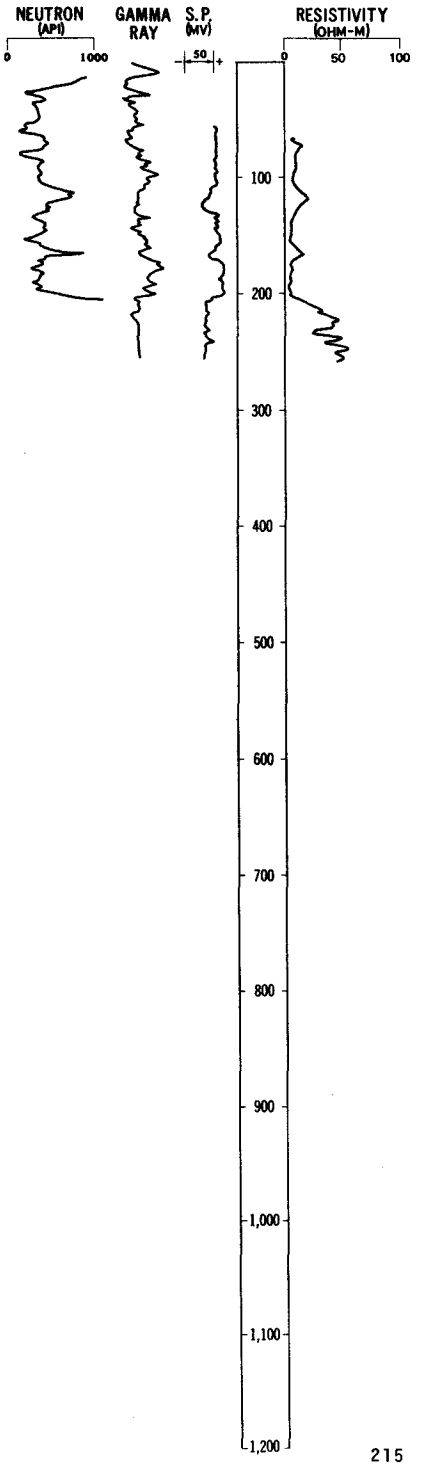
NDSWC 5132

LOCATION: 144-100-24BAC2

DATE DRILLED: 6/28/77

ALTITUDE: 2665
(FT, NGVD)

DEPTH: 263
(FT, LSD)



DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-22	Sandstone, yellowish-brown, very fine to medium; thin indurated beds.
22-55	Claystone, light-gray, silty, carbonaceous, bentonitic.
55-62	Lignite.
62-79	Claystone, light-gray, silty, bentonitic.
79-82	Lignite.
82-152	Claystone, light-olive-gray, very silty, tight.
152-155	Lignite.
155-201	Claystone, light-olive-gray, carbonaceous.
201-263	Sandstone, light-gray, very fine to medium; interbedded thin siltstone.

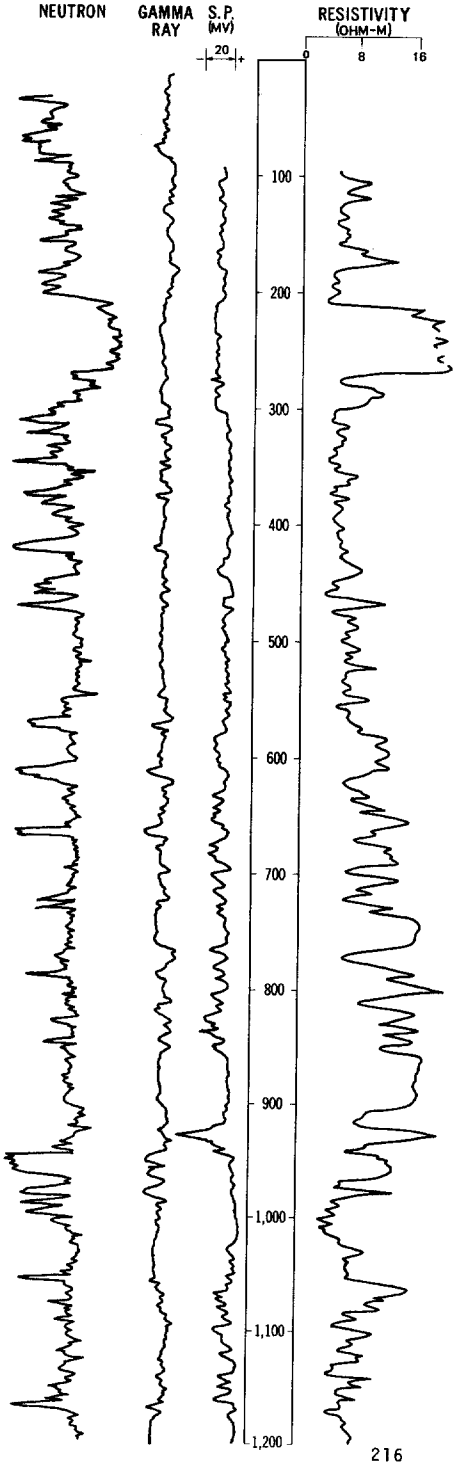
NDSWC 4814, 4815
(Log modified from Schlumberger)

LOCATION: 144-100-24BBD1, 2

ALTITUDE: 2670
(FT, NGVD)

DATE DRILLED: 9/05/75

DEPTH: 2160
(FT, LSD)



DESCRIPTION OF DEPOSITS

SENTINEL BUTTE MEMBER

0-10	Sandstone, yellowish-brown, fine to coarse, silty.
10-32	Sandstone, gray; thin indurated beds.
32-205	Claystone, greenish-gray, silty, carbonaceous; interbedded thin lignite.
205-295	Sandstone, bluish-gray, fine to coarse, slightly argillaceous.
295-365	Interbedded thin sandstone, siltstone, claystone, and lignite; gray.

TONGUE RIVER MEMBER

365-580	Interbedded thin sandstone, siltstone, claystone, and lignite; gray.
580-725	Siltstone, gray; interbedded claystone, thin sandstone, and lignite.
725-765	Sandstone, dark-gray, very fine to fine, slightly argillaceous.
765-850	Siltstone, gray; interbedded claystone; thin lignite.
850-905	Sandstone, gray, very fine, silty, very argillaceous.
905-920	Claystone, gray.
920-935	Sandstone, gray, very fine to fine, silty, very argillaceous.
935-948	Claystone, gray.
948-966	Lignite.
966-997	Lignite; with interbedded silty claystone.

LUDLOW MEMBER

997-1023	Claystone, gray, dark-greenish-gray, slightly silty.
1023-1175	Sandstone; with interbedded claystone and lignite.

CANNONBALL MEMBER

1175-1332	Siltstone, greenish-gray, very argillaceous; interbedded sandstone.

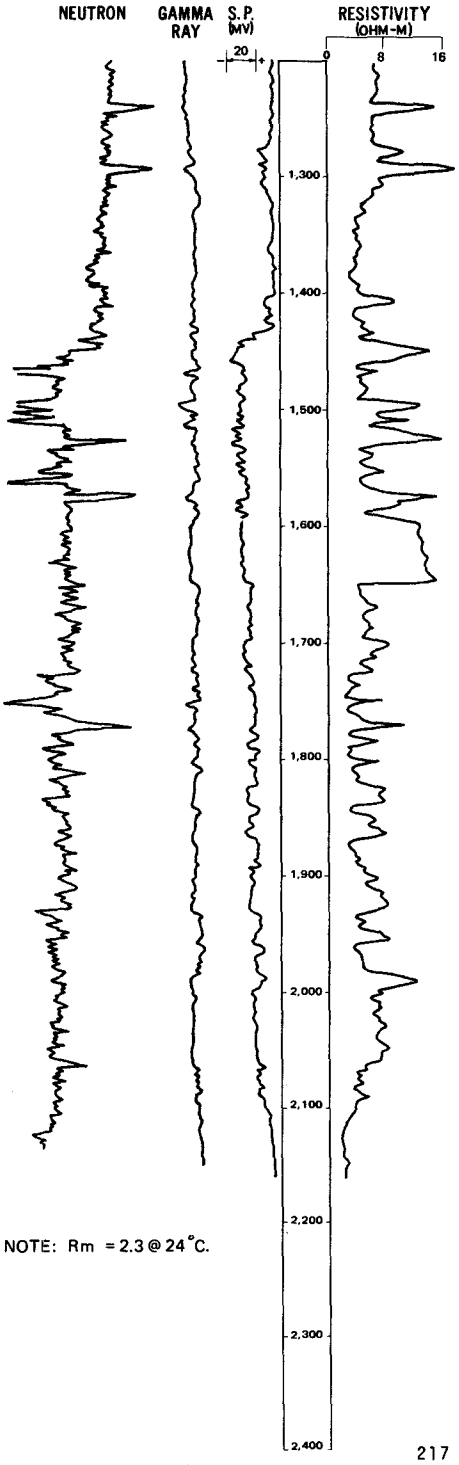
NDSWC 4814, 4815, Continued
(Log modified from Schlumberger)

LOCATION: 144-100-24BBD1, 2

DATE DRILLED: 9/05/75

ALTITUDE: 2670
(FT, NGVD)

DEPTH: 2160
(FT, LSD)



NOTE: Rm = 2.3 @ 24°C.

DESCRIPTION OF DEPOSITS

LUDLOW MEMBER

1332-1434 Claystone, gray; interbedded siltstone.

1434-1590 Interbedded sandstone, siltstone, and lignite; gray.

1590-1648 Sandstone, gray, very fine to medium, slightly argillaceous, well-sorted.

HELL CREEK FORMATION

1648-1740 Siltstone, gray.

1740-1824 Interbedded thin claystone, siltstone, and sandstone; gray.

1824-1840 Sandstone; poor sample recovery.

1840-1850 Claystone.

1850-1870 Sandstone, gray, fine to medium, slightly argillaceous.

1870-1880 Claystone.

FOX HILLS SANDSTONE

1880-1932 Sandstone, light-bluish-gray, very fine to fine.

1932-1946 Claystone, gray, silty.

1946-1958 Sandstone.

1958-2110 Siltstone.

PIERRE SHALE

2110-2160 Shale, dark-gray; silty near top.

NDSWC 4814, 4815, Continued

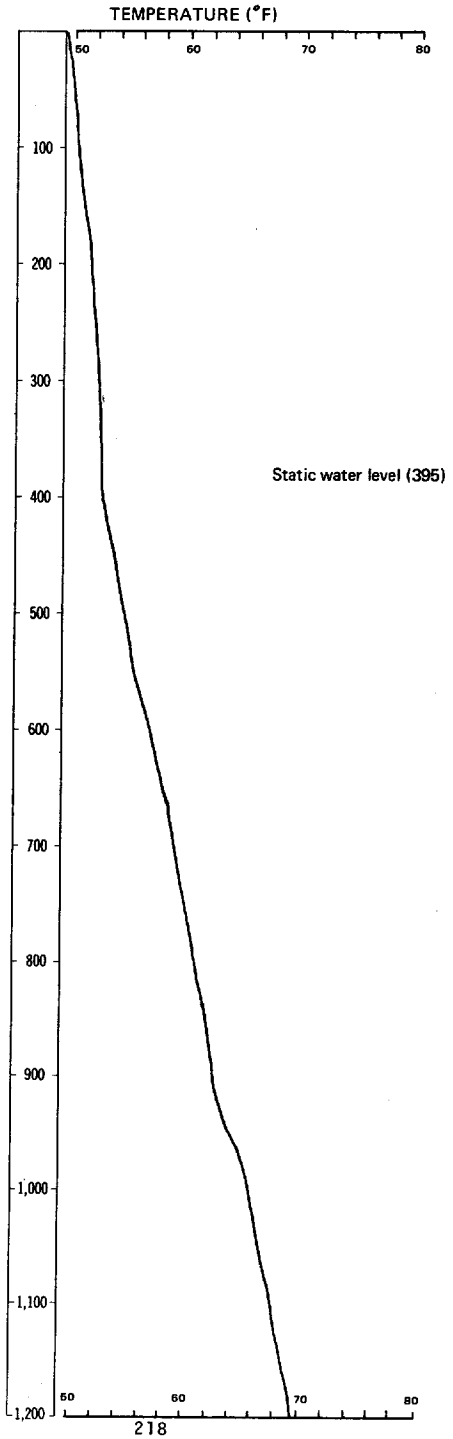
(Log modified from Schlumberger)

LOCATION: 144-100-24BBD1, 2

DATE DRILLED: 9/05/75

ALTITUDE: 2670
(FT, NGVD)

DEPTH: 2160
(FT, LSD)



NDSWC 4814, 4815, Continued

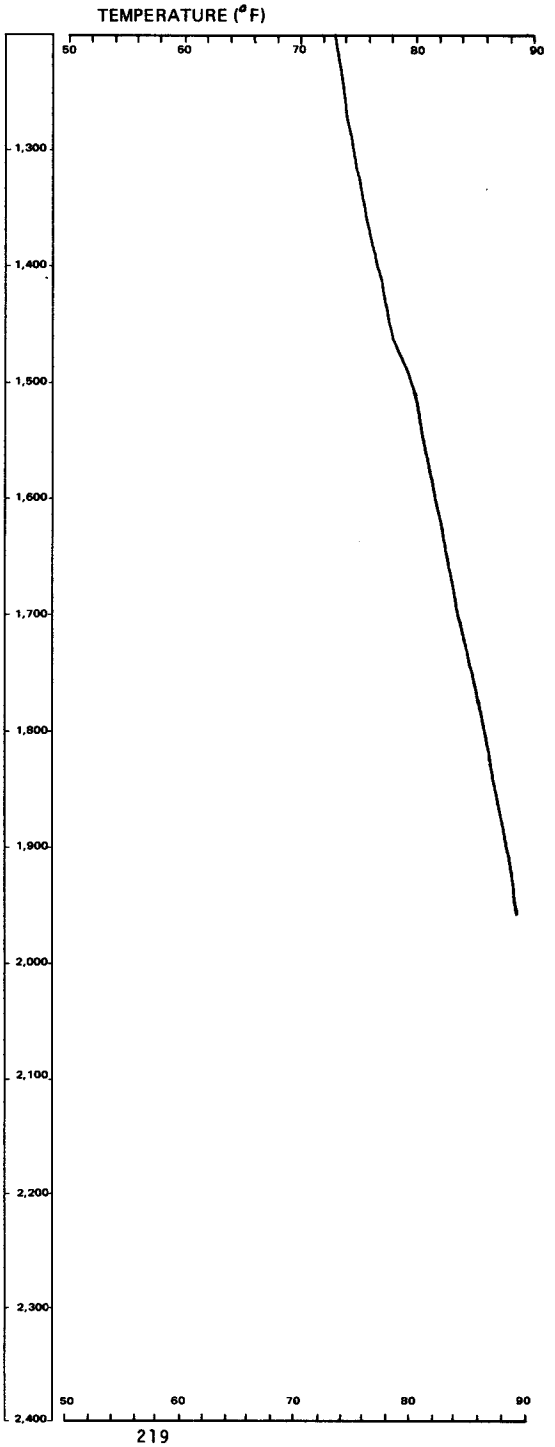
(Log modified from Schlumberger)

LOCATION: 144-100-24BBD1, 2

DATE DRILLED: 9/05/75

ALTITUDE: 2670
(FT, NGVD)

DEPTH: 2160
(FT, LSD)



144-102-01BBC
(Log modified from Francis Boyce & Sons)

Altitude: 2180 feet — Date drilled: 12/30/71

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Topsoil and clay	5	5
Clay; trace of fine rock	26	31
Rock, soft, crumbly	5	36
Clay, gray	88	124
Lignite	4	128
Shale, gray	112	240
Rock	5	245
Shale, gray	127	372
Rock	1	373
Shale, gray; with thin layers of rock and lignite	308	681
Rock	1	682
Shale, gray	97	779
Rock	2	781
Shale, gray	104	885
Rock	3	888
Shale, gray	57	945
Rock	5	950
Shale, gray	138	1,088
Rock	4	1,092
Shale, dark, hard	123	1,215
Rock	1	1,216
Shale, gray, hard	84	1,300
Sand, black and gray	35	1,335

144-102-05CCB
(Log modified from Harold Goodale)

Altitude: 2116 feet — Date drilled: 7/21/67

Sand and gravel	30	30
Gravel and shale	15	45
Lignite	10	55
Clay	40	95
Rock	5	100
Clay	25	125
Lignite	2	127
Clay	56	183
Rock	2	185
Clay	65	250
Lignite	13	263
Clay	101	364
Rock	6	370
Clay	145	515
Rock	10	525
Clay	35	560
Sand	30	590
Clay	75	665
Rock	1	666
Clay	24	690
Lignite	7	697
Clay	16	713
Rock	1	714
Sand	46	760

144-102-27DCC
(Log modified from Kruger Drilling Co.)

Altitude: 2200 feet

Date drilled: 9/11/64

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Sand	30	30
Gravel	10	40
Rock	1	41
Clay	9	50
Lignite, hard	10	60
Clay, gray	20	80
Lignite	10	90
Clay	120	210
Sand, white	30	240
Clay, sandy	5	245
Rock	1	246
Sand	14	260
Clay	40	300
Clay and lignite	80	380
Sand, rocky	10	390
Rock	2	392
Sand	8	400
Clay	100	500
Clay, sandy and rocky	40	540
Clay	30	570
Rock	8	578
Clay	2	580
Clay, sandy	20	600
Clay	20	620
Clay, brown	20	640
Clay	100	740
Sand	5	745
Clay, blue, sandy	300	1,045
Clay, brown	40	1,085
Shale, dark-gray	60	1,145
Sand, medium	20	1,165
No lithologic description	----	1,385

144-102-28ADC2
(Log modified from Francis Boyce & Sons)

Altitude: 2142 feet — Date drilled: 10/01/60

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Topsoil and clay	19	19
Clay and sand	5	24
Sand, fine, and gravel	13	37
Gravel and shale, gray	11	48
Clay, gray, and sand	3	51
Shale, gray	41	92
Rock	3	95
Shale	8	103
Rock	1	104
Shale	29	133
Lignite, soft	5	138
Shale, sandy	12	150
Rock, soft	4	154
Sand	9	163
Rock, soft	7	170
Shale	30	200
Lignite	2	202
Sand, brown, coarse	18	220
Shale	33	253
Rock	4	257
Shale	103	360
Sandstone	3	363
Shale	24	387
Sandstone and shale	21	408
Rock	4	412
Shale	34	446
Rock	1	447
Shale	9	456
Rock	3	459
Shale and rock	16	475
Rock	3	478
Shale	6	484
Sandstone	5	489
Shale	57	546
Rock	2	548
Shale	1	549
Rock	1	550
Shale	50	600
Sandstone	28	628

144-102-35CCB
(Log modified from Kruger Drilling Co.)

Altitude: 2205 feet — Date drilled: 9/08/64

Sand and gravel	20	20
Clay, gray	30	50
Lignite	5	55
Clay, brownish-gray	15	70
Lignite	5	75
Clay	8	83
Rock	5	88
Clay, light-gray	27	115
Lignite	15	130
Sand	10	140

144-103-03BDA
(Log modified from Francis Boyce & Sons)

Date drilled: 8/28/68

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Topsoil	2	2
Clay, yellow	9	11
Sandstone, gray, hard	2	13
Clay, gray, black, and yellow	27	40
Lignite	2	42
Shale, bluish-gray	42	84
Sandstone, gray, fine	26	110
Sandstone, gray, coarse	23	133

144-103-06DCC
(Log modified from Francis Boyce & Sons)

Date drilled: 8/01/68

Clay, yellow	25	25
Sand and clay	15	40
Clay, gray	30	70
Rock	5	75
Shale, gray	15	90
Sand, fine	35	125
Sand, gray, coarse	20	145

144-103-15DDC
(Log modified from Francis Boyce & Sons)

Altitude: 2150 feet

Date drilled: 8/30/68

Topsoil	1	1
Clay, yellow	31	32
Sand and gravel	13	45

144-103-21BBB
(Log modified from Francis Boyce & Sons)

Date drilled: 7/12/60

Topsoil and clay	20	20
Lignite	2	22
Clay; with lignite streaks	123	145
Clay; with some fine sand	49	194
Rock	3	197
Shale; with lignite streaks	8	205
Clay	42	247
Lignite	8	255
Sandstone and clay	19	274
Shale, gray	6	280

144-103-22CCD
(Log modified from Francis Boyce & Sons)

Altitude: 2220 feet

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Topsoil and yellow sandy clay	32	32
Clay	8	40
Gravel, fine	15	55
Shale, gray	63	118
Lignite	4	122
Shale, gray	31	153
Sandstone, fine	28	181
Shale, gray	27	208
Rock	2	210
Shale; gray and green layers	52	262
Rock	2	264
Shale, gray, crumbly	43	307
Rock	3	310
Shale, gray	24	334
Lignite	14	348
Shale, gray; crumbly and firm layers	59	407
Sandstone	36	443
Shale, gray	10	453
Rock	4	457
Shale, gray	278	735
Shale; gray and brown layers	162	897
Rock	5	902
Shale, gray	198	1,100
Shale, gray; firm to hard layers	148	1,248
Sandstone, coarse	32	1,280

144-103-22DBA
(Log modified from Francis Boyce & Sons)

Altitude: 2220 feet

Topsoil and fill	12	12
Gravel, fine	10	22
Shale, blue	22	44
Lignite	4	48
Shale, blue	62	110
Sand	25	135
Shale, blue	19	154
Rock	1	155
Shale	4	159
Rock	2	161
Shale	3	164
Rock	3	167
Shale	17	184
Lignite	6	190
Shale	50	240
Lignite	10	250
Shale, very soft	45	295
Lithologic description missing from log	55	350
Shale	101	451
Sandstone	2	453
Shale	128	581
Sand	15	596

144-103-23ABA
(Log modified from Francis Boyce & Sons)

Altitude: 2380 feet

Date drilled: 7/22/68

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay, yellow	20	20
Clay, yellow to black	17	37
Clay, gray	51	88
Lignite	2	90
Shale, gray	58	148
Lignite	7	155
Shale, gray	8	163
Rock	2	165
Shale, gray	4	169
Lignite	5	174
Shale, gray	3	177
Lignite	2	179
Shale, gray	72	251
Rock	3	254
Shale, gray	61	315
Lignite	4	319
Shale, gray	11	330
Sandstone, fine	35	365
Sandstone and bentonite	21	386
Shale, gray	8	394
Rock	1	395
Shale, gray	20	415
Rock	1	416
Shale, gray	10	426
Lignite	7	433
Shale, gray, and bentonite	25	458
Rock	2	460
Shale, gray	28	488
Lignite	5	493
Shale	44	537
Rock	3	540
Shale, gray	25	565
Shale, black to brown	5	570
Rock	22	592
Sandstone	11	603
Shale, gray	107	710
Rock	20	730
Shale, gray	11	741
Sandstone	19	760
Shale, gray	25	785

144-104-06BCB
(Log modified from Francis Boyce & Sons)

Altitude: 2425 feet — Date drilled: 1962

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Topsoil and clay	10	10
Clay	60	70
Lignite	2	72
Shale, gray	66	138
Rock	2	140
Shale	3	143
Rock	2	145
Shale	51	196
Sandstone, gray	26	222
Lignite	3	225
Sand	5	230
Shale	11	241
Sand, fine	9	250
Shale	10	260
Sand, fine	5	265
Shale	5	270
Sand and shale layers	36	306
Sand	8	314
Shale, black	6	320
Sand, coarse	25	345
Shale	13	358
Sand, fine	10	368
Shale	42	410

144-104-07BBC
(Log modified from Francis Boyce & Sons)

Date drilled: 9/24/67

Topsoil and yellow clay	56	56
Clay, sand, and decayed wood	6	62
Shale, gray	35	97
Rock	7	104
Shale, gray	23	127
Lignite	7	134
Shale, gray	14	148
Lignite	2	150
Shale	46	196
Lignite	3	199
Shale; with fine sand layers	73	272
Sandstone	25	297
Shale	24	321
Shale; with sand layers	54	375
Rock	6	381
Shale	20	401
Lignite	8	409
Sandstone	23	432
Shale	6	438
Shale, sand, and lignite layers	37	475

144-104-10CCC
(Log modified from Francis Boyce & Sons)

Altitude: 2575 feet — Date drilled: 12/27/67

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay, yellow	35	35
Clay, gray	32	67
Lignite	6	73
Shale, gray	31	104
Rock	2	106
Shale, gray	46	152
Rock	1	153
Shale, gray	62	215
Sand, fine	26	241
Shale, sandy	15	256
Rock	3	259
Shale and sand layers	28	287
Rock	4	291
Shale, gray	21	312
Shale and sand layers	24	336
Lignite	12	348
Shale	5	353
Rock	3	356
Shale, gray	69	425
Sand, gray, fine	20	445
Shale, gray	102	547
Rock	4	551
Shale	7	558
Sandstone, gray	22	580
Shale, gray	10	590

144-105-02CAA
(Log modified from Francis Boyce & Sons)

Altitude: 2330 feet — Date drilled: 10/05/61

Topsoil and yellow clay	45	45
Clay, yellow, and brown sand	30	75
Clay, gray	20	95
Sandstone	25	120

144-105-03AAA
(Log modified from McDanold Well Drilling)

Altitude: 2305 feet — Date drilled: 4/20/66

Silt	20	20
Clay, yellow, sandy	23	43
Sandstone	2	45
Clay, gray	14	59
Gravel, medium	1	60
Clay, gray	24	84
Sandstone	3	87
Clay, gray	4	91
Lignite	3	94
Sand, gray, fine	11	105

144-105-07DBB
(Log modified from Francis Boyce & Sons)

Altitude: 2379 feet — Date drilled: 12/07/65

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Clay, yellow	38	38
Clay, blue	25	63
Rock	4	67
Clay, blue	17	84
Clay, dark	6	90
Clay, blue	8	98
Sand	12	110
Clay, blue	45	155
Lignite	6	161
Shale, gray	3	164
Lignite	3	167
Shale, gray; with some sandstone	40	207
Lignite	3	210
Shale, gray	18	228
Sandstone	20	248

144-105-08DDD
(Log modified from Harold Goodale)

Altitude: 2447 feet — Date drilled: 7/23/64

Fill	15	15
Clay	48	63
Lignite	10	73
Clay	92	165
Lignite	5	170
Clay	45	215
Rock	2	217
Clay	13	230
Lignite	3	233
Clay	77	310
Sand	40	350

144-105-25ADD
(Log modified from Harold Goodale)

Altitude: 2590 *feet* Date drilled: 10/10/73

LITHOLOGIC DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET)
Fill	3	3
Shale	27	30
Lignite	12	42
Shale	194	236
Lignite	9	245
Shale	80	325
Lignite	20	345
Shale	75	420
Sand	60	480

144-105-32CCA
(Log modified from Harold Goodale)

Altitude: 2400 *feet* Date drilled: 5/09/74

Sand and shale	70	70
Sand	28	98
Lignite	3	101
Sand	19	120

144-105-33BBB
NDSWC 4935A

Altitude: 2405 feet Date drilled: 7/20/76

Sand, yellowish-brown, very fine to fine, clayey, well-sorted, rounded, highly oxidized; predominantly quartz; some carbonates	5	5
Clay, yellowish-brown to pale-yellow, very silty, sandy, moderately tight to soft, cohesive, oxidized; very sandy from 20 to 25 feet	45	50
Clay and shale; light-gray to medium-gray; tight; cohesive; brittle	10	60

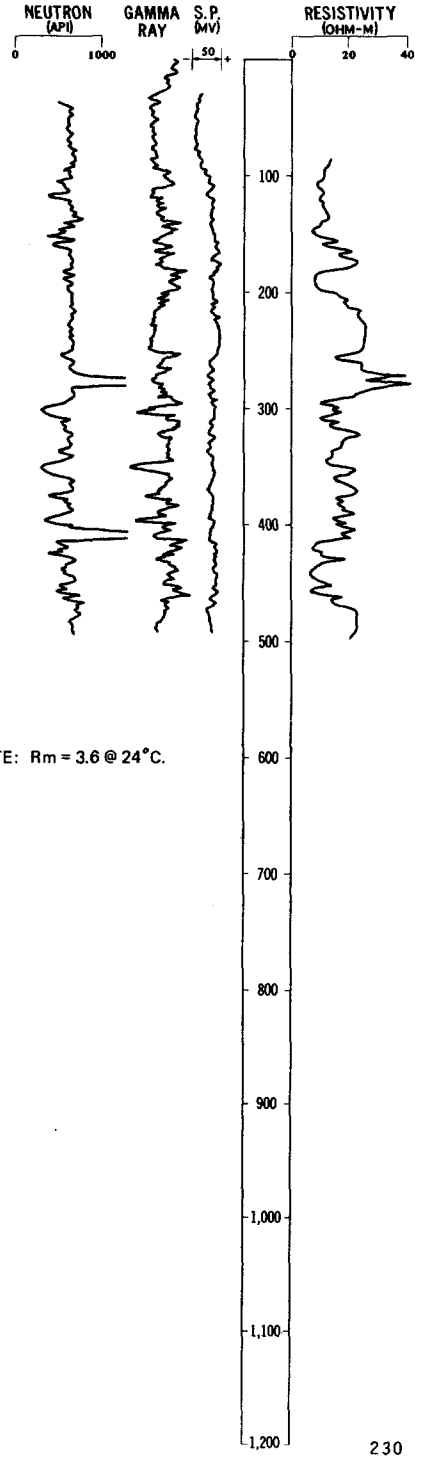
NDSWC 4935

LOCATION: 144-105-33BBC

DATE DRILLED: 7/21/76

ALTITUDE: 2360
(FT, NGVD)

DEPTH: 500
(FT, LSD)



NOTE: Rm = 3.6 @ 24°C.

DESCRIPTION OF DEPOSITS

TONGUE RIVER MEMBER

0-32	Sandstone, yellowish-brown, very fine, subrounded.
32-36	Gravel, yellowish-brown; fine sand to very coarse pebbles.
36-42	Claystone, pale-yellowish-brown, cohesive; minor sand and silt.
42-80	Sandstone, light-yellowish-gray, fine to medium; carbonaceous trash.
80-94	Sandstone, gray, fine to medium, carbonaceous trash.
94-120	Claystone, greenish-gray; interbedded thin lignites.
120-180	Claystone, bluish-gray; interbedded thin lignites.
180-205	Claystone; interbedded thin beds of bluish-gray clay and greenish-gray clay.
205-254	Sandstone, greenish-gray, very fine to fine; minor carbonaceous trash.
254-300	Claystone, gray, silty; minor sand.
300-309	Lignite, brittle.
309-365	Claystone, gray; interbedded sandstone.
365-376	Sandstone, gray, very fine to fine; interbedded claystone.
376-416	Siltstone, gray; interbedded claystone and sandstone.

LUDLOW MEMBER

416-472	Claystone, gray, very silty.
472-500	Sandstone, greenish-gray, very fine, argillaceous.

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	
110,	Quaternary
125,	Paleocene
211,	Upper Cretaceous
HCFH,	lower Hell Creek and Fox Hills aquifer
LHCK,	lower Ludlow and upper Hell Creek aquifer
QRNR,	alluvium
SNLB,	Sentinel Butte aquifer
TRVL,	lower Tongue River and upper Ludlow aquifer

Specific conductance

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

PRINCIPAL AQUIFER	LOCAL IDENTIFIER	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)	HARDNESS, NONCARBONATE (MG/L CACO3)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE (MG/L AS HCO3)	CARBONATE (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 NO3)	BORON, DISSOLVED (UG/L AS B)	IRON, DISSOLVED (UG/L AS FE)	MANGANESE, DISSOLVED (UG/L AS MN)
110DNNK	139-102-03BAC	22	77-07-26	1900	7.9	11.0	380	66	99	32	310	63	6.9	7.3	375	3	720	9.9	0.3	15	1360	0.40	240	1600	2300
110DNNK	139-102-03BCB2	29	77-09-29	1500	7.7	9.0	310	44	86	23	240	62	5.9	6.8	317	3	550	13	.4	18	1100	1.0	190	280	1200
110DNNK	143-102-09BCC2	22	77-08-11	2100	8.5	9.0	14	0	2.4	1.9	540	99	63	1.7	869	20	410	9.1	3.4	6.5	1610	1.0	380	240	10
125LMCK	133-098-14AAA	860	75-07-22	2200	8.6	16.0	13	0	3.7	1.0	590	99	70	2.1	1450	48	8.6	13	10	10	1430	.90	1600	190	0
125LMCK	134-103-30BB	500	75-07-16	2800	8.6	--	36	0	7.1	4.5	650	97	47	2.6	709	26	830	4.8	.4	5.5	1900	1.0	350	20	60
125LMCK	134-105-05AAA	98	75-07-16	1690	8.6	14.0	16	0	2.6	2.3	390	98	42	1.4	616	24	320	12	.8	5.4	1080	1.0	310	0	40
125LMCK	134-105-25AAU	95	75-07-08	3500	8.2	10.5	130	0	23	18	830	93	31	2.8	923	0	1200	5.5	.6	5.7	2490	2.0	350	100	70
125LMCK	134-106-27DBD	100	75-07-17	2860	8.4	10.5	41	0	6.7	6.0	660	97	45	2.1	897	27	710	5.4	.7	4.4	1660	2.5	280	230	40
125LMCK	135-101-26AAA	1082	74-08-28	2000	8.5	--	13	0	2.9	1.5	530	99	63	1.4	1300	51	2.9	24	6.1	9.9	1290	2.5	1300	270	20
125LMCK	136-098-31ABB	960	75-07-22	2070	8.5	14.0	19	0	2.7	3.0	540	98	54	2.1	1390	25	6.2	14	1.5	5.9	1350	4.0	1500	400	10
125LMCK	136-099-31DDC2	642	77-09-13	2950	8.6	10.0	78	0	6.4	15	670	94	33	8.7	553	0	1000	22	1.8	.2	1990	1.0	50	100	40
125LMCK	136-102-05BBB	960	69-07-28	1600	8.7	19.0	5	0	.8	.7	430	99	85	2.1	930	41	63	12	4.1	12	--	--	--	--	--
125LMCK	136-102-06ACC	500	69-07-28	1500	8.7	11.6	6	0	1.6	.5	410	99	73	2.1	900	35	100	5.0	6.0	8.7	--	--	--	--	--
125LMCK	136-102-17BDD	500	69-07-03	1410	8.8	20.0	4	0	.4	.7	400	99	88	1.7	880	29	88	5.5	5.1	10	--	--	--	--	--
125LMCK	136-103-19CDC	425	69-07-03	--	8.4	12.0	5	0	1.2	.5	410	99	79	1.7	860	34	150	5.5	4.7	9.3	--	--	--	--	--
125LMCK		425	75-07-11	1600	8.6	13.0	9	0	2.2	.9	400	98	57	3.2	827	24	160	7.6	7.0	5.9	1030	1.0	510	170	0
125LMCK	136-105-01AAD	440	75-07-25	1550	9.1	12.5	20	0	3.0	3.0	370	97	36	1.8	617	66	200	12	4.0	1.6	960	1.0	430	460	60
125LMCK	136-105-26ACA	570	76-10-18	1600	8.9	12.0	20	0	3.0	3.0	400	98	39	1.2	608	58	260	17	1.5	10	1080	1.0	460	230	40
125LMCK	137-101-19BBD	580	69-06-24	1800	8.4	14.5	2	0	.8	.0	470	100	145	2.2	1250	24	8.0	1.5	2.5	16	--	--	--	--	--
125LMCK	137-101-32CCB	585	69-07-02	1600	8.5	14.0	8	0	1.2	1.2	400	99	62	1.9	970	40	58	7.0	4.9	10	--	--	--	--	--
125LMCK		585	74-08-13	1640	8.7	14.0	8	0	2.3	.6	430	99	65	1.2	930	37	79	9.1	10	7.2	1020	1.0	1200	100	20
125LMCK	137-101-33CCA	600	69-07-02	1600	8.2	11.0	4	0	.8	.5	410	99	89	1.8	1010	34	27	2.0	4.9	11	--	--	--	--	--
125LMCK	137-101-34CCA	685	69-07-02	1550	8.2	17.0	6	0	.8	1.0	410	99	72	1.8	1058	36	7.0	1.5	5.1	11	--	--	--	--	--
125LMCK	137-103-01ACA	550	69-06-20	1700	8.5	13.5	0	0	.8	1.0	440	99	77	2.1	850	32	210	7.3	4.4	10	--	--	--	--	--
125LMCK	137-104-29ADA	400	75-07-02	2050	8.6	12.0	17	0	2.9	2.4	510	98	54	1.6	677	19	490	7.8	1.8	6.0	1380	1.0	870	310	10
125LMCK	138-100-07AAA1	980	76-08-26	2250	8.8	13.0	10	0	2.1	1.2	540	99	74	1.8	1300	64	.8	11	2.9	11	1290	1.0	1300	770	40
125LMCK	138-102-03BBC	650	69-07-02	1850	8.6	12.5	6	0	1.2	.7	470	99	88	2.1	1170	31	5.0	1.5	3.7	11	--	--	--	--	--
125LMCK	138-102-07CAC	500	69-06-20	1800	8.6	13.0	11	0	2.0	1.5	450	99	59	2.1	900	38	220	7.5	5.4	9.6	--	--	--	--	--
125LMCK	138-102-08BBC	425	69-06-24	1900	8.6	15.0	12	0	2.0	1.7	470	99	59	2.3	930	40	210	9.5	5.1	11	--	--	--	--	--
125LMCK	138-102-18CBB	480	69-06-20	1900	8.5	14.5	11	0	2.0	1.5	470	99	61	2.1	900	22	260	7.0	4.9	10	--	--	--	--	--
125LMCK	138-102-19ACD	478	69-06-24	1850	8.5	14.0	9	0	2.0	1.0	450	99	65	2.3	880	35	220	9.5	4.4	1.0	--	--	--	--	--
125LMCK	138-102-20ADA	777	69-06-24	--	8.6	15.0	8	0	1.6	1.0	440	99	67	2.3	1080	32	41	1.8	3.9	11	--	--	--	--	--
125LMCK	138-103-25BBA	405	69-06-20	--	8.7	14.0	8	0	1.6	1.0	420	99	66	1.8	770	35	250	7.5	4.3	12	--	--	--	--	--
125LMCK	139-101-17CDA	1290	75-07-10	1550	8.7	12.0	10	0	1.7	1.5	410	99	55	1.9	791	34	140	33	4.4	9.1	1030	2.5	1100	460	0
125LMCK	139-102-10BBD1	460	68-09-06	2000	8.3	12.5	24	0	3.2	3.9	480	97	43	2.4	990	26	220	8.0	4.9	10	--	--	--	--	--
125LMCK	139-102-10BBD2	600	68-09-07	1700	7.7	16.5	7	0	.8	1.2	700	99	116	3.9	1720	0	8.0	2.5	2.8	12	--	--	--	--	--
125LMCK	139-102-20ABB	460	69-06-18	--	8.6	14.0	10	0	1.6	1.5	550	99	75	2.2	910	19	410	9.0	4.9	10	--	--	--	--	--
125LMCK		460	74-08-14	2140	8.7	14.0	16	0	3.4	1.8	550	98	58	1.5	860	34	390	13	8.0	7.0	1400	1.0	870	140	10
125LMCK	139-102-21CAB	438	68-09-06	1900	8.5	14.0	18	0	2.4	2.9	470	98	48	2.4	940	31	230	13	4.9	10	--	--	--	--	--
125LMCK		438	69-07-02	--	8.4	12.0	9	0	1.8	1.2	490	99	71	2.4	1000	38	200	2.0	4.8	10	--	--	--	--	--
125LMCK	139-102-33CBB	400	69-07-02	1950	8.5	12.5	8	0	1.6	1.0	480	99	73	1.9	930	26	190	10	5.1	10	--	--	--	--	--
125LMCK	140-102-17CCA	600	68-08-29	2050	8.3	12.5	6	0	2.4	.5	510	99	78	2.4	112	24	170	3.0	4.1	12	--	--	--	--	--
125LMCK	140-102-27ACB2	950	69-07-24	--	8.8	14.5	4	0	.8	.5	410	99	89	1.7	900	48	71	29	3.2	14	--	--	--	--	--
125LMCK	141-101-02BBB	980	69-08-30	2020	8.2	19.0	8	0	1.6	1.0	570	99	87	2.9	1490	9	9.0	1.5	2.4	10	--	--	--	--	--
125LMCK	142-100-25DDA	1374	76-08-24	2180	8.7	16.5	19	0	2.8	2.9	580	98	58	2.4	1410	54	3.7	12	2.5	13	1330	1.0	1200	120	10
125LMCK	143-102-09CBB1	525	67-09-23	2000	8.1	11.0	14	0	3.2	1.5	570	99	66	.0	1500	0	12	1.0	--	12	--	--	--	--	--
125LMCK		525	68-09-05	--	8.1	15.0	8	0	2.0	.7	560	99	87	2.8	1470	0	9.0	2.0	1.5	10	--	--	--	--	--
125LMCK	143-102-21DDD	770	68-08-30	2300	8.7	15.0	6	0	2.0	.2	600	99	108	2.9	1460	41	15	2.0	2.6	11	--	--	--	--	--
125LMCK	144-100-24BBD2	1624	76-08-12	2400	8.9	10.0	32	0	3.5	5.8	610	97	47	2.6	1450	74	8.9	21	1.4	12	1470	1.0	1100	170	20
125LMCK	144-102-05CCB	760	69-07-09	2030	8.4	14.0	6	0	.4	1.2	560	99	100	2.5	1230	43	110	2.0	4.3	10	--	--	--	--	--
125LMCK	144-102-05DBA	600	69-07-09	2050	8.4	14.5	6	0	.4	1.2	550	99	98	2.4	1250	46	90	4.0	4.3	10	--	--	--	--	--
125LMCK	144-102-16BBB	600	69-07-09	1720	8.4	11.0	3	0	.4	.5	580	100	144	2.2	1320	40	110	1.5	3.7	9.2	--	--	--	--	--
125LMCK	144-102-24DDD	820	76-06-30	1620	8.6	16.5	8	0	1.8	.9	420	99	64	1.2	874	27	77	56	5.1	14	1010	.80	1200	250	10
125SNLB	134-101-35BCC	164	75-07-11	690	7.8	11.5	170	0	40	17	100	56	3.3	2.4	436	0	30	.9	.3	17	413	1.0	60	1600	60
125SNLB	135-098-32DAD1	62	75-07-02	4010	7.4	8.0	3200	2700	820	520	62	4	.5	5.5	574	0	2700	18	.5	11	4210	35	1300	80	10
125SNLB	135-101-16C0A	167	75-07-03	2050	7.7	11.0	320	0	69	36	370	71	9.0	5.6	707	0	560	3.0	.2	5.5	1360	1.0	430	7100	250
125SNLB	136-098-33CC0	120	75-07-02	2390	7.8	11.0	139	0	36	9.7	580	90	22	5.1	954	0	580	4.0	1.5	9.2	1660	1.0	630	730	160
125SNLB	142-099-03DCC	80	75-07-08	680	7.6	12.0	290	0	57	36	44	24	1.1	6.4	393	0	61	4.1	.7	11	444	7.6	40	190	20
125SNLB	142-099-10DDD	58	75-07-08	565	7.9	15.0	240	0	53	26	31	22	.9	3.0	318	0	46	6.2	.5	10	367	2.0	0	0	60
125SNLB	142-100-01BDC	115	75-07-08	5230	7.4	12.0	710	0	120	100	1100	77	18	13	1060	0	2200	18	1.6	11	4110	6.9	1100	100	160

PRINCIPAL AQUIFER	LOCAL IDENTIFIER	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)	HARDNESS, NONCARBONATE (MG/L CACO3)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE (MG/L AS HCO3)	CARBONATE (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 NO3)	BORON, DISSOLVED (UG/L AS B)	IRON, DISSOLVED (UG/L AS FE)	MANGANESE, DISSOLVED (UG/L AS MN)
125BNLB	144-099-30AAB	100	75-09-15	3800	7.5	15.5	980	96	180	130	610	57	8.5	6.2	1080	0	1300	8.0	.2	8.7	2870	1.0	280	5400	730
125BNLB	144-100-13DBD	105	75-09-11	2950	8.5	9.5	12	0	2.4	1.5	730	99	92	2.5	1220	28	590	2.9	1.0	6.3	1990	1.5	680	210	0
125BNLB	144-100-15CD	SPRING	75-08-27	4050	8.0	11.0	270	0	50	35	970	88	26	5.3	1380	0	1200	4.2	1.1	8.7	3020	1.5	400	630	120
125BNLB	144-100-17CDD	SPRING	75-08-27	1900	7.8	14.0	590	0	100	83	250	48	4.5	7.4	764	0	500	4.1	.9	11	1350	1.5	320	20	100
125BNLB	144-100-24BCD	SPRING	75-09-05	799	7.9	9.0	250	0	75	15	91	44	2.5	2.6	484	0	71	2.4	.7	9.8	507	1.0	40	270	300
125TRVL	133-098-06DCC	338	75-07-01	2280	8.7	14.0	24	0	5.6	2.4	550	96	49	2.1	548	27	730	5.1	.4	5.0	1570	1.0	590	1300	40
125TRVL	133-098-18DDD	95	75-07-01	2600	6.9	7.0	1200	860	220	160	130	19	1.6	7.6	425	0	1100	28	.3	16	2070	10	1900	13000	1600
125TRVL	133-098-19DDB	60	75-07-01	2700	8.0	10.0	180	0	41	14	600	89	21	5.9	791	0	830	5.1	1.1	5.4	1930	1.0	430	730	60
125TRVL	133-098-20CBC	91	75-07-01	1870	8.7	14.0	4	0	2.1	.2	460	99	81	1.9	877	41	130	79	5.1	8.8	1180	1.0	1500	1100	0
125TRVL	133-098-32BCA	106	75-07-01	2800	8.2	11.0	60	0	19	7.9	660	94	32	4.4	754	0	910	6.5	1.2	5.6	1990	1.0	790	370	60
125TRVL	133-099-20ADA	210	75-06-04	2290	8.3	10.5	28	0	7.7	2.2	530	97	43	2.3	588	7	640	11	.4	7.8	1520	1.0	340	1300	40
125TRVL	133-100-08ADA	74	75-06-03	2510	8.1	13.0	87	0	20	9.0	580	93	27	4.5	884	0	630	3.6	.2	16	1720	1.0	430	80	80
125TRVL	133-101-06CBA	45	75-06-03	600	7.7	9.0	230	0	56	22	45	30	1.3	1.8	331	0	58	3.4	.2	9.8	379	1.0	280	230	120
125TRVL	133-101-09CDD	64	76-06-30	510	7.5	14.0	220	0	61	16	40	28	1.2	2.6	351	0	24	1.4	.3	12	270	--	110	0	150
125TRVL	133-101-17ABB	65	76-06-29	2300	7.4	9.0	490	0	110	52	440	66	8.7	6.8	624	0	850	7.7	.3	10	1610	--	820	10	290
125TRVL	133-101-19DCC	101	76-06-30	4000	7.6	13.0	200	0	40	25	1000	91	31	12	1100	0	1500	7.6	.4	16	3300	--	1300	20	130
125TRVL	133-104-10BCC	137	75-06-03	650	7.5	9.0	190	0	37	24	79	66	2.5	8.6	334	0	92	2.7	.1	12	419	2.5	510	870	220
125TRVL	134-098-06DDA2	230	75-06-04	2090	8.5	9.0	22	0	6.1	1.7	510	98	47	2.2	806	16	370	8.0	.5	5.4	1400	2.5	630	550	120
125TRVL	134-098-33ACC	200	76-06-04	2190	8.4	10.0	26	0	6.1	1.9	510	97	42	2.2	651	9	560	13	.9	5.5	1510	3.4	1000	360	40
125TRVL	134-099-21DCC	411	76-10-22	1850	8.7	11.5	66	0	12	7.3	390	93	22	1.7	684	25	270	9.1	1.9	5.3	1170	.20	210	1100	50
125TRVL	134-100-07ADD2	384	77-09-08	1900	8.6	10.0	39	0	7.8	4.7	460	96	32	1.1	572	9	530	4.4	.6	5.7	1320	1.0	190	260	10
125TRVL	134-101-17UDD	160	76-06-30	975	7.5	10.0	200	0	42	22	160	65	5.0	5.5	395	0	210	2.3	.3	12	652	--	130	10	160
125TRVL	134-101-18ABB	75	76-07-01	2190	7.2	10.0	600	0	110	78	300	51	5.3	21	814	0	550	7.5	.2	9.1	1510	--	1000	0	220
125TRVL	134-102-12DDA	286	76-10-22	5200	8.8	11.0	380	0	120	19	760	81	17	17	530	22	1500	9.3	.9	5.8	2740	1.0	140	120	80
125TRVL	134-102-27ACC	222	75-07-15	4500	8.2	11.0	330	0	43	54	970	86	23	8.3	1020	0	1600	8.6	1.6	5.9	3200	1.0	1100	80	140
125TRVL	134-103-08AAA	366	76-10-21	2200	8.7	12.0	25	0	4.2	3.5	470	97	41	1.6	428	22	600	8.0	.6	9.5	1370	2.5	430	250	50
125TRVL	134-103-28BDA	168	75-07-08	2700	8.0	11.0	410	0	57	65	510	72	11	9.6	606	0	930	8.5	.3	4.6	1880	1.0	1900	710	70
125TRVL	135-099-01DDD2	902	74-08-29	2350	8.4	--	20	0	2.7	3.3	650	96	43	1.9	1600	26	19	12	4.6	8.1	1550	1.0	1300	410	40
125TRVL	135-102-08DAA	245	75-08-26	2630	8.5	12.0	28	0	5.9	3.3	630	96	52	1.7	785	21	730	5.0	.3	6.3	1840	1.0	510	440	0
125TRVL	135-102-28CCC	217	75-07-08	2900	8.5	12.5	21	0	6.6	1.1	690	98	46	2.1	833	16	830	6.0	.6	5.9	1900	2.0	790	310	10
125TRVL	135-104-06ADD1	102	77-09-29	1530	8.4	10.0	25	0	5.1	3.0	410	97	36	1.9	1080	0	4.5	8.7	2.7	6.5	989	1.0	140	160	120
125TRVL	136-099-26DAD	534	76-10-28	2000	8.8	12.0	20	0	2.6	3.3	460	98	45	1.9	976	47	120	9.1	4.6	5.1	1150	1.0	0	2400	30
125TRVL	136-101-02ABC	600	69-07-02	--	8.5	12.5	11	0	2.4	1.2	400	99	53	1.6	980	38	28	1.5	4.7	10	--	--	--	--	--
125TRVL	136-101-25ACC	515	75-06-06	1550	8.8	13.5	14	0	2.1	2.2	390	98	45	2.7	680	36	230	13	2.9	9.5	1020	1.0	1000	630	20
125TRVL	136-102-07ABB	250	69-07-28	1500	8.4	12.0	7	0	.0	1.2	400	99	60	2.0	880	44	77	1.3	4.9	9.3	--	--	--	--	--
125TRVL	136-102-08CBD	270	69-07-03	1600	8.5	11.0	8	0	2.0	.7	390	99	60	1.7	790	26	130	5.5	4.9	9.6	--	--	--	--	--
125TRVL	136-102-11BC6	300	69-07-04	1600	8.6	13.0	6	0	1.2	.7	440	99	79	1.8	990	48	52	1.3	6.5	8.7	--	--	--	--	--
125TRVL	136-102-12CCA	86	69-07-08	--	7.9	15.5	240	0	49	29	980	90	27	5.4	990	0	1600	3.0	1.4	6.8	--	--	--	--	--
125TRVL	136-103-24DAA	132	77-09-01	1340	9.2	10.0	39	0	5.7	6.1	340	95	24	2.5	659	72	91	6.4	2.5	12	889	1.0	190	790	0
125TRVL	136-103-24DCD	310	69-07-03	1490	8.6	10.5	12	0	2.4	1.5	350	98	44	1.4	710	36	150	6.5	4.0	10	--	--	--	--	--
125TRVL	136-105-02ADA	300	75-07-02	1760	8.6	11.5	12	0	3.2	1.0	420	98	53	1.5	629	18	360	13	3.2	6.0	1150	1.0	870	600	160
125TRVL	137-101-30BBD	352	69-06-26	1650	8.6	14.5	8	0	1.6	1.0	420	99	64	2.0	900	29	130	5.0	5.1	9.6	--	--	--	--	--
125TRVL	137-101-34ABA1	355	76-10-29	1620	8.9	11.0	18	0	4.0	1.9	340	97	35	1.3	508	42	270	9.8	1.7	7.8	985	1.3	670	1100	20
125TRVL	137-103-09CCB	90	75-07-02	1550	8.7	10.0	13	0	3.4	1.1	380	98	46	1.1	640	22	250	6.4	1.2	6.0	1010	1.0	670	420	200
125TRVL	137-104-10ABB	230	75-05-29	1000	8.7	9.5	23	0	4.2	3.0	250	96	23	1.1	520	23	98	4.0	.2	6.1	615	.30	310	110	60
125TRVL	137-105-34AAB	205	75-07-03	1730	8.8	10.0	19	0	3.7	2.4	420	98	42	1.5	681	34	380	6.3	1.1	3.9	1100	1.0	750	190	240
125TRVL	138-100-07AAA2	240	77-09-15	2080	8.0	10.0	49	0	7.0	7.7	510	95	32	8.1	730	21	460	7.6	3.8	5.4	1410	1.0	720	200	60
125TRVL	138-101-02BAC	343	76-08-31	1700	8.7	12.0	10	0	2.3	1.1	380	99	52	.9	677	34	280	6.0	3.2	7.6	923	1.0	760	940	40
125TRVL	138-102-23BBC	SPRING	69-07-02	--	8.0	--	260	0	52	32	770	86	21	5.1	964	0	1100	3.0	1.5	10	--	--	--	--	--
125TRVL	138-102-30CAB	365	69-06-29	1650	8.7	14.0	9	0	1.6	1.2	410	99	60	1.8	760	35	260	7.8	4.4	11	--	--	--	--	--
125TRVL	138-103-04AAA	365	69-06-28	--	8.7	11.0	9	0	1.6	1.2	410	99	60	1.9	760	41	260	7.3	4.4	11	--	--	--	--	--
125TRVL	138-105-07CCD	436	75-05-29	1610	8.7	12.0	6	0	2.9	.1	410	99	65	1.2	726	28	250	15	3.4	7.1	1080	.30	790	130	20
125TRVL	138-105-33CAB	306	76-09-10	1900	8.7	12.0	180	0	32	24	370	61	12	5.8	669	24	370	3.6	.4	13	1150	3.7	640	0	10
125TRVL	139-101-14BDC1	300	69-07-12	4000	8.5	10.0	30	0	7.2	2.9	970	98	77	3.1	820	24	140	4.5	3.5	7.3	--	--	--	--	--
125TRVL	139-102-03BCB1	99	77-07-26	2100	7.8	10.5	410	38	97	41	380	66	8.2	9.6	440	7	870	8.5	.3	13	1690	1.0	380	0	220
125TRVL	139-102-18DBD	SPRING	69-06-18	--	7.5	--	1200	1200	300	180	1300	70	17	11	744	0	3400	6.0	2.4	20	--	--	--	--	--
125TRVL	139-102-19DDB	SPRING	69-06-18	--	7.8	--	430	0	93	48	1300	87	27	6.1	642	0	2900	7.0	1.7	9.1	--	--	--	--	--
125TRVL	139-102-28BBB1	274	69-07-02	--	8.5	13.0	20	0	4.8	2.0	560	98	54	1.9	550	26	730	12	1.4	9.5	--	--	--	--	--
125TRVL	139-102-28BBB2	170	69-07-02	2400	8.5	14.0	20	0	4.8	2.9	540	98	52	1.9	570	26	780	13	1.8	10	--	--	--	--	--

PRINCIPAL AQUIFER	LOCAL IDENTIFIER	DEPTH OF WELL, TOTAL (FEET)	DATE OF SAMPLE	SPECIFIC CONDUCTANCE (µMHO/CM AT 25°C)	PH (UNITS)	TEMPERATURE (DEG C)	HARDNESS (MG/L AS CACO3)	NONCARBONATE (MG/L CACO3)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE (MG/L AS HCO3)	CARBONATE (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 NO3)	BORON, DISSOLVED (UG/L AS B)	IRON, DISSOLVED (UG/L AS FE)	MANGANESE, DISSOLVED (UG/L AS MN)
125TRVL	139-102-28CBB	170	69-07-02	2400	8.5	13.0	20	0	4.8	2.0	560	98	58	1.9	550	22	820	13	1.0	10	--	--	--	--	--
125TRVL	139-102-32ADD	190	69-07-02	2400	8.5	18.0	22	0	4.8	2.4	540	98	50	1.9	560	19	760	14	1.0	9.2	--	--	--	--	--
125TRVL	139-102-32DAA	200	69-02-02	2550	8.5	11.0	22	0	4.8	2.4	520	98	46	2.0	560	24	780	13	1.0	10	--	--	--	--	--
125TRVL	139-103-13DBA	285	76-10-15	2700	8.8	10.0	--	--	5.6	--	580	97	--	2.1	639	31	660	8.8	.4	7.9	1590	1.0	2200	90	80
125TRVL	139-104-22CDD	220	75-06-17	2920	8.3	11.0	45	0	9.1	5.5	680	97	44	1.5	597	3	1000	8.2	.6	5.3	2120	.90	630	130	80
125TRVL	139-104-28BBA	535	58-05-22	2400	8.7	14.0	25	0	4.9	3.2	580	98	50	.0	300	26	950	10	.4	.0	--	--	--	--	--
125TRVL	139-105-04AAC	150	75-06-18	2370	8.6	14.5	24	0	4.4	3.2	570	98	50	1.9	640	22	530	14	3.0	6.6	1600	.70	630	670	1400
125TRVL	139-105-19CBB	202	75-06-17	2900	8.4	7.0	74	0	14	9.5	720	95	36	3.2	821	14	690	5.4	.3	5.4	2070	1.8	710	370	400
125TRVL	140-102-11ADD	424	67-09-01	--	8.6	14.5	4	0	1.6	.0	460	100	100	.0	500	50	480	12	--	9.5	--	--	--	--	--
125TRVL		424	67-09-20	--	8.4	14.5	10	0	4.0	.9	430	99	59	.0	550	44	400	9.5	--	9.7	--	--	--	--	--
125TRVL		424	68-08-27	--	8.6	14.5	10	0	1.6	1.5	450	99	61	1.6	580	36	480	10	1.5	9.5	--	--	--	--	--
125TRVL		424	69-07-26	--	8.7	14.5	10	0	1.6	1.5	440	99	60	1.9	590	32	440	9.5	1.4	9.5	--	--	--	--	--
125TRVL	140-102-13AAD	420	68-08-28	1800	8.5	11.5	20	0	2.4	2.4	480	98	43	1.8	540	29	500	10	1.4	10	--	--	--	--	--
125TRVL	140-102-16DAA	364	73-06-13	1750	8.5	14.0	9	0	2.0	.9	420	99	52	1.4	616	28	340	11	1.6	9.2	1200	--	--	--	9
125TRVL		364	75-08-06	1700	--	12.5	10	0	2.0	1.1	430	99	61	1.6	686	--	310	11	1.6	8.9	1140	--	570	40	20
125TRVL	140-102-19DDB	190	76-08-19	1740	8.8	8.5	27	0	4.8	3.9	430	97	36	2.7	768	49	210	9.4	2.5	7.3	1100	2.5	530	60	20
125TRVL	140-102-35CCC	450	68-09-07	--	--	--	28	0	2.8	3.2	500	98	48	2.4	960	12	250	12	4.7	9.5	--	--	--	--	--
125TRVL		450	73-06-13	1930	8.4	12.5	9	0	2.1	1.0	490	99	70	1.7	965	28	210	14	4.4	9.4	1330	--	--	9	0
125TRVL	140-104-20CAB	280	75-06-27	2910	8.4	11.5	50	0	11	5.5	670	97	41	1.6	396	5	1100	10	.4	5.4	2070	2.5	630	460	80
125TRVL	140-105-30CCC3	114	77-09-26	1850	8.0	8.0	80	0	14	11	420	92	20	3.5	611	12	460	8.5	.4	6.7	1240	1.0	520	140	20
125TRVL	140-106-01AAA	354	76-10-13	2190	8.9	11.0	35	0	5.8	5.0	510	97	37	1.8	511	34	630	13	1.1	7.8	1420	1.0	450	130	60
125TRVL	140-106-25BCA	150	62-06-25	--	--	--	180	0	44	17	350	--	11	--	560	48	360	10	.5	--	1400	--	--	--	--
125TRVL	140-106-25BDD	108	74-08-13	2690	7.9	11.5	250	0	58	36	410	78	11	3.7	740	0	470	27	1.6	8.6	1400	9.7	510	2500	40
125TRVL	140-106-25CAC	130	62-06-25	--	--	--	570	180	96	81	150	--	2.7	--	480	0	460	8.8	.5	--	1280	--	--	--	--
125TRVL		130	74-08-13	2140	8.4	--	38	0	8.5	4.3	510	96	36	1.7	790	10	430	23	1.9	8.3	1420	1.1	470	1100	40
125TRVL	140-106-25CBB2	94	62-06-25	--	--	--	820	310	130	120	130	--	2.0	--	647	0	540	20	.2	--	1590	--	--	--	--
125TRVL		94	74-08-13	1810	7.4	11.0	760	180	140	100	150	30	2.4	10	710	0	420	35	.6	8.5	1270	26	310	450	300
125TRVL	140-106-25CBB3	110	62-06-25	--	--	--	530	6	92	72	170	--	3.2	--	634	0	360	15	.3	--	1350	--	--	--	--
125TRVL		110	74-08-13	1570	7.8	10.5	420	0	100	41	210	92	4.5	5.9	630	0	370	7.8	.7	10	1060	.30	350	2200	180
125TRVL	140-106-26DDC	120	62-06-25	--	--	--	640	120	120	81	260	--	4.4	--	630	0	760	8.0	.1	--	1650	--	--	--	--
125TRVL	141-100-34CBC	120	74-08-13	1990	6.8	9.0	230	0	49	26	400	79	11	4.8	690	0	520	6.4	.7	7.5	1330	.50	550	3200	60
125TRVL	141-101-02BCA	508	76-08-26	1650	6.9	12.0	11	0	2.0	1.5	410	99	53	1.0	790	46	150	9.2	4.8	9.2	1010	.70	760	400	40
125TRVL	141-101-08BBD	300	69-08-30	1700	8.6	16.5	7	0	1.2	1.0	450	99	73	1.7	770	31	250	8.5	2.8	9.2	--	--	--	--	--
125TRVL	141-101-19ACD	SPRING	69-00-00	--	8.2	--	86	19	34	21	1500	95	50	.0	82	0	3200	1.6	--	4.1	--	--	--	--	--
125TRVL		SPRING	69-07-24	--	7.8	--	2900	2600	410	440	650	33	5.3	19	322	0	3900	44	2.8	21	--	--	--	--	--
125TRVL	141-101-21BBC	SPRING	67-09-22	--	8.1	--	430	0	170	150	2600	85	35	.0	1800	0	5100	1.0	--	8.2	--	--	--	--	--
125TRVL	141-104-05BBB1	202	77-06-09	2600	7.1	9.0	47	0	9.3	5.8	610	96	39	2.5	486	12	920	7.3	.7	6.6	1690	1.0	570	5200	230
125TRVL	141-104-31AAA	62	75-06-27	3010	7.6	9.0	1600	1200	280	220	200	61	2.2	6.3	469	0	1600	9.9	.2	11	2780	11	120	380	60
125TRVL	141-105-26ADA	315	75-06-27	2590	8.4	10.5	45	0	8.8	5.6	590	96	38	1.6	698	11	730	7.8	.6	5.8	1720	1.0	470	830	1400
125TRVL	141-105-34CCC	180	75-06-13	2450	8.3	15.5	38	0	7.8	4.5	600	97	42	2.0	1010	9	580	6.6	.6	5.8	1650	1.0	390	250	20
125TRVL	141-105-35CCC	210	75-06-13	1910	8.2	10.0	74	0	13	10	430	92	22	3.0	717	0	430	5.9	.4	5.7	1270	2.5	670	40	60
125TRVL	142-101-31CDA	444	67-09-22	--	8.8	12.5	8	0	2.4	.5	460	99	71	.0	860	30	240	3.2	--	9.3	--	--	--	--	--
125TRVL		444	68-08-31	--	8.8	12.0	10	0	1.6	1.5	450	99	61	2.3	830	34	250	11	4.4	9.0	--	--	--	--	--
125TRVL	142-101-31DDA	570	67-09-22	--	8.6	12.5	8	0	2.4	.5	450	99	69	.0	772	39	260	4.8	--	11	--	--	--	--	--
125TRVL		570	68-08-31	--	8.6	14.0	10	0	1.6	1.5	430	99	59	2.2	760	38	270	14	3.2	9.5	--	--	--	--	--
125TRVL	142-102-12CCA	430	67-10-10	2100	8.1	14.0	20	0	3.2	2.9	510	98	50	.0	1120	0	200	3.0	--	11	--	--	--	--	--
125TRVL	142-102-25ADB	350	67-09-23	2150	8.2	12.0	12	0	2.4	1.5	490	99	61	.0	880	36	440	7.4	--	10	--	--	--	--	--
125TRVL	143-102-15ACD	400	67-09-23	2100	8.2	12.5	10	0	2.4	1.0	500	99	68	.0	1030	19	210	1.0	--	9.9	--	--	--	--	--
125TRVL	143-102-22BBA	400	67-09-23	2000	8.3	13.5	10	0	1.6	1.5	530	99	72	.0	1080	22	240	.8	--	10	--	--	--	--	--
125TRVL	143-102-26CCD	380	68-08-30	2200	8.4	11.5	10	0	1.6	1.5	550	99	75	2.8	1130	22	200	2.0	4.5	10	--	--	--	--	--
125TRVL	143-103-14DBC	446	76-11-04	2200	8.9	10.0	18	0	4.2	1.8	470	98	48	3.6	669	50	350	11	4.4	6.6	1230	1.2	530	420	30
125TRVL	143-104-30ACC	122	75-06-12	2670	8.3	11.0	62	0	6.6	11	610	95	34	1.7	569	7	880	13	1.8	5.0	1650	.70	240	540	60
125TRVL	143-105-24CBA	420	74-12-19	1600	8.5	7.0	18	0	4.4	.5	470	98	48	1.6	760	19	370	13	1.5	6.0	1220	2.6	630	230	20
125TRVL	143-105-10BBA	415	75-06-12	1760	8.0	12.5	140	0	25	19	370	85	14	2.5	746	0	340	6.3	2.1	5.8	1180	2.5	470	130	60
125TRVL	143-105-33ACA1	179	77-08-16	--	--	--	34	0	5.8	4.7	520	97	39	2.1	671	15	570	12	1.7	6.8	--	1.0	430	3000	80
125TRVL	144-102-16CCC	500	69-07-09	2050	8.3	10.5	10	0	1.6	1.5	610	99	83	2.4	1570	32	19	.5	1.6	8.7	--	--	--	--	--
125TRVL	144-102-20ADC1	375	68-08-30	2000	8.3	11.0	8	0	3.2	.0	510	99	79	2.5	1120	19	140	2.0	4.2	9.0	--	--	--	--	--
125TRVL	144-102-20ADC2	626	68-08-30	1590	8.4	12.5	6	0	1.6	.5	520	99	92	2.5	1300	29	22	8.5	2.7	10	--	--	--	--	--
125TRVL	144-104-06BCB	220	75-06-12	4100	7.7	12.0	420	0	58	64	920	83	20	5.5	1010	--	1600	5.1	.6	5.7	3140	2.5	870	3000	140
125TRVL	144-105-25ADD	480	75-06-13	1960	8.7	7.0	16	0	2.9	2.2	450	98	49	1.4	590	22	470	11	3.0	5.9	1280	1.0	430	380	20
125TRVL	144-105-32CCA	120	75-06-12	5010	7.3	9.5	1400	520	220	210	840	56	9.7	6.7	1090	0	2300	5.6	.2	6.3	4150	1.0	1500	1100	740
125TRVL	144-105-33BBC	374	76-04-04	1770	8.8	--	40	0	1.6	8.8	460	96	32	4.4	992	41	130	11	4.4	1.4	1360	1.3	110	5600	--

PRINCIPAL AQUIFER	LOCAL IDENTIFIER	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)	HARDNESS, NONCARBONATE (MG/L CACO3)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE (MG/L AS HCO3)	CARBONATE (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 NO3)	BORON, DISSOLVED (UG/L AS B)	IRON, DISSOLVED (UG/L AS FE)	MANGANESE, DISSOLVED (UG/L AS MN)
211MCFM	133-099-02CBB	1404	74-06-29	1980	8.6	--	13	0	2.7	1.6	470	99	56	1.8	890	34	140	80	3.8	9.8	1240	1.0	1700	310	40
211MCFM		1404	75-06-26	1920	8.7	13.0	12	0	2.6	1.5	480	99	60	1.9	891	32	150	80	4.0	9.4	1230	1.6	1800	750	10
211MCFM	133-099-32BBA	1252	74-08-28	1830	8.7	--	16	0	2.8	2.6	450	98	48	1.2	830	36	180	64	3.2	9.3	1140	2.6	1300	410	40
211MCFM	133-103-23ADC	671	75-07-08	1600	9.1	11.0	6	0	1.4	.6	410	99	73	5.5	814	91	65	8.2	6.5	5.5	1010	1.0	1000	290	10
211MCFM	133-105-30CCC	215	74-07-23	2570	8.7	14.0	22	0	5.9	1.8	610	96	56	1.5	700	28	720	9.8	.3	5.6	1720	.60	280	240	0
211MCFM	133-106-13AUB2	228	77-09-21	2400	8.5	11.0	31	0	6.1	5.1	570	97	44	1.8	678	25	660	8.1	.2	32	1560	1.0	380	80	40
211MCFM	133-106-34BAA	104	75-10-09	1950	8.8	8.5	11	--	3.0	.8	460	99	70	1.5	728	14	420	9.5	.3	8.7	1290	--	250	70	10
211MCFM		104	75-10-31	1960	8.8	8.5	11	--	3.0	.8	460	99	61	1.4	--	--	430	4.7	--	9.4	--	--	--	60	0
211MCFM	134-104-24DDD1	1300	75-10-02	1800	8.8	20.0	19	0	3.1	2.8	400	97	40	2.5	653	45	150	110	1.0	11	1070	--	940	250	10
211MCFM	134-105-09BAA	463	75-07-16	1420	8.8	12.5	14	0	1.9	2.3	330	98	38	.8	527	28	230	23	.7	5.0	887	2.5	310	270	20
211MCFM	134-105-26BAA	536	75-07-08	1480	8.6	14.0	7	0	1.8	.6	360	99	59	1.5	623	33	220	9.0	.6	7.3	952	2.0	350	210	10
211MCFM	135-102-03CDB	945	75-07-18	1780	8.7	17.5	12	0	2.3	1.6	420	98	52	1.8	712	29	220	66	2.1	6.4	1140	1.0	1300	350	0
211MCFM	135-102-19DAA	1080	75-07-08	1910	8.7	20.0	12	0	2.1	1.7	460	98	57	1.6	822	35	56	170	1.6	8.2	1140	1.0	1300	250	10
211MCFM	135-104-19CDD	740	75-07-16	1500	8.6	14.0	13	0	2.1	2.0	360	98	43	1.2	630	22	200	14	2.3	6.1	964	2.0	790	250	10
211MCFM	136-100-31DDC1	1725	75-10-03	1920	9.1	21.0	14	0	4.7	.6	470	98	54	1.5	742	87	220	57	2.3	13	1230	--	1300	80	10
211MCFM	136-102-11DAC	1120	69-07-02	1600	8.4	17.8	2	0	.8	.0	410	100	126	1.6	710	41	220	25	2.3	16	--	--	--	--	--
211MCFM	136-102-15ACC	1091	74-08-21	1700	8.6	15.5	9	0	2.1	1.0	420	99	60	1.3	730	30	140	88	3.6	9.9	1060	2.1	940	130	20
211MCFM	136-102-20BBD	1120	69-07-28	1550	8.6	18.0	4	0	.8	.5	410	99	89	1.6	700	31	220	28	2.1	14	--	--	--	--	--
211MCFM	136-102-21DBD	1100	69-07-03	1610	8.6	17.0	6	0	1.2	.7	400	99	72	1.6	730	34	220	22	2.8	14	--	--	--	--	--
211MCFM	136-103-14ADA	840	69-07-03	1650	8.5	15.5	4	0	.8	.5	410	99	89	1.7	720	41	220	18	2.5	12	--	--	--	--	--
211MCFM	136-103-23ADB	850	69-07-03	1600	8.5	13.5	6	0	1.6	.5	400	99	71	1.4	698	46	220	21	2.2	13	--	--	--	--	--
211MCFM	136-103-24ABD	840	69-07-03	1600	8.6	13.5	4	0	.8	.5	400	99	86	1.6	730	34	220	22	2.5	14	--	--	--	--	--
211MCFM	136-104-12BAU	987	75-07-23	1670	8.8	18.0	14	0	2.4	2.0	390	98	45	3.5	593	32	300	85	1.8	7.0	1020	1.0	350	80	10
211MCFM	137-101-29CCA	865	69-07-02	1680	8.5	17.5	6	0	1.6	.5	410	99	73	1.8	850	41	110	19	5.3	14	--	--	--	--	--
211MCFM	137-101-30ABC	925	69-06-24	1520	8.6	18.0	3	0	.8	.2	390	99	101	1.7	750	32	170	83	2.6	16	--	--	--	--	--
211MCFM	137-101-30BBC	925	74-08-13	1610	8.9	18.0	5	0	1.5	.4	390	99	73	1.2	710	37	180	27	3.8	10	1010	1.0	790	120	20
211MCFM		807	69-06-24	1590	8.5	16.0	2	0	.8	.0	400	100	123	1.8	860	32	110	15	3.1	14	--	--	--	--	--
211MCFM	137-102-06CBD	940	69-06-20	1600	8.7	18.5	7	0	.8	1.2	420	99	69	1.8	750	31	240	7.5	3.9	15	--	--	--	--	--
211MCFM	137-103-12BAB	950	69-06-20	1600	8.8	20.0	7	0	.4	1.5	400	99	65	1.7	620	36	200	31	2.8	15	--	--	--	--	--
211MCFM	137-105-10ABB	940	74-09-19	2020	8.6	17.0	19	0	5.9	1.1	500	98	50	1.4	770	21	370	18	1.8	9.7	1220	1.0	310	210	0
211MCFM	138-102-34DDA	988	69-06-24	--	8.6	18.0	3	0	.4	.5	400	99	108	1.7	690	38	210	27	2.3	16	--	--	--	--	--
211MCFM		988	74-08-13	1600	8.9	18.0	5	0	1.2	.5	410	99	79	.9	650	42	210	28	3.0	11	992	1.0	790	100	20
211MCFM	138-103-13BAA	880	74-09-20	1620	8.6	--	14	0	2.2	2.1	400	98	46	1.1	605	36	270	30	1.8	14	1050	1.0	910	130	20
211MCFM	138-106-25DDA	967	75-03-05	1780	8.7	13.5	10	0	1.5	1.6	420	99	57	.9	717	24	280	21	2.1	9.4	1100	2.5	830	80	20
211MCFM	139-102-02DCA	1100	69-06-23	1650	8.7	17.0	5	0	.8	.7	420	99	83	1.6	730	40	220	39	2.5	16	--	--	--	--	--
211MCFM	139-102-14DBD	1096	69-06-23	--	8.8	29.0	3	0	1.2	.0	410	99	105	1.8	735	32	210	41	2.4	16	--	--	--	--	--
211MCFM	139-102-17CAC2	1125	74-08-14	1700	9.0	17.0	8	0	2.0	.7	410	99	64	1.1	660	39	250	32	3.6	9.9	1100	1.0	900	1100	40
211MCFM	139-105-13BBC	1200	74-09-19	1840	8.6	16.0	11	0	3.0	.9	440	99	57	1.3	760	27	270	24	3.6	9.8	1150	3.5	790	340	0
211MCFM	140-100-28CAB	1770	75-07-10	1670	8.7	12.0	13	0	1.6	2.2	410	98	49	2.3	794	31	160	36	4.6	11	1090	--	1200	230	0
211MCFM	140-101-35DAD	1070	73-07-25	1590	8.7	28.0	5	0	1.5	.4	420	99	79	1.5	746	42	120	67	3.1	15	1050	--	1100	90	10
211MCFM	140-102-06DCC	1070	75-10-31	1690	8.8	--	13	--	4.3	.5	410	98	50	1.8	--	--	120	68	2.8	15	--	--	--	40	0
211MCFM		1250	68-08-29	--	8.6	14.0	8	0	2.4	.5	420	99	64	1.8	660	38	280	37	5.1	16	--	--	--	--	--
211MCFM		1250	74-08-15	1750	8.9	14.0	4	0	1.4	.1	430	99	95	1.1	680	40	260	37	4.6	10	1090	1.9	1100	140	20
211MCFM	140-102-19DDA	1196	66-08-08	--	--	--	12	0	4.8	.0	510	99	66	.8	120	77	.0	8.6	2.0	.0	--	--	--	--	--
211MCFM		1196	67-09-01	--	8.6	17.5	6	0	2.4	.0	460	99	82	.9	519	47	476	12	--	10	--	--	--	--	--
211MCFM		1196	67-09-18	--	9.0	16.0	12	0	4.0	.5	450	99	56	.8	560	36	440	11	--	11	--	--	--	--	--
211MCFM		1196	67-10-06	--	7.6	13.5	490	290	150	26	220	49	4.3	.0	250	0	720	14	--	15	--	--	--	--	--
211MCFM		1196	68-08-28	--	8.3	13.5	18	0	5.6	1.0	450	98	46	1.8	540	29	480	9.0	1.6	10	--	--	--	--	--
211MCFM		1196	68-08-28	--	8.6	20.0	8	0	2.8	.2	430	99	67	1.8	590	42	260	35	3.6	14	--	--	--	--	--
211MCFM		1196	68-09-04	--	7.3	16.0	410	150	130	19	330	63	7.1	10	320	0	880	15	.9	14	--	--	--	--	--
211MCFM		1196	69-06-17	--	8.3	11.5	4	0	1.2	.2	450	99	100	1.8	590	19	500	7.0	1.4	9.8	--	--	--	--	--
211MCFM		1196	69-10-31	--	7.7	--	590	380	170	40	260	48	4.7	9.8	250	0	850	15	.8	11	--	--	--	--	--
211MCFM		1196	69-10-31	--	8.6	--	12	0	2.8	1.2	480	99	60	1.6	590	41	500	6.5	1.7	9.0	--	--	--	--	--
211MCFM		1196	69-10-31	--	8.6	--	13	0	2.6	1.6	420	98	51	1.2	670	26	260	44	4.2	8.8	1110	3.8	1100	100	10
211MCFM	140-102-16DCC	1200	74-09-20	1800	8.6	14.0	13	0	3.1	1.3	410	98	49	1.2	668	38	220	56	1.7	13	1080	1.9	920	230	0
211MCFM	140-102-22DBD	1050	76-11-17	1700	8.8	19.5	13	0	3.1	1.3	410	98	49	1.2	668	38	220	56	1.7	13	1080	1.9	920	230	0
211MCFM	140-102-22DCD	1045	74-07-18	1700	8.8	22.0	10	0	3.1	.6	410	99	56	1.1	680	30	220	48	4.2	14	1060	1.0	1000	0	20
211MCFM		1045	75-08-06	1750	--	21.0	6	0	1.6	.4	410	99	75	1.5	738	--	220	51	2.6	14	1070	--	930	60	0
211MCFM		1045	75-10-31	1720	8.8	22.0	4	--	1.1	.3	410	99	89	1.3	--	--	220	59	2.6	14	--	--	--	60	0
211MCFM		1045	75-10-31	--	--	--	4	0	1.1	.3	410	99	91	.0	740	50	220	38	--	17	--	--	--	--	--
211MCFM	140-102-26ACC	1190	67-09-18	--	--	--	10	0	4.0	.0	440	--	46	--	580	22	220	38	--	17	--	--	--	--	--
211MCFM	140-102-26BBB	1040	67-10-06	--	--	--	14	0	3.2	1.5	400	--	46	--	580	22	220	38	--	17	--	--	--	--	--

PRINCIPAL AQUIFER	LOCAL IDENTIFIER	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)	HARDNESS, NONCARBONATE (MG/L CACO3)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE (MG/L AS HCO3)	CARBONATE (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 NO3)	BORON, DISSOLVED (UG/L AS B)	IRON, DISSOLVED (UG/L AS FE)	MANGANESE, DISSOLVED (UG/L AS MN)
211HGFM	140-102-26BBB	1040	68-08-28	--	--	--	16	0	3.2	1.0	420	98	53	1.8	660	46	270	36	2.8	15	--	--	--	--	--
211HGFM		1040	73-06-13	1670	8.6	20.0	8	0	2.7	.4	410	99	62	1.3	677	32	220	41	3.0	14	1130	--	--	0	0
211HGFM	140-102-26BCA	1080	68-09-06	--	--	--	8	0	3.2	.0	410	97	63	10	670	38	260	44	2.8	15	--	--	--	--	--
211HGFM		1080	74-07-18	1680	8.8	22.0	9	0	2.9	.5	410	99	59	.9	730	33	190	37	4.4	14	1060	1.0	940	140	20
211HGFM	140-102-27ACB1	1120	69-08-01	1700	8.8	19.0	5	0	1.2	.5	440	99	85	1.9	780	53	170	42	3.3	14	--	--	--	--	--
211HGFM	140-102-34AAU	1100	69-06-25	1700	8.8	20.0	3	0	1.2	.0	400	99	101	1.7	710	38	280	31	2.8	15	--	--	--	--	--
211HGFM	140-103-02COC	1455	74-09-20	1790	8.6	13.0	15	0	2.1	2.4	440	98	49	1.2	710	30	220	65	4.8	9.5	1170	1.9	1200	230	20
211HGFM	140-104-12ADB	1350	75-03-06	1670	8.6	13.5	8	0	1.6	1.0	430	99	66	1.7	666	23	300	38	3.6	11	1100	2.5	1400	130	10
211HGFM	140-104-15BBD	1400	75-03-05	1820	8.6	13.0	7	0	2.0	.5	430	99	70	2.3	674	22	310	38	3.4	10	1160	2.5	830	100	10
211HGFM	140-105-14ABA	1553	75-07-01	1690	8.8	22.0	12	0	4.0	.5	450	99	58	1.8	708	35	320	37	2.9	10	1280	1.0	1100	330	0
211HGFM	140-105-30CCC1	1251	77-10-13	2060	8.7	10.0	110	0	13	19	570	92	24	3.3	728	39	640	31	.7	7.3	1680	1.0	810	40	20
211HGFM	140-106-25CBB1	1259	62-06-25	--	--	--	22	0	4.0	3.0	510	--	47	--	710	36	420	20	1.4	.0	--	--	--	--	--
211HGFM		1259	74-08-07	2170	8.5	21.5	15	0	3.6	1.5	530	99	59	1.3	790	18	430	23	1.9	11	1430	.50	280	80	20
211HGFM	141-100-30ACA	1365	75-07-10	1690	8.7	19.0	9	0	1.8	1.1	410	99	59	2.1	765	30	170	37	5.1	10	1040	2.0	900	210	0
211HGFM	141-101-02AAC	1300	69-08-30	1700	7.9	16.5	0	0	.0	.0	440	100	--	2.0	890	0	150	46	3.4	15	--	--	--	--	--
211HGFM	141-101-21DCB	1280	67-09-20	1700	8.4	11.0	8	0	2.4	.5	430	--	66	--	760	42	200	33	--	16	--	--	--	--	--
211HGFM	141-101-21CAC	1200	67-09-01	1680	8.6	20.0	20	0	1.6	3.9	400	--	39	--	620	72	190	42	--	12	--	--	--	--	--
211HGFM		1200	68-08-31	--	8.6	18.0	5	0	1.6	.2	410	99	81	2.0	740	42	190	38	3.6	13	--	--	--	--	--
211HGFM	142-101-33UBA	1333	69-08-30	2400	8.6	19.0	1	0	.4	.0	960	100	209	1.9	820	41	190	35	3.4	15	--	--	--	--	--
211HGFM	142-102-04BC0	817	68-08-30	--	8.3	14.5	8	0	3.2	.0	570	99	88	2.8	1500	26	12	2.0	2.5	11	--	--	--	--	--
211HGFM	143-102-01BBU	1250	67-09-23	1700	8.4	18.0	8	0	2.4	.5	420	--	64	--	830	35	130	30	--	17	--	--	--	--	--
211HGFM		1250	68-10-05	--	8.4	19.5	3	0	.8	.2	470	100	122	1.8	870	29	140	48	4.4	15	--	--	--	--	--
211HGFM	143-102-29AAU	1200	68-08-30	--	8.6	16.5	27	0	2.4	5.0	450	97	38	1.8	750	42	250	44	3.7	16	--	--	--	--	--
211HGFM	143-105-33BAB	1177	76-11-05	2050	8.6	16.5	11	0	3.5	.6	450	99	58	1.3	834	26	190	40	2.7	13	1180	.80	1100	730	20
211HGFM	144-099-14ABB	2106	75-03-05	1550	8.5	5.0	8	0	1.8	.9	430	99	65	1.3	969	22	7.0	84	6.8	13	1050	2.1	1800	270	10
211HGFM	144-100-24BBD1	2160	75-10-06	1720	8.6	20.5	6	0	1.8	.2	430	99	81	1.7	928	39	29	77	4.1	13	1070	--	1500	500	10
211HGFM		2160	75-10-31	1720	8.8	20.5	7	--	2.7	.1	450	99	73	1.6	--	--	29	78	4.5	15	--	--	--	420	0
211HGFM	144-101-15BCC	1540	74-12-19	1590	8.7	11.0	16	0	1.9	2.8	440	98	47	1.6	940	33	3.3	--	7.4	9.4	1070	--	1500	340	20
211HGFM	144-102-27UCC	1280	67-09-23	1800	8.3	17.0	8	0	3.2	.0	430	--	66	--	830	30	160	33	--	14	--	--	--	--	--
211HGFM		1200	68-10-05	--	8.4	19.5	4	0	1.6	.0	470	99	102	2.0	890	34	160	56	4.7	14	--	--	--	--	--
211HGFM	144-102-29BBA	1200	68-08-30	--	8.3	18.5	4	0	1.6	.0	440	99	96	2.0	810	34	170	49	4.1	13	--	--	--	--	--

TABLE 5.--Chemical analyses of surface water (during low flow)

DISCHARGE (ft^3/s)	DATE OF SAMPLE	SPECIFIC CONDUCTANCE (umho/cm @ 25°C)	pH (UNITS)	TEMPERATURE (DEG C)	HARDNESS (Ca,Mg) (mg/L)	NON-CARBONATE HARDNESS (mg/L)	DISSOLVED CALCIUM (Ca) (mg/L)	DISSOLVED MAGNESIUM (Mg) (mg/L)	DISSOLVED SODIUM (Na) (mg/L)	PERCENT SODIUM	SODIUM ADSORPTION RATIO	DISSOLVED POTASSIUM (K) (mg/L)	BICARBONATE (HCO_3) (mg/L)	CARBONATE (CO_3) (mg/L)	CARBON DIOXIDE (CO_2) (mg/L)	DISSOLVED SULFATE (SO_4) (mg/L)	DISSOLVED CHLORIDE (Cl) (mg/L)	DISSOLVED FLUORIDE (F) (mg/L)	DISSOLVED SILICA (SiO_2) (mg/L)	DISSOLVED SOLIDS (RESIDUE AT 180°C) (mg/L)	DISSOLVED NITRATE (N) (mg/L)	DISSOLVED NITRATE (NO_3) (mg/L)	DISSOLVED ORTHO PHOSPHATE (PO_4) (mg/L)	DISSOLVED BORON (B) (ug/L)	DISSOLVED IRON (Fe) (ug/L)	DISSOLVED MANGANESE (Mn) (ug/L)
132-106-07A (gaging station) LITTLE BEAVER CREEK NEAR HARMARTH																										
4.5	11-05-74	1,500	8.4	2.5	240	0	45	31	250	69	7.0	4.2	430	13	--	420	5.6	0.6	4.2	981	--	1.0	--	350	110	20
3.9	12-11-74	2,450	8.6	.5	350	0	120	12	390	70	9.1	5.2	660	0	--	640	8.6	.6	7.1	1,480	--	1.0	--	310	100	180
1.9	1-08-75	2,600	8.2	.0	450	0	83	59	400	66	8.2	5.2	720	0	--	720	9.0	.6	6.7	1,640	--	1.0	--	280	530	80
1.6	2-06-75	2,200	8.1	.0	410	0	80	51	390	67	8.2	5.3	724	0	--	650	9.5	.5	11	1,560	--	1.0	--	470	20	80
7.4	3-11-75	924	8.0	.0	190	0	37	24	130	58	4.1	8.0	295	0	--	240	4.2	.2	9.5	623	--	1.0	--	350	230	60
6.0	8-06-75	1,660	8.6	21.0	240	0	38	35	270	70	7.6	6.5	423	0	--	490	7.9	.2	1.8	1,080	--	2.5	--	80	130	10
2.1	9-04-75	1,800	8.7	17.0	250	0	41	36	310	72	8.5	7.8	436	4	--	540	8.4	.3	2.4	1,200	--	2.5	--	80	120	40
133-088-21BAA (gaging station) WHITE BUTTE FORK CEDAR CREEK NEAR SCRANTON																										
8.0	4-18-75	1,200	7.2	.5	300	210	58	38	140	49	3.5	8.8	113	0	--	500	6.4	.1	3.9	836	--	16	--	550	320	400
.32	11-04-75	4,300	8.1	12.0	1,600	1,200	280	220	540	42	5.9	14	446	0	--	2,300	26	.3	3.9	3,970	--	2.5	--	1,500	250	60
.08	11-01-76	5,500	8.3	8.0	2,100	1,700	750	55	810	45	7.7	19	423	5	--	3,400	34	.1	4.2	5,200	--	2.5	--	40	60	160
133-105-30CDA (gaging station) LITTLE MISSOURI RIVER AT HARMARTH																										
4.6	10-02-74	3,160	8.3	11.0	280	0	34	47	610	82	16	9.2	580	7	--	1,100	18	.7	2.6	2,060	--	1.0	--	710	80	20
7.5	10-06-76	2,000	8.8	9.0	200	0	39	25	430	81	13	12	414	27	--	720	16	.1	1.9	1,490	--	--	--	420	60	10
.76	8-02-77	2,250	8.5	25.5	260	0	50	33	450	78	12	13	317	18	--	950	18	.3	3.0	1,680	--	--	--	210	140	10
135-097-03BAC (low-flow site, Hettinger County) NORTH FORK CANNONBALL RIVER NEAR NEW ENGLAND																										
.12	10-29-75	6,000	7.9	6.5	2,000	1,500	310	300	790	46	7.7	13	572	0	--	3,100	27	.3	4.7	5,190	--	--	--	1,600	--	--
135-100-24AAA (low-flow site) NORTH FORK CANNONBALL RIVER NEAR AMIDON																										
.13	10-30-75	2,880	8.7	5.5	150	0	22	24	580	89	20	5.4	810	23	--	740	8.2	.6	2.7	1,830	--	--	--	570	--	--
136-100-14DDD (low-flow site) PHILBRICK CREEK NEAR AMIDON																										
11	10-30-75	2,350	8.4	4.0	270	0	45	38	430	77	11	6.5	662	11	--	570	8.4	.8	4.5	1,460	--	--	--	400	--	--
136-102-16BDD (low-flow site) SAND CREEK NEAR AMIDON																										
--	10-30-75	3,800	8.4	5.0	640	150	120	82	640	68	11	9.7	584	2	--	1,500	7.4	.5	8.3	2,620	--	--	--	1,200	--	--
1.5	11-18-76	2,900	8.8	1.0	280	0	56	34	540	80	14	5.0	529	28	--	960	6.0	.4	9.3	1,890	--	1.0	--	920	120	80
136-103-24DDA (gaging station) DEEP CREEK NEAR AMIDON																										
.01	10-31-75	6,000	8.0	7.5	1,300	750	200	190	1,000	62	12	27	649	0	--	2,800	29	.4	9.9	4,560	--	--	--	1,800	--	--
2.0	11-18-76	3,800	8.6	2.5	640	14	140	71	650	68	11	13	706	29	--	1,400	7.7	.3	10	2,660	--	1.0	--	70	190	150
140-102-01ACC (low-flow site) LITTLE MISSOURI AT BEEF CORRAL																										
--	11-15-76	3,500	8.3	.0	550	0	110	67	700	73	13	13	638	20	5.4	1,400	26	.2	9.7	2,720	0.23	1.0	0.05	640	130	60
140-102-11BDD (low-flow site) LITTLE MISSOURI AT PEACEFUL VALLEY JUNCTION																										
12	11-11-76	2,600	8.4	.0	380	0	78	45	510	74	11	9.7	438	27	3.1	1,000	18	.2	6.2	1,930	.23	1.0	.03	460	100	10
140-102-15ACC (low-flow site) LITTLE MISSOURI AT COTTONWOOD CAMPGROUND																										
19	11-11-76	2,600	8.4	.0	380	0	77	46	500	73	11	9.6	444	21	3.1	1,000	18	.2	5.4	1,920	.23	1.0	.04	460	40	30
140-102-27ADB (gaging station) LITTLE MISSOURI RIVER AT MEDORA																										
12	11-01-76	2,600	8.4	.0	370	0	75	44	500	74	11	9.6	443	22	--	1,000	18	.1	6.1	1,900	--	1.0	--	320	170	20
141-098-13C (gaging station) GREEN RIVER NEAR NEW HRADEC																										
.52	10-17-74	1,200	8.2	8.0	260	0	44	36	160	57	4.3	5.0	420	0	--	260	4.7	.6	3.3	702	--	1.0	--	430	20	20
8.2	3-21-75	525	8.3	.0	130	0	23	18	67	52	2.5	3.7	229	0	--	83	3.8	.3	5.3	325	--	2.5	--	290	110	100
2.0	10-17-75	1,020	8.2	8.0	240	0	43	32	130	54	3.7	4.4	391	0	--	190	14	.2	5.1	657	--	2.5	--	280	60	10
.16	7-20-76	1,090	8.5	24.0	210	0	35	30	190	66	5.7	5.3	401	23	--	220	6.0	.2	1.7	702	--	1.0	--	380	80	10
.84	10-19-76	1,035	8.7	3.5	220	0	44	27	160	60	4.7	6.3	375	16	--	220	5.9	.1	3.9	705	--	--	--	530	0	0
1.0	11-15-76	975	8.4	2.0	230	0	45	28	140	57	4.0	5.0	360	4	--	220	5.1	.4	5.3	641	--	--	--	330	40	20
141-101-06DAA (low-flow site) LITTLE MISSOURI AT GRIGG'S OLD PLACE																										
--	11-16-76	3,600	8.3	.5	550	0	110	67	710	73	13	13	627	22	5.4	1,500	25	.2	9.4	2,750	.23	1.0	.06	500	100	60
142-102-12CDC (low-flow site) LITTLE MISSOURI AT ASH COULEE CREEK																										
--	11-15-76	3,700	8.4	.5	540	21	100	71	700	73	13	14	595	20	4.0	1,400	25	.2	8.5	2,740	.23	1.0	--	850	210	10
144-102-05CBC (low-flow site) LITTLE MISSOURI NEAR GOLDSBERRY RANCH																										
--	11-15-76	3,500	8.3	.0	560	48	110	69	700	73	13	14	583	19	5.0	1,500	24	.2	9.3	2,720	.23	1.0	.06	600	130	60

TABLE 6.--Chemical analyses of ground water for trace constituents

Principal aquifer	Lower Tongue River and upper Ludlow Member						Lower Hell Creek Formation and Fox Hills Sandstone											
Location	133-101-09CDD	133-101-17ABB	133-101-19DCC	134-101-17DDD	134-101-18ABB	140-102-16DAA	133-106-34BAA	133-106-34BAA	134-104-24DDD1	136-100-31DDC1	140-101-35DAD	140-101-35DAD	140-101-35DAD	140-102-22DCD	140-102-22DCD	140-102-22DCD	144-100-24BBD1	144-100-24BBD1
Total depth of well (feet)	64	65	101	160	75	364	104	104	1,300	1,725	1,870	1,870	1,870	1,045	1,045	1,045	2,160	2,160
Date of sample	76-06-30	76-06-29	76-06-30	76-06-30	76-07-01	75-08-06	75-10-29	75-10-31	75-10-02	75-10-03	73-07-25	75-10-29	75-10-31	75-08-06	75-10-29	75-10-31	75-10-29	75-10-31
Dissolved aluminum (Al) (ug/L)	20	10	10	20	10	10	--	--	10	40	--	--	--	0	--	--	--	--
Dissolved arsenic (As) (ug/L)	2	0	1	2	0	0	--	--	0	1	2	--	--	0	--	--	--	--
Dissolved barium (Ba) (ug/L)	0	0	0	0	0	<100	--	0	0	0	0	--	0	<100	--	0	--	0
Dissolved beryllium (Be) (ug/L)	0	20	0	10	0	<10	--	--	0	10	0	--	--	<10	--	--	--	--
Dissolved chromium (Cr) (ug/L)	0	0	0	0	0	0	--	--	0	0	0	--	--	0	--	--	--	--
Dissolved cobalt (Co) (ug/L)	0	0	0	0	2	0	--	--	0	0	1	--	--	0	--	--	--	--
Dissolved copper (Cu) (ug/L)	3	2	4	5	3	0	--	--	0	1	7	--	--	0	--	--	--	--
Cyanide (Cn) (mg/L)	--	--	--	--	--	.00	--	--	.00	.00	.00	--	--	.00	--	--	--	--
Iodide (I) (mg/L)	--	--	--	--	--	--	--	.00	--	--	--	--	.26	--	--	.16	--	.34
Dissolved lead (Pb) (ug/L)	2	1	13	7	12	2	--	--	3	2	4	--	--	1	--	--	--	--
Dissolved lithium (Li) (ug/L)	20	40	110	30	90	30	--	50	40	50	60	--	50	50	--	50	--	70
Dissolved mercury (Hg) (ug/L)	.0	.0	.0	.0	.0	.2	--	--	.0	.0	.0	--	--	.4	--	--	--	--
Dissolved molybdenum (Mo) (ug/L)	1	1	0	5	1	4	--	0	3	6	2	--	1	1	--	2	--	1
Dissolved nickel (Ni) (ug/L)	2	2	4	4	4	2	--	--	2	2	4	--	--	0	--	--	--	--
Dissolved selenium (Se) (ug/L)	0	0	0	0	0	0	--	--	0	0	0	--	--	0	--	--	--	--
Dissolved silver (Ag) (ug/L)	--	--	--	--	--	0	--	--	0	0	0	--	--	0	--	--	--	--
Dissolved strontium (Sr) (ug/L)	190	1,800	1,000	560	2,300	80	--	130	140	130	70	--	100	60	--	90	--	130
Dissolved vanadium (V) (ug/L)	.7	.2	1.3	.8	.2	.5	--	7.8	3.9	4.4	2.3	--	4.1	1.8	--	1.9	--	3.4
Dissolved zinc (Zn) (ug/L)	20	10	10	90	40	0	--	30	10	10	10	--	0	0	--	0	--	0
Total organic carbon (C) (mg/L)	--	--	--	--	--	--	6.4	--	--	--	--	2.0	--	--	2.6	--	3.6	--

TABLE 7.--Chemical analyses of ground water for dissolved gases and sulfide in milligrams per liter

Location	Date of sample	Well depth (feet)	Dissolved nitrogen (N_2)	Dissolved oxygen (O_2)	Dissolved argon (Ar)	Dissolved methane (CH_4)	Dissolved carbon dioxide (CO_2)	Dissolved ethane (C_2H_6)	Dissolved helium (He)	Dissolved hydrogen (H_2)	Dissolved ammonia (NH_4^+)	Dissolved sulfur as sulfide
133-106-34BAA	10-09-75	104	23	0.13	--	<0.02	2.38	--	<0.001	--	0.92	--
140-102-16DAA	5- -74	364	36	.05	1.0	.07	1.23	--	--	--	.5	0.1
140-102-16DAA	10-15-77	--	--	--	--	--	--	--	--	--	--	--
140-102-22DCD	5- -74	1,045	35	.02	.9	.09	1.2	--	--	--	.7	.2
140-102-22DCD	9- -75	--	26	.01	--	.04	1.71	--	.006	--	.95	--
140-102-22DCD	10-15-75	--	--	--	--	--	--	--	--	--	--	--
140-106-25CBB1	11-17-74	1,259	40.2	<.009	1.27	.04	3.4	--	--	--	1.4	.41
140-106-25CBB3	11-17-74	110	36.3	.011	1.22	.18	56	--	--	--	.0	.1
140-106-25CBB3	10-15-75	--	--	--	--	--	--	--	--	--	--	--

TABLE 8.--Hydraulic parameters and particle-size distribution data from core samples[1/]

Principal aquifer/ location	Depth (feet)	Horizontal hydraulic conductivity (ft/d @ 70°C)	Porosity (percent)	Median size (millimeters)	Percent of sizes (diameter in millimeters)									
					Clay	Silt	Sand					Sorting coefficient	Skewness	Uniformity coefficient	Specific gravity of solids (gm/cc)
					<0.004	0.004-0.0625	Very fine 0.0625-0.125	Fine 0.125-0.25	Medium 0.25-0.5	Coarse 0.5-1.0	Very coarse 1.0-2.0				
Sentinel Butte Member															
144-100-24BAC2[2/]	290	--	--	0.12	--	12.9	40.0	7.0	34.2	4.8	1.1	2.4	2.6	--	--
Tongue River Member															
136-100-31DDC1	505	--	--	.03	14	83	3	--	--	--	--	1.9	--	--	--
138-105-07CCC[2/]	305	--	--	.04	22.5	36.3	32.7	8.5	--	--	--	4.1	.3	--	2.68
143-105-33BAB	290	--	--	.05	11	59	29	1	--	--	--	--	--	--	--
143-105-33BAB	393	0.006	25.8	.02	26	63	8	3	--	--	--	2.9	.4	--	--
143-105-33BAB	479	.00024	22.1	--	--	--	--	--	--	--	--	--	--	--	--
144-100-24BBD1	595	.5	32.8	.05	8	75	17	--	--	--	--	1.4	.7	8.1	--
144-100-24BBD1[2/]	745	--	--	.11	--	27.5	29.9	41.2	1.3	--	--	2.0	.6	--	--
144-100-24BBD1	880	--	30.4	.10	10	26	41	23	--	--	28.7	2.0	.4	--	--
Upper Ludlow Member															
136-100-31DDC1	695	.7	38.3	.15	10	17	9	62	2	--	--	1.9	.4	41.5	--
143-105-33BAB	513	--	--	.03	18	72	10	--	--	--	--	2.0	.7	--	--
Lebo Shale equivalent															
143-105-33BAB	643	.02	22.2	--	--	--	--	--	--	--	--	--	--	--	--
Lower Ludlow Member															
136-100-31DDC1	1,180	.6	34.9	.12	13	17	21	49	--	--	--	--	--	--	--
140-101-35DAD	1,390	--	--	.10	6	17	66	11	--	--	--	--	--	--	--
143-105-33BAB	690	--	25.4	.02	35	43	20	2	--	--	--	--	--	--	--
143-105-33BAB	954	.02	21.0	--	--	--	--	--	--	--	--	--	--	--	--
144-100-24BBD1	1,452	.50	33.2	.04	14	67	18	1	--	--	--	1.7	.7	--	--
144-100-24BBD1	1,480	.2	31.4	.03	27	45	26	2	--	--	--	--	--	15.2	--
144-100-24BBD1	1,523	.9	33.2	.04	12	67	19	1	1	--	--	1.7	.6	--	--
144-100-24BBD1	1,620	.8	33.0	.13	6	18	24	51	1	--	--	1.5	.7	18.2	--
144-100-24BBD1[2/]	1,640	--	--	.17	--	18.4	12.2	55.2	10.2	3.6	.4	1.5	.8	--	--
Hell Creek Formation															
136-100-31DDC1	1,247	.01	20.6	--	--	--	--	--	--	--	--	--	--	--	--
136-100-31DDC1	1,390	1.0	38.2	.16	11	18	8	53	10	--	--	--	--	--	--
136-100-31DDC1	1,394	.5	31.8	.21	5	14	6	49	22	4	--	1.4	.3	14.3	--
140-101-35DAD	1,690	--	--	.12	5	15	65	49	1	--	--	--	--	--	--
140-101-35DAD	1,710	--	--	.09	15	19	39	26	1	--	--	--	--	--	--
140-101-35DAD	1,728	--	--	.17	8	11	13	45	23	--	--	--	--	--	--
143-105-33BAB	1,003	.02	25.3	.02	33	50	15	2	--	--	--	--	--	--	--
143-105-33BAB	1,024	.003	19.3	--	--	--	--	--	--	--	--	--	--	--	--
143-105-33BAB	1,095	--	32.4	.16	7	14	7	51	20	1	--	1.5	.8	17.4	--
143-105-33BAB	1,124	.0012	21.4	--	--	--	--	--	--	--	--	--	--	--	--
144-100-24BBD1	1,792	.3	28.1	--	--	--	--	--	--	--	--	--	--	--	--
144-100-24BBD1	1,867	.3	27.3	.07	18	31	19	25	7	--	--	--	--	--	--
Fox Hills Sandstone															
136-100-31DDC1	1,480	1.4	34.9	.16	6	17	8	62	7	--	--	1.3	.6	15.2	--
136-100-31DDC1	1,594	.2	29.0	.04	17	46	28	9	--	--	--	2.6	.7	--	--
136-100-31DDC1	1,623	.02	31.7	.03	20	76	4	--	--	--	--	2.7	.3	--	--
136-100-31DDC1	1,684	.02	26.6	.01	38	61	1	--	--	--	--	--	--	--	--
140-101-35DAD	1,794	--	--	.17	6	11	8	70	5	--	--	--	--	--	--
140-101-35DAD	1,808	--	--	.15	4	10	18	63	3	2	--	1.2	.9	4.4	--
140-101-35DAD	1,810	.4	38.7	.15	6	10	19	60	5	--	--	1.3	.8	6.3	--
140-101-35DAD	1,844	--	--	.11	5	16	51	28	--	--	--	1.3	.8	6.3	--
140-101-35DAD	1,848	--	--	.09	6	20	65	9	--	--	--	1.4	.9	9.1	--
140-101-35DAD	1,860	--	--	.08	4	15	78	3	--	--	--	1.2	1.1	3.2	--
140-101-35DAD	1,867	2.0	40.2	.08	9	17	72	2	--	--	--	4.2	.3	--	--
140-101-35DAD	1,870	1.4	39.7	.08	9	17	71	3	--	--	--	--	--	--	--
143-105-33BAB	1,150	.9	31.7	.09	14	23	37	24	1	1	--	2.1	.5	--	--
143-105-33BAB	1,180	--	--	.15	12	21	11	45	10	1	--	2.2	--	--	--
143-105-33BAB	1,220	.3	33.4	.05	15	46	37	2	--	--	--	2.2	.5	--	--
143-105-33BAB	1,243	2.7	33.5	.12	8	19	22	40	3	2	6	1.8	.8	18.2	--
143-105-33BAB	1,292	1.6	32.6	.11	11	21	25	41	2	--	--	2.2	.4	33.0	--
143-105-33BAB	1,328	.2	31.3	.06	21	34	43	2	--	--	--	3.2	.2	--	--
143-105-33BAB	1,353	.4	35.3	.02	24	65	11	--	--	--	--	3.0	.6	--	--
143-105-33BAB	1,390	.1	32.0	.04	27	37	35	1	--	--	--	--	--	--	--
144-100-24BBD1	1,920	7.1	33.9	.22	11	17	7	25	38	2	--	2.8	.3	--	--
144-100-24BBD1	1,930	1.1	40.2	.11	11	12	36	32	--	--	--	1.9	.3	--	--
144-100-24BBD1	1,993	2.7	31.6	.14	6	18	18	54	4	--	--	1.5	.7	25.2	--
144-100-24BBD1	2,015	3.2	33.1	.10	11	19	57	13	--	--	--	1.7	.5	--	--
144-100-24BBD1	2,030	1.3	34.5	.08	13	22	60	5	--	--	--	1.6	.5	--	--
144-100-24BBD1	2,057	1.4	34.7	.11	11	20	52	17	--	--	--	1.9	.4	28.7	--
144-100-24BBD1	2,080	.2	32.3	.06	13	36	50	1	--	--	--	1.9	.4	--	--
Pierre Shale															
143-105-33BAB	1,458	.0036	21.8	--	--	--	--	--	--	--	--	--	--	--	--
144-100-24BBD1	2,129	.1	22.4	--	--	--	--	--	--	--	--	--	--	--	--

[1/] Analyses by Core Laboratory, Williston, N. Dak.
[2/] Analyses by U.S. Geological Survey Hydrologic Laboratory, Lakewood, Colo.

TABLE 9.--Heavy mineral analyses from core samples[1/]
(Percent heavy minerals per 300-grain sample)

Principal aquifer/ location	Depth (feet)	Total heavy minerals (percent)	Pyrite/marcasite	Magnetite/ilmenite	Rutile	Limonite	Euhedral carbonate	Muscovite	Biotite	Amphiboles: Glaucophane	Amphiboles: Anthophyllite	Amphiboles: Tremolite/ actinolite	Amphiboles: Hornblende	Tourmaline	Zoisite	Clinozoisite	Epidote	Staurolite	Garnet	Zircon	Sphene	Unidentified
Sentinel Butte Member																						
144-100-24BBD1	290	7.7	--	1	--	--	91	--	3	--	--	--	--	<1	1	2	<1	--	3	--	--	1
Tongue River Member																						
136-100-31DDC1	675	1.5	--	24	1	18	--	--	13	--	--	--	1	3	6	2	11	--	15	4	--	1
138-105-07CCD	304.6 to 305.0	--	<1	21	1	2	--	--	7	--	--	--	2	16	21	1	11	--	10	6	1	<1
142-101-18CBD2	235	.6	5	2	--	25	27	1	34	--	2	--	1	--	<1	--	--	--	--	--	--	1
144-100-24BBD1	745	1.5	--	14	1	11	37	--	5	--	<1	--	9	4	5	--	5	--	6	2	--	1
144-100-24BBD1	880	.3	6	14	--	7	36	--	7	--	--	--	1	7	7	--	--	--	9	4	1	1
Lower Ludlow Member																						
136-100-31DDC1	1,180	9.0	--	21	1	10	--	<1	12	--	--	--	1	1	10	1	18	--	17	6	--	1
143-105-33BAB	690	.3	--	18	--	66	--	--	1	--	--	--	--	1	--	3	2	--	6	1	1	1
144-100-24BBD1	1,620	1.0	--	8	--	1	22	--	29	--	--	--	--	8	8	--	<1	--	20	3	--	1
144-100-24BBD1	1,640	2.0	--	1	1	58	8	--	14	--	--	--	--	3	2	<1	1	--	10	1	--	1
Hell Creek Formation																						
136-100-31DDC1	1,390	1.1	<1	33	--	31	2	1	7	--	<1	--	4	<1	6	--	8	--	4	--	--	2
136-100-31DDC1	1,394	3.6	--	30	--	46	--	--	1	--	--	--	4	--	2	--	9	--	5	2	--	2
143-105-33BAB	1,095	1.1	--	29	<1	48	--	--	1	--	--	--	2	<1	1	2	7	--	7	<1	2	1
144-100-24BBD1	1,867	.5	<1	23	<1	4	--	--	37	--	<1	--	--	3	11	--	9	--	11	1	1	--
Fox Hills Sandstone																						
133-106-13ADB2	224	.3	--	34	--	1	<1	4	25	--	--	8	--	--	2	--	9	--	8	1	1	2
136-100-31DDC1	1,480	.7	--	26	1	20	--	--	21	--	--	--	12	--	3	--	12	--	3	1	--	1
143-105-33BAB	1,150	1.7	--	29	<1	26	<1	1	11	--	--	--	7	1	4	--	10	--	9	2	--	1
143-105-33BAB	1,180	.5	--	25	<1	43	--	<1	6	--	--	--	1	1	5	--	12	--	6	--	--	1
143-105-33BAB	1,220	.2	--	24	--	10	--	--	18	--	<1	--	2	4	18	1	10	--	8	3	--	1
143-105-33BAB	1,243	.7	--	14	1	69	--	--	6	--	--	--	<1	<1	3	--	4	--	1	<1	--	1
143-105-33BAB	1,292	.2	--	24	<1	5	--	--	17	--	2	--	3	5	8	1	9	--	13	12	--	1
143-105-33BAB	1,328	.3	--	5	--	16	--	--	44	--	<1	--	6	7	8	1	5	--	5	3	--	1
143-105-33BAB	1,390	.6	--	22	--	5	1	--	6	<1	1	--	2	2	18	3	19	--	12	8	--	1
144-100-24BBD1	1,920	<.1	<1	30	1	20	1	--	19	--	--	--	2	2	4	1	8	--	6	2	2	<1
144-100-24BBD1	1,993	.1	--	28	<1	6	1	--	33	--	<1	--	1	3	3	--	16	--	5	2	--	1
144-100-24BBD1	2,015	--	--	33	1	2	--	--	34	--	--	--	--	4	5	<1	8	--	5	6	--	1
144-100-24BBD1	2,030	.2	--	17	--	19	--	1	40	--	--	--	1	4	6	--	4	--	6	--	<1	1
144-100-24BBD1	2,057	.6	--	7	--	9	--	--	21	<1	--	1	<1	19	20	--	15	<1	6	1	--	--
144-100-24BBD1	2,080	.9	1	14	1	4	3	--	16	--	1	--	--	19	15	--	1	--	16	7	--	1

[1/] Analyses by U.S. Geological Survey Hydrologic Laboratory, Lakewood, Colo.