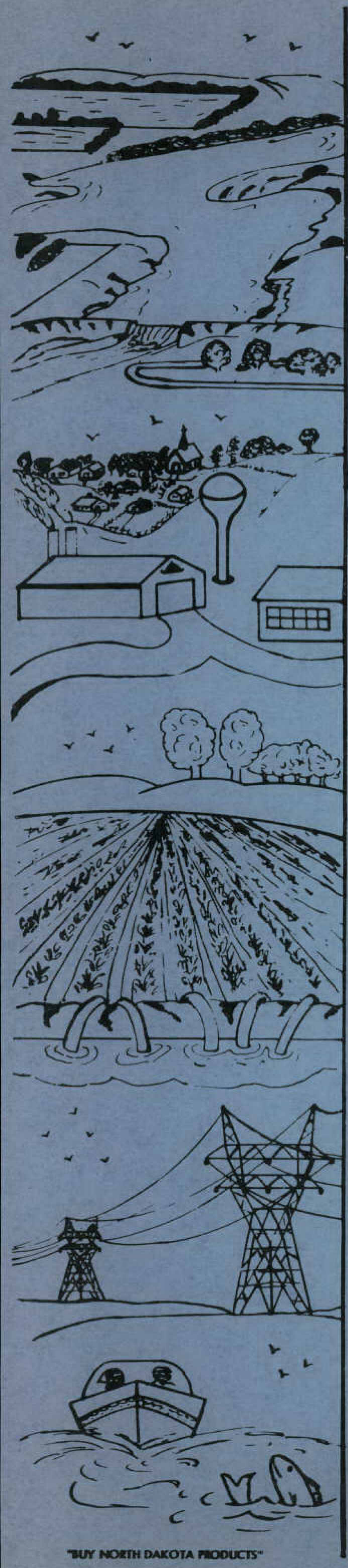

GEOLOGY AND GROUND-WATER RESOURCES OF THE LINTON-STRASBURG AREA EMMONS COUNTY, NORTH DAKOTA

By

P. G. Randich
Geological Survey
United States Department of Interior

NORTH DAKOTA GROUND WATER STUDIES

NO. 50

Prepared by the United States Geological Survey in cooperation with the North Dakota State Water Conservation Commission, and the North Dakota Geological Survey

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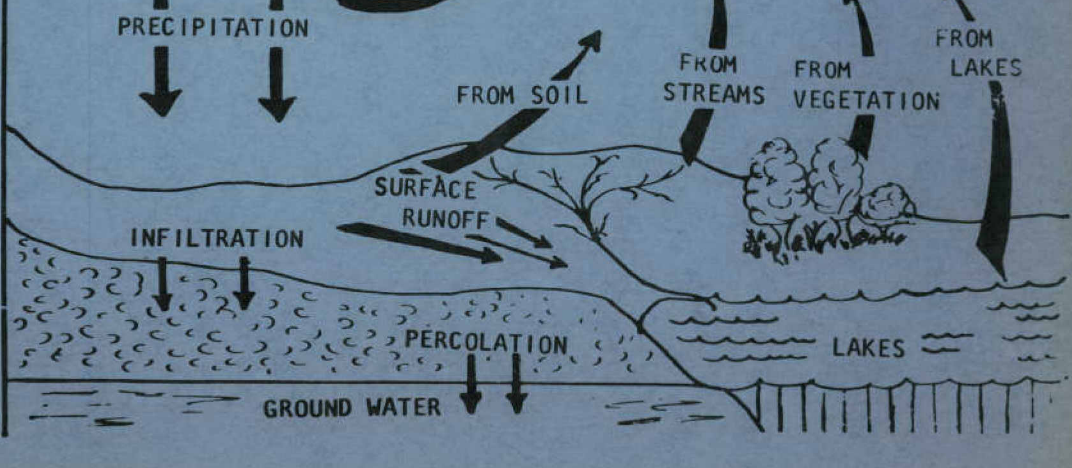
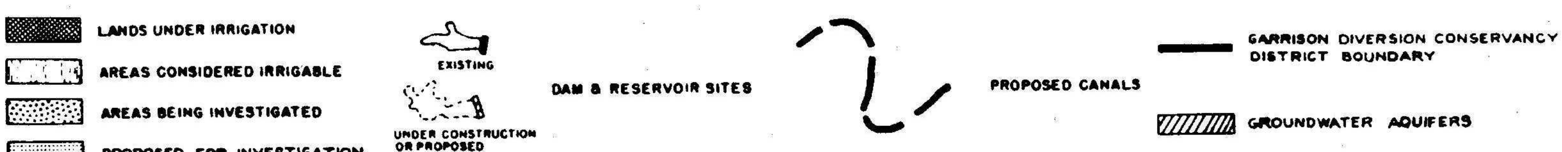


NORTH DAKOTA STATE WATER CONSERVATION COMMISSION

WATER RESOURCES DEVELOPMENT PLAN



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GEOLOGY AND GROUND-WATER RESOURCES OF THE LINTON-STRASBURG AREA, EMMONS COUNTY, NORTH DAKOTA

By
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ABSTRACT

The stratigraphic units in the Linton-Strasburg area include rocks of Paleozoic, Mesozoic, and Cenozoic age. Ground water in usable quantities is found in rocks of Cretaceous and younger age; thus only these rocks are described in this investigation.

The Dakota Sandstone of Early Cretaceous age lies about 2,500 feet below the land surface. It is an extensive artesian aquifer in North Dakota, and flowing wells that yield approximately 35 gpm (gallons per minute) from the Dakota Sandstone are located immediately southeast of the project area.

The Pierre Shale, Fox Hills Sandstone, and Hell Creek Formation of Late Cretaceous age are exposed in the area. The Pierre Shale yields small supplies of water to wells; but it is generally not a good source of water. The Fox Hills Sandstone yields water to many wells in the area. The Hell Creek Formation is not an aquifer in the area.

Glacial drift of Pleistocene age mantles much of the area and is a major source of ground water. The glacial drift consists of till and associated sand and gravel deposits and stratified outwash deposits. Till does not ordinarily yield water readily to wells, but within the till are deposits of sand and gravel; these deposits are generally

aquifers, although recharge through the till is so slow that large yields are not likely. Outwash deposits consist of larger continuous bodies of sand and gravel deposited by glacial streams. The deposits are found in the main drainage channels and are probably continuous in the valley of Beaver Creek. The deposits yield sufficient water for present municipal, farm and domestic use and probably for medium-sized industrial or irrigation developments.

Deposits of Recent age are: (1) colluvium and alluvium and (2) eolian deposits. The deposits are thin and discontinuous; they are unsaturated at most places and elsewhere contain only small quantities of water.

Water of satisfactory quality to meet U.S. Public Health Standards probably does not exist in the area. Chemical analyses show that the ground water generally contains large amounts of dissolved solids.

INTRODUCTION

Purpose and Scope of Investigation

The North Dakota State Water Conservation Commission, North Dakota Geological Survey, and the U.S. Geological Survey cooperate to study ground-water resources in North Dakota. Several ground-water investigations have begun in the vicinity of towns or cities that request aid in locating ground-water supplies. In 1957 both Linton and Strasburg requested aid to locate new sources of ground water of good quality for municipal water supplies. The results of the investigation in 1957 and later years, including the study of the surface and subsurface geology, well records, quality-of-water data, and logs from test drilling, are presented in this report.

Location and General Features of the Area

The project includes approximately 430 square miles, surrounding the cities of Linton and Strasburg, population 1,826 and 612, respectively (1960 census). These cities are in the central part of Emmons County in south-central North Dakota. (See fig. 1.) According to U.S. Weather Bureau records for a 45-year period, the average annual precipitation at Linton is 16.57 inches, and the average annual temperature is 42.9°F. The economy is based mainly on crop and livestock production; the principal crops are wheat, barley, flax, oats, and hay.

Previous Investigations and Acknowledgments

Moraines in the northeastern and southeastern parts of Emmons County were mapped by Todd (1896). Leonard (1912) described the geology of south-central North Dakota; also Leonard (1916) discussed Pleistocene drainage changes in the region. Stanton (1917) recognized white volcanic ash beds in the Cretaceous sediments in the vicinity of Linton. A general study of the geology and ground-water resources of North Dakota, including some data on each county of the State, was made by Simpson (1929). Chemical analyses of water from wells in Linton and Strasburg are given by Abbott and Voedisch (1938, p. 59). The geology of Emmons County was mapped by Fisher (1952).

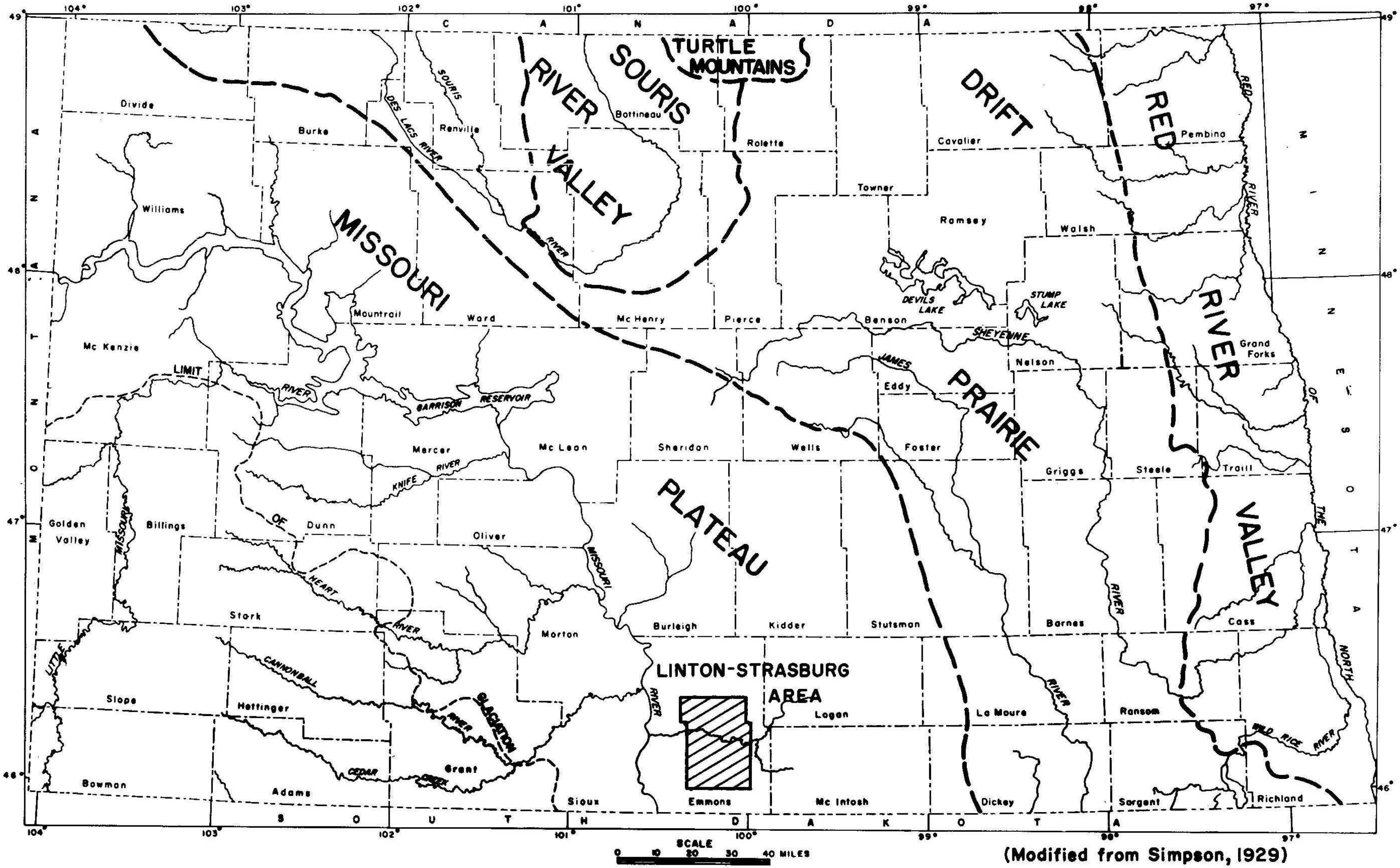

FIGURE 1--MAP SHOWING PHYSIOGRAPHIC PROVINCES IN NORTH DAKOTA AND LOCATION OF LINTON-STRASBURG AREA.

Well-Numbering System

The well-numbering system used in this report, illustrated in figure 2, is based upon the location of the well in the federal system of rectangular surveys of the public lands. The first numeral denotes the township north of the 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 sections, quarter-quarter sections, and quarter-quarter-quarter sections (10-acre tracts). Thus a typical well 131-76-15daa is in the NE$\frac{1}{4}$NE$\frac{1}{4}$SE$\frac{1}{4}$ sec. 15, T. 131 N., R. 76 W.

Physiographic Features

The Linton-Strasburg area is a part of the glaciated Missouri Plateau section of the Great Plains province of Fenneman (1931, p. 75) and Simpson (1929, p. 10-11). Most of the project area is gently rolling, and relief is moderate. The topography of that part of the area where glacial deposits are absent or relatively thin is characterized by high steep-sided, flat-topped buttes and conical hills. Those parts where glacial deposits are moderately thick are characterized by rounded hills, wide valleys, and, in places, numerous ponds and lakes.

The northern part of the area is drained by westward-flowing Beaver Creek. Its main tributaries are Sand, Spring, and Clear Creeks. Little Beaver Creek drains the southwestern part. Elsewhere, nonintegrated intermittent streams or draws drain into numerous ponds and lakes.

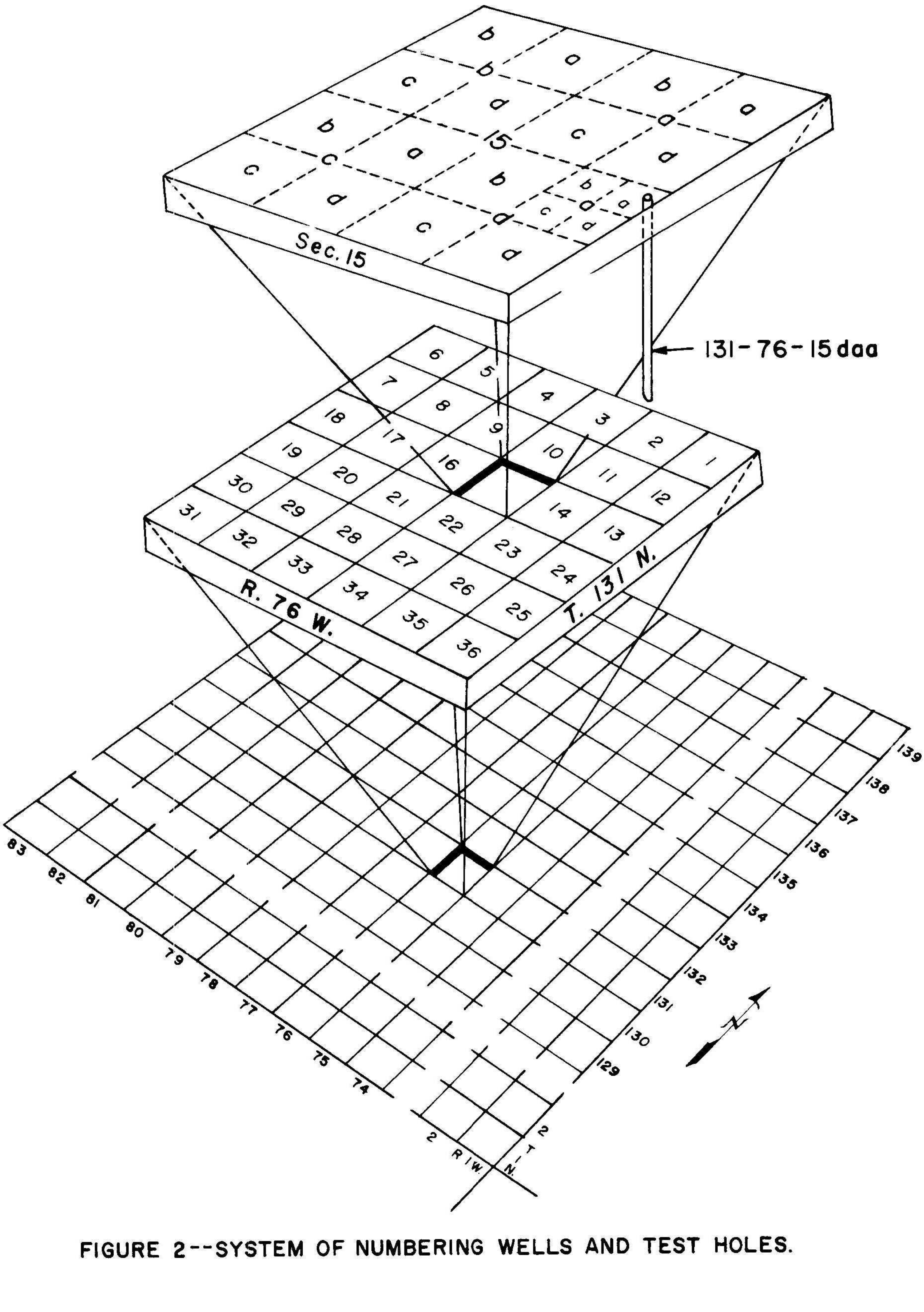

FIGURE 2--SYSTEM OF NUMBERING WELLS AND TEST HOLES.

GEOLOGY AND OCCURRENCE OF GROUND WATER

Geologic History

The character of the deep-lying rocks in the project area is shown by logs of oil-test holes. The subsurface section includes representative rocks of all periods of the Paleozoic and Mesozoic Eras except Pennsylvanian and Permian. Because of their great depths, rocks older than Cretaceous age are not important as potential sources of ground water.

During Early Cretaceous time most of the northern Great Plains region was being slowly eroded. Slow subsidence resulted in a gradual flooding by a shallow sea along whose advancing shoreline a uniformly-sorted quartz sand was deposited. This sandstone is called the Dakota Sandstone. After the advance of the sea, thick beds of silt and clay accumulated in the deeper part of the sea basin; these beds are the Upper Cretaceous sediments and include the Pierre Shale. In Late Cretaceous time the formation of mountains accompanied by some volcanism caused a gradual uplift of the land west of the sea. The uplift caused the sea to retreat southeastward and to become increasingly shallow in the area now known as North and South Dakota. As shallowing progressed, near-shore sand was deposited; the sand which progressively covered older clays, is called the Fox Hills Sandstone.

Overlying the Fox Hills is the Hell Creek Formation. The formation is composed of beds of sand, lignitic clay, and shale. The sediments were probably deposited on flood plains by many streams that flowed eastward from the mountains into the retreating sea. The Hell Creek Formation is the youngest bedrock exposed in the area and if younger (Tertiary) sediments ever existed they probably were removed by erosion prior to or during the Pleistocene Epoch.

The Pleistocene Epoch was characterized by widespread accumulation of great thicknesses of ice in northern Canada. Movement of the ice sheets southward over the relatively soft bedrock formations of the project area caused the accumulation of a heterogeneous mixture of rock materials within the ice mass. When the ice mass melted and (or) receded northward, a mantle of relatively unconsolidated sediments called glacial drift was left where the ice had been. The Linton-Strasburg area was covered by at least one and perhaps more than one ice advance. Many of the valleys and draws contain thin deposits of Recent age that have accumulated as a result of erosion since Pleistocene time.

General Stratigraphic Relations

Information regarding the stratigraphy in the Linton-Strasburg area was obtained in part from a study of the cuttings from 44 test holes and in part from published information. The depths of the test holes ranged from 10 to 294 feet and averaged 85 feet. Samples of the formations penetrated were taken at 5-foot intervals, and sample logs were prepared by visual inspection of the cuttings. The locations of test holes are shown on figure 3, and the test-hole logs are listed in table 4. Geologic cross-sections based upon logs of test holes are shown in figure 4.

Information about the deeper formations was obtained from logs of oil-test holes supplied by the North Dakota Geological Survey. Table 1 is based on the examination of samples from test holes, and the extrapolation of information from logs of oil-test borings.

Bedrock

Rocks of Paleozoic and Mesozoic age were penetrated by two oil-test wells in the report area (fig. 3). The Weber and the Franklin Investment oil-test well, 5,545 and 5,359 feet deep, respectively, penetrated Precambrian rocks.

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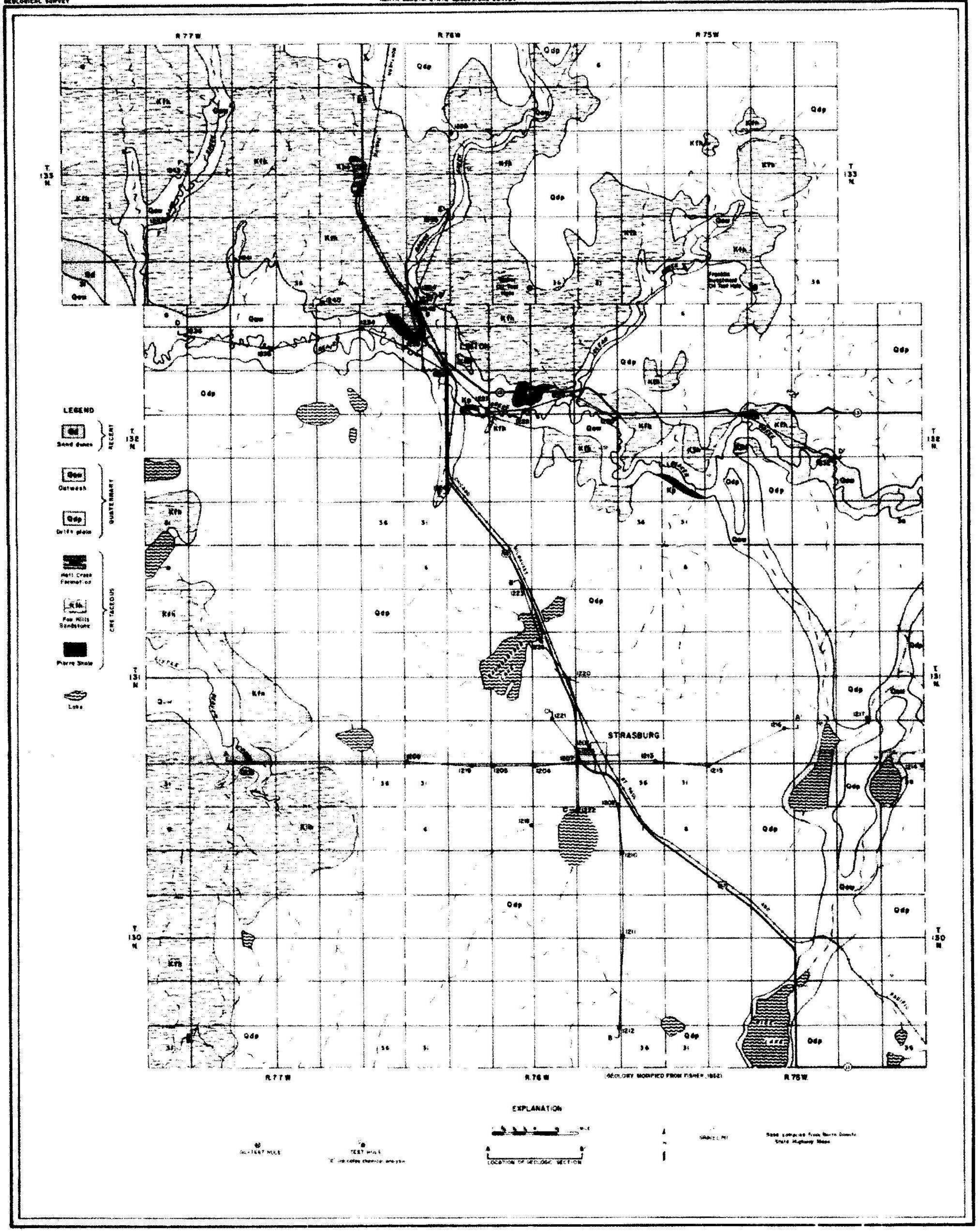
NORTH DAKOTA GROUND-WATER
STUDIES NO. 50 FIGURE 3



MAP SHOWING GEOLOGY AND LOCATION OF TEST HOLES AND GEOLOGIC SECTIONS IN THE LINTON-STRASBURG AREA.

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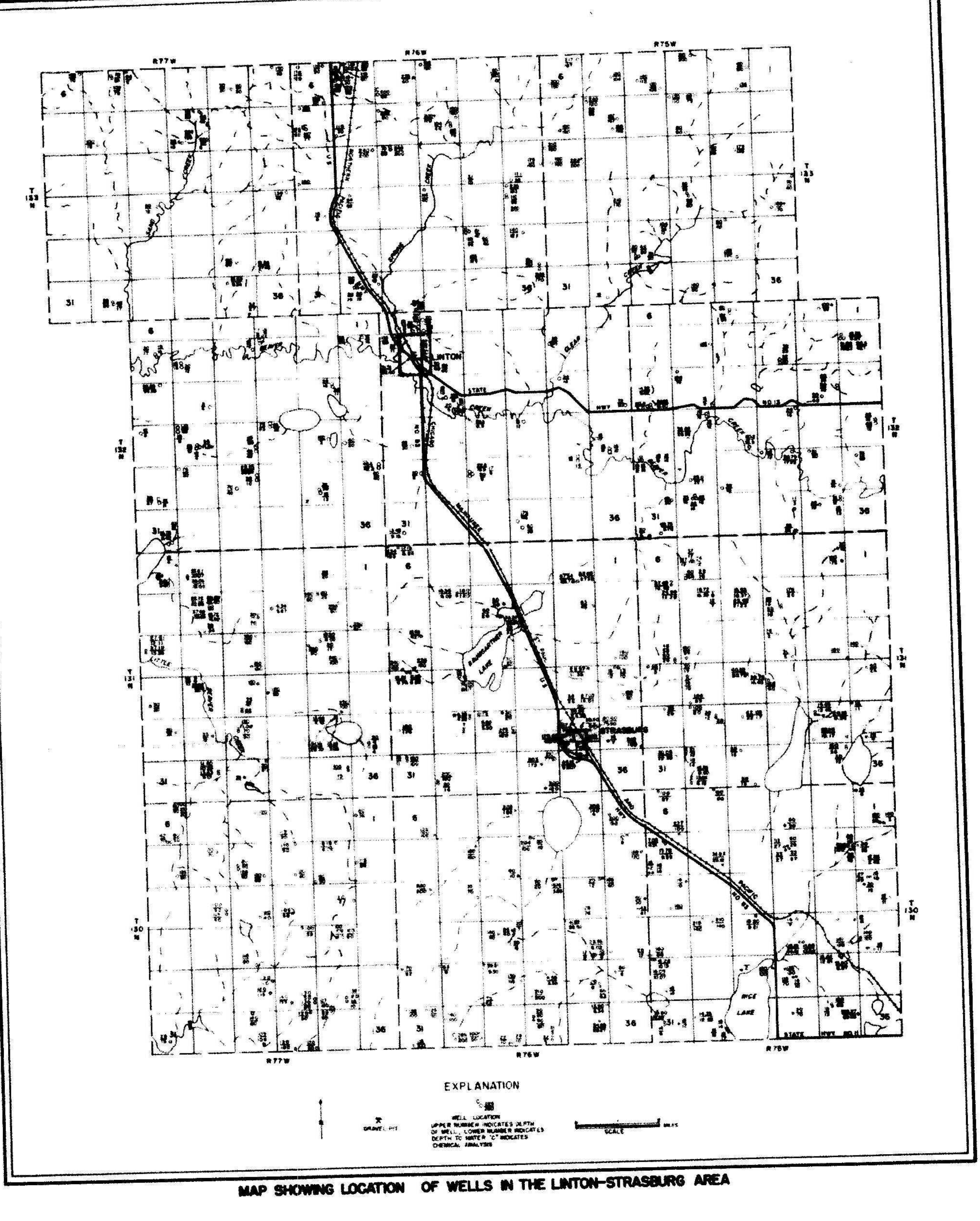
NORTH DAKOTA GROUND-WATER STUDIES NO 50 FIG 5



MAP SHOWING LOCATION OF WELLS IN THE LINTON-STRASBURG AREA

TABLE 1.--Geologic formations

Era	System	Series	Formation		Character
Cenozoic	Quaternary	Recent	Alluvium and colluvium		Clay, light-gray, sandy and fine to coarse silty sand
		Pleistocene	Glacial drift	Till	Clay, gray to brown; fine to coarse sand, gravel and shale pebbles
				Outwash deposits	Gravel, fine to coarse, fine to coarse sand, and gray
Mesozoic	Cretaceous	Upper Cretaceous	Hell Creek Formation		Shale, dark-brown, carbonaceous, fissile
			Fox Hills Sandstone		Clay, light-gray, sandy, and buff to brown coarse-grained platy calcareous sandstone
			Pierre Shale		Shale, gray; contains some thin bentonite beds and gypsum crystals
			Niobrara Shale		Shale, medium-gray, calcareous in parts; contains much bentonite
			Benton Shale		Shale, dark-gray, dense, calcareous, bentonitic
		Lower Cretaceous	Dakota Sandstone		Sandstone, light-gray, fine to coarse-grained, angular to subrounded grains; quartzose, and shale gray silty shale

and their water-bearing characteristics

Maximum thickness (feet)	Water-bearing characteristics
15 ±	Permeable; yields small amounts of water in places where a few feet of material is saturated.
200 ±	Relatively impermeable; yields small amounts of water from scattered sand and gravel deposits associated with till.
25 ±	Permeable; probably in most places yields enough water for medium-sized industrial or irrigation developments.
270	Impermeable; not known to yield water in the area.
325	Permeable; at places yields 100 to 300 gpm (estimated) of water.
900 - 1,000	Relatively impermeable; yields very small quantities of water in the area.
300 ±	Impermeable; does not yield water in the area.
1,000 ±	Impermeable; does not yield water in the area.
	Permeable; yields 50 to 500 gpm (estimated) of water a short distance south of the area. Probably would yield similarly in the project area.

Dakota Sandstone.--The Dakota Sandstone is Early Cretaceous in age and is composed of quartzose sand and shale. The logs of the Weber and Franklin Investment oil-test wells, respectively, show the top of the formation to be 2,460 and 2,500 feet below the land surface; it ranges in thickness from 160 to 207 feet. The Dakota is the most extensive artesian aquifer in North Dakota. It yields water having a high dissolved-solids content, and many wells tapping it flow. Immediately southeast of the project area, two wells (130-74-27dd and 130-74-33bbb), 2,500 and 2,503 feet deep, respectively, tap the Dakota, and each flows approximately 35 gpm (gallons per minute).

Pierre Shale.--The Pierre Shale consists of gray marine clay, shale, and sandy shale. Zones of carbonaceous matter, veins of gypsum, bentonite layers, and gray to brown hard sandy concretions are present in exposures. The formation crops out in Beaver Creek valley, and it was penetrated in some test holes. The Pierre is reported to yield relatively small quantities of water to wells; however, it is not a reliable source of ground water, and the quality of water from it is poor.

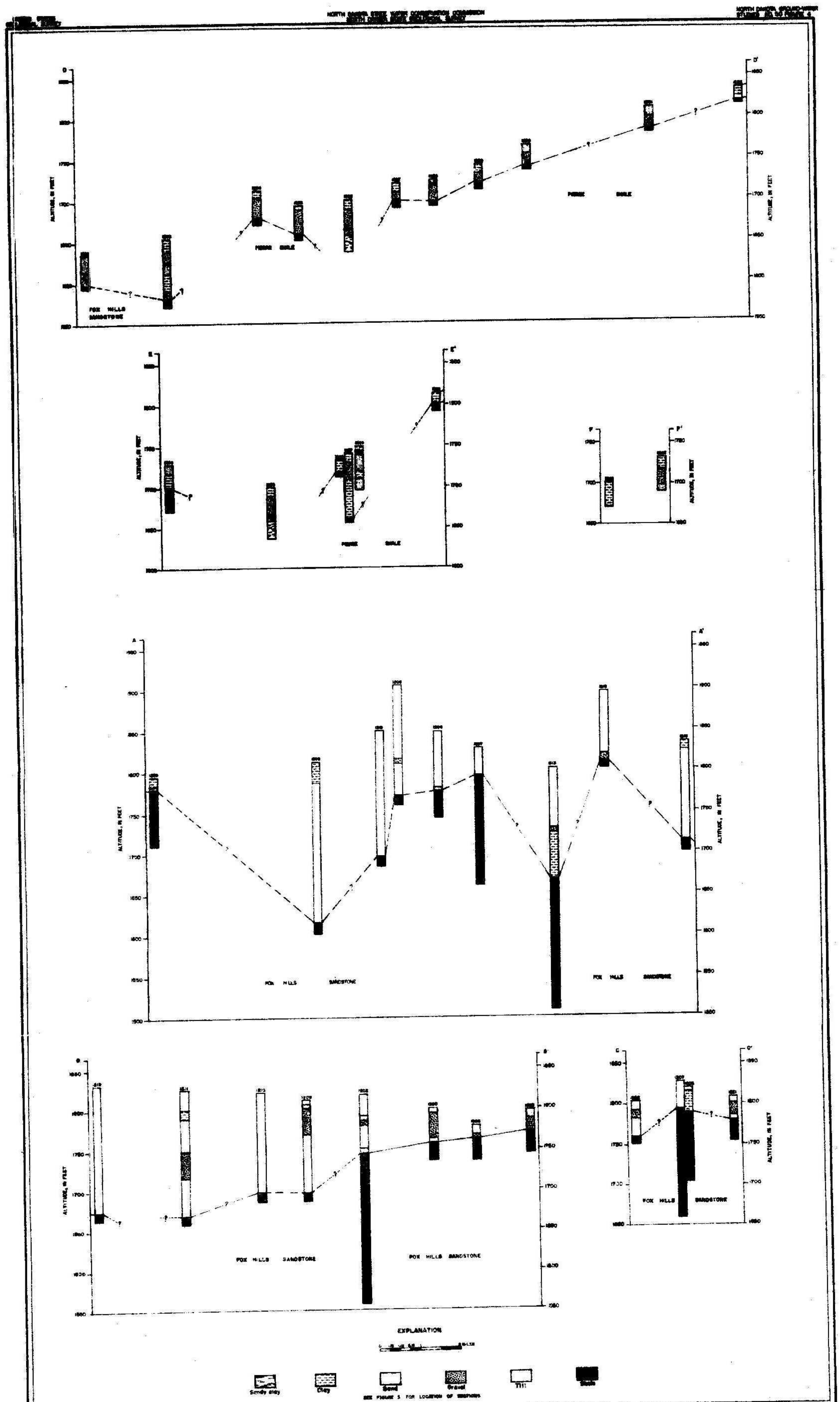
Fox Hills Sandstone.--The most extensive bedrock formation exposed in the area is the Fox Hills Sandstone (fig. 3). It consists of gray to yellow ferruginous sand and sandy clay. At the top of the formation is a resistant sandstone that caps the higher buttes and hills. Measured thicknesses of the Fox Hills range from 325 feet in southwestern Emmons County to 196 feet 1 mile east of Linton; this indicates thinning to the east and north (Fisher, 1952, p. 16). The formation is relatively dissected, and isolated exposures are common in parts of the area. In exposures around Linton, the Fox Hills contains a conspicuous volcanic ash bed.

The Fox Hills Sandstone contains water in sufficient quantities for farm, domestic, and municipal supplies in the project area. The quantity and the quality of the water at a given location is largely determined by the depth of the aquifer and the character of overlying material through which the aquifer is recharged. The city of Strasburg obtains an adequate supply of water from the Fox Hills; the aquifer near Strasburg probably receives some recharge through the overlying glacial drift.

Hell Creek Formation.--The Hell Creek Formation of Late Cretaceous age rests on the Fox Hills Sandstone. An erosional remnant of the formation 3 1/2 miles north of Linton along U.S. Highway 83 is the only known exposure in the area. The formation consists of gray sand, brown lignitic shale, and some bentonitic shale or clay. No wells are known to yield water from the Hell Creek in the project area.

Glacial Drift

Till and associated sand and gravel deposits.--The glacial drift in the area is composed primarily of till. The till is a heterogeneous mixture of materials ranging in grain size from clay to large boulders, but clay and silt are the predominant constituents. The till was deposited beneath the glacial ice with little or no sorting by wind or water. Because till is composed of unsorted materials and the spaces between the larger particles are filled with finer materials, till does not yield water readily to wells. Associated with the till, however, are deposits of sand and gravel that were deposited by melt



GEOLOGIC SECTIONS IN THE LINTON-STRASBURG AREA.

water from the glacial ice; these deposits are either completely enclosed by till or are at the base of the till. Generally the sand and gravel deposits are sources of ground water; however, well yields are small because the deposits are small and recharge through the till is slow. Periodic measurements of water levels in wells in the deposits are necessary to determine whether they are being depleted.

Outwash deposits.--Surficial outwash deposits consisting of stratified sand and gravel are found in the main channels of the present-day drainage system. The deposits range in thickness from 4 feet in test hole 1208 (131-77-28ccc) to 57 feet in test hole 1235 (132-77-9add) (table 4). They are generally mantled by thin deposits of alluvial and colluvial materials. Although the test drilling does not define the limits of the outwash deposits in the channels, the deposits are probably continuous throughout the drainage system. Well yields from the deposits generally are sufficient for municipal, domestic, and stock uses and may be adequate at places for medium-sized industrial or irrigation developments.

The municipal water supply of Linton is obtained from four wells (132-76-7dab, 132-76-8bcc, 132-76-8cbb, and 132-76-8cbb2) that yield water from the outwash deposits in Beaver Creek valley. The wells range from 31 to 70 feet in depth (table 3), and their locations are shown on figure 5. The quantity of water available is adequate for the city, but the water is high in dissolved solids; the average concentration is 1,270 ppm (parts per million).

The outwash deposits are recharged by infiltration of rain or snow melt and by influent seepage. Records of streamflow obtained at the U.S. Geological Survey gaging station in Beaver Creek, 0.7 mile south of the railway station in Linton, show that the average discharge for an 11-year period (1949-1960) was 54.8 cfs (cubic feet per second), and the median of the yearly mean discharges was 36 cfs. No flow in Beaver Creek was recorded at times in 1950 and at times during the period 1958-60. (U.S. Geol. Survey, 1960, p. 284). When there is little or no flow in Beaver Creek, the outwash aquifer receives little or no recharge, and heavy withdrawal by wells might need to be curtailed. The outwash deposits, therefore, probably are not an adequate source of water for large-scale industrial or irrigation developments.

Recent Deposits

Colluvium and alluvium.--Unconsolidated deposits of clay, silt, sand, and bedrock fragments along the slopes adjacent to bedrock hills and (or) in the principal drainage channels are referred to as colluvium and alluvium. The colluvium consists predominantly of bedrock fragments derived from and found in the vicinity of local bedrock exposures. The alluvium, which has a more distant origin, consists of glacial and bedrock material that has been deposited nearer the center of the valleys and in or close to the present-day stream channels. In the project area the deposits are thin and discontinuous and are tapped by only a few wells, which yield only small quantities of water, 2 to 10 gpm.

Eolian deposits.--Surficial sand, which was deposited by wind blowing across the channel deposits in Beaver Creek valley, occurs locally in T. 133 N., R. 77 W. The sand ranges from thin patches only a few feet thick to dunes at least 15 feet high. Shallow wells in these and (or) underlying deposits yield small quantities (2 to 10 gpm) of water for domestic and stock use.

QUALITY OF THE GROUND WATER

Water dissolves soluble mineral constituents of the rock particles as it moves toward and through an aquifer. The amount of mineral matter dissolved depends on many factors, including the amount of soluble materials with which the water has contact, the length of time of contact, and the amount of carbon dioxide in the water. In a homogeneous aquifer, water that has been stored a long time or that has traveled a long distance from the recharge area, generally has a higher dissolved-solids content than water that has been stored a short time or that has traveled a short distance from the recharge area.

Chemical analyses were made of water from eight wells in the Linton-Strasburg area and from two wells southeast of the area. (See table 2.) Two of the wells in the area yield water from glacial drift and six yield water from the Fox Hills Sandstone. Because no wells tap the Dakota Sandstone in the project area, analyses were made of water from two wells tapping the formation a short distance southeast of the area.

The water from outwash deposits has a high dissolved-solids content; the dissolved solids from two analyses ranges from 1,250 to 1,290 ppm. These analyses are of water from the Linton city wells and are shown in table 2. The principal constituents are bicarbonate, sodium, and sulfate. The water has a lower iron content than that from Fox Hills Sandstone. Analyses of water from wells tapping the Fox Hills Sandstone show a wide range of chemical composition. The principal constituents also are bicarbonate, sodium, and sulfate. In places the Fox Hills Sandstone probably receives recharge by percolation through the glacial drift. The percolation may be somewhat freer in certain areas than in others, resulting in different proportions of the minerals being dissolved. Water from the Dakota Sandstone is a sodium sulfate type and has a higher dissolved-solids content than any other water sample analyzed. The water contains higher concentrations of chloride and fluoride than that from the Fox Hills Sandstone or the outwash deposits. The total dissolved-solids content for the two samples taken from the Dakota Sandstone (130-74-27dd and 130-74-33bb, outside the project area) were 2,394 and 2,396 ppm, respectively. Water of similar quality is almost certainly available at approximately the same depth in the project area.

The quality of water for public supply and domestic use commonly is evaluated in relation to standards of the U.S. Public Health Service for drinking water. The standards, adopted in 1914 to protect the health of the traveling public, were revised several times in subsequent years. The latest revisions by the U.S. Public Health Service (1961) are, in part, as follows:

Constituent	Maximum concentration ppm
Iron (Fe)	0.3
Manganese (Mn)	.05
Sulfate (SO_4)	250
Chloride (Cl)	250
Fluoride (F)	1.5 a/
Nitrate (NO_3)	45
Dissolved solids	500

a/May vary slightly based on annual average of maximum daily air temperatures.

Dissolved-solids concentrations of 1,000 ppm are permitted if water of better quality is not available. The concentration of one or more chemical constituents exceeds the limits recommended above in every sample analyzed for this investigation. However, water containing more than the recommended concentration of certain chemical constituents has been used in some areas, including North Dakota, for many years without reported ill effects.

The consumption of water containing fluoride in concentrations of 0.7 to 1.2 (depending on annual average maximum daily air temperature), probably will lessen the incidence of tooth decay, especially in children. However, during the period of calcification of the teeth, the consumption by children of water having concentrations higher than about 1.5 ppm may cause mottling of tooth enamel (Dean, 1936). Fluoride in excess of the recommended limit was found in water from the Dakota Sandstone.

Practically all ground water contains small amounts of constituents causing hardness. Hardness of water is caused principally by calcium and magnesium and to a lesser extent by iron, aluminum, manganese, copper, strontium, barium, zinc, and free acid. Hardness is generally undesirable in water for domestic use; high soap consumption and soap scum result if the water is used for cleaning.

The following hardness ratings for water are in current usage:

Parts per million (as $CaCO_3$)	Rating
0 - 60	Soft
61 - 120	Moderately hard
121 - 180	Hard
181 +	Very hard

Water having a hardness of 181 or more generally requires softening to be satisfactory for most uses. Most of the water analyzed for this study was very hard.

Water containing concentrations of iron above the recommended limits is objectionable. High concentrations of iron adversely affect the taste of water and of beverages and foods prepared with the water. Iron may stain porcelain, fixtures, and laundry. Iron salts may plug well screens and reduce well output.

Water having a high concentration of sodium relative to the total cation concentration may be unsuitable for irrigation if the concentration of dissolved solids is relatively high; however, it may not be critical if the concentration of dissolved solids is low. The U.S. Department of Agriculture has listed quality-of-water characteristics that seem to have the most importance as far as irrigation use is concerned, and these are: "(1) total concentration of soluble salts; (2) relative proportion of sodium to other cations; (3) concentration of boron or other elements that may be toxic, and (4) under some conditions, the bicarbonate concentration as related to the concentration of calcium plus magnesium." (U.S. Salinity Laboratory Staff, 1954, p. 69). Other factors that are of importance are the water-transmission and drainage properties of the soil as well as the salt tolerance of the plants to be grown. Successful crop irrigation involves the proper relation of water quality, soil characteristics, and types of crop grown. The percent sodium was greater than 50 for 6 of the 10 water samples analyzed for this investigation. (See table 2.) Assistance in the solution of specific irrigation problems usually can be obtained from the County Agricultural Agent.

SUMMARY OF GROUND-WATER CONDITIONS

Most wells in the Linton-Strasburg area yield water from aquifers in the Fox Hills Sandstone and (or) glacial drift. Wells penetrating these aquifers yield adequate quantities of water to satisfy domestic, stock, and small municipal water-supply needs. Larger quantities of water, probably enough for small-to medium-sized industrial and irrigation developments, are contained in the outwash deposits in the valley of Beaver Creek and its tributaries.

The Dakota Sandstone in the project area is about 2,500 feet below land surface. Southeast of the project area, this formation yields relatively large quantities of water containing large quantities of dissolved solids to wells. If economical demineralization and waste-disposal methods are developed, this aquifer may become a major source of water supply in the area.

Chemical analyses show that the mineral content of the water from different aquifers is extremely variable. Water from aquifers in the glacial drift and Fox Hills Sandstone is high in iron, sodium, sulfate, and bicarbonate, but the iron content of water from the glacial drift is substantially lower than that from water of the Fox Hills Sandstone. Water from the Dakota Sandstone has high concentrations of chloride and fluoride and very high concentrations of total dissolved solids. Chemical analyses show that the concentration of one or more chemical constituents and of total dissolved solids exceeded the limits recommended by the U.S. Public Health Service.

TABLE 2.--Chemical

Geologic source: Qd, glacial drift; Kd, Dakota Sandstone
Kf, Fox Hills(?) Sandstone

Results in parts per million, except as indicated

Location no.	Owner or name	Geologic source	Depth of well (feet)	Date of collection	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)
130-74-27dd 2/	Peter Glatt	Kd	2,500	7- 8-60	1.8	6	8	752
130-74-33bb 2/	Felix Wald	Kd	2,503	7- 8-60	0.6	2	9	785
130-76-32cdb	Garret Van Beek	Kf	225	5-25-59	1.7	24	15	550
131-76-26cad1	City of Strasburg	Kf	167	....	2.6	120	49	31
131-76-26dcc 1/	Chicago,Milwaukee St.Paul & Pacific	Kf	140	....	6.8	71	35	48
131-76-28daa 1/	Jacob Marteri	Kf	275	5-26-59	5.5	62	47	340
132-76-7dab	City of Linton	Qd	32	5-25-59	.6	127	47	221
132-76-8cbb1	City of Linton #1	Qd	70	5-25-59	.7	92	43	235
133-76-4ccb 1/	Frank Weber	Kf	200	5-25-59	1.5	2	13	275
133-76-33cbb	Test hole 1244	Kf	52	10-28-57	1.4	93	49	130

1/Analyses shown do not meet the recommended limits of accuracy for

2/Water analyses from wells adjacent to the project area; they are analyses of ground water

Analyses by State Laboratories, Bismarck

Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Hardness as $CaCO_3$	Dissolved solids (sum of determined constituents)	Percent sodium
5.6	264	24	1,204	136	3.0	...	1.0	46	2,394	97
5.6	296	32	1,177	167	3.0	...	1.0	41	2,396	97
12.5	743	56	488	26	.2	2.4	.6	122	1,670	90
8.8	341	..	217	...	.4	.4	.2	501	720	10
4.5	318	..	92	...	.4	1.3	.2	322	524	22
14	936	..	104	26	.4	...	1.1	350	1,250	67
14.8	418	14	472	54	...	...	.6	510	1,290	48
14	393	..	501	31	.3	...	.6	408	1,230	55
7	513	26	94	...	.4	...	.9	58	778	90
11	374	...	334	14	.2	.8	...	436	932	33

chemical-quality analyses.

included to show the quality of water available from the Dakota Sandstone.

Depth to water: Measured water levels in tenths, and hundredths; reported water levels in feet.

Type of well: Dr, drilled; Du, dug.

Location no.	Owner or name	Depth of well (feet)	Diameter or size (inches)	Type	Date completed
130-75					
1bbc	John Krumm	14	42 x 42	Du	7- 3-45
1dcd1	Albert Bamgartner	140	2	Dr	....
1dcd2	..do....	120	2	Dr	....
3cdc	Henry Van Soest	60	24	Dr	1940
5aba	John J. Wagner	160	2	Dr	....
6bab	Clemences Roehrich	100	2	Dr	....
7aab	Peter S. Roehrich	227	2	Dr	....
7bad1	Jack Bernhardt	13.78	24 x 24	Du	....
7bad2	..do....	7.05	36 x 36	Du	1953
7ccc1	Matt Lipp	16	24	Dr	....
7ccc2	..do....	16	24	Dr	....
8ddb	Ed Nieusima	31.23	36	Dr	1956
10bdc1	Peter E. Nieusima	24	33	Dr	1929
10bdc2	..do....	50	6	Dr	1926
10bdc3	..do....	33	24	Dr	1930
10bdc4	..do....	33	24	Dr	1916
11add1	Peter F. Volk	20	48 x 48	Du	1955
11add2	..do....	20.50	48 x 48	Du	1952
11add3	..do....	22	48 x 48	Du	1952
12bcc	Anton E. Krumm	20	48 x 48	Du	1925
12cca	Peter S. Volk	12.85	36 x 36	Du	....
13bac1	Kasper Knoll	16	48 x 48	Du	....
13bac2	..do....	27	2	Dr	....
13bca	Roy Volk	30	3½	Dr	1917
13dac	Valentine Volk	15	36 x 36	Du	....
18aad	G. L. Peterman	14	48 x 48	Du	....
18dcb	Bolser Mattern	160	2	Dr	....
19ccc	Peter Droog	100	2	Dr	....
20abc	Eddie Silpernagel	210	2	Dr	1949
20bab	..do....	210	2	Dr	1925

of wells and test holes

Depth of well: Measured depths in tenths and hundredths; reported depths in feet.

Use of water: D, domestic; N, none; PS, public supply; RR, railroad; S, stock; T, test hole.

Depth to water below land surface (feet)	Date of measurement	Use of water	Aquifer	Remarks
6	....	D,S	Clay	
3	....	S	.....	Inadequate supply.
90	....	D,S	.....	
20	....	D,S	Gravel,sand	..Do....
80	....	S	.....	
97	....	D,S	Sandstone	Yellowish color.
100	....	D,S	Shale	
9.33	8- 6-57	D	Sand	
4.51	8- 6-57	S	Sand	Located near spring.
12	....	D	Sand	
14	....	S	Sand	
25.12	8- 6-57	S	Sand	Inadequate supply.
27	....	S	.....	Yields 200 gallons per day.
25	....	S	.....	Yields 125 gallons per day.
27	....	D	.....	..Do....
27	....	S	.....	..Do....
16	....	S	Sand	Yields 500 gallons per day; recovers in about 2 hours.
18.12	8- 5-57	D	Sand	Inadequate supply.
19	....	D	Sand	..Do....
18	....	D	Sand	..Do....
2.48	8- 7-57	S	.....	..Do....
10	....	S	Gravel	Yields 150 gallons per day.
20	....	D,S	Gravel	
12	....	D,S	Sand	Pumps dry; recovers in about 2 hours.
11	....	D,S	Sand,gravel	
10	....	D,S	.....	Inadequate supply; recovers in about 12 hours.
......	....	S	Clay	Water is rusty.
80	....	S	Sand	
140	....	D,S	Sand	
140	....	S	Sand	Water is yellow.

Location no.	Owner or name	Depth of well (feet)	Diameter or size (inches)	Type	Date completed
130-75 (Cont.)					
21abb	Bolser Mattern	10.20	48 x 48	Du	....
22abc	Steve V. Volk	14	48 x 48	Du	1937
22dbd1	Englbert F. Volk	14.53	36 x 36	Dr	10-56
22dbd2	..do....	15.01	48 x 48	Du	1937
23aad	Valentine Volk	18	36 x 36	Du	....
24cbc1	Steven A. Wolf	140	24 x 24	Dr	1955
24cbc2	..do....	141	24 x 24	Dr	1943
24cdd	Mike A. Wolf	18	18 x 18	Dr	1926
26abb1	Fritz Wolf	16.42	48 x 48	Du	....
26abb2	..do....	16.80	24	Dr	....
27caa1	Lawrence Miller	118	2	Dr	....
27caa2	..do....	14	48 x 48	Du	1935
28ada	Anton Weisbeck	120	2	Dr	....
28bca	Mrs. Margret B.Scherr	...	24	Dr	1952
30bbb1	Rensie Haak	16.28	48 x 48	Du	....
30bbb2	..do....	16.03	48 x 48	Du	....
30cda	Arie Von Vugt	18	48 x 48	Du	1913
31cab1	John E.Von Vugt	19.80	24	Dr	....
31cab2	..do....	14	6	Dr	....
31dba	George Wesder	18	36 x 36	Du	1917
32bcc	Peter Droog	14.35	24	Dr	....
32ddb1	Anthony Compaan	18	48 x 48	Du	1900
32ddb2	..do....	18	48 x 48	Du	....
32ddb3	..do....	18	48 x 48	Du	....
34bd	John Kocher	90	24	Dr	1952
35add	Max M Tschosik	105.27	24	Dr	....
35bac1	Joe Klien	108	24	Dr	1906
35bac2	..do....	18	24	Dr	....
27bac	Anton Weisbeck	136	2	Dr	1949
130-76					
1cba	Otto Van Vugt	200	4	Dr	....
2bbb	Test hole 1222	52	5	Dr	10-10-57
2dab	Jake Jafines	200	4	Dr	....

of wells and test holes -- Continued

Depth to water below land surface (feet)	Date of measurement	Use of water	Aquifer	Remarks
9.21	8- 6-57	S	Clay	
7	....	D,S	Gravel	Pumps dry; recovers in about 2 hours.
13.92	8- 7-57	D,S	Sand	Inadequate supply.
14.41	8- 7-57	D,S	Sand	Pumps dry; yields 50 gallons per day.
14	....	D,S	Sand	
120	....	S	Sand	Inadequate supply.
128	....	D	Sand	
11	....	D,S	Gravel	
12.01	8- 7-57	D,S	Sand	
6.87	8- 7-57	N	Sand	
70	....	S	Sand	Water has red color.
10	....	D	Gravel	Inadequate supply; gray color; bad taste.
100	....	D,S	Sand	
2	....	D,S	Gravel	Pumps dry; recovers in about 12 hours.
10.13	8- 7-57	S	Sand	
10.07	8- 7-57	N	Sand	
14	....	S	Shale	
13.62	8- 7-57	S	Sand	Unfit for drinking.
8	....	D,S	Sand	Pumps sand with water.
12	....	D,S	Sand	Pumps dry.
12.05	8- 7-57	S	.....	
14	....	D,S	Gravel	
16	....	S	Gravel	
17	....	S	Gravel	
70	....	D,S	Sand	Pumps dry; recovers in about 1 hour.
80.36	8- 7-57	S	Sand	Unfit for drinking.
60	....	S	Sand	Adequate supply; unfit for drinking.
13	....	D	Clay	
120	....	D,S	Sand	Inadequate supply.
150	....	N	Sand	
....	....	T	.....	See log; altitude 1,804.
140	....	D,S	Sand	Pumps sand with water.

Location no.	Owner or name	Depth of well (feet)	Diameter or size (inches)	Type	Date completed
130-76 (Cont.)					
4add1	Adam Neier	203	2	Dr	....
4add2	Test hole 1218	147	5	Dr	10- 5-57
6ddd	Max Tschosik	120	36	Dr	....
8aad	John Tschosik	180	2	Dr	....
9ddd	William Dyk	40	36	Dr	1934
10bab1	Theodore Mattern	20	24	Dr	1953
10bab2	..do....	204	8	Dr	1953
12abb	William Rohrich	10	36 x 60	Du	5-57
12add	Casper Roth	190	44	Dr	....
12bbb	Test hole 1210	136	5	Dr	9-25-57
13ccc	Test hole 1211	168	5	Dr	9-25-57
13daa	Eddy Kramer	160	2	Dr	....
13ddb	B. Maternzer	43	24	Dr	3-49
14aaa1	Joe Mattern	165	2	Dr	....
14aaa2	..do....	20	24	Dr	....
14cda	Mrs. Kate Dyk	28	24	Dr	1952
15aab1	Peter Dyk	30	24	Dr	....
15aab2	..do....	16.14	24	Dr	....
17add	Katie Selzler	95	24	Dr	....
18aac	Eugene Kramer	230	2	Dr	....
21aac1	Marvin Remfere	84	24	Dr	1954
21aac2	Marvin Wynveen	20	48 x 48	Du	1934
21aac3	..do....	20	24	Dr	1928
21bda	William V. Wolf	140	24	Dr	1931
23bbb	Gardis Dykema	41.85	24	Dr	1940
23dcd1	Alfred Dykema	23.55	24	Dr	1954
23dcd2	..do....	10	48 x 48	Du	....
23dcd3	..do....	12	48 x 48	Du	....
24ddd	Elizabeth Haak	20	48 x 48	Du	....
25bca	G. A. Vangt	20	24	Dr	1941

of wells and test holes -- Continued

Depth to water below land surface (feet)	Date of measurement	Use of water	Aquifer	Remarks
103	....	D,S	.....	
....	....	T	.....	See log.
100	....	D,S	Clay	
150	....	D,S	Sand	
10	....	D,S	Clay	
10	....	D	Sand	Pumps dry; recovers in about 1 hour.
100	....	S	Gravel	
8	....	D	Sand	Pumps dry; recovers in about 2 hours.
120	....	D,S	Sandstone	
....	....	T	.....	See log; altitude 1,822.
....	....	T	.....	See log; altitude 1,826.
50	....	D,S	Gravel	
41	....	D,S	Sand	Supply adequate for 100 head cattle.
60	....	N	Sand	Unfit for drinking.
12	....	D,S	Gravel	
26	....	D,S	Sand	Inadequate supply.
20	....	D,S	Sand	Pumps dry; recovers in about 2 weeks.
3.83	8- 8-57	S	Gravel	
70	....	D,S	Sand	Pumps dry; recovers in about 1 hour.
200	....	D,S	Sand	
40	....	D,S	Shale	Yields 300 gallons in 24 hours; inadequate for 30 head of cattle.
15	....	S	Sand	
7	....	S	Sand	Ordinarily yields adequately except in late summer & fall.
90	....	N	Shale	
28.52	8- 8-57	D,S	Sand, gravel	..Do....
6.02	8- 8-57	D,S	Clay	Inadequate supply.
6	....	S	.....	..Do....
8	....	S	.....	Water level in well fluctuates in response to water level in local sloughs.
12	....	S	Sand	
6	....	D,S	Gravel.	

Location no.	Owner or name	Depth of well (feet)	Diameter or size (inches)	Type	Date completed
130-76 (Cont.)					
26dab1	Ernest Dykema	20	48 x 48	Du	....
26dab2	..do....	65	24	Dr	....
27acb	Garet Slagh	11.55	48 x 48	Du	....
27cca	Huisenga	210	2	Dr	1917
28add	Ike D. Darnbush	130	6	Dr	1930
28bbb	Able Dykema	39.31	24	Dr	....
29ddd	Stevene Huizenga Sr.	73	36	Dr	1910
30aaa	J. L. Bumgartner & Son	63	24	Dr	1940
30bb	Ed. S. Van Vorst	70	24	Dr	1917
31aba	Garet Huizenga	125	6	Dr	....
31bba	Fred Cleveringa	138	2	Dr	1943
31cdc	John Cleveringa	115	2	Dr	....
32bcb	Isaac Huizenga	140	6	Dr	....
32cdb	Garet Van Beek	225	2	Dr	....
32dda	Steven G. Huizenga	100 +	2	Dr	....
33dcd1	John Van Gudt	22	9	Du	1955
33dcd2	..do....	28	36	Dr	1943
34bca1	John Millenaar	90	2	Dr	1933
34bca2	..do....	90	2	Dr	1957
34dca1	Ronald Rodenburg	21	24	Dr	1949
34dca2	..do....	32	24	Dr	1952
35aaa1	Lester Van Beek	13.90	48 x 48	Du	....
35aaa2	Test hole 1212	168	5	Dr	9-26-57
35adc	Lester Van Beek	54.49	24	Dr	1957
130-77					
1bcc	Oscar Ternes	60	3	Dr	....
3dcc	John M. Brawn	115	2	Dr	....
4aca	Josephine Unser	120	2	Dr	....
6aaa1	Anselm Heidrich	80	2	Dr	....

of wells and test holes -- Continued

Depth to water below land surface (feet)	Date of measurement	Use of water	Aquifer	Remarks
8	....	D	Clay	
63	....	S	.....	Pumps dry; recovers in about 2 hours.
9.38	8- 8-57	D,S	Gravel	
200	....	S	Shale	Unfit for drinking; pumps dry; recovers in about 1 hour.
115	....	D,S	Sand	Pumps dry; recovers in about 6 hours.
9.30	8- 9-57	D,S	Sand	
43	....	D,S	Clay	Pumps dry; recovers in about 12 hours.
8	....	D,S	Clay	Pumps dry.
52	....	D,S	Sand, clay	
50	....	D,S	Sand	
100	....	N	Sand	
100	....	D,S	Sand	
100	....	D,S	Sand	
200	....	D,S	Sand	Hard; water is rusty; see chemical analysis.
50	....	D,S	Sand	
10	....	D	Gravel	Pumps dry; recovers in about 1.5 hours.
10	....	S	Sand, gravel	Pumps dry; recovers 1,000 gallons in half a day.
80	....	D,S	Sand	
80	....	D,S	Sand	Inadequate supply.
5	....	S	Gravel	Pumps dry; recovers in about 12 hours.
5	....	S	Gravel	..Do....
6.34	8- 8-57	N	.....	
....	....	T	.....	See log; altitude 1,832.
29.27	8- 8-57	S	Clay	
36	....	D	.....	
30	....	D,S	.....	
......	....	S	.....	
50	....	S	Gravel	

TABLE 3.--Records

Location no.	Owner or name	Depth of well (feet)	Diameter or size (inches)	Type	Date completed
130-77 (Cont.)					
6aaa2	Anselm Heidrich	25	12	Du	....
6dcc1	Magnus Heidrich	80	2	Dr	1956
6dcc2	..do....	42	2	Dr	1955
7dbd	Zacheus Bachmeir	125	2	Dr	....
8abd	Ronhold Heidrich	110	2	Dr	1907
9cba1	John T. Wagner	80	2	Dr	....
9cba2	..do....	125	2	Dr	....
9ddb	Loe L. Kramer	120	2	Dr	....
10abb	Lewis Kramer	110	2	Dr	....
10dcb	Roy L. Kramer	120	2	Dr	1926
11abb	Mrs. Anton Ternes	18.18	48 x 48	Du	....
11ccc	Mrs. Rose Ternes	80	2	Dr	....
12cbb	Ida Frank	115	2	Dr	....
14add	Anton Reinbold	30	3	Dr	....
15cad	Clarence Van Beek	105	2	Dr	....
16dca	Stephen Bosch	90	2	Dr	1926
17da1	Romanaeus Shreiner	100	2	Dr	1917
17da2	..do....	115	2	Dr	1948
21dcc	Stevene Bosch	115	2	Dr	....
22aba	Ed. G. Van Beek	100	2	Dr	....
23abb1	Magnus T. Wagner	109	2	Dr	....
23abb2	..do....	103	2	Dr	1949
26cdc	Floyd Van Beek	127	2	Dr	....
26dca1	Edd G. Van Beek	16	48 x 48	Du	....
26dca2	..do....	38	36	Dr	....
27cd	Anton Van Beek	140	2	Dr	....
27dda1	Fred Wanderlaan	130	2	Dr	....
27dda2	..do....	130	2	Dr	1948
28ada	Rinka Looyenga	120	2	Dr	....
28da	..do....	120	2	Dr	....
31cad	Curtis Brooks	25	48 x 48	Du	....
33baa	Carl Vanderwal	140	2	Dr	....
33dca	Isaac Vanderlaan	109	2	Dr	....
34aab	Clarence Vanderlaan	120	2	Dr	....
34cdd	Lily Koluckman	120	2	Dr	1916
34ddd	..do....	120	2	Dr	1916
35bab	Gilbert Van Beek	90	2	Dr	....

of wells and test holes -- Continued

Depth to water below land surface (feet)	Date of measurement	Use of water	Aquifer	Remarks
20	....	D	Sand	Inadequate supply.
50	....	S	Clay	
30	....	D	Clay	
90	....	D,S	Clay	
70	....	D,S	.....	
50	....	S	Shale	
60	....	D	Shale	
60	....	D,S	Sand	
50	....	S	.....	
80	....	D,S	.....	
8.02	8-10-57	S	Sand	
50	....	D,S	Sand	
85	....	D,S	.....	
2	....	D,S	Gravel	Water is rusty.
50	....	D,S	Sand	
40	....	D,S	Gravel	
50	....	D,S	Clay	
50	....	S	Clay	
80	....	D,S	Gravel	
55	....	S	Sand	Unfit for drinking.
60	....	S	Sand	
80	....	D	Sand	
100	....	D,S	.....	
10	....	S	Sand	
20	....	D	Sand	Pumps dry; recovers in about 24 hrs.
135	....	D	.....	Pumps dry; recovers in about 12 hrs.
80	....	...	.....	
50	....	S	Clay	
110	....	D,S	Shale	
115	....	S	Shale	Pumps dry; recovers rapidly.
15	....	D	Sand	Pumps dry; recovers in about 1 hr. Clear, hard.
60	....	D,S	Shale	
108	....	D,S	.....	
90	....	D,S	Clay	
100	....	S	Sand	
90	....	D,S	.....	
60	....	D,S	.....	

Location no.	Owner or name	Depth of well (feet)	Diameter or size (inches)	Type	Date completed
131-75					
2adb	Joe Grinsteiner	30	48 x 48	Du	1941
2dad	Mrs. Tilly Greffe	180	4	Dr	....
5cab1	Mrs. John Lavinger	37	24	Dr	....
5cab2	..do....	24	24	Dr	....
5cab3	..do....	37	24	Dr	....
5ccd1	Joe Schwab	60	24	Dr	....
5ccd2	..do....	28	24	Dr	....
7aab1	Peter Bauman	37.48	24	Dr	....
7aab2	..do....	24.80	24	Dr	1957
8adb1	Jake P. Draft	18.72	24	Dr	....
8adb2	..do....	12	24	Dr	....
9acd1	Joe Ibach	15.63	24	Dr	1952
9acd2	..do....	29.65	24	Dr	....
10ad	John D. Zacher	170	2	Dr	....
10cad1	Jacob J. Schneider	25	12	Dr	....
10cad2	..do....	30	24	Dr	....
13cac	Larry Weichel	140	2	Dr	....
14ddd	Leo J. Keller	180	2	Dr	....
15bdb	John P. Zacher	14	48 x 48	Du	....
15dc	..do....	30	48 x 48	Du	....
17cc	John Reis	100	24	Dr	....
18ddc1	Alois Baumgartner	48	24	Dr	....
18ddc2	..do....	60	24	Dr	....
19bba	Peter S. Kraft	30	24	Dr	....
20bc1	Syl Kraft	18	48 x 48	Du	....
20bc2	..do....	30	24	Dr	....
20ccd	Joe H. Volk	100	24	Dr	....
21acb1	Jim Keller	40.23	24	Dr	....
21acb2	..do....	30.78	24	Dr	....
22bcc	Mathias Neis	120	24	Dr	....
23dcd	Test hole 1217	84	5	Dr	10- 4-57
24bad	Edmond Gross	40	24	Dr	....
25bbb	Frank C. Kraft	18	48 x 48	Du	....
25cd	Peter K. Kraft	16	24	Dr	1933
26bca1	John Senger	15.45	24	Dr	....
26bca2	..do....	20.15	24	Dr	....
26cc	Tom Wald	38.25	24	Dr	....

of wells and test holes -- Continued

Depth to water below land surface (feet)	Date of measurement	Use of water	Aquifer	Remarks
10	....	D,S	Sand	Pumps dry; recovers in about 2 hrs.
175	....	D	.....	Inadequate supply, clear, soft.
17	....	S	Sand	Pumps dry; recovers in about 24 hrs.
12	....	S	Gravel	Inadequate supply.
17	....	S	Sand	..Do....
44	....	D,S	Clay	..Do....
10	....	S	Gravel	
16.82	8-19-57	D,S	Gravel	
12.29	8-19-57	S	Gravel	
16.35	8-19-57	D,S	Sand	
7	....	D	Sand	
10.37	8-19-57	D	Gravel	
21.23	8-19-57	D,S	Gravel	Pumps dry; recovers in about 1 hr.
20	....	S	Sand	
16	....	S	Gravel	Inadequate supply, clear, hard.
16	....	D	Gravel	
......	....	D,S	Sand	
......	....	D,S	Sand	Slight oil film on water.
3	....	D,S	Sand, gravel	
5	....	N	Gravel	
55	....	D,S	Clay	
38	....	D,S	Shale	Pumps dry; recovers in about 12 hrs.
26	....	S	Shale	
10	....	D,S	Gravel	
10	....	S	Sand	
17	....	D,S	Sand	Pumps dry; recovers in about 1 day.
95	....	D,S	Clay	Inadequate supply.
30.73	8-20-57	D	Sand	
16.43	8-20-57	S	Sand	
60	....	S	Clay	Unfit for drinking.
......	....	T	.....	See log.
25	....	D,S	.....	
11	....	D,S	Clay	Inadequate supply.
4	....	D,S	Sand	..Do....
12.45	8-20-57	D,S	Sand	..Do....
8.34	8-20-57	S	Sand	..Do....
15.17	8-20-57	D,S	Sand	

Location no.	Owner or name	Depth of well (feet)	Diameter or size (inches)	Type	Date completed
131-75 (Cont.)					
28aac	Test hole 1216	136	5	Dr	10- 4-57
28bda	Peter Roehrich	62.05	24	Dr	1943
29adb1	Anton M. Wald	38	24	Dr	....
29adb2	..do....	28	6	Dr	....
29bba	Joe H. Volk	100	24	Dr	....
30abb	Rochus Dosch	30	24	Dr	....
31aac	Ed Dosch	30.05	24	Dr	....
32bbb1	Sabastian Voller	21	24	Dr	5-57
32bbb2	..do....	18	24	Dr	....
32bbb3	Test hole 1215	94	5	Dr	10- 2-57
32cca1	Martin Wald	16.35	24	Dr	....
32cca2	..do....	13.55	54 x 54	Du	....
33ba	Mike A. Volk	30	24	Dr	....
33dcd	John A. Wagner	30	18	Dr	....
35aa1	Joe E. Meier	100	24	Dr	....
35aa2	..do....	20	24	Dr	....
36aaa	Test hole 1214	105	5	Dr	10- 2-57
131-76					
2dcc1	Alois Wikenheiser	87.54	24	Dr	1957
2dcc2	..do....	53.05	24	Dr	....
4ddc	Test hole 1223	52	5	Dr	10-10-57
6bab	John F. Volk	17.15	48 x 48	Du	....
6bbb	John F. Roehrich	234	3	Dr	1955
8abd1	Alex Bichler	19.35	24	Dr	....
8abd2	..do....	160	4	Dr	8-57
9adc	Anton L. Baumgartner	50	24	Dr	....
9dbd	Wendelin A. Fischer	50	24	Dr	1952
10ccd1	Peter F. Braun	33.34	24	Dr	....
10ccd2	..do....	30	6	Dr	....
11daa	Joe L. Baumgartner	65	24	Dr	....
13cda	Matt Lowinger	160	2	Dr	....
15bbd	Test hole 1226	42	5	Dr	10-14-57
16ddc	Kasper J. Feist	70	24	Dr	1921
18aac	Frank F. Baumgartner	16.45	48 x 48	Du	....

of wells and test holes -- Continued

Depth to water below land surface (feet)	Date of measurement	Use of water	Aquifer	Remarks
......	....	T	.....	See log; altitude 1,834.
22.17	8-20-57	D,S	Sand	
12	....	D,S	Clay	
......	....	D,S	Clay	Inadequate supply; oily film on water.
80	....	S	Clay	
20	....	D,S	Gravel	Inadequate supply.
22.35	....	D,S	Sand	
12	....	D	Clay	Yields 200 gallons per day; recovers in 15-20 hours.
14	......	S	Sand	Yields 500 gallons per day; recovers in about 15 hours.
......	....	T	.....	See log; altitude 1,896.
9.90	8-20-57	D,S	Sand	Inadequate supply.
6.15	8-20-57	S	Sand	..Do....
15	....	D,S	Sand	..Do....
15	....	D,S	.....	
35	....	S	Sand	..Do....
12	....	D	Gravel	..Do....
......	....	T	.....	See log.
56.73	8-15-57	D,S	Shale	Pumps dry; yields 400-500 gallons per day.
27.35	8-15-57	D,S	Shale	Inadequate supply.
......	....	T	.....	See log; altitude 1,797.
8.25	8-13-57	D,S	Gravel	
160	....	S	Sand	
9.02	8-14-57	D,S	Sand	Inadequate supply.
120	....	S	Shale	
30	....	D,S	Sand	..Do....
20	....	D,S	Clay	
29.94	8-15-57	...	Sand	
23	....	D	Sand	
45	....	D,S	.....	
100	....	D,S	Sand	
......	....	T	.....	See log; altitude 1,778.
50	....	D,S	Gravel	Inadequate supply.
8.27	8-14-57	S	Sand	

Location no.	Owner or name	Depth of well (feet)	Diameter or size (inches)	Type	Date completed
131-76 (Cont.)					
18cdc	Sebastian A. Selzler	240	2	Dr	....
18dcc	Matt A. Scherr	230	2	Dr	1949
19baa1	Nick Scherr	16.81	48 x 48	Du	1895
19baa2	..do....	8.82	36 x 36	Du	....
20aac1	Pius & Jacob J. Baumgartner	25	24	Dr	1939
20aac2	..do....	74.20	24	Dr	....
22aba	Test hole 1220	63	5	Dr	10- 9-57
22cdd	Test hole 1221	53	5	Dr	10- 9-57
23aab	Karl Keller	22.57	24	Dr	....
23dcc1	Sabastian J. Feist	38	24	Dr	1938
23dcc2	..do....	27.03	48	Dr	....
24baa1	John J. Feist	13	26	..	....
24baa2	..do....	15	26	..	....
24dbc	Pius A. Volk	130	2	Dr	....
25cca	Ray Wagner	14	24	Dr	....
25ddc	Test hole 1213	294	5	Dr	9-30-57
25ddd	Frank Kuss	210	2	Dr	1931
26acc	Mike Dosch	20.30	....	..	....
26bdc	Joe Kuss	36.65	24	Dr	....
26caa	Joe P. Wickenheiser	180.60	2½	..	....
26cab1	Carl Keller	173.60	24	Dr	1956
26cab2	Test hole 1202	260	5	Dr	9-16-57
26cad1	City of Strasburg	167	6	Dr	....
26cad2	..do....	210	12	Dr	1959
26cbc	Test hole 1203	115	5	Dr	9-17-57
26ccc	Test hole 1207	168	5	Dr	9-23-57
26dcc	Chicago, Milwaukee, St. Paul and Pacific	140	....	Dr	....
28aba	Damian K. Feist	30	48 x 48	Du	....
28bb1	Carl Scherr	175	....	Dr	....
28bb2	..do....	5.90	....	..	....
28daa	Jacob Materi	275	4	Dr	....
29aa1	Valentine Scherr	6.25	48 x 48	Du	1937
29aa2	..do....	7	....	Du	....
30bcd	Anton Roth	180	3	Dr	1953
30ccc	Test hole 1206	210	5	Dr	9-19-57
31bab1	John K. Burgad	18	96 x 96	Du	....

of wells and test holes -- Continued

Depth to water below land surface (feet)	Date of measurement	Use of water	Aquifer	Remarks
190	....	D,S	Sand	
190	....	S	Clay	
9.36	8-14-57	D,S	Sand	Inadequate supply.
6.82	8-14-57	N	Sand	
12	....	D,S	Sand	..Do....
21.67	8-14-57	N	Sand	
......	....	T	.....	See log; altitude 1,800.
......	....	T	.....	See log; altitude 1,808.
11.35	8-15-57	D,S	Sand	Soft.
30	....	D,S	Sand	
16.01	8-15-57	S	Sand	
10	....	S	Gravel	Inadequate supply.
12	....	D	Gravel.	..Do....
90	....	D,S	Sand	
7	....	D,S	Sand	
......	....	T	.....	See log; altitude 1,802.
160	....	S	Sand	
6.01	......	D,S	Sand	
24.35	9- 6-57	D,S	Sand	
75.90	8- 7-57	D	Sand	
68.92	....	D	Sand	
......	....	T	.....	See log; altitude 1,818.
73	....	PS	Sand	See chemical analysis.
77.50	5-25-59	PS	Sand	
......	....	T	.....	See log; altitude 1,816.
......	....	T	.....	See log; altitude 1,828.
......	....	D,S	Sand	See chemical analysis.
20	....	D,S	Gravel	
......	....	S	Sand	
5.20	8- 7-57	S	Sand	
120	....	D,S	Sand	..Do....
4.92	8-14-57	D	Gravel	
2	....	S	Sand	
174	....	D,S	Sand	
......	....	T	.....	See log; altitude 1,812.
11	....	D,S	Gravel	

Location no.	Owner or name	Depth of well (feet)	Diameter or size (inches)	Type	Date completed
131-76 (Cont.)					
31bab2	John K. Burgad	150	2	Dr	7-47
32abb	Test hole 1219	167	5	Dr	10- 8-57
32cbc1	Mike D. Feist	200	2	Dr	....
32cbc2	..do....	30	24	Dr	7-56
33bbb	Test hole 1205	147	5	Dr	9-18-57
34acb	Alex Volk	203	3	Dr	....
34bbb	Test hole 1204	105	5	Dr	9-17-57
34dc	B. B. Mattern	300	4	Dr	....
35abb	Wendelin Wikenheiser	44.12	24	Dr	....
35ddd	Test hole 1209	126	5	Dr	9-24-57
131-77					
2dbd	Herman Mosset	38	7	Dr	1957
5cba1	Peter C. Wagner	35.57	24	Dr	....
5cba2	..do....	35.05	48 x 48	Du	....
6ada	Joe Cacher	15	48 x 48	Du	1927
6dbb	Martin Walther	8.90	48 x 48	Du	1940
8aca1	August Sauter	60.80	....	Dr	....
8aca2	..do....	25.75	24	Dr	....
8aca3	..do....	37.40	....	Dr	....
8aca4	..do....	18.72	24	Dr	....
8dcc	Joseph K. Jahner	58	24	Dr	....
9da1	Matthias Jahner	30	24	Dr	....
9da2	..do....	70	24	..	....
10bcd	B. B. Volk	14.34	60 x 60	Du	....
11adb	Kasper Burgad	250	2	Dr	....
11bab1	Joe Burgad	40	2	Dr	....
11bab2	..do....	180	2	Dr	1907
12cc	Clarence Burgad	250	4	Dr	1930
14bac1	George Zacher	18.50	24	Dr	7-57
14bac2	..do....	20	24	Dr	1954
14bcb	..do....	260	2	Dr	....
14dac	John Welk	240	2	Dr	....
16aab	Valentine Jacob	350	....	Dr	1950
16dca	Josephine Unser	150	1½	Dr	1940
18bc1	Lawrence Scherr	27.01	24	Dr	1953
18bc2	..do....	27.10	24	Dr	....
19cbd	Anton Zacher	30	24	Dr	....

of wells and test holes -- Continued

Depth to water below land surface (feet)	Date of measurement	Use of water	Aquifer	Remarks
100	....	S	Gravel	
......	....	T	.....	See log; altitude 1,850.
100	....	S	Sand	
14	....	D	Gravel	
......	....	T	.....	See log; altitude 1,905.
173	....	D,S	Sand	
......	....	T	.....	See log; altitude 1,848.
120	....	D,S	.....	
33.07	8- 8-57	N	Sand	
......	....	T	.....	See log; altitude 1,812.
20	....	D,S	Gravel	
30.07	8-14-57	S	Sand	
18.00	8-14-57	D	Sand	
4	....	D,S	Sand	
8.60	8-14-57	S	Sand	Inadequate supply.
43.40	8-14-57	D,S	.....	
22.65	8-14-57	D,S	.....	Inadequate supply, hard.
33.68	8-14-57	S	.....	..Do....
14.82	8-14-57	S	.....	..Do....
34	....	D,S	Sand	
......	....	S	Sand	
......	....	...	Sand	
5.67	8-13-57	D,S	Sand	
90	....	S	Sand	
25	....	D,S	.....	Inadequate supply.
60	....	D,S	.....	
80	....	D,S	Sand	
8.00	8-13-57	...	Sand	..Do....
17	....	D	Sand	..Do....
90	....	D,S	Sand	
100	....	D,S	Sand	
180	....	...	Sand	
100	....	S	.....	
12.11	8-13-57	S	Sand	
13.35	8-13-57	D	Sand	
20	....	S	Sand	

Location no.	Owner or name	Depth of well (feet)	Diameter or size (inches)	Type	Date completed
131-77 (Cont.)					
20bab1	Joe Selbernagel	25	24	Dr	1954
20bab2	..do....	25.92	24	..	1955
21aac	Valentine Jacob	100	2	..	1950
21cda1	Harry Heidlich	55	....	Dr	1955
21cda2	..do....	65	....	Dr	....
22bcc	Josephine Unser	120	$1\frac{1}{2}$	Dr	....
23ddc	Andy Hager	250	6	Dr	12-55
25cad1	Jake Schwahn	30	48 x 48	Du	1945
25cad2	..do....	16	....	Dr	1949
26aba1	John B. Wagner	13.44	24	Dr	....
26aba2	..do....	31.10	24	Dr	....
26aba3	..do....	13.14	24	Dr	....
28bdb1	Anton J. Zacher	150	2	Dr	1953
28bdb2	..do....	70	2	Dr	....
28ccc	Test hole 1208	84	5	Dr	9-24-57
29acd	Albert Jochim	23	24	Dr	1944
30adb	Kasper K. Feist Estate	60	2	Dr	....
32adb1	Alex A. Silvernagel	11.40	....	..	....
32adb2	..do....	13.63	24	Dr	....
33aaa	Max M. Heidrich	30	24	Dr	1953
33bdd	..do....	25	2	Dr	....
35ada1	Mrs. Magdlena Selvernagel	100	2	Dr	1916
35ada2	..do....	75	2	Dr	1954
132-75					
2dbc	Andy A. Wald	100 +	2	Dr	....
4cad1	Mike Jacob	80	2	Dr	....
4cad2	..do....	101	2	Dr	1957
8add	Wendelen Bosch	125	2	Dr	....
9cc	John A. Bosch	6	10	Dr	....
10dcc1	Tony Schwartzenberger	32	24	Dr	......
10dcc2	..do....	32	6	Dr	....
12bcc1	Jake Hoff	15.75	24	Dr	....

of wells and test holes -- Continued

Depth to water below land surface (feet)	Date of measurement	Use of water	Aquifer	Remarks
10	....	D	Gravel	
9.23	8-12-57	S	Gravel	
......	....	S	Sand	
43	....	D	.....	
......	....	S	.....	
90	....	D,S	.....	
100	....	D	Sand	
4	....	S	Sand, gravel	
4	....	D	Sand, gravel	
4.18	8-13-57	D,S	Gravel	
22.70	8-13-57	S	Gravel	Inadequate supply; unfit for drinking.
3.05	8-13-57	S	Gravel	
Flow	....	D,S	.....	
50	....	S	.....	Unfit for drinking; oily film on water.
......	....	T	.....	See log; altitude 1,795.
12	....	D,S	Gravel	Inadequate supply.
25	....	D,S	Sand	
10.20	8-13-57	S	Gravel	..Do....
9.01	8-13-57	N	Gravel, sand	..Do....
20	....	D,S	Sand	..Do....
......	....	S	Gravel	
......	....	D	.....	
......	....	S	.....	
98	....	D,S	.....	
......	....	D,S	.....	
95	....	D	.....	
......	....	D,S	Clay	..Do....
3	....	D	.....	
25	....	S	.....	..Do....
20	....	D	.....	..Do....
5.57	8-21-57	D,S	.....	

Location no.	Owner or name	Depth of well (feet)	Diameter or size (inches)	Type	Date completed
132-75 (Cont.)					
12bcc2	Edmund Wolfor	51.80	24	Dr	....
12bcc3	..do....	56.3	6	Dr	....
14daa1	Ben Rau	40	24	Dr	....
14daa2	..do....	80	2	Dr	....
14dcb	Ray Job	50	2	Dr	1952
17bb	Ray Senger	130	2	Dr	....
17ddd	Frank Jangula	15	4	Dr	....
18cdd1	Ludwig Stoppler	29.65	24	Dr	....
18cdd2	..do....	20.8	24	Dr	....
18cdd3	..do....	14.32	24	Dr	....
20aaa	Test hole 1231	31	5	Dr	10-17-57
20aac1	Ignate Kuhn	18	6	Dr	....
20aac2	..do....	18	6	Dr	....
20cac	Jacob Horner	36.62	24	Dr	....
21ddc	Markus Horner	20.2	24	Dr	....
22aaa	Phil Fischer	24	24	Dr	....
24adc1	John J. Docketer	40	36	Dr	1921
24adc2	..do....	43	36	Dr	1948
25bac	Joe W. Bosch	75	24	Dr	1928
26bba	Anton Senger	21	23	Dr	....
26ddd	Wendelin T. Bosch	18	30	Dr	....
27aaa	Test hole 1232	21	5	Dr	10-17-57
27aab	John Vetter	20.75	48	Du	....
27bb	Joe J. Jangula	16	48 x 48	Du	1943
28cc	Leo Vetter	30	24	Dr	1957
29ca	Anton Hagel	23.0	48 x 48	Du	....
30bba1	Pius Kelsch	18	36 x 36	Du	1942
30bba2	..do....	19	36 x 36	Du	....
30bda1	Peter G. Bosch	18	48 x 48	Du	....
30bda2	..do....	18	48 x 48	Du	....
31aa	John Hagel	48	24	Dr	....
31cdc	Theophile Ackerman	20	2	Dr	....
31dc	Frank Keller	48.75	24	Dr	....
32baa1	Joe F. Vetter	25	24	Dr	....
32baa2	..do....	25	24	Dr	....
32baa3	..do....	25	24	Dr	....

of wells and test holes -- Continued

Depth to water below land surface (feet)	Date of measure-ment	Use of water	Aquifer	Remarks
10.23	8-21-57	D,S	Gravel	
42.1	8-21-57	S	Gravel	
35	....	D,S	.....	Inadequate supply.
70	....	D	.....	
40	....	D	Gravel	
70	....	D,S	Sand	..Do....
9	....	D	Gravel	
16.30	8-22-57	S	.....	..Do....
5.0	8-22-57	S	Sand	
6.82	8-22-57	S	Sand	..Do....
......	....	T	.....	See log; altitude 1,810.
15	....	S	Gravel	
12	....	D	Gravel	
28.92	....	D	Sand	
18.9	8-22-57	D	.....	Inadequate supply.
16	....	D,S	.....	..Do....
13	....	D,S	Clay	..Do....
13	....	S	Clay	..Do....
50	....	D,S	Clay	..Do....
20	....	S	Gravel	
14	....	D,S	Gravel	..Do....
......	....	T	.....	See log; altitude 1,834.
17.55	8-21-57	D,S	Sand	Inadequate supply.
13	....	D	Sand	..Do....
18	....	S	Sand	..Do....
22.7	8-21-57	D,S	Shale	..Do....
12	....	S	Clay	..Do....
15	....	D	Clay	..Do....
15	....	D	Sand	..Do....
14	....	D	Sand	..Do....
20	....	D,S	Clay	
6	....	S	.....	
5.78	8-19-57	D,S	Gravel	
16	....	S	Sand	..Do....
16	....	S	Sand, gravel	..Do....
16	....	D	Clay	..Do....

Location no.	Owner or name	Depth of well (feet)	Diameter or size (inches)	Type	Date completed
132-75 (Cont.)					
34adc	George W. Bosch	11	36 x 36	Du	....
34ddc	Bernhard J. Felix	30	48 x 48	Du	1934
35aad1	Paul Ebach	16	48 x 48	Du	....
35aad2	..do....	16	48 x 48	Du	....
35bda	Anton W. Bosch	22	48 x 48	Du	1937
132-76					
5cbc	Markus Klein	70	24	Dr	....
5ccc	Philip O. Vetter	60	24	Dr	....
6caa	Test hole 1245	21	5	Dr	10-30-57
6dda	John Flagel	30	6	Dr	....
6ddc	Ben Wald	8	48 x 48	Du	....
6ddd	Betty E. Lovell	32	8	Dr	....
7bab1	John J. Schaltz	22	24	Dr	....
7bab2	..do....	13.5	24	Dr	....
7bcc	Test hole 1233	42	5	Dr	10-10-57
7dab	City of Linton	31.51	120	Du	1934
8bcc	..do....	57	8	Dr	1930
8cbb1	..do....	70	10	Dr	1925
8cbb2	..do....	60	10	Dr	1928
11bc	Mike Senger	85	24	Dr	1952
13dd	Markus Bosch	72	2	Dr	....
14bac	Sabastian Schwartzenberger	24	48 x 48	Du	1947
15daa	Test hole 1229	31	5	Dr	10-16-57
16dd	Test hole 1228	31	5	Dr	10-16-57
17bbb	Test hole 1225	63	5	Dr	10-14-57
17dbb	Leopold Bosch	19	6	Dr	....
17dd1	Linton Purk	336	2	Dr	....
17dd2	..do....	20	8	Dr	....
17dd3	..do....	19	8	Dr	....
17ddd	Test hole 1227	31	5	Dr	10-16-57
19dbd	Frank Lipp	65	24	Dr	1955
21bbb	Section Line Property (County)	99.5	4	Dr	....
22bad	Fred Petrie	18	36 x 36	Du	....
23aad	Test hole 1230	31	5	Dr	10-17-57

of wells and test holes -- Continued

Depth to water below land surface (feet)	Date of measurement	Use of water	Aquifer	Remarks
3	....	D,S	Sand	Inadequate supply.
25	....	D,S	Gravel	Yields about 1,000 gallons per day.
12	....	D,S	Gravel	Inadequate supply.
13	....	D,S	Gravel	..Do....
19	....	D,S	Sand, gravel	..Do....
45	....	D,S	Clay	
45	....	D,S	Sand	
......	....	T	.....	See log; altitude 1,733.
20	....	D,S	Sand	Inadequate supply.
5	....	D,S	Sand	
20	....	D,S	Sand	..Do....
11	....	D,S	Sand	Inadequate supply; unfit for drinking and cooking.
6.0	5-25-59	D,S	Shale	..Do....
......	....	T	.....	See log; altitude 1,693.
22.40	5-25-59	PS	Gravel	See chemical analysis.
33	....	PS	Gravel	
40	....	PS	Gravel	..Do....
40	....	PS	Gravel	
55	....	D,S	Shale	
50	....	D,S	Shale	Yields 400-500 gallons per day.
14	....	D,S	Gravel	
......	....	T	.....	See log; altitude 1,742.
......	....	T	.....	See log; altitude 1,723.
......	....	T	.....	See log; altitude 1,700.
13	....	D	Gravel	
16	....	N	Shale	
8	....	N	Gravel	Unfit for drinking.
10	....	D	Gravel	
......	....	T	.....	See log; altitude 1,720.
30	....	D,S	.....	
12.5	9-10-57	...	Gravel	Former seismic test hole.
12	....	D	Gravel	Inadequate supply.
......	....	T	.....	See log; altitude 1,765.

Location no.	Owner or name	Depth of well (feet)	Diameter or size (inches)	Type	Date completed
132-76 (Cont.)					
24cb	Pius Bosch	18	12	Dr	1954
24cdd1	Edward Schiele	18	24	Dr	....
24cdd2	..do....	14	24	Dr	....
26aba1	Matt A. Noel	16	6	Dr	....
26aba2	..do....	14	6	Dr	....
28bcc1	Paul Ferderder	22.6	48 x 48	Du	....
28bcc2	..do....	20	48 x 48	Du	....
28bcc3	..do....	17	48 x 48	Du	....
29cbb	Test hole 1224	57	5	Dr	10-14-57
30ada	Mike L. Holzer	20	24	Dr	1937
31cad	Peter Schell	13.45	24	Dr	....
34cac	Anton Tschosik	60	24	Dr	1950
34cba	Peter Lipp	175	4	Dr	....
132-77					
7aad	Test hole 1236	42	5	Dr	10-21-57
7ac1	Leo G. Marteri	19	48 x 48	Du	....
7ac2	..do....	20	8	Dr	....
8cba1	Matt Deisz	16	48 x 48	Du	....
8cba2	..do....	20	24	Dr	....
9ada	B. E. Ketchum	18	8	Dr	1923
9add	Test hole 1235	84	5	Dr	10-18-57
10bb1	Joe Bichler	17	....	Du	....
10bb2	..do....	18	24	Dr	....
12abb	Frank Malson	16	24	Dr	1956
12bbb	Test hole 1234	42	5	Dr	10-18-57
12bbd	Alex Ohlhouser	28	8	Dr	1947
14aac1	Carl Heidrich	24	24	Dr	1951
14aac2	..do....	34	24	Dr	1956
17da	Joseph Deisz	8	36 x 36	Du	....
18aba	Christ Kremer	58.65	24	Dr	1954
19bbd	Peter F. Bosch	12	48 x 48	Du	1935
20bbb1	Ralf Kremer	145	2	Dr	1944
20bbb2	..do....	10	36	Du	....
20dbb1	Fred Lenhart	18	36 x 48	Du	....

of wells and test holes -- Continued

Depth to water below land surface (feet)	Date of measurement	Use of water	Aquifer	Remarks
17	....	D	Sand	Inadequate supply.
15	....	D	Sand, gravel	
10	....	S	Sand, gravel	Inadequate supply; enough for 20 head of cattle only.
......	....	S	Gravel	
......	....	D	Gravel	
15.9	8-23-57	D	Sand	Inadequate supply.
8	....	S	Gravel	Yields 800 gallons per hour.
6	....	S	Gravel	
......	....	T	.....	See log; altitude 1,729.
6	....	D,S	Gravel	Inadequate supply.
9.15	8-23-57	D,S	Gravel	
28	....	D,S	Sand	
165	....	D,S	Sand	..Do....
......	....	T	.....	See log; altitude 1,636.
16	....	S	Gravel	
17	....	D	Gravel	
14	....	D	Gravel	
12	....	S	Gravel	Yields enough for 90 head of cattle.
12	....	D,S	Sand	
......	....	T	.....	See log; altitude 1,655.
8	....	S	Sand	
12	....	D	Sand	Inadequate supply.
14	....	D	Gravel	
......	....	T	.....	See log; altitude 1,712.
26	....	D,S	Sand	Inadequate supply.
14	....	D,S	Sand	..Do....
11	....	D	Sand	Yields 6 gallons per day.
4	....	D,S	Gravel	
54.05	9- 5-57	D,S	Sand	Inadequate supply.
6	....	D,S	Sand	
65	....	S	Sand	
8	....	D	Sand	..Do....
4	....	D,S	Sand	

Location no.	Owner or name	Depth of well (feet)	Diameter or size (inches)	Type	Date completed
132-77 (Cont.)					
20dbb2	George C. Wagner	55	2	Dr	1950
20dbb3	..do....	25	48 x 48	Du	....
21dad1	Bosch	115	2	Dr	1944
21dad2	..do....	48	24	Dr	1953
22bab1	Mattie F. Volk	75	24	Dr	....
22bab2	..do....	45	24	Dr	1954
23acd	Chris Maier	100	4	Dr	....
24cbb	Bill Frank	40	24	Dr	....
25aa1	John Knapp	48.6	24	Dr	....
25aa2	..do....	60	24	Dr	....
26cad1	Anton P. Horner	32	24	Dr	1945
26cad2	..do....	18	24	Dr	1945
28ada1	Sebold Nagel	29.25	24	Dr	....
28ada2	..do....	25	4	Dr	....
28caa	John Sehn	70	24	Dr	1949
29bbb	Jacob Kelsch	75	5	Dr	1930
30dcb1	Math K. Vetter	38	24	Dr	1953
30dcb2	..do....	18	36 x 36	Du	....
31ddb1	Martin F. Scherr	10.78	24	Dr	....
31ddb2	..do....	43	24	Dr	....
133-75					
2add	Raymond Keller	160	2	Dr	1916
2dcd	Paul Jod	136	2	Dr	....
3ab	Ben Loebs	210	2	Dr	....
4cac	Helmouth Heyne	140	2	Dr	....
4dd	Eddy Walker	130	2	Dr	....
5dba	Jacob Heyne	120	2	Dr	....
6aaa	Edgar Wohl	217	2	Dr	....
6cbd	Mrs. John Heer	200	2	Dr	....
7cda	Chester Sandwick	180	2	Dr	....
8bbb1	Iggie Bauman	240	2	Dr	....
8bbb2	..do....	89	2	Dr	....
8dab	Ed Bollinger	187	2	Dr	....
8dca	Henry Nathen	196	3	Dr	....
10aba	Emanuel Loebs	85	2	Dr	....
10bbb	Christeane Walker	130	2	Dr	....
10cdd	San Loebs	80	2	Dr	....

of wells and test holes -- Continued

Depth to water below land surface (feet)	Date of measurement	Use of water	Aquifer	Remarks
Flow	....	D	Sand	
10	....	S	Sand	
80	....	S	Sand	
43	....	D	Sand	
63	....	S	Sand	Inadequate supply.
32	....	D	Sand	..Do....
3	....	D	Gravel	
20	....	...	Sand	
42.8	8-23-57	S	Gravel	
40	....	D	Gravel	
28	....	...	Sand	
13	....	D	Gravel	
25.94	8-23-57	D,S	Sand	..Do....
10	....	S	Gravel	..Do....
40	....	D,S	Sand	
30	....	...	Sand	
37	....	D,S	.....	..Do....
11	....	S	Sand	..Do....
6.42	8-23-57	D,S	Gravel	..Do....
10	....	D,S	Sand	
150	....	D,S	Sand	
......	....	D,S	Gravel	
200	....	S	.....	
115	....	D,S	Sand	
105	....	D,S	Sand	
104	....	...	Sand	
187	....	D,S	Sand	
150	....	D,S	Sandstone	
150	....	S	Sand	Yields enough for more than 100 head of cattle.
120	....	D,S	Sandstone	
85	....	S	Sandstone	Inadequate supply.
167	....	D,S	Coal	
156	....	S	Coal	
75	....	D,S	Sandstone	
110	....	S	Coal	Oily film on water.
60	....	D,S	Gravel	

Location no.	Owner or name	Depth of well (feet)	Diameter or size (inches)	Type	Date completed
133-75(Cont.)					
14acc	Ben Sikel	175	2	Dr	....
14bbb	Emil Hoff	80	2	Dr	....
18bbc	Chester Sandwick	310	2	Dr	....
18cba	..do....	180	2	Dr	....
18daa	John Hoff	220 +	2	Dr	....
20daa	Henry Breckel	210	2	Dr	....
22bdd1	John James	80	2	Dr	....
22bdd2	..do....	85	2	Dr	....
24aaa	Thomas Grogan	70	4	Dr	....
24cda	Albert Hoff	180 +	2	Dr	....
26bab	Mrs. Elizabeth Lovelle	60	2	Dr	....
26dcc	Jake Baumgartner	145	2	Dr	....
28adb	Jack Schwab	104	2	Dr	....
28cc1	Hans Hanson	20	24	Dr	....
28cc2	..do....	40	4	Dr	....
28cc3	..do....	70	4	Dr	....
32cda	Curtis O. Donald	16	36 x 36	Du	....
34ccd	Alouis Ibach	140	2	Dr	....
35cb	Franklin Investment oil-test hole	5,359	....	Dr	7-22-43
133-76					
2daa	Jack Birdsell	90	2	Dr	....
3bb	Ferdinand Buezhler	192	2	Dr	....
4add	Mamie Foell	235	2	Dr	....
4ccb	Frank Weber	200	2	Dr	....
5bac1	Albert Wudtkey	160	2	Dr	1910
5bac2	..do....	115	2	Dr	1912
5bb	Uttlieb Grenz	110 +	2	Dr	....
5bba	Temvik School well	110	2	Dr	....
5bbc	Albert Wudtkey	120	2	Dr	1910
5bc	Northern Pacific Railroad	120	8	Dr	1953
6aab	Aloysius Deis	110	2	Dr	....
6bba	Clement Deis	136	2	Dr	....
6ddc	Gregory Nelson	100	2	Dr	....
7bba	Frank Deis	120	2	Dr	....

of wells and test holes -- Continued

Depth to water below land surface (feet)	Date of measurement	Use of water	Aquifer	Remarks
135	....	D,S	Sandstone	
65	....	D,S	Sand	
160	....	D,S	Sand	
160	....	S	Sand	
200	....	S	Sandstone	
170	....	D,S	Gravel	
55	....	S	Gravel	
60	....	D	Gravel	
40	....	D,S	Gravel	
170	....	D,S	Sand	
40	....	D,S	Gravel	
130	....	D,S	Coal	
34	....	D	Sand	
10	....	D	Sand	Inadequate supply.
20	....	S	Sand	
30	....	S	Sand	
......	....	D,S	Gravel	
50	....	D,S	Sandstone	
......	....	T	.....	Altitude 1,909.
60	....	D,S	Sand	
180	....	D,S	Sandstone	Inadequate supply.
60	....	S	Sandstone	
60	....	D,S	Sand	See chemical analysis.
60	....	D,S	Gravel	Inadequate supply.
60	....	D	Gravel	
30	....	D,S	Coal	
......	....	D	Sandstone	..Do....
50	....	D	Gravel	
60	....	RR	Gravel	
90	....	D	Clay	
125	....	D,S	Sandstone	
50	....	D,S	Gravel	
......	....	D,S	.....	

Location no.	Owner or name	Depth of well (feet)	Diameter or size (inches)	Type	Date completed
133-76 (Cont.)					
7cab1	Edwin Will	160	2	Dr	....
7cab2	..do....	147	2	Dr	1956
8ccb	Philip O. Pfeifer	110	2	Dr	1912
9bbc	Frank Weber	208	2	Dr	....
10add	Clarence Nelson	160	2	Dr	....
10bbb	Fred K. Nelson	200 +	2	Dr	....
10dab1	John Forderer	83	6	Dr	1957
10dab2	..do....	104	6	Dr	....
13ccd	Herbert O. Beck	111	2	Dr	....
13daa	Chester Sandwick	175	2	Dr	....
14ccc	Herbert O. Beck	31	2	Dr	....
15bbb	Test hole 1239	31	5	Dr	10-24-57
16bab1	John Schatz	70	2	Dr	....
16bab2	..do....	240	2	Dr	....
17aa	..do....	240	2	Dr	....
18cc	Oscar H. Will.	180	2	Dr	....
19dbd	Mike Fischer	18	48 x 48	Du	....
20bac	William Job	94	6	Dr	....
22bb	Vern McCulley	114	2	Dr	1951
24bbb	Herbert O. Beck	220	2	Dr	....
24bcb1	Elmer Witikko	110	2	Dr	....
24bcb2	..do....	200	2	Dr	....
25bad	Jacob J. Weber	140	2	Dr	....
25ddc	Theophile Ackerman	160	2	Dr	....
26bbb1	John W. Wohl	61	3	Dr	....
26bbb2	..do....	60	3	Dr	....
26bbb3	..do....	66	3	Dr	....
26cda	Rose Bollinger	185	2	Dr	1955
28aaa	Test hole 1238	21	5	Dr	10-22-57
31ccc	Test hole 1240	31	5	Dr	10-24-57
32ada	Herb Ketchum	25	24	Dr	....
32bd1	Val B. Better	90	2	Dr	....
32bd2	..do....	20	24	Dr	....
32bd3	..do....	20	24	Dr	....
33cbd	Test hole 1244	52	5	Dr	10-28-57
33ccd	Test hole 1237	84	5	Dr	10-22-57
33ddc	Serr	82	24	Dr	....

of wells and test holes -- Continued

Depth to water below land surface (feet)	Date of measurement	Use of water	Aquifer	Remarks
80	....	S	Sandstone	
77	....	D	Sandstone	
30	....	D,S	Sandstone	
80	....	D,S	Sand	Inadequate supply, soft.
100	....	D,S	Sandstone	
170	....	D,S	Sandstone	Inadequate supply.
73	....	D	Gravel	
44	....	S	Sand	..Do....
95	....	D,S	Sandstone	
160	....	D,S	Sand	
15	....	S	.....	
......	....	T	.....	See log.
65	....	S	Sand	
200	....	D,S	Sandstone	Inadequate supply.
200	....	D,S	Sand	..Do....
......	....	D,S	.....	Yields 200 gallons per hour.
8	....	D,S	Gravel	
62	....	D,S	Clay	
40	....	D,S	Sand	
193	....	D,S	Sandstone	
95	....	D,S	Sandstone	
......	....	S	Sandstone	
122	....	D,S	Sand	
150	....	D,S	.....	Inadequate supply.
41	....	D,S	Sand	
40	....	S	Sand	
46	....	S	Sand	
155	....	D,S	Sandstone	..Do....
......	....	T	.....	See log; altitude 1,813.
......	....	T	.....	See log.
19	....	D,S	Sand	Inadequate supply.
88	....	D,S	Sand	..Do....
19	....	S	Shale	..Do....
19	....	S	Shale	..Do....
......	....	T	.....	See log; altitude 1,748. Chemical analysis.
......	....	T	.....	See log; altitude 1,741.
68	....	D,S	Shale	Inadequate supply.

TABLE 3.--Records

Location no.	Owner or name	Depth of well (feet)	Diameter or size (inches)	Type	Date completed
133-76 (Cont.)					
35da	Weber oil-test hole	5,882	10 3/4	Dr	9-18-50
36aab	Theophile Ackerman	200	2	Dr	....
133-77					
1abb	Jacob Schatz	150	6	Dr	....
2dbb1	Peter Nelson Jr.	80	2	Dr	7-57
2dbb2	..do....	90	2	Dr	1952
4bbb	Beska Estate	96	4	Dr	....
5abd1	Edward Serr	70	2	Dr	....
5abd2	..do....	100	2	Dr	1957
6aaa	Abert Beck	135	2	Dr	....
8cdb	Mrs Henry Serr	100	2	Dr	....
10aab1	Neil Beitelspacher	65	3	Dr	....
10aab2	..do....	80	3	Dr	1917
10cdb1	Jacob Huber	28	36 x 36	Du	....
10cdb2	..do....	200	2	Dr	....
10ddc	..do....	200	4	Dr	....
16ddd	Test hole 1243	42	5	Dr	10-25-57
21aca	Mike P. Feist	20	48 x 48	Du	....
24aab	Arthur Berreth	130	2	Dr	....
25ccc	Mike V. Holzer	51.56	24	Dr	1956
26ccc	Test hole 1241	10	5	Dr	10-24-57
26dbc	Fred Richardson	100	2	Dr	....
28baa	Test hole 1242	31	5	Dr	10-25-57
32dbb1	Peter J. Salbernagel	30	28	Dr	1937
32dbb2	..do....	45	24	Dr	1956
35bac	Euguene Malson	19.65	24	Dr	....
35ddc	Valentine Holzer	32	36 x 36	Du	....

of wells and test holes -- Continued

Depth to water below land surface (feet)	Date of measurement	Use of water	Aquifer	Remarks
......	....	T	.....	Altitude 2,012.
170	....	S	.....	
98	....	D,S	.....	
30	....	D	Gravel	
30	....	S	Gravel	
6	....	D,S	.....	
50	....	S	Sand	
70	....	D	Sand	
70	....	D,S	Sand	
15	....	D,S	Sandstone	Inadequate supply.
25	....	S	Sandstone	
45	....	D	Sandstone	
10	....	D,S	Gravel	..Do....
155	....	S	Sandstone	
60	....	S	Sandstone	
......	....	T	.....	See log; altitude 1,732.
12	....	D,S	Sand	
95	....	D,S	Clay	
37.46	9- 5-57	D,S	Sand	Inadequate supply.
......	....	T	.....	See log.
60	....	D,S	Sandstone	
......	....	T	.....	See log; altitude 1,702.
20	....	S	Sand	Inadequate supply.
17	....	D	Sand	Yields 7.5 gpm.
9.35	9- 6-57	D,S	Sandstone	Inadequate supply.
27	....	D,S	Sand	..Do....

TABLE 4.--Logs of test holes

130-76-2bbb
Test hole 1222

Formation	Material	Thickness (feet)	Depth (feet)
Glacial drift:			
	Topsoil, black	2	2
	Clay, light-gray, and fine to medium gravel (till)	9	11
	Gravel, fine to coarse, shale pebbles and cobbles	10	21
	Clay, gray, fine to medium gravel, and shale pebbles (till)	22	43
Fox Hills Sandstone:			
	Clay, sandy, light-gray	9	52

130-76-4add2
Test hole 1218

Formation	Material	Thickness (feet)	Depth (feet)
Glacial drift:			
	Topsoil, black	1	1
	Clay, light-brown, fine to medium gravel, and shale pebbles (till)	35	36
	Clay, gray, fine to medium gravel, and shale pebbles (till)	103	139
Fox Hills Sandstone:			
	Clay, sandy, light-gray	8	147

130-76-12bbb
Test hole 1210

Formation	Material	Thickness (feet)	Depth (feet)
Glacial drift:			
	Topsoil, black	2	2
	Clay, light-brown, and fine to medium gravel (till)	38	40
	Clay, light-brown, and abundant fine to medium gravel (till)	14	54
	Clay, gray, fine to medium gravel, and shale pebbles (till)	69	123
Fox Hills Sandstone:			
	Clay, sandy, light-gray	13	136

TABLE 4.--Logs of test holes -- Continued

130-76-13ccc
Test hole 1211

Formation	Material	Thickness (feet)	Depth (feet)
Glacial drift:			
	Topsoil, black	1	1
	Clay, light-brown, and fine to medium gravel (till)	24	25
	Clay, sandy, gray	11	36
	Clay, gray, fine to medium gravel, and shale pebbles (till)	39	75
	Gravel, fine to coarse, and shale pebbles	33	108
	Clay, gray, fine to medium gravel, and shale pebbles (till)	48	156
Fox Hills Sandstone:			
	Clay, sandy, light-gray	12	168

130-76-35aaa2
Test hole 1212

Formation	Material	Thickness (feet)	Depth (feet)
Glacial drift:			
	Topsoil, black	4	4
	Clay, light-brown, and fine to medium gravel (till)	5	9
	Clay, light-brown, and abundant fine to medium gravel (till)	11	20
	Clay, gray, fine to medium gravel, and shale pebbles (till)	138	158
Pierre Shale:			
	Shale, gray	10	168

131-75-23dcd
Test hole 1217

Formation	Material	Thickness (feet)	Depth (feet)
Glacial drift:			
	Topsoil, black	1	1
	Clay, light-gray, and fine to medium gravel (till)	15	16
	Clay, gray, fine to medium gravel, cobbles, and shale pebbles (till)	68	84

TABLE 4.--Logs of test holes -- Continued

131-75-28aac
Test hole 1216

Formation	Material	Thickness (feet)	Depth (feet)
Glacial drift:			
	Topsoil, black	2	2
	Clay, smooth, light-brown	9	11
	Clay, light-brown, and fine to medium gravel (till)	18	29
	Clay, gray, fine to medium gravel, and shale pebbles (till)	92	121
Fox Hills Sandstone:			
	Clay, sandy, light-gray	15	136

131-75-32bbb3
Test hole 1215

Formation	Material	Thickness (feet)	Depth (feet)
Glacial drift:			
	Topsoil, black	1	1
	Clay, light-brown, and fine to medium gravel (till)	30	31
	Clay, gray, fine to medium gravel, and shale pebbles (till)	44	75
	Gravel, fine to coarse, and shale pebbles	9	84
Fox Hills Sandstone:			
	Clay, sandy, light-gray	10	94

131-75-36aaa
Test hole 1214

Formation	Material	Thickness (feet)	Depth (feet)
Glacial drift:			
	Topsoil, black	2	2
	Clay, light-brown, and fine to medium gravel (till)	19	21
	Clay, gray, fine to medium gravel, and shale pebbles (till)	64	85
Fox Hills Sandstone:			
	Clay, sandy, light-gray	20	105

131-76-4ddc
Test hole 1223

Formation	Material	Thickness	Depth
Glacial drift:			
	Topsoil, black----------------------	2	2
	Sand, fine to coarse, clayey---------	9	11
	Gravel, fine to coarse, and cobbles--	16	27
Fox Hills Sandstone:			
	Clay, sandy, light-gray--------------	25	52

131-76-15bbd
Test hole 1226

Formation	Material	Thickness	Depth
Glacial drift:			
	Topsoil, black----------------------	2	2
	Clay, light-brown, and fine to medium gravel (till)---------------------	9	11
	Gravel, fine to coarse, and cobbles--	5	16
Fox Hills Sandstone:			
	Clay, sandy, light-gray--------------	26	42

131-76-22aba
Test hole 1220

Formation	Material	Thickness	Depth
Glacial drift:			
	Topsoil, black----------------------	3	3
	Clay, light-brown, and fine to medium gravel (till)---------------------	3	6
	Gravel, fine to coarse, and cobbles--	31	37
	Clay, gray, fine to medium gravel, and shale pebbles (till)-----------	6	43
Fox Hills Sandstone:			
	Clay, sandy, light-gray--------------	20	63

TABLE 4.--Logs of test holes -- Continued

131-76-22cdd
Test hole 1221

Formation	Material	Thickness (feet)	Depth (feet)
Glacial drift:			
	Topsoil, black	1	1
	Clay, light-brown, and fine to medium gravel (till)	6	7
	Gravel, fine to coarse, and shale pebbles	3	10
	Gravel, fine to coarse, and cobbles	13	23
	Clay, gray, fine to medium gravel, and shale pebbles (till)	6	29
Fox Hills Sandstone:			
	Clay, sandy, light-gray	24	53

131-76-25ddc
Test hole 1213

Formation	Material	Thickness (feet)	Depth (feet)
Glacial drift:			
	Topsoil, black	2	2
	Clay, light-brown, and fine to medium gravel (till)	26	28
	Clay, gray, fine to medium gravel, and shale pebbles (till)	45	73
	Gravel, fine to coarse, and cobbles	6	79
	Clay, smooth, gray	56	135
Fox Hills Sandstone:			
	Clay, sandy, gray, and lignite fragments	95	230
	Clay, sandy, light-gray	64	294

TABLE 4.--Logs of test holes -- Continued

131-76-26cab2
Test hole 1202

Formation	Material	Thickness (feet)	Depth (feet)
Glacial drift:			
	Topsoil, sandy, black	2	2
	Clay, sandy, brown, and fine gravel (till)	24	26
	Sand, fine to medium, silty	6	32
	Gravel, fine to coarse, and medium to coarse sand	6	38
	Clay, sandy, light-gray, and fine to medium gravel (till)	28	66
	Sand, fine to coarse, and lignite fragments	6	72
Fox Hills Sandstone:			
	Clay, sandy, light-gray, and lignite fragments	103	175
	Clay, sandy, light-gray	85	260

131-76-26cbc
Test hole 1203

Formation	Material	Thickness (feet)	Depth (feet)
Glacial drift:			
	Topsoil, black	1	1
	Clay, gray, and fine to medium gravel (till)	4	5
	Clay, smooth, light-brown	21	26
Fox Hills Sandstone:			
	Clay, sandy, gray	58	84
	Sand, fine, silty, and lignite fragments	8	92
	Clay, sandy, light-gray	23	115

131-76-26ccc
Test hole 1207

Formation	Material	Thickness (feet)	Depth (feet)
Glacial drift:			
	Topsoil, black	1	1
	Clay, light-brown, and fine to medium gravel (till)	18	19
	Clay, gray, fine to medium gravel, and shale pebbles (till)	15	34
Fox Hills Sandstone:			
	Clay, sandy, light-gray	134	168

TABLE 4.--Logs of test holes -- Continued

131-76-30ccc
Test hole 1206

Formation	Material	Thickness (feet)	Depth (feet)
Alluvium and colluvium:			
	Topsoil, black	1	1
	Clay, smooth, dark-gray	12	13
Glacial drift:			
	Clay, smooth, brown	13	26
	Clay, gray, fine to medium gravel, and shale pebbles (till)	171	197
Fox Hills Sandstone:			
	Clay, sandy, light-gray	13	210

131-76-32abb
Test hole 1219

Formation	Material	Thickness (feet)	Depth (feet)
Glacial drift:			
	Topsoil, black	4	4
	Clay, brown, and fine to medium gravel (till)	18	22
	Clay, gray, fine to medium gravel, and shale pebbles (till)	132	154
Fox Hills Sandstone:			
	Clay, sandy, light-gray	13	167

131-76-33bbb
Test hole 1205

Formation	Material	Thickness (feet)	Depth (feet)
Glacial drift:			
	Topsoil, black	1	1
	Clay, smooth, brown, and fine gravel (till)	20	21
	Clay, gray, fine to medium gravel, and shale pebbles (till)	68	89
	Gravel, fine to medium, and shale pebbles	6	95
	Clay, gray, fine to medium gravel, and shale pebbles (till)	39	134
Fox Hills Sandstone:			
	Clay, sandy, light-gray	13	147

TABLE 4.--Logs of test holes -- Continued

131-76-34bbb
Test hole 1204

Formation	Material	Thickness (feet)	Depth (feet)
Glacial drift:			
	Topsoil, black	1	1
	Clay, light-brown, and fine to medium gravel (till)	25	26
	Clay, brown, fine to medium gravel, and selenite crystals (till)	26	52
	Clay, gray, and fine to medium gravel (till)	16	68
	Sand, fine to medium, silty	4	72
Fox Hills Sandstone:			
	Clay, sandy, light-gray	33	105

131-76-35ddd
Test hole 1209

Formation	Material	Thickness (feet)	Depth (feet)
Glacial drift:			
	Topsoil, black	2	2
	Clay, sandy, brown, and fine gravel (till)	3	5
	Sand, fine to coarse, and fine gravel	5	10
	Gravel, fine to coarse, and cobbles	10	20
	Gravel, fine to medium, and coarse sand	22	42
	Clay, gray, fine to medium gravel, and shale pebbles (till)	73	115
Fox Hills Sandstone:			
	Clay, sandy, light-gray	11	126

131-77-28ccc
Test hole 1208

Formation	Material	Thickness (feet)	Depth (feet)
Alluvium and colluvium:			
	Topsoil, black	1	1
	Clay, sandy and silty, light-gray	11	12
Glacial drift:			
	Gravel, fine to coarse (outwash)	4	16
Fox Hills Sandstone:			
	Clay, sandy, gray	58	74
	Clay, sandy, light-gray	10	84

132-75-20aaa
Test hole 1231

Formation	Material	Thickness (feet)	Depth (feet)
Alluvium and colluvium:			
	Topsoil, black	2	2
	Sand, fine to medium, silty	10	12
Glacial drift:			
	Gravel, medium to coarse, clayey (outwash)	13	25
Pierre Shale:			
	Shale, gray	6	31

132-75-27aaa
Test hole 1232

Formation	Material	Thickness (feet)	Depth (feet)
Alluvium and colluvium:			
	Topsoil, black	3	3
	Clay, sandy, dark-brown	8	11
Glacial drift:			
	Clay, light-brown, and fine to coarse gravel (till)	6	17
Pierre Shale:			
	Shale, gray	4	21

132-76-6caa
Test hole 1245

Formation	Material	Thickness (feet)	Depth (feet)
Alluvium and colluvium:			
	Topsoil, black	3	3
	Clay, sandy, and silty, light-brown	8	11
Glacial drift:			
	Clay, sandy, gray (outwash)	5	16
Pierre Shale:			
	Shale, gray	5	21

TABLE 4.--Logs of test holes -- Continued

132-76-7bcc
Test hole 1233

Formation	Material	Thickness (feet)	Depth (feet)
Glacial drift:			
	Topsoil, black	1	1
	Sand, fine to coarse (outwash)	4	5
	Gravel, fine to coarse (outwash)	5	10
	Gravel, fine to coarse, cobbles, and shale pebbles (outwash)	24	34
Pierre Shale:			
	Shale, gray	8	42

132-76-15daa
Test hole 1229

Formation	Material	Thickness (feet)	Depth (feet)
Alluvium and colluvium:			
	Topsoil, black	2	2
	Clay, sandy and silty, light-brown	9	11
Glacial drift:			
	Gravel, fine to coarse, clayey (outwash)	11	22
Pierre Shale:			
	Shale, gray	9	31

132-76-16dd
Test hole 1228

Formation	Material	Thickness (feet)	Depth (feet)
Alluvium and colluvium:			
	Topsoil, black	1	1
	Clay, sandy and silty, brown	4	5
Glacial drift:			
	Gravel, fine to coarse (outwash)	5	10
	Gravel, fine to coarse, and cobbles (outwash)	10	20
	Gravel, fine to coarse, and shale pebbles (outwash)	6	26
Pierre Shale:			
	Shale, gray	5	31

TABLE 4.--Logs of test holes -- Continued

132-76-17bbb
Test hole 1225

Formation	Material	Thickness (feet)	Depth (feet)
Alluvium and colluvium:			
	Topsoil, black	2	2
	Clay, silty, dark-brown	9	11
Glacial drift:			
	Gravel, fine to coarse, and cobbles (outwash)	23	34
	Clay, sandy, gray (outwash)	2	36
	Gravel, fine, and fine to coarse sand (outwash)	6	42
	Clay, sandy, light-gray	21	63

132-76-17ddd
Test hole 1227

Formation	Material	Thickness (feet)	Depth (feet)
Alluvium and colluvium:			
	Topsoil, black	2	2
	Clay, sandy and silty, dark-brown	9	11
Glacial drift:			
	Gravel, fine to coarse (outwash)	10	21
Pierre Shale:			
	Shale, gray	10	31

132-76-23aad
Test hole 1230

Formation	Material	Thickness (feet)	Depth (feet)
Glacial drift:			
	Topsoil, black	2	2
	Sand, fine to coarse, silty (outwash)	9	11
	Gravel, fine to coarse, cobbles, and shale pebbles (outwash)	15	26
Pierre Shale:			
	Shale, gray	5	31

TABLE 4.--Logs of test holes -- Continued

132-76-29cbb
Test hole 1224

Formation	Material	Thickness (feet)	Depth (feet)
Alluvium and colluvium:			
	Topsoil, black	1	1
	Sand, fine to medium, silty	11	12
Glacial drift:			
	Clay, smooth, gray (outwash)	16	28
	Gravel, fine to coarse (outwash)	2	30
Fox Hills Sandstone:			
	Clay, sandy, light-gray	27	57

132-77-7aad
Test hole 1236

Formation	Material	Thickness (feet)	Depth (feet)
Alluvium and colluvium:			
	Topsoil, black	1	1
	Sand, fine to coarse, silty	20	21
Glacial drift:			
	Gravel, fine to coarse (outwash)	15	36
Fox Hills Sandstone:			
	Clay, sandy, gray	6	42

132-77-9add
Test hole 1235

Formation	Material	Thickness (feet)	Depth (feet)
Alluvium and colluvium:			
	Topsoil, black	3	3
	Clay, sandy, dark-brown	8	11
	Clay, sandy and silty, gray	5	16
Glacial drift:			
	Gravel, fine to coarse, and shale pebbles (outwash)	13	29
	Sand, fine to coarse, silty (outwash)	14	43
	Clay, smooth, gray (outwash)	21	64
	Gravel, fine to coarse, and shale pebbles (outwash)	9	73
Fox Hills Sandstone:			
	Clay, sandy, light-gray	11	84

TABLE 4.--Logs of test holes -- Continued

132-77-12bbb
Test hole 1234

Formation	Material	Thickness (feet)	Depth (feet)
Alluvium and colluvium:			
	Topsoil, black	1	1
	Clay, sandy and silty, light-brown	8	9
Glacial drift:			
	Gravel, fine to medium, clayey (outwash)	12	21
	Gravel, medium to coarse, cobbles, and shale pebbles (outwash)	13	34
Pierre Shale:			
	Shale, gray	8	42

133-76-15bbb
Test hole 1239

Formation	Material	Thickness (feet)	Depth (feet)
Glacial drift:			
	Topsoil, black	2	2
	Clay, sandy, dark-brown, and fine gravel (till)	9	11
	Clay, sandy, light-brown, and fine gravel (till)	15	26
Fox Hills Sandstone:			
	Clay, sandy, light-gray	5	31

133-76-28aaa
Test hole 1238

Formation	Material	Thickness (feet)	Depth (feet)
Alluvium and colluvium:			
	Topsoil, black	1	1
	Clay, sandy and silty, light-brown	11	12
Pierre Shale:			
	Shale, gray	9	21

133-76-31ccc
Test hole 1240

Formation	Material	Thickness (feet)	Depth (feet)
Fox Hills Sandstone:			
	Topsoil, black	3	3
	Clay, sandy, light-brown	24	27
	Clay, sandy, light-gray	4	31

TABLE 4.--Logs of test holes -- Continued

133-76-33cbd
Test hole 1244

Formation	Material	Thickness (feet)	Depth (feet)
Alluvium and colluvium:			
	Topsoil, black----------------------	2	2
	Clay, sandy and silty, light-brown---	4	6
Glacial drift:			
	Gravel, fine to coarse (outwash)-----	5	11
	Sand, fine to coarse, silty, and cobbles (outwash)-----------------	10	21
	Sand, fine to coarse, silty (outwash)	9	30
	Clay, sandy, light-gray--------------	9	39
	Sand, medium to coarse---------------	13	52

133-76-33ccd
Test hole 1237

Formation	Material	Thickness (feet)	Depth (feet)
Alluvium and colluvium:			
	Topsoil, black----------------------	1	1
	Clay, sandy and silty, light-brown---	10	11
Glacial drift:			
	Gravel, fine to coarse, clayey (outwash)	21	32
	Clay, sandy, light-gray (outwash)----	47	79
Pierre Shale:			
	Shale, gray-------------------------	5	84

133-77-16ddd
Test hole 1243

Formation	Material	Thickness (feet)	Depth (feet)
Alluvium and colluvium:			
	Topsoil, black----------------------	2	2
	Clay, sandy and silty, light-brown---	12	14
Glacial drift:			
	Gravel, fine to coarse, clayey, and shale pebbles (outwash)------------	19	33
	Sand, fine, and shale pebbles (outwash)------------------------	9	42

TABLE 4.--Logs of test holes -- Continued

133-77-26ccc
Test hole 1241

Formation	Material	Thickness (feet)	Depth (feet)
Alluvium and colluvium:			
	Topsoil, black----------------------	1	1
	Clay, sandy and silty, brown---------	4	5
Glacial drift:			
	Clay, very sandy, gray (outwash)-----	5	10

133-77-28baa
Test hole 1242

Formation	Material	Thickness (feet)	Depth (feet)
Alluvium and colluvium:			
	Topsoil, black----------------------	3	3
	Clay, sandy and silty, dark-brown----	21	24
Glacial drift:			
	Clay, very sandy, dark-gray (outwash)	7	31

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