Geology and Ground-Water Resources of Buffalo County and Adjacent Areas Nebraska

By R. L. SCHREURS

With a section on

CHEMICAL QUALITY OF THE GROUND WATER

By FRANK H. RAINWATER

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By R. L. Schreurs

ABSTRACT

The area described in this report lies principally between the Platte and South Loup Rivers in south-central Nebraska. It is about 1,500 square miles in extent and includes the eastern half of Dawson County, all of Buffalo County, and the western quarter of Hall County. About three-fourths of the area is dissected upland; most of the remaining fourth of the area is in the Platte River valley and a small part of it is in the valleys of the Wood and South Loup Rivers.

The climate of the area is marked by wide seasonal variations, and the mean annual precipitation is about 20 inches. Farming is the principal occupation. In the Platte River valley, some of the farm land west of Kearney is irrigated by water diverted from the Platte River and some by ground water, whereas east of Kearney farm land is irrigated by ground water only. Use of ground water for irrigation on the upland and in the South Loup River valley is relatively new and is increasing.

The geologic formations exposed in the area are of Quaternary age; they are underlain by Tertiary and older formations. The saturated sand and gravel formations of Quaternary (Pleistocene) age and the coarser textured parts of the Ogallala formation of Tertiary (Pliocene) age are the aquifers from which ground water is pumped. In the valleys of the Platte and South Loup Rivers, ground water is obtained principally from Pleistocene deposits; on the upland between the valleys, ground water is obtained from both the Pleistocene deposits and the underlying Ogallala formation. The ground water generally occurs under water-table conditions, but in a few localities it may be confined by relatively impermeable beds. Irrigation wells tapping the sand and gravel formations of Pleistocene age yield copious supplies of water, whereas wells drilled into the Ogallala formation yield only small to moderate amounts.

The ground water, in general, is moving eastward. Ground-water movement in the Platte River valley is nearly parallel to the flow of the Platte River and the gradient of the water table is approximately the same as that of the river. Ground water in the South Loup River valley moves toward the river. The direction of ground-water movement in any part of the upland area is dependent on the location of that part of the area with respect to the water-table divides between the South Loup and Platte River valleys, between the Wood River and Platte River valleys, and between the Mud Creek and South Loup River valleys.

The depth to water ranges from a few feet to a little more than 250 feet and averages about 75 feet. In general, the depth to water in the valleys is much less than in the upland area. The water level in the valleys generally rises rapidly in response to precipitation, especially where the water table is shallow, and, in areas adjacent to streams, in response to increased streamflow. The water level in the upland generally fluctuates much less than that in the valleys. The aquifers are recharged by precipitation within the area, by influent seepage from streams and irrigation water, and by underflow across the western boundary of the area. Ground water is discharged by evaporation, wells, effluent seepage into streams, transpiration by plants, and underflow across the eastern boundary of the area.

Ground water in the report area is separated into three classes on the basis of its chemical characteristics. In the nonirrigated region north of the Platte River valley, the water is relatively dilute and is essentially of the calcium bicarbonate type; it contains considerable silica but only small amounts of fluoride. In the irrigated part of the area, the extent and method of irrigation influence the chemical quality of the ground water. Concentrations of the sulfate and sodium ions in water in this part of the area are higher than in the nonirrigated part. West of Kearney, where Platte River water is used for irrigation, the ground water is more mineralized than that in the eastern part where irrigation water is pumped from wells.

The ground water in its generally eastward movement undergoes little change in chemical quality as a result of geologic factors. Manmade modifications of the natural regimen, however, have resulted in a concentration of salts in the ground water of the Platte River valley west of Kearney.

As a general rule, ground water in the report area is suitable for irrigation on the basis of dissolved solids and percent sodium. The water is hard but not excessively so. Irrigation of valley lands east of Kearney by diverting water from the Wood and South Loup Rivers is unlikely to impair the quality of the ground water in that part of the area. Because water from the Platte River is used and reused for irrigation upstream from Kearney, its use for irrigation east of Kearney probably would be detrimental to the quality of the ground water in that part of the report area.

INTRODUCTION

PURPOSE OF THE INVESTIGATION

This investigation is one of the studies being made by the United States Geological Survey as a part of the program of the Interior Department for the development of the water resources of the Missouri River basin (fig. 1). Ground water is now used extensively for irrigation in the Platte River valley east of Kearney. The United States Bureau of Reclamation (1951) has planned a doubling of the irrigated acreage in that part of the valley between the towns of Kearney and Wood River. According to their plans, use of surface water will supplant in part the present use of ground water so that eventually about 84 percent of the land will be irrigated with water supplied from the Platte River. When upstream development depletes that supply, water is to be imported from the South Loup River; eventually, importations will be required from the Dismal River.

The purpose of the investigation on which this report is based was to obtain information on the extent, depth, and thickness of the water-bearing formations and to determine the direction of ground-water movement in Buffalo County and adjacent parts of Dawson and Hall Counties, Nebr. (See fig. 2.) The field study was begun in July 1950 and was completed in August 1951. The work was under the general supervision of A. N. Sayre, chief of the Ground Water Branch, U. S. Geological Survey, and G. H. Taylor, regional engineer in charge of ground-water investigations in the Missouri River basin, and under the immediate supervision of

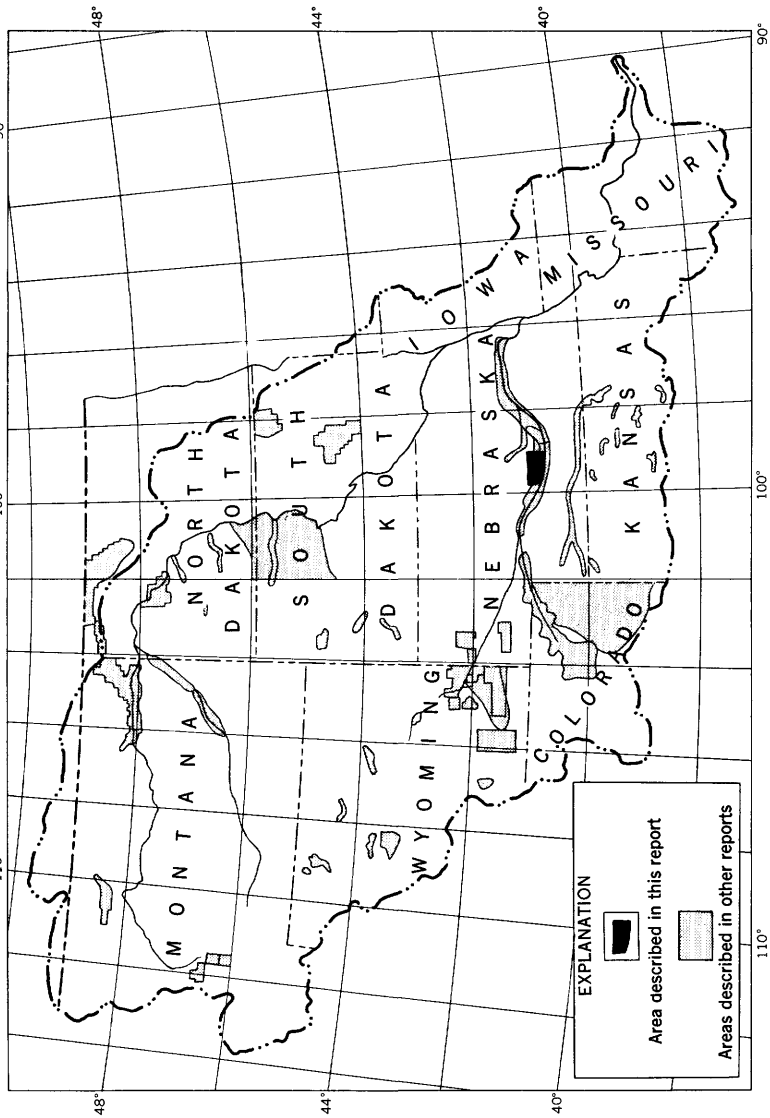

Figure 1.—Map of the Missouri River basin showing areas in which ground-water studies have been made under the program for the development of Missouri River basin.

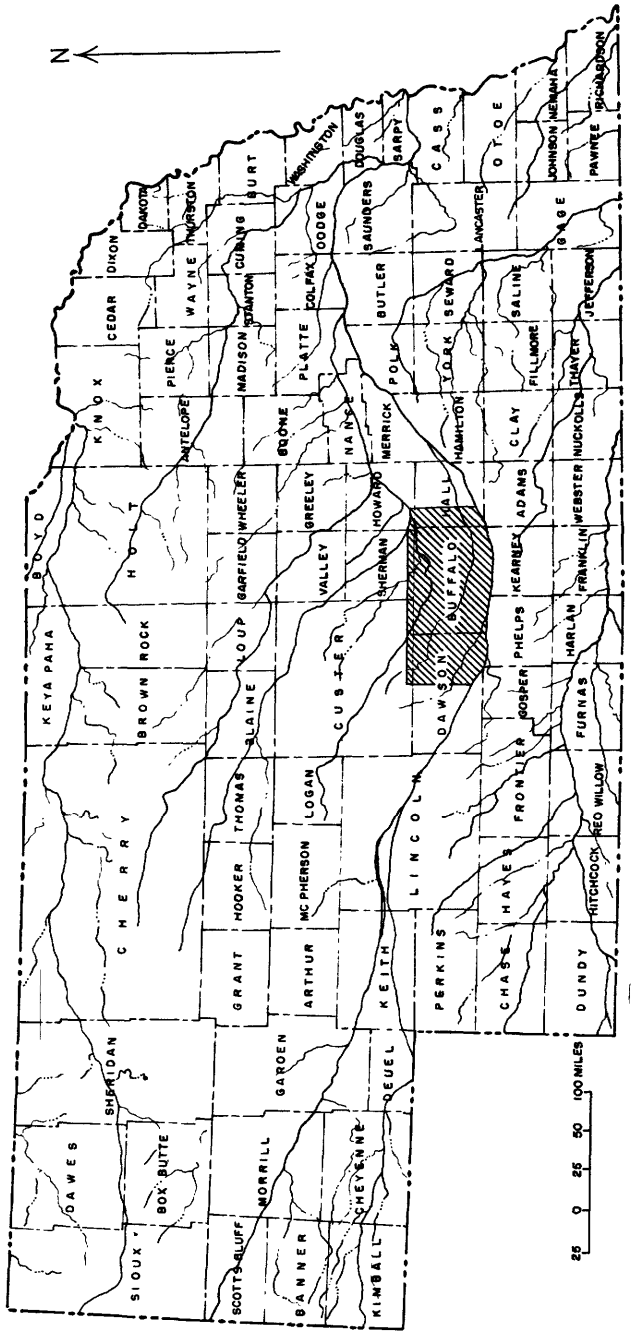

Figure 2.—Map of Nebraska showing area described by this report.

H. A. Waite, district geologist for Nebraska. The quality-of-water studies were under the general supervision of S. K. Love, chief of the Quality of Water Branch of the U. S. Geological Survey, and P. C. Benedict, regional engineer in charge of the quality-of-water studies in the Missouri River basin.

PREVIOUS INVESTIGATIONS

Darton (1898) made a survey of the ground-water conditions in southeastern Nebraska. Investigations of local conditions in the Platte River valley at Kearney and Lexington were included in his study.

Geologic and hydrologic studies in the Platte River valley have been in progress more or less continuously since 1929. During the first year the studies were made by the Conservation and Survey Division of the University of Nebraska, and since July 1930 the investigation has been a cooperative project between the Conservation and Survey Division and the U. S. Geological Survey. Lugn and Wenzel (1938) reported on the progress of the investigation from 1929 through 1934. Their report is comprehensive and contains a map showing generalized water-table contours for a large part of south-central Nebraska, including all the area described in this report. As a part of these cooperative ground-water studies in Nebraska, 95 test holes have been drilled in the report area. Of this total, 26 were drilled in 1931 and 1932 and the others during the period 1939–48.

In 1945 a more detailed study of the ground-water resources of the lower Platte River valley was begun as a part of the program of the Interior Department for the development of the Missouri River basin. Waite and others (1949) prepared a report based on the results of the investigation through 1948. In 1952 Keech reported on a detailed investigation of an area in the Platte River valley between the towns of Kearney and Wood River.

METHODS USED IN THE INVESTIGATION

All available well and test-hole records from previous published reports and from files of unpublished data, together with those from a partial field inventory, were assembled into a table which includes records of 529 wells and test holes. Beginning in July 1950, measurements were made of the depth to water and of the depth to the bottom of 165 wells scattered throughout the area. Measurements of the depth to water in 72 selected wells were made periodically, and hydrographs of water-level fluctuations

were prepared for 7 of them. Samples of water for chemical analysis were collected from 16 representative wells and 2 streams; these samples were analyzed in the laboratory of the U. S. Geological Survey at Lincoln, Nebr. Chemical analyses from 8 other wells were obtained from a previous report and from the Nebraska State Health Department. A map showing the contour of the water table was made from water-level data collected during the investigation. The field logs of test holes, drilled as a part of the cooperative ground-water investigations, were studied, and samples from test holes were examined under a binocular microscope. Seven geologic cross sections were prepared from this information. Maps showing the configuration of the erosional surface developed on the Ogallala formation and on the formations of Cretaceous age were prepared from logs of 70 test holes drilled as part of the cooperative ground-water investigation, 22 test holes drilled by the U. S. Bureau of Reclamation, and 40 water wells and 37 oil test holes drilled by commercial drillers.

WELL-NUMBERING SYSTEM

In this report wells and test holes are numbered according to their location within the system of land subdivision of the U. S. Bureau of Land Management. The first numeral in the number indicates the township, the second the range, and the third the section. The lowercased letters that follow the section number indicate the position of the well within the section; the first letter indicates the quarter section and the second letter the quarter-quarter section. The subdivisions of the section are lettered a, b, c, and d in a counterclockwise direction, beginning in the northeast quarter. Figure 3 illustrates this well-numbering system.

ACKNOWLEDGMENTS

Many residents of the area supplied information and permitted measurement of their wells. Well drillers supplied logs and information concerning wells they had constructed in the area. R. E. Spelts supplied the logs of test holes drilled by the Spelts, Cunningham, & Mevis Oil Exploration Co. Personnel of the U. S. Bureau of Reclamation made available the logs of test holes drilled by that agency and also determined the altitude of the measuring point of the wells and test holes north of the Platte River valley. E. C. Reed, Director and State Geologist, and V. H. Dreeszen, geologist, Conservation and Survey Division, University of Nebraska, were especially helpful in the preparation of the geologic cross sections and maps showing the configuration of the upper surface of the Ogallala formation and of the Cretaceous bedrock surface.

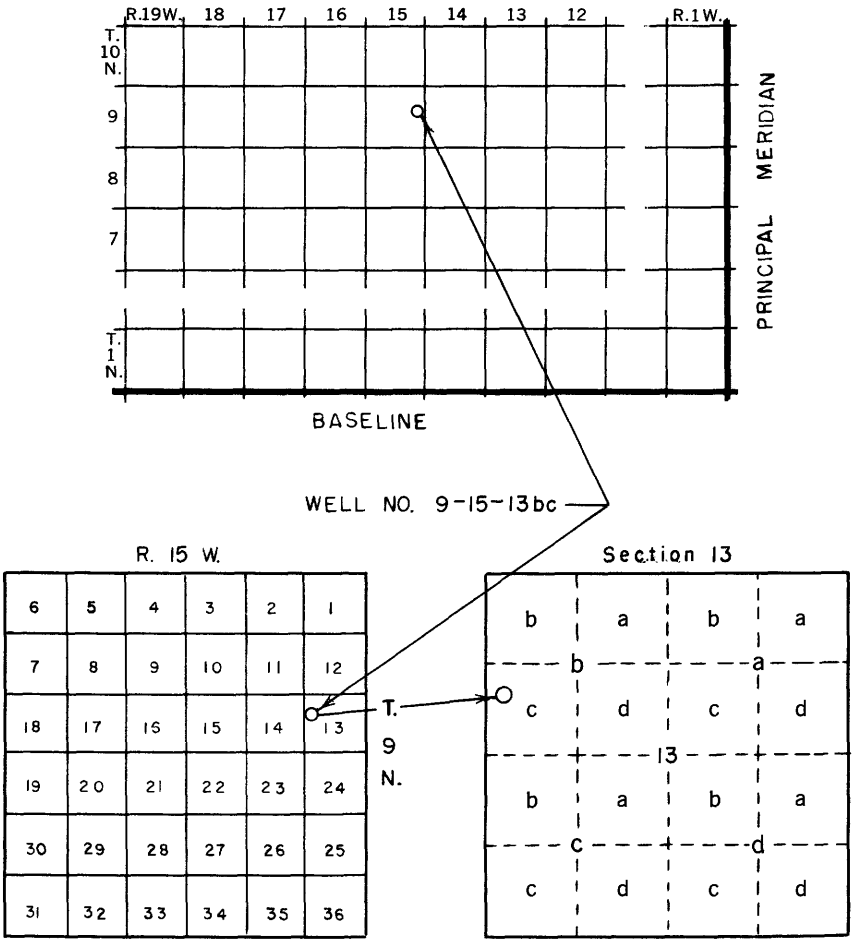

Figure 3.—Sketch showing well-numbering system.

GEOGRAPHY

LOCATION AND EXTENT OF THE AREA

The area described in this report is in south-central Nebraska and comprises the eastern half of Dawson County, all of Buffalo County, and the western quarter of Hall County (figs. 2 and 6). The boundaries of the area are the east line of R. 12 W. on the east, the Platte River on the south, the west line of R. 21 W. on the west, and the north line of T. 12 N. on the north. This area includes 38 townships and parts of 11 others, or approximately 1,500 square miles.

POPULATION AND TRANSPORTATION

The population of the area is estimated to be 35,000. The cities and villages in the area and their population, according to the 1950 census, are Kearney, 12,106; Lexington, 5,061; Ravenna, 1,444; Gibbon, 1,059; Shelton, 1,032; Wood River, 857; Elm Creek, 797; Overton, 499; Cairo, 417; Sumner, 270; Amherst, 219; Eddyville, 188; Pleasanton, 188; Miller, 178; Boelus, 167; Riverdale, 116; and Poole, 32.

The main line of the Union Pacific Railroad parallels the Platte River and a branch extends from Kearney northwestward up the valley of the Wood River. The main line of the Chicago, Burlington & Quincy Railroad, Lincoln, Nebr. to Billings, Mont., traverses the northeast corner of the area. U. S. Highway 30 parallels the Platte River, and State Highway 2 parallels the Chicago, Burlington & Quincy Railroad; both are paved. Three graveled State highways traverse the area north and south, and a fourth extends northwestward from Kearney up the Wood River valley. Many county roads, some graveled and some unsurfaced, are on section lines; in northern Dawson County, however, some of the roads are either in the valleys or on the interstream divides.

AGRICULTURE AND INDUSTRY

The predominant occupations in the area are agriculture and the processing of agricultural products. Wheat and other small grains and corn are the principal crops; sugar beets, soy beans, potatoes, and alfalfa also are raised. The rough parts of the upland are not cultivated; such areas generally are grazed by cattle. Grasses grow on some of the land along the principal streams; hay is cut as many as three times a year.

CLIMATE

The climate of the area is characteristic of the High Plains section of the Great Plains physiographic province and is marked by rather wide seasonal variations. Climatological data recorded by the U. S. Weather Bureau at Kearney and Ravenna are representative of the area as a whole. During the period 1878–1950 the highest annual precipitation at Ravenna was 37.72 inches in 1881 and the lowest was 12.33 inches in 1940. During the period 1895–1950 the highest annual precipitation at Kearney was 40.07 inches in 1915 and the lowest was 11.65 inches in 1940. The precipitation is heaviest during the summer months; in May and June the distribution of rainfall generally is favorable for agriculture, but in July, August, and September the distribution of rainfall generally is less favorable and drought sometimes reduces crop yields.

The mean annual temperature at Kearney is 50.7° F. The length of the growing season ranges from 140 to 190 days.

The annual precipitation and the cumulative departure from average during the period of record are shown in figures 4 and 5. The graphs showing the departure from average indicate that the period of drought generally associated with the 1930's actually had its beginning several years prior to 1930, and at least at Ravenna it continued during the 1940's though it was less pronounced.

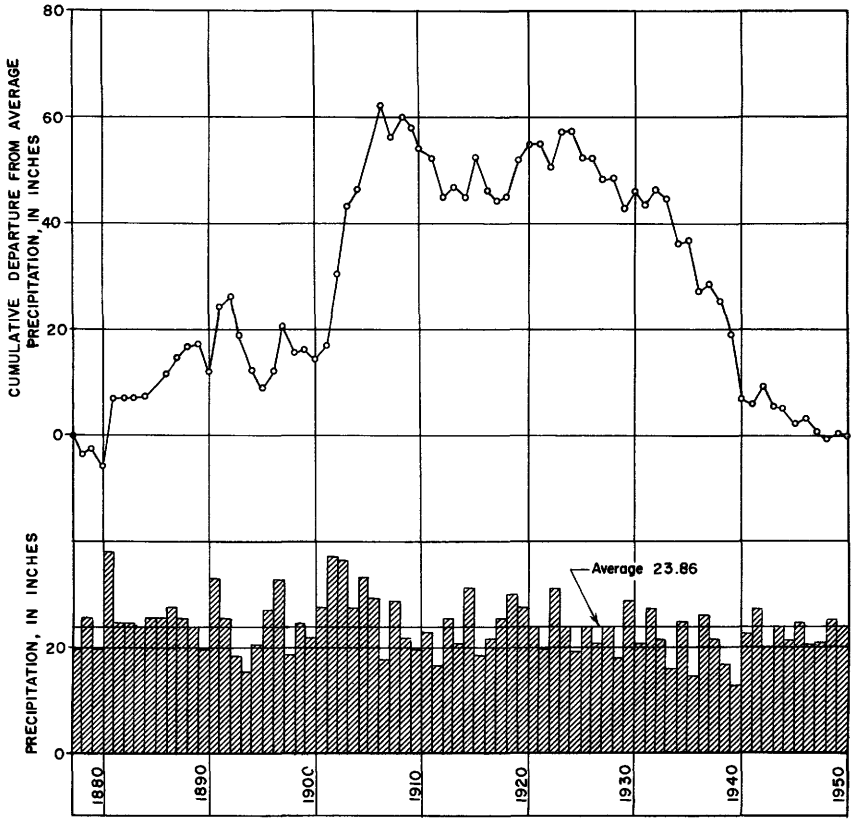

Figure 4.—Annual precipitation and cumulative departure from average at Ravenna.

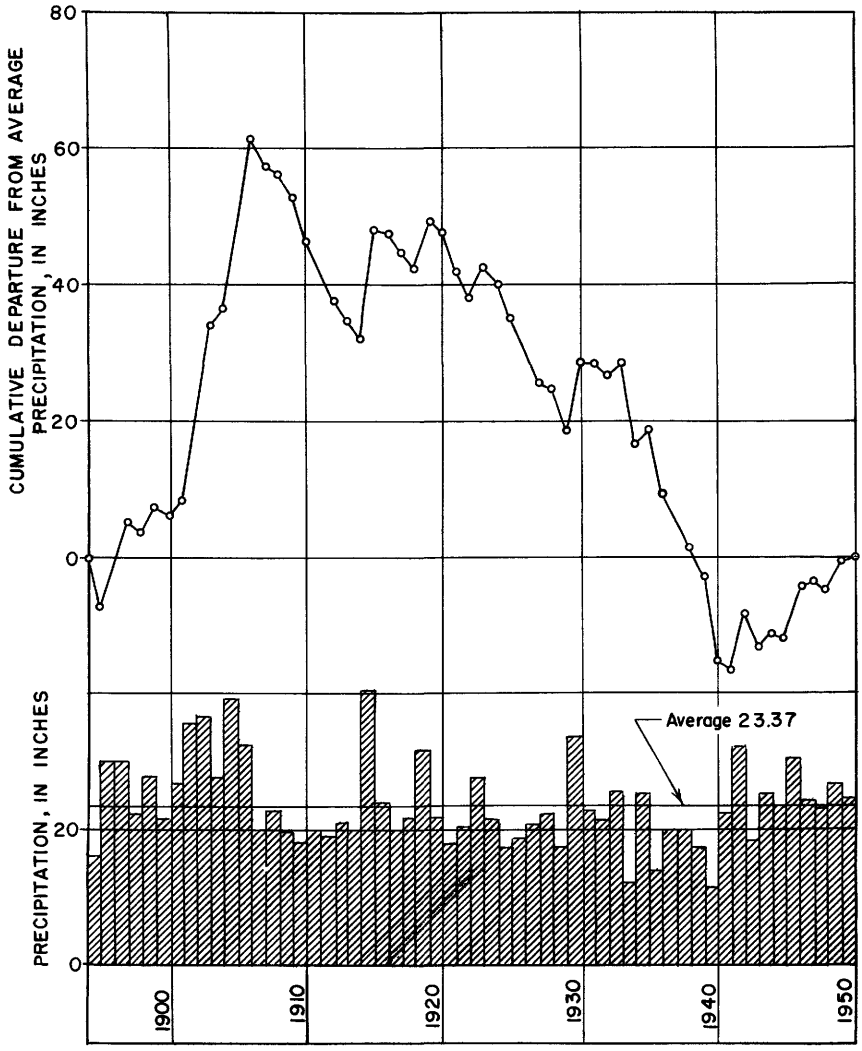

Figure 5.—Annual precipitation and cumulative departure from average at Kearney.

TOPOGRAPHY AND DRAINAGE

The area described in this report is in the eastern part of the High Plains section of the Great Plains physiographic province. The highest point, which lies about 15 miles north of Lexington, is about 2,770 feet above mean sea level; the lowest, in the South Loup River valley about 12 miles east of Ravenna, is about 1,900 feet above mean sea level. Thus, the area has a total relief of nearly 900 feet.

Approximately the northern three-fourths of the area is a dissected upland crossed by the relatively narrow valleys of the Wood and South Loup Rivers; the remainder of the area is the relatively flat or gently rolling terraces and flood plain in the Platte River valley. (See fig. 6.) The boundary between these two divisions is about 10 miles north of the Platte River at Lexington and 2 miles north of the Platte River at Kearney. East of Kearney the boundary extends to the northeast corner of the report area.

The dissected upland can be subdivided into three parts—the southern, central, and northern. These subdivisions correspond in a general way to the interstream areas. The southern upland is the triangular area between the Wood River and the Platte River, the central upland lies between the South Loup and Wood Rivers, and the northern upland lies north of the South Loup River.

The surface of the upland ranges from almost level to steeply rolling or hilly. Most of the comparatively level parts of the upland are small and are restricted to the highest and central part of the interstream areas. The largest of these tablelands is in the central upland north of Kearney. In general, the upland surface is roughest in the southern upland, where steep-sided ravines and narrow valleys are separated by relatively sharp divides.

Although the confluence of the Platte and Loup Rivers is 75 miles east of the area described in this report, the valleys of these rivers are separated in the northeast corner of the area by only a narrow belt of sand dunes that have been somewhat stabilized by wild prairie grasses. The width of this belt ranges from 2 to 3 miles, whereas to both the east and the west the upland area is much wider. The narrowness of the upland area at this point is evidence that the drainage pattern of the Loup and Platte Rivers was significantly altered in late Pleistocene time.

The principal streams draining the report area are the South Loup, Wood, and Platte Rivers. The South Loup River enters this area in the northwest corner of Buffalo County, continues southeastward to north-central Buffalo County, then swings northeastward and joins the Middle Loup River 4 miles beyond the northeast corner of Buffalo County. Mud Creek, whose drainage basin lies north of the report area, joins the South Loup River at Ravenna. Wood River, a major tributary of the Platte River, enters the Platte River valley near Kearney and flows eastward for about 35 miles before joining the north channel of the Platte River. Several intermittent tributaries contribute to the flow of the major streams.

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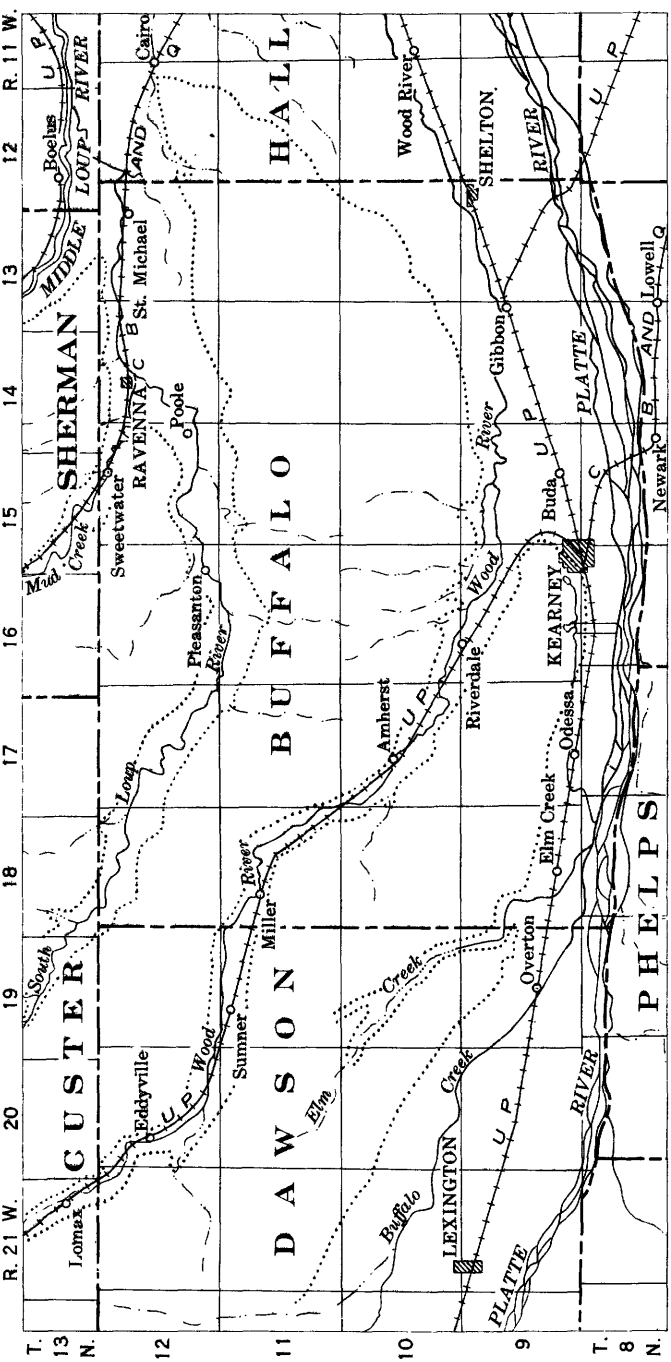

Figure 6.—Map of Buffalo County and adjacent parts of Hall and Dawson Counties showing physiographic features, streams, and localities.

The average gradient of the Wood River is less than 5 feet per mile; that of the South Loup River slightly more than 6 feet per mile; and that of the Platte River nearly 7 feet per mile. The Platte River is 30 to 90 feet higher than the South Loup River at points directly north.

VEGETATION

Before the arrival of settlers in the area, prairie grasses covered the upland areas. The treeless condition of the upland areas can be attributed principally to low precipitation and the prevalence of prairie fires. However, narrow belts of forest bordered all the large streams and some of the intermittent streams. At present most of the trees along the Platte and South Loup Rivers are cottonwood or willow, but in the upper part of the Wood River valley many ash, elm, box elder, and a few oak and hackberry also grow. Since the settlement of the area prairie grasses remain on the land that is too rough for cultivation and, in a few places, on land adjacent to streams. A few groves of trees have been planted on upland farms.

GEOLOGY

GENERAL FEATURES

The geologic formations exposed at the surface in the report area are unconsolidated deposits of Quaternary (Pleistocene and Recent) age. These sediments comprise loess and windblown sand underlain by water-laid clay, silt, sand, and gravel. These unconsolidated deposits rest upon poorly consolidated material of Tertiary age that consists of silt or siltstone, sand, gravel, and sandstone, parts of which are cemented with calcium carbonate. The Tertiary deposits overlie shale and chalk of Cretaceous age. The geologic formations that are recognized in the area and considered in the present study are shown in the following generalized geologic section, which gives their range in thickness, their lithologic character, and their water-bearing possibilities. It is based in large part on a publication by Condra and Reed (1943).

It is difficult to distinguish the sand and gravel deposits in the Ogallala formation of Tertiary age from those in the Pleistocene formations because they are very similar. Criteria generally used for the correlation of such fluviatile deposits are generally derived by study of their stratigraphic sequence, paleophysiography, and vertebrate paleontology. These methods are difficult to

Generalized geologic section

System	Series	Subdivision	Thickness (feet)	Character and distribution	Water supply
Quaternary.	Recent	Superficial alluvium, loess, dune sand, topsoil.	0–20	Reworked sand and gravel in river channels and flood plains; isolated wind deposits of clay, silt, and sand; widespread soil.	Significant only as transmitting mediums for recharge to ground water.
	Pleistocene.	Post-Iowan terrace deposits.	0–60	Valley fill deposits of silt, clay, sand, and gravel in present stream valleys.	Yield moderate to abundant supplies of water.
		Peorian loess.	0–75	Wind deposits of grayish-yellow silty clay (loess), locally grading into dune sand; contains several buried soils.	Significant principally as a transmitting medium for recharge to ground water; in valleys where it occurs below the water table it yields water, but very slowly.
		Todd Valley formation.	0–140	Silt, fine sand, and gravel deposited as valley fill; present in South Loup valley.	Serves principally as a transmitting medium for recharge to ground water; where present below water table, will yield water to wells.
		Loveland formation.	0–100	Stratified silt and clay with lenses of fine sand in valley phase of deposition. Reddish-brown silt and clay (loess) in upland phase; a well-developed buried soil usually present on top.	Significant as a transmitting medium for recharge to ground water; yields water very slowly where present below water table.
		Crete formation.	0–30	Channel-fill deposit of sand and gravel; present in some tributary valleys and in major stream valleys.	Serves principally as a transmitting medium for recharge to ground water.
		Sappa formation.	0–150	Aqueous-eolian deposits of silt, clay, and sand; gray to green in valley locations and darker in uplands; in some places capped by fossil soil. Contains Pearlette volcanic ash member.	Generally not a source of water supply.
		Grand Island formation.	0–75	Stream-deposited sand and gravel, which lies below some valleys and along some side slopes.	Yields abundant supplies of water.
		Red Cloud sand and gravel.	0–50	Stream-deposited sand and gravel; underlies some of the upland.	Yields abundant supplies of water where present below water table.

		Fullerton formation.	0–30	Brownish-gray silt, clay, and some fine sand of fluvial-eolian origin; only locally present.	Not a source of water supply.
		Holdrege formation.	0–50	Stream-deposited sand and gravel; underlies some of the upland.	Yields abundant supplies of water.
Tertiary.	Pliocene.	Ogallala formation.	10–400	Stream-deposited lenses and irregular beds of clay, silt, sand, gravel, and lime-cemented sandstone; underlies entire area.	Yields moderate supplies of water, depending upon the lithology.
	Oligocene.	Brule formation.	0–225	Pink to brownish-gray massive siltstone to clay stone and fine sand; underlies most of Dawson County.	Not a source of water supply.
Cretaceous.	Upper Cretaceous.	Pierre shale.	0–460	Gray to black marine shale and chalky shale overlain by weathered shale and gray silty clay; underlies most of the area.	Do.
		Niobrara formation.	400–500	Light- to dark-gray marine chalky shale and chalky limestone; underlies entire area.	Do.

apply in this area because the sand and gravel deposits are not exposed and must be studied indirectly through data from wells.

Geologic cross sections *A–A'*, *B–B'*, *C–C'*, *D–D'*, and *E–E'* shown in plate 1 are based on logs of test holes drilled as a part of the cooperative study of ground water. Geologic cross sections *F–F'* and *G–G'* of plate 1 are based on the logs of test holes drilled by the U. S. Bureau of Reclamation in connection with that agency's investigation of dam sites in this area. These cross sections show the general age relationships, lithologic character, and thickness of the rock formations.

STRUCTURE

The eastern flank of the northward-trending Cambridge arch extends into the western part of Dawson County and the northward-trending axis of the central Nebraska basin traverses eastern Buffalo County and northwestern Hall County. Only rocks of Cretaceous age and older were involved in the development of these structures. Erosion during early Tertiary time and the subsequent deposition of sediments totaling slightly more than 800 feet in thickness obscure the structure of the older rocks.

STRATIGRAPHY

CRETACEOUS SYSTEM—UPPER CRETACEOUS SERIES

NIOBRARA FORMATION

The Niobrara formation is composed of dark-gray marine chalky shale and lighter colored chalky limestone. The upper surface generally is weathered yellow or brown in areas where the Pierre shale has been removed by erosion. Except in the vicinity of the axis of the Cambridge arch, where the Pierre shale has been removed by erosion and the Niobrara formation is in contact with beds of Tertiary age, the Niobrara formation, in the area of this report, lies immediately below the Pierre shale. The Niobrara formation ranges in thickness from 400 to 500 feet. No ground-water supplies have been developed in the report area from this formation.

PIERRE SHALE

Where unweathered, the Pierre shale is a gray to black marine shale. Overlying the unweathered shale is weathered, yellowish-

brown shale which grades upward into gray clay. The clay, which is believed by the writer to be a weathering product of the Pierre shale, was penetrated in most of the test holes that reached the Pierre shale and ranges in thickness from less than 1 foot to 60 feet. Both the unweathered and weathered shale contain some beds that are calcareous, and the clay is calcareous in some places. Where present, the Pierre shale ranges in thickness from less than 1 foot to about 460 feet.

The Pierre shale is of small value as as aquifer. In other areas, where ground-water supplies have been developed from it, the permeability of the formation is low and the water is of poor quality. In the report area, the depth to the top of the Pierre shale ranges from 175 to 800 feet below the surface. Most well drillers are aware that it is almost impossible to obtain potable ground-water supplies from the Pierre.

After the deposition of the Pierre shale, erosion modified the eastward-sloping surface into low, rounded hills and broad, shallow eastward-trending valleys. In the part of the area near the axis of the Cambridge arch, erosion cut through the Pierre shale into the underlying Niobrara formation. A map showing the configuration of the surface of unweathered Pierre shale was prepared from the logs of wells and test holes, some of which are a few miles outside the area under study (pl. 2). Unreleased information was obtained from oil companies and, with their permission, was used in a general way in the preparation of the map. This map is of particular value to water-well drillers and others in that it aids in evaluating the possibility of developing ground-water supplies. The development of ground-water supplies of good quality in this area is limited to the water-bearing formations that lie above the upper surface of the Cretaceous rocks.

TERTIARY SYSTEM

OLIGOCENE SERIES—BRULE FORMATION

The Brule formation consists of pink to brownish-gray siltstone, clay stone, and fine sand or soft sandstone. A considerable amount of muscovite and biotite mica is present in the sand. The Brule formation has been subdivided into two members in certain other areas, but no attempt has been made to differentiate the members in this area. It is 225 feet thick in the northwest corner of the report area and thins southward and eastward; it was not penetrated in any test hole east of Overton. In many places, much reworked Brule material is contained in what is believed to be the basal part of the Ogallala formation; consequently, the contact

between the two formations is not distinct. In some areas, notably in western Nebraska, the Brule formation is fractured and yields moderate amounts of water, but in this area it is not known to be fractured and water supplies have not been developed from it.

PLIOCENE SERIES—OGALLALA FORMATION

The Ogallala formation underlies the entire area described in this report. Most of the test holes in the area have been drilled to or into it.

The Ogallala is composed principally of calcareous fine- to medium-grained sandstone and clayey or sandy silt containing scattered lenses of coarse sand and gravel. It contains also minor amounts of marl, volcanic ash, and opaline sandstone resembling quartzite. Because the lithologic character differs both vertically and laterally, local drillers are hesitant to guarantee the amount of water that can be pumped economically from a well that taps the formation. In general, the formation is progressively finer textured in an eastward direction.

The Ogallala formation ranges in thickness from a little less than 10 to slightly more than 400 feet and averages about 300 feet. The top of the formation ranges from about 30 to 350 feet below the land surface. No outcrops were found in the report area, but in some places it may form the bottom of the South Loup and Platte River channels.

The Ogallala formation is present at the surface at two localities a few miles north of the report area. The eastern exposure is 0.5 mile northwest of the village of Rockville, Sherman County, where State Highway 58 crosses Rock Creek. The other exposure is in Custer County, 6 miles west of State Highway 183 and 2.5 miles north of the Dawson County line. At this location the Ogallala crops out high in the side of the South Loup River valley.

The Ogallala is the source of much of the ground water pumped in the report area. Formerly most irrigation and public-supply wells in the Platte River valley were drilled only to the top of the formation, but in recent years drillers have installed deeper wells in order to obtain greater yields and water of better quality. As a result, the importance of the Ogallala formation as an aquifer in the Platte River valley, as elsewhere, is increasing. Depending upon the texture of the water-bearing materials penetrated, the yield of wells ranges from relatively small to large.

At the close of the deposition of the Ogallala formation, the surface was an almost flat or featureless aggradational plain sloping southeastward. Subsequent erosion modified this surface into broad, low ridges and shallow valleys. A map showing the configuration of this surface was prepared from the logs of wells and test holes (pl. 3). The altitude of the measuring point of the wells and test holes was determined by instrumental leveling, by altimeter survey, or by estimation from topographic maps. The contour lines indicate that an ancestral valley underlying the present South Loup River valley was incised more deeply into the Ogallala formation than were other ancestral valleys in the report area. An ancestral valley underlies the present Wood River valley northwest from Kearney to a point 2 miles upstream from Amherst. The present Platte River valley, however, appears to be unrelated to the erosional surface on the top of the Ogallala formation. The axes of the buried valleys and ridges trend at an oblique angle to the axis of the Platte River valley, especially east of Dawson County.

QUATERNARY SYSTEM

PLEISTOCENE SERIES

HOLDREGE FORMATION

The advance of the Nebraskan glacier in the region east of the area described by this report caused eastward-flowing streams to be diverted southward. It also caused these streams to aggrade their valleys and some parts of the upland with sand and gravel. The sand and gravel north of the Platte River valley (see *A–A'*, *B–B'*, *C–C'*, and *D–D'*, pl. 1) is believed to be at least in part of Nebraskan age and to correlate with the Holdrege formation. Where present below the water table this sand and gravel yields abundant supplies of water. In the report area the thickness ranges from a featheredge to 50 feet.

FULLERTON FORMATION

After the retreat of the Nebraskan glacier, the Ogallala and Holdrege formations were exposed to weathering and erosion, and gray silt, clay, and fine sand of a fluvial-eolian origin were deposited in the topographically low areas. These deposits are known as the Fullerton formation of Aftonian age, but because they are present only locally the formation is difficult to identify. A sandy silt having a weathered profile and overlying the Holdrege sand and gravel was penetrated by a few of the test holes drilled

in the area and has been identified tentatively as the Fullerton formation. This formation is not a source of ground water; it ranges in thickness from less than 1 foot to 30 feet.

RED CLOUD SAND AND GRAVEL

During the advance of the Kansan ice sheet, the eastward-flowing streams were again diverted southward, and the valleys and the upland were again aggraded with sand and gravel. Deposits identified tentatively as the Red Cloud sand and gravel, first described by Schultz, Reed, and Lugn (1951), generally are restricted to the area north of the topographic divide between the Wood and South Loup Rivers. These deposits overlie the Fullerton formation and range in thickness from a featheredge to 50 feet. The Red Cloud is an excellent source of ground water where the sand and gravel occurs below the water table. In Buffalo County the Red Cloud is usually above the water table or is only partly saturated. The Red Cloud is not known to be present in Dawson County or Hall County.

GRAND ISLAND FORMATION

During the waning stages of Kansan glaciation, erosion was greatly accelerated. Diastrophic uplift in the Rocky Mountain area may have caused this erosion (Schultz, Lueninghoener, and Frankforter, 1951, p. 5), or the increased volume of water released by the melting glacier may have initiated a cycle of erosion and fill (Condra, Reed, and Gordon, 1950, p. 20). In the area described by this report, the Red Cloud and older formations of Pleistocene age were dissected during this period of erosion and the sheet of sand and gravel that had mantled the area to a depth ranging from 75 to a little more than 100 feet was so reduced in thickness that in some places there remained only a rubble zone 1 foot or less thick. In a few places, erosion cut through the older Pleistocene deposits into the underlying Ogallala formation.

Sand and gravel of the Grand Island formation was deposited in and on the side slopes of the valleys, which had been incised during the period of erosion in late Kansan time. The relationship of the Grand Island formation to the older formations in the area is illustrated by geologic cross sections *C–C'*, *D–D'*, *E–E'*, *F–F'*, and *G–G'* (pl. 1). The Grand Island formation lies below the water table and, where present, ranges in thickness from less than 1 foot to 75 feet, but generally is less than 25 feet thick. This sand and gravel yields adequate supplies of ground water for domestic and stock wells but generally the formation is not thick enough to yield sufficient water for irrigation.

SAPPA FORMATION

Although the mode of deposition of the Sappa formation was much the same as that of the Fullerton formation, the Sappa is thicker and more continuous. It was deposited in both valley and upland environments and was in part fluvial and in part eolian in origin. Where present it ranges in thickness from less than 1 foot to 150 feet.

Where deposited in a valley environment, the Sappa formation is generally gray, bluish gray, or light green, and consists of silty clay, sand, and a trace of gravel. A few fossil plant and animal remains have been found in test holes. In the better drained upland environment the sediments have been oxidized to light brown. In many places the formation is loesslike and is similar to the overlying Loveland formation. For this reason it is difficult to differentiate between the two formations, except where a fossil soil or weathered zone is present at the top of the Sappa formation.

In some places throughout the High Plains the Sappa formation contains lenticular beds of volcanic ash. This eolian deposit is known as the Pearlette ash member and is one of the most important stratigraphic horizon markers in the Pleistocene deposits. Test hole 9–18–27aa in Buffalo County, at a depth of 85 to 90 feet below the land surface, passed through an ashy silt that correlates with the Pearlette ash member.

Although the Sappa formation is not usually considered to be an aquifer, sandy layers in the formation may yield a small amount of water.

CRETE FORMATION

The Crete formation, in general, is limited to ancestral valleys of the present streams. In places where the Sappa formation has been removed by erosion, the Crete rests directly on the Grand Island formation. In many places, the Crete has been partially removed by subsequent valley cutting and remains as terrace remnants along the valley sides. It has been recognized in several outcrops along the South Loup River. The thickness of the formation ranges from less than 1 foot to 30 feet. The lithologic character of the Crete formation is dependent on the composition of the local material that was available for reworking, and in the area described by this report, the formation is similar to the older sand and gravel of Pleistocene age, but commonly is more silty. In this area the Crete formation is not known to be present

below the water table and, consequently, it is important only as a transmitting agent of recharge to underlying aquifers.

LOVELAND FORMATION

The Loveland formation, which is present throughout most of the area north of the Platte River valley, is similar to the Sappa formation in that it also was deposited in part on the upland and in part in valleys. The upland or eolian phase consists of massive loess that ranges from reddish brown to light brown. The darker colors are characteristic of the upper part and are believed to be the result of oxidation. The valley phase consists of stratified silt, clay, and lenses of fine sand and is less red than the upland phase, probably as a result of less favorable conditions for oxidation. In some places the valley phase is separated from the upland phase by colluvial, or slope, deposits.

The Loveland formation generally is capped by a persistent fossil soil that is useful as a stratigraphic horizon marker. In many places in the western part of the report area (*A–A'* and *B–B'*, pl. 1), a fine- to medium-grained sand is present at what is believed to be the base. This sand may represent an upland phase of the Crete formation but, until it is more clearly defined by further study, the sand is included in the Loveland formation.

The Loveland formation serves as a transmitting agent of recharge to the zone of saturation. Where it occurs below the water table, it yields water very slowly to wells. The formation ranges in thickness from a featheredge to 100 feet.

TODD VALLEY FORMATION

During the time of the Iowan glaciation, the present valleys were aggraded to their highest level. This fill, known as the Todd Valley formation, is composed of fine- to medium-grained sand, some gravel, and thin beds of silt and peat. Eolian deposition and erosion resulted in the formation of sand dunes on the surface of the formation. The sand dunes are principally on the south side of the present stream valleys, probably because the prevailing winds were from the northwest. The dune areas have been somewhat stabilized by wild prairie grasses. The Todd Valley formation is present in the South Loup River valley (see *D–D'*, *F–F'*, and *G–G'*, pl. 1) and may be present also in the lower reaches of the intermittent tributaries of the South Loup River. The logs of test holes indicate that the thickness of this formation may be as much as

150 feet; however, part of this thickness probably is due to the presence of dunes on the surface of the formation.

In the South Loup River valley several irrigation wells have been drilled into the Todd Valley formation. The logs of two of these wells (11–16–8ad and 12–13–20cb) are included in table 7. The saturated lower part of the formation yields small to moderate amounts of water. The possibilities for recharge and storage in the Todd Valley formation are excellent because the surface of the formation is very porous, and a large part is above the water table.

PEORIAN LOESS

In a strict sense the Peorian loess represents the deposition between the Iowan and Tazewell glacial substages. In the area described by this report, however, several buried fossil soils are present in the loess that overlies the Loveland formation and hence the loess represents deposition during several glacial substages. As it is not yet possible to subdivide this loess satisfactorily, the term "Peorian loess" is applied in this report to more sediments than would be included in the formation as strictly defined.

The loess generally is light brown to yellowish gray. In places the loess has been removed by erosion, but in general it ranges in thickness from 20 to 75 feet in the area. As the Peorian loess generally is above the water table in the area, it serves as a transmitting agent of recharge to the ground-water reservoir.

POST-IOWAN TERRACE DEPOSITS

During the Wisconsin glacial stage, several periods of downcutting and alluviation in the river valleys resulted in the formation of depositional terraces. In addition to the Todd Valley terrace, two or three terraces were noted during this investigation, but no attempt was made to date them precisely.

Locally the deposits underlying these terraces yield moderate to large amounts of water to wells. In general, the importance of these deposits as aquifers is greatest in the Platte River valley. Where present they range in thickness from less than 1 foot to 60 feet, but generally they are about 20 feet thick.

Sand and gravel deposits that are believed to be of late Wisconsin age lie near the surface in the Platte River valley (see *A–A'*, *B–B'*, *C–C'*, and *E–E'*, pl. 1). These deposits comprise well-sorted

gravel and some coarse sand and probably have the greatest permeability of any sediments in the report area. Field coefficients of permeability in excess of 3,500 gpd per square foot have been calculated for the sand and gravel lying near the surface in the Platte River valley (Waite and others, 1949).

RECENT SERIES

The contact of deposits of Recent age with deposits of Pleistocene age is not well defined. The topsoil, thin loess deposits, and alluvium near the surface of the present flood plains are considered to be of Recent age. In dune areas (see *D–D'*, *F–F'*, and G–G', in pl. 1), some of the sand was reworked during Recent time. The Recent deposits serve as transmitting agents for the downward movement of precipitation to the ground-water reservoir. Where present in the report area they range in thickness from less than 1 foot to 20 feet.

GROUND WATER

The only aquifers in the report area from which ground water can be pumped economically are the saturated parts of the sand and gravel formations of Pleistocene age and the coarser textured parts of the Ogallala formation of Tertiary age. In the Platte River valley and in the western part of the upland the sand and gravel of Pleistocene age is the principal aquifer, whereas in the central and eastern parts of the upland the Pleistocene sand and gravel, where present, either lies above the water table or is thin, and the Ogallala formation is the principal source of supply. The water in both aquifers is under water-table conditions except where the water is confined locally beneath a relatively impermeable layer. Wells drilled into the sand and gravel of Pleistocene age yield as much as 2,000 gpm, whereas those tapping the Ogallala formation rarely yield more than 800 gpm.

MOVEMENT

The altitude of the water level in 360 wells and test holes was used in making a map showing the contour of the water table (pl. 4). Most of the water-level measurements were made during the fall of 1950 and the spring of 1951. Information pertaining to the wells and test holes is given in table 10.

Because ground water moves in the direction of the maximum slope of the water table—that is, at a right angle to the contour

lines—ground water in this area is moving eastward. (See pl. 4.) The gradient of the water table in this area ranges from about 5 to 20 feet or more to the mile. In the Platte River valley the average gradient is between 6 and 7 feet to the mile and conforms closely to the gradient of the Platte River. The water-table contour lines in the Platte River valley are nearly parallel and are spaced more uniformly than those north of the valley. The uniform spacing of the contour lines indicates that the relatively smooth slope of the water table may be due in large part to higher and more uniform permeability of the sand and gravel underlying the floor of the valley.

The water-table contour lines on the north side of the Platte River valley between Kearney and the village of Wood River are at a right angle to the river; hence the river apparently is in equilibrium with the water table in this reach of the valley, and the direction of ground-water movement is almost parallel to the stream flow. Therefore, little or no ground water was being discharged as surface flow and practically no surface flow was being lost to ground-water storage at the time the water-level data were obtained. After a period of above-normal precipitation the ground water doubtless makes a substantial contribution to stream flow; if water-table contour lines were based on water-level measurements made during such a period, the contour lines would bend upstream near the river. Conversely, when the stage of the Platte River is higher than the adjacent water table, the river contributes to ground-water storage and the contour lines would bend downstream near the river. This condition could result from the withdrawal of large amounts of ground water by pumping, as well as from maintenance of the river stage by releases from storage upstream.

In the Platte River valley between Overton and Kearney the water-table contour lines indicate ground-water movement toward the river. Apparently ground water is being discharged into the river because the ground-water reservoir is receiving recharge from the canals and laterals and from irrigation water applied to the land. Fewer irrigation wells have been drilled in this part of the valley than between Kearney and Wood River. Mounding of the water table is particularly noticeable between Elm Creek and Kearney.

The water-table contour lines in the Platte River valley between Lexington and Overton indicate that the Platte River is a losing stream in this part of the valley. Wenzel (Lugn and Wenzel, 1938, p. 130) called attention to this situation in the vicinity of Lexington as follows:

The direction of movement of the ground water is somewhat away from the Platte River into the valley to the east, hence the area a few miles north of the river is an area of ground-water discharge that receives underflow both from the river and from the area nearer the valley limit....It is probable that the direction of movement of the ground water in the vicinity of Lexington has changed somewhat since 1900, because the water table in places has been built up by seepage water from irrigation. In 1896 Darton made a survey of the underground-water conditions in Dawson County and found that the water table around Lexington stood about 21 to 22 feet below the land surface. At the present time (1930–1934), the water table around Lexington stands less than 10 feet below the surface....If the contour lines in the vicinity of Lexington were rearranged to show altitudes about 10 feet lower and the water level at the river were kept the same the indicated movement of the ground water would be changed from the general eastward direction that now exists for a few miles north of the Platte River to a northeastward direction. Thus, before irrigation with water diverted from the Platte River became prevalent, probably more water was lost from the river to the valley north of the river than there is at the present time.

A profile of the water table, constructed at right angles to the valley, would show a slight sag between the Platte River and the north valley edge. This sag may be due to a buried valley a few miles north of the present stream. (See *A–A'* and *B–B'*, pl. 1; pl. 3.)

The water-table gradient north of the Platte River valley ranges from 5 to slightly more than 20 feet to the mile. In the upland part of Dawson County, north of Lexington, the slope of the water table is uniformly 5 to 7 feet per mile to the east. This uniform slope persists partly because the water table is not lowered by influent streams in this part of the area and partly because the water table lies above moderately permeable deposits of sand and gravel through which the ground water moves laterally. (See *A-A'* and *B-B'*, pl. 1.) If this permeable aquifer were not present, the ground water would be mounded, creating a well-defined ground-water divide between the South Loup and Platte Rivers. Actually, the ground-water divide in Dawson County is not distinct, and it coincides approximately with the topographic divide.

The South Loup River is dependent largely upon ground water for its flow, and the drainage effect of this effluent stream causes the steep slope of the water table on both sides of its valley. The ground-water divide between the South Loup and Platte River valleys is more pronounced in Buffalo and Hall Counties than in Dawson County. This divide generally coincides with the topographic divide, except north of Kearney. There the ground-water divide lies 2 or 3 miles north of the Wood River, but the topographic divide is about 5 miles farther north. A topographic high of the Ogallala formation north of Kearney is mantled by only a thin cover of sand and gravel of Pleistocene age and the water table is near the top of the Ogallala formation. Recharge from precipitation causes the water table to be mounded because no highly permeable material is present to permit the lateral flow of ground water away from the area. The channel of the Wood River is below the water table in the vicinity of Amherst and thereby

becomes a gaining stream and causes a lowering of the water table along its course downstream from that point. Mud Creek also is an effluent stream in its lower course.

A comparison of the map showing the contour of the water table (pl. 4) with the map showing the configuration of the upper surface of the Ogallala formation (pl. 3) indicates that the shape and slope of the surface of the Ogallala formation affects to some degree the direction of movement of the ground water. The water table generally conforms to the upper surface of the Ogallala formation only where the water table is near or below the top of the formation.

The Bureau of Reclamation has made detailed studies of a proposed dam site across the Wood River valley at Amherst. The proposed site appears to be favorable inasmuch as the geologic and hydrologic conditions at that locality indicate that only a small to moderate amount of seepage would result from the impoundment of water by the dam. A minimum loss of stored water by lateral percolation to the south would take place because the ground-water gradient toward the Wood River valley from the south is relatively steep. Any water lost by percolation to the north and east from the proposed reservoir would eventually return to the South Loup River. Inasmuch as the water table north of Wood River valley is below the top of the sand and gravel of Pleistocene age, a rise of the water table in that vicinity would not be injurious.

The Bureau of Reclamation also has made a preliminary investigation of subsurface conditions at a proposed dam site across Dry Creek west of Cairo. Geologic cross sections *F–F'* and *G–G'* (pl. 1) were prepared from the results of test drilling by the Bureau. Some storage loss probably would result from seepage at the Cairo site. The axis of the proposed dam would cross the contact between the upland and a high terrace. Probably a minimum amount of water loss by seepage would occur to the south, into the Peorian and Loveland formations, but a large loss might take place to the northeast, into the Todd Valley formation.

DEPTH TO THE WATER TABLE

The depth to the water table in the area described in the report ranges from less than 1 foot to a little more than 250 feet and is dependent largely on the configuration of the land surface. Because adequate topographic maps were not available, no attempt has been made to delimit the areas in which the depth to water lies within specified ranges. The depth to water is greatest in the upland north of the Platte River valley. In the principal stream valleys the depth to water generally is less than 50 feet. In the

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upland in Buffalo and Hall Counties the depth to water ranges from about 50 to 175 feet, and in the upland part of Dawson County the depth to water ranges from about 50 to a little more than 250 feet. The depth to water is shown on plate 4 for all wells and test holes listed in table 10. The relation of the water table to the land surface is shown in the seven geologic cross sections in plate 1.

FLUCTUATIONS OF THE WATER TABLE

The stage of the water table is an indication of the quantity of water in the ground-water reservoir. In general, the water table rises when the amount of recharge exceeds the amount of discharge and declines when the discharge is greater than the recharge.

Water-level measurements were made periodically in 72 wells in order to record the fluctuations of the water table. (See tables 8 and 9.) Measurements in many of the wells were begun during previous studies (Lugn and Wenzel, 1938; Waite and others, 1949) and were continued through the current investigation. The records of measurements in wells used in previous reports are not included in this report, but the records are brought up to date.

In general, the water level in wells in the valleys rises rapidly in response both to precipitation, especially where the water table is less than 10 feet below the land surface, and to increased stream flow in areas adjacent to streams.

Under natural conditions the water level in wells in the upland part of the area fluctuates less than the water level in wells in the valleys. The water table in the upland declines rapidly in response to heavy pumping, and the recovery of the water table is relatively slow. Recharge from precipitation undoubtedly occurs, but the rise of the water table cannot be correlated with specific periods of rainfall. As a long-term record of water-level fluctuations is not available for any well in the upland, only general conclusions can be made. On the other hand, water-level records for a 22-year period are available for several wells in the Platte River valley.

Hydrographs of the water level in five wells in the Platte River valley, one in the Wood River valley, and one on the upland between the Wood and South Loup River valleys are shown in plate 5 along with graphs of the monthly precipitation at Lexington and Kearney.

The water level in wells 10–21–30aa and 10–21–7aa is very shallow, and no significant net gain or loss during the period of record is apparent. The water level in well 11–21–31dd appears to fluctuate in response to the application of surface water for irrigation. In

general, the low water levels in this well occur in March and the high water levels occur during the irrigation season. The low stages recorded in August 1947, 1948, and 1951 probably were caused by the pumping of a nearby irrigation well.

The hydrographs of the water level in wells in Buffalo County (pl. 5) do not show as wide a range as do those for Dawson County. The water level in wells 8–16–12cc and 10–13–24bc fluctuates less because no surface water is diverted for irrigation in the area from Kearney eastward. The water level in well 8–16–12cc showed a net decline of less than 1 foot during the period of record. The water level in well 10–13–24bc showed a progressive net decline from 1930 until about 1946, after which it showed a gradual recovery until 1951. However, the water level in this well has not yet fully returned to the level of 1930–31. Inspection of the hydrograph of well 10–17–21cd emphasizes the need for long and continuous water-level records in order to evaluate properly the true ground-water conditions in an area. An erroneous impression of a high water level might be gained from a casual look at the hydrograph of this well. The water level is about 4 feet higher than at the start of the record; however, the measurements were begun during a period of low water levels. At the end of 1951, the water level in this well probably had not risen to a stage equal to the high water level prevailing in most wells in the area prior to the drought of the thirties.

The hydrograph of well 11–16–35ad showed a decline in water level in August 1950 and a more pronounced decline in August 1951. This well is pumped during the irrigation season and the water level is affected accordingly.

HYDROLOGIC PROPERTIES OF THE WATER-BEARING FORMATIONS

The quantity of ground water that a water-saturated material will yield to wells depends principally upon the permeability and coefficient of storage. The permeability is related closely to the size, shape, number, and degree of interconnection of the interstices of the material, and under water-table conditions the coefficient of storage also is closely related to them.

The permeability of a water-saturated material is its capacity for transmitting water under pressure. The coefficient of permeability, in Meinzer units, is defined as the number of gallons of water, at 60° F, that will flow in 1 day through a cross-sectional area of 1 square foot under a unit hydraulic gradient (1 foot per foot). The field coefficient of permeability is the same unit except that it expresses the rate of flow at the prevailing temperature of

Table 1.—*Coefficients of permeability and transmissibility determined from field permeability tests*

Well no.	County	Date of test	Discharge (gpm)	Maximum measured drawdown (feet)	Duration of pumping (hours)	Specific capacity (gpm/ft)	Coefficient of transmissibility (gpd/ft)	Thickness of water-saturated material (feet)	Field coefficient of permeability (gpd/ft^2)
9-14-27bb	Buffalo	1933	1,100	11.00	24	100	193,000	48	4,030
9-11- 8bc	Hall	1945	1,100	9.74	24	113	237,000	67.5	3,510
8-18-16cc	Phelps	1946	805	15.5	50	52	167,000	34	4,930

Table 2.—*Coefficients of storage determined from field permeability tests*

Well no.	County	Date of test	Coefficient of storage										
			Pumping time, in hours						Recovery time, in hours				
			1	3	6	12	24	48	1	3	6	12	24
9-14-27bb	Buffalo	1933	———	———	———	———	0.07	———	———	———	———	———	———
9-11- 8bc	Hall	1945	0.047	0.068	0.086	0.116	.181	———	———	———	———	———	———
8-18-16cc	Phelps	1946	.056	.083	.96	.114	.163	0.262	0.066	0.088	0.110	0.140	0.199

tne water. The coefficient of transmissibility is a similar measure and is the product of the average field coefficient of permeability and the saturated thickness, in feet, of the aquifer.

The quantity of water that can be removed from a saturated material depends upon the coefficient of storage of the material. The coefficient of storage may be defined as the quantity of water, expressed as a fraction of a cubic foot, released from storage in a column of the aquifer having a basal area of 1 square foot and a height equal to the saturated thickness of the aquifer, when the head declines 1 foot. Under water-table conditions the coefficient of storage is essentially the same as the specific yield, which is the quantity of water that will drain by gravity from saturated material, expressed as a percentage (or decimal fraction) of the total volume drained.

The permeability and specific yield of an aquifer can be ascertained by field or laboratory methods. The field tests probably are the more accurate for unconsolidated materials. No field permeability tests were made during this investigation, but the results of tests made during previous investigations (Waite, 1949, tables 5 and 6) are shown in tables 1 and 2. Three tests were made on irrigation wells in the Platte River valley and the results are representative of sand and gravel of Pleistocene age. Field coefficients of permeability of the Ogallala formation probably would range widely but, in general, would be much lower. Therefore, the drawdowns and total pumping lifts of irrigation wells tapping the Ogallala formation are greater than of wells tapping sand and gravel of Pleistocene age. In addition, recovery from pumping is correspondingly slower in areas in which the Ogallala formation is utilized as an aquifer than in areas where the principal aquifer is sand and gravel of Pleistocene age.

The specific capacity of a well is defined as the number of gallons per minute that the well yields for each foot of drawdown. Under water-table conditions, this relation is constant only when the drawdown is but a small fraction of the saturated thickness of the aquifer. The construction and development of a well also influence its specific capacity. However, a comparison of specific capacities of wells in different aquifers is useful in estimating the permeability of the water-bearing formations. Specific capacities ranging from 8 to 96 gpm per foot of drawdown have been calculated for 9 wells in Buffalo and Hall Counties.

Table 3.—*Specific capacities of 9 wells in Buffalo County and Hall County*

Well number	Depth (feet)	Yield (gpm)	Drawdown (feet)	Specific capacity (gpm per foot of drawdown)
9-15-13bc	63	957	10	96
17- 2bc	252	920	61	15
10-11-30bc	65	934	19	49
12- 4cc	58	750	15	50
21cc	60	605	17	36
14-35ad	75	620	23	27
16- 7ba	295	[a]550	71	8
11-12- 5bc	311	[a]550	51	11
12-14- 9bd	97	460	30	15

[a]Estimated.

The Ogallala formation is the principal aquifer in the three deeper wells. Higher specific capacities, some exceeding 100 gpm per foot of drawdown, have been recorded (Keech, 1952, table 4) for wells drilled into sand and gravel of Pleistocene age in the Platte River valley.

RECHARGE

Sources of ground-water recharge in the report area are precipitation, subsurface inflow from the west, and seepage from irrigation water and streams.

PRECIPITATION

A large part of the ground-water recharge in the area is from local precipitation. The average annual precipitation is about 20 inches and the total area comprises about 1,500 square miles; hence, a total of approximately 1,750,000 acre-feet of water falls on the area each year. A large part of the total precipitation leaves the area by runoff through the South Loup and Platte Rivers and their tributaries, part is evaporated, part is transpired by plants, and part moves downward and becomes ground water. The amount of average annual recharge to the ground-water reservoir from precipitation cannot be determined on the basis of existing data, but probably only a small percentage of the average annual rainfall of about 20 inches reaches the zone of saturation. In areas of shallow water table and of high permeability of intake material, the amount of recharge is large. Favorable areas for ground-water recharge from precipitation are the Platte River and South Loup River valleys. The belt of sand dunes on the south side of the South Loup River is a particularly favorable intake area. Nearly

all the water falling on the sand dunes infiltrates, and there is relatively little loss by evaporation or by surface runoff.

The response of ground-water levels to precipitation is shown in plate 5.

UNDERFLOW INTO THE AREA

Subsurface flow into the area from the west recharges the underground reservoir. (See pl. 4.) The rate of movement of water in sand and gravel of Pleistocene age in the Platte River valley south of Lexington was computed by Wenzel (Lugn and Wenzel, 1938, p. 132) to be less than 3 feet per day. This velocity is believed to be somewhat higher than that of ground water in the sand and gravel of Pleistocene age north of the Platte River valley and considerably higher than that of ground water in the Ogallala formation. The total discharge of ground water moving through sand and gravel of Pleistocene age in the 12-mile width of the Platte River valley at Lexington was computed by Wenzel (Lugn and Wenzel, 1938, p. 131) to be about 6,850,000 gpd. The sand and gravel of Pleistocene age underlying the upland north of Lexington in Dawson County is three times as thick as that underlying the Platte River valley (*A–A'* pl. 1). However, it may be less permeable, and hence possibly transmits only about twice as much ground water as the sand and gravel of Pleistocene age underlying the Platte River valley at Lexington. The amount of ground water moving into the area through the Ogallala formation probably is as great as or greater than the amount moving through the sand and gravel of Pleistocene age, because of the greater thickness and areal extent of the Ogallala and in spite of its lower permeability.

SEEPAGE FROM IRRIGATION

Most of the irrigation canals and laterals in the Platte River valley west of Kearney are above the water table and hence are sources of a large amount of ground-water recharge. Because these canals are unlined, seepage from them occurs whenever they contain water; consequently, the water table is higher during the irrigation season. The altitude of the water surface in these canals is dependent on the amount of inflow into them and on the amount diverted from them. When the water surface in a canal is high, more water seeps to the water table than when the water surface is low.

SEEPAGE FROM STREAMS

The stage of the principal rivers and the stage of the adjacent water table in the area are interrelated. During periods of low precipitation and heavy pumping for irrigation, the Platte River contributes to the ground-water reservoir. The Wood River probably makes only a minor contribution to the ground-water reservoir during periods of high river stage. Mud Creek and the South Loup River lose water to the adjacent ground-water reservoir only during extremely high river stages.

DISCHARGE

Ground water is discharged from the report area by underflow, evaporation, transpiration, wells, streams, and springs. The rate at which the ground water is discharged varies according to the stage of the water table, the depth to water below the land surface, and the season of the year.

UNDERFLOW OUT OF THE AREA

Ground water is discharged by underflow out of the area toward the east. (See pl. 4.) Where the water table lies at great depth, underflow is the only means of natural discharge. The quantity of ground water leaving the area by underflow is believed to be less than that entering the area from the west because the Loup and Platte Rivers intercept part of the ground-water flow and the total thickness of the aquifers is less at the eastern than at the western margin.

EVAPORATION

Evaporation of water directly from the zone of saturation is restricted almost exclusively to land adjoining streams, where the water table is very shallow. The rate of evaporation depends upon the proximity of the water table to the surface, the type of surface material, and climatic conditions. The high temperature and high wind velocities that are common in the area produce a relatively high rate of evaporation. Many additional data, which are not within the scope of this report, would be needed to determine the amount of ground water lost by evaporation.

TRANSPIRATION

Direct transpiration of ground water takes place only in lowland areas where the roots of plants draw water directly from the zone of saturation or from the capillary fringe. In the upland area plants obtain their water supply from soil moisture. Although this does not constitute a direct loss of ground water, it does result in an indirect loss in that precipitation intercepted by plants is returned to the atmosphere and thus the quantity of water available for infiltration to the zone of saturation is reduced by that amount.

The total amount of moisture transpired by plants is large, especially in the Platte River valley where the water table is shallow and plant growth is greatest. Keech (1952) estimates the amount of water lost by transpiration in 1947 in the Platte River valley between Kearney and Wood River to be nearly three times the quantity pumped from wells. The amount of water transpired in the area described by this report, however, probably is much more than three times the quantity pumped from wells.

WELLS

IRRIGATION SUPPLIES

Many farmers in the area, especially in the Platte and Wood River valleys, pump from wells to irrigate crops. Deficiencies in the amount and distribution of precipitation in most years have been the impetus for the development of pump irrigation. Approximately 2,000 irrigation wells have been drilled in this area. Most of these wells are in the Platte River valley east of Kearney; approximately 100 wells are in the Wood River valley northwest of Kearney; and less than 20 wells are in the remainder of the area north of the Platte River valley.

Keech (1952) determined that the average annual pumpage for irrigation in the Platte River valley between Kearney and Wood River for the period 1945–48 inclusive amounted to approximately 68,000 acre-feet. It is estimated that the average annual pumpage for irrigation in the area described by this report during the same period amounted to at least 100,000 acre-feet.

The amount of ground water used each year for irrigation depends largely on the amount and distribution of precipitation during the growing season. Ordinarily little water is used for irrigation before the end of June. However, during the critical months of July, August, and September, pumping increases greatly unless precipitation is unusually favorable. A prolonged drought would

stimulate the installation of irrigation wells in the area north of the Platte River valley and would result in increased pumping of the present wells.

The yield of irrigation wells tapping sand and gravel of Pleistocene age ranges from about 500 gpm to as much as 2,000 gpm. The yield of wells in the Ogallala formation is somewhat less and ranges from about 500 to 800 gpm. In general, the largest yields are obtained from wells in the Platte River valley.

DOMESTIC AND STOCK SUPPLIES

All the rural residents within the report area obtain water for domestic and stock use from wells. Generally the wells are of small diameter and yield only a few gallons a minute. The installation of modern plumbing facilities on farms has increased the per-capita consumption of water in recent years; much more water is used when it is available from a faucet than when the water must be drawn from a well with a bucket. On the other hand, the consumption of ground water by livestock has declined since the introduction of land-conservation practices including the construction of ponds. Many cattle in pastures are watered from stock ponds and, as a result, little use is made of the windmills in the area. A severe drought, however, might result in the renewed use of many of these wells. The total volume of ground water pumped for domestic and stock use is small compared to that pumped for irrigation.

PUBLIC SUPPLIES

Ground water is the source of supply for all towns in the area. The public supply for towns in the Platte River valley is described in a report by Waite and others (1949, p. 57–63). Cairo, Miller, Pleasanton, and Ravenna, north of the Platte River valley, have public water systems. The water supplies for Cairo and Pleasanton are pumped from wells tapping sand and gravel of Pleistocene age. Miller obtains its water supply from a well drilled through the sand and gravel of Pleistocene age and into the Ogallala formation. Two wells furnish the water supply for Ravenna. One, drilled in 1924, taps Pleistocene sand and gravel; the other, drilled in 1940, derives water from the sand and gravel of Pleistocene age and also the Ogallala formation. Water used in Ravenna ranges from 6 to 9 million gallons per month. Pumpage figures are not available for the other towns. The total quantity of ground water pumped for public supplies in the area described by this report is also very small compared to the amount pumped for irrigation.

SEEPAGE INTO STREAMS

Ground water is discharged into a stream wherever the water table slopes toward the stream. Fluctuations of the water table or changes in the stage of the Platte River may cause the river to be a gaining or losing stream. The South Loup River and Mud Creek, at least within the area described by this report, derive part of their flow from ground water. Likewise, ground water sustains the flow of the Wood River in part of its course in the report area. Ground-water discharge by seepage probably is greatest along the South Loup River.

The location of a ground-water divide between two streams does not necessarily indicate the amount of ground water moving toward those streams. The quantity of ground water moving toward a river is dependent upon three factors: the permeability of the water-bearing materials, the hydraulic gradient, and the dimensions of the vertical cross section through which the water moves. In the area described by this report, the ground-water divide is somewhat nearer the Platte River valley than the South Loup River valley. The Wood River becomes an effluent stream in the vicinity of Amherst and a ground-water divide is created between it and the Platte River valley. This divide is much nearer the Platte River valley than it is to the Wood River valley. Ground water moves toward the South Loup River valley and toward the Platte River valley through approximately equal cross-sectional areas. Similarly, ground water moves toward the Wood River valley and toward the Platte River valley through approximately equal cross-sectional areas. In the upland between the Platte and South Loup River valleys, ground water moves toward the South Loup River valley down a steeper gradient than toward the Platte River valley. Similarly, in the divide area between the Platte and Wood River valleys, ground water moves toward the Wood River valley down a steeper gradient than toward the Platte River valley. However, the permeability of the water-bearing formations may be lower on the north side of the above-mentioned ground-water divides than on the south side. Therefore, the proximity of the ground-water divides to the Platte River valley may not indicate that larger amounts of ground water are being contributed to the South Loup and Wood Rivers, respectively, than move toward the Platte River.

SPRINGS

Although no springs were observed in the report area during the field investigation, and the residents of the area did not refer to any springs, minor springs and seeps probably are present along

the banks of the South Loup River, Mud Creek, part of the Wood River, and some parts of the Platte River.

CHEMICAL QUALITY OF THE GROUND WATER

By Frank H. Rainwater

The extent to which fresh water may be effectively utilized is closely associated with its chemical quality. Therefore, an evaluation of the ground-water resources of the area described by this report necessitates an integration of information on the chemical quality of the water with that on the geology and hydrology of the area. The purposes of this section are: to discuss the quality of the ground water in terms of its predominant characteristics and with respect to the geography and irrigation practices of the area; to correlate the geology and streamflow with the chemical quality of the ground water; to establish the suitability of ground water for present and future uses; and to evaluate the effect of extended irrigation on the quality of the ground water in the Wood and Platte River valleys east of Kearney.

During the period August 1950 through June 1951, water samples were collected from 16 wells and 2 streams. These include analyses of some water samples collected during 1951 from wells and drains in the area between Elm and Buffalo Creeks. The sampled wells range in depth from 11.5 to 311 feet. In addition, data pertaining to the quality of the ground water in 4 wells in the Platte River valley, as previously recorded by Swenson (*in* Waite and others, 1949), and the chemical analyses made by the Nebraska State Health Department on samples from 4 wells in the valley are included in this report. Connor (1951, p. 5) includes chemical-quality data for the South Loup River at St. Michael in his discussion of the chemical quality of surface waters of the Loup River basin.

AREAL DISTRIBUTION OF CLASSES OF WATER

Lithologically, the Ogallala formation and the sand and gravel of Pleistocene age are similar in many respects, and the zone of saturation is continuous from one to the other. Under such conditions, the chemical quality of the water from both deposits would be expected to be similar. This was true for all samples collected north of the irrigated area. Swenson (*in* Waite and others, 1949) discussed the effect of the reuse of surface water for irrigation on the chemical quality of the ground water of the Platte River valley.

On the basis of its chemical characteristics, ground water in the report area may be divided into three chemical classes which are related to the kind of irrigation or the lack of irrigation. Although several ratios of concentration of certain constituents can be used to show these classes, the ratio of sulfate to total mineralization in parts per million was selected because it could be calculated for all samples. The location of the sampled wells, the total dissolved salts, and the percentage of sulfate in the water have been plotted on a modification of a map (fig. 7) that was prepared by the U. S. Bureau of Reclamation (1951, p. 47–48, exhibit 4) to show the extent and type of present irrigation in the area.

The water from wells in area "*A*" (see fig. 7), where little or no irrigation is practiced, is very uniform in both mineral concentration and percentage composition. The water from these wells is essentially of the calcium bicarbonate type and has a high content of silica and a low concentration of sodium and sulfate. The minimum and maximum concentrations in 15 samples from area "*A*" are as follows:

Constituent	*Concentration in ppm*	
	Minimum	*Maximum*
Solids	304	413
Hardness as $CaCO_3$	194	292
Sodium (Na)	6.4	20
Sulfate (SO_4)	3.0	31
Silica (SiO_2)	42	54

The ground water in area "*B*" (see fig. 7), where surface water is extensively used for irrigation, shows no such uniformity. In general, the water is more mineralized and harder than in area "*A*" and sulfate is present in higher concentration. Maximum concentrations in six samples of the ground water from area "*B*" are as follows:

Constituent	*Concentration in ppm*
	Maximum
Solids	1,050
Hardness as $CaCO_3$	604
Sulfate (SO_4)	488

Swenson (*in* Waite and others, 1949) states:

...shallow ground waters in the western part of the [Platte River] valley generally are found to contain somewhat greater amounts of dissolved mineral solids than are found

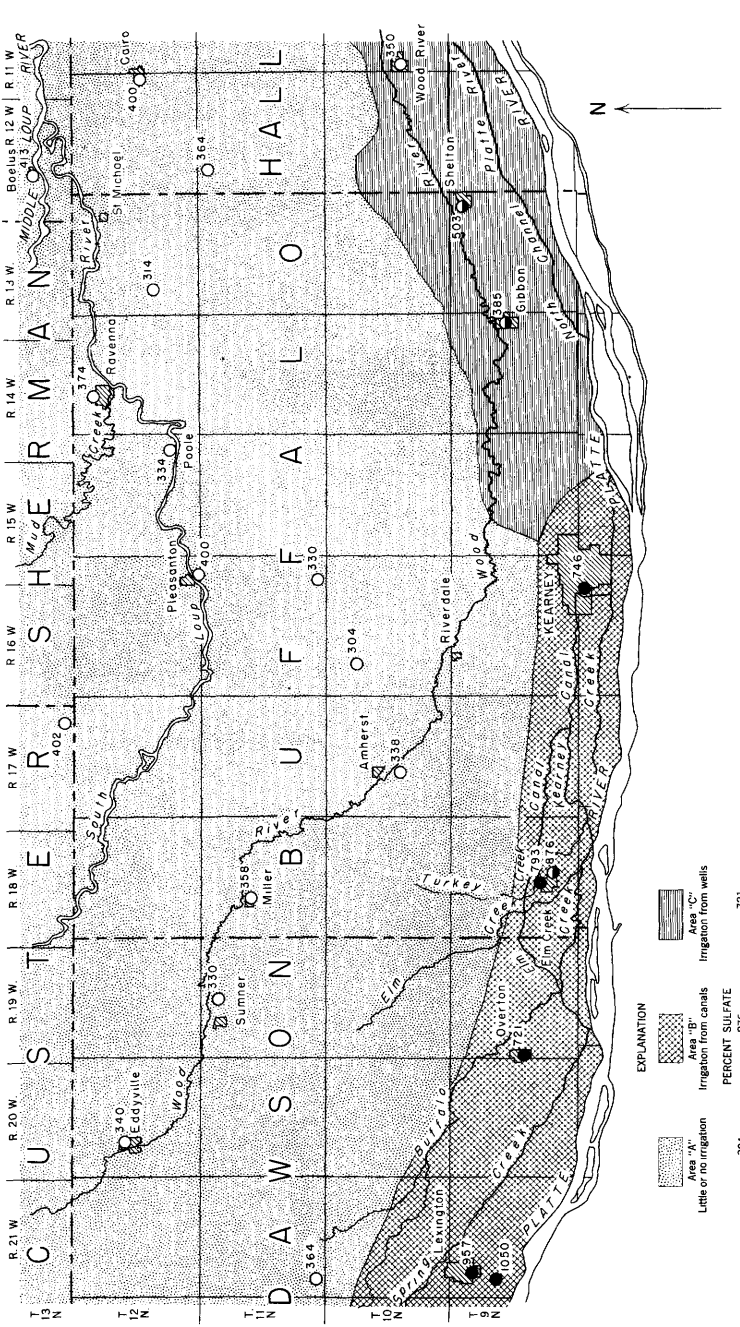

Figure 7.—Location of sampled wells and irrigated areas.

downstream from Shelton. This may be due to the many diversions of the river water in the western part of the valley creating a condition in which the water is used over and over for downstream agricultural development. The concentration of salts in drainage water from irrigated lands is greater than that found in waters applied to the land. This drainage water upon mixing with the ground water will in general increase the salinity of the latter.

The extent of reuse and of dilution with Platte River water affects the chemical quality of the ground water in this area.

Wells in area "*C*" (see fig. 7) are used extensively for irrigation and yield water that has a lower content of dissolved mineral salts than the water in area "*B*" but has a higher sulfate content than the water in area "*A*."

Concentrations of constituents in a chemical system are often expressed in terms of equivalents rather than as weight per unit weight (parts per million). Equivalents per million are calculated by dividing parts per million by the combining weight of the individual ions. For any system reduced to equivalent form, the total equivalents per million of the positively charged ions (generally, calcium, magnesium, sodium, and potassium), termed "cations," is equal to the total equivalents per million of the negatively charged ions (generally, carbonate, bicarbonate, sulfate, chloride, nitrate, and fluoride), termed "anions." Such a presentation expresses the true chemical relationship of the various ions in the water. The chemical character of the water in terms of concentration in equivalents per million is shown in figure 8.

RELATION OF GEOLOGY TO CHEMICAL QUALITY OF THE GROUND WATER

The chemical quality of ground water reflects its geologic and hydrologic environment. Ground water, as it moves through permeable deposits, dissolves soluble salts and becomes more mineralized. The extent of solution is dependent on the solubility of the rock materials and on the length of time in contact. Dilution of the dissolved mineral salts may occur in areas in which conditions are favorable for ground-water recharge from precipitation or from surface water of low concentration. The chemical quality of the ground water is often a useful tool in defining these hydrologic and geologic factors.

Although calcareous sandstone is a major constituent of the Ogallala formation, which is an important aquifer north of the Platte River valley, and the average velocity of water movement through the Ogallala formation is relatively slow, chemical analyses of ground water in the area north of the Platte River valley show no appreciable differences in either total mineral content or percentage composition. No substantial increase in calcium bi-

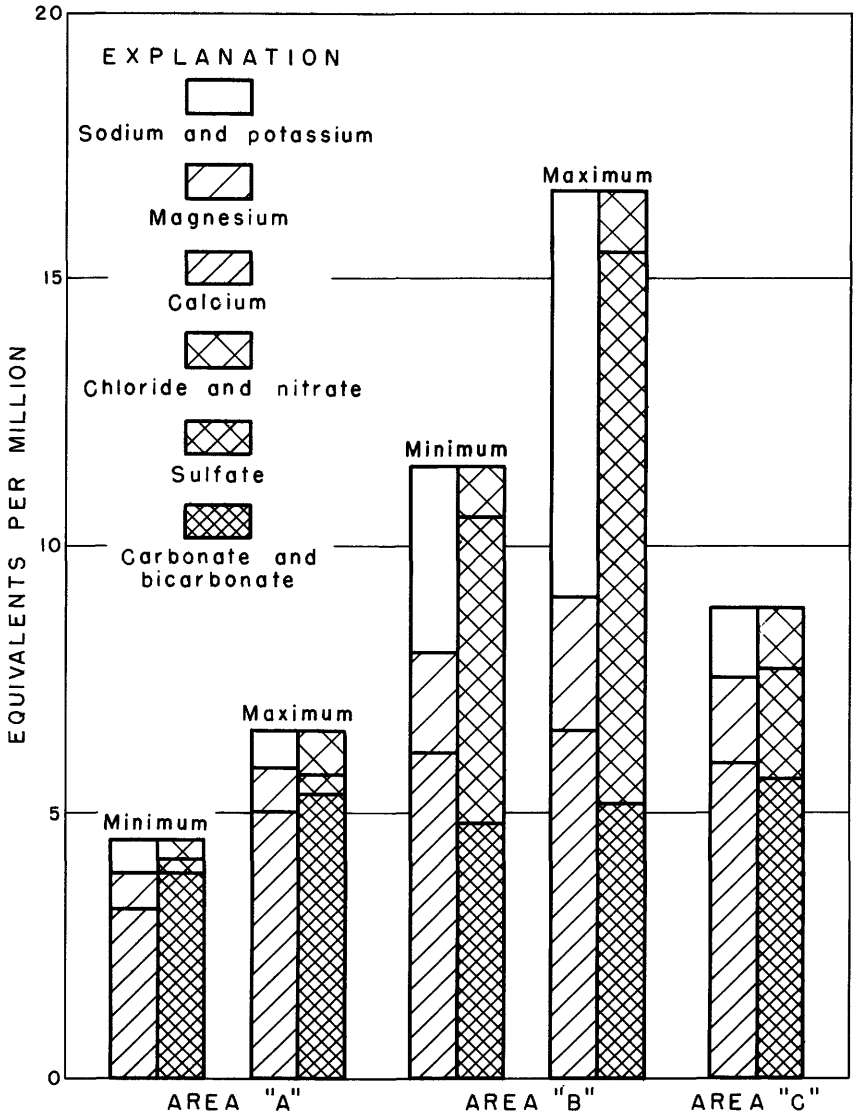

Figure 8.—Principal mineral constituents in the ground water.

carbonate occurs in the ground water as the ground water moves eastward through the area. Apparently the ground water within the Ogallala formation moves fastest through deposits that either have been leached of their soluble material or never have contained appreciable quantities of such material. The calcareous sandstone

seemingly is not an important source of ground-water supply and contributes little to the chemical quality of the water. Strata of the Ogallala formation that have low permeability and yield probably are characterized by relatively hard, mineralized water.

Classification of water samples according to geochemical type may be made on the basis of the percentage relationship of the various components. The ions are divided into four groups: the strong bases (sodium and potassium), the weak bases (calcium and magnesium), the strong acids (sulfate, chloride, fluoride, and nitrate), and the weak acids (carbonate and bicarbonate). This classification does not show variations in total salt content. The geochemical similarity of the samples of ground water collected in the area north of the Platte River valley and the divergence of the composition of samples collected in the valley are shown by figure 9.

RELATION OF STREAMFLOW TO CHEMICAL QUALITY OF THE WATER

The hydrologic relation of ground water to surface water in the report area has been discussed in the sections on the movement, recharge, and discharge of ground water. Under the prevailing hydrologic conditions north of the Platte River valley, streamflow would be expected to affect the chemical quality of the ground water only during periods of high river stage. Conversely, the chemical quality of the river water at low stage reflects the chemical quality of the ground water at that time. Table 4 shows the total mineralization and percentage composition of the South Loup and Wood Rivers during periods of relatively high and low stages as compared with similar data for water from adjacent wells. The surface waters at high stage are less concentrated than the adjacent ground water, although both are relatively uniform in percentage composition; the only effect of recharge from streams on the chemical quality of the ground water is dilution.

EFFECT OF PRESENT IRRIGATION ON CHEMICAL QUALITY OF THE WATER

Irrigation from canals, and to a lesser extent from wells, has been practiced in the Platte River valley west of Kearney since the 1890's. The effect of irrigation on the chemical quality of the ground water can best be discussed in terms of the direction of water movement in the area and the chemical quality of water in drains in the vicinity of the towns of Overton and Elm Creek.

Some of the land between Lexington and Overton is poorly drained. The slow movement of the water, and also discharge of water by evapotranspiration, causes an increase in the dissolved-salt content of the ground water. The samples of water from the

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Lexington public supply and from a well southwest of Lexington had the highest concentration of minerals. Between Overton and Kearney the drainage is better. Ground-water samples from this area are slightly less mineralized than samples from the vicinity of Lexington.

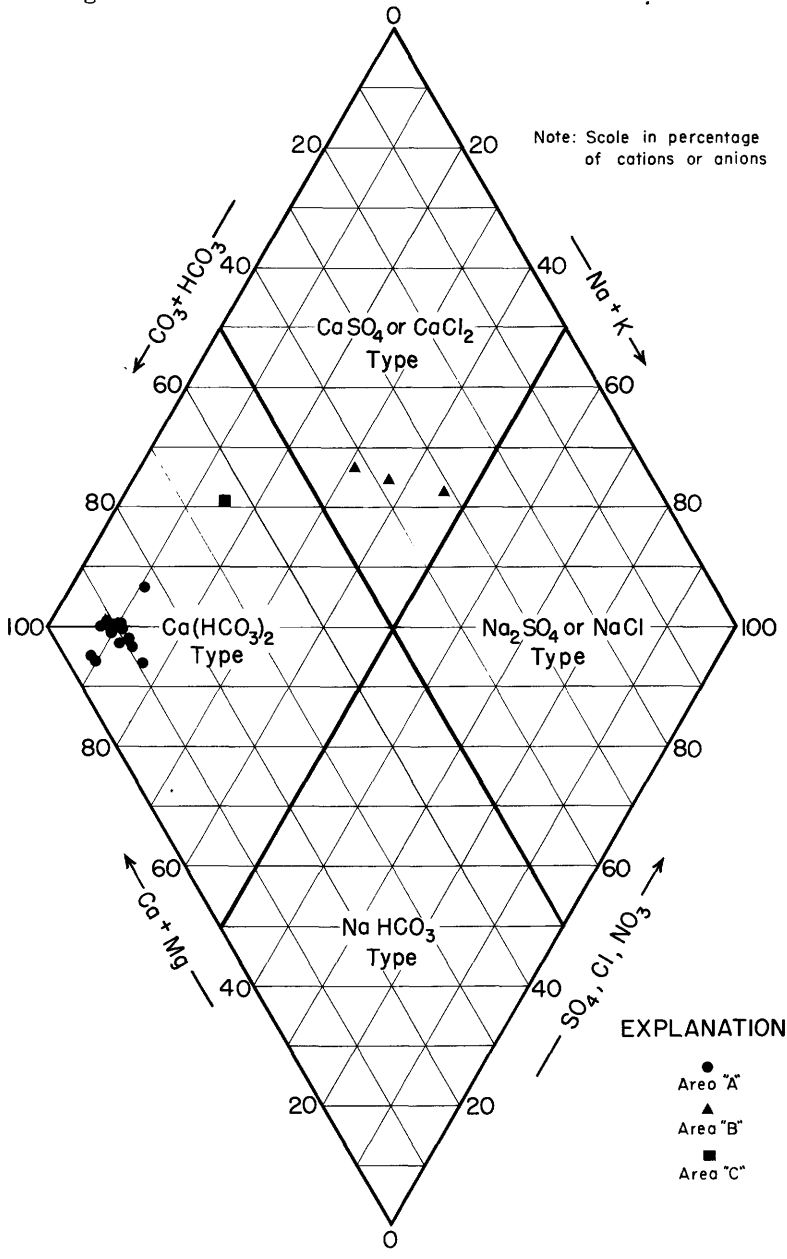

Figure 9.—Geochemical characteristics of the ground water.

Table 4.— *Percentage composition and dissolved solids of ground and surface waters*

Date	Location	River gage height (feet)		Cation percentages		Anion percentages		Dissolved solids (ppm)
		Maximum for year	At sampling time	Alkaline earths	Alkalies	Weak acids	Strong acids	
Apr. 2, 1947	South Loup at St. Michael	----------	1.89	80	20	85	15	280
May 1	do	----------	1.94	79	21	84	16	296
Aug. 20	do	----------	1.64	79	21	82	18	298
June 22, 1948	do	7.26	3.55	87	13	92	8	218
July 18	do	7.26	4.06	86	14	92	8	206
July 29	do	7.26	3.83	74	26	91	9	204
Sept. 22, 1949	do	5.87	2.03	83	17	88	12	284
Aug. 31, 1950	Well 12-13-20cb near St. Michael	[a]4.35	[a]2.70	86	14	89	11	314
Oct. 24	South Loup at Pleasanton	[b]4.65	[b]2.88	85	15	89	11	278
Sept. 12	Well 12-16-35ad2 at Pleasanton	[b]4.90	[b]2.91	89	11	89	11	400
Oct. 28	Mud Creek at Ravenna	[c]13.42	[c]4.69	86	14	88	12	428
Aug. 30	Well 12-14-5dd at Ravenna	[c]15.81	[c]5.11	90	10	91	9	374
Mar. 27, 1947	Wood River near Riverdale	19.75	2.99	83	17	83	17	324
May 7	do	19.75	2.93	94	6	90	10	468
June 18, 1948	do	12.07	3.52	89	11	92	8	184
July 31	do	12.07	6.46	73	27	93	7	164
Sept. 25	do	12.07	2.83	94	6	96	4	358
June 7, 1949	do	10.97	9.90	78	22	88	12	118
Sept. 7, 1950	Well 10-17-21cb near Amherst	[d]9.57	[d]2.02	94	6	92	8	338

[a] River gage height, South Loup at St. Michael, Nebr.
[b] River gage height, South Loup at Ravenna, Nebr.
[c] River gage height, Mud Creek near Sweetwater, Nebr.
[d] River gage height, Wood River near Riverdale, Nebr.

Some of the perennial drains in the vicinity of Overton and Elm Creek have been sampled before, during, and after the irrigation season. During the irrigation season these drains carry a mixture of overland waste water and infiltrated drainage water. The dissolved salts in the drain water reach their maximum concentration before the irrigation season, because then the flow is composed principally of water that has infiltrated to the ground-water reservoir and has had longer contact with the soluble material of the earth. Where flow is substantial before the irrigation season, the water in drains is indicative of the water infiltrating to or in the upper part of the ground-water reservoir. Four drains in the vicinity of Overton and Elm Creek were sampled during March 1951; the dissolved solids in these samples ranged from 706 to 992 ppm. The average concentration in daily samples from the Platte River at Brady (about 40 miles upstream from Lexington) during the 1951 irrigation season was 434 ppm, and the average concentration in 3 samples from the Platte River near Cozad (about 15 miles upstream from Lexington) during the irrigation season 1947–49 was 498 ppm. Irrigation results in concentration of the minerals in solution and in their movement downward to the ground-water reservoir.

CHEMICAL QUALITY OF WATER IN RELATION TO USE

IRRIGATION

The suitability of the ground water for irrigation is divided along the same geographical boundaries that separate the classes of water. Wilcox (1948) developed a diagram for use in interpreting analyses with respect to suitability of the water for irrigation. Interpretation is made on the basis of the percent sodium and the specific conductance. The percent sodium is calculated by dividing the equivalents per million of sodium by the total equivalents per million of the cations and multiplying by 100. The specific conductance is measurement of the electrical conductivity of the water and is approximately proportional to the total concentration of ionized salts in solution. The analyses of water from the report area are classified in figure 10 as to the suitability of the water for irrigation. In classifying irrigation water on the basis of the empirical chart shown in this figure, Wilcox pointed out that factors such as soil composition, permeability, drainage, irrigation practices, and type of crop grown are important because satisfactory use of the water is also dependent on them.

Magistad and Christiansen (1944, table 2) report that water containing less than 0.33 ppm of boron is classified as excellent to good so far as that constituent is concerned, and is suitable for

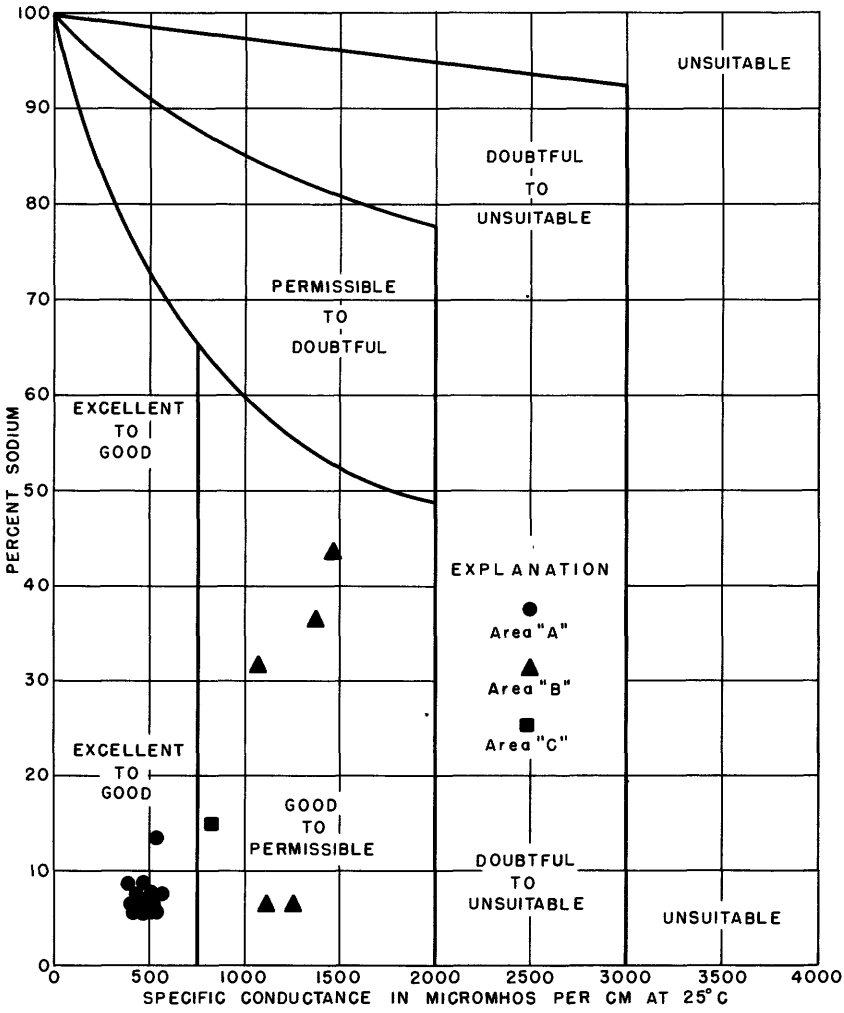

Figure 10.—Classification of ground water for irrigation.

most plants under most conditions. The maximum boron concentration found in the samples collected in the report area was 0.12 ppm.

DOMESTIC AND INDUSTRIAL USE

Whereas total mineralization, percent sodium, and boron content of water are of primary concern to the irrigationist, hardness and such constituents as iron, fluoride, and silica are of principal

Table 5.—*Mineral constituents and related physical measurements of ground water*

[Analytical results in parts per million except as indicated. Analyzing agency: USGS, U. S. Geological Survey; NSDH, Nebraska State Department of Health]

Location		Owner	Date of collection	Well depth (feet)	Analyzing agency	pH	Specific conductance (micromhos at 25°C)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)
Well no.	Area									
Standard maximum for drinking water, U. S. Public Health Service									0.3	
8-16- 2da2	B	City of Kearney	4-21-47	42	USGS	7.3	1,060		0.05	
9-13- 1ca	C	City of Shelton	4-21-47	42	USGS	7.8	779		.05	
14-13ca	C	City of Gibbon	4-15-48	59-64	NSDH	8.0			0	0
18-27cc	B	Sear	6-21-51	25	USGS	7.5		47	.56	
18-28ad	B	Village of Elm Creek	4-21-47	29.4	USGS	7.4	1,090		.05	
19-19bb	B	Village of Overton	1-20-47	38-40	NSDH	7.2			0	.03
21- 8bb	B	City of Lexington	4-22-47	60	USGS	7.7	1,340	46	.05	
21-18aa	B	U. S. Geological Survey	6-20-51	11.5	USGS	7.7	1,440	27	.70	
10-11-19cb	C	Village of Wood River	4-28-44	61	NSDH	7.5			trace	0
16- 7ba	A	Eisele	9- 6-50	295	USGS	7.7	408	52	.03	
17-21cb	A	Ludwig (near village of Amherst)	9- 7-50		USGS	7.6	466	53	.03	
11-12- 5bc	A	Hulme	8-30-50	311	USGS	7.4	485	52	.07	
16-35ad	A	Cruise	9- 6-50	183	USGS	7.5	464	50	.08	
18-17ad	A	Village of Miller	8- 7-50		USGS	7.6	414	53	.02	
19- 4dd	A	Vermas (near village of Sumner)	1- 3-51	163	USGS	7.5	488	48	.09	
21-31dd	A	U. S. Geological Survey	6-20-51	57.0	USGS	7.7	542	42		
12-12-24ab	A	Village of Cairo	11- 8-50	92	USGS	7.5	557	44	.08	
13-20cb	A	Urwiller	8-31-50	207	USGS	7.4	403	50	.05	
14- 5dd	A	City of Ravenna	8-30-50	231	USGS	7.5	515	54	.03	
15-25cb	A	Standage (near village of Poole)	8- 9-50	96	USGS	7.4	440	50	.05	
16-35ad2	A	Village of Pleasanton	9-12-50	119	USGS	7.5	522	48	.92	
20-17ac	A	Eddyville Cafe	9-13-50	100	USGS	7.5	433	49	.10	
13-12-29ca	A	Village of Boelus	3- 5-48	30	NSDH	7.2			0	0
17-36bc	A	Tatum	10-27-50	126	USGS	7.7	583	43	4.0	

Well no.	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Solids		Hardness as $CaCO_3$		Percent sodium
											Dissolved	Total	Calcium, magnesium	Noncarbonate	
Standard maximum for drinking water, U. S. Public Health Service		125				250	250	1.5			[1]500				
8-16- 2da2	122	23	81		292	277	30	0.4	5.0	0.03	746		399	160	31
9-13- 1ca	119	19	31		344	91	38	.2	15	.07	503		375	93	15
14-13ca						67	41	.3	12			385	264		
18-27cc	182	36	22	14	397	153	72	.1	74	.08	876		604	278	7
18-28ad	190	26	22		394	214	48	.1	20	.07	793		581	258	8
19-19bb					314	180	15	.3	2.2			721	260		
21- 8bb	141	30	126		346	387	35	.5	15	.11	957		475	191	37
21-18aa	131	30	167	13	314	488	30	.4	9.4	.12	1,050		450	193	44
10-11-19cb						24	23	0				350	270		
16- 7ba	71	8.0	6.4	5.2	260	3.0	4.0	.0	2.1	.00	304		210	0	6
17-21cb	81	11	6.8	5.9	304	13	3.5	.0	4.1	.00	338		248	0	6
11-12- 5bc	85	11	9.4	4.7	308	19	3.0	.0	1.7	.00	364		256	3	7
16-35ad	81	9.0	7.6	5.7	292	11	6.5	.0	3.0	.10	330		240	1	6
18-17ad	78	14	7.6	8.2	298	20	3.0	.0	3.3		358		252	8	6
19- 4dd	79	12	7.7	7.5	313	4.0	3.5	.0	2.0	.00	330		246	0	6
21-31dd	80	17	8.9	10	328	21	4.5	.1	5.5	.07	364		271	2	6
12-12-24ab	89	12	20	8.2	356	23	9.0	.0	.6	.10	400		272	0	13
13-20cb	64	8.4	9.6	8.0	236	12	2.0	.1	8.9	.00	314		194	0	9
14- 5dd	88	12	10	6.1	332	18	4.0	.0	1.9	.00	374		268	0	7
15-25cb	71	11	11	6.2	276	21	4.0	.0	.6	.00	334		222	0	9
16-35ad2	89	13	11	6.6	332	19	9.0	.0	.5		400		276	4	8
20-17ac	70	12	8.2	8.6	276	12	4.0	.0	4.5	.00	340		222	0	7
13-12-29ca						31	13	.2	31			413	222		
17-36bc	100	10	12	7.5	326	18	25	.0	.4	.00	402		292	25	8

[1] 1,000 ppm is permitted if a better supply is not available.

interest to the homemaker and industrialist. Municipalities and industries may adjust the composition of their water by chemical or mechanical treatment, but rural residents generally use untreated water from their own wells. Many municipal-supply wells have been sampled for chemical analysis either by the U. S. Geological Survey or by the Nebraska State Health Department. Where a town does not have a municipal supply, samples have been collected from privately owned wells in the vicinity of the town in order to obtain information concerning the chemical quality of the water available in the area.

The U. S. Public Health Service (1946) has defined the maximum limits for certain chemical constituents in water used by interstate carriers. Specifically, these limits apply only to the water that is used for drinking and culinary purposes on trains, aircraft, and vessels in interstate traffic. However, the standards are accepted by many States for evaluating municipal supplies. Table 5 shows these limits and the results of analyses (abridged) of water from municipally or privately owned wells in the report area.

Hardness is caused almost entirely by calcium and magnesium, although a few other constituents like iron and free acid, normally present in only small amounts, also contribute to hardness. In the home, hard water is objectionable because of its soap-consuming capacity. Hard water is recognized not only by the quantity of soap required to produce a lather but also by the formation of an insoluble curd, which is objectionable in all washing processes. Hardness is generally expressed as the amount of calcium carbonate ($CaCO_3$) that is chemically equivalent to the calcium and magnesium present. Hardness caused by the calcium and magnesium equivalent to the bicarbonate in the water is called carbonate hardness; the remainder is noncarbonate hardness. These terms approximate "temporary hardness" and "permanent hardness," respectively, which are based on the fact that when hard water is boiled the bicarbonate is decomposed and most of the calcium corresponding to the bicarbonate is precipitated as calcium or magnesium carbonate. Hard water is objectionable also because of the formation of scale in boilers, water heaters, radiators, and pipes; the scale results in a loss in heat transfer, failure of boilers, and loss of flow. However, some calcium bicarbonate in water makes the water less corrosive and may produce a protective coating on pipes and other equipment.

A high content of iron or manganese in domestic water is objectionable because these elements stain porcelain or enameled fixtures, clothing, and other fabrics. Laundries, ice manufac-

turers, breweries, and other industries require water practically free from iron and manganese.

Many of the samples analyzed from wells north of the Platte River valley contained less than 0.05 ppm of fluoride, which is much less than the concentration of about 1.0 that has been established by Dean (1936) as optimum for reduction of dental caries (tooth decay). The observed fluoride content of ground water along the Platte River valley ranges from 0.1 to 0.5 ppm.

Comly (1945) and others have shown that cyanosis may occur in infants who drink water of high nitrate content. The nitrate compounds, when ingested, may be converted to nitrites by bacterial action. The nitrite ion oxidizes the hemoglobin of the blood to methemoglobin, which causes cyanosis. Water containing more than 45 ppm of nitrate (as NO_3) is widely regarded as unsafe for infant feeding. The only sample that contained more than 45 ppm of nitrate was from well 9–18–27cc. The nitrate content of this water was 74 ppm.

The silica content of water is significant if the water is to be used as feed water for high-pressure boilers and steam turbines, because silica contributes to the formation of boiler scale and adheres to steam-turbine blades.

The quality of water required for industrial uses is as varied as the types of industries themselves. Interested water users are referred to "Progress report of the Committee on Quality Tolerances of Water for Industrial Uses," by E. W. Moore (1940).

EFFECT OF PROPOSED IRRIGATION ON THE CHEMICAL QUALITY OF THE GROUND WATER

The extent to which the chemical quality of ground water is affected by irrigation is dependent on the chemical quality of the water applied to the land, the increase in concentration of salts in solution through evapotranspiration, the amount of irrigation water that infiltrates to the ground-water reservoir, the chemical nature of the soluble salts in the soil, and the extent of solution of these salts by water.

Water from the Wood and South Loup Rivers is generally less mineralized and softer than the ground water in the Platte River valley east of Kearney. However, Platte River water is somewhat higher in dissolved solids than ground water that was sampled in this area. Table 6 shows the maximum and minimum values for certain chemical characteristics of water from the Wood, South Loup,

Table 6.— *Chemical character of the water proposed for irrigation use*

	Period of record	Number of analyses	Dissolved solids (ppm)		Hardness (ppm)		Percent sodium	
			Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
Ground water	1944-50	4	503	338	375	248	-------	-------
Wood River near Riverdale	1947-49	7	468	118	381	67	27	6
South Loup River at St. Michael	1947-49	7	298	204	198	102	25	13
Platte River near Odessa	1947-50	7	700	476	331	206	58	37

and Platte Rivers. Only those samples of Platte River water collected during the normal irrigation season are included in the tabulation. A further concentration of salts in the Platte River water may be expected as a result of increased use for irrigation of the water upstream from and within the report area.

SOILS OF THE AREA AND THEIR EFFECT ON THE CHEMICAL QUALITY OF GROUND WATER

A soil survey of Buffalo County was made by Hayes and others (1928) and of Hall County by Veatch and Seabury (1918). The predominant soil types in these counties are described briefly as follows:

Waukesha silt loam is the predominant terrace soil along the Wood and Platte Rivers in Buffalo County. The upper part of the subsoil is moderately compact silty clay loam or silty clay. The material is low in lime to a depth of 3 feet.

Waukesha very fine sandy loam lies on the upland between the Wood and Platte Rivers, ranges in texture from loam to silty clay loam, and is loose and friable. The uppermost 3 feet of the soil is calcareous in a few places, but lime is very abundant below a depth of 4 feet.

Hall silt loam occurs only in patches in Buffalo County and is the principal type of soil along the Wood River in Hall County. The soil is stiff and plastic when wet but becomes hard and tough on drying. Highly calcareous silty material is present below a depth of about $2\frac{1}{2}$ feet. The lime commonly occurs in a finely divided form.

Hall sandy loams occur primarily on the Platte River terraces and along the Wood River in Hall County. The texture ranges from silty loam to medium-grained sand and scattered fine gravel.

The soil is calcareous below an average depth of 22 inches, and the lower part of the subsoil and the substratum contain much lime.

The soils in approximately two-thirds of the Platte River valley east of Kearney are calcareous. Because the soil is fine textured, irrigation water infiltrates the soil slowly and dissolves mineral salts before entering the ground-water reservoir. However, the solution of calcareous material would be very gradual because of the low solubility of calcium carbonate, and more soluble salts are not present in large quantities. Therefore, the concentration of salts in the water by solution of salts in the soil would not impair the chemical quality of the ground water for irrigation and domestic purposes, but concentration by evaporation might.

Thus the principal factors that could impair the chemical quality of the ground water of the Platte River valley east of Kearney appear to be waterlogging and the application of overused Platte River water for irrigation. An increase in the mineralization of ground water similar to that which has occurred in the western part of the Platte River valley may conceivably develop in the Platte River valley east of Kearney unless the percentage of Platte River water in the irrigation blend is closely regulated.

CONCLUSIONS

Unconsolidated deposits of sand and gravel of Pleistocene age and the Ogallala formation of Pliocene age are the important water-bearing formations in the area described by this report. The Pleistocene deposits of sand and gravel are the principal source of ground water in the river valleys and in the western part of the upland north of the Platte River valley. In Dawson County, the sand and gravel in the upland is thicker but lies at a greater depth than in the Platte River valley. Wells drilled into the sand and gravel of Pleistocene age yield as much as 2,000 gpm. In the eastern part of the upland, where the Pleistocene deposits are not only thinner than elsewhere but generally are above the water table, the underlying Ogallala formation is the principal aquifer.

The Ogallala formation underlies the entire area. Its wide range in lithologic characteristics causes a corresponding range in permeability both vertically and horizontally. Consequently the utilization of the Ogallala formation as an aquifer is limited by differences in permeability. However, wells yielding a minimum of 400 gpm probably could be constructed anywhere in the area. The drawdown of the water level in wells yielding this amount might be as much as 100 feet.

The ground water, except locally where it is confined by an impermeable layer, is under water-table conditions. The depth to water ranges from a few feet to slightly more than 250 feet. Ground water enters the area by underflow from the west. While moving eastward through the area it is recharged principally by precipitation and seepage from irrigation and is discharged, in part, by evapotranspiration, pumping from wells, and seepage into effluent streams. The rest of the ground water leaves the area by underflow to the east.

The South Loup River is an effluent stream throughout its course in the area. The Platte River at some times and places is an influent stream and at others, an effluent stream; on the whole it is in approximate equilibrium with the adjacent ground-water reservoir in the valley. After the Wood River enters the Platte Valley it becomes a part of the influent-effluent Platte system.

A poorly defined water-table divide in the western part of the area separates ground water moving toward the Platte River from that moving to the South Loup River. In the central part of the area the water-table divide forks into two more sharply defined divides that separate ground water moving toward the Platte River from that moving to the Wood River and ground water moving to the Wood River from that moving to the South Loup River.

Much ground water is used for irrigation in the Wood and Platte River valleys and relatively little is used for this purpose elsewhere in the report area. Surface water is diverted from the Platte River for irrigation in the Platte River valley west of Kearney—hence less ground water is used for irrigation in this part of the area than in the Platte River valley east of Kearney. Although now there are few irrigation wells in the Loup River valley and on the upland, the use of ground water for this purpose probably will increase considerably.

All water used for municipal supply and rural domestic purposes in the area is pumped from the ground. In recent years the retention of surface runoff by small dams has created ponds that are used for the watering of stock and correspondingly less use now is made of ground water for this purpose.

The three observed chemical classes of ground water in the report area are related to irrigation. In the upland north of the Platte River valley, where irrigation is slight, the Ogallala formation and the sand and gravel of Pleistocene age yield a calcium bicarbonate water of relatively low dissolved mineral content, much of which is silica. In the Platte River valley west of Kearney, where Platte River water is used for irrigation, the ground water

varies in chemical composition and concentration. Sulfate and sodium, which are only minor constituents in the nonirrigated part of the area, are present in appreciable concentrations in the irrigated part of the area. Although ground water in the Platte River valley east of Kearney, where ground water is pumped extensively for irrigation, contains less dissolved minerals than ground water in the Platte River valley west of Kearney, it contains a higher percentage of the sulfate ion than ground water in the area north of the Platte River valley.

Although calcareous sandstones comprise a large percentage of the Ogallala formation, no discernible increase in the concentration of calcium bicarbonate takes place when the water moves through the formation. This suggests either that the sandstones contribute little to the chemical quality of the ground water because the water is moving primarily through deposits that have been leached of their soluble salts or that the dilution of the water by recharge from precipitation is in balance with the solution of material from the Ogallala.

Ground water in the area north of the Platte River valley has a low content of dissolved solids and a low percent sodium and is classified as excellent to good for irrigation. Because of its higher dissolved-salt content, ground water west of Kearney falls in the "good-to-permissible" class for irrigation. No boron problem exists in the report area. In many places the ground water is hard, although not excessively so, and the quality of the water generally is satisfactory for domestic use.

In the vicinity of Lexington and Overton the land is poorly drained. As a consequence, some deterioration of the quality of the ground water occurs by solution of salts from the soil and by further concentration resulting from evaporation. The salt content of water samples from drains in the vicinity of the towns of Overton and Elm Creek is approximately twice that of the Platte River at Brady or near Cozad. The ground water in the Platte River valley east of Kearney is of better quality than that to the west. Therefore, consideration should be given to the possibility that use of Platte River water for irrigation west of Kearney would detrimentally affect the quality of the ground water east of Kearney.

Future studies should include a more comprehensive investigation of the effects of surface-water irrigation on the chemical quality of the ground water beneath the irrigable lands of the report area.

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Table 7.—*Logs of test holes and wells*

[Drillers' logs are marked by an asterisk (*) after the well number. Logs showing no owner or driller are of test holes or wells drilled by the Conservation and Survey Division, University of Nebraska, in cooperation with the U. S. Geological Survey]

BUFFALO COUNTY

	Thickness (feet)	Depth (feet)
8-13-1ad. Altitude (instrument), 2,013.08 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, sandy, dark-brownish-gray (road fill and soil)	1	1
Sand, fine to coarse, light-brownish-gray	3.3	4.3
Sand, silty, dark-brownish-gray; contains interbedded gravel	1.2	5.5
Silt, clayey to sandy, light-gray	.5	6
Sand and gravel, silty, dark-brownish-gray	.5	6.5
Sand and fine- to medium-grained gravel, brownish- to pinkish-gray	15.5	22
Silt, fine-sandy, light-yellowish- to brownish-gray	5	27
Sand and fine- to medium-grained gravel, light-brownish-gray	17	44
Sand and fine- to medium-grained gravel, light-brownish- to pinkish-gray	16	60
Sand and fine to coarse gravel, brownish-, yellowish-, or pinkish-gray	43.5	103.5
Tertiary—Ogallala formation (Pliocene):		
Silt, clayey to very fine sandy, light-brownish-gray	6	109.5
Silt, slightly clayey to fine sandy, light-brownish-tan interbedded with light-gray	35.5	145
Silt, very fine sandy, medium-brownish-gray	5	150
Silt, very fine sandy, and sandstone, light-brownish-gray to yellowish-gray-green; contains many rootlets	4	154
Sandstone, whitish-gray with a yellowish-tint; contains clay, light-gray, limonitic-stained	6	160
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-gray, limonitic-stained; contains some bentonitic clay and a few aragonite fragments	19	179
Clay shale, dark-gray to black	11	190
8-15-24aa. Altitude (instrument), 2,093.5 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Sand, fine, grading to coarse gravel	69	69
Silt, slightly clayey to sandy, brownish-gray	8.5	77.5
Sand and gravel	3.5	81
Silt, moderately clayey, grayish-brown	10	91
Sand and gravel	18.5	109.5
Silt, slightly clayey to sandy	14.5	124
Sand and a trace of gravel, fine to coarse sand; contains silt layers 142 to 142.5 ft and 154 to 154.3 ft	41	165
Tertiary—Ogallala formation (Pliocene):		
Clay, silty, very calcareous, brownish-gray	14.5	179.5
Sand, silty to medium	24.5	204
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-gray to yellow	33	237
Shale, dark-gray	23	260
8-16-1dc. Altitude (from topographic map), 2,142 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil, dark-brown	2	2
Silt, gray	3.5	5.5
Sand and gravel	45.1	50.6
Tertiary—Ogallala formation (Pliocene): Clay, calcareous, light-brown to gray	9.1	59.7

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
8-16-2ab. Altitude (altimeter), 2,140.7 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Road fill and soil, dark-brown	7	7
Clay, gray; contains some gravel	2	9
Sand and some gravel	8	17
Sand and gravel	39.2	56.2
Tertiary—Ogallala formation (Pliocene):		
Clay; contains some hard calcareous layers	20.3	76.5
Clay, light-reddish-brown; contains thin layers of gravel below 110 ft	38.5	115
Sand, fine, green; partially cemented with lime	25	140
Sand, light-green; considerably cemented with lime	51	191
Marlite	3	194
Sandstone, fine, green	26	220
Marlite	1	221
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, greenish-gray, with limonitic staining	6	227
Shale, light-gray to black	7	234
8-16-2db. Altitude (altimeter), 2,141.6 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil, very dark brown	5	5
Clay, silty, sandy to gravelly, yellow	3	8
Gravel; contains sand and pebbles	37	45
Tertiary—Ogallala formation (Pliocene):		
Silt, medium-brown to light-brown; contains calcareous concretions below 80 ft	49.7	94.7
Marlite	.3	95
Marl, light-yellow	3	98
Sand, clayey, gray	13	111
Sandstone, light-gray	16	127
Sand, silty, gray with a green tint	16	143
Marlite	1	144
Sand to sandstone, fine, calcareous cement, light-gray with a green tint	53	197
Cretaceous—Pierre shale (Upper Cretaceous): Shale, black	10	207
8-16-2dd. Altitude (from topographic map), 2,139 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil, dark-brown	2	2
Clay, sandy, calcareous, brownish-gray	9	11
Sand and gravel	35	46
Tertiary—Ogallala formation (Pliocene): Clay, silty, light reddish-brown	11	57
8-16-12ab. Altitude (from topographic map), 2,137 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil, dark-brown	2	2
Clay, calcareous	4	6
Sand, fine	4	10
Sand and gravel	37	47
Tertiary—Ogallala formation (Pliocene): Clay, silty, light reddish-brown	11	58
8-18-5bc. Altitude (altimeter), 2,261.9 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Clay, silty, dark-brownish-gray (road fill)	1	1
Clay, silty, brownish-black to brownish-gray; contains a few limy nodules	4	5
Silt, calcareous, buff-gray	2.5	7.5

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
8-18-5bc—Continued		
Quaternary—Pleistocene and Recent—Continued		
Silt, clayey to sandy, dark-grayish-brown	0.5	8
Sand, fine to coarse, and fine to coarse gravel, buff-gray	2	10
Gravel, fine to coarse, buff-gray; contains some coarse sand	17.5	27.5
Clay, silty, partly sandy, tannish-gray with pinkish tint; contains some limy nodules	23.5	51
Sand, coarse, and fine to medium gravel, with large pebbles, pink	5	56
Tertiary—Ogallala formation (Pliocene):		
Sandstone, moderately soft, brownish-tan	12	68
Sandstone, calcareous, light-grayish-green to reddish-brown, hard at 72.5 to 76 ft	8	76
Sand, medium- to coarse-grained, tannish-gray	4.5	80.5
Sand, silty, light-gray to light-greenish-gray; may contain volcanic ash	5.5	86
Sandstone, grayish-green to brown	10	96
Sand, fine to coarse, and fine to medium gravel, tannish-gray	1.5	97.5
Sandstone, calcareous, grayish-brown; contains much rootlet material and hackberry seeds	17.5	115
Sand, fine to coarse, and poorly cemented sandstone; slightly calcareous	8	123
Sandstone, light-greenish-gray to buff-gray; contains sandy silt and clay layers	57	180
Sand, clayey to silty, light-grayish-green	8	188
Sand, fine to coarse, brownish-gray	4	192
Sandstone, slightly consolidated, brownish-gray with a greenish tint	22	214
Sand, fine- to medium-grained, silty, greenish-gray with some pinkish-gray; contains green clay pebbles	16	230
Sand, coarse and fine- to medium-grained gravel, greenish-brown to pink	12.5	242.5
Sandstone, moderately calcareous, buff-gray to brownish-gray	30.5	273
Sand and slightly consolidated sandstone, slightly calcareous, fine- to medium-grained, brownish-gray	10	283
Siltstone, grayish-green	2	285
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-gray; contains weathered material and limonitic fragments	6	291
Clay shale, dark-gray to black	19	310
8-18-9cb*. Carter Oil Co. Altitude (from topographic map), 2,250 feet above mean sea level		
Quaternary—Pleistocene and Recent: Sand and gravel	45	45
Tertiary—Ogallala formation (Pliocene): Sandstone, silt, sand, and some gravel	230	275
Cretaceous—Pierre shale (Upper Cretaceous): Shale, black	-------	-------
9-13-4aa. Altitude (altimeter), 2,035.6 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, dark-brown	2	2
Silt, clayey, dark-brownish-gray; medium-brownish-gray below 4 ft	4	6
Silt, soil-like clayey, medium-grayish-brown	1	7
Silt, medium-brownish-tan	1.7	8.7
Silt, fine sandy, light-gray to green; contains a few limy nodules	3.3	12
Sand, very fine to coarse, light-gray with slight buff tint	4	16
Sand and some fine- to medium-grained gravel, light-gray with some green and pink grains	4	20
Sand and fine to coarse gravel, medium-gray with green and pink grains; coarser texture below 25 ft; contains pebbles below 40 ft	28.5	48.5
Tertiary—Ogallala formation (Pliocene):		
Silt, dark-green	1	49.5
Silt, slightly clayey, light-gray with green tint	.5	50
Siltstone, very fine sandy, brownish-green	2.5	52.5
Silt, very fine to fine sandy, slightly calcareous, light grayish-tan	12	64.5

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
9-13-4aa—Continued		
Tertiary—Ogallala formation (Pliocene)—Continued		
Sand and fine- to medium-grained gravel, in part silty, brownish-gray with pink and yellow grains	20	84.5
Sandstone, light-yellowish-gray	5	89.5
Sandstone, moderately to very calcareous, light-tan-gray; contains a few rootlets	9	98.5
Silt, very fine to fine sandy, light-grayish-green; light-brownish-gray below 100 ft; more sandy below 105 ft	11.5	110
Sand, fine, silty, light-brownish-gray	5	115
Siltstone, sandy, to sandstone, silty, light-greenish-gray	8	123
Siltstone, very fine sandy, grayish-green	4	127
Silt, very fine sandy, to sand, silty, light-greenish-gray to brownish-gray	7.5	134.5
Sandstone, silty, light-yellowish-green; contains some rootlets and interbedded silty sand	5.5	140
Sand, silty, to sandy silt, light-grayish-green to brownish-gray, in part consolidated	10	150
Sand, very fine to medium-grained, light-brownish-gray, in part consolidated; contains some silty clay granules	19	169
Silt, in part clayey, in part moderately calcareous, light-grayish-green; contains thin limy beds	5.5	174.5
Sand, very fine to medium-grained, light-brownish-gray	3	177.5
Sandstone, slightly to moderately calcareous, light-greenish-gray to brownish-gray; contains a few silty layers; yellow to light-greenish-gray below 190 ft	21	198.5
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, moderately calcareous, white; contains a few calcareous nodules; contains aragonite and limonite stain below 200 ft	29	227.5
Clay shale, slightly to moderately calcareous, medium-gray to dark-gray; dark-gray to black with limonite layers below 230 ft	12.5	240
9-13-10dd. Altitude (altimeter), 2,032.5 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, in part very fine sandy, dark-brownish-gray	1	1
Clay, silty, to clayey silt, dark-brown with slight grayish tint; brownish-gray below 2 feet	3	4
Silt, very fine sandy to slightly clayey, brownish-gray	1	5
Sand to medium-grained gravel, brownish-gray to pink	4	9
Clay, silty, light-buff-gray	1	10
Sand to coarse gravel, brownish-gray with pink and yellow grains; contains some pebbles	50	60
Tertiary—Ogallala formation (Pliocene):		
Clay, silty, to silt, clayey, light-gray to light-brownish-gray; contains limonite stain from 60 to 61 ft; contains slight tan to pink tint below 68 ft	11	71
Silt, clayey, very calcareous, light-gray to light-tan-gray; contains a few limy nodules and rootlets	9.5	80.5
Silt, slightly clayey, and siltstone, interbedded, in part calcareous, light-brown	7	87.5
Siltstone, very fine sandy, light-brown	10	97.5
Silt, very fine sandy, light-grayish-green	2	99.5
Sand to medium-grained gravel, light-brownish-gray with green and pink grains	16	115.5
Silt, very fine sandy, grading to silty light-greenish-gray sandstone	14.5	130
Sandstone, silty, light-grayish-green; contains some rootlets	4	134
Sand, very fine to fine, silty, grading to sandy, light-gray silt with green tint	3	137
Sand, fine to coarse, brownish-gray with green tint; contains a few green silty clay fragments; contains a trace of fine to medium-grained gravel below 140 ft	22	159

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
9-13-10dd—Continued		
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, silty, light-gray to yellowish-brown	1	160
Clay, slightly to moderately calcareous, light-gray to medium-gray, limonite stain; contains limy fragments and aragonite	24	184
Clay shale, moderately calcareous, medium-gray; contains a thin limonitic layer at 188.5 ft	6	190
9-13-26aa. Altitude (altimeter), 2,025.3 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, brownish-black	1	1
Silt, sandy, light-gray to buff	.5	1.5
Silt, brownish-black; contains some sand	1	2.5
Sand, silty, light-brownish-gray; contains peat	1	3.5
Sand, silty, medium-gray to dark-gray; contains peat and many mica flakes	.5	4
Sand and fine- to medium-grained gravel, light-brownish to pinkish-gray	16	20
Sand and fine to coarse gravel, brownish- to pinkish-gray with a yellowish tinge	27.5	47.5
Tertiary—Ogallala formation (Pliocene):		
Silt, very fine sandy to slightly clayey, light-buff-gray with limonitic stain	2.5	50
Silt, slightly clayey to fine, sandy, buff to light-tan-gray	10	60
Siltstone, fine-sandy, light-brown	3.5	63.5
Silt and clay, light-gray; contains thin consolidated beds	7	70.5
Clay, silty, very slightly calcareous, light-green; contains silty sandstone	1.5	72
Siltstone, sandy, olive-gray	3	75
Sandstone, silty, slightly calcareous, light-tan-gray to grayish-green; contains some rootlet material	60	135
Silt, calcareous, and sandstone, light-gray	3	138
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, silty to sandy, moderately to very calcareous, light-gray, slightly limonitic-stained	2	140
Clay, moderately to very calcareous, light-gray, moderately limonitic-stained; contains much aragonite and some yellow bentonitic clay	33	173
Clay shale, dark-gray to black	12	185
Clay shale, slightly to moderately calcareous, dark-brown to black	5	190
9-13-27ad*. Carter Oil Co. Altitude, 2,023 feet above mean sea level		
Quaternary—Pleistocene and Recent: Sand and gravel	75	75
Tertiary—Ogallala formation (Pliocene): Sandstone, silt, sand and some gravel	85	160
Cretaceous—Pierre shale (Upper Cretaceous): Shale, black	-------	-----
9-13-36dd. Altitude (instrument), 2,015.18 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, very sandy, dark-brownish-gray	0.8	0.8
Sand, fine, light-brownish-gray; contains some dark-brownish-gray silt	1.2	2
Silt, sandy, dark-brownish-gray; contains some gravel	1	3
Silt, sandy, moderately to very calcareous, light brownish-gray	1.5	4.5
Silt, very sandy, light-yellowish-brown to gray	.5	5
Sand, fine, and coarse gravel; contains limonite stains in upper part	17	22
Silt, very sandy, very fine to fine, calcareous in part, light-greenish-gray	2	24

Table 7.—*Logs of test holes and wells*— Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
9-13-36dd—Continued		
Quaternary—Pleistocene and Recent—Continued		
Sand, fine, and coarse gravel, slightly finer texture below 70 ft, and much finer texture below 100 ft; contains thin silt layers from 56 to 60 ft and a silt layer at 98 ft	79.5	103.5
Tertiary—Ogallala formation (Pliocene):		
Silt, sandy, fine, light-yellowish- to brownish-gray	1.5	105
Silt, sandy, fine, very calcareous, light-gray	1.5	106.5
Sandstone, light-greenish-gray	1.5	108
9-15-6cb*. Frank Richter. Mattison Well Co. Altitude (from topographic map), 2,195 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil	3	3
Clay, yellow; contains snails and hard lime rock	5	8
Clay, yellow; contains snails	22	30
Soil, dark-brown	3	33
Clay, yellow	3	36
Clay, brown	19	55
Clay, brown and yellow	9	64
Clay; contains traces of lime rock	17	81
Clay, light-colored, tough drilling	2	83
Clay, light-brown; contains traces of lime rock	10	93
Clay; contains traces of lime rock	19	112
Clay, soft; contains traces of hard limestone	20	132
Clay; contains traces of gravel	2	134
Sandstone and gravel, mixed	2	136
Tertiary—Ogallala formation (Pliocene):		
Clay, gray	6	142
Clay and gravel, mixed	2	144
Gravel, pea-size, yellow	3	147
Clay, light-colored	7	154
Lime rock, hard	1	155
Clay	3	158
Clay and gravel, mixed	1	159
Clay, sandy and fine sand	2	161
Clay, sandy, brown	9	170
Lime rock, very hard	1	171
Clay and lime rock	21	192
Lime rock, hard	2	194
Clay and hard rock	6	200
Clay	7	207
Clay and gravel, mixed	9	216
Sand, rice-size, and yellow gravel	3	219
Sand, cemented; contains some gravel	9	228
Sand, very fine	2	230
Clay, green	2	232
Sand, very fine	5	237
Clay, light-green	8	245
Sand, rice-size, and green gravel	2	247
Sandstone and green gravel	3	250
Sand, medium-green	5	255
Sand, rice-size, and green gravel	21	276
9-15-14bc*. Henline. Weber Machine and Irrigation Co. Altitude (from topographic map), 2,110 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil and clay	61	61
Sand, fine	4	65

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
9-15-14bc*—Continued		
Quaternary—Pleistocene and Recent—Continued		
Sand, good	5	70
Gravel	6	76
Clay	7	83
Gravel	3	86
Tertiary—Ogallala formation (Pliocene):		
Clay; contains a few layers of soft rock	38	124
Sand, fine	5	129
Clay	71	200
9-15-17ab*. W. Hendricksen. Cornhusker Well and Supply Co. Altitude (from topographic map), 2,160 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil	2	2
Clay and sand	2	4
Sand and a trace of gravel	6	10
Clay and sand	5	15
Sand, fine	35	50
Sand and a trace of gravel	10	60
Sand and clay	10	70
Clay, blue	3	73
Clay	57	130
Clay and sand	10	140
Clay and blue sand	20	160
Tertiary—Ogallala formation (Pliocene):		
Sand and hard clay	10	170
Clay, hard, thin layers	5	175
Sand and some gravel	5	180
Clay, sand, and gravel	10	190
Sandstone and white clay	20	210
Gravel	35	245
Sand and gravel	12	257
Sand, fine, and clay	10	267
Sandstone, very fine	13	280
Sandstone, hard	17.5	297.5
9-15-17bc*. W. Hendricksen. Cornhusker Well and Supply Co. Altitude (from topographic map), 2,160 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil	3	3
Clay	2	5
Clay and sand	2.5	7.5
Clay, yellow	12.5	20
Clay, yellow, and fine sand	10	30
Sand and a trace of gravel	5	35
Clay and sand	5	40
Clay	10	50
Clay, blue, and fine sand	10	60
Sand	5	65
Gravel	2	67
Gravel, blue	13	80
Gravel and clay	5	85
Clay and sandstone	2	87
Clay, blue	23	110
Clay, blue; contains a trace of gravel	10	120

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
9-15-17bc*—Continued		
Tertiary—Ogallala formation (Pliocene):		
Stone, white	17	137
Clay, yellow	10	147
Clay, dark, and sandstone	13	160
Clay, soft	40	200
Sandstone	5	205
Sandstone, very hard	1	206
Sandstone; contains some gravel	9	215
Gravel, good	10	225
Gravel, and clay balls	12	237
Gravel, coarse	23	260
Gravel and clay	7	267
9-16-5cc*. Hart. Weber Machine and Irrigation Co. Altitude (from topographic map), 2,200 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil and clay	67	67
Sand, good	2	69
Sand, fine	10	79
Sand, good	7	86
Clay	39	125
Sand, good	9	134
Tertiary—Ogallala formation (Pliocene):		
Sandstone	7	141
Clay, sandy	23	164
Rock, white, soft	12	176
Rock, hard		
9-16-8bd*. Eickmeier. Mattison Well Co. Altitude (from topographic map), 2,180 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil	3	3
Clay	29	32
Sand, fine, and blue mixed clay	39	71
Sand, coarse, blue	5	76
Gravel	5	81
Gravel and coarse sand	9	90
Gravel, fine, and sand	10	100
Tertiary—Ogallala formation (Pliocene):		
Clay	10	110
Rock and sandstone	2	112
Clay	6	118
Sandstone	18	136
Sand, little gravel, and some sandstone	4	140
Sandstone	40	180
Sandstone and sandy clay, white	7	187
Sand	2	189
Sandstone	2	191
Sand	5	196
Sandstone	5	201
Rock	2	203
9-16-9cb*. Charles Theis. Don Barney Drilling Co. Altitude (instrument), 2,186.42 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil	2	2
Clay, yellow	37	39

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
9-16-9cb*—Continued		
Quaternary—Pleistocene and Recent—Continued		
Clay, blue	18	57
Clay, brown	6	63
Sand, fine	4	67
Sand and gravel, rice-size, blue	10	77
Sand, blue	2	79
Sand, fine, and gravel	3	82
Clay, sandy	12	94
Sand, quick	4	98
Sand, fine, and clay	34	132
Tertiary—Ogallala formation (Pliocene):		
Lime rock, soft	9	141
Sandstone, soft	35	176
Clay, sandy	18	194
Sandstone, soft	4	198
Lime rock, soft	15	213

9-16-11bc*. Weber. Mattison Well Co. Altitude (from topographic map), 2,160 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Top soil	37	37
Sand and gravel, very coarse	18	55
Clay	21	76
Sand, fine	8	84
Sand and gravel, very coarse	4	88
Gravel	5	93
Sand, fine	31	124
Tertiary—Ogallala formation (Pliocene):		
Clay	29	153
Sand, very fine	3	156
Clay	1	157
Sand, fine	2	159
Clay	9	168
Sand, fair	5	173
Gravel, very coarse	4	177
Sand, very fine	5	182
Rock, hard, whitish-gray	2	184

9-16-13bc*. Lawrence Richter. Don Barney Drilling Co. Altitude (instrument), 2,154.07 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Top soil	2	2
Clay, brown	6	8
Clay, yellow	21	29
Sand, fine, and clay	2	31
Sand, quick	7	38
Sand, fine, blue	12	50
Clay, blue	6	56
Sand, fine, and a trace of gravel	2	58
Clay, blue	2	60
Sand and gravel, rice-size	2	62
Sand, medium-fine	2	64
Clay, blue	15	79
Sand	5	84
Sand, fine	2	86
Sand, medium-fine	7	93
Sand, medium-fine, and a trace of gravel	6	99
Gravel and sand	3	102

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
9-16-13bc*—Continued		
Tertiary—Ogallala formation (Pliocene):		
Clay, sandy	27	129
Sand, cemented	15	144
Clay, sandy	14	158
9-16-14bb*. Fales. Mattison Well Co. Altitude (from topographic map), 2,155 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil	3	3
Clay, yellow	13	16
Sandstone?	14	30
Clay, sandy	4	34
Clay, blue, and sandy clay	15	49
Sand and gravel, blue	13	62
Clay, blue and gray	10	72
Clay, sandy, yellow	7	79
Gravel	16	95
Clay, sandy, gray	14	109
Sand, fine	8	117
Tertiary—Ogallala formation (Pliocene):		
Clay	12	129
Clay, sandy; traces of hard rock	20	149
Clay, sandy, some sandstone	21	170
Gravel, red	15	185
Sandstone	2	187
9-16-15ab*. Haring. Mattison Well Co. Altitude (from topographic map), 2,150 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil	3	3
Clay, yellow	13	16
Clay, sandy, some sandstone?	19	35
Clay, brown and blue	9	44
Clay, blue, and sandy brown clay	18	62
Gravel, blue	1	63
Clay, blue	2	65
Gravel, rice-size, blue	3	68
Clay and sand, mixed	5	73
Clay, sandy, blue	9	82
Sandstone and fine sand	10	92
Tertiary—Ogallala formation (Pliocene):		
Clay, yellow, mixed with sandstone	21	113
Sandstone	6	119
Rock, very hard	2	121
Limestone, soft and hard	17	138
Clay, sandy, and sandstone, green	14	152
Clay, green	2	154
Sandstone, green	13	167
Sand and gravel	16	183
Clay, green	3	186
Sandstone, green, and fine sand	8	194
Limestone, brown	11	205
Sandstone, green	10	215

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
9-16-15bb*. Webb. Mattison Well Co. Altitude (from topographic map), 2,160 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil	2	2
Clay	14	16
Clay and sand	4	20
Clay, light-green; contains peat	5	25
Clay, light-brown; contains gastropod fragments	5	30
Clay, blue; contains peat	22	52
Sand and gravel, blue	10.5	62.5
Siltstone, sandy, fine, green	5.5	68
Clay, brown, and sand, fine	9.5	77.5
Clay and sand, fine, light-brown	9.5	87
Clay, light-brown; contains bone fragments	9.5	96.5
Tertiary—Ogallala formation (Pliocene):		
Sand, cemented	1	97.5
Sand, fine, slightly cemented	5	102.5
Clay and fine sand	24	126.5
Clay	8	134.5
Clay, light-green and brown	2	136.5
Clay, dark-red-brown	5.5	142
Sand, cemented	6.5	148.5
Clay, sandy; contains a trace of gravel	1	149.5
Sandstone; contains some gravel	15.5	165
Clay	2	167
Sandstone	3	170
Rock, hard	5	175
Sandstone	8	183
Clay	2	185
Sandstone	3	188
Lime rock, hard	1	189
Sand rock	18	207
Rock, hard	-------	-------
9-16-15db*. Kuebler. Mattison Well Co. Altitude (instrument), 2,170.01 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil	3	3
Clay, yellow	13	16
Clay, yellow, brown, and green	10	26
Clay, yellow, brown, and some limestone	8	34
Clay, blue	5	39
Clay, brown, strong odor (peat?)	10	49
Clay, blue; some fine sand	10	59
Gravel, rice-size, blue	10	69
Clay	4	73
Clay, sandy, yellow and brown	9	82
Clay, sandy, brown	5	87
Sand, fine	2	89
Clay, sandy	3	92
Clay and gravel, mixed	5	97
Tertiary—Ogallala formation (Pliocene):		
Sandstone	4	101
Clay, sandy	4	105
Lime rock, very hard	1	106
Sandstone	17	123
Magnesia, hard	1	124
Clay, sandy	8	132
Magnesia, traces of lime rock	6	138
Clay, sandy	13	151
Sand, green, cemented	9	160

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
9-16-15db*—Continued		
Tertiary—Ogallala formation (Pliocene)—Continued		
Sandstone, with some gravel	6	166
Gravel, rice-size, and medium-grained sand	8	174
Sandstone	1	175
Rock, very hard	1	176
9-16-16da*. Eickmeier. Mattison Well Co. Altitude (from topographic map), 2,165 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil, and clay	40	40
Sand, quick	23	63
Clay, sandy, fine	6	69
Sand, quick	5	74
Tertiary—Ogallala formation (Pliocene):		
Clay, white	5	79
Clay, white and yellow	10	89
Clay	10	99
Sand	2	101
Clay, sandy, fine	27	128
Clay	3	131
Gravel, rice-size	5	136
Sandstone	1	137
Sandstone and gravel	4	141
Sandstone and some clay	10	151
Clay, sandy	1	152
Sandstone and gravel, mixed	4	156
Gravel, rice-size	2	158
Sandstone	9	167
9-16-23bb*. Pratt. Mattison Well Co. Altitude (from topographic map), 2,225 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil	3	3
Clay, yellow	55	58
Clay, sandy	9.5	67.5
Clay	28.5	96
Clay and lime rock	9.5	105.5
Clay, sandy	9.5	115
Clay	10	125
Clay, sandy	6	131
Sand, fine, and sandy clay	4	135
Sand, fine	8	143
Clay, sandy	1	144
Sand, fine	1	145
Tertiary—Ogallala formation (Pliocene):		
Clay, sandy, and fine sand	2	147
Clay, sandy	1	148
Clay	7	155
Clay and rock	2	157
Rock, very hard	6	163
Rock and green clay	4	167
Rock, very hard	4	171
Sand rock, fine-grained	4	175
Sand rock, medium-grained	7	182
Clay, sandy	3	185
Lime, semihard	2	187
Sand, cemented	3	190
Sand rock	5	195

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
9-16-23bb*—Continued		
Tertiary—Ogallala formation (Pliocene)—Continued		
Sand, cemented; contains some sandstone	5	200
Sand, cemented; contains lime rock, hard	1	201
Sand, cemented; contains some sandstone	2	203
Sand, cemented; contains lime rock	1	204
Sandstone	3	207
Clay, sandy, and sandstone	9	216
Sandstone and sand, cemented	3	219
Sandstone and some sandy clay	1	220
Sandstone	8	228
Sandstone and sandy clay	15	243
Clay, sandy, fine-grained	4	247
Sandstone and sand, fine-grained	5	252
Sandstone	9	261
Sandstone and limestone		
9-16-23dd*. Homes and Staubitz. Mattison Well Co. Altitude (from topographic map), 2,220 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil	3	3
Clay	88	91
Clay; contains a trace of limestone	28	119
Clay and sandy clay	9	128
Tertiary—Ogallala formation (Pliocene):		
Clay, green	5	133
Sand, fine, tight	5	138
Clay, light-colored	24	162
Magnesia rock, soft and hard	2	164
Magnesia rock, and gravel, mixed	2	166
Magnesia rock, semihard, and sandstone	4	170
Sandstone	11	181
Magnesia, soft and hard	4	185
Sandstone	32	217
Clay, green	4	221
Rock, hard	1	222
Clay, sandy	5	227
Sand, fine	4	231
Clay, sandy	19	250
Magnesia rock and fine sand	6	256
Magnesia rock, very hard	5	261
9-16-29ba*. Markus. Weber Machine and Irrigation Co. Altitude (from topographic map), 2,300 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Clay	182	182
Sand	3	185
Tertiary—Ogallala formation (Pliocene): Sandstone	12	197
9-16-36bb*. Frank Hervert Drilling Co. Altitude (from topographic map), 2,235 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil	2	2
Clay, sandy in part; contains traces of lime rock	136	138
Clay, sandy, white, soft	1	139
Gravel	1	140
Tertiary—Ogallala formation (Pliocene): Sandstone		

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
9-16-36bd. Altitude (from topographic map), 2,144 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil, dark-brown	5	5
Sand and gravel, coarse-textured below 25 ft	45	50
Tertiary—Ogallala formation (Pliocene):		
Clay, light-brown	17	67
Marl	3	70
Sand to sandstone, light-green	23	93
Marlite	.9	93.9
Sandstone, green	1.1	95
Marlite	1.8	96.8
9-17-2bc*. Jester. Mattison Well Co. Altitude (from topographic map), 2,300 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil	3	3
Clay	93	96
Sand, fine, and sandy clay	16	112
Tertiary—Ogallala formation (Pliocene):		
Lime rock, hard	.5	112.5
Lime rock and fine sand	2.5	115
Sand, fine, and clay; contains some lime rock	10	125
Clay and lime rock	10	135
Clay	9	144
Lime rock, hard	1	145
Clay; contains some lime rock	9.5	154.5
Clay	5.5	160
Clay and gravel, mixed	2	162
Sand and gravel, rice-size	9.5	171.5
Clay, sandy	11	182.5
Sand, cemented	2	184.5
Sand, cemented, very hard	4	188.5
Sand rock	6	194.5
Gravel and sandstone, mixed	4.5	199
Sand, cemented	7	206
Sand rock	12	218
Lime rock and sand, cemented	12	230
Lime rock, very hard	3	233
Limestone, hard	2.5	235.5
Lime rock, very hard	.5	236
Gravel and sand rock	6	242
Gravel, rice-size	4	246
Sand and limestone	9	255
9-17-7bd. Altitude (instrument), 2,342.40 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, fine-sandy, brownish-gray (road fill)	0.5	0.5
Soil; silt, dark-brown to black	1	1.5
Silt, slightly calcareous, medium-brownish-gray	2	3.5
Soil; silt, sandy, dark-brown to black	1	4.5
Silt, slightly clayey to sandy, medium-brownish-buff	3	7.5
Silt, light-brown with limonitic flecks; contains limy rootlets	19	26.5
Silt, light-brown with a pink tint; a thin dark-brown layer at 26.5 ft	10.5	37
Silt, fine-sandy, slightly calcareous, light-brown; contains many limy nodules	45	82
Silt, slightly to moderately calcareous, light-brown; contains many limy nodules	26	108
Silt, sandy, calcareous, fine- to medium-grained with some coarse sand, light-brown to green-gray; contains some fine gravel	22	130

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
9-17-7bd—Continued		
Tertiary—Ogallala formation (Pliocene):		
Silt, very sandy, light-brown to olive-gray	9	139
Marl, sandy, light-buff to light-gray	1.5	140.5
Silt, sandy, calcareous, light-gray with slight green tint; contains limy nodular layers	12	152.5
Silt, very sandy, interbedded with soft sandstone, olive-gray to brownish-gray	3.5	156
Sand, very fine to coarse, with some gravel, fine to medium, brownish-gray	4	160
Sandstone, fine- to medium-grained, slightly silty, olive-gray to brownish-gray; contains rootlet material	43.5	203.5
Silt, fine-sandy, light-olive-gray	3.5	207
Sandstone, slightly silty, brown to olive-gray	13	220
Silt, fine-sandy, light-olive-gray	2	222
Sand, fine to coarse, light-brownish-gray	8.5	230.5
Sandstone, silty, light-gray to brownish-gray; contains hard limy layers	12.5	243
Silt, sandy, slightly clayey, light-brown to grayish-brown	4	247
Sand, fine to coarse, and gravel, fine to medium, brownish-gray with some pink grains	13.5	260.5
Sandstone, silty, calcareous, light-gray; contains a hard limestone layer at 260.5 ft	9.5	270
Sand, fine to coarse, and gravel, fine to medium, partially consolidated, brownish-gray with some pink grains	5	275
Sand, silty, calcareous, and fine-grained light-gray sandstone	5	280
Sandstone, calcareous, light-gray; contains a hard limestone layer at 282.5 ft	6	286
Siltstone, calcareous, and a layer of sandstone at 287 ft, light-gray to greenish-gray	4	290
Sandstone, fine- to coarse-grained, calcareous, grayish-green to light-gray	19	309
Sand, slightly silty, partially consolidated, brownish-gray	14	323
Clay, light-reddish-brown	3	326
Sandstone, very fine to medium-grained, silty, light-gray to grayish-green; contains thin limy layers	29	355
Sand, fine- to medium-grained, with consolidated limy layers	5	360
Silt, sandy, calcareous, light-gray	6.5	366.5
Marl, sandy, light-gray	7.5	374
Sandstone, silty, to light-yellowish-gray	9	383
Sand, slightly silty, very fine- to fine-grained, brownish-gray	7	390
Sand, fine- to medium-grained, silty, brownish-gray with green tint; contains some green clay	60	450
Sand, fine- to medium-grained, and clay pebbles, gray to greenish-gray	29.5	479.5
Marl, white to yellowish-gray to grayish-green	.5	480
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, moderately calcareous, medium-gray to buff-gray with green tint	3	483
Clay shale, silty, calcareous, medium-gray	7	490
Clay shale, medium-gray; contains hard limonitic fragments, some aragonite and dark-gray clay	10	500

9-18-9cd. Altitude (instrument), 2,390.94 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Silt, clayey, dark-brown	1	1
Silt, clayey, medium-brownish-gray	1.5	2.5
Silt, slightly clayey, light-brownish-buff	30	32.5
Silt, clayey, soil-like, dark-brown	1.5	34
Silt, clayey, light-reddish-brown; contains white limy nodules	81	115
Silt, sandy, light reddish-brown	15	130
Sand, silty, light-brown; contains rootlets	34	164

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
9-18-9cd—Continued		
Quaternary—Pleistocene and Recent—Continued		
Silt, clayey, medium-brown to light-brown	9	173
Silt, light-gray	3	176
Sand, fine to coarse, and gravel, fine; contains some white limy layers and greenish-gray silt	14	190
Sand, fine- to medium-grained; contains a white layer at 191.5 ft	5.5	195.5
Tertiary—Ogallala formation (Pliocene):		
Siltstone, white	.5	196
Sandstone, medium-grained, brownish-gray	5	201
Sand, fine- to medium-grained, brownish-gray; contains silt layers and sandstone layers	19	220
Sandstone, fine- to medium-grained; brownish-gray with a green tint; contains rootlets and limy nodules	44	264
Silt, sandy, light-gray	1	265
Sand, fine to coarse, and fine- to medium-grained light tan-gray gravel; contains thin silt layers	23	288
Silt, sandy, interbedded with sandstone, light-grayish-tan	2	290
Sandstone, fine- to medium-grained, light-brownish-gray	20	310
Sand, fine- to medium-grained, silty, light-brownish-gray	17.5	327.5
Sandstone, light-brownish-gray	1.5	329
Sand, very fine to medium-grained	33	362
Sand, silty, and fine- to medium-grained, light greenish-gray gravel; contains a siltstone layer at 375 ft	25.5	387.5
Silt, slightly clayey, light-greenish-gray to light-reddish-brown; contains layers of siltstone	17	404.5
Sandstone, light-greenish-gray; contains interbedded siltstone and silty sand	40.5	445
Sand, fine to coarse, silty, slightly calcareous, light-gray with green tint	15	460
Silt, slightly clayey, with a trace of fine- to medium-grained gravel	17	477
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-gray with limonitic stain	3	480
Clay, medium-gray to dark-gray	11	491
Clay shale, dark-gray	9	500

9-18-27aa. Altitude (instrument), 2,277.80 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Silt, sandy, dark-brownish-gray	1	1
Silt, clayey to fine sandy, medium-brownish-gray	3	4
Silt, soil-like, slightly clayey, granular, dark-brownish-gray	1	5
Silt, slightly clayey to sandy, light-brown	5.5	10.5
Silt, clayey, light-brown with a slight gray tint; contains a few gastropods	5.5	16
Silt, fine, sandy, granular, light-brown; contains rootlets	12	28
Clay, silty, granular, light-brown	10	38
Sand, fine to coarse, and fine- to medium-grained brownish-gray gravel with some pink grains	12	50
Silt, clayey, buff to light-greenish-gray; contains limy layers and rootlets	10	60
Sand, silty, brownish-gray, with much limonitic stain	5	65
Sand, fine to coarse, and fine brownish-gray gravel with some pink grains; contains many iron granules and small bone fragments	9.5	74.5
Silt, clayey, greenish-gray with brown tint	28	102.5
Sand, fine- to medium-grained, slightly silty, brownish-gray with green tint	2.5	105
Sand, fine to coarse, and fine- to medium-grained brownish-gray gravel with some pink grains and iron stain	10	115
Clay, slightly calcareous, greenish-gray	3	118
Gravel, fine to coarse, and medium- to coarse-grained sand, yellow to greenish-yellow with some pink grains	6.5	124.5

Table 7.—*Logs of test holes and wells*— Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
9-18-27aa—Continued		
Tertiary—Ogallala formation (Pliocene):		
Sandstone, fine-grained, grayish-green with a slight brown tint; contains limy rootlets and fossil hackberry seeds	60	184.5
Sand, fine to coarse, and some fine partly consolidated gravel, brownish-gray with green tint	19.5	204
Silt, sandy, light-grayish-green	6	210
Sandstone, calcareous, light-greenish-gray	14.5	224.5
Sand, fine- to medium-grained, silty, partially consolidated, brownish-gray-green	5.5	230
Sandstone, brownish-gray-green; contains some rootlet material	22.5	252.5
Silt, sandy, light-grayish-green	5	257.5
Sandstone, fine- to medium-grained, brownish-gray-green	22.5	280
Silt, sandy, grayish-green	13	293
Sandstone, fine- to medium-grained, calcareous, light-grayish-green	10	303
Sand, fine- to medium-grained, brownish-gray	14.5	317.5
Silt, moderately calcareous, very light grayish-green	3	320.5
Marl, medium-gray	.5	321
Silt, calcareous, grayish-green	13	334
Quartzite, slightly calcareous, brownish- to greenish-gray	.3	334.3
9-18-28dd. Altitude (altimeter), 2,257 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil; clay, silty, brown	1.5	1.5
Clay, brown	1	2.5
Silt, clayey, light-brown; contains many small gastropods	13.5	16
Sand, medium- to coarse-grained, and medium- to coarse-grained gravel, brownish-gray to pink	6	22
Tertiary—Ogallala formation (Pliocene):		
Silt, sandy, and siltstone, light-brown to brownish-gray	2.5	24.5
Marl, white	1.5	26
Silt, sandy, and siltstone, light-brown	4	30
Sand, silty with layers of sand and gravel, light-brownish-gray	4	34
Sand, lime-cemented, white	4.5	38.5
Siltstone, light- brownish-gray; contains limy and silty sand layers	127.5	166
Silt, clayey to sandy, calcareous, light-tan to gray	4	170
Sand, silty, grayish-tan	10	180
Siltstone, light-grayish-tan to brownish-gray	20	200
Clay, limy, grayish-white	10	210
Sand, fine, light-brownish-gray	9.5	219.5
Clay, silty, grayish-white	4	223.5
Siltstone, light-greenish-gray	23.5	247
Sand, fine to coarse, and fine- to medium-grained gravel	6	253
Sand, silty, grayish-green	4	257
Sand, fine to coarse, brownish- to greenish-gray	7.5	264.5
Sand, limy, grayish-white	7.5	272
Siltstone, grayish-green; contains layers of sand and fine gravel	18	290
Silt, limy, white to gray	10	300
Silt, sandy, and siltstone, light-gray	6	306
Siltstone, light-brownish-gray	4	310
Sand, silty, and siltstone, light-gray	8	318
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, medium-gray, some yellow	12	330
Clay shale, medium-gray	30	360
10-13-18aa. Altitude (altimeter), 2,135.8 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, in part sandy to clayey, dark-gray to reddish-tan	5	5
Silt, very fine to fine, sandy, medium-brownish-gray; in part clayey below 8.5 ft	8.5	13.5

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
10-13-18aa—Continued		
Quaternary—Pleistocene and Recent—Continued		
Silt, very fine sandy, light-buff-gray; tan-gray below 20 ft	16.5	30
Silt, very fine sandy, light-brown; contains a few limy nodules in lower part	15	45
Silt, in part very fine sandy, light-brown; contains limy nodules and a buff-gray calcareous layer in upper part	5	50
Silt, very fine sandy, light-brown, granular; contains a thin limy layer at 59 ft	10	60
Silt, very fine sandy to slightly clayey, slightly to moderately calcareous, brownish-gray; contains calcareous nodules	10	70
Silt, slightly to moderately calcareous, brownish-gray; contains limy nodules	9	79
Silt to siltstone, light-brown; contains thin limy layers from 90 to 95 ft, in part clayey below 95 ft	19	98
Sand and gravel, silty, greenish-gray with pink grains; contains hard limy layer at 98 ft	7	105
Tertiary—Ogallala formation (Pliocene):		
Sand, silty, to sandy light-gray-green silt; in part consolidated	4	109
Sandstone, fine-grained, silty, light-green with gray tint	20.5	129.5
Silt, in part very fine sandy, grayish-green, in part consolidated	7.5	137
Sandstone, fine-grained, silty, light-green with gray tint; yellow tint below 140 ft	13	150
Sand, very fine to coarse, silty, brownish-gray with green tint	9.5	159.5
Sandstone, fine- to medium-grained, very calcareous, light-gray	1	160.5
Silt, sandy, light-greenish-gray	4	164.5
Sand and sandstone, brownish-gray to greenish-gray; slightly cemented with silty layers	5.5	170
Sandstone, fine- to medium-grained, light-brown	7	177
Sandstone, light-brownish-gray with green tint	4	181
Sand, very fine- to medium-grained, light-brownish-gray; some cemented layers below 184.5 ft	9.5	190.5
Sandstone and silt, interbedded	4	194.5
Silt, sandy, light-grayish-green	2.5	197
Sandstone, very calcareous, light-gray; contains a grayish-green sandy silt from 197.2 to 199 ft; less calcareous and a brown tint below 200 ft	9	206
Sand, fine- to medium-grained, brownish-gray, in part consolidated; contains thin calcareous sandstone layers below 210 ft	12	218
Sandstone, silty, very calcareous, light-gray; contains a few fossil seeds	3	221
Sandstone, silty, green to grayish-green	4	225
Silt, in part very fine sandy and clayey, slightly to moderately calcareous, light-grayish-green	5	230
Silt, very fine sandy to slightly clayey, moderately calcareous, light-grayish-green; contains thin limy layers	7	237
Sand, medium-grained, silty, light-brownish-gray	13.5	250.5
Sandstone, very calcareous, light-gray; contains a thin layer of volcanic ash	1	251.5
Sand, very fine to coarse, light-brownish-gray	8.5	260
Sand, medium-grained, silty, brownish-gray with green tint; in part consolidated below 270 ft	17	277
Sandstone, very calcareous, light-tan-gray	1.5	278.5
Sand and sandstone, brownish-gray to green, slightly consolidated	14	292.5
Sandstone, very calcareous, light-grayish-green	.5	293
Sandstone, fine, silty, very calcareous	2.2	295.2
Sand, brownish-gray to green, in part consolidated	4.8	300
Sandstone, slightly to moderately calcareous, brownish-gray to green; lighter and more calcareous below 304.5 ft	10	310
Clay, silty, light-grayish-green; contains limy layers	9	319
Sand, very fine to medium-grained, in part silty, brownish-gray to green; contains calcareous sandstone from 327.9 to 328.4 ft	16	335
Clay, silty, moderately to very calcareous, light-gray; less silty below 340 ft	13	348

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
10-13-18aa—Continued		
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, moderately calcareous, light-gray to medium-gray, limonite-stained; contains aragonite	4	352
Clay shale, moderately calcareous, medium-gray to dark-gray; contains a thin limonitic layer; slightly darker and slightly to moderately calcareous below 360 ft	18	370
10-13-29aa. Altitude (altimeter), 2,050.0 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, very fine sandy to slightly clayey, dark-brownish-black	2	2
Silt, clayey, dark-grayish-brown	1.5	3.5
Silt, very fine sandy, brownish-buff-gray	3	6.5
Silt, slightly clayey, soil-like, medium-brownish-gray	.5	7
Silt, very fine sandy to slightly clayey, medium-buff-gray; contains a few limonitic flecks	1	8
Silt, very fine sandy, light-buff-gray; contains some limy nodules and limonitic flecks	2	10
Silt, very fine sandy to very slightly clayey, light-gray with buff tint; contains a few limonitic flecks; contains gastropods from 15 to 18 ft	15	25
Silt, clayey, light-bluish-green; contains peat; medium-bluish-gray below 30 ft	7.5	32.5
Sand and gravel, fine- to medium-grained, light-gray with pink and green grains; brownish-gray from 35 to 39 ft; tan-gray and contains coarse gravel and pebbles below 39 ft	20	52.5
Tertiary—Ogallala formation (Pliocene):		
Sandstone, very calcareous, light-gray	.2	52.7
Silt, very fine to fine sandy, light-brown; in part consolidated below 60 ft	15.3	68
Siltstone, sandy, to sandstone, silty, light-brown	3.5	71.5
Silt, in part sandy, light-gray; more sandy below 76 ft	13.5	85
Sandstone, yellowish-gray	.5	85.5
Sand and gravel, fine, light-brownish-gray with pink and yellow grains; contains thin silt layers at 8.8 and 92.5 ft; contains some medium gravel below 90 ft; contains some pebbles below 95 ft	14.5	100
Sandstone, in part calcareous, light-yellowish-gray	2.5	102.5
Sandstone, silty, very calcareous, white	5	107.5
Silt, sandy, moderately to very calcareous, light-gray	2.5	110
Sandstone, silty, very calcareous, light-gray; contains some moderately calcareous silty sand	10	120
Sandstone, very calcareous, light-gray with brown tint; contains a few rootlets	10	130
Sandstone, silty, very calcareous, light-gray	7.5	137.5
Silt, sandy, slightly calcareous, yellowish-gray	2.5	140
Sandstone, silty, to sand, silty, yellowish-green with gray tint	5	145
Sand, silty, to silt, sandy, yellowish-green with gray tint	6	151
Siltstone, sandy, very calcareous, light-gray; contains yellowish-gray moderately calcareous sandstone from 152 to 152.8 ft	2.5	153.5
Sandstone, moderately to very calcareous, light-yellowish-gray	4.5	158
Silt, sandy, to sand, silty, light-grayish-green, in part consolidated	7	165
Sand, silty, slightly to moderately calcareous, light-brownish-gray with green tint; contains some sandstone layers	4	169
Sandstone, slightly to moderately calcareous, light-brownish-gray with green tint; contains some rootlets	14.5	183.5
Sand, silty, to sandy silt, light-grayish-green	6.5	190
Sand, fine- to medium-grained, light-gray to brown	5	195
Sand, silty, to silt, sandy, light-grayish-green	1.5	196.5
Sandstone, fine- to medium-grained, light-gray to brown; slightly silty below 205.5 ft	15.5	212
Sandstone, fine, light-grayish-green; calcareous from 212 to 214 ft; contains silt below 214 ft	4	216

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
10-13-29aa—Continued		
Tertiary—Ogallala formation (Pliocene)—Continued		
Sandstone, fine- to coarse-grained, slightly calcareous, light-brownish-gray	4	220
Sandstone, fine-grained, in part silty, very calcareous, light-brownish-gray to white	29	249
Clay, silty, very calcareous, light-gray	3	252
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, moderately to very calcareous, white to light-gray, much limonite stain; contains some aragonite	9	261
Clay, moderately to very calcareous, light-gray to medium-gray	4	265
Clay shale, moderately calcareous, dark-gray; less calcareous below 270 ft	15	280
10-15-13cc*. Carter Oil Co. Altitude, 2,233 feet above mean sea level		
Quaternary—Pleistocene and Recent: Silt	128	128
Tertiary—Ogallala formation (Pliocene): Sandstone, silt, sand, and some gravel	269	397
Cretaceous—Pierre shale (Upper Cretaceous): Shale, black	———	———
10-15-20bb*. Rest Haven Church. Ray Hand Drilling Co. Altitude (from topographic map), 2,225 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt and some clay	93	93
Sand and gravel	7	100
Tertiary—Ogallala formation (Pliocene): Sandstone	———	———
10-15-29ba*. Altmaier. Weber Machine and Irrigation Co. Altitude (from topographic map), 2,230 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt	82	82
Clay, sandy	5	87
Clay	23	110
Clay, sandy	13	123
Tertiary—Ogallala formation (Pliocene?):		
Clay	39	162
Sand, fair	3	165
Sandstone	5	170
Clay, sandy	2	172
Sandstone, brown	2	174
Limestone, hard; used rock bit	6	180
Sandstone	7	187
Clay, sandy	4	191
Sandstone	10	201
Clay, sandy	3	204
Limestone	6	210
Clay, sandy	9	219
Sand, fair	4	223
Sand, good	19	242
Sand, fair	3	245
Clay, sandy	22	267

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
10-16-7ba*. Eisele. Mattison Well Co. Altitude (instrument), 2,307.29 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil	3	3
Clay, yellow	31	34
Clay, dark	10	44
Clay, yellow	38	82
Clay, yellow; contains traces of rock from 85-91 ft	9	91
Tertiary—Ogallala formation (Pliocene?):		
Clay, yellow; contains tough sandy clay	19	110
Clay, yellow; contains 0.5 ft lime rock at 118 ft	9	119
Clay, yellow; contains traces of lime rock	57	176
Clay and gravel, mixed	9.5	185.5
Gravel, red	5.5	191
Clay, sandy	4	195
Sand, cemented	11	206
Clay	8	214
Lime, rock, hard	1	215
Sand, cemented, and sandstone	10	225
Sandstone; contains traces of hard rock	15	240
Lime rock, some hard	5	245
Sandstone, lime rock and clay	5	250
Clay, sandy	5	255
Sandstone	16	271
Clay, sandy	7	278
Sand rock, bottom is soft magnesia rock	6	284
Clay, brule; sandy clay	6	290
Sandstone	4	294
10-16-9ba*. Weber. Weber Machine and Irrigation Co. Altitude (instrument), 2,287 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Clay, light-colored	42	42
Clay, dark at top	95	137
Gravel	8	145
Tertiary—Ogallala formation (Pliocene):		
Sand, dull-gray	7	152
Clay and sand	3	155
Clay, white, and sand rock	10	165
Sand rock	4	169
Rock, hard	1	170
Sandstone, soft	16	186
Rock, hard	1	187
Sandstone, clean, soft	4	191
Sandstone, clayey, soft	21	212
Rock, hard	1	213
Sand rock and clay	27	240
Sand, dark-colored	8	248
Sand rock	32	280
Gravel, pea-size	10	290
Hard drilling material		
10-16-31db*. Wescott. Weber Machine and Irrigation Co. Altitude (from topographic map), 2,200 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt	40	40
Sand, blue	6	46
Clay, blue	3	49
Sand, blue	3	52

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
10-16-31db*—Continued		
Quaternary—Pleistocene and Recent—Continued		
Sand, good, blue	11	63
Sand, good, brown	14	77
Clay, brown	10	87
Sand, good, brown	7	94
Tertiary—Ogallala formation (Pliocene):		
Clay	1	95
Sandstone	31	126
Rock, gray and brown	2	128
Clay, brown	2	130
Clay, sandy	2	132
Sandstone	3	135
Sand, fair	2	137
Sandstone	3	140
Rock, gray and brown	4	144
Sand, fair	4	148
Clay, sandy	12	160
Sandstone	7	167
Clay, sandy	3	170
Sandstone	9	179
Clay, sandy	5	184
Sandstone	5	189
Limestone	6	195
Sandstone	2	197
Clay	5	202
Sand and rock	3	205
Limestone and rock	2	207
10-16-35ab*. Belmundez. Walter T. Dunlap and Co. Altitude (from topographic map), 2,205 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil and clay, brown	81	81
Gravel	1	82
Tertiary—Ogallala formation (Pliocene):		
Sandstone and clay, brown and white; contains a trace of limestone	176	258
Gravel, fine- to medium-grained, trace of coarse; contains a trace of clay	22	280
Sandstone, white clay, and limestone, alternating layers	25	305
10-17-13ab*. Jensen-Wallace. Mattison Drilling Co. Altitude (from topographic map), 2,280 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil	5	5
Clay, yellow	21	26
Clay, buried soil at top	25	51
Clay	40	91
Tertiary—Ogallala formation (Pliocene?):		
Clay, sandy	15	106
Clay, sandy, light-colored, and fine sand	20	126
Clay	20	146
Rock, hard	2	148
Clay, brown	15	163
Clay and gravel	3	166
Rock, hard	1	167
Sand, cemented, hard and tight	7	174
Sandstone	24	198
Rock, hard	2	200
Sandstone	3	203

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
10-17-13ab*—Continued		
Tertiary—Ogallala formation (Pliocene?)—Continued		
Rock, hard	0.5	203.5
Sandstone	8.5	212
Limestone, hard	.5	212.5
Sandstone	3	215.5
Lime rock, hard	.5	216
Sandstone	3	219
Sand	4	223
Clay, sandy	3	226
Sand, cemented	10	236
Sandstone	4	240
Clay, sandy	1	241
Sandstone	2.5	243.5
Sand, cemented	1	244.5
Clay, sandy	9.5	254
Sandstone	19	273
Clay		
10-17-14dd. Altitude (instrument), 2,277.29 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, slightly clayey, dark-brown (road fill)	1.5	1.5
Silt, slightly clayey, dark-brownish-black	1.5	3
Silt, slightly clayey, medium-brownish-buff with a gray tint; contains small gastropods and limy nodules	18	21
Silt loam, slightly clayey, medium-dark- to dark-reddish-brown	3.5	24.5
Silt, fine sandy, light-brown with a pink tint	15.5	40
Silt, slightly sandy, calcareous, light-reddish-tan with a gray tint; contains small limy nodules; a fossil soil from 45 to 46 ft	6	46
Silt, slightly sandy to slightly clayey, light-brown with a pink tint; contains large limy nodules	14	60
Silt, moderately to very sandy, light-gray	13	73
Sand, very fine to fine, slightly silty, light-gray	21	94
Tertiary—Ogallala formation (Pliocene):		
Silt, fine sandy, light-buff-gray	6	100
Sand, very fine to fine, silty, light-brown with a gray tint; contains a limy nodular layer	10	110
Silt, sandy, light-brown	7.5	117.5
Silt, sandy, in part calcareous, reddish-tan	28.5	146
Silt, calcareous, light-grayish-buff; contains thin hard limy layers	3	149
Siltstone, in part calcareous, light-brown; contains hard thin limestone layers and some fine to coarse sand	20.5	169.5
Sand, fine to coarse, slightly silty; contains some fine gravel	2.5	172
Sand and gravel, medium-grained sand to medium-grained gravel, yellow to pink	4.5	176.5
Silt, slightly sandy, light-brown	5.5	182
Sand, fine to coarse, brownish-gray	3	185
Sand and gravel, fine sand to medium-grained gravel, brown to yellow to pinkish-gray	5	190
Siltstone, partly sandy, calcareous, hard, light-gray	6	196
Sandstone, calcareous, light-gray; contains rootlets and several fossil seeds	22	218
Sand, fine- to medium-grained, partly silty, light-brownish-gray	9	227
Sandstone, calcareous, slightly consolidated, light-gray to brownish-gray; contains a few rootlets	3	230
Sand, fine- to medium-grained, slightly silty, brownish-gray	6	236
Sandstone, calcareous, brownish-gray	4	240
Sand, fine- to medium-grained, brownish-gray; contains some greenish-gray clay granules	18	258
Clay, silty to sandy, light-gray	1.5	259.5
Silt, calcareous, light-gray	2.5	262

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
10-17-14dd—Continued		
Tertiary—Ogallala formation (Pliocene)—Continued		
Clay, light-gray with a green tint	9.5	271.5
Sand, fine to coarse, light-brownish-gray	2.5	274
Silt, slightly sandy, calcareous, light-gray	6	280
Sandstone, fine- to medium-grained, calcareous, light-brownish-gray; contains hard limy layers	12	292
Sand, silty, light-greenish-gray to brownish-gray	20	312
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-gray, in part; yellowish-orange	7.5	319.5
Clay shale, dark-gray to black; contains some bentonite and limonitic stain	10.5	330
10-17-15ba*. U. S. Bureau of Reclamation. Altitude (instrument), 2,267.1 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Clay, silty, brown, light-brown below 20 ft	26	26
Clay, silty, light-gray	12	38
Sand, gray; contains streaks of gray clay	12	50
Clay, sandy	40	90
Tertiary—Ogallala formation (Pliocene): Clay, sandy, and sandstone	20	110
10-17-15bb*. U. S. Bureau of Reclamation. Altitude (instrument), 2,315.7 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Clay, silty, light-brown	25	25
Clay, silty, dark-brown	5	30
Clay, silty, brown	33	63
Clay, sandy, brown	39	102
Clay, sandy, light-colored	20	122
Clay, very sandy, brown	20	142
Tertiary—Ogallala formation (Pliocene):		
Clay, sandy; contains fossil stems	40	182
Sand, fine	10	192
Sand and gravel	10	202
10-17-20cc*. U. S. Bureau of Reclamation. Altitude (from topographic map), 2,305 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Clay, sandy	10	10
Silt, sandy	1	11
Clay, sandy, and silty	10	21
Clay, in part silty	9	30
Clay, dark-brown	1	31
Clay, brown	9	40
Clay, silty, light-brown; contains calcareous concretions	10	50
Clay, silty	8	58
Sand	2	60
Sand and clay, sandy, green	1	61
Clay, sandy, light-brown and dark-brown	5	66
Sand	2	68
Clay, silty to sandy	3	71
Silt, in part clayey, white to gray	9	80
Silt, sandy, gray	4	84
Clay and silt, sandy	9	93
Sand, gravel, and sandstone fragments	5	98

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
10-17-20cc—Continued		
Tertiary—Ogallala formation (Pliocene): Sandstone, with calcareous cement	4	102

10-17-21cc*. Buettner, Mattison Well Co. Altitude (estimated from instrument level 150 feet east), 2,231.5 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Top soil	4	4
Clay, yellow	36	40
Clay, blue	18	58
Clay, blue, and sand	6	64
Sand, fine	7	71
Sand and gravel	2	73
Gravel, coarse	15	88
Sand and gravel	7	95
Gravel, coarse	3	98
Sand and gravel	4	102
Gravel, coarse	4	106
Tertiary—Ogallala formation (Pliocene):		
Sandstone	9	115
Sandstone and clay; contains some embedded gravel	4	119
Sand, fine, and sandstone	4	123
Sand	4	127
Rock and sandstone	3	130
Sandstone	3	133
Limestone	1	134
Rock	6	140
Rock and sandstone	2	142
Sandstone	8	150

10-17-22dd. Altitude (instrument), 2,215.89 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Soil; silt, very fine sandy, dark-brown	1	1
Silt, coarse, medium-brownish-gray	1	2
Silt, fine to coarse, dark-brownish-gray	1	3
Silt, coarse, granular, medium-brown with a gray tint; contains a few calcareous nodules	5	8
Silt, very slightly clayey, medium-brownish-gray; contains many calcareous rootlets below 10 ft	7	15
Silt, in part very slightly clayey, slightly calcareous, light-brown; contains some calcareous rootlets, medium-brownish-gray below 20 ft	15	30
Silt, slightly clayey, medium-gray with brown tint	5	35
Sand, medium-grained, brownish-gray; contains some interbedded silt	3	38
Sand, medium- to coarse-grained, medium-gray, containing interbedded clay, granular, light-gray to dark-gray; contains gastropods; contains some peat and wood below 45 ft	12	50
Sand, fine to coarse, and some fine gravel; contains rounded green clay fragments, wood, some gastropods and a few calcareous nodules	5	55
Sand and gravel, fine sand to coarse gravel, slightly coarser below 65 ft	11	66
Silt to sandy silt, light-brown; contains large calcareous roots below 70 ft	9	75
Silt, slightly to very sandy, moderately calcareous, medium- to dark-brownish-gray, light-gray below 80 ft; contains many shell fragments	10	85
Sand, fine to coarse, with considerable fine- to medium-grained gravel	3.5	88.5

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
10-17-22dd—Continued		
Tertiary—Ogallala formation (Pliocene):		
Sandstone, fine- to medium-grained calcareous, light-olive-gray; contains rootlets	3.5	92
Sandstone, fine- to medium-grained, slightly silty, light-brownish-gray	4	96
Silt, in part clayey, light-brown to light-greenish-gray	4	100
Silt, light-reddish-brown	2	102
Sand, fine to coarse, brownish-gray; contains interbedded silt and marl	5	107
Sandstone, very fine, silty, light-brown; contains a calcareous layer at 107 ft	1.5	108.5
Sandstone, very fine- to coarse-grained, slightly silty, light-brown to brownish-gray	5	113.5
Gravel, fine to coarse, and some medium- to coarse-grained sand; contains a few calcareous pebbles	6.5	120
Sand, cemented, and siltstone, light-gray; contains a few rootlets	2.5	122.5
Clay, red-brown	4	126.5
Marl, light-brownish-gray	1	127.5
Sand, very fine to medium-grained, slightly silty, in part calcareous, light-brown	5.5	133
Clay, red-brown	2	135
Marl, in part slightly sandy, light-gray	2.5	137.5
Sand, fine, partially cemented with lime, light-brown-gray	7.5	145
Sand, fine to coarse, and a trace of fine gravel; slightly cemented; contains a hard calcareous layer from 153.5 to 154.5 ft	9.5	154.5
Sand, very fine to fine and some medium-grained, cemented with lime, light-brownish-gray	2	156.5
Marl, sandy, light-gray	7.5	164
Silt, sandy, calcareous, light-brownish-gray	2.5	166.5
Sand, very fine to fine, silty, calcareous, light-brownish-gray	3.5	170
Sandstone, very fine to fine and some medium-grained, in part calcareous, light-brownish-gray	9	179
Sandstone, fine- to medium-grained, in part calcareous, brownish-gray with a slight green tint	7.5	186.5
Sandstone, very fine- to fine-grained, calcareous, light-brownish-gray; contains alternate hard and soft layers; contains fine to coarse sand below 198 ft	16	202.5
Silt, clayey to slightly sandy, greenish-gray; interbedded with light-brown clay	4.5	207
Silt, clayey to very slightly sandy, light-olive-gray	3	210
Silt, in part slightly sandy, moderately calcareous, light-gray	3	213
Sand, very fine to coarse, brownish-gray	2	215
Silt, sandy, to silty, fine- to medium-grained sand, with a trace of coarse, light-greenish-gray sand	3.5	218.5
Sand, very fine to medium-grained, with a trace of coarse, in part slightly silty, brownish-gray sand	6	224.5
Sandstone, fine- to medium-grained, with a trace of coarse, slightly to moderately calcareous, brownish-gray sand with a green tint; contains alternate hard and soft layers; contains rootlets	7	231.5
Silt, sandy, very calcareous, light-gray	2	233.5
Sandstone, fine, calcareous, light-gray with an olive tint; contains a few rootlets	2.5	236
Silt, slightly sandy, fine, light-grayish-green	4	240
Sand, fine- to medium-grained, in part silty, brownish-gray with a green tint	3	243
Sand, silty to silt, sandy, very fine to medium-grained, very slightly calcareous, grayish-green	2.5	245.5
Sand, fine- to medium-grained, in part slightly silty, brownish-gray with a green tint	4.5	250
Sand, medium, in part silty, light-brownish-gray; contains a trace of coarse sand below 260 ft	17.5	267.5

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
10-17-22dd—Continued		
Tertiary—Ogallala formation (Pliocene)—Continued		
Sand, silty to silt, sandy, very fine to medium-grained, light-grayish-green	2	269.5
Sand, very fine to medium-grained, with a trace of coarse, brownish-gray; contains thin layers of silt, clayey to siltstone; contains a trace of gravel below 285 ft	52.5	322
Silt, clayey, granular, green to grayish-green	3	325
Sand, fine- to medium-grained, brownish-gray with a green tint; contains medium-grained to coarse sand and many green silt granules below 330 ft	15.5	340.5
Cretaceous—Pierre shale (Upper Cretaceous): Shale, medium-gray to dark-gray; contains a few limonitic layers	9.5	350
10-17-28da. Altitude (instrument), 2,227.42 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, slightly clayey, dark-brownish-gray (road fill)	1	1
Silt, clayey, dark-brownish-gray	2	3
Silt, clayey, medium-brownish-gray	5	8
Silt, slightly clayey, granular, soil-like, brownish-gray; contains large limy rootlet nodules	1	9
Silt, very fine, sandy, to siltstone, dark-brownish-gray; contains many limy nodules	3	12
Silt, slightly clayey, medium-brownish-gray	5	17
Silt, coarse, light-gray to buff; contains gastropods	15	32
Silt, coarse, dark-grayish-brown; contains peat	18	50
Silt, fine-sandy, medium-gray	6	56
Sand, medium- to coarse-grained, and fine- to medium-grained gravel, brownish-gray with pink grains	13	69
Tertiary—Ogallala formation (Pliocene):		
Sand, very fine to medium-grained, and poorly cemented sandstone, calcareous, buff-gray; contains a few rootlets	6	75
Sandstone, silty, fine-grained, light-gray; contains a hard limy layer	15	90
Sand, partly consolidated, calcareous, brownish-gray with a greenish tinge; contains rootlet material	20	110
Siltstone, fine-grained, brownish-gray	5	115
Sand, fine to coarse, and some fine- to medium-grained gravel, brownish-gray with many pink grains	8	123
Clay, silty, light-grayish-green to tan	3	126
Sandstone, moderately calcareous, light-greenish-gray to brownish-gray	6	132
Sand, very fine to fine, silty, partly consolidated, light-gray	8	140
Sandstone, fine-grained, slightly calcareous, light-gray to light-brown; contains thin hard limestone layers, a few rootlets and many fossil seeds	25	165
Marl, white with gray specks	2.5	167.5
Sandstone, calcareous, fine- to medium-textured, light-gray with a tan tint	1.5	169
Marl, sandy, light-gray	1	170
Sandstone, moderately calcareous, light-gray; contains many rootlets	3	173
Silt, clayey, calcareous, light-gray	6.5	179.5
Sandstone, poorly consolidated, slightly calcareous, fine- to coarse-grained, light-brownish-gray	5	184.5
Sand, fine to coarse, and fine- to medium-grained gravel, brownish-gray with yellow and pink grains	13.5	198
Sand, fine- to medium-grained, silty, in part calcareous, light-olive-gray	11.5	209.5
Clay, silty, containing sandy layers, green to gray	10.5	220
Sand, very fine to medium-grained, silty, brownish-gray	16	236
Limestone, slightly sandy, buff-gray with a green tint	3.5	239.5
Silt, sandy, in part calcareous, grayish-green	10.5	250
Sand, fine- to medium-grained, slightly silty, brownish-gray	15	265

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
10-17-28da—Continued		
Tertiary—Ogallala formation (Pliocene)—Continued		
Silt, sandy, grayish-green with a brown tint	4	269
Sand, fine- to medium-grained slightly silty, brownish-gray with a slight green tint	23.5	292.5
Silt, moderately sandy, grayish-green	4	296.5
Clay, silty to sandy, grayish-green	3.5	300
Sand, fine- to medium-grained, silty, light-brownish-gray with a green tint; contains some fine gravel	7.5	307.5
Silt, clayey to fine sandy, grayish-green with limonitic stain	2.5	310
Cretaceous—Pierre shale (Upper Cretaceous): Clay shale, silty, dark-gray to black with orange to brown weathered shale; contains limonitic stain, bentonitic shale and green clay from 325 to 330 ft	20	330
10-17-30cc*. U. S. Bureau of Reclamation. Altitude (instrument), 2,359.5 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Clay, silty, dark-brown to light-brown	10	10
Clay, silty, light-brown	14	24
Clay, silty, brown	56	80
Clay, sandy, brown with light streaks; contains chalky sandstone from 100 to 105 ft	25	105
Clay, sandy, dark-brown; hard from 120 to 130 ft; rubbery from 130 to 150 ft	45	150
Clay, sandy, brown	4	154
Tertiary—Ogallala formation (Pliocene):		
Clay, sandy, fine, gray	6	160
Clay, very sandy, gray	10	170
Clay, sandy, gray	20	190
Sand, fine to coarse, gray	10	200
10-17-33cb*. Carter Oil Co. Altitude 2,265 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt	70	70
Sand, fine, and silt	30	100
Tertiary—Ogallala formation (Pliocene): Sandstone, silt, sand, and some gravel	315	415
Cretaceous—Pierre shale (Upper Cretaceous): Shale, black	———	———
10-18-9cb. Altitude (altimeter), 2,353.1 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, medium-brown	8.5	8.5
Silt, slightly clayey, light-brown	1.5	10
Silt, slightly granular, dark-buff	5	15
Silt, medium-buff; contains a few limy rootlets	32	47
Silt, clayey, light-grayish-buff; contains a few gastropods	8	55
Silt; contains limy nodules, gravel, limonitic nodules, rodent bones, and manganese pellets	6	61
Silt, slightly granular, grayish-buff; contains many hard nodules and limy rootlets	9	70
Silt, slightly clayey, light-reddish-buff	4.5	74.5
Silt, granular, dark-reddish-tan; contains a few limy particles	11	85.5
Sand, medium- to coarse-grained and fine- to medium-grained gravel, gray, yellow to reddish-brown	12	97.5
Tertiary—Ogallala formation (Pliocene):		
Silt, clayey to sandy, light-yellowish-gray	9	106.5
Sandstone, yellowish-gray	1	107.5
Silt, sandy, light-gray	2.5	110

Table 7.—*Logs of test holes and wells*— Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
10-18-9cb—Continued		
Tertiary—Ogallala formation (Pliocene)—Continued		
Sand, fine to coarse, and fine- to medium-grained gravel, grayish-tan to reddish-tan	12	122
Silt, slightly sandy, calcareous, light-gray	8	130
Sandstone, granular, dark-reddish-brown	6.5	136.5
Sand, silty, with hard limy particles, grayish-tan	8.5	145
Sandstone, light-grayish-green; contains hard limy particles	5	150
Sand, fine- to medium-grained, grayish-tan; contains limy nodules	6	156
Sandstone and siltstone, limy, light-greenish-gray	14	170
Sand, fine- to medium-grained, dark-grayish-tan	15	185
Sandstone, light-greenish-gray	10	195
Sand, fine- to medium-grained, grayish-tan	10	205
Sandstone, with interbedded limy layers, medium-grayish-tan	15	220
Sand, fine- to medium-grained, grayish-tan	5.5	225.5
Marl, light-bluish-gray	1.1	225.6
Sandstone, dark-grayish-tan	4.4	230
Sandstone, limy, light-grayish-tan	15	245
Sandstone, limy, light-gray to light-tan	5	250
Sand, fine- to medium-grained, limy, light-gray-tan	6	256
Sand, silty, light-gray	4	260
Sandstone and limy sandstone, interbedded, light-grayish-tan	12	272
Sand, medium- to coarse-grained, and fine gravel, yellow to red	10	282
Sandstone, limy, granular, light-grayish-tan	12	294
Sand, fine- to medium-grained, grayish-tan	7	301
Sandstone, limy, light-grayish-tan	1	302
Sand, fine- to medium-grained, dark-grayish-tan	8	310
Sandstone, fine- to medium-grained, light-grayish-tan	40	350
Sand, fine- to medium-grained, with interbedded silty layers, medium-grayish-tan	25	375
Silt, sandy, light-gray	2.5	377.5
Sand, dark-grayish-tan	1.5	379
Marl, silty to fine-sandy, light-gray	3	382
Sand, dark-gray	5.5	387.5
Marl, light-gray	2.5	390
Sandstone and limy layers	10	400
Sand, fine- to medium-grained, light-grayish-tan	7	407
Sand, fine- to medium-grained, silty, grayish-tan to light-yellowish-gray	21	428
Silt, sandy, light-gray	15	443
Silt, clayey to sandy, light-pinkish-gray	27	470
Sand, medium-grained, to fine gravel; contains limonitic particles	6.5	476.5
Silt, light-brown	8.5	485
Cretaceous—Pierre shale (Upper Cretaceous): Clay, moderately calcareous, medium-gray	15	500

10-18-24cc*. U. S. Bureau of Reclamation. Altitude (instrument), 2,315.0 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Silt, dark-brown	4	4
Clay, silty, brown	6	10
Clay, silty, light-brown	40	50
Clay, sandy, light-brown	15	65
Clay, sandy, light-gray	1	66
Sand and gravel, fine sand to fine gravel	4	70

10-18-28cc. Altitude (instrument), 2,369.62 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Silt, medium-grayish-brown	4.5	4.5
Silt, dark- to medium-reddish-buff	9	13.5

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
10-18-28cc—Continued		
Quaternary—Pleistocene and Recent—Continued		
Silt, slightly clayey, medium-reddish-buff	6.5	20
Silt, coarse, medium-reddish-buff	10	30
Silt, fine-sandy, grayish-buff to reddish-buff; contains limy nodules and a thin hard layer at 44 ft	35	65
Silt, slightly clayey, calcareous, light-gray	11	76
Silt, sandy, slightly clayey, reddish-buff; contains a hard limy concretion at 81.5 ft	8	84
Sand, clayey to silty, light-brownish-red	6	90
Sand, fine to coarse, and fine- to medium-grained gravel, grayish-yellow to pink	17.5	107.5
Tertiary—Ogallala formation (Pliocene):		
Sandstone, silty, light-reddish-gray	6.5	114
Gravel, fine- to medium-grained, interbedded with sandstone, reddish-gray	6	120
Sand, fine, and fine gravel, grayish-tan to pink	13	133
Sandstone, silty, light-reddish-gray to yellowish-gray	7	140
Sand, fine to coarse, and fine gravel, grayish-tan to yellow to pinkish-gray	40	180
Sand, fine to coarse, grayish-tan	11.5	191.5
Sandstone, grayish-tan	2	193.5
Sand, fine to coarse	3.5	197
Silt, sandy, limy, light-gray	5.5	202.5
Sand, fine to coarse with some fine gravel, grayish-tan	17	219.5
Sandstone, moderately calcareous, grayish-tan; contains hard limy layers	28.5	248
Marl, light-bluish-gray	2	250
Sandstone and thin limy layers, dark-grayish-tan	10	260
Marl, light-bluish-gray to white	3	263
Silt, limy, with some fine sand, calcareous, pinkish-tan	17	280
Sandstone, fine-grained, limy, grayish-tan	40	320
Sandstone, fine- to medium-grained, grayish-tan	10	330
Sand, fine- to medium-grained, slightly calcareous, grayish-tan	14	344
Silt, limy, light-gray with green tint	1.5	345.5
Sand, fine- to medium-grained, grayish-tan; contains limy layers	4.5	350
Sand and silt, interbedded, grayish-tan to greenish-gray	10	360
Clay, grayish-green	.5	360.5
Sand, fine to coarse, grayish-tan	29.5	390
Sand, silty, light-grayish-green	5	395
Silt, and clay stone, limy, interbedded, grayish-green	5	400
Silt, limy, and sandstone, interbedded	5	405
Sandstone, limy, silty, gray to grayish-tan	19	424
Silt, clayey, light-yellowish-gray	8	432
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-green	5.5	437.5
Clay, medium-gray	42.5	480

10-18-34dc*. U. S. Bureau of Reclamation. Altitude (instrument), 2,430.58 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Clay, silty, light-brown	34	34
Clay, silty, dark-brown to brown	50	84
Clay, sandy, brown	47	131
Clay, sandy, dark-brown	10	141
Clay, sandy, some coarse sand	10	151
Clay, sandy, brown, with some white layers	20	171
No sample (lost all water return below 171 ft)	20	191
Tertiary—Ogallala formation (Pliocene?): Drills like soft sandstone and (or) siltstone	20	211

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
10-18-35bb*. U. S. Bureau of Reclamation. Altitude (instrument), 2,332.95 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Clay, silty, dark-brown to light-brwon	10	10
Clay, silty, brown	30	40
Clay, silty, brown; contains calcareous concretions	20	60
Clay, silty, brown to light-gray	5	65
Clay, gray	3	68
Clay, sandy, gray	10	78
Sand and gravel, fine sand to fine gravel	6	84
Tertiary—Ogallala formation (Pliocene?): Clay, sandy	6	90
11-13-14dc*. Holtz. Walter T. Dunlap and Co. Altitude (instrument), 2,123.59 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil and clay, brown	88	88
Gravel, fine to coarse	1	89
Clay, brown	5	94
Clay, white, with gravel	4	98
Gravel, fine to coarse; contains a trace of cement	24	122
Tertiary—Ogallala formation (Pliocene):		
Clay, white, and sandstone	8	130
Sandstone	20	150
Limestone, hard	4	154
Sandstone	10	164
Limestone, hard	5	169
Clay, white; contains a trace of sandstone and limestone	46	215
(Adjacent test hole drilled to a depth of 325 ft did not enter Pierre shale.)		
11-14-12ba2*. Knerl. Frank Hervert Drilling Co. Altitude (estimated from instrument altitude 100 feet south), 2,095 feet above mean sea level		
Quaternary—Pleistocene and Recent: Clay and sand, fine	120	120
Tertiary—Ogallala formation (Pliocene):		
Sandstone, calcareous	1	121
Sandstone and clay	24	145
11-15-33dc*. Schmitz, Don Barney Drilling Co. Altitude (from topographic map), 2,245 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil	2	2
Clay, yellow	29	31
Clay, brown	92	123
Sand, gravel and clay	6	129
Sand, medium-grained, and wheat-size gravel	13	142
Sand and gravel	16	158
Tertiary—Ogallala formation (Pliocene):		
Sand, fine, and clay	2	160
Sandstone	2	162
Sand, cemented	8	170
11-16-8ad*. Maude Fling. Mattison Well Co. Altitude (instrument), 2,178.28 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil	3	3
Clay, sandy, yellow	13	16

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
11-16-8ad*—Continued		
Quaternary—Pleistocene and Recent—Continued		
Clay, sandy	5	21
Clay, yellow	9	30
Sand, fine, and clay	5	35
Sand, fine, red, and clay, mixed	5	40
Clay, yellow to dark	9	49
Clay, sandy	4	53
Sand, fine	7	60
Clay, blue	10	70
Sand, coarse, blue	2	72
Clay, blue	9	81
Sand, fine	4	85
Clay, blue	5	90
Sand, blue, and clay, mixed	9	99
Clay, sandy, blue	9	108
Sand, fine	5	113
Gravel mixed with clay	4	117
Gravel, blue	5	122
Clay, blue	3	125
Tertiary—Ogallala formation (Pliocene):		
Magnesia, soft	6	131
Magnesia rock, hard	10	141
Clay	5	146
Gravel, rice-size, green	1	147
Sand and gravel, 80 percent fine	19.5	166.5
Sand, fine	3.5	170
Clay, sandy	6	176
Sand, fine	14	190
Clay, sandy	5	195
Sandstone, soft; contains a trace of clay	10	205
Clay, sandy	5	210
Sandstone	15	225
Sandstone, mixed with clay	10	235
Sandstone	5	240
Clay	2	242
Clay, sandy, fine	23	265
11-16-15da. Altitude (instrument), 2,155.14 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil; silt, slightly clayey, dark-brown to black	1.5	1.5
Silt, dark-brownish-gray	4.5	6
Silt, clayey, brownish-buff to gray	4.5	10.5
Silt, clayey, grayish-white to buff; contains gastropods	4.5	15
Silt, clayey, very calcareous, light-buff-gray with limonitic stain	2.5	17.5
Sand, medium- to coarse-grained, light-brownish-gray to pinkish-gray; contains some fine gravel	13	30.5
Silt, clayey to peaty, light-gray with bluish-green tint; contains gastropods, pelecypods, and wood fragments	29.5	60
Sand, medium- to coarse-grained, slightly silty, light-gray with pink tint	4	64
Sand, coarse, to medium-grained gravel, brown, pink and greenish-gray	13.5	77.5
Tertiary—Ogallala formation (Pliocene):		
Sandstone, fine-grained, consolidated, greenish-gray to brownish-gray	12.5	90
Sandstone to siltstone, interbedded with limy layers, brownish-gray to light greenish-gray; contains rootlets	58	148
Sand, fine- to medium-grained, partly calcareous, light-gray to brownish-gray with a green tint	7	155
Sandstone, slightly consolidated, brownish-gray with a green tint; contains a hard marl layer at 162 ft	10	165

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
11-16-15da—Continued		
Tertiary—Ogallala formation (Pliocene)—Continued		
Clay, silty, hard and soft layers interbedded, brownish-gray to light-gray	4	169
Sand, fine- to medium-grained, brownish-gray; contains traces of fine gravel	11	180
Sandstone, moderately calcareous, slightly consolidated, light-brownish-gray	10	190
Sand, medium- to coarse-grained, silty, brownish-gray to green; contains white siliceous rootlets	57.5	247.5*
Sandstone, calcareous; contains thin hard limy layers, light-brownish-gray	12.5	260
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, grayish-green; contains a hard layer of marl	7	267
Clay, light-gray; contains limonitic fragments and weathered material	20	287
Clay shale, slightly silty, dark-gray to black	3	290
Clay shale, dark-gray to black; contains some bentonite and limonitic layers	15	305
Limestone, shaly, very hard, dark-brownish-gray	1.5	306.5
Clay shale, slightly calcareous, dark-gray to black	3.5	310
11-16-31da. Altitude (instrument), 2,304.25 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, clayey, dark-brown (road fill)	1.5	1.5
Silt, clayey, dark-grayish-brown to buff	3	4.5
Silt, coarse, granular, buff to brownish-gray; contains limy nodules and iron stain; contains a few gastropods from 10 to 20 ft	15.5	20
Silt, clayey, buff to light-tannish-gray with some limonitic stain	12	32
Silt, clayey, soil-like, dark-reddish-brown	4	36
Clay, silty, medium-brown with pink tint	9	45
Silt, clayey to sandy, light-brown	15	60
Silt, fine-sandy, calcareous, grayish-brown; contains many limy nodules	37	97
Silt, calcareous, light-brownish-gray	.5	97.5
Gravel, fine to coarse, pink	4.5	102
Sand, very fine to fine, silty, light-brown	11	113
Sand, medium- to coarse-grained, and fine- to medium-grained gravel, brownish-gray to pink	25	138
Tertiary—Ogallala formation (Pliocene):		
Silt, very sandy, light-brownish-gray; contains a few rootlets	7	145
Sandstone, silty, calcareous, light-gray; contains interbedded clay, greenish-gray	15	160
Siltstone, sandy, light-gray with green tint	2	162
Sand, medium-grained, to medium-grained gravel, brownish-gray with pink grains	12	174
Clay, light-gray with green tint	.5	174.5
Sandstone, slightly calcareous, brownish-gray	20.5	195
Sand, fine- to medium-grained, silty, brownish-gray	21	216
Sandstone, calcareous, light-brownish-gray	19	235
Silt, marl and clay, light-gray to light-brown	10	245
Sandstone, calcareous, light-brownish-gray	19.5	264.5
Sand, fine- to medium-grained, silty, brownish-gray with green tint; contains siliceous rootlets	18.5	283
Sandstone, silty, slightly consolidated, calcareous	7	290
Sand, fine- to medium-grained, slightly silty, light-brownish-gray	9.5	299.5
Sandstone, silty, and marl, sandy, light-gray	4.5	304
Sand, fine- to coarse-grained, light-gray with a brown tint; contains some green clay granules	31	335
Sand, fine- to medium-grained, with a trace of fine- to medium-grained gravel	21	356

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
11-16-31da—Continued		
Tertiary—Ogallala formation (Pliocene)—Continued		
Silt, clayey, calcareous, light-gray	4	360
Sand, medium-grained to medium-grained gravel, gray with pink and green; contains a silt layer and many limy fragments	11	371
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, moderately calcareous, light-gray to light-buff-gray	15	386
Clay shale, moderately calcareous, medium-gray to dark-gray; contains some bentonite and weathered shale	14	400
11-16-34ad*. Cruise. Weber Machine and Irrigation Co. Altitude (from topographic map), 2,300 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Clay	122	122
Sand, coarse	8	130
Sand, fine	12	142
Sand, coarse	6	148
Clay	4	152
Sand, fine	2	154
Sand, coarse	31	185
Gravel, coarse	5	190
Tertiary—Ogallala formation (Pliocene): Sandstone	———	———
11-16-35ad*. Cruise. Weber Machine and Irrigation Co. Altitude (instrument), 2,286.75 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Clay	111	111
Sand, good	7	118
Clay	3	121
Sand, good	3	124
Clay, sandy	8	132
Sand, good	2	134
Clay, sandy	3	137
Clay, white	12	149
Sand, good	32	181
Tertiary—Ogallala formation (Pliocene): Rock	———	———
11-17-24aa*. U. S. Bureau of Reclamation. Altitude (instrument), 2,287.5 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Clay, silty, light-brown	25	25
Clay, silty, dark-brown	3	28
Clay, silty, light-brown; contains some calcareous concretions	43	71
Clay, silty, brown with white streaks	7	78
Clay, sandy, some gravel, brown	3	81
Sand and gravel	10	91
Clay, sandy, fine, brown with white streaks	10	101
Sand, very fine, silty	10	111
Sand and gravel	20	131
11-17-25bb*. U. S. Bureau of Reclamation. Altitude (instrument), 2,313.2 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Clay, silty, light-brown	28	28
Clay, silty, dark-brown	7	35
Clay, sandy, light-brown; contains some gravel below 41 ft	16	51
Clay, silty, light-brown with white streaks	20	71

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
11-17-25bb*—Continued		
Quaternary—Pleistocene and Recent—Continued		
Clay, silty, brown	13	84
Sand and gravel	45	129
Tertiary—Ogallala formation (Pliocene):		
Clay, sandy, and rock, white	2	131
Sand, fine to coarse, clayey	8	139
Rock	1	140
11-17-27bb*. U. S. Bureau of Reclamation. Altitude (instrument), 2,318.07 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Clay, silty, dark-brown to light-brown	30	30
Clay, sandy, light-brown	20	50
Clay, sandy, light-brown grading to gray, and fine sand	10	60
Clay, sandy, light-brown to brown	10	70
Clay, sandy, brown	25	95
Sand and gravel, grading to sandy clay	32	127
Clay, silty	3	130
Sand and gravel	5	135
Tertiary—Ogallala formation (Pliocene): Layers of rock	5	140
11-17-34aa*. U. S. Bureau of Reclamation. Altitude (instrument), 2,277.9 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Clay, silty, dark-brown to light-brown, sandy at 32 ft	32	32
Clay, silty, brown	28	60
Clay, sandy; contains layers of fine and coarse sand	10	70
Sand, fine to coarse	10	80
Tertiary—Ogallala formation (Pliocene):		
Clay, sandy, gray, and sandstone, calcareous	20	100
Sandstone, soft and hard layers	10	110
11-17-34dd*. U. S. Bureau of Reclamation. Altitude (instrument), 2,334.0 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Clay, silty, brown	32	32
Clay, silty, dark-brown	4	36
Clay, sandy, brown	22	58
Sand, fine, gray	4	62
Clay, sandy, gray	6	68
Sand, fine, gray	14	82
Clay, sandy, gray	4	86
Clay, sandy, brown	4	90
Clay, sandy, light-brown	20	110
Tertiary—Ogallala formation (Pliocene): Clay, sandy, and sandstone	60	170
11-18-9cc. Altitude (instrument), 2,304.86 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, very fine to fine-sandy, brownish-buff with a gray tint	2.5	2.5
Silt, dark-brownish-gray	1	3.5
Silt, slightly clayey, buff-gray	1.5	5
Silt, slightly sandy, grayish-buff; contains limy rootlets and nodules	25	30
Silt, fine-sandy, peaty, light- to dark-brownish-gray	4.5	34.5
Silt, moderately clayey, medium- to dark-bluish-gray; contains many gastropods	5	39.5
Sand, fine- to medium-grained, light-brownish-gray	3	42.5

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
11-18-9cc—Continued		
Quaternary—Pleistocene and Recent—Continued		
Silt, peaty, brown	2	44.5
Silt, slightly clayey, bluish-gray	5.5	50
Sand, very fine to coarse, light-brownish-gray	5	55
Sand, fine to coarse, and some gravel, fine- to medium-grained, light-brownish-gray	5	60
Sand and gravel, fine- to medium-grained, brownish-gray with some pink grains	2.5	62.5
Tertiary—Ogallala formation (Pliocene):		
Silt, fine to coarse, sandy, light-tannish-gray	2.5	65
Sandstone, fine- to medium-grained, light-brown; contains a few rootlets	1.5	66.5
Sand, fine- to medium-grained, tan-gray	5	71.5
Sandstone, calcareous, fine- to medium-grained, light-brownish-gray	6.5	78
Silt, sandy, with some interbedded sandstone, light-greenish-gray	6.5	84.5
Sandstone, very fine- to fine-grained, calcareous, very light greenish-gray; contains some rootlets	8	92.5
Sand, fine to coarse, and some medium-grained gravel, brownish-gray with some pink grains	15	107.5
Sandstone, very fine to medium-grained, light-greenish-gray; contains some coarse sand and a few rootlets	25.5	133
Sand, fine- to medium-grained, light-grayish-tan	5	138
Sand, silty, light-yellowish-gray	2	140
Sand, fine- to medium-grained, light-grayish-tan	10	150
Sandstone, moderately calcareous, light- to medium-grayish-tan	10	160
Sand, fine, light-grayish-tan	5	165
Sandstone, medium- to light-grayish-tan; contains interbedded sand and a few limy particles	25	190
Sandstone, limy; contains a few clay granules	3	193
Sand, fine- to medium-grained, light-grayish-tan	7	200
Sandstone, light-grayish-tan; contains some coarse sand	10	210
Sandstone, limy, interbedded with noncalcareous sand and siltstone, gray to tannish-gray	25	235
Sand, fine- to medium-grained, light-tannish-gray	60	295
Sandstone, light-brownish-gray with a slight green tint	5	300
Sand, fine- to medium-grained, slightly consolidated, brownish-gray	40	340
Silt, clayey to very fine sandy, light-green	1	341
Sand, very fine to medium-grained, brownish-gray; contains some clayey silt granules and sandstone layers	52.5	393.5
Silt, clayey, greenish-gray	4.5	398
Sand, fine to coarse, brownish-gray; contains a hard limy layer from 408 to 409 ft	11	409
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, moderately calcareous, light-gray with some limonitic stain	1	410
Clay, light-gray to dark-gray	3.5	413.5
Clay shale, calcareous, medium-gray to dark-gray with a slight brown tint	16.5	430

11-18-32aa. Altitude (instrument), 2,445.30 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Silt, fine-sandy, medium-brownish-gray	0.5	0.5
Silt, fine-sandy, buff-gray; contains a few gastropods	26.5	27
Silt, slightly sandy, soil-like, dark-brownish-gray	1.5	28.5
Silt, moderately sandy, light-reddish-tan with a slight gray tint	10.5	39
Sand, very fine to medium-grained, silty, light-gray with slight tan tint	25	64
Silt, clayey, light-brownish-gray	18	82
Silt, moderately clayey, light-brown with gray tint	8	90

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
11-18-32aa—Continued		
Quaternary—Pleistocene and Recent—Continued		
Silt, moderately sandy, light-brown; contains thin hard limy layers below 157 ft	90	180
Silt, very fine sandy, in part siltstone, light-brown with gray tint	30	210
Silt, very sandy, brownish-gray; contains a trace of gravel and thin hard limy layers	22	232
Sand, medium-grained, to gravel, medium-brownish-gray with pink and green grains	7	239
Silt, sandy, fine- to medium-grained, light-brownish-gray	6.5	245.5
Sand, fine, to medium- to coarse-grained gravel, brownish- to greenish-gray	12.5	258
Tertiary—Ogallala formation (Pliocene):		
Sandstone, fine- to medium-grained, light-brownish-gray with a green tint	6	264
Silt, slightly sandy, light-greenish-gray	3.5	267.5
Sandstone, fine- to medium-grained, light-brownish-gray; contains thin calcareous siltstone	2.5	270
Sandstone, calcareous, silty, light-gray	8	278
Sandstone, fine- to medium-grained, light-greenish-gray; contains a few rootlets	23.5	301.5
Sand, fine- to medium-grained, light-brownish-gray; contains layers of sandstone	24.5	326
Sandstone and calcareous silt, white	.5	326.5
Sandstone, fine- to medium-grained, calcareous, light-brown	4.5	331
Silt, moderately sandy, light-greenish-gray	17	348
Sandstone, light-brownish-gray	4.5	352.5
Silt, fine- to medium-sandy, light-greenish-gray	1.5	354
Sandstone, fine- to medium-grained, light-brownish-gray	10	364
Silt, sandy, calcareous, white	2	366
Sandstone, fine- to medium-grained, calcareous, light-brownish-gray	19	385
Sand, fine- to medium-grained, silty, light-brownish-gray	8	393
Silt, fine- to medium-sandy, light-greenish-gray	1	394
Sand, very fine to medium-grained, light-brownish-gray	12	406
Silt, slightly clayey to sandy, light-greenish-gray; contains limy nodular fragments	6.5	412.5
Silt, sandy, calcareous, white to greenish-gray	13.5	426
Sand, fine to coarse, light-brownish-gray	10	436
Silt, sandy, light-green to greenish-gray	1	437
Sand, fine to coarse, light-brownish-gray; contains some green siltstone at 455 ft	21	458
Silt, calcareous, and sandstone, light-gray	2	460
Silt, slightly clayey, calcareous, white	2.5	462.5
Silt, slightly sandy, clayey, dark-green	.5	463
Cretaceous—Pierre shale—(Upper Cretaceous):		
Clay, light-greenish-gray; contains limy fragments	5	468
Clay, light-gray with limonitic stain	16.5	484.5
Clay shale, dark-gray	5.5	490

11-18-36cc*. Stevens. Water T. Dunlap and Co. Altitude (from topographic map), 2,280 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Soil and clay	48	48
Clay, blue	6	54
Clay	2	56
Sand, coarse	8	64
Gravel	12	76
Tertiary—Ogallala formation (Pliocene):		
Rock	2	78
Sand	22	100

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
11-18-36cc*—Continued		
Tertiary—Ogallala formation (Pliocene)—Continued		
Sandstone	20	120
Sand	24	144
Limestone	9	153
Sand	11	164
Sand and limestone	4	168
Limestone, hard and soft layers	18	186
12-13-1cc*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,936 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Sand	75	75
Sand, gravel, and clay	40	115
Tertiary—Ogallala formation (Pliocene):		
Silt, blue-green	7	122
Clay, yellow	10	132
Gravel and clay, alternate layers	58	190
Sand	3	193
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, yellow	22	215
Shale, blue-gray	———	———
12-13-20cb*. Urwiller. Woodman Well Co. Altitude (instrument), 2,030.68 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Sand	20	20
Clay	3	23
Sand, fine	17	40
Clay, sandy	6	46
Gravel, fair	4	50
Clay, sandy	3	53
Sand, fine	1	54
Clay, sandy	4	58
Clay, blue	2	60
Sand, good	2	62
Sand, fine	8	70
Sand, good	6	76
Gravel and clay	2	78
Clay, blue	9	87
Sand, good	4	91
Sand, fine	3	94
Clay	2	96
Sand, fine	4	100
Clay	8	108
Sand, fine	4	112
Sand, good	7	119
Tertiary—Ogallala formation (Pliocene):		
Sand, packed, good	9	128
Clay	5	133
Sand, packed, good	7	140
Sandstone	5	145
Sand, packed	9	154
Clay, mixed	4	158
Clay	1	159
Sandstone	4	163
Sand, packed	3	166
???	2	168
Sandstone, packed	6	174
Sandstone	6	180

Table 7.— *Logs of test holes and wells*— Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
12-13-20cb*—Continued		
Tertiary—Ogallala formation (Pliocene)—Continued		
Rock	1	181
Limestone	3	184
Lime sand	4	188
Sandstone, soft	1	189
Rock	1.5	190.5
Limestone, good	1.5	192
Rock	2	194
Limestone, good	8	202
Sandstone, good	5	207
12-15-12ba. Altitude (instrument), 2,013.68 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Sand, silty, dark-brownish-gray	1	1
Soil: silt, sandy, dark-brown	1.5	2.5
Silt, sandy, light-brownish-gray; contains small limy nodules and fragments of gastropods and pelecypods	2.5	5
Sand, medium- to coarse-grained; contains rounded clay granules	3	8
Sand, medium-grained,to medium-grained gravel; contains some clay and bluish-gray silt	12	20
Gravel, fine- to medium-grained; contains many rootlets	5	25
Sand, bluish-gray; contains interbedded clay, bluish-gray	5	30
Clay, medium-gray with a green tint	4	34
Clay and peat, brown	9.5	43.5
Sand, medium- to coarse-grained; contains some fine- to medium-grained gravel, bluish-gray; contains clay granules	6.5	50
Gravel, medium- to coarse-grained, pink to yellow	18	68
Tertiary—Ogallala formation (Pliocene):		
Sand, silty, slightly consolidated, light-greenish-gray	17	85
Silt, slightly sandy, light-greenish-gray	6	91
Sandstone, slightly silty, greenish-gray	14	105
Sand and slightly consolidated sandstone, brownish-gray to green	12	117
Silt and sandstone, greenish-gray; contains limy layers	8	125
Sandstone, interbedded with silty, sandy,and limy layers, greenish-gray to brownish-gray; contains a few rootlets	100	225
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-gray in part yellowish-orange; contains some bentonitic material	13	238
Clay, slightly calcareous, medium-gray	22	260
Clay, calcareous, dark-gray	10	270
12-15-14ab. Altitude (instrument), 2,089.70 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, clayey to sandy, dark-brownish-gray	2	2
Clay, silty, buff-gray with limonitic stain	2	4
Sand, fine to coarse, brownish-gray	20	24
Clay, light-gray with some limonitic stain	1	25
Sand, fine- to medium-grained, brownish-gray	7.5	32.5
Clay, light-gray with some limonitic stain	.5	33
Sand, fine- to medium-grained, brownish-gray	5	38
Clay, slightly silty; contains limonitic fragments	2	40
Sand, fine- to medium-grained, light-gray	2.5	42.5
Clay, slightly silty, light-gray	5.5	48
Sand, fine- to medium-grained, brownish-gray	8	56
Silt, clayey, light-gray to dark-gray with limonitic stain; contains some peat	4	60
Sand, medium-grained, brownish-gray	7	67
Clay, slightly silty, medium-blue-gray; contains a few wood fragments	8	75
Silt, clayey, peaty, dark-blue-gray; contains many wood fragments	13	88
Sand, medium-grained, brownish-gray with blue tint	32	120

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
12-15-14ab—Continued		
Quaternary—Pleistocene and Recent: Gravel, medium- to coarse-grained, greenish-gray with some pink grains	7	127
Tertiary—Ogallala formation (Pliocene):		
Silt, slightly clayey, calcareous, light-gray	3	130
Silt, very fine sandy, calcareous, medium-gray	10	140
Sand, fine, silty, brownish-gray to gray	17	157
Sandstone, slightly consolidated, fine-grained, grayish-buff	3	160
Sand and slightly consolidated sandstone, fine- to medium-grained, light-brown	50	210
Gravel, fine- to medium-grained, and some coarse sand, yellow to pink	30	240
Sand, coarse, to fine gravel, greenish-gray to pinkish-gray; contains many limy fragments	10.5	250.5
Sand, very fine to fine, silty, light-brownish-gray to greenish-gray; contains limy layers	38.5	289
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, green	1	290
Clay, light-gray to medium-gray; contains some limonitic stain	13	303
Clay, black; contains some bentonitic material	38	341
Clay shale, black	4	345
Clay shale, moderately calcareous, dark-gray	15	360
12-15-22ab. Altitude (instrument), 2,122.97 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, dark-brown	8	8
Silt, slightly clayey, light-brownish-gray	9.5	17.5
Silt, slightly clayey, soil-like brownish-gray	1	18.5
Silt, clayey, light-buff-gray to light-gray; contains limonitic stain and nodules	6.5	25
Silt, light-buff to light-gray	15	40
Silt, slightly sandy to very sandy, light-gray	10	50
Sand, fine, silty, light-buff-gray to light-gray	20	70
Sand and silty sand, buff-gray to gray	15	85
Sand and silty sand, tannish-gray to brown	27	112
Tertiary—Ogallala formation (Pliocene):		
Silt to sandy silt, brown; contains shell fragments	4.5	116.5
Silt, sandy, calcareous, light-gray to buff	3.5	120
Silt, sandy, greenish-gray	9	129
Sand, medium- to coarse-grained, brown	6	135
Sand, silty, greenish-gray to buff	4	139
Sand, medium- to coarse-grained, brown to gray	10.5	149.5
Silt, slightly sandy, greenish-gray to gray	33.5	183
Sand and silty sand, brownish-gray	29.5	212.5
Sand, fine to coarse, brownish-gray	5.5	218
Gravel, fine to coarse, light-brownish-gray to pink; contains clayey silt layers	70	288
Silt, slightly sandy, greenish-gray	4	292
Sandstone, calcareous; light-gray to brownish-gray	3	295
Siltstone, slightly calcareous, light-brownish-gray to greenish-gray	2	297
Silt, slightly sandy, light-greenish-gray to brownish-gray	7	304
Sand, fine- to medium-grained, brownish-gray	4	308
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-gray with a green tint, with limonitic stain	14	322
Clay, black with some orange weathered material	3	325
Clay shale, black	15	340

Table 7.—*Logs of test holes and wells*— Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
12-15-28bd. Altitude (instrument), 2,056.75 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, very sandy, dark-brown to black	0.5	0.5
Sand, medium-grained, slightly silty, buff-gray	1.5	2
Sand, medium-grained, light-brownish-gray	8	10
Gravel, fine- to medium-grained, medium-gray to brownish-gray	13	23
Silt, sandy, light-bluish-green	5	28
Sand, silty, buff-gray with green tint	12	40
Sand, in part silty, light-brownish-gray	7	47
Tertiary—Ogallala formation (Pliocene):		
Sand and silty sand, interbedded, brownish-gray	11	58
Sand to silty sand, brownish-gray with green tint; contains many limy nodular fragments	15.5	73.5
Sandstone, silty, calcareous, light-brownish-gray	14.5	88
Sand, medium- to coarse-grained, calcareous, light-brownish-gray	5	93
Sandstone, consolidated, brownish-green	7	100
Silt, grayish-green to green; contains sandy layers	13	113
Marl, tannish-gray	3	116
Silt, clayey, grayish-green to green; contains interbedded volcanic ash	3.5	119.5
Sandstone, fine- to medium-grained, brownish-gray with a green tint	10.5	130
Sand, medium- to coarse-grained, brownish-gray with a green tint	26	156
Sand, silty, brownish-gray	20	176
Sandstone, light-buff-gray	34	210
Sand, brownish-gray with some pink grains	13	223
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-gray with limonite stain	15.5	238.5
Clay shale, dark-gray to black with limonitic stain	21.5	260
12-15-31dd. Altitude (instrument), 2,133.44 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil: silt, very sandy, brownish-gray to black	1	1
Sand, light-brownish-gray	2.5	3.5
Silt, clayey, light-brownish-gray; contains limy nodules	12.5	16
Sand, medium- to coarse-grained, light-brownish-gray	81.5	97.5
Clay, peaty, medium-brownish-gray	9	106.5
Sand, fine- to medium-grained, light-gray	3.5	110
Clay, silty, peaty, medium-gray to brown	4.5	114.5
Sand, fine- to medium-grained, light-gray	3.5	118
Clay, silty, light-gray	1.5	119.5
Sand, fine to coarse, light-gray	20	139.5
Tertiary—Ogallala formation (Pliocene):		
Silt, sandy, light-gray with a green tint	5.5	145
Sand, slightly silty, light-brownish-gray with green tint	29	174
Sandstone, slightly consolidated, calcareous, brownish-gray to greenish-gray; contains layers of siltstone and limy layers	116	290
Sand, very fine to medium-grained, silty, brownish-gray	12	302
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, greenish-gray to gray	2.5	304.5
Clay, light-buff-gray; contains limonitic fragments	1.5	306
Clay shale, medium-gray to dark-gray with much brownish-orange stain	4	310
Clay shale, dark-gray to black; contains some bentonitic material and limonitic layers	20	330
12-18-5ab. Altitude (altimeter), 2,218.17 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Sand, silty, light-brownish-gray (road fill)	1	1
Silt, fine to coarse, sandy, medium-brownish-gray	1.5	2.5

Table 7.—*Logs of test holes and wells*— Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
12-18-5ab—Continued		
Quaternary—Pleistocene and Recent—Continued		
Sand, very fine, silty, slightly calcareous, light-brownish-gray	1	3.5
Sand, very fine, silty, slightly calcareous, medium-brownish-gray	1	4.5
Silt, moderately calcareous, light-brownish-gray; contains a few snails	2	6.5
Silt and sandy silt, interbedded, medium-bluish-gray; contains many gastropods	2	8.5
Sand, very fine to coarse, light-gray; contains some gravel, medium	11.5	20
Sand and gravel, fine to coarse, brownish-gray to pink	35	55
Gravel, fine to coarse, and some sand, brownish-gray to pink	15.5	70.5
Tertiary—Ogallala formation (Pliocene):		
Sandstone, very fine to medium-grained, light-gray with green tint	13.5	84
Sandstone, very fine to fine-grained, calcareous, medium-brownish-gray with a green tint	6	90
Sand, fine, to medium-grained gravel, brownish-gray to pink and green; contains silty clay granules and limy granules	25	115
Sandstone, calcareous, white with tan tint; contains many rootlets	17	132
Silt, slightly sandy, white	2.5	134.5
Sandstone, very fine to fine-grained, light-brownish-gray	20.5	155
Siltstone and sandstone, interbedded, greenish-gray	5	160
Sandstone, fine- to coarse-grained, slightly consolidated	15	175
Sandstone, fine- to medium-grained, light-gray and greenish-gray	35	210
Sand, very fine to medium-grained, slightly consolidated, light-brownish-gray	47	257
Sandstone, slightly calcareous, light-brownish-gray; contains rootlets	40.5	297.5
Sandstone, calcareous, white to greenish-gray; contains layers of sandy silt	10.5	308
Sand, fine to coarse, light-brownish-gray	26.5	334.5
Silt, light-gray with a green tint	2.5	337
Sand, fine- to medium-grained, light-brownish-gray	3	340
12-18-17dd. Altitude (instrument), 2,284.44 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, medium-brownish-gray (road fill)	1	1
Silt, dark-brownish-gray	1.5	2.5
Silt, light-brownish-gray	4.5	7
Silt, medium-brownish-gray	3	10
Silt, light-brownish-gray	4	14
Silt, slightly clayey, light-brownish-gray	11	25
Silt, mottled brownish-gray and brown with black spots; contains a trace of sand and gravel	2	27
Clay, silty, light-gray with limonitic stain; contains a few pelecypods	3	30
Sand, fine- to medium-grained, light-gray	3	33
Silt, light-bluish-gray; contains wood fragments	.5	33.5
Sand, fine- to medium-grained, light-gray	1.5	35
Silt, light-bluish-gray; contains peat and wood fragments	10	45
Silt, medium-bluish-gray; contains ostracods and gastropods and a few limy nodules	10	55
Silt and fine sandy silt, interbedded, light-greenish-blue-gray	5	60
Silt, sandy, greenish-blue-gray; contains a few layers of peat	13	73
Sandstone, reworked, and sand and gravel, brownish-gray with some pink grains	2	75
Tertiary—Ogallala formation (Pliocene):		
Sandstone, light-gray with a tan tint; contains some clay particles and silt layers	55	130
Sand, very fine to medium-grained, very silty, light-yellowish-gray	5	135
Sand, fine- to medium-grained, to slightly consolidated sandstone, light-brownish-gray; contains a few rootlets	4	139
Sandstone, very fine to fine-grained, brownish-gray; contains clayey silt and limy layers	25.8	164.8

Table 7.—*Logs of test holes and wells*—Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
12-18-17dd—Continued		
Tertiary—Ogallala formation (Pliocene)—Continued		
Marl, light-tannish-gray	0.3	165.1
Silt, clayey, light-reddish-tan with a gray tint	4.9	170
Sandstone, calcareous, fine- to medium-grained, light-tannish-gray; contains a few rootlets	4	174
Silt, clayey, white	1	175
Sandstone, light-reddish-tan to tannish-gray; contains layers of sandy silt	15	190
Sand, fine- to medium-grained; contains hard limy particles	20	210
Sandstone, calcareous, and sand, fine- to medium-grained, interbedded, tannish-gray	20	230
Sandstone, calcareous, fine- to medium-grained, light-grayish-tan	20	250
Sandstone, light-greenish-gray, and sandstone, calcareous, light-gray, interbedded; contains white clay layer at 260 ft	23.5	273.5
Silt, light-gray	3.5	277
Sandstone, gray to greenish-gray to light-tannish-gray; contains some gravel	33	310
Sandstone and silt, sandy, interbedded, light-tannish-gray	28	338
Sand, fine- to medium-grained, silty, light-gray	12	350
Sandstone, silty sand, and sand, interbedded, moderately calcareous, light-tannish-gray	55	405
Siltstone, interbedded with calcareous silt, light-greenish-gray	25	430
Silt, slightly clayey to sandy, grayish-white; contains layers of siltstone	20	450
Sand, fine- to medium-grained, medium-grayish-tan	11.5	461.5
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, moderately calcareous, light-grayish-tan	4.5	466
Clay shale, moderately calcareous, medium-gray with a brown tint	14	480

12-18-32ad. Altitude (instrument), 2,403.64 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Silt, sandy, dark-brown	1	1
Silt, dark-brownish-gray	1.5	2.5
Silt, slightly clayey, medium-brownish-gray	2.5	5
Silt, medium-buff	37	42
Silt, dark-reddish-brown	3	45
Silt, slightly clayey, light-reddish-tan	15	60
Silt, slightly clayey to fine sandy, light-tan	8	68
Sand, fine- to medium-grained, silty, light-grayish-tan	4.5	72.5
Sand, fine- to medium-grained, light-reddish-tan	9	81.5
Silt, slightly sandy, medium-grayish-brown	1.5	83
Sand, slightly silty, light-grayish-tan	8	91
Silt, light-grayish-tan	7	98
Silt, sandy to fine gravelly, light-reddish-tan	10	108
Sand, medium-grained, to medium-grained gravel, gray, orange, and pink	11	119
Silt, sandy, light-gray	5	124
Sand, medium- to coarse-grained, silty, medium-grayish-brown	1	125
Sand, medium-grained, to fine gravel, gray, orange, and pink	36	161
Tertiary—Ogallala formation (Pliocene):		
Silt, fine-sandy, light-gray to grayish-tan	12.5	173.5
Sandstone, calcareous, medium-brown	5	178.5
Silt, fine-sandy to fine-gravelly	6.5	185
Silt, fine-sandy to fine-gravelly	11	196
Sandstone, fine- to medium-grained, brown	9.5	205.5
Silt, fine-sandy, light-grayish-tan to reddish-tan	1.5	207
Silt, fine-sandy, light-gray	3	210
Sandstone, fine-grained, medium-grayish-tan; contains hard limy layers	8.5	218.5
Silt, sandy, medium-grayish-tan	3.5	222
Sand, fine, to medium-grained gravel, gray-tan to pink	11.5	233.5
Silt, sandy, and interbedded sandstone	11	244.5

Table 7.—*Logs of test holes and wells*— Continued

BUFFALO COUNTY—Continued

	Thickness (feet)	Depth (feet)
12-18-32ad—Continued		
Tertiary—Ogallala formation (Pliocene)—Continued		
Sand, medium-grained, to gravel, coarse; yellow, pink, and brown	31.5	276
Sand, silty, light-brownish-gray	5.5	281.5
Sand, fine to coarse, and fine gravel, brownish-gray to pink	4.5	286
Sandstone, light-gray to light-brownish-gray	14	300
Sand, medium-grained, to fine gravel, grayish-tan to pinkish-tan	20	320
Marl, light-gray to white	2.5	322.5
Sandstone, calcareous, light-gray with a tan tint	3.5	326
Sand, fine, silty, light-gray	4	330
Sand, very fine to medium-grained, slightly silty, light-grayish-tan	30	360
Sand, fine- to medium-grained with a trace of coarse, light-grayish-tan	26	386
Sand, medium- to coarse-grained, grayish-tan	6.5	392.5
Sand, very fine to medium-grained, slightly silty, light-brownish-gray; contains some limy rootlets	51.5	444
Silt, sandy, to calcareous sandstone, tannish-gray	3.5	447.5
Sand, fine- to medium-grained, tannish-gray	10.5	458
Sandstone, silty, calcareous, light-gray to greenish-gray	7.5	465.5
Sand and sandstone	4.5	470
Sand, fine- to medium-grained, tannish-gray	6.5	476.5
Sandstone, calcareous, light-gray	3.5	480
Sand, fine- to medium-grained, tannish-gray	7	487
Cretaceous—Pierre shale (Upper Cretaceous): Clay shale, dark-gray to black	23	510

CUSTER COUNTY

13-18-33ad*. Ohio Oil Co. Altitude (instrument), 2,275 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Silt, dark-brown to light-brown	10	10
Sand, silty, and clay, blue-gray	40	50
Clay, silty, blue-gray	20	70
Clay, silty to sandy, blue-gray	20	90
Sand, fine- to medium-grained, clayey to silty, light-blue-gray	40	130
Sand and gravel, silty	8	138
Tertiary—Ogallala formation (Pliocene):		
Sand, silty, to sandy silt, light-brown	12	150
Sandstone, light-brown	10	160
Sand, silty to clayey, light-greenish-gray	10	170
Sand, clayey, light-yellow to brown	20	190
Sand, slightly silty, grading to fine- to medium-grained sand	10	200
Sand, slightly silty, very fine to medium-grained	10	210
Sand, moderately silty, very fine to medium-grained, light-brown	20	230
Sand, very fine to medium-grained, silty, alternating with light-greenish-gray sandstone	45	275
Sandstone, light-greenish-gray	25	300
Sand, very silty, light-brown	10	310
Sand, slightly silty, light-brown; contains some limonite-stained clayey sand from 330 to 340 ft	50	360
Sand, silty to clayey	10	370
Sand, slightly silty	20	390
Marlite, white	10	400
Sand, silty, calcareous, light-brown, slightly clayey below 410 ft	31	431
Silt, sandy, limonite-stained, some pebbles	1	432
Cretaceous—Pierre shale (Upper Cretaceous): Shale, black	10	442

13-19-31dc. Altitude (instrument), 2,445.17 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Silt, medium- to light-grayish-brown	1	1
Silt, medium- to dark-grayish-brown	4	5

Table 7.—*Logs of test holes and wells*—Continued

CUSTER COUNTY—Continued

	Thickness (feet)	Depth (feet)
13-19-31dc—Continued		
Quaternary—Pleistocene and Recent—Continued		
Silt, light-grayish-brown	4	9
Silt, light-yellowish-gray	8	17
Silt, medium-yellowish-buff	3	20
Sand, fine- to medium-grained, light-yellowish-gray	1	21
Silt, light-gray with pink to yellow tint	9	30
Sand, fine, silty, light-gray with pink tint	20	50
Silt, sandy, light-gray	2.5	52.5
Sand, fine, light-gray	7.5	60
Silt, fine-sandy, light-gray with a tan tint	10	70
Silt, light-gray; contains a few limy nodules	10	80
Silt, slightly clayey to sandy, light-pinkish-gray	7	87
Sand, fine- to medium-grained, slightly silty; contains a trace of gravel	3	90
Silt, slightly clayey; contains a trace of sand	7.5	97.5
Gravel, fine to coarse, gray, yellow and pink	19.5	117
Tertiary—Ogallala formation (Pliocene):		
Silt, slightly clayey to sandy, light-gray with a pink tint	2	119
Sand, fine to coarse, and some fine gravel	9	128
Silt, slightly clayey; contains some sand, slightly calcareous, light-gray	2	130
Silt, calcareous, to marl, white	3	133
Silt, slightly clayey, calcareous, light-gray to medium-reddish-gray to brown	4	137
Silt, medium-reddish-brown	9	146
Silt, slightly clayey to medium-sandy, light-gray; contains a few hard limy particles	16	162
Silt, slightly clayey, light-gray; contains some sand	4	166
Silt, slightly clayey to medium-sandy, moderately calcareous, grayish-white	8	174
Sandstone, fine- to medium-grained, grayish-tan	3	177
Silt, sandy, slightly clayey, light-gray	5.5	182.5
Sandstone, fine- to medium-grained, light-grayish-tan; contains interbedded hard layers below 204.5 ft	29	211.5
Silt, slightly clayey to medium-sandy, light-gray with a yellow tint	6	217.5
Sandstone and some fine gravel, gray to greenish-tan	2.5	220
Sand, fine, to fine gravel, grayish-tan to pink	20	240
Sand, fine to coarse, light-gray to tan	10	250
Sand, coarse, to medium-grained gravel, gray, yellow and pink	6	256
Sand, slightly silty, medium- to coarse-grained, with some limy fragments, light-tannish-gray to pink	4	260
Sand, fine- to medium-grained, slightly silty, grayish-tan; contains a few limy fragments and limy silt layers	15	275
Claystone, light-greenish-gray	5	280
Sandstone, fine- to medium-grained, light-greenish-gray	2	282
Claystone, light-grayish-green to medium-reddish-brown	8	290
Sand, fine- to medium-grained, light-grayish-tan	6	296
Silt, slightly clayey, light-gray	1	297
Sand, fine- to medium-grained, and sandstone, in part cemented with lime, light-tan to grayish-tan	43	340
Sandstone and limy sandstone, interbedded, light-gray to tan	15	355
Sand, fine- to medium-grained, light-gray; contains clay particles	28	383
Silt, slightly clayey, light-gray with a green tint	6.5	389.5
Sand, fine to coarse, light-gray with a tan tint	30.5	420
Silt, fine, slightly clayey, calcareous, light-gray	2	422
Sand, fine- to medium-grained, light-gray with a green tint; contains clay particles	18	440
Claystone, light-greenish-gray	10	450
Sand, medium- to coarse-grained; composed of claystone particles, greenish-gray	10	460
Tertiary—Brule formation? (Oligocene):		
Claystone and sandy particles, light-gray to green	6	466
Siltstone, sandy, medium-reddish-brown	4	470
Siltstone, light-grayish-green	10	480

Table 7.—*Logs of test holes and wells*—Continued

CUSTER COUNTY—Continued

	Thickness (feet)	Depth (feet)
13-19-31dc—Continued		
Tertiary—Brule formation? (Oligocene)—Continued		
Silt, clayey, light-grayish-tan	50	530
Silt, slightly sandy, light-gray to white	11.5	541.5
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-gray with some limonitic stain	11	552.5
Clay shale, dark-brown to black	7.5	560
13-20-13ca*. Sinclair-Prairie Oil Co. Altitude, 2,377 feet above mean sea level		
Quaternary—Pleistocene and Recent: Silt	60	60
Tertiary—Ogallala formation (Pliocene): Sandstone, silt, sand, and some gravel	470	530
Cretaceous—Pierre shale (Upper Cretaceous): Shale, black	----------	------
13-21-32cc. Altitude (instrument), 2,675.97 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, dark-brownish-gray	3	3
Silt, granular, light-grayish-buff	42	45
Silt, very fine to coarse—sandy, light-grayish-buff	12.5	57.5
Silt, soil-like, dark-reddish-brown	2.5	60
Silt, light-reddish-buff	27	87
Silt, slightly clayey, light-gray with a buff tint	1	88
Silt, medium-grayish-buff	4.5	92.5
Sand, light-grayish-tan	5	97.5
Silt, medium-grayish-buff; contains a thin soil layer, dark-grayish-brown	2.5	100
Silt, light-grayish-buff; contains limy nodules	45	145
Silt, fine- to medium-sandy, medium-grayish-buff	15	160
Silt, light-gray; contains a hard layer at 169 ft	15	175
Silt, slightly clayey to fine—sandy; contains hard layers	25	200
Silt and calcareous silt, interbedded, light-gray	27.5	227.5
Silt, slightly clayey to sandy, medium-grayish-tan	12.5	240
Silt, fine-sandy, interbedded with marl, light-grayish-brown	10	250
Sand, coarse, to coarse gravel, gray, yellow, orange, and reddish-brown	20	270
Sand, fine, to medium-grained gravel; contains a few fragments of light-gray silt at 309 ft	40	310
Sand, fine to coarse, and some fine gravel, grayish-tan to pinkish-tan	5	315
Sand, medium-grained, to medium-grained gravel; contains thin silt layers	3	318
Tertiary—Ogallala formation (Pliocene):		
Silt, light-reddish-tan to grayish-tan	2	320
Silt and fine sand, interbedded, light-pink	20	340
Sand, fine, silty; contains hard calcareous layers	13	353
Sandstone, fine- to medium-grained, light-gray to reddish-tan	4	357
Silt, fine-sandy, light-gray	3	360
Sand, silty, light-grayish-tan	2.5	362.5
Sand, fine- to medium-grained, light-grayish-tan	22	384.5
Silt, slightly clayey, light-grayish-white	7.5	392
Sandstone, fine- to medium-grained, light-grayish-tan	24	416
Sand, fine to coarse, brownish-gray	7	423
Sand, silty	1.5	424.5
Silt, calcareous, to marl, light-gray to white	4.5	429
Sandstone, fine-grained, light-brown	2	431
Silt with hard limy layers, light-gray	11	442
Sand, fine, light-grayish-tan	4	446
Silt, fine-sandy, light-gray with a tan tint	2	448
Marl, light-gray to white	2	450
Sandstone, fine-grained, light-tan	5	455

Table 7.—*Logs of test holes and wells*—Continued

CUSTER COUNTY—Continued

	Thickness (feet)	Depth (feet)
13-21-32cc—Continued		
Tertiary—Ogallala formation (Pliocene)—Continued		
Marl, light-bluish-gray to light-gray	5	460
Sandstone, fine-grained, light-tan	27.5	487.5
Sand, silty, calcareous, light-gray to light-tan	6.5	494
Marl, light-bluish-gray	1	495
Sandstone, fine, silty, calcareous, light-grayish-tan to white	7.5	502.5
Marl, light-bluish-gray	2.5	505
Sandstone, fine- to medium-grained, silty, light-tan	81	586
Marl, silty, light-gray	9	595
Tertiary—Brule formation (Oligocene):		
Clay, silty, light-tannish-gray	3	598
Silt, clayey, brownish-gray	39	637
Marl, dendritic pattern	1	638
Siltstone, medium-brownish-gray	7	645
13-21-36ca*. Line. Walter T. Dunlap and Co. Altitude (instrument), 2,480.06 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil and clay	45	45
Sand, fine	10	55
Clay, blue	30	85
Sand, fine	7.5	92.5
Sand and gravel	28.5	121
Tertiary—Ogallala formation (Pliocene): Clay	2	123

DAWSON COUNTY

8-20-1ca. Altitude (altimeter), 2,308.5 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Silt, very fine sandy, dark-brownish-gray	1	1
Sand, very fine to medium-grained, silty, light-buff-gray	.5	1.5
Sand, fine to coarse, and some fine to coarse gravel, brownish-gray with some pink grains	3.5	5
Sand, medium-grained to coarse gravel, brownish-gray with some pink grains	32	37
Tertiary—Ogallala formation (Pliocene):		
Silt, moderately sandy, fine- to medium-grained, reddish-tan to light-gray	3	40
Sand, fine, to medium-grained gravel, brownish-gray with some pink grains	3.5	43.5
Silt to siltstone, light-brownish-gray	1	44.5
Siltstone to sandstone, light-brown with a green tint	2.5	47
Silt, slightly clayey to sandy, light-greenish-gray	2	49
Sand, silty, to sandstone, light-brownish-gray with a green tint	2	51
Sandstone, very fine to fine-grained, silty, light-greenish-gray to brownish-gray; contains fossil rootlets	23	74
Silt, moderately sandy, greenish-gray	2.5	76.5
Sandstone, calcareous, brownish-gray	6.5	83
Silt, slightly to moderately sandy, brownish-gray with green tint	3	86
Sandstone, calcareous, light-brownish-gray	4	90
Siltstone, sandy, calcareous, white	1	91
Sandstone, very fine to fine-grained, brownish-gray; contains fossil seeds	2	93
Sandstone, fine- to medium-grained, calcareous, light-gray to brownish-gray	4	97
Silt, very fine to fine-sandy, brownish-gray	4	101
Silt, clayey, reddish-tan	5	106
Marl, light-pinkish-gray	2.5	108.5
Clay, silty, reddish-tan; contains thin limy layers	17.5	126

Table 7.—*Logs of test holes and wells*—Continued

DAWSON COUNTY—Continued

	Thickness (feet)	Depth (feet)
8-20-1ca—Continued		
Tertiary—Ogallala formation (Pliocene)—Continued		
Sandstone, slightly consolidated, light-brownish-gray; contains rootlets and fossil seeds	5	131
Sand, fine, to medium-grained gravel, brownish-gray with some pink grains	6	137
Sandstone, moderately calcareous, light-greenish-gray	4	141
Silt, very sandy, light-greenish-gray	2.5	143.5
Sandstone, moderately calcareous; contains silt layers, light-greenish-gray to brownish-gray	21.5	165
Sand, fine, to medium-grained gravel, brownish-gray with some pink and green grains	8	173
Sandstone and silt, calcareous, light-greenish-gray; contains a few rootlets	87	260
Marl, white	1	261
Silt, calcareous, white	2	263
Silt, clayey to sandy, light-greenish-gray; contains limy layers	18	281
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-gray with iron stain	26	307
Clay shale, medium-gray with iron stain	3	310
Clay shale, medium-gray to dark-gray	10	320
9-20-13dd. Altitude (instrument), 2,317.95 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, dark-gray (road fill)	0.5	0.5
Soil; silt, dark-brownish-gray	2	2.5
Silt, slightly clayey, light-tannish-gray	7	9.5
Sand, fine, to coarse gravel, light-gray; contains a limy layer at 37 ft	32.5	42
Tertiary—Ogallala formation (Pliocene):		
Sandstone, light-brown with a green tint	4	46
Silt, fine- to coarse-sandy, and sandstone interbedded, light-gray with a green tint	4	50
Sandstone with interbedded sandy silt, light-greenish-gray with a brown tint; contains limy nodules and rootlets	36	86
Sand, very fine to coarse and some fine- to medium-grained gravel, light-tannish-gray; contains limy nodules	9.5	95.5
Sandstone, fine- to coarse-grained, light-gray with a green tint; contains rootlets and limy nodules	54.5	150
Sandstone, calcareous, light-gray with green tint	20	170
Sandstone with interbedded fine-sandy silt and limy layers, light-gray with a green tint	46	216
Sand, fine- to medium-grained, silty, with interbedded sandstone, light-brownish-gray with a green tint	34	250
Sandstone, calcareous, with interbedded fine-sandy silt, light-brownish-gray	6	256
Silt, clayey to sandy, calcareous, light-gray with green tint; contains some interbedded sandstone	36	292
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-tannish-gray with limonitic stain	11	303
Clay, slightly calcareous, light-gray	7	310
Clay, slightly silty, medium-gray to dark-gray	10	320
9-22-1db. Altitude (from topographic map), 2,407 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil	4.5	4.5
Sand and gravel	3.5	8
Gravel, fine to coarse	17	25
Clay, calcareous, light-gray	3.5	28.5
Clay, sandy, greenish-gray	6.5	35

Table 7.—*Logs of test holes and wells*— Continued

DAWSON COUNTY—Continued

	Thickness (feet)	Depth (feet)
9-22-1db—Continued		
Quaternary—Pleistocene and Recent—Continued		
Clay, sandy, brown	2	37
Sand and gravel, calcareous	3	40
Tertiary—Ogallala formation (Pliocene):		
Sandstone, brown	3	43
Clay, sandy, greenish-gray	3	46
Clay, sandy, calcareous, light-green and light-reddish-brown	4	50
Sandstone, light-reddish-brown	5	55
Sand, clayey, reddish-brown	9.5	64.5
Clay, sandy, greenish-gray and reddish-brown	3.5	68
Clay, sandy, calcareous, gray	5	73
Sandstone, calcareous, gray	4	77
Gravel, fine to coarse, red, cemented with lime	12	89
Sandstone, brown	5	94
Sandstone; contains some gravel, fine	9.5	103.5
Sandstone, gray	8.5	112
Sandstone, greenish-gray	1.5	113.5
Clay, calcareous, light-gray	3.5	117
Sand, calcareous	5	122
Sandstone, greenish-gray	9	131
Clay, slightly sandy, reddish-brown	12	143
Sandstone, calcareous, greenish-gray; contains fossil stems	13	156
Sand, calcareous	3	159
Clay, sandy, brown	6	165
Clay, sandy, calcareous, light-gray to brown	5	170
Sandstone, light-green	11	181
Clay, sandy, calcareous	4	185
Sandstone, and fine gravel, red	13	198
Sandstone, calcareous, brown to gray	2	200
Gravel, fine- to medium-grained, red and green; contains some sandstone	19	219
Sand, silty, light-green	4	223
Sandstone, greenish-gray	11	234
Sandstone, green, and sand, calcareous	3	237
Gravel, fine, and sandstone, light-green	9	246
Gravel, fine to coarse, slightly calcareous, red and green	8	254
Clay, calcareous	5	259
Gravel, fine- to medium-grained, slightly calcareous, green and red	11	270

9-22-24dd. Altitude (instrument), 2,389.90 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Soil: silt, dark-brownish-gray	1	1
Sand, silty, light-gray with limonitic stain	2	3
Sand, coarse, to gravel, coarse, gray, yellow and pinkish-brown	29.5	32.5
Tertiary—Ogallala formation (Pliocene):		
Silt, light-brown to pinkish-gray	1	33.5
Silt, fine- to coarse-sandy, light-gray	2	35.5
Marl, light-gray	.5	36
Sandstone, fine- to medium-grained, dark-reddish-brown	6	42
Sand, coarse, to medium-grained gravel, reddish-brown	12	54
Silt and sandstone, interbedded, light-gray to light-pinkish-gray	16	70
Sandstone, fine- to medium-grained, light-brown to light-greenish-tan; contains calcareous layers	70	140
Siltstone to clay stone, light-brown	2	142
Sand, fine to coarse, light-grayish-brown	8	150
Sandstone with hard calcareous layers, light-grayish-brown	60	210
Sand, fine to medium, light-grayish-tan	75	285
Sandstone, fine- to medium-grained, light-grayish-brown with a pink tint	24	309
Silt, light-gray	1	310

Table 7.—*Logs of test holes and wells*— Continued

DAWSON COUNTY—Continued

	Thickness (feet)	Depth (feet)
9-22-24dd—Continued		
Tertiary—Ogallala formation (Pliocene)—Continued		
Silt, fine, light-gray with a pink tint	47	357
Sandstone, fine- to medium-grained, light-gray to greenish-gray	9	366
Silica?, very hard, (no sample obtained)	1	367
10-19-14bb*. Carter Oil Co. Altitude, 2,443.00 feet (instrument) above mean sea level		
Quaternary—Pleistocene: Silt, sand in lower part	145	145
Tertiary—Ogallala formation (Pliocene): Sandstone, silt, sand, and some gravel	370	515
Cretaceous—Pierre shale (Upper Cretaceous): Shale, black	----------	------
10-19-19bb. Altitude (instrument), 2,467.16 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil; silt, dark-brownish-gray	1.5	1.5
Silt, granular, medium-brownish-gray	.5	2
Silt, slightly clayey, brownish-buff with gray tint; contains snail fragments	5	7
Silt, light-gray with a buff tint; contains a few rootlets	8	15
Silt, fine-sandy, buff-gray	8.5	23.5
Silt, very fine to fine-sandy, light-reddish-tan with a gray tint; contains limy nodules	11	34.5
Silt, slightly clayey, light-reddish-tan with a thin gray layer	5.5	40
Silt, calcareous, light-gray with a tan tint	4.5	44.5
Silt, moderately clayey, reddish-tan	5.5	50
Silt, slightly clayey to slightly sandy, light-reddish-tan	6	56
Silt, moderately clayey, light-gray	3.5	59.5
Silt, very fine to fine-sandy, light-brown with a gray tint; contains a few rootlets and limy fragments	41	100.5
Silt, slightly clayey to sandy, light-brown	13	113.5
Silt, light-brown	1.5	115
Sand, very fine to fine, very silty, light-brown with a gray tint	3.5	118.5
Silt, moderately clayey to sandy, tannish-gray	1.5	120
Silt, very fine to medium-sandy, light-tannish-gray	14.5	134.5
Silt, slightly clayey, light-brown	15.5	150
Silt, light-brown	20	170
Silt, moderately sandy and gravelly, brownish-gray	7.5	177.5
Sand, fine, to fine gravel, light-brownish-gray to pinkish-gray	7.5	185
Tertiary—Ogallala formation (Pliocene):		
Silt, fine- to medium-sandy, calcareous, light-gray	15	200
Sandstone, fine- to coarse-grained, calcareous, light-gray	2	202
Silt, fine- to medium-sandy, light-gray to tannish-gray	4	206
Sandstone, fine- to medium-grained, reddish-tan	4.5	210.5
Silt, slightly clayey to sandy, pinkish-tan	7.5	218
Sand, fine, to medium-grained gravel, brownish-gray to pinkish-gray	21	239
Sandstone, very fine to medium-grained, brownish-gray	8.5	247.5
Silt, sandy, light-brownish-gray	1.5	249
Sandstone, calcareous, white to light-brown	10	259
Silt, fine-sandy to medium-gravelly, reddish-tan	9	268
Sand, fine, to medium-grained gravel, brownish-gray to pink	25	293
Silt, brown; contains a limy layer at 293 ft	1	294
Sand, fine, to fine gravel, brownish-gray to pink	11	305
Silt, very fine to fine-sandy, reddish-tan	5	310
Silt, clayey to sandy, reddish-tan; contains limy layers	7.5	317.5
Silt, fine-sandy, calcareous, brownish-gray	5.5	323
Sandstone, very fine to medium-grained, yellowish-gray	2	325
Sand, fine- to medium-grained gravel, brownish-gray	8	333
Sand, fine- to medium-grained, silty, light-gray to pink to light-tannish-gray	7	340

Table 7.—*Logs of test holes and wells*—Continued

DAWSON COUNTY—Continued

	Thickness (feet)	Depth (feet)
10-19-19bb—Continued		
Tertiary—Ogallala formation (Pliocene)—Continued		
Sandstone, fine- to medium-grained, calcareous, white to light-brownish-gray to greenish-gray	30	370
Sandstone and silt, calcareous, interbedded, light-brownish-gray to greenish-gray	5.5	375.5
Marl, white	1.5	377
Sandstone, and silty sand, interbedded, light-brownish-gray to greenish-gray	43	420
Sand, fine- to medium-grained, light-brownish-gray	16	436
Silt, clayey to sandy, light-gray	4	440
Sandstone and silt, calcareous, white to greenish-gray	5	445
Sand, fine to coarse, brownish-gray; contains limy fragments and some fine- to medium-grained gravel	15	460
Sandstone, very fine to medium-grained, calcareous, light-gray	4.5	464.5
Marl, sandy, white to yellowish-gray; contains silt layers	17.5	482
Silt, very fine sandy, light-brown; contains limy layers	4.5	486.5
Silt, moderately sandy, light-brownish-gray	3.5	490
Sand, fine, to medium-grained gravel, silty, brownish-gray	4	494
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, mottled yellowish-buff and light-gray	20	514
Clay shale, calcareous, light-gray to medium-gray	13	527
Clay shale, moderately calcareous, dark-gray	3	530
10-19-22dc*. Nelson. Cornhusker Well and Supply Co. Altitude (from topographic map), 2,375 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil and clay	70	70
Shale, white, and sand	7	77
Clay, blue	17	94
Sand, coarse, and gravel	11	105
Tertiary—Ogallala formation (Pliocene):		
Clay, white	6	111
Magnesia rock	9	120
Magnesia clay	20	140
Sand, coarse	4	144
Magnesia rock	3	147
Sand, fine	6	153
Magnesia rock	5	158
Magnesia clay, hard	9	167
Clay, sandy, and hard stone	43	210
Sand, coarse, and gravel, small	17	227
Lime rock and clay, light-red	3	230
Limestone, hard in spots	110	340
Sand, fine	15	355
Clay, white	5	360
10-20-1ad. Altitude (instrument), 2,441.71 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil; silt, medium-brownish-gray	1	1
Silt, medium-grayish-brown	3	4
Silt, light-buff-gray with limonitic stain; contains a few rootlets	11	15
Silt, light-gray	9.5	24.5
Silt, slightly clayey, medium-reddish-brown	11.5	36
Silt, dark-reddish-brown	8	44
Silt, slightly peaty, dark-brown	2	46
Silt, light-reddish-brown	41	87
Silt, medium-brown to light-gray	19	106
Marl	1.5	107.5

Table 7.—*Logs of test holes and wells*—Continued

DAWSON COUNTY—Continued

	Thickness (feet)	Depth (feet)
10-20-1ad—Continued		
Quaternary—Pleistocene and Recent—Continued		
Silt, slightly clayey, light-reddish-brown	24.5	132
Sand, coarse, to medium-grained gravel, pink, yellow to black	8	140
Sand, coarse, to coarse gravel, gray, yellow to pink	24	164
Tertiary—Ogallala formation (Pliocene):		
Silt, slightly sandy, calcareous, light-gray and pink	6	170
Sandstone, fine- to medium-grained, calcareous, light-gray with a tan tint	6	176
Sand, coarse, to medium-grained gravel, gray, yellow and pink	6	182
Silt, yellowish-gray with white layers; contains very fine sand	8	190
Silt, calcareous, and sandstone, interbedded, light-gray to white	4	194
Sandstone and interbedded silt, calcareous, light-gray to greenish-gray	56	250
Sandstone, medium-reddish-brown; contains limy sandstone layers	30	280
Silt, calcareous, light-gray	3	283
Sand, fine- to medium-grained	7	290
Silt, fine-sandy, calcareous	16	306
Sandstone, fine- to medium-grained, moderately calcareous, light-gray with green to tan tint	37	343
Silt, slightly sandy, calcareous; contains thin hard limy layers	4	347
Sandstone, fine- to medium-grained, light-grayish-tan with a green tint	13	360
Sand, fine- to medium-grained, light-grayish-tan	6	366
Silt, light-greenish-gray	1	367
Sand, fine- to medium-grained, medium-grayish-tan; contains silt layers	49	416
Sandstone and silt, sandy, interbedded, light-grayish-green	4	420
Sand, fine- to medium-grained, light-greenish-tan	7	427
Marl and sandstone, interbedded, light-gray	18	445
Sand, fine- to medium-grained, light- to medium-grayish-tan	22	467
Silt, moderately calcareous, medium-gray to white; contains hard limy layers	13	480
Silt, light-grayish-green; contains hard limy layers	10	490
Silt, slightly clayey, moderately calcareous, light-gray	10	500
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-gray with yellow stain	4	504
Clay shale, dark-brown to black	7	511
10-20-36dd. Altitude (altimeter), 2,342.3 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, dark-brownish-gray	2	2
Silt, brownish-buff	1	3
Silt, slightly sandy, light-buff to tannish-gray	2.5	5.5
Silt, brownish-buff with a gray tint	4.5	10
Silt, slightly to moderately clayey, light-brown with a gray tint	5	15
Silt, fine- to coarse-sandy, calcareous, light-gray	4.5	19.5
Sand, medium-grained, to coarse gravel, brownish-gray to pinkish-gray	26	45.5
Tertiary—Ogallala formation (Pliocene):		
Sandstone, fine- to coarse-grained, calcareous, light-brownish-gray	3	48.5
Sand, fine to coarse, silty, light-brown	1.5	50
Sand, fine, to fine gravel, brownish-gray to pinkish-gray	2	52
Sandstone, calcareous, light-gray	1	53
Sand, fine, to medium-grained gravel, brownish-gray to pink	9.5	62.5
Silt, fine- to medium-sandy, light-gray with a green tint	3.5	66
Sand, fine, to medium-grained gravel, brownish-gray to pink	2	68
Silt, sandy to gravelly, light-gray	3	71
Sand, fine, to medium-grained gravel, brownish-gray to pink	1	72
Sandstone with interbedded sandy silt, reddish-brown to tannish-gray	14	86

Table 7.—*Logs of test holes and wells*—Continued

DAWSON COUNTY—Continued

	Thickness (feet)	Depth (feet)
10-20-36dd—Continued		
Tertiary—Ogallala formation (Pliocene)—Continued		
Sand, fine, to medium-grained gravel, brownish-gray with some pink grains	13.5	99.5
Sandstone, medium- to coarse-grained, calcareous, light-gray	1.5	101
Silt, calcareous, white	1.5	102.5
Sand, fine, to medium-grained gravel	6.5	109
Silt, sandy, light-brownish-gray; contains fossil seeds	6	115
Sandstone, fine- to medium-grained, calcareous, light-brownish-gray	13	128
Marl, white with slight tan tint	1	129
Sandstone, fine-grained, light-gray with green tint	11	140
Silt, clayey, reddish-tan; contains thin limy layers; light-greenish-gray below 144 ft	7.5	147.5
Sandstone, fine-grained, calcareous, greenish-gray to brown; contains rootlets	41.5	189
Silt, calcareous, and sandstone, white	8	197
Sandstone, fine- to medium-grained, calcareous, light-tannish-gray with green tint	33	230
Silt, calcareous, and sandstone, white	3.5	233.5
Sandstone, fine- to medium-grained, calcareous, light-gray to brownish-gray	6.5	240
Sand to medium-grained gravel, brownish-gray with some pink and green grains	10.5	250.5
Silt, fine- to medium-sandy, light-greenish-gray	2.5	253
Sandstone, fine- to medium-grained, in part calcareous, greenish-gray	21	274
Sand, very fine to medium-grained, brownish-gray	13.5	287.5
Clay, silty, light-greenish-gray; contains thin limy layers	5	292.5
Sand, fine to coarse, and some fine- to medium-grained gravel, brownish-gray to greenish-gray	7	299.5
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-gray with limonitic stain	1.5	301
Clay, light-gray to yellowish-gray with limonitic stain; contains hard limy layers	22.5	323.5
Clay, yellowish-buff to gray	1	324.5
Clay, calcareous, light-gray with limonitic stain	3	327.5
Clay, shale, calcareous, light-gray to medium-gray	4.5	332
Clay shale, calcareous, dark-gray	8	340

10-22-1aa. Altitude (altimeter), 2,444.9 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Silt, dark-brownish-gray	1	1
Silt, medium-brownish-gray	1	2
Silt, medium-buff	1	3
Soil; silt, dark- to medium-brownish-gray	1	4
Silt, medium-buff to light-brownish-gray	5	9
Silt, slightly clayey, medium-brownish-gray; contains a few limy rootlets	1	10
Silt, slightly calcareous, granular, medium-buff; contains limy and limonitic rootlets and gastropod shells	26	36
Silt, light-gray-green	.5	36.5
Peat; contains wood fragments	1.5	38
Sand, fine to coarse, light-greenish-gray	2	40
Sand, fine, to medium-grained gravel, gray, green, and pink	10	50
Tertiary—Ogallala formation (Pliocene):		
Sandstone with thin silt and sandy silt layers, light-brown	6	56
Sand, medium-grained, to coarse gravel	4	60
Sand, fine to coarse, and some fine gravel	8	68
Silt, mottled, light-gray to pink	2	70
Sand, coarse, to fine gravel, gray, yellow and pink	8	78
Silt, light-gray	2	80

Table 7.—*Logs of test holes and wells*—Continued

DAWSON COUNTY—Continued

	Thickness (feet)	Depth (feet)
10-22-1aa—Continued		
Tertiary—Ogallala formation (Pliocene)—Continued		
Silt and sandstone, interbedded, light-gray to pink	15	95
Sand, coarse, to coarse gravel, gray to red	3	98
Silt, light-gray	2	100
Sand, coarse, to coarse gravel, reddish-gray to pinkish-gray	7.5	107.5
Silt, sandy, light-pinkish-gray	2.5	110
Silt, light-gray	6	116
Sandstone and siltstone, light-brown; contains some hard limy particles	4	120
Sand, medium-grained, to coarse gravel, light-gray to pink	10	130
Sand and gravel and sandstone, interbedded; contains hard limy layers	6	136
Sandstone, light-grayish-tan; contains layers of hard calcareous sandstone	10	146
Marl, light-gray	4	150
Sandstone, fine-grained, interbedded light-gray and light-brown	5	155
Sandstone, fine- to medium-grained light-brown with a green tint	7.5	162.5
Sand, fine to coarse, light-grayish-tan to yellowish-tan	7.5	170
Sandstone, fine- to medium-grained, medium-brown	6	176
Siltstone, light-brown; contains hard thin, calcareous layers	14	190
Sand, fine- to medium-grained, light-grayish-tan	10	200
Silt, calcareous, white	6	206
Sandstone, in part calcareous, light-brown to pinkish-brown; contains calcareous silt layers	92	298
Silt, fine-sandy, calcareous, light-gray	3	301
Marlite, light-gray	3	304
Sand, fine- to medium-grained, light-grayish-tan	16	320
Siltstone, light-grayish-green	2	322
Sandstone, fine- to medium-grained, light-greenish-gray	2	324
Sand, fine- to medium-grained, light-grayish-green	6	330
Siltstone, light-yellowish-gray	2	332
Sandstone, fine- to medium-grained, light-grayish-green	.5	332.5
Sand, fine to coarse, light-gray	12.5	345
Sandstone, fine- to medium-grained, medium-gray to greenish-tan	5	350
Sand, fine- to medium-grained	2.5	352.5
Marlite, light-gray to white	1.5	354
Sand, fine- to medium-grained, light-gray	12	366
Sandstone, fine-grained, light-gray	1	367
Tertiary—Brule formation (Oligocene):		
Siltstone, to fine-grained sandstone, light-grayish-brown	3	370
Siltstone, light-grayish-brown	7	377
Sandstone to siltstone, dark-brown	13	390
Sandstone, fine-grained, dark-brown	10	400
Sand, fine, light-brown; contains a few black grains	10	410
Clay, light-gray to tan	3	413
Silt to siltstone, dark-brown to light-brown with orange tint	17	430
Siltstone, dark-brown to light-brown to greenish-gray	60	490
Silt, medium-gray	5	495
Reworked material, gravelly	10	505
Cretaceous—Pierre shale (Upper Cretaceous):		
Shale to shaly limestone, yellowish-brown	6.5	511.5
Clay shale, silty, calcareous, dark-brownish-gray	2	513.5
Shale, calcareous, silty, dark-gray	6.5	520

10-22-25dd. Altitude (from topographic map), 2,413 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Clay, silty, dark-brown to light-brown; contains pelecypods	7.5	7.5
Sand, fine, to coarse gravel; grades coarser downward	29.5	37
Silt, clayey, light-grayish-brown; contains some sand below 50 ft	18	55
Sand, medium-grained, to coarse gravel	6	61

Table 7.—*Logs of test holes and wells*—Continued

DAWSON COUNTY—Continued

	Thickness (feet)	Depth (feet)
10-22-25dd—Continued		
Tertiary—Ogallala formation (Pliocene):		
Silt, clayey, light-reddish-brown	9	70
Silt, sandy to clayey, light-reddish-brown	4	74
Sand, medium-grained, to coarse gravel	8	82
Siltstone, light-greenish-gray	4	86
Sand and gravel, slightly cemented	10	96
Marlite	1	97
Sand, medium-grained, to coarse gravel	3	100
Sandstone, silty, brownish-gray to green	2	102
Silt, sandy, calcareous, grayish-brown	3	105
Sandstone, fine- to medium-grained, in part calcareous, light-brownish-gray to green	35	140
Marl, sandy, white	6	146
Sandstone and siltstone, interbedded, calcareous, brownish-gray	4	150
Clay, silty; contains hard limy layers	5	155
Sand and some gravel, in part cemented	12	167
Sandstone, fine- to medium-grained, calcareous, light-brownish-gray	10	177
Silt, sandy, and clay, calcareous, light-greenish-gray	3	180
Sand, fine, to fine gravel, cemented from 197 to 203 ft and from 207 to 211 ft	56.5	236.5
Silt, sandy, light-gray to light-brown	1.5	238
Sand, medium-grained, to medium-grained gravel	8	246
Silt, sandy, calcareous, light-greenish-gray; contains some interbedded sand and gravel from 255-260 ft	14	260
Silt, sandy, to sand, silty, light-grayish-green	10	270
Sandstone, fine- to medium-grained, light-grayish-green	10	280
Sand, fine to coarse, light-brownish-gray	12	292
Sand, silty, light-greenish-gray	3	295
Sand, fine to coarse, light-brown-gray	2	297
Sand, silty, light-greenish-gray	1.5	298.5
Sand, fine to coarse, slightly cemented, light-brown-gray; contains silt from 325 to 326.5 ft	31.5	330
Silt, sandy, light-green to gray	2	332
Sand, fine to coarse, light-brown-gray	3	335
Silt, clayey to sandy, light-green to gray	2	337
Sand, fine to coarse, light-brown-gray	6	343
Siltstone, sandy, light-greenish-gray to white	1.5	344.5
Sand, fine to coarse, light-brown-gray	1	345.5
Sandstone, silty, calcareous, light-greenish-gray	8.5	354
Sand, fine- to medium-grained, light-brown-gray	4	358
Sandstone, silty, calcareous, light-brown-gray to green; contains some sand layers	8	366
Silt, sandy, calcareous, light-greenish-gray	8.5	374.5
Cretaceous—Pierre shale (Upper Cretaceous):		
Chalk, white	3.5	378
Shale, chalky, white and yellowish-green	4	382
Chalk, white and orange-yellow	38	420
11-19-6bc. Altitude (instrument), 2,384.68 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil; silt, dark-brownish-gray to medium-brownish-gray	2	2
Silt, light-brown to dark-buff	3	5
Silt, granular, dark-brownish-gray	1	6
Silt, slightly clayey, light-grayish-brown	3	9
Silt, light-buff	18	27
Silt, soil-like, dark-reddish-brown	7.5	34.5
Silt, granular, light-buff to medium-buff; contains limy nodules	2.5	37
Clay, silty, slightly calcareous, medium-bluish-gray	3	40
Silt, clayey, medium-greenish-gray	5	45
Clay, black	4	49

Table 7.—*Logs of test holes and wells*—Continued

DAWSON COUNTY—Continued

	Thickness (feet)	Depth (feet)
11-19-6bc—Continued		
Quaternary—Pleistocene and Recent—Continued		
Silt, slightly clayey, calcareous, light-gray; contains gastropods	5	54
Peat; contains shell fragments, wood fragments, and sand, greenish-gray	11	65
Sand and gravel; contains limy fragments	5	70
Silt, slightly clayey, light-bluish-gray; contains medium-grained gravel	4	74
Silt, light-gray	3	77
Sand, fine, to coarse gravel, gray, pink and yellow	28	105
Tertiary—Ogallala formation (Pliocene):		
Silt with embedded sand grains	1	106
Silt, clayey, with embedded sand grains, light-gray to light-reddish-tan	4	110
Sand, fine- to medium-grained, silty, light-reddish-tan	8	118
Silt, slightly clayey to sandy, light-gray	3.5	121.5
Sand, fine- to medium-grained, slightly silty, light-gray	3.5	125
Sand, fine, to coarse gravel, gray, pink and yellow	15	140
Sandstone, fine- to medium-grained, grayish-tan	30	170
Sand, fine to coarse, and some fine gravel, tannish-gray	14	184
Silt, slightly sandy, light-gray	1	185
Sandstone, fine- to medium-grained, medium-brown	1	186
Clay stone, reddish-brown	4	190
Sand, fine- to medium-grained, light-reddish-tan	35	225
Sandstone, fine- to medium-grained, light-reddish-tan; contains limy and silty layers	25	250
Sand, fine- to medium-grained, light-reddish-tan to grayish-tan; contains interbedded sandstone and calcareous layers	107	357
Sandstone, light-tannish-gray; contains limy layers	43	400
Sand, medium-grayish-tan; principally limy fragments and reddish-brown clay fragments	10	410
Sand, fine to coarse, light-greenish-gray; principally limy fragments, red clay stone to siltstone fragments	35	445
Siltstone, light-gray	4	449
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-gray to yellow	20	469
Clay shale, moderately calcareous, dark-bluish-gray	11	480
11-19-19bb. Altitude (instrument), 2,467.09 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, slightly clayey, medium-brownish-gray	0.5	0.5
Silt, brownish-buff with a gray tint	1.5	2
Silt, very fine to coarse-sandy, granular, light-buff to tan with a gray tint; contains pelecypods and gastropods	32	34
Silt, slightly clayey, light-reddish-tan	6	40
Silt, very fine sandy, light-reddish-tan with a slight gray tint	10	50
Silt, slightly sandy, brown; contains a limy nodular layer at 51.5 ft	19	69
Silt, very fine sandy, granular, brown	5	74
Sand, very fine to fine, slightly silty, light-brown	6	80
Silt, in part sandy, brown	10	90
Silt, calcareous, brown to gray	11	101
Silt, coarse, brown; contains a trace of sand and gravel	17	118
Silt, very sandy, light-tannish-gray	3.5	121.5
Silt, slightly sandy, calcareous, white	4	125.5
Sand, fine to coarse, slightly silty, brownish-gray	4.5	130
Sand, fine, to coarse gravel, brownish-gray to pink	24	154
Silt, slightly to very sandy, light-gray with a green tint	2	156
Sand, fine, to coarse gravel, brownish-gray with some pink and yellow grains	27	183

Table 7.—*Logs of test holes and wells*— Continued

DAWSON COUNTY—Continued

	Thickness (feet)	Depth (feet)
11-19-19bb—Continued		
Tertiary—Ogallala formation (Pliocene):		
Silt, fine- to medium-grained, sandy, calcareous, light-tannish-gray	7	190
Sandstone, fine- to medium-grained, calcareous, light-tannish-gray	8	198
Silt, fine- to coarse-sandy, light-tannish gray	2	200
Sand, fine to coarse, and some fine gravel, brownish-gray; contains a layer of sandy silt from 202.5 to 204.5 ft	18	218
Silt, fine to coarse, sandy, light-gray with green tint	11	229
Ash, volcanic, white	1	230
Silt, slightly sandy, light-gray	9	239
Sand, fine to coarse, light-brownish-gray	4.5	243.5
Silt, sandy, calcareous, light-gray with green tint	13.5	257
Sandstone, fine- to medium-grained, greenish-gray	13	270
Silt, slightly to moderately clayey, light-greenish-gray; contains a few limy fragments	10	280
Marl, interbedded with clayey silt, light-gray to light-greenish-gray	13	293
Sand, very fine to medium-grained, brownish-gray	7	300
Marl, slightly sandy, white	1.5	301.5
Sandstone, very fine to medium-grained, brownish-gray with a green tint	8.5	310
Sand, fine- to medium-grained, and sandstone, brownish-gray; contains calcareous layers	40	350
Sand, fine to coarse, part cemented, brownish-gray with a slight green tint	25	375
Sand, fine- to medium-grained, slighty silty, light-brownish-gray	25	400
Sand, fine- to medium-grained, slightly consolidated, light-brownish-gray	14	414
Sand, fine to coarse, light-gray with a brown tint	6	420
Sand, fine- to medium-grained, in part silty, light-brownish-gray	40	460
Silt, moderately clayey, calcareous, light-gray with a green tint	6	466
Marl, in part sandy, white	9	475
Silt, slightly clayey, light-greenish-gray; contains thin limy layers, yellowish-gray	6.5	481.5
Silt, coarse- to fine-sandy, light-greenish-gray	9	490.5
Sand, very fine, brownish-gray with a slight green tint	3	493.5
Marl, white	1.5	495
Silt, moderately clayey, light-greenish-gray	10	505
Silt, clayey to fine-sandy, light-tannish-gray	11	516
Sand, fine to coarse, and some gravel, fine to medium, light-brownish-gray; contains limy and limonitic fragments	5	521
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-gray with some limonitic stain	9.5	530.5
Clay shale, dark-brown to black	19.5	550

11-19-31cc. Altitude (altimeter), 2,492.5 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Soil, dark-brown-gray	1.5	1.5
Silt, slightly clayey, granular, medium-brown	1.5	3
Silt, granular, light-brownish-gray	2	5
Silt, granular, medium-buff to light-buff	33	38
Silt, dark-reddish-brown	6	44
Silt, very fine, light- to medium-reddish-buff; contains a few limy nodules	42	86
Silt, dark-brown	2	88
Silt, medium-buff	14	102
Silt, peaty, dark-brown	6	108
Silt, slightly clayey, medium-brownish-buff	20	128
Silt, light-gray	2	130

Table 7.—*Logs of test holes and wells*—Continued

DAWSON COUNTY—Continued

	Thickness (feet)	Depth (feet)
11-21-18dd. Altitude (instrument), 2,514.07 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil: silt, light-brownish-gray	1	1
Silt, in part granular, buff-gray; contains gastropods	30	31
Silt, slightly clayey, dark-buff-gray	5	36
Silt, slightly clayey, light-gray	12.5	48.5
Silt, very fine sandy, light-brownish-gray; contains reworked limy fragments	1.5	50
Silt, sandy to fine gravelly, light-brownish-gray	2	52
Silt, slightly clayey, moderately calcareous, light-gray with a slight brown tint	3	55
Silt, fine sandy, calcareous, light-gray	1.5	56.5
Silt, brown	3.5	60
Silt, slightly clayey, brown; contains limy nodules	25.5	85.5
Silt, slightly sandy to fine gravelly, brown	2.5	88
Silt, slightly sandy, white	4	92
Silt, slightly clayey to sandy to gravelly, light-gray with green tint	7	99
Sand, fine, to medium-grained gravel, brown to pinkish-gray	33	132
Tertiary—Ogallala formation (Pliocene):		
Silt, slightly clayey to sandy, with fine to coarse sand and some gravel, brown to grayish-tan	5.5	137.5
Sand to sandstone, fine- to coarse-grained, slight calcareous cementation, brownish-gray	12.5	150
Sand, fine, to medium-grained gravel, brownish-gray to pinkish-gray	9	159
Silt, moderately sandy, calcareous, white to light-gray to greenish-gray	23.5	182.5
Sandstone, light-gray with green tint; contains a few limy rootlets and a hard limy layer	2.5	185
Silt, very fine to coarse-sandy, calcareous, white	19	204
Sandstone, very fine to medium-grained, brownish-gray	13.5	217.5
Sand to sandstone, fine- to coarse-grained, silty, brownish-gray	9.5	227
Sandstone, calcareous, light-gray	13	240
Sandstone, fine- to medium-grained, calcareous, brownish-gray	38	278
Silt, light-greenish-gray	1.5	279.5
Sand, fine- to medium-grained, light-brownish-gray	7	286.5
Marl, light-yellowish-gray to tannish-gray	2.5	289
Sand, fine to coarse, slightly consolidated, brownish-gray; contains limy and clayey granules	6.5	295.5
Sandstone, fine- to medium-grained, calcareous, yellowish-gray to brownish-gray; contains hard limy layers	9.5	305
Sand, with limy and clayey silt granules, reddish-tan	2.5	307.5
Silt, clayey, calcareous, light-gray with a tan tint	2	309.5
Sand, fine to coarse, brownish-gray; contains limy and clayey silt	5.5	315
Sandstone, very fine to medium-grained, calcareous, brown to light-gray	25	340
Silt, calcareous, and sandstone, light-gray	8.5	348.5
Sandstone, light-greenish-gray	4	352.5
Sand, fine- to medium-grained, silty, light-greenish-gray	17	369.5
Silt, slightly clayey, greenish-gray	.5	370
Sand, fine- to medium-grained, very silty, greenish-gray	34	404
Silt, calcareous, light-gray with green tint	2	406
Silt, slightly sandy, calcareous, light-gray	1	407
Silt, with thin limy layers, light-greenish-gray to yellowish-gray	5.5	412.5
Tertiary—Brule formation (Oligocene):		
Siltstone, greenish-gray to brownish-gray	26.5	439
Silt, clayey, reddish-tan to light-gray	2	441
Silt, clayey, to siltstone, light-brownish-gray; contains some iron concretions and pink bentonitic fragments	49	490

Table 7.—*Logs of test holes and wells*—Continued

DAWSON COUNTY—Continued

	Thickness (feet)	Depth (feet)
12-19-33cc. Altitude (instrument), 2,372.85 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, sandy, very fine, medium-gray-brown	47	47
Silt, sandy, very fine, light-brown	8	55
Silt, slightly calcareous, light-gray	14	69
Clay, silty, very calcareous, medium-gray; contains gravel	11	80
Sand, very fine to medium-grained, and silt, black; contains peat	9	89
Sand, medium-grained, and fine gravel; contains iron-manganese stains	4.5	93.5
Tertiary—Ogallala formation (Pliocene):		
Sandstone, silty, calcareous in part; contains fossil rootlets	17.5	111
Sandstone, silty, medium-red-brown	8.5	119.5
Sandstone, calcareous; contains many fossil rootlets	5.5	125
Sand and gravel, very fine sand to fine gravel; contains sandstone fragments	6	131
Marl	3	134
Sand, coarse, to fine gravel	12	146
Sand, very coarse- to medium-grained gravel	16	162
Sand, medium, to fine gravel; contains many sandstone fragments and fossil rootlets	9	171
Sandstone, light-gray	6	177
Sandstone, silty, light-red-brown	6	183
Sand, coarse, to fine gravel	27	210
Sandstone, calcareous (drillers' log - gravel)	35	245
Sand, coarse, and some fine gravel	5	250
Marl	2	252
Gravel or sandstone	108	360
12-20-18ab*. Lashly. Weber Machine and Irrigation Co. Altitude (instrument), 2,477.90 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Clay	54	54
Sand	3	57
Clay	55	112
Sand	13	125
Tertiary—Ogallala formation (Pliocene):		
Sandstone	5	130
Sand	8	138
Sandstone	2	140
Sand	19	159
Clay		
12-20-24aa. Altitude (instrument), 2,507.02 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, dark-brownish-gray	1	1
Silt, in part clayey, brownish-buff	1	2
Silt, light-brownish-buff with gray tint	1	3
Silt, light-buff-gray; contains gastropods	17	20
Silt, tannish-gray to light-gray	7	27
Silt, light-buff to tannish-gray	8.5	35.5
Silt, soil-like, dark-brownish-gray	4.5	40
Silt, very slightly sandy, light-reddish-tan	10	50
Silt, very fine to coarse—sandy, calcareous, tannish-gray with pink tint	8	58
Sand, fine- to medium-grained, tannish-gray	2	60
Sand, fine- to medium-grained, slightly silty, tannish-gray	5	65
Silt, very fine to fine—sandy, brown	8	73
Silt, very fine—sandy, to siltstone, brown	17	90

Table 7.—*Logs of test holes and wells*—Continued

DAWSON COUNTY—Continued

	Thickness (feet)	Depth (feet)
12-20-24aa—Continued		
Quaternary—Pleistocene and Recent—Continued		
Silt, very fine sandy, to siltstone and sandstone, brown; contains some rootlets	20	110
Silt, very fine to fine—sandy, light-buff-gray	10	120
Sand, very fine to medium-grained, light-brownish-gray	16.5	136.5
Silt, brown; contains thin limy layers	8.5	145
Silt, very fine sandy, light-brown with a gray tint	14.5	159.5
Marl, white	.5	160
Silt, brown; contains thin limy layers and a trace of gravel	20	180
Silt, slightly sandy to gravelly, brown	2	182
Sand, fine, to medium-grained gravel, light-brownish-gray with some pink grains; contains some coarse gravel	28.5	210.5
Tertiary—Ogallala formation (Pliocene):		
Sandstone, fine-grained, silty, brown	5.5	216
Silt, slightly to moderately sandy, light-gray with a green tint	9	225
Silt, slightly sandy, calcareous, and sandstone	8.5	233.5
Silt, sandy, to sandstone, silty, light-greenish-gray	2	235.5
Sandstone, very fine to fine-grained, light-greenish-gray	11.5	247
Sand, fine to coarse, brownish-gray; contains some silt granules	15	262
Siltstone, very fine sandy, light-gray	5.5	267.5
Sand, very fine to medium-grained, light-brownish-gray to greenish-gray	4	271.5
Sandstone, fine- to coarse-grained, light-greenish-gray	6.5	278
Sandstone to siltstone, very fine, light-gray	4	282
Silt, clayey, light greenish-gray; contains white limy layers	6	288
Silt, slightly sandy, calcareous, white	1.5	289.5
Sandstone, fine- to medium-grained, brownish-gray; contains some calcareous cement	18.5	308
Sand to sandstone, brownish-gray with a green tint; contains a few rootlets	22.5	330.5
Sand, fine to coarse, calcareous in part, brownish-gray to light-gray	7	337.5
Sand, fine to coarse, brownish-gray	1.5	339
Sand, fine to coarse, silty, brownish-gray; contains limy fragments	11	350
Sand to sandstone, very fine to medium-grained, brownish-gray	11	361
Sand, fine, to fine gravel, light-brownish-gray with some pink and light-green grains	4	365
Silt, calcareous, white	1.5	366.5
Sand, fine, to fine gravel, light-brownish-gray with some pink and light-green grains	5	371.5
Silt, sandy, calcareous, white to light-gray	1.5	373
Sand, fine to coarse, and fine- to medium-grained gravel, brownish-gray with some pink grains	10	383
Sandstone, calcareous, light-yellowish-gray	7	390
Silt, clayey, light-greenish-gray; contains thin limy layers	3	393
Sandstone, calcareous, light-gray with green tint	2	395
Sand, fine- to medium-grained, silty, light-gray	16	411
Sand, fine to coarse, light-brownish-gray	9	420
Sand, very fine to medium-grained, slightly silty, light-brownish-gray	22	442
Sand, fine- to medium-grained, silty, brownish-gray	3	445
Sand, fine to coarse, light-brownish-gray	8	453
Sandstone, fine- to medium-grained, calcareous, light-brownish-gray	5	458
Sand, very fine to fine, brownish-gray	16.5	474.5
Sandstone, fine- to medium-grained, calcareous, yellowish-gray; contains some hard layers of silt or marl	25.5	500
Tertiary—Brule formation? (Oligocene):		
Siltstone, light-gray with a tan tint	20	520
Siltstone, granular, light-brown; contains interbedded light-gray silt	27	547
Sand, very fine to fine, brownish-gray	3	550
Siltstone, light-brown; contains interbedded silt, light-gray with a slight green tint	34.5	584.5
Sand, fine, to fine gravel, brownish-gray with some pink and green grains	11.5	596

Table 7.—*Logs of test holes and wells*—Continued

DAWSON COUNTY—Continued

	Thickness (feet)	Depth (feet)
12-20-24aa--Continued		
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-gray to medium-gray with limonitic stain	22	618
Clay shale, black	12	630
12-20-28cd*. Owen Gunningham. Don Barney Drilling Co. Altitude (from topographic map), 2,435 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil	3	3
Clay, yellow	28	31
Clay, brown	11	42
Clay, blue	21	63
Sand, fine	13	76
Sand, fine; contains a trace of gravel	3	79
Sand, fine- to medium-grained	1	80
Cement sand	9	89
Sand and some gravel	1	90
Sand, medium-grained, and some gravel	2	92
Sand and gravel	19	111
Tertiary—Ogallala formation (Pliocene):		
Clay, sandy	5	116
Sand, fine, and clay	22	138
12-21-2ac. Altitude (instrument), 2,485.23 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, sandy, very fine, light-brown; contains gastropods	41	41
Silt, very fine sandy, very calcareous, light-brown-gray; contains gastropods	23	64
Silt, fine- to medium-grained, sandy	7.5	71.5
Sand, fine to coarse, silty; contains a trace of calcareous nodules and gastropods	8.5	80
Sand, very fine to medium-grained, silty, medium-red-brown	17	97
Sand, medium-grained to very coarse, and some fine gravel	11	108
Clay, sandy, gray	5	113
Sand, fine to very coarse, and some fine gravel	9	122
Sand, coarse, to fine gravel	12	134
Clay, sandy, gray	1	135
Sand, coarse, to fine gravel	8	143
Tertiary—Ogallala formation (Pliocene):		
Sandstone, light-gray; contains fossil rootlets	8	151
Sandstone, very calcareous, light-gray	31	182
Sand, fine to coarse	34	216
Sandstone, calcareous, light-gray	24	240
Sandstone? (lost circulation at 236 ft)	60	300
12-21-20bb. Altitude (altimeter), 2,544.12 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, slightly granular, medium-brownish-gray	3	3
Silt, medium-gray-buff; contains a few limy nodules, and limonitic rootlets	29	32
Gravel, medium- to coarse-grained, light-gray; contains calcareous concretionary layers	.5	32.5
Silt, slightly clayey to slightly sandy, light-reddish-tan	7.5	40
Silt, very slightly sandy, medium-reddish-tan	10	50
Sand, very fine, light-grayish-tan	10	60
Silt, slightly clayey, light-grayish-tan; contains a white limy layer from 66.5 to 67.5 ft	10	70

Table 7.—*Logs of test holes and wells*—Continued

DAWSON COUNTY—Continued

	Thickness (feet)	Depth (feet)
12-21-20bb—Continued		
Quaternary—Pleistocene and Recent—Continued		
Silt, light-grayish-tan; contains calcareous concretionary layers	20	90
Silt, light-reddish-tan	10	100
Silt, slightly clayey, light-reddish-tan	12.5	112.5
Silt, calcareous, light-gray	15.5	128
Silt, very slightly clayey to sandy, light-gray to greenish-gray to pinkish-gray	9.5	137.5
Silt, fine- to coarse-sandy, peaty, dark-reddish-brown	.5	138
Sand, medium-grained, to medium-grained gravel, yellowish-brown to pinkish-brown	32	170
Sand, fine, to medium-grained gravel, light-brownish-gray; contains clay granules	10	180
Sand, fine, to fine gravel, light-brownish-gray with some pink grains	19	199
Tertiary—Ogallala formation (Pliocene):		
Silt, slightly sandy, light-gray	3	202
Silt, calcareous, and sandstone, white	6.5	208.5
Silt, slightly sandy, light-gray with some tannish-gray	8	216.5
Sand, fine, to fine gravel, light-tannish-gray	7.5	224
Silt, calcareous, and sandstone, white to light-gray	6.5	230.5
Marl, white to light-yellowish-gray	5	235.5
Sand, fine to coarse with a trace of gravel, light-brownish-gray	16.5	252
Sandstone, fine- to medium-grained, light-brownish-gray; contains a few rootlets	28	280
Sand, fine- to medium-grained, light-brownish-gray	20	300
Sandstone, calcareous, to siltstone, light-gray	6	306
Silt, slightly clayey to slightly sandy, light-gray with a green tint; contains a hard limy layer	7	313
Sand, fine to coarse, light-brownish-gray; contains clay granules	5	318
Sandstone, fine- to medium-grained, brownish-gray	7.5	325.5
Silt, calcareous, and sandstone, fine- to medium-grained, light brownish-gray	9.5	335
Sand to sandstone, light-brownish-gray	8.5	343.5
Sandstone, calcareous, light-tannish-gray	3.5	347
Sandstone, fine- to coarse-grained, slightly calcareous, light-reddish-tan	23	370
Sandstone, calcareous, light-gray	6.5	376.5
Sandstone, calcareous, light-brownish-gray with green tint; contains interbedded silty sand	14	390.5
Sandstone, fine- to medium-grained, calcareous, light-gray	17.5	408
Sand, fine- to medium-grained, light-brownish-gray	22	430
Silt, slightly sandy, light-greenish-gray	1.5	431.5
Sand, very fine to medium-grained, brownish-gray	11.5	443
Sand, slightly silty, light-brownish-gray	2	445
Sandstone, fine- to medium-grained, calcareous, light-yellowish-gray	9.5	454.5
Silt, light-gray, and interbedded, marl, yellowish-gray	5.5	460
Tertiary—Brule formation (Oligocene):		
Sandstone, very fine grained, brownish-gray	12	472
Silt, clayey, light-brownish-gray	2.5	474.5
Sandstone, very fine grained, brownish-gray	9.5	484
Silt and siltstone, grayish-brown	12.5	496.5
Silt, slightly clayey, light-gray with a buff tint	10.5	507
Silt, very fine sandy, light-brownish-gray	3	510
Siltstone and fine sandstone, brown	10	520
Sand, fine, slightly silty, brown	33.5	553.5
Siltstone, very fine sandy, reddish-brown	2.5	556
Silt, light-tannish-gray to light-gray	12	568
Siltstone, very fine sandy	2	570
Silt, granular, brown	20	590
Sand, very fine, brown to brownish-gray	46.5	636.5
Silt, brown	3.5	640
Sand, fine, slightly silty, brown	10	650

Table 7.—*Logs of test holes and wells*—Continued

DAWSON COUNTY—Continued

	Thickness (feet)	Depth (feet)
12-21-20bb—Continued		
Tertiary—Brule formation (Oligocene)—Continued		
Silt, light-gray to tannish-gray; contains a few limonitic fragments	25	675
Sand and gravel, slightly silty, yellowish-brown to gray; contains limonitic fragments	5.5	680.5
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-gray to medium-gray	8.5	689
Clay shale, dark-brown to black	11	700
12-21-32cb. Altitude (instrument), 2,564.0 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, medium- to dark-brownish-gray	6	6
Silt, slightly clayey, brownish-buff with a gray tint; contains a few snails	4	10
Silt, in part sandy, brownish-buff with gray tint; contains limy nodular fragments and limonitic grains	22	32
Silt, very fine sandy, light-reddish-tan	18	50
Sand, fine- to medium-grained, silty, tannish-gray	12	62
Silt, very fine sandy, light-reddish-brown	18	80
Silt, slightly clayey to slightly sandy, tannish-gray	16	96
Silt, slightly sandy, calcareous; contains hard limy layers	24	120
Silt, brown with a gray tint	14.5	134.5
Silt, slightly sandy, calcareous, white	5.5	139
Silt, very sandy, fine- to medium-grained sand, brown	3.5	142.5
Silt, slightly sandy, calcareous, white; contains a trace of coarse sand and gravel	8	150.5
Silt, very sandy, tannish-gray	5.5	156
Sand, fine to coarse, silty, slightly consolidated, tannish-gray	6.5	162.5
Sand, fine, to medium-grained gravel, brownish-gray with some pink and yellow grains	42.5	205
Tertiary—Ogallala formation (Pliocene):		
Silt, very fine to fine-sandy, brown to light-gray with a green tint	4.5	209.5
Sand, fine, to medium-grained gravel	5.5	215
Sand, fine to coarse, very silty, moderately calcareous, light-gray	2.5	217.5
Silt, calcareous, and sandstone, light-gray	3.5	221
Sand, fine- to medium-grained, silty, light-gray	19	240
Sandstone, very fine to medium-grained, light-brownish-gray; contains a few rootlets	9	249
Sandstone, calcareous, light-gray	11	260
Sand, fine to coarse, light-brownish-gray	4.5	264.5
Sandstone, calcareous, light-gray	.5	265
Sand, fine- to medium-grained, silty, light-brownish-gray	13.5	278.5
Sandstone, calcareous, light-gray	1.5	280
Marl, silty to fine-sandy, light-gray	8	288
Sandstone, fine- to medium-grained, light-grayish-brown	7	295
Sand, fine to coarse, and some fine gravel, light-grayish-brown	28	323
Silt, slightly clayey; contains a hard limy layer at 323 ft	8	331
Siltstone, very fine sandy, light-gray	3	334
Sandstone, very fine to fine-grained, brownish-gray	15	349
Sand, fine- to medium-grained, silty, light-brownish-gray with a green tint	5.5	354.5
Sandstone to sandy marl, white to light-brownish-gray	15.5	370
Silt, sandy, to sandstone, interbedded, light-gray to white	16	386
Sandstone, light-gray with green tint	9	395
Sandstone, silty, to sand, silty, fine- to medium-grained, light-gray with green tint	55.5	450.5
Silt, sandy, calcareous, light-gray with a green tint	6.5	457
Sandstone, very fine grained, greenish-gray	3	460
Tertiary—Brule formation (Oligocene):		
Siltstone, brownish-gray	10	470
Silt to siltstone, light-gray to pinkish-tan	50	520

Table 7.—*Logs of test holes and wells*—Continued

DAWSON COUNTY—Continued

	Thickness (feet)	Depth (feet)
12-21-32cb—Continued		
Tertiary—Brule formation (Oligocene)—Continued		
Siltstone, brown with gray tint	7	527
Silt to siltstone, light-gray with green tint; contains some sand in part	43	570
Silt, clayey, reddish-tan	25.5	595.5
Sand, very fine to fine, light-brownish-gray	8.5	604
Clay and siltstone, light-gray	23	627
Clay, silty, bentonitic, light-gray	6	633
Silt to siltstone, light-gray with yellow tint	2	635
Siltstone, very fine sandy, brown	5	640

HALL COUNTY

9-11-8bc. Altitude (instrument), 1,957.5 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Silt, sandy	4	4
Sand and gravel	6	10
Gravel and some sand	62.5	72.5
Clay, yellowish-green	4	76.5
Gravel	2.5	79
Clay, yellowish-green		
Tertiary—Ogallala formation (Pliocene):		
Silt, clayey, calcareous below 120 ft, brown	56	135
Silt, sandy, brown to gray; in part calcareous	15	150
Sandstone, calcareous, light-greenish-gray, and sand, silty	10	160
Silt, sandy	3	163
Sandstone, light-greenish-gray; calcareous in part	22	185
Sand, fine- to medium-grained, in part cemented	5	190
Cretaceous—Pierre shale (Upper Cretaceous):		
Shale, light-bluish-gray with limonitic stain	5	195
Limestone?, limonitic stain	5	200

11-12-5bc*. Hulme. Woodman Well Co. Altitude (instrument), 2,092.70 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Clay	99	99
Lime balls (concretions)	2	101
Clay	21	122
Clay, hard	8	130
Clay, sandy	1	131
Tertiary—Ogallala formation (Pliocene):		
Sand, packed, mixed, hard	1.5	132.5
Clay, sandy	1.5	134
Clay, chalky	1	135
Sand, packed, and limestone, hard	1	136
Sand, packed, and 1 ft of limestone	3	139
Clay, chalky	1	140
Lime rock (drilled 2 hrs)	3	143
Sandstone and limestone	2	145
Lime rock	1	146
Sandstone and limestone	9	155
Sandstone and limestone, hard	1	156
Lime rock	2	158
Clay, chalky, white	2	160
Lime rock	.5	160.5
Limestone and sandstone	1.5	162
Lime rock; not very hard	1	163
Sandstone and clay, mixed	2	165
Clay, sandy	1	166

Table 7.—*Logs of test holes and wells*—Continued

HALL COUNTY—Continued

	Thickness (feet)	Depth (feet)
11-12-5bc*—Continued		
Tertiary—Ogallala formation (Pliocene)—Continued		
Clay and limestone, mixed	2	168
Clay, pretty hard	6	174
Sand, sandstone, and lime rock, mixed	2	176
Sand, pure, coarse	2.5	178.5
Clay	3.5	182
Clay, sandy, soft	11	193
Sand, packed, and limestone, mixed	7	200
Clay, hard	2	202
Sand, packed	6	208
Clay, sandy	3	211
Clay	5	216
Limestone and sand, packed	5	221
Clay, sandy	1	222
Sand, packed, and a little gravel	6	228
Sand, packed, and clay, mixed	4	232
Sandstone, clean	1	233
Clay, sandy	2	235
Sand, packed, clean	15	250
Clay, sandy, limestone, soft	10	260
Clay, white	2	262
Shale, soapy, white	1.5	263.5
Clay, soft, white	.5	264
Shale, soapy	3	267
Clay, sandy	.5	267.5
Lime rock	1	268.5
Clay	3.5	272
Rock	.5	272.5
Limestone and 4 in. of clay	1.5	274
Sandstone, clean	3	277
Rock	1	278
Limestone	2.5	280.5
Rock	.5	281
Clay and limestone, mixed	1	282
Limestone, soft	2.5	284.5
Limestone and clay, soft	2	286.5
Sandstone	3	289.5
Clay	4.5	294
Limestone and a little gravel	4	298
Gravel, fair	2	300
Gravel, good	8	308
Sand, coarse	1	309
Clay	2	311
(Adjacent test hole drilled by Morris Merryman to 348 ft was still in Ogallala formation at that depth.)		

12-11-5dd*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,963 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Soil	2	2
Sand, fine	36	38
Clay, sandy	12	50
Sand and gravel	45	95
Gravel, coarse	7	102
Clay, blue	3	105
Sand and gravel	30	135
Gravel, coarse	20	155
Tertiary—Ogallala formation (Pliocene):		
Clay	7	162
Clay, brown	3	165

Table 7.—*Logs of test holes and wells*—Continued

HALL COUNTY—Continued

	Thickness (feet)	Depth (feet)
12-11-5dd*—Continued		
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-gray	47	212
Clay, medium-gray	13	225
Shale, medium-gray to black		
12-11-7ad*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,954 feet above mean sea level		
Quaternary and Tertiary:		
Soil	2	2
Sand	13	15
Clay, yellow	7	22
Sand, fine, with layers of sandstone, blue clay, gravel, and buff clay	260	282
Cretaceous—Pierre shale (Upper Cretaceous): Shale, dark-gray to black		
12-11-21bb*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,933 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil	3	3
Clay, yellow	33	36
Sand and gravel	81	117
Clay, sandy, gray	8	125
Sand and gravel	80	205
Tertiary—Ogallala formation (Pliocene):		
Sandstone, calcareous	25	230
Sand and gravel	25	255
Sandstone, calcareous	13	268
Cretaceous—Pierre shale (Upper Cretaceous): Shale, light-gray to medium-gray		
12-12-3bb*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,907 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil	3	3
Sand	62	65
Gravel	23	88
Tertiary—Ogallala formation (Pliocene):		
Clay	94	182
Sand and gravel	13	195
Cretaceous—Pierre shale (Upper Cretaceous): Shale, light-gray		
12-12-6ab*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,920 feet above mean sea level		
Quaternary—Pleistocene and Recent: Sand and gravel	62	62
Tertiary—Ogallala formation (Pliocene):		
Clay, sandy	26	88
Sandstone, sand, and clay	140	228
Cretaceous—Pierre shale (Upper Cretaceous): Shale, light-gray		
12-12-8bb*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,922 feet above mean sea level		
Quaternary—Pleistocene and Recent: Sand and gravel	128	128
Tertiary—Ogallala formation (Pliocene):		
Clay, buff	27	155
Clay, blue	13	168
Sand and gravel	14	182
Cretaceous—Pierre shale (Upper Cretaceous): Clay shale, light-blue-gray		

Table 7.—*Logs of test holes and wells*—Continued

HALL COUNTY—Continued

	Thickness (feet)	Depth (feet)
12-12-12dd*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,963 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil	2	2
Clay, yellow	12	14
Sand	4	18
Clay, yellow	4	22
Sand	32	54
Clay, yellow	11	65
Sand	70	135
Clay, green	3	138
Clay, brown	7	145
Sand	31	176
Tertiary—Ogallala formation (Pliocene):		
Clay, gray	9	185
Sandstone	61	246
Shale, gray	14	260
Sand and gravel	25	285
Cretaceous—Pierre shale (Upper Cretaceous): Shale, black	———	———
12-12-14ab*. U. S. Bureau of Reclamation. Altitude (instrument), 2,018.6 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Sand, fine, brown	11.5	11.5
Sand, fine, with streaks of medium-brown; contains thin layers of silty sand	14.5	26
Sand, fine, silty, gray	2	28
Silt, slightly clayey to sandy, brown	10	38
Sand, fine, white	12	50
Silt, gray	6	56
Sand, fine, gray	15.5	71.5
Silt and sand, fine- to medium-grained, alternate layers, gray	5.5	77
Sand, fine and some coarse, gray; contains some layers of gray silt	10	87
Silt, sandy, gray; contains layers of fine, gray sand	4	91
Sand, fine, gray; contains some medium-grained sand below 101 ft	20	111
Sand, fine to coarse, gray	15.5	126.5
Sand, fine to coarse, light-blue	39.5	166
Sand, fine to coarse, and silt, blue, alternate layers	2	168
Sand and gravel	10	178
Silt, blue	3	181
Tertiary—Ogallala formation (Pliocene):		
Silt, slightly clayey, gray with green streaks; contains chalky streaks and nodules	25.2	206.2
Sand, fine, brown with green and white streaks	4.7	210.9
12-12-14ba*. U. S. Bureau of Reclamation. Altitude (instrument), 1,994.9 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, slightly sandy, fine, black	0.7	0.7
Sand, fine, silty	.8	1.5
Silt and sand, light-brown	2.5	4
Silt, dark-brown	2	6
Silt, light-brown with black and gray streaks	10	16
Sand, very fine to fine, gray; contains silt layers from 16 to 31 ft; contains streaks of medium-grained sand from 61 to 71 ft	90	106
Sand, fine, bluish-gray; contains some medium-grained and coarse sand below 121 ft; contains thin layers of blue silt below 131.5 ft	40	146
Sand and gravel; contains sandstone fragments and layers of blue-green silt	9	155

Table 7.—*Logs of test holes and wells*— Continued

HALL COUNTY—Continued

	Thickness (feet)	Depth (feet)
12-12-14ba*—Continued		
Tertiary—Ogallala formation (Pliocene):		
Sand, fine, silty, gray; contains layers of grayish-green silt	9	164
Silt, sandy, fine, gray with green streaks	12	176
Sand, fine, greenish-gray with green and white streaks	4.6	180.6
12-12-14da*. U. S. Bureau of Reclamation. Altitude (instrument), 1,960.4 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Sand, fine, silty	1	1
Sand, fine, brown	2	3
Silt, sandy, gray	1.5	4.5
Sand, fine, gray; contains thin layers of silt below 7 ft	16.5	21
Sand, fine with a trace of medium to coarse, gray	38	59
Sand, very fine, gray	2	61
Sand, fine- with medium- to coarse-grained, gray	14	75
Sand, medium- to coarse-grained	3	78
Silt, black, gray streaked	2	80
Silt, black to blue	5	85
Sand, fine- to medium-grained, with a trace of coarse-grained, and gravel, bluish-gray	13	98
Sand, fine, silty, brown	2	100
Sand, fine to coarse, and gravel	4	104
Tertiary—Ogallala formation (Pliocene):		
Silt, slightly sandy, fine, greenish-gray with white streaks	7	111
Silt, slightly sandy, fine, grayish-brown with white and green streaks; contains small white particles	30	141
Silt, slightly sandy, brown; contains chalky layers	10	151
12-12-14dd*. U. S. Bureau of Reclamation. Altitude (instrument), 1,956.8 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, dark-brown	0.7	0.7
Silt, sandy, brown-gray; contains layers of silty sand	4.3	5
Sand, fine, brown-gray; contains thin layers of gray silt	1.5	6.5
Sand, fine- to medium-grained	1.5	8
Silt, gray	7	15
Silt, brownish-gray	6	21
Silt, slightly clayey, brownish-gray	40	61
Silt, slightly calcareous, light-brown with white streaks; contains calcareous nodules and thin layers of silty sand from 66 to 76 ft	15	76
Silt, brown with white streaks; contains calcareous, nodules	5	81
Silt, brown-gray with white streaks; contains layers of silty sand	5	86
Sand and silt, brown	2	88
Sand, fine, gray	2	90
Sand, fine to coarse, with a trace of gravel	6	96
Sand and gravel, gray	6	102
Tertiary—Ogallala formation (Pliocene):		
Silt, slightly sandy, very fine, gray; contains a few calcareous nodules	4	106
Silt, calcareous, brown-gray with white streaks	10	116
Silt, light-brown	10	126
Silt, brown with white streaks; contains calcareous nodules	15	141
Silt, brown	9	150
Sand, fine	1	151
Silt, brown; contains layers of fine sand	2	153
Silt, brown with black, white and yellowish-green streaks	12.7	165.7
Silt, green; contains fragments of green sandstone	.3	166

Table 7.—*Logs of test holes and wells*— Continued

HALL COUNTY—Continued

	Thickness (feet)	Depth (feet)
12-12-15ab*. U. S. Bureau of Reclamation. Altitude (instrument), 2,049.7 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Sand, silty, dark-brown to brown	2	2
Sand, fine, brown	18	20
Sand, fine, brown; contains medium-grained sand and layers of silty sand	11	31
Sand, fine to coarse	5	36
Sand, fine, silty	5	41
Sand, brown; contains silt layers	7	48
Silt, brown	4	52
Sand, fine, gray	9	61
Sand, fine, brownish-gray; contains very silty layers	5	66
Sand, fine, brownish-gray; contains silty sand layers below 71 ft	15	81
Sand, fine, gray	10	91
Sand, very fine, gray; slightly coarser below 96 ft	12	103
Silt, sandy, gray	13	116
Sand, fine, gray	5	121
Sand, fine- to medium-grained, gray	5	126
Sand, fine to coarse, gray	9.6	135.6
Sand, fine, gray	17.4	153
Sand, fine, silty, blue-gray	4	157
Sand, fine, blue-gray	15	172
Silt, sandy, fine, blue; contains peat	5	177
Sand, fine, blue-gray	8.3	185.3
Sand, fine to coarse	5.2	190.5
Sand, fine, blue-gray	9.5	200
Tertiary—Ogallala formation (Pliocene):		
Silt, sandy, fine, gray with white spots	10	210
Silt, sandy, fine, brownish-gray with white streaks	6	216
Silt, sandy, fine, gray with white streaks	10	226
Silt, sandy, fine, grayish-brown with white streaks	10	236
12-12-15bb*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,999 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Sand, fine	6	6
Clay, sandy	8	14
Sand and gravel	166	180
Tertiary—Ogallala formation (Pliocene): Sandstone, calcareous	60	240
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, yellow	18	258
Shale, blue to gray	----------	-------
12-12-15da*. U. S. Bureau of Reclamation. Altitude (instrument), 1,970.7 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, sandy, dark-brown	1	1
Sand, fine, brown	1	2
Silt, sandy, brown	2	4
Sand, fine, brownish-gray	2	6
Sand, fine, gray; contains thin layers of silty sand	15	21
Sand, fine, grayish-brown; contains a few thin silt layers	11	32
Sand, fine- to medium-grained	14	46
Sand, fine, brown	13	59
Sand, fine to coarse, and some gravel; contains some blue silt	2.5	61.5
Sand, fine, blue-gray; contains some coarse sand to gravel and a few thin silt layers below 75.5 ft	19.3	80.8
Sand, fine, blue-gray	6.2	87
Silt, sandy, fine, blue; contains peat	7	94

Table 7.—*Logs of test holes and wells*—Continued

HALL COUNTY—Continued

	Thickness (feet)	Depth (feet)
12-12-15da*—Continued		
Quaternary—Pleistocene and Recent—Continued		
Silt, blue, and silty sand and sandy silt, alternate layers	2	96
Sand, fine, and some coarse sand to gravel, blue-gray; contains some layers of sandy silt	4.8	100.8
Sand, fine to coarse, and gravel; contains thin layers of blue sandy silt from 105.8 to 111 ft	14.2	115
Tertiary—Ogallala formation (Pliocene):		
Silt, sandy, fine, brown with gray-green streaks	33	148
Sand, fine, green with white streaks	2.5	150.5
12-12-23aa*. U. S. Bureau of Reclamation. Altitude (instrument), 1,978.3 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, grayish-brown; contains a few calcareous nodules	16	16
Sand, fine, brown	12	28
Silt, gray	3	31
Silt, dark-brown to gray	16	47
Silt, gray; contains streaks of very fine sand	4	51
Silt, gray	20	71
Silt, brown with some white spots	20	91
Silt, brown to dark-brown	10	101
Silt, dark-brown	9	110
Silt, sandy, dark-brownish-gray; contains layers of silty sand, fine, dark-gray	3	113
Sand, silty, medium to coarse	5	118
Tertiary—Ogallala formation (Pliocene):		
Silt, slightly calcareous, greenish-gray with white and green streaks	5	123
Silt, calcareous, light-brown; contains calcareous nodules	8	131
Silt, light-brown	11	142
Silt, slightly calcareous, light-brown	20	162
Sand, fine, calcareous, grayish-green	2.3	164.3
12-12-23ad*. U. S. Bureau of Reclamation. Altitude (instrument), 1,989.8 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, light-brown	18	18
Silt and sand, fine	2.5	20.5
Sand, fine, white; contains thin layers of silt from 31.5 to 40 ft	19.5	40
Silt, slightly clayey, grayish-brown	5	45
Silt, black	3	48
Silt, slightly clayey, brown; contains streaks and pockets of fine sand	7	55
Silt, slightly clayey, brown; contains white streaks below 61.5 ft	31.5	86.5
Silt, slightly sandy, brown-gray; contains calcareous nodules	5	91.5
Tertiary—Ogallala formation (Pliocene):		
Silt, brown; contains calcareous nodules	14	105.5
Silt, slightly clayey, light-brown	11	116.5
Silt, light-brown; contains calcareous nodules below 131.5 ft and a trace of fine sand below 136.5 ft	30	146.5
Silt, sandy, fine, light-brown	3.5	150
Sand, fine, calcareous, greenish-gray	3.3	153.3
12-12-23bb*. U. S. Bureau of Reclamation. Altitude (instrument), 1,971.1 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt and sand, fine, brown	2	2
Sand, silty	2	4

Table 7. — *Logs of test holes and wells* — Continued

HALL COUNTY—Continued

	Thickness (feet)	Depth (feet)
12-12-23bb*—Continued		
Quaternary—Pleistocene and Recent—Continued		
Silt, sandy, fine, dark-brown	2	6
Sand, silty, to sandy fine silt	4.7	10.7
Silt, gray	44.3	55
Silt, dark-brown	5	60
Silt, brown; contains calcareous nodules from 66 to 76 ft	21	81
Silt, dark-brown	12	93
Silt, sandy, brown and gray	2	95
Sand, fine, silty, gray	6	101
Sand, fine, brown and gray	4	105
Sand, fine- to medium-grained brown and gray	3	108
Tertiary—Ogallala formation (Pliocene):		
Silt, brown; contains calcareous nodules	3	111
Silt, brown; contains some sand, fine to coarse and a trace of gravel	14	125
Silt, sandy, fine, brown with a few green streaks	3	128
Silt and sand, fine, calcareous, green with white and brown streaks	3	131
12-12-23db*. U. S. Bureau of Reclamation. Altitude (instrument), 2,010.0 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, dark-brown	2	2
Silt, sandy, brown	1.5	3.5
Silt, dark-brown; contains layers of sandy silt	5.0	8.5
Silt, light-brown with white streaks; contains calcareous nodules	2.5	11
Silt, light-brown	32	43
Silt, black-brown; contains little pockets of fine sand	4	47
Silt, brown; contains streaks and pockets of fine sand, gray	4	51
Silt, slightly clayey, brown	4	55
Silt, sandy, brown	1	56
Silt, slightly clayey, brown; contains some fine sand from 81 to 86 ft	45	101
Silt, grayish-brown	5	106
Silt, light-brown	5	111
Silt, calcareous, alternate layers brown and light-brown	19	130
Silt, slightly sandy, fine, brown	2	132
Tertiary—Ogallala formation (Pliocene):		
Silt, calcareous streaks, brown	4	136
Silt, calcareous streaks, light-brown	15	151
Silt, calcareous streaks, brown; contains streaks and pockets of very fine sand, gray	.7	151.7

HOWARD COUNTY

13-11-30dd*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,895 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Soil	2	2
Sand, fine	81	83
Tertiary—Ogallala formation (Pliocene): Sandstone, calcareous, and sand	77	160
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, yellow	18	178
Shale, blue to gray	———	———

13-11-31bc*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,914 feet above mean sea level

Quaternary—Pleistocene and Recent:		
Sand, fine	18	18
Clay	7	25
Sand and gravel	89	114
Tertiary—Ogallala formation (Pliocene): Sandstone, calcareous, and sand	51	165
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, yellow	5	170
Shale, blue to gray	———	———

Table 7.—*Logs of test holes and wells*—Continued

HOWARD COUNTY—Continued

	Thickness (feet)	Depth (feet)
13-11-32cc*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,922 feet above mean sea level		
Quaternary—Pleistocene and Recent: Sand and gravel	105	105
Tertiary—Ogallala formation (Pliocene):		
Clay, sandy	20	125
Clay and sandstone	17	142
Sand and gravel	13	155
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, white and yellow	40	195
Shale, blue		
13-11-33bb*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,882 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil	2	2
Clay, sandy, light-yellow	23	25
Sand and gravel	50	75
Tertiary—Ogallala formation (Pliocene): Sandstone, calcareous	65	140
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, yellow	8	148
Shale, blue to gray		
13-12-20dd*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,925 feet above mean sea level		
Quaternary and Tertiary:		
Soil	4	4
Clay, yellow, some hard layers	89	93
Shale, green	7	100
Sandstone, green	29	129
Sandstone and siltstone	12	141
Clay, yellow	49	190
Cretaceous—Pierre shale (Upper Cretaceous): Shale, blue to gray		
13-12-25ba. Altitude (instrument), 1,923 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Clay, silty, black to brown	10	10
Clay, silty, light-brown	9	19
Tertiary—Ogallala formation (Pliocene):		
Clay, silty, very hard	8	27
Sandstone	8	35
Clay, silty, to sandstone, calcareous	75	110
13-12-25db. Altitude (instrument), 1,900 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, sandy, black to gray	5	5
Clay, silty	10	15
Gravel	4	19
Tertiary—Ogallala formation (Pliocene):		
Clay, silty, some calcareous nodules	6	25
Sandstone	5	30
Clay, silty, light-brown	10	40
Sandstone, calcareous	5	45
Clay, silty, light-brown	5	50
Sandstone, calcareous	15	65
Gravel	3	68
Clay, silty, and some sandstone	17	85
Sandstone	15	100

Table 7.—*Logs of test holes and wells*— Continued

HOWARD COUNTY—Continued

	Thickness (feet)	Depth (feet)
13-12-26bb*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,893 feet above mean sea level		
Quaternary—Pleistocene and Recent: Sand	25	25
Tertiary—Ogallala formation (Pliocene):		
Clay, calcareous	5	30
Clay, sandy, buff	45	75
Siltstone and sandstone	37	112
Marlite	2	114
Silt, calcareous in part, green-gray	46	160
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, yellow	35	195
Shale, blue-gray	----------	-------
13-12-26cc*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,916 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil	2	2
Clay, yellow	16	18
Sand and gravel	7	25
Clay, yellow	37	62
Sand and gravel	13	75
Tertiary—Ogallala formation (Pliocene):		
Sandstone, calcareous	15	90
Sand and gravel	15	105
Clay, yellow	10	115
Sandstone, calcareous	42	157
Sandstone, green	2	159
Clay, sandy, green	19	178
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, yellow	30	208
Clay, blue	2	210
Clay, yellow	2	212
Clay, light-gray	5	217
Clay, yellow	13	230
Shale, blue to gray	----------	-------
13-12-31bb*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,930 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil	2	2
Sand	43	45
Sand and gravel	17	62
Tertiary—Ogallala formation (Pliocene):		
Sandstone, silty, calcareous, gray	68	130
Sandstone, silty, calcareous, light-green	55	185
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-blue-green	25	210
Shale, light-gray	----------	-------
13-12-31cd*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,931 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Clay, sandy	5	5
Sand	53	58
Gravel	4	62
Tertiary—Ogallala formation (Pliocene):		
Clay, yellow, and gravel	33	95
Clay, yellow, and sandstone	80	175
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, yellow	22	197
Shale, light-blue-gray	----------	-------

Table 7.—*Logs of test holes and wells*—Continued

HOWARD COUNTY—Continued

	Thickness (feet)	Depth (feet)
13-12-32bb*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,924 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil	3	3
Sand	35	38
Gravel and clay	17	55
Tertiary—Ogallala formation (Pliocene): Clay and sandstone	107	162
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, yellow	28	190
Shale, blue		
13-12-34bb*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,906 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Sand	50	50
Gravel	7	57
Tertiary—Ogallala formation (Pliocene):		
Clay, yellow	8	65
Sandstone and clay, calcareous, buff	75	140
Clay, white	15	155
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-buff	35	190
Shale, blue-gray		
13-12-35aa1*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,892 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil	1	1
Sand	38	39
Tertiary—Ogallala formation (Pliocene): Sandstone and siltstone	141	180
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, yellow	10	190
Shale, gray		
13-12-36aa. Altitude (instrument), 1,900 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, light-brown	5	5
Clay, sandy, light-brown	5	10
Clay, blue to gray	10	20
Sand and gravel	9	29
Tertiary—Ogallala formation (Pliocene):		
Clay, sandy	11	40
Silt and sandstone, calcareous	30	70
13-12-36da. Altitude (instrument), 1,904 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Clay, silty, and gravel	5	5
Clay, silty, black	5	10
Sand and gravel	61	71
Tertiary—Ogallala formation (Pliocene):		
Clay, silty	19	90
Sandstone	10	100

Table 7.—*Logs of test holes and wells*—Continued

KEARNEY COUNTY

	Thickness (feet)	Depth (feet)
8-14-19cc. Altitude (instrument), 2,096.1 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, very sandy	2.5	2.5
Sand and gravel	22	24.5
Silt, clayey, dark-brownish-gray to gray	.7	25.2
Sand and gravel	22.8	48
Silt, sandy to clayey, yellowish-brown	3	51
Sand and gravel	7	58
Silt, slightly clayey to sandy, yellowish-brown	3	61
Sand and gravel, with yellowish-brown silt layers from 110-115.5 ft	62	123
Silt, sandy	4.5	127.5
Sand and gravel	15.5	143
Tertiary—Ogallala formation (Pliocene):		
Silt, clayey, gray to brown	27	170
Silt to sandy siltstone, brownish-gray	29	199
Sand and gravel	10.5	209.5
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-gray to yellow	7.5	217
Shale, medium-gray		
8-16-23aa. Altitude (instrument), 2,146.05 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, sandy, and fine to coarse sand, brownish-gray	4.8	4.8
Silt, sandy to clayey, black	1.4	6.2
Sand and gravel	41.8	48
Tertiary—Ogallala formation (Pliocene):		
Sandstone, silty, yellowish-brown	12	60
Sandstone, in part calcareous, brownish-gray to green	10	70

PHELPS COUNTY

8-19-12dc. Altitude (instrument), 2,264.19 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, sandy, brownish-gray	4.5	4.5
Sand and gravel, very fine sand to very coarse gravel	27.5	32
Tertiary—Ogallala formation (Pliocene):		
Silt, clayey to sandy	8	40
Sandstone, calcareous in part, greenish-gray to reddish-brown	40	80
Siltstone, brownish-gray to greenish-gray	10	90
Sandstone, calcareous in part, greenish-gray	43	133
Sand, silty, to silt, sandy, grayish-green	9.5	142.5
Sandstone, calcareous in part, greenish-gray	72.5	215
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-gray with limonitic stain	44	259
Clay shale, dark-gray	11	270

SHERMAN COUNTY

13-13-19dd*. Spelts-Cunningham-Mevis. Altitude (instrument), 2,074 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil	2	2
Clay, yellow	151	153
Tertiary—Ogallala formation (Pliocene): Sandstone, calcareous, and sand, fine	177	330
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, yellow	30	360
Shale, blue to gray		

Table 7.—*Logs of test holes and wells*— Continued

SHERMAN COUNTY—Continued

	Thickness (feet)	Depth (feet)
13-13-20aa*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,968 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil	2	2
Sand	60	62
Gravel	5	67
Tertiary—Ogallala formation (Pliocene): Sandstone and clay	155	222
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, yellow and gray	23	245
Clay, blue and yellow	15	260
13-13-22ca*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,946 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Sand	40	40
Gravel	32	72
Tertiary—Ogallala formation (Pliocene): Clay and sandstone	130	202
Cretaceous—Pierre shale (Upper Cretaceous):		
Shale, yellow	38	240
Shale, gray and blue		
13-13-24cc*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,934 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil	3	3
Sand	9	12
Gravel	3	15
Gravel and clay	5	20
Tertiary—Ogallala formation (Pliocene): Clay and sandstone	165	185
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, yellow and white	10	195
Shale, light-blue and yellow	30	225
Shale, light-blue-gray		
13-13-24dd*. Spelts-Cunningham-Mevis. Altitude (instrument), 1,941 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil	5	5
Clay, sandy	7	12
Clay, gray	24	36
Sand, medium	2	38
Tertiary—Ogallala formation (Pliocene):		
Clay, silty with some chalk, buff	62	100
Sand, fine	30	130
Sand, fine, with some chalk	20	150
Sand and gravel, coarse	6	156
Sandstone, brown	4	160
Silt, light-green	10	170
Sand, medium- to coarse-grained	10	180
Silt, light-green	20	200
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-buff	30	230
Shale, dark-gray		
13-13-26da2. Altitude (altimeter), 1,951 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, sandy, black to light-brown	5	5
Clay, silty, sandy in lower part, grayish-brown to brown	12	17
Gravel, medium- to coarse-grained	3	20

Table 7.—*Logs of test holes and wells*—Continued

SHERMAN COUNTY—Continued

	Thickness (feet)	Depth (feet)
13-13-26da2—Continued		
Quaternary—Pleistocene and Recent—Continued		
Clay, silty, calcareous, light-brown to dark-brown	10	30
Gravel, medium-grained	5	35
Clay and peat, black	10	45
Gravel, medium- to coarse-grained	5	50
Clay, silty	5	55
Gravel, coarse	10	65
Tertiary—Ogallala formation (Pliocene):		
Clay, silty, light-brown	15	80
Sandstone, calcareous	13	93
13-13-27dd*. Spelts-Cunningham-Mevis. Altitude (instrument), 2,051 feet above mean sea level		
Quaternary and Tertiary:		
Sand	18	18
Clay, sandy	42	60
Sandstone	97	157
Gravel	28	185
Sandstone	120	305
Cretaceous—Pierre shale (Upper Cretaceous): Shale, gray and blue	----------	----------
13-13-29dd*. Spelts-Cunningham-Mevis. Altitude (instrument), 2,056 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil	5	5
Clay, silty, buff	139	144
Gravel	4	148
Tertiary—Ogallala formation (Pliocene):		
Siltstone, light-green	12	160
Clay, silty, light-green	10	170
Siltstone, light-green	11	181
Sandstone	7	188
Siltstone, calcareous, light-green	5	193
Clay, light-green	4	197
Clay, calcareous, white	8	205
Sandstone, silty, calcareous	40	245
Clay, light-green	5	250
Sandstone, silty, calcareous	15	265
Clay, light-green	5	270
Clay and sandstone, calcareous	27	297
Sandstone and marlite, alternate layers	18	315
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, yellow	10	325
Shale, blue-gray	----------	----------
13-13-34aa. Altitude (altimeter), 2,048 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, sandy, black to light-brown	15	15
Clay, silty, light-brown	31	46
Soil: silt, sandy, dark-brown	4	50
Clay, silty, slightly sandy, light-brown	35	85
Clay, sandy, light-brown	5	90
Tertiary—Ogallala formation (Pliocene): Sandstone, calcareous; contains some gravel	30	120

Table 7.—*Logs of test holes and wells*— Continued

SHERMAN COUNTY—Continued

	Thickness (feet)	Depth (feet)
13-13-35dd*. Spelts-Cunningham-Mevis. Altitude (instrument), 2,063 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Sand	5	5
Clay	147	152
Sand	2	154
Tertiary—Ogallala formation (Pliocene):		
Clay	89	243
Clay and sandstone, calcareous	67	310
Cretaceous—Pierre shale (Upper Cretaceous): Shale, gray and blue		
13-14-23cc. Altitude (altimeter), 2,134.5 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, dark-brown to black	1	1
Silt, light-brownish-gray; contains a few gastropods	30	31
Silt, slightly clayey, dark-brown to black	4.5	35.5
Clay, silty, dark-reddish-brown	1	36.5
Clay, silty, medium-brown	1.5	38
Silt, clayey, light-brown	13	51
Silt, sandy, slightly clayey, light-brown; contains a few calcareous nodules	9	60
Silt, sandy, and silty sand, light-brown; contains a few calcareous nodules	5	65
Silt, sandy, very fine, light-brown; contains some calcareous nodules	15	80
Sand, fine- to medium-grained, light-brownish-gray; contains silt below 90 ft	13.5	93.5
Silt, light-gray	8.5	102
Silt, slightly sandy, very fine to fine, light-brownish-gray	3	105
Silt, sandy, light-brownish-gray; contains a calcareous layer	3	108
Silt, sandy, fine, light-brownish-gray, moderately calcareous	8	116
Silt, light-gray, calcareous; contains a few shell fragments	4	120
Silt, in part clayey, light-gray, calcareous	4	124
Silt, in part sandy, fine, light-reddish-brown, calcareous	20.5	144.5
Tertiary—Ogallala formation (Pliocene):		
Silt to sand, silty, light-greenish-gray	6	150.5
Silt, sandy, fine- to medium-grained, light-greenish-gray; contains hard calcareous layers	10	160.5
Sandstone, very calcareous, light-grayish-brown	6.5	167
Sandstone, brownish-green, in part calcareous	8	175
Sandstone, light-gray, very calcareous	9.5	184.5
Sandstone, silty, to silt, light-gray to green, calcareous	4.5	189
Sand, silty, to silt, sandy, fine- to medium-grained grayish-green, slightly calcareous	6	195
Sand, slightly silty, very coarse sand; contains thin calcareous layers	11	206
Silt, clayey, and silt, sandy, grayish-green	4	210
Sandstone, brownish-gray	2	212
Sand, fine- to medium-grained, brownish-gray	9.5	221.5
Sand, silty, to silt, sandy, greenish-gray, slightly calcareous	2.5	224
Sand, fine- to medium-grained, brownish-gray	6	230
Sand and sand, silty, interbedded, brownish-gray to green	5	235
Silt, slightly sandy, in part clayey, light-gray	4	239
Sand, slightly silty, fine- to medium-grained, brownish-gray	5	244
Sand, silty, light-grayish-green, calcareous	6	250
Sandstone, silty, light-gray, calcareous; contains some green silt	5	255
Silt, slightly sandy, light-gray; contains calcareous layers	9.5	264.5
Sand, fine- to medium-grained, brownish-gray	6.5	271
Silt and sandstone, light-gray, calcareous	2	273
Sand, silty, to silt, sandy, medium-grained, brownish-gray	7	280
Sand and sandstone, slightly to moderately calcareous, brownish-gray; contains calcareous silt layers below 285 ft	11	291
Silt, sandy, greenish-gray, moderately calcareous	2.5	293.5
Sand, silty, to silt, sandy, light-brownish-gray	6.5	300

Table 7.—*Logs of test holes and wells*—Continued

SHERMAN COUNTY—Continued

	Thickness (feet)	Depth (feet)
13-14-23cc—Continued		
Tertiary—Ogallala formation (Pliocene)—Continued		
Sand, silty, medium-grained, trace of coarse sand and fine gravel, brownish-gray	3	303
Sand, medium- to coarse-grained, brownish-gray	8.5	311.5
Marlite, light-gray to white	1.5	313
Silt, clayey to sandy, light-greenish-gray, slightly calcareous	2	315
Sand, medium-grained, brownish-gray	5	320
Sand, medium- to coarse-grained, brownish-gray	2	322
Silt, clayey to sandy, very fine to fine, grayish-green	7.5	329.5
Sand, in part silty, brownish-gray to green	2.5	332
Silt, sandy, light-brownish-gray	2	334
Sand and sandstone, fine, brownish-gray	6.5	340.5
Silt and sandstone, light-gray to brownish-gray; contains hard calcareous layers	3	343.5
Silt, slightly clayey and sandy, grayish-green	4.5	348
Sand, in part silty, fine- to medium- and some coarse-grained, brownish-gray	12	360
Sand, silty, and silt, sandy, light-brownish-gray	5	365
Sand, medium- to coarse-grained, with some fine gravel, brownish-gray	8	373
Silt, slightly sandy, light-gray	2	375
Silt, light-brown, slightly calcareous	3.5	378.5
Marl, light-gray to white	1.5	380
Silt, clayey to sandy, light-brown; contains a trace of gravel and limonite nodules	4.5	384.5
Cretaceous—Pierre shale (Upper Cretaceous):		
Clay, light-gray with yellowish-orange stain; contains a few limonitic fragments	5.5	390
Clay, light-gray to medium-gray, interbedded with light-green clay	10	400
Clay, silty, light-gray to medium-gray, slightly to moderately calcareous	4	404
Shale, silty clay, medium-gray, moderately calcareous	6	410
Shale, silty clay, medium-gray to dark-gray, moderately to very calcareous	10	420
13-14-24cc*. Spelts-Cunningham-Mevis. Altitude (instrument), 2,100 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Sand	5	5
Clay	37	42
Sand	3	45
Clay; contains some calcareous concretions	59	104
Sand	2	106
Tertiary—Ogallala formation (Pliocene):		
Sandstone, calcareous, and clay	179	285
Sand	3	288
Clay and sandstone, calcareous	74	362
Cretaceous—Pierre shale (Upper Cretaceous):		
Shale, yellow and gray	33	395
Shale, blue		
13-14-25dd*. Spelts-Cunningham-Mevis. Altitude (instrument), 2,110 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Soil	3	3
Clay	49	52
Clay; contains some calcareous concretions	8	60
Clay, sticky	75	135

Table 7.—*Logs of test holes and wells*—Continued

SHERMAN COUNTY—Continued

	Thickness (feet)	Depth (feet)
13-14-25dd[a]—Continued		
Tertiary—Ogallala formation (Pliocene):		
Clay and sandstone, calcareous	50	185
Sandstone, calcareous	187	372
Cretaceous—Pierre shale (Upper Cretaceous):		
Shale, silty	13	385
Shale, blue		
13-15-28cd. Altitude (altimeter), 2,087 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, clayey, brownish-gray	4	4
Silt, light-brown	25	29
Silt, clayey, light-gray	5	34
Sand and gravel, silty	5	39
Silt, clayey, light-gray to brown	20	59
Sand and gravel, silty	10	69
Gravel, fine to coarse, with some coarse sand; contains a few pebbles	22	91
Tertiary—Ogallala formation (Pliocene): Sandstone, calcareous, light-greenish-gray; contains some interbedded greenish-gray clay	8	99
13-15-28da. Altitude (altimeter), 2,076 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, slightly sandy, dark-brownish-gray to light-brown	24	24
Silt, moderately clayey, gray	25	49
Silt, sandy, gray	5	54
Silt, light-gray to grayish-brown	13	67
Sand, silty, to gravel; contains many sandstone fragments	12	79
Gravel, fine to coarse, with some pebbles	3	82
Tertiary—Ogallala formation (Pliocene):		
Sandstone, silty, light-gray to brown	3	85
Sandstone, very calcareous, light-gray	1	86
13-15-32ad. Altitude (altimeter), 2,096 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, clayey, brownish-gray	9	9
Silt, clayey, light-brown, slightly sandy in lower part	15	24
Gravel and sand, fine gravel to coarse sand; contains a few wood fragments	10	34
Sand and gravel, coarse sand to fine gravel; contains some gray silt layers in lower part	25	59
Silt, clayey, light-gray	5	64
Silt, clayey, dark-brownish-gray	5	69
Silt, sandy, dark-gray to gray	7	76
Gravel, fine to coarse; contains some pebbles in lower part	24	100
Tertiary—Ogallala formation (Pliocene): Sandstone, silty, white	9	109
13-15-35bd*. Rathjen. Walter T. Dunlap and Co. Altitude (from topographic map), 2,080 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Top soil and clay, brown	40	40
Clay, blue	43	83
Sand, medium- to coarse-grained, trace of blue clay	15	98
Sand, fine, and fine gravel	14	112

Table 7.—*Logs of test holes and wells*—Continued

SHERMAN COUNTY—Continued

	Thickness (feet)	Depth (feet)
13-15-35bd*—Continued		
Tertiary—Ogallala formation (Pliocene):		
Clay, white	2	114
Sandstone, limestone, very fine sand, and clay, white, alternating layers	82	196
13-16-31cc*. Ohio Oil Co. Altitude (altimeter), 2,216 feet above mean sea level		
Quaternary—Pleistocene and Recent:		
Silt, slightly clayey, black to medium-gray	10	10
Sand and some gravel	2	12
Silt, slightly to moderately clayey, light-yellow-gray	28	40
Sand, very fine to medium-grained	22	62
Clay and sandstone fragments	11	73
Silt, slightly clayey to sandy, medium-red-brown	7	80
Sand and gravel, fine sand to fine gravel; contains silty clay from 90 to 92 ft	24	104
Tertiary—Ogallala formation (Pliocene):		
Sand, silty, to sandstone, light-gray	26	130
Sandstone, light-gray	20	150
Sandstone to sand, silty, light-gray	10	160
Sand and gravel	20	180
Sandstone and clay stone, light-gray	30	210
Sand, very fine to medium-grained, silty to clayey, light-green-gray	50	260
Sand, fine- to medium-grained slightly, silty, light-brown	50	310
Sand, very fine to medium-grained, moderately silty, light-brown	30	340
Sand, very fine to medium-grained, slightly silty to moderately clayey, light-brown	40	380
Sandstone to silty sand, fine- to medium-grained, light-brown	24	404
Cretaceous—Pierre shale (Upper Cretaceous): Shale, light-gray to medium-gray	16	420

Table 8.—*Water-level measurements in wells, in feet below land-surface datum*

BUFFALO COUNTY

Date	Water level	Date	Water level	Date	Water level
8-16-3cb					
Jan. 6, 1948	12.40	Apr. 13, 1949	11.32	Sept. 6, 1950	11.37
Mar. 9	12.52	July 6	10.99	Nov. 7	11.60
May 3	12.62	Sept. 7	10.06	Jan 9, 1951	12.09
July 6	12.36	Nov. 1	10.61	Mar. 27	12.18
Sept. 7	10.97	Jan. 4, 1950	11.25	May 7	12.37
Nov. 3	12.10	Mar. 1	11.60	Aug. 2	10.59
Jan. 7, 1949	12.12	May 10	11.73	Oct. 18	11.24
Mar. 10	11.77	July 5	11.30		
8-16-10cc					
Jan. 6, 1948	2.00	Apr. 13, 1949	1.84	July 5, 1950	3.64
Mar. 9	1.77	July 6	1.70	Sept. 6	2.43
May 4	2.26	Sept. 6	3.18	Nov. 7	2.70
July 6	3.23	Nov. 1	2.73	Jan. 8, 1951	2.29
Sept. 7	3.79	Jan. 4, 1950	2.47	Mar. 27	1.98
Nov. 3	2.78	Mar. 1	1.95	May 7	2.35
Jan. 7, 1949	2.05	May 10	2.21		
8-16-12cc					
Jan. 6, 1948	6.07	Apr. 13, 1949	4.47	Sept. 13, 1950	5.58
Mar. 9	5.74	July 6	4.42	Nov. 7	5.13
May 4	5.49	Sept. 6	5.73	Jan. 9, 1951	5.43
July 6	5.12	Nov. 1	5.25	Mar. 27	5.49
Sept. 7	5.70	Jan. 3, 1950	5.92	May 7	5.69
Nov. 3	5.47	Mar. 1	5.92	July 25	4.95
Jan. 7, 1949	5.64	May 10	5.75	Oct. 18	4.98
Mar. 9	5.22	July 5	6.36		
8-17-1da					
Jan. 6, 1948	8.72	Apr. 13, 1949	6.41	July 5, 1950	8.05
Mar. 9	8.55	July 6	6.48	Sept. 6	8.78
May 4	8.95	Sept. 6	7.65	Nov. 7	8.64
July 6	9.07	Nov. 1	8.18	Jan. 9, 1951	8.10
Sept. 7	8.90	Jan. 4, 1950	7.95	Mar. 27	7.62
Nov. 3	9.27	Mar. 1	7.64	May 7	7.07
Jan. 12, 1949	8.38	May 10	6.70	Oct. 18	8.28
Mar. 10	7.50				
8-17-4bc					
Jan. 6, 1948	8.85	Apr. 13, 1949	7.18	Sept. 6, 1950	8.11
Mar. 9	8.30	July 6	5.85	Nov. 7	8.06
May 4	8.55	Sept. 7	9.22	Jan. 9, 1951	7.23
July 6	9.69	Nov. 1	9.00	Mar. 27	6.61
Sept. 7	11.19	Jan. 4, 1950	8.25	May 7	6.14
Nov. 3	10.74	Feb. 28	7.85	Aug. 2	6.92
Jan. 12, 1949	9.75	May 10	7.00	Oct. 18	8.15
Mar. 10	8.38	July 5	7.73		
8-18-4cb					
Jan. 6, 1948	9.08	July 6, 1948	9.75	Jan. 12, 1949	9.35
Mar. 9	8.91	Sept. 7	10.07	Mar. 10	9.01
May 4	9.42	Nov. 3	9.98	Apr. 13	9.54

Table 8.—*Water-level measurements in wells, in feet below land-surface datum*—Con.

BUFFALO COUNTY—Continued

Date	Water level	Date	Water level	Date	Water level
8-18-4cb—Continued					
July 6, 1949	8.22	May 8, 1950	9.68	Mar. 27, 1951	9.92
Sept. 7	10.05	July 5	9.89	May 7	9.84
Nov. 1	10.05	Sept. 6	9.67	Aug. 2	9.16
Jan. 4, 1950	9.20	Nov. 8	9.56	Oct. 18	9.62
Mar. 1	9.83	Jan. 9, 1951	9.74		
9-13-5cb					
Jan. 3, 1950	18.25	Sept. 13, 1950	21.73	Mar. 26, 1951	17.77
Mar. 1	18.14	Nov. 7	18.84	May 4	17.92
May 1	17.72	Jan. 8, 1951	18.47	July 25	17.00
July 3	17.34				
9-13-9cc					
Jan. 3, 1950	12.29	Sept. 13, 1950	12.56	Mar. 26, 1951	14.22
Mar. 1	12.45	Nov. 7	12.10	May 4	13.92
May 1	12.18	Jan. 8, 1951	14.04	Oct. 17	14.18
July 3	11.85				
9-14-1dc—See table 9.					
9-14-4cc					
Jan. 4, 1950	19.25	Sept. 13, 1950	19.54	May 4, 1951	18.65
Mar. 1	19.22	Nov. 7	18.92	July 25	18.77
May 10	19.09	Jan. 9, 1951	18.77	Oct. 17	20.15
July 5	19.15	Mar. 26	18.68		
9-14-13cb					
Jan. 3, 1950	18.18	Sept. 13, 1950	17.96	Mar. 26, 1951	17.73
Mar. 1	18.22	Nov. 7	17.93	May 4	17.62
May 10	18.10	Jan. 8, 1951	17.72	Oct. 17	18.46
July 3	18.15				
9-14-19dd					
Jan. 28, 1950	24.56	Sept. 2, 1950	24.73	Apr. 27, 1951	24.79
Feb. 28	24.59	28	23.74	May 27	24.27
Mar. 28	24.47	Nov. 1	24.91	July 4	23.77
Apr. 29	24.38	Jan. 2, 1951	24.48	27	23.59
May 29	23.35	30	24.39	Sept. 28	23.92
June 30	24.14	Feb. 26	24.41	Oct. 27	24.49
July 29	23.95	Mar. 27	24.36	Nov. 28	24.45
9-14-21cc					
Jan. 9, 1951	19.41	Mar. 26, 1951	19.12	May 4, 1951	19.02
9-14-22bb					
Jan. 4, 1950	16.39	July 5, 1950	16.00	Jan. 8, 1951	16.13
Mar. 1	16.20	Sept. 13	16.73	Mar. 26	16.06
May 10	16.15	Nov. 7	16.19	May 4	15.99

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Table 8.— *Water-level measurements in wells, in feet below land-surface datum*— Con.

BUFFALO COUNTY—Continued

Date	Water level	Date	Water level	Date	Water level
9-14-34bb					
Jan. 4, 1950	11.20	Sept. 13, 1950	12.31	Mar. 26, 1951	10.86
Mar. 1	10.97	Nov. 7	11.57	May 4	10.48
May 10	11.04	Jan. 9, 1951	11.27	Oct. 17	10.46
July 5	12.80				
9-15-11cb					
Jan. 4, 1950	25.70	Sept. 13, 1950	23.77	May 4, 1951	24.80
Mar. 1	25.78	Nov. 7	24.13	July 25	24.57
May 10	25.62	Jan. 8, 1951	24.44	Oct. 17	26.17
July 5	25.64	Mar. 26	24.70		
9-15-34bb					
Jan. 4, 1950	20.04	Sept. 13, 1950	20.45	Mar. 26, 1951	18.95
Mar. 1	20.06	Nov. 7	19.30	May 4	19.32
May 10	20.47	Jan. 9, 1951	19.34	Oct. 17	19.57
July 5	19.70				
9-16-9cb					
May 3, 1949	30.98	Mar. 27, 1950	30.55	Jan. 29, 1951	30.37
June 3	30.93	May 4	30.56	Mar. 17	30.20
July 7	30.18	June 9	32.65	Apr. 6	30.20
Sept. 19	31.63	July 17	30.51	30	30.11
Nov. 3	31.07	Sept. 7	33.35	May 30	30.19
Dec. 1	31.01	Oct. 3	30.50	July 26	28.94
Jan. 5, 1950	30.86	Nov. 2	30.37	Aug. 20	39.16
Feb. 7	30.69	Nov. 30	30.24	28	32.87
Mar. 1	30.81	Jan. 3, 1951	30.18		
9-16-13bc					
May 2, 1949	27.23	Mar. 27, 1950	27.48	Jan. 29, 1951	27.26
June 3	27.15	May 4	27.38	Mar. 17	27.11
July 7	26.71	June 9	27.28	Apr. 6	27.20
Sept. 19	28.25	July 17	27.38	30	27.15
Nov. 3	27.91	Sept. 7	27.84	May 30	27.17
Dec. 1	28.03	Oct. 3	27.48	July 26	27.30
Jan. 5, 1950	27.79	Nov. 2	27.39	Aug. 23	29.66
Feb. 7	27.65	30	27.27	28	28.98
Mar. 1	26.64	Jan. 3, 1951	27.19		
9-17-31cd					
Jan. 6, 1948	12.58	Apr. 13, 1949	9.52	Sept. 6, 1950	10.51
Mar. 9	13.01	July 6	8.75	Nov. 7	10.21
May 4	11.74	Sept. 7	9.98	Jan. 9, 1951	10.75
July 6	10.12	Nov. 1	10.52	Mar. 27	10.81
Sept. 7	10.22	Jan. 4, 1950	11.30	May 7	11.73
Nov. 3	10.73	Mar. 1	12.32	Aug. 2	10.04
Jan. 12, 1949	11.29	May 10	11.59	Oct. 18	10.15
Mar. 10	10.36	July 5	10.75		

Table 8.— *Water-level measurements in wells, in feet below land-surface datum*— Con.

BUFFALO COUNTY—Continued

Date	Water level	Date	Water level	Date	Water level
9-18-27dd					
Jan. 6, 1948	7.03	Apr. 13, 1949	7.45	Sept. 6, 1950	7.82
Mar. 9	7.25	July 6	5.55	Nov. 8	7.96
May 4	7.52	Sept. 7	6.82	Jan. 9, 1951	7.98
July 6	8.57	Nov. 1	7.10	Mar. 27	8.05
Sept. 7	8.28	Jan. 4, 1950	7.33	May 7	8.25
Nov. 3	8.58	Mar. 1	7.50	Aug. 2	7.05
Jan. 12, 1949	8.80	May 10	7.26	Oct. 18	5.92
Mar. 10	8.02	July 5	7.79		
9-18-31cc					
Jan. 6, 1948	11.45	Apr. 13, 1949	11.00	July 5, 1950	10.96
Mar. 8	11.10	July 6	9.62	Sept. 6	10.74
May 4	11.36	Sept. 7	10.54	Nov. 8	11.18
July 6	11.17	Nov. 1	11.55	Jan. 9, 1951	11.14
Sept. 7	12.50	Jan. 4, 1950	11.32	Mar. 27	11.06
Nov. 4	12.32	Mar. 1	11.12	May 7	11.12
Jan. 12, 1949	11.97	May 8	11.00	Oct. 18	10.64
Mar. 10	11.18				
10-13-24bc					
Jan. 3, 1950	23.27	Sept. 13, 1950	21.03	May 4, 1951	22.92
Mar. 1	23.18	Nov. 7	25.00	July 25	22.00
May 1	22.90	Jan. 8, 1951	23.74	Oct. 17	22.67
July 3	22.60	Mar. 26	22.98		
10-16-7ba					
Aug. 18, 1950	128.43	Jan. 29, 1951	127.86	July 26, 1951	127.38
Oct. 3	128.30	Mar. 17	127.50	Aug. 20	128.53
Nov. 3	128.02	Apr. 9	127.49	27	127.93
29	127.00	Apr. 30	127.35	Dec. 12	127.30
Jan 3, 1951	127.42	May 30	127.51		
10-17-21cd					
Oct. 9, 1934	32.34	June 18, 1937	30.71	Feb. 7, 1950	28.52
Nov. 13	31.85	Oct. 16	30.74	Mar. 1	28.52
Dec. 26	31.48	June 25, 1938	30.11	27	27.23
Feb. 27, 1935	31.19	Oct. 25	30.28	May 4	28.22
Apr. 23	30.98	June 1, 1939	30.18	June 9	28.19
June 11	30.41	Nov. 25	31.80	July 17	28.39
July 16	30.74	Mar. 26, 1940	30.34	Sept. 7	29.15
Aug. 16	31.04	July 16	31.02	Oct. 3	28.71
Sept. 17	30.98	Oct. 16, 1941	30.43	Nov. 2	28.52
Oct. 24	30.92	Nov. 26, 1942	29.11	30	28.30
Nov. 27	29.68	Nov. 15, 1948	29.80	Jan. 3, 1951	28.17
Dec. 31	30.59	May 3, 1949	28.39	29	28.30
Jan. 20, 1936	30.56	June 3	28.48	Mar. 17	28.10
Mar. 28	30.39	July 7	27.98	Apr. 6	28.12
June 4	30.47	Sept. 19	29.72	30	27.99
July 22	31.21	Nov. 3	28.85	May 30	28.06
Aug. 26	31.81	Dec. 1	28.80	July 26	35.40
Nov. 26	32.48	Jan. 5, 1950	28.63	Dec. 12	28.16
Apr. 3, 1937	30.99				

Table 8.— *Water-level measurements in wells, in feet below land-surface datum*— Con.

BUFFALO COUNTY—Continued

Date	Water level	Date	Water level	Date	Water level
10-17-26cb					
May 3, 1949	22.91	Mar. 1, 1950	23.55	Jan. 3, 1951	23.18
June 3	23.14	27	23.16	29	23.31
July 7	22.17	May 4	23.31	Mar. 17	23.27
Aug. 2	23.29	June 9	23.03	Apr. 6	23.10
Sept. 19	24.07	July 17	23.32	May 30	22.75
Nov. 3	23.78	Sept. 7	23.98	July 26	22.90
Dec. 1	23.74	Oct. 3	23.39	Aug. 20	24.30
Jan. 5, 1950	23.65	Nov. 2	23.28	28	24.18
Feb. 7	23.63	30	23.19	Dec. 12	22.76
10-18-10ad					
July 28, 1949	57.04	Jan. 3, 1951	56.19	Apr. 30, 1951	56.00
Oct. 3, 1950	56.85	29	56.42	May 30	56.08
Nov. 2	56.65	Mar. 17	56.20	July 26	55.95
30	56.40	Apr. 6	56.15	Aug. 20	58.13
10-18-12aa					
May 3, 1949	28.25	Mar. 27, 1950	28.12	Jan. 29, 1951	29.29
June 3	28.51	June 9	28.63	Mar. 17	29.09
July 7	27.26	July 17	29.16	Apr. 9	29.04
Sept. 19	29.01	Sept. 7	29.50	30	28.95
Nov. 3	28.69	Oct. 3	29.44	May 30	29.12
Dec. 1	28.75	Nov. 2	29.29	July 26	29.11
Jan. 5, 1950	28.81	30	29.17	Aug. 20	29.79
Mar. 1	28.79	Jan. 3, 1951	29.09		
11-16-35ad					
July 19, 1950	151.54	Jan. 4, 1951	151.73	May 30, 1951	151.45
Sept. 9	152.39	30	151.45	July 26	151.45
Oct. 4	151.62	Mar. 17	151.59	Aug. 24	153.15
Nov. 3	151.73	Apr. 6	151.50	27	152.66
Dec. 1	151.44	30	151.52		
11-18-9dc					
May 3, 1949	33.18	Mar. 1, 1950	33.64	Nov. 30, 1950	34.10
June 3	33.22	27	33.94	Jan. 3, 1951	33.95
July 7	33.02	May 4	33.35	Apr. 2	33.86
Sept. 19	34.36	June 9	33.81	30	33.70
Nov. 3	34.08	July 17	34.04	May 30	33.72
Dec. 1	34.56	Sept. 7	34.45	July 26	33.60
Jan. 5, 1950	33.96	Oct. 3	34.42	Aug. 20	35.04
Feb. 7	33.65	Nov. 3	34.24		
12-13-20bc					
Aug. 3, 1950	25.46	Jan. 4, 1951	25.49	Apr. 28, 1951	25.43
Sept. 6	25.76	30	25.47	May 30	25.49
Oct. 4	25.53	Mar. 3	25.45	July 26	25.47
Nov. 3	25.54	Apr. 6	25.44	Aug. 20	25.51
Dec. 1	25.37				

Table 8.— *Water-level measurements in wells, in feet below land-surface* datum— Con.

BUFFALO COUNTY—Continued

Date	Water level	Date	Water level	Date	Water level
12-15-3bb					
Aug. 29, 1950	29.88	Jan. 4, 1951	29.92	Apr. 28, 1951	29.51
Oct. 4	30.08	30	29.90	May 30	29.30
Nov. 3	30.10	Mar. 3	29.78	July 26	29.56
Dec. 1	29.90	Apr. 6	29.73	Aug. 20	30.47
12-16-35ad1					
Aug. 11, 1950	6.09	Jan. 4, 1951	6.10	Apr. 30, 1951	4.75
Oct. 4	6.23	30	6.08	May 30	4.81
Nov. 3	6.28	Mar. 17	5.78	July 26	5.62
Dec. 1	6.07	Apr. 6	5.46	Aug. 20	6.42

CUSTER COUNTY

13-21-36ca					
Sept. 7, 1950	51.90	Jan. 29, 1951	51.71	May 30, 1951	50.55
Oct. 3	51.82	Mar. 17	51.56	Aug. 20	51.77
Nov. 2	51.73	Apr. 6	51.53	28	51.57
30	51.65	Apr. 30	51.46	Dec. 12	51.40
Jan. 3, 1951	51.55				

DAWSON COUNTY

9-19-16ab					
Jan. 6, 1948	8.50	Apr. 13, 1949	8.42	Sept. 6, 1950	8.12
Mar. 5	8.35	July 7	6.86	Nov. 8	8.37
May 4	8.38	Sept. 7	9.08	Jan. 9, 1951	8.30
July 6	9.10	Nov. 1	8.47	Mar. 27	8.12
Sept. 7	10.70	Jan. 4, 1950	8.41	May 7	8.11
Nov. 4	10.14	Mar. 2	8.34	Aug. 2	7.80
Jan. 12, 1949	9.87	May 8	7.89	Oct. 25	8.06
Mar. 10	9.29	July 5	7.92		
9-19-25bb					
Jan. 6, 1948	7.68	Apr. 13, 1949	7.35	July 5, 1950	6.96
Mar. 4	7.75	July 6	5.12	Nov. 8	8.30
May 4	7.52	Sept. 7	6.95	Jan. 9, 1951	8.46
July 6	6.33	Nov. 1	7.95	Mar. 27	8.48
Sept. 7	8.44	Jan. 4, 1950	8.34	May 7	7.70
Nov. 4	9.72	Mar. 2	8.29	Aug. 2	5.83
Jan. 12, 1949	9.60	May 8	7.32	Oct. 25	6.75
Mar. 10	8.81				
9-19-33bb					
Jan. 6, 1948	7.53	Apr. 13, 1949	6.98	Sept. 6, 1950	7.46
Mar. 5	7.29	July 7	5.68	Nov. 8	7.49
May 4	7.10	Sept. 7	7.64	Jan. 9, 1951	7.46
July 6	7.31	Nov. 1	7.44	Mar. 27	7.73
Sept. 7	8.32	Jan. 4, 1950	7.45	May 7	7.64
Nov. 4	8.46	Mar. 2	7.22	Aug. 2	6.20
Jan. 12, 1949	8.23	May 8	6.54	Oct. 25	5.85
Mar. 10	8.57	July 5	6.82		

Table 8.—*Water-level measurements in wells, in feet below land-surface datum*—Con.

DAWSON COUNTY—Continued

Date	Water level	Date	Water level	Date	Water level
9-20-3dd					
Jan. 6, 1948	11.14	Apr. 16, 1949	10.89	Sept. 6, 1950	10.45
Mar. 5	10.82	July 7	9.17	Nov. 8	10.18
May 4	10.68	Sept. 7	10.10	Jan. 9, 1951	10.57
July 6	11.63	Nov. 1	10.20	Mar. 27	10.22
Sept. 7	12.92	Jan. 4, 1950	10.35	May 7	9.99
Nov. 4	12.90	Mar. 2	9.97	Aug. 2	8.16
Jan. 12, 1949	12.47	May 8	9.44	Oct. 25	5.65
Mar. 6	11.65	July 5	10.26		
9-20-5bc					
Jan. 6, 1948	22.42	Apr. 16, 1949	21.95	July 5, 1950	20.15
Mar. 5	21.36	July 7	20.80	Sept. 6	21.38
May 4	21.42	Sept. 7	21.68	Nov. 8	21.53
July 6	22.22	Nov. 1	21.16	Jan. 9, 1951	21.71
Sept. 7	22.98	Jan. 4, 1950	21.50	Mar. 27	21.49
Nov. 4	23.50	Mar. 2	21.35	May 7	21.23
Jan. 12, 1949	23.21	May 8	20.69	Oct. 25	20.11
Mar. 10	23.07				
9-20-13bc					
Jan. 6, 1948	10.02	Apr. 16, 1949	9.90	Sept. 6, 1950	9.51
Mar. 5	9.70	July 7	7.72	Nov. 8	11.72
May 4	9.64	Sept. 7	9.40	Jan. 9, 1951	9.34
July 6	10.59	Nov. 1	9.10	Mar. 27	9.03
Sept. 7	11.94	Jan. 4, 1950	9.12	May 7	8.82
Nov. 4	11.85	Mar. 2	8.96	Aug. 2	8.14
Jan. 12, 1949	11.22	May 8	7.80	Oct. 25	8.43
Mar. 10	10.69	July 5	7.94		
9-20-22cc					
Jan. 6, 1948	10.65	Apr. 16, 1949	10.46	July 5, 1950	9.88
Mar. 4	10.34	July 7	9.14	Sept. 6	9.74
May 4	10.40	Sept. 7	10.09	Nov. 8	10.38
July 6	11.15	Nov. 1	10.16	Jan. 9, 1951	10.26
Sept. 7	12.42	Jan. 4, 1950	10.19	Mar. 27	9.87
Nov. 4	12.37	Mar. 2	9.55	May 7	9.97
Jan 12, 1949	11.85	May 8	9.21	Oct. 25	9.29
Mar. 10	11.06				
9-20-33dd					
Jan. 6, 1948	2.89	Apr. 16, 1949	2.71	July 5, 1950	4.19
Mar. 4	3.01	July 7	2.09	Sept. 6	4.00
May 4	3.42	Sept. 7	4.05	Nov. 8	3.97
July 6	4.43	Nov. 1	3.40	Jan. 9, 1951	3.78
Sept. 7	5.28	Jan. 4, 1950	3.76	Mar. 27	3.41
Nov. 4	5.00	Mar. 2	3.61	May 7	3.52
Jan. 12, 1949	4.13	May 8	3.10	Oct. 25	3.65
Mar. 10	4.09				

Table 8.— *Water-level measurements in wells, in feet below land-surface datum*— Con.

DAWSON COUNTY—Continued

Date	Water level	Date	Water level	Date	Water level
9-21-6ad					
Jan. 6, 1948	5.80	Apr. 16, 1949	4.16	Sept. 6, 1950	5.64
Mar. 4	5.50	July 6	4.85	Nov. 8	5.67
May 4	5.97	Sept. 7	5.25	Jan. 9, 1951	5.56
July 6	5.79	Nov. 1	5.58	Mar. 27	5.44
Sept. 7	6.52	Jan. 4, 1950	5.59	May 7	5.47
Nov. 4	6.40	Mar. 2	5.39	Aug. 9	4.17
Jan. 12, 1949	5.80	May 8	4.65	Oct. 29	4.64
Mar. 10	4.95	July 5	5.79		
9-21-7aa					
Jan. 6, 1948	7.45	Mar. 10, 1949	7.10	May 8, 1950	7.03
Mar. 4	7.85	Apr. 16	6.52	July 5	6.55
May 4	7.95	July 6	6.74	Sept. 7	6.56
July 6	7.10	Sept. 7	7.07	Nov. 8	7.23
Sept. 7	8.20	Nov. 1	7.46	Jan. 9, 1951	7.08
Nov. 4	8.70	Jan. 4, 1950	7.21	Mar. 27	7.01
Jan. 12, 1949	7.38	Mar. 4	7.12	May 7	7.07
9-21-7da					
Jan. 6, 1948	6.87	Apr. 16, 1949	6.06	Sept. 7, 1950	6.11
Mar. 4	6.85	July 6	6.17	Nov. 8	6.24
May 4	7.08	Sept. 7	6.22	Jan. 9, 1951	6.34
July 6	6.85	Nov. 1	6.82	Mar. 27	6.34
Sept. 7	7.07	Jan. 4, 1950	6.60	May 7	6.50
Nov. 4	7.32	Mar. 4	6.46	Aug. 9	5.38
Jan. 12, 1949	6.40	May 8	6.15	Oct. 29	6.41
Mar. 10	6.42	July 5	6.25		
9-21-12cb					
Jan. 6, 1948	11.53	July 6, 1949	9.95	Sept. 6, 1950	10.00
Mar. 5	11.59	Sept. 7	10.49	Nov. 8	10.89
May 4	11.41	Nov. 1	11.02	Jan. 9, 1951	10.91
July 6	11.08	Jan. 4, 1950	11.00	Mar. 27	10.89
Sept. 7	12.19	Mar. 2	10.71	May 7	10.56
Nov. 4	12.32	May 8	9.90	Oct. 25	10.58
Apr. 16, 1949	10.49	July 5	10.66		
9-21-18aa					
Jan. 6, 1948	5.45	Apr. 16, 1949	4.45	Sept. 7, 1950	5.06
Mar. 4	5.43	July 6	4.22	Nov. 8	5.59
May 4	5.60	Sept. 7	4.67	Jan 9, 1951	5.55
July 6	5.54	Nov. 1	5.54	Mar. 27	5.37
Sept. 7	5.50	Jan. 4, 1950	5.47	May 7	5.67
Nov. 4	6.21	Mar. 2	5.34	Aug. 9	3.87
Jan. 12, 1949	5.69	May 8	4.92	Oct. 29	5.16
Mar. 10	4.94	July 5	4.97		
9-21-18da					
Jan. 6, 1948	5.58	Sept. 7, 1948	5.98	Apr. 17, 1949	4.54
Mar. 4	5.44	Nov. 4	6.22	July 6	4.00
May 4	5.37	Jan. 12, 1949	5.86	Sept. 7	5.14
July 6	5.55	Mar. 10	5.03	Nov. 1	5.64

Table 8.—*Water-level measurements in wells, in feet below land-surface datum*—Con.

DAWSON COUNTY—Continued

Date	Water level	Date	Water level	Date	Water level
9-21-18da—Continued					
Jan. 4, 1950	5.72	Sept. 7, 1950	5.69	May 7, 1951	5.67
Mar. 4	5.52	Nov. 8	5.95	Aug. 9	3.07
May 8	5.40	Jan. 9, 1951	5.92	Oct. 29	4.11
July 5	5.57	Mar. 27	5.30		
9-21-19aa1					
Jan. 6, 1948	4.35	Apr. 17, 1949	3.47	Sept. 7, 1950	5.12
Mar. 4	3.90	July 6	2.85	Nov. 8	5.06
May 4	4.33	Sept. 7	4.79	Jan. 9, 1951	5.06
July 6	4.67	Nov. 1	4.49	Mar. 27	4.86
Sept. 7	5.10	Jan. 4, 1950	4.92	May 7	4.78
Nov. 4	4.95	Mar. 2	4.71	Aug. 9	4.35
Jan. 12, 1949	4.59	May 8	4.47	Oct. 29	4.69
Mar. 10	3.64	July 5	5.02		
9-21-19aa2					
Jan. 6, 1948	1.18	Apr. 17, 1949	.49	Sept. 7, 1950	2.27
Mar. 4	.75	July 6	+.20	Nov. 8	1.94
May 4	1.31	Sept. 7	1.90	Jan. 9, 1951	2.04
July 6	1.70	Nov. 1	1.32	Mar. 27	1.92
Sept. 7	2.10	Jan. 4, 1950	1.97	May 7	1.80
Nov. 4	1.97	Mar. 4	1.75	Aug. 9	1.51
Jan. 12, 1949	1.65	May 8	1.49	Oct. 29	1.78
Mar. 10	.55	July 5	2.13		
9-21-24aa					
Jan. 6, 1948	3.90	Mar. 10, 1949	3.45	July 5, 1950	3.18
Mar. 4	3.86	July 7	2.62	Sept. 6	2.64
May 4	4.02	Sept. 7	2.90	Nov. 8	3.57
July 6	3.67	Nov. 1	3.65	Jan. 9, 1951	3.69
Sept. 7	4.10	Jan. 4, 1950	3.74	Mar. 27	3.51
Nov. 3	5.05	Mar. 2	3.47	May 7	3.28
Jan. 12, 1949	4.40	May 8	2.25	Oct. 25	3.06
10-20-21cb					
Jan. 6, 1948	23.46	Apr. 16, 1949	24.82	July 5, 1950	24.72
Mar. 5	23.50	July 7	24.42	Sept. 6	25.14
May 4	23.70	Sept. 7	24.97	Nov. 8	24.44
July 6	24.09	Nov. 1	24.50	Jan. 9, 1951	23.94
Sept. 7	25.41	Jan. 4, 1950	24.38	Mar. 27	24.29
Nov. 4	25.32	Mar. 2	24.34	May 7	24.39
Jan. 12, 1949	25.22	May 8	24.35	Oct. 25	27.89
Mar. 10	25.05				
10-20-35bb					
Jan. 6, 1948	16.83	July 7, 1949	16.60	Sept. 6, 1950	17.71
Mar. 4	16.90	Sept. 7	17.65	Nov. 8	17.58
May 4	17.00	Nov. 1	17.02	Jan. 9, 1951	17.63
July 6	17.30	Jan. 4, 1950	17.19	Mar. 27	17.70
Sept. 7	18.64	Mar. 2	17.27	May 7	17.72
Nov. 4	18.43	May 8	17.22	Aug. 2	16.00
Jan. 12, 1949	18.29	July 5	17.20	Oct. 25	16.05
Mar. 10	17.86				

Table 8.— *Water-level measurements in wells, in feet below land-surface datum*—Con.

DAWSON COUNTY—Continued

Date	Water level	Date	Water level	Date	Water level
10-21-6da					
Jan. 6, 1948	7.23	July 6, 1949	8.34	Sept. 7, 1950	7.91
Mar. 4	7.20	Sept. 7	8.37	Nov. 8	7.41
May 4	7.32	Nov. 1	8.29	Jan. 9, 1951	8.24
July 6	7.90	Jan. 4, 1950	8.19	Mar. 27	8.20
Sept. 7	8.35	Mar. 2	8.12	May 7	8.23
Nov. 4	8.65	May 8	8.10	Aug. 9	6.43
Mar. 10, 1949	8.70	July 5	8.12	Oct. 29	6.83
Apr. 16	8.59				
10-21-7aa					
Jan. 6, 1948	7.37	Apr. 16, 1949	7.25	Sept. 7, 1950	6.81
Mar. 4	7.49	July 6	7.25	Nov. 8	7.27
May 4	7.79	Sept. 7	7.42	Jan. 9, 1951	7.19
July 5	7.92	Nov. 1	7.91	Mar. 27	7.32
Sept. 7	7.85	Jan. 4, 1950	7.79	May 7	7.29
Nov. 4	8.70	Mar. 2	7.85	Aug. 9	6.07
Jan. 12, 1949	8.56	May 8	7.73	Oct. 29	5.87
Mar. 10	8.06	July 5	7.94		
10-21-7da					
Jan.. 6, 1948	7.82	July 6, 1949	6.89	Sept. 7, 1950	7.24
Mar. 4	7.93	Sept. 7	6.88	Nov. 8	7.59
May 4	8.05	Nov. 1	8.07	Jan. 9, 1951	6.61
July 6	7.82	Jan. 4, 1950	8.19	Mar. 27	6.76
Sept. 7	7.40	Mar. 2	8.28	May 7	6.67
Nov. 4	8.92	May 8	7.93	Aug. 9	5.35
Mar. 10, 1949	8.34	July 5	7.90	Oct. 29	5.26
Apr. 16	7.50				
10-21-18aa					
Jan. 6, 1948	7.12	Apr. 16, 1949	7.23	Sept. 7, 1950	6.62
Mar. 4	7.29	July 6	6.48	Nov. 8	6.86
May 4	7.24	Sept. 7	6.52	Jan. 9, 1951	6.98
July 6	7.01	Nov. 1	7.52	Mar. 27	7.12
Sept. 7	7.24	Jan. 4, 1950	7.65	May 7	7.07
Nov. 4	8.48	Mar. 2	7.72	Aug. 9	5.46
Jan. 12, 1949	8.54	May 8	7.45	Oct. 29	5.58
Mar. 10	7.89	July 5	7.39		
10-21-18dd					
Jan. 6, 1948	11.87	July 6, 1949	12.12	Sept. 7, 1950	11.41
Mar. 4	12.03	Sept. 7	11.82	Nov. 8	11.56
May 4	12.15	Nov. 1	12.42	Jan. 9, 1951	11.59
July 6	12.18	Jan. 4, 1950	12.55	Mar. 27	11.87
Sept. 7	13.06	Mar. 2	12.67	May 7	11.95
Nov. 4	13.58	May 8	12.57	Aug. 9	9.79
Mar. 10, 1949	13.05	July 5	12.07	Oct. 29	11.02
Apr. 16	12.65				

Table 8.— *Water-level measurements in wells, in feet below land-surface datum*— Con.

DAWSON COUNTY—Continued

Date	Water level	Date	Water level	Date	Water level
10-21-19aa					
Jan. 6, 1948	13.99	Apr. 16, 1949	15.18	Sept. 7, 1950	13.35
Mar. 4	14.30	July 6	14.40	Nov. 8	13.74
May 4	14.55	Sept. 7	14.12	Jan. 9, 1951	14.19
July 6	14.34	Nov. 1	14.67	Mar. 27	14.23
Sept. 7	15.82	Jan. 4, 1950	14.87	May 7	14.59
Nov. 4	16.00	Mar. 2	15.02	Aug. 9	13.14
Jan. 12, 1949	15.89	May 8	15.04	Oct. 29	12.36
Mar. 10	15.56	July 5	14.39		
10-21-19da					
Jan. 6, 1948	13.99	Apr. 16, 1949	14.94	Sept. 7, 1950	12.94
Mar. 4	14.26	July 6	13.87	Nov. 8	13.64
May 4	14.50	Sept. 7	14.00	Jan. 9, 1951	13.74
July 6	13.88	Nov. 1	14.47	Mar. 27	14.48
Sept. 7	15.25	Jan. 4, 1950	14.82	May 7	14.56
Nov. 4	15.82	Mar. 2	14.96	Aug. 9	12.60
Jan. 12, 1949	15.80	May 8	14.92	Oct. 29	12.37
Mar. 10	15.44	July 5	12.85		
10-21-23ab					
Jan. 6, 1948	10.79	Apr. 16, 1949	11.42	Sept. 6, 1950	11.43
Mar. 5	10.74	July 7	10.87	Nov. 8	11.98
May 4	10.76	Sept. 7	11.65	Jan. 9, 1951	11.95
July 6	11.25	Nov. 1	11.94	Mar. 27	11.68
Sept. 7	11.55	Jan. 4, 1950	11.90	May 7	12.02
Nov. 4	12.63	Mar. 1	11.92	Aug. 2	10.94
Jan. 12, 1949	12.52	May 8	11.70	Oct. 25	10.68
Mar. 10	11.87	July 5	12.75		
10-21-30aa					
Jan. 6, 1948	6.77	Apr. 16, 1949	7.92	Sept. 7, 1950	5.98
Mar. 4	6.97	July 6	6.35	Nov. 8	6.49
May 4	7.10	Sept. 7	6.20	Jan. 9, 1951	6.86
July 6	6.05	Nov. 1	6.96	Mar. 27	7.08
Sept. 7	7.40	Jan. 4, 1950	7.40	May 7	7.16
Nov. 4	8.42	Mar. 2	7.46	Aug. 9	6.28
Jan. 12, 1949	8.35	May 8	7.65	Oct. 29	5.25
Mar. 10	7.62	July 5	7.56		
10-21-30da					
Jan. 6, 1948	7.73	Apr. 16, 1949	6.60	Sept. 7, 1950	5.48
Mar. 4	7.88	July 6	6.05	Nov. 8	7.66
May 4	7.90	Sept. 7	6.52	Jan. 9, 1951	7.97
July 6	5.85	Nov. 1	7.80	Mar. 27	8.08
Sept. 7	5.77	Jan. 4, 1950	8.32	May 7	8.09
Nov. 4	9.13	Mar. 2	8.29	Aug. 9	3.18
Jan. 12, 1949	9.10	May 8	7.95	Oct. 29	6.31
Mar. 10	8.15	July 5	5.45		

Table 8.—*Water-level measurements in wells, in feet below land-surface datum*— Con.

DAWSON COUNTY—Continued

Date	Water level	Date	Water level	Date	Water level
10-21-31da					
Jan. 6, 1948	6.86	July 6, 1949	5.51	Sept. 7, 1950	6.73
Mar. 4	6.82	Sept. 7	5.99	Nov. 8	7.00
May 4	6.59	Nov. 1	6.65	Jan. 9, 1951	7.01
July 6	5.97	Jan. 4, 1950	7.10	Mar. 27	6.93
Sept. 7	7.20	Mar. 2	7.15	May 7	7.07
Nov. 4	8.00	May 8	6.94	Aug. 9	5.27
Mar. 10, 1949	6.98	July 5	6.95	Oct. 29	5.56
Apr. 16	6.42				
11-19-4dd					
May 3, 1949	54.95	May 4, 1950	54.88	Mar. 17, 1951	54.75
June 3	55.19	June 9	54.79	Apr. 9	54.73
July 7	54.94	Sept. 7	55.38	30	54.60
Sept. 19	55.45	Oct. 3	55.29	May 30	54.66
Nov. 3	55.38	Nov. 2	54.18	July 26	54.50
Dec. 1	55.35	30	54.98	Aug. 20	56.20
Jan. 5, 1950	55.26	Jan. 3, 1951	54.84	28	55.48
Mar. 1	55.14	29	54.97	Dec. 12	54.80
27	54.93				
12-20-36cc					
May 3, 1949	34.76	Mar. 27, 1950	35.04	Jan. 29, 1951	34.99
June 3	33.27	May 4	35.02	Mar. 17	34.79
July 7	34.51	June 9	35.00	Apr. 6	34.76
Sept. 19	36.02	July 17	34.92	30	34.66
Nov. 3	35.54	Sept. 7	35.02	May 30	34.74
Dec. 1	35.54	Oct. 3	35.38	July 26	34.56
Jan. 5, 1950	35.46	Nov. 2	35.16	Aug. 28	38.08
Feb. 7	35.28	30	35.00	Dec. 12	35.12
Mar. 1	35.27	Jan. 3, 1951	34.86		

HALL COUNTY

9-12-1dc					
Jan. 3, 1950	6.45	Sept. 13, 1950	5.86	May 4, 1951	4.02
Feb. 28	6.22	Nov. 7	5.75	July 25	5.09
May 1	5.79	Jan. 8, 1951	5.87	Nov. 5	5.27
July 3	5.34	Mar. 26	4.52		
9-12-9ba					
Jan. 3, 1950	20.83	Nov. 7, 1950	20.40	May 4, 1951	20.12
Feb. 28	20.98	Jan. 8, 1951	20.59	July 25	19.34
May 1	20.90	Mar. 26	20.55	Nov. 5	20.09
July 3	20.35				
10-11-30bc					
Jan. 3, 1950	18.52	July 3, 1950	18.62	May 4, 1951	18.66
Feb. 28	18.70	Jan. 8, 1951	18.49	Nov. 5	18.84
May 1	18.82	Mar. 26	18.62		

Table 8.—*Water-level measurements in wells, in feet below land-surface datum*—Con.

HALL COUNTY—Continued

Date	Water level	Date	Water level	Date	Water level
10-12-21cc					
Jan. 3, 1950	27.85	Sept. 13, 1950	28.86	May 4, 1951	27.09
Feb. 28	27.80	Jan. 8, 1951	27.18	July 25	26.76
May 1	27.54	Mar. 26	27.04	Oct. 17	27.54
July 3	27.35				
11-12-5bc					
Aug. 14, 1950	120.80	Jan. 4, 1951	120.98	Apr. 28, 1951	120.47
Oct. 4	121.43	30	120.67	May 30	119.65
Nov. 3	121.36	Mar. 3	120.78	Aug. 24	122.17
Dec. 1	120.80	Apr. 9	120.55	27	121.76
11-12-34dc					
Jan. 3, 1950	26.02	Nov. 6, 1950	25.51	May 4, 1951	25.28
Feb. 28	25.94	Jan. 8, 1951	25.41	July 25	25.11
May 1	25.85	Mar. 26	25.33	Oct. 17	25.41
July 3	25.68				

Table 9.—*Water-level measurements in well 9–14–1dc, Buffalo County, Nebr.*

[Measurement in feet below land-surface datum. No data for months of February and April 1950]

1950

Day	Jan.	Mar.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	17.12	16.95	16.55	16.35	16.22	15.72	16.47	16.78	16.62	16.50
2	17.11	16.95	16.53	16.35	16.23	15.72	16.47	16.83	16.62	16.55
3	17.09	16.87	16.55	16.37	16.24	15.66	16.51	16.83	16.67	16.55
4	17.10	16.87	16.55	16.35	16.25	15.63	16.53	16.82	16.68	16.57
5	17.11	16.85	16.65	16.29	16.27	15.62	16.56	16.73	16.58	16.61
6	17.11	16.83	16.65	16.28	16.27	15.62	16.57	16.73	16.64	16.59
7	17.11	16.85	16.66	16.27	16.25	15.62	16.62	16.76	16.62	16.49
8	17.10	16.85	16.60	16.30	16.23	15.62	16.68	16.78	16.63	16.52
9	17.06	16.84	16.62	16.30	16.21	15.60	16.73	16.75	16.67	16.55
10	17.11	16.78	16.63	16.30	16.12	15.58	16.77	16.75	16.67	16.55
11	17.11	16.78	16.62	16.28	16.06	15.57	16.81	16.75	16.59	16.49
12	17.11	16.78	16.57	16.28	16.03	15.56	16.82	16.75	16.60	16.49
13	17.06	16.78	16.55	16.24	16.02	15.56	16.83	16.70	16.60	16.48
14	17.09	16.79	16.52	16.27	15.97	15.54	16.83	16.73	16.55	16.50
15	17.09	16.80	16.52	16.25	15.91	15.60	16.80	16.70	16.63	16.51
16	17.09	16.80	16.52	16.29	15.90	15.71	16.82	16.71	16.63	16.51
17	17.09	16.80	16.52	16.29	15.92	15.81	16.83	16.71	16.60	16.51
18	17.09	16.80	16.49	16.28	15.87	15.90	16.81	16.67	16.55	16.50
19	17.08	-----	16.51	16.28	15.86	15.94	16.85	16.72	16.63	16.50
20	17.08	-----	16.48	16.25	15.85	15.93	16.80	16.70	16.63	16.48
21	17.09	-----	16.45	16.25	15.83	15.97	16.83	16.66	16.50	16.47
22	-----	-----	16.43	16.21	15.81	16.04	16.83	16.68	16.59	16.47
23	-----	-----	16.40	16.22	15.79	16.13	16.80	16.68	16.64	16.47
24	-----	-----	16.41	16.22	15.79	16.23	16.81	16.68	16.63	16.47
25	-----	-----	16.42	16.25	15.77	16.28	16.78	16.67	16.58	16.48
26	-----	-----	16.42	16.28	15.76	16.33	16.76	16.61	16.58	16.53
27	-----	-----	16.39	16.26	15.74	16.35	16.78	16.63	16.56	16.49
28	-----	-----	16.37	16.25	15.72	16.38	16.79	16.63	16.56	16.42
29	-----	-----	16.35	16.25	15.70	16.43	16.75	16.62	16.55	16.44
30	-----	-----	16.37	16.23	15.69	16.45	16.75	16.60	16.53	16.43
31	-----	-----	16.37	-----	15.72	16.46	-----	16.57	-----	16.42

1951

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	16.44	16.25	16.18	16.10	15.95	15.80	15.60	16.09	17.04	16.90	16.84	16.59
2	16.41	16.22	16.07	16.10	15.97	15.80	15.60	16.21	17.06	16.86	16.83	16.58
3	16.43	16.20	16.09	16.05	15.95	15.80	15.61	16.30	17.06	16.85	16.80	16.59
4	16.46	16.22	16.17	16.04	15.95	15.79	15.61	16.36	17.06	16.93	16.80	16.59
5	16.48	16.18	16.10	16.03	15.97	15.76	15.58	16.43	17.06	16.95	16.80	16.55
6	16.50	16.18	16.10	16.04	15.99	15.74	15.57	16.50	17.06	16.95	16.78	16.59
7	16.51	16.25	16.16	16.04	15.97	15.74	15.55	16.55	17.07	16.95	16.78	-----
8	16.32	16.20	16.17	16.04	15.91	15.76	15.57	16.62	17.05	16.94	16.73	-----
9	16.32	16.21	16.16	16.03	15.92	15.76	15.59	16.65	17.02	16.92	16.74	-----
10	16.35	16.20	16.14	16.03	15.93	15.74	15.59	16.72	17.02	16.90	16.74	-----
11	16.30	16.18	16.17	16.06	15.92	15.71	15.60	16.77	17.00	16.86	16.73	-----
12	16.31	16.19	16.18	16.05	15.89	15.70	15.60	16.82	17.04	16.85	16.66	-----
13	16.34	16.25	16.12	16.01	15.90	15.70	15.60	16.85	17.04	16.85	16.68	-----
14	16.29	16.26	16.12	16.01	15.90	15.70	15.57	16.92	17.05	16.87	16.70	-----
15	16.31	16.20	16.11	16.04	15.91	15.68	15.56	16.94	17.05	16.86	16.75	-----
16	16.26	16.17	16.06	16.04	15.90	15.69	15.56	16.94	17.05	16.88	16.78	-----
17	16.27	16.17	16.07	15.98	15.86	15.69	15.56	16.95	17.00	16.90	16.78	-----
18	16.26	16.17	16.12	15.99	15.85	15.69	15.55	16.96	17.00	16.92	16.73	-----
19	16.25	16.17	16.12	16.04	15.86	15.68	15.52	16.96	16.97	16.92	16.68	-----
20	16.60	16.20	16.12	16.02	15.86	15.67	15.52	16.97	16.98	16.82	16.66	-----
21	16.26	16.17	16.07	16.02	15.86	15.65	15.55	17.01	17.00	16.84	16.66	16.45
22	16.22	16.18	16.03	16.06	15.86	15.66	15.55	17.03	17.00	16.88	16.67	16.48
23	16.25	16.17	16.03	16.01	15.85	15.67	15.53	17.03	16.97	16.88	16.68	16.50
24	16.28	16.13	16.10	16.00	15.82	15.67	15.55	17.03	16.97	16.85	16.68	16.50
25	16.25	16.13	16.09	16.00	15.84	15.63	15.60	17.03	16.97	16.83	16.67	16.48
26	16.19	16.13	16.03	15.99	15.84	15.63	15.67	17.03	16.97	16.85	16.67	16.50
27	16.25	16.11	16.03	15.98	15.83	15.67	15.74	17.02	16.98	16.84	16.65	16.50
28	16.31	16.09	16.07	15.96	15.80	15.65	15.78	17.03	16.98	16.80	16.63	16.44
29	16.32	-----	16.08	15.93	15.81	15.61	15.85	17.03	16.93	16.78	16.62	16.44
30	16.27	-----	16.08	15.92	15.79	15.61	15.90	17.03	16.91	16.84	16.61	16.42
31	16.27	-----	16.07	-----	15.79	-----	16.00	17.04	-----	16.84	-----	16.45

Table 10.—*Records of wells and test holes*

Well number: See text for explanation of well-numbering system.
Owner, tenant, or driller: S. D., School District; S. C. M., Spelts, Cunningham, and Mevis Oil Exploration; U. N., Conservation and Survey Division, University of Nebraska; USBR, U. S. Bureau of Reclamation; USGS, U. S. Geological Survey.
Type of well: DD, dug and drilled; Dn, driven; Dr, drilled; Du, dug; J, jetted.
Depth of well: Measured depths given in feet and tenths below measuring point; reported depths given in feet below land surface.
Type of casing: C, concrete or brick; N, none; P, iron or steel pipe; T, clay tile; W, wood.
Geologic source: O, Ogallala formation; P, sand and gravel of Pleistocene age.
Method of lift: C, horizontal centrifugal; Cy, cylinder; N, none; T, turbine; V, vertical centrifugal.
Type of power: D/G, diesel or gas engine; E, electric; H, hand; Lp, liquid petroleum; T, tractor; W, windmill.
Use of water: D, domestic; I, irrigation; N, none; O, observation; P, public supply; S, stock.
Measuring point: Edp, end of discharge pipe; Ls, land surface; Tb, hole in base of turbine; Tc, top of casing, pipe, or curb; Ts, opening in side of turbine.
Altitude: Altitudes determined by spirit level given in feet, tenths, and hundredths; altitudes determined by altimeter given in feet and tenths; reported altitudes or altitudes obtained from topographic maps given in feet.
Depth to water: Measured depths given in feet, tenths, and hundredths; reported depths given in feet.
Remarks: Ca, sample collected for chemical analysis; L, log given in table 7.

Well no.	Owner, tenant, or driller	Year drilled	Type of well	Depth below measuring point (feet)	Diameter (inches)	Type of casing	Geologic source	Method of lift and type of power	Use of water	Measuring point: Description	Measuring point: Distance above or below (-) land surface (feet)	Measuring point: Altitude above mean sea level (feet)	Depth to water below measuring point (feet)	Date of measurement	Remarks
BUFFALO COUNTY															
8-13- 1ad	U. N., USGS	1947	Dr	190.0	4	N	P	N	N	Ls	------	2,013.08	5.49	9-22-47	L
7aa	------do	1931	Dr	157.0	4	N	P	N	N	Ls	------	2,049	5.40	1931	-----
15- 2bb	------do	1932	Dr	80.0	4	N	P	N	N	----	------	2,110	-----	-------	-----
3cb	Peterson	1932	DD	43.0	60-24	C, P	P	T, T	I	Tc	0.6	2,119.29	15.17	5- 4-51	-----
8ba	Smacker	1934	Dr	48.2	24	----	P	V, E	I	Tc	------	2,128.67	13.03	5- 4-51	-----
24aa	U. N., USGS	1947	Dr	260.0	4	N	P, O	N	N	Ls	------	2,093.54	1.70	10- 1-47	L
16- 1dc	------do	1939	Dr	59.7	4	N	P	N	N	-----	------	2,142	-----	-------	L
2ab	------do	1939	Dr	234.0	4	N	P, O	N	N	----	------	2,140.7	-----	-------	L
2da2	Kearney, Nebr	1924	Dr	42	26	P	P	T, E	P	Ls	------	------	17.00	4-21-47	Ca
2db	------do	1939	Dr	207.0	4	N	P, O	N	N	-----	------	2,141.6	------	-------	L

2dd	——do——	1939	Dr	57.0	4	N	P	N	N	———	———	2,139.0	———	———	L
3cb	Sheldon	1934	Dr	32	18	———	P	T, E	I, O	Ts	.5	2,165.49	12.87	5- 7-51	———
5ca	———	———	Dr	54.6	36	P	P	T, T	I	Tc	-1.6	2,188.49	17.51	5- 7-51	———
7cb	U.N., USGS	1931	Dr	65.0	4	N	P	N	N	Ls	———	2,173.00	4.00	1931	———
10cc	USGS	1946	Dr	8.2	1¼	P	P	N	O	Tc	1.0	2,155.48	3.35	5- 7-51	———
12ab	U.N., USGS	1939	Dr	58.0	4	N	P	N	N	———	———	2,137	———	———	L
12cc	Garvin	1936	Dr	23.4	18	P	P	N	O	Tc	———	2,139.27	5.69	5- 7-51	———
17- 1ab	U.N., USGS	1931	Dr	90.0	4	N	P	N	N	Ls	———	2,212.00	17.00	1931	———
1da	U.N	1931	Dn	18.0	1	P	P	N	O	Tc	1.2	2,186.72	8.27	5- 7-51	———
4bc	Richards	1934	Dr	30.0	24	W	P	N	I, O	Tc	1.0	2,215.16	7.14	5- 7-51	———
6ac	———	1934	DD	42.2	96-36	C, P	P	C, E	I	Tc	1.6	2,229.75	11.74	5- 7-51	———
10cc	———	1932	DD	36	108-36	C, P	P	C, T	I	Tc	1.0	2,198.95	6.68	5- 7-51	———
12dd	U.N., USGS	1931	Dr	45.0	4	N	P	N	N	Ls	———	2,174.00	5.00	1931	———
18- 1cc	Kinnan	1942	———	25.6	36	W, P	P	V, T	I	Tc	.6	2,229.19	3.66	5- 7-51	———
3ab	———	———	Dr	33.3	———	———	P	T, E	I	Tb	.1	2,244.87	8.95	5- 7-51	———
4bd	U.N., USGS	1932	Dr	32.0	4	N	P	N	N	Ls	———	2,246.00	———	———	———
4cb	USGS	1946	Dn	16.4	1¼	P	P	N	O	Tc	1.0	2,253.45	10.84	5- 7-51	———
5bb	———	———	Dr	24.8	18	———	P	T, E	I	Tb	.6	2,263.83	11.74	5- 7-51	———
5bc	U.N., USGS	1947	Dr	310.0	4	N	P, O	N	N	Ls	———	2,261.9	7.64	7-25-47	L
9cb	Carter Oil Co	1941	Dr	———	———	———	P, O	N	N	Ls	———	2,250	———	———	L
9-13- 1ca	Shelton, Nebr	1939	Dr	42	18	P	P	T, E	P	Ls	———	———	15	4-21-46	Ca
4aa	U.N., USGS	1947	Dr	240.0	4	N	P, O	N	N	Ls	———	2,035.6	(1)	9-25-47	L
5cb	Scott	1930	Dr	53	24	P	P	T, T	I, O	Tc	.5	2,050.63	18.42	5- 4-51	———
9cc	Smith	1930	Dr	61	———	P	P	T, E	I, O	Ts	2.0	2,040.95	13.92	5- 4-51	———
10dd	U.N., USGS	1947	Dr	190.0	4	N	P	N	N	Ls	———	2,032.5	12.20	9-24-47	L
11bb	Shippers	1946	Dr	50	18	P	P	T, D/G	I, O	Ts	.5	2,028.14	14.77	5- 4-51	———
13ab	Dawson	1944	Dr	82	18	P	P	T, T	I	Tb	.5	2,022.10	17.68	5- 4-51	———
14dd	U.N., USGS	1932	Dr	65.0	4	N	P	N	N	Ls	———	2,028.00	4.00	1932	———
17cc	Lippencott	———	Dr	42.4	18	P	P	T, D/G	I	Ts	1.0	2,052.75	15.80	5- 4-51	———
26aa	U.N., USGS	1947	Dr	190.0	4	N	P, O	N	N	Ls	———	2,025.3	4.67	9-24-47	L
27ad	Carter Oil Co	———	Dr	———	———	———	P, O	N	N	Ls	———	2,023	———	———	L
28cb	Peilstick	———	Dr	43.6	18	P	P, O	C, T	I	Tc	1.0	2,037.09	3.88	5- 4-51	———
36dd	U.N., USGS	1947	Dr	108.0	4	N	P	N	N	Ls	———	2,015.18	6.14	9-19-47	L
14- 1dc	USGS	1946	Dr	33.8	8	P	P	N	O	Tc	.8	2,061.23	16.75	5- 4-51	———
4cc	USGS	1946	Dn	29.0	1¼	P	P	N	O	Tc	1.0	2,088.47	19.65	5- 4-51	———

See footnotes at end of table.

Table 10.—*Records of wells and test holes*—Continued

Well no.	Owner, tenant, or driller	Year drilled	Type of well	Depth below measuring point (feet)	Diameter (inches)	Type of casing	Geologic source	Method of lift and type of power	Use of water	Measuring point: Description	Measuring point: Distance above or below (-) land surface (feet)	Measuring point: Altitude above mean sea level (feet)	Depth to water below measuring point (feet)	Date of measurement	Remarks
							BUFFALO COUNTY—Continued								
9-14-11bc	Gamble	----	Dr	64	18	P	P	T, E	I	Ts	1.0	2,077.53	20.63	5- 4-51	----
13ca	Gibbon, Nebr	1922	Dr	55	24	----	P	T, E	P	----	-------	-------	-----	-------	Ca
13cb	Davis	1927	Dr	50	24	P	P	T, T	I, O	Tb	.5	2,068.60	18.12	5- 4-51	----
14aa	U.N., USGS	1931	Dr	105	4	N	P	N	N	Ls	-------	2,063	-----	-------	----
17bb	Randall	1934	DD	75	24	P	P	T, T	I	Tb	-------	2,094.99	19.43	5- 4-51	----
19dd	Lewis	1924	Dr	54	24	P	P	V, T	I, O	Tb	.7	2,102.86	24.97	5-27-51	----
21cc	Adair	1927	Dr	55	24	P	P	V, T	I, O	Tc	-------	2,089.22	19.02	5- 4-51	----
22bb	Doty	----	Dr	63	18	----	P	T, E	I, O	Tb	-------	2,079.81	15.99	5- 4-51	----
25ba1	U.N., USGS	1931	Dr	173.0	4	N	P, O	N	N	Ls	-------	2,055	-----	-------	----
25ba2	Chapman	1945	Dr	40	18	P	P	T, E	I	Tb	.3	2,061.14	11.62	5- 4-51	----
27bb	Teed	1928	Dr	44.4	25	----	P	T, E	I	Tb	1.0	-------	13.44	5-25-32	----
31bb	Barlow	1942	Dr	58	24	P	P	T, E	I	Tb	.4	2,098.88	14.81	5- 4-51	----
34bb	Nicholson	1928	Dr	50	24	P	P	V, T	I, O	Tc	.35	2,077.96	10.83	5- 4-51	----
15- 2db	Clark	----	Dr	79.0	4	P	P	Cy, W	D, S	Tc	.5	2, 155.03	58.62	8-23-49	----
6bc	Jensen	----	Dr	122	3	P	P	Cy, E	D, S	Tc	-------	2, 196.28	63.60	8-23-49	----
6cb	Richter	1951	Dr	276	18	C	O	T, -	I	----	-------	2, 195	-----	-------	----
9ab	Anderson	----	Dr	96.0	4	T	P	Cy, N	N	Tc	.5	2, 176.40	69.34	8- 9-50	----
11cb	Aldeen	1930	Dr	53	24	P	P	T, -	I, O	Tc	.5	2, 117.70	25.30	5- 4-51	----
13bc	Newland	1945	Dr	63.0	24	P	P	T, E	I	Tb	.6	2, 108.57	24.00	5- 4-51	----
14bc	Henline	----	Dr	200	------	----	P, O	T, E	I	Ls	-------	2, 110	-----	-------	L
17ab	Hendricksen	1949	Dr	297.5	------	N	P, O	N	N	Ls	-------	2, 160	-----	-------	L

17bc	——do——	1949	Dr	267.0	——	N	P, O	N	N	Ls	——	2,160	——	——	L
30cc	Hartman	1936	Dr	——	24	P	——	T, D/G	I	Tc	1.4	2,149.55	32.30	5- 4-51	——
34bb	Wolford	1922	Dr	48	24	P	P	T, E	I, O	Ts	1.3	2,121.03	20.57	5- 4-51	——
16- 3da	Knoll	——	Dr	91.0	3	P	P	Cy, N	N	Tc	1.0	2,192.66	53.55	8-26-49	——
5cc	Hart	——	Dr	176.0	——	N	P, O	N	N	Ls	——	2,200	——	——	L
8bd	Eickmeier	——	Dr	203.0	——	N	P, O	N	N	Ls	——	2,180	——	——	L
8cb	Jacobson	——	Dr	65.0	——	——	——	Cy, W	N	Tb	——	2,221.24	54.90	10-25-50	——
9cb	Theis	1948	Dr	213.0	18	P	P, O	T, D/G	I, O	Tb	.5	2, 186.92	31.00	10- 3-50	L
11bc	Weber	1946	Dr	184.0	——	——	P, O	T, -	I	——	——	2,160	——	——	L
12ac	Eberhart	1948	Dr	65	18	P	P	T, D/G	I	Tb	——	2, 144.15	18.78	3-28-49	——
13bc	Richter	1948	Dr	110.0	18	P	P	T, T	I, O	Tb	.60	2, 154.07	28.08	10- 3-50	L
14bb	Fales	——	Dr	187.0	——	——	P, O	——	N	Ls	——	2, 155	——	——	L
15ab	Haring	——	Dr	215.0	——	——	P, O	——	N	Ls	——	2, 150	——	——	L
15bb	Webb	1951	Dr	207.0	18	C	P, O	T, -	I	——	——	2,160	——	——	L
15db	Kuebler	——	Dr	176	18	C	P, O	T, L	I	Tb	.50	2, 170.51	24.90	9-15-50	L
16da	Eickmeier	1947	Dr	167.0	——	C	P, O	——	D	Ls	——	2, 165	——	——	L
17cc	Olson	——	Dr	——	3	P	——	Cy, W	N	Tc	-3.5	2, 249.13	70.03	8-24-50	——
19ca	Larson	——	Dr	199.0	4	P	——	Cy, W	S	Tc	——	2, 360.29	167.22	10-26-50	——
19dd	Patterson	——	Dr	99.0	3	O	——	Cy, W	S	Tc	2.0	2, 246.99	61.28	9-14-50	——
21dd	Anderson	——	Dr	53.0	3	P	P	Cy, W	S	Tc	.5	2, 208.55	42.51	8-24-50	——
22bb	Eickmeier	——	Dr	48.0	3	P	P	Cy, W	S	Tc	1.0	2, 283.97	27.74	8-16-50	——
23bb	Pratt	1951	Dr	261.0	18	C	P, O	T, D/G	I	Ls	——	2,225	80	8- -51	L
23dd	Holmes and Staubitz	1951	Dr	261.0	24	C	P, O	T, D/G	I	Ls	——	2,220	88.49	8-20-51	L
24ab	Beadle	1948	Dr	142	18	P	P, O	T, D/G	I	Tb	.5	2, 176.58	55.34	9-29-50	——
26cd	Barber	——	Dr	97.0	4	P	P	Cy, W	S	Tc	1.5	2, 209.13	62.87	10-25-50	——
29ba	Markus	——	Dr	197.0	——	——	——	——	D, S	——	——	2,300	——	——	L
30ac	Deeter	——	Dr	195.0	4	P	——	Cy, W	S	Tc	.5	2, 336.24	141.20	9-14-50	——
30cb	Anson	——	Dr	175.0	4	P	——	N	N	Tc	1.5	2, 349.45	144.59	10-27-50	——
30cd1	U. N., USGS	1931	Dr	160.0	4	N	P, O	N	N	Ls	——	2,260	——	——	——
30cd2	Herring	——	Dr	96.0	3	P	——	Cy, W	S	Tc	1.3	2, 254.53	56.12	10-25-50	——
32bd	Walters	——	Dr	90	2	P	——	Cy, W	S	Tc	1.0	2, 231.09	38.29	8-25-50	——
36bb	Frank Hervert Drilling Co	1951	Dr	——	——	——	O	——	D	Ls	——	2,235	——	——	L
36bd	U. N., USGS	1939	Dr	96.8	4	N	——	N	N	Ls	——	2, 144	——	——	L
17- 2bc	Jester	1951	Dr	255.0	18	C	P, O	T, D/G	I	Ls	——	2,300	125	7- -51	L
7ac	Richards	——	Dr	192.0	4	P	——	Cy, W	D, S	Tc	2.0	2, 394.75	156.00	9-27-50	——
7bd	U. N., USGS	1947	Dr	500.0	4	N	P, O	N	N	Ls	——	2, 342.40	105.85	7-25-47	L
8aa	Marshal	——	Dr	208.0	2	P	——	Cy, W	D, S	Tc	3.5	2, 381.75	148.50	8-31-50	——

Table 10.— *Records of wells and test holes*— Continued

Well no.	Owner, tenant, or driller	Year drilled	Type of well	Depth below measuring point (feet)	Diameter (inches)	Type of casing	Geologic source	Method of lift and type of power	Use of water	Measuring point: Description	Measuring point: Distance above or below (-) land surface (feet)	Measuring point: Altitude above mean sea level (feet)	Depth to water below measuring point (feet)	Date of measurement	Remarks
							BUFFALO COUNTY—Continued								
9-17-11ca	Thatcher	----	Dr	78.0	3	P	----	Cy, W	D, S	Tb	------	2,251.99	47.12	10-30-50	----
12aa	Knox	----	Dr	115.0	2	P	----	N	N	Tb	------	2,291.14	104.30	9-27-50	----
19dd	Broe	----	Dr	52.0	3	P	----	Cy, W	N	Tc	1.5	2,282.70	46.87	8-22-50	----
20ad	Westeson	----	Dr	159.0	------	----	----	Cy, W	S	Tb	1.0	2,382.12	152.95	8-22-50	----
24cc	Kennedy	----	Dr	185.0	5	T	----	Cy, W	D, S	Tc	1.0	2,369.75	160.15	10-30-50	----
31cd	USGS	1946	Dn	19.3	1¼	P	P	N	O	Tc	1.0	2,237.73	12.73	5- 7-51	----
33aa	U. N., USGS	1931	Dr	131.0	4	N	P, O	N	N	Ls	------	2,287.00	------	------	----
18- 1cc	Richards	----	B	164.0	3	P	----	Cy, W	D, S	Tc	1.0	2,396.71	143.60	8-22-50	----
5da	Stevens	----	Dr	------	------	----	----	Cy, W	D, S	Tb	1.0	2,385.48	105.74	10-31-50	----
9cd	U. N., USGS	1948	Dr	500.0	4	N	P, O	N	N	Ls	------	2,390.94	120.65	8-30-48	L
10cc	Wave	----	Dr	140	4	P	----	Cy, W	S	Tc	1.5	2,336.40	68.93	9-29-50	----
18ad	Murry	----	Dr	84.0	4	P	----	Cy, W	D, S	Tc	1.0	2,312.09	33.82	10-31-50	----
23aa	Beavers	----	Dr	71.0	3	P	----	Cy, W	S	Tc	1.0	2,295.69	45.10	9-27-50	----
27aa	U. N., USGS	1947	Dr	334.3	4	N	P, O	N	N	Ls	------	2,277.80	20.07	7-25-47	L
27bb	------do	1932	Dr	70.0	4	N	P, O	N	N	Ls	------	2,263.00	------	------	----
27cc	Sear	----	----	25	------	P	P	P	D, S	----	------	------	------	------	Ca
27dd	USGS	1946	Dn	14.4	1¼	P	P	N	O	Tc	2.0	2,256.66	10.25	5- 7-51	----
28ab	Elm Creek, Nebr	----	DD	29.4	120-18	C, P	P	C, E	P	Ls	------	------	9.8	4-21-47	Ca
28dd	U. N., USGS	1946	Dr	360.0	4	N	P, O	N	N	Ls	------	2,257	8.68	5-10-46	L
30ab		1939	Dr	27.8	60?	P	P	T, E	I	Tb	1.8	2,277.08	5.80	5- 7-51	----
31cc	Dworak	1942	Dr	32.0	24	P	P	T, T	I, O	Tb	------	2,274.59	11.12	5- 7-51	----

33cb				21.8			P	N	I	Tc	1.0	2,259.3	6.44	5- 7-51	
33dc			Dr	27.6	24	P	P	C, E	I	Tc		2,256.81	9.89	5- 7-51	
10-13-10ad	Pope		Dr	52.0	5	P		N	N	Tc	.5	2,037.95	32.81	10- 9-50	
10bb	School District	1949	Dr	56.0	5	P		Cy, W	D	Tc	.5	2,052.93	25.83	8- 8-50	
18aa	U. N., USGS	1947	Dr	370	4	N	P, O	N	N	Ls		2,135.8	79.42	9-26-47	L
18cc	Pool		Dr	82.0	4	P		Cy, W	N	Tb		2,115.48	58.60	7-27-50	
21cc	MacMullen	1942	Dr	50	18	P	P	T, D/G	I	Ts	.8	2,047.67	26.20	5- 4-51	
24bc	Bentley	1942	DD	51.6	96-24	C, P	P	T, E	I, O	Tc		2,014.17	22.92	5- 4-51	
27dd	Kirk		Dr	60	24	P	P	T, T	I	Tb	.6	2,027.95	20.52	5- 4-51	
29aa	U. N., USGS	1947	Dr	280	4	N	P, O	N	N	Ls		2,049.5	31.68	9-26-47	L
30bb	Gibbon Golf Club		Dr	149.0	3	P		Cy, W	D, S	Tc	1.0	2,184.40	139.93	9-14-50	
14- 5bb	Little		Dr	138.0	4	P		Cy, W	S	Tc	1.0	2,211.16	118.00	8- 2-50	
7dc	Muegerl		Dr	105.0	3	P		Cy, W	S	Tc	.5	2,172.98	76.36	9-29-50	
9cb	Skala	1949	Dr	161.0	4	P		Cy, W	S	Tc	.5	2,242.00	153.35	8- 9-50	
13cc	Henline		Dr	69.0	5	P		Cy, N	N	Tc	2.0	2,131.21	61.35	7-27-50	
15bb	Keaschell		Dr	124.0	5	P		Cy, W	S	Tc	1.0	2,206.48	122.02	9-19-50	
19aa	Davis		Dr	72.0	4	P		Cy, N	N	Tc	1.0	2,147.99	52.78	7-21-50	
26dd	Griffin		Dr	87.0	3	P		Cy, W	S	Tc	.5	2,124.44	73.20	7-27-50	
28dd	School District 53		Dr	128.0	3	P		Cy, W	D	Tc		2,161.23	89.78	7-27-50	
29bb	School District 97	1939	Dr	84.5	4	P		Cy, H	D	Tc	2.0	2,140.74	47.19	7-27-50	
35ad	Hemmerlings	1946	Dr	75.0	24	P		T, D/G	I	Tb	.5	2,084.79	32.69	5- 4-51	
36cb	U. N., USGS	1931	Dr	98.0	4	N	P, O	N	N	Ls		2,082.00			
15- 5cc	Kegley		Dr	132.0	3	P		Cy, W	S	Tc	1.0	2,250.75	123.84	7-25-50	
9aa	School District 110		Dr	142.0	4	P		Cy, H	D	Tc		2,251.03	132.69	7-25-50	
10cc	McConnell		Dr	112.0	3	P		Cy, N	N	Tc	1.0	2,228.61	110.63	8-23-49	
13cc	Carter Oil Co		Dr					N	N	Ls		2,233			L
14dc	Wink		Dr	131.0	3	P		Cy, W	S	Tc	1.0	2,233.96	125.66	8-25-49	
17cc	Richards		Dr	130.0	3	P		Cy, W	S	Tc	1.0	2,225.87	92.75	7-25-50	
20bb	Rest Haven Church		Dr				P, O		D	Ls		2,225			L
22aa	Luth		Dr	125.0	3	P		Cy, W	S	Tc	1.0	2,217.07	100.25	9-29-50	
28cb	Geisert		Dr	79.0	4	P		Cy, N	N	Tc	1.0	2,177.60	49.72	8-25-49	
29ba	Altmaier	1951	Dr	267.0		P	O	T, T	I	Ls		2,230			L
34aa	Busch		Dr	66.5	3	P		Cy, N	N	Tc	2.0	2,166.34	54.69	7-20-50	
16- 2dd	Bissell		Dr	142.0	3	P		Cy, W	D, S	Tb		2,251.22	112.05	8-23-49	
6ac	Scheihing		Dr	142.0	4	P		Cy, N	N	Tc	1.0	2,286.43	118.02	8-24-49	

Table 10.—*Records of wells and test holes*—Continued

Well no.	Owner, tenant, or driller	Year drilled	Type of well	Depth below measuring point (feet)	Diameter (inches)	Type of casing	Geologic source	Method of lift and type of power	Use of water	Measuring point: Description	Measuring point: Distance above or below (-) land surface (feet)	Measuring point: Altitude above mean sea level (feet)	Depth to water below measuring point (feet)	Date of measurement	Remarks
							BUFFALO COUNTY—Continued								
10-16- 7ba	Eisele	1950	Dr	297.0	18	C	O	T, L	I, O	Tb		2,307.29	128.30	10- 3-50	Ca
9ab	Weber		Dr	153.0	3	D		Cy, W	D, S	Tc	.5	2,280.18	127.72	9-25-50	
9ba	do	1951	Dr	290.0		N	O	N	N	Ls		2,287.00	140	4- -51	L
20ad	Daake		Dr	89.0	3	P		Cy, W	D, S	Tb		2,230.41	70.15	11-21-50	
25cb	Dickerson		Dr	62.0	4	P		Cy, W	S	Tc	1.0	2,210.78	56.00	8-11-50	
31db	Wescott		Dr	207			P, O		N	Ls		2,200			L
33ad	Kucera		Dr	142.0	3	P		Cy, N	N	Tb	1.0	2,217.49	65.20	8-24-49	
35ab	Belmundez		Dr	305		N	O	N	N	Ls		2,205			L
17- 1aa	Herrman		Dr	159.0				Cy, W, T	S	Tc		2,326.27	146.28	10-27-50	
10ba	Parker		Dr	200	3	P		Cy, W	D	Tc	2.0	2,346.28	141.20	7-23-50	
13ab	Jenson-Wallace	1951	Dr	273		C	O	T, -	I			2,280			L
14dd	U. N., USGS	1947	Dr	330.0	4	N	P, O	N	N	Ls		2,277.29	(2)	7-18-47	L
15ba	USBR	1948	Dr	110.0	1½	P	O	N	O	Tc	2.3	2,269.38	63.40	1948	L
15bb	do	1948	Dr	202.0	1½	P	O	N	O	Tc	2.5	2,318.18	113.30	7- -48	L
20cc	do	1948	Dr	102			P	N	N			2,305			L
20dd	do	1948	Dr	70.0	1½	P	P	N	O	Tc	.4	2,241.28	31.3	3- -48	
21aa	do	1948	Dr	60.0	1½	P	P	N	O	Tc	2.5	2,229.41	31.8	3- -48	
21cb	Ludwig	1946	Dr	118	18	P	P, O	T, D, G	I	Tb	1.0		29.60	4- 6-51	Ca
21cc	Buettner Estate	1948	Dr	150.0	18	P	P, O	T, G	I	Edp	3.5	2,235	34.03	4- 6-49	L
21cd	do	1930	Dr	104	18	P	P	T, G	I, O	Tb	1.0	2,236.14	29.71	10- 3-50	
22dd	U. N., USGS	1947	Dr	350.0	4		P, O	N	N	Ls		2,215.89	26.07	7-21-47	L
26cb	Sanquist	1948	Dr		18	P		T, T	I, O	Tb	.5	2,212.34	23.89	10- 3-50	

28da	U. N., USGS	1947	Dr	330.0	4	N	P, O	N	N	Ls		2,227.42	20.56	7-24-47	L
29bb	USBR	1948	Dr	80.0	1¼	P	P	N	O	Tc	5.3	2,303.33	69.9	5- 8-48	
30cc	do	1948	Dr	200.0	1¼	P	O	N	O	Tc	1.3	2,360.82	110.5	5-11-48	L
33cb	Carter Oil Co		Dr				O		N	Ls		2,265			L
36dc			Dr	117.0	18		P	T, T	I	Tb		2,213.18	32.52	11- 1-50	
18- 9cb	U. N., USGS	1948	Dr	500.0	4	N	P, O	N	N	Ls		2,353.1	66.95	8-30-48	L
10ab	Harris	1946	Dr	103	18	P	P, O	T, D/G	I	Ts	1.0	2,328.38	60.34	7-28-49	
10ad	do	1947	Dr	106	18	P	P, O	T, T	I, O	Ts	.5	2,323.53	57.35	10- 3-49	
12aa	Arrant	1946	Dr	126	18	P	P, O	T, T	I, O	Tb	.5	2,261.46	29.94	10- 3-49	
24cc	USBR	1948	Dr	70.0	1¼	P	P		O	Tc	2.0	2,317.01	63.8	3- -48	L
28cc	U. N., USGS	1948	Dr	480.0	4	N	P, O		N	Ls		2,369.62	85.73	9-15-48	L
31ba	Becker		Dr	161.0	1¼	P			N	Tc	5.0	2,424.10	129.60	11-17-50	
34dc	USBR	1948	Dr	211.0	1¼	P	O		O	Tc	2.8	2,433.38	166.0	3- 7-48	L
35bb	do	1948	Dr	90.0	1¼	P	P		O	Tc	3.0	2,336.02	70.4	3- 7-48	L
11-13- 9ab	Spahr		Dr	78.0				Cy, W	S	Tc	1.0	2,050.00	29.94	10- 4-50	
12bb	Hanousek		Dr	114.0	4	P		Cy, W	S	Tc	1.0	2,084.42	89.85	10- 9-50	
14da	School District 61		Dr	145.0	4	P		Cy, H	D	Tc		2,118.98	116.49	7-26-50	
14dc	Holtz	1948	Dr	169	18	P	O	T, L	I	Tb		2,123.59	116.12	10- 4-50	L
18cd	Harris		Dr	110.0	3	P		Cy, W	N	Tc	1.0	2,135.31	84.40	8-26-49	
29dd	School District 43	1949	Dr	134.0	3	P		Cy, W	D	Tc	.5	2,141.58	98.10	7-28-50	
30bc	Huff		Dr	119.0	5	P		Cy, H	N	Tc	.5	2,171.11	113.78	10- 9-50	
36bc	School District 112		Dr	155.0	3	P		Cy, W	D	Tc		2,045.87	45.67	7-26-50	
14- 2dd	School District 65	1946	Dr	99.0	3	P		Cy, H	D	Tc	.5	2,126.40	80.10	7-21-50	
3cc	Ures		Dr	52.0	3	P		Cy, W	N	Tb	1.0	2,077.34	24.65	10-11-50	
10cc	School District 92		Dr	80.0	4	P		Cy, W	D	Tc		2,100.65	37.73	7-26-50	
12ba1	Knerl		Dr	90.0	4	P		Cy, W	D, S	Tc	1.5	2,099.50	52.60	10-18-50	
12ba2	do	1950	Dr	145			P, O	Cy, E	D			2,095			L
15cd	Vokoun		Dr	86.0	4	P		Cy, W	N	Tc		2,097.50	28.25	8-22-49	
18aa	School District 117		Dr	74.0	3	P		Cy, H	D	Tc	.5	2,109.42	38.27	7-26-50	
23aa	School District 103		Dr	59.0	3	P		Cy, H	D	Tc	.5	2,104.99	45.20	7-21-50	
27ab	Benisek		Dr	70.0	4	P		Cy, H	N	Tc		2,131.81	57.42	7-26-50	
33cd	Hoffman		Dr	101.0	3	P		Cy, W	S	Tc		2,184.26	96.48	9-19-50	
35ad	Novotni		Dr	121.0	5	P		Cy, H	D	Tc	1.0	2,187.33	118.55	8- 9-50	

See footnotes at end of table.

Table 10.— *Records of wells and test holes*— Continued

Well no.	Owner, tenant, or driller	Year drilled	Type of well	Depth below measuring point (feet)	Diameter (inches)	Type of casing	Geologic source	Method of lift and type of power	Use of water	Measuring point: Description	Measuring point: Distance above or below (-) land surface (feet)	Measuring point: Altitude above mean sea level (feet)	Depth to water below measuring point (feet)	Date of measurement	Remarks
							BUFFALO COUNTY—Continued								
11-15- 1cb	Tuchel	1928	Dr	180.0	4	P	----	Cy, W	D, S	Tb	1.0	2,164.66	108.20	8-29-50	----
9bb	Tatem	----	Dr	80.0	3	P	----	Cy, W	N	Tc	.5	2,156.80	67.47	7-19-50	----
10cc	Heider	----	Dr	41.0	3	P	----	Cy, N	N	Tb	------	2,129.67	36.28	9-22-52	----
16cc	Schuller	1920	Dr	86.0	12	T	----	Cy, W	D, S	Tb	1.0	2,179.49	74.84	9-22-50	----
16da	------do	1930	Dr	132.0	3	P	----	Cy, W	S	Tc	1.5	2,192.50	93.35	9-22-50	----
18bd	Hendrickson	----	Dr	76.0	5	P	----	Cy, W	S	Tc	1.0	2,171.55	64.03	10-17-50	----
19bc	Bayley	----	Dr	104.0	5	P	----	Cy, W	N	Tc	1.0	2,212.60	91.64	10-17-50	----
24cc	Wolf	----	Dr	------	4	P	----	Cy, N	N	Tc	------	2,146.68	56.98	8-22-49	----
26cb	School District 64	----	Dr	79.0	3	P	----	Cy, W	D	Tc	------	2,174.38	70.32	7-26-50	----
28cd	Jochem	----	Dr	142.0	3	P	----	Cy, W	S	Tc	.5	2,242.53	127.80	8-18-50	----
33dc	Schmitz	----	Dr	170	------	----	P	------	----	Ls	------	2,245	------	------	----
16- 3ca	Peters estate	1935	Du	------	5	P	P	N	N	Tc	------	2,128.49	35.51	10-13-50	----
4bb	Pierson	1941	Dr	82.0	6	P	P	Cy, W	D, S	Tc	.5	2,131.24	32.82	10-12-50	----
6ab	Downey	1937	Dr	24.0	6	P	P	Cy, W	S	Tc	1.0	2,126.60	21.50	10-17-50	----
8ad	Fling	1949	Dr	224.0	24	C	P, O	T, L	I	Ts	.5	2,178.78	62.74	9- 6-50	L
8ca	Frank	----	Dr	79.0	5	P	----	Cy, W	S	Tc	------	2,187.05	54.43	10- 6-50	----
12bb	Reese	----	Dr	76.0	5	P	----	Cy, W	D, S	Tc	.5	2,160.35	63.72	9-28-50	----
15da	U. N., USGS	1947	Dr	310.0	4	N	P, O	N	N	Ls	------	2,155.14	30.28	7-17-47	L
18dc	Zwienert	----	Dr	50.0	4	N	----	Cy, W	S	Tc	1.0	2,199.93	32.62	8-18-50	----
31da	U. N., USGS	1947	Dr	400.0	4	N	P, O	N	N	Ls	------	2,304.25	143.09	7-17-47	L
34ad	Cruise	1951	Dr	190	18	P	P	T,-	I	Ls	------	2,300	------	------	L
35ad	------do	1947	Dr	183	18	P	P	T, L	I, O	Ts	1.0	2,287.75	152.62	10- 4-47	Ca, L

17- 2ac	Arp	1929	Dr	97.0	3	P	----	Cy, W	D, S	Tc	1.0	2,208.96	49.20	10- 5-50	----
10bc	Bergt	1925	Dr	72	3	P	----	Cy, W	S	Tc	1.0	2,226.04	32.75	8-23-50	----
12bc	Clatter	----	Dr	54.0	3	P	----	Cy, W	S	Tc	1.0	2,203.34	37.67	8-18-50	----
16bb	Sohrweid	1928	Dr	119.5	2	P	----	Cy, W	D	Tc	1.0	2,314.96	105.69	8-24-50	----
17cc	Buehler	----	Dr	143.0	2	P	----	Cy, W	D, S	Tc	2.0	2,335.38	113.73	10-18-50	----
24aa	USBR	1948	Dr	131.2	1¼	P	P	N	O	Tc	.7	2,288.22	117.9	8- -48	L
25bb	------do	1948	Dr	140.0	1¼	P	O	N	O	Tc	1.3	2,314.50	131.6	8- -48	L
27bb	------do	1948	Dr	140.0	1¼	P	P	N	O	Tc	1.5	2,319.54	116.3	7- 6-48	L
28ba	Hostetter	1942	Dr	188.0	----	----	----	Cy, W	D, S	Tc	1.0	2,380.84	173.72	8-24-50	----
34aa	USBR	1948	Dr	110.0	1¼	P	O	N	O	Tc	1.0	2,278.91	84.0	3- 6-48	L
34dd	------do	1948	Dr	170.0	1¼	P	O	N	O	Tc	.5	2,334.50	137.4	3- 6-48	L
18- 2ad	School District 111	----	Dr	-----	3	P	----	Cy, H	D	Tc	1.0	2,390.94	154.08	11- 1-50	----
7ac	Wyle	1946	Dr	135	18	P	P, O	T, D/G	I	Tb	.5	2,326.15	36.05	9-19-49	----
9cc	U. N., USGS	1948	Dr	430.0	4	N	P, O	N	N	Ls	------	2,304.86	30.62	9- 8-48	L
9dc	Rogers	1946	Dr	110	18	P	P, O	T, D/G	I, O	Ts	1.0	2,304.89	35.42	10- 3-50	----
15ac	------do	1948	Dr	117	18	P	P, O	T, T	I	Tb	------	2,302.25	48.28	7-26-49	----
17ad	Miller, Nebr	----	Dr	-----	------	----	----	T, E	P	----	------	----------	-------	-------	Ca
25cd	Sanquist	1948	Dr	93	18	P	----	T, T	I	Tb	------	2,269.33	29.78	7-22-49	----
31ad	Atchison	----	Dr	192.0	3	P	----	Cy, W	S	Tc	.5	2,450.79	152.17	9-26-50	----
32aa	U. N., USGS	1948	Dr	490.0	4	N	P, O	N	N	Ls	------	2,445.30	162.48	9- 8-48	L
36cc	Stevens	1946	Dr	186.0	18	----	P, O	T, D/G	I	-----	------	2,280	37	1946	L
12-13- 1cc	S. C. M	1941	Dr	-----	------	N	P, O	N	N	Ls	------	1,936.00	------	-------	L
16cd	Campbell	----	Dr	122.0	3	P	----	Cy, W	S	Tc	1.0	2,042.60	51.46	8- 8-50	----
20cb	Urwiller	1950	Dr	207.0	18	P	P, O	T, L	I, O	Ts	.5	2,031.18	26.03	10- 4-50	Ca, L
22dd	O'Connor	----	------	16.0	1	P	P	N	N	Tc	2.0	1,990.01	5.59	10-11-50	----
31cd	Beranek	----	Dr	116.0	5	P	-----	Cy, W	S	Tc	.5	2,113.80	84.48	8- 8-50	----
34cd	Bassnett	----	Dr	90.0	3	P	-----	Cy, W	S	Tc	------	2,079.30	73.07	8- 3-50	----
35cd	School District	----	Dr	------	3	P	-----	Cy, W	D	Tc	------	2,064.70	70.01	8- 8-50	----
14- 4cc	Pabian	1950	Dr	110.0	------	----	-----	T, D/G	I	Tb	.5	2,027.60	40.98	8- 9-50	----
5dd	Ravenna, Nebr	1940	Dr	235	18	C	P, O	T, E	P	Ls	------	---------	45	7- -40	Ca
9bd	------do	1924	Dr	97	24	C	P, O	T, E	P	Ls	------	---------	19	6- -24	----
14dd	Chop	1940	Dr	87.0	3	P	-----	N	N	Tc	------	2,070.04	64.48	8-11-50	----
15ad	Boucher	----	Dr	120.0	------	----	P	T, D/G	I	Tb	------	2,007.28	18.50	10-11-50	----

Table 10.—*Records of wells and test holes*—Continued

Well no.	Owner, tenant, or driller	Year drilled	Type of well	Depth below measuring point (feet)	Diameter (inches)	Type of casing	Geologic source	Method of lift and type of power	Use of water	Measuring point: Description	Measuring point: Distance above or below (-) land surface (feet)	Measuring point: Altitude above mean sea level (feet)	Depth to water below measuring point (feet)	Date of measurement	Remarks
							BUFFALO COUNTY—Continued								
12-14-18cd	_____	____	Dr	122.0	3	P	_____	Cy, W	S	Tc	0.5	2,104.69	105.50	8-10-50	____
21dc	Secora_____	____	Dr	_____	2	P	_____	Cy, W	S	Ts	1.5	2,089.11	76.05	7-24-50	____
22bb	_____do_____	____	Dr	_____	3	P	_____	Cy, W	S	Tc	.5	2,044.32	41.72	7-24-50	____
29dd	Johnson_____	1942	Dr	91.0	6	P	_____	Cy, W	D, S	Tc	1.0	2,096.53	68.22	7-26-50	____
15- 2ab	Psota_____	____	Dr	77.0	3	P	_____	N	N	Tc	1.0	2,079.24	59.11	7-24-50	____
3bb	Wilke_____	1941	Dr	110.0	18	P	_____	T, T	I, O	Tb	_____	2,061.14	30.08	10- 4-50	____
11aa	Brown_____	____	Dr	72.5	3	P	_____	Cy, W	N	Tc	.5	2,023.35	12.89	8- 9-50	____
12ba	U.N., USGS_____	1947	Dr	270.0	4	N	P, O	N	N	Ls	_____	2,013.68	6.4	7- 8-47	L
14ab	_____do_____	1947	Dr	360.0	4	N	P, O	N	N	Ls	_____	2,089.70	72	7-10-47	L
16aa	Raffington_____	____	Dr	138.0	4	P	_____	Cy, W	N	Tc	2.5	2,152.84	118.44	8- 3-50	____
17cd	Klein_____	____	Dr	_____	3	P	_____	Cy, W	S	Tc	1.0	2,211.69	153.80	7-21-50	____
22ab	U.N., USGS_____	1947	Dr	340.0	4	N	P, O	N	N	Ls	_____	2,122.97	91.76	7-11-47	L
25cb	Standage_____	1945	Dr	96	3	P	_____	Cy, E	D	Tb	.5	2,038.84	16.80	8-10-50	Ca
28bd	U.N., USGS_____	1947	Dr	260.0	4	N	P, O	N	N	Ls	_____	2,056.75	(3)	7-15-47	L
31dd	_____do_____	1947	Dr	330.0	4	N	P, O	N	N	Ls	_____	2,133.44	66.14	7-14-47	L
16- 2da	Flanigan_____	____	Dr	63.0	3	P	_____	Cy, W	D, S	Tc	.5	2,139.91	47.78	7-19-50	____
6cc	Feldman_____	1940	Dr	128.0	_____	____	_____	Cy, W	D, S	Tc	1.5	2,278.15	119.40	9-25-50	____
7ab	Carman_____	1949	Dr	147	4	P	_____	Cy, W	D, S	Tc	1.0	2,192.65	43.82	9-21-50	____
9ac	Hermanni estate_____	____	Dr	82.0	_____	____	_____	Cy, W	D, S	Tb	.5	2,178.83	60.47	9-11-50	____
15bc	Nickman_____	1934	Dr	49.0	5	P	_____	Cy, W	D, S	Tb	_____	2,143.65	32.44	10-12-50	____
17dd	Latzke_____	____	Dr	59.0	_____	____	_____	Cy, H	D	Ts	2.0	2,167.08	47.04	10-12-50	____
19cd	Jones_____	1887	Dr	117	3	P	_____	Cy, E	D, S	Tc	1.0	2,242.06	114.98	10-24-50	____
22ca	Nickman_____	1940	Dr	53.0	4	P	_____	Cy, W	S	Tc	.5	2,136.90	31.27	10-12-50	____

24aa	Berkheimer	1943	Dr	133.0	4	P	____	Cy, W	D, S	Tc	1.0	2,202.05	125.00	10-12-50	____
29ad	Seifert	____	Dr	126.0	4	P	____	Cy, W	S	Tc	.5	2,221.91	106.04	9-25-50	____
30dc	Jahn	1944	Dr	271	____	____	____	Cy, W	D, S	Tc	.5	2,226.67	104.00	10-17-50	
35ad1	Asher	1935	Dr	24.0	12	P	P	Cy, H	O	Tb	____	2,080.46	6.23	10- 4-50	
35ad2	Pleasanton, Nebr	____	Dr	119	18	P	____	T, E	P	____	____	____	____	____	Ca
17- 5aa	Maack	1936	Dr	90.0	3	P	____	Cy, W	D, S	Tc	____	2,243.03	61.97	10-16-50	____
5cc	Schwab	____	Dr	138.0	1¼	P	____	N	N	Tc	2.0	2,234.73	52.90	10-16-50	
9aa	Lintner	____	Dr	____	3	P	____	Cy, W	S	Tc	____	2,297.45	126.61	10- 6-50	____
11ad	Feldman	____	Dr	____	4	P	____	N	N	Tc	1.0	2,318.33	159.80	10-24-50	____
16dc	Royle	____	____	17.0	3	P	P	N	N	Tc	4.5	2,172.83	14.88	10-16-50	____
17ac	Cool	____	____	42	4	P	P	Cy, W	D, S	Tb	____	2,182.59	16.10	10- 6-50	____
33dc	Trampe	____	Dr	143.0	3	P	____	Cy, W	S	Tc	2.0	2,305.06	117.17	8-23-50	____
36aa	Downey	1942	Dr	85.0	6	P	____	Cy, W	D, S	Tc	____	2,175.76	49.40	10-17-50	____
18- 5ab	U.N., USGS	1948	Dr	340.0	4	N	P, O	N	N	Ls	____	2,218.17	8.59	9-14-48	L
15dc	Bentley	____	Dr	175.0	3	P	____	Cy, W	N	Tc	2.0	2,366.86	137.23	8-21-50	____
17aa	Harnagel	____	Dr	104.0	4	P	____	Cy, W	S	Tc	1.0	2,278.17	40.55	9-26-50	____
17dd	U.N., USGS	1948	Dr	480.0	4	N	P, O	N	N	Ls	____	2,284.44	32.56	9-13-48	L
23cc	School District 82	1927	Dr	178.5	2	P	____	Cy, W	D	Tc	4.0	2,322.35	85.60	8-24-50	____
26da	Day	____	Dr	151.0	3	P	____	Cy, W	S	Tc	2.0	2,308.54	75.05	8-23-50	____
32ad	U.N., USGS	1948	Dr	510	4	N	P, O	N	N	Ls	____	2,403.64	127.79	9-10-48	L

CUSTER COUNTY

13-17-36bc	Tatum	____	Dr	126.0	3	P	____	Cy, W	D, S	Tc	1.0	2,287.56	110.17	10-27-50	Ca
18-28cc		____	Dr	144.0	3	P	____	Cy, W	N	Tc	3.0	2,343.81	118.02	9-26-50	____
33ad	The Ohio Oil Co	1952	Dr	442.0	4	N	P, O	N	N	Ls	____	2,275.00	____	____	L
19-31dc	U.N., USGS	1948	Dr	560.0	4	N	P, O	N	N	Ls	____	2,445.17	101.70	9-17-48	L
20-13ca	Sinclair-Prairie Oil Co	____	Dr	____	____	____	O	N	N	Ls	____	2,377	____	____	L
21-32cc	U.N., USGS	1948	Dr	645.0	4	N	P, O	N	N	Ls	____	2,675.97	210.44	10- 6-48	L
36ca	Line	1946	Dr	123.0	18	P	P	T, D/G	I, O	Tb	.5	2,480.56	52.32	10- 3-50	L

DAWSON COUNTY

8-20- 1ca	U.N., USGS	1948	Dr	320.0	4	N	P, O	N	N	Ls	____	2,308.5	4.78	9- 2-48	L
9-19- 6cd	____do	1932	Dr	42.0	4	N	P, O	N	N	Ls	____	2,321.00	____	____	____

See footnotes at end of table.

Table 10.—*Records of wells and test holes*— Continued

Well no.	Owner, tenant, or driller	Year drilled	Type of well	Depth below measuring point (feet)	Diameter (inches)	Type of casing	Geologic source	Method of lift and type of power	Use of water	Measuring point: Description	Measuring point: Distance above or below (-) land surface (feet)	Measuring point: Altitude above mean sea level (feet)	Depth to water below measuring point (feet)	Date of measurement	Remarks
							DAWSON COUNTY—Continued								
9-19-12dc	Morrison	----	Dr	81.0	3	P	-----	Cy, W	D, S	Tc	2.0	2,343.52	56.95	11-17-50	----
14aa	Thayer	----	Dr	135.0	3	P	-----	Cy, N	N	Tc	-----	2,406.01	114.14	11-17-50	----
16ab	Kapp	----	Dr	34.0	36	W, P	-----	N	O	Tc	.5	2,313.07	8.61	5- 7-51	----
19bb	Overton, Nebr	1916	Dr	43	14	---	P	C, E	P	---	-----	-----	-----	-----	Ca
22ba	Brennan	1939	Dr	56.8	24	P	-----	V, E	I	Tc	-.5	2,311.79	19.24	5- 7-51	----
25bb	Bliss	1938	Dr	52.0	24	P	-----	T, T	I, O	Tb	.4	2,289.24	8.10	5- 7-51	----
33bb	Gamble	----	----	35.0	18	W	-----	T, T	I, O	Tc	.2	2,300.17	7.84	5- 7-51	----
35cc	Barber	1944	Dr	33.9	---	---	-----	T, E	I	Ts	.8	2,286.93	8.30	5- 7-51	----
20- 1bb		1946	Dr	41	18	P	-----	T, T	I	Tb	.8	2,345.88	16.53	5- 7-51	
3dd	USGS	1946	Dn	18.4	1¼	P	-----	N	O	Tc	1.0	2,344.38	10.99	5- 7-51	----
5bc	Rhoadarmer	1943	Dr	52.5	18	P	-----	T, T	I, O	Ts	.6	2,374.28	21.83	5- 7-51	----
10bb	Oswald	1946	Dr	42.0	18	P	-----	T, T	I	Tb	1.5	2,347.22	10.16	5- 7-51	----
12ab		1939	Dr	36	18	P	-----	T, T	I	Tb	.6	2,333.26	10.69	5- 7-51	----
13bc	Brick	1927	Dr	43	18-24	P	-----	C, T	I, O	Tc	1.0	2,329.22	9.82	5- 7-51	----
13dd	U.N., USGS	1948	Dr	320.0	4	N	P, O	N	N	Ls	-----	2,317.95	7.67	8-30-48	L
17bb		1931	Dr	21.6	10	---	-----	C, T	I	Tc	-3.8	2,349.22	2.26	5- 7-51	----
20bb	U.N., USGS	1932	Dr	52.0	4	N	P, O	N	N	---	-----	2,349	-----	-----	----
22cc	Priel	----	----	36.5	18	---	-----	T, T	I, O	Tb	.5	2,338.35	10.47	5- 7-51	----
29cc		1931	DD	29.0	96	T	-----	V, T	I	Tc	-.5	2,345.36	6.26	5- 7-51	----
33dd	USGS	1946	Dn	12.2	1¼	P	-----	N	O	Tc	1.0	2,329.02	4.52	5- 7-51	----
34bb	Weitzel	1931	DD	28.2	72	W	-----	V, T	I	Tc	1.0	2,330.82	5.74	5- 7-51	----
36dd	U.N., USGS	1932	Dr	50	4	N	P, O	N	N	---	-----	2,309	-----	-----	----
21- 3ab	McKee	1936	Dr	32.0	18	---	---	T, E	I	Tc	4.8	2,387.10	14.77	5- 7-51	----

6ad	U. N	1940	Dn	19.5	1	P	P	N	O	Tc	2.5	2,406.12	7.97	5- 7-51	____
7aa	____do	1914	Dn	15.7	1½	P	P	N	O	Tc	.9	2,402.61	7.97	5- 7-51	____
7da	____do	1930	Dn	11.5	1¼	P	P	N	O	Tc	2.0	2,402.28	8.50	5- 7-51	____
8bb	Lexington, Nebr	____	Dr	60	18	P	P	T, E	P	Ls	____	____	10	4-22-47	Ca
12cb	Myers	1921	Dr	35	24	P	____	C, T	I, O	Tc	.2	2,369.76	10.76	5- 7-51	____
18aa	U. N	1930	Dn	11.5	1¼	P	P	N	O	Tc	.9	2,400.55	6.57	5- 7-51	Ca
18da	____do	1930	Dn	11.4	1¼	P	P	N	O	Tc	1.0	2,399.83	6.67	5- -51	____
19aa1	USGS	1946	Dn	12.0	1¼	P	P	N	O	Tc	1.0	2,398.24	5.78	5- 7-51	____
19aa2	U. N	1930	Dn	12.0	1¼	P	P	N	O	Tc	2.6	2,396.84	4.40	5- 7-51	____
24aa	____do	1931	Dn	10.9	1	P	P	N	O	Tc	1.2	2,359.98	4.38	5- 7-51	____
26ab	Resch	1942	Dr	31.6	18	P	____	T, T	I	Ts	1.0	2,368.27	6.44	5- 7-51	____
22- 1db	U. N., USGS	1941	Dr	270.0	4	N	P, O	N	N	____	____	2,407	____	____	L
12ad	USGS	1932	Dr	45.0	4	N	P, O	N	N	Ls	____	2,408	____	____	____
24dd	____do	1948	Dr	367.0	4	N	P, O	N	N	Ls	____	2,389.90	3.98	10- 5-48	L
10-19- 8bc	Purintun	____	Dr	133.0	18	P	P, O	N	N	Tc	.5	2,406.93	60.63	11-28-50	____
14bb	Carter Oil Co	1941	Dr	____	____	____	____	N	N	____	____	2,443.00	____	____	L
19bb	U. N., USGS	1948	Dr	530.0	4	N	P, O	N	N	Ls	____	2,467.16	121.14	10- 6-48	L
22dc	Nelson	1951	Dr	227.0	18	P	P, O	____	I	Tc	____	2,375	52.38	4-27-51	L
27bb	Else	____	Dr	80.0	2	P	____	Cy, W	D, S	Tc	-3.0	2,389.00	58.30	9- 8-50	____
33ca	Brenker	____	Dr	____	4	P	____	Cy, W	S	Tb	.5	2,407.20	90.73	11-17-50	____
20- 1ad	U. N., USGS	1948	Dr	511.0	4	N	P, O	N	N	Ls	____	2,441.71	89.35	10- 6-48	L
4da	____	____	Dr	161.0	4	P	____	Cy, W	S	Tc	1.5	2,503.77	127.11	11-16-50	____
9dc	Beatty	____	Dr	146.0	4	P	____	Cy, W	S	Tc	.5	2,481.91	108.25	11-17-50	____
18ad	____	1938	Dr	60.8	16	P	____	T, D/G	I	Ts	____	2,407.34	35.50	5- 7-51	____
21cb	Hill	1938	Dr	54.6	24	P	____	T, E	I, O	Ts	1.0	2,386.87	25.39	5- 7-51	____
27aa	____	1938	Dr	81.5	____	____	____	T, E	I, O	Ts	1.2	2,384.24	37.47	5- 7-51	____
30cb	Brown	1938	Dr	35.6	24	P	____	T, T	I	Tb	____	2,380.21	15.86	5- 7-51	____
35bb	USGS	1946	Dn	25.9	1¼	P	P	N	O	Tc	1.0	2,359.50	18.72	5- 7-51	____
36dd	U. N., USGS	1948	Dr	340.0	4	N	P, O	N	N	Ls	____	2,342.3	16.04	9-17-48	L
21- 3bb	____	1946	Dr	97.6	24	P	____	T, D/G	I	Tb	1.6	2,454.97	41.76	5- 7-51	____
6da	U. N	1940	Dn	22.5	1	P	P	N	O	Tc	1.4	2,442.70	8.83	5- 7-51	____
7aa	____do	1930	Dn	29.2	1¼	P	P	N	O	Tc	1.1	2,437.33	8.49	5- 7-51	____
7da	____do	1914	Dn	33.9	1½	P	P	N	O	Tc	-.5	2,433.07	7.17	5- 7-51	____
15ca	White	1936	Dr	50.4	18	P	____	V, T	I	Tc	.5	2,413.45	15.72	5- 7-51	____
18aa	U. N	1930	Dn	29.2	1¼	P	P	N	O	Tc	1.3	2,431.04	8.37	5- 7-51	____
18dd	____do	1914	Dn	28.3	1½	P	P	N	O	Tc	.5	2,432.26	12.65	5- 7-51	____
19aa	____do	1930	Dn	27.4	1¼	P	P	N	O	Tc	1.7	2,432.13	16.29	5- 7-51	____

Table 10.—*Records of wells and test holes* — Continued

Well no.	Owner, tenant, or driller	Year drilled	Type of well	Depth below measuring point (feet)	Diameter (inches)	Type of casing	Geologic source	Method of lift and type of power	Use of water	Measuring point: Description	Measuring point: Distance above or below (-) land surface (feet)	Measuring point: Altitude above mean sea level (feet)	Depth to water below measuring point (feet)	Date of measurement	Remarks
							DAWSON COUNTY—Continued								
10-21-19da	U.N	1930	Dn	24.4	1¼	P	P	N	O	Tc	1.4	2,429.37	15.96	5- 7-51	
23ab	Delap	1938	Dr	42.0	24			N	O	Tb	1.0	2,399.30	13.02	5- 7-51	
30aa	U.N	1930	Dn	15.6	1¼	P	P	N	O	Tc	1.2	2,418.74	8.36	5- 7-51	
30da	do	1930	Dn	15.3	1¼	P	P	N	O	Tc	.6	2,416.12	8.69	5- 7-51	
31da	do	1914	Dn	13.6	1¼	P	P	N	O	Tc	.6	2,407.90	7.67	5- 7-51	
34bc				43.3				T, E	O	Tb	.1	2,397.81	15.67	5- 7-51	
22- 1aa	U.N., USGS	1948	Dr	520.0	4	N	P, O	N	N	Ls		2,444.9	16.50	10- 4-48	L
12da	do	1932	Dr	60.0	4	N	P, O	N	N	Ls		2,441			
24da	do	1932	Dr	53.0	4	N	P, O	N	N	Ls		2,423			
25dd	do	1946	Dr	420.0	4	N	P, O	N	N	Ls		2,413	9.71	5- 9-46	L
11-19- 4dd	Vermas	1947	Dr	163	18	P	P, O	T, E	I, O	Tb	-4.0	2,377.23	51.29	10- 3-50	Ca
6bc	U.N., USGS	1948	Dr	480.0	4	N	P, O	N	N	Ls		2,384.68	33.72	9-20-48	L
8bb	Reier	1946	Dr	118	18	P	P, O	T, D/G	I	Tb		2,392.40	48.38	11-30-50	
19bb	U.N., USGS	1948	Dr	550.0	4	N	P, O	N	N	Ls		2,467.09	110.30	9-23-48	L
31cc	do	1948	Dr	130.0	4	N		N	N	Ls		2,492.5			
21- 4ca			Dr	156.0	3			Cy, W	S	Tc	3.5		137.78	4- 3-51	
7aa			Dr		2	P		Cy, W	S	Tc	3.0		176.90	4- 4-51	
16bd			Dr	174.0	4	P		Cy, W	S	Tc	1.0		120.46	4- 3-51	
18dd	U.N., USGS	1948	Dr	490.0	4	N	P, O	N	N	Ls		2,514.07	77.98	10- 6-48	L
24dc	Anderson		Dr	147.0	4	P		N	N	Tc	1.5	2,538.38	130.65	11-15-50	
31dd	U.N	1914	Dn	57.0	1	P	P	N	O	Tc	.5	2,466.34	26.52	5- 7-51	Ca

35da	Farley	----	Dr	123.0	4	P	-----	Cy, W	S	Tc	2.0	2,505.15	101.32	11-15-50	----
22-25dd	U.N., USGS	1932	Dr	82.0	4	N	P, O	N	N	Ls	------	2,478	------	--------	----
12-19-33cc	------do	1941	Dr	360.0	4	N	P, O	N	N	Ls	------	2,372.85	------	--------	L
20-11cb	----------	----	Dr	190.0	2	P	-----	Cy, W	S	Tc	1.0	--------	174.90	4- 4-51	----
17ac	Eddyville Cafe	1910	DD	100	72-2	P	-----	Cy, E	D	Ls	------	--------	48	1940	Ca
18ab	Lashly	1949	Dr	126	18	P	P	T, D/G	I	Ts	1.0	2,478.90	72.36	11-30-50	L
24aa	U.N., USGS	1948	Dr	630.0	4	N	P, O	N	N	Ls	------	2,507.02	166.38	9-17-48	L
28cd	Cunningham	----	Dr	138	-----	----	P	T, -	I	----	------	2,435	------	--------	L
34cd	----------	----	Dr	------	18	P	-----	T, T	I	Tb	------	--------	46.45	11-30-50	----
36cc	Thomas	1948	Dr	145	18	P	-----	T, D/G	I, O	Tb	1.0	2,396.50	36.38	10- 3-50	----
21- 2ac	U.N., USGS	1941	Dr	300.0	4	N	P, O	N	N	Ls	------	2,485.23	58.5	1941	L
20bb	------do	1948	Dr	700.0	4	N	P, O	N	N	Ls	------	2,544.12	87.39	10- 6-48	L
32ab	----------	----	Dr	121.0	4	P	-----	Cy, W	S	Tc	2.5	--------	108.83	4- 4-51	----
32cb	------do	1948	Dr	640.0	4	N	P, O	N	N	Ls	------	2,564.00	110.70	10- 6-48	L

HALL COUNTY

9-11- 5cc	U.N., USGS	1931	Dr	71.0	4	N	P	N	N	Ls	------	1,959	7.50	1931	----
8bc	------do	1945	Dr	200.0	4	N	P, O	N	N	Ls	------	1,957.5	4.90	11- 7-45	L
12- 1dc	Kipp	1930	Dr	46.3	24	P	P	T, T	I, O	Tc	------	1,964.30	4.02	5- 4-51	----
9ba	Ohlman	1929	Dr	59.5	24	----	P	T, T	I, O	Tc	------	2,002.48	20.32	5- 4-51	----
14cc	Schmidt	1945	Dr	60	18	P	P	T, D/G	I	Tb	0.5	1,982.70	5.35	5- 4-51	----
20bc	Burmood	----	Dr	26.8	18	P	P	T	I	Tb	.5	2,001.71	3.67	5- 4-51	----
10-11-30bc	Weldon	1927	Dr	65.0	24	C	P	T, T	I	Tb	.6	1,969.70	19.26	5- 4-51	----
12- 2cc	U.N., USGS	1931	Dr	124.0	4	N	P, O	N	N	Ls	------	1,975	------	--------	----
4cc	Frazell	----	Dr	58	-----	----	P	T, T	I	Tb	.3	1,988.9	27.53	5- 4-51	----
18cc	Arnold	----	Dr	------	18	----	-----	T, E	I	Tb	.2	2,006.46	25.29	5- 4-51	----
21cc	Knight	----	Dr	59.6	-----	----	P	T, E	I, O	Tb	------	1,998.57	27.19	5- 4-51	----
25ab	U.N., USGS	1931	Dr	87	4	N	P, O	N	N	Ls	------	1,986	------	--------	----
27cc	Green	1946	Dr	62.5	18	P	P	T, E	I	Tb	1.0	1,988.68	18.53	5- 4-51	----
11-12- 4cb	Mieth	1949	Dr	320	18	P	O	T, B	I	Ts	.5	2,102.73	143.80	9- 9-50	----
5bc	Hulme	1948	Dr	311	18	P	O	T, D/G	I, O	Tb	.5	2,093.20	121.93	10- 4-50	Ca, L
9cc	Headley	----	Dr	162	4	P	-----	Cy, W	S	Tc	1.5	2,065.07	107.98	9- 9-50	----
12cd	----------	----	Dr	------	24	P	-----	T, D/G	I	Tb	.4	1,946.83	23.56	5- 2-51	----
19cb	Wood River, Nebr	1916	Dr	58	24	----	P	C, E	P	----	------	--------	------	--------	Ca
20ba	School District 70	----	Dr	------	4	P	-----	Cy, W	D	Tc	1.0	2,053.60	86.07	8- 7-50	----
24cc	----------	----	Dr	56.8	-----	----	-----	T, E	I	Tb	1.0	1,954.50	24.21	5- 4-51	----

Table 10.—*Records of wells and test holes*—Continued

Well no	Owner, tenant, or driller	Year drilled	Type of well	Depth below measuring point (feet)	Diameter (inches)	Type of casing	Geologic source	Method of lift and type of power	Use of water	Measuring point: Description	Measuring point: Distance above or below (-) land surface (feet)	Measuring point: Altitude above mean sea level (feet)	Depth to water below measuring point (feet)	Date of measurement	Remarks
							HALL COUNTY—Continued								
11-12-29ad	U. N., USGS	1931	Dr	105.0	4	N	P, O	N	N	Ls		1,975	30	1931	
32dd			Dr				T, E	I	Ts	2.0	1,986.60	26.65	5- 4-51	
34dc			Dr	58.0	24	P	T, -	O	Tb	1.0	1,974.00	26.28	5- 4-51	
12-11- 5dd	S. C. M	1941	Dr			N	P	N	N	Ls		1,963.00			L
7ad	do	1941	Dr			N	P, O	N	N	Ls		1,954.00			L
21bb	do	1941	Dr			N	P, O	N	N	Ls		1,933.00			L
31cc	Johnson		Dr	56.0	18	P		T, T	I	Tb		1,939.30	23.77	5- 2-51	
12- 3bb	S. C. M	1941	Dr			N	P, O	N	N	Ls		1,907.00			L
6ab	do	1941	Dr			N	P, O	N	N	Ls		1,920.00			L
8bb	do	1941	Dr			N	P, O	N	N	Ls		1,922.00			L
10dd	Waite	1950	Dr	143.0	3	P		Cy, W	S	Tc	2.0	1,987.61	59.11	11- 8-50	
12dd	S. C. M	1941	Dr				P, O	N	N			1,963.00			L
14ab	USBR	1950	Dr	210.9	4	N	P	N	N	Ls		2,018.60			L
14ba	do	1950	Dr	180.6	1¼	P	P	N	O	Tc		1,994.90	66.96	2- 7-50	L
14da	do	1950	Dr	151.0	4	N	P	N	N	Ls		1,960.40			L
14dd	do	1950	Dr	166.0	4	N	P	N	N	Ls		1,956.80			L
15ab	do	1950	Dr	236.0	4	N	P	N	N	Ls		2,049.70			L
15bb	S. C. M	1941	Dr			N	P	N	N	Ls		1,999.00			L
15da	USBR	1950	Dr	150.5	4	N	P	N	N	Ls		1,970.70			L
20dc	School District 62		Dr		4	P		Cy, W	D, S	Tc	.5	2,040.35	84.35	8-14-50	
23aa	USBR	1950	Dr	164.3	4	N		N	N	Ls		1,978.30			L

23ad	____do____	1949	Dr	153.3	4	N	____	N	O	Ls	____	1,989.80	76.5	9-20-49	L
23bb	____do____	1949	Dr	131.0	4	N	P	N	N	Ls	____	1,971.10	33.5	9-26-49	L
23db	____do____	1950	Dr	151.7	4	N	____	N	N	Ls	____	2,010.00	____	____	L
24ab	Cairo, Nebr____	1950	Dr	92	18	P	P	T, E	P	Ls	____	1,955	47	11- 8-50	Ca
26dd	____	____	Dr	74.0	24	P	____	T, D/G	I	Tb	1.0	1,971.84	51.40	10- 9-50	____
27dd	____	____	Dr	155.0	5	P	____	N	N	Tc	____	2,051.96	116.43	10- 9-50	____
31ba	____	____	Dr	90.0	5	P	____	Cy, W	N	Tc	1.0	2,025.22	50.10	10- 9-50	____
32dd	School District____	____	Dr	142.0	5	P	____	Cy, W	D	Tc	____	2,089.66	129.85	8-14-50	____
33aa	____	____	Dr	114.0	5	P	____	Cy, W	S	Tc	.5	2,046.17	96.13	10- 9-50	____

HOWARD COUNTY

13-11-29cb	USGS____	1949	Dn	11.0	1¼	P	P	N	O	Tc	1.0	1,876.92	6.29	10- 4-50	____
30aa	____	____	____	20.0	3	P	P	N	O	Tc	1.0	1,879.58	10.25	10-27-50	____
30dd	S. C. M____	1941	Dr	____	____	N	P, O	N	N	Ls	____	1,895.00	____	____	L
31bc	____do____	1941	Dr	____	____	N	P, O	N	N	Ls	____	1,914.00	____	____	L
32cc	____do____	1941	Dr	____	____	N	P, O	N	N	Ls	____	1,922.00	____	____	L
33bb	____do____	1941	Dr	____	____	N	P, O	N	N	Ls	____	1,882.00	____	____	L
13-12-20dd	____do____	1941	Dr	____	____	N	P, O	N	N	Ls	____	1,925.00	____	____	L
25ba	U. N., USGS____	1944	Dr	110.0	4	N	O	N	N	Ls	____	1,923.00	37.70	8-12-44	L
25db	____do____	1944	Dr	100.0	4	N	O	N	N	Ls	____	1,900.00	20.80	8-12-44	L
26bb	S. C. M____	1941	Dr	____	____	N	P, O	N	N	Ls	____	1,893.00	____	____	L
26cc	____do____	1941	Dr	____	____	N	P, O	N	N	Ls	____	1,916.00	____	____	L
27aa	USGS____	1949	Dn	10.7	1¼	P	____	N	O	Tc	1.3	1,895.71	6.33	10- 4-50	____
29ca	Boelus, Nebr____	1934	Dr	31.5	18	P	P	T, E	O	Tb	____	____	9.02	5- 6-52	Ca
29ba	Young____	1910	Du	30.7	36	C	____	N	O	Tc	.2	1,938.28	26.47	10- 4-50	____
31ba	USGS____	1950	J	10.0	¾	P	____	N	O	Tc	1.2	1,923.23	2.56	10- 4-50	____
31bb	S. C. M____	1941	Dr	____	____	N	P, O	N	N	Ls	____	1,930.00	____	____	L
31cd	____do____	1941	Dr	____	____	N	P, O	N	N	Ls	____	1,931.00	____	____	L
32bb	____do____	1941	Dr	____	____	N	P, O	N	N	Ls	____	1,924.00	____	____	L
32cb	USGS____	1949	Dn	20.9	1¼	P	____	N	O	Tc	3.0	1,926.38	8.89	10- 4-50	____
34bb	S. C. M____	1941	Dr	____	____	N	P, O	N	N	Ls	____	1,906.00	____	____	L
35aa1	____do____	1941	Dr	____	____	N	P, O	N	N	Ls	____	1,892.00	____	____	L
35aa2	USGS____	1950	J	16.0	¾	P	____	N	O	Tc	3.0	1,894.63	12.44	10-31-50	____
36aa	U. N., USGS____	1944	Dr	70.0	4	N	P, O	N	N	Ls	____	1,900.00	9.20	8-16-44	L
36cc	USGS____	1950	J	10.5	¾	P	____	N	O	Tc	2.0	1,905.60	2.94	10-31-50	____
36da	U. N., USGS____	1944	Dr	100.0	4	N	P	N	N	Ls	____	1,904.00	____	____	L

Table 10. — *Records of wells and test holes* — Continued

Well no.	Owner, tenant, or driller	Year drilled	Type of well	Depth below measuring point (feet)	Diameter (inches)	Type of casing	Geologic source	Method of lift and type of power	Use of water	Measuring point: Description	Measuring point: Distance above or below (-) land surface (feet)	Measuring point: Altitude above mean sea level (feet)	Depth to water below measuring point (feet)	Date of measurement	Remarks
							KEARNEY COUNTY								
8-13-17cc	U.N., USGS	1931	Dr	189.0	4	N	P,O	N	N	Ls	------	2,052	------	-------	----
14-19cc	------do	1947	Dr	220.0	4	N	P	N	N	Ls	------	2,096.14	5.52	10- 1-47	L
16-23aa	------do	1947	Dr	70.0	4	N	P,O	N	N	Ls	------	2,146.05	4.32	9-30-47	L
							PHELPS COUNTY								
8-18-16cc	Nelson	1934	Dr	38	24	----	P	T,E	I,O	Ts	1.0	2,252.82	7.23	5-11-51	----
21ba	U.N., USGS	1932	Dr	55.0	4	N	P	N	N	Ls	------	2,245.00	------	-------	----
19-12dc	------do	1947	Dr	270.0	4	N	P,O	N	N	Ls	------	2,264.19	4.07	7-28-47	L
							SHERMAN COUNTY								
13-13-19dd	S.C.M	1941	Dr	------	-----	N	O	N	N	Ls	------	2,074.00	------	-------	L
20aa	------do	1941	Dr	------	-----	N	P,O	N	N	Ls	------	1,968.00	------	-------	L
22ca	------do	1941	Dr	------	-----	N	P,O	N	N	Ls	------	1,946.00	------	-------	L
24cc	------do	1941	Dr	------	-----	N	P,O	N	N	Ls	------	1,934.00	------	-------	L
24dd	------do	1941	Dr	------	-----	N	O	N	N	Ls	------	1,941.00	------	-------	L
26da	USGS	1950	J	16.0	dug	P	P	N	O	Tc	2.4	1,942.47	13.19	10- 4-50	----
26db	U.N., USGS	1944	Dr	93.0	4	N	P	N	N	Ls	------	1,951.0	14.5	9-25-44	L
27ba	USGS	1950	J	10.0	dug	P	P	N	O	Tc	1.0	1,944.30	3.10	10- 4-50	----
27dd	S.C.M	1941	Dr	------	-----	N	P,O	N	N	Ls	------	2,051	------	-------	L
29cd	----------	----	Dr	109.0	4	P	----	Cy, W	N	Tc	.5	2,045.43	82.25	8- 3-50	----

29dd	S. C. M	1941	Dr	------	------	N	P, O	N	N	Ls	------	2,056.00	------	-------	L
34aa	U. N., USGS	1944	Dr	120.0	4	N	O	N	N	Ls	------	2,048.0	------	-------	L
35aa	USGS	1950	J	31.0	¾	P	-----	N	O	Tc	3.7	1,956.96	24.37	10- 4-50	----
35dd	S. C. M	1941	Dr	------	------	N	P, O	N	N	Ls	------	2,063.00	------	-------	L
14-23cc	U. N., USGS	1947	Dr	420	4	N	O	N	N	Ls	------	2,134.5	133.54	7- 7-47	L
24cc	S. C. M	1941	Dr	------	------	N	O	N	N	Ls	------	2,100.00	------	-------	L
25dd	------do	1941	Dr	------	------	N	O	N	N	Ls	------	2,110.00	------	-------	L
35ab		----	Dr	51.0	4	P	-----	Cy, W	S	Tc	3.0	2,038.65	46.62	10- 4-50	----
15-28cd	U. N., USGS	1944	Dr	99.0	4	N	P	N	N	Ls	------	2,087.0	28.15	10-24-44	L
28da	------do	1944	Dr	86.0	4	N	P	N	N	Ls	------	2,076.0	23.55	10-24-44	L
29ad	USGS	1950	J	29.0	¾	P	-----	N	O	Tc	1.0	2,064.42	6.36	9-27-50	----
31dd		----	Dr	68.0	4	P	-----	Cy, W	N	Tc	1.0	2,122.40	43.34	8- 3-50	----
32ad	U. N., USGS	1944	Dr	109.0	4	N	P	N	N	Ls	------	2,096.0	30.80	10-24-44	L
35bd	Rathjen	1947	Dr	196	------	----	P, O	------	N	Ls	------	2,080	------	-------	L
16-31cc	The Ohio Oil Co	1952	Dr	420.0	4	N	P, O	N	N	Ls	------	2,216.0	49.50	5-31-52	L
32dc	Hawley	----	Dr	105.5	8	W	-----	Cy, W	D	Tb	1.0	2,254.71	101.18	9-11-50	----
36cb		----	Dr	142.0	2	P	-----	N	N	Tc	3.0	2,227.38	120.56	9-21-50	----

[1] Caved at 13.9.
[2] Caved at 78.8.
[3] Caved at 6.5.

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