GROUND-WATER RESOURCES AND GEOLOGY OF TUSCALOOSA COUNTY, ALABAMA

By Quentin F. Paulson, J. D. Miller, Jr., and C. W. Drennen

GEOLOGICAL SURVEY OF ALABAMA COUNTY REPORT 6

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COUNTY REPORT 6

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Prepared by the United States Geological Survey
in cooperation with the
Tuscaloosa County Board of Revenue
and the
Geological Survey of Alabama

UNIVERSITY, ALABAMA

1962

LETTER OF TRANSMITTAL

University, Alabama
March 21, 1962

Honorable John Patterson
Governor of Alabama
Montgomery, Alabama

Dear Governor Patterson:

I have the honor to transmit the manuscript of a report entitled "Ground-Water Resources and Geology of Tuscaloosa County, Alabama" by Q. F. Paulson, J. D. Miller, Jr., and C. W. Drennen, with the request that it be printed as County Report 6 of the Geological Survey of Alabama.

The report points out the close relationship between the occurrence and availability of ground water in the county and the geology. In the northern and eastern parts of the county the pre-Pennsylvanian rocks and the Pottsville Formation generally yield less than 25 gallons per minute to individual wells. In the southern and western parts of the county, however, adequate water for municipal, industrial, or irrigation use is available from sand beds in the Tuscaloosa Group of Late Cretaceous Age, and, in parts of the Black Warrior River valley, from alluvial sand and gravel deposits.

Respectfully,

Philip E. LaMoreaux
State Geologist

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ABSTRACT

Tuscaloosa County, in the west-central part of Alabama, has an area of 1,340 square miles and a population of 109,182 (1960 census). It is the second largest county in the State. The climate is subtropical; the average annual rainfall is 52.77 inches and the average annual temperature, 64.9°F.

The county occupies parts of three physiographic divisions, the Valley and Ridge, Appalachian Plateaus, and Coastal Plain provinces. Each province has characteristic drainage features. Streamflow is more nearly uniform in the Coastal Plain province.

The occurrence and availability of ground water in Tuscaloosa County are closely related to the geology. Seven major geologic units crop out in the county. These units are the pre-Pennsylvanian rocks, the Pottsville Formation of Pennsylvanian age, the Coker, Gordo, and McShan Formations of Late Cretaceous age, and the terrace and alluvial deposits of probable Pleistocene and Recent age.

The pre-Pennsylvanian rocks and the Pottsville Formation consist of indurated sandstone, siltstone, shale, conglomerate, chert, limestone, dolomite, and coal. Ground water in these rocks occurs in fractures and solution cavities. Individual well yields are generally less than 25 gpm (gallons per minute), but as much as 200 gpm can be obtained in places. Springs are relatively common in areas underlain by these rocks.

The Coker, Gordo, and McShan Formations crop out in the southern and western parts of the county and consist of widespread but lenticular deposits of clay, sand, and gravel. The sand and gravel beds form productive aquifers in many

places. Individual yields of several hundred gallons per minute are obtainable from properly constructed wells tapping the Coker Formation. Flowing artesian wells in the Coker Formation are common in the Black Warrior River valley south of Tuscaloosa. An inventory of these wells in 1956-57 showed an average flow of 30 gpm and a total discharge estimated to be more than 3 mgd (million gallons per day).

Productive sand and gravel aquifers occur also at shallow depths in the terrace and alluvial deposits along major streams. These water-bearing beds are highly permeable and, where of sufficient saturated thickness, have potential yields of at least 1,000 gpm to individual wells. The largest yields from these beds are obtainable in the Black Warrior River valley.

The ground water is generally of good chemical quality but locally contains excessive iron. The hardness of water in the pre-Pennsylvanian rocks and Pottsville Formation is more than 100 ppm (parts per million) in many places.

INTRODUCTION

Location and General Features

Tuscaloosa County, in west-central Alabama, is bounded on the north by Fayette and Walker Counties, on the east by Jefferson and Bibb Counties, on the south by Bibb, Hale, and Greene Counties, and on the west by Greene and Pickens Counties (fig. 1). It has an area of 1,340 square miles and, according to the 1960 census, a population of 109,182.

The economy of Tuscaloosa County is industrial and agricultural. The principal industries are meat packing, oil refining and the manufacturing of paper, soil pipe, chemicals, rubber, asphalt roofing, fertilizers, and coke. Agricultural products consist mainly of livestock, cotton, corn, and timber. The forests of the county, which cover about 80 percent of its area, provide a substantial part of its income. State, Federal, and private institutions include the Alabama State Hospitals, Veterans Administration Hospital, University of Alabama, and Stillman College.

The city of Tuscaloosa is served by 3 railroads, 1 airline, 2 major bus lines, several transport lines, and river-barge

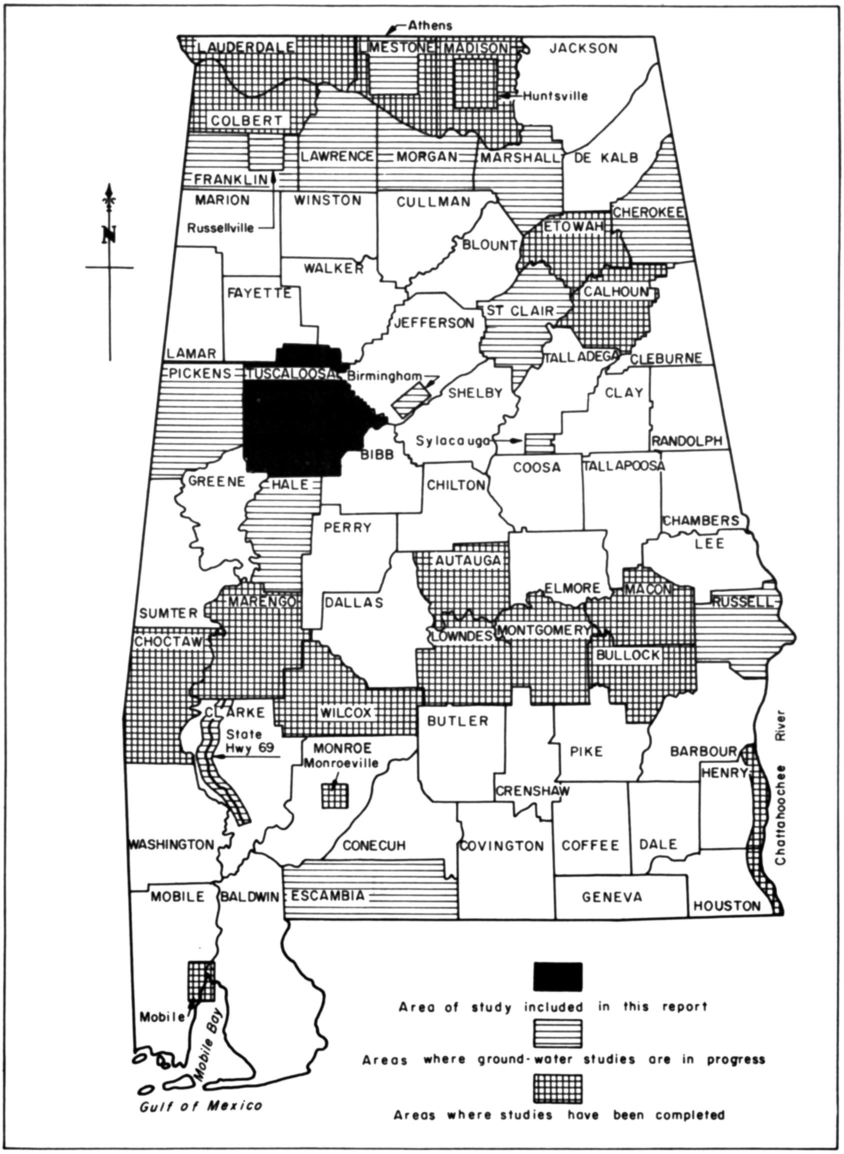


Figure 1.—Map of Alabama showing area studied and areas of other ground-water studies.

traffic. The population of the city has grown from 46, 364 in 1950 to 63, 125 in 1960--an increase of about 36 percent in 10 years.

Historical Sketch

Tuscaloosa County, created by an Act of the Alabama Territorial Legislature February 7, 1818, is the second largest county in the State. The name was derived from that of the Indian chief, Tuskalusa, a 7-foot giant who reigned over a large area in southwestern Alabama. The word "Tuska" means warrior and "Lusa" means black, in the language of the Choctaw and Creek Indians. Chief Tuskalusa and several hundred Indian warriors were killed by Ferdinand de Soto and his soldiers in a bloody battle approximately 100 miles south of the city of Tuscaloosa in 1540.

The first white explorers reached the immediate vicinity of Tuscaloosa in 1810, and the first settlers arrived from South Carolina in 1816.

Incorporated in 1819, Tuscaloosa grew rapidly and became the State capital in 1826. The city is at the head of navigation on the Black Warrior River and the availability of river transportation assured plantation owners in the area of a ready market in Mobile for their cotton and other produce.

The University of Alabama was established at Tuscaloosa in 1831, and in 1846 the State capital was transferred to Montgomery by a vote of the Alabama Legislature. Bryce Hospital was opened in 1861. The Civil War left its mark on the city when the university and several public stores were burned by Union cavalry in 1865. Navy and Army personnel took special courses at the University of Alabama during World War II, and many French and British cadets took pilot training at Van de Graff airport, 2 miles west of Tuscaloosa.

Purpose and Scope

The U.S. Geological Survey began ground-water studies in Tuscaloosa County in 1946 in cooperation with the Geological Survey of Alabama, and work progressed intermittently as funds and manpower were available. A study of the availability of ground water on properties of the Alabama State Hospitals in Tuscaloosa County was made during 1955-56 in cooperation with the Hospitals and the Geological Survey of Alabama.

The present county investigation was begun in May 1951 by the U. S. Geological Survey in cooperation with the Tuscaloosa County Board of Revenue and the Geological Survey of Alabama. Its purpose was to make a detailed study of the quantity, quality, and availability of ground water in Tuscaloosa County and to relate its occurrence and movement to the geology of the county.

This report is the third in a series of ground-water reports publishing the results of the county investigations. The first two, "Ground Water in the Vicinity of Bryce State Hospital, Tuscaloosa County, Alabama," by J. D. Miller, Jr., and "Geology and Ground-Water Resources of Tuscaloosa County, Alabama," an interim report by J. D. Miller, Jr. and L. V. Causey, were published in 1958 as a means of expediting the release of basic data. Most of the basic data presented in the previous reports are not repeated in this report but were used substantially in its preparation.

Most of the fieldwork was done by J. D. Miller, Jr., C. W. Drennen, and L. V. Causey. The work was under the direct supervision of P. E. LaMoreaux and W. J. Powell, former and present district geologists of the U. S. Geological Survey in charge of ground-water investigations in Alabama.

Collection of Basic Data

More than 1,000 wells and springs were inventoried in Tuscaloosa County, and information was obtained concerning their construction, depths, water levels or artesian pressures, yields, and use, and the water-bearing formations which they tap. Most of these wells and springs were listed by Miller and Causey (1958, table 1), but those inventoried since the publication of their report are cited in table 4 of this report. Also included are key wells selected from those described by Miller and Causey for which significant additional data have been obtained. The locations of the wells listed in table 4 are shown on figure 6. Altitudes of wells, springs, and geologic features were determined by aneroid altimeter.

The outcrops of the various geologic formations were studied and mapped in the field with the aid of aerial photographs (scale 1:20,000) and topographic quadrangle maps (scale 1:62, 500).

Test wells were drilled at 68 selected sites throughout the county to obtain additional geologic and hydrologic data. Drillers', sample, drilling-time, and electric logs were obtained for most of the test wells and also for several private wells. Data on 43 of the test wells were presented in reports by Miller (1958) and Miller and Causey (1958). Data on 25 test wells plus additional data on 25 of those previously reported are given in this report. A total of 78 lithologic and 77 electric logs of test wells and private wells are included and are shown on plates 2 and 3 and in the appendix. The electric logs denote the measurement of the electrical properties, resistivity, and spontaneous potential of material penetrated by a bore hole and are of particular use in identifying the various beds penetrated by a bore hole, determining the depth and thickness of an aquifer or impermeable bed, and determining the quality of water and porosity of an aquifer.

Pumping tests were made on selected wells to obtain information concerning the hydraulic properties of the water-bearing beds. The discharges and the drawdown and recovery of water levels in the wells were measured during the tests.

Recording gages were installed in selected wells to obtain a record of water-level fluctuations in various aquifers. Precipitation and other climatic data were obtained from records of the U.S. Weather Bureau. The water-level records were correlated with the precipitation data to determine the character and extent of recharge to the ground-water reservoirs.

Samples of water were collected from 26 wells and springs and analyzed in the laboratory for chemical content. The hardness and chloride content of water from most of the wells inventoried were determined by field analyses. The analyses of these samples were given by Miller and Causey (1958, tables 1 and 2). Geochemical interpretation of the data are included in this report.

Previous Investigations

A considerable amount of geologic work has been done in

Tuscaloosa County. The first published work is that of Michael Tuomey who, in his first and second biennial reports (1850 and 1858), described the geology of the county and listed localities at which coal beds and Cretaceous fossils were found. Henry McCalley (1897) described the geologic formations exposed in the county in his report on the valley regions of Alabama.

The first ground-water study of the county was made by E. A. Smith (1907), who recorded depths, drillers' logs, and chemical analyses of water from 27 wells and 2 springs. W. D. Johnston, Jr. (1933), who made a reconnaissance investigation of ground water in northern Alabama, recorded data on 64 wells in Tuscaloosa County.

Other geologic studies that contain information pertinent to Tuscaloosa County are those of Smith and Johnson (1887), Smith, Johnson, and Langdon (1894), Adams and others (1926), Bowles (1941), Conant and others (1945), Eargle and others (1946), Conant and Eargle (1947), Drennen (1953a), McGlamery (1955), Miller (1958), and Miller and Causey (1958).

A selected list of references is given at the end of this report.

Acknowledgments

The authors are grateful to many of the residents of Tuscaloosa County who cooperated during the course of the study by contributing much helpful information. Special thanks are given for the many logs and other well data made available by the drilling companies of Causey, Hendon, Ace, Peerson, Bozeman & Son, Null, Black Belt, Layne-Central, Carl Beard, and George Beard.

Well-Numbering System

The numbering of wells in Tuscaloosa County is based on the Federal land classification system. Townships are designated by letters, beginning with "A" in the northeast corner of the county and continuing through "Z" and from "AA" through "SS," as shown in figure 2. Wells within a township are numbered consecutively; for example, in township A they are designated A-1, A-2, A-3, and in township B, B-1 and B-2.

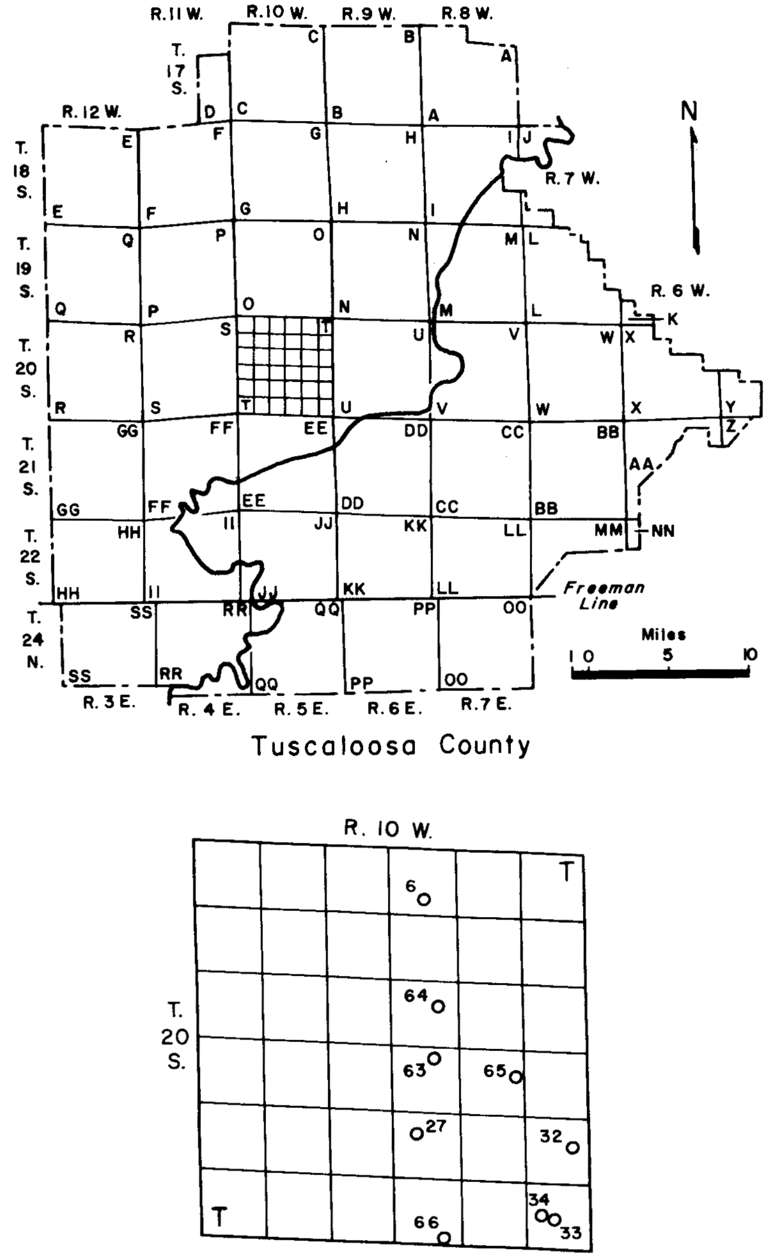


Figure 2.—Diagram showing well-numbering system used in this report.

The wells included in this report represent only a small part of the total number of wells inventoried in Tuscaloosa County. Some of the wells are taken from the Miller and Causey report (1958, table 1) and are designated by the numbers used in that report. Others have been inventoried since publication of that report, and are numbered consecutively from the last number used.

GEOGRAPHY

Climate

Tuscaloosa County is in a region of temperate subtropical climate characterized by high humidity and moderate temperature variations. The average annual temperature, as recorded at the city of Tuscaloosa by the U. S. Weather Bureau, is 64.9°F; the average winter temperature is 48.5°F, and the average summer temperature is 81.1°F. The average monthly temperatures at Tuscaloosa for the 76-year period of record, 1881 through 1957, are shown graphically in figure 3. The length of the growing season, determined by the latest spring and earliest fall dates on which a killing frost is recorded, averages 229 days.

Precipitation in Tuscaloosa County is almost entirely in the form of rain. The average annual precipitation at Tuscaloosa for the 79-year period of record, 1878 through 1957, is 52.77 inches. The greatest amount of rainfall generally occurs from December through March and the least amount in September and October. The wettest year of record was 1929 with 81.34 inches, 28.57 inches above average. The driest year of record was 1954 with 32.87 inches.

Physiography

Tuscaloosa County is divided physiographically into two approximately equal parts by the "Fall Line," which extends diagonally across the county from the southeast to the northwest corners (fig. 4). The "Fall Line" marks the boundary between resistant rocks of Paleozoic age in the northeastern part of the county and the relatively soft unconsolidated deposits of clay, sand, and gravel of Cretaceous age in the southwestern part.

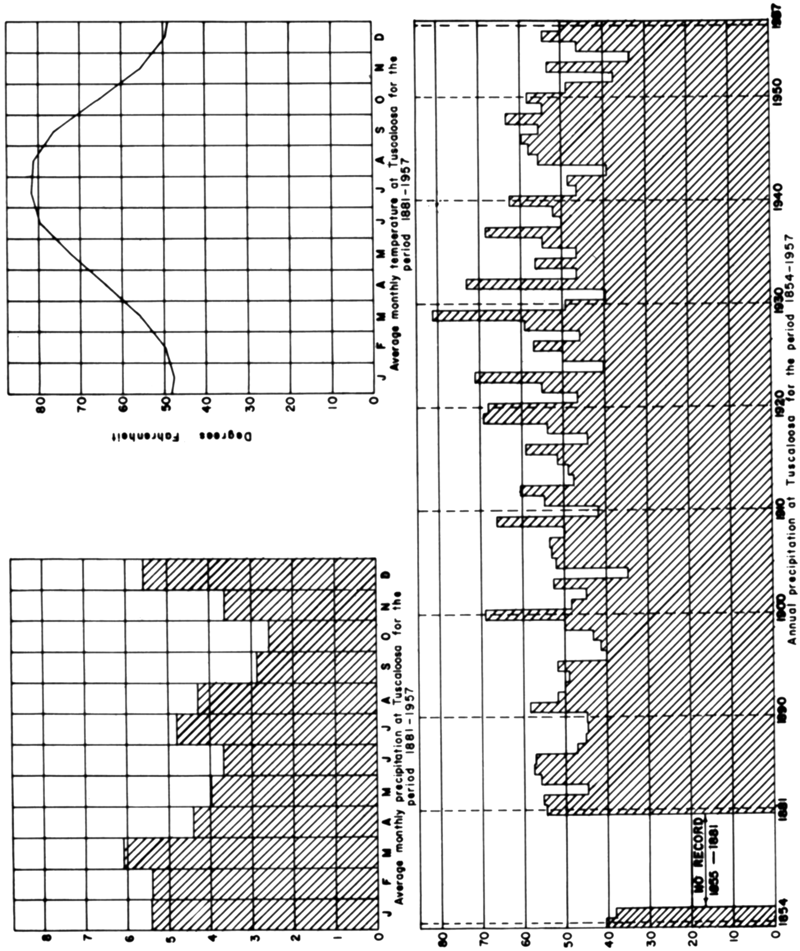


Figure 3.—Climatic data recorded at Tuscaloosa, Ala.
(from records of the U. S. Weather Bureau)

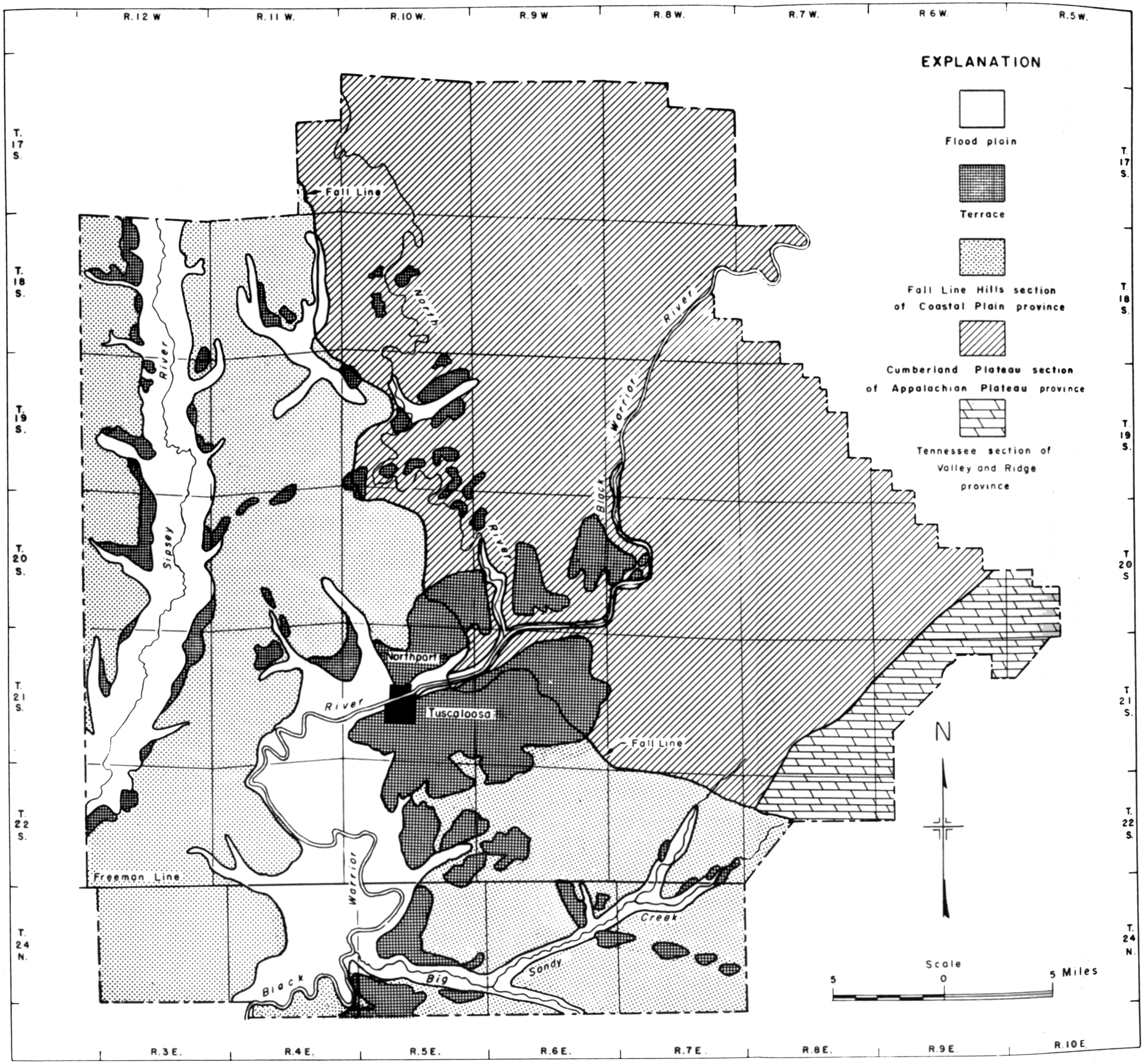


Figure 4.-Map of Tuscaloosa County, Ala., showing physiographic divisions (after Fenneman).

Most of the northeastern part of the county is in the Cumberland Plateau section of the Appalachian Plateaus province, and about 50 square miles is in the Valley and Ridge province. The Cumberland Plateau section is characterized by rather rugged topography. The streams occupy steep-sided valleys which in places form gorges. The Valley and Ridge province is characterized by alternating ridges and valleys, which trend northeastward in Tuscaloosa County. The topography in this area is the result of geologic structure and differential erosion of folded beds of sandstone, shale, limestone, and dolomite of Paleozoic age.

The southwestern part of Tuscaloosa County is in the Fall Line Hills belt of the East Gulf Coastal Plain (Fenneman, 1938, p. 67). Fenneman described this region as "a dissected upland with a few broad or flat divides." Generally, the topography is less rugged than in either the Appalachian Plateaus or the Valley and Ridge provinces.

Altitudes in the Cumberland Plateau section range from 150 to 750 feet above mean sea level. They range from 400 to 800 feet in the Valley and Ridge province, and from 100 to 450 feet in the Fall Line Hills.

Deeply dissected terraces border the flood plains of the major streams in all but the northeastern part of the county. These terraces are extensive near the city of Tuscaloosa (fig. 4). The larger terraces form flat to gently rolling uplands, some as high as 300 feet above the present level of the Black Warrior River. Lower terraces flank the flood plains.

Drainage

Drainage in the Cumberland Plateau section is dendritic, and the streams are incised. The drainage pattern in the Valley and Ridge province is somewhat trellised and shows the effects of the geologic structure. A large anticlinal uplift with a northeasterly trend has caused some of the streams to flow southwestward into the Black Warrior River and some to flow southeastward into the Cahaba River. Drainage in the Coastal Plain areas of Tuscaloosa County is dendritic.

The Black Warrior and Sipsey Rivers are the largest streams in the county. The main tributaries of the Black

Warrior are North River and Yellow, Blue, Davis, Hurricane, Big Sandy, and Grant Creeks. The Sipsey River has no large tributaries in the county.

The discharge records available for streams in Tuscaloosa County (Wells, 1958) are summarized in table 1.

The flood plains of streams incised in consolidated rocks in the Appalachian Plateaus and Valley and Ridge provinces are relatively narrow and are underlain by thin deposits of alluvium. Ground-water storage in these valleys is small. Because the topography is rugged and the rocks are relatively impermeable, most of the precipitation becomes runoff; the streams rise rapidly during periods of heavy precipitation and subside rapidly afterward.

Drainage characteristics in parts of the county in the Coastal Plain are markedly different from those in parts lying in the Appalachian Plateaus and Valley and Ridge provinces. The streams meander widely over broad valleys underlain by relatively thick terrace and alluvial deposits. These deposits in many places form reservoirs for large quantities of ground water in transient storage. The stream levels decline below the water tables in the adjacent ground-water reservoirs during prolonged drought, allowing discharge from the reservoirs to maintain the flow of the streams. Conversely, when precipitation occurs, it does not flow directly into the streams as runoff, for a considerable portion is absorbed into the permeable terrace and alluvial deposits (as well as the permeable sand and gravel common in the Coastal Plain formations). Thus the streams are slow to rise and slow to recede in response to precipitation or the lack of it, and they maintain a relatively uniform flow throughout the year.

GENERAL PRINCIPLES OF GROUND-WATER OCCURRENCE

Ground water occurs below the land surface in the zone of saturation, where rock openings are filled with water that is free to move in response to forces of gravity. The top of the zone of saturation, except where confined by an impermeable layer, is known as the water table. If confined, the water is generally under artesian pressure and will rise above the top of the water-bearing bed in a tightly cased well that penetrates

Table 1. --Summary of streamflow in Tuscaloosa County, Ala.

[Discharge measurements in cubic feet per second]

Stream	Location of measurement	Period of record (years)	Maximum discharge and date of measurement		Minimum discharge and date of measurement		Average discharge
Black Warrior River	Tuscaloosa	38	223,000	3-29-51	37	10-23-53	7,684
Sipsey River	Elrod	22	21,000	1- 9-50	12	9-20-54	748
North River	Bridge crossing State Highway 69	6	11,300	2- 7-55	8.4	7-29-52	482
Hurricane Creek	Bridge crossing State Highway 116	6	8,380	4- 6-56	1.7	9- 5-54	134
Big Sandy Creek	Duncanville	2	956	5- 2-58	21	9-27-56	.....
Davis Creek	Bridge crossing SE$\frac{1}{4}$ sec. 12, T. 20 S., R. 7 W.	2	2,630	4- 4-57	No flow	9- 7-57	.....
Lake Creek	NE$\frac{1}{4}$ sec. 28, T. 20 S., R. 11 W.	2	45	5- 2-58	.3	9- 7-57	.....

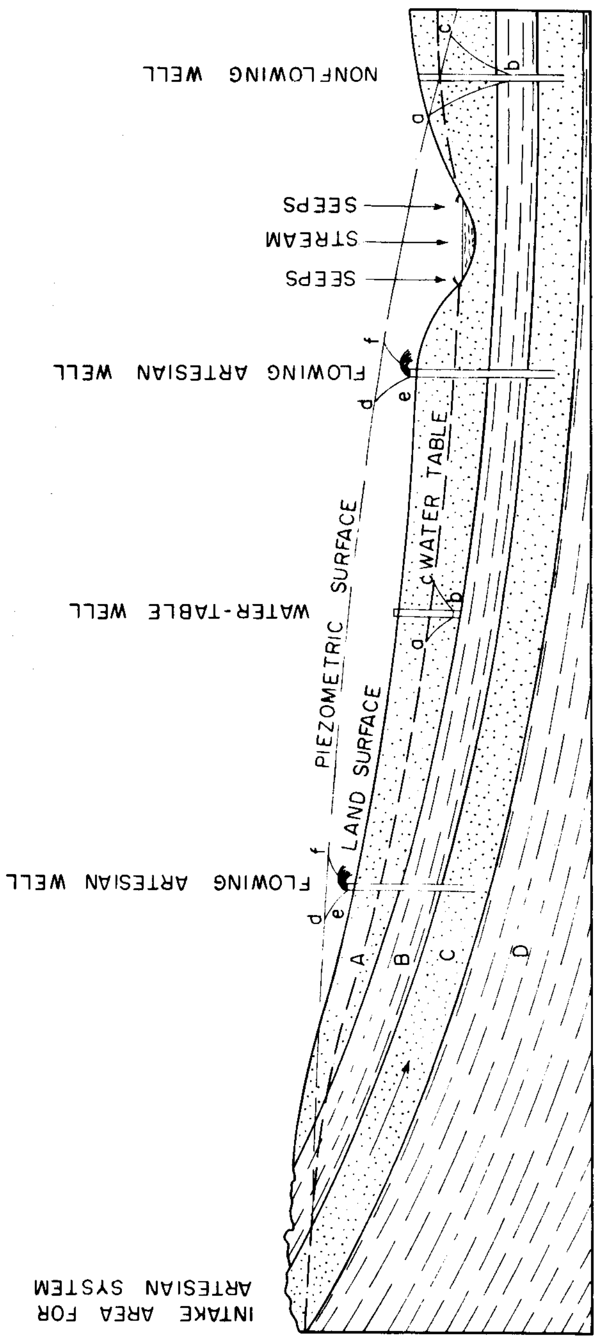
the confining layer. The imaginary surface to which the water will rise is called the piezometric surface. Water-table and artesian conditions are illustrated in figure 5.

A geologic formation, group of formations, or part of a formation that will yield water to wells or springs is termed an aquifer. The terms "water-bearing beds" and "water-bearing deposits" are commonly used synonymously with aquifer.

Almost all ground water is in motion from areas of recharge toward areas of discharge. The rate of movement in most aquifers is very slow and depends on the size and degree of interconnection of the water-bearing openings. Rocks that transmit water readily are said to have high permeability or to be permeable. Among the more permeable rocks are well-sorted sand and gravel and fractured limestone and sandstone. Rocks that do not transmit water readily are said to have low permeability or to be impermeable. Among the more impermeable rocks are clay, chalk, shale, and unfractured sandstone, limestone, and granite. The degree of cementation affects the permeability of sandstone; in an unfractured sandstone the permeability decreases as cementation increases.

The rate of movement of water through an aquifer is dependent also on the hydraulic gradient. The hydraulic gradient is the slope of the profile of hydrostatic pressure at various points in the aquifer and is usually measured in feet per mile. The hydrostatic pressure at any point in an aquifer is indicated by the level to which the water will rise in a tightly cased well that taps the aquifer.

Recharge to an aquifer is the process by which water is taken into it either by direct absorption in its areas of outcrop or by leakage from other aquifers in the subsurface. Most of the water is from rain falling on the outcrop. Studies indicate that nearly 20 percent of the precipitation in parts of northern Alabama recharges the ground-water reservoirs (Curtis, 1953, p. 35). Conditions for recharge in Tuscaloosa County, particularly in the southern part, appear to be as favorable as those in northern Alabama. Recharge also may result from streams flowing over the outcrop of the aquifer. Where the water level in the aquifer is below that of the stream, water may percolate through the stream channel and into the aquifer if the channel bottom is not too impermeable.



A. Permeable surficial material B. Upper confining bed C Artesian aquifer D. Lower confining bed

abc Cone of depression caused by pumping a water-table or a nonflowing artesian well.

def Cone of depression caused by natural discharge from flowing artesian well

Figure 5.-- Schematic diagram showing artesian and water - table conditions.

Discharge from an aquifer is the withdrawal of ground water by natural or artificial means. Discharge of springs, seepage into streams, evaporation from free water surfaces, and transpiration of plants are forms of natural discharge, and the removal of water by wells is artificial discharge. In a natural state of dynamic equilibrium, the discharge from an aquifer is equal to the recharge to it.

The amount of water that can be pumped or that will flow from a well depends on certain properties of the aquifer, provided the well is properly constructed. These properties, referred to as hydrologic properties in this report, include the coefficients of transmissibility, permeability, and storage.

The coefficient of transmissibility expresses the ability of an aquifer to transmit water. It is defined as the number of gallons of water that will move in 1 day through a vertical strip of the aquifer 1 foot wide, extending the full height of the aquifer, under a hydraulic gradient of 100 percent, or 1 foot per foot. The coefficient of permeability is defined as the number of gallons of water that will move in 1 day through 1 square foot of the aquifer under a 100-percent gradient. It can be computed by dividing the coefficient of transmissibility by the thickness (in feet) of the aquifer. The coefficient of storage of an aquifer is defined as the volume of water it releases from or takes into storage per unit surface area of the aquifer per unit change in the component of head normal to that surface. Specific capacity is a useful index with which to compare well performances. It is computed by dividing the yield of the well in gallons per minute by the total drawdown in feet.

These properties, as well as others concerning aquifers and wells, are best determined by the aquifer-test method. This involves pumping a well or allowing a well to flow at a constant rate of discharge and measuring the rate of drawdown of the water level (or recovery of the water level after the discharge is stopped) in one or more nearby observation wells and (or) in the pumped well. The data are generally analyzed by the Theis method (1935) which, although it imposes certain restrictions on the conditions of the test, yields acceptable results for many practical purposes.

A knowledge of the coefficients of transmissibility and storage of an aquifer, combined with other hydrologic and geologic data, makes it possible to supply quantitative answers to such questions as: What will be the drawdown in a well after a certain period of pumping at a fixed rate? From how large an area must a well draw water to be able to discharge a certain quantity, and what spacing would be necessary in order to minimize interference among a group of wells? What is the quantity and rate of movement of ground water that moves as underflow through the alluvial or terrace deposits in a valley? These are typical of the many engineering and geologic problems that arise during most large-scale ground-water developments.

GEOLOGIC FORMATIONS AND THEIR WATER SUPPLY

The rocks that crop out in Tuscaloosa County are of sedimentary origin and range in age from Cambrian to Recent. The total thickness of the sedimentary rocks is not known, but it exceeds 5,000 feet (McGlamery, 1955, p. 380-389).

The lithologic character of the rocks varies greatly as a result of the different conditions that prevailed during their deposition. The rocks that crop out in the northeastern half of the county are of Paleozoic age and are represented by the Pottsville Formation and pre-Pennsylvanian units on the geologic map (pl. 1). They are relatively dense and well indurated, except where weathered. Ground water occurs in fractures and in solution openings that have been developed near the land surface in some of the formations, but these openings are relatively difficult to locate.

Rocks ranging in age from Late Cretaceous to Recent crop out in the southern and western parts of the county. They attain a maximum thickness of more than 600 feet and consist of unconsolidated lenticular beds of clay, sand, and gravel. These rocks comprise the Coker, Gordo, and McShan Formations and the terrace and alluvial deposits. Ground water occurs in the sand and gravel beds and is generally abundant and easily located.

The geologic structure in most of Tuscaloosa County is relatively simple; the formations generally dip toward the southwest at 30 to 40 feet per mile. The structure is complex, however, in the Valley and Ridge province near the eastern margin of the county, where rocks have been folded into a northeastward-trending anticline. The rocks dip generally toward the northwest at high angles, and are faulted at many places.

Pre-Pennsylvanian Rocks

Pre-Pennsylvanian rocks that range in age from Cambrian through Mississippian crop out in an area of about 50 square miles along the southeast edge of the county (pl. 1). These rocks have been folded and faulted into complex structures. Differential weathering has formed a series of near-parallel ridges and valleys which trend northeastward. Rocks most resistant to weathering, such as sandstone and chert, form the ridges, and those less resistant or more soluble, such as shale and limestone, underlie the valleys.

The pre-Pennsylvanian rocks include beds of limestone, dolomite, chert, sandstone, shale, conglomerate, hematite, limonite, and coal. Limestone and dolomite are predominant. The total thickness of these rocks is not known but may be several thousands of feet. They unconformably overlie Precambrian rocks and are unconformably overlain by the Pottsville Formation of Pennsylvanian age.

The most productive aquifers in the pre-Pennsylvanian rocks are the beds of limestone and dolomite. Ground water in limestone and dolomite occurs in solution openings developed along fractures and bedding planes. Interconnected solution openings in these rocks form a system of conduits that permits relatively free movement of large quantities of ground water. The yield of a well drilled into a limestone or dolomite aquifer depends on the number, size, and extent of the openings penetrated. Large quantities of water are available in places, but test drilling is often necessary to locate it. The beds of sandstone and conglomerate also yield water, but in smaller quantities because the water-bearing openings have not been enlarged by solution. Yields from individual wells tapping the pre-Pennsylvanian rocks in Tuscaloosa County are generally less than 25 gpm (gallons per minute); however, well MM-5 (fig. 6), which taps solution channels in dolomite of Cambrian and Ordovician age, was estimated to yield 150 to 200 gpm in January 1957.

Springs discharge from pre-Pennsylvanian rocks where water-bearing solution openings intersect the land surface. The large quantities of water in these rocks in some areas is indi-

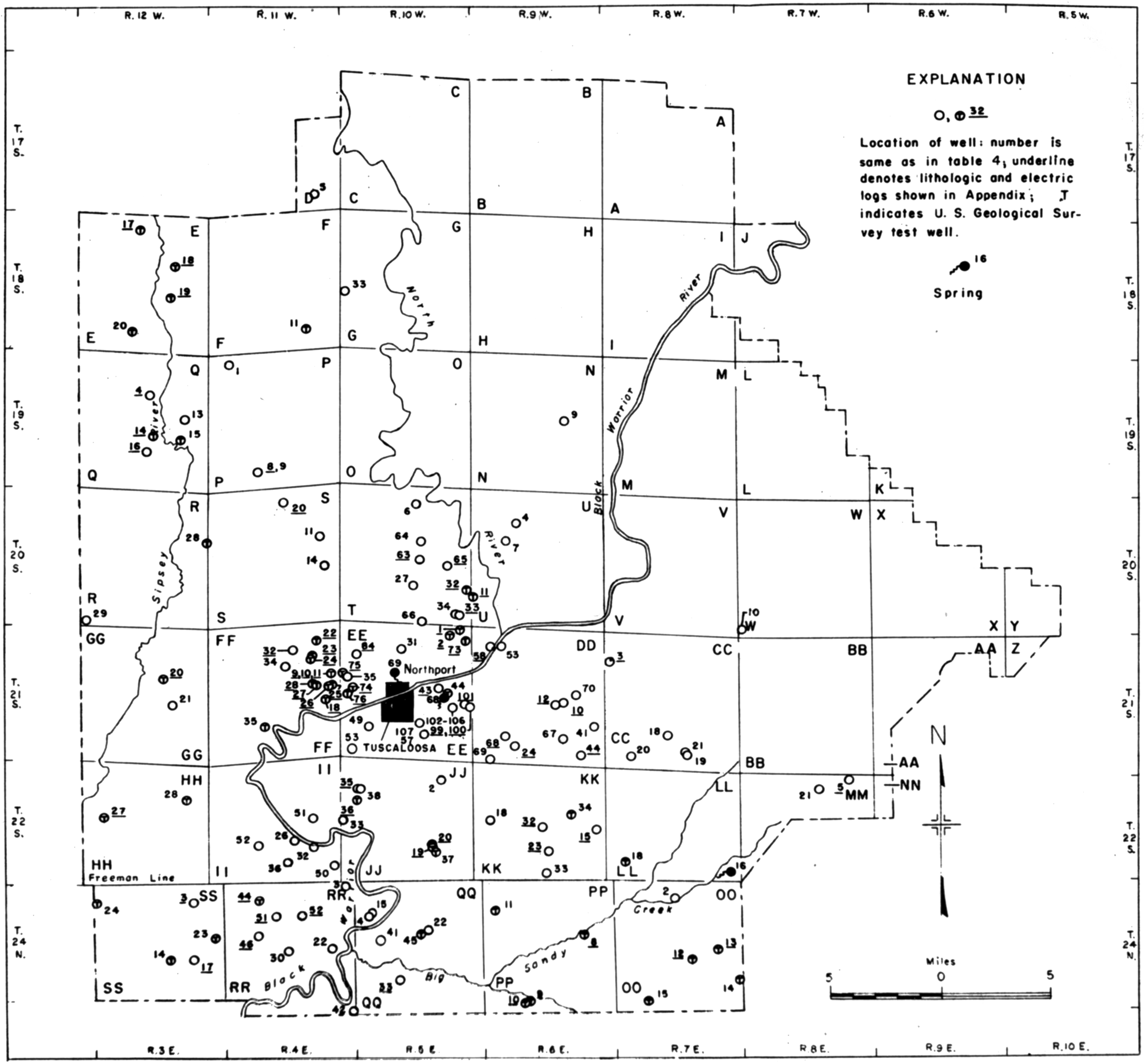


Figure 6.-Map showing location of selected wells and springs in Tuscaloosa County, Ala.

cated by the magnitude of flow of the larger springs. Big Sandy Spring (LL-16, fig. 6) flowed 7,360 gpm on April 19, 1944. Several other springs in Tuscaloosa County are reported to flow from pre-Pennsylvanian rocks and to discharge 75 to 200 gpm (Miller and Causey, 1958, table 1).

The quality of the ground water from these rocks varies considerably because of the variety of rock types. Generally, the chloride content is low, but the hardness of the water is more than 100 ppm (parts per million) as $CaCO_3$.

Pennsylvanian System

Pottsville Formation

The Pottsville Formation of Pennsylvanian age was named for exposures near the town of Pottsville in the anthracite coal field of eastern Pennsylvania (Lesley, 1876, p. 221-227). The formation crops out in approximately the northeastern half of the county and underlies all but the southeast corner (pl. 1). Its area of outcrop coincides with the Cumberland Plateau physiographic division. The southern edge of its outcrop extends south-southeastward from the Fayette County line near the longitude of New Lexington, through Tuscaloosa to a point about midway between Coaling and Vance in the eastern part of the county, where it abuts older Paleozoic rocks in the Valley and Ridge province.

Stratigraphy

The Pottsville Formation consists of sandstone, shale, siltstone, conglomerate, and beds of coal. The thickness of the formation in the county is not known but may be nearly 3,000 feet (McGlamery, 1955, p. 380-385).

The formation is the youngest unit of Paleozoic age cropping out in Tuscaloosa County. It unconformably overlies rocks of Mississippian age and is unconformably overlain by the Coker Formation of Late Cretaceous age. The eroded top of the formation slopes about 30 to 35 feet per mile toward the southwest (fig. 7).

The contact between the Pottsville and Coker Formations is difficult to distinguish locally because of the deep weathering to which the rocks have been subjected. Sandstone and shale beds in the Pottsville Formation have been so deeply weathered in some places that they resemble the friable sand beds and relatively soft clay beds in the overlying Coker Formation.

Electric logs show rapid changes and rather wide ranges in the electrical properties of the Pottsville Formation. (See app., wells T-32 and U-11.) This is probably due to thin beds of alternating sandstone and shale but may be due, in part, to changes in degree of induration. The Pottsville is difficult to drill because of its hardness, and its presence is usually apparent from the increased bit wear and drilling time. In electric logs it is indicated by an abrupt decrease in resistivity.

Water supply

The Pottsville Formation generally yields small quantities of water to wells and springs in the area of outcrop. Wells that tap the formation supply most of the water used for domestic and stock purposes in the northeastern half of the county. Ground water in the Pottsville occurs in openings along joints and other fractures, and along bedding planes. The average yield from individual wells is about 10 gpm; however, some wells that penetrate extensive systems of openings may yield as much as 100 gpm. Available data indicate that if sufficient supplies of ground water have not been obtained at depths of less than about 250 feet, the possibility of getting a supply at greater depths is remote. This is because the deeper part of the formation is less weathered and consequently contains fewer openings. To locate yields substantially larger than 10 gpm generally requires test drilling.

Little is known concerning the recharge to and movement of ground water in the Pottsville Formation. Most of the water is derived directly from precipitation on the areas of outcrop. Substantial quantities of water may be contributed by streams where they flow across extensively fractured rocks in areas where the water table is below stream levels. The main direction of movement of ground water is probably downdip to the southwest. Locally, however, ground water may move in other directions because of topographic influence and the orientation of fracture systems.

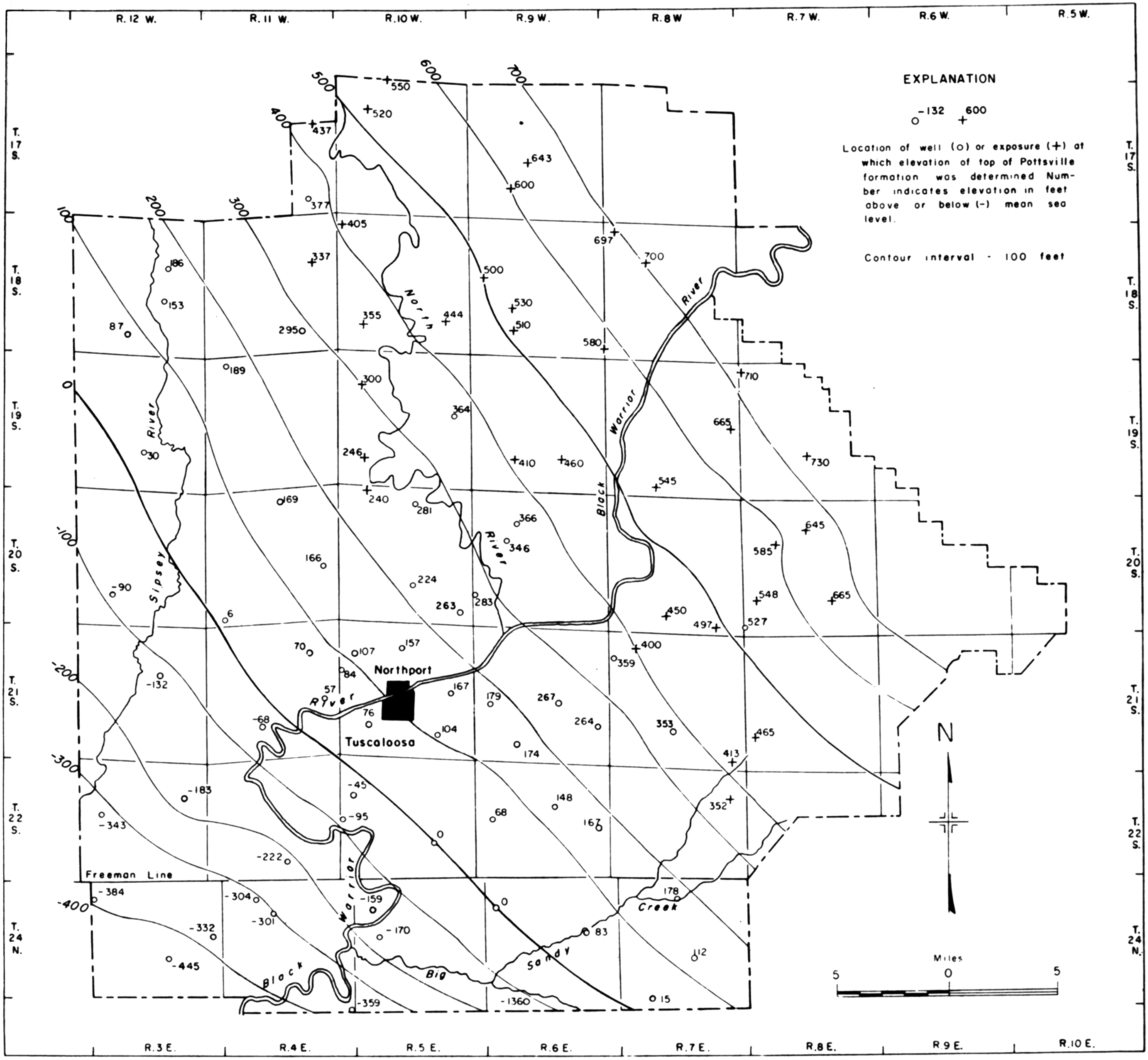


Figure 7.- Map showing configuration of top of Pottsville Formation in Tuscaloosa County, Ala.

Discharge from the Pottsville is mainly through springs and wells. Springs occur near the heads of ravines and generally yield less than 5 gpm. Their discharge fluctuates from season to season, and many springs cease flowing during the fall and early winter.

Water from the Pottsville Formation in Tuscaloosa County has an average hardness of about 125 ppm and an average chloride content of about 15 ppm. Locally, the iron content is reported to be sufficiently high to render the water unsuitable for laundering because of its staining properties. Logs of wells yielding water that are reported to be high in iron commonly show that one or more coal beds have been penetrated.

Cretaceous System - Upper Cretaceous Series

Upper Cretaceous deposits crop out in central Alabama in a crescent-shaped belt 40 to 60 miles wide. The beds dip southwesterly in the western part of the State but more southerly in the eastern part. The deposits thicken toward the southwest in Tuscaloosa County (fig. 8). The Upper Cretaceous series in the county consists, in ascending order, of the Coker and Gordo Formations of the Tuscaloosa Group and the McShan Formation.

The first description of beds here assigned to the Coker and Gordo Formations was made by Hilgard (1860, p. 62-75), who included them in his designation of the Eutaw Group. Smith and Johnson (1887, p. 95-116) excluded from the Eutaw Group beds of variegated clay, sand, and gravel that overlie the Paleozoic rocks and designated them the Tuscaloosa Formation. More recently, the Tuscaloosa Formation of Smith and Johnson was divided into the Cottondale, Eoline, Coker, and Gordo Formations, in ascending order, and the rank of the entire sequence was raised to that of group (Conant and others, 1945). Drennen (1953a) redefined the Coker Formation to include the Cottondale, Eoline, and Coker Formations of Conant and others (1945). Drennen's classification, which divides the Tuscaloosa Group into two formations, the Coker Formation at the bottom and the Gordo Formation at the top, is used in this report.

Coker Formation

The Coker Formation, the lower unit of the Tuscaloosa Group of Late Cretaceous age, was named for exposures near the community of Coker, about 6 miles west of Tuscaloosa (Conant and others, 1945). The formation was later redefined by Drennen (1953a, p. 534-535), and the following description is based on his classification.

The formation crops out in a crescent-shaped belt about 12 miles wide that extends from the southeast to the northwest corners of the county (pl. 1). Eroded outliers of the formation extend northeast of the main belt into the outcrop area of the Pottsville Formation.

Stratigraphy

The Coker Formation consists of varicolored unconsolidated lenticular beds of clay, sand, and gravel that were deposited in a deltaic environment. The Coker is separated from the underlying Pottsville Formation and other Paleozoic rocks by a great unconformity, which represents a long geologic time interval for which there is no record of sedimentation.

The coarser sand beds and the beds of gravel are near the bottom of the formation. They are readily identified in lithologic and electric logs (pl. 2 and app.)--in electric logs by strong outward "kicks" (high resistance and low self-potential). The beds are generally at least 25 feet thick and in places are more than 100 feet thick. The gravel contains large amounts of quartz pebbles derived from the underlying Pottsville Formation.

The upper part of the formation consists chiefly of clay and sandy clay containing some lenses of micaceous and glauconitic sand. Drennen (1953b, p. 4) reported massive clay beds as thick as 80 feet in the upper part of the Coker Formation in Fayette County, which bounds Tuscaloosa County on the northwest. The clay and sand beds in Tuscaloosa County range from light brown to dark greenish gray and purple. Weathered exposures commonly exhibit reddish-brown or yellowish hues because of the oxidation of iron-containing minerals. These colors also are typical of the other Cretaceous formations in Tuscaloosa County.

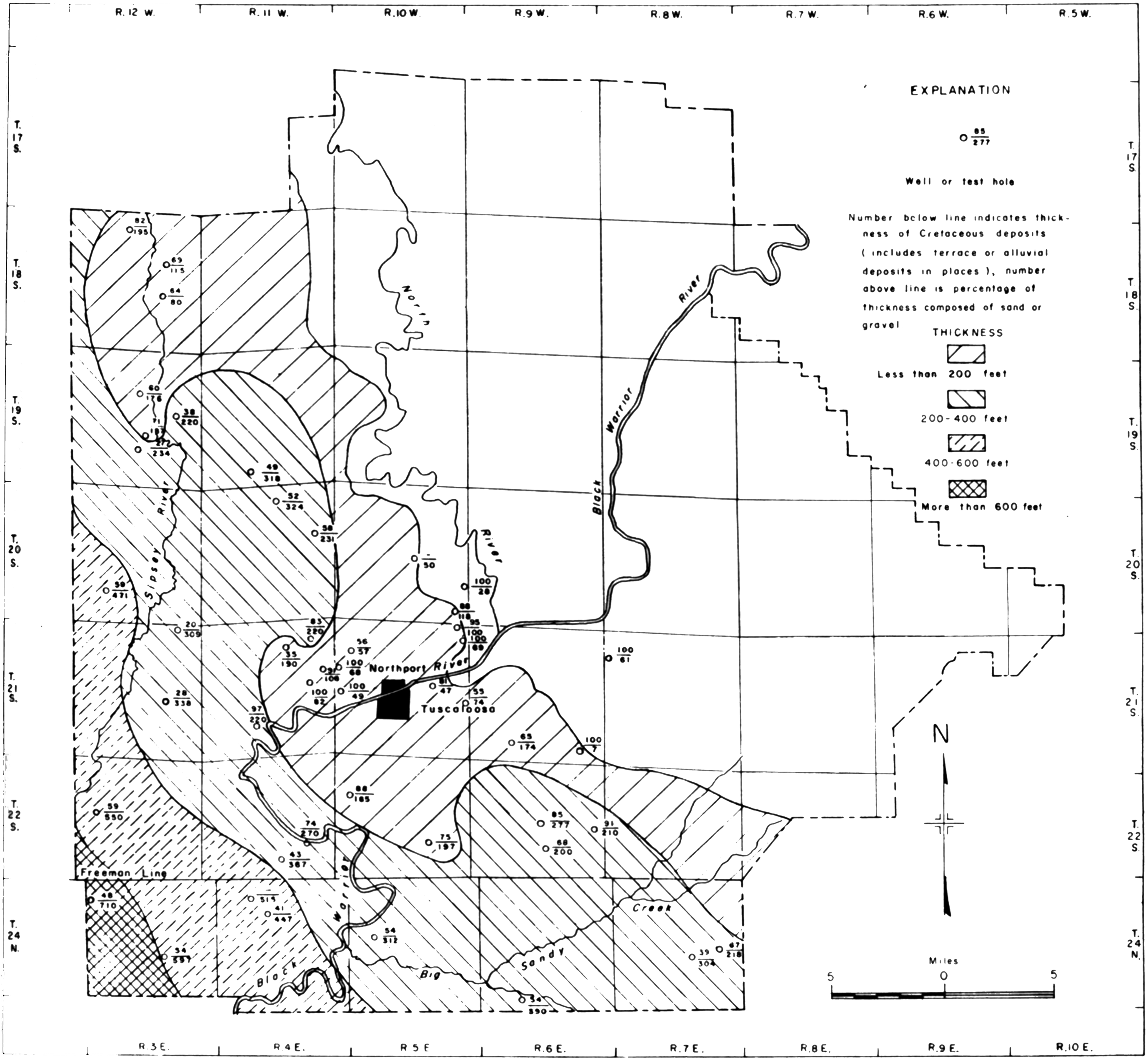


Figure 8.-Map showing thickness of Late Cretaceous and younger deposits in Tuscaloosa County, Ala.

The Coker Formation dips toward the southwest about 30 or 35 feet per mile. It thickens toward the southwest to a known maximum of nearly 500 feet (well SS-14, pl. 3). The thickening is mainly the result of erosion, which probably has removed hundreds of feet of the formation from the northeastern part of the county.

The contact between the Coker and the overlying Gordo Formation is unconformable and commonly is marked by a thin but persistent layer of limonite.

Water supply

Sand and gravel beds in the Coker Formation form the most extensive and probably the most productive aquifers in Tuscaloosa County; these aquifers underlie more than half the county. As many as three aquifers may be penetrated by a single well, the most productive being the basal beds of sand and gravel.

Wells that obtain water from aquifers in the Coker Formation range in depth from less than 20 feet in the area of outcrop to more than 500 feet in the southern part of the county, where the formation is deeply buried. The shallower wells are usually dug or bored and the deeper wells drilled.

Aquifer tests were made at the sites of seven wells that tap the Coker Formation in Tuscaloosa County (table 2 and figs. 9 and 10). The results of the tests, combined with other hydrologic and geologic data, indicate that yields of several hundred gallons per minute per well should be obtainable from the formation in many places. The specific capacities of the wells tested ranged from 1 to 15 gpm per foot of drawdown and averaged 6. The coefficients of transmissibility, obtained in five tests, ranged from 3,000 to 77,000 gpd (gallons per day) per foot and the coefficient of storage, obtained in only one test, was 2.2×10^{-4}. The wells tested, except QQ-41, were not designed for large capacities, and they did not penetrate full thicknesses of the aquifers; therefore, the test results probably are conservative. The highest transmissibility, 77,000 gpd per foot, was obtained from QQ-41 and is probably the most representative of the formation where its saturated thickness is at least 100 feet.

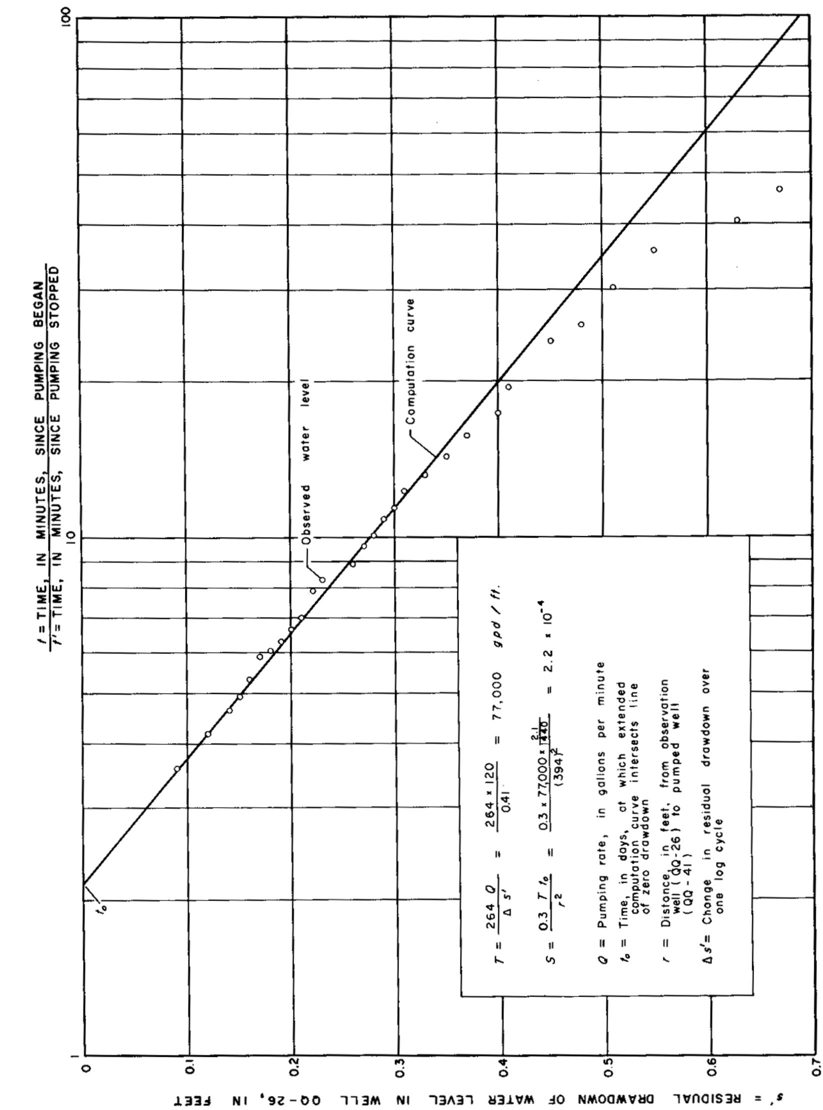


Figure 9.-Semilogarithmic plot of recovery data obtained from aquifer test at site of well QQ-41.

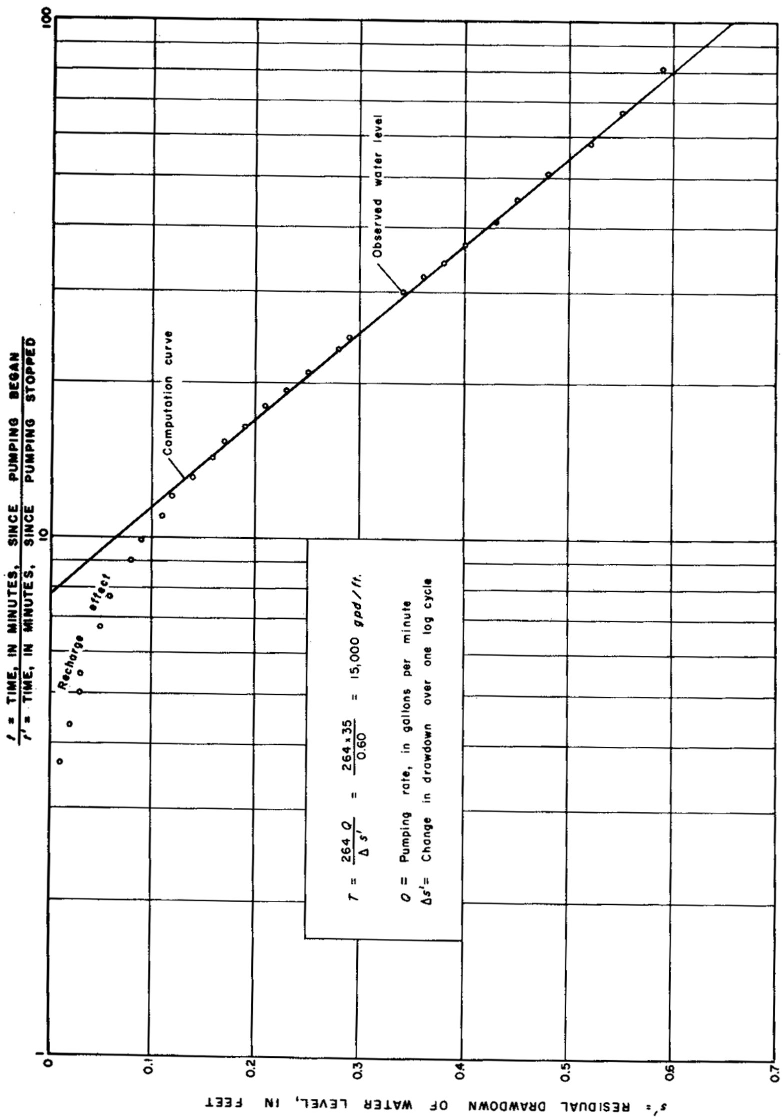


Figure 10.-Semilogarithmic plot of recovery data obtained from aquifer test at site of well FF-11.

Table 2.--Summary of aquifer tests in Tuscaloosa County, Ala.

Test site	Well(s) observed	Date of test	Duration of discharge (hours)	Rate of discharge (gpm)	Specific capacity (gpm per foot drawdown)	Coefficient of transmissibility (gpd per foot)	Thickness of aquifer (feet)	Average coefficient of permeability (gpd per square foot)	Coefficient of storage	Aquifer	Remarks
E-17	Pumped well.	10-4-57	5.5	10	2	7,000	...	....	....	Sand in Coker Formation.	
DD-53	Pumped well and two observation wells.	9-4-51	17	66	8	10,000-20,000	18	800	5×10^{-3}	Sand and gravel in terrace deposits.	Test analysis showed recharge from nearby lake.
EE-44	Pumped well.	10-2-57	3.5	10	1	....	33	....	....	Sand in Coker Formation.	
EE-49	Pumped well and two observation wells.	6-3-52	28.7	250	71	190,000	54	2,300	6.2×10^{-2}	Sand and gravel in terrace deposits.	See figure 13.
EE-53	Pumped well.	......	1	20	2	3,000	63	475	....	Sand in Coker Formation.	
FF-11	Pumped well.	10-6-59	6.7	35	15	15,000	...	....	....	Coarse sand in Coker Formation.	Test analysis indicated vertical leakage from overlying terrace deposits. See figure 10.
JJ-36	Pumped well.	10-3-57	3.5	10	3	....	...	....	....	Sand in Coker Formation.	
JJ-37	Pumped well.	10-7-57	5.7	11	4	9,000	50	180	....	Coarse sand and gravel in Coker Formation.	
QQ-41	Pumped well, one observation well.	11-1-56 to 11-3-56	24	120	12	77,000	162	500	2.2×10^{-4}	Sand and gravel in Coker Formation.	Well normally flows 80 gpm. See figure 9.

Conditions for recharge to the Coker Formation are favorable. Particularly good areas for recharge occur where relatively flat-lying terrace sand and gravel overlies the formation. From the areas of recharge the ground water moves downward and laterally through the formation toward places of discharge at lower altitudes. The movement is controlled mainly by the topography in the area of outcrop. However, in the southwestern part of the county, where the Coker is covered by the Gordo Formation, the ground water probably moves in the direction of regional dip, which is toward the southwest.

A large amount of the water that is taken into the formation in Tuscaloosa County is probably discharged in the areas to the southwest, where the Coker is the source of many flowing and nonflowing artesian wells. A considerable amount of water also is discharged within the county by springs, evapotranspiration, and withdrawal by wells. The total discharge from flowing wells in Tuscaloosa County is estimated to be more than 3 mgd (million gallons per day), most of which is unused. All but a few of these wells tap the Coker Formation.

Water obtained from wells tapping the Coker in the outcrop area is of good chemical quality except locally where it contains excessive amounts of iron. The hardness of water in most areas ranges from 6 to about 130 ppm and the chloride content from 0 to 156 ppm; however, the water is hard and contains excessive quantities of chloride downdip in southern parts of the county, particularly in the eastern part of T. 24 N., R. 4 E.

Artesian conditions.--Aquifers in the Coker Formation in the southwestern part of Tuscaloosa County contain water that is under considerable artesian pressure. The artesian conditions are the result of southward-dipping beds and confinement of the water-bearing beds by thick beds of relatively impermeable clay and sandy clay (pl. 2). Extensive artesian aquifers occur also in formations overlying the Coker south of Tuscaloosa County.

The hydrostatic pressures in aquifers in the Coker Formation are great enough to produce flowing wells in areas of low altitude. Ninety flowing wells that tap the formation were inventoried south of Tuscaloosa in valleys of the Black Warrior River and its larger tributaries. The location of these wells and the area of artesian flow were shown by Miller and Causey (1958, pl. 1). Most of the flows were obtained between depths of 200 and 500 feet; they ranged from less than 1 to 285 gpm and averaged 30 gpm in the period 1956-57. Pressure heads measured during the same period ranged from less than 1 foot to 25 feet above the land surface and averaged 8 feet.

Flows are obtained in the vicinity of Fosters where the land surface is 140 feet above mean sea level, or less. In the vicinity of Duncanville flows are obtained at altitudes as high as 190 feet. The land surface in the Sipsey River valley is too high to obtain flows from aquifers in the Coker Formation, but the hydrostatic pressure is great enough to maintain water levels in the wells generally less than 15 feet below the land surface.

Gordo Formation

The Gordo Formation, the upper unit of the Tuscaloosa Group, was named for exposures near the town of Gordo, about 23 miles west of Tuscaloosa (Conant and others, 1945). It crops out mainly in the southwestern part of the county, but outliers extend northward and eastward into the outcrop area of the Coker Formation (pl. 1).

Stratigraphy

The Gordo Formation consists of light-colored irregular beds of sand, clay, and chert gravel which closely resemble those in the underlying Coker Formation. The Gordo ranges in thickness from a few feet at the northern edge of its outcrop to about 300 feet in the southwestern part of the county.

The sand and gravel beds are most prevalent in the lower part of the formation, and the base of the formation is usually defined as being at the base of these beds. Gravel in the Gordo usually can be separated from that in the Coker because of its large chert content. The clay beds in the upper part range from laminated to massive. Weathering of these beds has produced purple, red, pink, buff, and gray colorings on exposed surfaces, but they are predominantly gray in the subsurface. The contact between the Gordo Formation and the overlying McShan Formation is unconformable and is generally placed at the top of a mottled red, pink, and white massive to laminated clay bed in the Gordo Formation that is 5 to 25 feet thick.

The electrical properties are similar to those of the Coker; the sand and cherty gravel beds near the base produce strong outward "kicks" on the resistance logs (pl. 2 and app., wells SS-3 and SS-17).

Water supply

The large number of sand and gravelly sand beds in the Gordo Formation, particularly in the lower part, are good aquifers in the southwestern part of Tuscaloosa County. Wells tapping these aquifers at depths of less than 50 feet generally obtain water of good quality in quantities sufficient to meet most domestic and farm needs. Most of these wells are dug or bored and penetrate only a few feet of aquifers that may be as much as 50 feet thick in places.

Aquifers in the Gordo Formation probably are permeable, as indicated by their lithologic similarity with aquifers in the underlying Coker Formation. However, they are thinner and less extensive than those in the Coker and will not yield as much water. A properly constructed and developed well in the thicker parts of the Gordo Formation will probably yield as much as 100 gpm.

The Gordo Formation is recharged by rainfall that seeps into its aquifers in the outcrop area. Conditions for recharge to this formation are particularly favorable because it lies at the surface through almost its entire extent in Tuscaloosa County, except for a few square miles near the southwest corner. The ground water moves from the recharge areas downward and laterally toward points of discharge in topographically low areas. The movement follows the topography in general, except near the southwest corner of the county where it probably is toward the southwest, in response to structural control.

The ground water in the Gordo Formation is generally of good quality; the water, in most of the samples analyzed, was soft and low in chlorides.

McShan Formation

The McShan Formation was named for exposures near the community of McShan, about 33 miles west of Tuscaloosa (Conant and others, 1945). It is the uppermost Cretaceous formation in Tuscaloosa County and crops out in a few square miles in the southwest corner (pl. 1).

Stratigraphy

The McShan Formation unconformably overlies the Gordo Formation, and its thickness in Tuscaloosa County ranges from a few feet in erosional remnants to about 50 feet near the southeast corner of the county. Only the lower part of the formation is exposed. Exposures consist chiefly of rusty-brown to dark-red sand but contain also a few lenses of greenish-gray to gray clay. The sand commonly contains glauconite and muscovite. Stringers of chert gravel occur near the base of the formation.

Water supply

The McShan Formation is not a good aquifer in Tuscaloosa County because of its thinness and small areal extent. Dug wells in a few places yield small quantities of water, generally less than 10 gpm, from sand beds near the base of the formation.

Quaternary System

Terrace and Alluvial Deposits

Terrace deposits occur along the flanks of the valleys of the Black Warrior and Sipsey Rivers and their major tributaries. These deposits were laid down by ancestral streams and, since their deposition, have been eroded into isolated remnants that generally range in size from an acre to several square miles (pl. 1). These terraces are relatively flat and range in height from about 40 to 300 feet above the valley floors (pl. 3).

Alluvial deposits underlie the flood plains of the Black Warrior and Sipsey Rivers and their major tributaries. These deposits are most extensive in the Coastal Plain province, where, in places in the Black Warrior River valley, they attain a width of 7 miles.

Stratigraphy

The terrace and alluvial deposits are lithologically similar and consist of lenticular beds of clay, sand, and gravel, having rather sharp gradations both laterally and vertically. The sand and gravel beds, which generally occur in the lower part of the deposits (fig. 11), are relatively free of clay and silt and are highly permeable in many places. These beds in the Black Warrior River valley contain a large proportion of quartz, whereas in the Sipsey River valley they contain much chert.

The upper parts of the terrace and alluvial deposits generally consist of clay and silt beds which have weathered to a reddish brown in the higher terraces but which are gray in other places.

The terrace deposits are commonly less than 50 feet thick. The alluvial deposits in the Black Warrior River valley (fig. 12) are as thick as 80 feet.

Water supply

The value of the terrace and alluvial deposits as aquifers varies considerably and depends on the areal extent of the deposits, their permeability and thickness, and topography. The extensive low terrace and alluvial deposits in the Black Warrior River valley and, possibly, parts of the Sipsey River valley, contain large quantities of ground water readily available for development by properly constructed wells. Figures 11 and 12 show the extent and thickness of the deposits in the Black Warrior River valley and give data concerning the type of material and depth to water. Most of the isolated terrace remnants that cap the hills and ridges lie above the general level of the water table and do not contain large amounts of ground water. Also, much of the alluvium in the valleys of minor streams is too thin or too fine grained to be of importance.

Most of the wells that obtain water from the terrace and alluvial deposits in Tuscaloosa County are relatively shallow and tap only a few feet of the total saturated thickness of available aquifers. They yield from 5 to 25 gpm. Wells that are properly drilled and screened to utilize greater thicknesses of the terrace and alluvial deposits generally yield more than 100 gpm. Results of aquifer tests and other hydrologic and geologic

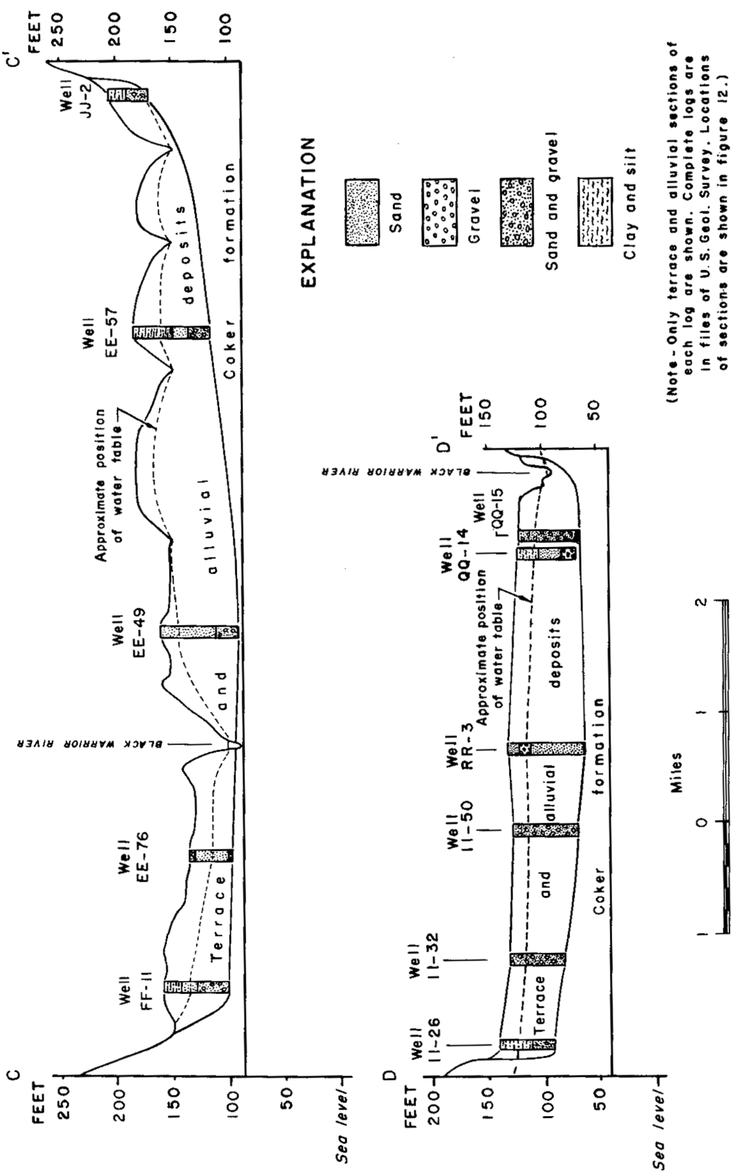


Figure 11. - Geologic sections across the Black Warrior River valley.

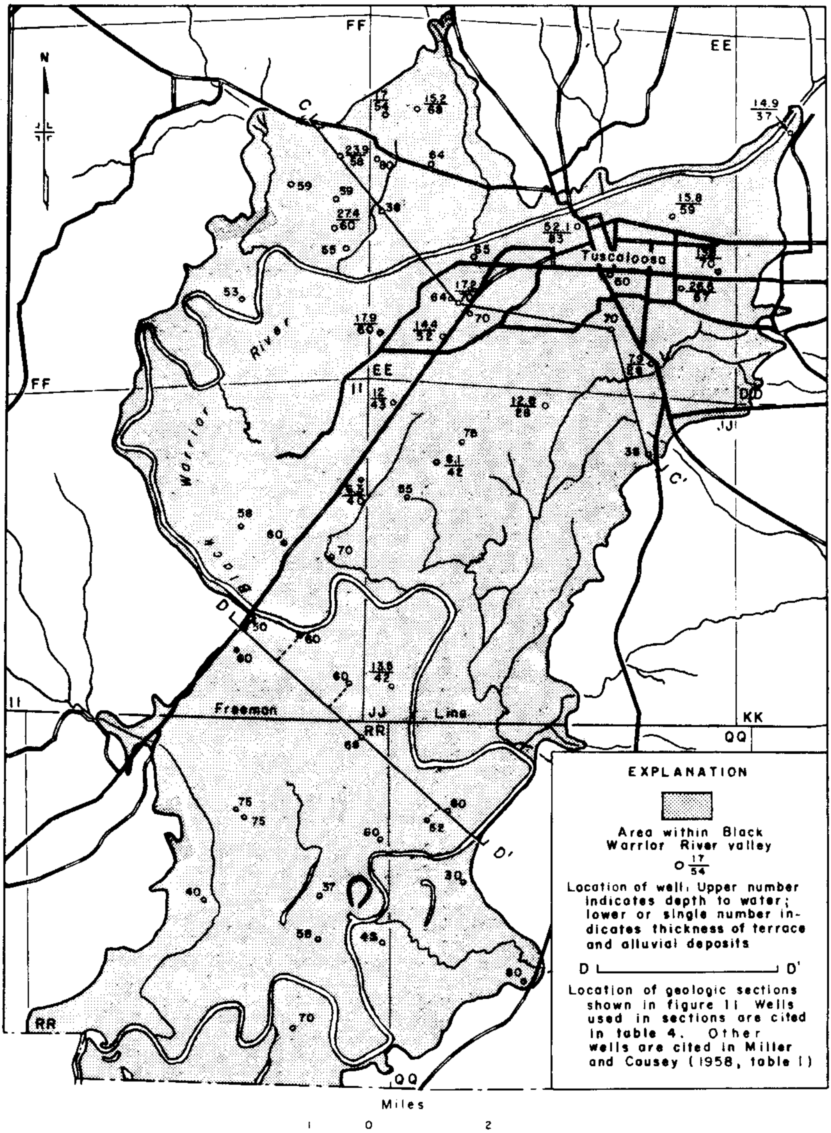


Figure 12.- Map showing thickness of terrace and alluvial deposits and depth to water in the Black Warrior River valley.

data indicate potential yields of more than 1,000 gpm in places. The large-capacity wells are located in and near Tuscaloosa because of the greater water needs, but the construction of additional large-capacity wells should be possible in other parts of the Black Warrior River valley.

There has been a mounting interest in Tuscaloosa County in recent years in the possibility of supplemental irrigation by ground water. Well JJ-38, on the Ray Walker farm about 2 miles southwest of Tuscaloosa, is one of the first wells constructed for this purpose. This well was drilled at the same location as U.S. Geological Survey test well JJ-35, and its log is similar. (See app., log JJ-35.) The well is 70 feet deep and is finished with 10-inch slotted casing opposite sand and gravel in the alluvial deposits of the Black Warrior River (table 4). Used to irrigate cotton, the well has been pumped steadily at 1,500 gpm for periods of 48 and 72 hours.

Aquifer tests were made on two wells, DD-53 and EE-49, which obtain water from the terrace and alluvial deposits. The data from these tests indicate a wide range in the hydrologic properties of the aquifers (table 2). The logs of the wells are given in table 4. Well DD-53 is near Holt, where the Black Warrior River valley is narrow and the terrace and alluvial deposits are relatively thin and of small extent. The test on this well indicated a specific capacity of 8 gpm per foot of drawdown, a coefficient of transmissibility of 10,000 to 20,000 gpd per foot, and a coefficient of storage of 5×10^{-3}. The storage coefficient for water-table aquifers generally ranges from 0.05 to 0.30, whereas the storage coefficient for artesian aquifers generally ranges from 0.0001 to 0.001. Although terrace and alluvial deposits in Tuscaloosa County constitute water-table aquifers, they may be semiconfined by lenses of clay, and, therefore, during a longer period of testing the storage coefficient would become greater than the value determined for the test on well DD-53. Well EE-49 is in the Black Warrior River valley southwest of Tuscaloosa, where the valley is much broader and the terrace and alluvial deposits are considerably greater in extent and thickness (fig. 12). The analysis of the test on this well is shown in figure 13. The test data indicate a specific capacity of 71 gpm per foot of drawdown, a coefficient of transmissibility of 190,000 gpd per foot, and a coefficient of storage of 6.2×10^{-2}.

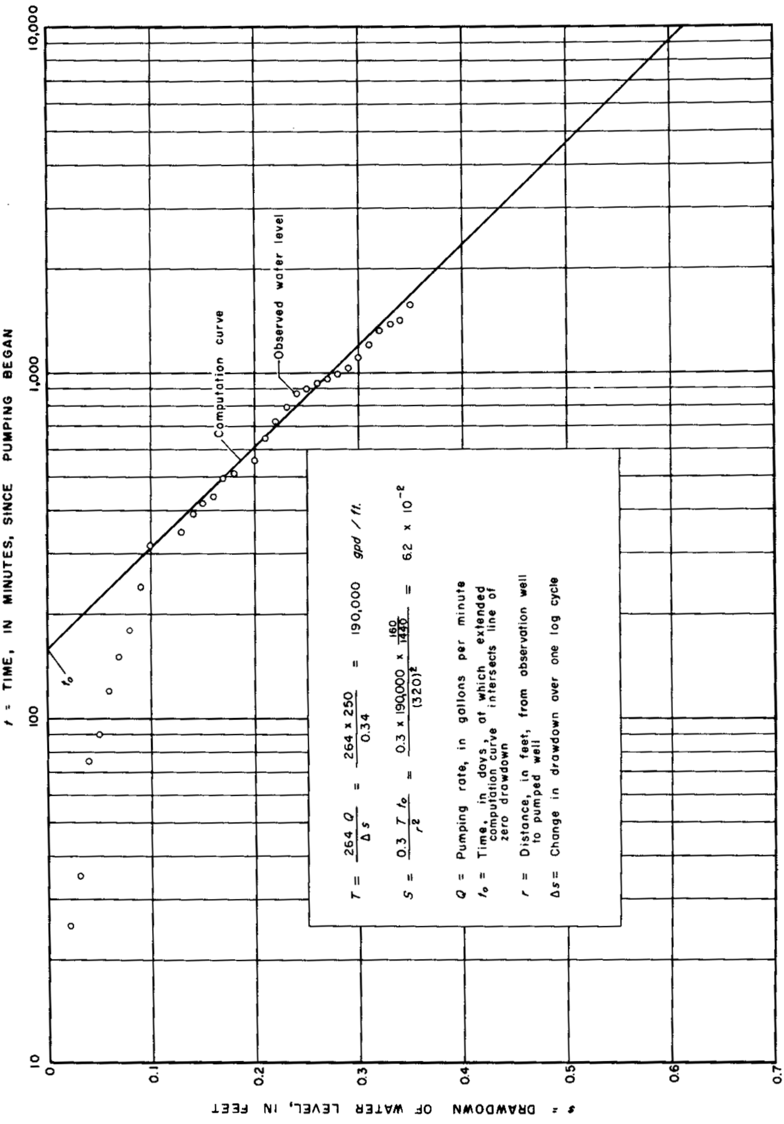


Figure 13.-Semilogarithmic plot of drawdown data obtained from aquifer test at site of well EE-49.

Where permeable sand and gravel deposits lie adjacent to perennial streams and are hydraulically connected to the streams, large sustained yields of water may be available through induced recharge. When water is withdrawn from the deposits through wells or infiltration galleries, the hydraulic gradient, which normally is toward the stream, is reversed, and water from the stream percolates through the streambed and toward the source of withdrawal. Thus, a practically inexhaustible supply of water can be obtained, limited only by the rate of movement of the water through the sand and gravel and the amount of streamflow available. The quality of the water should be superior to that of the stream because of the filtering action of the sand and gravel.

Recharge to the terrace and alluvial deposits is derived mainly from rainfall. The lower terraces and the alluvial deposits probably receive some recharge by ground water moving laterally from formations that crop out in the valley walls.

The water table in the terrace and alluvial deposits in Tuscaloosa County is higher than adjacent stream levels, except during extreme flood stages. Ground water moves downward and laterally toward points of discharge at lower altitudes; therefore, the hydraulic gradient is toward the streams, and ground water discharges into them.

There is evidence that the ground water in the terrace and alluvial deposits provides recharge to the underlying formations. The test on well FF-11, which is cased through the terrace and alluvial deposits and is screened in sand in the underlying Coker Formation, indicated that recharging conditions prevailed during the latter part of the test (fig. 10). The log of the well (see app.) shows that only 7 feet of sandy clay from 58 to 65 feet separates the aquifers in the terrace and alluvial deposits from the underlying formations. When the hydrostatic pressure in the Coker Formation was decreased by pumping, recharge may have been induced from the overlying deposits, causing the abnormal decrease in the rate of drawdown in the pumped well.

Spring discharge is common along contacts between the terrace and alluvial deposits and the underlying bedrock formations. Most of the springs flow only a few gallons per minute; some dry up during the late summer and fall when rainfall diminishes. One of the largest known springs in these deposits is EE-68, on the grounds of the University of Alabama, which discharges near the base of a terrace deposit at a rate estimated to be 100 gpm (fig. 6 and table 4). This spring was formerly used as a source of water supply for the University. Another spring (EE-69) furnished the municipal supply for the city of Northport until 1942 (fig. 6). Its discharge ranges from 50 to 100 gpm (table 4).

Unknown but probably large quantities of ground water in the terrace and alluvial deposits are discharged by evapotranspiration. Discharge of this type occurs mainly in the numerous swamp and marsh areas in the Black Warrior and Sipsey River valleys, where the water table is close to the land surface.

Water discharged from the terrace and alluvial deposits, whether by wells or springs, is generally of good chemical quality, being soft and low in dissolved solids and chloride. The hardness of water from the terrace and alluvial deposits ranges from 5 to 130 ppm and the chloride content ranges from 0 to 248 ppm. Locally, the water is reported to be objectionable for domestic use because of high iron content.

WATER-LEVEL FLUCTUATIONS

Periodic water-level measurements made in selected observation wells indicate that the water tables and piezometric surfaces in Tuscaloosa County are highest during April, May, and June and lowest during November, December, and January (fig. 14).

Water tables in parts of the county may decline during extreme drought to such an extent that some shallow wells become dry or inadequate. The use of many of these wells could be restored by deepening them.

The pressure heads in many of the older artesian wells in the southern part of the county are reported to have declined after years of continual discharge. Very few specific data regarding pressure heads of early artesian wells are available; however, incomplete records indicate that the loss in pressure head in wells tapping aquifers in the Coker Formation is in the magnitude of 10 to 30 feet.

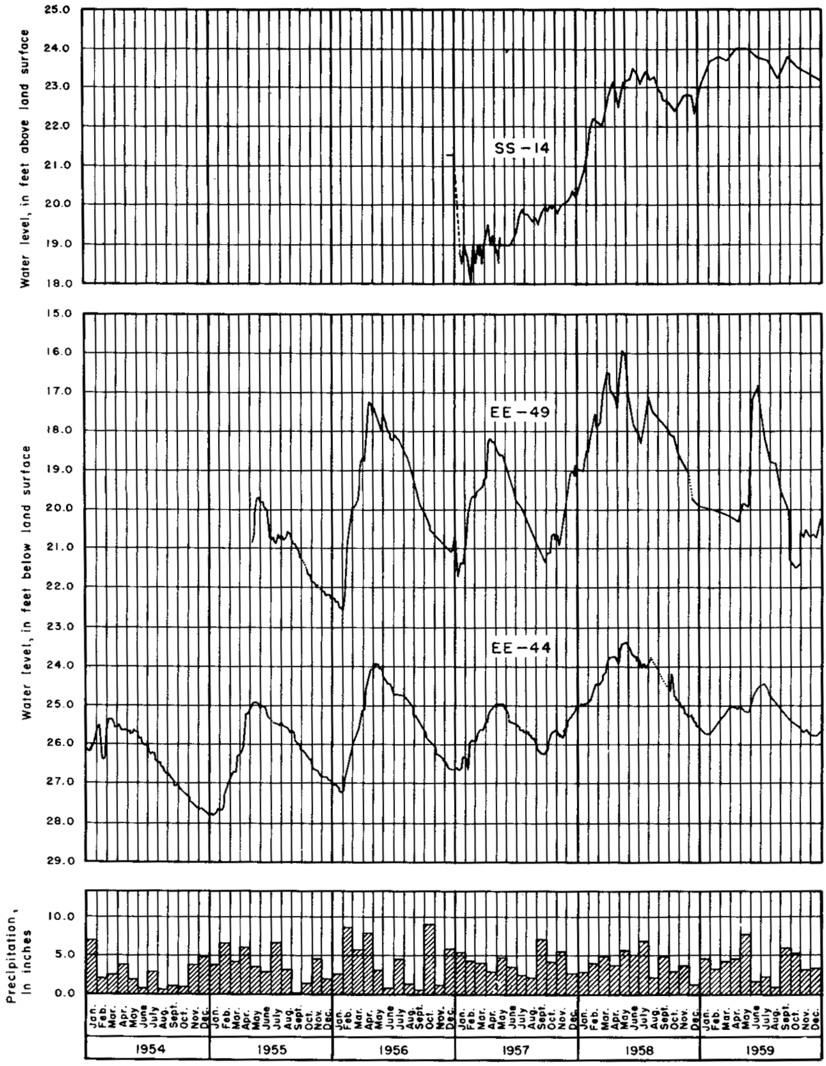


Figure 14.-Hydrographs showing fluctuations of ground-water levels in Tuscaloosa County, Ala.

QUALITY OF WATER

Practically all rocks and minerals are water soluble to some extent. As water moves over and through the soil it takes into solution carbon dioxide, a product of organic decomposition, which greatly increases the solvent action of the water. The amount and type of minerals dissolved, usually termed "dissolved solids," depend on the rock composition, the amount of carbon dioxide in the water, the temperature of the water, and the length of time that the water is in contact with the rock.

The most common constituents dissolved in ground water are calcium, magnesium, sodium, potassium, iron, silica, bicarbonate, chloride, sulfate, nitrate, and fluoride. Other constituents also may be present in very small quantities but generally are not determined, except for special purposes. The relative amount of each of the various minerals that are present depends mainly on the chemical makeup of the rocks through which the water moves. For example, water obtained from limestone aquifers is commonly high in calcium and magnesium (hardness-producing salts). Where ground water has migrated for considerable distances from the areas of recharge, the geohydrologic relationships are complex, and the quality-of-water data are difficult to interpret. For a more complete discussion of the interpretation of such data the reader is referred to Hem (1959).

The quality of water may restrict its use for domestic, municipal, industrial, or irrigational supplies. The exact limits imposed or the amount of dissolved mineral matter that can be tolerated are not easily defined. Table 3 gives suggested allowable limits of constituents of water used for various manufacturing purposes (New England Water Works Association, 1940, p. 263). The U.S. Public Health Service has published (1946) a set of standards for water that is used in public carriers that cross interstate boundaries. According to these standards, water of good quality should not contain more than 500 ppm of dissolved solids (1,000 ppm is permissible where water of better quality is not available), 250 ppm chloride, 250 ppm sulfate, 125 ppm magnesium, 1.5 ppm fluoride, 0.3 ppm iron and manganese combined, 3.0 ppm copper, 0.1 ppm lead, 0.05 ppm arsenic, 0.05 ppm selenium, and 0.05 ppm hexavalent chromium. However, water of such quality is not available in many areas of the United States, and poorer quality water is used for many purposes apparently with little or no ill effects.

Table 3. --Suggested water quality tolerances for selected industrial uses a/

Industry or use	Turbidity	Color	Hardness as $CaCO_3$	Iron as Fe	Manganese as Mn	Allowable limits (ppm)			Hydrogen sulfide	Other requirements c/
						Total solids	Alkalinity as $CaCO_3$	Odor, taste		
Air conditioning	. . .	. . .	. . .	b/0.5	0.5	. . .	. . . . .	Low	1	No corrosiveness or slime formation.
Baking	10	10	. . .	b/ .2	.2	. . .	. . . . .	Low	0.2	P c/
Canning legumes . . .	10	. . .	25-75	b/ .2	.2	. . .	. . . . .	Low	1	P
General.	10	. . .	. . .	b/ .2	.2	. . .	. . . . .	Low	1	P
Carbonated beverages	2	10	250	.2	.2	850	50-100	Low	.2	P. Organic color plus oxygen consumed less than 10 ppm.
				b/(.3)	. . .	. . .	. . . . .	. . .	. . .	
Cooling	50	. . .	50	b/ .5	.5	. . .	. . . . .	. . .	5	No corrosiveness or slime formation.
Ice	5	5	. . .	b/ .2	.2	. . .	. . . . .	Low	. . .	P. SiO_2 less than 10 ppm.
Laundering	. . .	. . .	50	.2	.2	. . .	. . . . .	. . .	. . .	
Tanning.	20	10-100	50-135	b/ .2	.2	. . .	Total, 135 Hydroxide, 8	. . .	. . .	
Textiles, general . . .	5	20	. . .	.25	.25	. . .	. . . . .	. . .	. . .	
Dyeing	5	5-20	. . .	b/ .25	.25	200	. . . . .	. . .	. . .	Constant composition. Residual alumina less than 0.5 ppm.
Wool scouring	. . .	70	. . .	b/1.0	1.0	. . .	. . . . .	. . .	. . .	
Cotton bandage	5	5	. . .	b/ .2	.2	. . .	. . . . .	Low	. . .	

a/ From New England Water Works Assoc. Jour., v. 54, p. 271, 1940.

b/ Limit given applies both to iron alone and to the sum of iron and manganese.

c/ P indicates that potable water, conforming to U.S. Public Health Service standards, is necessary.

Nitrogen in ground water, most often reported as nitrate (NO_3), is generally of organic origin and indicates possible pollution from surface sources. Investigations have shown that water containing high amounts of nitrate can cause infant cyanosis, or the so-called "blue baby" disease (Maxcy, 1950, p. 265). The upper limit of nitrate in water for human consumption has been tentatively set at 44 ppm.

Much attention has been focused recently on the relationship between the amount of fluoride in drinking water and the rate of tooth decay. According to Dean and others (1942), a small amount of fluoride, as much as 1.0 ppm, is beneficial in inhibiting tooth decay in children. However, there is evidence that fluoride in excess of 1.5 ppm causes mottled enamel if continuously used while the teeth are in the calcification stage. Amounts of fluoride above 4 ppm may affect bone structure (California State Water Pollution Control Board, 1952, p. 257). It seems likely that future studies may disclose further linkage between human health and the quality of water used for human consumption.

Water samples were collected from most of the wells and springs in the county and were analyzed for chloride content and hardness (calcium, magnesium). Samples from 26 selected wells and springs were analyzed for additional chemical constituents. The analyses were reported by Miller and Causey (1958, tables 1 and 2), and only a geochemical summary of the results is given here.

The chemical data indicate that ground water in the Pottsville and pre-Pennsylvanian formations generally has a hardness of more than 100 ppm. The chloride content in most of the samples analyzed was less than 20 ppm, but in a few it exceeded 100 ppm.

Water samples from the Coker, Gordo, and McShan Formations and the terrace and alluvial deposits were similar in chemical quality. The average chloride content was 15 ppm, and the average hardness was 40 ppm, except in the eastern part of T. 24 N., R. 4 E., where water from artesian aquifers in the Coker Formation was highly mineralized (fig. 15).

Perhaps the most serious ground-water-quality problem in Tuscaloosa County is that in many parts of the county the water contains objectionable quantities of iron. There does not

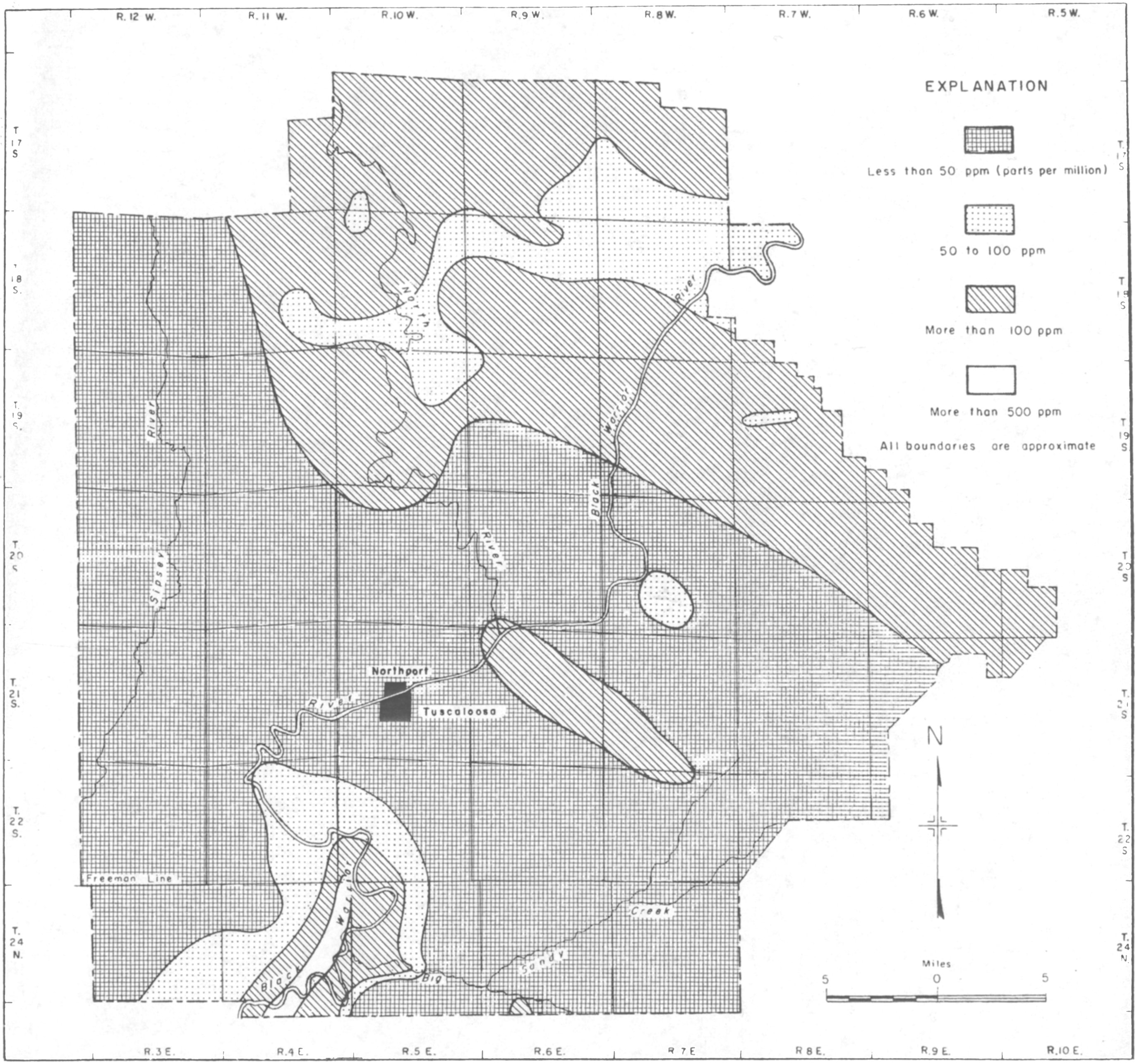


Figure 15.–Map showing distribution of hardness in ground water used in Tuscaloosa County, Ala.

appear to be any strong relationship between its occurrence and the geologic sources of the water. Adequate study of this problem, however, requires sampling and analytical techniques that were considered beyond the scope of this investigation. It may be helpful to note that iron-removal facilities have been developed commercially and are now available for home use.

SUMMARY AND CONCLUSIONS

Tuscaloosa County occupies parts of three physiographic divisions, the Appalachian Plateaus, Valley and Ridge, and Coastal Plain provinces, which coincide with major geologic divisions. The boundary between the Coastal Plain and the other provinces is termed the "Fall Line." The largest streams in the county are the Black Warrior, Sipsey, and North Rivers, and Big Sandy, Hurricane, Yellow, Blue, Davis, and Grant Creeks. Streamflow is more nearly uniform in the Coastal Plain area than elsewhere in the county.

The availability and occurrence of ground water in Tuscaloosa County depend mainly on geologic factors. The rocks that crop out in the county are of sedimentary origin and range in age from Cambrian to Recent. Pre-Pennsylvanian rocks crop out in an area of about 50 square miles near the eastern margin of the county. The depth to which wells must be drilled and the quantity of ground water obtainable in this area vary considerably because of the complex geology. Springs are common and some have exceptionally large yields (Big Sandy Spring has a discharge of about 7,000 gpm).

The Pottsville Formation is of Pennsylvanian age, and consists of beds of sandstone, shale, conglomerate, and coal, which underlie the northeastern half of the county. Yields from wells tapping this formation at depths of less than 250 feet average about 10 gpm. Available data indicate that substantial quantities of water are not generally obtainable from the formation below this depth.

The most extensive and productive aquifers occur in the Coker, Gordo, and McShan Formations of Late Cretaceous age. Sufficient quantities of water for average domestic and stock needs are obtainable practically anywhere in the county from drilled or dug wells that tap water-bearing beds in these formations. The Coker Formation is the thickest and most extensive of these and offers the best opportunity for developing high-capacity wells. Aquifer-test data indicate that potential yields of several hundred gallons per minute are available from the thicker parts of this formation. Water in the Coker Formation is confined under artesian pressure, and flowing wells are obtainable in low areas in the southern part of the county, particularly in the Black Warrior River valley. Most of these wells are between 200 and 500 feet deep, and their average flow was about 30 gpm during the period 1956-57. Flows of as much as 285 gpm and pressure heads as high as 25 feet above the land surface were measured during the investigation. Aquifers of similar character but having less extent and thickness occur in the Gordo Formation. These aquifers would probably yield as much as 100 gpm to individual wells. The McShan is too thin to be of importance as a water-bearing formation in Tuscaloosa County.

Ground water is available also at relatively shallow depths from terrace and alluvial deposits in the major stream valleys. These deposits are as thick as 80 feet and contain beds of highly permeable sand and gravel. Results of aquifer tests and other data indicate potential yields of more than 1,000 gpm in some areas of the Black Warrior River valley. The deposits are favorably situated for recharge by precipitation. Where wells are constructed near streams or ponds, recharge from these sources may be induced into the water-bearing beds as a result of pumping, provided there is hydraulic connection.

The water tables and piezometric surfaces in Tuscaloosa County are generally highest in the spring and lowest during late fall and early winter. During extreme drought, the water tables may decline below the bottoms of some of the shallower dug wells. These wells could be restored to usefulness by deepening them. Pressure heads in some of the older flowing artesian wells in the southern part of the county have probably declined 10 to 30 feet since the wells were drilled.

Ground water is of good chemical quality in most sections of the county. Locally, the quality is impaired because of excessive iron content. The hardness of water from the pre-Pennsylvanian rocks and the Pottsville Formation is more than 100 ppm, whereas water from the other formations is generally less than 100 ppm. An anomalous condition exists in the eastern part of T. 24 N., R. 4 E., where flowing wells that tap the Coker Formation yield water that is extremely salty and hard.

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BASIC DATA

Table 4.--Records of selected wells and springs in Tuscaloosa County, Ala.

Well or spring no.: Numbers in table correspond with those in figure 6.

Type: D, drilled; Du, dug; Spr, spring.

Depth of well and water level: Depths shown in feet are reported; those shown in feet and tenths of feet are measured.

Altitude: Altitudes determined by aneroid altimeter.

Method of lift: C, centrifugal; J, jet; M, manual; T, turbine.

Use of water: D, domestic; Ind, industrial; Irr, irrigation; N, none; Ps, public supply; S, stock; T, test.

Water-bearing formation: pIP, pre-Pennsylvanian rocks; IPpv, Pottsville Formation; Kck, Coker Formation; Kg, Gordo Formation; Qt, terrace deposits; Qal, alluvial deposits.

Well or spring no.	Owner and location	Driller	Type	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Altitude of land surface (feet)	Water level: Above (+) or below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
D- 5	Etteca School NE¼SE¼NE¼ sec. 35, T. 17 S., R. 11 W.	Causey Drilling Co .	D	180.0	6	IPpv	439	90	11-23-54	...	Ps	Casing: 6-in. from surface to 76 ft.; none below. Pottsville Formation at 62 ft.
E-17	U.S. Geol. Survey NW¼SE¼ sec. 4, T. 18 S., R. 12 W.	Null Drilling Co ...	D	82	...	...	286	....	......	...	T	Test hole. Abandoned and filled. See appendix and table 2.
E-18	U.S. Geol. Survey NE¼NW¼ sec. 14, T. 18 S., R. 12 W.	....do........	D	130.5	...	...	270	....	......	...	T	Do.
E-19	U.S. Geol. Survey NE¼SW¼ sec. 23, T. 18 S., R. 12 W.	....do........	D	167	...	...	271	....	......	...	T	Do.
E-20	U.S. Geol. Survey SW¼NW¼NE¼ sec. 33, T. 18 S., R. 12 W.	....do........	D	206	6, 2	Kck	282	32.0	7- 8-57	...	T	Casing: 6-in. to 47 ft.; 2-in. to 195 ft. Slotted casing: 175 to 195 ft. Water has strong metallic taste. Driller's, sample, and electric logs in files of U.S. Geol. Survey
F-11	U.S. Geol. Survey NE¼NW¼NW¼ sec. 35, T. 18 S., R. 11 W.	Causey Drilling Co .	D	135	6	IPpv	268	12.0	7- 8-58	...	T	Casing: 6-in. to 10 ft.; none below. Measured drawdown 108 ft. after 1 hr. bailing 3 gpm. Driller's, sample, and electric logs in files of U.S. Geol. Survey.
G-33	County Board of Education SW¼SW¼ sec. 19, T. 18 S., R. 10 W.	....do........	D	200	6	IPpv	338	50.1	8- 4-58	...	N	Casing: 6-in. to 27 ft.; none below. Measured drawdown 25.4 ft. after 1 hr. bailing 10 gpm. Electric log in files of U.S. Geol. Survey.

N- 9	J. L. Howell SW$\frac{1}{4}$SE$\frac{1}{4}$SW$\frac{1}{4}$ sec. 14, T. 19 S., R. 9 W.	Ace Drilling Co. . . .	D	111.5	4	Kck	579	84.0	7-21-57	J	D, S	Casing: 4-in. to 103 ft.; 2-in. to 109 ft.; none below. Screen: 103 to 109 ft. Water has metallic taste. Driller's log in files of U.S. Geol. Survey.
P- 1	Southern Natural Gas Co., SW$\frac{1}{4}$NW$\frac{1}{4}$ sec. 5, T. 19 S., R. 11 W.	Layne-Central Co. .	D	240	8, 6	Kck	406	111	9- 1-48	T	D, Ind	Casing: 8-in. to 181 ft. Screen: 6-in. from 181 to 221 ft. Sample and driller's logs in files of U.S. Geol. Survey. Top of Pottsville Formation at 217 ft.
P- 8	W. D. Montgomery SE$\frac{1}{4}$NW$\frac{1}{4}$ sec. 33, T. 19 S., R. 11 W.	Ace Drilling Co. . . .	D	348	4	Kck	463	91.1	1-28-58	J	N	Casing: 4-in. to 140 ft. Screen: 2-in. from 140 to 151 ft. Well abandoned, insufficient domestic supply. See appendix.
P- 9	. . . . do	Causey Drilling Co .	D	190	4	Kck	463	90.3	2- 4-58	J	D	Casing: 4-in. to 180 ft. Screen: 2-in. from 180 to 186 ft. Water has slight metallic taste. Drilled 6 ft. west of P-8. See log for P-8 in appendix.
Q- 4	V. L. Brown SW$\frac{1}{4}$SW$\frac{1}{4}$ sec. 10, T. 19 S., R. 12 W.	. . . . do	D	183	4, 2	Kck	303	75.0	6-16-55	J	D, S	Casing: 4-in. to 174.5 ft. Screen: 2-in. from 174.5 to 180.5 ft. See appendix.
Q-13	Brownville Lumber Co. SE$\frac{1}{4}$SE$\frac{1}{4}$ sec. 14, T. 19 S., R. 12 W.	. . . . do	D	125	2	Qal	249	2.3	8- 7-57	. . .	Ps	
Q-14	U.S. Geol. Survey SE$\frac{1}{4}$NW$\frac{1}{4}$ sec. 22, T. 19 S., R. 12 W.	Null Drilling Co . . .	D	264	. . .	. . .	296	. . . .	. . . . . .	. . .	. . . .	Test hole. Abandoned and filled. See appendix.
Q-15	U.S. Geol. Survey SW$\frac{1}{4}$SE$\frac{1}{4}$ sec. 23, T. 19 S., R. 12 W.	. . . . do	D	206.5	. . .	. . .	229	. . . .	. . . . . .	. . .	. . . .	Test hole. Abandoned and filled.
Q-16	W. J. Brown SW$\frac{1}{4}$NW$\frac{1}{4}$ sec. 27, T. 19 S., R. 12 W.	Ace Drilling Co. . . .	D	278	4	Kck	287	115	8-19-57	J	D, S	Casing: 4-in. to 225 ft. Screen: 2-in. from 225 to 235 ft. Water has metallic taste. See appendix.
R-28	U.S. Geol. Survey NE$\frac{1}{4}$NE$\frac{1}{4}$ sec. 13, T. 20 S., R. 12 W.	Null Drilling Co . . .	D	209	6, 4	Kck	294	9	10-15-57	. . .	T	Casing: 6-in. to 58.5 ft.; 2-in. from 58.5 to 230 ft. Slotted from 188 to 209 ft. Driller's, sample, and electric logs in files of U.S. Geol. Survey.
R-29	Bart Skelton SE$\frac{1}{4}$SW$\frac{1}{4}$SW$\frac{1}{4}$ sec. 31, T. 20 S., R. 12 W.	Causey Drilling Co .	D	84	4	Kg	316	. . . .	. . . . . .	J	D	Casing: 4-in. to 78 ft. Screen: 2-in. from 78 to 84 ft.
S-11	Dick Hall, NW$\frac{1}{4}$NW$\frac{1}{4}$ sec. 13, T. 20 S., R. 11 W.	. . . . do	D	233.0	4, 2	Kck	361	159	12- 9-54	. . .	. . . .	Casing: 4-in. to 194 ft. Screen: 2-in. from 194 to 200 ft. Sample, electric, and driller's logs in files of U.S. Geol. Survey.
S-14	Dr. -- Shamblin SE$\frac{1}{4}$NE$\frac{1}{4}$SW$\frac{1}{4}$ sec. 24, T. 20 S., R. 11 W.	. . . . do	D	78.0	4, 2	Kck	238	9.0	9-28-54	J	D	Casing: 4-in. to 66 ft. Screen: 2-in. from 66 to 72 ft. Driller's log in files of U.S. Geol. Survey. Pottsville Formation at 72 ft.

Table 4. --Records of selected wells and springs in Tuscaloosa County, Ala. --Continued

Well or spring no.	Owner and location	Driller	Type	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Altitude of land surface (feet)	Water level: Above (+) or below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
S-20	Thurman Reed NE¼SW¼ sec. 3, T. 20 S., R. 11 W.	Ace Drilling Co . . .	D	333	4, 2	Kck	495	180	9-15-57	C	D	Casing: 4-in. to 235 ft.; 2-in. from 235 to 274 ft.; none below. See appendix.
T- 6	Thomas Lake SE¼SE¼SW¼ sec. 3, T. 20 S., R. 10 W.	Causey Drilling Co .	D	116	4, 2	Kck	397	86	8- -51	T	D	Casing: 4-in. to 110 ft. Screen: 2-in. from 110 to 116 ft. Sample log in files of U.S. Geol. Survey. Pottsville Formation at 116 ft.
T-27	Wiley Hagler SE¼SE¼NW¼ sec. 27, T. 20 S., R. 10 W.	. . . . do	D	106.0	4, 2	Kck	330	71.2	10-12-54	. . .	D	Casing: 4-in. to 100 ft. Screen: 2-in. from 100 to 106 ft. Sample and driller's logs in files of U.S. Geol. Survey. Pottsville Formation at 106 ft.
T-32	U.S. Geol. Survey SE¼NE¼ sec. 25, T. 20 S., R. 10 W.	. . . . do	D	224.5	5	IPpv	331	23.2	3-21-55	. . .	N	Partlow Boys Colony test well 2. Casing: 5-in. to 37.5 ft.; none below. Measured drawdown, 7 ft. after pumping 28 gpm for 1.5 hours on 4-7-55. See appendix.
T-33	U.S. Geol. Survey SE¼NW¼ sec. 36, T. 20 S., R. 10 W.	. . . . do	D	122.0	4, 2	Kck	366	92.8	3-16-55	. . .	N	Partlow Boys Colony test well 1. Casing: 4-in. to 113 ft. Screen: 2-in. from 113 to 119 ft. Measured drawdown, 6 ft. after pumping 20 gpm for 2 hours on 8-3-55. See appendix.
T-34	U.S. Geol. Survey NE¼NW¼SW¼ sec. 36, T. 20 S., R. 10 W.	. . . . do	D	127.0	6, 4	Kck	357	83.5	8- 5-55	. . .	N	Partlow Boys Colony test well 7. Casing: 6-in. to 111 ft. Screen: 4-in. from 111 to 117 ft. Measured drawdown, 14 ft. after pumping 43 gpm for 22 hours on 8-26-27, 1955. See plate 2.
T-63	Ellis Franklin NW¼NE¼ sec. 22, T. 20 S., R. 10 W.	Ace Drilling Co. . . .	D	54.5	4, 2	Kck	205	37.0	5- 6-56	J	D	Casing: 4-in. to 41.5 ft.; 2-in. from 41.5 to 43 ft. Screen: 2-in. from 43 to 49 ft. See appendix.
T-64	J. Frank Clements SW¼NE¼ sec. 15, T. 20 S., R. 10 W.	. . . . do	D	72	4	Kck	272	58.0	1- 5-57	J	D	Casing: 4-in. to 64 ft. Screen: 2-in. from 64 to 70 ft. Driller's log in files of U.S. Geol. Survey.
T-65	James Taylor SE¼NE¼ sec. 23, T. 20 S., R. 10 W.	. . . . do	D	320	4	IPpv	495	190	9-25-57	. . .	D	Casing: 4-in. to 190 ft.; none below. See appendix.

T-66	Leon Sanford SE¼SE¼SE¼ sec. 34, T. 20 S., R. 10 W.	. . . . do	D	60.5	4	Kck	255	28	11-25-58	J	D	Casing: 4-in. to 48 ft.; 2-in. from 48 to 51 ft. Screen: 2-in. from 51 to 57 ft. Driller's log in files of U.S. Geol. Survey.
U- 4	J. O. Smith NW¼SW¼SW¼ sec. 9, T. 20 S., R. 9 W.	Causey Drilling Co.	D	109	4,2	Kck	475	. . . .	. . . . . .	. . .	D,S	Casing: 4-in. to 101 ft.; 2-in. from 101 to 107 ft. Pottsville Formation at 109 ft.
U- 7	J. C. E. Sextant SE¼NW¼ sec. 17, T. 20 S., R. 9 W.	. . . . do	D	110	4	Kck	456	. . . .	. . . . . .	J	D	Casing: 4-in. to 110 ft. Pottsville Formation at 110 ft.
U-11	U.S. Geol. Survey NW¼SW¼ sec. 30, T. 20 S., R. 9 W.	. . . . do	D	242.5	5	Ppv	319	23.0	3-29-55	. . .	N	Partlow Boys Colony test well 4. Casing: 5-in. to 44 ft.; none below. See appendix.
W-10	Brookwood School NW¼SW¼ sec. 31, T. 20 S., R. 7 W.	. . . . do	D	60.0	. . .	. . .	581	48.0	9-17-55	. . .	N	Owner's test well 2. Not cased. Insufficient for public supply. Pottsville Formation at 54 ft.
CC- 3	Peterson School NW¼NW¼ sec. 7, T. 21 S., R. 8 W.	. . . . do	D	170.0	5	Ppv	421	. . . .	. . . . . .	. . .	Ps	Casing: 5-in. to 62 ft.; none below. See appendix.
CC-18	J. C. Kyzer SE¼SE¼NE¼ sec. 28, T. 21 S., R. 8 W.	Ace Drilling Co . . .	D	95.5	5	Ppv	448	45.1	9-12-57	J	D	Casing: 5-in. to 67.5 ft.; none below. Water has metallic taste. Driller's log in files of U.S. Geol. Survey.
CC-19	H. T. Hubbard SW¼SW¼NE¼ sec. 34, T. 21 S., R. 8 W.	. . . . do	D	103.5	5	Ppv	400	14.2	9-13-57	J	D	Casing: 5-in. to 22.5 ft.; none below. Driller's log in files of U.S. Geol. Survey.
CC-20	C. E. Sellers SW¼SW¼NW¼ sec. 32, T. 21 S., R. 8 W.	. . . . do	D	207	6	Ppv	395	21.2	11-15-58	J	D	Casing: 5-in. to 24.5 ft.; none below. Well was developed by exploding 10 lbs. of 60 percent dynamite at 130 ft., 5 lbs. at 100 ft., and 3 lbs. at 67 ft. Driller's log in files of U.S. Geol. Survey.
CC-21	Verner B. Steele NE¼SW¼NE¼ sec. 34, T. 21 S., R. 8 W.	. . . . do	D	105.5	5.5	Ppv	429	34.5	8- 6-57	J	D	Casing: 5-in. to 45 ft.; none below. Measured drawdown 15.5 ft. after 1 hr. pumping 5 gpm.
DD-10	Mrs. W. G. Echols NW¼NW¼ sec. 23, T. 21 S., R. 9 W.	Causey Drilling Co.	D	160.0	5	Ppv	303	129.5	7-29-54	. . .	D	Casing: 5-in. to 18 ft.; none below. See appendix.
DD-12	Stanley Park NE¼NE¼ sec. 22, T. 21 S., R. 9 W.	Hendon Drilling Co.	D	200.0	6	Ppv	291	109.5	4-18-55	. . .	D	Casing: 6-in. to 35 ft.; none below. See appendix.
DD-24	Dr. W. R. White, Jr. NE¼NE¼ sec. 32, T. 21 S., R. 9 W.	Causey Drilling Co.	D	179.0	. . .	Kck	353	96	4- -55	. . .	D	See appendix.
DD-41	Ivey T. Riley SE¼NW¼ sec. 25, T. 21 S., R. 8 W.	. . . .	Du	40	. . .	. . .	304	. . . .	. . . . . .	J	D	Tile curbing. Pottsville Formation at 40 ft.

Table 4. --Records of selected wells and springs in Tuscaloosa County, Ala. --Continued

Well or spring no.	Owner and location	Driller	Type	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Altitude of land surface (feet)	Water level: Above (+) or below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
DD-44	James A. Johnson NE¼NE¼ sec. 35, T. 21 S., R. 9 W.	Causey Drilling Co .	D	90.0	5	IPpv	260	. . . .	. . . . . .	J	D	Casing: 5-in. to 14 ft.; none below. See appendix.
DD-53	Gulf States Paper Corp. SW¼SW¼ sec. 5, T. 21 S., R. 9 W.	. . . . do	D	36	10	Qal	152	16	11- -50	. . .	T	Test well. Abandoned and filled. Log: 0 to 18 ft., clay; 18 to 27 ft., medium to coarse sand; 27 to 36 ft., coarse gravel; 36 to 37 ft., shale. See table 2.
DD-58	T. K. Kilgore SE¼SE¼ sec. 6, T. 21 S., R. 9 W.	Ace Drilling Co . . .	D	162.0	6	IPpv	270	22.0	10- 2-56	. . .	S	Casing: 6-in. to 19 ft.; none below. Measured drawdown 1.0 ft. after 1 hr. pumping 6 gpm on 10-2-56. See appendix.
DD-67	James Morrison SW¼SW¼ sec. 26, T. 21 S., R. 9 W.	. . . . do	D	74	4	Kck	277	37.5	7- 2-57	J	D	Casing: 4-in. to 69 ft. Screen: 2-in. from 69 to 74 ft.
DD-68	Dr. Hudson Strode SE¼SW¼ sec. 29, T. 21 S., R. 9 W.	Causey Drilling Co .	D	175	4	Kck	356	. . . .	. . . . . .	C	Irr, D	Casing: 4-in. to 169 ft. Screen: 2-in. from 169 to 175 ft. See appendix.
DD-69	Tuscaloosa Memorial Gardens, SE¼SE¼ sec. 31, T. 21 S., R. 9 W.	. . . . do	D	184	6	Kck	322	99.5	7-10-58	T	Irr	Casing: 6-in. to 184 ft. Screen: 6-in. from 184 to 190 ft. Reported yield 100 gpm.
DD-70	William B. Driver SE¼SW¼SE¼ sec. 14, T. 21 S., R. 9 W.	Ace Drilling Co . . .	D	162.5	5	IPpv	450	104	8-13-57	J	D	Casing: 5-in. to 26.5 ft.; none below. Driller's log in files of U.S. Geol. Survey.
EE- 1	U.S. Geol. Survey NE¼NW¼ sec. 1, T. 21 S., R. 10 W.	. . . . do	D	109.0	4,2	Kck	331	67.7	8- 3-55	. . .	N	Partlow Boys Colony test well 3. Casing: 4-in. to 100 ft. Screen: 2-in. from 100 to 106 ft. Measured drawdown 9 ft. after 2 hrs. pumping 21 gpm on 8-3-55. See appendix.
EE- 2	U.S. Geol. Survey SE¼NE¼ sec. 2, T. 21 S., R. 10 W.	. . . . do	D	121.0	4,2	Kck	339	77.2	8- 4-55	. . .	S	Partlow Boys Colony test well 6. Casing: 4-in. to 112 ft. Screen: 2-in. from 112 to 118 ft. Measured drawdown 20 ft. after 2 hrs. pumping 20 gpm on 8-11-55. See appendix.

EE-31	Emmett Comer NE¼NE¼ sec. 9, T. 21 S., R. 10 W.	Causey Drilling Co.	D	127.0	4,2	Kck	273	92	1- -55	...	D	Casing: 4-in. to 110 ft. Screen: 2-in. from 110 to 116 ft. Pottsville Formation at 116 ft.
EE-35	U.S. Geol. Survey NW¼NW¼NW¼ sec. 18, T. 21 S., R. 10 W.	....do........	D	100.0	4,2	Kck	164	15.2	5-18-55	...	N	Bryce Negro Colony test well 4. Casing: 4-in. to 62 ft. Screen: 2-in. from 62 to 68 ft. Measured drawdown 11 ft. after 2.5 hrs. pumping 26 gpm on 5-18-55. See plate 2.
EE-43	Harlan Meredith SW¼SE¼ sec. 14, T. 21 S., R. 10 W.	....do........	D	152.0	5	IPpv	209	42.5	5- 5-54	J	D	Casing: 5-in. to 51 ft.; none below. See appendix.
EE-44	U.S. Geol. Survey NE¼NE¼ sec. 23, T. 21 S., R. 10 W.	Mobile Drilling Co.	D	60	4,2	Kck	226	27.8	1-10-55	...	N	Observation well. Casing: 4-in. to 55 ft. Screen: 2-in. from 55 to 61 ft. Sample and driller's logs in files of U.S. Geol. Survey. See fig. 14 and table 2.
EE-49	B. F. Goodrich Tire and Rubber Co. SE¼NE¼SW¼ sec. 29, T. 21 S., R. 10 W.	Causey Drilling Co.	D	94	6,5	Qal	161	22.5	1-30-56	...	N	Observation well. Casing: 6-in. to 56 ft.; 5-in. from 56 to 58 ft. Screen: 5-in. from 58 to 71 ft. Log: 0 to 15 ft., clay; 15 to 50 ft., fine to coarse sand; 50 to 74 ft., coarse sand and gravel; 74 to 94 ft., clay. See figs. 13 and 14 and table 2.
EE-53	H. B. Worsham NW¼SE¼ sec. 31, T. 21 S., R. 10 W.	Black Belt Drilling Co.	D	109.6	4	Kck	151	7.5 10.1	5- 4-53 4-29-54	...	N	Casing: 4-in. to 46 ft. See table 2.
EE-57	R. L. Ziegler, Inc. SE¼SE¼ sec. 27, T. 21 S., R. 10 W.	Causey Drilling Co.	D	100	6,4	Kck	185	28	11- 1-50	T	Ind	Casing: 6-in. to 75 ft. Screen: 4-in. from 75 to 90.5 ft. Reported yield 145 gpm on 11-1-50. See fig. 11.
EE-68	University of Alabama NW¼NE¼ sec. 23, T. 21 S., R. 10 W.	....	Spr	....	...	Qt	173	Flows	12-21-55	...	N	Estimated flow 100 gpm on 9-13-28 and 12-21-55.
EE-69	City of Northport NE¼NW¼ sec. 16, T. 21 S., R. 10 W.	....	Spr	....	...	Qt	162	Flows	12-22-55	...	N	Estimated flow 60 gpm on 12-22-55. Reported flow 100 gpm on 9-13-28.
EE-73	U.S. Geol. Survey NE¼SE¼ sec. 1, T. 21 S., R. 10 W.	Causey Drilling Co.	D	75.0	...	...	304	....	......	...	N	Partlow Boys Colony test well 5. Plugged and abandoned. See appendix.
EE-74	U.S. Geol. Survey SW¼SE¼ sec. 18, T. 21 S., R. 10 W.	....do........	D	100.0	...	...	158	....	......	...	N	Bryce Negro Colony test well 2. Abandoned and plugged. See appendix.
EE-75	U.S. Geol. Survey SW¼NW¼ sec. 18, T. 21 S., R. 10 W.	....do........	D	120.0	...	...	170	....	......	...	N	Bryce Negro Colony test well 3. Abandoned and plugged. See appendix.
EE-76	U.S. Geol. Survey NW¼NW¼ sec. 19, T. 21 S., R. 10 W.	....do........	D	70.0	...	...	136	....	......	...	N	Bryce Negro Colony test well 9. Abandoned and plugged. See appendix.
EE-84	John Lemonis SE¼NE¼ sec. 7, T. 21 S., R. 10 W.	....do........	D	80.0	...	...	168	....	......	...	N	See appendix.

Table 4. --Records of selected wells and springs in Tuscaloosa County, Ala. --Continued

Well or spring no.	Owner and location	Driller	Type	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Altitude of land surface (feet)	Water level: Above (+) or below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
EE-99	Druid City Hospital NE¼SE¼ sec. 24, T. 21 S., R. 10 W.	Ace Drilling Co . . .	D	100	. . .	. . .	275	. . . .	. . . . . .	. . .	T	Test hole. Abandoned and filled. See appendix.
EE-100	. . . . do	. . . . do	D	104	4	Kck	275	. . . .	. . . . . .	J	Ind	Casing: 4-in. to 90 ft. Screen: 2-in. from 90 to 96 ft. See appendix.
EE-101	Dills Motor Court SW¼NE¼ sec. 24, T. 21 S., R. 10 W.	. . . . do	D	100	4	Kck	276	54.5	3-31-58	J	Ps	Casing: 4-in. to 80 ft. Screen: 2-in. from 80 to 85 ft. See appendix.
EE-102	University of Alabama NW¼NW¼SW¼ sec. 24, T. 21 S., R. 10 W.	Causey Drilling Co .	D	80	. . .	Kck	224	22.0	7- 8-57	. . .	T	Test hole. Abandoned and filled. Sample, driller's, and electric logs in files of U.S. Geol. Survey.
EE-103	. . . . do	. . . . do	D	72	. . .	. . .	218	. . . .	. . . . . .	. . .	T	Do.
EE-104	. . . . do	. . . . do	D	80	. . .	. . .	222	. . . .	. . . . . .	. . .	T	Do.
EE-105	. . . . do	. . . . do	D	30	. . .	. . .	224	. . . .	. . . . . .	. . .	T	Test hole. Abandoned and filled. Drill cuttings in files of U.S. Geol. Survey
EE-106	. . . . do	. . . . do	D	30	. . .	. . .	224	. . . .	. . . . . .	. . .	T	Do.
EE-107	Tuscaloosa Steam Laundry, SE¼NE¼ sec. 27, T. 21 S., R. 10 W.	. . . . do	D	95	6	Kck	201	37.0	7-26-57	T	Ind	Casing: 6-in. to 83 ft. Screen: 6-in. from 83 to 95 ft. Yield reported 100 gpm 7-27-57. Sample, driller's, and electric logs in files of U.S. Geol. Survey.
FF- 9	U.S. Geol. Survey NE¼NW¼ sec. 13, T. 21 S., R. 11 W.	. . . . do	D	110.0	4, 2	Kck	157	24.6	8-11-55	. . .	Irr	Bryce Negro Colony test well 16. Casing: 4-in. to 103 ft. Screen: 2-in. from 103 to 109 ft. See appendix.
FF-10	. . . . do	. . . . do	D	113.0	4, 2	Kck	157	24.7	8- 5-55	. . .	Irr	Bryce Negro Colony test well 15. Casing: 4-in. to 103 ft. Screen: 2-in. from 103 to 109 ft. See appendix.
FF-11	U.S. Geol. Survey NW¼NE¼ sec. 13, T. 21 S., R. 11 W.	. . . . do	D	119.0	8, 6	Kck	158	23.9	8- 2-55	. . .	Irr	Bryce Negro Colony test well 10. Casing: 8-in. to 93.5 ft. Screen: 6-in. from 93.5 to 108.5 ft. See fig. 10, table 2, and appendix.

FF-18	U.S. Geol. Survey SE¼NW¼ sec. 24, T. 21 S., R. 11 W.	. . . . do	D	120.0	4, 2	Kck	141	27.6	5-11-55	. . .	N	Bryce Negro Colony test well 1. Casing: 4-in. to 75.5 ft. Screen: 2-in. from 75.5 to 81.5 ft. Measured drawdown 9.8 ft. after 1 hr. pumping 23 gpm on 8-2-55. See appendix.
FF-22	U.S. Geol. Survey SE¼SE¼ sec. 2, T. 21 S., R. 11 W.	. . . . do	D	230.0	. . .	. . .	299	. . . .	. . . . . .	. . .	N	Bryce Negro Colony test hole 14. Abandoned and filled. See appendix.
FF-23	U.S. Geol. Survey NW¼SE¼ sec. 11, T. 21 S., R. 11 W.	. . . . do	D	125.0	. . .	. . .	189	. . . .	. . . . . .	. . .	N	Bryce Negro Colony test hole 7. Abandoned and filled. See appendix.
FF-24	. . . . do	. . . . do	D	100.0	. . .	. . .	164	. . . .	. . . . . .	. . .	N	Bryce Negro Colony test well 6. Abandoned and filled. See appendix.
FF-25	U.S. Geol. Survey SW¼SE¼ sec. 13, T. 21 S., R. 11 W.	. . . . do	D	80.0	. . .	. . .	138	. . . .	. . . . . .	. . .	N	Bryce Negro Colony test well 8. Abandoned and filled. See appendix.
FF-26	U.S. Geol. Survey SE¼SW¼ sec. 13, T. 21 S., R. 11 W.	. . . . do	D	70.0	. . .	. . .	132	. . . .	. . . . . .	. . .	N	Bryce Negro Colony test well 11. Abandoned and filled. See appendix.
FF-27	U.S. Geol. Survey SE¼SE¼ sec. 14, T. 21 S., R. 11 W.	. . . . do	D	110.0	. . .	. . .	140	. . . .	. . . . . .	. . .	N	Bryce Negro Colony test well 5. Abandoned and filled. See appendix.
FF-28	U.S. Geol. Survey NW¼SE¼ sec. 14, T. 21 S., R. 11 W.	. . . . do	D	90.0	. . .	. . .	140	. . . .	. . . . . .	. . .	N	Bryce Negro Colony test well 12. Abandoned and filled. See appendix.
FF-32	M. R. Hardin, Jr. NE¼NE¼ sec. 10, T. 21 S., R. 11 W.	. . . . do	D	144	4	Kck	173	60.0	1- 8-57	. . .	N	Test well. Abandoned and filled. See appendix.
FF-34	Walter Wyatt SE¼SE¼SW¼ sec. 10, T. 21 S., R. 11 W.	Ace Drilling Co . . .	D	164	4, 2	Kck	206	44.0	4-18-58	J	D	Casing: 4-in. to 151 ft. Screen: 2-in. from 151 to 157 ft. Drill cuttings in files of U.S. Geol. Survey.
FF-35	U.S. Geol. Survey NE¼NW¼ sec. 28, T. 21 S., R. 11 W.	Causey Drilling Co .	D	460	6	Kg	374	126.5	7-16-58	. . .	T	Casing: 6-in. to 130 ft.; none below. Screen: 2-in. from 130 to 142 ft. See plate 2.
GG-20	U.S. Geol. Survey NE¼NE¼ sec. 15, T. 21 S., R. 12 W.	Null Drilling Co . . .	D	346	6, 2	Kck	205	12.5	10-29-57	. . .	T	Casing: 6-in. to 21.5 ft.; 2-in. from 21.5 to 314 ft.; none below. Slotted casing: 300 to 314 ft. Water has strong metallic taste. See appendix.
GG-21	L. D. Boothe SE¼NW¼ sec. 23, T. 21 S., R. 12 W.	Causey Drilling Co .	D	97	4	Kck	276	44.0	9-18-57	J	D	Casing: 4-in. to 91 ft. Screen: 2-in. from 91 to 97 ft. Water has strong metallic taste.
HH-27	U.S. Geol. Survey SW¼NW¼ sec. 17, T. 22 S., R. 12 W.	Null Drilling Co . . .	D	570	6, 2	Kck	208	28.9	7-25-57	. . .	T	Casing: 6-in. to 33 ft.; 2-in. from 33 to 570 ft. Slotted casing: 530 to 551 ft. Water has strong metallic taste. See appendix.

Table 4. --Records of selected wells and springs in Tuscaloosa County, Ala. --Continued

Well or spring no.	Owner and location	Driller	Type	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Altitude of land surface (feet)	Water level: Above (+) or below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
HH-28	U.S. Geol. Survey NE¼SE¼ sec. 11, T. 22 S., R. 12 W.	Causey Drilling Co.	D	502	6	Kg	305	61	9-23-58	...	T	Casing: 6-in. to 74 ft.; none below. Screen: 2-in. from 74 to 86 ft. See plate 2.
II-26	George Christian SE¼SE¼SE¼ sec. 22, T. 22 S., R. 11 W.	J. K. Scott......	D	250	4	Kck	141	+ 2	5- -46	C	D, S	Owner's well 1. Casing: 4-in. to 55 ft.; none below. Not flowing on 9-21-54. Driller's log in files of U.S. Geol. Survey. See fig. 11.
II-32	George Christian SE¼NE¼NE¼ sec. 26, T. 22 S., R. 11 W.	....do........	D	290	4	Kck	132	3.9	10-14-54	...	D, S	Owner's well 2. Casing: 4-in. to 64 ft.; none below. Driller's and electric logs in files of U.S. Geol. Survey. See fig. 11.
II-36	Guy Glover NE¼SW¼ sec. 27, T. 22 S., R. 11 W.	Black Belt Drilling Co.	D	371	4, 2	Kck	145	4	11- -55	...	D	Pottsville Formation at 367 ft. Sample, driller's, and electric logs in files of U.S. Geol. Survey.
II-50	Largus Barnes NW¼NE¼NE¼ sec. 36, T. 22 S., R. 11 W.	J. K. Scott......	D	230	2	Kck	127	+ 7 + 1.3	5- -46 5-16-54	J	D, S	Casing: 2-in. to 230 ft. Driller's log in files of U.S. Geol. Survey. See fig. 11.
II-51	-- Palmer SE¼NW¼SE¼ sec. 14, T. 22 S., R. 11 W.	Causey Drilling Co.	D	285	4, 2	Kck	128	....	......	Flows	D	Casing: 4-in. to 64 ft.; 2-in. from 64 to 250 ft.; none below. Screen: 2-in. from 250 to 260 ft. Measured flow 7 gpm on 4-14-57. Drill cuttings and electric log in files of U.S. Geol. Survey.
II-52	Tinnie Smith SW¼SW¼ sec. 21, T. 22 S., R. 11 W.	....do........	D	135	4	Kg	310	....	......	J	D	Casing: 4-in. to 108 ft. Screen: 2-in. from 108 to 113 ft. Drill cuttings and electric log in files of U.S. Geol. Survey.
JJ- 2	Southern Tree and Landscape Co. SW¼SW¼SE¼ sec. 2, T. 22 S., R. 10 W.	....do........	D	110.0	4, 2	Kck	208	47	5- -55	J	D	Casing: 4-in. to 94 ft. Screen: 2-in. from 94 to 100 ft. Driller's log in files of U.S. Geol. Survey. See fig. 11.
JJ-19	U.S. Geol. Survey SW¼SW¼ sec. 23, T. 22 S., R. 10 W.	....do........	D	210.0	...	...	208	....	......	...	N	Test hole. Abandoned and filled. See appendix.

JJ-20	. . . . do	. . . . do	D	110.0	. . .	. . .	210	. . . .	. . . . . .	. . .	N	Do.
JJ-33	Albert Holman SW¼SW¼SW¼ sec. 18, T. 22 S., R. 10 W.	J. K. Scott	D	270	3	. . .	135	1	3- -46	. . .	N	Abandoned and plugged. Driller's log in files of U.S. Geol. Survey. Pottsville Formation at 230 ft.
JJ-35	Ray Walker SE¼NE¼ sec. 7, T. 22 S., R. 10 W.	Causey Drilling Co.	D	128.0	8	. . .	141	. . . .	. . . . . .	. . .	N	See appendix.
JJ-36	U.S. Geol. Survey SW¼SE¼ sec. 7, T. 22 S., R. 10 W.	Null Drilling Co . . .	D	180	6, 2	Kck	127	+ 2.5	6-20-57	. . .	T	Casing: 6-in. to 23 ft.; 2-in. from 23 to 165 ft.; none below. Slotted casing: 145 to 165 ft. See table 2 and appendix.
JJ-37	U.S. Geol. Survey NW¼NE¼NW¼ sec. 26, T. 22 S., R. 10 W.	. . . . do	D	205	6, 2	Kck	167	12.0	6-25-57	. . .	T	Casing: 6-in. to 37 ft.; 2-in. to 195 ft.; none below. Slotted casing: 175 to 195 ft. Sample, driller's, and electric logs in files of U.S. Geol. Survey. See table 2.
JJ-38	Ray Walker SE¼NE¼ sec. 7, T. 22 S., R. 10 W.	Delta Wells and Supply Co.	D	70	10	Qal	140	13	7- -60	T	Irr	Casing: 10-in. to 70 ft. Slotted casing: 34 to 70 ft. First known large-capacity irrigation well in Tuscaloosa County. Measured discharge 1,500 gpm for periods of 48 to 72 hrs. during summer of 1960. Log: 0 to 12 ft., sand and clay; 12 to 15 ft., coarse sand; 15 to 29 ft., sandy clay; 29 to 57 ft., sand and gravel; 57 to 58 ft., clay; 58 to 65 ft., sand and coarse gravel; 65 to 105 ft., sandy clay.
KK-15	Raymond Cook SW¼SE¼ sec. 13, T. 22 S., R. 9 W.	Causey Drilling Co.	D	240.0	4, 2	Kck	417	204.5	5-19-55	. . .	D	Casing: 4-in. to 23 ft.; 2-in. from 23 to 234 ft. Screen: 2-in. from 234 to 240 ft. See appendix.
KK-18	Ward Dockery NW¼SE¼ sec. 18, T. 22 S., R. 9 W.	. . . . do	D	305	4, 2	Kck	364	89.0	7-14-54	J	D	Casing: 4-in. to 114 ft. Screen: 2-in. from 114 to 120 ft. Test well drilled to 305 ft. Sample, driller's, and electric logs in files of U.S. Geol. Survey. Pottsville Formation at 296 ft.
KK-23	John Leland SE¼SW¼ sec. 22, T. 22 S., R. 9 W.	. . . . do	D	200.0	. . .	Kck	352	133.8	5-19-55	. . .	Ps	Casing: Surface to 194 ft. Screen: 194 to 200 ft. See appendix.
KK-32	J. S. Wood SW¼SW¼ sec. 16, T. 22 S., R. 9 W.	Ace Drilling Co . . .	D	299	4, 2	Kck	360	158	2- -57	. . .	D, S	Casing: 4-in. to 248 ft. Screen: 2-in. from 248 to 257 ft. Test well drilled to 299 ft. See appendix.
KK-33	Hargrove and Cameron SE¼SW¼ sec. 27, T. 22 S., R. 9 W.	. . . . do	D	250.5	4	Kck	340	144	8-24-57	T	D	Casing: 4-in. to 238 ft. Screen: 2-in. from 238 to 248 ft. Water has metallic taste. Driller's and electric logs in files of U.S. Geol. Survey.
KK-34	U.S. Geol. Survey NE¼NW¼ sec. 14, T. 22 S., R. 9 W.	Causey Drilling Co.	D	242	. . .	. . .	382	. . . .	. . . . . .	. . .	T	Test hole. Abandoned and filled. Sample, driller's, and electric logs in files of U.S. Geol. Survey.

Table 4. --Records of selected wells and springs in Tuscaloosa County, Ala. --Continued

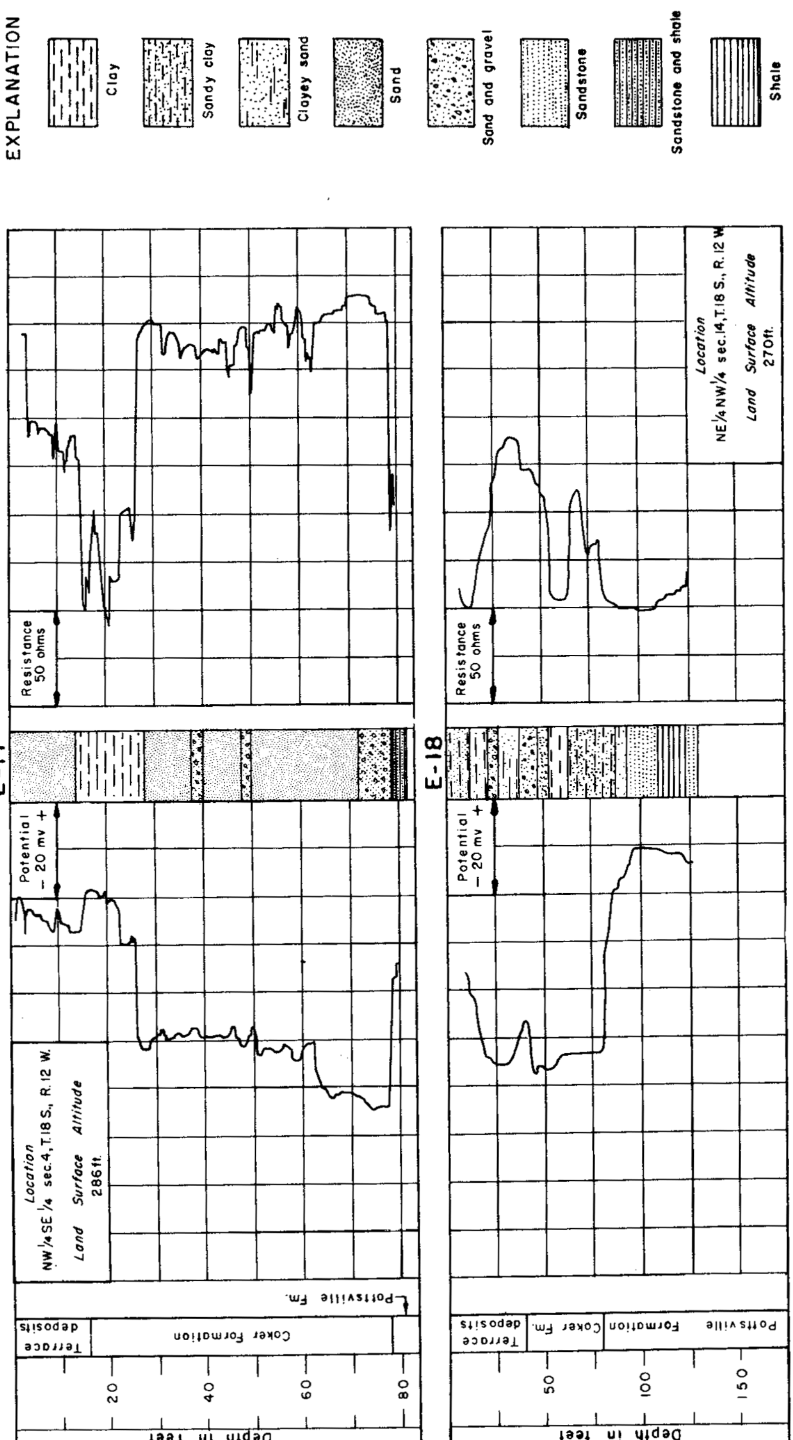
Well or spring no.	Owner and location	Driller	Type	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Altitude of land surface (feet)	Water level: Above (+) or below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
LL-16	.... NW¼ sec. 25, T. 22 S., R. 7 W.	....	Spr	....	...	pP	272	....	......	Flows	N	Big Sandy Spring. Measured flow 7,360 gpm on 4-19-44 and 6,740 gpm on 7-22-52.
LL-18	U.S. Geol. Survey NE¼NE¼ sec. 30, T. 22 S., R. 8 W.	Causey Drilling Co.	D	86	4	Kck	275	45	10-13-58	...	T	Casing: 4-in. to 75 ft. Screen: 2-in. from 75 to 81 ft. Sample, driller's, and electric logs in files of U.S. Geol. Survey.
MM- 5	Frank Caffee NE¼NE¼ sec. 2, T. 22 S., R. 7 W.	Peerson Drilling Co.	D	197	6	pP	481	81.0	1-17-56	J	D,S	Casing: 6-in. to 82.5 ft.; none below. Driller estimated capacity of well 150 to 200 gpm on 1-4-47. See appendix.
MM-21	L. C. Tingle NW¼SE¼ sec. 3, T. 22 S., R. 7 W.	....	Du	46.1	45	pP	482	45 36	8-20-56 2-11-57	M	N	Casing: 3 joints of 36-in. concrete tile. Gas reported.
OO- 2	H. D. Clarke NW¼SE¼SE¼ sec. 4, T. 24 N., R. 7 E.	Causey Drilling Co.	D	149.5	4,2	Kck	327	99.0	5-24-54	J	D,S	Casing: 4-in. to 140 ft. Screen: 2-in. from 140 to 146 ft. See plate 3.
OO-12	U.S. Geol. Survey NW¼NW¼SE¼ sec. 22, T. 24 N., R. 7 E.	....do........	D	160	...	Kck	240	6.8	6- 5-58	...	T	Test hole. Abandoned and filled. Sample and electric logs in files of U.S. Geol. Survey.
OO-13	U.S. Geol. Survey NE¼NE¼ sec. 23, T. 24 N., R. 7 E.	....do........	D	170	6,2	Kck	282	46.8	6-10-58	...	T	Casing: 6-in. to 75 ft.; 2-in. from 75 to 134 ft.; none below. Screen: 2-in. from 134 to 146 ft.
OO-14	U.S. Geol. Survey NE¼SE¼ sec. 25, T. 24 N., R. 7 E.	Null Drilling Co...	D	240	2	Kck	288	21	10-18-57	...	T	Casing: 2-in. to 209 ft.; none below. Slotted casing: 188 to 209 ft. Sample, driller's, and electric logs in files of U.S. Geol. Survey. See appendix.
OO-15	U.S. Geol. Survey NW¼SE¼ sec. 32, T. 24 N., R. 7 E.	....do........	D	316	...	...	320	....	......	...	T	Test hole. Abandoned and filled. See appendix.
PP- 8	U.S. Geol. Survey SW¼NE¼ sec. 14, T. 24 N., R. 6 E.	....do........	D	115	6,2	Kck	188	+ 1.5	10-18-57	...	T	Casing: 6-in. to 25.5 ft.; 2-in. from 25.5 to 115 ft. Slotted casing: 95 to 105 ft. Measured flow 4 gpm on 10-18-57. See appendix.

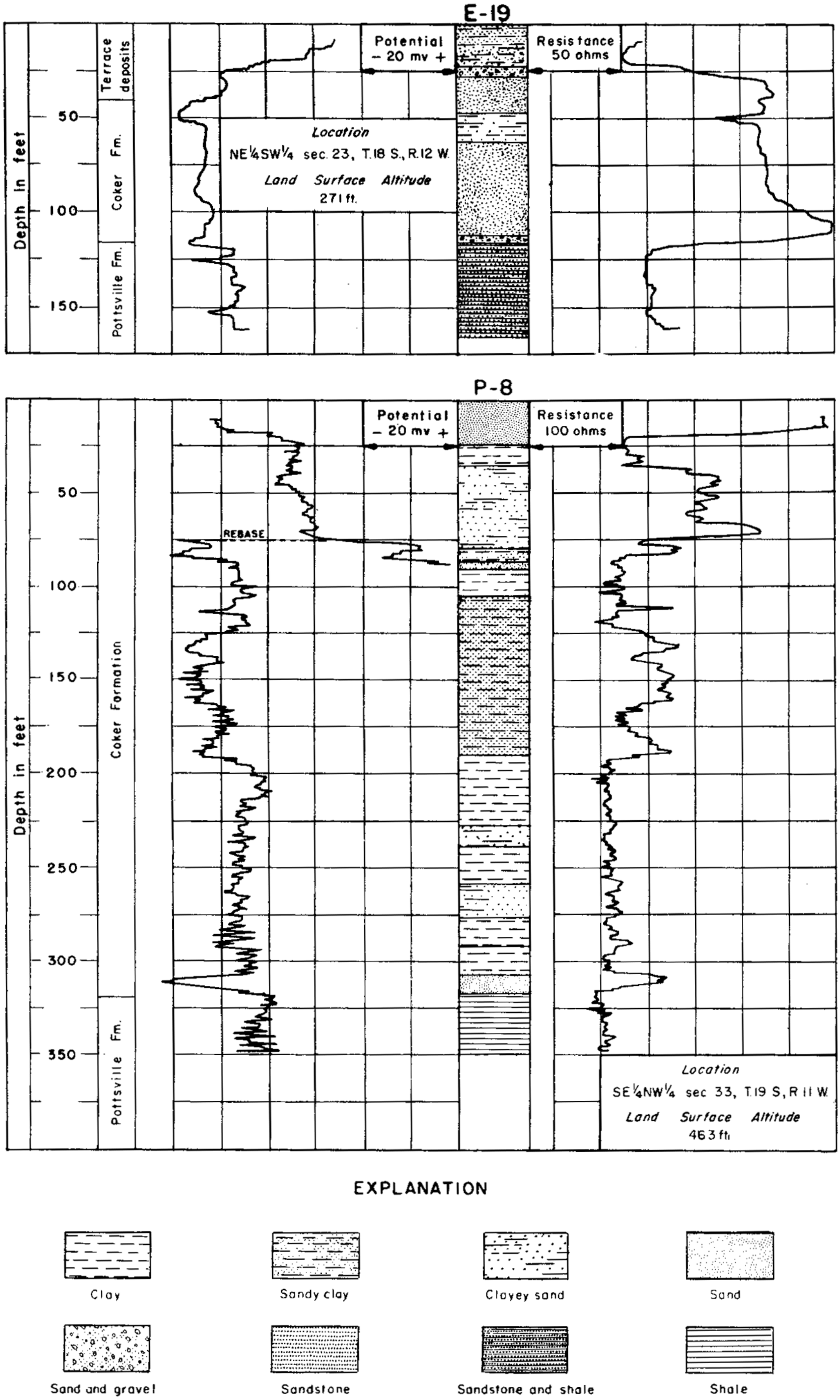
PP- 9	U.S. Geol. Survey NW¼SW¼ sec. 33, T. 24 N., R. 6 E.	....do........	D	250	6,2	Kck	174	+ 21.0	9-19-57	...	T	Casing: 6-in. to 44 ft.; 2-in. from 44 to 196 ft.; none below. Slotted casing: 154 to 175 ft. Measured flow 85 gpm on 9-19-57. Water has metallic taste. See appendix.
PP-10	U.S. Geol. Survey NE¼SE¼ sec. 32, T. 24 N., R. 6 E.	....do........	D	352	6,2	Kck	204	12.5	10-18-57	...	T	Casing: 6-in. to 31.5 ft.; 2-in. from 31.5 to 231 ft. Slotted casing: 219 to 231 ft. Water has metallic taste. See appendix.
PP-11	U.S. Geol. Survey SW¼NE¼ sec. 7, T. 24 N., R. 6 E.	Causey Drilling Co.	D	365	...	...	351	....	......	...	T	Test hole. Abandoned and filled. Sample, driller's, and electric logs in files of U.S. Geol. Survey.
QQ-14	Buddy Fitts NW¼SE¼ sec. 7, T. 24 N., R. 5 E.	....do........	D	280.0	6	Kck	126	....	......	...	Ind	Casing: 6-in. to 170 ft.; none below. Sample and driller's logs in files of U.S. Geol. Survey. See fig. 11.
QQ-15	Buddy Fitts SE¼NE¼ sec. 7, T. 24 N., R. 5 E.	J. K. Scott	D	190	4	Kck	126	+ 17 + 18	5- -46 7- -51	...	Ind	Casing: 4-in. to 64 ft.; none below. Measured flow 100 gpm in May 1946 and 85 gpm in July 1951. Driller's log in files of U.S. Geol. Survey. See fig. 11.
QQ-22	G. W. Carroll SW¼NE¼NW¼ sec. 15, T. 24 N., R. 5 E.	Causey Drilling Co.	D	226.0	4,2	Kck	304	90.5	3- 4-55	...	D	Casing: 4-in. to 220 ft. Screen: 2-in. from 220 to 226 ft. See plate 3.
QQ-33	R. C. Tidmore NW¼SW¼ sec. 28, T. 24 N., R. 5 E.	....do........	D	300.0	4,2	Kck	164	4.0	2-20-52	...	D,S	Casing: 4-in. to 88 ft.; 2-in. from 88 to 210 ft.; none below. Slotted casing: 190 to 210 ft. See appendix.
QQ-41	Southern Pine Chemical Recovery Corp. NE¼SW¼ sec. 17, T. 24 N., R. 5 E.	....do........	D	320.0	6	Kck	134	+ 9.5	10-15-56	...	Ind	Casing: 6-in. to 280 ft. Screen: 6-in. from 280 to 300 ft. Measured flow 60 gpm on 10-20-56. See pl. 3, fig. 9, and table 2.
QQ-45	U.S. Geol. Survey SW¼NW¼ sec. 15, T. 24 N., R. 5 E.	....do........	D	210	4	Kck	362	....	......	...	D	Sample cuttings, driller's and electric logs in files of U.S. Geol. Survey. See fig. 11.
RR- 3	Joe Rice NW¼NW¼NE¼ sec. 1, T. 24 N., R. 4 E.	....do........	D	275.0	4	Kck	131	+ 2.5	6-15-55	...	D,S	Casing: 4-in. to 81 ft.; none below. Measured flow 3 gpm on 6-15-55. Driller's and electric logs in files of U.S. Geol. Survey. See fig. 11.
RR-22	S. A. Wiggins NE¼SE¼SE¼ sec. 14, T. 24 N., R. 4 E.	....do........	D	280	4	Kck	124	+ 17.1	4-28-55	...	S	Casing: 4-in. to 61 ft.; none below. Measured flow 25 gpm on 4-25-55. See plate 3.
RR-30	V. P. Fisher SE¼SE¼ sec. 16, T. 24 N., R. 4 E.	....do........	D	350	4	Kck	126	Flows	9-29-54	...	S, Irr	Casing: 4-in. to 108 ft.; none below. Measured flow 265 gpm on 9-29-54. See plate 3.
RR-42	Mound State Monument, NE¼NE¼ sec. 1, T. 23 N., R. 4 E.	....	D	515	...	Kck	156	Flows	3- 3-55	J	...	Owner's well 2. Sample log in files of U.S. Geol. Survey. Pottsville Formation at 515 ft.

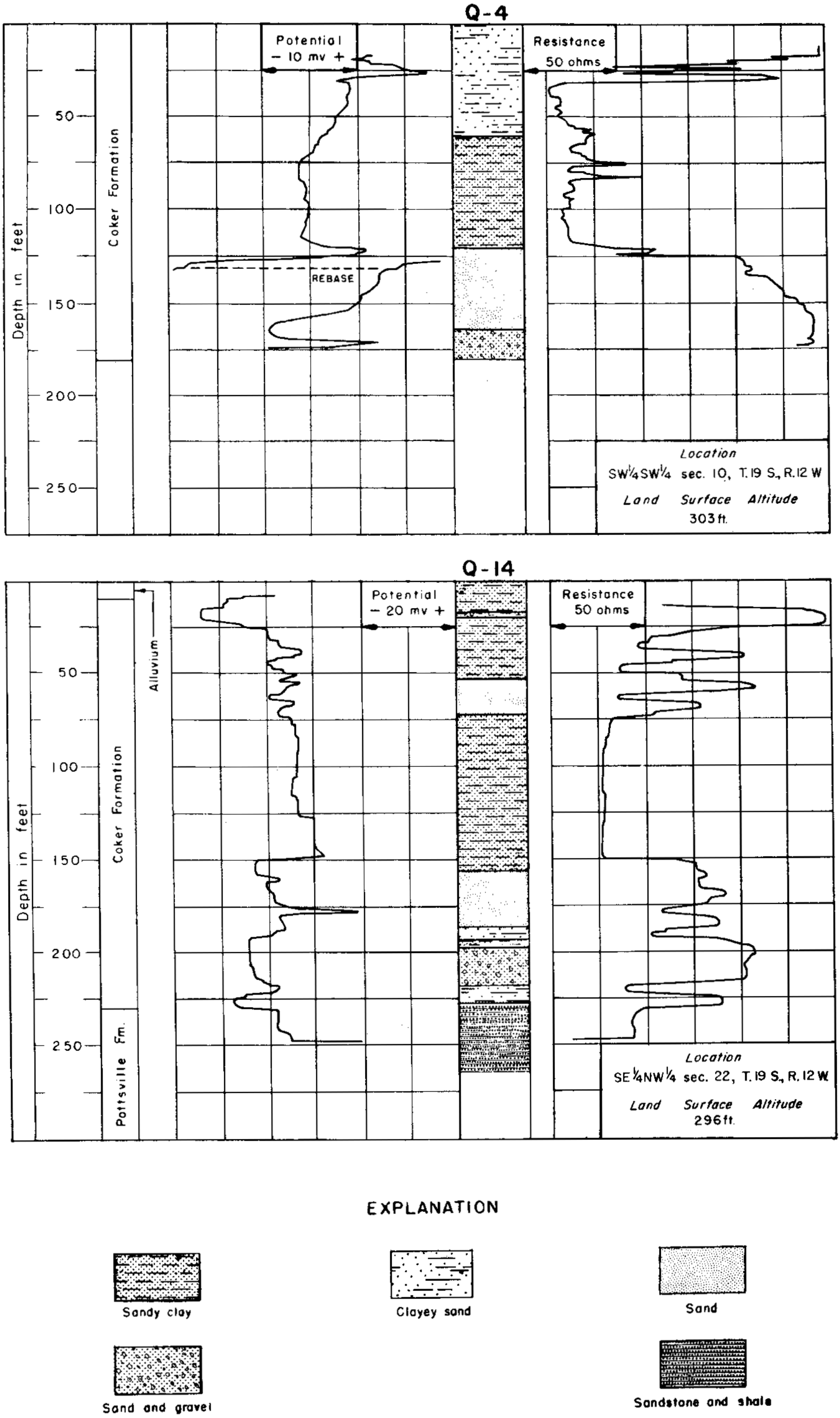
Table 4. --Records of selected wells and springs in Tuscaloosa County, Ala. --Continued

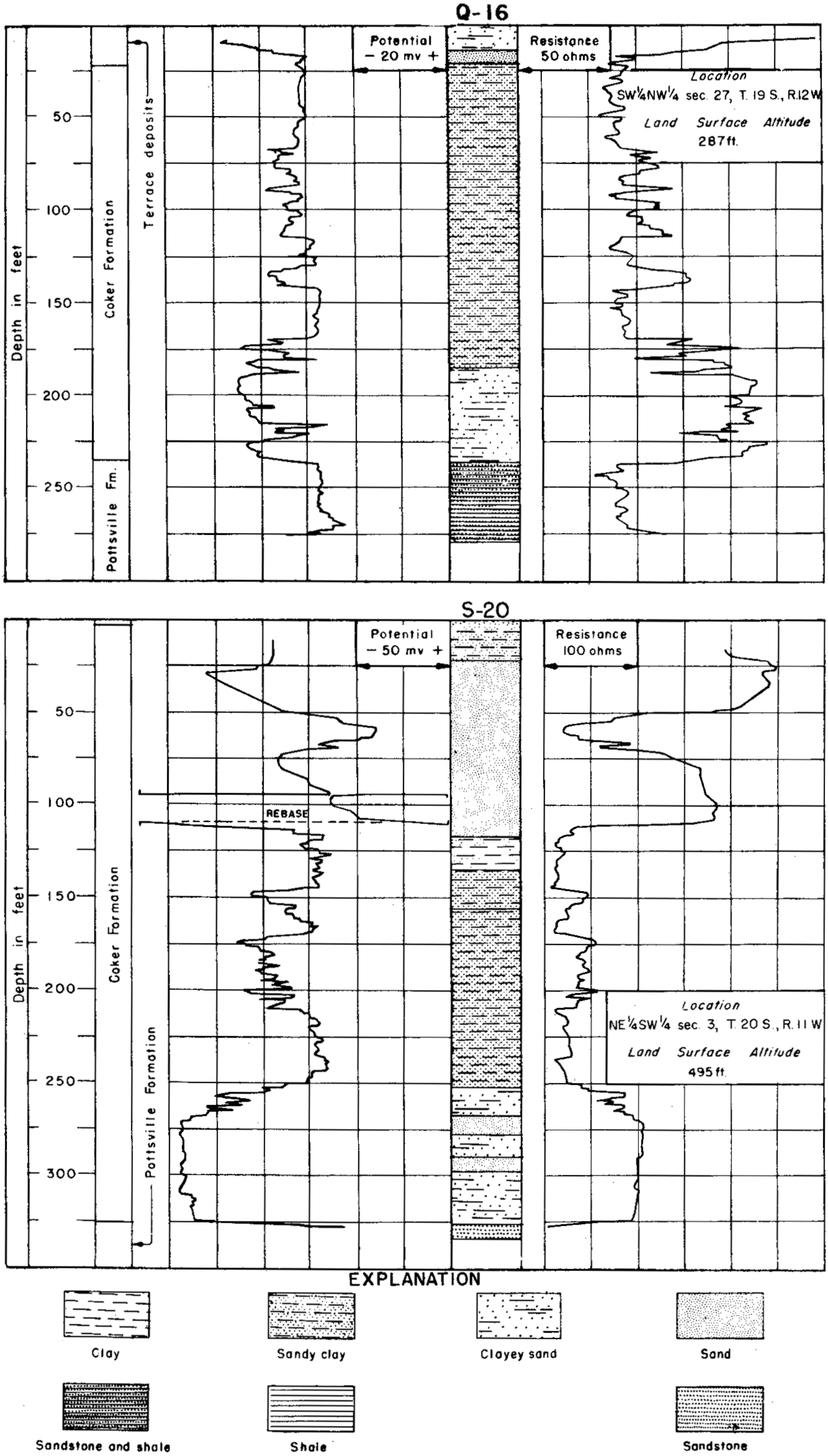
Well or spring no.	Owner and location	Driller	Type	Depth of well (feet)	Diameter of well (inches)	Water-bearing formation	Altitude of land surface (feet)	Water level: Above (+) or below land surface (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
RR-44	U.S. Geol. Survey SW$\frac{1}{4}$SE$\frac{1}{4}$ sec. 5, T. 24 N., R. 4 E.	Walter's Drilling Co.	D	523.5	...	...	212	....	......	...	T	Known as Boykin test well 2. Abandoned and plugged. See appendix.
RR-46	J. M. Jacobs SW$\frac{1}{4}$NE$\frac{1}{4}$ sec. 17, T. 24 N., R. 4 E.	Black Belt Drilling Co.	D	440.0	...	...	261	....	......	...	N	Test hole. Abandoned and plugged. See appendix.
RR-51	Tiny Morgan NE$\frac{1}{4}$SW$\frac{1}{4}$ sec. 9, T. 24 N., R. 4 E.	Ace Drilling Co ...	D	460	4, 2	Kck	150	23	1- -57	C	D, S	Casing: 4-in. to 69 ft. Screen: 2-in. from 69 to 75 ft. Test hole drilled to 460 ft. See appendix.
RR-52	Buddy Fitts NW$\frac{1}{4}$SE$\frac{1}{4}$ sec. 10, T. 24 N., R. 4 E.	.... do	D	398	6, 4	Kck	128	Flows	10-18-57	...	Ind	Casing: 6-in. to 335 ft. Slotted casing: 4-in. from 335 to 395 ft. Measured flow 66 gpm on 10-18-57. See appendix.
SS- 3	A. D. Styles SW$\frac{1}{4}$SE$\frac{1}{4}$ sec. 2, T. 24 N., R. 3 E.	Causey Drilling Co .	D	95.0	4, 2	Kck	241	....	......	...	D	Casing: 4-in. to 88 ft. Screen: 2-in. from 88 to 94 ft. See appendix.
SS-14	U.S. Geol. Survey NW$\frac{1}{4}$NW$\frac{1}{4}$SE$\frac{1}{4}$ sec. 22, T. 24 N., R. 3 E.	.... do	D	598.4	4, 2	Kck	152	+ 18.0	2-22-57	...	N	Observation well. Casing: 4-in. to 175 ft.; 2-in. from 175 to 598.5 ft. Slotted casing: 532 to 576 ft. See plate 3 and fig. 14.
SS-17	Victor Phillips SW$\frac{1}{4}$NE$\frac{1}{4}$ sec. 23, T. 24 N., R. 3 E.	.... do	D	120.0	4, 2	Kg	227	51.0	5-25-41	J	D	Casing: 4-in. to 114 ft. Screen: 2-in. from 114 to 120 ft. See appendix.
SS-23	U.S. Geol. Survey SW$\frac{1}{4}$NE$\frac{1}{4}$ sec. 13, T. 24 N., R. 3 E.	Null Drilling Co ...	D	585	...	...	233	....	......	...	...	Test hole. Abandoned and filled. Sample, driller's, and electric logs in files of U.S. Geol. Survey.
SS-24	U.S. Geol. Survey SW$\frac{1}{4}$SW$\frac{1}{4}$ sec. 6, T. 24 N., R. 3 E.	Causey Drilling Co .	D	735	...	...	326	....	......	...	...	Test hole. Abandoned and filled. See plate 2.

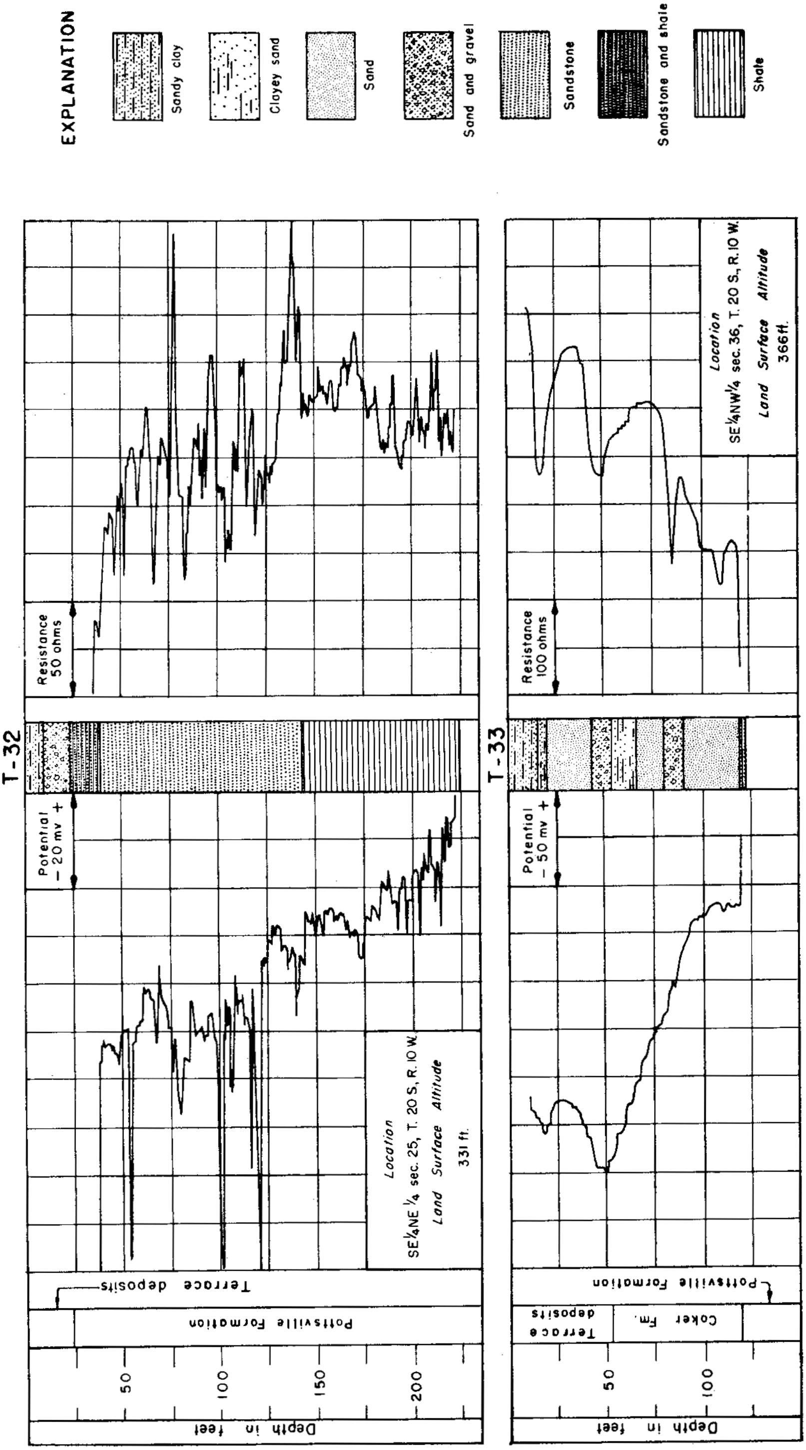
APPENDIX


EXPLANATION
Clay
Sandy clay
Clayey sand
Sand
Sand and gravel
Sandstone
Sandstone and shale
Shale
E-17
Potential
− 20 mv +
Resistance
50 ohms
Location
NW1/4 SE1/4 sec.4, T.18 S., R.12 W.
Land Surface Altitude
286 ft.
Terrace deposits
Coker Formation
Pottsville Fm.
Depth in feet
20
40
60
80
E-18
Potential
− 20 mv +
Resistance
50 ohms
Location
NE1/4 NW1/4 sec.14, T.18 S., R.12 W.
Land Surface Altitude
270 ft.
Terrace deposits
Coker Fm.
Formation
Pottsville
Depth in feet
50
100
150

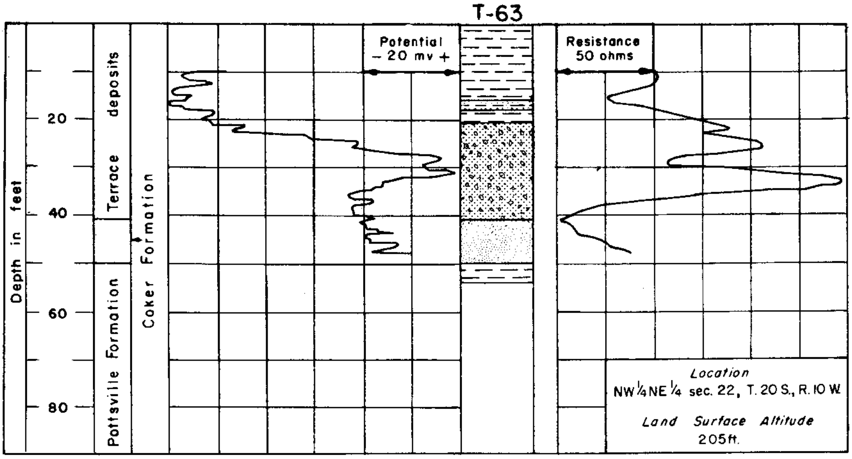

E-19
Potential
– 20 mv +
Resistance
50 ohms
Depth in feet
50
100
150
Terrace deposits
Coker Fm.
Pottsville Fm.
Location
NE¼SW¼ sec. 23, T.18 S., R.12 W.
Land Surface Altitude
271 ft.
P-8
Potential
– 20 mv +
Resistance
100 ohms
Depth in feet
50
100
150
200
250
300
350
REBASE
Coker Formation
Pottsville Fm.
Location
SE¼NW¼ sec 33, T.19 S, R 11 W.
Land Surface Altitude
463 ft.
EXPLANATION
Clay
Sandy clay
Clayey sand
Sand
Sand and gravel
Sandstone
Sandstone and shale
Shale


Q-4
Depth in feet
50
100
150
200
250
Coker Formation
Potential
− 10 mv +
REBASE
Resistance
50 ohms
Location
SW¼SW¼ sec. 10, T. 19 S., R. 12 W.
Land Surface Altitude
303 ft.
Q-14
Depth in feet
50
100
150
200
250
Alluvium
Coker Formation
Pottsville Fm.
Potential
− 20 mv +
Resistance
50 ohms
Location
SE¼NW¼ sec. 22, T. 19 S., R. 12 W.
Land Surface Altitude
296 ft.
EXPLANATION
Sandy clay
Clayey sand
Sand
Sand and gravel
Sandstone and shale

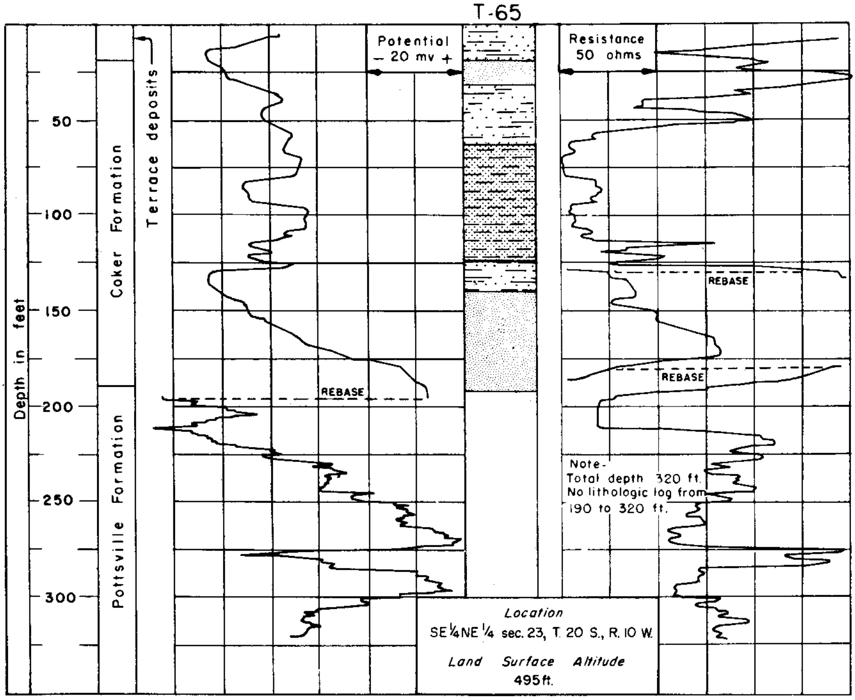

Q-16
Depth in feet
50
100
150
200
250
Coker Formation
Pottsville Fm.
Terrace deposits
Potential
− 20 mv +
Resistance
50 ohms
Location
SW¼NW¼ sec. 27, T. 19 S., R.12 W.
Land Surface Altitude
287 ft.
S-20
Depth in feet
50
100
150
200
250
300
Coker Formation
Pottsville Formation
Potential
− 50 mv +
Resistance
100 ohms
REBASE
Location
NE¼SW¼ sec. 3, T. 20 S., R. 11 W.
Land Surface Altitude
495 ft.
EXPLANATION
Clay
Sandy clay
Clayey sand
Sand
Sandstone and shale
Shale
Sandstone


EXPLANATION
Sandy clay
Clayey sand
Sand
Sand and gravel
Sandstone
Sandstone and shale
Shale
T-32
Resistance 50 ohms
Potential − 20 mv +
Location SE¼NE¼ sec. 25, T. 20 S., R. 10 W.
Land Surface Altitude 331 ft.
Terrace deposits
Pottsville Formation
Depth in feet
50
100
150
200
T-33
Resistance 100 ohms
Potential − 50 mv +
Location SE¼NW¼ sec. 36, T. 20 S., R. 10 W.
Land Surface Altitude 366 ft.
Pottsville Formation
Terrace deposits
Coker Fm.
Depth in feet
50
100

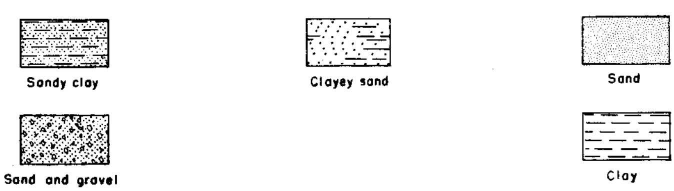
T-63



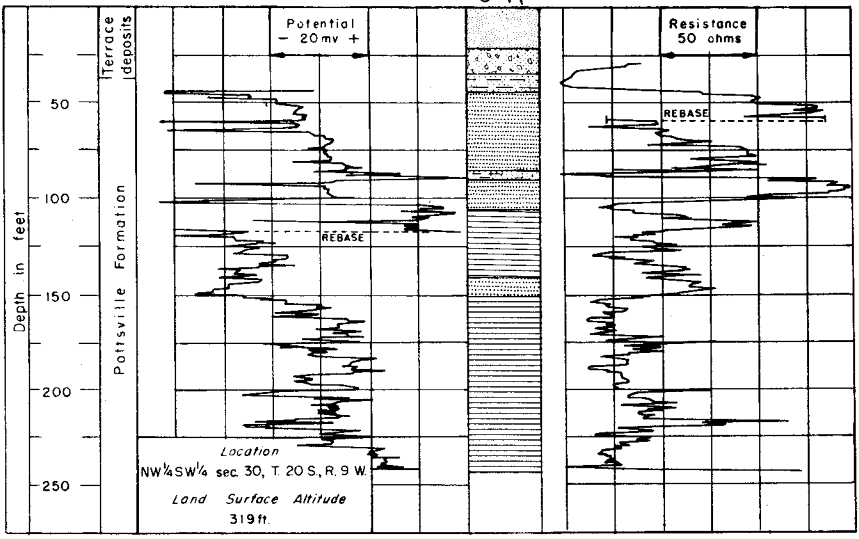
T-65



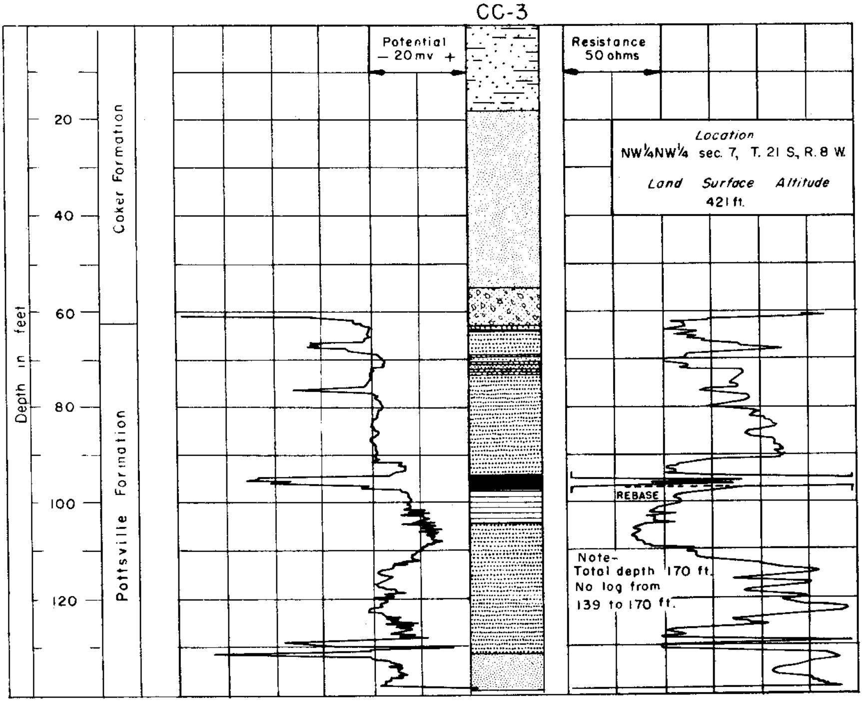
EXPLANATION



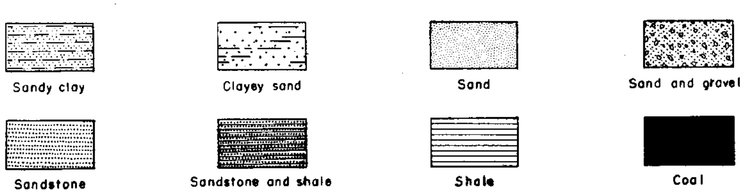
U-11

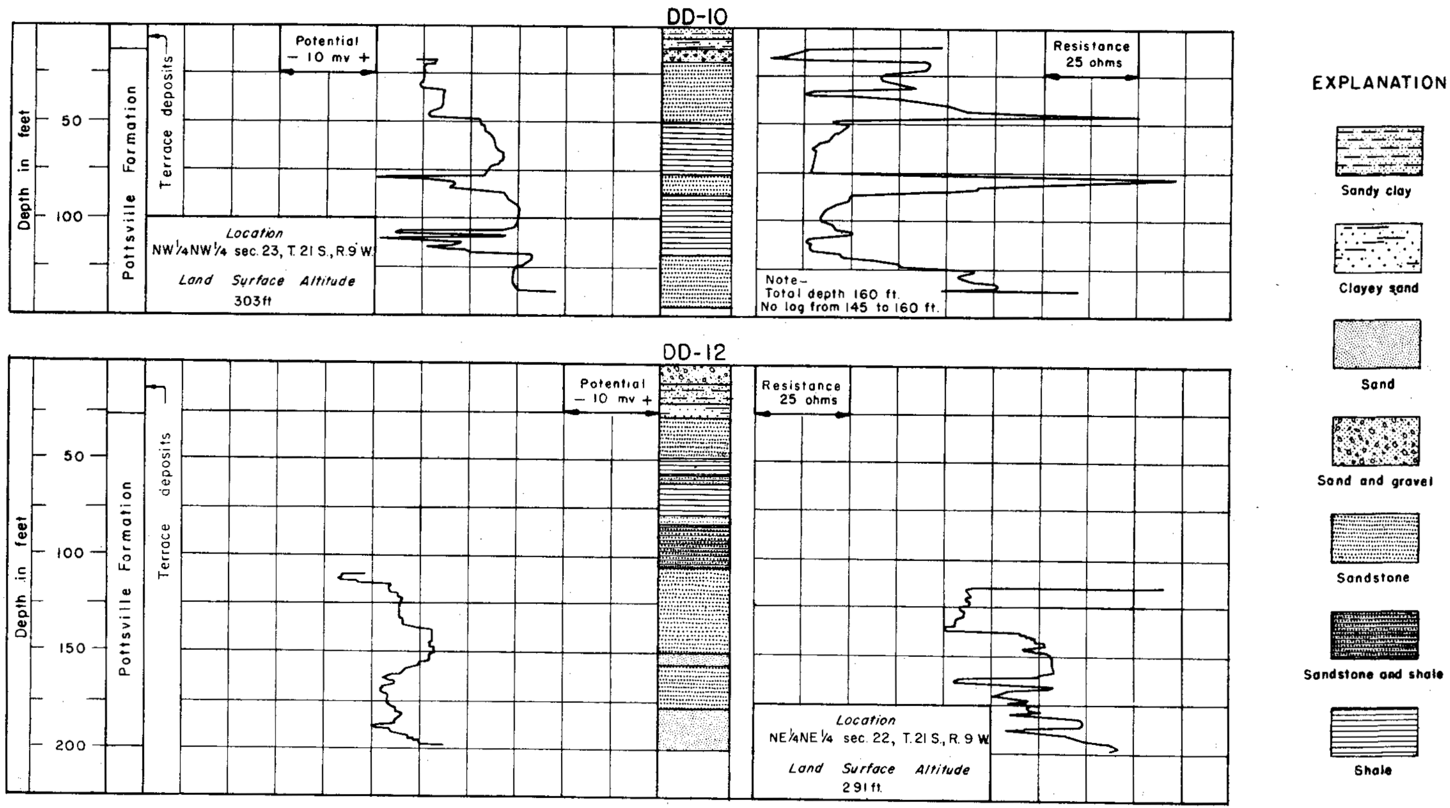


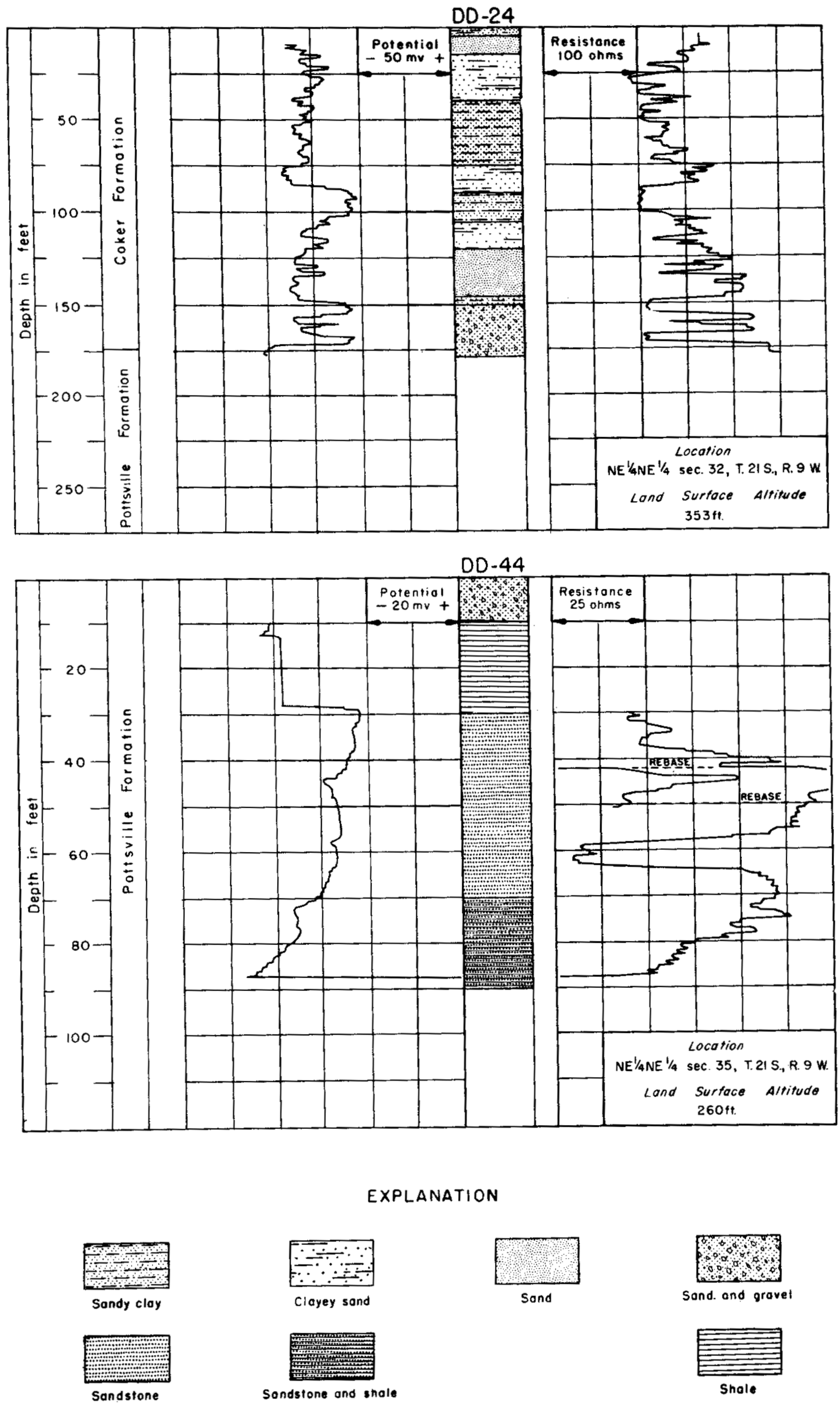
CC-3

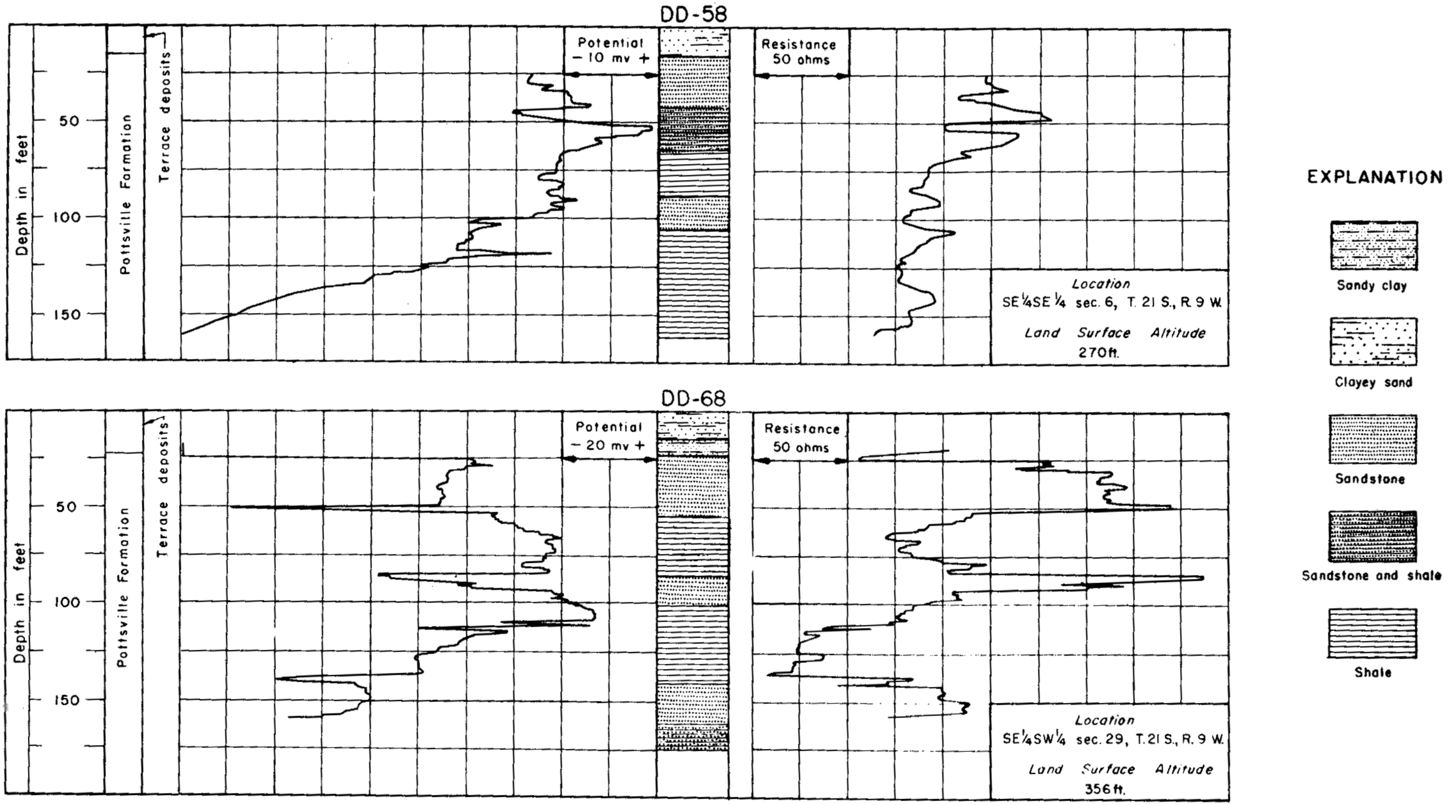


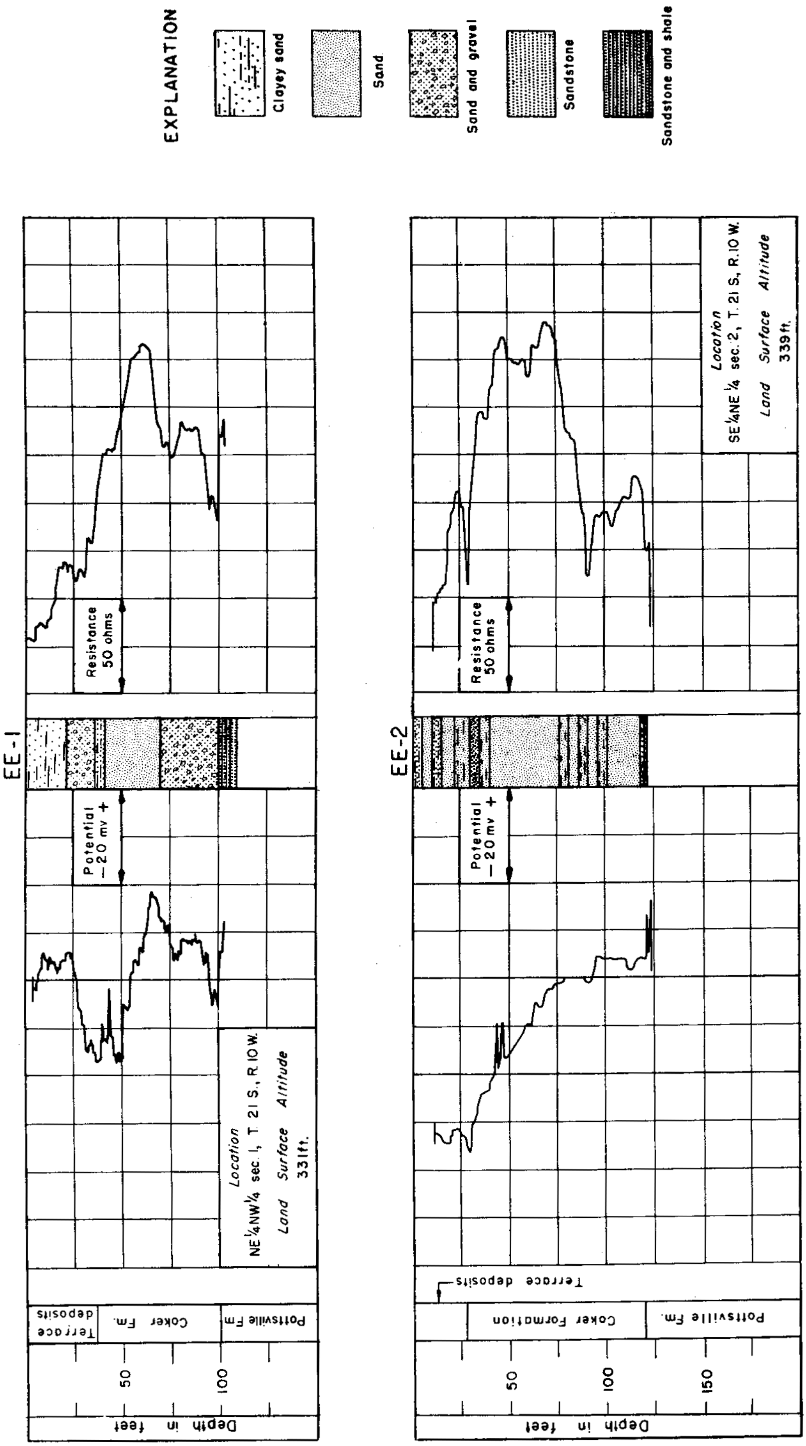
EXPLANATION

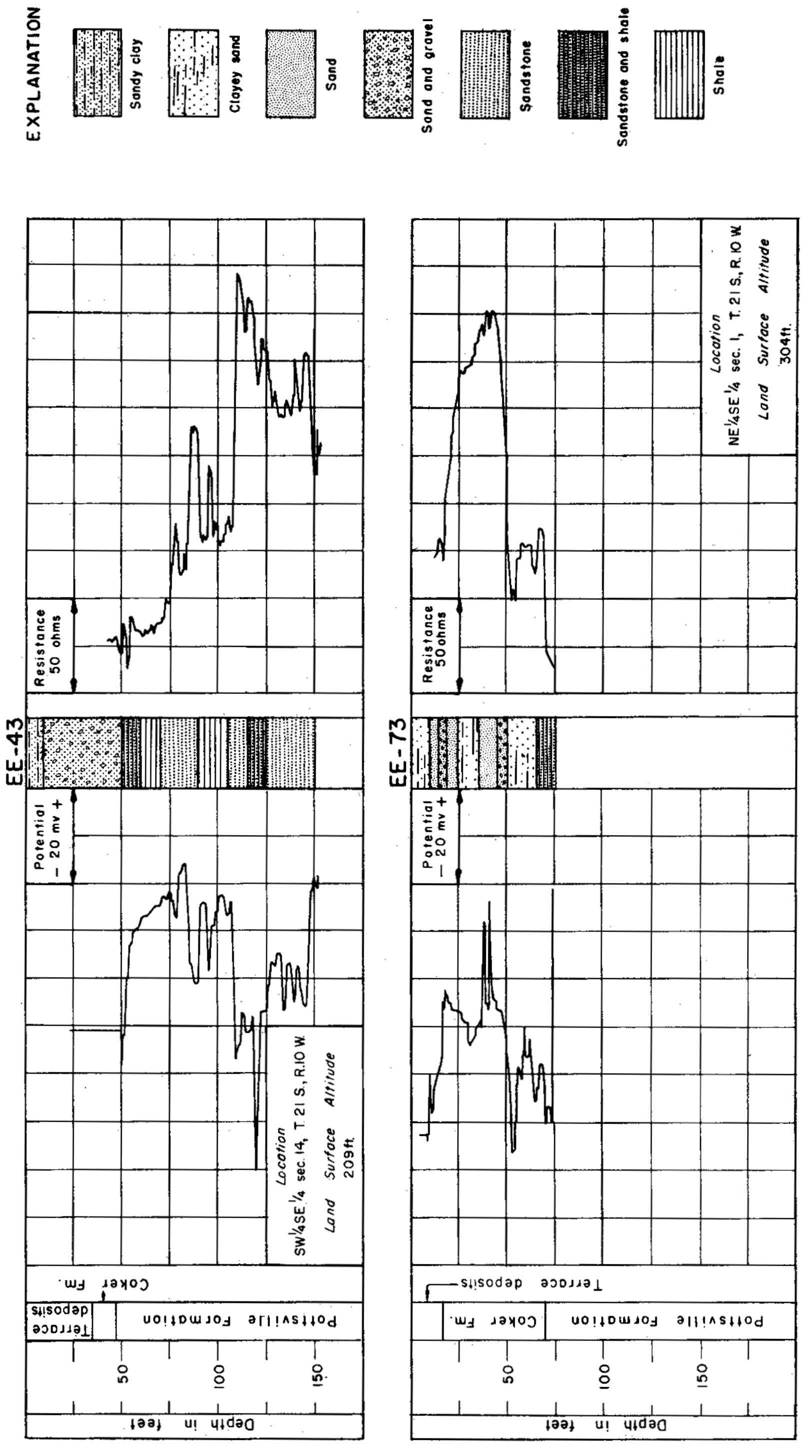


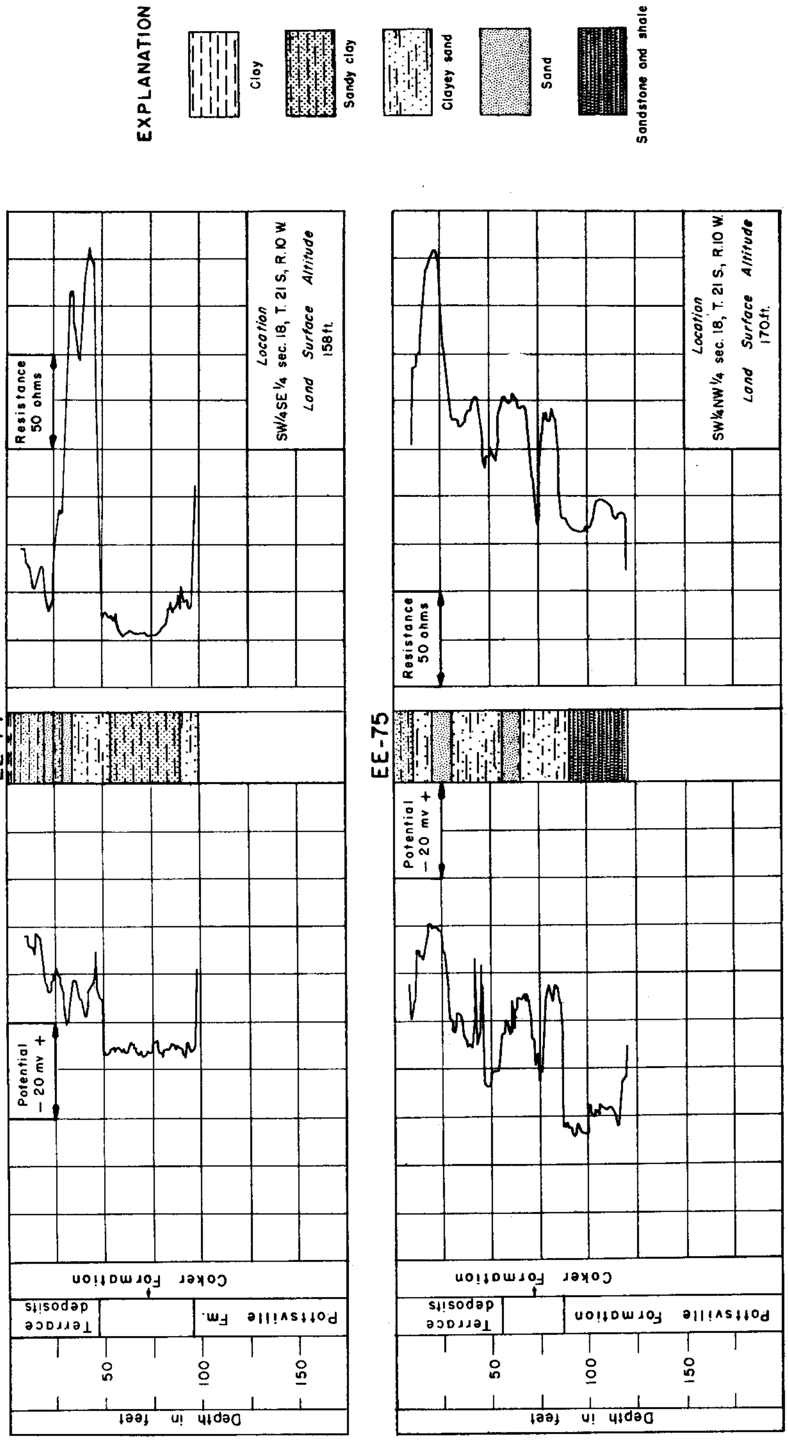

DD-10
Depth in feet
50
100
Pottsville Formation
Terrace deposits
Potential
− 10 mv +
Location
NW¼NW¼ sec. 23, T. 21 S., R. 9 W.
Land Surface Altitude
303 ft
Resistance
25 ohms
Note–
Total depth 160 ft.
No log from 145 to 160 ft.
DD-12
Depth in feet
50
100
150
200
Pottsville Formation
Terrace deposits
Potential
− 10 mv +
Resistance
25 ohms
Location
NE¼NE¼ sec. 22, T. 21 S., R. 9 W.
Land Surface Altitude
291 ft.
EXPLANATION
Sandy clay
Clayey sand
Sand
Sand and gravel
Sandstone
Sandstone and shale
Shale

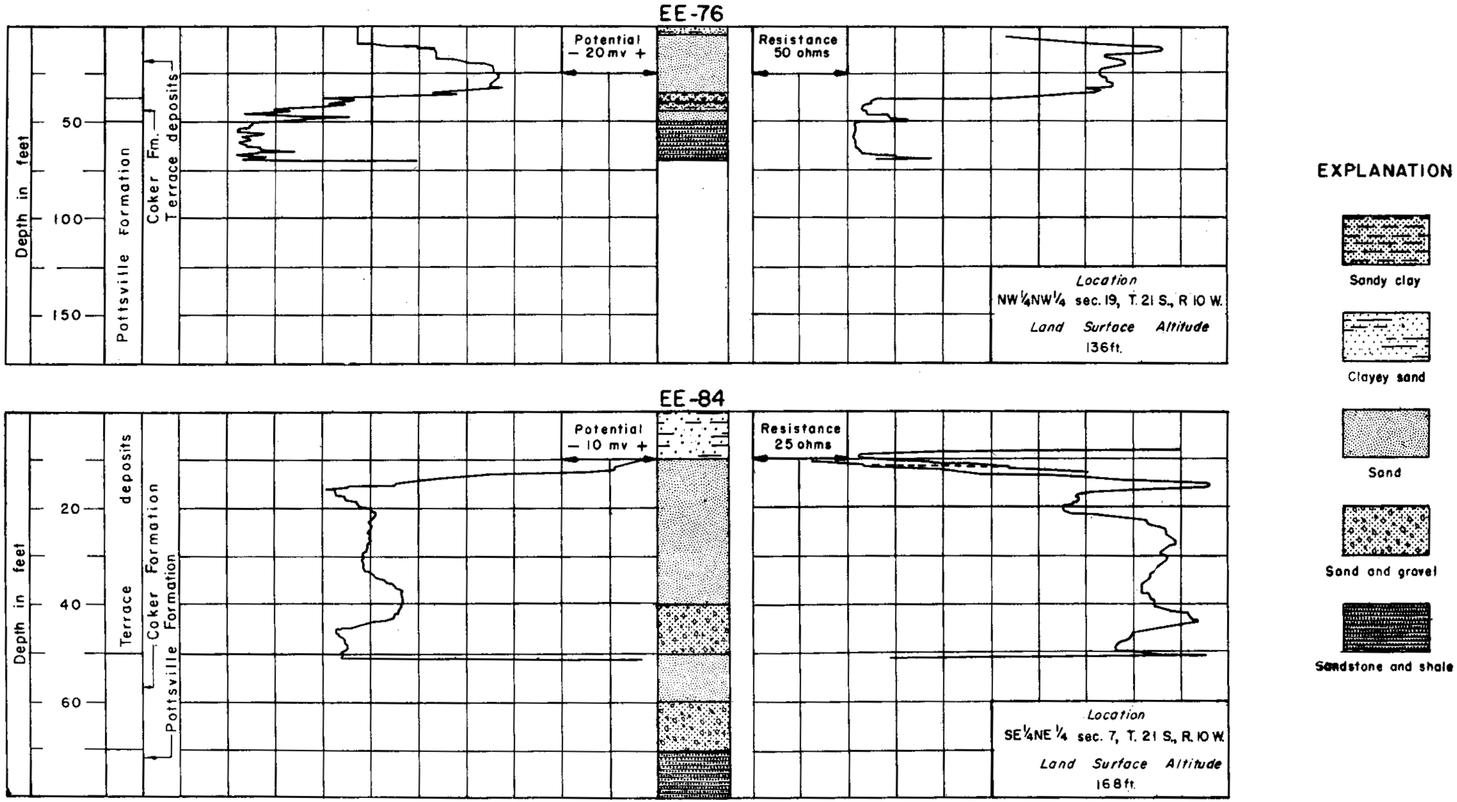

DD-24
Depth in feet
50
100
150
200
250
Coker Formation
Pottsville Formation
Potential
– 50 mv +
Resistance
100 ohms
Location
NE¼NE¼ sec. 32, T. 21 S., R. 9 W.
Land Surface Altitude
353 ft.
DD-44
Depth in feet
20
40
60
80
100
Pottsville Formation
Potential
– 20 mv +
Resistance
25 ohms
REBASE
REBASE
Location
NE¼NE¼ sec. 35, T. 21 S., R. 9 W.
Land Surface Altitude
260 ft.
EXPLANATION
Sandy clay
Clayey sand
Sand
Sand and gravel
Sandstone
Sandstone and shale
Shale

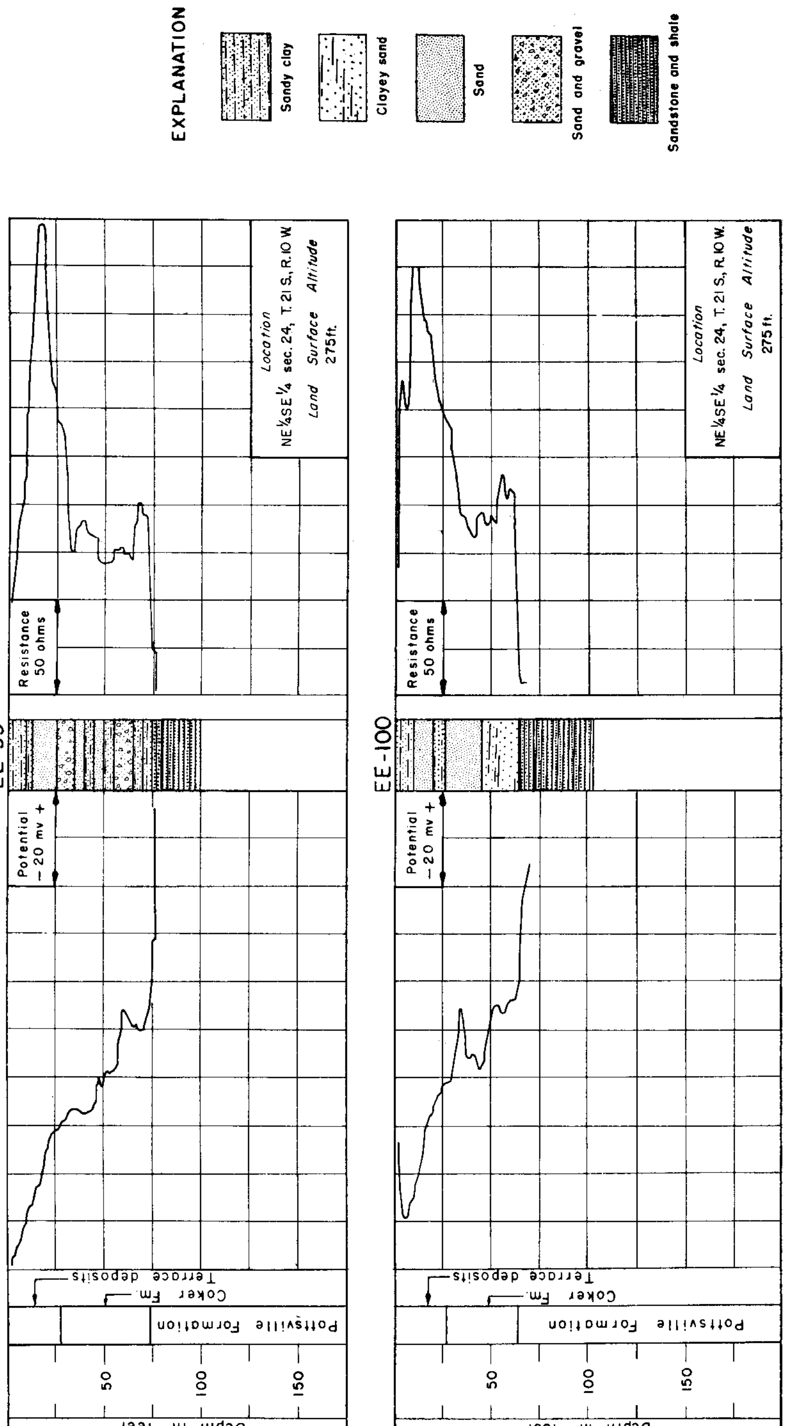

DD-58
Depth in feet
50
100
150
Pottsville Formation
Terrace deposits
Potential
− 10 mv +
Resistance
50 ohms
Location
SE¼SE¼ sec. 6, T. 21 S., R. 9 W.
Land Surface Altitude
270 ft.
DD-68
Depth in feet
50
100
150
Pottsville Formation
Terrace deposits
Potential
− 20 mv +
Resistance
50 ohms
Location
SE¼SW¼ sec. 29, T. 21 S., R. 9 W.
Land Surface Altitude
356 ft.
EXPLANATION
Sandy clay
Clayey sand
Sandstone
Sandstone and shale
Shale

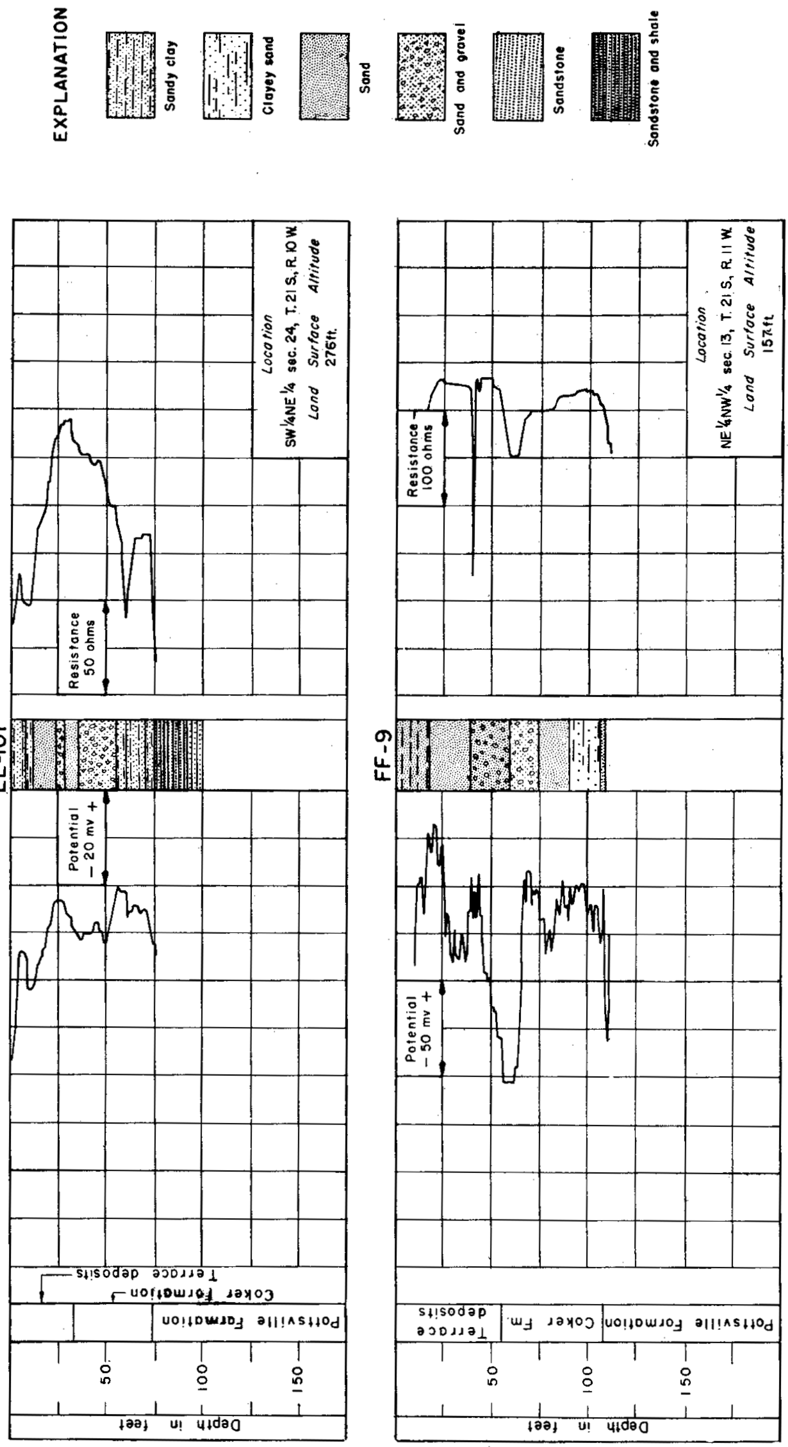

EXPLANATION
Clayey sand
Sand
Sand and gravel
Sandstone
Sandstone and shale
EE-1
Resistance 50 ohms
Potential −20 mv +
Location NE¼NW¼ sec. 1, T. 21 S., R. 10 W.
Land Surface Altitude 331 ft.
Terrace deposits
Coker Fm.
Pottsville Fm.
Depth in feet
50
100
EE-2
Resistance 50 ohms
Potential −20 mv +
Location SE¼NE¼ sec. 2, T. 21 S., R. 10 W.
Land Surface Altitude 339 ft.
Terrace deposits
Coker Formation
Pottsville Fm.
Depth in feet
50
100
150

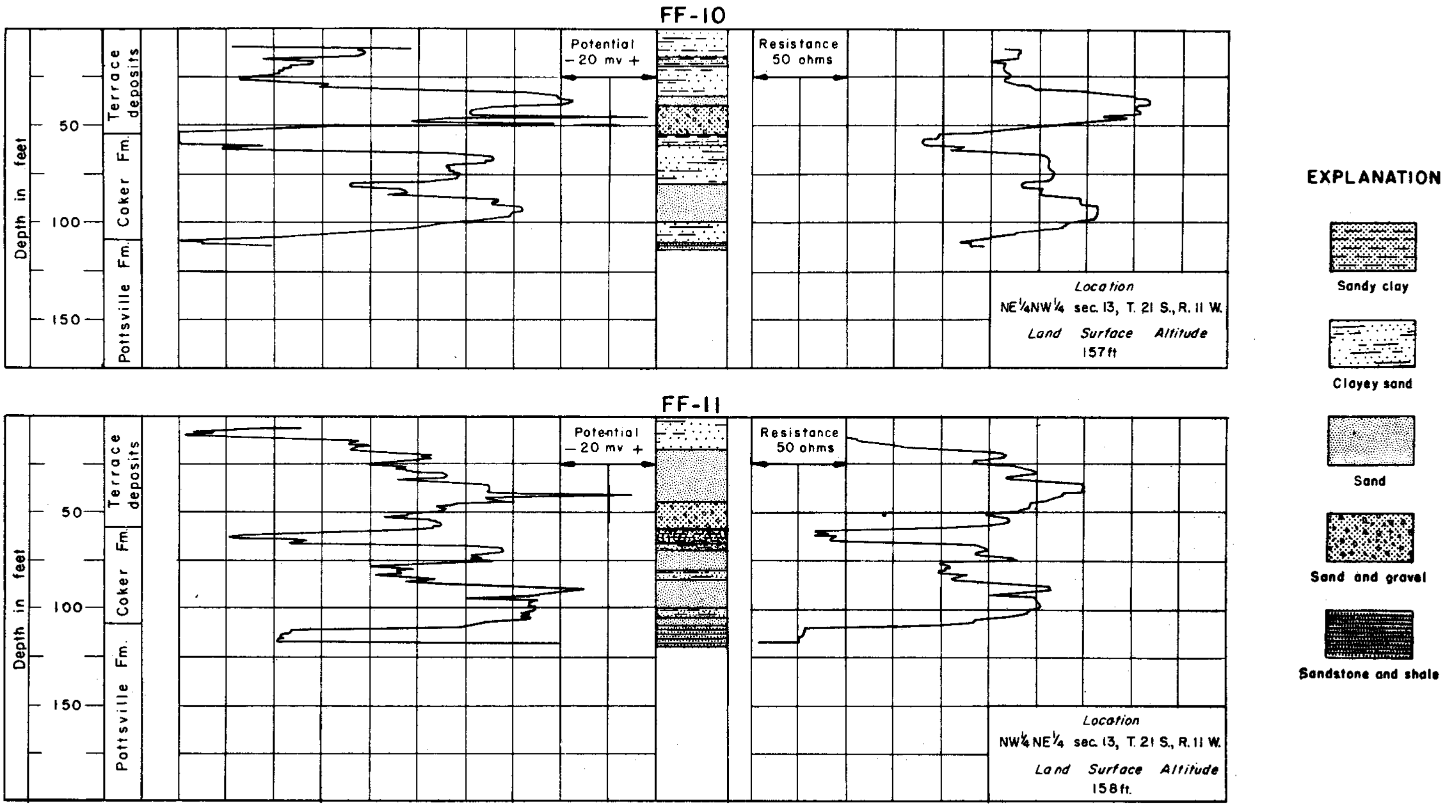

EXPLANATION
Sandy clay
Clayey sand
Sand
Sand and gravel
Sandstone
Sandstone and shale
Shale
EE-43
Potential
— 20 mv +
Resistance
50 ohms
Location
SW¼SE¼ sec. 14, T. 21 S., R. 10 W.
Land Surface Altitude
209 ft.
Terrace deposits
Coker Fm.
Pottsville Formation
Depth in feet
50
100
150
EE-73
Potential
— 20 mv +
Resistance
50 ohms
Location
NE¼SE¼ sec. 1, T. 21 S., R. 10 W.
Land Surface Altitude
304 ft.
Terrace deposits
Coker Fm.
Pottsville Formation
Depth in feet
50
100
150

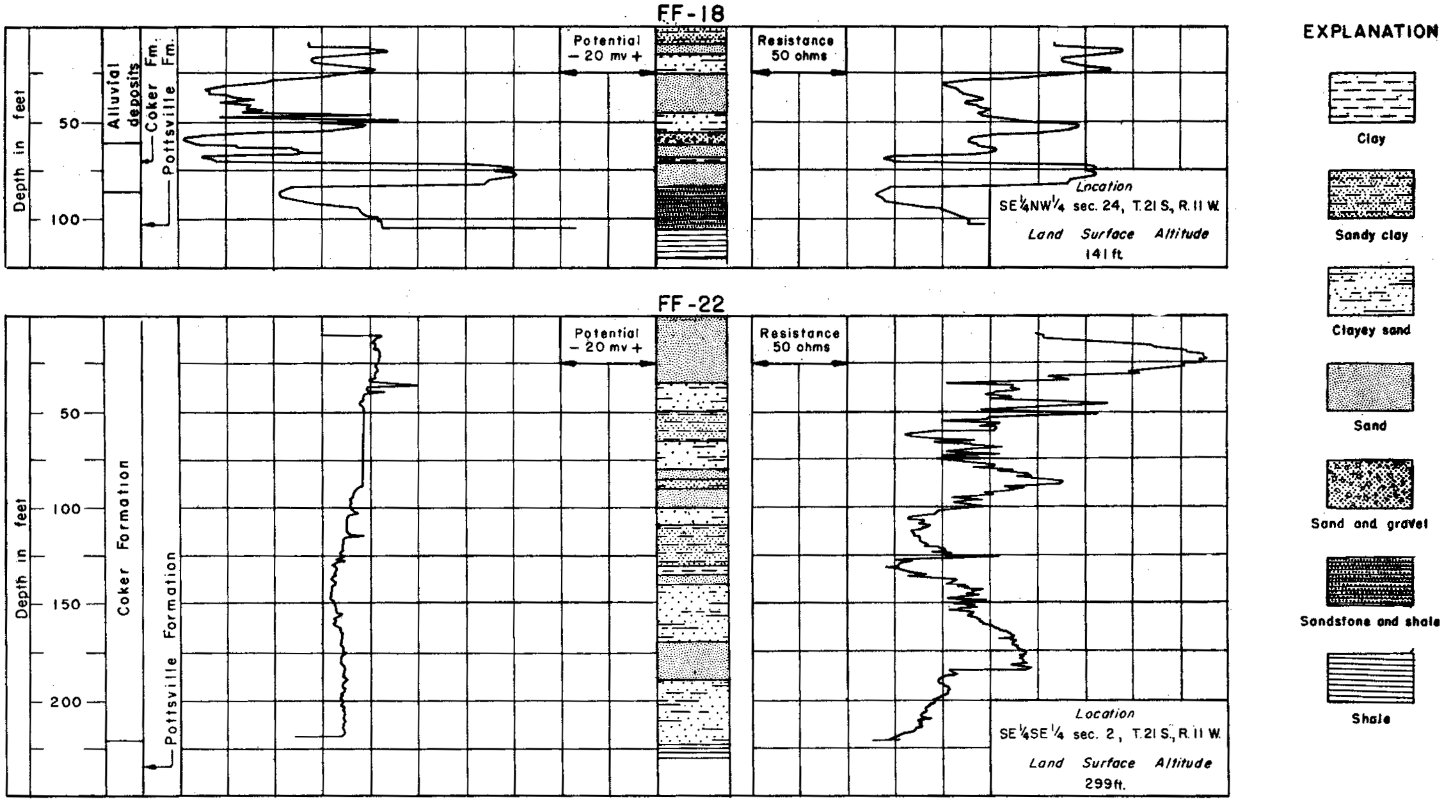

EXPLANATION
Clay
Sandy clay
Clayey sand
Sand
Sandstone and shale
EE-74
Resistance 50 ohms
Potential − 20 mv +
Location SW¼SE¼ sec. 18, T. 21 S., R. 10 W. Land Surface Altitude 158 ft.
Coker Formation
Terrace deposits
Pottsville Fm.
Depth in feet
50
100
150
EE-75
Resistance 50 ohms
Potential − 20 mv +
Location SW¼NW¼ sec. 18, T. 21 S., R. 10 W. Land Surface Altitude 170 ft.
Coker Formation
Terrace deposits
Pottsville Formation
Depth in feet
50
100
150

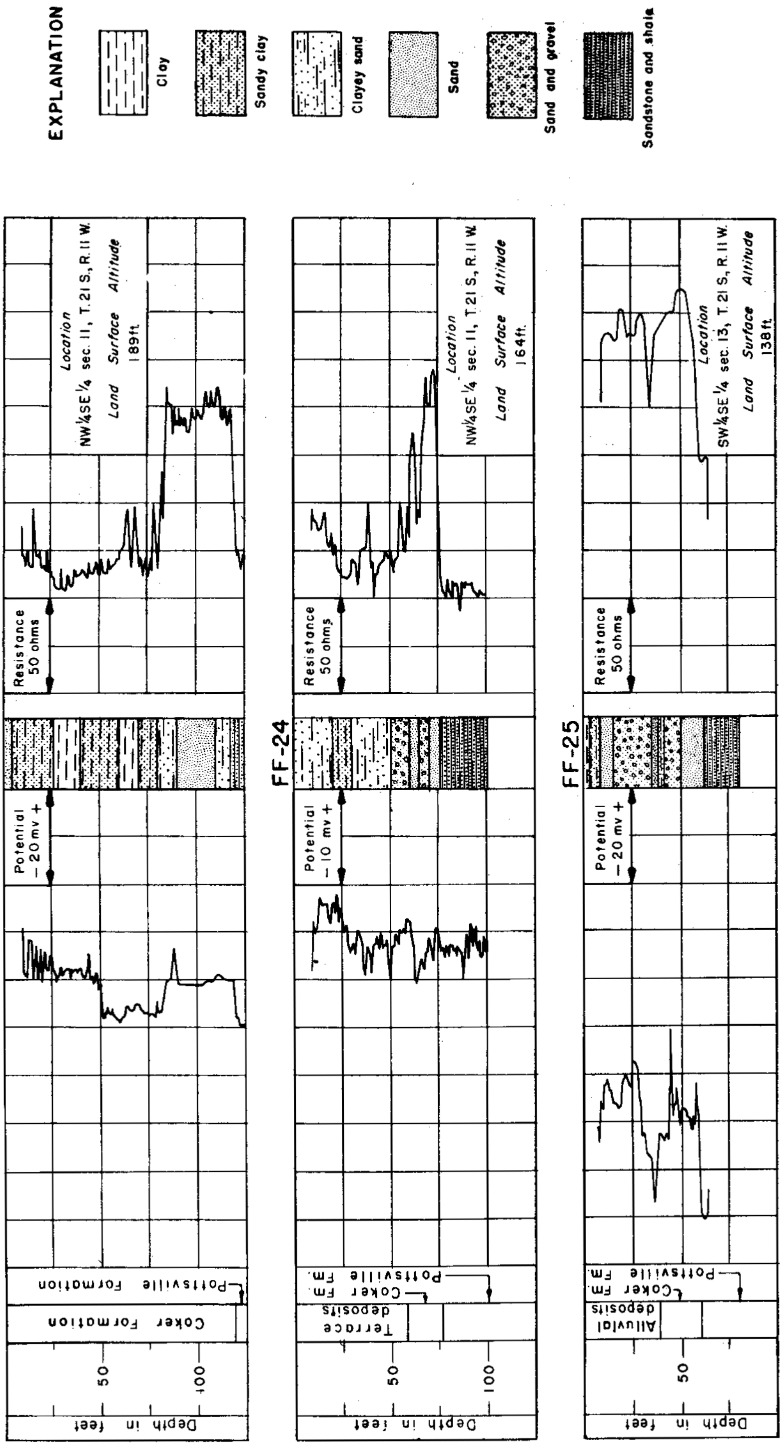

EE-76
Depth in feet
50
100
150
Pottsville Formation
Coker Fm.
Terrace deposits
Potential
− 20 mv +
Resistance
50 ohms
Location
NW¼NW¼ sec. 19, T. 21 S., R. 10 W.
Land Surface Altitude
136 ft.
EE-84
Depth in feet
20
40
60
Terrace deposits
Coker Formation
Pottsville Formation
Potential
− 10 mv +
Resistance
25 ohms
Location
SE¼NE¼ sec. 7, T. 21 S., R. 10 W.
Land Surface Altitude
168 ft.
EXPLANATION
Sandy clay
Clayey sand
Sand
Sand and gravel
Sandstone and shale

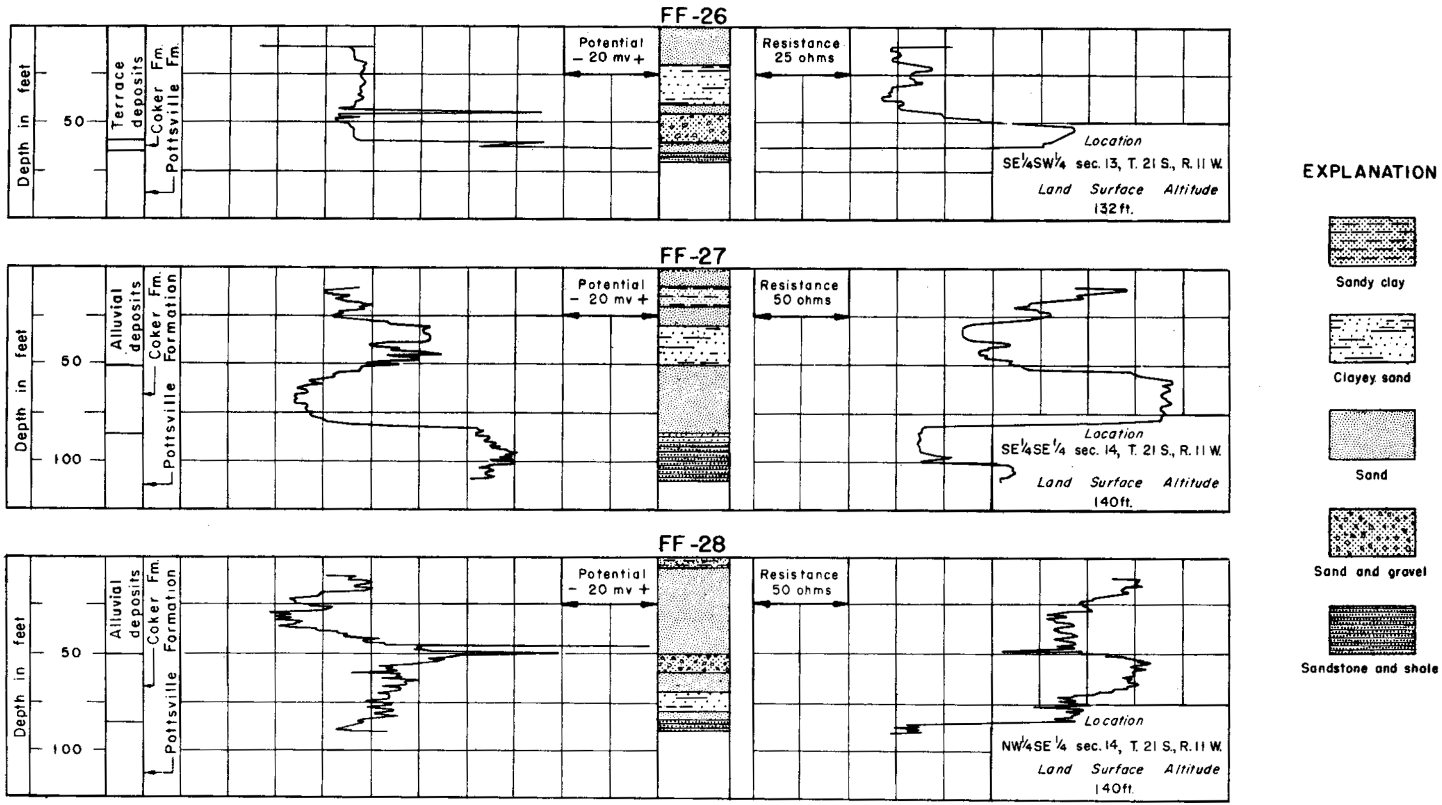

EXPLANATION
Sandy clay
Clayey sand
Sand
Sand and gravel
Sandstone and shale
EE-99
Location
NE¼SE¼ sec. 24, T. 21 S., R. 10 W.
Land Surface Altitude
275 ft.
Resistance
50 ohms
Potential
− 20 mv +
Terrace deposits
Coker Fm.
Pottsville Formation
50
100
150
Depth in feet
EE-100
Location
NE¼SE¼ sec. 24, T. 21 S., R. 10 W.
Land Surface Altitude
275 ft.
Resistance
50 ohms
Potential
− 20 mv +
Terrace deposits
Coker Fm.
Pottsville Formation
50
100
150
Depth in feet

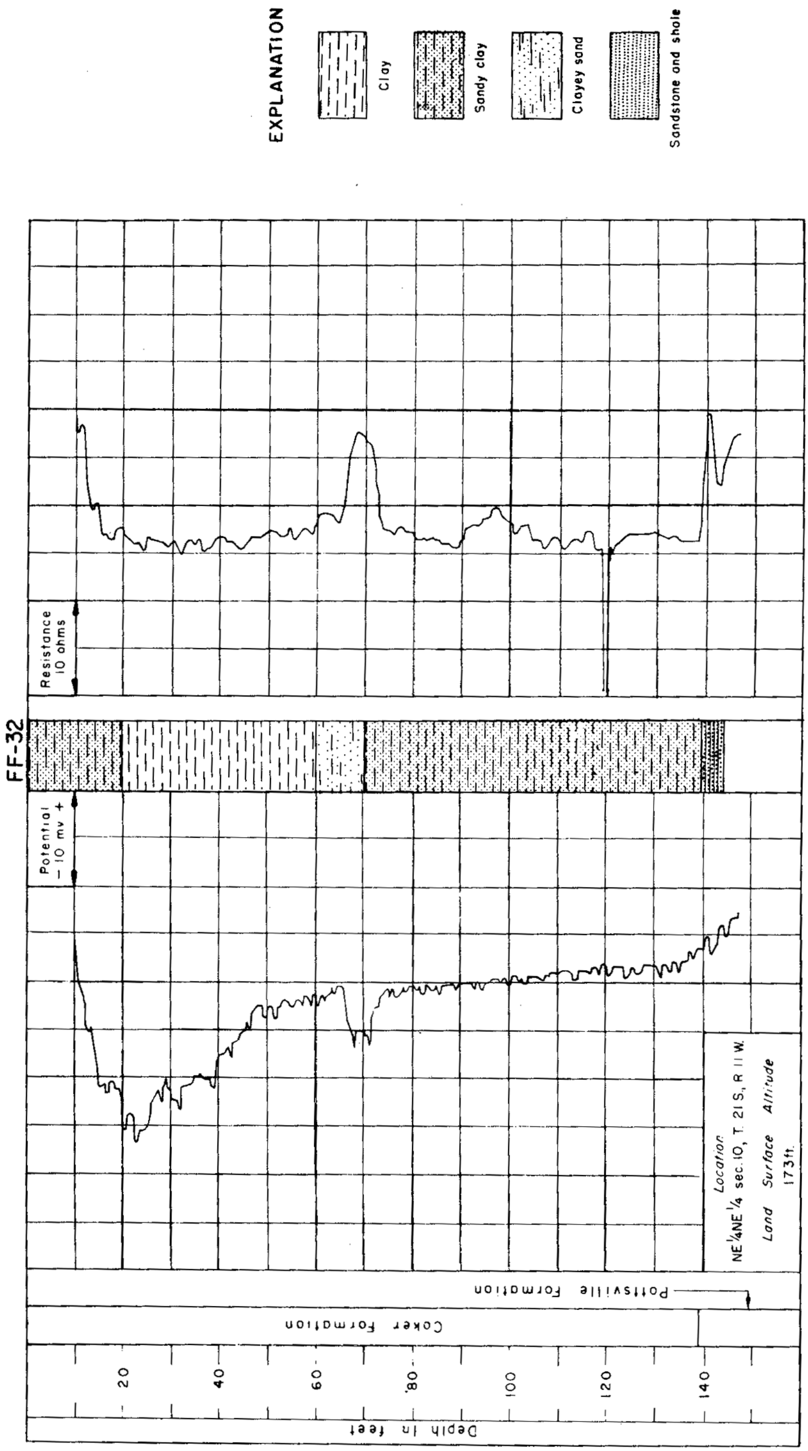

EXPLANATION
Sandy clay
Clayey sand
Sand
Sand and gravel
Sandstone
Sandstone and shale
EE-101
Location
SW¼NE¼ sec. 24, T. 21 S., R. 10 W.
Land Surface Altitude
276 ft.
Resistance
50 ohms
Potential
− 20 mv +
Terrace deposits
Coker Formation
Pottsville Formation
Depth in feet
50
100
150
FF-9
Location
NE¼NW¼ sec. 13, T. 21 S., R. 11 W.
Land Surface Altitude
157 ft.
Resistance
100 ohms
Potential
− 50 mv +
Terrace deposits
Coker Fm.
Pottsville Formation
Depth in feet
50
100
150

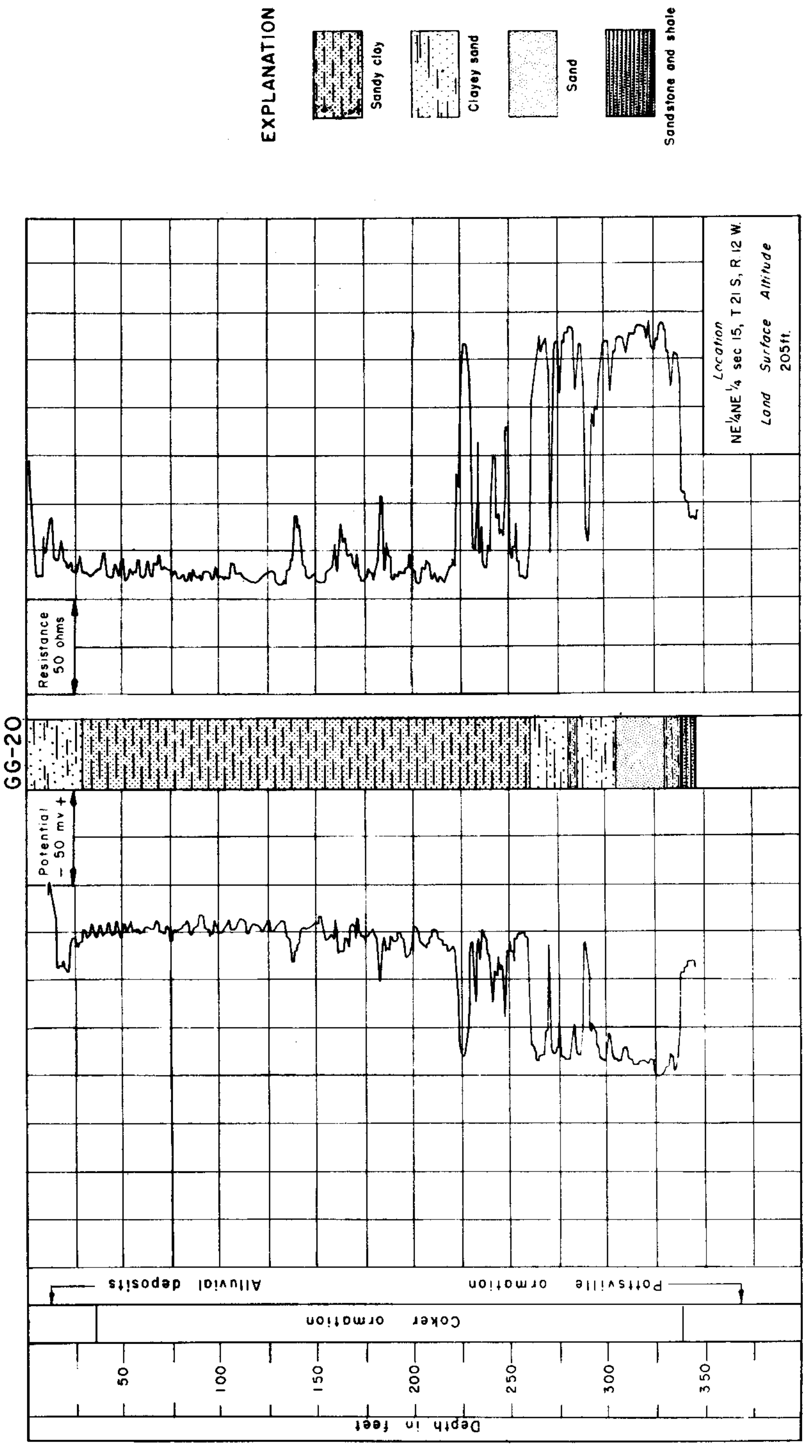

FF-10
Depth in feet
50
100
150
Terrace deposits
Coker Fm.
Pottsville Fm.
Potential
− 20 mv +
Resistance
50 ohms
Location
NE¼NW¼ sec. 13, T. 21 S., R. 11 W.
Land Surface Altitude
157 ft
FF-11
Depth in feet
50
100
150
Terrace deposits
Coker Fm.
Pottsville Fm.
Potential
− 20 mv +
Resistance
50 ohms
Location
NW¼ NE¼ sec. 13, T. 21 S., R. 11 W.
Land Surface Altitude
158 ft.
EXPLANATION
Sandy clay
Clayey sand
Sand
Sand and gravel
Sandstone and shale

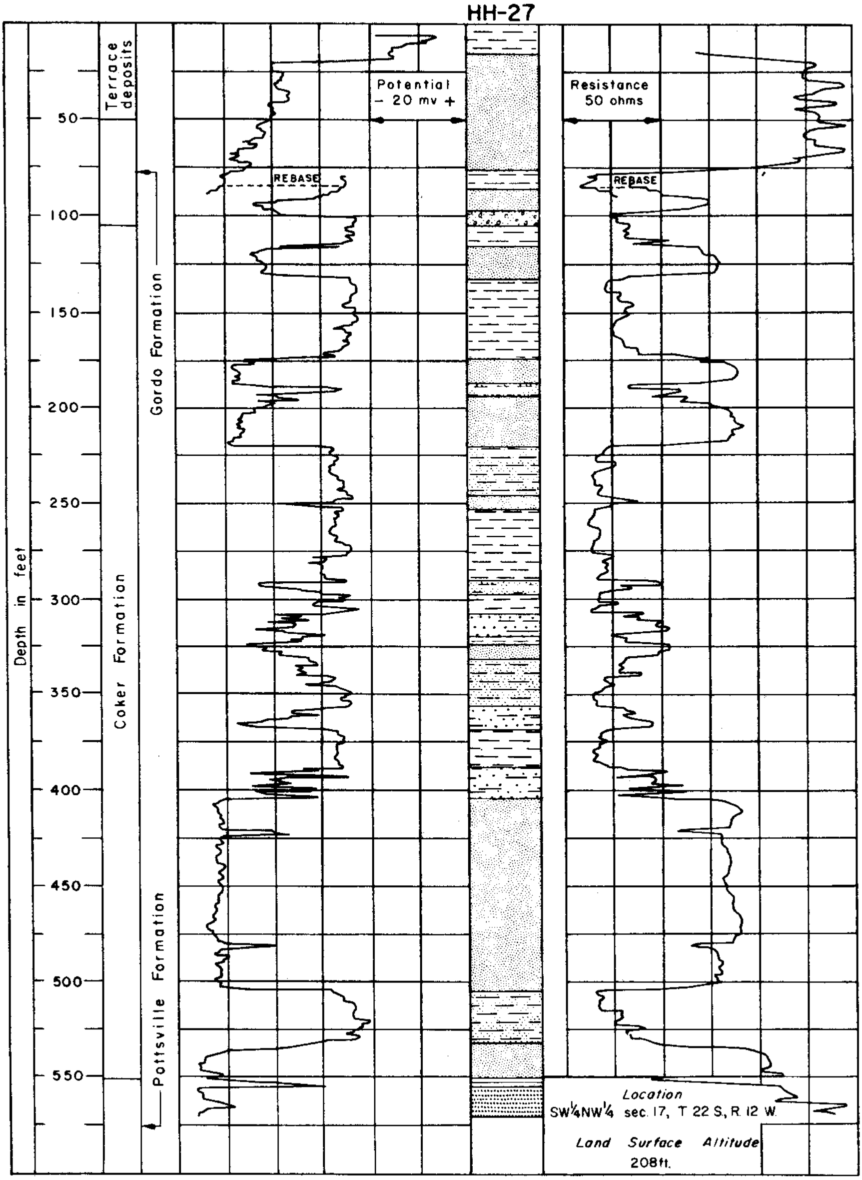

FF-18
Depth in feet
50
100
Alluvial deposits
Coker Fm.
Pottsville Fm.
Potential
− 20 mv +
Resistance
50 ohms
Location
SE¼NW¼ sec. 24, T.21 S., R.11 W.
Land Surface Altitude
141 ft.
FF-22
Depth in feet
50
100
150
200
Coker Formation
Pottsville Formation
Potential
− 20 mv +
Resistance
50 ohms
Location
SE¼SE¼ sec. 2, T.21 S., R.11 W.
Land Surface Altitude
299 ft.
EXPLANATION
Clay
Sandy clay
Clayey sand
Sand
Sand and gravel
Sandstone and shale
Shale


EXPLANATION
Clay
Sandy clay
Clayey sand
Sand
Sand and gravel
Sandstone and shale
FF-23
Location NW¼SE¼ sec. 11, T. 21 S., R. 11 W.
Land Surface Altitude 189 ft.
Resistance 50 ohms
Potential − 20 mv +
Coker Formation
Pottsville Formation
Depth in feet
50
100
FF-24
Location NW¼SE¼ sec. 11, T. 21 S., R. 11 W.
Land Surface Altitude 164 ft.
Resistance 50 ohms
Potential − 10 mv +
Terrace deposits
Coker Fm.
Pottsville Fm.
Depth in feet
50
100
FF-25
Location SW¼SE¼ sec. 13, T. 21 S., R. 11 W.
Land Surface Altitude 138 ft.
Resistance 50 ohms
Potential − 20 mv +
Alluvial deposits
Coker Fm.
Pottsville Fm.
Depth in feet
50

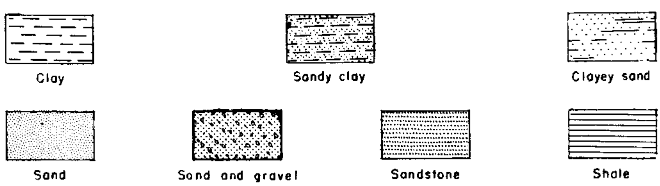

FF-26
Depth in feet
50
Terrace deposits
Coker Fm.
Pottsville Fm.
Potential
− 20 mv +
Resistance
25 ohms
Location
SE¼SW¼ sec. 13, T. 21 S., R. 11 W.
Land Surface Altitude
132 ft.
FF-27
Depth in feet
50
100
Alluvial deposits
Coker Fm.
Pottsville Formation
Potential
− 20 mv +
Resistance
50 ohms
Location
SE¼SE¼ sec. 14, T. 21 S., R. 11 W.
Land Surface Altitude
140 ft.
FF-28
Depth in feet
50
100
Alluvial deposits
Coker Fm.
Pottsville Formation
Potential
− 20 mv +
Resistance
50 ohms
Location
NW¼SE¼ sec. 14, T. 21 S., R. 11 W.
Land Surface Altitude
140 ft.
EXPLANATION
Sandy clay
Clayey sand
Sand
Sand and gravel
Sandstone and shale

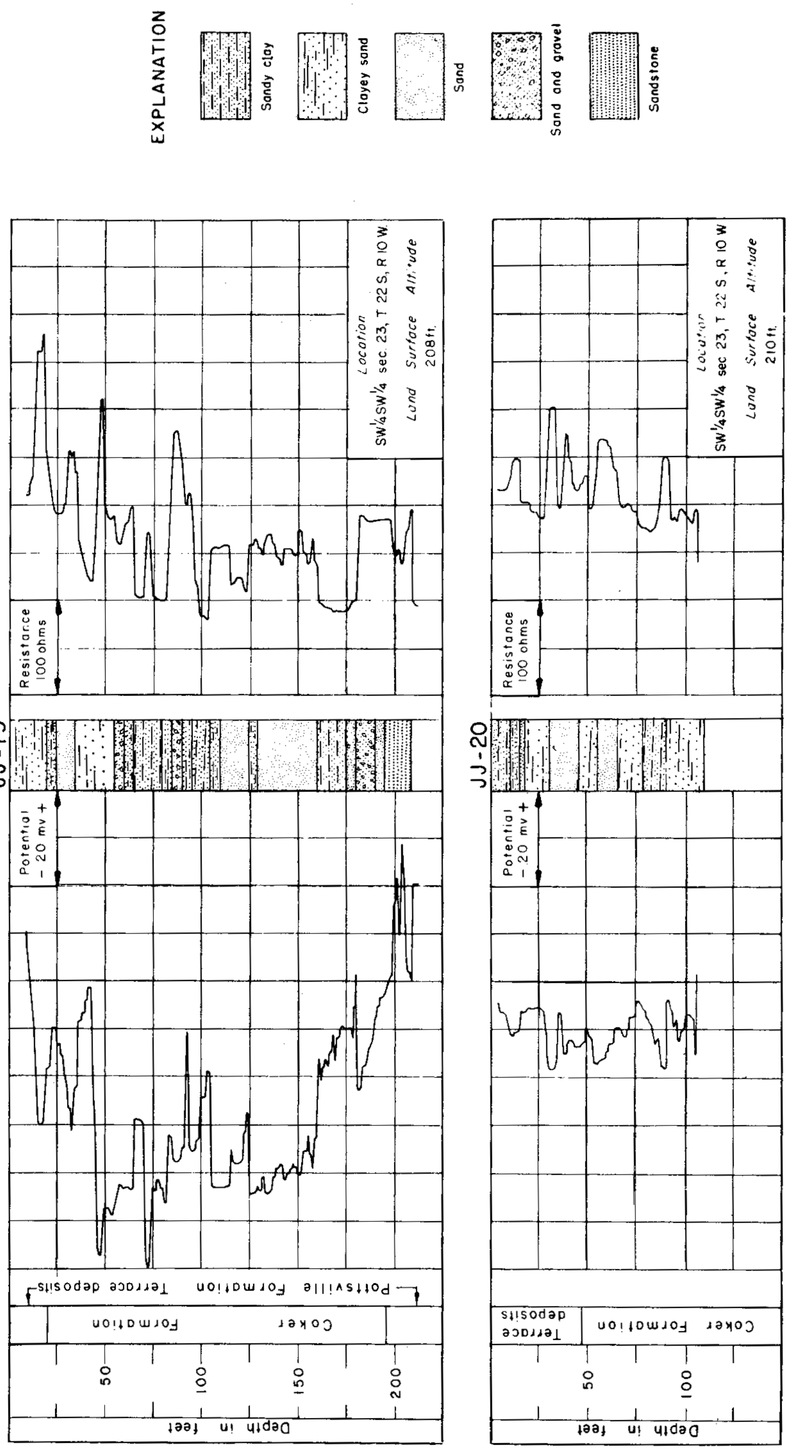

EXPLANATION
Clay
Sandy clay
Clayey sand
Sandstone and shale
FF-32
Resistance
10 ohms
Potential
− 10 mv +
Location
NE 1/4 NE 1/4 sec. 10, T. 21 S., R 11 W.
Land Surface Altitude
173 ft.
Pottsville Formation
Coker Formation
20
40
60
80
100
120
140
Depth in feet

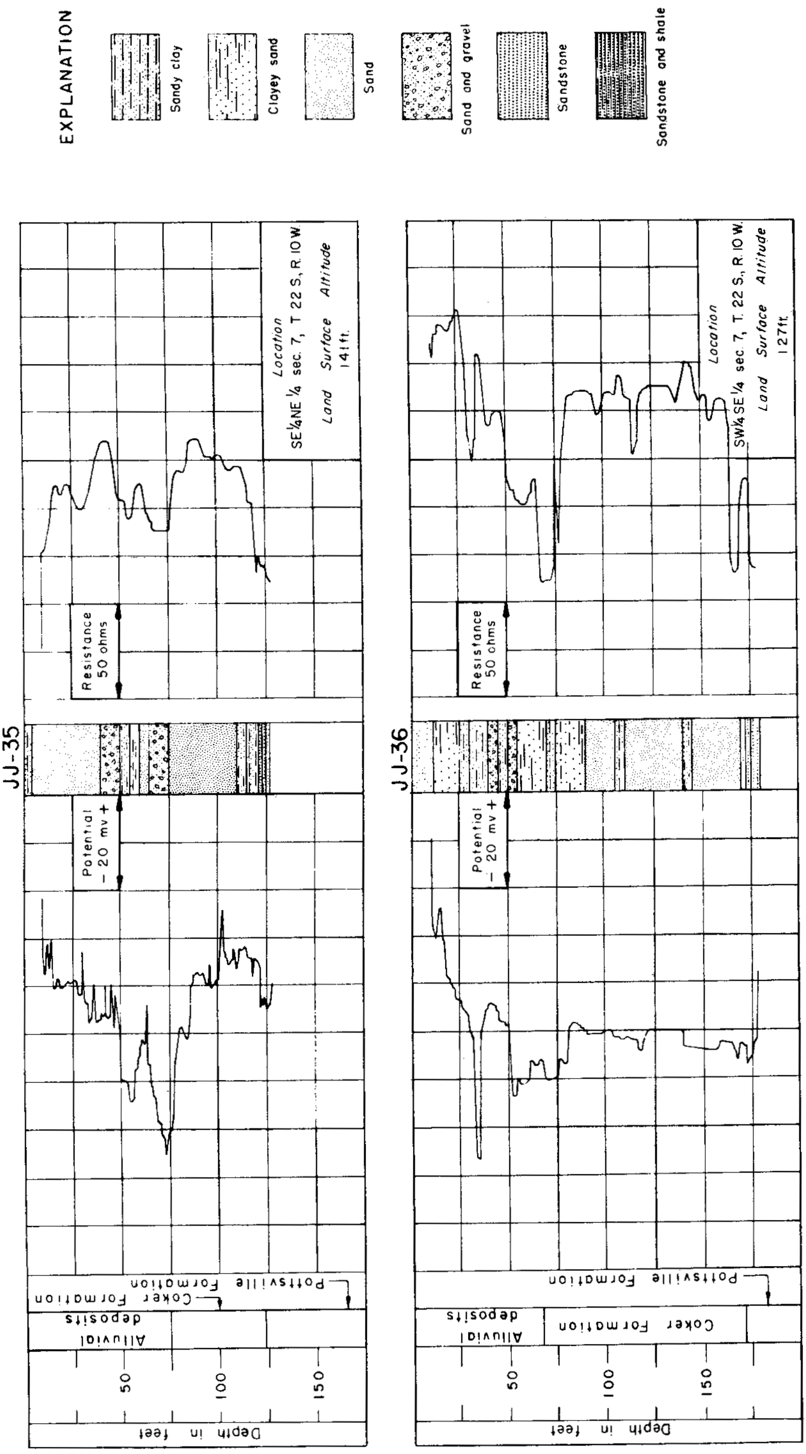

EXPLANATION
Sandy clay
Clayey sand
Sand
Sandstone and shale
GG-20
Resistance 50 ohms
Potential − 50 mv +
Location NE¼NE¼ sec 15, T 21 S, R 12 W.
Land Surface Altitude 205ft.
Alluvial deposits
Pottsville ormation
Coker ormation
50
100
150
200
250
300
350
Depth in feet

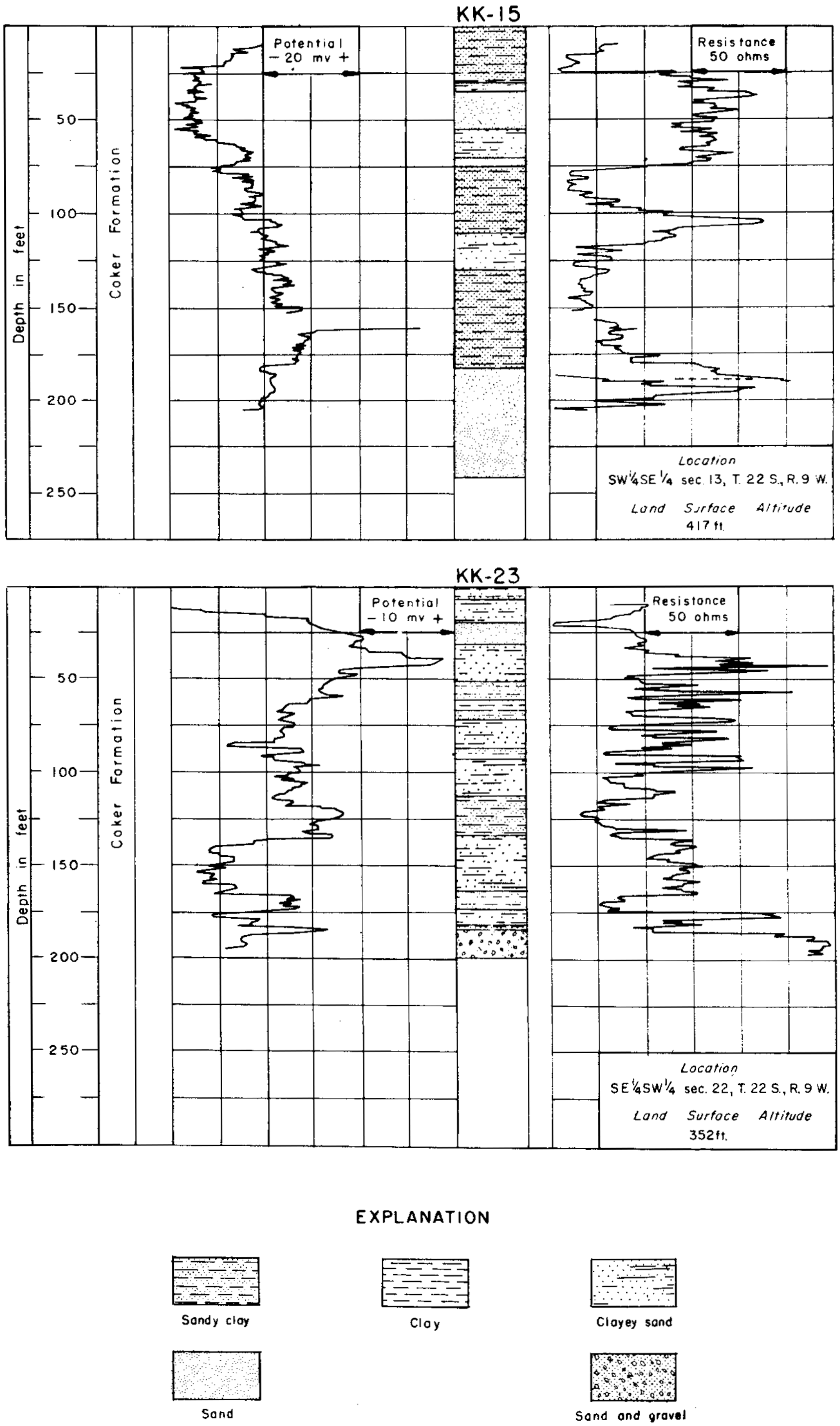


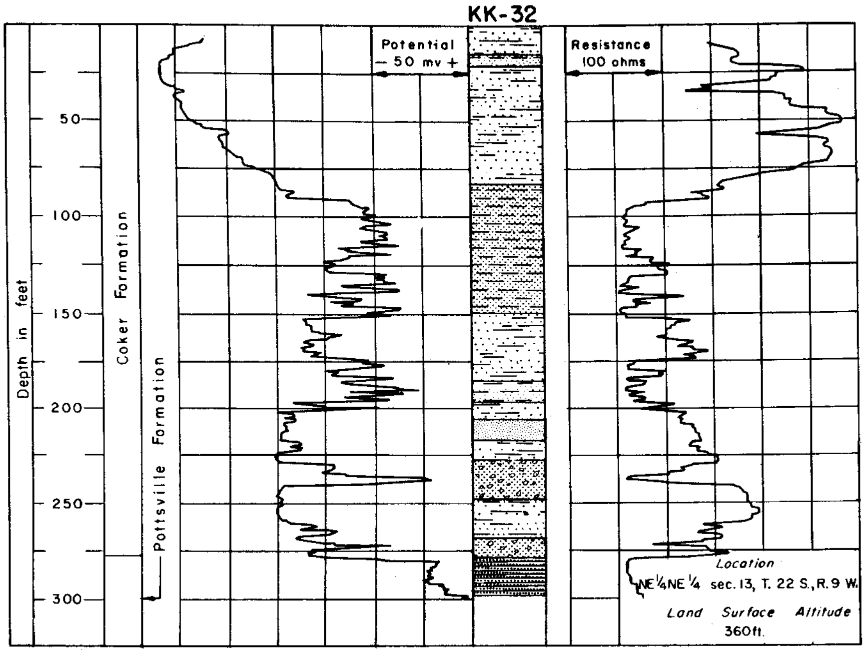
EXPLANATION

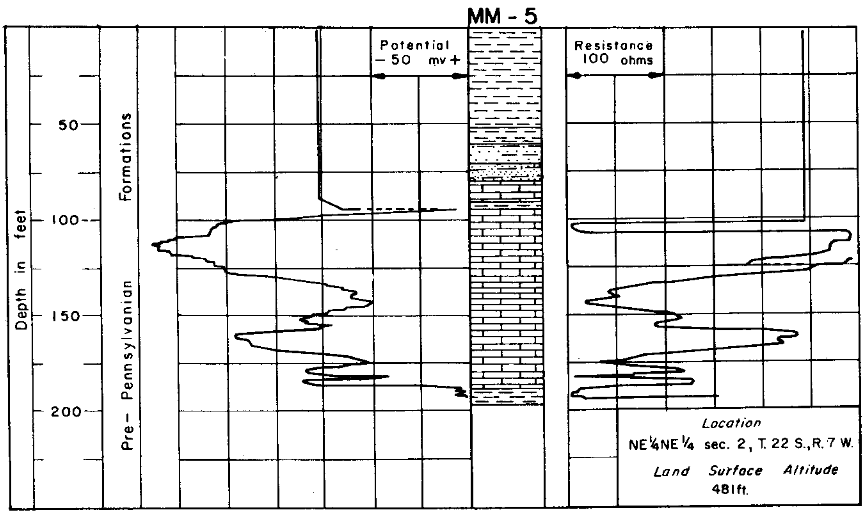



EXPLANATION
Sandy clay
Clayey sand
Sand
Sand and gravel
Sandstone
JJ-19
Location
SW1/4SW1/4 sec 23, T 22 S, R 10 W.
Land Surface Altitude 208 ft.
Resistance 100 ohms
Potential - 20 mv +
Terrace deposits
Pottsville Formation
Coker Formation
Depth in feet
50
100
150
200
JJ-20
Location
SW1/4SW1/4 sec 23, T 22 S, R 10 W
Land Surface Altitude 210 ft.
Resistance 100 ohms
Potential - 20 mv +
Terrace deposits
Coker Formation
Depth in feet
50
100

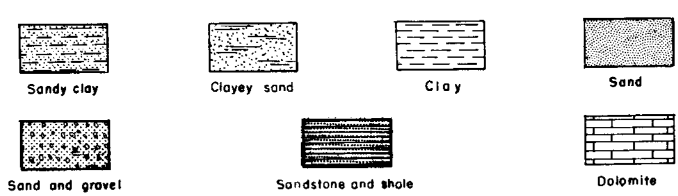

EXPLANATION
Sandy clay
Clayey sand
Sand
Sand and gravel
Sandstone
Sandstone and shale
JJ-35
Location
SE1/4NE1/4 sec. 7, T 22 S., R. 10 W.
Land Surface Altitude
141 ft.
Resistance
50 ohms
Potential
− 20 mv +
Alluvial deposits
Coker Formation
Pottsville Formation
Depth in feet
50
100
150
JJ-36
Location
SW1/4SE1/4 sec. 7, T. 22 S., R. 10 W.
Land Surface Altitude
127 ft.
Resistance
50 ohms
Potential
− 20 mv +
Alluvial deposits
Coker Formation
Pottsville Formation
Depth in feet
50
100
150


KK-15
Depth in feet
50
100
150
200
250
Coker Formation
Potential
−20 mv +
Resistance
50 ohms
Location
SW¼SE¼ sec. 13, T. 22 S., R. 9 W.
Land Surface Altitude
417 ft.
KK-23
Depth in feet
50
100
150
200
250
Coker Formation
Potential
−10 mv +
Resistance
50 ohms
Location
SE¼SW¼ sec. 22, T. 22 S., R. 9 W.
Land Surface Altitude
352 ft.
EXPLANATION
Sandy clay
Clay
Clayey sand
Sand
Sand and gravel





EXPLANATION



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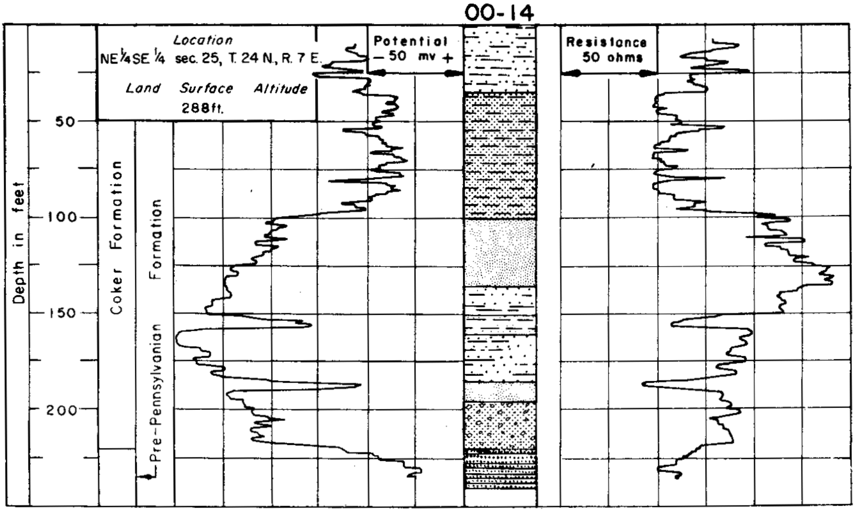

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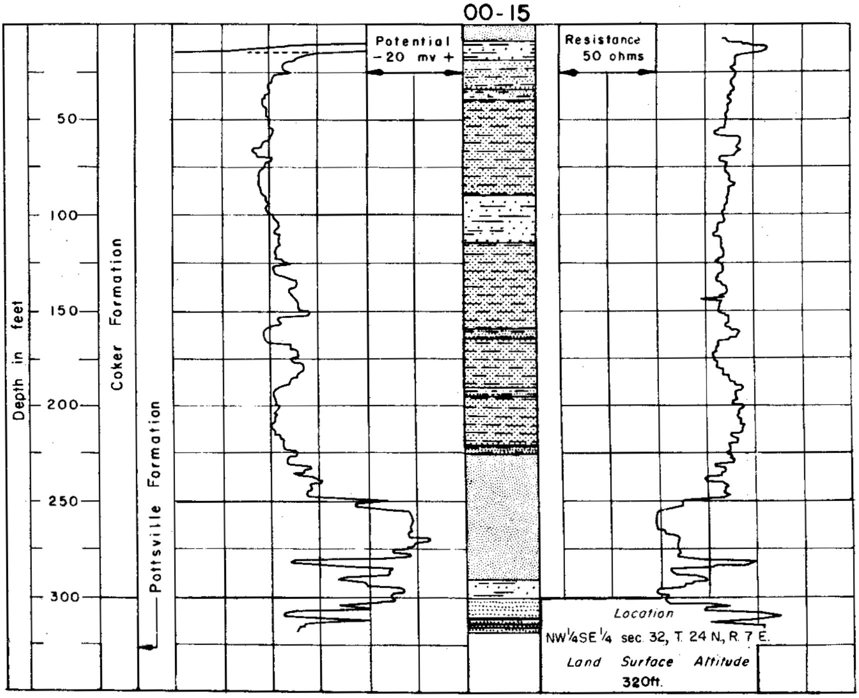
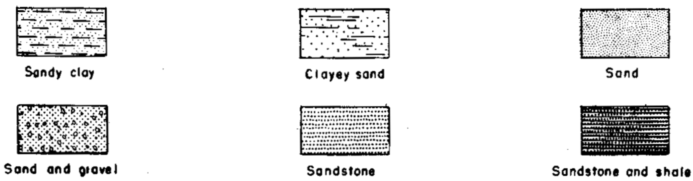
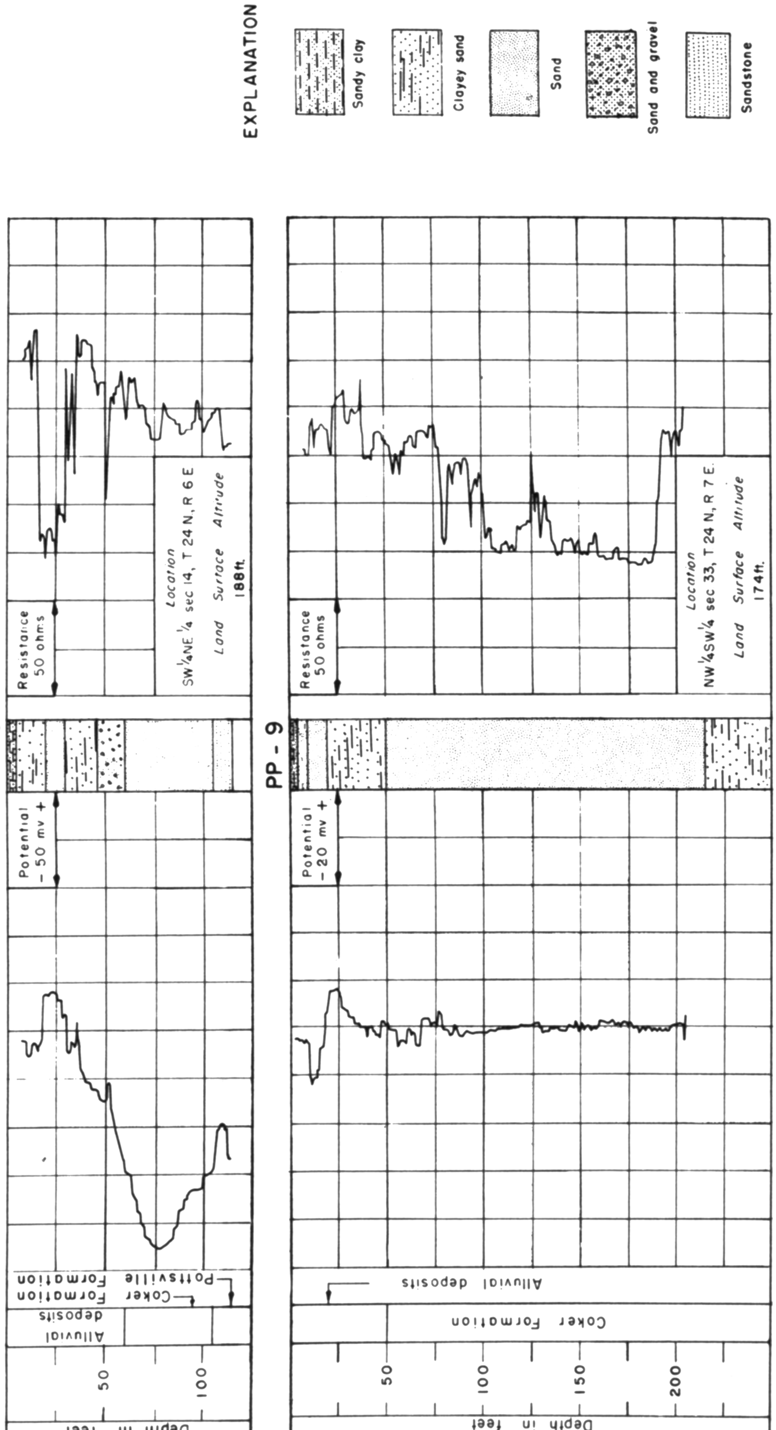
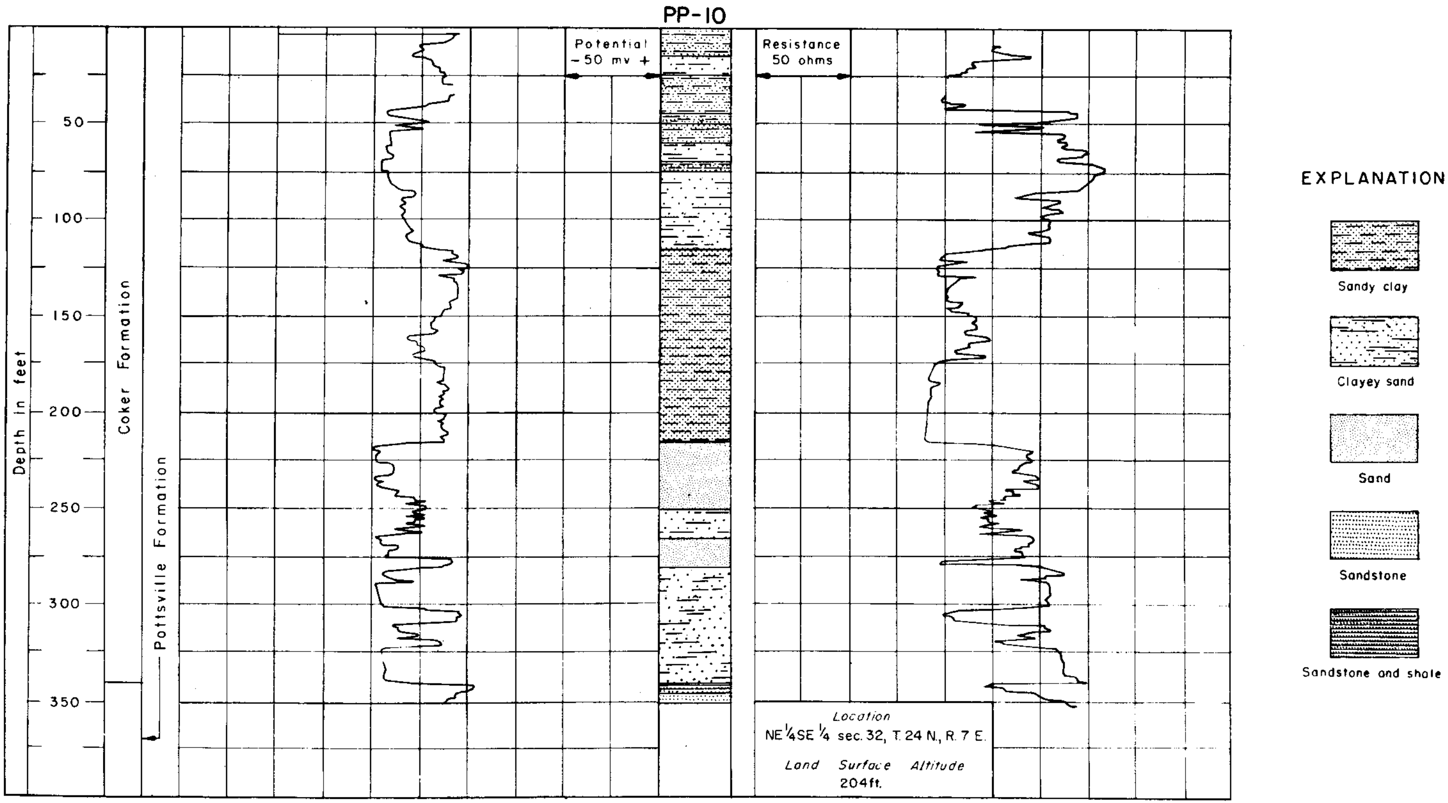
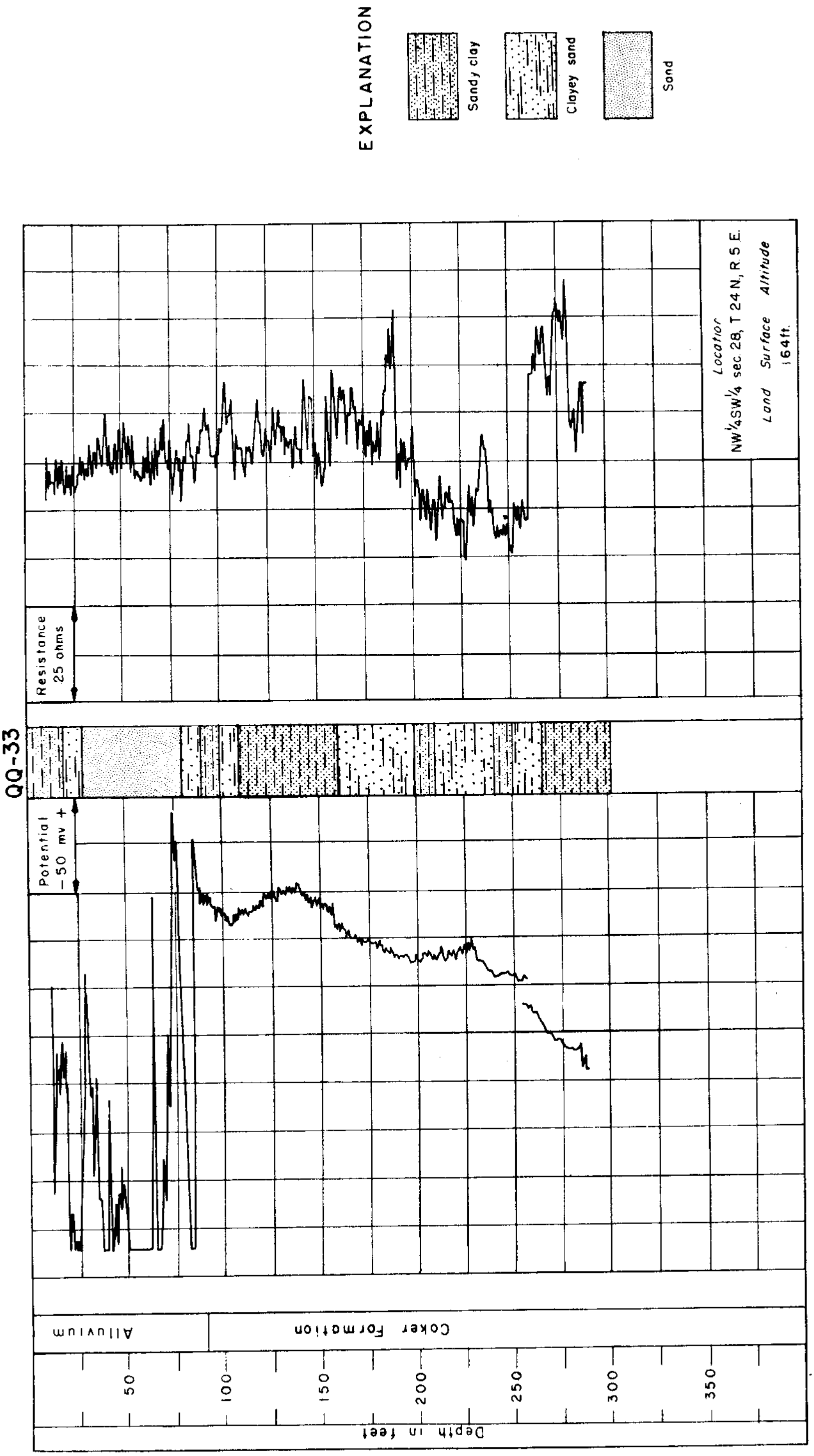


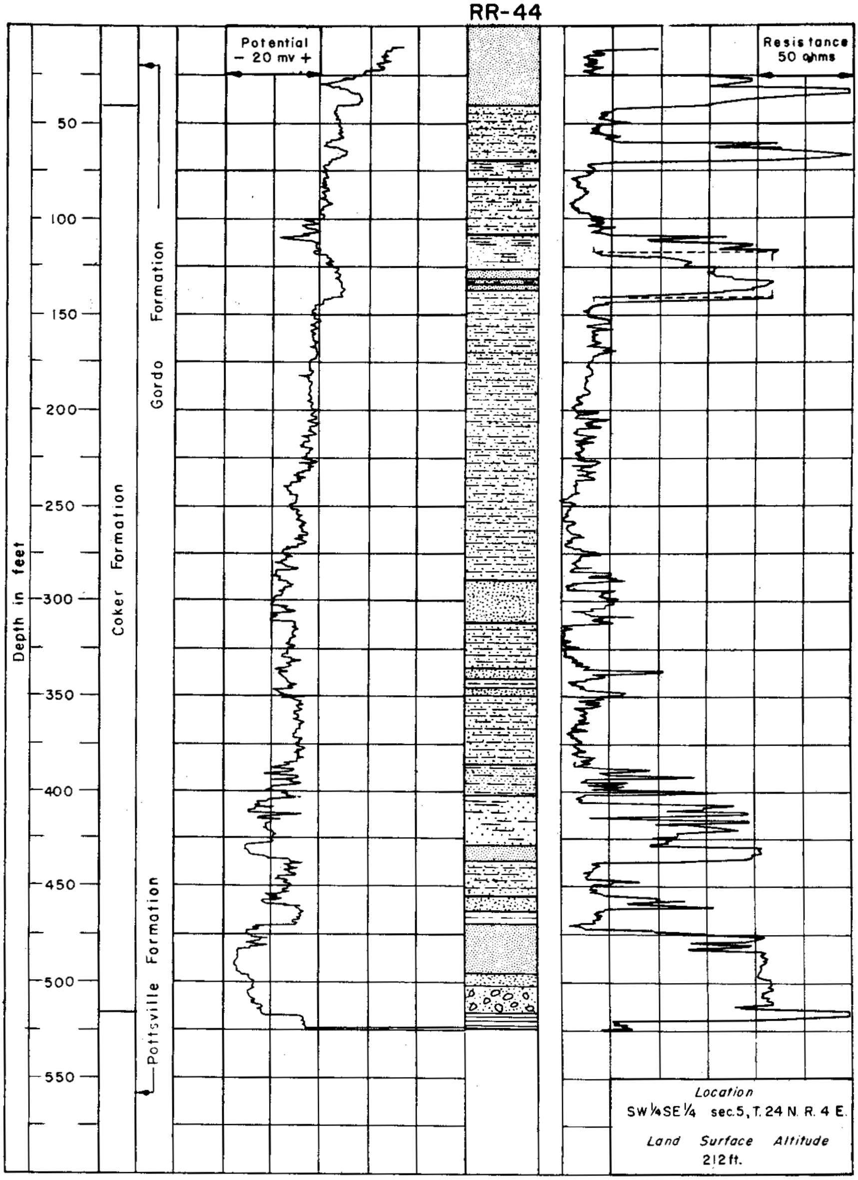
EXPLANATION



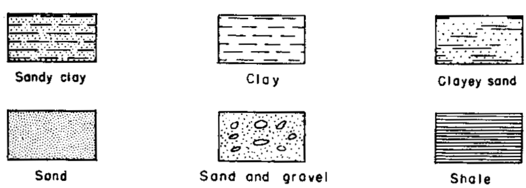

EXPLANATION
Sandy clay
Clayey sand
Sand
Sand and gravel
Sandstone
PP - 8
Potential
− 50 mv +
Resistance
50 ohms
Location
SW¼NE¼ sec 14, T 24 N, R 6 E
Land Surface Altitude
188ft.
Alluvial deposits
Coker Formation
Pottsville Formation
Depth in feet
50
100
PP - 9
Potential
− 20 mv +
Resistance
50 ohms
Location
NW¼SW¼ sec 33, T 24 N, R 7 E
Land Surface Altitude
174ft.
Alluvial deposits
Coker Formation
Depth in feet
50
100
150
200

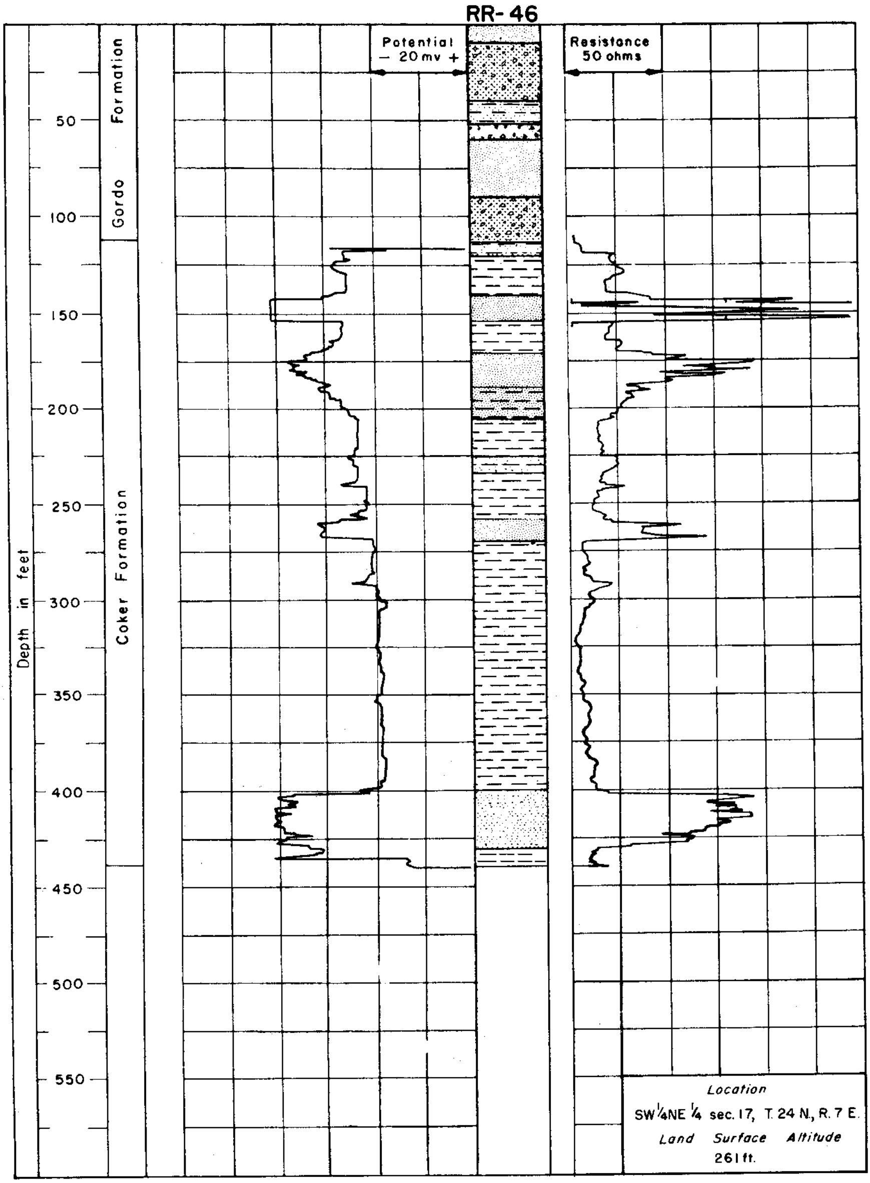

PP-10
Depth in feet
50
100
150
200
250
300
350
Coker Formation
Pottsville Formation
Potential
-50 mv +
Resistance
50 ohms
Location
NE1/4SE1/4 sec. 32, T. 24 N., R. 7 E.
Land Surface Altitude
204ft.
EXPLANATION
Sandy clay
Clayey sand
Sand
Sandstone
Sandstone and shale


EXPLANATION
Sandy clay
Clayey sand
Sand
QQ-33
Resistance
25 ohms
Potential
−50 mv +
Location
NW¼SW¼ sec. 28, T 24 N, R 5 E.
Land Surface Altitude
164 ft.
Alluvium
Coker Formation
50
100
150
200
250
300
350
Depth in feet



EXPLANATION





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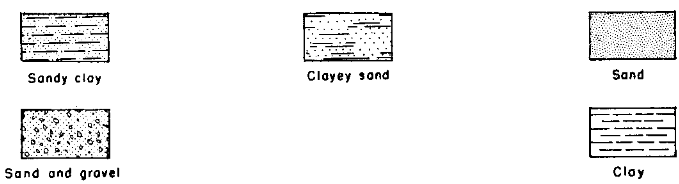
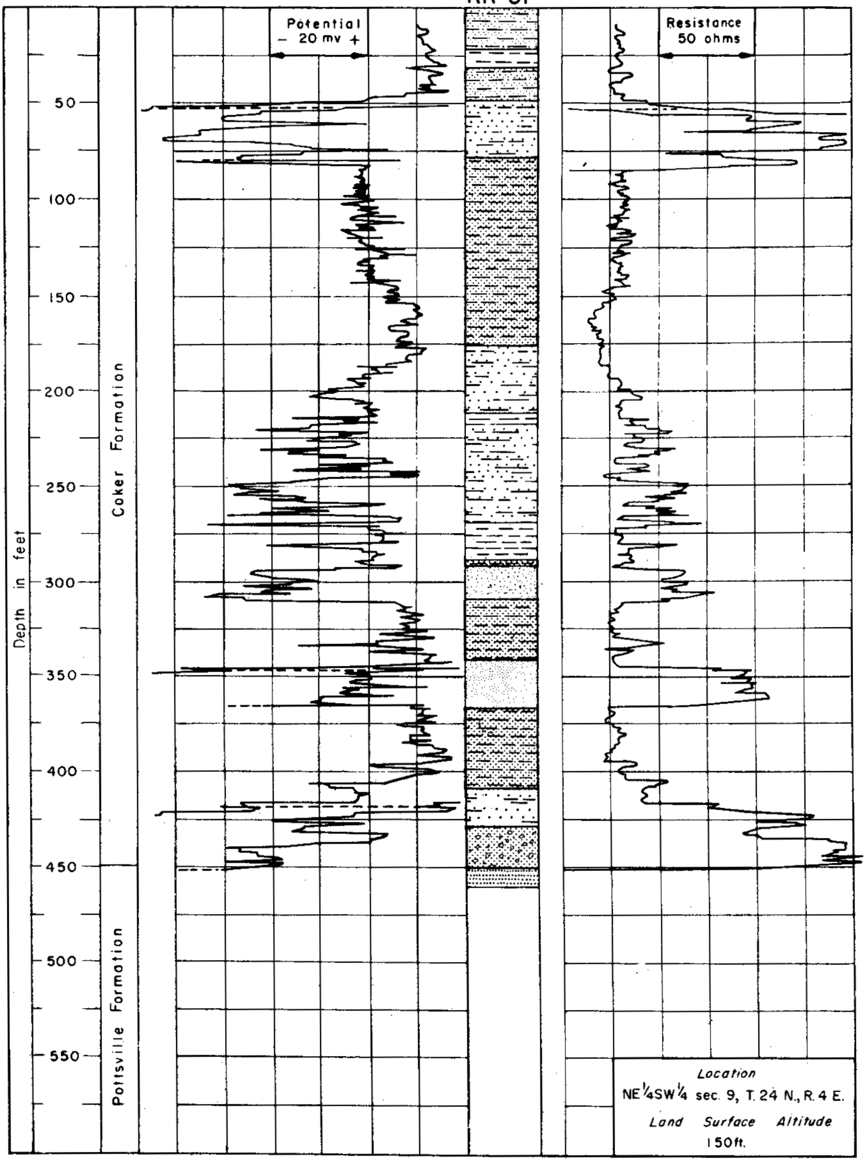


RR-51



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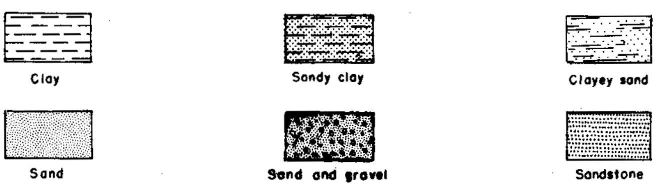
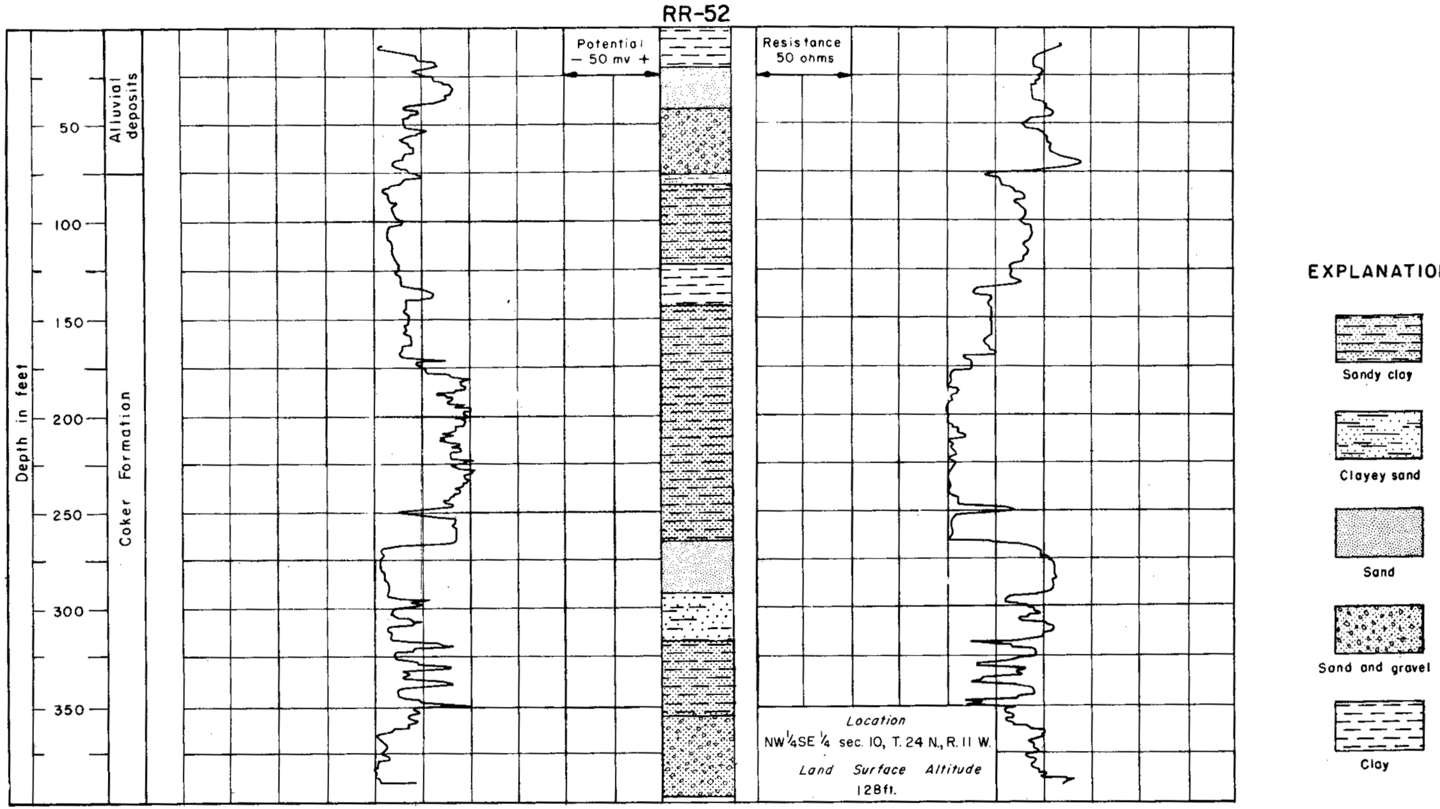
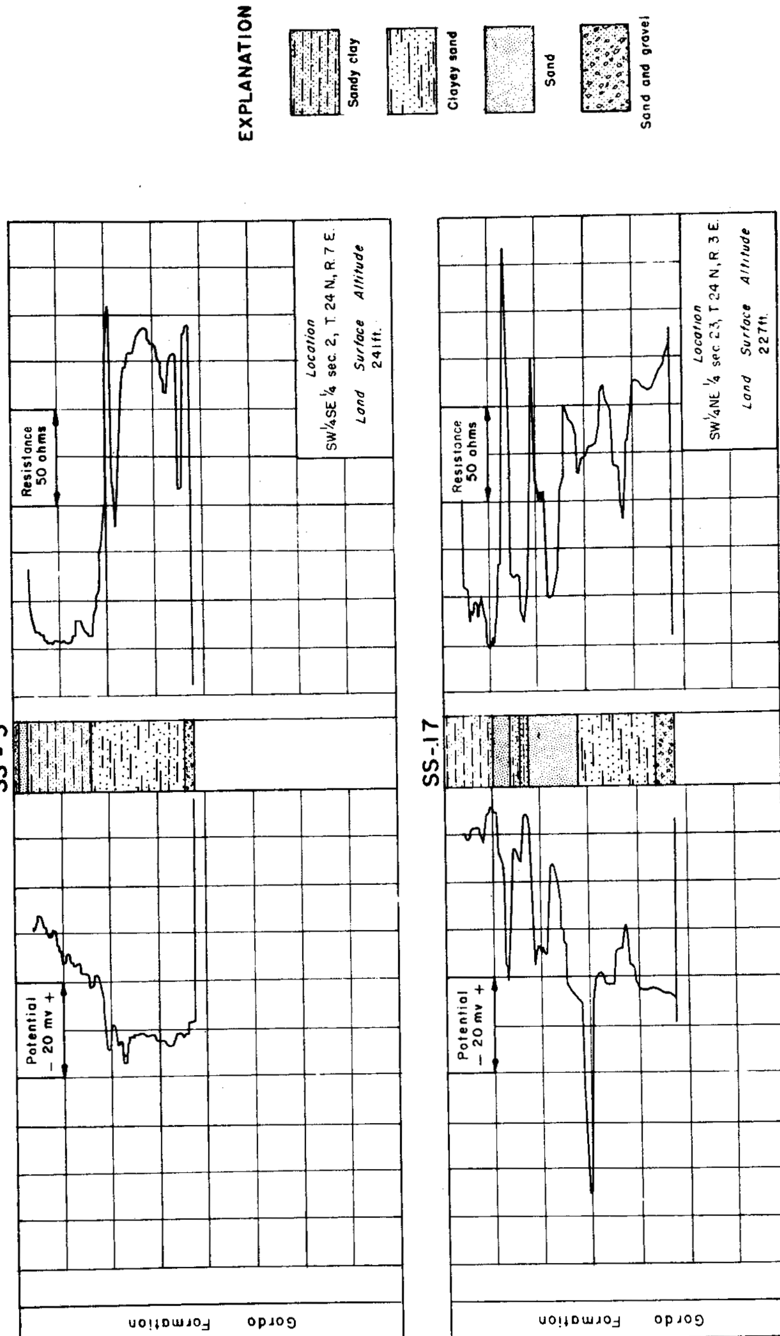



RR-52
Potential
— 50 mv +
Resistance
50 ohms
Depth in feet
50
100
150
200
250
300
350
Alluvial deposits
Coker Formation
Location
NW¼SE ¼ sec. 10, T. 24 N., R. 11 W.
Land Surface Altitude
128ft.
EXPLANATION
Sandy clay
Clayey sand
Sand
Sand and gravel
Clay


EXPLANATION
Sandy clay
Clayey sand
Sand
Sand and gravel
SS - 3
Resistance 50 ohms
Potential − 20 mv +
Location SW¼SE¼ sec. 2, T. 24 N., R. 7 E.
Land Surface Altitude 241 ft.
Gordo Formation
Depth in feet
50
100
150
SS-17
Resistance 50 ohms
Potential − 20 mv +
Location SW¼NE¼ sec. 23, T 24 N., R. 3 E.
Land Surface Altitude 227 ft.
Gordo Formation
Depth in feet
50
100
150