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GROUND WATER RESOURCES
OF
LIBERTY COUNTY, TEXAS

By W. H. Alexander, Jr.

With section on surface-water runoff

By Seth D. Breeding

Prepared in cooperation with the United States
Department of the Interior, Geological Survey

October 1945

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INTRODUCTION

Location and extent of area

Liberty County is a part of the Coastal Plain in southeastern Texas and the south boundary of the county is 25 to 40 miles from the Gulf Coast. It is bounded on the west by Harris and Montgomery Counties, on the north by San Jacinto and Folk Counties, on the east by Hardin and Jefferson Counties, and on the south by Chambers County. The land surface is level to gently rolling, except in areas bordering the valleys of the Trinity River and the East Fork of the San Jacinto River where it has been eroded into small hills. The minimum elevation is about 5 feet above sea level on the flood plain of the Trinity River at the southern boundary of the county and the maximum elevation is about 170 feet near Cleveland in the northwestern part of the county. The Trinity River crosses the county from north to south in a broad valley 4 to 8 miles wide and 25 to 50 feet below the general level. The county has an area of 1,160 square miles and in 1940, according to the U. S. Bureau of the Census, had a population of 24,541, an average of 21 persons per square mile. The principal towns and their population in 1940 are: Liberty, (county seat) 3,087; Daisetta, 2,000; Cleveland, 1,783; Dayton, 1,279; Hall, 1,000.

Economic development

The economic development of Liberty County is diversified. The county ranks high as a producer of oil. During the year ending August 31, 1942, a total of 5,258,800 barrels was produced according to the Texas Almanac for 1942-44, published by the Dallas News. The total production in the county from 1918 to 1940, inclusive, was 129,640,000 barrels ^{1/}. Other mineral resources are natural gas, sulphur, sand, and gravel. Considerable timber is cut commercially, especially in the northern part of the county. Agriculture is diversified, the most important crops being rice and cotton. Beef cattle and hogs are the major livestock products, but some sheep and goats are raised. Dairying is also an important industry.

^{1/} Leavenworth. P. B., Oil and gas production in the Texas Gulf Coast during 1940: Am. Inst. Min. Met. Eng., Petroleum Development and Technology, 1941, pp. 440-458.

Precipitation

According to records of the United States Weather Bureau, the average annual precipitation at Liberty during 40 years was 51.05 inches. Among the wettest years were 1914 with 68.64 inches; 1919 with 85.08 inches; 1923 with 71.56 inches; 1926 with 62.13 inches; 1941 with 65.27 inches; and 1943 with 63.74 inches. The driest years include 1904 with 30.15 inches; 1909 with 39.36 inches; 1916 with 34.88 inches; 1917 with 29.82 inches; 1924 with 33.99 inches; and 1936 with 39.61 inches. The following table gives the U. S. Weather Bureau records of precipitation at Liberty by months.

Precipitation in inches, 1903 to 1944, at Liberty, Texas

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1905	-	-	-	-	-	-	-	-	-	1.96	.00	1.60	-
1904	.08	2.20	.07	5.70	4.00	4.50	2.50	2.85	2.00	1.70	1.65	2.90	30.15
1905	2.60	5.09	9.95	4.60	4.65	6.85	3.60	1.10	.40	2.65	4.70	5.10	51.29
1906	1.40	2.50	1.85	3.30	.80	.59	5.60	2.10	7.63	10.65	.75	4.30	41.47
1907	.61	2.11	2.70	2.65	18.10	2.20	1.45	3.03	5.75	6.85	6.75	4.80	57.00
1908	3.65	8.00	2.35	9.50	4.39	5.95	4.10	3.66	6.32	2.24	1.66	1.31	53.04
1909	T	1.88	.67	1.65	5.02	7.01	5.17	2.99	.60	8.25	2.51	4.11	39.36
1910	2.46	2.72	.94	2.19	6.28	4.66	7.42	1.95	2.77	4.27	.82	6.06	42.54
1911	.35	.04	3.98	6.52	5.08	3.83	8.93	2.54	1.68	2.82	2.24	14.10	52.11
1912	1.31	2.98	4.65	7.68	5.86	6.39	3.90	5.50	1.16	1.22	1.41	11.79	53.85
1913	5.67	4.42	2.28	5.44	3.43	2.39	.65	4.85	8.49	9.13	4.28	5.13	56.16
1914	1.34	3.47	6.30	3.93	14.88	2.14	1.23	9.28	3.19	1.84	19.91	10.13	68.64
1915	3.44	4.38	3.16	3.30	1.65	.37	4.80	22.70	1.48	2.60	3.45	6.30	57.63
1916	3.39	.18	T	2.27	7.69	1.08	4.09	4.12	5.73	.32	2.94	3.97	34.88
1917	2.12	2.08	2.72	4.28	2.66	.13	5.88	3.96	.31	2.31	.92	1.95	29.82
1918	1.41	2.47	3.79	5.55	.81	3.97	1.17	2.66	3.21	5.12	6.36	4.89	41.41
1919	7.60	4.62	5.02	1.63	10.31	15.66	6.36	6.60	4.39	16.76	3.29	2.84	85.08
1920	6.22	2.05	2.24	.33	6.25	6.19	3.24	9.64	1.18	9.87	4.08	3.99	55.28
1921	4.22	1.12	3.65	5.72	2.22	4.97	5.34	.56	5.71	1.12	1.04	7.19	42.86
1922	6.31	3.27	7.44	4.93	5.58	7.24	5.39	1.51	1.46	1.25	7.14	4.48	56.09
1923	2.59	5.71	5.74	9.06	7.33	5.77	3.66	5.13	4.42	4.41	3.71	14.03	71.56
1924	5.34	4.77	2.47	3.81	4.42	3.08	.93	2.24	1.16	T	1.58	4.19	33.99
1925	4.86	1.00	1.49	.66	.63	4.39	3.14	3.79	3.15	10.51	12.67	2.44	48.73
1926	6.25	1.68	11.27	4.88	4.19	9.32	4.23	3.25	5.47	5.60	2.01	3.98	62.13
1927	1.33	2.99	2.80	5.00	2.72	11.78	2.03	T	5.06	6.39	2.05	7.90	50.55
1928	1.24	4.43	1.87	2.95	7.03	9.29	2.66	3.67	3.53	3.15	6.66	3.52	50.00
1929	5.65	2.72	3.25	4.53	13.18	1.91	3.95	.57	2.60	1.92	10.21	2.78	53.27
1930	6.42	3.63	2.07	.64	6.50	2.50	1.72	2.58	3.35	8.72	3.28	5.36	46.77
1931	5.06	7.09	4.65	3.02	2.28	1.00	4.42	3.19	1.39	1.18	4.58	7.11	44.98
1932	7.78	4.24	1.24	1.91	3.38	4.38	1.23	6.88	1.81	1.42	2.51	6.09	42.87
1933	-	4.10	2.88	1.93	2.98	2.41	15.04	2.42	3.63	1.57	.63	3.30	-
1934	10.08	4.56	6.79	6.01	1.31	.97	2.24	3.36	7.41	.69	6.04	3.69	53.15
1935	3.34	3.34	4.66	4.71	4.18	6.76	5.62	1.84	7.28	2.74	4.05	10.85	59.38
1936	1.40	3.72	.99	2.29	8.81	.39	6.55	1.24	2.16	2.45	2.72	6.89	39.61
1937	5.79	2.42	9.18	.52	T	5.83	2.22	5.17	6.05	6.79	1.97	5.58	51.52
1938	6.11	3.92	2.63	2.30	7.93	6.90	4.95	1.89	4.22	1.23	4.03	2.63	48.74
1939	10.73	4.06	1.14	2.73	2.72	1.77	8.20	2.49	2.25	.71	3.38	3.21	43.39
1940	1.42	3.86	1.54	4.05	2.20	4.42	2.03	6.68	.83	4.84	10.33	10.37	53.47
1941	2.59	2.93	5.28	6.80	7.06	8.94	4.81	.97	12.62	8.99	2.04	2.24	65.27
1942	3.59	3.05	3.00	8.50	3.29	6.82	7.33	7.45	5.11	3.22	2.18	2.55	56.09
1943	4.20	.55	3.64	1.14	7.00	2.82	16.40	1.24	4.89	.70	6.79	4.80	54.17
1944	8.73	2.19	7.71	.76	13.42	1.80	2.01	8.59	1.91	1.66	5.93	9.03	63.74

Average -- 51.05

Acknowledgments

The writer is indebted to many persons who have contributed information for this report. The representatives of several oil companies, city officials of Liberty, Cleveland, and Dayton, and water-well drilling contractors furnished well logs and other important well data.

The work was done under the general direction of W. N. White, engineer in charge of ground-water investigations in Texas.

The water analyses were made under the supervision of W. W. Hastings, chemist of the Quality of Water Division of the U. S. Geological Survey. The results of the analyses, which relate to the mineral constituents in the water and not to its sanitary character, are tabulated in parts per million on pages 61 to 66.

OCCURRENCE AND MOVEMENT OF GROUND WATER

General principles

For discussion of the fundamental principles of the occurrence and movement of ground water the reader is referred to papers by Meinzer and Wenzel ^{2/}.

Ground water is derived chiefly from water that falls as rain and snow. A part of the precipitation runs off in streams, a part is returned to the atmosphere by evaporation and transpiration of trees and other plants, and a part sinks to the zone of saturation in which all the interstitial openings of the rocks are filled with water.

In most places ground water is slowly but steadily moving under the influence of gravity from areas of intake to areas of discharge. In the more permeable rocks, such as coarse sand, gravel, and porous limestone, the water moves with comparative freedom although the movement is very slow as compared to the flow of a stream. Such rocks are capable of yielding abundant supplies of water to wells. In less permeable rocks such as shale or clay, molecular attraction and surface tension retard the movement of the water which may be almost infinitely slow. Such rocks yield little or no water to wells.

On the outcrop of water-bearing beds, the water is usually unconfined and does not rise in wells above the water table, which is the upper surface of the zone of saturation and the level at which the water is first encountered.

The water table is not a level surface, but it usually slopes in about the same direction as the slope of the land surface. It is generally high under areas of ground-water intake and low under areas of ground-water discharge. The land surface in places is lower than the water table in adjacent areas and in such localities some of the ground water emerges as springs. In some localities perched water accumulates above the main zone of saturation, especially during the winter and spring when the rates of evaporation and transpiration are low. Such supplies are usually small and are not dependable.

^{2/} Meinzer, O. E., The occurrence of ground water in the United States; U. S. Geol. Survey Water-Supply Paper 489, 1923; Outline of methods for estimating ground-water supplies: U. S. Geol. Survey Water-Supply Paper 638C, pp. 99-145, 1931.

Wenzel, L. K., Method for determining permeability of water-bearing materials: U. S. Geol. Survey Water-Supply Paper 887, 1942.

Meinzer, O. E., and Wenzel, L. K., Physics of the Earth, vol. 9, Hydrology, pp. 385-478, McGraw-Hill, New York, 1942.

In areas down the dip of the water-bearing beds where the rocks are under cover and inclined between relatively impermeable strata, the water usually is under artesian pressure and will rise in wells above the level at which it is first encountered. If the altitude to which the water will rise is greater than the altitude of the land surface, flowing wells may be obtained.

The rocks underlying Liberty County to depths of at least 2,000 feet consist chiefly of clays and shales interbedded with sands. The beds are inclined, the dip being toward the Gulf of Mexico. The general slope of the land surface is also toward the southeast. Hence, artesian conditions occur in all parts of the county. The valley of the Trinity River is well known for its flowing water wells which range from 100 to 808 feet in depth. On the upland only the deeper wells flow, the shallowest flowing well being about 1,200 feet.

Most wells are subject to water-level fluctuations of varying magnitude. These fluctuations are due to many different causes, but most of them are a manifestation of a change in the ratio between the rate of ground-water intake or recharge and the rate of loss or discharge. Most water-table wells are supplied in part from intake areas close at hand and respond with a moderate lag to changes in rainfall. In very shallow wells the water level may rise several feet after heavy rains and decline until the wells go dry during prolonged droughts. Artesian wells that draw from sand or sandstone and at considerable distances from the outcrops of the water-bearing beds seldom are affected by seasonal or yearly changes in rainfall, although they may respond to the effect of a series of wet or dry years. Fluctuations in pressure in such wells and accompanying rise and fall in water levels are usually due to withdrawals of ground-water from the well itself or from other wells.

When a well is pumped the water level in the well drops and a hydraulic gradient is developed toward the well from all directions. It is this hydraulic gradient that causes water to flow toward the well. Within limits the amount of water that will enter a well varies directly with the amount the water level is lowered. For example, if a pumped well in fairly permeable material will yield 50 gallons a minute when the water level is lowered 10 feet, it will yield about 100 gallons a minute when the water level is lowered 20 feet. This ratio between the drawdown and the yield of the well is called the specific capacity and is expressed as yield in gallons a minute per foot of drawdown. The ratio is a very useful gauge of the productivity of a well.

Heavy withdrawals of ground water are sure to be accompanied by a general lowering of the water table or artesian pressures, a cone of depression gradually spreading out in all directions from the center of pumpage until large areas may be affected. However, this is usually considered not very serious unless the rate of decline persists without a corresponding increase in the rate of pumping or the trend is such as to indicate that the pumping lift may eventually exceed the economic limit. In some areas beds carrying fresh water are overlain by beds carrying salty water and excessive pumping may lead to the invasion of salt water into the wells.

GEOLOGIC FORMATIONS AND THEIR WATER-BEARING PROPERTIES

With the exception of recent alluvial deposits along the Trinity River and one small area of Willis sand in the northwestern corner of the county, the rocks that crop out in Liberty County are of Pleistocene age and belong to the Lissie formation and Beaumont clay (see geologic map, fig. 1). These rocks are underlain in downward succession by the Willis sand (and possibly by the Goliad sand), Lagarto clay, and Oakville sandstone, Catahoula sandstone, and older rocks. The Oakville sandstone and Lagarto clay have not been differentiated east of the Brazos River on the U. S. Geological Survey map of Texas and are considered in this report as though they were one unit. The rocks of these formations crop out in Montgomery, San Jacinto and Polk Counties, and a part of the outcrop area is shown on the geologic map. The Goliad sand has not been identified in outcrop in this part of Texas, but may be present and hidden by overlap of younger formation.

The information given below is based in part on Bulletin 3232 of the Texas Bureau of Economic Geology 3/, in part on recent articles in the Bulletin of the American Association of Petroleum Geologists, and in part on well logs obtained by the writer.

Beginning with the Oakville sandstone and Lagarto clay, the rocks are listed in the order in which they were deposited or in age from oldest to youngest. This is the order in which the outcrops are successively crossed in travelling over the area from northwest to southeast.

Miocene and Pliocene series

Oakville sandstone and Lagarto clay - The beds of the Oakville sandstone (Miocene) and Lagarto clay (Miocene?) which, as previously mentioned, crop out in Montgomery, San Jacinto and Polk Counties, dip southeastward toward the Gulf at the rate of about 60 feet to the mile (see figs. 2 and 3). In northern Liberty County they consist predominantly of clay, usually containing calcareous layers, but include important beds of water-bearing sands. They are believed to have a total thickness of at least 1,400 feet. At Cleveland, in the northwest corner of the county, wells in sands of these formations yield water of good quality. Down the dip in the central part of the county the water becomes brackish. The estimated position of the contact between fresh and brackish water in these formations based on the writer's interpretation of electrical logs of a few oil tests, is shown by the dashed lines in figures 1 and 2.

Willis sand (and Goliad sand?) - The Willis sand of Pliocene (?) age and possibly the Goliad sand of Pliocene age crop out in a belt 10 to 15 miles wide, paralleling and just south of the outcrop of the Oakville sandstone and Lagarto clay. The Willis sand has been described 4/ in general as a red sand, coarse and gravelly in part, and slightly indurated, having a total thickness of about 85 feet.

3/ Sellards, E. H., Adkins, W. S., and Plummer, F. B., The Geology of Texas: vol. 1, Stratigraphy, Texas Univ. Bull. 3232, pp. 727-795, 1932.

4/ Dearing, John, Post-Fleming surface formations of Coastal Southeast Texas and South Louisiana: Am. Assoc. Pet. Geologists Bull. vol. 19, pp. 660-668, 1935.

Pleistocene and Recent series

Lissie formation - The Lissie formation of Pleistocene age overlies the Willis sand (and Goliad sand?) and appears in outcrop in a belt about 15 miles wide, paralleling and just south of the outcrop of the Willis sand (see fig. 1). The Lissie formation has been described by Meyer 5/ as a sequence of gravels, sands, sandy clays, and clays which are distinguished from the underlying Willis sand by a generally finer texture and from the overlying Beaumont clay by a generally coarser texture. However, in Liberty County it is not possible to differentiate between the beds of the Willis sand, Goliad sand (if present), and Lissie formation in drillers' and electrical logs, and for convenience in this report the combination will be called the Lissie formation. The total thickness of the Lissie formation, as thus designated, ranges from about 200 feet in the northwestern part of the county to about 1,400 feet in the southern part. The individual beds of sand range from a few feet to about 80 feet in thickness.

In the northern and central parts of the county the Lissie formation contains fresh water at all depths, but in the southern part the middle and lower beds contain brackish or salty water. The estimated position of the contact between the fresh and salty water in the formation in the southern part of the county is shown in figures 2 and 3.

Beaumont clay - The Beaumont clay of Pleistocene age overlies the Lissie formation, and its outcrop area covers all the county south of the outcrop of the Lissie. The Beaumont clay has been described 6/ as being composed of calcareous, mottled clays and sand, and silt, with clays locally comprising as much as 80 percent of the formation. Surface exposures of sand in the Beaumont clay are largely confined to narrow belts which are believed to be old stream channels. The individual beds of sand range in thickness from a fraction of a foot to 30 feet, and locally slightly more. Drillers' logs of wells within a belt which extends for 5 or 6 miles south of the outcrop belt of the Lissie formation show a distinct contrast between the clays and thin sands of the Beaumont clay and the thicker sands of the underlying Lissie formation. Farther south the distinction is not so sharp and the lower limit of the Beaumont clay is difficult to define. The Beaumont clay thickens from a feather-edge at the Lissie outcrop to an estimated depth of about 400 feet in the southern part of the county. The sands in the Beaumont are fine-textured, and it is usually more difficult to develop a satisfactory well in them than in the sands of the Lissie formation.

Alluvial deposits - Deposits of Recent alluvial sand, clay, and gravel, having a thickness of a few feet to 80 feet, are reported in drillers' logs of water wells in the flood plain and adjacent terraces of the Trinity River. The alluvium covered area ranges from 4 to 8 miles in width and extends all the way across the county. These deposits are an important source of ground water for domestic use and stock. The water is of varying chemical quality, but is usually potable.

5/ Meyer, Willis G., Stratigraphy and historical geology of Gulf Coastal Plain in vicinity of Harris County, Texas: Am. Assoc. Petroleum Geologists Bull., vol. 23, pp. 188-190, 1939.

6/ Meyer, Willis G., op. cit., pp. 190-192.
Plummer, F. B., op. cit., p. 788.

PRESENT DEVELOPMENT OF WATER SUPPLIES FROM WELLS

One railroad in Liberty County uses water from the Trinity River, but with this exception all the public and industrial water supplies in Liberty County are obtained from wells. In 1944 approximately 24,000 acres of rice was grown in the county, of which about 4,000 acres was irrigated from wells. Most of the ground water is obtained from the Lissie formation from wells ranging between 350 and 1,000 feet in depth.

Most of the wells in the rural areas are less than 50 feet in depth and furnish small supplies of water for domestic use and stock. Such supplies can be obtained almost anywhere in the county from shallow wells. In the northern part of the county and in the Trinity River valley shallow bored or dug wells are common but in the southern part practically all the wells are drilled.

The development of ground water in different parts of the county is briefly discussed below.

Northwestern part of the county, Cleveland-Hightower area

The railroad well at Cleveland (well 2), is 1,512 feet in depth and draws water from the Oakville sandstone - Lagarto clay sequence. When the well was completed in 1937 it is reported to have had an artesian flow of 30 gallons a minute. At present it is equipped with a deep-well turbine pump and a 5-horsepower electric motor by means of which water is raised to an elevated storage tank. The pumpage from this well is estimated to have averaged about 220,000 gallons a day in 1944.

The municipal water supply of the city of Cleveland is obtained from wells 7 and 8, respectively 845 and 929 feet in depth, drawing from the Oakville sandstone - Lagarto clay sequence. These wells were drilled in 1938 and each had an initial yield of 350 gallons a minute with a drawdown of 70 feet. The pumpage from the two wells is estimated to have averaged 97,000 gallons a day in 1944.

Well 21, about one mile west of Hightower, reported to have been 1,200 feet in depth, also drew from the Oakville sandstone - Lagarto clay sequence. The well was destroyed in 1939.

Several wells in the Cleveland area are used to supply water to lumber mills, and oil pipeline pump stations. These wells range from 100 to about 300 feet in depth and draw water from the Lissie formation.

Wells 14 and 15, about 4 miles southwest of Cleveland in the valley of the East Fork of the San Jacinto River, have small flows, although they are comparatively shallow, the reported depth being 187 and 327 feet deep, respectively. The flow of each was estimated as about 10 gallons a minute in April 1945. The water is used for household supply.

Well 20, about six miles northeast of Cleveland, supplied water for the irrigation of 250 acres of rice in 1944. The well is equipped with a deep-well turbine pump and a 125-horsepower diesel engine. It is reported to yield 900 gallons a minute.

All the wells in this area for which analyses are available yield water of comparatively low mineral content (see table of analyses pages 61 to 66). In general, the hardness of the water decreases with depth, the water from wells 2 and 22, the two deepest wells, being exceptionally soft. However, some of the shallow wells yield very soft water; wells 11, 20, and 25, for example.

Northeastern part of county, Romayor-Rayburn area

The Romayor area is locally well known for its flowing water wells. Information was obtained on 13 such wells, wells 44 and 45, and 47 to 57. The flow from 9 of the wells was measured with a current meter, or with a barrel or smaller container, and the flow from 3 of them was estimated. It was noted that with one or two exceptions the deeper wells (580 to 808 feet in depth) have the largest flow, the range in flow being from 152 to 205 gallons a minute. The flow from the shallower wells (100 to 480 feet in depth) is comparatively small, ranging from 4 to 60 gallons a minute. At the time of the investigation three of the flowing wells were used to supply sawmills, one to supply locomotive boilers, two for washing gravel and domestic supply; and six of the wells were unused.

Well 50 at the Santa Fe Railroad station at Romayor, used to supply locomotives, is 645 feet in depth and had a flow of 205 gallons a minute, the largest in the area. The artesian head in this well was 37 feet above the surface in January 1945. The well supplied an average of only about 55,000 gallons a day in 1944, the flow being cut off most of the time.

The non-flowing wells of the area are shallow and used for domestic purposes and stock.

The water from nearly all the wells recorded in the Romayor-Rayburn area is low in total dissolved solids. In four wells less than 200 feet in depth, the hardness ranges from 11 to 135 parts per million and averages 80 parts per million. In 11 wells between 233 and 808 feet in depth the hardness ranges from 88 to 168 parts per million and averages 122 parts per million.

Southwestern part of county, Dayton area

The largest development of ground water in Liberty County is in the rice-growing district near Dayton where a total of about 4,000 acres of rice was irrigated from wells in 1944. This development was started in 1943 and by the spring of 1945 twelve irrigation wells had been drilled. The irrigation wells are numbered 76 to 79 inclusive; 81, 82, and 84 to 89, inclusive. Well 87 had a flow of about 30 gallons a minute when it was visited, and is reported to be 2,500 feet in depth. The others range from 558 to 1,205 feet in depth and average about 800 feet. The water level in four of them ranged from about 38 to about 54 feet below the surface when the wells were measured by the writer in the spring of 1945, before the start of the irrigation season. The reported pumping yield of 10 of the wells (given in the remarks column of the table of well records) ranges from 1,170 to 3,500 gallons a minute. Well 78 is reported to have a specific capacity of about 26 (yield in gallons a minute per foot of drawdown), and well no. 82 a specific capacity of about 20. The wells are equipped with deep-well turbine pumps and diesel engines.

The casings in the rice wells are perforated opposite all the principal water-bearing sands, starting at depths as shallow as 118 to 150 feet in some wells and at greater depths in others, for example, at 389 feet in well 78,

The boundary between the base of the Beaumont clay and the top of the Lissie formation is easily recognized in drillers' logs of the rice wells and varies in depth from 146 to 370 feet below the surface. Most of the wells are supplied with water from both formations. The individual sands in the Beaumont clay range from 10 to 30 feet in thickness and are not numerous, while in the underlying Lissie formation the drillers' logs of some of the wells show sands ranging upward to 80 feet in thickness and comprising 60 to 75 percent of the sediments penetrated (see logs of wells 78, 82, 84, 85 and 90).

The public water supply of the city of Dayton is obtained from wells 119 and 120, respectively 395 and 399 feet in depth. Each well is equipped with a deep-well turbine pump operated by a 15-horsepower electric motor. The original yield of these wells is reported to have been 300 gallons a minute each with a specific capacity of about 27. The pumpage from the wells is estimated to have averaged 190,000 gallons a day in 1944 of which 65,000 gallons a day was used by the city and 115,000 gallons a day was used by the Texas and New Orleans (Southern Pacific) Railroad. The water is obtained from a sand 75 to 80 feet thick in the upper part of the Lissie formation and is of fairly good chemical quality.

As shown by the analyses of water from about 30 wells (see table pages 61 to 66), the ground water in the Dayton area shows a rather wide range in chemical content. There is a tendency for the total dissolved solids to increase and the hardness to decrease with depth, but several wells show exceptions to this general rule. In most of the wells of shallow or moderate depth, the water is rather hard.

South-central part of county. Liberty, Moss Bluff,
Rayburn and Daisetta areas

Information was obtained regarding 10 flowing wells in the Liberty area of which nos. 176, 181 to 184 inclusive, 188 to 190 inclusive, and 199, were drilled between 1895 and 1911 and one, well 187, was drilled more recently. Six of these wells are in use today: two furnish a part of the public supply for the city of Liberty, two are used for stock one furnishes water for a swimming pool, and one is used as a domestic supply.

Most of the public supply of Liberty is pumped from well 179, which is 565 feet deep, and is reported to have had a yield of 321 gallons a minute with a specific capacity of about 7 when completed in 1939. Well 180, 351 feet deep, serves as an additional supply. Both wells are equipped with deep-well turbine pumps and electric motors. Two flowing wells, nos. 178 and 182, respectively 680 and 651 feet in depth, also contribute a small supplementary supply. The production from the four wells in 1944 is estimated to have averaged about 115,000 gallons a day.

The ice plant of the Trinity Valley Cold Storage Company at Liberty is supplied from well 195, 350 feet deep, which is equipped with a deep-well turbine pump and electric motor, and has an average production of 3,000 gallons a day.

According to the logs of the deeper wells at Liberty, the individual sands range from 15 to 40 feet in thickness and in the aggregate make up about 25 percent of the total thickness of the sediments penetrated by the wells. The city water supply is obtained from sands which are probably in the upper part of the Lissie formation. In well 168, below a depth of 320 feet which is regarded as the base of the Beaumont clay, sands make up about 70 percent of the material logged.

Analyses of well waters in the Liberty area show a rather wide range in mineral content. In 7 wells, 260 to 651 feet in depth, the total dissolved solids ranged from 312 to 750 and averaged 454 parts per million; the hardness ranged from 63 to 234 and averaged 170 parts per million; and the chloride ranged from 46 to 303 and averaged 156 parts per million.

Twenty-two of the water wells recorded in this part of the county are in the vicinities of Moss Bluff and Rayburn, respectively south and east of Liberty. One well (no. 218) was drilled to a depth of 1,500 feet as an oil test, then pulled to 800 feet. It has a flow of about 50 gallons a minute but is unused. Thirteen of the wells are less than 250 feet in depth and 9 range from 275 to 538 feet in depth. One well (no. 213), 628 feet in depth, was not completed when it was visited in May 1945. Well 223 and 224, respectively 349 and 568 feet in depth, formerly supplied water for oil drilling rigs. These two wells are in Chambers County, a short distance south of the Liberty County boundary. The remaining wells are used for domestic purposes and stock. Logs of 9 water wells and 2 oil tests are given in the table of drillers' logs.

In the Moss Bluff-Rayburn areas, analyses of samples from 7 wells, ranging in depth from 137 to 528 feet, showed an average of 750 parts per million in total dissolved solids, 300 in chloride and 144 in hardness. Five wells less than 100 feet in depth yield water having a rather wide range in mineral character.

Well 166, 365 feet in depth, owned by the Hull-Daisetta Water Company, furnishes the public supply for Daisetta. This well is equipped with a centrifugal pump and a 5-horsepower electric motor and the average pumpage is estimated to have been 50,000 gallons a day in 1944. Well 173, 255 feet in depth, supplies water for a drilling rig. Well 168, 3 miles west of Daisetta, drilled to a depth of 703 feet in 1917, is reported to have furnished enough water by pumping to irrigate about 500 acres of rice in 1918. The well is no longer in use.

Wells 166 and 173 yield water of relatively low mineral content, 288 and 358 parts per million total dissolved solids, respectively. Well 175, 161 feet in depth, yields water containing 631 parts per million of total dissolved solids and 246 parts per million of chloride.

Scutheastern part of the county, Devers area

Water for the irrigation of rice in the area is supplied from the Trinity River. Of the 22 wells recorded in this area, 12 are less than 250 feet in depth and 10 range from 318 to 501 feet. Wells 227 and 237, respectively 406 and 492 feet in depth, formerly furnished water for the operation of oil pipe line pump stations, but are now used for domestic supply. Wells 232, 245, 246, 247, and 248, respectively 232, 224, 344, 335, and 318 feet in depth, formerly supplied water for drilling oil tests, but are now unused. The remaining wells are used for domestic purposes and stock.

Analyses of samples from 18 wells in the Devers area show a rather wide range in the chemical character of the water. The range in total solids, chloride and hardness is indicated in the following table.

Chemical content of ground water in Devers area
(in parts per million)

Number of wells	Depth	Total dissolved solids		Chloride		Hardness	
		Range	Average	Range	Average	Range	Average
11	92 to 234	274 to 804	504	55 to 300	127	110 to 350	203
7	400 to 501	420 to 932	644	68 to 344	209	55 to 104	69

ESTIMATED WITHDRAWALS OF GROUND WATER

The withdrawals of ground water for irrigation, and for municipal and industrial purposes in Liberty County is estimated to have averaged about 7,500,000 gallons a day in 1944. The distribution of the draft for these uses is shown in the following table.

Estimated average daily withdrawals of ground water in Liberty County in 1944 (in gallons a day)

Irrigation	6,780,000
Industrial	
Railroads	390,000
Sawmills	5,000
	<u>395,000</u>
Municipal	
Liberty	115,000
Cleveland	95,000
Dayton	65,000
Daisetta	50,000
	<u>325,000</u>
Grand Total	7,500,000

In computing the above figure on the amount pumped for the irrigation of rice, it was estimated that 4,000 acres was irrigated and that an average of 1.9 acre-feet of water was applied to each acre of land. In order that a comparison can be made between the volumes of water used for each purpose, the rice pumpage is expressed as a daily average, although the water is used only during the summer.

TEMPERATURE OF GROUND WATER

The temperature of ground water has become increasingly important in the last few years because of the large quantities of water used for cooling and air conditioning. The relation of the temperature of the water to the depth of the screens in 19 flowing or pumped wells in Liberty County is shown graphically in figure 4. Most of these wells have only one section of screen, and the middle of the screen section was considered to be the point of entry of the water into the well. Measurements were made with a mercury thermometer, and in pumped wells no measurements were made until the pump had been in operation for at least half an hour. The temperature for wells of about the same depth varies somewhat and the heavy line in the graph has been drawn to represent the approximate average. Based on this median line, the average rate of increase in temperature is one degree Fahrenheit to each 94 feet increase in depth.

SURFACE WATER SUPPLIES

Stream runoff

By

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Surface Water Division, U. S. Geological Survey

The principal stream in Liberty County is the Trinity River which traverses the county from north to south near the center and with its tributaries, drains about one-half of the county. The eastern part of the county is drained by the West Fork of Pine Island Bayou, a tributary of the Neches River, and the northwestern part is drained by the East Fork of San Jacinto River and its tributary, Lugo Bayou. The extreme southwestern and southeastern parts of the county are drained by small coastal streams.

Records of daily flow have been obtained for the Trinity River at a gaging station at Rcmayor near the northern boundary of the county since May 1924, and for the East Fork of the San Jacinto River at a station near Cleveland since April 1939. In addition, records of the daily flow of the Trinity River at Liberty have been obtained since 1940 when the flow amounted to 4,000 cubic feet per second or more. When the flow at that point has been below 4,000 cubic feet per second the records have not been prepared because of tidal effect. These records were collected by the U. S. Geological Survey, in cooperation with the Texas Board of Water Engineers, and have been published in Geological Survey Water-Supply Papers which are obtainable at the Government Printing Office, Washington, D. C. Copies of the papers may be consulted at the Washington office of the Geological Survey, or at the offices of the Survey and the Texas Board of Water Engineers in Austin.

Records of rainfall collected at Liberty (south-central Liberty County) by the United States Weather Bureau from October 1903 to date, with the exception of January 1933, are tabulated elsewhere in this report. These records show the average annual rainfall for the 40 complete years of record, through 1944, to be 51.05 inches. For the 41 years included, the annual rainfall varied from a minimum of 29.82 inches in 1917, to a maximum of 85.38 inches in 1919. However, the minimum 12 consecutive months of rainfall occurred June 1924 to May 1925, and amounted to 21.82 inches. Annual rainfall of less than 40 inches occurred in only six of the 40 complete years of record, namely - 1904, 1909, 1916, 1917, 1924, and 1936.

The following tables give the maximum and minimum runoff in one day and in one month, the average daily run-off, and the total yearly run-off, in acre-feet, at the gaging station on the Trinity River at Rcmayor from 1925 to 1943 inclusive, and at the station on the East Fork of the San Jacinto River near Cleveland from 1940 to 1942 inclusive.

Run-off of Trinity River in acre-feet at Rmayer, Texas, 1925-43, (Drainage area, 17,190 square miles).						
Calendar year	Maximum day	Minimum day	Average daily	Maximum month	Minimum month	Total yearly
1925	90,400	262	5,670	1,030,000	9,850	2,070,000
1926	92,400	823	17,700	1,380,000	107,000	6,440,000
1927	80,500	774	15,600	1,190,000	29,700	5,670,000
1928			8,830	582,000	16,000	3,230,000
1929	132,000	793	18,900	2,240,000	30,400	6,880,000
1930	114,000	486	15,500	1,420,000	20,800	5,650,000
1931	48,800		9,560	728,000	23,900	3,490,000
1932	101,000	1,040	21,800	2,090,000	35,200	7,980,000
1933	61,300	803	10,300	972,000	34,200	3,750,000
1934	87,470	357	10,350	1,290,000	15,200	3,779,000
1935	122,200	1,500	23,740	2,823,000	100,000	8,667,000
1936	49,590	585	8,315	677,200	21,240	3,044,000
1937	42,840	486	8,188	845,600	26,100	2,989,000
1938	81,920	700	17,470	1,750,000	28,720	6,376,000
1939	60,300	417	6,379	419,700	14,650	2,328,000
1940	120,600	793	17,760	2,658,000	25,930	6,500,000
1941	103,900	2,182	28,320	1,751,000	158,600	10,340,000
1942	218,200	1,468	25,210	3,732,000	177,200	9,206,000
1943	44,630	781	10,560	847,100	47,240	3,854,000

Run-off of East Fork San Jacinto River near Cleveland, Texas, in acre-feet, 1940-42 (Drainage area, 330 square miles)						
Calendar Year	Maximum day	Minimum day	Average daily	Maximum month	Minimum month	Total yearly
1940	85,690	15	954	184,500	669	349,190
1941	26,980	50	940	64,310	2,210	343,400
1942	12,460	54	555	52,040	2,460	202,900

Note: An acre-foot is the quantity of water required to cover one acre to a depth of one foot and amounts to about 325,000 gallons.

No continuous records of the flow of any of the small streams in Liberty County have been obtained; however, sufficient periodic measurements have been made on Luce Bayou at a point near its mouth to show that during periods of drought its flow is very small or may cease altogether.

The data indicate that abundant supplies of surface water are available in Liberty County from the Trinity River and other streams within the county, but storage will have to be provided if large continuous supplies of water are to be obtained.

Quality of water of Trinity River in Liberty County

Analyses of water from the Trinity River near Romayor are available in a report issued by the Texas Board of Water Engineers ^{a/}, Specific conductance and chloride of daily samples, with occasional partial analyses of composite samples, have been made on daily samples collected from the Trinity River near Romayor from October 1941 to September 1942, and from January 1944 to September 1944.

The water during these periods was generally of good chemical quality. The analyses show that the dissolved solids exceeded 500 parts per million only on 11 days during the 21 months of study. The dissolved solids were less than 250 parts per million more than one quarter of the time. The hardness of the Trinity water was greater than 100 parts per million at most times.

SUMMARY

Liberty County is in the Gulf Coastal Plain of southeastern Texas in the second tier of counties back from the Gulf.

The geologic formations discussed in the report in upward sequence consist of the Oakville sandstone of Miocene age, and the Lagarto clay of Miocene (?) age, the Willis sand of Pliocene (?) age, and the Lissie formation and Beaumont clay of Pleistocene age. The rocks of these formations crop out in belts roughly parallel to the Gulf shore, and dip southeastward. As one travels across San Jacinto and Liberty Counties from northwest to southeast the belts of outcrop are traversed in the above order beginning with the Oakville sandstone and Lagarto clay.

The land surface slopes southeastward toward the Gulf at a rate less than the dip of the rocks, consequently, artesian conditions exist in all parts of the county. The valley of the Trinity River is well known for its flowing wells which range from 100 to 808 feet in depth.

Most of the ground water used in the county is obtained from wells ranging in depth from 350 to about 1,000 feet and is drawn from the Lissie formation. Wells yielding from 1,000 to 3,500 gallons a minute and ranging from 740 to 1,030 feet in depth have been developed for rice irrigation in the North Dayton area in the southwestern part of the county. These wells draw mostly from sands in the Lissie formation but most of them are also screened in overlying thinner sands in the Beaumont clay. The municipal water supplies of Liberty, Cleveland, Dayton, and Daisetta are obtained from wells ranging from 350 to 833 feet in depth with reported yields of from 300 to 350 gallons a minute.

Most of the wells in the rural areas are less than 50 feet in depth and furnish small supplies of water for domestic use and stock. Such supplies can be obtained almost anywhere in the county from shallow wells in the Lissie and Beaumont formations or alluvial deposits.

^{a/} Chemical Composition of Texas Surface Water, 1938-1944, by W. W. Hastings and J. H. Rowley. Mimeographed report, Texas Board of Water Engineers, and U. S. Department of the Interior, Geological Survey, and others.

The average daily withdrawals of ground water for irrigation, public supply and industrial use is estimated to have been about 7,500,000 gallons in 1944, divided as follows: irrigation, 6,780,000 gallons; public supply, 325,000 gallons; industrial use, 395,000 gallons.

As shown by analyses of water from 145 wells and springs the chemical character of the ground water varies materially in different localities and in different wells in the same locality. In general the water is relatively low in total dissolved solids but somewhat hard. Beds containing comparatively fresh water extend to depths exceeding 1,000 feet in the northern and central parts of the county, and to a few hundred feet in the extreme southern part according to estimates based on electrical logs of 8 oil tests. These logs are shown in cross sections A-A' in figure 2 and B-B' in figure 3, and extend across the county from northwest to southeast.

Abundant supplies of surface water are available in Liberty County from the Trinity River and other streams within the county, but storage will have to be provided if large continuous supplies of water are obtained.

According to daily tests of water from Trinity River from October 1941 to September 1942, and from January 1944 to September 1944, the total dissolved solids exceeded 500 parts per million on only 11 days during the 21 months of study and was less than 250 parts per million more than a quarter of the time. The hardness was greater than 100 parts per million most of the time.

Records of wells and springs in Liberty County, Texas
All wells are drilled unless otherwise noted in the remarks column

Well	Distance from Cleveland	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Height of measuring point above ground (ft.)
1	In Cleveland	Gulf Colorado and Santa Fe R.R. Co.	R. C. Davant	1916	1,360	8,6,4	0.0
2	do.	do.	--	1937	1,512	13, 8-5/8, 6,4	0.0
3	do.	Gulf States Utilities Co.	A.J. Lesterjetts	1905	306	4,3	0.0
4	7½ miles south	Jordan Campbell	Humble Oil and Refining Co.	1928	2,000	--	--
5	2 miles southwest	-- Hornback	do.	1931	5,633	--	--
6	do.	Humble Oil and Refining Co.	F. Gay	1931	125	4	--
7	In Cleveland	City of Cleveland	Layne-Texas Co.	1938	845	13-3/8, 7	0.0
8	do.	do.	do.	1938	929	13-3/8, 7	0.0
9	5½ miles southeast	Black Gold Petroleum Co.	do.	1934	95	6	--
10	3½ miles southeast	Russ Mitchell Co.	Pitre Water Well Drilling Co.	1936	304	4	1.6
11	In Cleveland	Grimes Veneer and Panel Co.	--	1937	90	6	0.0
12	do.	Cleveland Veneer Co.	--	1938	300	4	0.0
13	do.	Cleveland Mfg. Co.	--	1935	200	6	0.0
14	4 miles southwest	Grogan Mfg. Co.	--	1910	187	4	0.0
15	4½ miles southwest	Clarkson and Mechim	Ford and Thompson	1920	327	8	--
16	4½ miles southeast	Gulf Oil Corp.	--	1940	100	4	0.0
17	In Cleveland	Magnolia Pipe Line Co.	--	1915	175	6	--
18	4 miles southwest	W. E. Henry	E. L. Chambers	1944	18	1½	0.0
19	4 miles southeast	Shell Oil Co.	L. Patterson	1944	179	4	0.0

a/ Plus (+) indicates water level above measuring point.

b/ Pump or lift: T, turbine; Cf, centrifugal; A, air lift; C, cylinder; B, rope and bucket,

Power: E, electric; G, gas or gasoline engine; S, steam; W, windmill; H, hand.
Number indicates horsepower,

Chemical analyses of water from most of these wells and springs are given in the table of analyses

Well	WATER LEVEL		Method of lift	Use of water	Remarks
	Below measuring point (ft.) a/	Date of measurement			
1	+ 44	Dec. 1916	Flows	N	Screens: 690 to 710; 763 to 784, 912 to 952, 1,190 to 1,203 1,258 to 1,298 feet. Reported flow Dec. 1916. 300 gallons a minute. Replaced by well no. 2 in October 1937.
2	+ 30	Oct. 1937	T,E, 5	RR.	Screened in five sands between 1,181 and 1,478 feet. Reported flow Oct. 1937, 30 gallons a minute. Supplies locomotive boilers
3	32	1950	--	N	Screen from 364 to 386 feet. Well [See log, sealed in 1938. Formerly used for municipal
4	--	--	--	--	Oil test. See log. [water supply.
5	--	--	--	--	Do.
6	--	--	--	N	Screen from 105 to 125 feet. Formerly supplied water for drilling oil test.
7	14.70	Jan. 26, 1945	T,E, 15	P	City well 1. Screened in [Hornbeck well 1] 3 sands between 618 and 833 feet. Reported yield 378 gallons a minute on June 17, 1938.
8	16.90	do.	T,E, 15	P	City well 2. Screened in 3 sands between 614 and 833 feet. Reported yield 353 gallons a minute on June 17, 1938. Temperature 79½ F.
9	--	--	--	N	Supplied water for drilling rig. [See log, See log.
10	7.75	June 8, 1945	--	N	Owner's well 1. Supplied water for construction of concrete highway. See log.
11	d/24	Jan. 26, 1945	A,S	Ind	Supplies boilers at lumber mill.
12	d/30	do.	A,S	Ind	Screen at 277 to 300 feet. Supplies boilers at lumber mill
13	28.40	do.	A,S	Ind	Supplies boilers at lumber mill.
14	+ 7	Feb. 1945	Flows	D	Flow estimated 10 gallons a minute on Apr. 6, 1945. Formerly supplied water for boilers at sawmill. Hydraulic ram pumps water to tank for domestic use of six families.
15	--	--	Flows	D	Screen at 287 to 327 feet. Flow estimated 10 gallons a minute on Apr. 6, 1945. Formerly
16	d/20	1940	N ₃	Ind	Screen at 94 to 100 [supplied gravel pit.
17	--	--	A,G	Ind	Supplies water for boilers at pump station. Supplies water for pipe line pump station.
18	d/13	Apr. 5, 1945	C,H	D	Screen at 15 to 18 feet.
19	d/20	Oct. 5, 1944	--	N	Screen at 129 to 152 feet. Formerly supplied water for drilling oil test. (Grassan well 1).

c/ P, public supply; Ind, industrial; RR, railroad; D, domestic; S, stock; N, not used
d/ Water level reported by driller or owner.

e/ Number under which well is listed in U. S. Geological Survey Water-Supply Paper 335, Alexander Deussen, 1914.

Records of wells and springs in Liberty County--Continued

Well	Distance from Cleveland	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Height of measuring point above ground (ft.)
20	5 $\frac{3}{4}$ miles northeast	M. A. Ellis	Layne-Texas Co.	1943	226	18, 12 $\frac{3}{4}$	0.0
21	6 $\frac{1}{4}$ miles northeast	B. E. Quinn Est.	--	Old	1,200	8	0.0
22	6 miles northeast	M. A. Ellis	--	1912	36	30	0.0
23	7 $\frac{3}{4}$ miles northeast	W. P. Johnston	Pitre Water Well Drilling Co.	1945	440	4	0.5
24	7 $\frac{1}{4}$ miles northeast	J. W. Whatley	Jim Gibson	1943	52	8	2.6
25	do.	I. H. Ellington	Otto Adams	1940	110	3	0.0
26	7 $\frac{1}{2}$ miles east	Ida Smith	--	Old	45	12	0.0
27	6 $\frac{1}{2}$ miles southeast	Russ Mitchell Co.	Pitre Water Well Drilling Co.	1936	224	4	--
28	10 $\frac{3}{4}$ miles southeast	do.	do.	1936	204	4	2.0
29	9 $\frac{1}{2}$ miles southeast	M. N. Cunningham	do.	1943	368	4	1.0
30	7 $\frac{3}{4}$ miles southeast	W. C. Crawley	--	1939	35	8	1.0
31	do.	Tarkington School	--	1933	500	4, 2 $\frac{1}{2}$	0.0
32	9 $\frac{1}{2}$ miles southeast	L. O. Ward	A. E. Fawcett, Sr.	1944	247	3	1.0
33	13 $\frac{1}{4}$ miles southeast	Charles Morris	do.	1944	222	3	--
34	13 $\frac{1}{2}$ miles southeast	C. D. Jones	C. D. Jones	1942	60	2	--
35	10 $\frac{1}{2}$ miles southeast	J. E. Wigley	A. E. Fawcett, Sr.	1944	103	4	0.0
36	5 $\frac{1}{2}$ miles southeast	R. E. Wertham	-- Adams	1936	100	2	0.0
37	do.	do.	Lee Angel	1936	39	8	2.6
38	8 $\frac{1}{2}$ miles east	H. E. Kirk	-- Bland	1944	95	4	0.8
39	13 miles southeast	Joe Simmonds	--	1900	24	48x18	0.0

Well	WATER LEVEL		Method of lift b/	Use of water c/	Remarks
	Below measuring point (ft.) a/	Date of measurement			
20	d/32	June 16, 1943	T, D, 125	Irr	Casing slotted opposite 3 sands between 57 and 225 feet. Reported yield 900 gallons a minute. Irrigated 250 acres of rice in 1944.
21	+ 5	Dec. 29, 1936	Flows	N	Drilled to 1,200 feet as an oil test, casing then pulled to 1,200 feet and completed as a water well. Well was destroyed in 1939. See log.
22	d/28	Mar. 29, 1945	C, G, 1/2	D	Tile casing. Well was destroyed in 1939.
23	61.50	Apr. 17, 1945	J, G, 1	D, S	Screen at 415 to 430 feet. See log.
24	34.50	Apr. 5, 1945	B, H	D	Concrete casing.
25	d/22	do.	C, G, 1	D, S	Screen at 98 to 110 feet.
26	32.25	Apr. 17, 1945	B, H	D	Wooden casing 12 x 12 inch.
27	d/18	--	--	--	Owner's No. 2. Supplied water for construction of concrete highway. See log.
28	41.45	Jan. 25, 1945	C, G	S	Owner's No. 3. Formerly supplied water for construction of concrete highway. See log.
29	50.90	do.	J, E, 1/2	D, S	Screen at 322 to 343 feet. Supplies water for dairy. See log.
30	24.95	do.	B, H	D	Concrete casing.
31	d/50	do.	C, E, 1/3	P	Originally drilled to 325 feet and later deepened to 500 feet. Supplies Tarkington
32	45.95	do.	J, E, 1/2	D, S	Screen 241 to 247 feet. Supplies School. water for dairy.
33	--	--	C, G	D, S	Screen at 210 to 222 feet.
34	--	--	C, H	D, S	Screen at 57 to 60 feet,
35	d/14	Mar. 1944	J, E, 3/4	D, S	Screen at 96 to 103 feet. Supplies water for dairy.
36	d/15	Jan. 26, 1945	A, G, 1	D	Screen at 90 to 100 feet.
37	12.54	do.	B, H	D	Concrete casing.
38	42.30	Apr. 17, 1945	J, E, 1/2	D, S	Screen at 85 to 95 feet. Supplies water for dairy.
39	7.50	June 8, 1945	C, W	D, S	Dug well.

Records of wells and springs in Liberty County--Continued

Well	Distance from Romayor	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Height of measuring point above ground (ft.)
40	11 miles south	Mrs. Corina Brown	Pitre Water Well Drilling Co.	1942	174	4	0.0
41	8 $\frac{1}{2}$ miles south	John Kite	John Kite	1936	18	1 $\frac{1}{2}$	0.0
42	7 $\frac{3}{4}$ miles southwest	Wirt Davis	J. W. Gibson	1943	40	8	2.0
43	8 $\frac{1}{2}$ miles south	N. Gibson	Lee V. Angel	1940	46	8	2.5
44	9 miles south	A. G. Lesterjette	--	1907	662	--	--
45	4 miles east	F. A. Racki Lumber Co.	--	1906	580	10,4	--
46	do.	do.	Chas. Carlson	1935	86	6,3	0.0
47	2 miles east	Miller and Vidor Lumber Co.	R. B. Melat	1907	585	10,4	0.0
48	do.	T. B. Allen and Co.	do.	1907	659	3	0.0
49	In Romayor	Gulf, Colcrado and Santa Fe R.R. Co.	Giles-Williams	1902 1909	300 650	6	0.0
50	do.	do.	Homer Wright	1943	645	8,6	0.0
51	8 $\frac{1}{4}$ mile southeast	Texas Construction Material Co.	-- Jackson	1917	808	8	0.0
52	4 $\frac{1}{2}$ miles southeast	do.	do.	1937	808	6,4	--
53	do.	do.	do.	1937	310	6	0.0
54	4 miles southwest	do.	--	1937	135	4	0.0
55	6 $\frac{3}{4}$ miles south	South Texas Hardwood Co.	A. E. Fawcett	1933	480	6	0.0
56	2 miles west	Liberty Hardwood Lumber Co.	W. J. Giles	1907	608	8,6	0.0

Well	WATER LEVEL		Method of lift b/	Use of water c/	Remarks
	Below measuring point (ft.) a/	Date of measurement			
40	d/16	Sept. 5, 1942	C,H	D	Screen at 133 to 143 feet. See log.
41	d/15	1936	C,H	D,S	No screen.
42	34.10	Jan. 9, 1945	B,H	D	Concrete casing.
43	25.55	Apr. 17, 1945	B,H	D,S	Do.
44	--	1908	Flows	N	Owner's No. 1. Water reported mineralized, well was plugged in 1909 Deussen No. 763 e/.
45	--	--	Flows	Ind	Flow estimated 150 gal- Oil test. See log. lons a minute Jan. 11, 1945. Supplies boilers.
46	d/40	1935	C,E,	Ind	Screen at 76 to 86 feet. Sup- [at sawmill. plies drinking water to employees.
47	+d/40	1908	Flows	D	Measured flow 152 gallons a minute on Jan. 11, 1945. 42 feet of screen. Formerly supplied boilers at sawmill; domestic supply at present. Temperature 75½° F. Deussen No. 761 e/.
48	+d/30	1908	Flows	--	(Flow of 300 gallons a minute reported in Estimated flow 25 gallons a minute on [1908.] Jan. 11, 1945. Formerly supplied boilers at sawmill. Temperature 75½° F. Deussen No.
49	+d/32	1932	Flows	Ind	Estimated flow 200 [762 e/. See log. gallons a minute on July 22, 1932. Drilled to 300 feet in 1902, deepened to 650 feet in 1909. Formerly supplied water for locomotive boilers. Replaced by well No. 50 in June
50	+ 37	Jan. 5, 1945	Flows	RR	Screen from 536 to 600 feet. Measured [1943. flow 205 gallons a minute on Jan. 4, 1945. Supplies water for loc motive boilers. Water flows from well and is lifted to elevated tank by a centrifugal pump driven by a 2 horsepower electric motor. Temperature 75½°
51	+ 15	Nov. 23, 1944	Flows	Ind	Measured flow 170 gallons a [F. See log. minute on Nov. 23, 1944. Supplies water for gravel pit. Temperature 76½° F.
52	--	--	Flows	N	Measured flow 173 gallons a minute on Jan. 4, 1945. Screens in tw. sands between 706 and 808 feet. Formerly supplied water for gravel pit. Temperature 78½° F. See log.
53	+ 20	Jan. 5, 1945	Flows	N	Measured flow 25 gallons a minute on Jan. 5, 1945. Screen from 270 to 310 feet. Formerly supplied water for gravel pit. Temperature
54	+ 18	Jan. 9, 1945	Flows	Ind	Measured flow 60 gallons a minute [71½° F. on Jan. 9, 1945. Supplies water for gravel
55	+ 12	do.	Flows	Ind	Measured flow 28 [pit. Temperature 69° F. gallons a minute on Jan. 9, 1945. Supplies water for boilers at sawmill. Temperature
56	+ 55	1908	Flows	N	Measured flow 165 gallons a minute on [72° F. Jan. 10, 1945. Formerly supplied water for boilers at sawmill Deussen No. 762 e/. Tem- perature 75° F.

Records of wells and springs in Liberty County--Continued

Well	Distance from Romayor	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Height of measuring point above ground (ft.)
57	4 $\frac{1}{4}$ miles southwest	Dolen School	--	1940	100+	4	--
58	1 mile west	W. D. Dunnan	--	1939	233	4	1.7
59	2 $\frac{3}{4}$ miles west	A. M. Smith	--	1924	23	1 $\frac{1}{2}$	0.0
60	4 miles west	C. Die	Jim Gibson	1911	56	8	1.0
61	5 $\frac{3}{4}$ miles west	do.	J. W. Smith	1911	140	4	1.0
62	4 $\frac{1}{2}$ miles west	S. J. Keith	--	1940	86	2	2.3
63	3 $\frac{1}{2}$ miles southwest	Pearl Kirkham	-- Reuter	1943	22	2	0.0
64	4 $\frac{3}{4}$ miles southwest	--	--	--	--	--	--
65	6 miles southwest	J. W. Phillips	--	1940	85	3	0.0
66	do.	J. C. Carter	Jim Gibson	1943	45	8	1.0
67	5 $\frac{1}{2}$ miles southwest	Henderson Landers	--	1940	30	2	0.0
68	4 $\frac{3}{4}$ miles southwest	J. H. Haltom	Jim Gibson	1940	62	2	0.0
69	4 $\frac{1}{2}$ miles east	Concord School	Pitre Water Well Drilling Co.	1943	104	4	0.0
70	4 $\frac{3}{4}$ miles east	Boyd Sewell	do.	1940	135	2	0.0
71	4 $\frac{1}{2}$ miles east	John Griffin	Chas. Carlson	--	165	4	0.6
72	do.	Hollis Griffin	--	1940	90	2	0.0
73	4 miles east	Mrs. W. M. Emanuel	Chas. Carlson	1929	87	4, 2	0.0
74	4 $\frac{1}{2}$ miles southeast	--	--	--	Spring	--	--

Well	WATER LEVEL		Method of lift b/	Use of water c/	Remarks
	Below measuring point (ft.) a/	Date of measurement			
57	--	--	Flows	P	Estimated flow 4 gallons a minute, Nov. 23, 1944. Supplies Dolen School. Drilled for seismograph test hole. Temperature 70 $\frac{1}{2}$ ^o F.
58	4.30	Jan. 10, 1945	C, G, 1	D, S	
59	d/14	Apr. 4, 1945	C, H	D	Screen at 20 to 23 feet.
60	48.85	do.	B, H	D	Concrete casing.
61	50.50	do.	C, E, 2	D, S	Screen at 130 to 140 feet.
62	9.35	do.	C, H	D, S	
63	d/ 9	do.	C, E, 2	D	Screen at 18 to 22 feet.
64	--	--	Flows	N	Estimated flow 5 gallons a minute, Apr. 4, 1945. Temperature 69 ^o F.
65	d/37	June 1940	C, G, 1	D	Screen at 80 to 85 feet.
66	33.67	Apr. 5, 1940	B, H	D	Concrete casing.
67	d/20	Apr. 6, 1945	C, H	D	
68	d/52	do.	C, E, 3 4	D, S	Screen at 58 to 62 feet.
69	d/21	Jan. 25, 1943	C, E, 3 4	P	Screen at 87 to 97 feet. Supplies Concord School. See log.
70	d/70	Dec. 1940	--	N	Screen at 116 to 126 feet. Abandoned. Algae in well. See log.
71	42.10	Jan. 11, 1945	C, H	D	
72	d/40	1940	J, E, 1 2	D	
73	d/47	Jan. 23, 1945	C, E, 1	D	Screen at 81 to 87 feet.
74	--	--	Flows	N	Estimated flow 10 gallons a minute, Jan. 24, 1945. Deussen no. 758 e/. Known as Concord Spring. Temperature 69 ^o F.

Records of wells and springs in Liberty County--Continued

Well	Distance from Dayton	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Height of measuring point above ground (ft.)
75	4 miles northwest	Chas. B. Peterson	--	Old	3,407	--	--
76	7 $\frac{1}{4}$ miles northwest	J. W. Anslen	A. E. Fawcett, Sr.	1943	750	20,12	--
77	6 $\frac{1}{2}$ miles northwest	W. A. Connor	Layne-Texas Co.	1944	742	20,12	2.0
78	6 miles northwest	A. J. and S. O. Carter	do.	1943	569	18-5/8, 14	0.0
79	do.	D. A. Reidland	do.	1943	740	16,10	1.0
80	6 $\frac{1}{2}$ miles northwest	do.	do.	1943	550	--	--
81	7 miles northwest	do.	do.	1944	1,000	20,8	2.0
82	5 $\frac{1}{2}$ miles northwest	Ralph Graves	do.	1943	558	18,10 $\frac{3}{4}$	0.0
83	do.	do.	do.	1943	189	2 $\frac{1}{2}$	--
84	5 miles northwest	Arnold Wolfe	do.	1943	834	20,16	0.0
85	7 $\frac{3}{4}$ miles west	E. J. Stoesser	do.	1944	808	24,12	0.0
86	4 $\frac{1}{2}$ miles west	W. F. Graves	A. E. Fawcett, Sr.	1944	1,005	20,12	--
87	4 $\frac{1}{2}$ miles west	do.	--	Old	2,500	6	--
88	4 miles west	Luc Moreau	A. E. Fawcett, Sr.	1944	870	20,12	1.5
89	5 miles west	A. C. Holbrook	do.	1944	780	20,12	0.0
90	4 $\frac{1}{2}$ miles west	Peterson and Sterling	Layne-Texas Co.	1920	592	--	--
91	do.	Chas. B. Peterson	--	--	1,910	--	--
92	7 miles west	Patrick-Tyrrell Drilling Co.	Pitre Water Well Drilling Co.	1941	256	4	0.0
93	do.	Henry Bode	Rudolph Okracha	1942	276	3,2	1.0
94	3 $\frac{1}{2}$ miles west	Sun Pipe Line Co.	--	1923	384	6	0.0
95	do.	B. T. Sturrock	B. T. Sturrock	1936	19	2 $\frac{1}{2}$	0.0

Well	WATER LEVEL		Method of lift	Use of water	Remarks
	Below measuring point (ft.) a/	Date of measurement			
75	--	--	--	--	Owner's No. 2. Oil test. See log.
76	d/50	1943	T,D, 165	Irr	Irrigated 350 acres of rice in 1944. Temperature 75° F.
77	50.30	Apr. 19, 1945	T,D, 150	Irr	Casing slotted opposite sands below 150 feet. Reported yield 2,500 gallons a minute. Irrigated 400 acres of rice in 1944.
78	d/60	Sept. 1943	T,D, 150	Irr	Casing slotted opposite sands below 389 feet. Reported yield 1,700 gallons a minute. See log.
79	38.40	Apr. 19, 1945	T,D, 120	Irr	Casing slotted opposite sands below 118 feet. Reported yield 2,000 gallons a minute. Irrigated 400 acres of rice in 1944. Owner's No. 1.
80	--	--	--	--	Test well.
81	40.55	Apr. 19, 1945	T,D, 160	Irr	Casing slotted opposite sands below 120 feet. Reported yield 2,500 gallons a minute. Irrigated 500 acres of rice in 1944. Temperature 76 ¹ / ₂ ° F.
82	d/41	May 24, 1943	T,D, 120	Irr	Casing slotted opposite sands below 140 feet. Reported yield 1,170 gallons a minute. Irrigated 350 acres of rice in 1944. See log.
83	--	--	--	--	Screen 169 to 189 feet. Drilled to 558 feet as a test well.
84	d/45	Aug. 1943	T,D, 120	Irr	Reported yield 2,000 gallons a minute. Irrigated 500 acres of rice in 1944. Temperature 78° F. See log.
85	d/57	Mar. 1944	T,D, 125	Irr	Casing slotted opposite sands below 135 feet. Reported yield 3,000 gallons a minute. Irrigated 300 acres of rice in 1944. Temperature 75° F. See log.
86	d/60	Mar. 1944	T,D, 160	Irr	Casing slotted opposite sands below 240 feet. Reported yield 3,000 gallons a minute. Irrigated 300 acres of rice in 1944; 400 acres in 1945. Temperature 77° F.
87	--	--	Flows	Irr	Estimated flow 30 gallons a minute on April 18, 1945. Used with well 86 to irrigate rice. Temperature 104° F.
88	54.32	Apr. 18, 1945	T,D, 160	Irr	Casing perforated opposite sands below 240 feet. Reported yield 3,500 gallons a minute. Irrigated 425 acres of rice in 1944. Temperature 76° F.
89	d/60	Feb. 1944	T,D, 160	Irr	Casing perforated opposite sands below 240 feet. Reported yield 3,000 gallons a minute. Irrigated 500 acres of rice in 1944. Temperature 74° F.
90	--	--	--	N	Screens opposite three sands between 349 and 592 feet. Formerly used for rice irrigation.
91	--	--	--	N	Oil test. See log. See log.
92	d/46	June 1941	--	N	Screen at 243 to 253 feet. Formerly supplied water for drilling rig. See log.
93	47.00	Apr. 18, 1945	C,W	D,S	
94	d/56	Jan. 27, 1945	C,E, 2	Ind	Screen at 376 to 384 feet. Supplies water for pipe line pump station.
95	d/10	do.	C,H	S	No screen.

Records of wells and springs in Liberty County--Continued

Well	Distance from Dayton	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Height of measuring point above ground (ft.)
96	8 miles northwest	Myrtle Ridge School	F. Gay	1928	165	4,2	0.8
97	7 $\frac{1}{2}$ miles west	Joe Sobctik	J. N. Nadrntil	1927	20	4	0.0
98	7 $\frac{1}{2}$ miles west	Magnolia Pipe Line Co.	--	1927	540	4	0.0
99	6 $\frac{1}{2}$ miles west	Wolf Island School	F. Gay	1928	360	4	--
100	8 $\frac{1}{2}$ miles northwest	R. F. Janik	R. F. Janik	1913	32	8	0.0
101	5 $\frac{1}{2}$ miles northwest	Roy Seaburgh	Layne-Texas Co.	1945	1,030	16,12	0.0
102	7 $\frac{1}{2}$ miles northwest	do.	F. Gay	1945	209	4	0.0
103	7 miles west	C. Newman	C. A. Brown	Old	400	10,7	0.0
104	6 $\frac{1}{2}$ miles northwest	Sun Oil Co.	Sun Oil Co.	1905	775	--	--
105	6 $\frac{1}{2}$ miles northwest	do.	do.	1905	1,763	--	--
106	7 $\frac{1}{2}$ miles northwest	Taylor-Dayton Co.	--	Old	1,200	--	--
107	6 $\frac{1}{2}$ miles southwest	R. Freeman	--	--	175	2	--
108	5 $\frac{1}{2}$ miles southwest	C. M. Rogers	--	Old	650	4	0.0
109	5 miles southwest	Heal and Brown	Layne Bowler Co.	Old	407	9-5/8, 8	--
110	do.	do.	--	Old	487	8	0.0
111	6 $\frac{1}{2}$ miles southwest	J. M. Hlavaty	F. Gay	1940	400	4 $\frac{1}{2}$	0.0
112	3 $\frac{1}{2}$ miles southwest	N. B. Sapp	C. A. Brown	Old	380	10,8	0.5
113	4 $\frac{1}{2}$ miles southwest	Chas. Seaburgh	do.	1902	115	11,8	0.0
114	5 $\frac{1}{2}$ miles southwest	W. A. Noble	do.	1904	400	9	0.0
115	3 $\frac{1}{2}$ miles southwest	C. S. Brown	C. S. Brown	1902	400	--	0.0
116	7 $\frac{1}{2}$ miles southwest	Bud Kay	F. Gay	1928	125	4,2	0.0
117	8 miles southwest	General Crude Oil Co.	do.	1931	375	--	--
118	7 $\frac{1}{2}$ miles southwest	Rewan Drilling Co.	do.	--	480	--	--
119	In Dayton	City of Dayton	J. A. Walling	1929	395	8,6	0.0
120	do.	do.	do.	1929	399	8,6	0.0

Well	WATER	LEVEL	Method of lift b/	Use of water c/	Remarks
	Below measuring point (ft.) a/	Date of measure- ment			
96	37.90	Apr. 18, 1945	--	N	Screen at 155 to 165 feet. Formerly supplied water for Myrtle Ridge School. School house abandoned.
97	d/12	do.	C,G, 1 1/2	D	No screen.
98	d/30	do.	A,G	Ind	Supplies water for pipe line pump station.
99	--	--	--	N	Screen at 350 to 360 feet. Formerly supplied water for Wolf Island School. School house abandoned.
100	d/15	Apr. 19, 1945	C,H	D,S	No screen.
101	d/47	Mar. 1945	T,D, 180	Irr	Reported yield 3,000 gallons a minute. Temperature 80° F.
102	47.00	June 9, 1945	C,H	D	Screen at 199 to 209 feet.
103	d/17	1908	--	N	Formerly used for rice irrigation. Deussen No. 740 a/
104	--	--	--	--	Reported in 1908 as producing oil at 775 feet. Deussen No. 752 a/.
105	--	--	--	--	Owner's No. 1. Oil test. Deussen No. 753 a/. See log.
106	--	--	--	--	Oil test. Deussen No. 755 a/. See log.
107	--	--	C,H	D,S	
108	13.02	Oct. 10, 1931	None	N	Formerly used for rice irrigation.
109	--	--	--	N	Screens set in two sands between 248 and 395 feet. Formerly used for rice irrigation.
110	d/10	1903	--	N	Formerly used for rice irrigation. Deussen No. 743 a/. See log.
111	d/38	Aug. 1944	Ng	D	Screen at 380 to 400 feet.
112	50.22	Jan. 27, 1945	C,H	D,S	Formerly used for rice irrigation. Deussen No. 739 a/.
113	d/17	1908	--	N	Formerly used for rice irrigation. Deussen No. 741 a/.
114	d/ 8	1908	--	N	Formerly used for rice irrigation. Deussen No. 742 a/.
115	d/16	1908	--	N	Formerly used for rice irrigation. Deussen No. 744 a/.
116	d/ 9	1928	--	N	Screen at 115 to 125 feet. Formerly supplied water for stock.
117	--	--	--	N	Formerly supplied water for drilling oil test. (Kirby no. 1).
118	--	--	--	N	Formerly supplied water for drilling oil test.
119	d/45	Nov. 1929	T,E, 15	P,RR	City well No. 1, also supplies locomotive boilers. Reported yield in 1929, 300 gallons a minute.
120	d/45	Nov. 1929	T,E, 15	P,RR	City well No. 2, also supplies locomotive boilers. Screen from 316 feet to 376 feet. Reported yield in 1929, 300 gallons a minute. Temperature 73° F. See log.

Records of wells and springs in Liberty County--Continued

Well	Distance from Dayton	Owner	Drillor	Date completed	Depth of well (ft.)	Diameter of well (in.)	Height of measuring point above ground (ft.)
121	9½ miles south	-- League	The Texas Co.	1926	1,428	--	--
122	1½ miles northwest	C. A. Greboy	Pitre Water Well Drilling Co.	1944	193	4	0.0
123	3 miles southeast	Frank Gay	Frank Gay	1942	404	4	0.0
124	In Dayton	Peoples Lumber and Supply Co.	dc.	1942	685	4	0.0
125	2¼ miles south	Humble Fine Line Co.	--	Old	400	6	1.0
126	2 miles south	A. Graves	F. Gay	1931	135	4	0.0
127	4¼ miles southeast	Bullard and Wilson	--	Old	670	--	--
128	2 miles east	Ed Pruitt	J. A. Conklin	1904	1,014	8	0.0
129	7¼ miles south	McGees Bluff Canal Co.	F. Gay	1935	110	4	--
130	3¼ miles south	J. B. Sterling	dc.	1941	108	4,2	0.0
131	2¾ miles south	F. Gay	dc.	1941	376	4½	0.0
132	2½ miles north	E. R. Gordon	--	--	180	4	--
133	3 miles east	Texas Pipe Line Co.	--	1918	350	6	0.0
134	3¾ miles southeast	Noble and Baker	F. Gay	1941	404	4	0.0
135	4½ miles southeast	Gulf Pipe Line Co.	-- Blair	1918	428	6	--
136	5¾ miles southeast	Leftis Bros.	F. Gay	1942	190	4½	--
137	6½ miles southeast	Joe Durac	dc.	1934	120	4	0.0
138	6½ miles southeast	Dayton Canal Co.	dc.	--	350	4,2	0.0
139	dc.	dc.	dc.	--	350	4.2	0.0
140	6½ miles north	Sudermann-Delsen Co.	Layne-Bowler Co.	1906	225	4	--
141	3¾ miles north	Russ Mitchell Co.	Pitre Water Well Drilling Co.	1936	413	3	0.0
142	4½ miles north	A. H. Case	Ed Paul	1933	45	4	0.0
143	5½ miles northeast	V. L. Moore	F. Gay	1934	116	4	0.0
144	5 miles northeast	L. L. Batchelor	--	1940	26	36	0.0
145	7¼ miles north	Mrs. S. B. Brantcn	F. Gay	1937	301	4	0.0

Well	WATER LEVEL		Method of lift b/	Use of water c/	Remarks
	Below measuring point (ft.) a/	Date of measurement			
121	--	--	--	--	Oil test. See log.
122	d/44	July 19, 1944	J,E, $\frac{1}{2}$	D	Screen at 179 to 190 feet. See log.
123	d/42	Jan. 25, 1945	C,E, $\frac{3}{4}$	D,S	Screen at 384 to 404 feet.
124	d/60	Jan. 27, 1945	A,S	Ind	Screen at 665 to 685 feet. Supplies sawmill boilers.
125	50.46	do.	A,G	D,S	Formerly supplied water for pipe line pump station.
126	d/17	do.	C,W	D,S	Screen at 132 to 135 feet.
127	--	--	--	N	Salty water charged with hydrogen sulphide reported below 360 feet. Well abandoned and casing pulled Oil test No. 5. Deussen No.
128	+d/50	1904	Flows	S	Drilled as oil test, developed as 751 a/. water well. Deussen No. 757 e/.
129	--	--	C,W	--	
130	d/10	1941	C,W	S	Screen at 98 to 108 feet.
131	d/40	1941	C,W	S	Screen at 356 to 376 feet.
132	--	--	--	D	
133	7.95	June 15, 1945	C,H	D	Formerly supplied water for pipe line pump station. Flow reported 50 gallons a minute in 1919; ceased flowing in 1940.
134	d/50	1941	--	N	Screen at 384 to 404 feet. Formerly supplied water for drilling rig.
135	--	--	C,W	D,S	Formerly supplied water for pipe line pump station.
136	--	1942	Flows	N	Screen at 170 to 190 feet. Formerly supplied water for drilling rig. Flowed when drilled,
137	d/20	1934	C,W	D,S	No screen. now abandoned and plugged.
138	d/35	--	--	Ind	Screen at 330 to 350 feet. Supplies water for pump station.
139	d/35	--	--	Ind	Do.
140	--	--	--	--	Screen at 204 to 225 feet. See log.
141	d/50	1936	--	N	Owner's No. 4. Well sealed. Supplied water for construction of concrete highway. See log.
142	d/15	Apr. 1933	C,W	D,S	No screen.
143	d/30	1934	C,H	D,S	No screen. Formerly supplied Moore School.
144	d/20	June 15, 1934	J,E, $\frac{1}{2}$	D	Dug well.
145	d/28	1937	C,H	D,S	No screen.

Records of wells and springs in Liberty County--Continued

Well	Distance from Liberty	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Height of measuring point above ground (ft.)
146	13 miles north	L. E. Wiggins	Pitre Water Well Drilling Co.	1942	116	2	--
147	15½ miles north	Sun Oil Co.	A. E. Fawcett, Sr.	1938	286	6,4	--
148	13¼ miles north	J. E. Dillon	Pitre Water Well Drilling Co.	1945	213	2	0.0
149	12¼ miles north	John Morgan	do.	1945	192	4	0.0
150	do.	Luther McDaniel	do.	1945	183	2	0.0
151	10¾ miles north	L. Daffern	do.	1945	125	4	0.0
152	7¾ miles north	Morgan and Morgan Lumber Co.	do.	1937	228	4	2.6
153	do.	Hardin Baptist Church	do.	1943	99	4,2	0.0
154	7 miles north	John Rosnick	do.	1944	110	4	0.0
155	8½ miles north	Humble Oil and Refining Co.	do.	1938	230	4	0.0
156	do.	do.	do.	1940	257	4	0.0
157	9 miles north	do.	do.	1938	200	4	0.0
158	7¼ miles north	James R. Nowery Drilling Co.	do.	1941	254	4	0.0
159	8¾ miles north	Humble Oil and Refining Co.	do.	1938	218	6,4	0.0
160	8¼ miles north	do.	do.	1938	226	6	0.0
161	7¾ miles north	do.	do.	1940	230	4	0.0
162	8 miles north	do.	do.	1940	244	4	0.0
163	8¾ miles north	do.	do.	1938	223	4½,4	0.0
164	8½ miles north	Mrs. A. Cassna	do.	1945	192	4,2½	0.8
165	7½ miles north	A. J. Huddleson	do.	1945	107	4	0.0
166	11 miles northeast	Hull-Daisetta Water Co.	do.	1940	365	6	0.0
167	10½ miles northeast	Joe Haines	do.	1938	106	6	0.0

Well	WATER LEVEL		Method of lift b/	Use of water c/	Remarks
	Below measuring point (ft.) a/	Date of measurement			
146	d/40	Oct. 25, 1942	J,E, $\frac{1}{2}$	D	Screen at 90 to 95 feet. See log.
147	--	--	--	N	Screen at 263 to 286 feet. Formerly supplied water for drilling rig.
148	d/40	May 1945	J,E, $\frac{1}{4}$	D	Screen at 200 to 206 feet. See log.
149	d/40	May 1945	J,E, $\frac{1}{4}$	D	Screen at 163 to 173 feet. See log.
150	d/40	Apr. 1945	J,E, $\frac{1}{4}$	D	Screen at 177 to 192 feet.
151	d/40	Apr. 1945	J,E, $\frac{1}{2}$	D	Screen at 108 to 120 feet. See log.
152	37.50	June 7, 1945	--	N	Formerly supplied boiler at sawmill. See log.
153	d/28	June 1943	C,E, $\frac{3}{4}$	P	Supplies water to Hardin Baptist Church. Screen at 61 to 66 feet. See log.
154	d/25.5	Mar. 21, 1944	Cf, G, $\frac{1}{2}$	D	Screen at 71 to 82 feet. See log.
155	d/12	Dec. 14, 1938	--	N	Screen at 183 to 211 feet. Formerly supplied water for drilling oil test. (Partlow no.10); casing pulled and well abandoned in 1939. See log.
156	d/15	July 1940	--	N	Screen at 199 to 228 feet. Formerly supplied water for drilling oil test. (Partlow no. 17); casing pulled and well abandoned in 1940. See log.
157	d/15	July 1938	--	N	Screen at 178 to 199 feet. Formerly supplied water for drilling oil test (Johnson no. 1); casing pulled and well abandoned in 1938. See log.
158	d/15	June 1941	--	N	Screen at 175 to 197 feet. Formerly supplied water for drilling oil test; casing pulled and well abandoned in 1941. See log.
159	d/15	Nov. 1938	--	N	Screen at 185 to 212 feet. Formerly supplied water for drilling oil test. (Partlow A no. 8); casing pulled and well abandoned in 1939. See log.
160	d/15	Aug. 1938	T,E, 3	D	Screen at 191 to 213 feet. Supplies drinking water for oil camp. See log.
161	d/16	May 26, 1940	--	N	Screen at 186 to 214 feet. Formerly supplied water for drilling oil test (Rye no. 1); casing pulled and well abandoned in 1940.
162	d/15	May 1930	--	N	Screen at 199 to 228 feet. Formerly supplied water for drilling oil test (Cessna no. 1); casing pulled and well abandoned in 1940.
163	d/14	Oct. 21, 1938	--	N	Screen at 185 to 211 feet. Formerly supplied water for drilling oil test (Partlow A no. 5); casing pulled and well abandoned in 1939. See log.
164	40.06	June 16, 1945	J,E, $\frac{1}{4}$	D	Screen at 179 to 191 feet. See log.
165	d/25	May 1945	J,E, $\frac{1}{4}$	D	Screen at 83 to 94 feet.
166	d/27	May 1940	Cf,E, 5	P	Screen at 327 to 350 feet. Supplies water for city of Daisetta. Temperature 74 $\frac{1}{2}$ ° F. See log.
167	31.5	May 30, 1938	--	N	Screen at 85 to 106 feet. Water reported highly mineralized; well destroyed in 1940. See log.

Records of wells and springs in Liberty County--Continued

Well	Distance from Liberty	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Height of measuring point above ground (ft.)
168	7½ miles northeast	Liberty Ranch Co.	--	1917	703	24, 13, 10	0.0
169	11 miles northeast	Hancomer Lumber Co.	Pitre Water Well Drilling Co.	1943	222	4	0.0
170	9½ miles northeast	Gulf Oil Corp.	do.	1944	321	4	0.0
171	10 miles northeast	John Mecom	do.	1937	236	4½	0.0
172	9½ miles northeast	Hamill and Smith	do.	1938	305	4	0.0
173	do.	do.	do.	1938	255	5½, 5	0.0
174	do.	Houston Production Co.	do.	1939	255	7, 5	0.0
175	do.	do.	do.	1941	161	7, 5	0.0
176	do.	do.	do.	1941	374	5	0.0
177	9¾ miles northeast	The Texas Co.	L. Patterson	1941	383	5	0.0
178	In Liberty	City of Liberty	J. A. Walling	Old	630	8	0.0
179	do.	do.	Texas Water Supply Company	1939	565	13, 7	1.6
180	do.	do.	do.	1939	351	8	0.0
181	do.	do.	-- Tucker	Old	695	8	0.0
182	do.	do.	do.	Old	651	4	0.0
183	do.	Southern Pacific R.R. Co.	Layne-Bowler Co.	1911	601	10	0.0 0.0
184	do.	do.	--	Old	576	6	--
185	do.	Layl Sandwich Shop	Pitre Water Well Drilling Co.	1940	119	4	1.0
186	3 miles south	Texas Pipe Line Co.	do.	1941	333	4½, 4	0.2
187	1 mile south	John Mecom	--	--	540	4	--
188	½ mile south	Mecom and Harrison	Serles Yount	1909	260	8	0.0
189	do.	do.	--	1903	260	4½	--
190	¾ mile south	do.	--	1903	260	4½	--
191	1½ miles southeast	Liberty County Fairgrounds	Pitre Water Well Drilling Co.	1943	65	4	0.0

Well	WATER LEVEL		Method of lift	Use of water	Remarks
	Below measuring point (ft.)	Date of measurement			
168	d/5 a/	1917	--	--	Formerly supplied water for irrigation of 500 acres of rice. See log.
169	6.75	Nov. 5, 1943	--	N	Screen at 161 to 181 feet. Formerly supplied boiler at sawmill. Well abandoned when water
170	d/21	Sept. 22, 1944	--	N	Screen at 288 } became mineralized. See log. to 310 feet. Supplied water for drilling oil test (Well Hannah no. 20). See log.
171	d/20	Nov. 1937	--	N	Screen at 226 to 236 feet. Water reported mineralized. See log.
172	d/20	1938	--	N	Screen at 285 to 305 feet. Reported sulphur water. See log.
173	d/17	1938	A,E, 15	Ind, D	Screen at 225 to 255 feet. Supplies water for oil lease. See log.
174	d/30	1939	--	N	Screen at 233 to 255 feet. Supplied water for drilling oil test (Baldwin no. 3).
175	d/30	July 1941	A,E, 5	Ind	Screen at 120 to 140 feet. Supplies lease.
176	d/30	July 1941	--	N	Screen at 353 to 373 feet. Supplies water for drilling oil test (Holmple no. 1). See
177	d/30	Oct. 1941	--	N	Screen at 355 to 379 feet. Supplied water for drilling oil test (Armeln no. 2). Estimated flow 4 gallons a minute See log.
178	+ 7	Dec. 7, 1944	Flows	P	Estimated flow 4 gallons a minute on Dec. 7, 1944.
179	1.02	Nov. 26, 1943	T,E, 30	F	Screened in two sands from 445 to 562 feet. Reported yield 321 gallons a minute on Jan. 24, 1939. Temperature 75½° F. See log.
180	d/6	July 1943	T,E, ()	P	This well and wells no. 178, 179, and 182 supply the city of Liberty. Temperature 72° F.
181	d/18	Oct. 30, 1931	--	--	Well destroyed in 1939.
182	+ 8	Nov. 17, 1944	Flows	P	Reported flow 40 gallons a minute on Nov. 7, 1944. Temperature 76½° F.
183	+ 7	Feb. 1911	--	N	Formerly supplied water for locomotive boilers. Screen at 559 to 591 feet. Deussen No. 736 e/ See log.
184	--	--	--	N	Formerly supplied water for locomotive boilers. Reported flowing in 1907. Deussen No. 735 e/.
185	13.60	Dec. 7, 1944	T,E, ½	P	Screen at 98 to 108 feet. Supplies water for restaurant. See log.
186	5.30	3c.	Cf,E 3	Ind	Screen at 301 to 321 feet. Supplies water for pipe line pump station. Temperature 77° F.
187	--	--	Flows	D	Flow estimated 5 gallons a minute See log. on Jan. 16, 1945.
188	+ 5	Dec. 9, 1944	Flows	S	Flow estimated 1 gallon a minute on Dec. 9, 1944.
189	--	--	Flows	D	Flow estimated 50 gallons a minute on Dec. 9, 1944. Supplies water for swimming pool.
190	--	--	Flows	S	Measured flow 50 gallons a minute on Dec. 9, 1944.
191	d/19	Oct. 1943	T,E, ½	P	Screen at 45 to 57 feet. With well no. 192 supplies fairgrounds. See log.

Records of wells and springs in Liberty County--Continued

Well	Distance from Liberty	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Height of measuring point above ground (ft.)
192	1½ miles southeast	Liberty County Fairgrounds	Pitre Water Well Drilling Co.	1943	65	4	0.0
193	In Liberty	Mrs. Maggie L. Moorefield	do.	1941	200	2	0.0
194	5 miles north	Martin Leissner	do.	1941	103	3	0.0
195	In Liberty	Trinity Valley Cold Storage Co.	--	1924	350	10	--
196	do.	Louis Fair	Louis Fair	1933	18	2	0.0
197	do.	A. C. Neyland	--	1927	28	4	0.0
198	do.	Sun Pipe Line Co.	Sun Pipe Line Co.	1932	40	6	0.0
199	do.	C. W. Fisher	C. W. Fisher	1895	232	2	0.0
200	7½ miles east	Howard Mc Cour	Pitre Water Well Drilling Co.	1942	191	2½	0.0
201	9½ miles east	Carl Johnson	do.	1942	528	4	0.0
202	9½ miles southeast	Chas. Welch	do.	1938	96	2½	0.0
203	7½ miles east	Silva and Welch	do.	1940	151	4, 2	0.0
204	do.	Mrs. -- Robinett	do.	1944	161	4	0.0
205	6 miles southeast	C. C. Thornton	do.	1944	287	4	0.0
206	7 miles east	Leo B. Pitre	do.	1944	370	4	0.0
207	do.	J. W. Swinney	do.	1942	137	2	0.0
208	4 miles southeast	Edward Mallet	Edward Mallet	1938	35	1½	0.0
209	5½ miles southeast	Cleveland Domain	Cleveland Domain	1944	20	5	2.0
210	2¾ miles east	do.	Pitre Water Well Drilling Co.	1940	80	2	0.0
211	7¾ miles southeast	C. M. Mitchell	F. Gay	1930	400	2	0.0
212	7¼ miles east	Chas. Welch	Pitre Water Well Drilling Co.	1945	145	2	0.0
213	do.	Leo B. Pitre	do.	1945	628	--	--
214	7 miles south	S. S. Hill	S. S. Hill	1924	22	1½	0.0
215	6½ miles south	Jack Moss	Jack Moss	1942	28	1½	0.0
216	7¾ miles south	Devers Canal Co.	Paul Acheson	1940	176	3	0.5
217	7¾ miles southeast	do.	do.	1943	238	2	0.0

Well	WATER LEVEL		Method of lift b/	Use of water c/	Remarks
	Below measuring point (ft.) a/	Date of measurement			
192	d/19	Oct. 1943	J,E, $\frac{1}{2}$	P	Screen at 47 to 57 feet.
193	d/18	Aug. 1941	J,E, $\frac{1}{2}$	D	Screen at 134 to 144 feet. See log.
194	d/25	June 1941	J,E, $\frac{1}{2}$	D,S	Screen at 87 to 97 feet. See log.
195	--	--	T,E, 15	Ind	Supplies water for ice plant.
196	d/ 8	Jan. 27, 1945	C,E, $\frac{1}{4}$	D	Screen at 14 to 18 feet.
197	d/12	Mar. 31, 1945	C,E, $\frac{1}{4}$	D	Screen at 24 to 28 feet.
198	d/10	Apr. 20, 1945	C,E, 20	Ind	Screen at 30 to 40 feet. Supplies water for pipe line pump station.
199	+d/34	1908	--	N	Flow reported 17 gallons a minute in 1908, no flow in 1945. Deussen No. 731 e/. See log.
200	d/24	Feb. 1942	J,E, $\frac{1}{4}$	D	Screen at 179 to 189 feet. See log.
201	d/22	Nov. 20, 1942	J,E, $\frac{1}{2}$	D,S	Screen at 415 to 437 feet. See log.
202	d/ 8	July 1938	Cf,G, 2	D,S	Screen at 88 to 93 feet. See log.
203	d/26	Sept. 1940	J,E, $\frac{1}{4}$	D	Screen at 138 to 148 feet. See log.
204	d/26	Apr. 1944	J,E, $\frac{1}{4}$	D	Screen at 147 to 157 feet. See log.
205	d/32	Sept. 1, 1944	C,W	S	Screen at 273 to 283 feet. See log.
206	d/27	July 1944	J,E, $\frac{1}{4}$	D	Screen at 360 to 370 feet. See log.
207	d/17	Oct. 1942	J,E, $\frac{1}{2}$	D,S	Screen at 132 to 137 feet.
208	d/15	1938	C,H	D,S	
209	4.27	Jan. 16, 1945	C,W	S	
210	d/30	1940	J,E, $\frac{1}{2}$	D	Screen at 70 to 80 feet.
211	d/25	1930	C,W	D,S	
212	d/24.50	May 22, 1945	J,E, $\frac{1}{4}$	D	Screen at 134 to 145 feet. See log.
213	--	--	--	--	Well not completed. See log.
214	d/16	Dec. 8, 1944	C,H	D,S	Screen from 20 to 22 feet. Temperature 73° F.
215	d/15	do.	C,H	D,S	Screen from 25 to 28 feet. Temperature 71° F.
216	4.10	do.	C,E, $\frac{1}{2}$	D	Screen from 170 to 176 feet. Temperature 70° F.
217	d/17	Aug. 1943	C,W	D	Screen from 226 to 238 feet. Supplies water for 4 families.

Records of wells and springs in Liberty County--Continued

Well	Distance from Liberty	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Height of measuring point above ground (ft.)
218	5 miles southeast	Bab Le Cour	-- Waggoner	1910	300	8	0.0
219	8½ miles south	J. M. Heiskell Est.	Rycade Oil Corp.	1930	5,927	--	--
220	10 miles south	Liberty Investment Co.	The Pure Oil Co.	1929	5,766	--	--
221	9 miles southeast	Shilo School	Pitre Water Well Drilling Co.	1940	333	2½	0.0
222	6½ miles southeast	A R. Milintz	do.	1944	275	4	1.5
223	12¼ miles southeast Chambers Co.	Franklin and Tideman, Ltd.	do.	1943	349	4	0.0
224	13½ miles southeast, Chambers Co.	Shell Oil Co.	Lavne-Texas Co.	1930	568	4	0.0
225	9¼ miles southeast	R. F. Whittington	F. Gay	1930	346	--	--

Well	Distance from Devers	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Height of measuring point above ground (ft.)
226	2¼ miles northeast	Sabine Tram Co.	Humble Oil and Refining Co.	1930	5,800	--	--
227	3 miles south	Texas Pipe Line Co.	Pitre Water Well Drilling Co.	1938	406	4	0.0
228	3¾ miles south	Bert Hays	do.	1942	234	2	0.0
229	1 mile east	V. D. Myers	do.	1943	99	2½	0.2
230	In Devers	W. E. Jenkins	do.	1943	443	2	0.0
231	6¼ miles south	Dan Hart	do.	1944	488	4	0.0
232	3½ miles northeast	The Texas Co.	do.	1944	232	4	0.0
233	1 mile south	E. V. Boyt	Jess Hollingshead	1937	210	4	0.0
234	5¾ miles east	B. H. Willis Est.	--	--	180	6	1.8
235	7½ miles east	do.	--	--	200	6	2.0
236	9¼ miles east	do.	--	1941	180	3	0.8
237	5½ miles east	Sinclair Pipe Line Co.	--	1923	492	8,6	1.8
238	In Devers	American Rice Growers Association	Pitre Water Well Drilling Co.	1941	107	3	0.0

Well	WATER	LEVEL	Method of lift b/	Use of water c/	Remarks
	Below measuring point (ft.) a/	Date of measurement			
218	+ 3	Dec. 22, 1944	Flows	N	Drilled to 1.500 feet as an oil test; casing then pulled to 800 feet and completed as flowing water well. Water is mineralized and contains marsh gas. Estimated flow 50 gallons a minute on Dec. 22, 1944. Temperature 72° F.
219	--	--	--	--	Oil test. See log.
220	--	--	--	--	Do.
221	d/ 4.5	June 1940	J, E, $\frac{1}{2}$	P	Screen at 306 to 317 feet. Supplies Shilo School. See log.
222	12.23	June 16, 1945	C, W	D, S	Screen at 261 to 273 feet. See log.
223	d/ 3	Aug. 1943	--	N	Screen at 326 to 347 feet. Water reported highly mineralized; supplied water for drilling rig. (Sherman no. 1). See log.
224	d/ 6	Feb. 19, 1930	--	N	Screen at 546 to 566 feet. Supplied water for drilling rig. Sulphur water reported between
225	--	--	C, W	S	681 and 707 feet. See log.
Well	WATER	LEVEL	Method of lift b/	Use of water c/	Remarks
	Below measuring point (ft.) a/	Date of measurement			
226	--	--	--	--	Oil test. See log.
227	d/14	Mar. 17, 1938	C, G, $\frac{1}{2}$	D, S	Screen at 384 to 404 feet. Formerly supplied water to pipe line pump station. See log.
228	d/13.5	June 11, 1942	Cf. G, $\frac{1}{2}$	D, S	Screen at 211 to 221 feet. See log.
229	9.00	Jan. 23, 1945	C, E, $\frac{1}{2}$	D	Screen at 74 to 79 feet. See log.
230	d/21	Nov. 10, 1943	J, E, $\frac{1}{2}$	D	Screen at 407 to 417 feet. See log.
231	d/15	Feb. 1944	C, W	D, S	Screen at 476 to 498 feet. See log.
232	d/11	Aug. 1944	--	N	Screen at 209 to 231 feet. Supplied water for drilling oil test (C. A. Moore no. 1). See
233	d/11 d/18	1937 1945	C, E, $\frac{1}{2}$	D	Screen at 201 to 210 feet. See log.
234	14.90	Jan. 17, 1945	C, W	D, S	"Pearson Place".
235	11.40	do.	C, W	D, S	"Headquarters well".
236	11.18	do.	C, H	D	"Gilmore Place".
237	13.72	June 20, 1945	A	D	Formerly supplied water to pipe line pump station; domestic supply at present. Screen at 429 to 492 feet. See log.
238	d/12	June 1941	J, E, $\frac{1}{2}$	P	Screen at 92 to 112 feet. Supplies drinking water for employees.

Records of wells and springs in Liberty County--Continued

Well	Distance from Devers	Owner	Driller	Date completed	Depth of well (ft.)	Diameter of well (in.)	Height of measuring point above ground (ft.)
239	4 $\frac{1}{2}$ miles southeast	J. E. Clark, Jr.	-- Hollingshead	1940	92	1 $\frac{1}{2}$	0.0
240	6 $\frac{1}{2}$ miles south	J. M. Rich	-- Abshier	1940	200	2	0.0
241	In Devers	H. A. Gripon	Pitre Water Well Drilling Co.	1945	501	2	0.0
242	9 $\frac{1}{4}$ miles southeast	E. W. Boyt	Paul Acheson	1941	403	2	0.0
243	7 $\frac{3}{4}$ miles southeast	do.	Jack White	1928	400	2	0.0
244	8 $\frac{1}{2}$ miles south	E. F. Abshier	J. F. Abshier	1920	150	2	0.0
245	9 miles south	E. W. Boyt	Gulf Oil Corp.	1935	225	7	--
246	9 $\frac{1}{2}$ miles south	do.	do.	1935	314	6	--
247	9 miles south	do.	do.	1935	335	6	--
248	do.	do.	do.	1935	318	6	--

a/ Plus (+) indicates water level above measuring point.

b/ Pump or lift: T, turbine; Cf, centrifugal; A, air lift; C, cylinder; B, rope and bucket.

Power: E, electric; G, gas or gasoline engine; S, steam; W, windmill; H, hand.
Number indicates horsepower.

Well	WATER LEVEL		Method of lift	Use of water	Remarks
	Below measuring point (ft.) a/	Date of measurement			
239	d/ 4	Jan. 3, 1945	C,W	D,S	Screen at 77 to 92 feet.
240	d/10	1940	C,E, 1/6	D,S	
241	d/21.30	Mar. 12, 1945	J,E, 1/2	D	Screen at 483 to 499 feet. Supplies 8 customers. See log.
242	d/15	July 1941	C,W	D,S	Screen at 391 to 403 feet.
243	d/15	Nov. 1923	C,W	D,S	Screen at 390 to 400 feet.
244	d/16	1920	C,W	D,S	
245	--	--	--	N	Screen at 182 to 205 feet. Supplied water for drilling oil test. (Boyt no. 19). See log.
246	--	--	--	N	Screen at 311 to 336 feet. Supplied water for drilling oil test. (Boyt no. 20). See log.
247	--	--	--	N	Screen at 315 to 335 feet. Supplied water for drilling oil test. (Boyt no. 3).
248	--	--	--	N	Screen at 274 to 318 feet. Supplied water for drilling oil test. (Boyt no. 5).

c/ P, public supply; Ind. industrial; RR, railroad; D, domestic; S, stock; N, not used.

d/ Water level reported by driller or owner.

e/ Number under which well is listed in U. S. Geological Survey "Water-Supply Paper 335, Alexander Deussen, 1914.

Table of Drillers' Logs, Liberty County, Texas

<u>Well 2</u>			<u>Well 2--Continued</u>		
	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Gulf, Colorado and Santa Fe R. R. Co., in Cleveland.			Gumbo	9	980
			Shale	127	1107
Surface	44	44	Fine packsand	21	1128
Sand	62	106	Gumbo	42	1170
Clay	13	119	Shale streaks	10	1180
Sand and gravel	27	146	sand	25	1205
Rock	3	149	Boulders	2	1207
Clay	66	215	Sand and gravel	32	1239
Fine-grained sand	24	239	Gravel	6	1245
Shale	34	273	Gumbo	5	1250
Sand and gravel	55	328	Sand	30	1280
Gumbo	137	465	Gumbo	5	1285
Shale	35	500	Sand	52	1337
Rock	1	501	Shale and boulders	58	1395
Gumbo	26	527	Tight sand	21	1416
Gumbo and boulders	40	567	Sand	35	1451
Soft shale	23	590	Shale streaks	13	1464
Boulders	5	595	Sand	14	1478
Shale	7	602	Shale	34	1512
Boulders	9	611			
Ledges of rock	13	624	<u>Well 4</u>		
Gumbo	68	692	Humble Oil & Refining Co., Campbell		
Fine-grained sand	18	710	No. 1, 7½ miles south of Cleveland.		
Gumbo	7	717	Surface sand	12	12
Shale	33	750	Sandy clay	13	25
Sand	20	770	Sand	13	38
Gumbo	24	794	Clay	22	60
Sand	45	839	Sand	26	86
Shale	66	905	Clay	5	91
Loose sand	13	918	Gumbo	13	104
Gumbo	3	921	Shale	27	131
Sand	9	930	Sand	42	173
Shale	15	945	Gravel	64	237
Rock	12	957	Shale	11	248
Gumbo	8	965	Sand and gravel	13	261
Shale	6	971			

(continued on next page)

Table of Drillers' Logs, Liberty County--Continued

Well 4 --Continued		Well 4--Continued			
	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sticky shale	22	283	Gumbo	32	1192
Shale	24	307	Hard sandy shale	3	1195
Gumbo	5	312	Gumbo and boulders	9	1204
Sticky shale	17	329	Gumbo	9	1213
Sand and gravel	44	373	Boulders	3	1216
Rock	3	376	Sand	24	1240
Gumbo	40	416	Hard sandy shale	5	1245
Gumbo, lime and sand	17	433	Gumbo	121	1366
Gumbo and lime	32	465	Sand	2	1368
Sand and boulders	21	486	Sandy shale	17	1385
Hard sand	5	491	Gumbo	15	1400
Gumbo and lime	20	511	Sand	3	1403
Hard lime	4	515	Soft sandy shale	16	1419
Sand and boulders	15	530	Gumbo	62	1481
Hard lime	4	534	Sand	21	1502
Gumbo and lime	47	581	Gumbo	39	1541
Sand and boulders	19	600	Sandy shale	40	1581
Hard brown sand	12	612	Rock	2	1583
Sand	8	620	Gumbo	11	1594
Gumbo and lime	108	728	Sticky shale and lime	11	1605
Sand	3	731	Packsand	5	1610
Sand and boulders	28	759	Sand	10	1620
Gumbo and lime	41	800	Sticky shale	6	1626
Shale and lime	18	818	Gumbo and lime	2	1628
Tough sticky shale	18	836	Shale and lime	1	1629
Rock	1	837	Sticky shale and lime	28	1657
Sticky shale	16	853	Shale and lime	15	1672
Gumbo	54	907	Sand and shale	4	1676
Rock	1	908	Hard sand and shale	10	1686
Gumbo	27	935	Shale and lime	18	1704
Sand	9	944	Gumbo	4	1708
Gumbo	43	987	Gumbo and lime	47	1755
Sand	3	990	Gumbo and lime, sand and boulders	62	1817
Sandy shale	26	1016	Sand	52	1869
Gumbo	44	1030	Sand and boulders	16	1885
Rock	1	1061	Gumbo	7	1892
Gumbo	8	1070	Tough gumbo	55	1947
Sand	40	1110	Gumbo	2	1949
Gumbo	34	1144	Sandy shale and lime	32	1981
Sand and boulders	16	1160	Gumbo	19	2000

Table of Drillers' Logs, Liberty County--Continued

	Thickness (feet)	Depth (feet)
<u>Well 5, partial log</u>		
Humble Oil & Refining Co., Hornbeck No. 1, 2 miles southwest of Cleveland.		
Surface clay	55	55
Quicksand	50	105
Clay and gravel	207	312
Rock	1	313
Sand and boulders	59	372
No record	248	620
Gumbo	15	635
Sandy shale	60	695
Gumbo	20	715
Sandy shale and boulders	170	885
Gumbo	15	900
Sandy shale and boulders	45	945
Sticky shale and gumbo	172	1117
Rock	1	1118
Gumbo with streaks of shale	91	1209
Gumbo with streaks of sticky shale	76	1285
Sand and shale	6	1291
Fresh water sand	3	1294
Sand and shale	6	1300
Broken lime and gumbo, sticky shale	96	1396
Sandy shale	5	1401
Sticky shale with streaks of lime	24	1425
Broken lime and sand	2	1427
Coarse-grained sand	4	1431
Broken lime and sand	44	1475
Gumbo	85	1560
Sticky shale with streaks of lime and gumbo	88	1648
Sand	3	1651
Water sand	29	1680
Gumbo and sticky shale	35	1715
Sandy shale	35	1750
Gumbo	18	1768
Sand and sandy shale with streaks of lime	30	1798
Sticky shale	13	1811
Sticky shale and gumbo	19	1830
Rock	1	1831
Water sand	19	1850
Sticky shale and gumbo	30	1880

	Thickness (feet)	Depth (feet)
<u>Well 5, partial log--continued</u>		
Water sand	11	1891
Sand	14	1905
Sticky shale and gumbo	15	1920
Hard rock	1	1921
Water sand and red shale	4	1925
Sand and broken lime	10	1935
Gumbo and hard shale	30	1965
Broken lime, shale, and gumbo	120	2085
Shale and gumbo	215	2300
Gumbo	10	2310
Rock	3	2313
Sand	2	2315
Sand and shale	15	2330
Gumbo	15	2345
Sand and sandy shale	10	2355
Broken sand and shale	75	2430
Sticky shale and gumbo	15	2445
Sand and shale	15	2460
Broken sand and shale	35	2495
Gumbo	11	2506
TOTAL DEPTH		5633

<u>Well 8</u>		
City of Cleveland, No. 2, in Cleveland.		
Surface soil	6	6
Soft yellow clay	14	20
Sand	6	26
Soft clay	24	50
Sand	29	79
Clay	2	81
Sand	29	110
Clay	5	115
Sand	30	145
Clay	61	206
Coarse sand and gravel	11	217
Clay	17	234
Gravel	51	285
Soft yellow clay and sand	4	289
Sand and gravel	25	314
Clay with sand breaks	21	335
Clay	98	433
Hard layers	1	434
Clay	61	495
Hard layers	2	497
Clay	29	526

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Table of Drillers' Logs, Liberty County--Continued

	Thickness (feet)	Depth (feet)
<u>Well 8--Continued</u>		
Hard layers	1	527
Clay	83	610
Sand	26	636
Clay	10	646
Gumbo	105	751
Sand	19	770
Sticky shale	21	791
Hard sandy shale	22	813
Sand breaks and shale	17	830
Sticky shale	80	910
Sand	16	926
Sticky shale	3	929

<u>Well 9</u>		
Black Gold Petroleum Co., $5\frac{1}{4}$ miles southeast of Cleveland.		
Sand	10	10
Clay	33	43
Sand rock	24	67
Sand and gravel	21	88
Clay	7	95

<u>Well 10</u>		
Russ Mitchell Co., No. 1, $3\frac{1}{4}$ miles southeast of Cleveland.		
Sand and gravel	112	112
Sandy shale	88	200
Sand and gravel	104	304

<u>Well 20</u>		
M. A. Ellis, $5\frac{3}{4}$ miles northeast of Cleveland.		
Sandy soil	2	2
Red clay	10	12
Fine red sand and streaks of clay	30	42
White sand (good)	18	60
White sand and streaks of clay	10	70
Clay	26	96
Gray sand (good)	29	125
Clay	30	155
Broken, fine, brown sand and clay	21	176
Sand and fine gravel	48	224

	Thickness (feet)	Depth (feet)
<u>Well 20--Continued</u>		
Clay	2	226

<u>Well 23</u>		
W. P. Johnston, $7\frac{3}{4}$ miles northeast of Cleveland.		
Hard, red to pink sand	38	38
Sandy, red clay	21	59
Brown sand	21	80
Gravel and streaks of sandy clay	18	98
Sand	19	117
Sandy clay	7	124
Gravel	2	126
Sandy clay	3	129
Gravel	11	140
White sandy clay	9	149
Tough, cream colored clay	24	173
Rock	1	174
Sand and gravel	16	190
Hard, brown, red, and white clay	47	237
Sand and lenses of lime	18	255
Lime rock	2	257
Sand	1	258
Lime rock	2	260
Sand	8	268
Lime rock	6	274
Hard and soft sand	32	306
Brown, red, and white clay	48	354
Sand	2	356
Clay	44	400
Brown sand rock	4	404
Gray sand	26	430
Clay	4	434
Sandy clay	6	440

<u>Well 27</u>		
Russ Mitchell Co. No. 2, $6\frac{1}{2}$ miles south-east of Cleveland.		
Clay	69	69
Sand	10	79
Clay	5	84
Shale	13	97
Sand	33	130
Sticky clay	1	131

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Table of Drillers' Logs, Liberty County--Continued

	Thickness (feet)	Depth (feet)
<u>Well 27--Continued</u>		
Sand and gravel	9	140
Clay	11	151
Sandy clay	6	157
Sand	3	160
Clay	47	207
Sand	77	284

<u>Well 28</u>		
Russ Mitchell Co., No. 3, 10 $\frac{3}{4}$ miles southeast of Cleveland.		
Sand	8	8
Clay	16	24
Sand	61	85
Sand and gravel	34	119
Fine gray sand	51	170
Shale	6	176
Sand and gravel	26	202
Fine-grained sand	2	204

<u>Well 29</u>		
M. N. Cunningham, 9 $\frac{1}{2}$ miles southeast of Cleveland.		
Sand	3	3
Clay	9	12
Sand	6	18
Hard clay	49	67
Red sand	29	96
Hard clay	21	117
Red sand	6	123
Hard clay	40	163
Sand	23	186
Hard clay	12	198
Sand	6	204
Hard clay	2	206
Coarse red sand and gravel	15	221
Hard clay	72	293
Sand and gravel	12	305
Hard clay	2	307
Sand and gravel	4	311
Hard clay	10	321
Sand and gravel	15	336
Hard clay	10	346
Medium gravel	5	351
Clay	17	368

	Thickness (feet)	Depth (feet)
<u>Well 40</u>		
Mrs. Corine Brown, 11 miles south of Romayor.		
Sand	31	31
Clay	6	37
Sand	45	82
Shale	6	88
Fine-grained sand	26	114
Medium sand	16	130
Shale	3	133
Sand	9	142
Clay	32	174

<u>Well 44</u>		
A. G. Lesterjette, well No. 1, 9 miles south of Romayor.		
Top soil	12	12
Shale and sand; showing of dead oil	173	185
Blue gumbo	100	285
Shale and packsand	95	380
Gumbo, showing oil	40	420
Sand and shale	150	570
Gumbo	5	575
Oil sand (blow-out)	18	593
Gumbo	47	640
Sand with salt water	22	662

<u>Well 48</u>		
T. B. Allen & Co., 2 miles east of Romayor.		
Clay	10	10
Sand	70	80
Clay and gravel	20	100
Sand	40	140
Clay and gravel	20	160
Sand	20	180
Rock	2	182
Clay and gravel	6	188
Rock	3	191
Gravel	19	210
Rock and sand	30	240
Clay and gravel	160	400
Sand	20	420
Clay and gravel	50	470
Thin layers of "rocksand"	12	482
Shale	78	520
Clay and gravel	30	550
Water sand	109	659

Table of Drillers' Logs, Liberty County--Continued

	Thickness (feet)	Depth (feet)
<u>Well 50</u>		
Gulf, Colorado, and Santa Fe R. L. Co., in Romayor.		
Surface soil	7	7
Sandy clay and gravel	39	46
Red clay	12	58
Sand and clay	32	90
Very fine sand	34	124
Shale	17	141
Hard sand	7	148
Shale	21	169
Sand and boulders	63	232
Shale	29	261
Sand	24	285
Gumbo	17	302
Sand	40	342
Shale	43	385
Very hard sand	20	405
Gumbo	67	472
Hard sand	12	484
Hard gumbo	8	492
Hard sand	40	532
Salt and pepper sand	64	596
Very rough sand	14	610
Shale	35	645

	Thickness (feet)	Depth (feet)
<u>Well 52</u>		
Texas Construction Material Co., 4½ miles southeast of Romayor.		
Clay and sand	24	24
Sand and gravel	26	50
Clay	8	58
Sand and gravel	72	130
Clay and gravel	16	146
Sand and gravel	26	172
Hard clay	68	240
Sand and gravel	12	252
Clay	26	278
Sand and gravel	17	295
Gravel	52	347
Shale	3	350
Gravel	29	379
Rock	1	380
Clean sand	11	391
Clay and gravel	5	396
Sand and gravel	20	416
Sand	26	442
Sand and gravel	62	504
Shale	11	515

	Thickness (feet)	Depth (feet)
<u>Well 52--Continued</u>		
Sand, clay and boulders	15	530
Shale	102	632
Sand and gravel	96	728
Shale and gumbo	21	749
Sand and gravel	59	808

	Thickness (feet)	Depth (feet)
<u>Well 69</u>		
Concord School, 4½ miles east of Romayor.		
Soft clay	24	24
Sand and gravel	13	37
Medium clay	5	42
Soft sand	53	95
Medium clay	9	104

	Thickness (feet)	Depth (feet)
<u>Well 70</u>		
Boyd Sewell, 4½ miles east of Romayor.		
Sand	7	7
Clay	11	18
Fine sand	21	39
Clay	28	67
Sand and gravel	11	78
Clay	23	101
Sand	8	109
Clay	1	110
Sand	18	128
Clay	1	129
Sand	4	133
Clay	2	135

	Thickness (feet)	Depth (feet)
<u>Well 75</u>		
Chas. B. Peterson, Well 52, 4 miles northwest of Dayton.		
Shale and clay	60	60
Clay	283	343
Blue gumbo	64	407
Sand and gravel	22	429
Shale and sand	91	520
Hard sand and gravel	35	555
Shale and sand	40	595
Gumbo and sand	115	710
Shale and sand	25	735
Shale and gumbo	17	752
Rock	4	756
Hard sand and boulders	24	780
Gyp and gumbo	14	794
Sand and shale	46	840
Sand and rock	17	857

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Table of Drillers' Logs, Liberty County--Continued

	Thickness (feet)	Depth (feet)
<u>Well 75--Continued</u>		
Gumbo	15	872
Hard sand and boulders	68	940
Rock	5	945
Gumbo	58	1003
Rock	2	1005
Sand and boulders	25	1030
Shale and shell	20	1050
Sand and boulders	12	1062
Gumbo and sand	119	1181
Gumbo and gypsum	4	1185
Hard sand and boulders	29	1214
Shale and shell	10	1224
Gumbo	11	1235
Sand and boulders	28	1263
Gumbo and gypsum	15	1278
Rock	2	1280
Pyrites and sand	32	1312
Rock	3	1315
Shale	5	1320
Gumbo and gypsum	42	1362
Rock	3	1365
Gumbo	23	1388
Rock	3	1391
Hard sand and boulders	8	1399
Rock	16	1415
Gumbo and shale	101	1516
Hard packsand	19	1535
Shale and gumbo	75	1610
Sand and boulders	17	1627
Gumbo and boulders	46	1673
Hard sand	21	1694
Rock	2	1696
Sand and boulders	6	1702
Gumbo	16	1718
Hard sand and boulders	14	1732
Gumbo	14	1746
Lime rock	6	1752
Gumbo and sand	195	1947
Sand and boulders	4	1951
Gumbo	34	1985
Hard sand and shale	39	2024
Gumbo and shale	121	2145
Gypsum	2	2147
Shale and gumbo	41	2188
Hard sticky shale	24	2212
Shelly clay	53	2265
Gyp, rock and blue shale	15	2280
Shale	50	2330
Gypsum	1	2331
Gumbo and shale	311	2642
Hard shell	38	2680

	Thickness (feet)	Depth (feet)
<u>Well 75--Continued</u>		
Gumbo and shale	70	2750
Lime rock	18	2768
Gypsum and sand rock	23	2791
Gumbo and sand	35	2826
Hard sand rock	21	2847
Hard rock	5	2852
Hard sand	9	2861
Hard sand and boulders	27	2888
Gypsum rock	3	2891
Hard sand	8	2899
Hard rock	3	2902
Rock and hard sand	50	2952
Gumbo	23	2975
Shale and sand	8	2983
Gumbo and shale	424	3407

Well 78

A. J. and S. O. Carter, 6 miles northwest of Dayton.

Soil, sand, and clay	56	56
Clay	42	98
Clay	22	120
Sandy clay	20	140
Clay	10	150
Sand	30	180
Sandy clay	10	190
Sandy clay	15	205
Sand	23	228
Sandy clay	40	268
Clay	36	304
Sandy clay	14	318
Clay	42	360
Sandy clay	10	370
Sand	30	400
Clay	40	440
Sand	22	462
Clay	10	472
Sand	68	540
Clay	12	552
Sand	14	566
Sandy clay	16	582
Clay	12	594
Sand	24	618
Clay	7	625
Sand	85	710
Clay	15	725
Sandy clay	5	730
Sand	42	772
Clay	5	777
Sand	30	807
Clay	5	812

Table of Drillers' Logs, Liberty County--Continued

	Thickness (feet)	Depth (feet)
<u>Well 82</u>		
Ralph Graves, $5\frac{1}{2}$ miles northwest of Dayton.		
Surface	9	9
Sandy clay	35	44
Sand and clay streaks	12	56
Joint clay	34	90
Sandy clay	20	110
Hard shale	7	117
Shale	29	146
Sand (good)	57	203
Sandy shale	10	213
Sand and streaks of shale	11	224
Sandy shale	6	230
Sand and streaks of shale	21	251
Sandy shale	6	257
Sand (good)	18	275
Hard shale	8	283
Sand	32	315
Hard shale	3	318
Sand and boulders	7	325
Hard shale	5	330
Sand and streaks of hard shale	28	358
Shaley sand	6	364
Sand (good)	58	422
Shale and sand	17	439
Sand (good)	13	452
Sand and boulders	4	456
Sand, shale and boulders	16	472
Shale and lime	8	480
Sandy shale	3	483
Sand (good)	14	497
Hard packsand and boulders	5	502
Sand	12	514
Hard sand	2	516
Sand	19	535
Shale	4	539
Sand and boulders	14	553
Shale and sand boulders	5	558

<u>Well 84</u>		
Arnold Wolfe, 5 miles northwest of Dayton.		
Surface clay	4	4
Yellow clay	14	18
Sand	27	45

	Thickness (feet)	Depth (feet)
<u>Well 84--Continued</u>		
Clay	75	120
Sand	12	132
Clay	28	160
Sand	10	170
Clay	46	216
Sand	30	245
Clay	19	265
Sandy clay	15	280
Clay	82	362
Sand	25	387
Clay	7	394
Sand and clay	18	412
Sand	12	424
Clay	6	430
Sand	54	484
Clay	29	513
Sand	40	553
Clay	32	585
Sand	20	605
Clay and sand	79	684
Sand	40	724
Clay	15	739
Sand	93	832
Clay	2	834

<u>Well 85</u>		
E. J. Stoesser, $7\frac{1}{2}$ miles west of Dayton.		
Sandy soil	3	3
Clay	17	20
Sandy clay	21	41
Clay and sandy clay	92	133
Sand (good)	31	164
Clay	22	186
Sandy shale	16	202
Shale	10	212
Sandy shale	10	222
Shale	22	244
Sand (good)	19	263
Sandy shale	13	276
Sand (good)	58	334
Shale	7	341
Shale and layers of sand	22	363
Sand (good)	31	394
Hard sandy shale	20	414
Shale	8	422
Sand (good)	87	509
Hard shale	8	515
Sand (good)	17	532
Shale	3	535

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Table of Drillers' Logs, Liberty County--Continued

	Thickness (feet)	Depth (feet)
<u>Well 85--Continued</u>		
Sand (good)	45	580
Sandy shale	5	585
Shale	13	598
Sand (good)	12	610
Sticky shale	14	624
Sandy shale	6	630
Sticky shale	15	645
Sandy shale	5	650
Sand (good)	37	687
Shale	13	700
Sand	55	755
Sand and gravel	27	782
Fine sand and boulders	20	802
Hard shale	6	808

Well 90

Peterson & Sterling, $4\frac{1}{4}$ miles west of Dayton.

Soil	3	3
Clay	63	66
Buckshot clay	85	151
Soft clay and gumbo	176	327
Fine-grained sand	16	343
Coarse-grained sand	50	393
Gumbo	11	404
Coarse-grained sand	74	478
Gumbo	35	513
Coarse-grained sand	77	590
Gumbo	2	592

Well 91

Chas. B. Peterson, $4\frac{1}{2}$ miles west of Dayton.

Shale and clay	21	21
Gumbo	138	165
Sand	171	336
Gumbo	5	341
Water sand	10	351
Gumbo	48	399
Shale	6	405
Sand	15	420
Shale	55	475
Gumbo	15	490
Shale	6	496
Sand	27	523
Gumbo	70	593
Sand	49	642

	Thickness (feet)	Depth (feet)
<u>Well 91--Continued</u>		
Gumbo	5	647
Sand	13	660
Gumbo	66	726
Sand	12	738
Shale	10	748
Sand rock	12	760
Gypsum	12	772
Gumbo	15	787
Shale	25	812
Gravel and shale	15	827
Gumbo	11	838
Sand	19	857
Rock	12	869
Gumbo	2	871
Sand	9	880
Gypsum	35	915
Gumbo	21	936
Gypsum	40	976
Sand	3	979
Shell and shale	6	985
Rock	55	1040
Gumbo	1	1041
Sand and shale	86	1127
Gumbo	36	1163
Sand and boulders	2	1165
Gumbo	38	1203
Rock	14	1217
Sand, shell and boulders	3	1220
Gumbo	23	1243
Sand and boulders	15	1258
Gumbo	36	1294
Hard sand and boulders	8	1302
Soft rock	26	1328
Hard sand	2	1330
Rock	10	1340
Sand, boulders and gravel	3	1343
Gumbo and boulders	40	1383
Sand	30	1413
Gypsum and hard gumbo	6	1419
Sand	179	1598
Gumbo	6	1604
Sand	46	1650
Gumbo	15	1665
Sand and boulders	17	1682
Gumbo and boulders	20	1702
Lime rock	14	1716
Gumbo and boulders	14	1730
Gumbo	24	1754
Sand	36	1790
Gumbo	18	1808

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Table of Drillers' Logs, Liberty County--Continued

	Thickness (feet)	Depth (feet)
<u>Well 91--Continued</u>		
Hard shale	2	1810
Gypsum and gumbo	7	1817
Sand	29	1846
Rock	64	1910

<u>Well 92</u>		
Patrick and Tyrrell Drilling Co., 7 miles west of Dayton.		
Clay	94	94
Fine-grained sand	15	109
Clay	2	111
Streaks of sand and clay	18	129
Fine-grained sand	5	134
Clay	2	136
Fine-grained sand	7	143
Clay	58	201
Fine-grained sand	25	226
Rock	1	227
Fine-grained sand	11	238
Medium sand	18	256

<u>Well 105</u>		
Sun Oil Co., Quintette well No. 1, 6 $\frac{1}{2}$ miles northwest of Dayton.		
Yellow surface clay	20	20
Blue shale	13	33
White sand	20	53
Sand and clay	105	158
White quicksand	13	171
Blue shale	9	180
White sand	6	186
Blue shale	7	193
Gumbo	47	240
Sand and gravel	85	325
Gumbo	22	347
Sand, putty sand	11	358
Sand and gravel	79	437
Shale	6	443
Sand	22	465
Gumbo	16	481
Sand	15	496
Gumbo	17	513
Sand, putty sand	14	527
Gumbo	38	565
Sand, putty sand	32	597
Shale	4	601

	Thickness (feet)	Depth (feet)
<u>Well 105--Continued</u>		
Sand	12	613
Gumbo	8	621
Shale, rock, and clay	39	660
Shale	12	672
Hard rock	1	673
Gumbo	6	679
Sand	26	705
Shale	25	730
Gumbo	65	795
Rock	4	799
Gumbo	7	806
Shale	12	818
Gumbo	27	845
Yellow clay	10	855
Gumbo	20	875
Clay	9	884
Gumbo	6	890
Sand, putty sand	5	895
Limestone	1	896
Sand, putty sand	8	904
Coarse-grained sand	6	910
Gumbo	23	933
Sand, putty sand	9	942
Shale	16	958
Rock	3	961
Gumbo and shale	64	1025
Shale, rock, and shale	11	1036
Rock	2	1038
Shale	22	1060
Rock	5	1065
Gumbo and shale	47	1112
Shale and rock	12	1124
Limestone	2	1126
Sand, putty sand	7	1133
Limestone	1	1134
Brown and blue shale	33	1167
No record	78	1245
Boulders (concretions) and rock	4	1249
Gumbo	41	1290
Shale	5	1295
Rock and clay	4	1299
Gumbo	7	1306
Shale	86	1392
Hard sand	6	1398
Shale	8	1406
Gumbo	14	1420
Shale	34	1454
Very tough gumbo	71	1525
Hard shale	27	1552

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Table of Drillers' Logs, Liberty County--Continued

	Thickness (feet)	Depth (feet)
<u>Well 105--Continued</u>		
Shale and gumbo	39	1591
White shell and rock	7	1598
Blue shale	32	1630
Soft rock	2	1632
Gumbo	8	1640
Hard blue sand with strata of rock	10	1650
Blue gumbo	30	1680
Rock	3	1683
Shale	8	1691
Hard sandstone	2	1693
Blue shale and blue sand, very slight show of oil	12	1705
Blue shale and thin strata of rock	13	1718
Blue shale	45	1763

<u>Well 106</u>		
Taylor-Dayton Co., 7 $\frac{1}{2}$ miles northwest of Dayton,		
Black dirt	6	6
Blue clay	22	28
Water sand	8	36
Blue marl	37	73
Quicksand	12	85
Blue clay	15	100
Boulders (sandstone)	2	102
Quicksand	39	141
Blue marl	66	207
Boulders	2	209
Coarse quicksand	20	229
Blue marl and boulders	3	232
Blue marl	6	238
Boulders	3	241
Blue marl: gas at 244 Ft.	32	273
Quicksand	47	320
Water sand	6	326
Quicksand	3	329
Blue marl	-	
No record	271	600
Limestone	200	800
Rock salt	400	1200

<u>Well 109</u>		
Heal & Brown, 5 miles southwest of Dayton.		
Soil and clay	26	26
Fine-grained sand	5	31

	Thickness (feet)	Depth (feet)
<u>Well 109--Continued</u>		
Shale and clay	57	88
Sand	11	99
Clay	71	170
Sand	5	175
Clay	70	245
Sand, layers of rock	42	287
Soft clay	16	303
Sand	2	305
Clay	5	310
Sand, layers of rock	87	397
Clay	6	403
Sand	4	407

Well 120
City of Dayton, No. 2, in Dayton.

Clay	52	52
Sand	11	63
Clay	7	70
Boulder	2	72
Red clay	41	113
Sticky clay	46	159
Sandy shale	11	170
Shale	43	213
Gumbo	97	310
Sand	75	385
Shale	14	399

Well 121
The Texas Co., League No. 3, 9 $\frac{1}{2}$ miles
south of Dayton.

Soil	1	1
Clay	21	22
Yellow clay and gravel	62	84
Sand and clay	37	121
Gumbo, blue	260	381
Shale, sand, shell, and gravel	56	437
Gray sand and shell	33	470
Blue gumbo	34	504
Gumbo and shell, sandy	57	561
Blue gumbo	44	605
Gray sand and shell	46	651
Blue sandy gumbo	58	709
Shale, sand, shell, and gravel	48	757
Blue sandy gumbo	82	789
Blue gumbo	38	827

(continued on next page)

Table of Drillers' Logs, Liberty County--Continued

	Thickness (feet)	Depth (feet)
<u>Well 121--Continued</u>		
Blue shale and shell	36	863
Blue sandy gumbo	94	957
Blue shale and shell	61	1018
Gray sand and shell	16	1034
Gumbo and lime, sandy	65	1099
Blue shale and shell	24	1123
Blue sandy gumbo	28	1151
Shale and boulders	68	1219
Blue gumbo	17	1236
Blue gumbo and lime	28	1264
Gumbo	52	1316
Shale and lime	19	1335
Brown gumbo	39	1374
Blue shale and lime	37	1411
Blue gumbo	17	1428

<u>Well 122</u>		
C. A. Grebey, 1 $\frac{1}{2}$ miles northwest of Dayton.		
Clay	140	140
Fine-grained sand	10	150
Clay	14	164
Coarse-grained sand	29	193

<u>Well 140</u>		
Sudermann-Dolsen Co., 6 $\frac{1}{2}$ miles north of Dayton.		
Clay	60	60
Sand	13	73
Joint clay	17	90
Gumbo	20	110
Joint clay	35	145
Gumbo	40	185
Sand	40	225

<u>Well 141</u>		
Russ Mitchell Co., No. 4, 3 $\frac{5}{8}$ miles north of Dayton.		
Clay	23	23
Sand	8	31
Clay	89	120
Very fine, red and gray sand	58	178
Hard shale	122	300
Sticky clay	64	364

	Thickness (feet)	Depth (feet)
<u>Well 141--Continued</u>		
Fine-grained sand	41	405
Sand	8	413

<u>Well 146</u>		
L. E. Wiggins, 13 miles north of Liberty.		
Yellow clay	65	65
Sand	14	79
Clay	4	83
Sand and gravel	33	116

<u>Well 148</u>		
J. E. Dillon, 13 $\frac{1}{4}$ miles north of Liberty.		
Clay	22	22
Sand	22	44
Clay	22	66
Fine-grained sand	23	89
Coarse-grained sand	20	109
Fine-grained sand	17	126
Clay	69	195
Sand and gravel	18	213

<u>Well 149</u>		
John Morgan, 12 $\frac{1}{4}$ miles north of Liberty.		
Yellow clay	15	15
Tight fine-grained sand	6	21
Yellow clay	31	52
Fine-grained sand	32	84
Clay	3	87
Hard packsand	13	100
Clay	29	129
Sand and gravel	63	192

<u>Well 151</u>		
L. Daffern, 10 $\frac{5}{8}$ miles north of Liberty.		
Yellow clay	60	60
Blue clay	21	81
Coarse-grained sand	41	122
Shale	3	125

<u>Well 152</u>		
Morgan and Morgan Lumber Co., 7 $\frac{1}{2}$ miles north of Liberty.		

(continued on next page)

Table of Drillers' Logs, Liberty County--Continued

	Thickness (feet)	Depth (feet)
<u>Well 152--Continued</u>		
Clay	60	60
Fine-grained sand	26	86
Clay	29	115
Sand	2	117
Clay with lenses of sand	28	145
Clay	15	160
Blue sandy clay	22	182
Good sand and gravel	46	228

Well 153

Hardin Baptist Church, $7\frac{3}{4}$ miles north of Liberty.

Soft sand	4	4
Soft clay	66	70
Coarse-grained sand	18	88
Medium clay	11	99

Well 154

John Rosnick, 7 miles north of Liberty.

Clay	50	50
Sand and gravel	32	82
Clay	28	110

Well 155

Humble Oil & Refining Co., (Partlow No.10) $8\frac{1}{2}$ miles north of Liberty.

Sand	2	2
Clay	10	12
Sand and gravel	26	38
Clay	4	42
Sandy clay	56	98
Sand	18	116
Lenses of sand and clay	35	151
Sand	25	176
Clay	13	189
Sand and gravel	30	219
Clay	11	230

Well 156

Humble Oil & Refining Co., (Partlow No. 17), $8\frac{1}{2}$ miles north of Liberty.

	Thickness (feet)	Depth (feet)
<u>Well 156--Continued</u>		
Clay	26	26
Fine-grained sand	51	77
Clay	20	97
Rock	2	99
Clay	31	130
Fine-grained sand	29	159
Clay	18	177
Sand	14	191
Clay	14	205
Coarse-grained sand	23	228
Clay	14	242
Coarse-grained sand	11	253
Clay	4	257

Well 157

Humble Oil & Refining Co., (Johnson No. 1), 9 miles north of Liberty.

Red sand	42	42
Red clay	20	62
Sand	4	66
Sandy clay	4	70
Fine sand, "salt and pepper"	20	90
Tough red clay	6	96
Very fine gray sand	30	126
Sand with lenses of of shale	26	152
Sand and gravel	15	167
Blue clay	10	177
Sand and gravel	23	200

Well 158

James R. Nowery Drilling Co., $7\frac{1}{2}$ miles north of Liberty.

Sand and gravel	36	36
Clay	60	96
Fine-grained sand	22	118
Clay	43	161
Fine-grained sand	35	196
Streaks of sand and clay	6	202
Gravel	5	207
Clay	13	220
Streaks of clay and gravel	13	233
Clay	8	241
Fine-grained sand	13	254

(continued on next page)

Table of Drillers' Logs, Liberty County--Continued

	Thickness (feet)	Depth (feet)
<u>Well 159</u>		
Humble Oil & Refining Co. (Partlow "A" No. 8), 8 $\frac{1}{4}$ miles north of Liberty.		
Sand	2	2
Clay	10	12
Sand and gravel	26	38
Clay	4	42
Lenses of sand and clay	56	98
Sand	18	116
Lenses of sand and clay	35	151
Sand	24	175
Clay	6	181
Sand and gravel	35	216
Tough clay	2	218

	Thickness (feet)	Depth (feet)
<u>Well 160</u>		
Humble Oil & Refining Co., Hardin Camp Well, 8 miles north of Liberty.		
Clay	12	12
Loose, fine, red sand	23	35
Clay	15	50
Sand and gravel	18	68
Clay	41	109
Sand and gravel	29	138
Blue clay	37	175
Sand and gravel	51	226

	Thickness (feet)	Depth (feet)
<u>Well 164</u>		
Mrs. A. Cessna, 8 $\frac{1}{2}$ miles north of Liberty.		
Surface sand	3	3
Yellow clay	38	41
Clay streaks and sand	24	65
Gray sand	21	86
Yellow clay	69	155
Gray sand	37	192

	Thickness (feet)	Depth (feet)
<u>Well 166</u>		
Hull-Daisetta Water Co., 11 miles northeast of Liberty.		
Clay	20	20
Fine-grained sand	10	30
Coarse-grained sand	33	63
Clay	1	64
Coarse-grained sand	11	75

	Thickness (feet)	Depth (feet)
<u>Well 166--Continued</u>		
Clay	3	78
Coarse-grained sand	4	82
Yellow clay	3	85
Coarse-grained sand	5	90
Clay	1	91
Sand	5	96
Clay	60	156
Fine-grained sand	19	175
Clay	23	198
Rock	6	204
Clay	30	234
Gravel	3	237
Clay	71	308
Coarse-grained sand	57	365

	Thickness (feet)	Depth (feet)
<u>Well 167</u>		
Joe Haines, 10 $\frac{1}{2}$ miles northeast of Liberty.		
Tough clay	53	53
Sand	26	79
Tough clay	5	84
Sand and gravel	22	106

	Thickness (feet)	Depth (feet)
<u>Well 168</u>		
Liberty Ranch Co., 7 $\frac{1}{2}$ miles northeast of Liberty.		
Yellow clay	120	120
Soft shale	10	130
Light blue gumbo	110	240
Sand	20	260
Gumbo	60	320
Sand	120	440
Gumbo	32	472
Sand	36	508
Gumbo	21	529
Fine-grained sand	35	564
Gumbo	20	584
Sand	13	597
Gumbo	46	643
Fine-grained sand	19	662
Gumbo	5	667
Good sand	36	703

Table of Drillers' Logs, Liberty County--Continued

	Thickness (feet)	Depth (feet)
<u>Well 169</u>		
Hancock Lumber Co., 11 miles northeast of Liberty.		
Sand	2	2
Clay	15	17
Fine-grained sand	41	58
Clay	4	62
Sand	12	74
Shale	24	98
Sand	24	122
Clay	24	146
Medium sand	32	178
Clay	44	222

	Thickness (feet)	Depth (feet)
<u>Well 170</u>		
Gulf Oil Corp. (Hannah No. 20), 9 $\frac{3}{4}$ miles northeast of Liberty.		
Clay	60	60
Fine-grained sand	27	87
Yellow clay	127	214
Fine-grained sand	21	235
Clay	27	262
Fine-grained sand	59	321

	Thickness (feet)	Depth (feet)
<u>Well 171</u>		
John Mecom, 10 miles northeast of Liberty.		
Clay	12	12
Sand	43	55
Shale	2	57
Sand	23	80
Shale	20	100
Sand	7	107
Shale	113	220
Sand	16	236

	Thickness (feet)	Depth (feet)
<u>Well 172</u>		
Hamill and Smith, 9 $\frac{1}{2}$ miles northeast of Liberty.		
Clay	35	35
Sandy clay	5	40
Sand	35	75
Clay	70	145
Tough clay	78	223
Fine sand and clay	52	275
Clean sand and gravel	30	305

	Thickness (feet)	Depth (feet)
<u>Well 173</u>		
Hamill and Smith, (Barngrover lease), 9 $\frac{1}{2}$ miles northeast of Liberty.		
Clay	6	6
Red sand	34	40
Sandy clay	10	50
Tough blue clay	69	119
Coarse sand and gravel	6	125
Tough blue clay	33	158
Fine gray sand	9	167
Clay	3	170
Coarse-grained sand	10	180
Tough blue clay	10	190
Hard packsand	10	200
Tough blue clay	23	223
Coarse sand and gravel	32	255

	Thickness (feet)	Depth (feet)
<u>Well 176</u>		
Houston Production Co., 9 $\frac{1}{2}$ miles northeast of Liberty.		
Clay	42	42
Fine-grained sand	25	67
Clay	37	104
Fine sand and streaks of clay	20	124
Clay	41	165
Sandy clay	25	190
Clay	22	212
Sand	20	232
Sand and gravel	3	235
Sand	23	258
Sand and gravel	21	279
Sand	21	300
Fine-grained sand	20	320
Hard sand	13	333
Clay	10	343
Sand and gravel	27	370
Fine sand	4	374

	Thickness (feet)	Depth (feet)
<u>Well 177</u>		
The Texas Co., 9 $\frac{5}{8}$ miles northeast of Liberty.		
Soil	24	24
Shale	21	45
Sand	63	108
Shale	14	122
Sand	10	132

(continued on next page)

Table of Drillers' Logs, Liberty County--Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
<u>Well 177--Continued</u>			<u>Well 185</u>		
Shale	117	249	Layl Sandwich Shop, in Liberty		
Sand	134	383	Sand	32	32
<u>Well 179</u>			Coarse red sand	17	49
City of Liberty, in Liberty.			Clay	43	92
Surface clay	12	12	Coarse-grained sand	14	106
Sand	48	60	Clay	2	108
Clay	20	80	Coarse-grained sand	4	112
Sand	14	94	Clay	7	119
Clay	25	119	<u>Well 186</u>		
Sand and clay	27	146	Texas Pipe Line Co., 3 miles south of Liberty.		
Sticky shale	110	256	Sand	60	60
Sand	42	298	Clay	45	105
Sticky shale	8	306	Streaks of sand and shale	46	151
Sand and gravel	14	320	Sand and gravel	9	160
Sticky shale	40	360	Fine-grained sand	70	230
Sand	16	376	Coarse-grained sand	46	276
Sticky shale	69	445	Rock	2	278
Sand	10	455	Coarse-grained sand	37	315
Sand and shale	10	465	Shale	3	318
Sticky shale	58	523	Fine-grained sand	10	328
Sand	39	562	Tight sand	4	332
Sticky shale	3	565	rock	1	333
<u>Well 183</u>			<u>Well 191</u>		
Southern Pacific R. R. Co., in Liberty.			Liberty County Fair Grounds, 1 1/2 miles southeast of Liberty.		
Soil and clay	8	8	Soft clay	15	15
Sand	33	41	Sand	16	31
Clay	2	43	Clay	5	36
Sand	30	73	Sand	29	65
Sandy clay	21	94	<u>Well 193</u>		
Sand	23	117	Mrs. Maggie L. Moorefield, in Liberty.		
Clay	33	150	Sand	60	60
Sand	14	164	Clay	73	133
Clay	9	173	Fine-grained sand	11	144
Sand	8	181	Clay	56	200
Sandy clay	20	201			
Clay	75	276			
Sandy clay	27	303			
Sand with streaks of clay	28	331			
Clay	45	376			
Sand	10	386			
Clay	174	560			
Sand	28	588			
Clay	13	601			

Table of Drillers' Logs, Liberty County--Continued

	Thickness (feet)	Depth (feet)
<u>Well 194</u>		
Martin Leissner, 5 miles north of Liberty.		
Clay	37	37
Fine-grained sand	17	54
Shale	14	68
Gravel	4	72
Clay	9	81
Medium sand	16	97
Clay	6	103

	Thickness (feet)	Depth (feet)
<u>Well 199</u>		
C. A. Fisher, in Liberty.		
Clay with layers of sand	40	40
Sand and gravel	160	200
Blue clay	30	230
Water-bearing sand	8	238

	Thickness (feet)	Depth (feet)
<u>Well 200</u>		
Howard LeCour, 7 $\frac{1}{4}$ miles east of Liberty.		
Clay	106	106
Fine-grained sand	9	115
Clay	25	140
Fine-grained sand	7	147
Clay	8	155
Fine-grained sand	5	160
Clay	21	181
Fine-grained sand	7	188
Clay	3	191

	Thickness (feet)	Depth (feet)
<u>Well 201</u>		
Carl Johnson, 9 $\frac{1}{2}$ miles east of Liberty.		
Clay	41	41
Fine-grained sand	19	60
Coarse-grained sand	45	105
Sandy clay	10	115
Clay	63	178
Sand and gravel	3	181
Shale	31	212
Fine-grained sand	44	256
Sand	85	341
Fine-grained sand	94	435
Clay	24	459

	Thickness (feet)	Depth (feet)
<u>Well 201--Continued</u>		
Sand	3	462
Fine-grained sand	7	469
Clay	59	528

	Thickness (feet)	Depth (feet)
<u>Well 202</u>		
Chas. Welch, 9 $\frac{1}{4}$ miles southeast of Liberty.		
Sand	4	4
Clay	31	35
Fine-grained sand	25	60
Sand	22	82
Sand and gravel	14	96

	Thickness (feet)	Depth (feet)
<u>Well 203</u>		
Silva and Welch, 7 $\frac{1}{2}$ miles east of Liberty.		
Clay	72	72
Fine-grained sand	6	78
Clay	59	137
Fine-grained sand	10	147
Clay	4	151

	Thickness (feet)	Depth (feet)
<u>Well 204</u>		
Mrs. Robinett, 7 $\frac{1}{2}$ miles east of Liberty.		
Hard yellow clay	147	147
Fine-grained sand	5	152
Hard clay	9	161

	Thickness (feet)	Depth (feet)
<u>Well 205</u>		
C. C. Thornton, 6 miles southeast of Liberty.		
Yellow sticky clay	149	149
Clay	72	221
Shale	16	237
Fine-grained sand	20	257
Medium sand	30	287

	Thickness (feet)	Depth (feet)
<u>Well 206</u>		
Leo B. Pitre, 7 miles east of Liberty.		
Clay	310	310
Sand	60	370

Table of Drillers' Logs, Liberty County--Continued

	Thickness (feet)	Depth (feet)
<u>Well 213</u>		
Leo B. Pitre, 7 miles east of Liberty.		
Clay	41	41
Clay and sand streaks	43	84
Fine-grained sand	24	108
Clay	109	217
Fine-grained sand	15	232
Clay	55	287
Fine hard sand	41	328
Clay	6	334
Fine hard sand	25	359
Clay	3	362
Fine hard sand	67	429
Tough clay	57	486
Fine gray sand	71	557
Clay	15	572
Fine, hard, gray to white sand with lenses of clay F3		628

	Thickness (feet)	Depth (feet)
<u>Well 219, partial log</u>		
Rycade Oil Corp., Heiskell No. 1, 8 3/4 miles south of Liberty.		
Sandy clay	45	45
Sand	35	80
Clay	100	180
Sand	32	212
Sand and shale	184	396
Sand and gravel	102	498
Gumbo	122	620
Sandy shale	60	680
Gumbo	40	720
Hard sandy lime	60	780
Gumbo	40	820
Sand and boulders	40	860
Gumbo	80	940
Sand and boulders	58	998
Gumbo	57	1055
Sandy shale	57	1112
Gumbo	28	1140
Sand	71	1211
Gumbo	21	1232
Sand and boulders	4	1236
Sand and lime	64	1300
Gumbo	30	1330
Sand and lime	6	1390
Gumbo	95	1485
Sand	29	1514
TOTAL DEPTH		5927

	Thickness (feet)	Depth (feet)
<u>Well 220, partial log</u>		
The Pure Oil Co., Liberty Investment Co., No. 1, 10 miles south of Liberty.		
Clay	31	31
Sand, clay	129	160
Sand	46	206
Clay	30	236
Sand	46	282
Clay	47	329
Sand, gravel	42	371
Gumbo	37	408
Sand, gravel	122	530
Clay	32	562
Sand	21	583
Clay	25	608
Sand	15	623
Clay	78	701
Sand, gravel	69	770
Clay	10	780
Sand, gravel	16	796
Clay	26	822
Sand, gravel	103	925
Gumbo, lime	29	954
Sand, gravel	42	996
Sandy gumbo	33	1029
Sand	22	1051
Gumbo	63	1114
Sand	18	1132
Gumbo	4	1136
Sand, gravel	9	1145
Gumbo	10	1155
Sand, gravel	45	1200
Gumbo	32	1232
Sand, gravel	15	1247
Gumbo	40	1287
Sand	37	1324
Gumbo	79	1403
Sand	90	1493
Gumbo	17	1510
TOTAL DEPTH		5766

	Thickness (feet)	Depth (feet)
<u>Well 221</u>		
Shilo' School, 9 miles southeast of Liberty.		
Clay	17	17
Fine-grained sand	22	39
Clay	12	51
Sandy clay	13	64

(continued on next page)

Table of Drillers' Logs, Liberty County--Continued

	Thickness (feet)	Depth (feet)
<u>Well 221--Continued</u>		
Clay	152	216
Fine-grained sand	34	250
Clay	52	302
Sand	10	312
Fine-grained sand	8	320
Clay	13	333

Well 222

A. R. Milintz, 6 $\frac{1}{2}$ miles southeast of Liberty.

Clay	5	5
Sand	15	20
Clay	180	200
Sand	23	223
Blue shale	4	227
Sand	5	232
Blue shale	2	234
Fine-grained sand	16	250
Coarse-grained sand	23	273
Shale	2	275

Well 223

Franklin and Tideman, Ltd., 12 $\frac{1}{4}$ miles southeast of Liberty.

Clay	18	18
Coarse-grained sand	7	25
Hard clay	92	117
Hard shale	144	261
Tight fine sand	69	330
Soft, coarse sand		
salt water	13	343
Hard shale	6	349

Well 224

Shell Oil Co., 13 $\frac{1}{2}$ miles southeast of Liberty.

Clay	44	44
Sand	117	161
Clay	36	198
Sandy shale	84	282
Sandy shale	15	297
Sticky shale	21	319
Sandy shale	22	341
Sticky shale	28	369

	Thickness (feet)	Depth (feet)
<u>Well 224--Continued</u>		
Gumbo	23	392
Sandy shale	21	414
Sticky shale	12	426
Sand	10	436
Gumbo	102	538
Sand	30	568
Gumbo	81	650
Tough shale	31	681
Sand	26	707

Well 226, partial log

Humble Oil & Refining Co., Sabine Tram No. 1, 2 $\frac{1}{2}$ miles northeast of Levers.

Surface clay	45	45
Sand	49	94
Shale, sand	78	172
Sand	42	214
Shale	53	267
Gumbo	37	304
Sand	30	334
Shale	27	361
Sand	29	390
Gumbo	160	550
Sand	98	648
Gumbo	38	686
Shale	23	709
Sand, gravel	73	782
Gumbo	16	798
Sand	20	818
Gumbo	12	830
Sand	10	840
Gumbo	16	856
Sand	46	902
Sand, boulders	40	942
Shale, lime	30	972
Sand, boulders	58	1030
Gumbo	19	1049
Sand, boulders	159	1208
Shale, lime	15	1223
Sand	26	1249
Shale, lime, sand	32	1281
Shale, lime	17	1298
Lime	45	1343
Sand, boulders	35	1378
Gumbo, lime	40	1418
Sand, lime	34	1452
Gumbo	4	1456
Sand	44	1500

(continued on next page)

Table of Drillers' Logs, Liberty County--Continued

	Thickness (feet)	Depth (feet)
<u>Well 226--Continued</u>		
Lime, shale, sand	2	1502
Sandy shale	12	1514
Gumbo, lime	38	1552
Sand	2	1554
Sand, shale	15	1569
Sandy shale	16	1585
Gumbo	169	1754
Sand	3	1757
Sandy lime	40	1797
Gumbo	32	1829
Sand	5	1834
Sticky shale	88	1922
Sandy lime	10	1932
Sticky shale	33	1965
Sand	31	1996
Shale	27	2023
TOTAL DEPTH		5800

Well 227

Texas Pipe Line Co., 3 miles south of Devers.

Clay	38	38
Shell	3	41
Sandy shale	59	100
Fine red sand	22	122
Sandy shale with beds of shell	79	201
Fine-grained sand	5	206
Sandy shale	49	255
Sandy shale and shell	21	276
Fine sand with lenses of shale	21	297
No record	36	333
Sand and boulders	5	338
Lime rock	3	341
Very fine gray sand	45	386
Fine gray sand	20	406

Well 228

Bert Hays, $3\frac{3}{4}$ miles south of Devers.

Clay	209	209
Fine white sand	11	220
Clay	14	234

	Thickness (feet)	Depth (feet)
<u>Well 229</u>		
V. D. Meyers, 1 mile east of Devers.		
Clay	74	74
Coarse, loose sand	25	99

Well 230

W. E. Jenkins, in Devers.

Clay	19	19
Soft sand	49	68
Sand and shale	32	100
Sandy shale	154	254
Soft, fine sand	11	265
Shale	34	299
Fine-grained sand	45	344
Shale	15	359
Sandy shale	14	373
Water sand	70	443

Well 231

Dan Hart, $6\frac{1}{4}$ miles south of Devers.

Clay	95	95
Fine-grained sand	45	140
Hard clay	10	150
Fine-grained sand	10	160
Shale	22	182
Fine-grained sand	48	230
Shale	55	285
Fine-grained sand	11	296
Shale	18	314
Shale and sand	141	455
Shale	18	473
Fine-grained sand	13	486
Shale	2	488

Well 232

The Texas Co., (Moore No. 1) $3\frac{1}{2}$ miles northeast of Devers.

Clay	40	40
Sand	21	61
Sand and shale	142	203
Fine-grained sand	29	232

Table of Drillers' Logs, Liberty County--Continued

	Thickness (feet)	Depth (feet)
<u>Well 237</u>		
Sinclair Pipe Line Company, 5 $\frac{1}{2}$ miles east of Devers.		
Clay	22	22
Sand	86	108
Blue clay	319	427
Sand	65	492

	Thickness (feet)	Depth (feet)
<u>Well 241</u>		
H. A. Gripon, in Devers.		
Red and white sand	66	66
Blue clay	24	90
Streaks of sandy clay and sticky blue clay	80	170
Fine gray sand	44	214
Sandy clay	36	250
Tough clay	70	320
Fine gray sand	6	326
Blue shale	2	328
Gray sand	10	338
Gray sandy clay	51	379
Fine gray sand	6	385
Gray sandy shale	10	395

	Thickness (feet)	Depth (feet)
<u>Well 241--Continued</u>		
Streaks of sand and blue shale	38	433
Hard fine sand	25	458
Blue sandy clay	8	466
Gray hard fine sand	32	498
Tough clay	3	501

	Thickness (feet)	Depth (feet)
<u>Well 245</u>		
Gulf Oil Corp., 9 miles south of Devers.		
Clay	39	39
Clay and sand	110	149
Sand	76	225

	Thickness (feet)	Depth (feet)
<u>Well 246</u>		
Gulf Oil Corp., 9 $\frac{1}{2}$ miles south of Devers.		
Surface clay and sand	150	150
Sand	90	240
Gumbo	50	290
Sand and boulders	54	344

Partial analyses of water from wells and springs in Liberty County, Texas

Analyzed at The University of Texas under the direction of W. W. Hastings, Chemist, U. S. Department of the Interior, Geological Survey, and Dr. E. P. Schoch, Director of the Bureau of Industrial Chemistry. Results are in parts per million. Well numbers correspond to numbers in table of well records.

Well	Owner	Depth of well (ft.)	Date of collection	Total dissolved solids	Silica (SiO ₂)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and Potassium (Na+K) (calc.)	Bicarbonate (HCO ₃)	Sulfate (SO ₄)	Chloride (Cl)	Fluoride (F)	Nitrate (NO ₃)	Total hardness as CaCO ₃ (calc.)
1	Gulf, Colorado & Santa Fe R.R.	1,360	Oct. --, 1931	--	--	--	16	--	129	--	34	49	--	--	--
2	do.	1,512	Jan. 8, 1937	323	--	--	4	--	133	270	16	47	--	0	16
3	do.	1,512	June 8, 1945	378	19	0.02	65	0.9	140	269	15	17	0.8	0.8	20
3	Gulf States Utilities Co.	386	Jan. 8, 1937	180	--	--	--	--	1.5	186	2	14	--	0	171
8	City of Cleveland	929	Apr. 11, 1944	377	17	0.12	34	7.2	97	321	15	27	0.6	0.5	114
11	Grimes Veneer and Panel Co.	90	Jan. 26, 1945	171	--	--	12	3.2	33	29	2	57	--	10	43
12	Cleveland Veneer Co.	300	do.	190	26	0.05	47	3.4	11	154	2	18	0.2	0	131
13	Cleveland Mfg. Co.	200	Jan. 27, 1945	157	--	--	21	2.7	22	52	3	47	--	0.5	64
14	Grogan Mfg. Co.	187	Apr. 6, 1945	265	--	--	71	3.7	17	239	3	21	--	0.2	192
15	Clarkson and Machin	327	do.	238	--	--	68	3.1	12	222	3	16	--	0	182
16	Gulf Oil Corp.	100	Mar. 30, 1945	298	--	--	31	5.7	43	24	7	118	--	0	101
17	Magnolia Pipe Line Co.	175	do.	207	--	--	51	2.7	20	191	3	16	--	0.2	138
18	W. F. Henry	18	Apr. 6, 1945	268	--	--	40	7.5	27	104	10	47	--	33	131
20	M. A. Ellis	226	June 8, 1945	143	--	0.10	17	1.7	18	66	2	22	--	0.5	49
21	B.F. Quinn Est.	1,200	Jan. 8, 1937	493	--	--	2	--	208	402	1	98	--	0.0	16
22	M. A. Ellis	36	Mar. 29, 1945	119	--	--	9.2	3.3	21	42	2	21	--	20	31
23	W. P. Johnston	440	Apr. 17, 1945	201	--	0.29	33	6.0	31	172	4	20	--	0.2	107
24	J. T. Whatley	52	Apr. 5, 1945	600	--	--	81	7.3	104	156	13	215	--	5.6	232
25	I. H. Ellington	110	do.	97	--	--	7.7	1.3	24	64	2	11	--	7.5	25
26	Ida Smith	45	Apr. 17, 1945	92	--	0.71	5.7	2.8	14	34	5	15	--	3.7	26
29	M.N. Cunningham	368	Jan. 25, 1945	212	--	--	49	4.1	18	178	3	20	--	0.2	139
30	W. C. Crawley	35	do.	1,040	--	0.11	62	10	256	88	26	410	--	94	196
31	Tarkington School	500	do.	252	30	0.05	64	4	15	221	2	18	0	0.2	176
32	L. O. Ward	247	do.	238	--	--	57	4.4	17	205	4	18	--	0	160
33	Charles Morris	222	do.	183	--	--	36	2.7	24	139	5	24	--	0	101
34	C. D. Jones	60	do.	99	--	17	6.9	2.6	28	64	3	18	--	11	28

Partial analyses of water from wells and springs in Liberty County—Continued
(Results are in parts per million)

Well	Owner	Depth of well (ft.)	Date of collection	Total dissolved solids	Silica (SiO ₂)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and Potassium (Na+K) (calc.)	Bicarbonate (HCO ₃)	Sulfate (SO ₄)	Chloride (Cl)	Fluoride (F)	Nitrate (NO ₃)	Total hardness as CaCO ₃ (calc.)
35	J. E. Wigley	103	Jan. 25, 1945	161	--	--	13	1.9	38	90	2	32	--	2.5	40
36	R. E. Wortham	100	Jan. 26, 1945	145	--	0.06	17	2.2	26	87	4	23	--	0.2	52
37	do.	39	do.	120	--	0.09	19	1.4	18	61	2	26	--	4.5	53
38	H. E. Kirk	95	Apr. 17, 1945	106	--	0.41	5.9	1.7	27	63	2	18	--	1.2	22
39	Joe Simmonds	24	June 8, 1945	85	--	0.26	5.2	2.4	16	19	2	19	--	16	23
41	John Kite	18	Jan. 9, 1945	380	--	0.07	108	4.4	22	350	14	13	--	11	288
42	Wirt Davis	40	do.	164	--	0.10	31	1.9	13	117	9	6	--	0.0	85
43	N. Gibson	46	Apr. 17, 1945	218	--	0.23	34	4.1	11	63	4	34	--	28	102
45	Racki Lumber Co.	580	Apr. 13, 1942	211	--	--	6.4	5.4	75	207	4	18	--	0	38
47	Miller and Vidor Lumber Co.	535	do.	197	--	--	60	4.6	12	207	4	14	--	0	168
48	T.B. Allen Co.	659	Jan. 11, 1945	268	--	0.08	41	7.1	31	210	4	16	--	0	132
49	Gulf, Colorado and Santa Fe R.R.	650	Apr. 13, 1942	210	--	--	53	2.2	29	214	5	16	--	0	141
50	do.	645	Nov. 23, 1944	237	--	0.49	44	7.4	32	216	7	18	--	0	140
51	Texas Construction Materials Co.	808	Apr. 13, 1942	211	--	0.15	46	4.5	33	220	5	14	--	0	133
52	do.	808	Apr. 13, 1942	209	--	--	27	1	58	207	5	16	--	0	71
			Jan. 4, 1945	--	--	--	--	--	--	196	6	17	--	--	88
53	do.	310	Apr. 13, 1942	158	--	--	51	2.2	9.2	171	2	10	--	0	136
			Jan. 4, 1945	--	--	--	--	--	--	155	3	12	--	--	135
54	do.	135	Nov. 23, 1944	232	--	0.06	55	3.8	15	188	2	21	--	0	153
55	South Texas Hardwood Co.	480	Jan. 19, 1945	217	--	0.04	45	3.9	22	163	2	29	--	0	128
56	Liberty Hardwood Lumber Co.	608	Jan. 10, 1945	244	20	0.06	36	6.6	44	219	7.8	18	0	0	117
57	Dolen School	100	Nov. 23, 1944	247	--	0.06	48	4.7	5.8	150	2	19	--	0	139
58	W. D. Dunnan	233	Jan. 10, 1945	207	22	0.04	43	3.5	25	170	3	24	0	0.2	122
59	A. M. Smith	23	Apr. 4, 1945	419	--	--	18	16	61	11	17	74	--	138	111
60	C. Die	56	do.	1,060	--	--	217	14	94	219	7	425	--	20	599
61	do.	140	do.	249	--	--	65	4.8	13	207	3	26	--	0.5	182
62	S. J. Keith	86	do.	157	--	--	31	2.7	11	94	3	23	--	0	98

Partial analyses of water from wells and springs in Liberty County--Continued
(Results are in parts per million)

Well	Owner	Depth of well (ft.)	Date of collection	Total dissolved solids	Silica (SiO ₂)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and Potassium (Na+K) (calc.)	Bicarbonate (HCO ₃)	Sulfate (SO ₄)	Chloride (Cl)	Fluoride (F)	Nitrate (NO ₃)	Total hardness as CaCO ₃ (calc.)
63	Pearl Kirkham	22	Apr. 4, 1945	65	—	—	3	0.9	12	26	4	6	—	5.5	11
64	—	Spring	do.	148	—	—	17	2.1	20	32	3	45	—	1.8	51
65	J. W. Phillips	85	Apr. 5, 1945	172	—	—	23	1.9	22	89	2	27	—	0	65
66	J. C. Carter	45	do.	179	—	—	27	2.2	27	101	8	31	—	0.2	76
67	H. Landers	30	Apr. 6, 1945	147	—	—	23	2.4	17	71	11	24	—	0.8	67
68	J. H. Halton	62	do.	229	—	—	28	6.4	17	21	7	17	—	104	96
69	Concord School	104	Jan. 10, 1945	168	—	0.10	30	1.8	20	92	2	34	—	0.2	82
71	John Griffin	165	Jan. 11, 1945	121	—	37	20	1.5	16	62	14	18	—	0.2	56
72	Hollis Griffin	90	do.	72	—	0.81	6.6	1.6	15	26	2	22	—	0.5	23
73	Mrs. W. M. Emanuel	87	Jan. 24, 1945	123	18	5.2	19	2.3	15	65	2	24	0.2	0	57
74	—	Spring	do.	184	—	—	29	3.2	24	78	10	45	—	0.5	86
76	J. W. Anslen	750	June 9, 1945	254	—	0.06	53	4.9	28	201	4	32	—	0.2	152
79	D. A. Reidland	740	do.	470	—	0.48	97	8.3	46	264	12	104	—	0.2	276
81	do.	1,000	do.	550	—	0.61	92	8.5	104	354	12	133	—	0.2	264
84	Arnold Wolfe	840	Apr. 19, 1945	1,140	—	0.40	26	3.3	423	240	12	560	—	0.8	78
85	E. J. Stoesser	808	June 9, 1945	388	—	0.26	68	8.1	61	205	8	113	—	0	203
86	W. F. Graves	1,005	June 19, 1945	708	—	0.21	18	2.1	250	221	18	270	—	0	54
87	do.	2,500	Apr. 18, 1945	856	—	1.7	5.2	1.2	329	455	2	254	—	0	18
88	Leo Moreau	370	June 9, 1945	542	—	0.08	4.2	0.8	212	258	19	172	—	0.2	14
89	A. C. Holbrook	780	June 15, 1945	382	—	0.65	11	1.6	132	204	12	69	—	0	34
93	Henry Bode	276	Apr. 13, 1945	264	—	0.26	50	5.9	40	204	7	43	—	0.2	149
94	Sun Pipe Line Co.	384	Jan. 27, 1945	401	14	2.3	51	5.7	91	228	2	112	0.6	0	151
95	B. T. Sturrock	19	do.	400	—	4.3	110	5.2	32	408	2	21	—	0.8	296
97	Joe Sobotik	20	Apr. 18, 1945	523	—	0.38	129	11	40	423	6	68	—	6.9	367
98	Magnolia Pipe Line Co.	540	do.	502	—	0.89	66	7.5	108	210	7	178	—	0	196
100	R. F. Janik	32	Apr. 19, 1945	623	—	1.7	103	11	106	434	8	119	—	0	302
101	Roy Seaburgh	1,030	do.	638	—	0.54	12	2.0	235	250	12	234	—	0	38
102	do.	209	June 9, 1945	235	—	0.06	40	4.8	41	178	2	43	—	0.2	120
107	R. Freeman	175	Oct. 30, 1931	—	—	—	—	—	—	—	—	224	—	—	—
111	J. M. Hlavaty	400	Jan. 27, 1945	389	12	0.68	5.2	1.5	149	333	2	45	1.4	0.2	19

Partial analyses of water from wells and springs in Liberty County—Continued
(Results are in parts per million)

Well	Owner	Depth of well (ft.)	Date of collection	Total dissolved solids	Silica (SiO ₂)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and Potassium (Na+K) (calc.)	Bicarbonate (HCO ₃)	Sulfate (SO ₄)	Chloride (Cl)	Fluoride (F)	Nitrate (NO ₃)	Total hardness as CaCO ₃ (calc.)
112	N. B. Sapp	380	Jan. 27, 1945	1,080	—	64	128	21	271	450	11	436	—	0	406
119	City of Dayton	395	Oct. 30, 1931	—	—	—	—	—	—	—	—	208	—	—	—
120	do.	399	Apr. 17, 1944	590	21	0.11	40	4.4	174	239	2	207	0.8	0	118
122	C. A. Grebey	193	Jan. 27, 1945	592	—	4.2	126	13	60	400	9	115	—	0	368
123	Frank E. Gay	404	Jan. 25, 1945	296	19	3.1	87	3.1	15	288	2	17	0	0	230
124	Peoples Lumber and Supply Co.	685	Jan. 27, 1945	753	11	0.06	29	5.6	247	272	2	307	0.2	0.5	96
125	Humble Pipe Line Co.	400	do.	304	—	—	7.2	1.3	112	229	4	54	—	0.2	24
126	A. Graves	135	do.	382	—	7.6	103	6	32	382	2	25	—	0	282
133	Texas Pipe Line Co.	350	June 15, 1945	542	—	1.4	32	3.8	166	248	3	177	—	0	96
142	A. H. Case	45	Jan. 12, 1945	503	—	0.02	147	5	35	446	9	61	—	3.5	388
143	V. L. Moore	116	June 15, 1945	559	—	6.9	130	14	54	464	9	72	—	9.0	382
144	L.L. Batchelor	26	do.	770	—	0.26	202	11	39	394	14	210	—	1.0	549
146	L. E. Wiggins	116	June 7, 1945	317	—	1.4	82	4.4	27	292	4	26	—	0.5	222
148	J. E. Dillon	213	June 16, 1945	365	—	0.79	92	4.4	29	247	4	49	—	0	248
150	L. McDaniel	183	June 20, 1945	384	—	1.2	92	4.9	45	319	10	54	—	0	250
153	Hardin Baptist Church	99	June 7, 1945	359	—	0.85	107	6.1	14	366	3	14	—	0.2	292
160	Humble Oil and Refining Co.	226	Apr. 7, 1945	379	—	—	89	5.1	42	316	7	47	—	0.5	243
164	Mrs. A. Cessna	192	June 16, 1945	407	—	1.3	96	6.3	43	345	5	50	—	0	266
166	Hull-Daisetta Water Works Co.	355	Apr. 17, 1944	288	24	0.03	50	3.2	50	213	4.7	44	0.8	0.5	138
173	Hamill-Smith Co.	255	June 21, 1945	358	—	0.08	42	4.6	81	203	9	77	—	0	124
175	Houston Production Co.	161	do.	631	—	0.58	45	6.8	180	220	4	246	—	0	140
178	City of Liberty	680	Nov. 1, 1931	9	—	—	—	—	—	—	5	256	—	—	—
179	do.	565	Nov. 18, 1943	419	21	0.08	70	6.6	66	190	6.8	125	0.4	0.2	202
180	do.	351	do.	312	21	0.10	53	4.7	57	240	9.5	46	0.6	0.8	152

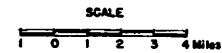
Partial analyses of water from wells and springs in Liberty County—Continued
(Results are in parts per million)

Well	Owner	Depth of well (ft.)	Date of collection	Total dissolved solids	Silica (SiO ₂)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and Potassium (Na+K) (calc.)	Bicarbonate (HCO ₃)	Sulfate (SO ₄)	Chloride (Cl)	Fluoride (F)	Nitrate (NO ₃)	Total hardness as CaCO ₃ (calc.) ³
182	City of Liberty	651	Nov. 13, 1943	636	16	0.08	76	11	115	149	3.7	251	0.2	1.0	234
183	T. & N. O. R.R.	602	Oct. 30, 1931	—	—	—	—	—	—	—	10	130	—	—	—
186	Texas Pipe Line Co.	333	Dec. 7, 1944	750	—	0.05	19	3.8	277	282	5	303	—	0	63
187	John Mecom	540	Jan. 16, 1945	341	—	24	55	7.5	65	206	2	93	—	0.8	168
190	Mecom and Harrison	260	Dec. 9, 1944	379	—	—	67	7	89	231	5	138	—	1.0	196
194	M. Leissner	103	June 7, 1945	333	—	0.48	80	7.3	45	342	2	32	—	0.5	230
195	Trinity Valley Cold Storage Co.	350	Jan. 23, 1945	345	20	0.37	60	6.8	54	210	4	83	0.4	0	178
196	Louis Fair	18	Jan. 27, 1945	361	—	—	26	28	11	12	6	30	—	1.0	180
197	A. C. Neyland	28	Mar. 31, 1945	259	—	—	62	5.2	15	185	4	33	—	0	176
198	Sun Pipe Line Co.	40	Apr. 20, 1945	142	—	0.53	38	2.4	1.7	108	8	8	—	0.2	105
201	Carl Johnson	528	Jan. 24, 1945	788	23	0.04	44	4.8	254	282	2	316	1.0	0.8	130
202	Chas. Welch	96	Jan. 17, 1945	312	—	—	74	6.1	38	315	2	23	—	0.2	210
206	Leo B. Pitre	370	Dec. 23, 1944	868	0	0	50	6.3	285	280	2	382	—	0	151
207	J. W. Swinney	137	do.	688	—	0.04	78	11	157	398	14	170	—	0	240
208	Edward Mallet	35	Jan. 16, 1945	650	—	0.15	166	6.8	20	302	13	101	—	1.03	442
209	C. Domain	20	do.	330	—	0.12	80	4.3	49	352	2	22	—	1.5	217
210	do.	80	Jan. 23, 1945	414	—	9.7	98	4.8	47	360	7	45	—	0	264
211	C. M. Mitchell	400	Jan. 24, 1945	808	20	5.4	65	7	233	252	2	345	0.2	0.5	191
214	S. S. Hill	22	Dec. 8, 1944	508	—	0.02	58	3.9	43	94	20	64	—	82	160
215	Jack Moss	28	do.	84	—	0.03	7.5	2.1	18	24	14	14	—	16	27
216	Devers Canal Co.	176	do.	760	—	0.04	39	7.4	244	294	3	294	—	0	128
217	do.	238	Jan. 6, 1945	752	—	0.10	30	2.9	268	368	2	260	—	0.2	87
218	"Bab Le Cour Well" 1,	500	Dec. 22, 1944	1,080	—	0.06	50	4.8	336	136	2	510	—	0.2	144
221	Shilo School	333	Jan. 6, 1945	836	—	0.07	26	4.1	300	318	2	334	—	0	82
227	Texas Pipe Line Co.	406	Jan. 24, 1945	615	24	1.1	23	3.1	213	279	2	212	1.0	0.2	70
228	Bert Hays	234	do.	673	—	—	45	9.8	206	358	3	215	—	0	153
229	V. D. Meyers	99	Jan. 23, 1945	274	—	25	56	6.6	29	171	21	49	—	0	167
230	W. F. Jenkins	443	Jan. 24, 1945	420	25	0.11	18	2.4	131	292	2	68	0.6	0.5	55
231	Dan Hart	488	do.	832	22	0.26	20	3.8	304	338	2	315	1.0	0.8	66
233	F. V. Boyt	210	Jan. 17, 1945	449	—	—	36	5	142	360	3	36	—	0.8	110

Partial analyses of water from wells and springs in Liberty County—Continued
(Results are in parts per million)

Well	Owner	Depth of well (ft.)	Date of collection	Total dissolved solids	Silica (SiO ₂)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and Potassium (Na+K) (calc.)	Bicarbonate (HCO ₃)	Sulfate (SO ₄)	Chloride (Cl)	Fluoride (F)	Nitrate (NO ₃)	Total hardness as CaCO ₃ (calc.)
234	B. H. Willis Est.	180	Jan. 17, 1945	338	--	--	35	5.6	94	269	4	63	--	1.0	110
235	do.	200	do.	311	--	0.03	61	3.2	47	229	3	55	--	0.2	165
236	do.	180	do.	804	--	0.20	76	9.3	213	303	18	300	--	0.2	228
237	Sinclair Pipe Line Co.	585	June 20, 1945	854	--	1.1	21	3.9	308	281	2	344	--	2.5	63
238	American Rice Growers Assn.	107	Jan. 23, 1945	395	--	15	88	6.3	47	358	4	36	--	0	246
239	J. E. Clark, Jr.	92	do.	372	--	7.8	75	4.6	60	308	5	56	--	0.2	206
240	J. M. Rich	200	Jan. 24, 1945	692	--	--	117	14	114	344	48	188	--	0	350
241	H. A. Gripon	501	June 20, 1945	441	--	0.37	16	2.2	154	290	2	90	--	0	49
242	F. W. Boyt	403	Jan. 16, 1945	673	--	0.18	21	2	242	330	2	223	--	0	673
243	F. V. Boyt	400	do.	671	12	0.16	32	5.9	236	353	2	211	0.6	0	104
244	T. F. Abshier	150	Jan. 24, 1945	737	--	--	95	15	163	356	37	228	--	0	298

MAP OF LIBERTY COUNTY, TEXAS SHOWING LOCATIONS OF WATER WELLS AND SPRINGS LISTED

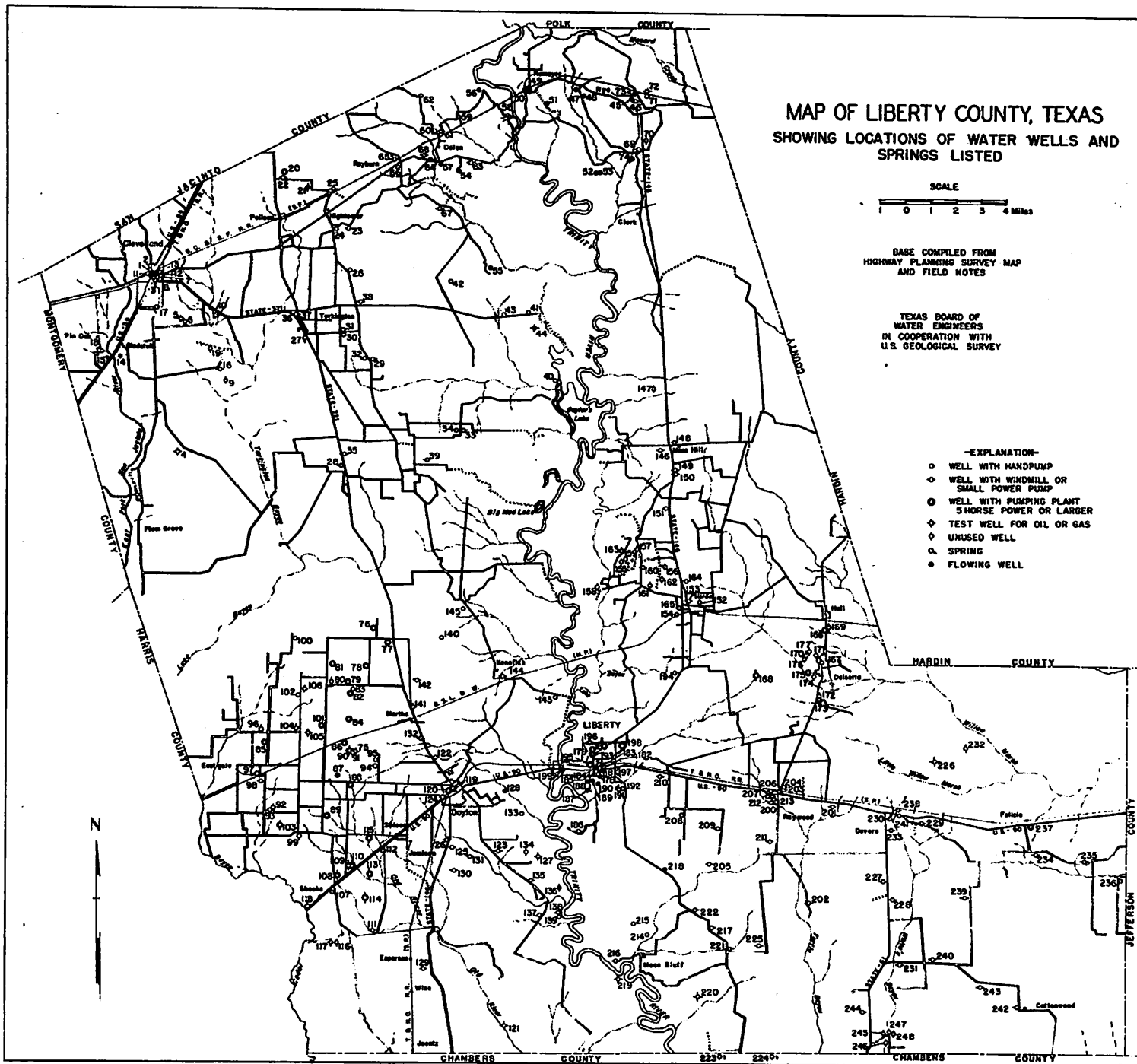


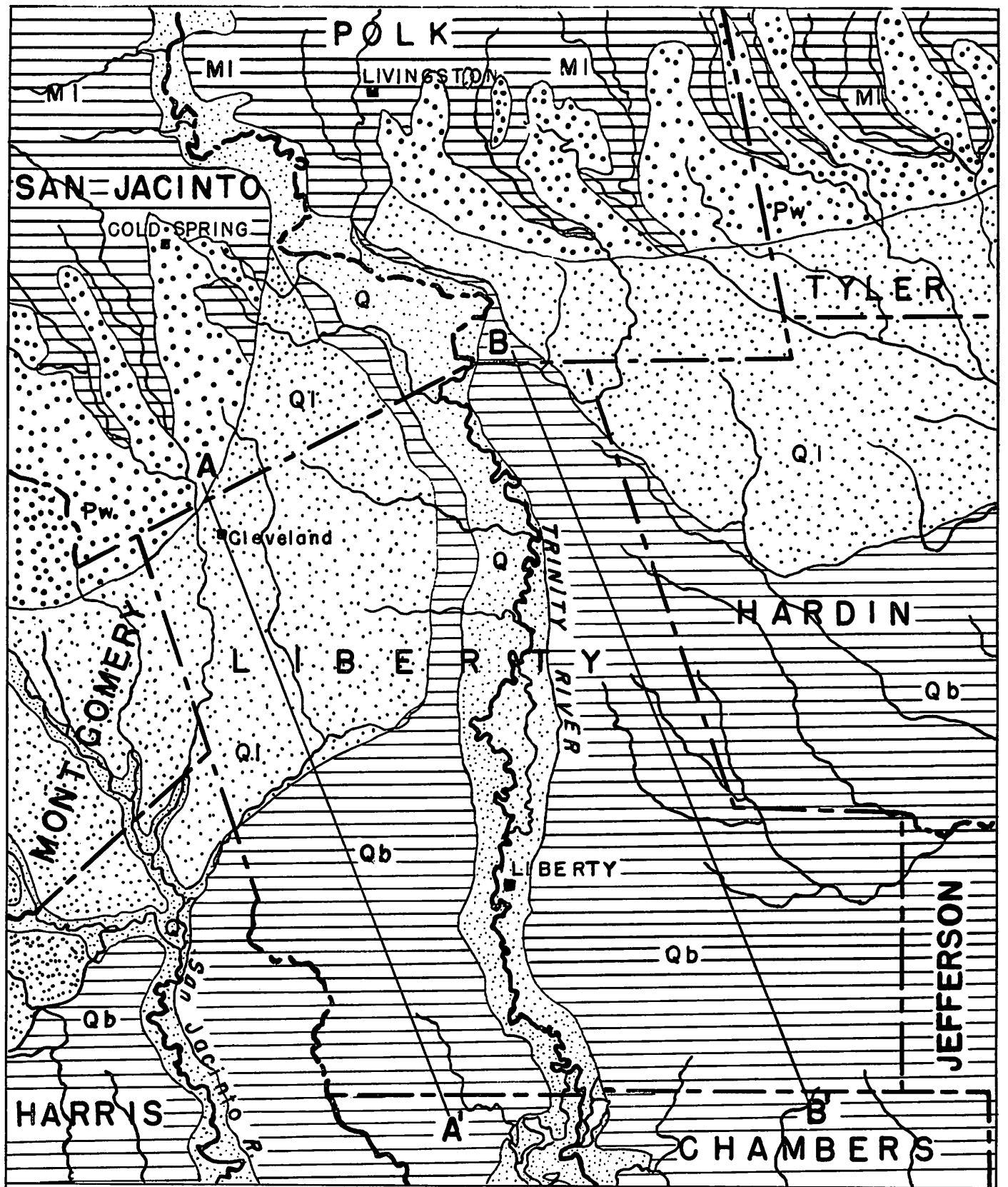
BASE COMPILED FROM
HIGHWAY PLANNING SURVEY MAP
AND FIELD NOTES

TEXAS BOARD OF
WATER ENGINEERS
IN COOPERATION WITH
U.S. GEOLOGICAL SURVEY

-EXPLANATION-

- WELL WITH HANDPUMP
- ◊ WELL WITH WINDMILL OR SMALL POWER PUMP
- ⊙ WELL WITH PUMPING PLANT 5 HORSE POWER OR LARGER
- ◇ TEST WELL FOR OIL OR GAS
- ◊ UNUSED WELL
- SPRING
- FLOWING WELL





LEGEND

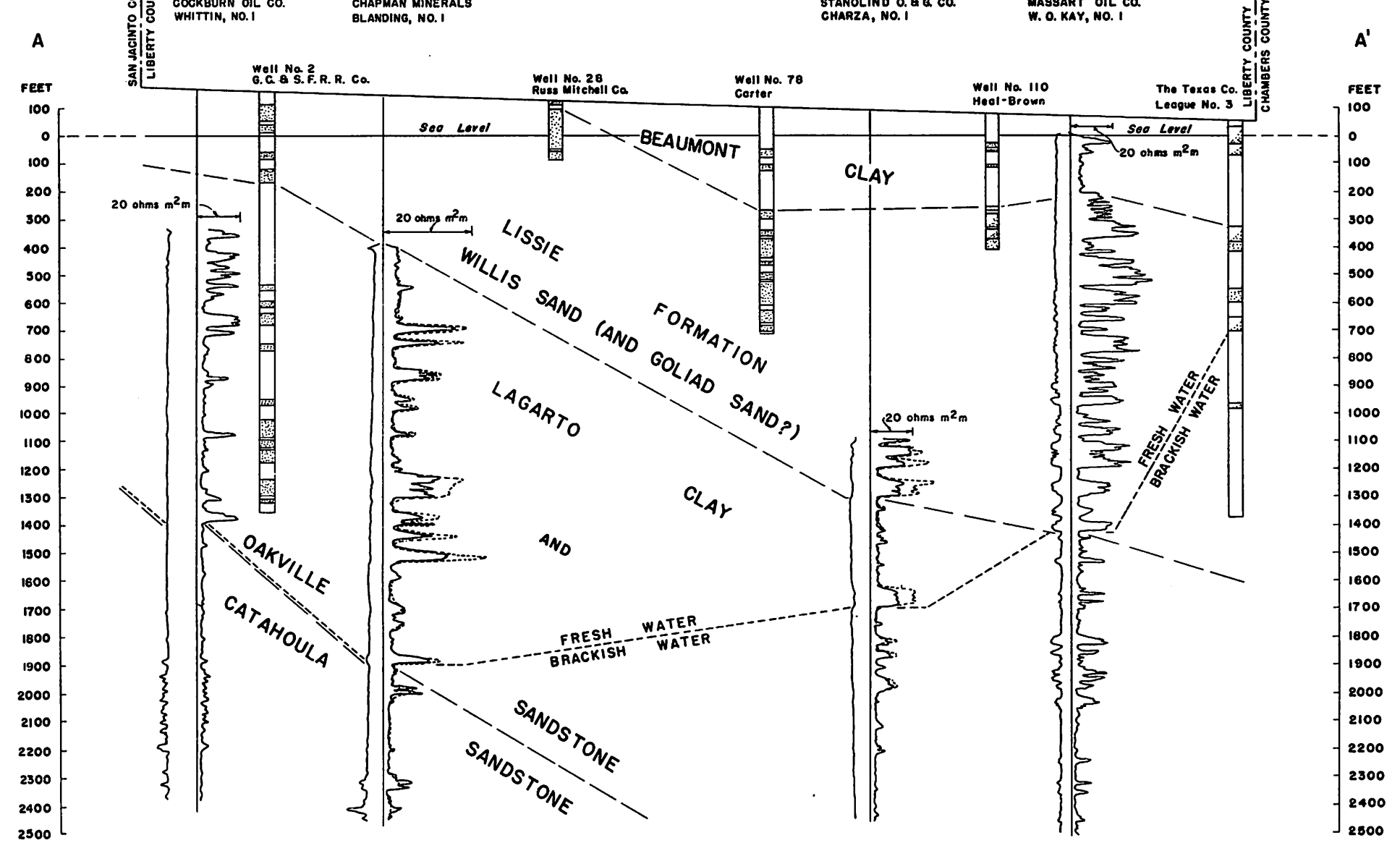


- Q Alluvium
- Qb Beaumont clay
- Ql Lissie formation
- Pw Willis sand
- MI Lagarto clay and Oakville sandstone

**GEOLOGIC MAP OF
LIBERTY COUNTY
TEXAS**



Northwest Southeast



Explanation
 Sand and sandstone
 Clay and shale

Scale
 0 1 2 3 4 5 Miles

GEOLOGIC CROSS-SECTION A-A'
LIBERTY COUNTY, TEXAS

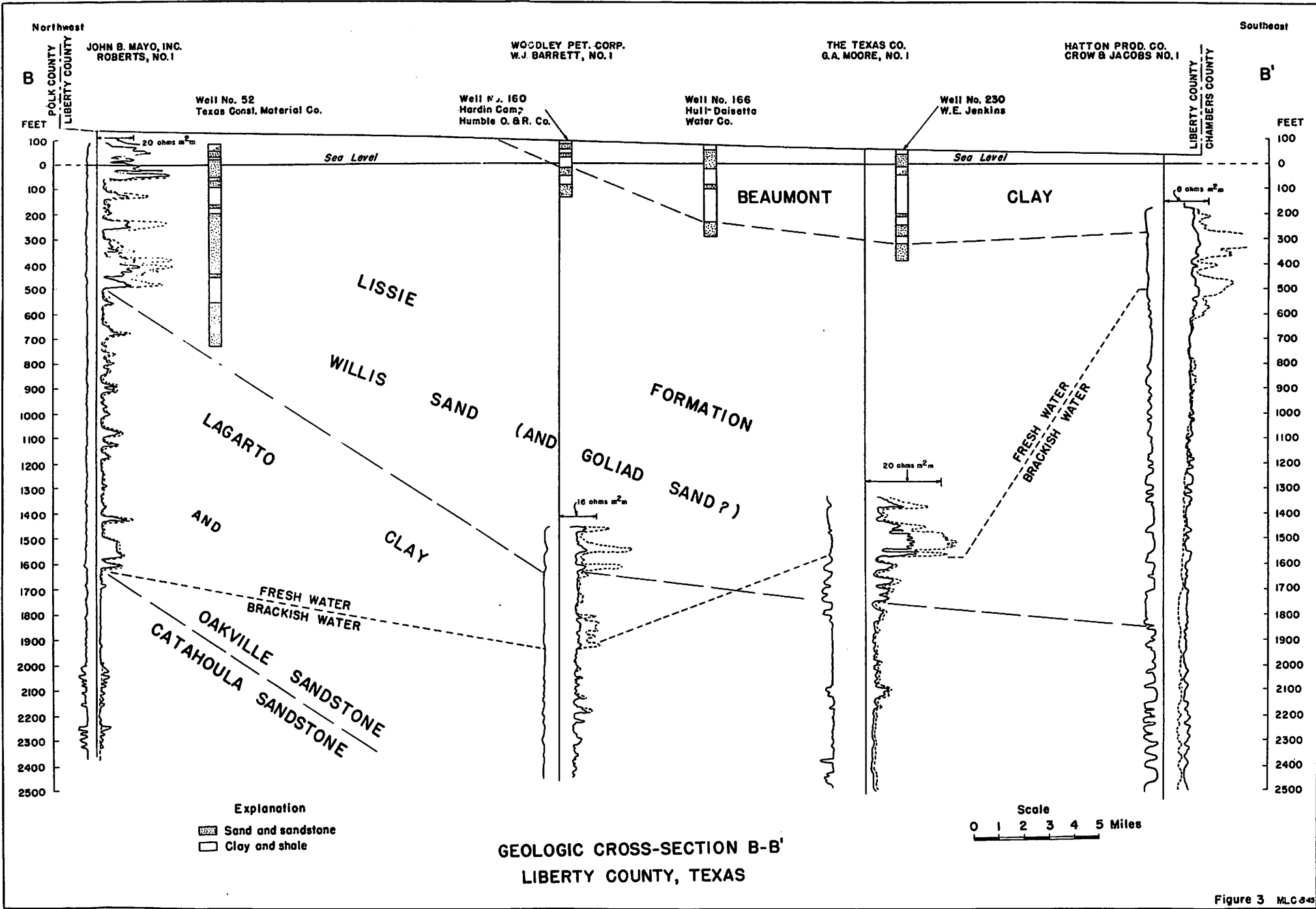


Figure 3 MLC 3-49

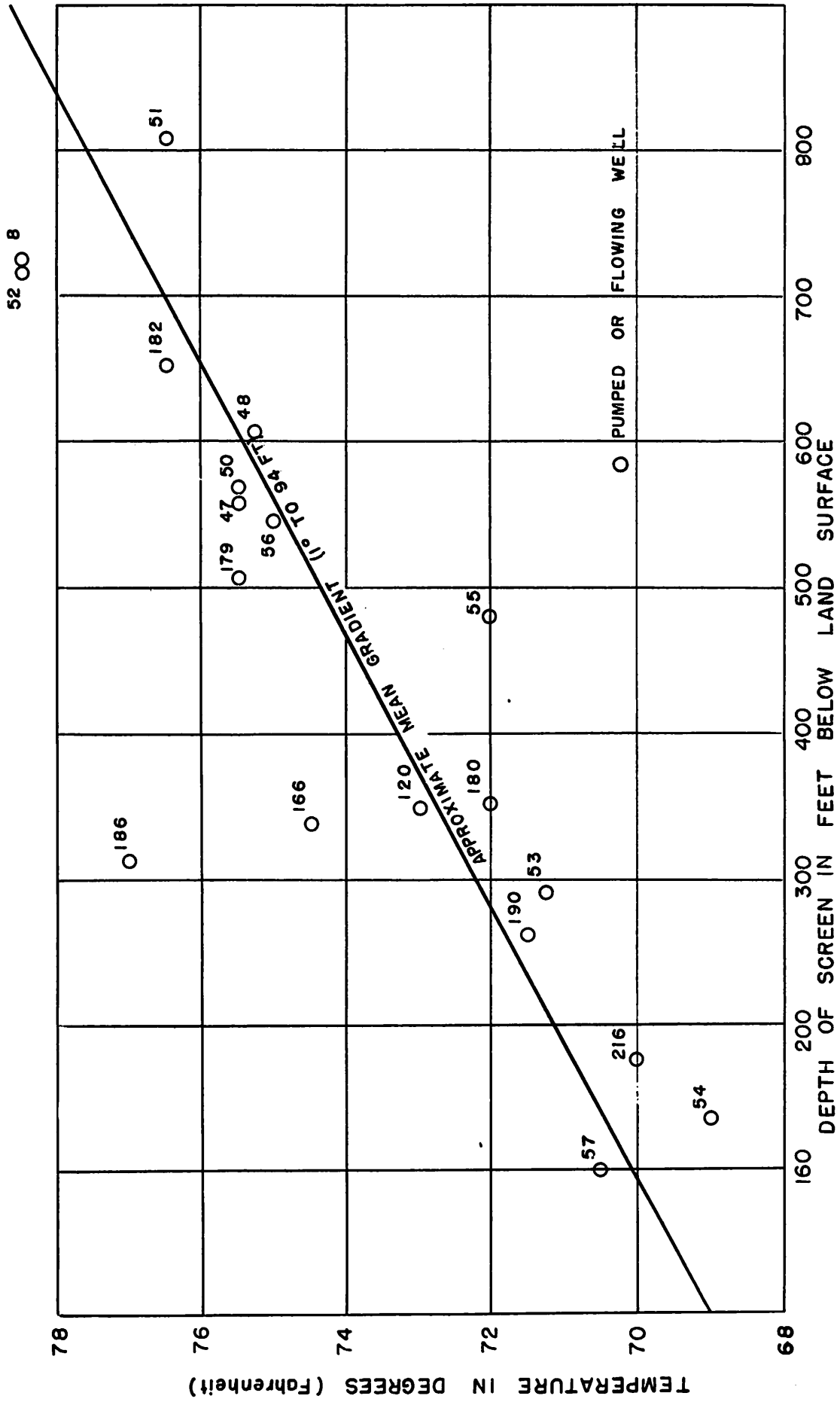


FIGURE - 4: Relation of temperature of water to depth of screen in 19 pumped or flowing wells in Liberty County, Texas