TEXAS WATER DEVELOPMENT BOARD

REPORT 161

# GROUND-WATER RESOURCES OF HARDEMAN COUNTY, TEXAS

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# GROUND-WATER RESOURCES OF HARDEMAN COUNTY, TEXAS

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## ABSTRACT

The Blaine Formation of Permian age and the alluvial terrace deposits of Quaternary age are the most important sources of large quantities of ground water in Hardeman County. In a broad sense, ground water moves eastward from Childress and Cottle Counties, but in detail the water moves from the uplands to the major rivers and streams. The quantity of water moving through the alluvium in the vicinity of Chillicothe is estimated at 2,600 acre-feet per year, which is equivalent to about 1 inch or 5 percent of the average annual precipitation. Recharge to the Blaine Formation is estimated to be about 17,000 acre-feet per year, assuming that 5 percent of the average annual precipitation on the outcrop area of the aquifer percolates to the water table.

Water levels in most wells in the Blaine Formation during the period 1953-69 showed a net decline of 10 to 20 feet; water levels in wells in the alluvium near Chillicothe during the period 1960-69 had an average decline of 3.6 feet, or less than 0.5 foot per year. Withdrawal of ground water for municipal and domestic supply, livestock use, industrial use, and irrigation is estimated at 11,500 acre-feet in 1968. In general, the records indicate that pumping of ground water from the Blaine Formation has caused a considerable decline in water levels in some irrigation areas, but pumping from the alluvium in the Chillicothe area has not caused a serious decline in water levels.

Water from the alluvium is very hard, but generally has a dissolved-solids content less than 1,000 milligrams per liter. Water from the Blaine Formation is more mineralized than water from the alluvium, but has been used successfully for irrigation for many years.

# GROUND-WATER RESOURCES OF HARDEMAN COUNTY, TEXAS

## INTRODUCTION

### Location and Extent of the Area

Hardeman County, which has an area of 685 square miles, is in the western part of north-central Texas (Figure 1). Hardeman County is bordered by Childress and Cottle Counties on the west, Foard County on the south, Wilbarger County on the east, and Harmon and Jackson Counties, Oklahoma, on the north.

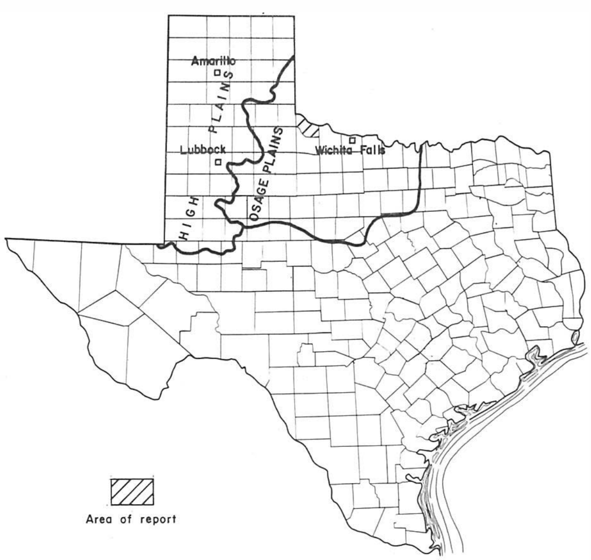


Figure 1.—Location of Hardeman County

### Purpose and Scope of the Investigation

The purpose of this investigation was to obtain data on the ground-water resources of Hardeman County, with emphasis on the sources of water suitable for public supply, industrial use, and irrigation.

The study included an inventory of 425 wells and 8 springs, the collection of 96 water samples for chemical analyses, and the compilation of data obtained during previous investigations by the U.S. Geological Survey, the Texas Water Development Board, and other agencies. The locations of the wells and springs are shown on Figure 10.

### Geography

Hardeman County is near the western margin of the Osage Plains on the divide between the Red and Pease Rivers. The land surface is flat in the eastern part of the area, rolling in the central and western parts, and fairly rugged along the rivers and major streams. The altitude of the land surface ranges from 1,855 feet above mean sea level in the northwest to 1,250 feet in the southeast. Sandy to sandy loam soils prevail over most of the county.

The major streams in the area are the Red River, Pease River, Groesbeck Creek, and Wanderers Creek. Streamflow data from the U.S. Geological Survey gaging and partial record stations are summarized in Table 1. Throughout most of the year, the streams are dry or have very low flows; but during periods of heavy precipitation, peak flows of 64,000 cfs (cubic feet per second) and 106,000 cfs have been recorded for the Red River near Quanah and the Pease River near Crowell, respectively.

The climate in the area is characterized by a wide range in humidity, precipitation, and temperature. The monthly precipitation for the period 1952-68 varied from zero to 9.45 inches, and the annual precipitation varied from 12.03 to 37.87 inches. The average annual precipitation for Quanah is 24.70 inches (Figure 2). The temperature for the period 1952-68 ranged from a low of -7°F to a high of 113°F. The average monthly temperature at Quanah is shown on Figure 2.

The economy of the county is based on agriculture. Most of the income is derived from farming and to a lesser extent from ranching. The number of acres under cultivation has decreased from 70,890 in 1958 (Gillett and Janca, 1965) to an estimated 65,000 acres (8,700 acres irrigated) in 1968. Wheat, cotton, and grain sorghums are the principal crops.

Industrial development has been related to natural resources and agriculture. Such industries as oil and gas production, oil refining, a gypsum products plant,

Table 1.—Streamflow in Hardeman County

| | GAGING STATION | PERIOD OF RECORD | FLOW IN CFS MEAN | MAXIMUM | MINIMUM |
|---|---|---|---|---|---|
| 07-2995.7 | Red River near Quanah | 1958-68 | 168 | 64,000 | no flow |
| 07-2996.7 | Groesbeck Creek at State Highway 283 near Quanah | 1961-68 | 9.69 | 12,000 | no flow |
| 07-3080.0 | Pease River near Crowell (14 miles south of Quanah) | 1924-47 | 221 | 106,000 | no flow |
| | Partial-record station | | | | |
| 07-2995.8 | North Groesbeck Creek at North Groesbeck | 1962-64 | — | 0.19 | no flow |
| 07-2996.0 | North Groesbeck Creek near North Groesbeck | 1951-64 | 2.44 | 5.78 | 0.35 |
| 07-2996.3 | South Groesbeck Creek near Goodlett | 1962-64 | 3.12 | 6.25 | no flow |
| 07-2996.5 | South Groesbeck Creek near Acme | 1951-64 | 3.65 | 7.07 | 1.32 |
| 07-2997.0 | Groesbeck Creek below West Texas Utilities Company pumping plant near Quanah | 1950-62 | 9.10 | 83.8 | no flow |
| ——— | Wanderers Creek at Chillicothe | 1949-50 | 0.66 | 1.59 | .10 |
| | | Streamflow in Wilbarger County | | | |
| 07-2997.5 | Wanderers Creek at Odell | 1949-69 | 4.17 | 77.8 | .31 |

cotton ginning, and meat packing provide additional income in the county.

According to the 1970 census, the population of the county is 6,975. Quanah, the county seat, has a population of 3,948, and Chillicothe has a population of 1,116.

## Well-Numbering System

The numbers assigned to wells and springs in this report conform to the Statewide system used by the Texas Water Development Board. This system is based on the division of the State into 1-degree quadrangles and subsequent division of these quadrangles into smaller units (Figure 3).

Each 1-degree quadrangle is divided into 64 7½-minute quadrangles, each of which is further divided into nine 2½-minute quadrangles. The first two digits of a location number identify the 1-degree quadrangle; the third and fourth digits identify the 7½-minute quadrangle; the fifth digit identifies the 2½-minute quadrangle; and the last two digits designate the order in which the well or spring was inventoried within the 2½-minute quadrangle. In addition to the 7-digit well number, a 2-letter prefix is used to identify the county; the prefix for Hardeman County is LD.

## Previous and Related Investigations

Data on Hardeman County have been included in the regional investigations of Gordon (1913) and Baker and others (1963). Other investigations that are pertinent to the study include those of Russell and Huggins (1936), Willis and Knowles (1953), Follett (1956), Shafer (1957), Gillett and Janca (1965), Steele and Barclay (1965), and Myers (1969). Basic data on the quantity and quality of surface water in the county have been published by the U.S. Geological Survey and the Texas Water Development Board.

# GEOLOGY

Rocks of Permian and Quaternary age are exposed in Hardeman County (Figure 4, Table 2). The Permian rocks, which have an approximate maximum thickness of 1,830 feet, consist of the Lower Permian Clear Fork Group and the Upper Permian Pease River Group. The Pease River Group includes, from oldest to youngest, the San Angelo Sandstone, the Flowerpot Shale, the Blaine

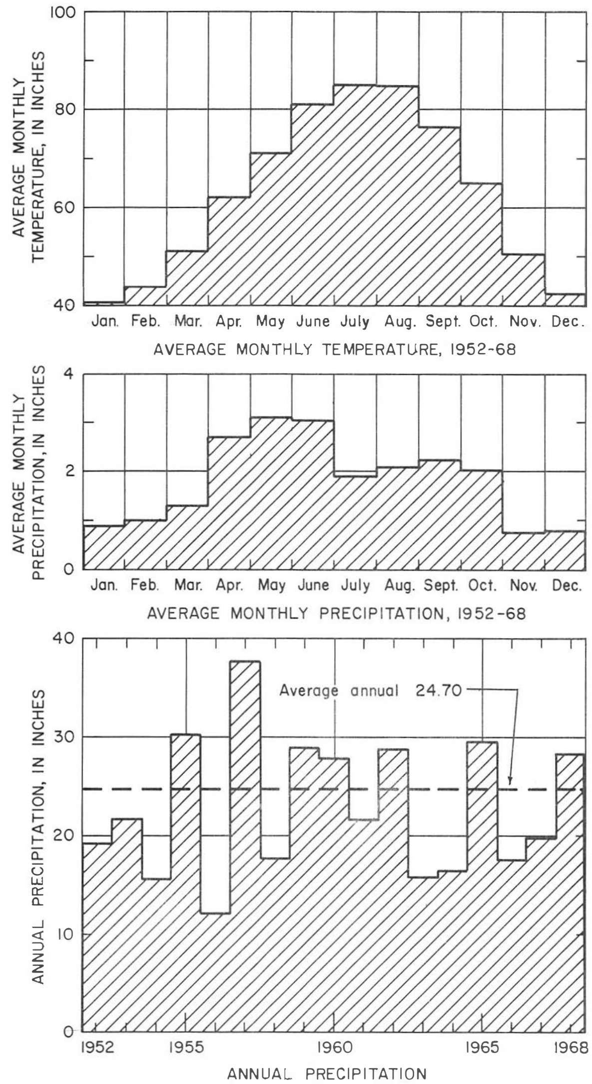


Figure 2.—Annual and Average Monthly Precipitation and Average Monthly Temperature at Quanah, 1952-68

Formation, and the Dog Creek Shale. The Permian rocks are composed of shale, limestone, sandstone, dolomite, gypsum, and anhydrite.

The Quaternary rocks, which have an approximate maximum thickness of 160 feet, consist of the Seymour Formation, terrace deposits, channel deposits, and eolian deposits of Pleistocene and Holocene age. These units consist of clay, silt, sand, and gravel.

The physical and water-bearing characteristics of the geologic units are given in Table 2. The subsurface relationships are shown on Figure 5.

The most prominent geologic structures in the area are the Amarillo-Wichita uplift, north and northwest of Hardeman County and the Red River uplift south of the county. The structural depression between these two uplifts is known as the Hardeman Basin. These structures do not have any significant effect on the occurrence of ground water in the Permian rocks.

In the following description of the water-bearing properties of the geologic units, the yields of wells and springs are described according to the following rating:

| DESCRIPTION | YIELD (GALLONS PER MINUTE) |
|---|---|
| Small | Less than 50 |
| Moderate | 50 to 500 |
| Large | More than 500 |

The chemical quality of the water is classified according to the dissolved-solids content (after Winslow and Kister, 1956) as follows:

| DESCRIPTION | DISSOLVED-SOLIDS CONTENT (MILLIGRAMS PER LITER) |
|---|---|
| Fresh | Less than 1,000 |
| Slightly saline | 1,000 to 3,000 |
| Moderately saline | 3,000 to 10,000 |
| Saline | 10,000 to 35,000 |
| Brine | More than 35,000 |

## Permian System

TheSan Angelo Sandstone and the Blaine Formation are the most important water-bearing units of the Permian System in Hardeman County. The San Angelo Sandstone, which crops out in the southern and eastern parts of the county, consists of about 60 feet of red and gray, medium- to fine-grained crossbedded sandstone, siltstone, and shale. The formation yields small quantities of fresh to moderately saline water to domestic and stock wells on the outcrop. Downdip, the water is too highly mineralized for domestic supply or livestock use.

The Blaine Formation consists generally of reddish-brown and blue-gray shale, anhydrite, gypsum, and dolomite. The formation includes five prominent members: The Haystack Gypsum; the Cedartop Gypsum; the Collingsworth Gypsum; the Mangum Dolomite; and the Acme Dolomite. An unnamed dolomite unit about 1 foot thick, which occurs 15 to 20 feet above the Acme, was used in this study as the top of the Blaine Formation. The approximate maximum thickness of 280 feet is therefore greater than the thickness reported by other authors (Scott and Ham, 1957; Sellards and others, 1933).

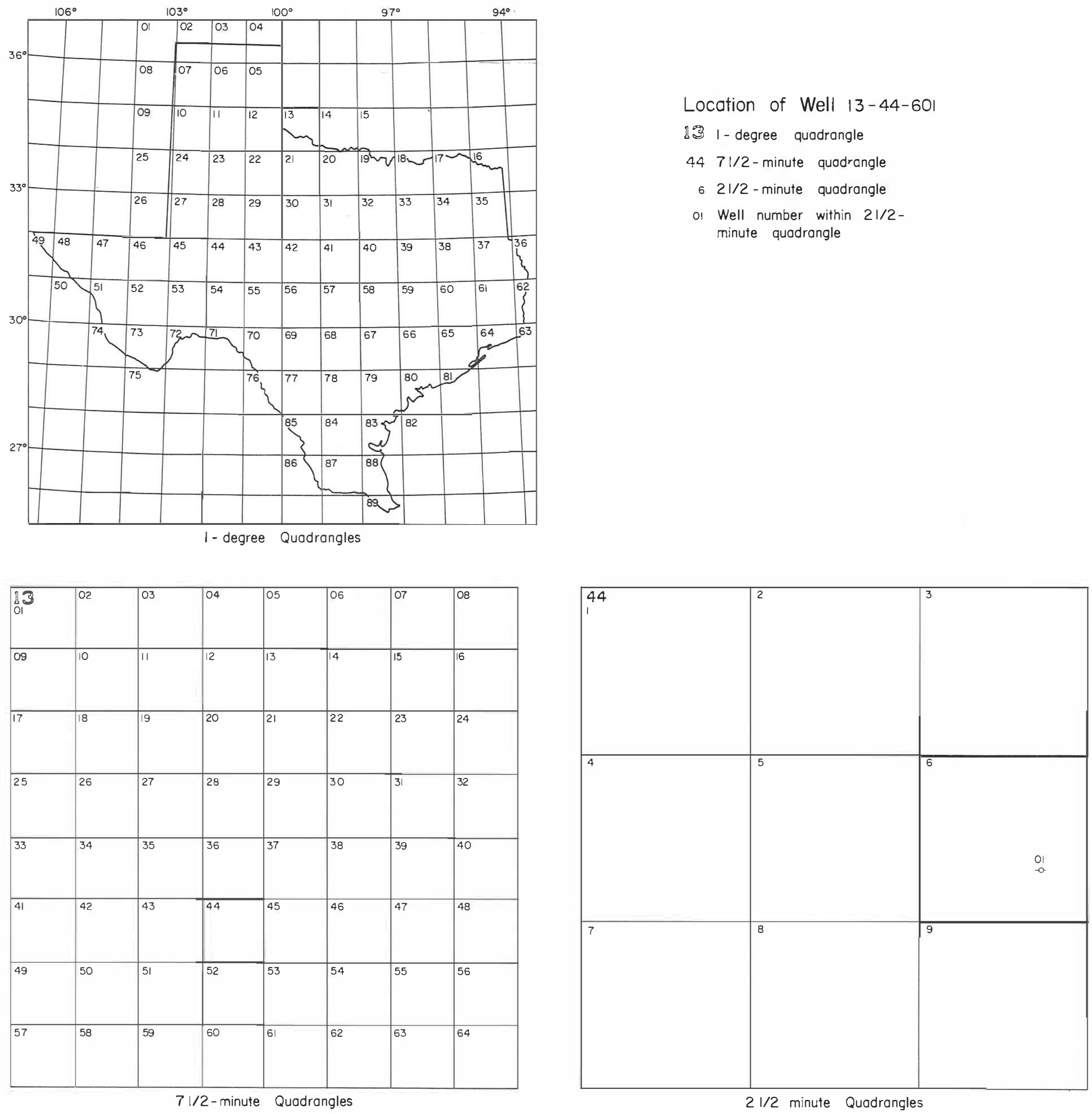


Figure 3

Well-Numbering System

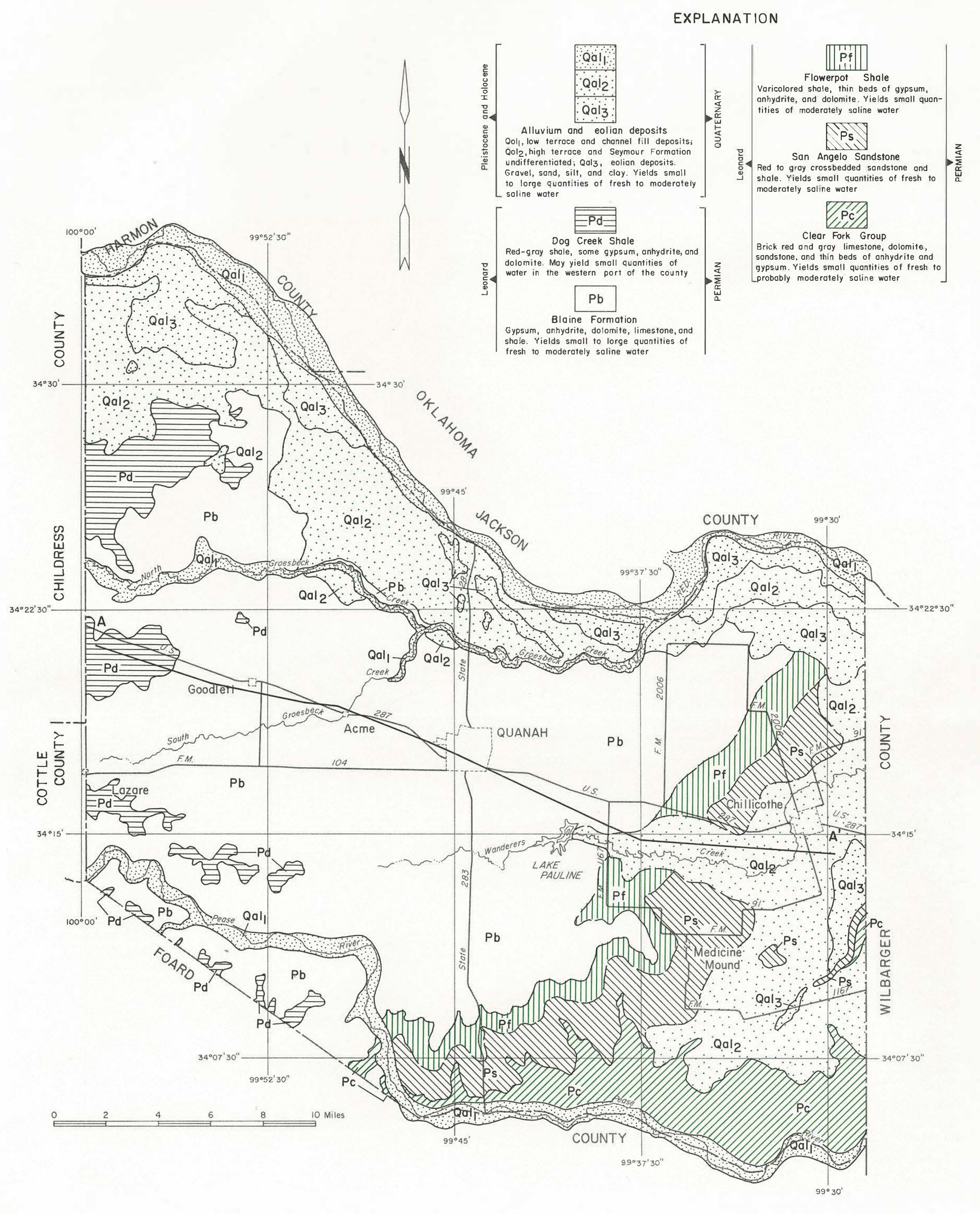


Figure 4

Geology of Hardeman County

Base from U.S. Geological Survey topographic quadrangles

Geology modified from geologic map of Texas (Darton, Stephenson, and Gardner, 1937)

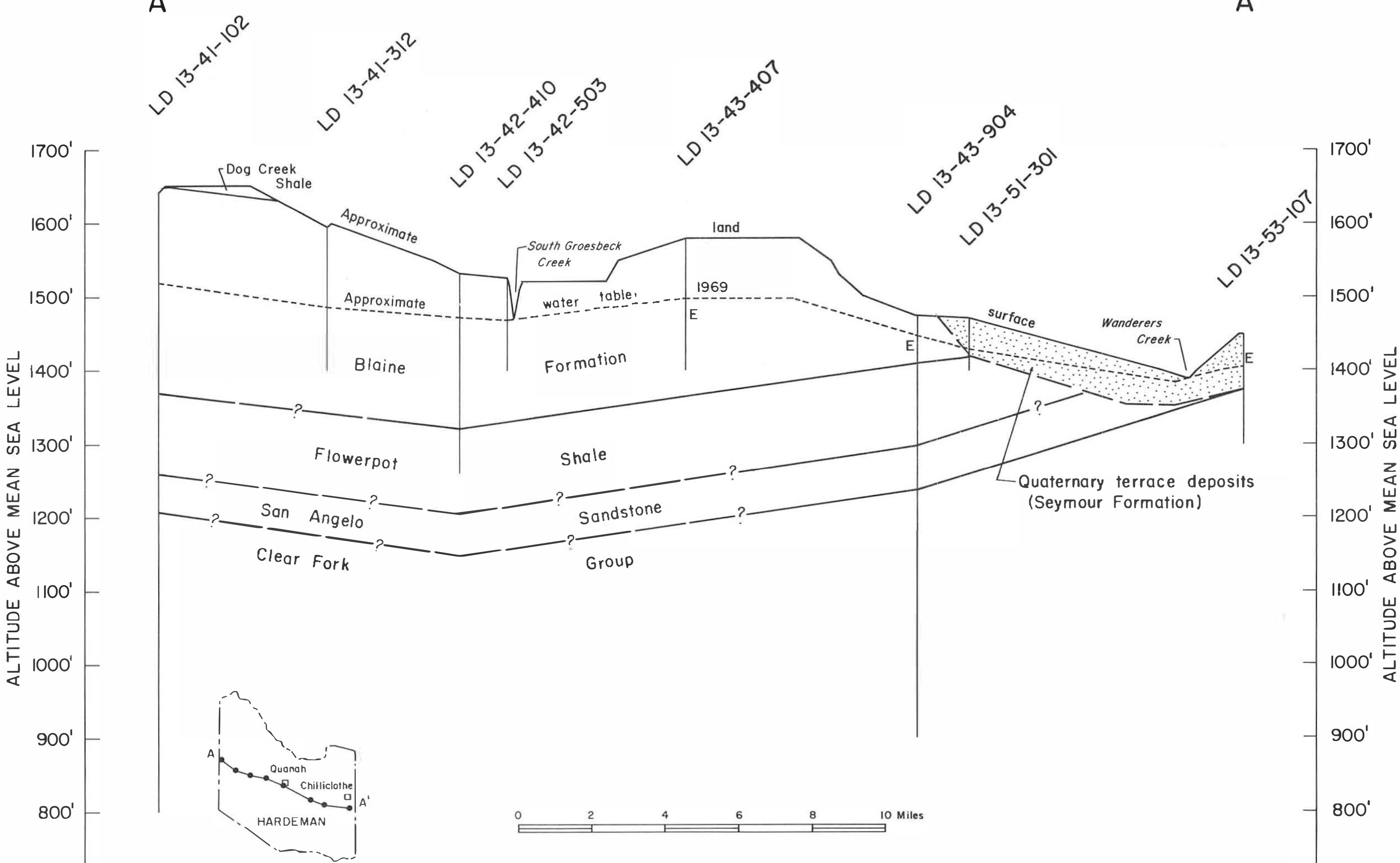


Figure 5

Correlation of Geologic Units Along Line A-A'

NOTE: "E" indicates estimated

## Table 2.—Geologic Units and Their Water-Bearing Characteristics

| ERA | SYSTEM | SERIES | GROUP | STRATIGRAPHIC UNITS | | APPROXIMATE MAXIMUM THICKNESS (FT) | CHARACTER OF ROCKS | WATER-BEARING CHARACTERISTICS |
|---|---|---|---|---|---|---|---|---|
| Cenozoic | Quaternary | Pleistocene and Holocene | | Eolian deposits | | 15 | Mostly poorly stratified sand and silt deposits with some clay. | May yield small quantities of fresh water to stock wells. Sand deposits form areas of recharge. |
| | | | | Alluvium | Channel deposits | 50 | Poorly stratified, sorted to poorly sorted deposits of gravel sand, silt, and clay. | May yield small to large quantities of fresh to moderately saline water to wells and springs along major streams. |
| | | | | | Terrace deposits and Seymour Formation undifferentiated | 95 | Poorly stratified, sorted to poorly sorted deposits of gravel, sand, silt, and clay. | Yields small to large quantities of fresh to moderately saline water to wells and springs in the eastern half of the county. |
| Paleozoic | Permian | Leonard | Pease River | Dog Creek Shale | | 170 | Shale, red and gray, with beds of gypsum, anhydrite and dolomite. | May yield small quantities of water to domestic and stock wells in the western part of the county. |
| | | | | Blaine Formation | | 280 | Gypsum, anhydrite, dolomite and limestone separated by varicolored shale beds. Gypsum commonly cavernous. | Yields small to large quantities of fresh to moderately saline water to wells and springs in the western and central parts of the county. |
| | | | | Flowerpot Shale | | 120 | Shale, varicolored, and some thin beds of gypsum, anhydrite, and dolomite. | Yields small quantities of fresh to moderately saline water to stock wells in the southern and northeastern parts of the county. |
| | | | | San Angelo Sandstone | | 60 | Sandstone, medium to fine grained crossbedded, red and gray, siltstone, and shale. | Yields small quantities of fresh to moderately saline water to domestic and stock wells in the southern and eastern parts of the county. |
| | | | Clear Fork | | | 1,200 | Shale, mostly brick red, gray, and some beds of limestone, dolomite, anhydrite, gypsum, and sandstone. | Yields small quantities of fresh to probably moderately saline water to domestic and stock wells in southern and southeastern parts of the county. |

The Blaine Formation is the most important source of large quantities of water for irrigation in Hardeman County. Wells tapping the cavernous and honeycombed beds of gypsum and dolomite yield water that generally is not suitable for drinking because of the high sulfate content, but is satisfactory for irrigation.

### Quaternary System

The youngest rocks exposed in Hardeman County are the alluvial and eolian deposits of Quaternary age. The alluvium consists of floodplain and channel deposits of the major streams, and terrace deposits of similar origin but deposited at higher levels.

The channel deposits, which consist primarily of sand and gravel, are of hydrologic significance only in the valleys of the Red and Pease Rivers and along the main stem of Groesbeck Creek, where the deposits reach a maximum thickness of 50 feet. Along the other streams, the channel deposits are too thin to yield more than small quantities of water to wells. No wells are known that tap these deposits, but in some areas the saturated thickness is probably sufficient for the deposits to yield moderate to large quantities of fresh to moderately saline water to wells.

The terrace deposits, which consist of sorted to poorly sorted gravel, sand, silt, and clay occur in an irregular belt in the eastern part of the county and along the Red River (Figure 4). In the eastern part of the county, the terrace deposits that trend northeasterly through Chillicothe and which parallel the outcrop of the San Angelo Sandstone, are probably remnants of the Seymour Formation. Because of their restricted occurrence and their similar hydrologic properties, the Seymour Formation and the terrace deposits are mapped and discussed as a single unit.

The terrace deposits, which have a maximum thickness of about 95 feet, are the most important source of fresh water for municipal and domestic supply and irrigation. The town of Chillicothe obtains its water supply from several wells that tap the terrace deposits (probably the Seymour Formation in this part of the report area).

The eolian deposits, which consist of sand and silt, occur generally as dunes along the Red River and in two areas south and southeast of Chillicothe. In most places, the dunes are above the water table and therefore are not a source of water; however, they are significant as sources of recharge to the underlying formations.

## GROUND-WATER HYDROLOGY

The ground water in Hardeman County is derived from precipitation on the outcrops of the water-bearing formations, but only a small part of the approximately 25 inches of annual rainfall reaches the water table. Most of the precipitation runs off or is lost by evapotranspiration. The amount of precipitation that reaches the water table is determined by such factors as geology, soils, farming practices, vegetal cover, and rainfall intensity.

### Occurrence and Movement of Ground Water

Ground water in Hardeman County occurs under both water-table and artesian conditions. Generally the water in the Quaternary and Permian units is unconfined (water-table condition) and does not rise in a well above the level at which it is encountered during drilling.

Where a water-bearing unit is overlain by a relatively impermeable bed, the water may be confined under hydrostatic pressure and will rise in a well to a level above the top of the water-bearing unit. Artesian conditions in the area exist locally in the Blaine Formation, where cavernous gypsum and anhydrite beds are overlain by shale beds, and in the down-dip part of the San Angelo Sandstone. No wells tap this part of the San Angelo, however, because water of better quality is available at shallower depths.

Ground water moves by gravity from areas of recharge to areas of discharge. The rate of movement, which is rarely uniform, is in proportion to the hydraulic gradient and to the permeability of the rocks. In the Quaternary deposits the water moves slowly, perhaps on the order of a few hundred feet per year. In the Permian rocks containing cavernous and honeycombed beds of gypsum and dolomite, the water moves more rapidly.

The general direction of ground-water movement (hydraulic gradient) in the area is shown by the water-level contour map (Figure 6). In a broad sense, the water moves eastward through the county. Locally, the water moves from the uplands toward the major streams. In general configuration, the water table is a subdued image of the land surface (Figures 5 and 6).

The water-level contours show a mounding of the water table about 12 miles northwest of Goodlett, and in two areas at and near Medicine Mound. The highs in the water table northwest of Goodlett and southeast of Medicine Mound apparently reflect recharge from the infiltration of precipitation on sandy soils.

### Recharge and Discharge of Ground Water

Recharge from the infiltration of rainfall ranges over wide limits and varies from area to area and from aquifer to aquifer. The hydrographs of eight wells (Figure 7) clearly indicate this wide range in the response of the water table to rainfall. The greatest response is shown by wells tapping the Blaine Formation.

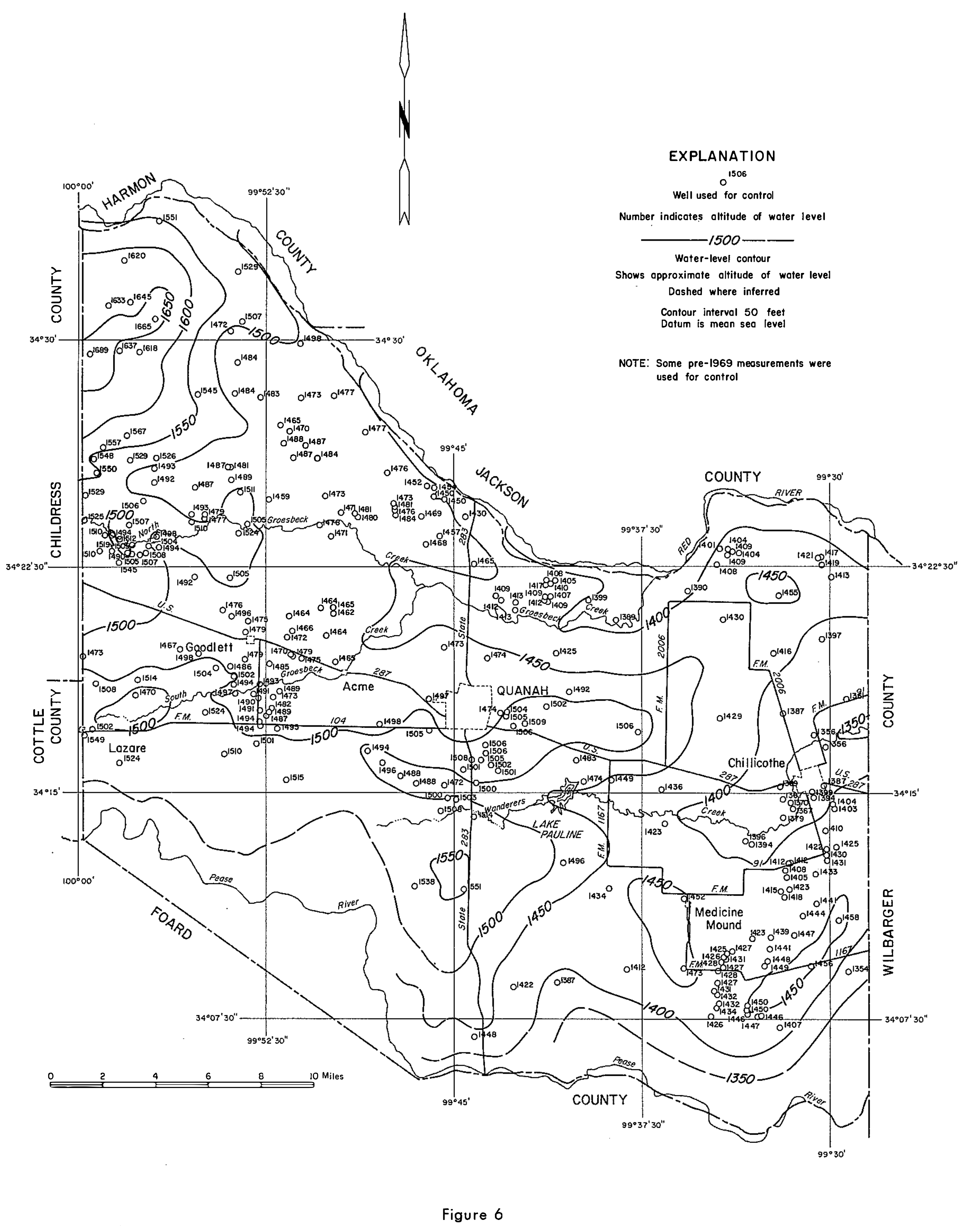


Figure 6

Approximate Altitude of Water Levels in Wells, 1969

Base from U.S. Geological Survey topographic quadrangles

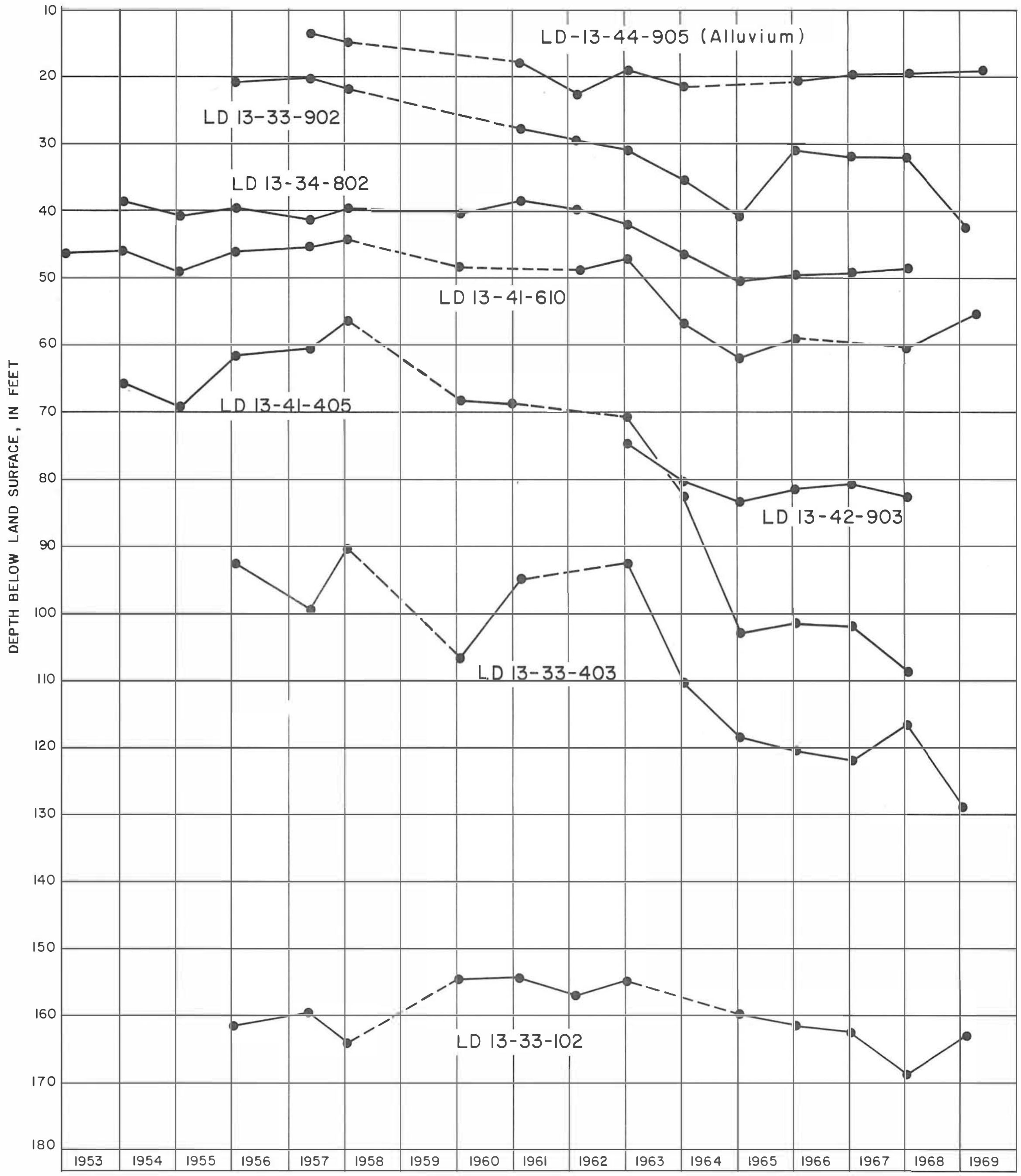


**Figure 7.—Hydrographs of Seven Wells in the Blaine Formation and One Well in the Quaternary Alluvium**

Although the recharge to the alluvium near Chillicothe cannot be computed accurately, some idea of its magnitude is indicated by the quantity of water moving through the aquifer, which is roughly equivalent to the recharge. On the basis of the ability of the aquifer to transmit water (the coefficient of transmissibility) and the present hydraulic gradient (15 feet per mile), approximately 2,600 acre-feet per year is moving through the aquifer. Although aquifer tests to determine the ability of the water-bearing units to transmit and store water were not made, tests made in similar materials near Odell (9 miles north-northeast of Chillicothe) in Wilbarger County (Myers, 1969) indicate that the terrace deposits (Seymour Formation) near Chillicothe have a permeability (flow in gallons per day through a cross section of 1 square foot of the aquifer under a unit hydraulic gradient) of about 650 gpd per square foot. The estimate of recharge to the alluvial deposits near Chillicothe lacks precision; nevertheless, it is sufficiently accurate to indicate that only one inch or about 5 percent of the average annual precipitation on the aquifer is needed to replace the water moving through the aquifer.

Recharge to the Blaine Formation was not determined, but studies made in Harmon and in parts of Greer and Jackson Counties in Oklahoma (immediately north of Hardeman County) show that about 7 percent of the rainfall becomes recharge. On this basis, recharge from precipitation on the 170,000 acres underlain by the Blaine Formation amounts to about 24,000 acre-feet per year. On the other hand, if 5 percent of the precipitation reaches the water table (as estimated for the alluvial deposits near Chillicothe) then recharge to the Blaine would be about 17,000 acre-feet per year. The latter figure agrees closely with the estimate of that part of the base flow of the Red and Pease Rivers contributed by the aquifers in Hardeman County. In all probability, the amount of recharge to the Blaine Formation from direct infiltration of precipitation lies between these two estimates.

Ground water is discharged naturally through springs and seeps, evaporation, transpiration, underflow into another aquifer, and artificially by pumping.

The water-level contour map (Figure 6) shows that the ground water in the county moves toward the major drainageways, where it is discharged through springs and seeps. The volume of discharge through springs and seeps is difficult to determine because part of the flow in the Red River is derived from the terrace deposits in Oklahoma and part of the flow in the Pease River is derived from the Blaine Formation, the San Angelo Sandstone, and the alluvium in Foard County.

Records of the U.S. Geological Survey indicate that the winter base flows at three stations on the Red and Pease Rivers and Groesbeck Creek (Figure 10) range from 9.0 to 36.0 cfs or 6,500 to 26,000 acre-feet per year. After subtracting the effluent seepage assumed to be contributed from outside the area and adding that part of the base flow of Wanderers Creek sustained by springs and seeps, the effluent seepage from Hardeman County probably ranges from 4,600 to 19,000 acre-feet per year. Both of these estimates are conservative because they do not consider losses by evapotranspiration.

## Changes in Water Levels

The discharge from wells and recharge from precipitation are the most important factors controlling the changes in water levels. The magnitude of the change depends mainly on the proximity of the observation well to an area of discharge or recharge, and to some extent on the lithology of the water-bearing unit.

Data available for the period 1953 to 1969 indicate that few definite trends in water levels can be determined (Tables 4 and 5). The changes in water levels in 8 wells (7 in the Blaine Formation and one in the alluvium) are illustrated by the hydrographs in Figure 7.

During the period 1953 to 1969, water levels for most wells in the Blaine Formation showed a net decline of 10 to 20 feet. Water levels were highest during 1957 and 1958, and declined with minor fluctuations through 1969. The general decline since 1963 (Figure 7, Tables 4 and 5) reflects the below normal rainfall and the accompanying increase in pumping. During the period 1963-67, the annual precipitation at Quanah was below normal (24.70 inches) in 4 of the 5 years. In 1968 rainfall was above normal, and water levels rose in some wells.

The change in water levels in the Blaine from 1968 to 1969 ranged from a rise of 4.6 feet to a decline of 12.4 feet. Although the records are inconclusive, they tend to indicate that the pumping of ground water has caused a considerable decline in water levels in some irrigation areas.

Water levels measured in 1960 and 1969 in wells in the alluvium near Chillicothe showed a decline ranging from 0.6 to 8.8 feet; the average decline was about 3.6 feet or slightly less than 0.5 feet per year.

## Yields and Specific Capacities of Wells

The yields of wells in the Quaternary alluvium depend largely on the thickness and permeability of the water-bearing material, the efficiencies of the wells, and the allowable drawdown. The yield of a well in the Blaine Formation is determined by the size and number of solution openings encountered by the well. The yields of closely spaced wells may range over wide limits because of the erratic distribution of the solution openings.

The yields, either reported or measured, of a large number of wells are given in Table 4. Most of the wells used for irrigation generally yield more than 150 gpm; however, many wells—principally livestock and domestic wells—are not pumped at their maximum capacity, hence the yield shown in the table may not be representative of the potential of the aquifer at the well site.

In general, the largest yields—as much as 1,000 gpm—have been reported from wells in the Blaine Formation. The average yield of 108 wells in the Blaine was about 275 gpm. The average yield for 69 wells in the alluvium was about 220 gpm, and the largest reported yield was 600 gpm.

The specific capacities (the ratio of the yield in gallons per minute to drawdown in feet) determined for 99 wells ranged from less than 1 to about 30 gpm per foot of drawdown. The average specific capacity for 54 wells in the alluvium was about 9 gpm per foot of drawdown. For 29 wells in the Blaine Formation, the average was 4.6 gpm per foot of drawdown.

Normally, a higher average specific capacity for wells in the Blaine Formation would be expected because the permeable zones in the gypsum beds permit almost unrestricted flow.

However, the average specific capacity determined for wells in the Blaine was less than that for the alluvium because most of the drawdown data were for wells that had average yields of less than 275 gpm.

When aquifer-test data are not available, specific capacities are useful in estimating the ability of the aquifer to transmit water. On the basis of the specific capacities of wells in the alluvium, the coefficient of transmissibility ranged from 5,000 to 60,000 gpd per foot and averaged about 25,000 gpd per foot. These estimated values compare favorably with those obtained from aquifer tests made in 1951 in similar alluvial deposits in Wilbarger County, about 9 miles east of Chillicothe. The coefficients of transmissibility determined from these tests ranged from 19,600 to 41,000 gpd per foot (Myers, 1969).

### Ground-Water Use

Nearly all the ground water pumped in Hardeman County is used for irrigation. The use of ground water for domestic supply, livestock, and industrial use was not determined, but it is doubtful that these uses exceeded 1,100 acre-feet, or about 10 percent of the 1968 total estimated pumpage of 11,500 acre-feet.

Prior to the early 1950's, the use of ground water for irrigation was insignificant. In 1958, about 12,000 acre-feet of ground water was used to irrigate 10,000 acres (Gillett and Janca, 1965); and by 1964, 22,900 acre-feet was pumped to irrigate 15,110 acres. During the next 4 years, rainfall was below normal in 1966 and 1967. Many irrigation-well owners reported that despite the below-normal rainfall, some wells were not pumped because of decreased yields of wells resulting from lowered water tables and a concomitant increase in operating costs. These factors, plus the above-normal rainfall in 1968, caused a substantial decrease not only in the amount of water pumped during the year (9,900 acre-feet) but also in the acreage irrigated (8,700 acres).

Of the approximately 300 wells available for use in 1968, about half were used at one time or another. Nearly 60 percent of all the ground water used for irrigation in 1968 (5,900 acre-feet) was from the Blaine Formation; the rest (4,000 acre-feet) was from the alluvium, and of this, 3,600 acre-feet was from the vicinity of Chillicothe.

The use of ground water for municipal supply declined from a maximum of about 1.2 mgd prior to 1967 to about 500,000 gpd in 1968. The decrease in pumpage resulted when the city of Quanah began obtaining its municipal supply from the Greenbelt Reservoir near Clarendon, Texas. During the late 1950's and early 1960's Quanah withdrew an estimated average of 500,000 gpd of ground water from two well fields in the northern part of the county. The maximum quantity pumped during that period was about 700,000 gpd and the minimum was about 350,000 gpd.

The water supply for Chillicothe is obtained from four wells in the alluvium. The estimated average quantity pumped during the last few years was 250,000 gpd; the maximum pumpage was about 500,000 gpd, and the minimum was about 75,000 gpd.

## CHEMICAL QUALITY OF GROUND WATER

The suitability of ground water for use in the county depends upon the chemical quality of the water and the limitations imposed by the contemplated use of the water. The chemical quality of the ground water is shown by the analyses of 76 samples collected during this study from 68 wells and eight springs, and by 20 analyses of samples collected during previous studies by the U.S. Geological Survey. In addition, four samples of water were collected and analyzed for pesticides. The location of the wells and springs are shown on Figure 10 and the results of the analyses are shown in Table 6.

### Chemical Quality of Ground Water as Related to Geology

The chemical quality of the water generally reflects the chemical composition of the rocks with which water comes in contact. The amount of minerals dissolved from the rocks depends on several factors, including the temperature of the water, the rate of movement through the rocks, and the solubility of the rocks.

The dissolved-mineral constituents in water (Table 6) are reported in mg/l (milligrams per liter), which is defined as the weight of a solute per liter of solution. However, it is frequently more convenient for interpretive purposes to compare waters in terms in milliequivalents per liter, which is a measure of the reactive weights of the different constituents. The chemical character of samples of water from the various aquifers in the county is shown graphically (Figure 8) by means of patterns modified from a system suggested by Stiff (1951). In this system the three principal cations—calcium, magnesium, and sodium (including potassium)—are shown to the left of the zero point, and the three principal anions—bicarbonate (including carbonate if present), sulfate, and chloride (including

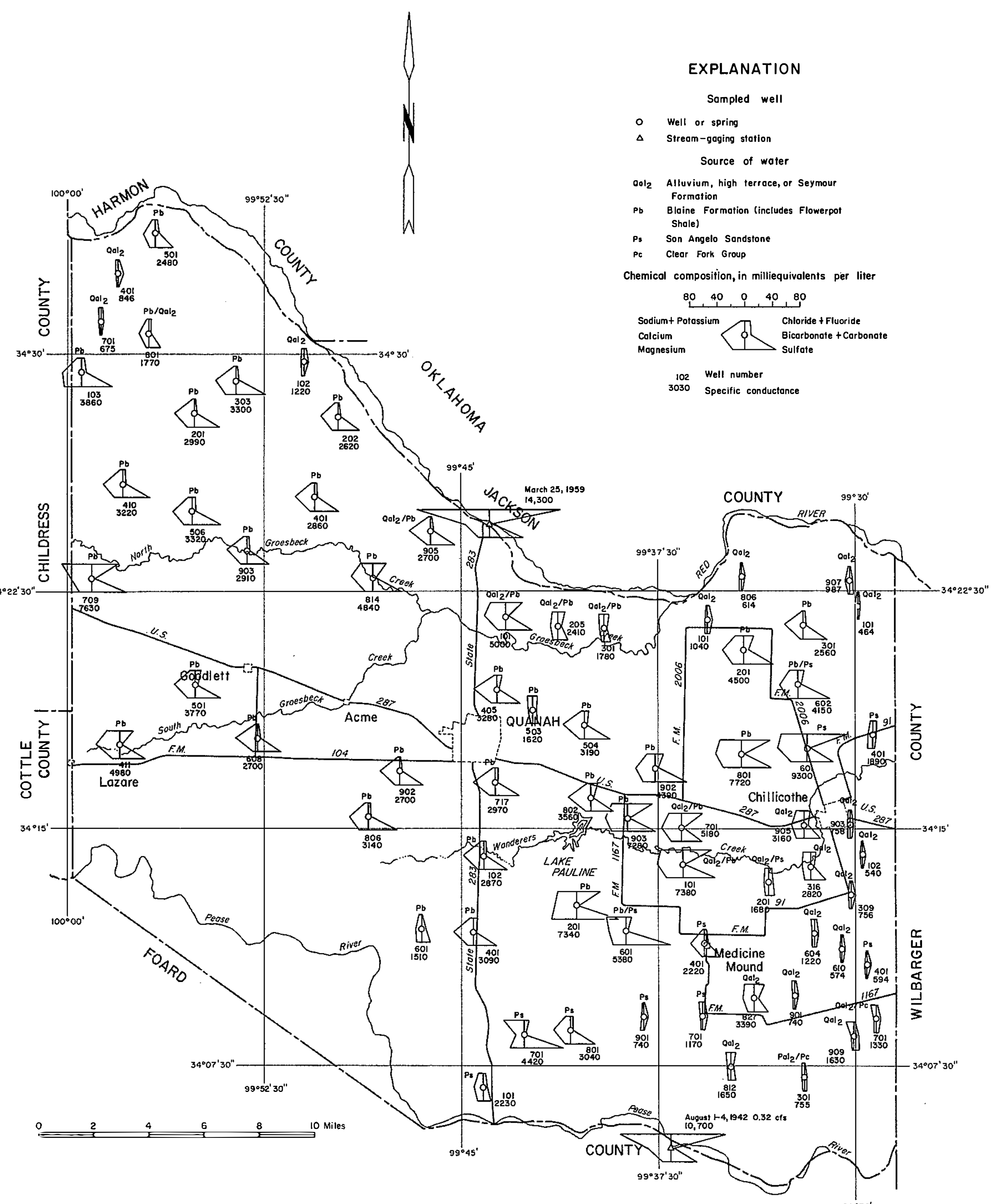


Figure 8

Chemical Quality of Water From Selected Wells and Springs

Base from U.S. Geological Survey topographic quadrangles

fluoride)—are shown to the right of the zero point. In general, water native to a particular formation has a somewhat characteristic shape or pattern.

The specific conductance, which was determined both in the field and laboratory, can be used to estimate the dissolved-solids content of the water. Although no exact relation exists between conductance and dissolved solids in natural water, the conductivity (Table 6) multiplied by a constant (0.6 for the alluvium, and 0.9 for the Blaine Formation) is a close approximation of the dissolved-solids concentration in milligrams per liter.

Water from the alluvium (excluding the channel and flood plain deposits) is very hard, has a dissolved-solids content that is generally less than 1,000 mg/l, and is a calcium bicarbonate type. Where the alluvium adjoins Permian rocks, or is recharged at least in part by streamflow, the water will probably be of the calcium sulfate type.

Water from the Blaine Formation is more mineralized than water from the alluvium, is very hard, and is generally of a calcium sulfate type. The dissolved-solids content ranged from about 1,000 to 6,000 mg/l, but most of the samples ranged from 2,500 to 3,500 mg/l. Some wells in the Blaine had high concentrations of sodium and chloride. High sodium and chloride concentrations may result when a well has penetrated a salt source within or underlying the aquifer, or it may indicate contamination from a surface source.

The chemical quality of the water from the other geologic units—channel and flood-plain deposits, the Flowerpot Shale, and the San Angelo Sandstone—varies widely, depending upon the source of recharge. The channel deposits generally contain water similar in quality to the base flow of the streams. In the Red River and Pease River Valleys, the water in the channel deposits contains considerable concentrations of sodium and chloride. Where the deposits adjoin the Blaine Formation, the water is likely to be of the calcium sulfate type. The San Angelo Sandstone contains water of a calcium bicarbonate type where recharge is from direct precipitation, but where recharge is from the other Permian units, the water will probably be of a calcium sulfate type.

Wells are often completed in more than one aquifer, and such wells commonly blend the waters of different chemical characteristics. The chemical quality or character of the pumped water is generally similar to that of water from one or another of the water-bearing units tapped, depending in part on the position of the pump intake, the mineral characteristics of the water-bearing sediments, and the different pressure heads. Examples of variations in the chemical characteristics of water from wells obtaining water from more than one aquifer are shown in Figure 8 and Table 6.

## Suitability of Ground Water for Use

Most state and municipal authorities have adopted the standards set by the U.S. Public Health Service (1962) for drinking water used on common carriers in interstate commerce. The standards are useful in evaluating public-water supplies, although they may not be directly applicable in some parts of the report area where the available ground water may exceed the standards for some of the constituents. According to the standards, the chemical constituents in a public-water supply should not be present in excess of the concentrations shown in the following table except where more suitable sources are not available.

| CONSTITUENT | CONCENTRATION IN MG/L |
| --- | --- |
| Chloride | 250 |
| Fluoride | 1.0* |
| Iron | .3 |
| Nitrate | 45 |
| Sulfate | 250 |
| Dissolved solids | 500 |

* Based on the average of maximum daily air temperature of 75.1°F at Quanah. A minimum concentration of 0.7 mg/l is desirable.

Only a few wells in the terrace deposits (the source of municipal water for the city of Chillicothe) and in the San Angelo Sandstone have water that meets the chemical standards established by the U.S. Public Health Service. The water from a few other wells in the same units would be acceptable if the fluoride, nitrate, and dissolved-solids content did not slightly exceed the recommended limits of 1.0, 45 and 500 mg/l, respectively. Water from the other geologic units is generally unsuitable for domestic and municipal supplies, and is used for domestic purposes only because water of better quality is not available.

Water from the Blaine Formation and the terrace deposits has been used successfully for irrigation for many years, but under unfavorable soil and slope conditions some of the water from the Blaine Formation and the terrace deposits may not be suitable for irrigation because of the medium sodium hazard (SAR) and very high salinity hazard (Figure 9).

Most of the water from the San Angelo Sandstone is suitable for irrigation; however, there is little possibility of obtaining adequate quantities of water for this purpose. The yields of wells and the quality of the water in the Flowerpot Shale and Clear Fork Group are generally considered inadequate for irrigation.

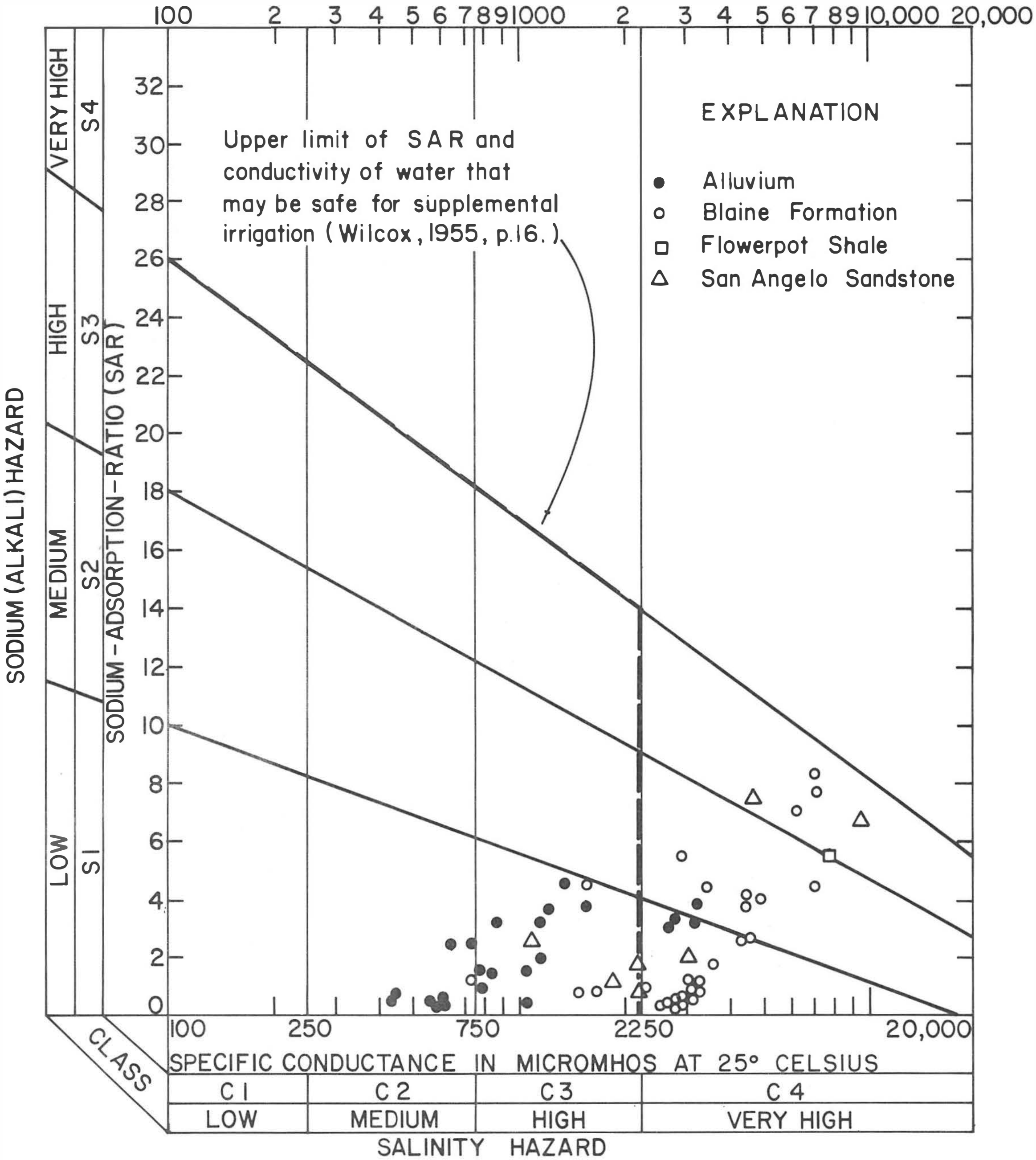


**Figure 9.—Classification of Irrigation Water From Selected Wells and Springs**

Samples of water were collected for pesticides analyses from two irrigation wells in the Blaine Formation and two wells in the terrace deposits near Chillicothe. The results of the analyses showed no evidence of contamination by pesticides.

In general, the water from the aquifers, particularly the Permian rocks, is too mineralized for most industrial uses. The silica content may render much of the water from the alluvium unsuitable for use in boilers operating at high pressures without first treating the water. The temperature of the water, which is an important property in regard to cooling processes, ranges from about 16°C to 22°C.

## PRODUCTION AND DISPOSAL OF OILFIELD BRINES

Small quantities of brine are produced in the report area in conjunction with the production of oil. Table 3 shows the reported amount of brine produced in

**Table 3.—Production and Disposal of Oilfield Brines, 1961**

| FIELD | DISPOSAL IN OPEN PITS (BBLS) | DISPOSAL IN INJECTION WELLS (BBLS) | TOTAL BRINE PRODUCTION (BBLS) |
|---|---|---|---|
| Conley (Ellenburger) | 225 | 14,111 | 14,338 |
| Conley (Mississippian) | 0 | 1,984 | 1,984 |
| Conley (Osage) | 0 | 2,218 | 2,218 |
| Conley (Palo Pinto) | 0 | 56,985 | 56,985 |
| Medicine Mound (Mississippian) | 0 | 0 | 0 |
| Quanah | 1,759 | 0 | 1,759 |
| Total | 1,984 | 75,300 | 77,284 |
| Percent | 2.6% | 97.4% | |

1961 for three fields and the method used for the disposal of the brine. Figure 10 shows the location of the fields. The table is based on a report of the Texas Water Commission and Texas Water Pollution Control Board (1963), and shows that the total brine production in the county in 1961 was 77,284 barrels (about 10 acre-feet). Of this amount, 97.4 percent or 75,300 barrels was disposed of in injection wells and the rest of the brine was discharged into open pits. The formations into which the brine is injected are not known.

The open-pit method of brine disposal is a hazardous method of disposal. Generally, brine in open pits is allowed to evaporate, but the ineffectiveness of disposal by evaporation in sandy soils is readily recognized by the general absence of appreciable quantities of precipitated salts. Unless the pit is lined, the brine usually is free to percolate downward to the water table.

A statewide "no pit" order was issued by the Railroad Commission of Texas to become effective January 1, 1969. Despite the elimination of the pits, salt water that had percolated from the pits over a period of years presents a potential source of contamination. The effects of contamination on ground water may be long lasting because the salts from the pits tend to dilute very slowly.

## NEEDS FOR FURTHER STUDIES

The data collected during the present study were inadequate for an accurate evaluation of the potential of the aquifers. The 1968 rate of ground-water withdrawal can probably be sustained for many years without further depleting the overall ground-water resource of the county. The adequacy of presently (1970) available supplies to meet any future increase in the demands for water for irrigation, municipal, industrial, and domestic use was not determined. More detailed studies should consider: (1) The hydrologic properties of the aquifers; (2) sources and rates of natural recharge and discharge; (3) the effect of concentrated pumping on the regional water table; (4) the hydrologic relationship between aquifers; (5) the quantity and quality of the water in storage; (6) the changes in quality resulting from heavy pumping; (7) the subsurface extent of the moderately saline water in the Flowerpot Shale and the San Angelo Sandstone; (8) and the availability of water from the Clear Fork Group.

The periodic collection of basic data, such as the observation of water levels, an inventory of pumpage, and the collection of water samples for quality studies are necessary items for detailed evaluation of the ground-water resources in the county. A study is also needed to determine the natural discharge of ground water to the Red and Pease Rivers. More detailed geologic mapping is needed to determine the areal extent and thickness of the alluvial deposits, and to determine the relation between local geology (particularly faulting) and the occurrence and movement of fresh to moderately saline water.

Data are needed to determine if the high concentrations of chloride are natural or the result of man's activities. Although future studies will require this information for evaluating the ground-water resources within the county, any new study should consider the hydrologic system over an area considerably larger than Hardeman County.

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Table 4.--Records of Wells and Springs

All wells are drilled unless otherwise noted in remarks column.

Water level : Reported water levels are given in feet; measured water levels are given in feet and tenths.

Method of lift and type of power: B, gas, butane, LP; C, cylinder; Cf, centrifugal; E, electric; G, gasoline; J, jet; N, none; S, submergible; T, turbine; W, wind.

Use of water : D, domestic; Ind, industrial; Irr, irrigation; P, public supply; S, stock; U, unused.

Yield and drawdown : R, reported; E, estimated.

Water-bearing unit : $Qal_2$, alluvium (terrace deposits and Seymour Formation); Pb, Blaine Formation; Ps, San Angelo Sandstone; Pc, Clear Fork Group; Pf, Flowerpot Shale.

| WELL | OWNER | DATE COMPLETED | DEPTH OF WELL (FT) | CASING DIAMETER (IN) | WATER-BEARING UNITS | ALTITUDE OF LAND SURFACE (FT) | WATER LEVEL: ABOVE (+) BELOW LAND SURFACE DATUM (FT) | WATER LEVEL: DATE OF MEASUREMENT | METHOD OF LIFT | USE OF WATER | YIELD IN (GALLONS PER MINUTE) | DRAWDOWN IN FEET | ESTIMATED ACRES IRRIGATED 1968 | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * LD-13-25-401 | -- | -- | Spring | -- | $Qal_2$ | 1,620 | + | Apr. 14, 1969 | Flows | S | 50 E | -- | -- | |
| * 501 | -- | -- | 133 | 6 | Pb | 1,620 | 68.6 | do. | C,W | S | 4 | -- | -- | |
| * 701 | H.W. Trelinder | -- | 120 | 6 | $Qal_2$ | 1,736 | 103.3 | do. | J,E | D | 5 | -- | -- | |
| 702 | do. | -- | 88 | 5 | $Qal_2$ | 1,710 | 65.4 | do. | C,W | S | 4 | -- | -- | Field conductance 570. 2/ |
| * 801 | L.L. Montgomery | 1964 | 290 | 11 | Pb/$Qal_2$ | 1,785 | 120 | Apr. 1969 | S,E | Irr | 100 | 40 | 60 | |
| 901 | --Little | -- | -- | 14 | Pb | 1,602 | 75.4<br>95.1 | Jan. 10, 1956<br>Jan. 19, 1968 | N | U | -- | -- | -- | Abandoned irrigation well. |
| 902 | W. Williams | 1965 | 250 | 14 | Pb | 1,598 | 126.2 | May 21, 1969 | T,B | Irr | 300 R | -- | 125 | |
| 903 | M. Watson | 1950 | 60 | 6 | Pb/$Qal_2$ | 1,570 | 41.4 | do. | C,W | U | -- | -- | -- | |
| 904 | do. | 1965 | 180 | 14 | Pb | 1,598 | -- | -- | T,B | Irr | 300 R | -- | 140 | |
| 33-101 | F. Lindsey Est. | -- | 230 | 6 | Pb | 1,813 | 178.5<br>181.7<br>175.6 | Jan. 10, 1956<br>May 22, 1957<br>Jan. 6, 1958 | C,W | S | 4 | -- | -- | Field conductance 2,200. 2/ |
| 102 | do. | -- | 192 | 6 | Pb | 1,781 | 161.6<br>163.1 | Jan. 10, 1956<br>Feb. 5, 1969 | C,W | S | 2 | -- | -- | Field conductance 2,800. 1/ 2/ |
| * 103 | do. | -- | 210 | 6 | Pb | 1,765 | 75.8 | do. | C,W | S | 3 | -- | -- | |
| * 201 | K. Horton & Williams | 1943 | 200 | 6 | Pb | 1,637 | 91.8 | Feb. 6, 1969 | C,W | S | 4 | -- | -- | |
| 301 | R. Tabor | 1955 | 145 | 14 | Pb | 1,572 | 77.0<br>89.0 | Jan. 10, 1956<br>Jan. 13, 1965 | T,B | Irr | 100 E | -- | 20 | 1/ |
| 302 | Williams Ranch | -- | 140 | 6 | Pb | 1,582 | 97.5 | Feb. 6, 1969 | C,W | S | 8 | -- | -- | Field conductance 3,000. 2/ |
| * 303 | do. | -- | 152 | 6 | Pb | 1,612 | 128.0 | do. | C,W | S | 5 | -- | -- | |
| 401 | L. Trosper | -- | 93 | 5 | Pb | 1,665 | 84.4<br>98.0 | Jan. 10, 1956<br>Jan. 16, 1969 | C,W | S | -- | -- | -- | |
| 402 | J. Hacker | 1955 | 270 | 12 | Pb | 1,666 | 79.2<br>70.8<br>81.7<br>108.8 | Jan. 10, 1956<br>Jan. 6, 1958<br>Jan. 26, 1960<br>Jan. 16, 1969 | T,B | Irr | 200 R | -- | -- | |

See footnotes at end of table.

Table 4.--Records of Wells and Springs--Continued

| WELL | OWNER | DATE COMPLETED | DEPTH OF WELL (FT) | CASING DIAMETER (IN) | WATER-BEARING UNITS | ALTITUDE OF LAND SURFACE (FT) | WATER LEVEL: ABOVE (+) BELOW LAND SURFACE DATUM (FT) | WATER LEVEL: DATE OF MEASUREMENT | METHOD OF LIFT | USE OF WATER | YIELD IN (GALLONS PER MINUTE) | DRAW-DOWN IN FEET | ESTIMATED ACRES IRRIGATED 1968 | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LD-13-33-403 | J.F. Harrell | 1955 | 230 | 14 | Pb | 1,677 | 92.8<br>129.1 | Jan. 10, 1956<br>Jan. 16, 1969 | N | U | -- | -- | -- | 1/ |
| 404 | do. | -- | 250 | 12 | Pb | 1,661 | 111.0 | do. | T,B | Irr | 250 R | -- | -- | |
| 405 | K. McSpadden | 1957 | 200 | 12 | Pb | 1,649 | 90 | -- | T,B | U | 100 R | 60 | -- | |
| 406 | do. | 1955 | 300 | 14 | Pb | 1,654 | 90 | 1955 | T,B | Irr | 150 R | -- | -- | |
| 407 | do. | 1960 | 300 | 14 | Pb | 1,653 | 90 | 1953 | T,B | Irr | 250 R | 185 R | 30 | |
| 408 | do. | 1955 | 275 | 12 | Pb | 1,657 | 90 | 1957 | T,B | Irr | 150 R | 160 R | 25 | |
| 409 | do. | 1956 | 300 | 14 | Pb | 1,652 | 100 | 1952 | T,B | Irr | 100 R | 150 R | -- | |
| * 410 | T. Coklendother | 1957 | 230 | 11 | Pb | 1,633 | 100.4 | Jan. 29, 1969 | T,B | Irr | 150 R | -- | 44 | |
| * 501 | R. Hines | -- | 200 | 14 | Pb | 1,628 | 88.9 | May 22, 1957 | T,B | Irr | -- | -- | -- | 1/ |
| 502 | do. | -- | 205 | 14 | Pb | 1,652 | 101.7 | Jan. 19, 1968 | T,B | Irr | 150 R | -- | -- | |
| 503 | do. | -- | 200 | 14 | Pb | 1,618 | 124.7 | Jan. 31, 1969 | T,B | Irr | -- | -- | -- | Well not used in 1968. |
| 504 | do. | -- | 200 | 14 | Pb | 1,613 | -- | -- | T,B | Irr | -- | -- | -- | Do. |
| 505 | do. | -- | 200 | 14 | Pb | 1,608 | 115.7 | Feb. 3, 1969 | T,B | Irr | -- | -- | -- | Do. |
| 506 | J. Baker | 1966 | 240 | 14 | Pb | 1,567 | 80.2 | Feb. 5, 1969 | T,B | Irr | 450 R | 157 | 90 | |
| 601 | M. Watson | -- | -- | -- | Pb | 1,597 | -- | -- | N | U | -- | -- | -- | Well destroyed Dec. 4, 1969. |
| * 602 | do. | 1952 | 115 | 14 | Pb | 1,590 | 75.3<br>103.0 | Jan. 10, 1953<br>Feb. 4, 1969 | -- | -- | -- | -- | -- | 1/ |
| 603 | do. | 1945 | 200 | 14 | Pb | 1,586 | 81.2<br>104.6 | Jan. 10, 1956<br>Feb. 4, 1969 | N | U | -- | -- | -- | 1/ |
| 604 | do. | 1955 | 225 | 14 | Pb | 1,570 | 81.1 | do. | T,B | Irr | 200 R | -- | -- | Not used in 1968. |
| 605 | W. Smith | -- | 200 | 14 | Pb | 1,590 | -- | -- | T,B | Irr | -- | -- | -- | |
| 701 | D. McSpadden | 1953 | 180 | 16 | Pb | 1,622 | 61.1 | Sept. 27, 1960 | T,B | Irr | 550 R | -- | -- | |
| 702 | W. Tabor | 1956 | 200 ± | 12 | Pb | 1,580 | 40.4<br>89.9 | Jan. 13, 1964<br>Jan. 15, 1969 | T,B | Irr | -- | -- | -- | |
| 703 | do. | 1957 | 200 ± | 12 | Pb | 1,580 | 74.4 | do. | T,B | Irr | -- | -- | -- | |
| 704 | do. | 1960 | 200 ± | 12 | Pb | 1,582 | 76.6 | do. | T,B | Irr | -- | -- | -- | |
| 705 | do. | 1960 | 200 ± | 12 | Pb | 1,592 | 80.0 | do. | T,B | Irr | -- | -- | -- | |

See footnotes at end of table.

Table 4.--Records of Wells and Springs--Continued

| WELL | OWNER | DATE COMPLETED | DEPTH OF WELL (FT) | CASING DIAMETER (IN) | WATER-BEARING UNITS | ALTITUDE OF LAND SURFACE (FT) | WATER LEVEL: ABOVE (+) BELOW LAND SURFACE DATUM (FT) | WATER LEVEL: DATE OF MEASUREMENT | METHOD OF LIFT | USE OF WATER | YIELD IN (GALLONS PER MINUTE) | DRAW-DOWN IN FEET | ESTIMATED ACRES IRRIGATED 1968 | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LD-13-33-706 | W. Tabor | 1960 | 200 ± | 12 | Pb | 1,582 | 87.6 | Jan. 15, 1969 | T,B | Irr | -- | -- | -- | |
| 707 | do. | 1965 | 200 ± | 10 | Pb | 1,589 | 70.2 | Jan. 16, 1969 | T,B | Irr | -- | -- | -- | |
| 708 | do. | 1962 | 200 ± | 12 | Pb | 1,592 | 86.6 | Jan. 15, 1969 | T,B | Irr | -- | -- | -- | |
| * 709 | R. Nippert | 1954 | 245 | 12 | Pb | 1,593 | 82.5 | Jan. 16, 1969 | T,B | Irr | 200 R | 113 | -- | |
| 710 | do. | 1964 | 205 | 14 | Pb | 1,591 | -- | -- | T,B | Irr | -- | -- | -- | |
| * 711 | do. | 1962 | 210 | 12 | Pb | 1,591 | 81.0 | Jan. 16, 1969 | T,B | Irr | 250 R | 115 | -- | |
| 712 | do. | 1968 | 210 | 14 | Pb | 1,618 | -- | -- | T,B | Irr | -- | -- | -- | |
| 713 | B. King | 1948 | 250 | 14 | Pb | 1,608 | -- | -- | T,B | Irr | -- | -- | -- | |
| 714 | P. Conant | -- | 250 | 12 | Pb | 1,632 | -- | -- | T,B | Irr | -- | -- | -- | |
| 715 | G. Reed | 1963 | 180 | 14 | Pb | 1,612 | -- | -- | T,B | Irr | 300 E | -- | 65 | |
| 716 | K. McSpadden | -- | 200 | 16 | Pb | 1,604 | 80 | Jan. 1969 | T,B | Irr | 250 R | 120 | -- | |
| 717 | do. | -- | 200 | 14 | Pb | 1,605 | 80.4 | Jan. 29, 1969 | T,B | Irr | 300 R | 120 R | -- | |
| 718 | H.E. Sharp | -- | 224 | 16 | Pb | 1,614 | 84.7 | do. | T,B | Irr | 200 E | -- | -- | |
| 719 | J.W. Tabor | 1963 | 225 | -- | Pb | 1,625 | 117.8 | Jan. 31, 1969 | T,B | Irr | 300 R | -- | -- | Not used in 1967 & 68. |
| 801 | W. Tabor | 1956 | 200 ± | 12 | Pb | 1,570 | 71.9 | Jan. 15, 1969 | T,B | Irr | -- | -- | -- | |
| 802 | do. | 1956 | 200 ± | 12 | Pb | 1,572 | 68.1 | do. | T,B | Irr | -- | -- | -- | |
| 803 | do. | 1956 | 200 ± | 12 | Pb | 1,578 | 70.3 | do. | T,B | Irr | -- | -- | -- | |
| 804 | do. | 1956 | 200 ± | 12 | Pb | 1,569 | 70.7 | do. | T,B | Irr | -- | -- | -- | |
| 805 | do. | 1956 | 200 ± | 12 | Pb | 1,572 | 78.0 | do. | T,B | Irr | -- | -- | -- | |
| 806 | J.H. King | 1953 | 250 | 12 | Pb | 1,591 | 84.7 | Jan. 17, 1969 | T,B | Irr | -- | -- | -- | Not used since 1965. |
| 807 | C. Vestal | 1950 | 96 | 12 | Pb | 1,565 | 54.8 | Feb. 3, 1969 | T,G | Irr | -- | -- | -- | Irrigated 240 acres in 1968 from 5 wells - LD-13-33-807 to 809, 904, and 905. |
| 808 | do. | 1950 | 250 | 14 | Pb | 1,568 | 89.1 | do. | T,G | Irr | -- | -- | -- | |
| 809 | do. | 1950 | 235 | 14 | Pb | 1,568 | 74.6 | do. | T,G | Irr | -- | -- | -- | |
| 901 | J.W. Tabor | -- | 150 | 16 | Pb | 1,558 | 42.1<br>49.2 | Jan. 10, 1956<br>Feb. 28, 1962 | T,B | Irr | -- | -- | -- | 1/ |

See footnotes at end of table.

Table 4.--Records of Wells and Springs--Continued

| WELL | OWNER | DATE COM-PLET-ED | DEPTH OF WELL (FT) | CASING DIAM-ETER (IN) | WATER-BEAR-ING UNITS | ALTITUDE OF LAND SURFACE (FT) | WATER LEVEL: ABOVE (+) BELOW LAND SURFACE DATUM (FT) | WATER LEVEL: DATE OF MEASUREMENT | METHOD OF LIFT | USE OF WATER | YIELD IN (GALLONS PER MINUTE) | DRAW-DOWN IN FEET | ESTIMATED ACRES IRRIGATED 1968 | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LD-13-33-902 | I. Smith | -- | 130 | 16 | Pb | 1,566 | 21.1<br>42.4 | Jan. 10, 1956<br>Feb. 5, 1969 | T,G | Irr | -- | -- | -- | [1] |
| * 903 | W. Goodman | 1952 | 160 | 12 | Pb | 1,540 | 35 | 1952 | S,E | S | 50 E | -- | -- | |
| 904 | C. Vestal | 1950 | 200 | 14 | Pb | 1,558 | 81.0 | Feb. 3, 1969 | T,G | Irr | -- | -- | -- | |
| 905 | do. | 1950 | 168 | 14 | Pb | 1,558 | 79.8 | do. | T,G | Irr | -- | -- | -- | |
| 906 | H. Wells | -- | 150 | -- | Pb | 1,562 | 50.8 | Feb. 5, 1969 | T,B | Irr | -- | -- | -- | Not used in 1968. |
| 34-101 | H. Poole | 1964 | 250 | 16 | Pb | 1,563 | -- | -- | T,B | Irr | 300 R | -- | 75 | |
| 102 | R.M. Wells | -- | 86 | 6 | $Qal_2$ | 1,570 | 71.5 | Feb. 6, 1969 | C,W | D,S | 3 | -- | -- | |
| 103 | A.A. Lindsey | -- | 140 | 6 | Pb | 1,575 | 111.5 | do. | C,W | D | 3 R | -- | -- | |
| 201 | Windberry Est. | 1953 | 147 | 14 | Pb | 1,541 | 74 | -- | N | U | -- | -- | -- | |
| * 202 | do. | 1966 | 90 | 5 | Pb | 1,540 | 63.1 | Feb. 6, 1969 | C,E | D,S | 10 | -- | -- | |
| * 401 | B. Hunter | -- | 158 | -- | Pb | 1,560 | -- | -- | T | U | -- | -- | -- | |
| 402 | H. Becknell | 1956 | 150 | 12 | Pb | 1,583 | 99.4 | Mar. 21, 1969 | T,B | Irr | -- | -- | -- | Irrigated 150 acres in 1968 from 3 wells - LD-13-34-402, 506, and 507. |
| 403 | A. Cunningham | 1951 | 65 | -- | Pb | 1,575 | -- | -- | T,B | Irr | -- | -- | 40 | |
| 404 | do. | 1951 | 65 | -- | Pb | 1,570 | -- | -- | T,B | Irr | -- | -- | 40 | |
| 405 | H. Becknell | 1957 | 150 | -- | Pb | 1,583 | -- | -- | T,B | Irr | -- | -- | 35 | |
| 406 | B. Hunter | -- | 150 | -- | -- | 1,558 | -- | -- | T | U | -- | -- | -- | |
| 407 | S.P. Robertson | -- | 130 | 16 | Pb | 1,580 | 92.8 | Apr. 15, 1969 | T,B | Irr | 400 R | 30 E | 50 | |
| 408 | do. | 1960 | 130 | 14 | Pb | 1,562 | 74.6 | do. | T,B | Irr | 100 R | 45 E | 30 | |
| 409 | do. | -- | 130 | 12 | Pb | 1,560 | 71.9 | do. | T,B | Irr | 250 R | 45 E | 40 | |
| 410 | do. | -- | 130 | 14 | Pb | 1,570 | 105.0 | do. | T,B | Irr | 150-75 R | 14 E | 30 | |
| 411 | do. | -- | 130 | 14 | Pb | 1,560 | 89.5 | do. | T,B | Irr | 125 R | 30 E | -- | |
| 501 | J. Hunter | 1953 | 150 | 12 | Pb | 1,548 | -- | -- | T,B | Irr | 250 R | -- | 110 | |
| 502 | do. | 1960 | 150 | 12 | Pb | 1,552 | -- | -- | T,B | Irr | 250 R | -- | 110 | |
| 503 | R. Smith | 1956 | 190 | 14 | Pb | 1,554 | -- | -- | T | Irr | 600 R | -- | 137 | |
| 504 | H. Kubicek | 1955 | 120 | 14 | Pb | 1,548 | -- | -- | T,B | Irr | 450 R | -- | -- | |

See footnotes at end of table.

Table 4.--Records of Wells and Springs--Continued

| WELL | OWNER | DATE COMPLETED | DEPTH OF WELL (FT) | CASING DIAMETER (IN) | WATER-BEARING UNITS | ALTITUDE OF LAND SURFACE (FT) | WATER LEVEL: ABOVE (+) BELOW LAND SURFACE DATUM (FT) | WATER LEVEL: DATE OF MEASUREMENT | METHOD OF LIFT | USE OF WATER | YIELD IN (GALLONS PER MINUTE) | DRAW-DOWN IN FEET | ESTIMATED ACRES IRRIGATED 1968 | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LD-13-34-505 | H. Kubicek | 1960 | 132 | 14 | Pb | 1,521 | 45.4 | Mar. 21, 1969 | T,B | Irr | 450 R | -- | 160 | |
| 506 | H. Becknell | 1957 | 150 | -- | Pb | 1,588 | -- | -- | T,B | Irr | -- | -- | -- | See remarks under well 13-34-402. |
| 507 | do. | 1957 | 150 | -- | Pb | 1,589 | -- | -- | T,B | Irr | -- | -- | -- | Do. |
| 508 | do. | 1957 | 114 | -- | $Pb/Qal_2$ | 1,572 | 45.1 | Mar. 21, 1969 | T,B | Irr | -- | -- | 40 | |
| 601 | B. Conley | 1954 | 108 | -- | $Pb/Qal_2$ | 1,510 | -- | -- | -- | U | 120 R | -- | -- | Well reported to yield 120 gpm. |
| 602 | W. Mosely | 1959 | 100 | 12 | $Pb/Qal_2$ | 1,511 | 59.0 | Mar. 25, 1969 | N | U | -- | -- | -- | |
| 603 | J. Conley | 1965 | 115 | -- | $Pb/Qal_2$ | 1,509 | 55.1 | do. | T,E | Irr | 325 R | -- | 25 | |
| 604 | do. | 1958 | 120 | -- | $Pb/Qal_2$ | 1,510 | -- | -- | T,B | Irr | 300 R | -- | 25 | |
| 605 | W. Mosely | 1966 | 100 | 12 | $Pb/Qal_2$ | 1,509 | -- | -- | T,E | Irr | 140 R | -- | 30 | |
| 701 | J. Robertson | 1955 | 193 | 14 | Pb | 1,571 | 112.0 | Mar. 26, 1969 | T,B | Irr | 225 R | -- | 60 | |
| 702 | J. Rine | -- | 180 | -- | Pb | 1,542 | 68.6 | Apr. 9, 1969 | T,B | Irr | 600 R | -- | 50 | |
| 703 | do. | 1963 | 180 | -- | $Pb/Qal_2$ | 1,515 | 36.6 | do. | T,B | Irr | 350 R | -- | 35 | |
| 704 | L. Powell | 1957 | 176 | -- | Pb | 1,542 | -- | -- | T,E | Irr | 150 R | -- | 30 | |
| 705 | F. Word | -- | 180 | -- | -- | 1,549 | -- | -- | T,B | Irr | -- | -- | -- | |
| * 801 | J. Hunter | 1948 | 126 | -- | Pb | 1,522 | 37.2<br>38.0 | Jan. 10, 1953<br>Feb. 2, 1961 | T,B | Irr | 900 R | -- | -- | 1/ |
| 802 | do. | 1953 | 110 | 14 | Pb | 1,520 | 38.7<br>48.8 | Jan. 9, 1954<br>Jan. 19, 1968 | T,B | Irr | 900 R | -- | 155 | 1/ |
| 803 | do. | -- | 100 | -- | Pb | 1,525 | 63.9<br>43.6 | Jan. 9, 1955<br>Jan. 19, 1968 | T,B | Irr | 500 R | -- | 40 | 1/ |
| 804 | -- | -- | -- | -- | -- | -- | -- | -- | N | U | -- | -- | -- | Well destroyed. |
| 805 | -- | -- | -- | -- | -- | -- | -- | -- | N | U | -- | -- | -- | Do. |
| 806 | -- | -- | -- | -- | -- | -- | -- | -- | N | U | -- | -- | -- | Do. |
| * 807 | B. Conley | -- | 174 | -- | Pb | 1,520 | -- | -- | T,B | Irr | -- | -- | -- | |
| 808 | J. Hurst | 1963 | 110 | -- | Pb | 1,549 | -- | -- | T,B | Irr | 300 R | -- | 60 | |
| 809 | J. Hunter | 1957 | 150 | -- | Pb | 1,538 | -- | -- | T,B | Irr | 1,000 R | -- | 70 | |
| 810 | L. Powell | 1965 | 150 | -- | Pb | 1,522 | 51.3 | Apr. 10, 1969 | T,B | Irr | 400 R | -- | 40 | |

See footnotes at end of table.

Table 4.--Records of Wells and Springs--Continued

| WELL | OWNER | DATE COMPLETED | DEPTH OF WELL (FT) | CASING DIAMETER (IN) | WATER-BEARING UNITS | ALTITUDE OF LAND SURFACE (FT) | WATER LEVEL: ABOVE (+) BELOW LAND SURFACE DATUM (FT) | WATER LEVEL: DATE OF MEASUREMENT | METHOD OF LIFT | USE OF WATER | YIELD IN (GALLONS PER MINUTE) | DRAW-DOWN IN FEET | ESTIMATED ACRES IRRIGATED 1968 | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LD-13-34-811 | J. Hunter | 1953 | 100 | -- | Pb | 1,528 | 48.1 | Apr. 9, 1969 | T,E | Irr | 200 R | -- | 25 | |
| 812 | do. | 1959 | 150 | -- | Pb | 1,548 | -- | -- | T,B | Irr | 500 R | -- | 70 | |
| 813 | Q. Wilson | 1955 | 110 | -- | Pb | 1,523 | -- | -- | T,B | Irr | 500 R | -- | 55 | |
| * 814 | -- | -- | Spring | -- | Pb | 1,450 | + | -- | Flows | S | 350 | -- | -- | |
| 901 | J. Hurst | 1963 | 120 | 16 | Pb/$Qal_2$ | 1,528 | -- | -- | T,B | Irr | -- | -- | -- | Not used in 1967 & 68. |
| 902 | do. | 1963 | 120 | 14 | Pb/$Qal_2$ | 1,531 | -- | -- | T,B | U | -- | -- | -- | Do. |
| 903 | B. Nowell | 1957 | 110 | 14 | Pb/$Qal_2$ | 1,528 | 58.7 | Mar. 23, 1969 | T,B | Irr | 140 R | -- | 15 | |
| 904 | --Foster Bros. | 1955 | 105 | 16 | Pb/$Qal_2$ | 1,526 | 59.6 | do. | T,B | U | 200 R | -- | -- | Not used in 1967 or 68. |
| * 905 | do. | 1964 | 137 | 8 | Pb/$Qal_2$ | 1,525 | -- | -- | S,E | U | 200 | -- | -- | Do. |
| 906 | --Medley | 1956 | 85 | 6 | Pb/Qal2 | 1,549 | 64.9 | Mar. 25, 1969 | N | U | -- | -- | -- | |
| 907 | do. | 1956 | 85 | 8 | Pb/$Qal_2$ | 1,540 | 66 | do. | N | U | -- | -- | -- | |
| 908 | do. | 1956 | 70 | 6 | -- | 1,547 | -- | -- | N | U | -- | -- | -- | |
| 909 | do. | 1956 | 110 | 6 | Pb/$Qal_2$ | 1,544 | 68.2 | Mar. 25, 1969 | N | U | -- | -- | -- | |
| 910 | do. | 1956 | 110 | 8 | Pb/$Qal_2$ | 1,541 | 60.0 | do. | N | U | -- | -- | -- | |
| 911 | J. Conley | 1955 | 135 | 14 | Pb/$Qal_2$ | 1,514 | 65.5 | Mar. 25, 1969 | T,B | Irr | 450 R | -- | 45 | |
| 912 | M. Watson | 1957 | 90 | 12 | Pb/$Qal_2$ | 1,504 | -- | -- | T,E | Irr | 200 R | -- | -- | Not used in 1967 & 68. |
| 913 | do. | 1957 | 90 | 12 | Pb/$Qal_2$ | 1,497 | 46.8 | Mar. 26, 1969 | T,E | Irr | 50 R | -- | -- | Do. |
| 914 | F. Dennis | 1968 | 90 | 14 | Pb/$Qal_2$ | 1,527 | 45 | 1968 | S,E | Irr | 70 R | -- | 25 | |
| 915 | do. | 1963 | 115 | 14 | Pb/$Qal_2$ | 1,522 | 54.2 | June 5, 1969 | T,B | Irr | -- | -- | -- | Not used in 1967 & 68. |
| 916 | do. | 1965 | 90 | 14 | Pb/$Qal_2$ | 1,527 | 45 | -- | S,E | Irr | 150 R | -- | 25 | |
| 917 | do. | 1961 | 115 | 14 | Pb/$Qal_2$ | 1,519 | 62.3 | June 5, 1969 | T,B | Irr | 175 R | -- | 40 | |
| 35-701 | R. Monroe | -- | 78 | 12 | Pb/$Qal_2$ | 1,490 | 59.6 | Apr. 17, 1969 | T,B | Irr | 50 R | 15 | 3 | |
| 702 | -- | -- | 102 | 12 | Pb/$Qal_2$ | 1,541 | 76.1 | do. | T,E | Irr | 50 R | -- | -- | |
| 36-801 | City of Quanah, Well #1 | 1930 | 89 | 16 | $Qal_2$ | 1,440 | 11<br>32 | 1930<br>1938 | -- | U | -- | -- | -- | Abandoned. |
| 802 | City of Quanah, Well #2 | 1930 | 95 | 16 | $Qal_2$ | 1,440 | 16 | Aug. 1930 | -- | U | -- | -- | -- | Do. |

See footnotes at end of table.

Table 4.--Records of Wells and Springs--Continued

| WELL | OWNER | DATE COMPLETED | DEPTH OF WELL (FT) | CASING DIAMETER (IN) | WATER-BEARING UNITS | ALTITUDE OF LAND SURFACE (FT) | WATER LEVEL: ABOVE (+) BELOW LAND SURFACE DATUM (FT) | WATER LEVEL: DATE OF MEASUREMENT | METHOD OF LIFT | USE OF WATER | YIELD IN (GALLONS PER MINUTE) | DRAW-DOWN IN FEET | ESTIMATED ACRES IRRIGATED 1968 | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * LD-13-36-803 | City of Quanah, Well #3 | 1930 | 100 | 16 | $Qal_2$ | 1,440 | 15 | Aug. 1930 | -- | U | -- | -- | -- | Abandoned. |
| 804 | B.B. Thrash | 1956 | 56 | 14 | $Qal_2$ | 1,440 | 31.2 | Apr. 18, 1969 | T,B | Irr | 150 R | 18 E | -- | |
| 805 | Dr. Sitta | 1940 | 55 | 12 | $Qal_2$ | 1,434 | 30 | do. | T,E | Irr | 35 | -- | 10 | Field conductance 1050. 2/ |
| * 806 | do. | 1965 | 65 | 7 | $Qal_2$ | 1,430 | 28.5 | do. | S,E | Irr | 40 | 20 | 5 | |
| * 807 | E. Wofford | -- | 54 | 10 | $Qal_2$ | 1,442 | 33.8 | do. | T,E | Irr | 90 | 20 | 30 | |
| 808 | B.B. Thrash | -- | 48 | 14 | $Qal_2$ | 1,432 | 28.3 | do. | T,B | Irr | 150 R | 12 E | 30 | |
| 809 | do. | -- | 60 | 14 | $Qal_2$ | 1,440 | 34.8 | do. | T,B | Irr | 125 R | 18 E | 20 | |
| 810 | Dr. Sitta | 1954 | 65 | 14 | $Qal_2$ | 1,441 | 36.7 | do. | T,B | Irr | 65 R | 14 E | 15 | |
| 901 | H. Reinhardt | 1955 | 56 | 16 | $Qal_2$ | -- | -- | -- | -- | U | -- | -- | -- | Abandoned. |
| 902 | B.B. Thrash | -- | 36 | 18 | $Qal_2$ | 1,437 | 20.2 | Apr. 18, 1969 | T,E | Irr | 200 R | 13 E | 20 | 902, 903, & 904 used together. |
| 903 | do. | -- | 31 | 16 | $Qal_2$ | 1,440 | 19.3 | do. | S,E | Irr | 100 R | 10 E | -- | |
| 904 | do. | -- | 32 | 18 | $Qal_2$ | 1,431 | 11.5 | do. | T,E | Irr | 100 R | 17 E | -- | |
| 905 | M.H. Henderson | -- | 44 | 14 | $Qal_2$ | 1,450 | 30.8 | do. | T,B | Irr | 100 R | 10 E | 15 | |
| 906 | do. | -- | 54 | 14 | $Qal_2$ | 1,451 | 31 | Mar. 2, 1969 | T,B | Irr | 100 R | -- | 15 | Red bed at 50 ft. |
| * 907 | B.B. Thrash | -- | Spring | -- | $Qal_2$ | 1,420 | + | Apr. 18, 1969 | Flows | S | 25 E | -- | -- | |
| 41-101 | W. Tabor | 1962 | 200 ± | 12 | Pb | 1,604 | -- | -- | T,B | Irr | -- | -- | -- | |
| 102 | E.V. Perkins #1 | 1960 | 4,769 | -- | -- | 1,643 | -- | -- | N | N | -- | -- | -- | Oil test. Base of San Angelo Sandstone at 400 ft. |
| 201 | V. Tabor | 1953 | 250 | -- | Pb | 1,610 | 118.4 | Feb. 6, 1969 | T,B | Irr | -- | -- | -- | |
| 301 | -- | -- | -- | -- | Pb | 1,610 | 83.0<br>104.9 | Jan. 10, 1956<br>Jan. 17, 1968 | N | U | -- | -- | -- | 1/ |
| * 302 | V. Tabor | 1953 | 146 | 16 | Pb | -- | 86.0 | Feb. 1953 | -- | U | -- | -- | -- | Well destroyed. |
| 303 | do. | 1954 | 225 | 14 | Pb | 1,567 | 109.6 | Feb. 6, 1969 | T,B | Irr | -- | -- | 60 | |
| * 304 | do. | 1953 | 265 | 16 | Pb | 1,569 | 93.0 | do. | T,B | U | -- | -- | -- | Reported water "salty". |
| 305 | do. | -- | -- | -- | -- | -- | -- | -- | -- | U | -- | -- | -- | Well destroyed 1961. |

See footnotes at end of table.

Table 4.--Records of Wells and Springs--Continued

| WELL | OWNER | DATE COMPLETED | DEPTH OF WELL (FT) | CASING DIAMETER (IN) | WATER-BEARING UNITS | ALTITUDE OF LAND SURFACE (FT) | WATER LEVEL: ABOVE (+) BELOW LAND SURFACE DATUM (FT) | WATER LEVEL: DATE OF MEASUREMENT | METHOD OF LIFT | USE OF WATER | YIELD IN (GALLONS PER MINUTE) | DRAW-DOWN IN FEET | ESTIMATED ACRES IRRIGATED 1968 | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LD-13-41-306 | M.E. Watson | 1955 | 150 | 14 | Pb | 1,571 | 55.9<br>74.5 | Jan. 10, 1956<br>Jan. 17, 1968 | T,B | U | -- | -- | -- | 1/ |
| 307 | W. Mitchell | 1963 | 220 | -- | Pb | 1,562 | 83.2 | Feb. 6, 1969 | T,B | Irr | 650 R | -- | 100 | |
| 308 | do. | 1955 | 150 | -- | Pb | 1,582 | -- | -- | T,B | Irr | -- | -- | -- | Not used in 1968. |
| 309 | do. | -- | 150 | -- | Pb | 1,555 | 80.0 | Feb. 6, 1969 | N | U | -- | -- | -- | |
| 310 | V. Tabor | 1956 | 150 | 12 | Pb | 1,555 | -- | -- | T,B | Irr | -- | -- | 40 | |
| 311 | C. Vestal | 1958 | 130 | -- | Pb | 1,593 | -- | -- | T,B | U | -- | -- | -- | Not used in 1967 & 68. |
| 312 | L. Morgan | 1965 | 175 | 5 | Pb | 1,613 | -- | -- | -- | S | -- | -- | -- | -- |
| 401 | T. Willimson | -- | 275 | -- | Pb | -- | -- | -- | -- | U | -- | -- | -- | Well destroyed. |
| * 402 | Close Est. | -- | 245 | 16 | Pb | 1,612 | 83.8 | Oct. 14, 1960 | T,B | Irr | 500 R | -- | -- | |
| 403 | do. | -- | 226 | 16 | -- | 1,601 | 78.0 | do. | T,B | Irr | 500 R | -- | -- | |
| 404 | J. Finley | 1963 | 240 | 16 | Pb | 1,582 | 56.8<br>68.6<br>68.5 | Jan. 6, 1958<br>Jan. 27, 1960<br>Dec. 19, 1960 | T,B | Irr | 450 R | -- | 55 | |
| 405 | R. Nippert | 1952 | 200 | -- | Pb | 1,588 | 65.8<br>109.0 | Jan. 8, 1954<br>Jan. 11, 1968 | T,B | Irr | -- | -- | 80 | 1/ |
| 406 | do. | 1961 | 200 | -- | Pb | 1,602 | -- | Apr. 30, 1969 | T,B | Irr | -- | -- | 80 | |
| 407 | J.R. Dowler | 1960 | 245 | -- | Pb | 1,602 | -- | -- | T,B | Irr | -- | -- | 40 | |
| 408 | do. | 1955 | 200 | 14 | Pb | 1,602 | 94.2 | June 3, 1969 | T,B | Irr | -- | -- | 30 | |
| 409 | R. Nippert | 1959 | 200 | -- | Pb | 1,593 | -- | -- | T,B | Irr | -- | -- | 80 | |
| 410 | do. | 1961 | 200 | -- | Pb | 1,589 | -- | -- | T,B | Irr | -- | -- | 80 | |
| * 411 | do. | 1961 | 200 | -- | Pb | 1,583 | -- | -- | T,B | Irr | 430 R | -- | 80 | |
| 412 | --Hassel | -- | 230 | -- | Pb | 1,610 | 136.5 | May 1, 1969 | T | U | -- | -- | -- | |
| 413 | E. Johnson | 1958 | 248 | -- | Pb | 1,589 | 118.9 | do. | T,B | Irr | 200 R | -- | 30 | |
| * 414 | do. | 1962 | 208 | -- | Pb | 1,580 | -- | -- | T,B | Irr | 500 R | -- | 80 | |
| * 501 | P. Ratliff | 1948 | 266 | -- | Pb | 1,598 | 87.9<br>100.4 | Jan. 10, 1953<br>Jan. 17, 1968 | T,B | Irr | 500 R | -- | 13 | Well drilled to 129 ft. in 1948. Deepened in 1963. 1/ |
| 502 | J.M. Finley | 1956 | 150 | 14 | Pb | -- | -- | -- | -- | U | -- | -- | -- | Well abandoned 1963. |

See footnotes at end of table.

Table 4.--Records of Wells and Springs--Continued

| WELL | OWNER | DATE COM-PLET-ED | DEPTH OF WELL (FT) | CASING DIAM-ETER (IN) | WATER-BEAR-ING UNITS | ALTITUDE OF LAND SURFACE (FT) | WATER LEVEL | | METHOD OF LIFT | USE OF WATER | YIELD IN (GALLONS PER MINUTE) | DRAW-DOWN IN FEET | ESTIMATED ACRES IRRIGATED 1968 | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | ABOVE (+) BELOW LAND SURFACE DATUM (FT) | DATE OF MEASUREMENT | | | | | | |
| LD-13-41-503 | J.M. Finley | 1956 | 165 | 14 | Pb | -- | -- | -- | -- | U | -- | -- | -- | Well abandoned 1962. |
| 504 | G. Gillispie | 1962 | 185 | -- | Pb | 1,579 | 111.6 | Apr. 29, 1969 | T,B | Irr | -- | -- | 40 | |
| 505 | J.L. Finley | 1965 | 240 | -- | -- | 1,590 | -- | -- | T | U | -- | -- | -- | |
| 506 | E. Howard | -- | 180 | -- | -- | 1,579 | -- | -- | T,E | Irr | -- | -- | -- | |
| 601 | D. Newman | 1951 | 125 | 16 | Pb | 1,570 | 63.8<br>65.8 | Jan. 10, 1953<br>Mar. 1, 1962 | N | U | -- | -- | -- | 1/ |
| 602 | do. | 1952 | 117 | 14 | Pb | 1,555 | 50.1<br>68.7 | Jan. 10, 1953<br>Apr. 10, 1969 | T | U | -- | -- | 55 | 1/ |
| * 603 | R.E. Sullivan | 1952 | 125 | 14 | Pb | -- | 65 | Jan. 1952 | -- | U | -- | -- | -- | Destroyed. |
| 604 | do. | 1955 | 120 | 14 | Pb | -- | 69.0 | Oct. 14, 1960 | -- | U | -- | -- | -- | Do. |
| 605 | do. | 1955 | 93 | 14 | Pb | -- | 61.8 | do. | -- | U | -- | -- | -- | Do. |
| 606 | L. Butts | 1956 | 212 | 12 | Pb | 1,560 | 58.0 | do. | T,B | Irr | 700 R | -- | 120 | |
| * 607 | O.H. Brandon | 1946 | 110 | 12 | Pb | -- | -- | -- | T,B | U | -- | -- | -- | Well destroyed. |
| * 608 | C.W. Butts | -- | 100 | -- | Pb | 1,548 | -- | -- | T,E | Irr | 200 R | -- | -- | |
| 609 | do. | 1959 | 150 | -- | Pb | 1,553 | 62.2 | Apr. 14, 1969 | N | U | -- | -- | -- | |
| 610 | L. Moore | -- | 110 | 14 | Pb | 1,546 | 46.6<br>55.6 | Jan. 10, 1953<br>Apr. 14, 1969 | T,B | Irr | -- | -- | -- | 1/ |
| * 611 | V. Sparkman | -- | 100 | -- | Pb | 1,542 | 49.4 | do. | T | U | -- | -- | -- | |
| 612 | F. Barbee | 1956 | 80 | -- | Pb | 1,548 | -- | -- | T,B | Irr | 300 R | -- | 35 | |
| 613 | J. Brandon | 1963 | 135 | -- | Pb | 1,550 | 58.5 | Apr. 15, 1969 | T,B | Irr | 300 R | -- | 12 | |
| 614 | O. Brandon | -- | 120 | -- | Pb | 1,569 | -- | -- | S,E | Irr | -- | -- | -- | Not used in 1968. |
| 615 | D. Newman | 1965 | 210 | -- | Pb | 1,558 | -- | -- | T,E | Irr | 450 R | -- | -- | |
| 616 | B. Sparkman | 1953 | 120 | -- | Pb | 1,553 | 58.6 | Apr. 10, 1969 | T,B | Irr | -- | -- | 20 | |
| 617 | do. | 1952 | 120 | -- | Pb | 1,549 | 64.4 | do. | T,B | Irr | -- | -- | 20 | |
| 618 | V. Sparkman | 1952 | 120 | -- | Pb | 1,551 | 54.4 | do. | T,B | Irr | 300 R | -- | 20 | |
| 619 | do. | 1953 | 120 | -- | Pb | 1,554 | -- | -- | T,B | Irr | 300 R | -- | 20 | |
| 620 | T. Barbee | 1945 | 110 | 6 | Pb | 1,578 | 54.4 | June 3, 1969 | -- | S | -- | -- | -- | |
| 621 | R.C. Sullivan | 1963 | 198 | -- | Pb | 1,559 | 80.0 | Apr. 29, 1969 | T | U | -- | -- | -- | |

See footnotes at end of table.

Table 4.--Records of Wells and Springs--Continued

| WELL | OWNER | DATE COMPLETED | DEPTH OF WELL (FT) | CASING DIAMETER (IN) | WATER-BEARING UNITS | ALTITUDE OF LAND SURFACE (FT) | WATER LEVEL: ABOVE (+) BELOW LAND SURFACE DATUM (FT) | WATER LEVEL: DATE OF MEASUREMENT | METHOD OF LIFT | USE OF WATER | YIELD IN (GALLONS PER MINUTE) | DRAW-DOWN IN FEET | ESTIMATED ACRES IRRIGATED 1968 | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LD-13-41-701 | F. Gregory | 1960 | 250 | 14 | Pb | 1,600 | 50.9<br>98.3 | Jan. 6, 1958<br>Jan. 11, 1967 | T,B | Irr | -- | -- | 50 | 1/ |
| 702 | A. Wilson | 1957 | 204 | -- | Pb | 1,618 | 68.7 | May 1, 1969 | T,B | Irr | 250 R | -- | 30 | |
| 703 | F. Gregory | 1962 | 250 | -- | Pb | 1,604 | 110 | Apr. 30, 1969 | T,B | Irr | -- | -- | 40 | |
| 704 | A. Wilson | 1961 | 204 | -- | Pb | 1,610 | 130.5 | May 1, 1969 | T,B | Irr | 170 R | -- | 14 | |
| 705 | C. Lockhart | 1965 | 340 | -- | Pb | 1,648 | 124.0 | May 21, 1969 | T,B | Irr | -- | -- | 200 | |
| 901 | S. Quisenberry | 1955 | 109 | 14 | Pb | 1,575 | -- | -- | T,E | Irr | 100 R | -- | 20 | |
| 902 | S. Brown | 1958 | 220 | -- | Pb | -- | -- | -- | -- | U | -- | -- | -- | Abandoned. |
| 903 | C.W. Butts | 1953 | 133 | 14 | Pb | -- | 81.0 | Dec. 19, 1960 | -- | U | -- | -- | -- | Do. |
| 904 | B. McDaniel | 1963 | 190 | -- | Pb | 1,561 | 66.6 | Apr. 14, 1969 | T,B | Irr | -- | -- | 15 | |
| 905 | J. Quisenberry | 1955 | 120 | -- | Pb | 1,592 | 82.4 | do. | T | Irr | -- | -- | 50 | |
| 906 | W. Davis | 1957 | 100 | -- | Pb | 1,557 | 63.2 | do. | T,B | Irr | -- | -- | -- | Not used in 1968. |
| 907 | do. | 1962 | 100 | -- | Pb | 1,559 | -- | -- | T,B | Irr | -- | -- | -- | |
| 908 | C. Barbee | 1955 | 202 | -- | Pb | 1,586 | 85.4 | May 2, 1969 | T,B | Irr | 250 R | -- | 20 | |
| 42-101 | J. Good | 1955 | 125 | -- | Pb | 1,540 | 56.8<br>76.2 | Jan. 10, 1956<br>Mar. 1, 1969 | N | U | -- | -- | -- | 1/ |
| 102 | C. Haynes | -- | -- | -- | Pb | 1,528 | 64.2 | Feb. 28, 1969 | T,B | Irr | -- | -- | -- | |
| 103 | B. Parker | 1954 | 154 | -- | Pb | 1,561 | -- | -- | S,E | Irr | -- | -- | 15 | |
| 104 | N. Smith | -- | 90 | -- | Pb | 1,541 | 68.6 | Feb. 27, 1969 | T,B | Irr | -- | -- | 60 | |
| 105 | R. Henderson | 1956 | 145 | -- | Pb | 1,541 | -- | -- | T,B | Irr | -- | -- | 25 | |
| 106 | W. Wilson | 1953 | 150 | -- | Pb | 1,532 | 65.8 | Feb. 28, 1969 | T,B | Irr | -- | -- | 70 | |
| 107 | C. Vestal | 1959 | 195 | -- | Pb | 1,572 | 123.4 | Feb. 27, 1969 | T,B | Irr | -- | -- | 85 | |
| 108 | B. Parker | 1967 | 172 | -- | Pb | 1,554 | -- | -- | S,E | Irr | -- | -- | 8 | |
| 109 | J. Good | 1953 | 100 | -- | Pb | 1,508 | 44.0 | Feb. 28, 1969 | T,B | Irr | -- | -- | 160 | |
| 201 | do. | 1964 | 100 | -- | Pb | 1,508 | 46.2 | Mar. 1, 1969 | T,B | Irr | -- | -- | 60 | |
| 202 | do. | 1962 | 100 | -- | Pb | 1,519 | 54.3 | do. | T,B | Irr | -- | -- | 66 | |
| 401 | L. Butts | 1944 | 150 | -- | Pb | 1,548 | 60.4<br>77.8 | Jan. 8, 1954<br>Apr. 15, 1969 | T,B | Irr | 450 R | -- | 30 | 1/ |

See footnotes at end of table.

Table 4.--Records of Wells and Springs--Continued

| WELL | OWNER | DATE COMPLETED | DEPTH OF WELL (FT) | CASING DIAMETER (IN) | WATER-BEARING UNITS | ALTITUDE OF LAND SURFACE (FT) | WATER LEVEL: ABOVE (+) BELOW LAND SURFACE DATUM (FT) | WATER LEVEL: DATE OF MEASUREMENT | METHOD OF LIFT | USE OF WATER | YIELD IN (GALLONS PER MINUTE) | DRAW-DOWN IN FEET | ESTIMATED ACRES IRRIGATED 1968 | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LD-13-42-402 | C. Butts | 1943 | 100 | 10 | -- | 1,548 | 60.9<br>69.0 | Jan. 9, 1953<br>Jan. 17, 1968 | N | U | -- | -- | -- | 1/ |
| * 403 | L. Moore | 1953 | 103 | 16 | Pb | 1,550 | 43 | Dec. 1953 | T,B | Irr | 300 R | -- | -- | |
| 404 | W. Butts | 1963 | 100 | -- | Pb | 1,558 | 68.8 | Apr. 14, 1969 | T,B | Irr | -- | -- | -- | |
| 405 | --Loveless | 1953 | 100 | -- | Pb | 1,544 | 71.1 | do. | T,B | Irr | -- | -- | 15 | |
| 406 | do. | 1955 | 100 | -- | Pb | 1,537 | 47.6 | do. | T,B | Irr | -- | -- | 15 | |
| 407 | W. Davis | 1955 | 100 | -- | Pb | 1,550 | 63.4 | do. | T,B | Irr | -- | -- | 15 | |
| 408 | E. Brandon | 1950 | 100 | -- | Pb | 1,552 | 66.7 | Apr. 15, 1969 | T,B | Irr | -- | -- | 10 | |
| 409 | Harginshier | -- | 100 | -- | Pb | 1,556 | 74.5 | Apr. 14, 1969 | T,B | U | -- | -- | -- | |
| 410 | L. Butts | 1952 | 276 | 12 | Pb | 1,534 | 59.4 | Apr. 15, 1969 | T,B | Irr | 200 R | -- | 10 | Well deepened in 1967 to 276, originally 126 ft. deep. Not used in 1968. |
| 501 | W. Griffen | -- | 120 | -- | -- | 1,525 | -- | -- | S,E | Irr | -- | -- | 40 | |
| 502 | do. | -- | 120 | -- | Pb | 1,525 | -- | -- | S,E | Irr | -- | -- | 40 | |
| 503 | J. Baker | 1967 | 123 | -- | Pb | 1,525 | 60.3 | May 21, 1969 | T,B | Irr | 250 R | -- | 30 | |
| 601 | B. Womack | -- | 100 | -- | Pb | -- | -- | -- | -- | Irr | -- | -- | -- | Well not located in 1969. |
| 602 | do. | 1954 | 100 | 1 | Pb | 1,560 | 63.2 | June 4, 1969 | T,E | Irr | 500 R | -- | 70 | |
| 603 | R. Hamrick | 1953 | 90 | -- | Pb | 1,542 | 68.9 | May 20, 1969 | T,E | Irr | 250 R | -- | 20 | |
| 701 | O. Brandon | 1958 | 80 | 12 | Pb | 1,560 | 65.3 | Apr. 15, 1969 | T,B | Irr | 300 R | -- | 50 | |
| 702 | do. | -- | 110 | -- | Pb | 1,555 | -- | -- | T,B | Irr | -- | -- | 15 | |
| 703 | N. McAdams | -- | -- | -- | Pb | 1,572 | 57.0 | May 21, 1969 | C,W | D | -- | -- | -- | |
| 801 | V. Sparkman | 1954 | 100 | -- | Pb | 1,583 | -- | -- | T,B | Irr | -- | -- | -- | Unused in 1967 & 68. |
| 802 | E. Wofford | 1954 | 123 | -- | Pb | 1,587 | 92.8 | Apr. 15, 1969 | T,B | Irr | 100 R | -- | 20 | |
| 803 | do. | 1955 | 123 | -- | Pb | 1,591 | -- | -- | T,B | Irr | 300 R | -- | 20 | |
| 804 | W. Griffen | -- | 120 | -- | Pb | 1,572 | 74.4 | May 20, 1969 | T,E | Irr | -- | -- | 40 | |
| 805 | do. | -- | 120 | -- | Pb | 1,602 | 106.3 | May 2, 1969 | T,B | Irr | -- | -- | 55 | |
| * 806 | --Swindle | 1955 | 136 | -- | Pb | 1,609 | -- | -- | S,E | Irr | 75 | -- | 40 | |
| 901 | E. McBay | 1951 | 105 | 14 | -- | -- | 73.1<br>73.5 | Jan. 8, 1954<br>Feb. 1, 1961 | T,G | Irr | -- | -- | -- | Not located. 1/ |

See footnotes at end of table.

Table 4.--Records of Wells and Springs--Continued

| WELL | OWNER | DATE COMPLETED | DEPTH OF WELL (FT) | CASING DIAMETER (IN) | WATER-BEARING UNITS | ALTITUDE OF LAND SURFACE (FT) | WATER LEVEL: ABOVE (+) BELOW LAND SURFACE DATUM (FT) | WATER LEVEL: DATE OF MEASUREMENT | METHOD OF LIFT | USE OF WATER | YIELD IN (GALLONS PER MINUTE) | DRAW-DOWN IN FEET | ESTIMATED ACRES IRRIGATED 1968 | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * LD-13-42-902 | R.J. Taylor | 1938 | 75 | 5 | Pb | -- | -- | -- | -- | U | -- | -- | -- | Abandoned. |
| 903 | J. Hurst | 1960 | 115 | 12 | Pb | 1,571 | 74.9<br>82.9 | Jan. 17, 1963<br>Jan. 17, 1968 | T,E | Irr | 250 R | -- | 20 | 1/ |
| 904 | R. Dennison | 1951 | 90 | 14 | Pb | 1,564 | 91.8 | June 5, 1969 | T,E | Irr | -- | -- | 30 | |
| 905 | B. Gilmer | 1959 | 90 | 14 | Pb | 1,570 | -- | -- | T,E | Irr | -- | -- | -- | Unused in 1967 & 68. |
| 906 | B. Parker | 1968 | 90 | -- | Pb | 1,597 | 108.9 | May 2, 1969 | T,B | Ir | 250 R | -- | 20 | |
| 907 | E. McBay | 1951 | 105 | 14 | Pb | 1,568 | 63.2 | June 6, 1969 | T,B | Irr | 200 E | -- | -- | |
| * 43-101 | W.H. Glover | -- | 122 | 14 | $Qal_2$/Pb | 1,482 | 77 | Apr. 16, 1969 | T,B | Irr | 500 | 43 | 80 | |
| 102 | do. | -- | 124 | 14 | $Qal_2$/Pb | 1,472 | 62.7 | do. | T,B | Irr | 225 R | 50 E | 40 | |
| 103 | B.W. Stoffel | -- | 100 | 14 | $Qal_2$/Pb | 1,459 | 45.6 | do. | T,B | Irr | 250 R | 50 E | 40 | |
| 104 | do. | -- | 100 | 14 | $Qal_2$/Pb | 1,454 | 41.2 | do. | T,B | Irr | 550 R | 55 E | 80 | |
| 105 | do. | -- | 111 | 14 | $Qal_2$/Pb | 1,479 | 67.4 | do. | T | Irr | 150 | -- | -- | |
| 201 | A.W. Cunningham | 1958 | 68 | 14 | $Qal_2$/Pb | 1,458 | 36.9<br>40.8 | Sept. 15, 1960<br>Apr. 16, 1969 | T,E | Irr | 125 | 22 E | -- | Field conductance 2,200. 2/ |
| * 202 | do. | 1955 | 67 | 14 | $Qal_2$/Pb | 1,450 | 40.1 | Apr. 16, 1969 | T,E | Irr | 225 | 20 E | -- | |
| 203 | J. Hunter | -- | 70 | 12 | $Qal_2$/Pb | 1,450 | 38.3 | do. | T,E | Irr | 50 R | -- | -- | Unused in 1968. |
| 204 | do. | -- | 70 | 12 | $Qal_2$/Pb | 1,450 | 41.0 | do. | T,E | Irr | 50 R | 20 E | -- | Do. |
| * 205 | Quanah Country Club | -- | 70 | 72 | $Qal_2$/Pb | 1,451 | 41.5 | do. | S,E | R,P | 75 R | 30 E | -- | |
| 206 | do. | -- | 100 | 14 | $Qal_2$/Pb | 1,457 | 49.8 | do. | S,E | R,P | 150 R | 40 E | -- | |
| 207 | A.W. Cunningham | -- | 51 | 8 | $Qal_2$/Pb | 1,438 | 29.7 | do. | S,E | Irr | 50 | 15 E | 20 | Field conductance 2,900. 2/ |
| 208 | do. | -- | 53 | 8 | $Qal_2$/Pb | 1,439 | 34.4 | do. | S,E | Irr | 50 | 15 E | -- | Field conductance 2,500. 2/ |
| * 301 | -- | -- | 67 | 12 | $Qal_2$/Pb | 1,435 | 36.2 | Apr. 17, 1969 | T,E | Irr | 125 | 15 | 10 | |
| 302 | J.C. Wilson | -- | 89 | 12 | $Qal_2$/Pb | 1,415 | 25.5 | Apr. 30, 1969 | T,B | Irr | 70 R | 57 E | -- | Unused in 1967 & 68. |
| 401 | Hopkins | -- | 110 | -- | Pb | 1,500 | -- | -- | -- | U | -- | -- | -- | Abandoned. |
| 402 | B. Nichols | -- | 100 | 12 | Pb | 1,572 | 67.5 | Apr. 29, 1969 | T,B | Irr | 100 R | 20 E | 20 | |
| 403 | do. | -- | 100 | 14 | Pb | 1,571 | 68 | do. | T,B | Irr | 100 R | 20 E | -- | |

See footnotes at end of table.

Table 4.--Records of Wells and Springs--Continued

| WELL | OWNER | DATE COMPLETED | DEPTH OF WELL (FT) | CASING DIAMETER (IN) | WATER-BEARING UNITS | ALTITUDE OF LAND SURFACE (FT) | WATER LEVEL: ABOVE (+) BELOW LAND SURFACE DATUM (FT) | WATER LEVEL: DATE OF MEASUREMENT | METHOD OF LIFT | USE OF WATER | YIELD IN (GALLONS PER MINUTE) | DRAWDOWN IN FEET | ESTIMATED ACRES IRRIGATED 1968 | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LD-13-43-404 | W.D. Hopkins | 1963 | 51 | 12 | Pb | 1,510 | 36.0 | Apr. 30, 1969 | T,E | Irr | 500 R | -- | 30 | |
| * 405 | do. | 1954 | 70 | 12 | Pb | 1,530 | 56.3 | do. | T,E | Irr | 150 | -- | 20 | |
| 406 | W.H. Outlaw | -- | 100 | 10 | Pb | 1,567 | 62.4 | Apr. 29, 1969 | T,B | Irr | 100 R | 25 E | 10 | Unused in 1967 & 68. |
| 407 | J. Wade | 1966 | 108 | 6 | Pb | 1,580 | 72 | Nov. 1966 | S,E | D | 10 R | -- | -- | |
| * 501 | -- | -- | 88 | 6 | Pb | 1,557 | 54.5 | Apr. 29, 1969 | C,W | S | 3 | -- | -- | |
| 502 | -- | -- | 53 | 6 | Pb | 1,472 | 47.0 | Apr. 30, 1969 | C,W | S | -- | -- | -- | |
| * 503 | C. Holcomb | -- | Spring | -- | Pb | 1,480 | + | do. | -- | S | 38 | -- | -- | |
| * 504 | do. | 1968 | 72 | 6 | Pb | 1,561 | 68.6 | do. | C,W | S | ½ | -- | -- | |
| 701 | J. T. Vantine | 1953 | 165 | 14 | Pb | -- | 78.2 | Dec. 17, 1960 | T,E | Irr | -- | -- | -- | |
| 702 | S. Bynum | 1957 | 100 | 16 | Pb | -- | -- | -- | N | N | -- | -- | -- | Well abandoned. |
| 703 | do. | 1954 | 100 | 14 | Pb | 1,564 | 58.1<br>63.6 | Dec. 17, 1960<br>Apr. 29, 1969 | T,B | Irr | 150 E | -- | -- | Yield reported at 150 gpm. |
| 704 | V. Daughtry | 1955 | 101 | -- | Pb | -- | 50 | 1955 | T,E | Irr | -- | -- | -- | Well abandoned. |
| 705 | T. H. Garner | 1955 | 100 | 14 | Pb | 1,578 | 72.0 | Apr. 28, 1969 | T,E | Irr | 100 | 17 E | 10 | |
| 706 | A. H. Stepp | 1954 | 103 | 14 | Pb | 1,573 | 65.3 | do. | T,B | Irr | 250 R | 30 E | -- | Unused 1966, 67 & 68. |
| 707 | do. | 1954 | 103 | 14 | Pb | 1,568 | 63 | do. | T,B | Irr | 75 R | -- | -- | Do. |
| 708 | do. | 1954 | 103 | 14 | Pb | 1,572 | 67.0 | do. | T,B | Irr | 75 R | 30 E | -- | |
| 709 | J. Milligan | -- | 100 | 10 | Pb | 1,564 | 65 | Apr. 29, 1969 | T,E | Irr | 100 R | 25 E | 8 | |
| 710 | V. Daughtry | 1957 | 92 | 12 | Pb | 1,570 | 68.9 | Apr. 28, 1969 | T,E | Irr | 250 R | 18 E | -- | |
| 711 | do. | 1946 | 110 | 12 | Pb | 1,572 | 72.2 | do. | T,B | Irr | 250 R | 35 E | 25 | |
| 712 | J. E. Stepp | 1950 | 150 | 14 | Pb | 1,562 | 61 | Apr. 29, 1969 | T,B | Irr | 75 R | 58 E | 10 | |
| 713 | do. | -- | 150 | 14 & 12 | Pb | 1,563 | 61.6 | do. | T,B | Irr | 100 E | 65 E | 20 | |
| 714 | J. Hurst | -- | 110 | 14 | Pb | 1,573 | 70.5 | do. | N | Irr | 150 R | -- | -- | Unused in 1968. |
| 715 | do. | -- | 110 | 14 | Pb | 1,572 | 70 | do. | T,G | Irr | 150 R | -- | 30 | |
| 716 | W. H. Outlaw | -- | 100 | 12 | Pb | 1,569 | 63.1 | do. | T,E | Irr | 150 R | 25 E | -- | |
| * 717 | T. H. Garner | 1955 | 100 | 14 | Pb | 1,582 | 76.1 | Apr. 28, 1969 | T,E | Irr | 100 | 17 E | 10 | |
| 718 | do. | 1955 | 100 | 14 | Pb | 1,581 | 74.6 | do. | T,E | Irr | 50 R | 18 E | -- | |

See footnotes at end of table.

Table 4.--Records of Wells and Springs--Continued

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LD-13-43-719 | B. Parker | -- | 100 | 10 | Pb | 1,565 | 65.1 | Apr. 29, 1969 | T,B | Irr | 125 R | -- | 10 | |
| * 801 | W. H. Outlaw | -- | 160 | 14 | Pb | 1,573 | 64.3 | do. | S,E | D & Irr | 100 | 24 E | 9 | |
| * 802 | H. L. Irvin | -- | 29 | 14 | Pb | 1,501 | 18.0 | May 1, 1969 | T,E | S | 75 | -- | -- | |
| 803 | F. H. McNabb | -- | | 12 | Pb | 1,503 | 20 | do. | T,E | Irr | 50 R | -- | -- | |
| 901 | L. N. Berngen | -- | 18 | 6 | Pb | 1,482 | 7.9 | do. | Cf,B | Irr | 100 E | -- | 20 | 4-wells manifold. |
| * 902 | W. W. McPherson | -- | 35 | 10 | Pb | 1,530 | 23.8 | do. | C,W | S | 3 | -- | -- | |
| * 903 | Shell Oil Co. | -- | 35 | 10 | Pb | 1,473 | 24.4 | May 6, 1969 | S,E | Ind | 7 | -- | -- | |
| 904 | do. | 1961 | 469 | -- | -- | 1,459 | -- | -- | N | U | -- | -- | -- | Oil test. Top of San Angelo Sandstone at 160 ft. |
| * 44-101 | -- | -- | 42 | 36 | $Qal_2$ | 1,429 | 39.3 | Apr. 30, 1969 | C,W | S | ½ R | -- | -- | |
| * 201 | B. Hamn | -- | 36 | 6 | Pb | 1,463 | 33.0 | do. | C,W | S | 1 | -- | -- | |
| * 301 | C. E. Taylor | -- | 140 | 6 | Pb | 1,541 | 86.2 | May 1, 1969 | J,E | D | 5 R | -- | -- | |
| * 302 | Moffet Ranch | -- | Spring | -- | $Qal_2$ | 1,397 | + | May 2, 1969 | Flows | U | 4 | -- | -- | |
| * 601 | W. R. McPherson | -- | 25 | 6 | Ps | 1,405 | 17.7 | May 1, 1969 | J,E | S | 3 R | -- | -- | |
| * 602 | G. O. Hendrix | -- | 60 | 6 | Pf/Ps | 1,423 | 7.1 | do. | C,W | S | 3 R | -- | -- | |
| * 701 | W. A. Mealer | -- | 30 | 36 | $Qal_2$/Pf | 1,453 | 17.0 | May 2, 1969 | C,W | S | 3 R | -- | -- | |
| * 801 | -- | -- | 30 | 24 | Pf | 1,443 | 14.2 | May 1, 1969 | C,W | S | 5 E | -- | -- | |
| 901 | L. E. Mcpherson | 1956 | 35 | 6 | $Qal_2$ | 1,368 | 12 | do. | Cf,B | Irr | 150 R | -- | -- | 5-wells; manifold system unused in 1967 & 68. |
| 902 | W. R. Mcpherson | -- | 225 | -- | Ps | -- | -- | -- | N | U | -- | -- | -- | Test hole. |
| * 903 | City of Chillicothe | 1927 | 39 | 144 | $Qal_2$ | 1,418 | 32.7<br>31.4 | July 23, 1960<br>Apr. 17, 1969 | T,E | P | 150 R | -- | -- | |
| * 904 | do. | 1912 | 52 | 120 | $Qal_2$ | 1,410 | 35.8<br>21.4 | July 23, 1960<br>Apr. 17, 1969 | T,E | P | 50 E | -- | -- | Field conductance 860. 2/ |
| * 905 | R. H. Burrell | 1957 | 50 | 14 | $Qal_2$ | 1,388 | 13.8<br>19.0 | May 22, 1957 | T,B | Irr | 300 R | 22 E | 50 | 1/ |
| * 45-101 | M. H. Henderson | -- | 78 | 8 | $Qal_2$ | 1,466 | 53.0 | May 2 1969 | S,E | Irr | 100 R | -- | 10 | |
| * 401 | L. Morrison | -- | 23 | 16 | Ps | 1,374 | 12.7 | do. | C,W | D | 2 R | -- | -- | |
| 50_101 | B. Edmonds | 1956 | 120 | 12 | Pb | -- | -- | -- | T,E | Irr | -- | -- | -- | |

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Table 4.--Records of Wells and Springs--Continued

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LD-50-301 | E. Wofford | 1964 | 85 | 14 | Pb | 1,553 | 44.6 | June 5, 1969 | T,E | Irr | 125 R | -- | 15 | |
| 302 | K. Dennison | -- | 105 | 14 | Pb | 1,562 | 62.1 | June 6, 1969 | T,E | Irr | 150 E | -- | -- | |
| 303 | do. | -- | 105 | 14 | Pb | 1,562 | 61.3 | do. | T,E | Irr | 150 E | -- | -- | |
| * 601 | L. Taylor | 1950 | 81 | 6 | Pb | 1,610 | 72.0 | 1950 | C,W | S | 2 R | -- | -- | |
| 51-101 | J. W. Landers | 1956 | 107 | 14 | Pb | 1,560 | 57 | 1956 | T,B | Irr | 150 R | -- | -- | |
| * 102 | E. B. Smith | -- | 30 | 10 | Pb | 1,540 | 25.7 | June 4, 1969 | C,W | S | 3 R | -- | -- | |
| * 201 | - Conley Est. | -- | 30 | 6 | Pb | 1,520 | 23.8 | June 5, 1969 | C,W | S | 2 R | -- | -- | |
| 301 | W. A. Melear | 1965 | 40 | -- | -- | -- | 22 | May 1965 | -- | S | -- | -- | -- | |
| * 401 | G. L. Dake | -- | 30 | 30 | Pb | 1,574 | 22.8 | June 4, 1969 | C,W | S | 3 R | -- | -- | |
| * 601 | C. R. Hargeshimer | -- | 131 | 6 | Pb/Ps | 1,518 | 83.9 | June 5, 1969 | C,W | S | | -- | -- | |
| * 701 | J. Hurst | -- | 60 | 6 | Ps | 1,470 | 48.4 | June 4, 1969 | C,W | S | 3 | -- | -- | |
| * 801 | do. | -- | 58 | 5 | Ps | 1,443 | 55.5 | do. | C,W | S | 2 | -- | -- | |
| * 901 | J. D. Gilliland | 1889 | 20 | 36 | Ps | 1,423 | 11.3 | do. | J,E | D | 2 E | -- | -- | |
| 52-101 | E. D. Turner | -- | 35 | 6 | $Qal_2$/Pb | 1,451 | 27.6 | June 5, 1969 | C,W | S | 3 | -- | -- | |
| * 201 | E. M. Lance | -- | 30 | 36 | $Qal_2$/Ps | 1,418 | 22.1 | do. | C,W | S | 2 R | -- | -- | |
| 202 | do. | 1955 | 54 | 14 | $Qal_2$ | 1,418 | 24.2 | June 6, 1969 | T,B | Irr | 450 R | -- | -- | Unused in 1967 & 68. |
| 301 | City of Chillicothe | 1932 | 58 | 14 | $Qal_2$ | 1,424 | 29.5 | Apr. 17, 1969 | T,E | P | 150 R | -- | -- | Field Conductance 680. 2/ |
| 302 | A. Higgenbathum | 1954 | 67 | 14 | $Qal_2$ | 1,458 | 19.6<br>35.7 | June 25, 1960<br>May 20, 1969 | T,B | Irr | 180 R | 28 E | 50 | |
| 303 | E. E. Jackson | 1955 | 70 | 14 | $Qal_2$ | 1,458 | 26.1<br>27.7 | June 13, 1960<br>May 5, 1969 | T,B | Irr | 475 R | 24 E | -- | |
| 304 | L. G. Emerson | 1954 | 48 | 16 | $Qal_2$ | 1,430 | 15.3<br>17.9 | June 13, 1960<br>May 5, 1969 | T,B | Irr | 75 R | 26 E | -- | Unused in 1967 & 68. |
| 305 | do. | 1958 | 48 | 12 | $Qal_2$ | 1,430 | 17.9 | do. | T,B | Irr | 100 R | 27 E | -- | Unused in 1967 & 68. |
| 306 | E. E. Jackson | -- | 70 | 16 | $Qal_2$ | 1,463 | 32.4 | do. | T,B | Irr | 475 R | 24 E | -- | |
| 307 | G. G. Norton | 1961 | 42 | 14 | $Qal_2$ | 1,397 | 17.9 | May 5, 1969 | T,B | Irr | 550 R | -- | 40 | |
| 308 | R. Sims | 1963 | 59 | 16 | $Qal_2$ | 1,438 | 29.9 | May 20, 1969 | T,B | Irr | 150 R | 28 E | 20 | |
| * 309 | A. Higgenbathaum | -- | 67 | 14 | $Qal_2$ | | 1,453 | do. | S,E | Irr | 120 | -- | -- | Field conductance 550. 2/ |

See footnotes at end of table.

Table 4.--Records of Wells and Springs--Continued

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LD-13-52-310 | H. V. Tabor Est. | -- | Spring | -- | $Qal_2$ | 1,433 | + | do. | Flows | S | 6 | -- | -- | Field conductance 620. 2/ |
| * 311 | R. H. Burrell | -- | 50 | 14 | $Qal_2$ | 1,391 | 23.5 | May 1, 1969 | T,B | Irr | 350 R | -- | 50 | |
| 312 | North Texas Alfalfa Mill Co. | -- | 50 | 14 | $Qal_2$ | 1,390 | 20.5 | June 2, 1969 | T | U | -- | -- | -- | |
| 313 | do. | -- | 49 | 14 | $Qal_2$ | 1,391 | 23.9 | do. | T,- | Irr | 100 R | -- | -- | |
| 314 | J. McMichael | 1957 | 70 | 16 | $Qal_2$ | 1,442 | 30 | June 3, 1969 | T,B | Irr | 400 R | -- | -- | Used in 1967 & 68. |
| * 315 | T. L. Ward | -- | Spring | -- | $Qal_2$ | -- | + | June 6, 1969 | Flows | S | 12 | -- | -- | |
| * 316 | G. G. Norton | -- | Spring | -- | $Qal_2$ | 1,475 | + | do. | Flows | S | 1 | -- | -- | |
| * 401 | E. M. Bellamly | -- | 45 | 6 | Ps | 1,468 | 16.2 | June 5, 1969 | C,W | S | 3 | -- | -- | |
| 501 | J. R. Young | 1955 | 58 | 14 | $Qal_2$ | 1,445 | 22.1 | May 23, 1969 | T,B | Irr | 350 R | -- | 40 | |
| 601 | L. Wright | 1957 | 49 | 16 | $Qal_2$ | 1,420 | 11.2<br>12.3 | June 25, 1960<br>May 20, 1969 | T,B | Irr | 250 R | 34 E | 40 | |
| 602 | do. | 1959 | 48 | 16 | $Qal_2$ | 1,415 | 7.1<br>8 | June 25, 1960<br>May 20, 1969 | T,B | Irr | 300 R | 32 E | -- | |
| * 603 | do. | 1953 | 55 | 18 | $Qal_2$ | 1,420 | 12.6<br>15.3 | June 25, 1960<br>May 20, 1969 | T,B | Irr | 600 R | 40 E | -- | |
| * 604 | T. Campbell | 1954 | 56 | 14 | $Qal_2$ | 1,441 | 16.3<br>17.7 | June 28, 1960<br>May 20, 1969 | T,E | Irr | 500 R | -- | 57 | Field conductance 610. 2/ |
| 605 | Texas A&M Exp. Sta. | 1954 | 58 | 18 | $Qal_2$ | 1,434 | 13.7<br>15.9 | June 28, 1960<br>May 20, 1969 | T,B | Irr | 450 R | 32 E | 40 | |
| 606 | Meharg Bros. | 1955 | 47 | 16 | Pb | -- | 17 | Apr. 18, 1955 | -- | U | -- | -- | -- | Well abandoned. |
| 607 | do. | 1955 | 45 | 16 | Pb | -- | 16 | do. | -- | U | -- | -- | -- | Do. |
| 608 | Texas A&M Exp. Sta. | 1954 | 42 | 7 | Pb | -- | -- | -- | -- | U | -- | -- | -- | Do. |
| 609 | E. L. Meharg | 1955 | 60 | 14 | $Qal_2$ | 1,466 | 18.2<br>22.0 | June 27, 1960<br>May 21, 1969 | T,B | Irr | 170 R | 34 E | 40 | Unused in 1967 & 68. |
| * 610 | A. J. Lambert | 1959 | 65 | 14 | $Qal_2$ | 1,465 | 23.6 | May 20, 1969 | T,B | Irr | 250 R | 28 | 40 | |
| 611 | E. L. Meharg | 1957 | 60 | 14 | $Qal_2$ | 1,483 | 30.6<br>36.0 | June 28, 1960<br>May 21, 1969 | T | Irr | 170 R | 22 E | -- | Unused in 1967 & 68. |
| 612 | H. L. Walser | 1955 | 58 | 14 | $Qal_2$ | 1,464 | 21.4<br>25.1 | Sept. 13, 1960<br>May 22, 1969 | T,B | Irr | 210 | -- | 80 | -- |
| 613 | D. Sills | -- | 50 | 14 | $Qal_2$ | 1,420 | 12 | June 2, 1969 | T,B | Irr | 80 R | 30 E | 10 | -- |

See footnotes at end of table.

Table 4.--Records of Wells and Springs--Continued

| WELL | OWNER | DATE COM-PLET-ED | DEPTH OF WELL (FT) | CASING DIAM-ETER (IN) | WATER-BEAR-ING UNITS | ALTITUDE OF LAND SURFACE (FT) | WATER LEVEL: ABOVE (+) BELOW LAND SURFACE DATUM (FT) | WATER LEVEL: DATE OF MEASUREMENT | METHOD OF LIFT | USE OF WATER | YIELD IN (GALLONS PER MINUTE) | DRAW-DOWN IN FEET | ESTIMATED ACRES IRRIGATED 1968 | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LD-13-52-614 | Texas A&M Exp. Sta. | 1966 | 57 | 12 | $Qal_2$ | 1,428 | 12.9 | May 20, 1969 | T,B | Irr | 400 R | -- | 40 | |
| 615 | A.J. Lambert | -- | 75 | 14 | $Qal_2$ | 1,469 | 25 | do. | T,B | U | 275 R | -- | -- | Unused. Reported yield 275 gpm & 1600 ppm chloride. |
| 616 | H.J. Tabor Est. | -- | 60 | 16 | $Qal_2$ | 1,459 | 25.9 | do. | T,B | Irr | 380 R | 32 E | 80 | |
| * 701 | V.M. Martten | -- | 35 | 36 | Ps | 1,495 | 22.3 | June 4, 1969 | T,E | D | 3 R | -- | -- | |
| 801 | C. Wall | 1955 | 58 | 14 | $Qal_2$ | 1,465 | 25.4<br>34.2 | Sept. 15, 1960<br>May 23, 1969 | T,E | Irr | 75 R | 12 E | -- | |
| 802 | B.C. Gibson | 1955 | 60 | 14 | $Qal_2$ | 1,464 | 36.0 | do. | T,E | Irr | 175 R | 20 R | -- | |
| 803 | do. | 1955 | 60 | 14 | $Qal_2$ | 1,463 | 36.4 | May 22, 1969 | T,E | Irr | 250 R | 22 E | -- | |
| 805 | O. Wofford | 1957 | 58 | 14 | $Qal_2$ | 1,466 | 31.2<br>39.0 | Sept. 13, 1960<br>May 23, 1969 | T,E | Irr | 175 R | 16 E | 50 | |
| 806 | do. | 1956 | 60 | 12 | $Qal_2$ | -- | 30.7 | Sept. 13, 1960 | T,B | U | -- | -- | -- | Abandoned. |
| 807 | L.B. Wofford | 1955 | 57 | 14 | $Qal_2$ | 1,467 | 35.5 | May 22, 1969 | T,B | Irr | 130 R | -- | 10 | |
| 808 | do. | 1956 | 56 | 14 | $Qal_2$ | 1,466 | 30.4<br>34 | Sept. 13, 1960<br>May 22, 1969 | T,E | Irr | 175 R | -- | 10 | |
| 809 | do. | 1955 | 55 | 16 | $Qal_2$ | 1,467 | 33.3<br>35.3 | Sept. 13, 1960<br>May 22, 1969 | S,E | Irr | 60 R | -- | -- | |
| 810 | A.R. Rogers | 1954 | 54 | 16 | $Qal_2$ | 1,468 | 30.8<br>34.4 | Sept. 13, 1960<br>May 22, 1969 | T,E | Irr | 80 R | 18 E | 20 | |
| 811 | L.B. Wofford | -- | 55 | 14 | $Qal_2$ | 1,466 | 34.5 | do. | T,E | Irr | 80 R | -- | -- | |
| * 812 | O.T. Holmes | 1957 | 54 | 14 | $Qal_2$ | 1,462 | 33.9<br>36.4 | Sept. 13, 1960<br>May 22, 1969 | T,E | Irr | 70 E | 15 E | 20 | |
| 813 | --Dodson Est. | -- | 68 | 14 | $Qal_2$ | 1,492 | 46.4 | May 21, 1969 | T,E | Irr | 200 R | 20 R | 100 | |
| 814 | do. | -- | 81 | 14 | $Qal_2$ | 1,494 | 46.9 | do. | T,E | Irr | 400 R | 30 R | 10 | |
| 815 | do. | -- | 80 | 14 | $Qal_2$/Ps | 1,491 | 44.6 | do. | T,E | Irr | 400 R | 32 R | 70 | |
| 816 | do. | -- | 68 | 14 | $Qal_2$ | 1,492 | 42.4 | May 22, 1969 | T,E | Irr | 100 R | 22 E | -- | |
| 817 | do. | -- | 58 | 14 | $Qal_2$ | 1,493 | 43 | do. | T,E | Irr | 100 R | 22 E | -- | |
| 818 | do. | -- | 48 | 14 | $Qal_2$ | 1,468 | 34 | do. | T,E | Irr | 50 R | 12 E | -- | |
| 819 | B. C. Gibson | -- | 69 | 14 | $Qal_2$ | 1,463 | 36 | May 23, 1969 | T,E | Irr | 175 R | 20 R | 20 | |
| 820 | O. Wofford | -- | 58 | 14 | $Qal_2$ | 1,466 | 37.8 | do. | T,E | Irr | 300 R | 17 E | 50 | |

See footnotes at end of table.

Table 4.--Records of Wells and Springs--Continued

| WELL | OWNER | DATE COMPLETED | DEPTH OF WELL (FT) | CASING DIAMETER (IN) | WATER-BEARING UNITS | ALTITUDE OF LAND SURFACE (FT) | WATER LEVEL: ABOVE (+) BELOW LAND SURFACE DATUM (FT) | WATER LEVEL: DATE OF MEASUREMENT | METHOD OF LIFT | USE OF WATER | YIELD IN (GALLONS PER MINUTE) | DRAW-DOWN IN FEET | ESTIMATED ACRES IRRIGATED 1968 | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LD-13-52-821 | G. Caldwell | 1955 | 60 | 14 | $Qal_2$ | 1,466 | 38.8 | May 23, 1969 | T,E | Irr | 250 E | 14 E | 75 | |
| 822 | S. Grange | -- | 70 | 14 | $Qal_2$ | 1,486 | 38.2 | do. | T,B | Irr | 80 R | 28 E | -- | |
| 823 | do. | -- | 62 | 14 | $Qal_2$ | 1,473 | 25 | do. | T,B | Irr | 75 E | -- | -- | |
| 824 | do. | -- | 61 | 14 | $Qal_2$ | 1,479 | 29.7 | do. | T,B | Irr | 70 R | -- | -- | |
| 825 | B. Green | 1959 | 70 | 14 | $Qal_2$ | 1,461 | 34.8 | May 22, 1969 | T,E | Irr | 500 R | 30 R | 100 | |
| 826 | do. | 1964 | 55 | 14 | $Qal_2$ | 1,456 | 31.4 | do. | T,B | Irr | 600 R | 20 R | -- | |
| * 827 | do. | 1964 | 52 | 14 | $Qal_2$ | 1,453 | 26.1 | do. | T,E | Irr | 350 R | 20 | 100 | |
| * 901 | L. J. Kirkpatrick | 1953 | 54 | 14 | $Qal_2$ | 1,468 | 22.6<br>26.5 | June 28, 1960<br>June 2, 1969 | T,B | Irr | 150 | 21 E | -- | |
| 902 | do. | 1959 | 53 | 14 | $Qal_2$ | 1,468 | 26 | do. | T,B | Irr | 125 R | -- | -- | |
| 903 | A. H. Reynolds | 1958 | 50 | 16 | $Qal_2$ | 1,479 | 22.9<br>23.3 | June 27, 1960<br>May 21, 1969 | T,B | Irr | 75 R | 25 E | 10 | |
| 904 | do. | 1959 | 52 | 14 | $Qal_2$ | 1,481 | 26.9 | June 27, 1960 | T,B | Irr | 100 R | 26 E | -- | |
| 905 | J. B. Barnfield | 1957 | 34 | 14 | $Qal_2$ | 1,460 | 11<br>15 | Sept. 6, 1957<br>May 21, 1969 | T,B | Irr | 100 R | 19 E | 20 | |
| 906 | do. | 1959 | 35 | 14 | $Qal_2$ | 1,462 | 15 | do. | T,B | Irr | 100 R | 20 E | | |
| 907 | do. | 1957 | 36 | 14 | Pb | -- | 10 | Sept. 6, 1957 | T,B | Irr | -- | -- | -- | |
| 908 | L. J. Kirkpatrick | 1952 | 55 | 14 | $Qal_2$ | 1,476 | 27.6 | June 2, 1969 | T,B | Irr | 80 R | 22 E | 15 | Formerly No. LD-13-52-804. |
| * 909 | R. R. Boucher | -- | Spring | -- | $Qal_2$ | 1,380 | + | June 3, 1969 | Flows | U | 89 | -- | -- | |
| 910 | L. J. Kirkpatrick | 1969 | 53 | 14 | $Qal_2$ | 1,470 | 22.1 | June 2, 1969 | T,B | Irr | -- | -- | -- | |
| 53-101 | J. McMichael | 1957 | 82 | 14 | $Qal_2$ | 1,443 | 39.8 | June 3, 1969 | T,B | Irr | 300 R | -- | -- | Unused in 1967 & 68. |
| * 102 | City of Chillicothe #5 | 1953 | 86 | 14 | $Qal_2$ | 1,451 | 46 | Apr. 17, 1969 | T,E | P | 250 | 9 R | -- | |
| 103 | A. Higgenbothaum | 1954 | 67 | 16 | $Qal_2$ | 1,461 | 27.4<br>35.5 | June 25, 1960<br>May 20, 1969 | T,B | Irr | 300 R | 31 E | 50 | |
| 104 | G. Gatewood | 1955 | 68 | 14 | Pb | -- | 30.0 | June 25, 1960 | T,B | Irr | -- | -- | -- | Well abandoned. |
| 105 | Thirsty Water System | 1968 | 81 | 16 | $Qal_2$ | 1,462 | 42 | Feb. 1968 | S,E | P | 45 | 27 R | -- | |
| 106 | J. McMichael | 1953 | 84 | 14 | $Qal_2$ | 1,442 | 38.4 | June 2, 1969 | T,E | Irr | 150 R | -- | -- | |

See footnotes at end of table.

Table 4.--Records of Wells and Springs--Continued

| WELL | OWNER | DATE COMPLETED | DEPTH OF WELL (FT) | CASING DIAMETER (IN) | WATER-BEARING UNITS | ALTITUDE OF LAND SURFACE (FT) | WATER LEVEL | | METHOD OF LIFT | USE OF WATER | YIELD IN (GALLONS PER MINUTE) | DRAW-DOWN IN FEET | ESTIMATED ACRES IRRIGATED 1968 | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | ABOVE (+) BELOW LAND SURFACE DATUM (FT) | DATE OF MEASUREMENT | | | | | | |
| LD-13-53-107 | City of Chillicothe #2 | 1955 | 90 | 16 | $Qal_2$ | 1,451 | -- | -- | T,E | P | 300 R | -- | -- | |
| * 401 | G. Mertink | -- | 44 | 6 | Ps | 1,491 | 32.9 | June 3, 1969 | C,W | D | 1 R | -- | -- | |
| * 701 | I. A. Boyles | -- | 30 | 5 | $Qal_2$/Pc | 1,360 | 5.8 | do. | C,H | D | 2 E | -- | -- | |
| * 59-101 | J. E. Long | -- | 50 | 6 | Ps | 1,472 | 23.9 | June 4, 1969 | J,E | D | 3 R | -- | -- | |
| * 60-301 | Dodson | -- | 30 | 5 | $Qal_2$/Pc | 1,419 | 11.9 | May 21, 1969 | J,E | D | 5 E | -- | -- | |

* See Table 6 for chemical analyses from wells.
1/ For water levels in wells see Table 5.
2/ Measured in micromhos at 25°C.

## Table 5.—Water Levels in Wells

**Well LD 13-25-901**

Owner: — Little

| DATE | | WATER LEVEL |
|---|---|---|
| Jan. | 10, 1956 | 75.45 |
| May | 22, 1957 | 77.36 |
| Jan. | 6, 1958 | 71.02 |
| Jan. | 26, 1960 | 75.80 |
| Feb. | 1, 1961 | 73.36 |
| Jan. | 16, 1963 | 74.31 |
| Jan. | 13, 1964 | 76.22 |
| Jan. | 13, 1965 | 89.60 |
| Jan. | 18, 1966 | 88.94 |
| Jan. | 11, 1967 | 91.98 |
| Jan. | 19, 1968 | 95.09 |

**Well LD 13-33-102**

Owner: F. Lindsey Est.

| DATE | | WATER LEVEL |
|---|---|---|
| Jan. | 10, 1956 | 161.60 |
| May | 22, 1957 | 159.80 |
| Jan. | 6, 1958 | 164.13 |
| Jan. | 26, 1960 | 154.95 |
| Feb. | 1, 1961 | 154.53 |
| Feb. | 28, 1962 | 157.10 |
| Jan. | 16, 1963 | 154.96 |
| Jan. | 13, 1965 | 159.83 |
| Jan. | 18, 1966 | 161.33 |
| Jan. | 11, 1967 | 162.48 |
| Jan. | 19, 1968 | 168.7 |
| Feb. | 5, 1969 | 163.1 |

**Well LD 13-33-301**

Owner: R. Tabor

| DATE | | WATER LEVEL |
|---|---|---|
| Jan. | 10, 1956 | 77.00 |
| May | 22, 1957 | 79.85 |
| Jan. | 6, 1958 | 75.25 |
| Jan. | 26, 1960 | 77.26 |
| Jan. | 16, 1963 | 77.50 |
| Jan. | 13, 1964 | 82.63 |
| Jan. | 13, 1965 | 88.97 |

**Well LD 13-33-401**

Owner: L. Trosper

| DATE | | WATER LEVEL |
|---|---|---|
| Jan. | 10, 1956 | 84.36 |
| May | 22, 1957 | 84.83 |
| Jan. | 6, 1958 | 76.76 |
| Jan. | 26, 1960 | 87.42 |
| Feb. | 28, 1962 | 84.32 |
| Jan. | 16, 1963 | 82.93 |
| Jan. | 13, 1964 | 92.46 |
| Jan. | 13, 1965 | 83.10 |
| Jan. | 18, 1966 | 92.65 |
| Jan. | 20, 1967 | 90.19 |
| Jan. | 19, 1968 | 92.86 |
| Jan. | 16, 1969 | 98.0 |

**Well LD 13-33-403**

Owner: J. F. Harrell

| DATE | | WATER LEVEL |
|---|---|---|
| Jan. | 10, 1956 | 92.84 |
| May | 22, 1957 | 99.46 |
| Jan. | 9, 1958 | 90.37 |
| Jan. | 26, 1960 | 106.91 |
| Feb. | 1, 1961 | 95.02 |
| Jan. | 16, 1963 | 92.77 |
| Jan. | 13, 1964 | 110.26 |
| Jan. | 13, 1965 | 118.60 |
| Jan. | 18, 1966 | 120.62 |
| Jan. | 20, 1967 | 122.05 |
| Jan. | 19, 1968 | 116.68 |
| Jan. | 16, 1969 | 129.1 |

**Well LD 13-33-501**

Owner: R. Hines

| DATE | | WATER LEVEL |
|---|---|---|
| May | 22, 1957 | 88.87 |
| Jan. | 16, 1963 | 83.14 |
| Jan. | 13, 1964 | 92.64 |
| Jan. | 13, 1965 | 102.29 |
| Jan. | 18, 1966 | 97.22 |
| Jan. | 20, 1967 | 100.86 |
| Jan. | 19, 1968 | 101.72 |

**Well LD 13-33-602**

Owner: M. Watson

| DATE | | WATER LEVEL |
|---|---|---|
| Jan. | 10, 1953 | 75.32 |
| Jan. | 9, 1954 | 77.44 |
| Jan. | 9, 1955 | 84.45 |
| Jan. | 10, 1956 | 81.98 |
| May | 22, 1957 | 85.30 |
| Jan. | 6, 1958 | 80.89 |
| Feb. | 2, 1961 | 82.59 |
| Feb. | 28, 1962 | 84.45 |
| Jan. | 16, 1963 | 85.65 |
| Jan. | 13, 1964 | 91.71 |
| Jan. | 18, 1966 | 101.72 |
| Jan. | 11, 1967 | 100.58 |
| Jan. | 19, 1968 | 103.16 |
| Feb. | 4, 1969 | 103.0 |

**Well LD 13-33-603**

Owner: M. Watson

| DATE | | WATER LEVEL |
|---|---|---|
| Jan. | 10, 1956 | 81.24 |
| May | 22, 1957 | 84.99 |
| Feb. | 2, 1961 | 71.35 |
| Feb. | 28, 1962 | 83.40 |
| Jan. | 16, 1963 | 83.94 |
| Jan. | 18, 1966 | 95.99 |
| Jan. | 11, 1967 | 95.84 |
| Jan. | 19, 1968 | 101.95 |
| Feb. | 4, 1969 | 104.6 |

**Well LD 13-33-901**

Owner: J. W. Tabor

| DATE | | WATER LEVEL |
|---|---|---|
| Jan. | 10, 1956 | 42.14 |
| May | 22, 1957 | 38.49 |
| Jan. | 6, 1958 | 42.33 |
| Jan. | 27, 1960 | 47.59 |
| Feb. | 1, 1961 | 45.47 |
| Feb. | 28, 1962 | 49.17 |

## Table 5.—Water Levels in Wells—Continued

**Well LD 13-33-902**

Owner: I. Smith

| DATE | WATER LEVEL |
|---|---|
| Jan. 10, 1956 | 21.11 |
| May 22, 1957 | 20.30 |
| Jan. 6, 1958 | 21.99 |
| Feb. 2, 1961 | 27.90 |
| Feb. 28, 1962 | 29.53 |
| Jan. 16, 1963 | 31.01 |
| Jan. 14, 1964 | 35.50 |
| Jan. 13, 1965 | 40.93 |
| Jan. 18, 1966 | 31.36 |
| Jan. 11, 1967 | 31.88 |
| Jan. 19, 1968 | 31.72 |
| Feb. 5, 1969 | 42.4 |

**Well LD 13-34-801**

Owner: J. Hunter

| DATE | WATER LEVEL |
|---|---|
| Jan. 10, 1953 | 37.25 |
| Jan. 9, 1954 | 38.06 |
| Jan. 10, 1956 | 38.90 |
| May 22, 1957 | 37.5 |
| Jan. 6, 1958 | 39.01 |
| Jan. 27, 1960 | 39.94 |
| Feb. 2, 1961 | 37.98 |

**Well LD 13-34-802**

Owner: J. Hunter

| DATE | WATER LEVEL |
|---|---|
| Jan. 9, 1954 | 38.74 |
| Jan. 9, 1955 | 41.05 |
| Jan. 10, 1956 | 39.84 |
| May 22, 1957 | 41.41 |
| Jan. 6, 1958 | 39.97 |
| Jan. 27, 1960 | 40.39 |
| Feb. 2, 1961 | 38.55 |
| Feb. 28, 1962 | 39.68 |
| Jan. 17, 1963 | 42.05 |
| Jan. 14, 1964 | 46.59 |
| Jan. 14, 1965 | 50.82 |
| Jan. 18, 1966 | 49.62 |
| Jan. 11, 1967 | 49.23 |
| Jan. 19, 1968 | 48.85 |

**Well LD 13-34-803**

Owner: J. Hunter

| DATE | WATER LEVEL |
|---|---|
| Jan. 9, 1955 | 63.92 |
| Jan. 10, 1956 | 35.00 |
| May 22, 1957 | 37.20 |
| Jan. 6, 1958 | 34.72 |
| Jan. 27, 1960 | 35.60 |
| Feb. 2, 1961 | 33.84 |
| Feb. 28, 1962 | 34.88 |
| Jan. 17, 1963 | 36.56 |
| Jan. 14, 1964 | 40.63 |
| Jan. 14, 1965 | 43.35 |
| Jan. 18, 1966 | 42.90 |
| Jan. 11, 1967 | 42.37 |
| Jan. 19, 1968 | 43.57 |

**Well LD 13-41-301**

Owner: —

| DATE | WATER LEVEL |
|---|---|
| Jan. 10, 1956 | 83.02 |
| May 22, 1957 | 77.36 |
| Jan. 6, 1958 | 82.41 |
| Jan. 27, 1960 | 93.98 |
| Feb. 2, 1961 | 75.60 |
| Feb. 28, 1962 | 77.85 |
| Jan. 14, 1964 | 78.50 |
| Jan. 13, 1965 | 93.84 |
| Jan. 18, 1966 | 104.05 |
| Jan. 11, 1967 | 106.62 |
| Jan. 17, 1968 | 104.91 |

**Well LD 13-41-306**

Owner: M. E. Watson

| DATE | WATER LEVEL |
|---|---|
| Jan. 10, 1956 | 55.93 |
| May 22, 1957 | 55.68 |
| Jan. 6, 1958 | 52.75 |
| Jan. 27, 1960 | 56.38 |
| Feb. 2, 1961 | 56.90 |
| Jan. 16, 1963 | 60.17 |
| Jan. 14, 1964 | 69.65 |
| Jan. 13, 1965 | 74.48 |

**Well LD 13-41-306—Continued**

| DATE | WATER LEVEL |
|---|---|
| Jan. 18, 1966 | 70.75 |
| Jan. 11, 1967 | 75.70 |
| Jan. 17, 1968 | 74.52 |

**Well LD 13-41-405**

Owner: R. Nippert

| DATE | WATER LEVEL |
|---|---|
| Jan. 8, 1954 | 65.85 |
| Jan. 9, 1955 | 69.32 |
| Jan. 9, 1956 | 61.73 |
| May 22, 1957 | 60.45 |
| Jan. 6, 1958 | 56.46 |
| Jan. 27, 1960 | 68.36 |
| Dec. 19, 1960 | 68.99 |
| Jan. 17, 1963 | 70.95 |
| Jan. 14, 1964 | 82.88 |
| Jan. 13, 1965 | 103.06 |
| Jan. 18, 1966 | 101.38 |
| Jan. 11, 1967 | 102.08 |
| Jan. 17, 1968 | 108.96 |

**Well LD 13-41-501**

Owner: P. Ratliff

| DATE | WATER LEVEL |
|---|---|
| Jan. 10, 1953 | 87.90 |
| Jan. 9, 1955 | 98.03 |
| Jan. 9, 1956 | 83.35 |
| May 22, 1957 | 73.96 |
| Jan. 6, 1958 | 80.69 |
| Jan. 27, 1960 | 86.70 |
| Dec. 19, 1960 | 86.05 |
| Mar. 1, 1962 | 86.36 |
| Jan. 17, 1963 | 84.65 |
| Jan. 14, 1964 | 96.15 |
| Jan. 13, 1965 | 103.84 |
| Jan. 18, 1966 | 100.30 |
| Jan. 20, 1967 | — |
| Jan. 17, 1968 | 100.38 |

**Well LD 13-41-601**

Owner: D. Newman

| DATE | WATER LEVEL |
|---|---|
| Jan. 10, 1953 | 63.80 |
| Jan. 8, 1954 | 61.85 |

## Table 5.—Water Levels in Wells—Continued

| DATE | | WATER LEVEL |
|---|---|---|
| **Well LD 13-41-601—Continued** | | |
| Jan. | 9, 1955 | 65.23 |
| Jan. | 9, 1956 | 61.09 |
| May | 22, 1957 | 58.45 |
| Jan. | 6, 1958 | 59.40 |
| Jan. | 27, 1960 | 66.35 |
| Dec. | 19, 1960 | 66.91 |
| Mar. | 1, 1962 | 65.78 |
| **Well LD 13-41-602** | | |
| Owner: D. Newman | | |
| Jan. | 10, 1953 | 50.14 |
| Jan. | 8, 1954 | 48.66 |
| Jan. | 9, 1955 | 52.15 |
| Jan. | 9, 1956 | 48.63 |
| May | 22, 1957 | 47.05 |
| Jan. | 6, 1958 | 46.44 |
| Jan. | 27, 1960 | 51.34 |
| Oct. | 14, 1960 | 54.66 |
| Mar. | 1, 1962 | 52.34 |
| Jan. | 17, 1963 | 53.49 |
| Jan. | 14, 1964 | 58.78 |
| Jan. | 13, 1965 | 64.52 |
| Jan. | 18, 1966 | 60.72 |
| Jan. | 11, 1967 | 66.34 |
| Jan. | 17, 1968 | 70.91 |
| Apr. | 10, 1969 | 68.7 |
| **Well LD 13-41-610** | | |
| Owner: L. Moore | | |
| Jan. | 10, 1953 | 46.58 |
| Jan. | 8, 1954 | 46.10 |
| Jan. | 9, 1955 | 49.28 |
| Jan. | 9, 1956 | 46.10 |
| May | 22, 1957 | 45.29 |
| Jan. | 6, 1958 | 44.22 |
| Jan. | 27, 1960 | 48.50 |
| Mar. | 1, 1962 | 48.92 |
| Jan. | 17, 1963 | 47.14 |
| Jan. | 14, 1964 | 56.84 |
| **Well LD 13-41-610—Continued** | | |
| Jan. | 13, 1965 | 61.89 |
| Jan. | 18, 1966 | 59.05 |
| Jan. | 17, 1968 | 60.16 |
| Apr. | 14, 1969 | 55.6 |
| **Well LD 13-41-701** | | |
| Owner: F. Gregory | | |
| Jan. | 6, 1958 | 50.87 |
| Jan. | 27, 1960 | 65.74 |
| Dec. | 19, 1960 | 67.37 |
| Mar. | 1, 1962 | 67.90 |
| Jan. | 17, 1963 | 72.18 |
| Jan. | 14, 1964 | 82.41 |
| Jan. | 13, 1965 | 97.13 |
| Jan. | 28, 1966 | — |
| Jan. | 11, 1967 | 98.34 |
| Jan. | 17, 1968 | — (tape hangs at 15′) |
| **Well LD 13-42-101** | | |
| Owner: J. Good | | |
| Jan. | 10, 1956 | 56.84 |
| May | 22, 1957 | 57.71 |
| Jan. | 6, 1958 | 55.34 |
| Jan. | 27, 1960 | 60.40 |
| Jan. | 28, 1962 | 59.53 |
| Jan. | 17, 1963 | — |
| Jan. | 14, 1964 | 66.08 |
| | 1966 | — |
| | 1967 | — |
| Jan. | 17, 1968 | 76.79 |
| Mar. | 1, 1969 | 76.2 |
| **Well LD 13-42-401** | | |
| Owner: L. Butts | | |
| Jan. | 8, 1954 | 60.35 |
| Jan. | 27, 1960 | 63.10 |
| Feb. | 1, 1961 | 62.23 |
| Feb. | 28, 1962 | 62.2 |
| Apr. | 15, 1969 | 77.8 |
| **Well LD 13-42-402** | | |
| Owner: C. Butts | | |
| Jan. | 9, 1953 | 60.89 |
| Jan. | 8, 1954 | 60.46 |
| Jan. | 9, 1955 | 64.04 |
| Jan. | 9, 1956 | 60.55 |
| May | 22, 1957 | 58.46 |
| Jan. | 6, 1958 | 59.74 |
| Jan. | 27, 1960 | 63.14 |
| Feb. | 1, 1961 | 60.08 |
| Feb. | 28, 1962 | 62.37 |
| Jan. | 17, 1963 | 62.17 |
| Jan. | 14, 1964 | 69.21 |
| Jan. | 14, 1965 | 72.20 |
| Jan. | 18, 1966 | 69.18 |
| Jan. | 11, 1967 | 69.20 |
| Jan. | 17, 1968 | 68.96 |
| **Well LD 13-42-901** | | |
| Owner: E. McBay | | |
| Jan. | 8, 1954 | 73.10 |
| Jan. | 9, 1955 | 74.34 |
| Jan. | 9, 1956 | 70.79 |
| May | 22, 1957 | 74.4 |
| Jan. | 27, 1960 | 74.65 |
| Feb. | 1, 1961 | 73.46 |
| **Well LD 13-42-903** | | |
| Owner: J. Hurst | | |
| Jan. | 17, 1963 | 74.93 |
| Jan. | 14, 1964 | 80.28 |
| Jan. | 14, 1965 | 83.48 |
| Jan. | 18, 1966 | 81.62 |
| Jan. | 11, 1967 | 80.86 |
| Jan. | 17, 1968 | 82.91 |
| **Well LD 13-44-905** | | |
| Owner: R. H. Burrell | | |
| May | 22, 1957 | 13.77 |
| Jan. | 6, 1958 | 15.06 |
| Feb. | 1, 1961 | 17.90 |

Table 5.—Water Levels in Wells—Continued

| DATE | WATER LEVEL |
|---|---|
| **Well LD 13-44-905—Continued** | |
| Feb. 28, 1962 | 22.93 |
| Jan. 17, 1963 | 19.08 |
| Jan. 14, 1964 | 21.33 |
| **Well LD 13-44-905—Continued** | |
| Jan. 14, 1965 | — |
| Jan. 18, 1966 | 20.47 |
| Jan. 11, 1967 | 19.94 |
| **Well LD 13-44-905—Continued** | |
| Jan. 17, 1968 | 19.82 |
| May 1, 1969 | 19.0 |

Table 6.--Chemical Analyses of Water From Selected Wells and Springs

Water-bearing unit: $Qal_2$, alluvium (terrace deposits and Seymour Formation); Pb, Blaine Formation; Ps, San Angelo Sandstone; Clear Fork Group; Pf, Flowerpot Shale.

(Analyses given are in milligrams per liter except specific conductance, pH, SAR, RSC, temperature, and percent sodium.)

| WELL | PRODUCING INTERVAL OR WELL DEPTH (FT) | WATER-BEARING UNIT | DATE OF COLLECTION | SILICA ($SiO_2$) | IRON (Fe) | CALCIUM (Ca) | MAGNESIUM (Mg) | SODIUM * AND POTASSIUM | | BICARBONATE ($HCO_3$) | SULFATE ($SO_4$) | CHLORIDE (Cl) | FLUORIDE (F) | NITRATE ($NO_3$) | BORON (B) | DISSOLVED SOLIDS | HARDNESS AS $CaCO_3$ | PERCENT SODIUM | SODIUM ADSORPTION RATIO (SAR) | RESIDUAL SODIUM CARBONATE (RSC) | SPECIFIC CONDUCTANCE (MICROMHOS AT 25° C) | pH | TEMPERATURE °C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Na | K | | | | | | | | | | | | | | |
| LD-13-25-401 | Spring | $Qal_2$ | Apr. 14, 1969 | 27 | -- | 57 | 23 | | 110 | 438 | 47 | 45 | 0.6 | 3.1 | -- | 528 | 236 | 50 | 3.1 | 2.45 | 846 | 8.1 | 19 |
| 501 | 133 | Pb | do. | -- | -- | 380 | 100 | | 123 | 264 | 1,210 | 108 | -- | -- | -- | -- | 1,360 | -- | -- | .00 | 2,480 | 7.6 | 17 |
| 701 | 120 | $Qal_2$ | do. | -- | -- | 56 | 11 | | 69 | 216 | 23 | 47 | -- | 84 | -- | -- | 184 | 45 | 2.2 | .00 | 675 | 7.8 | 17 |
| 801 | 290 | Pb/$Qal_2$ | do. | 22 | -- | 290 | 52 | | 65 | 206 | 750 | 77 | .4 | 23 | -- | 1,380 | 938 | 13 | .9 | .00 | 1,770 | 7.6 | 17 |
| 33-103 | 210 | Pb | Feb. 5, 1969 | -- | -- | 540 | 286 | | 145 | 402 | 2,200 | 156 | -- | -- | -- | -- | 2,520 | -- | -- | .00 | 3,860 | 7.5 | 17 |
| 201 | 200 | Pb | Feb. 6, 1969 | 13 | -- | 600 | 133 | | 51 | 204 | 1,810 | 72 | .6 | .0 | -- | 2,780 | 2,040 | 5 | .5 | .00 | 2,990 | 7.3 | 16 |
| 303 | 152 | Pb | do. | -- | -- | 590 | 189 | | 80 | 232 | 2,040 | 78 | -- | -- | -- | -- | 2,250 | -- | -- | .00 | 3,300 | 7.5 | 17 |
| 410 | 230 | Pb | Aug. 25, 1969 | 15 | -- | 590 | 153 | | 112 | 216 | 1,910 | 125 | -- | 3.7 | -- | 3,010 | 2,100 | 10 | 1.1 | .00 | 3,220 | 7.6 | 18 |
| 501 | 200 | Pb | Jan. 9, 1954 | 16 | -- | 584 | 169 | 85 | 7.3 | 264 | 1,950 | 91 | .8 | 11 | 0.98 | 3,050 | 2,150 | 8 | .8 | .00 | 3,240 | 7.3 | -- |
| * 506 | 240 | Pb | Aug. 25, 1969 | -- | -- | 600 | 143 | | 143 | 244 | 1,890 | 162 | -- | -- | -- | -- | 2,080 | -- | -- | .00 | 3,320 | 7.4 | 18 |
| 602 | 115 | Pb | Apr. 8, 1952 | 20 | -- | -- | -- | | 84 | 99 | 1,750 | 112 | -- | 4.0 | 1.05 | 2,940 | 1,880 | 9 | .8 | .00 | 3,200 | 7.8 | -- |
| 709 | 245 | Pb | Aug. 25, 1969 | 13 | -- | 640 | 217 | | 999 | 206 | 2,430 | 1,390 | -- | 5.2 | -- | 5,800 | 2,490 | 47 | 8.7 | .00 | 7,630 | 7.6 | 18 |
| 711 | 210 | Pb | Aug. 26, 1969 | -- | -- | 625 | 177 | | 660 | 228 | 2,170 | 750 | -- | -- | -- | -- | 2,290 | -- | -- | .00 | 5,490 | 7.3 | 18 |
| 718 | 224 | Pb | Aug. 1, 1953 | 17 | -- | -- | -- | 134 | 6.5 | 163 | 1,770 | 186 | -- | .5 | 1.0 | 3,170 | 1,930 | 13 | 4.2 | -- | 3,310 | 8.1 | -- |
| 903 | 160 | Pb | Mar. 20, 1953 | 17 | -- | 582 | 103 | 59 | | 213 | 1,630 | 98 | 1.0 | 8.3 | .31 | 2,600 | 1,880 | 6 | .7 | .00 | 2,910 | 7.5 | -- |
| 34-102 | 86 | $Qal_2$ | Feb. 6, 1969 | 20 | -- | 96 | 42 | | 95 | 284 | 79 | 138 | .3 | 134 | -- | 744 | 412 | 33 | 2.0 | .00 | 1,220 | 7.8 | 17 |
| 202 | 90 | Pb | do. | 12 | -- | 500 | 85 | | 85 | 202 | 1,430 | 60 | .5 | 53 | -- | 2,320 | 1,600 | 10 | .9 | .00 | 2,620 | 7.4 | 17 |
| 401 | 158 | Pb | Aug. 10, 1956 | 15 | -- | 598 | 83 | 53 | 4.9 | 193 | 1,640 | 80 | -- | 9.5 | .31 | 2,580 | 1,830 | 6 | .5 | .00 | 2,860 | 7.9 | -- |
| 503 | 190 | Pb | do. | 18 | -- | 604 | 74 | 62 | 4.3 | 225 | 1,610 | 70 | -- | 15 | -- | 2,570 | 1,810 | 7 | .6 | .00 | 2,840 | 7.5 | -- |
| 801 | 126 | Pb | Mar. 7, 1948 | 23 | -- | 603 | 110 | | 92 | 206 | 1,730 | 128 | -- | 7.3 | .23 | 2,790 | 1,960 | 9 | .9 | .00 | 3,070 | 7.3 | -- |
| -- | -- | Pb | Apr. 7, 1952 | 18 | -- | -- | -- | | 74 | 112 | 1,690 | 118 | -- | 3.0 | .46 | 2,870 | 1,860 | 8 | .7 | .00 | 3,050 | 7.8 | -- |
| 807 | 174 | Pb | Aug. 10, 1956 | 16 | -- | 690 | 143 | 775 | 10 | 215 | 2,030 | 1,260 | -- | 2.0 | 1.5 | 5,030 | 2,310 | 42 | 7.0 | .00 | 6,670 | 7.0 | -- |
| 814 | Spring | Pb | Apr. 15, 1969 | -- | -- | 650 | 136 | | 420 | 158 | 1,940 | 670 | -- | -- | -- | -- | 2,180 | -- | -- | -- | 4,840 | 7.6 | 17 |
| 905 | 137 | $Qal_2$/Pb | Oct. 22, 1969 | 18 | -- | 625 | 59 | | 63 | 220 | 1,600 | 42 | .5 | 39 | -- | 2,550 | 1,800 | 7 | .6 | .00 | 2,700 | 7.5 | 18 |
| 36-803 | 100 | $Qal_2$ | June 30, 1945 | 21 | 0.14 | 160 | 36 | 23 | 4.2 | 258 | 310 | 27 | .4 | 38 | -- | 796 | 553 | 8 | .4 | .00 | 1,060 | 7.9 | -- |
| 806 | 65 | $Qal_2$ | Apr. 18, 1969 | 21 | -- | 55 | 39 | | 18 | 240 | 86 | 13 | .6 | 38 | -- | 389 | 298 | 12 | .5 | .00 | 614 | 7.8 | 17 |
| 807 | 54 | $Qal_2$ | do. | -- | -- | 74 | 19 | | 22 | 216 | 79 | 15 | -- | 37 | -- | -- | 262 | 15 | .6 | .00 | 599 | 7.9 | 17 |
| 907 | Spring | $Qal_2$ | do. | -- | -- | 134 | 36 | | 32 | 272 | 277 | 29 | -- | -- | -- | -- | 482 | -- | -- | .00 | 987 | 7.7 | 16 |
| 41-302 | 146 | Pb | Aug. 10, 1953 | 19 | -- | -- | -- | 53 | | 200 | 1,660 | 60 | -- | 5.9 | .38 | -- | 1,860 | 6 | .6 | .00 | 2,850 | 7.0 | -- |
| 304 | 265 | Pb | do. | 15 | -- | -- | -- | | 1,860 | 194 | 2,390 | 2,550 | -- | -- | 2.1 | -- | 2,190 | 65 | 18 | .00 | 10,700 | 8.0 | -- |
| 402 | 245 | Pb | May 1, 1969 | -- | -- | 730 | 132 | | -- | 198 | 1,830 | 1,080 | -- | -- | -- | -- | 2,360 | -- | -- | -- | 5,920 | 7.6 | 20 |

See footnote at end of table.

Table 6.--Chemical Analyses From Selected Wells and Springs--Continued

| WELL | PRODUCING INTERVAL OR WELL DEPTH (FT) | WATER-BEARING UNIT | DATE OF COLLECTION | SILICA ($SiO_2$) | IRON (Fe) | CALCIUM (Ca) | MAGNESIUM (Mg) | SODIUM * AND POTASSIUM | | BICARBONATE ($HCO_3$) | SULFATE ($SO_4$) | CHLORIDE (Cl) | FLUORIDE (F) | NITRATE ($NO_3$) | BORON (B) | DISSOLVED SOLIDS | HARDNESS AS $CaCO_3$ | PERCENT SODIUM | SODIUM ADSORPTION RATIO (SAR) | RESIDUAL SODIUM CARBONATE (RSC) | SPECIFIC CONDUCTANCE (MICROMHOS AT 25° C) | pH | TEMPERATURE °C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Na | K | | | | | | | | | | | | | | |
| LD-13-41-411 | 200 | Pb | May 1, 1969 | 15 | -- | 685 | 120 | 418 | | 216 | 1,840 | 718 | -- | 7.2 | -- | 3,910 | 2,200 | 29 | 3.9 | 0.00 | 4,980 | 7.4 | 20 |
| 414 | 208 | Pb | do. | -- | -- | 672 | 110 | 435 | | 198 | 1,800 | 662 | -- | 4.3 | -- | -- | 2,130 | 32 | 4.1 | .00 | 4,640 | 7.5 | 21 |
| 501 | 129 | Pb | Jan. 8, 1954 | 15 | -- | 609 | 123 | 188 | 6.9 | 212 | 1,820 | 280 | 0.4 | 11 | 0.92 | 3,160 | 2,030 | 17 | 1.8 | .00 | 3,770 | 7.6 | -- |
| 603 | 125 | Pb | Apr. 7, 1952 | 32 | -- | -- | -- | 510 | | 57 | 1,670 | 88 | -- | 6.0 | .31 | 2,770 | 805 | 58 | 5.5 | .00 | 2,900 | 7.7 | -- |
| 607 | 110 | Pb | Jan. 30, 1948 | -- | -- | 604 | 111 | 354 | | 202 | 1,800 | 490 | -- | 4.0 | -- | 3,460 | 1,960 | 28 | 3.5 | .00 | 4,320 | -- | -- |
| 608 | 100 | Pb | Oct. 23, 1969 | 14 | -- | 620 | 72 | 51 | | 216 | 1,620 | 58 | .4 | 8.4 | -- | 2,550 | 1,840 | 6 | .5 | .00 | 2,700 | 7.5 | 19 |
| 611 | 100 | Pb | Sept. 2, 1949 | 18 | -- | 602 | 109 | | 9.4 | 224 | 1,650 | 46 | -- | 6.5 | .70 | 2,550 | 1,950 | 1 | .9 | .00 | 2,770 | 7.3 | -- |
| 42-403 | 103 | Pb | Mar. 24, 1953 | 14 | -- | 592 | 101 | 39 | | 191 | 1,680 | 55 | 1.2 | 7.0 | .40 | 2,580 | 1,890 | 43 | .5 | .00 | 2,760 | 7.1 | -- |
| 806 | 136 | Pb | Oct. 22, 1969 | 11 | -- | 570 | 158 | 97 | | 162 | 1,950 | 84 | .4 | .0 | -- | 2,950 | 2,070 | 9 | .9 | .00 | 3,140 | 7.4 | 19 |
| 902 | 75 | Pb | Mar. 26, 1953 | 15 | -- | 592 | 90 | 27 | | 206 | 1,640 | 31 | .6 | 5.5 | .25 | 2,500 | 1,850 | 31 | .4 | .00 | 2,700 | 7.7 | -- |
| 43-101 | 122 | $Qal_2$/Pb | Apr. 16, 1969 | 15 | -- | 635 | 136 | 512 | | 160 | 1,940 | 780 | -- | 9.0 | -- | 4,110 | 2,140 | 34 | 4.8 | .00 | 5,000 | 7.7 | 18 |
| 202 | 67 | $Qal_2$/Pb | do. | -- | -- | 244 | 92 | -- | | 162 | 805 | 418 | -- | -- | -- | -- | 988 | -- | -- | .00 | 2,750 | 7.7 | 17 |
| 205 | 70 | $Qal_2$/Pb | do. | 17 | -- | 221 | 80 | 206 | | 242 | 616 | 335 | .4 | 18 | -- | 1,610 | 880 | 34 | 3.0 | .00 | 2,410 | 7.7 | 17 |
| 301 | 67 | $Qal_2$/Pb | Apr. 17, 1969 | -- | -- | 132 | 56 | -- | | 268 | 388 | 205 | -- | -- | -- | 560 | -- | -- | -- | .00 | 1,780 | 7.6 | 17 |
| 405 | 70 | Pb | Apr. 30, 1969 | 17 | -- | 655 | 101 | 82 | | 204 | 1,620 | 235 | -- | 52 | -- | 2,860 | 2,050 | 8 | .8 | .00 | 3,280 | 7.4 | 17 |
| 501 | 88 | Pb | Apr. 29, 1969 | -- | -- | 635 | 110 | -- | | 188 | 1,690 | 210 | -- | -- | -- | -- | 2,040 | -- | -- | .00 | 3,220 | 7.5 | 18 |
| 503 | Spring | Pb | Apr. 30, 1969 | 20 | -- | 118 | 30 | 192 | | 294 | 268 | 208 | .2 | 28 | -- | 1,010 | 418 | 50 | 4.1 | .00 | 1,620 | 7.6 | 18 |
| 504 | 72 | Pb | do. | -- | -- | 630 | 115 | -- | | 182 | 1,700 | 200 | -- | -- | -- | -- | 2,040 | -- | -- | .00 | 3,190 | 7.2 | 17 |
| 709 | 100 | Pb | Apr. 29, 1969 | -- | -- | 630 | 119 | -- | | 198 | 1,740 | 185 | -- | -- | -- | -- | 2,060 | -- | -- | .00 | 3,210 | 7.6 | 17 |
| 717 | 100 | Pb | Apr. 28, 1969 | 14 | -- | 620 | 102 | 54 | | 184 | 1,680 | 120 | .4 | 16 | -- | 2,700 | 1,970 | 6 | .5 | .00 | 2,970 | 7.5 | 17 |
| 801 | 160 | Pb | Apr. 29, 1969 | -- | -- | 630 | 104 | -- | | 184 | 1,660 | 175 | -- | -- | -- | -- | 2,000 | -- | -- | .00 | 3,100 | 7.5 | 17 |
| 802 | 29 | Pb | May 1, 1969 | 15 | -- | 660 | 106 | 123 | | 192 | 1,610 | 338 | -- | 51 | -- | 3,000 | 2,080 | -- | -- | .00 | 3,560 | 7.5 | 17 |
| 902 | 35 | Pb | do. | 12 | -- | 580 | 231 | 282 | | 200 | 2,170 | 408 | -- | 14 | -- | 3,800 | 2,400 | 20 | 2.5 | .00 | 4,390 | 7.6 | 17 |
| 903 | 35 | Pb | Oct. 22, 1969 | 17 | -- | 675 | 300 | 527 | | 168 | 1,950 | 1,330 | 1.3 | 22 | -- | 4,910 | 2,920 | 28 | 4.2 | .00 | 7,280 | 7.2 | 20 |
| 44-101 | 42 | $Qal_2$ | Apr. 30, 1969 | 16 | -- | 84 | 52 | 73 | | 356 | 184 | 39 | .6 | 54 | -- | 678 | 424 | 27 | 1.5 | .00 | 1,040 | 7.8 | 16 |
| 201 | 36 | Pb | do. | 15 | -- | 620 | 199 | 302 | | 272 | 2,010 | 485 | -- | .28 | -- | 3,790 | 2,370 | 22 | 2.7 | .00 | 4,500 | 7.3 | 17 |
| 301 | 140 | Pb | May 1, 1969 | 13 | -- | 580 | 64 | 51 | | 138 | 1,580 | 34 | .3 | 19 | -- | 2,410 | 1,710 | 6 | .5 | .00 | 2,560 | 7.2 | -- |
| 302 | Spring | $Qal_2$ | May 2, 1969 | -- | -- | 550 | 342 | -- | | 290 | 3,120 | 35 | -- | -- | -- | -- | 2,780 | -- | -- | .00 | 4,600 | 7.6 | 20 |
| 601 | 25 | Ps | May 1, 1969 | 16 | -- | 890 | 300 | 908 | | 216 | 1,860 | 1,980 | -- | 648 | -- | 6,710 | 3,450 | 36 | 6.7 | .00 | 9,300 | 7.4 | 17 |
| 602 | 60 | Pf/Ps | do. | 14 | -- | 560 | 200 | 306 | | 212 | 2,210 | 272 | -- | 34 | -- | 3,700 | 2,220 | 23 | 2.8 | .00 | 4,150 | 7.5 | 16 |
| 701 | 30 | $Qal_2$/Pf | May 2, 1969 | 16 | -- | 590 | 166 | 455 | | 162 | 1,420 | 1,040 | -- | 82 | -- | 3,850 | 2,160 | 31 | 4.3 | .00 | 5,180 | 7.5 | 16 |
| 801 | 30 | Pf | May 1, 1969 | 12 | -- | 740 | 324 | 701 | | 188 | 2,210 | 1,510 | -- | 149 | -- | 5,740 | 3,180 | 32 | 5.4 | .00 | 7,720 | 7.3 | 17 |
| 903 | 39 | $Qal_2$ | Apr. 17, 1969 | 27 | -- | 68 | 28 | 54 | | 294 | 80 | 31 | .7 | 41 | -- | 475 | 284 | 29 | 1.4 | .00 | 758 | 7.7 | 16 |

See footnote at end of table.

Table 6.--Chemical Analyses From Selected Wells and Springs--Continued

| WELL | PRODUCING INTERVAL OR WELL DEPTH (FT) | WATER-BEARING UNIT | DATE OF COLLECTION | SILICA ($SiO_2$) | IRON (Fe) | CALCIUM (Ca) | MAGNESIUM (Mg) | SODIUM * AND POTASSIUM | | BICARBONATE ($HCO_3$) | SULFATE ($SO_4$) | CHLORIDE (Cl) | FLUORIDE (F) | NITRATE ($NO_3$) | BORON (B) | DISSOLVED SOLIDS | HARDNESS AS $CaCO_3$ | PERCENT SODIUM | SODIUM ADSORPTION RATIO (SAR) | RESIDUAL SODIUM CARBONATE (RSC) | SPECIFIC CONDUCTANCE (MICROMHOS AT 25° C) | pH | TEMPERATURE °C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Na | K | | | | | | | | | | | | | | |
| LD-13-44-904 | 52 | $Qal_2$ | Sept. 20, 1946 | 26 | 0.12 | 80 | 29 | 57 | 4.2 | 328 | 62 | 52 | 0.2 | 51 | -- | 522 | 318 | 28 | 1.2 | 0.00 | 836 | 7.4 | -- |
| 905 | 50 | $Qal_2$ | June 6, 1969 | 21 | -- | 355 | 138 | 259 | | 322 | 1,240 | 312 | -- | 26 | -- | 2,510 | 1,450 | 28 | 3.0 | .00 | 3,160 | 7.7 | 17 |
| * 45-101 | 78 | $Qal_2$ | Oct. 22, 1969 | 19 | -- | 60 | 12 | 18 | | 204 | 34 | 6.3 | .4 | 32 | -- | 282 | 199 | 16 | .6 | .00 | 464 | 7.8 | 20 |
| 401 | 23 | Ps | May 2, 1969 | 20 | -- | 160 | 102 | 75 | | 284 | 122 | 143 | .7 | 518 | -- | 1,280 | 818 | 17 | 1.1 | .00 | 1,890 | 7.8 | 17 |
| * 50-301 | 85 | Pb | Oct. 22, 1969 | 17 | -- | 620 | 67 | 45 | | 214 | 1,600 | 43 | .5 | 21 | -- | 2,520 | 1,820 | 5 | .5 | .00 | 2,620 | 7.9 | 19 |
| 601 | 81 | Pb | June 5, 1969 | 14 | -- | 193 | 82 | 58 | | 330 | 584 | 43 | .5 | 7.0 | -- | 1,140 | 819 | 13 | .9 | .00 | 1,510 | 7.4 | 21 |
| 51-102 | 30 | Pb | June 4, 1969 | 11 | -- | 585 | 104 | 65 | | 186 | 1,680 | 78 | .4 | 19 | -- | 2,630 | 1,890 | 7 | .6 | .00 | 2,870 | 7.8 | 17 |
| 201 | 30 | Pb | June 5, 1969 | 10 | -- | 630 | 456 | 664 | | 198 | 2,900 | 1,210 | -- | 4.8 | -- | 5,970 | 3,450 | 30 | 4.9 | .00 | 7,340 | 7.2 | 17 |
| 401 | 30 | Pb | June 4, 1969 | 9.0 | -- | 588 | 108 | 109 | | 162 | 1,660 | 199 | -- | 7.4 | -- | 2,760 | 1,910 | 11 | 1.1 | .00 | 3,090 | 7.5 | 17 |
| 601 | 131 | Pb/Ps | June 5, 1969 | 8.7 | -- | 492 | 213 | 683 | | 54 | 2,980 | 312 | -- | 2.0 | -- | 4,720 | 2,100 | 41 | 6.5 | .00 | 5,380 | 7.3 | 17 |
| 701 | 60 | Ps | June 4, 1969 | 15 | -- | 270 | 252 | 713 | | 160 | 2,780 | 202 | -- | 3.1 | -- | 4,260 | 1,710 | 48 | 7.5 | .00 | 4,420 | 7.6 | 17 |
| 801 | 58 | Ps | do. | 15 | -- | 502 | 108 | 184 | | 184 | 1,720 | 101 | -- | 15 | -- | 2,740 | 1,700 | 19 | 1.9 | .00 | 3,040 | 7.5 | 17 |
| 901 | 20 | Ps | do. | 24 | -- | 38 | 57 | 44 | | 384 | 60 | 14 | 1.8 | 30 | -- | 458 | 330 | 22 | 1.1 | .00 | 740 | 7.7 | 17 |
| 52-101 | 35 | $Qal_2$/Pb | June 5, 1969 | 13 | -- | 745 | 268 | 756 | | 206 | 2,260 | 1,470 | -- | 14 | -- | 5,630 | 2,960 | 36 | 6.0 | .00 | 7,380 | 7.2 | 17 |
| 201 | 30 | $Qal_2$/Ps | do. | 20 | -- | 137 | 72 | 149 | | 350 | 440 | 133 | 2.0 | 29 | -- | 1,150 | 638 | 34 | 2.6 | .00 | 1,680 | 7.6 | 17 |
| 309 | 67 | $Qal_2$ | Oct. 22, 1969 | 25 | -- | 84 | 28 | 39 | | 370 | 38 | 25 | .5 | 36 | -- | 458 | 324 | 21 | .9 | .00 | 756 | 7.6 | 20 |
| 311 | 50 | $Qal_2$ | June 6, 1969 | 19 | -- | 270 | 104 | 273 | | 314 | 914 | 332 | .7 | 20 | -- | 2,090 | 1,100 | 35 | 3.6 | .00 | 2,850 | 7.6 | 17 |
| 315 | Spring | $Qal_2$ | do. | -- | -- | 89 | 42 | 194 | | 418 | 272 | 130 | -- | 8.9 | -- | -- | 394 | 52 | 4.3 | .00 | 1,490 | 7.9 | 19 |
| 316 | Spring | $Qal_2$ | do. | 11 | -- | 280 | 118 | 254 | | 272 | 1,100 | 258 | .6 | 5.2 | -- | 2,160 | 1,180 | 32 | 3.2 | .00 | 2,820 | 7.8 | 27 |
| 401 | 45 | Ps | June 5, 1969 | 14 | -- | 415 | 61 | 77 | | 266 | 1,040 | 62 | .9 | 78 | -- | 1,880 | 1,290 | 12 | .9 | .00 | 2,220 | 7.3 | 17 |
| 603 | 55 | $Qal_2$ | Feb. 3, 1954 | 28 | -- | 85 | 34 | 152 | 2.8 | 355 | 214 | 100 | 1.0 | 13 | -- | 819 | 355 | 48 | 3.5 | .00 | 1,330 | 7.9 | -- |
| * 604 | 56 | $Qal_2$ | Oct. 22, 1969 | 26 | -- | 89 | 31 | 135 | | 394 | 110 | 96 | .9 | 83 | -- | 765 | 350 | 46 | 3.1 | .00 | 1,220 | 7.9 | 20 |
| 610 | 65 | $Qal_2$ | June 2, 1969 | 20 | -- | 71 | 20 | 24 | | 292 | 24 | 10 | 1.0 | 38 | -- | 352 | 260 | 17 | .6 | .00 | 574 | 8.1 | 17 |
| 701 | 35 | Ps | June 4, 1969 | 19 | -- | 79 | 43 | 114 | | 376 | 96 | 88 | 3.2 | 100 | -- | 727 | 374 | 40 | 2.6 | .00 | 1,170 | 7.9 | 17 |
| 812 | 54 | $Qal_2$ | May 22, 1969 | 24 | -- | 103 | 45 | 183 | | 218 | 234 | 272 | 1.6 | 37 | -- | 1,010 | 442 | 47 | 3.8 | .00 | 1,650 | 7.3 | 17 |
| 827 | 52 | $Qal_2$ | June 6, 1969 | 22 | -- | 330 | 114 | 317 | | 338 | 944 | 482 | -- | 54 | -- | 2,430 | 1,290 | 35 | 3.8 | .00 | 3,390 | 7.5 | 17 |
| 901 | 54 | $Qal_2$ | June 2, 1969 | 21 | -- | 56 | 22 | 79 | | 318 | 59 | 18 | .9 | 63 | -- | 475 | 230 | 43 | 2.3 | .61 | 740 | 7.7 | 17 |
| 909 | Spring | $Qal_2$ | June 3, 1969 | -- | -- | 65 | 36 | -- | | 376 | 390 | 108 | -- | -- | -- | -- | 310 | -- | -- | .00 | 1,630 | 7.9 | 18 |
| 53-102 | 86 | $Qal_2$ | Apr. 17, 1969 | 25 | -- | 56 | 23 | 24 | | 250 | 31 | 13 | .8 | 35 | -- | 331 | 234 | 18 | .7 | .00 | 540 | 8.0 | 16 |
| 401 | 44 | Ps | June 3, 1969 | 19 | -- | 72 | 28 | 17 | | 326 | 13 | 18 | .3 | 31 | -- | 358 | 294 | 11 | .4 | .00 | 594 | 8.0 | 18 |
| 701 | 30 | $Qal_2$/Pc | do. | 14 | -- | 71 | 40 | 182 | | 424 | 203 | 98 | 1.2 | 45 | -- | 862 | 342 | 54 | 4.3 | .12 | 1,330 | 7.8 | 16 |
| 59-101 | 50 | Ps | June 4, 1969 | 16 | -- | 245 | 95 | 132 | | 330 | 534 | 154 | 1.0 | 302 | -- | 1,640 | 1,000 | 22 | 1.8 | .00 | 2,230 | 7.4 | 17 |
| 60-301 | 30 | $Qal_2$/Pc | May 21, 1969 | 20 | -- | 61 | 24 | 71 | | 234 | 133 | 27 | .8 | 42 | -- | 494 | 250 | 38 | 2.0 | .00 | 755 | 7.5 | 17 |

* Sample analyzed for pesticides.

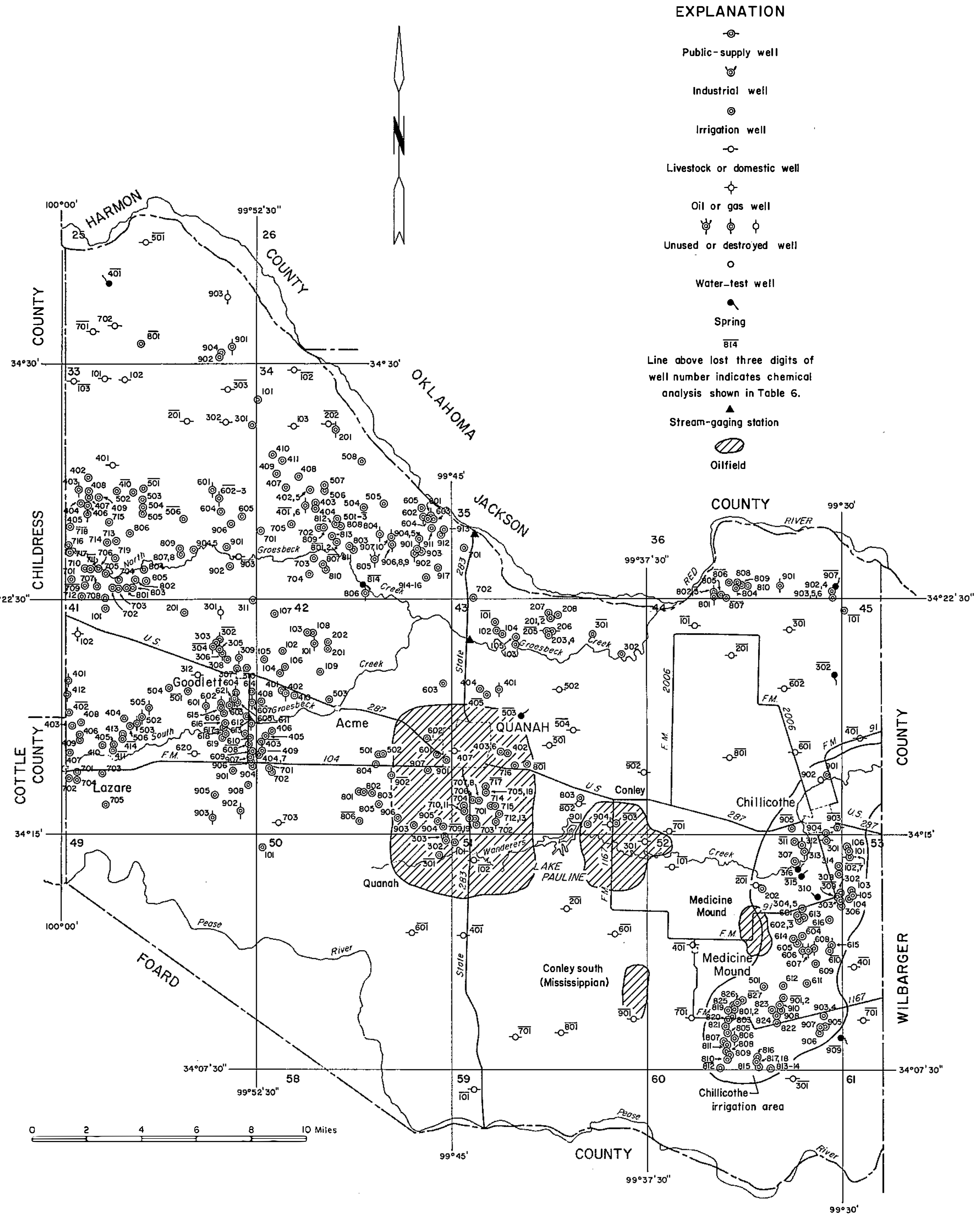


Figure 10

Locations of Wells, Springs, and Oilfields

Base from U.S. Geological Survey topographic quadrangles