GROUND-WATER RESOURCES OF MITCHELL AND WESTERN NOLAN COUNTIES, TEXAS

JUNE 1967
TEXAS WATER DEVELOPMENT BOARD

REPORT 50

GROUND-WATER RESOURCES OF MITCHELL
AND WESTERN NOLAN COUNTIES, TEXAS

By

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Prepared by the Texas Water Development Board
in cooperation with
Mitchell and Nolan Counties

June 1967
FOREWORD

On September 1, 1965 the Texas Water Commission (formerly, before February 1962, the State Board of Water Engineers) experienced a far-reaching realignment of functions and personnel, directed toward the increased emphasis needed for planning and developing Texas' water resources and for administering water rights.

Realigned and concentrated in the Texas Water Development Board were the investigative, planning, development, research, financing, and supporting functions, including the reports review and publication functions. The name Texas Water Commission was changed to Texas Water Rights Commission, and responsibility for functions relating to water-rights administration was vested therein.

For the reader's convenience, references in this report have been altered, where necessary, to reflect the current (post September 1, 1965) assignment of responsibility for the function mentioned. In other words credit for a function performed by the Texas Water Commission before the September 1, 1965 realignment generally will be given in this report either to the Water Development Board or to the Water Rights Commission, depending on which agency now has responsibility for that function.

TEXAS WATER DEVELOPMENT BOARD

John J. Vandertulip
Chief Engineer
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GROUND-WATER RESOURCES OF MITCHELL AND WESTERN NOLAN COUNTIES, TEXAS

ABSTRACT

Mitchell County and the western one-third of Nolan County embrace an area of about 1,150 square miles in the Callahan Divide subdivision of the Great Plains Province in central Texas. Most of the area is in the Colorado River drainage basin with the Colorado River flowing from northwest to southeast through Mitchell County. Colorado City, the largest city in the area and the county seat of Mitchell County, is about 75 miles west of Abilene and about 70 miles north-northwest of San Angelo. The area had a population of about 14,000 in 1960. The climate ranges from semiarid to subhumid, and the average annual precipitation is about 20 inches.

Irrigation is practiced in much of the area east of the Colorado River, where cotton and grain sorghums are the principal crops. A large part of the industrial development is associated with petroleum production and the mining of sand, gravel, and cement material.

Water-bearing rocks which contain usable quality water in Mitchell and western Nolan Counties include beds of Permian age, the Santa Rosa and Chinle Formations of Triassic age, the Trinity and Fredericksburg Groups of Cretaceous age, the Ogallala Formation, and Quaternary alluvium. The water-bearing unit of principal interest consists of basal gravel and sand of the Santa Rosa Formation, the upper Santa Rosa Formation, and the sand of the Trinity Group.

Recharge to the aquifer is primarily from precipitation on the outcrop. The amount and seasonal distribution of precipitation significantly affects the amount of water received by the aquifer. Locally the amount of replenishment varies according to the permeability of the outcropping rock or the nature of the soil mantle and vegetative cover. Movement of ground water east of the Colorado River is generally to the west, whereas west of the river the movement of ground water is to the east, toward the river. Water is discharged from the aquifer by seepage into the major drainageways, spring flow, evaporation, transpiration by plants, and by interformational leakage. Also, large quantities of water are discharged through irrigation wells in the Santa Rosa Formation.

Changes in water levels in the Santa Rosa Formation generally correlate with cumulative departures from the average annual precipitation. Observation well data indicate that water levels are in the process of recovery from an unusually large deficit of precipitation since 1946, and that water levels probably have not fully recovered from the effects of the drought. During the 1960-63 period of observation, water levels in wells in various areas responded differently to the combined effects of recharge and pumpage. Water-level changes during this period ranged from -9.0 to -13.3 feet.
Water of quality usable for municipal and most irrigation and industrial purposes occurs in the Santa Rosa Formation throughout the area east of Colorado City. Hardness, however, is very high and will require softening for many municipal and industrial uses. Fluoride is also marginally acceptable to excessive in many places. West of the Colorado River, water in the basal Santa Rosa sands is rather highly mineralized.

Principal irrigation development began in the early 1950's as a result of the drought. Since 1961, irrigation has accounted for more than 95 percent of the ground water pumped from the Santa Rosa Formation. In 1963 there were about 300 active irrigation wells in Mitchell and western Nolan Counties, 12 active municipal wells, and 7 industrial wells. In 1961, 10,035 acre-feet was pumped from the Santa Rosa Formation for municipal, industrial, and irrigation purposes; in 1962, 10,834 acre-feet was pumped; and in 1963, 15,069 acre-feet.

It is estimated that between 12,000 and 15,000 acre-feet of water per year can be developed from the Santa Rosa Formation, east of the Colorado River, on a perennial basis. In periods of drought, or adverse distribution of annual rainfall with respect to agricultural requirements, regional pumpage would exceed recharge in nearly all areas having a large number of wells. Only areas of very scattered development will sustain additional pumpage without causing progressive unwatering of sands and gravels until the economic limit of irrigation pumpage is reached.

In addition to the perennial yield, approximately 2,000,000 acre-feet of usable quality ground water is stored in the Santa Rosa Formation, of which about one-half could be recovered under the present economics of irrigation pumpage. Also, about 400,000 acre-feet of water is stored in the Trinity Group.

It is recommended that, where possible, new development should be restricted to areas having little or no water-level declines. In these areas the best prospects for development are those areas containing the maximum amount of saturated sand and gravel.
GROUND-WATER RESOURCES OF MITCHELL AND WESTERN NOLAN COUNTIES, TEXAS

INTRODUCTION

Purpose and Scope

The western one-third of Nolan County and the northeastern one-fourth of Mitchell County are underlain by strata containing fresh water, principally in the Santa Rosa Formation of Triassic age, which supplies water to many irrigation wells. Nearly all of these wells have been drilled since 1950 to supplement rainfall for cotton and feed-grain crops. Many of these wells were drilled during the severe 1951-56 drought.

Preliminary studies of water-bearing units in this area, accomplished as part of a statewide reconnaissance of ground-water resources, indicated that recharge to the water-bearing units in the area may equal or perhaps exceed amounts of water pumped for irrigation in periods of normal regional rainfall.

On the basis of the reconnaissance studies, recommendations were made by the Texas Water Commission for a more detailed ground-water study of the Santa Rosa Formation, with principal emphasis on recharge aspects. Also, considerable local interest developed in the area for a thorough study of water available for irrigation east of the Colorado River.

In early 1962 the Commissioners Court of Mitchell County requested assistance from the Texas Water Commission for a detailed study of the ground-water resources of the county, and that the study be directed principally toward determining the degree of permanence to be expected from existing irrigation development and the probable effects of future development. Other hopeful objectives would be to obtain guidance for future exploration for irrigation water in and near the present area, and possible disclosure of undiscovered areas favorable for developing large quantities of ground water.

The Texas Water Commission agreed to make a study which would be financed by the State and local cooperators, and urged that the program include also that part of the common Triassic aquifer which occurs in Nolan County. Subsequently, the Nolan County Commissioners Court contributed to the investigation. Additional contributions from well owners and business establishments in Mitchell and Nolan Counties supplied the balance of necessary funds.

A program was then outlined by the Texas Water Commission to accomplish the principal objectives within the framework of an overall study of ground water in Mitchell County and in the approximate western one-third of Nolan County. The program called for a study which would define: (1) ground-water
conditions throughout the area; (2) changes in ground-water conditions caused by previous development; (3) the estimated amount of ground water available from the principal aquifer on a perennial basis, if possible; (4) the estimated amount of ground water available from storage within the principal aquifer; and (5) recommendations for a future program of data collection to detect changes in ground-water conditions and the causes.

The scope of the investigation included the compilation, review, and analysis of all previously collected hydrologic data, the subsequent correlation thereof with data collected during the period of fieldwork which was from August 1962 to September 1963, and the presentation of results of the investigation in a report illustrating ground-water conditions in the area.

This investigation was made and the report prepared under the general direction of John J. Vandertulip, Chief Engineer, L. G. McMillion, former director, Ground Water Division, and Richard C. Peckham, director, Ground Water Division. The fieldwork and report preparation were under the direct supervision of Bernard B. Baker, assistant director in charge of Availability Programs.

Location and Extent

The area considered in this report embraces approximately 1,150 square miles, and includes all of Mitchell County and approximately the western one-third of Nolan County. Colorado City, the largest city in Mitchell County and the county seat, is approximately 75 miles west of Abilene and about 70 miles north-northwest of San Angelo. The location of the area of study within the State is shown on Figure 1.

Methods of Investigation

In conducting the detailed study of ground-water occurrence and development in Mitchell and Nolan Counties the following items of work were accomplished:

1. inventory of municipal, industrial, and irrigation wells and selected domestic and livestock wells;
2. collection of water samples from wells and springs for chemical analysis, and collection of available chemical analyses;
3. collection and examination of drill cuttings from selected wells;
4. determination of approximate altitudes of wells and outcrops;
5. periodic measurement of static water levels in selected wells;
6. measurement of depths to water in and discharge from selected wells;
7. conducting pumping tests on selected wells;
8. measurement of application rates of many irrigation wells;
9. determination of power-consumption rates of selected electric-powered irrigation pumps, and collection of power-consumption records from the utility company;
Figure 1
Map of Texas Showing Location of Mitchell and Western Nolan Counties
Texas Water Development Board in cooperation with Mitchell and Nolan Counties
(10) inventory of ground-water pumpage for municipal, industrial, and irrigation purposes;

(11) mapping of surface geology using topographic maps and aerial photographs;

(12) collection, compilation, and correlation of electrical logs and drillers' logs of oil tests and water wells;

(13) collection and analysis of streamflow, precipitation, temperature, and evaporation data pertinent to the study area; and

(14) compilation and analysis of data and preparation of illustrations showing geologic and hydrologic conditions.

Approximately 175 electrical logs were examined for information on thickness, depth, and attitude of subsurface strata. About 250 irrigation wells were inventoried for performance, completion, and construction data, and yields or application rates of approximately 130 wells were measured during the study. Static water-level measurements in about 475 wells were obtained during the period 1960-63, and comparative static water levels were measured annually in the winter months in approximately 75 irrigation wells during the same period.

One hundred and forty chemical analyses of ground water were evaluated. Power-rate tests were run on about 105 wells equipped with electric pumps, and about 200 altitude determinations of wells were made by hand-leveling. More than 175 drillers' logs of water wells were evaluated. Pumping tests were conducted on four wells to determine aquifer characteristics. Depths to water were measured in approximately 50 irrigation wells while pumping.

Previous Investigations

No previous detailed study of ground water in this area has been made. Broadhurst and Dale (1953) presented a memorandum report noting irrigation development in Mitchell County. Knowles (1947) compiled an inventory of wells in northwestern Nolan County.

Unpublished records of the U.S. Geological Survey which provided water-level and quality data during the course of this study included a water-quality survey in the vicinity of Cuthbert in 1948, the results of an investigation of ground-water conditions within a 4 to 5 mile radius of Colorado City in 1946 made in consideration of long-term water requirements, and a memorandum report on availability of additional ground water to the city of Sweetwater in 1950.

Well-Numbering System

The numbers assigned to wells and springs in this report are based on a grid system in which quadrangles formed by degrees of latitude and longitude are repeatedly subdivided into small quadrangles as shown on Figure 2.

The largest quadrangle, a 1-degree quadrangle, is divided into sixty-four 7.5-minute quadrangles, each of which is further divided into nine 2.5-minute quadrangles. Each 1-degree quadrangle in the State has been assigned a number...
LOCATION OF WELL 29-44-201

29 1-degree quadrangle
44 7 1/2 minute quadrangle
2 2 1/2 minute quadrangle
o Well number within 2 1/2 minute quadrangle

Figure 2
Well-Numbering System

Texas Water Development Board in cooperation with Mitchell and Nolan Counties
for indentification. The $7\frac{2}{10}$-minute quadrangles are numbered consecutively from left to right, beginning in the upper left-hand corner of the 1-degree quadrangle, and the $2\frac{1}{2}$-minute quadrangles within each $7\frac{2}{10}$-minute quadrangle are similarly numbered. The first two digits of a well number identify the 1-degree quadrangle; the third and fourth digits identify the $7\frac{2}{10}$-minute quadrangle; the fifth digit identifies the $2\frac{1}{2}$-minute quadrangle; and the last two digits identify the well within the $2\frac{1}{2}$-minute quadrangle.

Acknowledgements

Appreciation is expressed to personnel of Shell, Humble, and Skelly oil companies for their assistance with problems involving regional geology.

The writer is grateful to the many individual well owners and city officials who provided access to their records, wells, and property so that needed data could be obtained.

The writer is particularly indebted to deceased drilling contractors N. C. and O. R. House and their widows, and to Hopkins Drilling Company for making available their complete log files and giving freely of their working knowledge of ground water in Mitchell and Nolan Counties. Appreciation is also expressed to Lone Wolf Electric Cooperative for supplying the electricity-consumption data which was used to compute irrigation pumpage.

Appreciation and commendation are extended to those residents who, under the leadership of the late Frank Kelley, procured the funds for this study; and to the Commissioners Courts of Mitchell and Nolan Counties for their excellent cooperation throughout the study.

GEOGRAPHY

Physical Features

The study area lies within the Callahan Divide subdivision of the Great Plains in central Texas. The topography of the area is generally rolling except for a rather flat part in Nolan County, which is a remnant of the Edwards Plateau and constitutes a segment of the Callahan Divide which separates drainage of the Colorado and Brazos Rivers. Marginal to the Colorado River are small, flat, alluvial terraces and occasionally deeply eroded, rugged topography.

The land surface in Mitchell County slopes regionally from northwest to southeast and locally toward the Colorado River which traverses the county diagonally from northwest to southeast. The topography is gently rolling to moderately rugged along major streams. Local relief averages 50 to 100 feet and ranges upward to 150 feet along the Colorado River in places. Altitudes within Mitchell County range from about 1,900 feet along the Colorado River in the southeast to about 2,400 feet in the southwest and northeast (Figure 5).

Soils in Mitchell County are generally reddish-brown and of quartzitic, upland type. They are mainly sandy, gravelly, and loose, but in some places are clayey, loamy, and dense.
The topography of western Nolan County varies from gently rolling and rugged west of the Callahan Divide to generally flat in the area surrounding Roscoe and in west-central areas along the divide. Altitudes are generally between 2,400 and 2,600 feet along the topographic divide, and about 2,100 feet in the southwest at the county line.

Soils of flat, upland areas of northwestern and southwestern Nolan County are dark, loamy, and calcareous and are derived from calcareous alluvial sediments or Cretaceous limestones. Soils along the lower western slope of the Callahan Divide are generally brownish-red, sandy, and occasionally loamy.

Roscoe is the principal town of the Nolan County part of the study area and is about 20 miles east of Colorado City.

The Colorado River and its tributaries drain all the area of this report except for about 100 square miles of northwestern Nolan County which is slightly dissected by tributaries of the Clear Fork of the Brazos River. The Callahan Divide which separates the Colorado and Brazos drainage basins trends southeastward from the northwest corner of Nolan County and passes through the community of Maryneal in the south-central part of the county.

Principal tributaries of the Colorado River draining Nolan and eastern Mitchell Counties are the south and north forks of Champion Creek and Big Silver Creek. All are intermittent streams. Largest tributaries of the Colorado River draining western Mitchell County are Morgan, Wildhorse, and Beals Creeks, which also flow intermittently.

Climate

The climate of the area embraced by this report ranges from semiarid in western Mitchell County to subhumid in Nolan County. It is characterized by long, hot summers, and generally moderate winters which exhibit a wide range of temperatures. The average temperature in January is 44°F and the average temperature in July and August is 81°F. The mean annual temperature at Colorado City is 64°F.

The average annual precipitation for the period 1939-63 at Colorado City is 19.66 inches and at Roscoe 20.72 inches, most of which occurs between April and October. The driest months are in the winter when northerly winds prevail. Precipitation is mostly rain, a large proportion of which falls in relatively few torrential storms. Highest recorded annual precipitation in the area was in excess of 35 inches at Roscoe in 1936 and Colorado City in 1957; the lowest recorded was 11.4 inches at Colorado City in 1910. The average annual gross lake surface evaporation rate in study area for the 18 years, 1940-57, was about 81 inches (Lowry, 1960).

Figure 3 shows graphically the annual precipitation, average annual precipitation, and cumulative departure from the average annual precipitation at Roscoe and Colorado City for the period 1939-63. The distribution of the annual precipitation is illustrated by the mean monthly precipitation at the two stations, presented on Figure 4.
Cumulative departure from the average annual precipitation at Colorado City

Cumulative departure from the average annual precipitation at Roscoe

Annual Precipitation and Cumulative Departure from the Average Annual Precipitation at Colorado City and Roscoe, 1939–63
(Data from U.S. Weather Bureau)

Texas Water Development Board in cooperation with Mitchell and Nolan Counties
Figure 4
Mean Monthly Precipitation at Colorado City and Roscoe, 1939-63
(Data from U.S. Weather Bureau)
Texas Water Development Board in cooperation with Mitchell and Nolan Counties
Population and Economy

The census of 1960 shows a population of 11,255 for Mitchell County and 19,700 for Nolan County; it is estimated that approximately 2,900 people live in the Nolan County area of this study, generally termed the Roscoe subdivision of the county. From 1950 to 1960 the population of Mitchell County declined by about 20 percent. It is estimated that the population of Nolan within the study area declined by less than 5 percent.

Population decreases are principally attributed to the national trend of declining farm population and to a general lessening of intensity and variety of oil production activity. The economy of the area is largely based upon agriculture and livestock production, which were valued respectively at $5.4 million and $1.8 million in 1959. Principal crops are cotton and grain sorghums.

Principal income from the study area is probably derived from production of electric power; manufacture of refined petroleum and cottonseed oil; and from mineral industries producing oil, gas, sand and gravel, and cement valued at more than $11 million in 1958.

Major sources of employment in 1960 were: agriculture with 884 workers; wholesale and retail trade, 942 workers; manufacturing, 503 workers; construction, 426 workers; education, 239 workers; and mineral production, 267 workers.

GEOLOGY

General Geology

Water-bearing rocks with which this report is concerned include beds of the Guadalupe and Ochoa Series of Permian age, the Santa Rosa and Chinle formations of Triassic age, the Trinity and Fredericksburg Groups of Cretaceous age, the Ogallala Formation, and Quaternary alluvium. All of the units crop out within the study area. Figure 5 is a geologic map showing the areal distribution of the outcrops. Table 1 lists geologic units and summarizes lithology and water-bearing characteristics. Older rock units recognized in the subsurface but having no known fresh-water potential are, in ascending order: Pre-cambrian, Cambrian, Ordovician, Mississippian, Pennsylvanian, and lower Permian strata. Pennsylvanian and lower Permian strata are notable for the occurrence of oil and gas in the general area of this report.

Of paramount importance to this study are the Santa Rosa Formation and the sands of the Trinity Group which constitute the principal source of ground water in the area. The Santa Rosa Formation is of terrestrial origin whereas the Trinity Group is generally considered to be of littoral, or near-shore, origin. Triassic rocks dip regionally west and northwest at a generally low angle, apparently thickening toward the axis of a synclinal basin, while the Cretaceous rocks dip regionally to the southeast at low angles.

The Trinity Group overlies and overlaps the Santa Rosa Formation in eastern Mitchell and western Nolan Counties where, in places, a common hydrologic unit is formed by a sand-on-sand formational contact. The contact between the two is unconformable, as is their contact with underlying Permian strata. Figure 6 shows formational relationships and generalized topography of the study area.
Table 1.--Geologic units and their water-bearing characteristics in Mitchell and western Nolan Counties

<table>
<thead>
<tr>
<th>System</th>
<th>Series</th>
<th>Group</th>
<th>Formation</th>
<th>Approximate thickness (feet)</th>
<th>Lithology</th>
<th>Water-bearing characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleistocene</td>
<td>Recent Alluvium</td>
<td></td>
<td></td>
<td>0-100</td>
<td>Fine to coarse sand, and small to large gravel, with occasional clay and caliche beds.</td>
<td>Above the regional water table east of Colorado River, but yields up to 20 gpm of good quality water in southwestern Mitchell County.</td>
</tr>
<tr>
<td>Tertiary</td>
<td>Pliocene Ogallala</td>
<td></td>
<td></td>
<td>0-100</td>
<td>Fine to coarse sand, gravel, caliche, and zones of clay.</td>
<td>Above the water table east of Colorado River, but yields up to 20 gpm of good quality water to wells in northwestern Mitchell County.</td>
</tr>
<tr>
<td>Cretaceous</td>
<td>Comanche Fredericksburg</td>
<td></td>
<td></td>
<td>0-220</td>
<td>Predominantly limestone. 15 to 25 feet of sandy yellow marl at base overlain by chalk and shaly limestone. Very dense, massive, fossiliferous limestone in the upper part.</td>
<td>Upper limestones contain in places small to moderate supplies of potable but hard water in solutional openings developed along fracture systems; recharge to the openings occurs through numerous sinks.</td>
</tr>
<tr>
<td></td>
<td>Cretaceous Trinity</td>
<td></td>
<td></td>
<td>0-100</td>
<td>White to purplish quartz sand, fine to medium grained, moderately to loosely consolidated, with occasional lenses of quartz gravel at the base.</td>
<td>Yields small to large quantities of potable but hard water, the amount depends on saturated thickness which ranges from 100 percent under interior limestone areas to a few feet in parts of the outcrop; yields of several hundred gallons per minute are reported.</td>
</tr>
<tr>
<td>Triassic</td>
<td>Dockum Chinle</td>
<td></td>
<td></td>
<td>0-640</td>
<td>Predominantly red to maroon and purplish clay and shale, interbedded with thin, tight, cross-bedded, yellow-brown to reddish-white sandstone.</td>
<td>Sandstones contain generally small quantities of moderately to highly mineralized water; used principally for livestock.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Santa Rosa</td>
<td>0-330</td>
<td>Basal conglomerate overlain by brown to gray, micaceous and carbonaceous, cross-bedded sand alternating with beds of red and gray clay.</td>
<td>Sands and gravels contain moderate to large quantities of fresh water east of the Colorado River, with yields up to 1,000 gpm reported; west of Colorado River capacity of sand is reportedly substantial but water is generally not potable.</td>
</tr>
<tr>
<td>Permain</td>
<td>Guadalupe Ochoa</td>
<td></td>
<td></td>
<td></td>
<td>Fine-grained, red to brown sandstone; dense red silty shale with occasional gypsum or anhydrite beds.</td>
<td>Yield small quantities of moderately to highly mineralized water to livestock and domestic wells.</td>
</tr>
</tbody>
</table>
Figure 6
General Geologic Structure and Formation Relationships in Mitchell and Western Nolan Counties
Texas Water Development Board in cooperation with Mitchell and Nolan Counties
The regional structural setting of the report area is the Eastern platform of the Permian basin of West Texas. The structure of the Permian basin is illustrated on Figure 7 which shows the Permian marker bed dipping westward at a rate of about 25 to 30 feet per mile. Locally, structural features in the Permian rocks have influenced the thickness of overlying Triassic and Cretaceous sands and, consequently, their water-bearing characteristics.

The geologic history of the area of this report is largely a consequence of structural movements controlling the Permian basin. In early Permian time the sea encroached upon an eroded Pennsylvanian surface from the southwest as a result of regional subsidence, depositing at first great sequences of limestone. Later, evaporite deposition of anhydrite and salt interbedded with red clay and silt occurred as the seas began intermittent retreat to the southwest, producing once more a terrestrial environment.

Extensive erosion of the elevated Permian surface occurred prior to deposition of the coarse terrestrial sediments of Triassic age, which were transported by fast-moving waters from highlands probably lying to the east and south. Regional subsidence of the Permian basin apparently continued throughout the period of Triassic deposition.

A period of uplift followed Triassic deposition, during which unknown thicknesses of Triassic material were stripped away before the last marine transgression of the area brought shallow Cretaceous seas from the southeast. During Cretaceous time littoral sediments were initially deposited, followed later by alternating marine and littoral sediments, then finally, marine deposits.

Since retreat of the Cretaceous seas, Cretaceous strata, which once covered nearly all of Texas, were removed from all of Mitchell County, except for a small area east of Loraine, by erosion. Stripping and redeposition of Cretaceous rocks largely characterized the emergent post-Cretaceous time. Tertiary deposition is represented in this area principally by a remnant of the Ogallala Formation surrounding Roscoe in Nolan County. Quaternary deposits are represented by widely scattered erosional remnants of flood-plain and stream-terrace deposits largely containing reworked Triassic and Cretaceous sediments.

Tertiary and Quaternary sediments are above the water table in all of the area except western Mitchell County, and occur as scattered thin mantles of caliche, sand, and gravel overlying Triassic or Cretaceous rocks in Nolan County and Permian or Triassic rocks in Mitchell County.

<table>
<thead>
<tr>
<th>Geologic Units and Their Water-Bearing Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Permian System</strong></td>
</tr>
<tr>
<td><strong>Guadalupe and Ochoa Series</strong></td>
</tr>
</tbody>
</table>

Permian rocks are exposed principally in the southeastern quarter of Mitchell County. They are largely insignificant as a source of usable water except for livestock, and no attempt was made in this study to differentiate the Permian rock units. Electrical logs indicate, however, that most exposures are stratigraphically above the Yates Formation and thus belong in part to the
Guadalupe Series and in part to the Ochoa Series, both of upper Permian age. The exposed Permian rocks may include strata of the Tansill, Salado, and Dewey Lake Formations. About 175 feet of Permian rock thickness is exposed along the Colorado River and its principal tributaries.

Permian exposures consist principally of "red beds," which are dense red silty shales with gray-green inclusions, interbedded with tight red-brown to yellow-orange, fine-grained, laminated sandstones and occasional gypsum or anhydrite beds.

Permian rocks of this area are overlain unconformably by Triassic conglomerate or sandstone or are thinly mantled by remnants of Quaternary alluvium. The Permian beds dip westward at an average rate of about 25 to 30 feet per mile, steepening considerably in extreme western Mitchell County near the margin of the Midland basin.

Water wells in the Permian rocks generally are less than 100 feet deep and yield small quantities of moderately to highly mineralized water.

Triassic System

Dockum Group

Rocks of Late Triassic age belonging to the Dockum Group occur at the surface or in the subsurface in about 80 percent of the study area. They have been completely removed in much of southeastern Mitchell County by erosion and are absent in the subsurface of a part of southwestern Nolan County because of either pre-Cretaceous erosion or nondeposition.

Dockum beds are of continental origin and were probably laid down as river-channel and flood-plain deposits. Subdivision of the Dockum group has been made by several investigators. In this report the subdivision of Adams (1929, p. 1045) into the Santa Rosa and Chinle Formations is employed. Adams has stated of the southern end of the Southern High Plains: "In the area south of the 33rd parallel the Dockum group consists of red and non-red conglomerate, sandstone, and shale beds of terrestrial origin. Examination of a series of well samples shows that it is composed of two formations. The names Santa Rosa and Chinle, as used for the Triassic of central New Mexico is extended to include the equivalent formations in the Texas section."

The contact between the Santa Rosa Formation and the overlying Chinle Formation is not readily apparent in the Mitchell-Nolan Counties area due to the presence of lenticular sands and thick red clay or shale zones in both formations. It is not defined on the geologic map of Texas (Darton and others, 1937) and it was considered beyond the scope of this study to attempt to map it. During the field investigation, it was observed that a section composed of a thick, brick-red to maroon and purple shale with green and gray mottling and thin beds of red-brown to gray, fine-grained, micaceous sandstone occurs generally west of a north-south line through Westbrook in western Mitchell County. This section is presumed to be a component of the Chinle Formation.

It also is not possible with certainty to define the subsurface contact of the Chinle and Santa Rosa Formations on gamma-ray logs, as logs generally indicate simply an alternating series of sand and shale from the top of the Permian
section to the surface. Arenaceous materials that generally predominate in the lower part of the Triassic are considered to be the Santa Rosa Formation.

Santa Rosa Formation

The Santa Rosa Formation underlies the Chinle Formation in western Mitchell County. Although the western limit of the Santa Rosa Formation outcrop cannot be defined on Figure 5, all Triassic sediments in the study area eastward from the general vicinity of Westbrook are considered to belong to the Santa Rosa Formation. The geologic map on Figure 5 shows that the Santa Rosa is overlain in places by alluvium or the Ogallala Formation, as in the Roscoe area, and by the Trinity Group in areas south and southwest of Roscoe. The Santa Rosa crops out both on the east and west sides of the Brazos-Colorado river basin divide in Nolan County.

The Santa Rosa sediments east of the Colorado River generally consist of a few to 20 or 30 feet of hard, coarse-gravel conglomerate at the base, succeeded upward by alternating red and gray micaceous shale, clay, and sand or gravel. Sand and gravel generally predominate in the lower 100 feet of the formation. The conglomerate comprising the base of the Santa Rosa Formation marks the base of the fresh water section in the area for local well drillers. On the outcrop, the sands are generally buff-brown to red-brown or grayish, fine to medium grained, slightly to highly micaceous, with much carbonaceous material, very slightly to moderately consolidated, and cross-bedded. Sands in the subsurface are characteristically gray to gray-white, containing much dark colored minerals.

The sand and clay beds are highly lenticular, grading both laterally and vertically into one another within short distances as revealed by a study of many drillers' logs and outcrops. East of the river the sediments appear to gradually become finer-grained to the west, and fossil wood fragments and "coal" are reported in drill cuttings from wells.

Thick of the Santa Rosa Formation in the outcrop ranges from a few feet in parts of southwestern Nolan County to over 300 feet north and northeast of Colorado City. The thickness of the formation encountered in irrigation wells is generally about 150 to 200 feet.

Local structures in the Triassic strata are difficult to detect because of the lack of persistent marker horizons in the lenticular beds and because of the unconformable surfaces at the base and top of the Triassic sediments. Figure 8 shows the varying slope of the Permian surface (and the base of the Triassic sediments in most of the area). In eastern Mitchell and western Nolan Counties the slope is about 20 to 25 feet per mile westerly, becoming northwesterly and steepening to 40 to 80 feet per mile west of the Colorado River.

The Santa Rosa Formation supplies water to nearly all the irrigation wells and to all the municipal wells in the area of study, which yield up to 1,000 gpm (gallons per minute) of fresh but generally hard water. The Santa Rosa Formation west of the Colorado River in several localities has reportedly yielded over 300 gpm to individual wells, but the water was excessively mineralized for irrigation.
Chinle Formation

The lower boundary of the Chinle Formation on the outcrop is not precisely defined. It occurs principally west of Westbrook. The Chinle Formation is predominantly red clay and shale with thin, lenticular, sandstone interbeds, and overlies the more arenaceous Santa Rosa Formation. The Chinle is generally unimportant as a source of water except for livestock. It yields only small quantities of moderately to highly mineralized water from fine-grained sandstones near the surface. Its thick red shales appear to constitute an effective aquiclude, which prevents local recharge to the sands of the Santa Rosa Formation below. The maximum thickness of the Chinle is probably as much as 640 feet in the westernmost part of Mitchell County.

Cretaceous System

Cretaceous rocks within the area of the study are of Lower Cretaceous age and belong to the Trinity and Fredericksburg Groups.

Trinity Group

The basal Cretaceous sand of the Southern High Plains of Texas has been considered to be the equivalent of the Paluxy Sand of the Fort Worth area (Hill, 1901, p. 132-140), and the name Paluxy has been used in West Texas by some investigators. In this report, the sands are referred to as the Trinity Group.

The sand of the Trinity Group was deposited in a near-shore, or littoral, environment of an advancing Cretaceous sea and is thus epicontinental in nature. The sand is present in western Nolan County, cropping out beneath Cretaceous limestone or Tertiary and Quaternary deposits. The Trinity Group principally overlies Triassic rocks, but in a sizeable part of southwestern Nolan County it rests upon Permian rocks.

In Nolan County the Trinity Group principally consists of white to purplish, loosely to moderately consolidated, fine- to coarse-grained quartz sand. The sand is mainly fine grained, and is sometimes referred to as "sugar sand" by well drillers. The coarser sand beds generally consist of highly varicolored quartz, and occasionally lenses of quartz gravel occur near the base.

The Trinity Group ranges in thickness from 60 to about 100 feet and averages about 80 feet throughout the area. In measured sections of exposures along the Mitchell-Nolan County line in southwestern Nolan County the Trinity was found to be 70 to 80 feet thick. The sand appears more yellowish and calcareous near the top, seemingly grading into sandy yellow limestone.

The regional dip of the Trinity Group is to the southeast at low angles. However, some variation in dip occurs due to local structural influence. The local elevation of the base of the sand, as interpreted from drill cuttings, electrical logs, and drillers' logs, is highly variable, probably due in part to structural influence and to the erosional character of the surface of the Triassic or Permian rocks below it.

Figures 9, 10, and 11 illustrate the relationship of the Trinity Group with the underlying Triassic and Permian sediments. The Trinity Group overlaps
Figure II

Geologic Section C-C'

Texas Water Development Board in cooperation with Mitchell and Nolan Counties
the Santa Rosa Formation which pinches out on a high Permian surface trending southwestward from Maryneal (Figure 8).

The sand of the Trinity Group is the only important source of water in most of southwestern Nolan County; in some places it is fully saturated to the base of the overlying limestones (Figures 10 and 11). Although yields of 250 to 500 gpm have been reported from wells developed in the Trinity Group, yields are generally expected to be much less.

**Fredericksburg Group**

As much as 220 feet of calcareous sediments overlie the Trinity Group, seemingly grading upward from sandy marl to arenaceous limestone to chalky, fossiliferous limestone, and finally, to thin- and massive-bedded, gray-white, resistant, fossiliferous limestone. These beds are of little importance as water sources in the area, and therefore no attempt was made to distinguish individual formations of this group. However, available literature and field observations indicate that the Walnut Clay is probably represented within the basal 15 to 20 feet of the Fredericksburg Group, overlain by undetermined thicknesses of the Comanche Peak and Edwards Limestones.

Occasionally, solutional openings in the Edwards Limestone yield small to moderate supplies of water to domestic wells. The Edwards Limestone outcrop is characterized by many large, circular areas of interior drainage, or sinks, which are the result of collapse into solution-formed openings and provide a source of recharge to the underlying sands.

**Tertiary System**

**Ogallala Formation**

Rocks generally regarded as Tertiary in age crop out in the divide area which surrounds Roscoe. They are erosional remnants of the Ogallala Formation of the High Plains of Texas. In Nolan County, they consist of a maximum of 40 to 50 feet of caliche, and sand and gravel interbedded with light-colored clay. The sediments are entirely above the regional water table and are not a source of water; however, they appear to constitute an effective recharge conduit to saturated sand and gravel of the Santa Rosa Formation or Trinity Group below.

Thin remnants of the Ogallala are also present in west-central and northwestern Mitchell County. They consist of a maximum of 100 feet of unconsolidated buff-brown sand with a zone of coarse gravel at the base. They generally yield small quantities of usable water of variable quality to domestic and livestock wells.
Quaternary System

Alluvium

Alluvium that is probably Pleistocene in age occurs both east and west of the Colorado River in Mitchell County. The alluvium is not a source of water east of the river, because it occurs as very thin mantles of caliche, sand, and gravel overlying Triassic strata. In southwestern Mitchell County, in the general vicinity of the Hyman community, up to 100 feet of Quaternary alluvium overlies Triassic red beds and yields small to moderate quantities of fresh water to livestock and domestic wells. Limited saturated thickness precludes development of large supplies of water in this area.

Recent alluvium occurs as small flood-plain deposits along the Colorado River. Because they are generally above the water table, they are not a source of ground water. On the east side of the Colorado River scattered outcrops of wind-blown sand mantle Triassic or Permian rocks to a depth of 8 to 10 feet, giving rise to dune topography.

GROUND WATER

General Principles of Occurrence

Figure 12 illustrates the earth's circulatory system, showing that water is constantly evaporating from and returning to the sea by different avenues of access. The part of the returning water which enters and moves through interstices of porous rocks of the earth's crust is ground water, and the source of all fresh ground water is precipitation although only a small percentage of precipitation becomes ground water.

Water moving downward through porous rocks first enters unsaturated voids which contain both air and water, and later enters a zone of saturation where all voids are full of water. The upper surface of the zone of saturation is called the water table, and water within it is ground water. If the water, in its downward movement, encounters impermeable strata above this level it forms a perched water table above the zone of saturation.

A geologic formation, group of formations, or part of a formation that yields water in usable quantities is termed an aquifer. A formation or part of a formation that is incapable of transmitting water in significant quantities is called an aquiclude.

Where the upper surface of the zone of saturation is under atmospheric pressure and unconfined, water-table conditions are said to exist. In areas where the water-bearing formation dips below impermeable beds in the subsurface, the water becomes confined under pressure and, if the formation is penetrated by a well, water will rise in the well above the base of the confining bed. Such water is said to be under artesian conditions.

The water table generally approximates the configuration of the regional topography, modified by local areas of recharge and discharge. Comparisons of elevations of the water table acquired in wells at selected points throughout
Figure 12
Earth's Hydrologic Cycle

Texas Water Development Board in cooperation with Mitchell and Nolan Counties
the extent of an aquifer indicate the direction of movement and the hydraulic
gradient, or slope, under which it moves.

The gradient and direction of movement can also be determined in artesian
aquifers by mapping the pressure surface (piezometric surface) as reflected by
elevations of water levels in wells. In contrast to the water table, this sur-
face is imaginary, representing the elevation to which water would rise if pe­
trated, but mapping of it shows the direction and relative rate of movement of
the confined water. Water will flow from wells in an artesian aquifer if the
piezometric surface is higher than the land surface. An artesian aquifer is
essentially an inclined conduit through which water moves under pressure.

The storage capacity of the voids of an aquifer is important in calculating
stored volumes of water, and in an artesian aquifer is expressed as the coeffi-
cient of storage, which is the volume of water per unit surface area that will
be taken into or released from storage when the piezometric surface is raised
or lowered by 1 foot. Under water-table conditions, the term specific yield is
used, and is defined as the ratio of the volume of water yielded to the volume
of aquifer unwatered. Artesian storage is dependent upon elastic properties of
the aquifer, and coefficients of storage are very small in comparison to spe­
cific yields of water-table aquifers.

An aquifer's ability to transmit water is important in computing the amount
of water available for development on a continuous basis. Its coefficient of
transmissibility is a measure of this characteristic and is expressed as the
amount of water in gallons per day which will flow through a vertical column of
the aquifer 1 foot wide under a 45-degree slope, or unit gradient. With a known
hydraulic gradient, the coefficient of transmissibility is used to calculate
volumes of water passing through given segments of an aquifer.

The coefficients of transmissibility and storage can be determined by pump-
ing tests of wells, with repeated measurements of water levels in the pumped
well and/or nearby observation wells while pumping at a constant rate. The co­
efficients may be used to determine proper well spacing, to predict effects one
well may have on another, and to predict drawdown of water levels at various
distances from a well pumping at a given rate for a specified time.

The specific capacity of a well also affords an indication of the hydraulic
characteristics of an aquifer. It is equal to the yield in gallons per minute
per foot of drawdown of the water level in a well pumped at a constant rate.
Specific capacities, however, vary with the rate and duration of pumping and
thoroughness of well completion.

Recharge, Discharge, and Movement

Recharge, or replenishment of water to an aquifer, may be artificial or
natural. Precipitation and the seepage from lakes or streams on the outcrop
contribute natural recharge. Artificial recharge may be effected through wells
or by spreading water over permeable outcrops. Over a long period of time,
recharge must equal discharge or water in storage will be progressively depleted.

Conduciveness to recharge of an aquifer is dependent on the topography and
vegetative cover of outcropping rocks and soils, and the ability of the rocks
to transmit infiltrating water. The amount and frequency of precipitation is,
of course, a controlling factor in recharge.
Discharge of water from an aquifer occurs artificially through wells or ditching. Natural discharge of water occurs as spring flow, effluent seepage, evaporation, transpiration by plants, and interformational leakage.

Water in an aquifer moves slowly from areas of recharge to discharge areas. Water under artesian conditions moves generally down the dip of the confined strata, and under water-table conditions generally follows the slope of the land surface, but discharging wells can materially change the direction of movement of water toward the wells. The rate of movement in most aquifers is no more than a few hundred feet per year.

Water Levels in Wells

Measurements of water levels in wells show locally the depths to the water table or piezometric surface. The measured level is termed static when no pumping influence is reflected. A pumping level reflects the position of the water table or piezometric surface in a pumping well. Changes in water levels are important in evaluation of aquifers, and may be due to local or regional influences. Changes in water levels are of significance over both long and short time intervals. The most significant changes result from imbalance of the recharge-discharge relationship.

Concentrated pumpage also can produce significant changes in water levels. The water table or piezometric surface near a pumped well is drawn down into the shape of an inverted cone with its apex at the pumped well. Development of this cone is dependent upon the hydraulic coefficients of the aquifer and the pumping rate. The cone of depression expands until it intercepts recharge which is equal to the demand, or it continues to expand as water is withdrawn from storage. In heavily developed irrigation areas the cone of each well is superimposed upon the cones of all adjacent wells, thus creating a regional cone of depression in the water table or piezometric surface.

Changes in atmospheric pressure, tidal forces, and earthquakes can effect changes in water levels, but the magnitude of fluctuations are usually very small.

Chemical Quality

All ground water contains minerals in solution generally dissolved from the rocks through which the water moves. The mineral composition of the rocks may vary considerably. Water in the form of precipitation is largely free of dissolved minerals but when it contacts rocks of the earth's crust, gradual solution commences. Concentrations of dissolved solids generally increase with depth of the aquifer.

Ground water is sometimes subject to contamination by surface disposal of brine produced with oil or by leakage from producing or abandoned oil wells. Improper disposal of sewage in the ground also may lead to contamination.

Chemical Quality Criteria

The principal chemical constituents found in ground water are calcium, magnesium, sodium, potassium, iron, silica, bicarbonate, carbonate, sulfate,
chloride, and minor amounts of manganese, nitrate, fluoride, and boron. Concentrations of these ions or chemical constituents are commonly reported by weight in parts per million (ppm). One ppm defines one part by weight of the ion to a million parts by weight of water.

Certain quality standards have been established or suggested for public, industrial, and irrigation supplies. Water used for public supplies should be colorless, odorless, palatable, and if possible within the mineral concentration limits set forth by the U.S. Public Health Service (1962) for drinking water used on interstate carriers. Some of these standards, in allowable parts per million, are as follows:

<table>
<thead>
<tr>
<th>Substance</th>
<th>Concentration (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chloride (Cl)</td>
<td>250</td>
</tr>
<tr>
<td>Fluoride (F)</td>
<td>(*)</td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>.3</td>
</tr>
<tr>
<td>Manganese (Mn)</td>
<td>.05</td>
</tr>
<tr>
<td>Nitrate (NO₃)</td>
<td>45</td>
</tr>
<tr>
<td>Sulfate (SO₄)</td>
<td>250</td>
</tr>
<tr>
<td>Total dissolved solids</td>
<td>500</td>
</tr>
</tbody>
</table>

*When fluoride is present naturally in drinking water, the concentration should not average more than the appropriate upper limit shown in the following table:

<table>
<thead>
<tr>
<th>Annual average of maximum daily air temperatures (°F)</th>
<th>Recommended control limits of fluoride concentrations (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lower</td>
</tr>
<tr>
<td>50.0 - 53.7</td>
<td>.9</td>
</tr>
<tr>
<td>53.8 - 58.3</td>
<td>.8</td>
</tr>
<tr>
<td>58.4 - 63.8</td>
<td>.8</td>
</tr>
<tr>
<td>63.9 - 70.6</td>
<td>.7</td>
</tr>
<tr>
<td>70.7 - 79.2</td>
<td>.7</td>
</tr>
<tr>
<td>79.3 - 90.5</td>
<td>.6</td>
</tr>
</tbody>
</table>

The use of drinking water having a fluoride content exceeding the upper recommended limits may cause mottling of the teeth of children (Dean, Dixon, and Cohen, 1935, p. 424-442). However, the use of drinking water that contains the optimum fluoride concentration appears to reduce the incidence of tooth decay (Dean, Arnold, and Elvove, 1942, p. 1155-1179).
In many areas of Texas, municipal water supplies complying with these standards cannot be obtained. However, supplies that fail to meet these standards have been used for long periods without apparent ill effects to the user. The Texas State Department of Health reports that some authorities recommend that drinking water should not contain in excess of 20 ppm of nitrate, as it may indicate organic pollution. Maxcy (1950, p. 271) states that water having a nitrate content exceeding 45 ppm should be regarded as unsafe for infant feeding.

Hardness of water is also important in consideration of water supplies. It is expressed in parts per million as calcium carbonate. A generalized classification for hardness, which is useful as an index to the analyses of water, is as follows: less than 60 ppm, soft; 61 to 120 ppm, moderately hard; 121 to 200 ppm, hard; and more than 200 ppm, very hard.

Standards for industrial supplies are varied depending upon the type of industry. A major concern to industries is the development of a water supply which does not contain corrosive or scale-forming constituents. Calcium and magnesium, which directly affect the hardness, are a limiting factor in the suitability of water for boiler use. Iron and silica in excessive amounts also cause scale deposits which clog lines and reduce the efficiency of other industrial processes. Each industry interested in developing a water supply will have its own quality requirements.

Whether water is suitable for irrigation depends not only on the quality of the water but also on the type of soil to which it is applied, adequacy of drainage, type of crops, and climatic conditions. The U.S. Salinity Laboratory Staff (1954) outlined the characteristics which are important in determining the suitability of water for irrigation. These characteristics are: (1) total concentration of soluble salts, (2) percentage of sodium in relation to the other cations, (3) residual sodium carbonate, and (4) concentrations of boron and other toxic elements.

### Treatment of Water

Water that does not meet the requirements of a municipal or industrial user commonly can be treated by various methods so that it will become usable. Treatment methods include softening, aeration, filtration, cooling, dilution or blending of poor and good quality waters, and addition of chemicals. The limiting factor in treatment is economics. Each water may require different treatment practices and the treatment should be designed for that particular water. However, once a treatment is established it probably will not have to be changed as the chemical characteristics of uncontaminated ground water remain fairly constant.

### Principal Aquifer

The water-bearing unit of principal interest in the study area consists of the basal gravel and sand of the Santa Rosa Formation, the upper Santa Rosa Formation, and the sand of the Trinity Group. In parts of western Nolan County the Trinity Group and Santa Rosa Formation are in direct contact with one another, but in places are separated by clay or shale.

In general, the base of fresh water east of the Colorado River is illustrated by Figure 8, which shows the altitude of the top of the Permian rocks.
Saturated thickness of the principal aquifer (in the Santa Rosa Formation and Trinity Group) in areas east of the Colorado River is shown on Figure 13. In much of the southwestern part of Nolan County, Trinity Group sand accounts for most of the saturated thickness values. In areas north and northeast of Colorado City, water-bearing parts of the upper Santa Rosa Formation are included in the saturated thickness values.

Santa Rosa Formation

Because this study is chiefly concerned with the availability of ground water in the Santa Rosa Formation under present and future conditions of irrigation development, and because the Santa Rosa contains no important quantities of fresh water west of the Colorado River, the formation is discussed separately in its occurrence east and west of the river.

Occurrence East of Colorado River

Most of the following information on the Santa Rosa Formation pertains to the basal gravel and sand of the Santa Rosa Formation; however, north and northeast of Colorado City the upper Santa Rosa sands are saturated and are also included in this discussion. The upper sands in this area have a different water level than the lower Santa Rosa and generally have inferior quality water to that contained in the lower unit, particularly in sulfate concentrations.

Recharge, Movement, and Discharge

The source of all water in storage in the Santa Rosa Formation and the source of recharge to it is precipitation on the formation outcrop and on the outcrops of overlying Cretaceous, Tertiary, and Quaternary rocks. Locally the amount of replenishment varies according to the permeability of the outcropping rock or the nature of the soil mantle and vegetative cover. Regionally, the amount varies with precipitation.

Recharge to the Santa Rosa appears to be substantial in flat, alluvial areas of northwestern Nolan County. Although the soils are comparatively tight, terraced surfaces retain considerable precipitation which infiltrates the soil and is transmitted downward through generally pervious caliche. In southwestern Nolan County recharge is from the Trinity Group where the two sands are, in places, in contact with one another. Sandy areas, highly conducive to recharge, are formed on outcrops of sand in the upper Santa Rosa and occur generally west of Loraine, particularly along Lone Wolf Creek. Recharge is undoubtedly substantial through the channels of tributaries of Champion Creek in sandy upper reaches above discharge areas. In the South Fork Champion Creek area in Nolan County, one well is reported to be capable of supplying 15 to 20 percent more sprinklers after sustained heavy runoff in the creek.

In general, the direction of movement of ground water is to the west, toward the Colorado River where much of it is discharged into the river or its principal tributaries, constituting a fairly constant increment of the flow or underflow of the streams. Before the advent of irrigation and the generally increased water demands, perennial flow reportedly occurred along South Fork Champion Creek almost as far east as the Nolan County lines, as a result of
natural ground-water discharge, or spring flow. However, the water table is now generally below the base of that stream except in its lowermost reaches.

The contours on Figure 14 show the slope of the water table or piezometric surface in Permian, Triassic, and Cretaceous strata and also reflect the direction of ground-water movement. Contours becoming more closely spaced may indicate a greater rate of movement of water, but closely spaced contours may also indicate, as they do in southwestern Nolan County, a transitional zone of ground-water occurrence from an upper to a lower water-bearing unit.

Figure 14 principally reflects the elevation of a largely unconfined water surface (water table) in Nolan County and a piezometric surface representing artesian conditions of the lower Santa Rosa Formation in much of Mitchell County and parts of Nolan County. Throughout the irrigation area, the average gradient of the water table or piezometric surface as indicated by the contours is 20 to 25 feet per mile. A ground-water divide occurs along or slightly east of the Roscoe-Maryneal highway and continues north-westward into Scurry County and southwest into Coke County. Northeast of the divide, water in the Santa Rosa Formation and Trinity Group moves toward discharge areas in the Brazos River basin; southeast of the divide, water moves into Coke County toward the Colorado River; and west of the divide, water moves into Mitchell County toward the Colorado River.

Water is discharged from the aquifer through seepage into the major drainages, spring flow, evaporation, transpiration by plants, and by downward leakage into the Permian rocks. Also, large quantities of water are discharged through wells, primarily for irrigation purposes.

Water-Bearing Characteristics

The Santa Rosa Formation east of the Colorado River generally consists of a few feet to 30 feet of hard, porous, gravel conglomerate at the base, succeeded upward by alternating red and gray micaceous shale, clay and sand or gravel. Sand and gravel generally predominate in the lower 100 feet of the formation. The sands and clays are highly lenticular, grading both laterally and vertically into one another within short distances.

The thickness of the Santa Rosa Formation ranges from a few feet in parts of southwestern Nolan County to over 300 feet north and northeast of Colorado City. Figure 13 shows the total saturated thickness of the Santa Rosa Formation and Trinity Group, and the calculated thickness of saturated sand and gravel. The saturated thickness of the aquifer ranges from a few feet at its periphery to as much as 280 feet in northern Mitchell County. From an analysis of 87 drillers' logs of water wells, some of which are included in Table 6, the average percentage of sand and gravel in the total saturated thickness of the Santa Rosa sediments is about 65 percent, and the average thickness of sand and gravel is about 76 feet.

Water-bearing characteristics of the lower Santa Rosa Formation were determined at four localities by pumping tests of wells having small to medium yields (Table 2). Coefficients of transmissibility and storage calculated from the data obtained in these tests averaged 8,845 gpd (gallons per day) per foot and 0.00019, respectively. Some of the tests indicated that under static conditions water may be artesian, but that with pumping, water levels may be lowered below
the confining strata, thus producing water-table conditions. Because the wells tested included none with large yields, which are numerous and widely distributed over the area, the average coefficient of transmissibility determined is probably low.

Table 2.--Summary of results of pumping tests of wells in the Santa Rosa Formation, Mitchell County

<table>
<thead>
<tr>
<th>Pumped well</th>
<th>Owner</th>
<th>Pumping rate (gpm)</th>
<th>Time pumped (hrs)</th>
<th>Distance to observation well (ft)</th>
<th>Coefficient of transmissibility (gpd per ft)</th>
<th>Coefficient of storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>29-34-714</td>
<td>Colorado City</td>
<td>70</td>
<td>11 &amp; 45</td>
<td>730 &amp; 795</td>
<td>* 5,955</td>
<td>*0.00008</td>
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<tr>
<td>29-35-106</td>
<td>H. E. Thomas</td>
<td>170</td>
<td>6</td>
<td>490</td>
<td>11,270</td>
<td>0.00013</td>
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<tr>
<td>29-35-712</td>
<td>Price Hall</td>
<td>245</td>
<td>18</td>
<td>178</td>
<td>5,856</td>
<td>0.00044</td>
</tr>
<tr>
<td>29-43-403</td>
<td>D. C. Stubblefield</td>
<td>70</td>
<td>17</td>
<td>274</td>
<td>12,300</td>
<td>0.00012</td>
</tr>
</tbody>
</table>

Average... 8,845 0.00019

*Average value from two tests.

No data are available on the hydrologic characteristics of the upper beds of the Santa Rosa, but it is not likely that they would sustain concentrated development in any one area. The sands are lenticular and comprise individual hydrologic units at distinctly different levels within the Santa Rose Formation. The sands are generally less than 100 feet deep.

Coefficients of transmissibility and storage obtained from reasonably homogeneous and confined aquifers can be used to predict future water-level declines and consequently amounts of water available for development in given areas. However, the practical value of these coefficients for an aquifer composed of lenticular sands such as the Santa Rosa beds appears questionable.

Well Construction and Performance

Construction of the irrigation wells in Mitchell and Nolan Counties presents few problems. Most recent irrigation, industrial, and municipal wells are completed with 6 to 12-inch casing which extends to the bottom of the well and is slotted below static water level. Municipal wells are often gravel packed with a 2- or 3-inch layer of gravel. Consolidated rock has permitted successful open-hole development below the water level in many of the older wells, but caving red clay below the water level in some areas has led to the use of perforated liners on the bottom, extending upward through the clay. Only a few Santa Rosa wells pump sand, which would cause wear on pumps. Wells are commonly flushed with acid to remove chemical deposits from perforations, and many are "shot" with nitroglycerin in an attempt to increase the effective diameter of the well, reportedly with varying degrees of success.
Table 5 shows reported yields or measured application rates for the irrigation wells. Reported or measured yields range from 20 to 1,400 gpm, probably averaging about 175 to 200 gpm. However, for the wells with largest reported yields, the measured application rates were generally found to be less than the reported yields. Because closely spaced wells with comparable saturated thicknesses in the developed irrigation area may range in yield from 60 to over 1,000 gpm, permeabilities are believed to vary considerably in the lower sand. Channel gravel is suggested in accounting for the well yields greater than 1,000 gpm, as the sands generally are not capable of supporting such withdrawals of water.

Two wells produce water from the upper Santa Rosa Formation for irrigation purposes, and yield about 40 gpm. These are wells 29-34-414 and 29-26-803.

Table 3 shows the approximate specific capacities of wells in the irrigated area. The specific capacities range from 0.4 to 183 gpm per foot of drawdown.

About 65 to 70 percent of the pumps are powered electrically, and most of the remainder, usually the larger wells, are powered by butane gas. A few wells use natural gas.

Pumps on the large-capacity wells are usually the standard turbine type. Submersible pumps are used in many wells that have relatively small yields. Pumps are selected and set on the basis of pumping tests which determine the maximum possible drawdown of the water level and the maximum well yield.

In Nolan County where soils are comparatively tight, irrigators generally gravity-flood individual crop rows from open discharge. However, in Mitchell County, sprinkler systems are used in more than 95 percent of irrigation operations. The sprinkler system causes a considerable addition to the pumping head, and commonly results in a reduction of pumping rate.

Behavior of Irrigation Wells

The following is an analysis of the behavior of wells in the Santa Rosa Formation during the course of an irrigation season and the following period of inactivity.

In a given pumping well the maximum rate of transmission of water occurs under artesian conditions when the water level is drawn down to the top of the producing strata; further lowering of the water level causes unwaterting of the saturated material, producing water-table conditions. This rate may be obtained by adjusting the pumping rate as necessary to approximately stabilize the water level at the top of the water-producing strata. If the induced recharge equals the rate of withdrawal, the well yield and water level will remain constant; if not, both will decline gradually.

If the pumping rate is not adjusted to stabilize the water level for artesian transmission, the water level will decline below the top of the water-producing strata. Subsequent unwaterting of sands by gravity drainage results in the availability of additional water from storage, which has the temporary effect of reducing the rate of decline of the water level. As pumping continues, artesian conditions progressively change to water-table conditions farther and farther from the pumped well, as the water level declines below the
<table>
<thead>
<tr>
<th>Well</th>
<th>Yield (gpm)</th>
<th>Drawdown (feet)</th>
<th>Specific capacity (gpm per foot)</th>
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</thead>
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<tr>
<td>29-34-207</td>
<td>* 50</td>
<td>133</td>
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<td>302</td>
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<tr>
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<td>106</td>
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<tr>
<td>505</td>
<td>130</td>
<td>113</td>
<td>1.2</td>
</tr>
</tbody>
</table>

* Yield reported by owner.
† Data from owner's records.
confining stratum. The water level will continue to decline in the well until it reaches the pump intake, at which point a marked decline in the well yield will occur.

If concentrated irrigation pumpage exceeds recharge in a given area it is expected that well yields should noticeably decline during the 2 to 3 months of seasonal pumpage as wells compete for both stored and transmitted water. Such performance is commonly reported in wells in the study area as some well yields decline 15 to 20 percent over the course of a pumping season. Interference between irrigation wells is frequently reported in nearly all areas of substantial development.

Irrigation wells are rarely pumped constantly over 60 days. They are generally not used at all from mid-September until late February. Upon cessation of seasonal irrigation pumpage a large inverted cone of depression exists in the water table or piezometric surface. It is caused by the extraction of ground water from storage in the aquifer and is replaced, at first, by water moving into it from all directions. Much of the recharge, however, comes to the irrigation area from the east as indicated by contours on Figure 14, the amount depending on the amount of regional precipitation received. Water levels subsequently rise in wells until pumping is resumed. If the recharge is adequate during the shut-down period, water levels will rise to about the same level they were before seasonal pumpage started, thus re-establishing the artesian conditions that prevailed under static conditions of the aquifer. If recharge is inadequate, the wells will show a decline in water level from one season to the next, which has been observed in areas of most concentrated development.

Water Levels in Wells

Water levels in wells in the lower Santa Rosa Formation range from 15 to 215 feet below land surface. The shallowest depths to water are along the streambeds of the North and South Forks of Champion Creek in Mitchell County, where the streambeds are at or below the water table. Greatest depths to water are in Nolan County. Table 5 shows depths to water in selected wells throughout the entire area studied. The average depth to water in the irrigated area of Nolan County is 140 to 150 feet, and 50 to 70 feet in the irrigated area of Mitchell County.

Because of the lenticular nature of sands in the Santa Rosa Formation, the hydrostatic head in the individual water-bearing zones may vary considerably at a particular locality. Saturated sands occur above the artesian water level of the lower Santa Rosa Formation in the Colorado City area and to the north and northeast. Generally, water levels are highest in wells penetrating the shallowest zones.

Figure 14 shows the altitude of water levels in wells, most of which were measured in 1960 and 1961. Observed changes in water levels over this 2-year period were generally less than 2 feet, which is insignificant in relation to the 20-foot contour interval employed on this map.
Changes in Water Levels

Since inception of this study it was recognized that changes in water levels are of singular importance in assessing the degree of permanence to be expected from wells of the developed irrigation area, the principal concern of this study. All available historical water-level data for this area were analyzed. Water-level data fall into four general categories:

1. two-measurement points, consisting of the oldest available measurement and a recent measurement in the same well, not necessarily measured in winter months;

2. annual measurements of winter static levels in observation wells from 1952 to 1963 (a part of the Texas Water Development Board's continuing Water-Level Observation Well Program);

3. annual measurements of winter static levels in many active irrigation wells and others, from November 1960 to February 1964; and

4. seasonal measurements, mainly in nonirrigation wells, to reveal the magnitude of drawdown in and near developed areas caused by irrigation pumpage.

Observed changes in each category were analyzed in relation to precipitation data in an attempt to predict the behavior of wells during periods of severe drought, normal rainfall, and greater than normal rainfall. The most significant conclusions of this report rest upon comparisons of winter static water-level measurements made in many irrigation wells from 1960 to 1964.

The water levels in irrigation wells generally fluctuate in seasonal cycles, being near the base of the aquifer during the pumping season and gradually rising toward a peak which is generally reached just prior to commencing pumpage the next year. This seasonal fluctuation of water levels is illustrated by hydrographs of Figure 15 which show effects of pumpage on water levels both near and away from active irrigation wells. Water levels in well 29-34-510, an unused well about 250 yards from active irrigation wells, declined 75 feet during the pumping season. Effects of regional irrigation pumpage are discernable in some wells up to a distance of 1.5 miles from the developed areas. The hydrographs on Figure 15 show the cyclic behavior of water levels in the irrigation area, and confirm the development of a regional cone of depression in the developed area during the irrigating season.

Comparative measurements made immediately prior to starting pumps each year for pre-watering should reveal whether the last season's pumpage has resulted in a net decline of water level in the well, assuming that static conditions prevail in the aquifer at the time of both measurements. Because of highly variable pumping practices and starting times, it is impossible to obtain measurements under static conditions in a large number of wells immediately prior to pumping--early pumpage in some wells destroys the static conditions of the aquifer. As an alternative to this procedure, it has been assumed that measurements made from November through February in a large number of wells should afford reasonably valid annual comparisons. Pumpage during this period is generally insignificant, and water levels should be at approximately the same stage of recovery each year.
Figure 15
Seasonal Measurements of Depth to Water in Selected Wells in or Near the Irrigation Area, and Monthly Precipitation at Colorado City, July 1962—March 1964
Texas Water Development Board in cooperation with Mitchell and Nolan Counties
References made in this report to winter static water levels of a particular year refer to December of that year, even though some of the measurements may have been made in January or February of the following year; for example, the 1963 winter measurements refer to measurements made in November and December of 1963 and January and February of 1964.

Oldest Available Comparisons of Water Levels.--During this study measurements were obtained in scattered wells where measurements dating back to 1946 were available. Comparisons of past and recent measurements are presented in Table 4. Most of the oldest water-level measurements are for wells in Nolan County, measured by the U.S. Geological Survey in 1946. In general, these data indicate that water levels have declined about 5 to 6 feet since 1946 in northwestern Nolan County. However, the 1946 water-level measurements were not acquired for comparative purposes as were the 1963 measurements, and may not reflect a static condition in all cases; the earlier data were obtained in summer months, the latter in winter months.

The data indicate that since 1946 water levels have declined about 7 feet at Roscoe and at the abandoned Sweetwater well field 4 miles south of Roscoe, and about 5 feet in the Champion area of Nolan County. In the Colorado City well field, water levels have risen 14 to 21 feet since 1946, reflecting cessation of pumping in the early 1950's. Historical water-level data are unavailable for Loraine municipal wells, and hence the effects of pumping on water levels there is unknown.

Water Levels in Observation Wells, 1952-63.--Unfortunately, no annual water-level data are available that are continuous from pre-drought years to the present. Earliest measurements in irrigation wells date back to 1952, a year well into the drought of 1951-56. Measurements in both active and abandoned irrigation wells, the Colorado City well field, and selected livestock wells were started by the U.S. Geological Survey in the period 1952-54 and have been made annually since then by Federal or State agencies during the months of December, January, or February. Figure 16 presents hydrographs of water levels in selected observation wells. The relationship of water levels to annual precipitation and cumulative departure from the average annual precipitation can be seen by comparing Figure 16 with Figure 3. Cumulative effects of the 1951-56 drought are reflected by the hydrographs, and also the effects of higher-than-average precipitation during 1957-63. Despite an excess of precipitation accrued during the latter period, the area has not fully regained the volume of water pumped during the drought years.

The water-level hydrographs correlate generally with the precipitation cumulative departure graph of Figure 3, illustrating a close relationship between the trend of water levels and regional rainfall. A net gain of about 25 inches of rain above the average annual precipitation was received at Colorado City from 1957 to 1963. Therefore, this period should have been optimum for water-level recovery because of a combination of less pumpage and more recharge. This is reflected in the hydrographs, some of which show a rising trend over the period, others showing a much slower decline than the generally sharp declines of the last years of the drought.

The full magnitude of water-level declines from 1951 to 1956, the drought years, is not available for any one well. Declines of 10 to 15 feet were recorded in two wells during 1956, the last drought year. It seems reasonable,
Figure 16
Annual Measurements of Depth to Water in Selected Wells in or Near the Irrigation Area, 1946-64
Texas Water Development Board in cooperation with Mitchell and Nolan Counties
Table 4.--Historical water-level measurements compared to recent measurements

<table>
<thead>
<tr>
<th>Well</th>
<th>Depth to water</th>
<th>Date</th>
<th>Depth to water</th>
<th>Date</th>
<th>Decline (feet)</th>
<th>Rise (feet)</th>
</tr>
</thead>
<tbody>
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<td>92.9</td>
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<td>--</td>
</tr>
<tr>
<td>34-701</td>
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<td>Mar. 1961</td>
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</tr>
<tr>
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<td>Jan. 1963</td>
<td>--</td>
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</tr>
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<td>--</td>
</tr>
<tr>
<td>507</td>
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<td>136.4</td>
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<td>603</td>
<td>88.0</td>
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<td>95.8</td>
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<td>7.8</td>
<td>--</td>
</tr>
<tr>
<td>808</td>
<td>139.5</td>
<td>July 1946</td>
<td>143.9</td>
<td>Feb. 1963</td>
<td>4.4</td>
<td>--</td>
</tr>
<tr>
<td>815</td>
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<td>127.9</td>
<td>do</td>
<td>7.5</td>
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</tr>
<tr>
<td>905</td>
<td>100.9</td>
<td>1928</td>
<td>104.7</td>
<td>Jan. 1964</td>
<td>3.8</td>
<td>--</td>
</tr>
<tr>
<td>906</td>
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<td>1928</td>
<td>109.9</td>
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<td>6.9</td>
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</tr>
<tr>
<td>919</td>
<td>97.4</td>
<td>Apr. 1950</td>
<td>104.4</td>
<td>Oct. 1963</td>
<td>7.0</td>
<td>--</td>
</tr>
<tr>
<td>42-205</td>
<td>87.8</td>
<td>May 1946</td>
<td>83.8</td>
<td>Mar. 1963</td>
<td>--</td>
<td>4.0</td>
</tr>
<tr>
<td>601</td>
<td>64.3</td>
<td>Jan. 1953</td>
<td>62.8</td>
<td>Jan. 1964</td>
<td>--</td>
<td>1.5</td>
</tr>
<tr>
<td>43-402</td>
<td>34.8</td>
<td>do</td>
<td>44.5</td>
<td>do</td>
<td>9.7</td>
<td>--</td>
</tr>
<tr>
<td>44-106</td>
<td>22.1</td>
<td>May 1946</td>
<td>27.2</td>
<td>Feb. 1962</td>
<td>5.1</td>
<td>--</td>
</tr>
<tr>
<td>108</td>
<td>47.7</td>
<td>July 1946</td>
<td>51.1</td>
<td>Jan. 1964</td>
<td>3.4</td>
<td>--</td>
</tr>
</tbody>
</table>

* Rise due to cessation of municipal pumpage, Colorado City well field.
therefore, to expect that declines of at least 30 to 40 feet were experienced in some wells over the period 1951-56 with an appreciable reduction of the aquifer's saturated thickness.

The hydrograph of well 29-44-106 (Figure 16), in Nolan County, shows that water-level declines which were established during the drought were essentially reversed after 1957 as a result of high rainfall.

The water level in well 29-34-401, in the abandoned Colorado City well field, has shown a uniformly consistent rise during 1956-63, probably resulting from a combination of additional recharge following the drought years and recovery from the drawdown caused by pumping in the last years of use in the early 1950's. Well 29-33-906, an occasionally used irrigation well, shows the same general pattern of recovery; its proximity to the Colorado City well field suggests that it may be subject to the same influences.

Notable on the hydrographs of Figure 16 are the rises of water levels in irrigation wells from the extremely dry year 1956 to the extremely wet year 1957. The water-level changes reflect responses to the effects of both decreases in recharge; the relative magnitude of either effect is unknown.

In some irrigation wells water-level trends appear to be anomalous to precipitation trends, probably as a result of variations in the amount and seasonal distribution of local precipitation.

The 1952-63 observation well data indicate that water levels are in the process of recovery from an unusually large deficit of precipitation since 1946, and that water levels are probably lower than usual. Of greatest significance to this study, however, is the trend of the water levels since 1957 in relation to precipitation. They indicate that higher-than-normal rainfall is in many areas capable of stabilizing or reversing downward trends of water levels caused by drought and pumpage such as occurred during 1951-56. However, the distribution of these observation wells, while covering a large area and many areas of pumpage, is insufficient for assessing adequacy of recharge in all areas. The foregoing analysis cannot be projected safely to undeveloped areas remote from these observation wells.

Changes in Water Levels, 1960-63.—An intensive program of winter water-level measurements in active irrigation wells was pursued in 1962 and 1963, using for comparison the measurements obtained during the reconnaissance investigation which began in 1960. The purpose of this program was to establish and analyze the behavior of water levels under the existing replenishment conditions in order to predict future water-level trends under similar, and less favorable, conditions of precipitation. Conditions for replenishment of water pumped from irrigation wells were generally favorable during 1960-63 owing to above-normal precipitation for the period.

Table 7 presents comparative winter water-level measurements used to construct Figures 17, 18, and 19, which show:

(1) net change of water levels in irrigation and other wells for approximately a 3-year period (1960-63), which consisted of three irrigating seasons (1961, 1962, and 1963) and was characterized by higher-than-normal annual rainfall;
net change of water levels during a 2-year period (1960-62), including the 1961 and 1962 pumping seasons which were characterized by higher-than-normal annual rainfall and lower-than-normal pumpage; and

net change of water levels for a 1-year period (1962-63) which includes the 1963 irrigation season of intensive pumpage necessitated by unfavorable seasonal distribution of rainfall.

Water-level changes on Figure 17 are principally for irrigation wells which have been used to some extent in each irrigation season of the 1960-63 period. Changes for other wells are included for comparison with those for the active irrigation wells. Analysis of Figure 17 shows that water levels in inactive wells marginal to developed areas closely correlate with water-level changes in wells in the developed area.

It is apparent that water levels in wells in the various areas represented on Figure 17 responded differently to the combined effects of recharge and pumpage during the 3-year period of observation. In grids 29-34 and 29-42 the water-level changes indicate that recharge generally exceeded discharge in the area. The water-level changes in these two grids ranged from -1.5 to +13.3 feet, with all but four wells showing rises.

In grids 29-36 and 29-44 recharge appears to have been approximately equal to the discharge. The areas of decline and rise of water levels were approximately equal, and both the declines and rises were generally slight. The water-level changes ranged from -3.1 to +3.4 feet.

Water levels declined in most of the wells in grids 29-35 and 29-43, indicating that the discharge in this area exceeded the recharge for the 3-year period. The water-level changes in these grids ranged from -9.0 to +4.4 feet, with most wells showing declines. In grid 29-35 the declines average about 4.5 feet. Thus the recharge in this area, which includes the Loraine municipal wells, was inadequate to sustain the pumpage for the 3-year period. In grid 29-43 the declines averaged about 2.5 feet.

Changes in Water Levels, 1960-62.--A study of water-level changes in irrigation wells during a two-season period (1961 and 1962) characterized by much higher than average rainfall and less than average pumpage is presented on Figure 18.

The water-level changes on Figure 18 indicate that recharge exceeded the discharge in grids 29-34, 29-36, and 29-42. In grids 29-34 and 29-42 the water-level changes ranged from -0.9 to +11.8 feet, with all but two wells showing rises. Grid 29-36 reflects the favorable effects of rainfall on the plateau area of northwestern Nolan County, where very slight declines were recorded in only 4 of the 17 wells studied. The changes in water levels ranged from -1.0 to +2.7 feet.

Figure 18 indicates that recharge was approximately equal to the discharge in grids 29-43 and 29-44 during the 1960-62 period. The water-level changes ranged from -4.6 to +4.0 feet, with more wells indicating rises than declines. Water levels in grid 29-43 generally rose during the 1960-62 period, except in the southern third of the grid, as compared with general declines for the period 1960-63 which includes the effects of unfavorable distribution of rainfall in 1963.
Only in grid 29-35 does it appear that discharge exceeded the recharge of the area. Despite highly favorable conditions of precipitation, water levels measured in central part of the grid generally declined from 1 to 4 feet. The declines were of a smaller magnitude than those for 1960-63. Parts of the grid, outside the central decline area, had substantial rises, thus indicating that some of the decline in the central area of the grid during 1960-62 was due in part to excessive concentration of pumpage.

Changes in Water Levels, 1962-63.---Figure 19 shows the changes in water levels in wells between the winters of 1962 and 1963, including a year of normal rainfall but unfavorable seasonal distribution that resulted in above-normal pumpage. Comparison of Figures 19 and 18 shows a marked contrast in the trends of water levels between the two periods.

Figure 19 shows no grids in which recharge exceeded discharge. Only in grids 29-34 and 29-42 did recharge equal discharge, where a sharp rising trend of the previous period was either sharply curtailed or reversed.

In grid 29-35, where the previous period had also shown discharge exceeding recharge, water levels continued downward at even a sharper rate than before and the area of decline expanded to include all but a very small area in the northeast corner of the grid. The range of water-level changes in the grid was from -8.4 to +1.5 feet.

Water-level measurements in grids 29-36, 29-43, and 29-44 also indicate that discharge exceeded recharge in 1963. The changes ranged from -4.0 to -3.2 feet, with only nine wells reflecting rises in water levels in contrast to the majority of rises reflected during 1960-62.

Chemical Quality

Criteria for judging the suitability of a particular water for municipal, industrial, and irrigation use were discussed under the general section on "Chemical Quality" (page 35). Selected chemical analyses of samples of ground water collected in the study area are presented in Table 8. Figure 20 shows locations of wells in the Santa Rosa Formation from which samples were collected, and selected chemical constituents analyzed. Inspection of Figure 20 reveals that the quality of water in the basal part of the Santa Rosa is considerably more mineralized in the west. Analyses of water from wells 29-34-414 and 29-35-108, which produce from the upper Santa Rosa Formation, show that the quality of water from these wells is inferior to the quality of water in the deeper sands of the area.

Water of a quality usable for municipal and most irrigation and industrial purposes occurs throughout the area east of Colorado City. Hardness, however, is always very high and will require softening for many municipal and industrial uses. For industrial purposes the silica content is generally acceptable, but bicarbonate and hardness, because of scale-forming properties, would cause water to be unsuitable for boiler use unless a treatment process is applied. Fluoride content is also marginally acceptable to excessive in many places. The amount of fluoride varies considerably from place to place, and ranges from 0.1 ppm to as much as 4.8 ppm. Water containing more than 1.5 ppm fluoride is not recommended for continuous consumption by children according to standards of the U.S. Public Health Service. All other standards for public supply are satisfied by water from the Santa Rosa Formation.
Ground water in and east of grids 29-35, 29-43, and 29-51 generally is less mineralized than to the west, having a fairly uniform quality which is generally represented by the following typical analysis:

<table>
<thead>
<tr>
<th>Substance</th>
<th>Concentration (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissolved solids</td>
<td>500-600</td>
</tr>
<tr>
<td>Hardness as calcium carbonate</td>
<td>270</td>
</tr>
<tr>
<td>Sulfate</td>
<td>70</td>
</tr>
<tr>
<td>Chloride</td>
<td>35</td>
</tr>
<tr>
<td>Bicarbonate</td>
<td>285</td>
</tr>
<tr>
<td>Boron</td>
<td>0.30</td>
</tr>
<tr>
<td>Silica</td>
<td>20</td>
</tr>
<tr>
<td>Fluoride</td>
<td>1.5</td>
</tr>
</tbody>
</table>

West from Loraine the quality of water becomes progressively more mineralized, particularly in sulfate concentrations. Water marginally acceptable for municipal use was formerly produced by wells at Colorado City. Ground water in that area shows a wide variation in quality, the concentration of dissolved solids generally increasing westward toward the Colorado River. The upper sands of the Santa Rosa were reportedly cased off in the municipal wells at Colorado City because of the poor quality water contained in them.

The quality of ground water east of the river has, in all but a few wells, been found by experience to be acceptable for irrigation of cotton. Water from wells 29-42-307, 29-43-123, and 29-35-905 seems anomalous in quality to water from other wells in the same areas and is believed to reflect some unknown contaminating source.

Water from well 29-34-207 is reported to have caused soil or crop damage over the past several years. According to Figure 21, a diagram for classification of irrigation waters, the water produced from this well has a medium sodium hazard but a very high salinity hazard. Bulletin 876 of the Texas Agricultural Experiment Station states: "Very high salinity water (C4) is not suitable for irrigation under ordinary conditions but may be used occasionally under special circumstances. The soils must be permeable, drainage must be adequate, irrigation water must be applied in excess to provide considerable leaching, and highly salt-tolerant crops should be selected." Soils on this farm appear to be quite sandy, but clay lenses are reported in the subsoil which may impede soil drainage. Irrigation was by sprinkling, and cotton was grown at the time of the reported damage. The chloride concentration of this water may have been the principal offender; the concentration was 670 ppm, which is about six to ten times higher than in any other nearby well. The source of this chloride is unknown.

Though generally regarded through experience as acceptable for irrigation of cotton and grain sorghums in Mitchell and Nolan Counties, Figure 21 shows the ground water in a large part of the irrigated area to be considerably high in salinity. The average salinity classification of ground water in Mitchell County is C3, and in Nolan County, C2 and C3. Bulletin 876 states further concerning class C3 salinity: "High salinity water cannot be used on soils with restricted drainage. Even with adequate drainage special management for salinity control may be required and plants with good salt tolerance should be selected."
Salinity hazard

very high

C3 C4

medium

CI C2

low

Conductivity - micromhos/cm (EC x 10^6) at 25°C.

S4

S3

S2

S1

Figure 21

Diagram for the Classification of Irrigation Waters

(After United States Salinity Laboratory Staff, 1954, p.80)

Texas Water Development Board in cooperation with Mitchell and Nolan Counties
The conditions specified for use of C3 water are met over a large part of Mitchell County, the soils generally being sandy with good drainage. Some areas of Mitchell County apparently having a dense red clay subsoil have employed C3 water for many years with apparently no detrimental effect on agriculture. With the exception of well 29-34-207, no report of plant or soil damage was received in Mitchell County, but in well 29-33-910, which is near the fresh-saline water interface, salt water was induced into the well by pumpage in 1962.

In Nolan County where the salinity hazard of ground water is generally somewhat less, soils are much more dense and drainage is probably not as adequate as in Mitchell County. Views based on previous experience conflict as to the merits of using Santa Rosa water on the gray-black dense soils of northwestern Nolan County. Although irrigation is generally regarded by well owners as economically advantageous, the belief has been expressed to the writer frequently in the course of well inventory that continuous seasonal irrigation of the same land with Santa Rosa water may impair soil fertility. Particularly has this been reported in connection with small gardens which are said to decline in productivity after the first year or two of irrigation. According to the classification shown of Figure 21, it appears that the use of Santa Rosa water on relatively tight soils of northwestern Nolan County may be capable of producing soil damage, since ground water ranges there in classification from C2 to C3.

Although a low sodium level (SAR) prevails generally in Santa Rosa water, a potential sodium hazard appears to exist due to generally high bicarbonate concentrations. Water containing large amounts of bicarbonate tend to precipitate calcium and magnesium carbonates when the soil becomes drier, increasing the sodium percentage in the soil moisture.

Where comparisons of an old and recent analyses are available for the same irrigation well it appears that changes in water quality have generally been favorable. However, studies of the quality of water in the Colorado City well field by the U.S. Geological Survey in 1946 tend to indicate that an increase in mineralization occurred with prolonged pumpage, particularly with respect to sulfate.

Contamination of Santa Rosa water by brine associated with oil drilling and producing operations has not been reported or detected during this study. However, in wells 29-33-202, 29-33-207, and 29-33-910 the water samples contained more chloride than sulfate, which differs from the usual pattern for ground water east of the Colorado River.

Utilization and Present Development

Figure 22 shows locations of all municipal, industrial, and irrigation wells, selected springs, and selected livestock and domestic wells. Data obtained for these are shown in Table 5.

Domestic and livestock wells commonly tap Santa Rosa sands over a large area. The volume of water produced from them was not determined but is believed small in comparison to amounts produced from the larger municipal, industrial, and irrigation wells.
There are 12 active municipal wells producing water from the Santa Rosa Formation east of the Colorado River. One well, 29-34-702, supplies water for a swimming pool in Colorado City. Four of the wells, in grid 29-35-7, supply water to Loraine, and 7 wells, in grids 29-36-5 and 29-36-6, supply the city of Roscoe. Five of the 7 active industrial wells are in grids 29-44-2 and 29-44-3 and are used by the Skelly Oil Company for water flooding of oil reservoirs. The other industrial wells are 29-34-405, used by the Standard Oil Company of Texas for oil production operations, and 29-34-718, used to supply a minnow pond.

In 1963 there were about 300 active irrigation wells in Mitchell and Nolan Counties--about 210 in Mitchell County and about 90 in Nolan County. Two of the wells in Mitchell County, 29-26-803 and 29-34-414, produce water from the upper Santa Rosa sand. Ground-water irrigation in the area began as early as 1936 with the operation of well 29-36-507 in Nolan County. There were probably less than 30 active irrigation wells in the study area prior to 1950. Thus, approximately 270 wells were developed during the past 13 years with principal development occurring from 1950 to 1956. Since 1956, due to more adequate rainfall, the average rate of development has probably been only 12 to 15 wells per year. A recent trend toward irrigation of row crops and pastures in both summer and winter is causing increased irrigation pumpage.

The following table shows approximate amounts of water pumped for municipal, industrial, and irrigation purposes during 1961, 1962, and 1963.

Principal pumpage from the Santa Rosa Formation, in acre-feet

<table>
<thead>
<tr>
<th>Year</th>
<th>Municipal</th>
<th>Industrial</th>
<th>Irrigation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1961</td>
<td>270</td>
<td>40</td>
<td>9,725</td>
<td>10,035</td>
</tr>
<tr>
<td>1962</td>
<td>272</td>
<td>126</td>
<td>10,436</td>
<td>10,834</td>
</tr>
<tr>
<td>1963</td>
<td>280</td>
<td>513</td>
<td>14,276</td>
<td>15,069</td>
</tr>
</tbody>
</table>

Of principal significance were irrigation withdrawals, which averaged about 11,500 acre-feet annually over the 3-year period, with a maximum of approximately 14,000 acre-feet in 1963.

Future Availability in Relation to Effects of Present Development

Water available to present and future wells in the Santa Rosa Formation is from two types of occurrence, which will be evaluated separately: recharge and storage. Future availability is predictable only from consideration of effects of present and past development on water levels, which were included in the preceding discussions.

Recharge.--Developed areas of the Santa Rosa Formation derive recharge both locally from the land surface and from undeveloped areas, including the Cretaceous sediments in Nolan County, which contribute water to the areas of development. The amount of recharge any one area might receive depends on a number of
factors such as soil and rock type, topography, extent of cultivation, and the intensity and distribution of rainfall.

The best indicator of the adequacy of recharge is the behavior of water levels in wells. The behavior of water levels, together with the amount of water pumped, can be used to estimate of the amount of water available on a continuing basis.

Based on Figure 18, which shows the changes in winter water-level measurements from 1960 to 1962, covering the pumping seasons of 1961 and 1962, recharge generally exceeded the discharge. During this period the average pumpage was about 10,400 acre-feet each year and they were years of above-normal rainfall. But even during years of favorable recharge, the area in the vicinity of and north of Loraine continued to show a decline of water levels, primarily due to the concentrated pumpage in this area.

Figure 19 represents the changes in winter water-level measurements from 1962 to 1963, which includes the pumping season of 1963. This was a year of normal rainfall, but the seasonal distribution was poor. During 1963, approximately 15,000 acre-feet of water was pumped. In most places the discharge exceeded the recharge, partly due to the poor distribution of rainfall which caused greater than normal pumpage. Thus, it would seem that not more than 15,000 acre-feet of pumpage annually could be depended upon on a perennial basis.

Figure 17 covers the entire period from the winter of 1960 to the winter of 1963 and includes the pumping seasons of 1961, 1962, and 1963. Rainfall was above normal during this period, and the average pumpage was approximately 12,000 acre-feet per year. Figure 17 indicates that recharge exceeded discharge in about one-third of the area, was equal to discharge in about one-third, and was less than discharge in the other one-third. Thus, about 12,000 acre-feet is available annually from the Santa Rosa Formation east of the Colorado River, under these conditions. To this amount could be added an increment of water now being lost by natural discharge into the Colorado River and its tributaries. The exact amount of natural discharge which could be intercepted by pumping is not known. The flow of the Colorado River averaged 3.2 cubic feet per second (a rate of about 2,300 acre-feet per year) over the dry period November 6, 1958 to May 31, 1959 at Colorado City. Not all of this amount would have been contributed from the area which is being considered in this report, nor would all of the area being considered have contributed to this flow.

It is estimated that between 12,000 and 15,000 acre-feet of water can be developed from the Santa Rosa Formation on a perennial basis, throughout its extent east of the Colorado River. In periods of drought or adverse distribution of annual rainfall with respect to agricultural requirements, regional pumpage would exceed recharge in nearly all areas having a large number of wells. In consideration of future development, therefore, it should be realized that during a drought such as occurred from 1951 to 1956, yields of wells are likely to decline seriously in areas having large concentrations of irrigation wells. Further development in these areas would accentuate the decline of yields in a particular developed area. It appears that only areas of very scattered development will sustain additional pumpage without causing progressive unwatering of sands and gravels until the economic limit of irrigation pumpage is reached.
Storage.--Most water pumped during the irrigation season is obtained from storage in the aquifer which is then, if the pumpage does not exceed recharge, replenished during the non-pumping season. If pumpage continually exceeds the recharge to the aquifer, then water is permanently removed from storage and water levels decline as the aquifer gradually is depleted. Under the latter condition, the availability of water must be related to the number of years that water in storage will sustain pumpage.

From an analysis of 87 drillers' logs of water wells, some of which are included in Table 6, the average percentage of sand and gravel in that total saturated thickness of the Santa Rosa Formation is about 65 percent, and the average thickness of sand and gravel is about 76 feet. During an irrigation season, most of the water pumped is from storage under water-table conditions. A specific yield of 0.15 was used to estimate the amount of water available from storage. Using this specific yield for the average thickness of sand and gravel, the total volume of water stored in the approximately 250,000 square miles of developed and potential irrigation area is about 2,000,000 acre-feet. Not all of this water can be recovered, as well yields will decline as the water levels decline. It is significant that when saturated thickness in a well decreases by 25 percent, the well's yield decreases by about 50 percent. Probably not more than one-half, or 1,000,000 acre-feet, could be recovered from storage under the present economics of irrigation pumpage.

In areas characterized by declining water levels the value of existing wells and future wells must be related to the amount of water in storage and the number of years that this water can sustain pumpage. Water levels in wells north of Loraine declined an average of about 4.5 feet over the 1961-63 irrigation seasons. The average saturated thickness of the aquifer in this area is about 140 feet. Projecting the 4.5-foot decline rate, which is probably low since it occurred under higher-than-average rainfall rates, in 15 years the saturated thickness will have decreased to about 70 feet with accompanying reduction in well yields. In no other area of the investigation have declines been so persistently great and irreversible, even during the wet years.

Even if the average annual recharge to the aquifer does not exceed 12,000 acre-feet per year, and the average annual pumpage was doubled (24,000 acre-feet per year), there is sufficient water in storage to allow this quantity of water to be pumped for approximately 80 years. But as pointed out before, as the saturated thickness decreases, so will the well yields, thus requiring more wells to produce the same amount of water.

Recommendations for Future Development

1. Wherever possible, new development should be restricted to areas outside of the areas having more than 1 foot of decline as shown on Figure 19. In areas of little or no decline the best prospects for development are those areas containing the maximum amount of saturated sand and gravel as shown on Figure 13.

2. Before developing new wells, historical water-level data should be examined to determine if water levels are already on a declining basis. If so, the economic value of the proposed well must be related to the number of years ground water in storage will sustain pumpage requirements.
3. New wells should be located beyond the radius of influence of existing wells.

4. Irrigation wells should largely be used only for per-watering except during droughts.

5. The trend toward pumpage of water the year-round for row crops of grass will greatly accelerate the decline of water levels. It is therefore suggested that irrigation be applied only to the use yielding the highest return.

6. Wherever possible, efforts should be made to retain all possible precipitation on permeable outcrops by tanks and dams, and to generally retard runoff by terracing.

Occurrence West of Colorado River

Discussion of the Santa Rosa Formation west of the Colorado River includes both lower and upper beds because of the relative importance of upper beds in this area. Water-quality data and reports by residents and well drillers indicate that no significant quantities of fresh water are available west of the river, hence the area was not studied in great detail. A representative well inventory was made of the area to provide information on the occurrence of water in the Santa Rosa and other formations west of the river.

Lithology and Structure

The Santa Rosa Formation west of the river appears to contain a much greater percentage of red clay or shale than east of the river. About 50 to 75 feet of sand and gravel is usually present at the base of the formation where it is exposed along the Colorado River and Beals Creek. The contact between the Santa Rosa Formation and the overlying Chinle Formation is not readily apparent in Mitchell County due to the presence of lenticular sands and thick red clay or shale zones in both formations. It appears, however, that a thick maroon shale and clay section which generally constitutes the land surface at higher elevations from Westbrook to the Howard County line is a part of the Chinle Formation and it is so considered in this study.

It also is not possible with certainty to define the subsurface contact of the Chinle and Santa Rosa Formations on gamma-ray logs. The structural position of the Santa Rosa Formation in relationship to the overlying Chinle and the underlying Permian rocks is shown on Figure 9. The thickness of the Santa Rosa Formation is approximately 250 to 300 feet, with the base of the Santa Rosa near the Howard County line being as deep as 900 feet below the land surface. The base of the Santa Rosa Formation as shown on Figure 8 generally dips westward and northwestward. A local high in the northwest corner of Mitchell County causes a reversal in the regional dip. The base of the Santa Rosa Formation along the west line of Mitchell County ranges from 300 to 550 feet below the level of the Colorado River.

Although the western limit of the Santa Rosa Formation outcrop is not delineated on Figure 5, the geologic map, all Triassic sediments in the study area eastward from the general vicinity of Westbrook are considered in this report to belong to the Santa Rosa Formation.
Hydrology

Water occurs in both the upper and lower sands of the Santa Rosa Formation west of the Colorado River. In the outcrop of the Santa Rosa Formation, water in the aquifer is recharged by rainfall and moves toward the river, as shown on Figure 14. The Colorado River has incised to and through the base of the aquifer in the lower half of Mitchell County and to considerable depths into the aquifer in the northern half of the county. The elevation of the bedrock channel of the river controls regional movement of the water, just as it does east of the river. The only usable quality water is contained in the shallow sands of the Santa Rosa Formation outcrop, east of the line on Figure 20 which marks the approximate western extent of water containing less than 3,000 ppm dissolved solids. Quality data reveal that no fresh water is produced from deep Santa Rosa wells any appreciable distance west of the river.

The shallow sand beds that yield fresh water derive their recharge locally through sandy outcrops. The water generally moves to the east, under water-table conditions, some of it discharging to small springs near the river. Perched water tables occur in the shallower beds of both the Santa Rosa and Chinle Formations.

The hydrology of the Santa Rosa sands in the deeper subsurface is more complex. The water in the Santa Rosa Formation in the downdip area, west of Westbrook, is under artesian head and moves to the east, opposite to the westward dip of the formation (Figures 6, 9, and 14). Water-level data on Figure 14 are from wells completed in the Santa Rosa and Chinle Formations. Wells 28-40-601 and 28-48-401 are completed in the Santa Rosa downdip from the outcrop area, and their water levels reflect a high artesian head. Because the artesian head decreases toward the Colorado River, recharge is from the west, although the area of recharge has not been determined. The gradient, although comparatively flat west of the river, causes an unknown amount of water to move continuously through the sands to discharge areas along the river and Beals Creek. It is probable that some water transmitted to the river from the west is moderately to highly mineralized.

Chemical Quality

Figure 20 shows selected chemical analyses of ground water, some of which were acquired during this study and some during a ground-water study conducted by the U.S. Geological Survey in 1948.

The analyses largely represent the quality of water in upper Santa Rosa beds, because development of water is principally from them. The quality of water at depths of 250 or more feet is shown to be moderately to highly mineralized by analyses of water from wells 28-32-704, 28-40-601, and 28-40-806. Several irrigation test wells drilled to the basal Santa Rosa sands reportedly encountered strong supplies of water at depths of 250 to 300 feet, but the water was too saline for agricultural use and became progressively more saline during pumping.

The quality of water in shallow Santa Rosa wells is highly variable, within short distances ranging from potable to highly mineralized. Sulfate exceeds desirable concentrations in nearly all wells. In the area west of the line marking the western extent of water containing less than 3,000 ppm dissolved.
Analyses of water from wells of varying depths in the outcrop areas show a wide range of chemical quality which bears no consistent relationship to depth; some wells may yield acceptable water for domestic use while others short distances away may contain highly mineralized water. Such quality occurs in areas where it is unlikely that contamination by oil-field operations is responsible for the variation. Since the quality varies so widely it would be difficult to detect possible contamination by oil-field brines; however, no complaints of such contamination were received during this study.

Present Development and Availability

This study revealed no major development of Santa Rosa water west of the Colorado River except for livestock watering. It thus appears that potential development of the aquifer would principally be for waterflooding of oil reservoirs.

Water suitable for most beneficial uses occurs only in upper sands, which are lenticular in character and reportedly are incapable of significant sustained withdrawals. Data are insufficient to estimate the quantity of water which is available. Reported yields of existing domestic and livestock wells range up to as much as 20 gpm.

Available electrical logs indicate that a significant quantity of highly mineralized water may be stored in basal Santa Rosa sands of western Mitchell County, but the logs are inadequate for accurate quantitative computations of storage. Nevertheless, they indicate an average thickness of potential water-bearing sand of about 150 feet over a 140-square-mile area of western Mitchell County west of Westbrook. Assuming a specific yield of 0.15, about 2,000,000 acre-feet of highly mineralized water is stored in the aquifer in this area. The amount of water available from recharge is unknown, but is probably small.

Trinity Group

The Trinity Group, which is the basal unit of Cretaceous rocks in this area, occurs throughout much of western Nolan County (Figure 5) and has significant potential as a source of water in much of this area. In northwestern Nolan County, it occurs beneath the Ogallala Formation or thin beds of limestone. In places the Trinity Group constitutes a common hydrologic unit with the underlying Santa Rosa Formation, and thus both are considered to comprise the principal aquifer in Mitchell and western Nolan Counties.

There is little development of water from the Trinity Group by large-capacity wells, and comparatively few hydrologic data are available to define the water-bearing characteristics of the sand.
Recharge, Movement, and Discharge

All water in the sand of the Trinity Group is derived from precipitation on its outcrop or from overlying Cretaceous limestones which serve as recharge conduits in areas where stress-type fracture systems and solutional openings extend down to the sand. Large surface depressions frequently seen in the area are indications of favorable recharge areas.

Cretaceous rocks in Nolan County essentially constitute a large isolated erosional remnant, or outlier, of the Edwards Plateau. The Trinity Group outcrop is exposed along the margins of the outlier. Movement of water in the Trinity Group is outward from central areas of the outlier, where the water table is highest, toward the outcrop areas along the periphery of the outlier, which is at lower elevations. (See Figures 5 and 14.)

In most areas, outcrop data and logs indicate that water in the Trinity sand moves along the top of impervious shale or clay of the underlying Santa Rosa Formation. But where sands of the two units are in contact, water from the Trinity Group moves directly into the Santa Rosa Formation.

Water discharged from the Trinity Group and which does not enter the Santa Rosa Formation is, for the most part, lost to evapotranspiration or spring flow along the periphery of the Trinity outcrop. The amount of recharge moving into the Santa Rosa Formation from the Trinity sand cannot be computed.

Water-Bearing Characteristics

The Trinity Group ranges in thickness from 60 to about 100 feet and averages about 80 feet throughout the area. Figure 13 shows the saturated thickness of the Santa Rosa Formation and Trinity Group. South of the Panhandle and Santa Fe Railroad, southwestern Nolan County, the contours on Figure 13 represent almost exclusively the Trinity Group, whereas north of the railroad it represents a combination of both the Trinity Group and Santa Rosa Formation.

Water-level and log data indicate that water in the Trinity Group is entirely under water-table conditions. No pumping tests were made on the Trinity Group sand in this investigation, but in other Edwards Plateau areas having a similar saturated thickness of Trinity Group sand, coefficients of transmissibility of 3,000 to 5,000 gpd per foot have been determined. The specific yield was not determined but is estimated to be about 0.15.

The average reported yield of the Trinity Group, where tested for irrigation or oil-rig supply, is about 100 gpm or less. In areas marginal to the Trinity Group outcrop, saturated thickness and well yields are very small, but they increase toward interior areas of the Cretaceous outlier. Reported yields of existing irrigation wells in areas of maximum saturated thickness range from 70 to 500 gpm. However, from available data the large yield seems to be quite exceptional for the Trinity Group sand. The source of water in these large wells is reported to be sand and small gravel of the Trinity Group. Test wells drilled south of large-capacity (500 gpm) well 29-52-307 yielded only 70 and 170 gpm indicating highly local occurrence of such large yields.
Water Levels

Historical water-level data are not available for wells completed in the Trinity Group in western Nolan County. Comparative measurements of the water level in well 29-53-205 during this study indicate that the water level has risen somewhat since 1960 in the Maryneal area.

Depths to water in the Trinity Group sand range from a few feet in outcrop areas to 215 feet in the high plateau area. Water levels generally are below the base of the limestone of the Fredericksburg Group or only slightly above it (Figures 9, 10, and 11).

Chemical Quality

Concentrations of chemical constituents in water from the Trinity Group sand are shown in Table 8 for selected wells. The water is invariably high in hardness and bicarbonate, making it desirable to soften the water before using it for municipal supply and for boiler-feed water. The dissolved solids do not exceed 400 ppm, and sulfate and chloride concentrations are generally very low. Fluoride concentrations range from 0.2 to 1.1 ppm, which is within the limits of the U.S. Public Health Service standards. Boron concentrations, which are particularly important in irrigation of stone-fruit trees, range from 0.25 to 0.42 ppm, which is acceptable.

No reports of contamination of water by oil-field brines were received during the well inventory of this area and none is indicated by analyses of water sampled during this study. It is possible that brine may still be detectable in northern areas of the Nena Lucia oil field where in 1959 brine was found entering the sands of the Trinity Group from the bottom of unlined earthen disposal pits. Since then, the use of such pits has ceased and brine is now disposed of into the deep subsurface.

Utilization and Present Development

Only four irrigation wells (29-44-901, 29-44-903, 29-52-307, and 29-53-208) obtained water exclusively from the Trinity Group. The estimated pumpage from these wells, based on a reported 60-day pumping season, is about 230 to 240 acre-feet per year. All four of the wells were drilled since 1958.

Many livestock and domestic wells obtain water from the Trinity Group sand over a large area, and an undetermined number of oil-rig supply wells frequently pump 10 to 20 gpm over extended periods.

Ground Water Available for Development

As overall recharge is probably limited, and that which moves into the Santa Rosa Formation has been considered with the availability discussed previously for the Santa Rosa Formation east of the Colorado River, the amount of water in storage is the important aspect of availability in the Trinity Group. The type and distribution of log control for Cretaceous sediments does not permit an accurate estimate of water in storage; however, selected data indicate that an average of about 60 feet of Trinity Group sand is saturated under the
The undissected interior area of the plateau, an area of about 70 square miles. Using a specific yield of 0.15 and an average saturated thickness of 60 feet, about 400,000 acre-feet of water is stored under the area.

The amount of water available to a well on a sustained basis at a given location will depend upon the local transmission capacity of the Trinity Group and the adequacy of recharge, and should be determined by long-term pumping tests. Recharge is undoubtedly inadequate to sustain concentrated irrigation pumpage in any locality, and the duration of such development would be related to the rate of water-level decline and saturated thickness.

**Minor Aquifers**

All other ground water in Mitchell and western Nolan Counties is in the Chinle Formation, Fredericksburg Group, Quaternary alluvium, Ogallala Formation, or Permian rocks and is of comparatively minor importance, although each water-bearing unit is locally important for domestic or livestock-watering purposes. Table 1 briefly summarizes the water-bearing properties of these units, and chemical analyses of water from these aquifers are shown in Table 8. Locations of these aquifers are shown on the geologic map (Figure 5), except for the Chinle Formation.

Permian rocks are exposed principally in the southeastern quarter of Mitchell County. Wells generally penetrate less than 100 feet of Permian rocks, and yield small quantities of moderately to highly mineralized water.

The lower boundary of the Chinle Formation on the outcrop is not precisely defined, but generally occurs in the vicinity of Westbrook and to the west. The Chinle generally yields only small quantities of moderately to highly mineralized water from fine-grained sandstones near the surface.

The Fredericksburg Group consists of as much as 200 feet of calcareous sediments overlying the Trinity Group in western Nolan County. In places, solution openings in the Edwards Formation yield small to moderate supplies of good quality water to domestic wells. The Edwards Formation outcrop is characterized by many large, circular areas of interior drainage, or sinks, which are the result of collapse into solution-formed openings and provide a source of recharge to the underlying sands.

The Ogallala Formation occurs in the northwest part of Nolan County in the vicinity of Roscoe and as small remnants in western Mitchell County. In Nolan County, the Ogallala consists of a maximum of 40 to 50 feet of caliche, and sand and gravel interbedded with light-colored clay. The Ogallala in Nolan County is entirely above the regional water table and is not a source of water, but does constitute an effective recharge conduit to the saturated sand and gravel of the Santa Rosa Formation and Trinity Group below. In western Mitchell County, the Ogallala consists of a maximum of 100 feet of unconsolidated sand with a zone of coarse gravel at the base. The Ogallala generally yields small quantities of usable quality water to domestic and livestock wells.

Quaternary alluvium occurs both east and west of the Colorado River in Mitchell County, but east of the river the deposits are not a source of water because they occur as very thin mantles of caliche, sand, and gravel overlying Triassic strata. In southwestern Mitchell County, the alluvium ranges up to
100 feet in thickness, yielding small to moderate quantities of fresh water to livestock and domestic wells.

In recent years brine disposed into unlined earthen pits contaminated ground water in the alluvium overlying Triassic beds in the Turner-Gregory oil field (grid 29-40-7), and may have also entered the Triassic beds. The Texas Railroad Commission has since issued a "no pit" order in this field. Although no reports of contamination came to the writer, it was noted that in the Westbrook oil field, which embraces a large area trending from southwest of Westbrook to Cuthbert in northwestern Mitchell County, produced brine is reportedly discharged directly to surface drainage or into pits, usually dug on red clay or shale outcrops. It is evident from the condition of the surface at many places in the field that such disposal practices have been employed for many years. In much of this area, however, shallow ground water is naturally highly mineralized and seldom used. Surface-disposed brine in this area which does not fine its way into the shallow Santa Rosa or Chinle beds ultimately must be carried by runoff into Lake Colorado City.

SUMMARY AND CONCLUSIONS

Since about 1950, an irrigation area of about 200 square miles with about 300 wells has been developed in northeastern Mitchell and northwestern Nolan Counties. Most of the wells were drilled during the drought years, 1951 to 1956, to supplement rainfall on cotton, grain sorghum, or pastures. Since 1956, development has continued at a steady, but comparatively slower rate due to higher-than-average regional rainfall. Most wells are completed in the Santa Rosa Formation of Triassic age.

Recognizing that there are now appreciably more wells than in the worst years of the drought and that declining yields were suspected in some wells, the Commissioners Courts of Mitchell and Nolan Counties entered into a cooperative agreement with the Texas Water Commission to make a study of the water resources of Mitchell and western Nolan Counties with principal emphasis to be placed on hydrologic effects of past irrigation development and projection of those effects to future periods of drought and normal rainfall.

A study of available historical water-level data with principal emphasis on the periods 1952-63 and 1960-63 in relation to pumpage determined for 1961, 1962, and 1963 indicated that water levels and, consequently, yields of all irrigation wells are solely dependent upon regional rainfall for replenishment of water removed by pumping. Only in wet periods, like the 1961 and 1962 seasons, will recharge be adequate to sustain water levels in most of the existing wells. Even under such favorable conditions, water levels and yields of some wells in heavily developed areas continue to decline.

Under drought conditions as in 1951-56, assuming pumpage at the 1963 level of 15,000 acre-feet per year, water levels in all developed areas are expected to decline significantly, up to as much as 35 to 50 feet, accompanied by substantial reduction of well yields.

Despite near-normal rainfall in 1963, approximately 80 percent of the wells measured showed declines in water levels. Pumpage in 1963 was approximately 15,000 acre-feet as compared with pumpage of about 10,000 and 11,000 acre-feet.
in 1961 and 1962, respectively. A recent trend toward irrigation of row crops and pastures in both summer and winter will cause a gradual increase in pumpage, with some variations in response to variations in rainfall.

It is estimated that between 12,000 and 15,000 acre-feet of water can be developed from the Santa Rosa Formation on a perennial basis, throughout its extent east of the Colorado River. In periods of drought, or adverse distribution of annual rainfall with respect to agricultural requirements, regional pumpage would exceed recharge in nearly all areas having a large number of wells. Only areas of very scattered development will sustain additional pumpage without causing progressive unwatering of sands and gravels.

The amount of water stored in the Santa Rosa sands and gravels within the developed and potential irrigation area is on the order of 2,000,000 acre-feet, but development of not more than one-half of this amount can be expected under present economics of irrigation pumpage. The large amount of water available from storage allows full development of the aquifer with a pumping rate equal to the average recharge of the aquifer during years of normal rainfall. By utilizing the water in storage, which can be replenished during years of above-normal rainfall, larger quantities of water can be pumped during drought years. It would be possible by depleting the aquifer to use both the recharge and available water in storage. About 24,000 acre-feet of water per year could be pumped for approximately 80 years, but as the saturated thickness decreases so will the well yields, thus requiring more wells to produce the same amount of water. The useful life of wells in areas showing persistent annual declines of water levels is dependent entirely upon the total saturated thickness and projected annual decline rates.

The quality of water in the basal Santa Rosa sands east of the Colorado River has been proven generally acceptable for irrigation of cotton despite excessive salinity classifications in some instances. It appears possible that without proper rotation of crops, irrigation with Santa Rosa water could eventually cause excessive salinity in soils of northwestern Nolan County.

Study of the Santa Rosa Formation west of the Colorado River revealed no significant supplies of normally usable water. Water acceptable for domestic use occurs only in sands at depths generally 100 feet or less, in some places there is no fresh ground water available. The quality of water in lower beds of the Santa Rosa Formation west of the river is sparsely documented by chemical analyses, but available information indicates it is too highly mineralized everywhere for most purposes except perhaps for flooding of oil reservoirs.

It is estimated that the sand of the Trinity Group of southwestern Nolan County contains about 400,000 acre-feet of water in storage. Recharge to the sand is believed to be inadequate to sustain concentrated pumpage in any one area without significant reduction of saturated thickness. At the present time only four irrigation wells are completed exclusively in the Trinity Group. Because anticipated well yields in the most favorable areas are not over 100 to 150 gallons per minute, with pumping lifts of 250 to 280 feet, it is unlikely that irrigation will become widespread.

The sand of the Trinity Group contains excellent quality water which has dissolved solids of less than 400 parts per million, and very low sulfate and chloride concentrations. The water is invariably high in hardness and bicarbonate, making it desirable to soften the water before using it for municipal supply and for boiler-feed water.
No significant new source of water of good quality was revealed by this study of Mitchell and western Nolan Counties. All water of generally acceptable quality in the subsurface is in strata above Permian rocks.

It is a principal conclusion of this study that additional irrigation withdrawals in substantially developed parts of the irrigation area will be almost entirely from aquifer storage, leading to progressively declining water levels and well yields until the economic limit of irrigation pumpage is reached.

An expanded network of annual water-level observation wells should be instituted utilizing some of the wells for which measurements were made in the winters of 1960-63. Available data indicate there is no present need for monitoring the quality of water in irrigation wells.
SELECTED REFERENCES


Livingston, Penn, and Bennett, R. R., 1944, Geology and ground-water resources of the Big Spring area, Texas: U.S. Geol. Survey Water-Supply Paper 913, 112 p.


Table 5.—Records of selected water wells, springs, and test wells

<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Casing Diameter (in.)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level/Method of measurement</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>902</td>
<td>E. E. Dunn</td>
<td>-- House</td>
<td>1949</td>
<td>70</td>
<td>6 70</td>
<td>Trc</td>
<td>32.4</td>
<td>32.4 July 1963</td>
<td>C</td>
<td>S</td>
<td>--</td>
<td>-- Rock-walled well.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>702</td>
<td>F. Carpenter</td>
<td>--</td>
<td>--</td>
<td>20</td>
<td>-- --</td>
<td>Ca</td>
<td>11.9</td>
<td>do</td>
<td>C</td>
<td>--</td>
<td>--</td>
<td>-- Rock-walled well.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>703</td>
<td>Mary Gatlin</td>
<td>--</td>
<td>--</td>
<td>21</td>
<td>36 21</td>
<td>Ca</td>
<td>2,258</td>
<td>12.5 July 1963</td>
<td>C</td>
<td>S</td>
<td>--</td>
<td>-- Concrete-pipe casing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>801</td>
<td>O. B. Strain</td>
<td>--</td>
<td>1946</td>
<td>93</td>
<td>6 --</td>
<td>Trc</td>
<td>2,240</td>
<td>57.6 May 1948</td>
<td>C</td>
<td>S</td>
<td>--</td>
<td>-- Reported strong supply.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>802</td>
<td>Albert Erwin</td>
<td>--</td>
<td>--</td>
<td>22</td>
<td>-- --</td>
<td>Ca</td>
<td>--</td>
<td>16.5 do</td>
<td>C</td>
<td>D,S</td>
<td>--</td>
<td>-- Reported strong supply of poor quality water.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>804</td>
<td>W. W. Hester</td>
<td>-- Longbottom</td>
<td>1953</td>
<td>80</td>
<td>6 80</td>
<td>Ca</td>
<td>2,261</td>
<td>7.4 do</td>
<td>T,E A, Irr</td>
<td>30</td>
<td>4</td>
<td>Drilled to 700 feet, plugged back to 90 feet; encountered salty water. Reported yield, 60 gpm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>805</td>
<td>J. B. Autry</td>
<td>--</td>
<td>1916</td>
<td>7 48</td>
<td>7 2,210</td>
<td>Ca</td>
<td>2.0</td>
<td>do</td>
<td>--</td>
<td>D</td>
<td>--</td>
<td>-- Reported yield, 5 gpm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>806</td>
<td>Cecil Erwin</td>
<td>--</td>
<td>--</td>
<td>14 60</td>
<td>-- 2,261</td>
<td>Ca</td>
<td>22.0</td>
<td>do</td>
<td>C</td>
<td>D</td>
<td>--</td>
<td>1½ Reported yield, 3-4 gpm of soft, potable water.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>901</td>
<td>Coleman Estate</td>
<td>--</td>
<td>--</td>
<td>115</td>
<td>6 20</td>
<td>Trd</td>
<td>2,238</td>
<td>65.1 May 1948</td>
<td>C</td>
<td>S</td>
<td>--</td>
<td>-- Reported strong supply.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

See footnotes at end of table.
Table 5.--Records of selected water wells, springs, and test wells--Continued

<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Diameter (in.)</th>
<th>Casing Depth (ft)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level 1)</th>
<th>Below land surface (ft)</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>* 39-801</td>
<td>Tom Jackson</td>
<td>Cliff Myrick</td>
<td>1939</td>
<td>203</td>
<td>6</td>
<td>Trd</td>
<td>2,251</td>
<td>89.4</td>
<td>do</td>
<td>C</td>
<td>D</td>
<td>--</td>
<td>--</td>
<td>1*</td>
<td>Reported strong supply, no water encountered above 200 ft.</td>
</tr>
<tr>
<td>* 901</td>
<td>Ben Van Tuyle</td>
<td>--</td>
<td>1918</td>
<td>12</td>
<td>52</td>
<td>12</td>
<td>Ca</td>
<td>2,217</td>
<td>6.4</td>
<td>do</td>
<td>J</td>
<td>D,S</td>
<td>--</td>
<td>1*</td>
<td>Supplied several families during drought in 1918. Reported yield, 10-12 gpm.</td>
</tr>
<tr>
<td>902</td>
<td>Pond &amp; Merritt</td>
<td>--</td>
<td>--</td>
<td>14</td>
<td>48</td>
<td>Ca</td>
<td>--</td>
<td>5.9</td>
<td>Mar. 1963</td>
<td>J</td>
<td>S</td>
<td>--</td>
<td>--</td>
<td>1*</td>
<td>Bottom of well in sand.</td>
</tr>
<tr>
<td>102</td>
<td>G. M. Solomon</td>
<td>--</td>
<td>1945</td>
<td>320</td>
<td>6</td>
<td>280</td>
<td>Trs</td>
<td>71.1</td>
<td>July 1963</td>
<td>C</td>
<td>S</td>
<td>--</td>
<td>--</td>
<td>2*</td>
<td>Water reported salty; sand 280-320 ft.</td>
</tr>
<tr>
<td>103</td>
<td>--</td>
<td>--</td>
<td>1945</td>
<td>12</td>
<td>56</td>
<td>13</td>
<td>Trc</td>
<td>11.7</td>
<td>July 1960</td>
<td>N</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>104</td>
<td>G. M. Solomon</td>
<td>--</td>
<td>1945</td>
<td>284</td>
<td>6</td>
<td>239</td>
<td>Trs</td>
<td>64.8</td>
<td>July 1963</td>
<td>C,W</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>201</td>
<td>Dutch Daws</td>
<td>--</td>
<td>1957</td>
<td>200</td>
<td>6</td>
<td>218</td>
<td>Trd</td>
<td>41.3</td>
<td>Mar. 1961</td>
<td>--</td>
<td>D</td>
<td>--</td>
<td>--</td>
<td>2*</td>
<td>Water well for water supply during recent drought.</td>
</tr>
<tr>
<td>202</td>
<td>J. C. Womack</td>
<td>--</td>
<td>1957</td>
<td>15</td>
<td>6</td>
<td>15</td>
<td>Trc</td>
<td>9.3</td>
<td>July 1963</td>
<td>S</td>
<td>D,S</td>
<td>--</td>
<td>--</td>
<td>2*</td>
<td>Water reported to have petroleum taste.</td>
</tr>
<tr>
<td>301</td>
<td>Ada Edwards</td>
<td>--</td>
<td>1943</td>
<td>139</td>
<td>6</td>
<td>139</td>
<td>Trd</td>
<td>110.6</td>
<td>May 1963</td>
<td>C,W</td>
<td>D,S</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>303</td>
<td>Lee Strain</td>
<td>--</td>
<td>1943</td>
<td>67</td>
<td>6</td>
<td>67</td>
<td>Trd</td>
<td>70.0</td>
<td>do</td>
<td>C,W</td>
<td>S</td>
<td>--</td>
<td>--</td>
<td>2*</td>
<td>--</td>
</tr>
<tr>
<td>310</td>
<td>T. G. Davenport</td>
<td>--</td>
<td>1943</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>Trd</td>
<td>--</td>
<td>--</td>
<td>C,E</td>
<td>D</td>
<td>--</td>
<td>--</td>
<td>1*</td>
<td>--</td>
</tr>
<tr>
<td>311</td>
<td>Muriel Thurman</td>
<td>--</td>
<td>1951</td>
<td>33</td>
<td>5</td>
<td>33</td>
<td>Trd</td>
<td>10.2</td>
<td>July 1963</td>
<td>J</td>
<td>D</td>
<td>--</td>
<td>--</td>
<td>1*</td>
<td>Reported strong supply of good quality water.</td>
</tr>
<tr>
<td>312</td>
<td>Cicero Martin</td>
<td>--</td>
<td>1951</td>
<td>100</td>
<td>6</td>
<td>20</td>
<td>Trd</td>
<td>88.6</td>
<td>do</td>
<td>C,E</td>
<td>D</td>
<td>--</td>
<td>--</td>
<td>1*</td>
<td>Reported yield, 4-5 gpm of poor quality water.</td>
</tr>
<tr>
<td>402</td>
<td>do</td>
<td>--</td>
<td>1935</td>
<td>240</td>
<td>6</td>
<td>230</td>
<td>Trd</td>
<td>44.8</td>
<td>do</td>
<td>C,W</td>
<td>A,S</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>Reported strong supply of salty water; artesian water-bearing sand at 193-230 ft; not used since 1960.</td>
</tr>
</tbody>
</table>

See footnotes at end of table.
| Well   | Owner            | Driller | Date completed | Depth of well (ft) | Casing Depth (ft) | Water-bearing unit | Altitude of land surface (ft) | Water level below land surface (ft) | Date of measurement | Method of lift | Use of water | Pump setting below land surface (ft) | Pump column size (in.) | Remarks                                                                 |
|--------|------------------|---------|----------------|--------------------|-------------------|-------------------|-------------------------|-----------------------------------|---------------------|---------------|-------------|--------------------------------------|-----------------------|------------------------------------------------|                      |
| 601    | R. R. Foster     | --      | --             | 300               | 8                 | --                | Trs 2,165               | 36.4                             | do                  | C, S         | --          | --                                    | --                    | Water not potable; reported strong supply.                               |
| 602    | Minor Bros.      | --      | 1920           | 65                | 36                | --                | Trd 2,150               | 33.8                             | July 1963            | C, W         | D           | 60                     | 14                    | Reported weak supply.                                               |
| 603    | Ed Strain        | --      | --             | 83                | 7                 | --                | Trs 2,181               | 47.1                             | July 1948            | --            | --          | --                                    | --                    | Test well for irrigation; reported water level 30 feet below land surface when drilled; reported yield, 250 gpm. |
| 607    | --               | --      | --             | 55                | 6                 | --                | Trs 2,146               | 23.4                             | July 1963            | C, W         | S           | --                                    | 14                    | Reported produces better quality water than neighboring wells.            |
| 608    | --               | --      | 1960           | 129               | 5                 | --                | Trs 2,171               | 60.4                             | do                  | J, D         | --          | --                                    | 14                    | Reported water-bearing sand at 100-129 ft.                                |
| 711    | T. E. Grant      | --      | --             | 25                | 36                | 25                | Ca                      | 2,190                            | 12.9                             | do            | C, W         | D           | 25                     | --                    | Water level measured while pumping; reported yield, 1-2 gpm.              |
| 712    | Bill Gregory     | --      | --             | 20                | 52                | 20                | Ca                      | 2,200                            | 7.1                             | do            | J, D         | --          | --                                    | 14                    | Brick curbing.                                                            |
| 713    | D. J. Henderson  | --      | --             | 263               | 5                 | 263               | Trd                     | --                               | --                                | --            | C, E         | Ind        | --                                    | 4                     | Too salty for irrigation use; reported yield, 10-12 gpm.                |
| 714    | T. A. Rees       | --      | --             | --                | --                | --                | Ca                      | --                               | --                                | --            | C, E         | S           | --                                    | --                    | Reported yield, 4-5 gpm.                                               |
| 715    | B. F. Elliott    | --      | --             | 20                | 6                 | --                | Ca                      | 2,176                            | 11.7                             | July 1963           | C, E         | D           | --                                    | 14                    | Reported strong supply of salty water.                                   |
| 716    | D. J. Henderson  | --      | --             | 45                | 36                | 45                | Ca                      | 2,212                            | 25.4                             | do            | J, D         | --          | --                                    | 14                    | Reported strong supply of potable water.                                 |
| 717    | F. E. York       | --      | --             | 70                | 6                 | --                | Trd 2,197               | 64.6                             | do                                | C, W         | A, S        | --          | --                                    | 14                    | Reported strong supply of potable water.                                 |
| 808    | do               | --      | --             | 300               | 10                | --                | Trs 2,170               | --                               | --                                | N, A, D      | --          | --          | --                                    | --                    | Reported weak supply of hard, potable water.                             |
| 901    | Burton Hines     | --      | --             | 21                | 30                | 21                | Trd 2,150               | 11.1                             | July 1963            | J, D         | --          | --                                    | 14                    | Reported weak supply of hard, potable water.                             |
| 902    | J. W. Lewis      | --      | --             | 41                | 5                 | 41                | Trd 2,121               | 20+                             | do                                | C, W         | D           | --          | --                                    | --                    | Reported weak supply of hard, potable water.                             |

See footnotes at end of table.
Table 5.--Records of selected water wells, springs, and test wells--Continued

<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Diameter of casing (in.)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level below land surface (ft)</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
</tr>
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<tbody>
<tr>
<td>* 47-604</td>
<td>Foster Ranch</td>
<td>--</td>
<td>--</td>
<td>106</td>
<td>4½</td>
<td>Tre</td>
<td>2,375</td>
<td>102.6</td>
<td>do</td>
<td>C, W</td>
<td>S</td>
<td>--</td>
<td>2</td>
<td>Water potable, but mineralized.</td>
</tr>
<tr>
<td>901</td>
<td>T. L. McKenney</td>
<td>--</td>
<td>--</td>
<td>61</td>
<td>4½</td>
<td>Ca</td>
<td>2,310</td>
<td>42.9</td>
<td>do</td>
<td>N</td>
<td>A, S</td>
<td>--</td>
<td>--</td>
<td>Water potable.</td>
</tr>
<tr>
<td>48-301</td>
<td>Westbrook Gin</td>
<td>--</td>
<td>--</td>
<td>171</td>
<td>5</td>
<td>Trs</td>
<td>2,155</td>
<td>30.3</td>
<td>June 1963</td>
<td>C, W</td>
<td>D</td>
<td>--</td>
<td>--</td>
<td>Water salty; formerly used to cool engines.</td>
</tr>
<tr>
<td>* 302</td>
<td>H. M. Rice</td>
<td>--</td>
<td>--</td>
<td>65</td>
<td>5½</td>
<td>Tre</td>
<td>2,168</td>
<td>44.9</td>
<td>do</td>
<td>C, W</td>
<td>D</td>
<td>--</td>
<td>1½</td>
<td>Water potable, but mineralized.</td>
</tr>
<tr>
<td>* 401</td>
<td>Etta Holt Brown</td>
<td>I. O. Fannin</td>
<td>1953</td>
<td>615</td>
<td>7</td>
<td>503</td>
<td>Trs</td>
<td>2,254</td>
<td>117.3</td>
<td>June 1963</td>
<td>N</td>
<td>A, Ind</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>* 601</td>
<td>Warren Costin</td>
<td>T. P. House</td>
<td>1962</td>
<td>212</td>
<td>5½</td>
<td>Trs</td>
<td>2,258</td>
<td>112.7</td>
<td>do</td>
<td>C, E</td>
<td>S</td>
<td>--</td>
<td>1½</td>
<td>Good quality water reported.</td>
</tr>
<tr>
<td>* 602</td>
<td>Mrs. J. M. Byrd</td>
<td>--</td>
<td>--</td>
<td>27</td>
<td>8</td>
<td>27 Tre</td>
<td>2,185</td>
<td>12.3</td>
<td>do</td>
<td>J</td>
<td>D</td>
<td>20</td>
<td>1</td>
<td>Reported strong supply.</td>
</tr>
<tr>
<td>603</td>
<td>D. J. Barber</td>
<td>--</td>
<td>--</td>
<td>63</td>
<td>6</td>
<td>Tre</td>
<td>2,178</td>
<td>39.9</td>
<td>do</td>
<td>N</td>
<td>A, S</td>
<td>--</td>
<td>--</td>
<td>Water potable.</td>
</tr>
<tr>
<td>604</td>
<td>Bedford Dunl</td>
<td>--</td>
<td>--</td>
<td>72</td>
<td>6½</td>
<td>Tre</td>
<td>2,230</td>
<td>47.0</td>
<td>do</td>
<td>C, W</td>
<td>A, S</td>
<td>--</td>
<td>--</td>
<td>Water potable.</td>
</tr>
<tr>
<td>605</td>
<td>Dalton Conaway</td>
<td>-- Blakely</td>
<td>1960</td>
<td>42</td>
<td>8</td>
<td>5 Trd</td>
<td>2,171</td>
<td>15.9</td>
<td>July 1963</td>
<td>J</td>
<td>D</td>
<td>--</td>
<td>1½</td>
<td>Unused; water-bearing zone reported at 32 ft; water potable but hard.</td>
</tr>
<tr>
<td>606</td>
<td>Jolette Rogers</td>
<td>--</td>
<td>--</td>
<td>86</td>
<td>5½</td>
<td>Tre</td>
<td>2,212</td>
<td>34.5</td>
<td>do</td>
<td>C, W</td>
<td>S</td>
<td>--</td>
<td>1½</td>
<td>Water potable.</td>
</tr>
<tr>
<td>902</td>
<td>J. D. Beal</td>
<td>--</td>
<td>--</td>
<td>53</td>
<td>6</td>
<td>Tre</td>
<td>2,255</td>
<td>38.0</td>
<td>do</td>
<td>C, W</td>
<td>S</td>
<td>--</td>
<td>--</td>
<td>Water potable.</td>
</tr>
<tr>
<td>55-902</td>
<td>J. B. Henderson</td>
<td>--</td>
<td>1953</td>
<td>80</td>
<td>5½</td>
<td>Ca</td>
<td>2,349</td>
<td>78.3</td>
<td>May 1963</td>
<td>C, E</td>
<td>S</td>
<td>80</td>
<td>2</td>
<td>Furnishes water for about 100 head of cattle; reported yield, 5-10 gpm.</td>
</tr>
</tbody>
</table>

See footnotes at end of table.
Table 5.—Records of selected water wells, springs, and test wells—Continued

<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Diameter (in.)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level(s)</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>906</td>
<td>H. L. Harkrider</td>
<td>do</td>
<td>1962</td>
<td>52 6 52</td>
<td>Ca</td>
<td>2,287</td>
<td>31.6</td>
<td>do</td>
<td>C, W</td>
<td>D</td>
<td>--</td>
<td>--</td>
<td>2 Water potable; reported yield, 1 gpm.</td>
</tr>
<tr>
<td>701</td>
<td>W. T. Scott</td>
<td>O. R. House</td>
<td>1953</td>
<td>62 5</td>
<td>Ca</td>
<td>2,304</td>
<td>44.5</td>
<td>Aug. 1963</td>
<td>C, E</td>
<td>D</td>
<td>--</td>
<td>--</td>
<td>Furnishes water for about 100 head of cattle; reported yield, 15 gpm.</td>
</tr>
<tr>
<td>901</td>
<td>Spade Ranch</td>
<td>--</td>
<td>--</td>
<td>6</td>
<td>Ca</td>
<td>--</td>
<td>11.5</td>
<td>July 1961</td>
<td>C, W</td>
<td>S</td>
<td>--</td>
<td>--</td>
<td>Reported weak supply.</td>
</tr>
<tr>
<td>902</td>
<td>do</td>
<td>1929</td>
<td>101</td>
<td>Ca</td>
<td>2,262</td>
<td>61.3</td>
<td>Nov. 1962</td>
<td>C, W</td>
<td>S</td>
<td>--</td>
<td>--</td>
<td>Reported yield, 6 gpm.</td>
<td></td>
</tr>
<tr>
<td>63-201</td>
<td>W. F. Stockton</td>
<td>--</td>
<td>--</td>
<td>100</td>
<td>Ca</td>
<td>2,419</td>
<td>83.8</td>
<td>Aug. 1963</td>
<td>C, W</td>
<td>S</td>
<td>--</td>
<td>--</td>
<td>Reported strong supply.</td>
</tr>
<tr>
<td>302</td>
<td>Spade Ranch</td>
<td>--</td>
<td>1951</td>
<td>80 6 80</td>
<td>Ca</td>
<td>2,310</td>
<td>77.4</td>
<td>Apr. 1963</td>
<td>C, W</td>
<td>S</td>
<td>--</td>
<td>--</td>
<td>Yielded 8 to 10 gpm when drilled; current reported yield, 2 gpm.</td>
</tr>
<tr>
<td>303</td>
<td>do</td>
<td>1963</td>
<td>90</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>C, W</td>
<td>S</td>
<td>--</td>
<td>--</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>29-25-701</td>
<td>Fuller</td>
<td>do</td>
<td>1963</td>
<td>151</td>
<td>Ca</td>
<td>--</td>
<td>43.5</td>
<td>May 1948</td>
<td>N, A</td>
<td>D</td>
<td>--</td>
<td>--</td>
<td>Abandoned due to caving.</td>
</tr>
<tr>
<td>702</td>
<td>R. E. Byrd</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>Ca</td>
<td>--</td>
<td>--</td>
<td>Flows</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>703</td>
<td>Robert McPhaul</td>
<td>--</td>
<td>1963</td>
<td>70</td>
<td>Ca</td>
<td>2,275</td>
<td>24.5</td>
<td>June 1963</td>
<td>J</td>
<td>D</td>
<td>--</td>
<td>--</td>
<td>2</td>
</tr>
</tbody>
</table>

* Asterisks indicate footnotes at end of table.
### Table 5: Records of selected water wells, springs, and test wells—Continued

<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>casing Diameter (in.)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level below land surface (ft)</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>29-25-705</td>
<td>J. D. Fuller</td>
<td>--</td>
<td>--</td>
<td>150</td>
<td>4½</td>
<td>Trs</td>
<td>2,242</td>
<td>99.0</td>
<td>June 1963</td>
<td>N</td>
<td>A,D</td>
<td>--</td>
<td>--</td>
<td>Water level measured 5 minutes after pumping ceased.</td>
</tr>
<tr>
<td>* 706</td>
<td>Robert McPhaul</td>
<td>--</td>
<td>--</td>
<td>68</td>
<td>--</td>
<td>Trs</td>
<td>2,228</td>
<td>34.4</td>
<td>do</td>
<td>C,E</td>
<td>S</td>
<td>--</td>
<td>1½</td>
<td></td>
</tr>
<tr>
<td>* 801</td>
<td>Longstring</td>
<td>--</td>
<td>--</td>
<td>143</td>
<td>--</td>
<td>Trs</td>
<td>2,210</td>
<td>88.2</td>
<td>Mar. 1963</td>
<td>C,W</td>
<td>D,S</td>
<td>--</td>
<td>--</td>
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<tr>
<td>901</td>
<td>J. J. Ford Est.</td>
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<td>--</td>
<td>100; 5</td>
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<td>Trs</td>
<td>2,225</td>
<td>81.1</td>
<td>Mar. 1963</td>
<td>C,W</td>
<td>D,S</td>
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</tr>
<tr>
<td>902</td>
<td>Alvarez</td>
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<td>--</td>
<td>101</td>
<td>5½</td>
<td>Trs</td>
<td>2,190</td>
<td>52.5</td>
<td>do</td>
<td>C,W</td>
<td>D,S</td>
<td>--</td>
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<td></td>
</tr>
<tr>
<td>* 903</td>
<td>Otis Chalk Ranch</td>
<td>--</td>
<td>--</td>
<td>100</td>
<td>6</td>
<td>Trs</td>
<td>2,182</td>
<td>79.9</td>
<td>Dec. 1963</td>
<td>C,E</td>
<td>D</td>
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</tr>
<tr>
<td>* 26-702</td>
<td>Feaster Estate</td>
<td>--</td>
<td>--</td>
<td>115</td>
<td>3½</td>
<td>Trs</td>
<td>2,293</td>
<td>60.2</td>
<td>July 1963</td>
<td>C,E</td>
<td>D</td>
<td>--</td>
<td>2</td>
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<tr>
<td>* 801</td>
<td>F. W. Merket</td>
<td>O. R. House</td>
<td>1961</td>
<td>332; 10</td>
<td>332</td>
<td>Trs</td>
<td>2,359</td>
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<td>Irr</td>
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<td>803</td>
<td>F. W. Merket</td>
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<td>6</td>
<td>90</td>
<td>Trs</td>
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<td>Nov. 1962</td>
<td>S</td>
<td>Irr</td>
<td>85</td>
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<td>Lane Compton</td>
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<td>--</td>
<td>35</td>
<td>--</td>
<td>Trs</td>
<td>2,318</td>
<td>22.1</td>
<td>June 1963</td>
<td>N</td>
<td>A,T</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>902</td>
<td>W. R. Dunn</td>
<td>--</td>
<td>--</td>
<td>1910</td>
<td>180</td>
<td>5</td>
<td>20</td>
<td>Trs</td>
<td>2,305</td>
<td>108.2</td>
<td>do</td>
<td>C,W</td>
<td>D</td>
<td>--</td>
</tr>
<tr>
<td>* 903</td>
<td>C. W. Valentine</td>
<td>--</td>
<td>--</td>
<td>91</td>
<td>5</td>
<td>Trs</td>
<td>2,331</td>
<td>43.3</td>
<td>do</td>
<td>C,W</td>
<td>D</td>
<td>--</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>904</td>
<td>Ernest Haggertor</td>
<td>Hopkins Drilg. Co.</td>
<td>1960</td>
<td>195</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>N</td>
<td>A,T</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>27-701</td>
<td>--</td>
<td>--</td>
<td>101; 5</td>
<td>--</td>
<td>Trs</td>
<td>2,406</td>
<td>76.4</td>
<td>Jan. 1961</td>
<td>S</td>
<td>D</td>
<td>--</td>
<td>--</td>
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<td></td>
</tr>
<tr>
<td>801</td>
<td>O. S. Riggs</td>
<td>--</td>
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See footnotes at end of table.
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<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
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<th>Diameter/Depth (in.)</th>
<th>Water-boring unit</th>
<th>Altitude below land surface (ft)</th>
<th>Water level below land surface (ft)</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
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<td>D, S</td>
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<td>124</td>
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<td>Trs</td>
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<td>do</td>
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<td>Trs</td>
<td>2,212</td>
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<td>Mar. 1961</td>
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<td>204</td>
<td>Del Barber</td>
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<td>--</td>
<td>96</td>
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<td>Trs</td>
<td>2,159</td>
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<td>June 1963</td>
<td>C, W</td>
<td>S</td>
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<td>207</td>
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<td>Trs</td>
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<td>O. L. Williams</td>
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<td>2,162</td>
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<td>do</td>
<td>S, S</td>
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<td>180</td>
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<td>Trs</td>
<td>2,232</td>
<td>103.0</td>
<td>Mar. 1961</td>
<td>C, W</td>
<td>D, S</td>
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<td>1945</td>
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<td>Trs</td>
<td>2,205</td>
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<td>May 1948</td>
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See footnotes at end of table.
Table 5.—Records of selected water wells, springs, and test wells—Continued

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<th>Well</th>
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<th>Depth of well (ft)</th>
<th>Diameter (in.)</th>
<th>Water-setting below land surface (ft)</th>
<th>other</th>
<th>Remarks</th>
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<td>6031 Del Barber</td>
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<td>1968</td>
<td>61</td>
<td>6</td>
<td>Trs 2,205</td>
<td>31.4</td>
<td>July 1963</td>
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<td>90</td>
<td>6</td>
<td>Trs 2,120</td>
<td>31.4</td>
<td>June 1963</td>
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<td>6041 Dr. H. C. Logsdon</td>
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<td>Trs 2,168</td>
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<td>5</td>
<td>Trs 2,133</td>
<td>83.2</td>
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<td>1953</td>
<td>160</td>
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<td>Trs 2,130</td>
<td>52.8</td>
<td>Aug. 1963</td>
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See footnotes at end of table.
Table 3.--Records of selected water wells, springs, and test wells--Continued

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<th>Diameter (in.)</th>
<th>Casing (in.)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level (ft)</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Remarks</th>
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<td>Roy Warren</td>
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<td>--</td>
<td>Trs</td>
<td>2,122</td>
<td>32.8</td>
<td>do</td>
<td>C, W</td>
<td>D, S</td>
<td>--</td>
<td>Water not potable.</td>
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<tr>
<td>803</td>
<td>Mrs. J. C. Costin, O. L. Williams</td>
<td>1962</td>
<td>40</td>
<td>5</td>
<td>40</td>
<td>Trs</td>
<td>2,156</td>
<td>20.6</td>
<td>July 1963</td>
<td>S</td>
<td>D</td>
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<td>Good quality water reported; used for irrigating lawn.</td>
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<td>804</td>
<td>Don Pritchett</td>
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<td>1963</td>
<td>57</td>
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<td>Trs</td>
<td>2,150</td>
<td>25.2</td>
<td>do</td>
<td>N</td>
<td>Ind</td>
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<td>806</td>
<td>Clay Smith</td>
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<td>72</td>
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<td>2,148</td>
<td>52.2</td>
<td>do</td>
<td>C, W</td>
<td>D</td>
<td>--</td>
<td>2</td>
</tr>
<tr>
<td>807</td>
<td>Harold Letcher</td>
<td>--</td>
<td>--</td>
<td>137</td>
<td>--</td>
<td>Trs</td>
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<td>107.6</td>
<td>May 1946</td>
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<td>6</td>
<td>Trs</td>
<td>--</td>
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<td>--</td>
<td>C, W</td>
<td>D, S</td>
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<td>809</td>
<td>L. E. Jordan</td>
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<td>Trs</td>
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<td>D</td>
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<tr>
<td>811</td>
<td>Col-Tex Refinery, House</td>
<td>1934</td>
<td>155</td>
<td>8</td>
<td>--</td>
<td>Trs</td>
<td>--</td>
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<td>--</td>
<td>N</td>
<td>A, Ind</td>
<td>--</td>
<td>Supplied refinery; reported yield, 17 gpm.</td>
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<td>--</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
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<td>T, E</td>
<td>A, Ind</td>
<td>4</td>
<td>Supplied refinery; reported yield, 66 gpm.</td>
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<td>816</td>
<td>R. H. Ratliff, Bill Justice</td>
<td>1956</td>
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<td>160</td>
<td>Trs</td>
<td>2,072</td>
<td>--</td>
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<td>T, G</td>
<td>Irr</td>
<td>148</td>
<td>Quality reported to have begun deteriorating in 1961; reported yield, 170 gpm.</td>
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See footnotes at end of table.
Table 5.--Records of selected water wells, springs, and test wells--Continued

<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Diameter (in.)</th>
<th>Water level below land surface (ft)</th>
<th>Water level measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
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<td>Standby well; reported yield, 30 gpm.</td>
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<td>913</td>
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<td>1934</td>
<td>155</td>
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<td>T, E</td>
<td>A, Ind</td>
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<td>Standby well; reported yield, 37 gpm.</td>
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<td>George Callan O. R. House</td>
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<td>50</td>
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<td>8</td>
<td>T, E</td>
<td>C, W</td>
<td>D</td>
<td>--</td>
<td>--</td>
<td>Reported strong supply.</td>
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<tr>
<td>a 915</td>
<td>Victoria Enderly</td>
<td>do</td>
<td>1962</td>
<td>142</td>
<td>6</td>
<td>T, E</td>
<td>S</td>
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<td>Mary Johnson</td>
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<td>1923</td>
<td>220</td>
<td>5</td>
<td>T, E</td>
<td>S, D, S</td>
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<td>--</td>
<td>Water not potable; reported yield, 10 gpm.</td>
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<tr>
<td>a 106</td>
<td>Lyndon Solomon</td>
<td>do</td>
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<td>200</td>
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<td>202</td>
<td>T, E</td>
<td>Irr</td>
<td>198</td>
<td>4</td>
<td>Discharge to 22 5-gpm sprinklers.</td>
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<tr>
<td>107</td>
<td>Ernest Brown</td>
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<td>90</td>
<td>6</td>
<td>T, E</td>
<td>Irr</td>
<td>198</td>
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<td>Discharge to 22 5-gpm sprinklers.</td>
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<td>H. G. Kruse John Weir</td>
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<td>T, E</td>
<td>Irr</td>
<td>178</td>
<td>3</td>
<td>Application rate measured for discharge to sprinkler system, 37 gpm (Mar. 1963); &quot;red beds&quot; encountered at 190 ft. Reported yield, 69 gpm.</td>
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<td>T, E</td>
<td>Irr</td>
<td>--</td>
<td>--</td>
<td>Irrigation test well.</td>
<td></td>
<td></td>
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<tr>
<td>204</td>
<td>do O. R. House</td>
<td>1961</td>
<td>183</td>
<td>6</td>
<td>130</td>
<td>T, E</td>
<td>Irr</td>
<td>165</td>
<td>3</td>
<td>Application rate measured for open discharge; 29 gpm (Mar. 1962); &quot;red beds&quot; encountered at 183 ft.</td>
<td></td>
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<tr>
<td>205</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>150</td>
<td>6</td>
<td>T, E</td>
<td>Irr</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>206</td>
<td>Grady Ezell O. R. House</td>
<td>1949</td>
<td>205</td>
<td>10</td>
<td>205</td>
<td>T, E</td>
<td>Irr</td>
<td>178</td>
<td>4</td>
<td>Discharge to sprinkler system; reported yield, 50 gpm.</td>
<td></td>
<td></td>
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<tr>
<td>a 207</td>
<td>do</td>
<td>do</td>
<td>1956</td>
<td>178</td>
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<td>T, E</td>
<td>Irr</td>
<td>175</td>
<td>4</td>
<td>Discharge to sprinkler system; pumping level, 146 ft; reported yield, 50 gpm.</td>
<td></td>
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</tbody>
</table>

* See footnotes at end of table.
Table 5.--Records of selected water wells, springs, and test wells--Continued

<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Diag. Diameter (in.)</th>
<th>Water bearing unit</th>
<th>Altitude below land surface (ft)</th>
<th>Water level ( y ) below land surface (ft)</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>29-34-208</td>
<td>H. G. Kruse</td>
<td>John Weir</td>
<td>--</td>
<td>188</td>
<td>6</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>S</td>
<td>Irr</td>
<td>180</td>
<td>Application rate measured for discharge to sprinkler system, 37 gpm (Mar. 1963); reported yield, 65 gpm.</td>
</tr>
<tr>
<td>210</td>
<td>H. G. Kruse</td>
<td>do</td>
<td>1962</td>
<td>160</td>
<td>5</td>
<td>92</td>
<td>Trs</td>
<td>2,197</td>
<td>--</td>
<td>--</td>
<td>S</td>
<td>D</td>
<td>--</td>
<td>Yielded over 35 gpm on bailer test when drilled.</td>
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<tr>
<td>212</td>
<td>Grady Ezell</td>
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<td>1956</td>
<td>248</td>
<td>--</td>
<td>--</td>
<td>Trs</td>
<td>2,202</td>
<td>--</td>
<td>--</td>
<td>N</td>
<td>A, Irr</td>
<td>--</td>
<td>Reported small yield; well destroyed.</td>
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<tr>
<td>213</td>
<td>Leslie Hamilton</td>
<td>--</td>
<td>1962</td>
<td>64</td>
<td>6</td>
<td>--</td>
<td>Trs</td>
<td>2,232</td>
<td>42.4</td>
<td>June 1963</td>
<td>C, W</td>
<td>D</td>
<td>--</td>
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<tr>
<td>* 301</td>
<td>C. L. LeFerre</td>
<td>U. Compton</td>
<td>1952</td>
<td>230</td>
<td>8</td>
<td>160</td>
<td>Trs</td>
<td>2,213</td>
<td>20.1</td>
<td>Jan. 1964</td>
<td>T, E</td>
<td>Irr</td>
<td>185</td>
<td>Application rate measured for discharge to sprinkler system, 158 gpm (Mar. 1963); reported yield, 290 gpm.</td>
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<tr>
<td>* 302</td>
<td>Mrs. C. G. Smith</td>
<td>Sam Smith</td>
<td>1956</td>
<td>290</td>
<td>10</td>
<td>290</td>
<td>Trs</td>
<td>97.6</td>
<td>--</td>
<td>do</td>
<td>T, G</td>
<td>Irr</td>
<td>275</td>
<td>Application rate measured for discharge to sprinkler system, 179 gpm (Aug. 1963); reported yield, 220 gpm.</td>
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<tr>
<td>303</td>
<td>R. H. McDaniel</td>
<td>--</td>
<td>1933</td>
<td>100</td>
<td>5</td>
<td>30</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>G, E</td>
<td>D</td>
<td>--</td>
<td>Reported yield, 4-5 gpm.</td>
</tr>
<tr>
<td>* 401</td>
<td>Colorado City</td>
<td>--</td>
<td>1947</td>
<td>250</td>
<td>8</td>
<td>250</td>
<td>Trs</td>
<td>2,169</td>
<td>109.5</td>
<td>Jan. 1964</td>
<td>T, E</td>
<td>A, P</td>
<td>175±</td>
<td>Standby well; formerly supplied city; reported yield, 50 gpm.</td>
</tr>
<tr>
<td>402</td>
<td>Huron Gist</td>
<td>--</td>
<td>1939</td>
<td>150</td>
<td>4</td>
<td>--</td>
<td>Trs</td>
<td>71.4</td>
<td>May 1946</td>
<td>G, E</td>
<td>D</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>403</td>
<td>E. L. Dorn</td>
<td>--</td>
<td>1942</td>
<td>220</td>
<td>6</td>
<td>166</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>G, E</td>
<td>D</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>404</td>
<td>Earl Hunter</td>
<td>--</td>
<td>1945</td>
<td>220</td>
<td>4</td>
<td>196</td>
<td>Trs</td>
<td>33.5</td>
<td>May 1966</td>
<td>G, W</td>
<td>D, S</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>405</td>
<td>Standard Oil of Texas</td>
<td>--</td>
<td>1930</td>
<td>210</td>
<td>10</td>
<td>210</td>
<td>Trs</td>
<td>2,191</td>
<td>98.3</td>
<td>Jan. 1963</td>
<td>S</td>
<td>Ind</td>
<td>--</td>
<td>5</td>
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<tr>
<td>406</td>
<td>Richardson</td>
<td>Kuei Well Co.</td>
<td>1929</td>
<td>239</td>
<td>--</td>
<td>--</td>
<td>Trs</td>
<td>2,206</td>
<td>--</td>
<td>--</td>
<td>N, A, T</td>
<td>--</td>
<td>--</td>
<td>Test well for Colorado City.</td>
</tr>
<tr>
<td>407</td>
<td>Huron Gist</td>
<td>do</td>
<td>1929</td>
<td>233</td>
<td>4½</td>
<td>--</td>
<td>Trs</td>
<td>2,100</td>
<td>--</td>
<td>--</td>
<td>N, A, T</td>
<td>--</td>
<td>--</td>
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</table>

See footnotes at end of table.
### Table 5.—Records of selected water wells, springs, and test wells—Continued

<table>
<thead>
<tr>
<th>Well</th>
<th>Owners</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Diameter (in.)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level (ft)</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>29-34-608</td>
<td>Richardson</td>
<td>Kelly Well Co.</td>
<td>1929</td>
<td>177</td>
<td>--</td>
<td>Trs</td>
<td>2,117</td>
<td>--</td>
<td>N</td>
<td>A, T</td>
<td>--</td>
<td>--</td>
<td>Test well for Colorado City.</td>
</tr>
<tr>
<td>* 413</td>
<td>J. Bourland</td>
<td>Huron Gist</td>
<td>1950</td>
<td>203</td>
<td>7</td>
<td>165</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>T, C</td>
<td>Irr</td>
<td>4</td>
<td>Irrigation of grass from sprinkler system; reported yield, 100 gpm.</td>
</tr>
<tr>
<td>* 414</td>
<td>Irvin Grant</td>
<td>E. W. Martin</td>
<td>1952</td>
<td>215</td>
<td>8</td>
<td>30</td>
<td>Trs</td>
<td>2,178</td>
<td>Jan. 1964</td>
<td>S</td>
<td>Irr</td>
<td>40</td>
<td>Completed in upper Santa Rosa Formation; reported yield, 40 gpm.</td>
</tr>
<tr>
<td>419</td>
<td>Homer Rodine</td>
<td>do</td>
<td>1960</td>
<td>205</td>
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<td>--</td>
<td>Trs</td>
<td>2,151</td>
<td>Mar. 1961</td>
<td>S</td>
<td>D</td>
<td>--</td>
<td>Formerly used for irrigation; reported yield, 70± gpm.</td>
</tr>
<tr>
<td>420</td>
<td>E. P. Hines</td>
<td>do</td>
<td>1950</td>
<td>190</td>
<td>6</td>
<td>190</td>
<td>Trs</td>
<td>71.4</td>
<td>July 1963</td>
<td>T, E</td>
<td>D</td>
<td>--</td>
<td>Reported yield, 130± gpm.</td>
</tr>
<tr>
<td>423</td>
<td>Jack Bourland</td>
<td>Huron Gist</td>
<td>1907</td>
<td>218</td>
<td>8</td>
<td>--</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>T, E</td>
<td>Irr</td>
<td>--</td>
<td>Irrigation of grass from sprinkler system; reported yield, 100± gpm.</td>
</tr>
<tr>
<td>424</td>
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<td>O. R. House</td>
<td>1961</td>
<td>245</td>
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<td>180</td>
<td>Trs</td>
<td>2,206</td>
<td>Jan. 1964</td>
<td>S</td>
<td>Irr</td>
<td>225</td>
<td>Application rate measured for discharge to sprinkler system, 118 gpm (Mar. 1963); reported yield, 450± gpm.</td>
</tr>
<tr>
<td>425</td>
<td>C. B. Hines</td>
<td>do</td>
<td>1961</td>
<td>--</td>
<td>8</td>
<td>--</td>
<td>Trs</td>
<td>2,135</td>
<td>July 1963</td>
<td>T, E</td>
<td>Irr</td>
<td>--</td>
<td>Discharge to sprinkler system; operation began in 1963; reported yield, 70± gpm.</td>
</tr>
<tr>
<td>* 426</td>
<td>Irvin Grant</td>
<td>O. R. House</td>
<td>1961</td>
<td>220</td>
<td>8</td>
<td>160</td>
<td>Trs</td>
<td>2,178</td>
<td>Jan. 1964</td>
<td>S</td>
<td>Irr</td>
<td>210</td>
<td>Application rate measured for open discharge to earth tank, 60 gpm (Mar. 1963); reported yield, 200± gpm.</td>
</tr>
<tr>
<td>427</td>
<td>Jasper Wood</td>
<td>Kenneth House</td>
<td>1963</td>
<td>232</td>
<td>7</td>
<td>--</td>
<td>Trs</td>
<td>--</td>
<td>May 1963</td>
<td>S</td>
<td>Irr</td>
<td>--</td>
<td>Discharge to sprinkler system; reported yield, 120± gpm.</td>
</tr>
<tr>
<td>* 501</td>
<td>C. H. Dorn</td>
<td>do</td>
<td>1963</td>
<td>51</td>
<td>5</td>
<td>--</td>
<td>Trs</td>
<td>--</td>
<td>May 1966</td>
<td>D, S</td>
<td>--</td>
<td>Discharge to sprinkler system; reported yield, 120± gpm.</td>
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<tr>
<td>502</td>
<td>Doyle Gray</td>
<td>E. W. Martin</td>
<td>1952</td>
<td>210</td>
<td>10</td>
<td>210</td>
<td>Trs</td>
<td>2,185</td>
<td>Jan. 1964</td>
<td>S</td>
<td>Irr</td>
<td>175</td>
<td>Discharge to sprinkler system; reported yield, 20±25 gpm.</td>
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See footnotes at end of table.
<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Diam. (in.)</th>
<th>Water level below ground surface (ft)</th>
<th>Water level below land surface (ft)</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below surface head (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
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<tr>
<td>29-34-503</td>
<td>O. B. Trulock</td>
<td>--</td>
<td>1953</td>
<td>190±</td>
<td>8</td>
<td>Trs</td>
<td>2,150</td>
<td>15.9</td>
<td>Jan. 1964</td>
<td>T</td>
<td>Irr</td>
<td>150±</td>
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<tr>
<td>505</td>
<td>A. K. McCarley, Jr.</td>
<td>Huron Gist</td>
<td>1952</td>
<td>160</td>
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<td>120</td>
<td>Trs</td>
<td>2,178</td>
<td>15.5</td>
<td>do</td>
<td>T,E</td>
<td>Irr</td>
<td>158</td>
</tr>
<tr>
<td>507</td>
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<td>E. W. Martin</td>
<td>1952</td>
<td>155</td>
<td>8</td>
<td>155</td>
<td>Trs</td>
<td>2,167</td>
<td>31.0</td>
<td>Jan. 1964</td>
<td>T,G</td>
<td>Irr</td>
<td>150</td>
</tr>
<tr>
<td>508</td>
<td>do</td>
<td>do</td>
<td>1952</td>
<td>171</td>
<td>6</td>
<td>107</td>
<td>Trs</td>
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<td>Irr</td>
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<td>Gale &amp; Thompson</td>
<td>1956</td>
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<td>190</td>
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<td>78.4</td>
<td>Jan. 1964</td>
<td>S</td>
<td>Irr</td>
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<td>Gale &amp; Thompson</td>
<td>1954</td>
<td>157</td>
<td>8</td>
<td>56</td>
<td>Trs</td>
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<td>--</td>
<td>--</td>
<td>T,E</td>
<td>Irr</td>
<td>157</td>
</tr>
<tr>
<td>513</td>
<td>James Cox</td>
<td>Bill Gale</td>
<td>1957</td>
<td>190</td>
<td>10</td>
<td>100</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T,E</td>
<td>Irr</td>
<td>185</td>
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<tr>
<td>514</td>
<td>do</td>
<td>O. R. House</td>
<td>1961</td>
<td>160</td>
<td>8</td>
<td>90</td>
<td>Trs</td>
<td>2,150</td>
<td>19.7</td>
<td>do</td>
<td>S</td>
<td>Irr</td>
<td>155</td>
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<tr>
<td>515</td>
<td>L. C. Webb</td>
<td>Preston House</td>
<td>1953</td>
<td>248</td>
<td>10</td>
<td>248</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T,E</td>
<td>Irr</td>
<td>230</td>
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<tr>
<td>517</td>
<td>J. C. Pritchett</td>
<td>Flores</td>
<td>1961</td>
<td>160</td>
<td>8</td>
<td>--</td>
<td>Trs</td>
<td>2,137</td>
<td>15.9</td>
<td>do</td>
<td>T,E</td>
<td>Irr</td>
<td>150</td>
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See footnotes at end of table.
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<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Casing Diameter (in.)</th>
<th>Water-holding unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level below land surface (ft)</th>
<th>Water level of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>29-34-520</td>
<td>Doyle Gray</td>
<td>E. W. Martin</td>
<td>1952</td>
<td>150</td>
<td>8</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>T,G</td>
<td>Irr</td>
<td>145</td>
<td>4</td>
<td></td>
<td>Reported bottom of well in &quot;red bed&quot;; discharge to sprinkler system; reported yield, 60 gpm.</td>
</tr>
<tr>
<td>521</td>
<td>J. D. Cox</td>
<td>O. R. House</td>
<td>1963</td>
<td>167</td>
<td>7</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>S</td>
<td>Irr</td>
<td>146</td>
<td>4</td>
<td></td>
<td>Yields only 50 gpm continuously; reported yield, 170 gpm.</td>
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<tr>
<td>601</td>
<td>Mrs. A. C. Pratt</td>
<td>--</td>
<td>1953</td>
<td>265</td>
<td>8</td>
<td>Trs</td>
<td>--</td>
<td>52.6</td>
<td>Feb. 1963</td>
<td>T,G</td>
<td>Irr</td>
<td>158</td>
<td></td>
<td>Water reported from tight sand and gravel; discharge to sprinkler system; reported yield, 135 gpm.</td>
</tr>
<tr>
<td>602</td>
<td>Do</td>
<td>Sam Smith</td>
<td>1960</td>
<td>252</td>
<td>10</td>
<td>Trs</td>
<td>2,272</td>
<td>55.2</td>
<td>Jan. 1964</td>
<td>T,G</td>
<td>Irr</td>
<td>252</td>
<td></td>
<td>Discharge to sprinkler system; used in 1962 and 1963; reported yield, 110 gpm.</td>
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<tr>
<td>603</td>
<td>Do</td>
<td>O. R. House</td>
<td>1961</td>
<td>--</td>
<td>8</td>
<td>Trs</td>
<td>2,260</td>
<td>92.3</td>
<td>do</td>
<td>S</td>
<td>Irr</td>
<td>--</td>
<td></td>
<td>Discharge to sprinkler system; used in 1962 and 1963; reported yield, 110 gpm.</td>
</tr>
<tr>
<td>605</td>
<td>Roy Reynolds</td>
<td>--</td>
<td>--</td>
<td>115</td>
<td>--</td>
<td>Trs</td>
<td>--</td>
<td>96.6</td>
<td>Nov. 1963</td>
<td>C,W</td>
<td>S</td>
<td>9</td>
<td></td>
<td>Drilled for irrigation; never used; reported yield, 95 gpm.</td>
</tr>
<tr>
<td>606</td>
<td>Dwayne Williams</td>
<td>O. R. House</td>
<td>1955</td>
<td>218</td>
<td>--</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>N</td>
<td>A,T</td>
<td>--</td>
<td>9</td>
<td></td>
<td>Never used; reported yield, 160 gpm.</td>
</tr>
<tr>
<td>607</td>
<td>Mrs. A. C Pratt</td>
<td>Do</td>
<td>1960</td>
<td>247</td>
<td>--</td>
<td>Trs</td>
<td>2,255</td>
<td>--</td>
<td>N</td>
<td>A,T</td>
<td>--</td>
<td>9</td>
<td></td>
<td>Never used; reported yield, 110 gpm.</td>
</tr>
<tr>
<td>608</td>
<td>Do</td>
<td>N. C. House</td>
<td>1960</td>
<td>265</td>
<td>--</td>
<td>Trs</td>
<td>2,269</td>
<td>--</td>
<td>N</td>
<td>A,T</td>
<td>--</td>
<td>9</td>
<td></td>
<td>Never used; reported yield, 110 gpm.</td>
</tr>
<tr>
<td>* 702</td>
<td>Do</td>
<td>--</td>
<td>1942</td>
<td>165</td>
<td>10</td>
<td>Trs</td>
<td>2,104</td>
<td>46.0</td>
<td>May 1946</td>
<td>T,E</td>
<td>P</td>
<td>--</td>
<td>4</td>
<td>Supplies swimming pool.</td>
</tr>
<tr>
<td>* 703</td>
<td>Do</td>
<td>1922</td>
<td>256</td>
<td>8</td>
<td>Trs</td>
<td>2,158</td>
<td>83.2</td>
<td>do</td>
<td>N</td>
<td>A,P</td>
<td>--</td>
<td>4</td>
<td></td>
<td>Reported yield, 21 gpm.</td>
</tr>
<tr>
<td>705</td>
<td>E. Bohanon</td>
<td>--</td>
<td>--</td>
<td>100</td>
<td>--</td>
<td>Trs</td>
<td>2,125</td>
<td>41.2</td>
<td>Dec. 1963</td>
<td>C,W</td>
<td>D</td>
<td>4</td>
<td></td>
<td>Application rate measured for open discharge, 75 gpm (Aug. 1963); reported yield, 105 gpm.</td>
</tr>
<tr>
<td>* 706</td>
<td>Jim Kelley</td>
<td>P. W. Martin</td>
<td>1957</td>
<td>105</td>
<td>6</td>
<td>Trs</td>
<td>2,070</td>
<td>30.7</td>
<td>do</td>
<td>T,E</td>
<td>Irr</td>
<td>95</td>
<td>4</td>
<td>Application rate measured for open discharge, 75 gpm (Aug. 1963); reported yield, 105 gpm.</td>
</tr>
<tr>
<td>708</td>
<td>Colorado City</td>
<td>--</td>
<td>1930</td>
<td>240</td>
<td>15</td>
<td>Trs</td>
<td>2,153</td>
<td>122.0</td>
<td>Mar. 1946</td>
<td>T,E</td>
<td>A,P</td>
<td>--</td>
<td>4</td>
<td>Standby well.</td>
</tr>
<tr>
<td>709</td>
<td>Do</td>
<td>O. R. House</td>
<td>1944</td>
<td>255</td>
<td>10</td>
<td>Trs</td>
<td>2,189</td>
<td>144.0</td>
<td>Dec. 1956</td>
<td>T,E</td>
<td>A,P</td>
<td>199</td>
<td>4</td>
<td>Reported yield, 75-100 gpm.</td>
</tr>
<tr>
<td>712</td>
<td>J. E. Cox</td>
<td>E. W. Martin</td>
<td>1957</td>
<td>179</td>
<td>8</td>
<td>Trs</td>
<td>2,131</td>
<td>59.1</td>
<td>Jan. 1964</td>
<td>T,G</td>
<td>Irr</td>
<td>158</td>
<td></td>
<td>Discharge to sprinkler system; irrigation; 15 acres of cotton; reported yield, 150 gpm.</td>
</tr>
</tbody>
</table>

See footnotes at end of table.
Table 5.—Records of selected water wells, springs, and test wells—Continued

<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Casing Diameter (in.)</th>
<th>Altitude of land surface (ft)</th>
<th>Water level below land surface (ft)</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>29-34-713</td>
<td>Colorado City</td>
<td>O. R. House</td>
<td>1921</td>
<td>--</td>
<td>8</td>
<td>--</td>
<td>Trs</td>
<td>2,149</td>
<td>91.6</td>
<td>Mar. 1961</td>
<td>T, E</td>
<td>A, P</td>
</tr>
<tr>
<td>714</td>
<td>do</td>
<td>do</td>
<td>1921</td>
<td>233</td>
<td>8</td>
<td>--</td>
<td>Trs</td>
<td>2,172</td>
<td>113.7</td>
<td>Jan. 1963</td>
<td>T, E</td>
<td>A, P</td>
</tr>
<tr>
<td>715</td>
<td>Mrs. Drew Cook</td>
<td>--</td>
<td>1055</td>
<td>5</td>
<td>--</td>
<td>Trs</td>
<td>2,168</td>
<td>79.0</td>
<td>Jan. 1964</td>
<td>S</td>
<td>D</td>
<td>100±</td>
</tr>
<tr>
<td>716</td>
<td>Colorado City</td>
<td>O. R. House</td>
<td>1944</td>
<td>249</td>
<td>10</td>
<td>--</td>
<td>Trs</td>
<td>2,173</td>
<td>128.2</td>
<td>1946</td>
<td>T, E</td>
<td>A, P</td>
</tr>
<tr>
<td>718</td>
<td>-- Bassinger</td>
<td>do</td>
<td>1960</td>
<td>112</td>
<td>6</td>
<td>--</td>
<td>Trs</td>
<td>2,060</td>
<td>27.2</td>
<td>Mar. 1963</td>
<td>S</td>
<td>Ind</td>
</tr>
<tr>
<td>719</td>
<td>-- Mitchell</td>
<td>do</td>
<td>1960</td>
<td>185</td>
<td>5</td>
<td>115</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>D</td>
<td>--</td>
</tr>
<tr>
<td>801</td>
<td>do</td>
<td>--</td>
<td>117</td>
<td>4</td>
<td>70</td>
<td>Trs</td>
<td>--</td>
<td>22.6</td>
<td>May 1946</td>
<td>C, W</td>
<td>D</td>
<td>--</td>
</tr>
<tr>
<td>802</td>
<td>O. B. Trulock</td>
<td>--</td>
<td>28</td>
<td>--</td>
<td>--</td>
<td>Trs</td>
<td>--</td>
<td>7.0</td>
<td>do</td>
<td>C, W</td>
<td>S</td>
<td>--</td>
</tr>
<tr>
<td>803</td>
<td>Noble Walker</td>
<td>E. W. Martin</td>
<td>1952</td>
<td>188</td>
<td>15½</td>
<td>--</td>
<td>Trs</td>
<td>--</td>
<td>47.6</td>
<td>Jan. 1964</td>
<td>T, G</td>
<td>Irr</td>
</tr>
<tr>
<td>804</td>
<td>do</td>
<td>do</td>
<td>1952</td>
<td>170</td>
<td>7</td>
<td>91</td>
<td>Trs</td>
<td>--</td>
<td>53.6</td>
<td>Jan. 1953</td>
<td>S</td>
<td>Irr</td>
</tr>
<tr>
<td>806</td>
<td>R. E. Golden</td>
<td>-- Mandell</td>
<td>1961</td>
<td>150</td>
<td>8</td>
<td>150</td>
<td>Trs</td>
<td>2,132</td>
<td>32.8</td>
<td>do</td>
<td>T, G</td>
<td>Irr</td>
</tr>
<tr>
<td>807</td>
<td>Noble Walker</td>
<td>E. W. Martin</td>
<td>1952</td>
<td>184</td>
<td>10</td>
<td>90</td>
<td>Trs</td>
<td>2,208</td>
<td>52.8</td>
<td>do</td>
<td>T, E</td>
<td>Irr</td>
</tr>
<tr>
<td>809</td>
<td>do</td>
<td>--</td>
<td>1934</td>
<td>1806</td>
<td>10</td>
<td>--</td>
<td>Trs</td>
<td>--</td>
<td>39.7</td>
<td>do</td>
<td>T, E</td>
<td>Irr</td>
</tr>
</tbody>
</table>

See continuos at end of table.
<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Diameter (in.)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level below land surface (ft)</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R. B. Golden</td>
<td>Bill Gale</td>
<td>1953</td>
<td>150</td>
<td>10</td>
<td>10</td>
<td>Trs</td>
<td>2,136</td>
<td>--</td>
<td>T,G</td>
<td>Irr 145</td>
<td>4 Top of &quot;red bed&quot; reported at 150 ft; discharge to 18-sprinkler system; reported yield, 160 gpm.</td>
<td></td>
</tr>
<tr>
<td>812</td>
<td>O. R. House</td>
<td></td>
<td>1962</td>
<td>180</td>
<td>5</td>
<td>120</td>
<td>Trs</td>
<td>2,166</td>
<td>31.0</td>
<td>Feb. 1963</td>
<td>S D -- 1½</td>
<td>Test well for irrigation; air-drilled; reported yield, 80 gpm.</td>
<td></td>
</tr>
<tr>
<td>814</td>
<td>Hopkins Drlg. Co.</td>
<td></td>
<td>1962</td>
<td>240</td>
<td>5</td>
<td>--</td>
<td>Trs</td>
<td>2,258</td>
<td>--</td>
<td>N A,T</td>
<td>--</td>
<td>Test well for irrigation; reported yield, 135 gpm.</td>
<td></td>
</tr>
<tr>
<td>817</td>
<td>R. B. Golden</td>
<td>Mandell</td>
<td>1953</td>
<td>150</td>
<td>6</td>
<td>10</td>
<td>Trs</td>
<td>2,132</td>
<td>--</td>
<td>S Irr 140</td>
<td>3 Discharge to 13-sprinkler system; reported yield, 80 gpm.</td>
<td></td>
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</tr>
<tr>
<td>901</td>
<td>M. R. House</td>
<td></td>
<td>1952</td>
<td>163</td>
<td>10</td>
<td>150</td>
<td>Trs</td>
<td>2,190</td>
<td>24.4</td>
<td>Jan. 1964</td>
<td>T,E Irr 160</td>
<td>Application rate measured for discharge to sprinkler system, 134 gpm (Aug. 1963); reported yield, 300 gpm.</td>
<td></td>
</tr>
<tr>
<td>902</td>
<td>C. C. Thompson</td>
<td>do</td>
<td>1952</td>
<td>167</td>
<td>12</td>
<td>140</td>
<td>Trs</td>
<td>2,184</td>
<td>20.9</td>
<td>do N A,Irr  --</td>
<td>-- Caved in after several years of use; reported yield, 160 gpm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>903</td>
<td>--</td>
<td>Carlock</td>
<td>1952</td>
<td>--</td>
<td>--</td>
<td>6</td>
<td>-- Trs</td>
<td>2,208</td>
<td>54.7</td>
<td>do C,W S -- 1½</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* 905</td>
<td>C. L. Root</td>
<td>Huron Gist</td>
<td>1952</td>
<td>232</td>
<td>10</td>
<td>232</td>
<td>Trs</td>
<td>2,236</td>
<td>73.0</td>
<td>do T,G Irr 225</td>
<td>5 Irrigated 60 acres in 1953; reported yield, 250 gpm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>906</td>
<td>Jim Kelley</td>
<td>E. W. Martin</td>
<td>1953</td>
<td>160</td>
<td>6</td>
<td>30</td>
<td>Trs</td>
<td>2,185</td>
<td>20.0</td>
<td>do T,E Irr 140</td>
<td>5 Irrigates cotton and grassland; reported yield, 200 gpm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>907</td>
<td>M. R. House</td>
<td></td>
<td>1953</td>
<td>178</td>
<td>10</td>
<td>10</td>
<td>Trs</td>
<td>2,206</td>
<td>35.6</td>
<td>do T,E Irr 165</td>
<td>4 Yielded 400 gpm when drilled; current reported yield, 225 gpm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* 908</td>
<td>Bill Justice</td>
<td></td>
<td>1952</td>
<td>150</td>
<td>8</td>
<td>100</td>
<td>Trs</td>
<td>2,177</td>
<td>27.0</td>
<td>do S Irr 145</td>
<td>3 Discharge to sprinkler system; 7½-hp motor; reported yield, 80 gpm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>909</td>
<td>M. R. House</td>
<td></td>
<td>1952</td>
<td>152</td>
<td>8</td>
<td>141</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>T,E Irr 145</td>
<td>4 Application rate measured for discharge to sprinkler system, 97 gpm (Mar. 1963); reported yield, 160 gpm, 10-hp motor.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>910</td>
<td>O. R. House</td>
<td></td>
<td>1959</td>
<td>203</td>
<td>10</td>
<td>203</td>
<td>Trs</td>
<td>2,203</td>
<td>38.9</td>
<td>Jan. 1964 T,G Irr 160</td>
<td>5 Application rate measured for discharge to sprinkler system, 125 gpm (Mar. 1963); reported yield, 150 gpm.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

See footnotes at end of table.
<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Diameter (in.)</th>
<th>Casing Depth (ft)</th>
<th>Casing Diameter (in.)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Below land surface (ft)</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
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</thead>
<tbody>
<tr>
<td>29-35-302</td>
<td>Ernest Parrott</td>
<td>O. R. House</td>
<td>1959</td>
<td>308</td>
<td>12</td>
<td>308</td>
<td>2,397</td>
<td>Trs</td>
<td>182.2</td>
<td>Jan. 1964</td>
<td>T,E</td>
<td>Irr</td>
<td>290</td>
<td>6 Motor; reported yield, 420 gpm.</td>
<td>30-1 6</td>
<td>Casing perforated at 190-290 ft; 70-hp motor; reported yield, 420 gpm.</td>
</tr>
<tr>
<td>303</td>
<td>do</td>
<td>do</td>
<td>1959</td>
<td>300</td>
<td>12</td>
<td>300</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T,E</td>
<td>Irr</td>
<td>290</td>
<td>6 Motor; reported yield, 315 gpm.</td>
<td>30-1 6</td>
<td></td>
</tr>
<tr>
<td>304</td>
<td>J. C. Bruce</td>
<td>do</td>
<td>1945</td>
<td>250</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>Trs</td>
<td>2,425</td>
<td>Nov. 1960</td>
<td>T,G</td>
<td>Irr</td>
<td>250</td>
<td>4 Application rate measured for open discharge, 76 gpm (Aug. 1962); reported yield, 125 gpm.</td>
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</tr>
<tr>
<td>306</td>
<td>Ernest Ater</td>
<td>--</td>
<td>--</td>
<td>300</td>
<td>12</td>
<td>--</td>
<td>--</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>T,E</td>
<td>Irr</td>
<td>--</td>
<td>5 Motor; reported yield, 130 gpm.</td>
<td>30-1 6</td>
<td></td>
</tr>
<tr>
<td>310</td>
<td>-- Wilson</td>
<td>--</td>
<td>1957</td>
<td>300</td>
<td>8</td>
<td>--</td>
<td>--</td>
<td>Trs</td>
<td>186.5</td>
<td>Nov. 1960</td>
<td>S</td>
<td>Irr</td>
<td>--</td>
<td>4 Application rate measured for open discharge, 119 gpm (Aug. 1962); reported yield, 100 gpm.</td>
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<td></td>
</tr>
<tr>
<td>311</td>
<td>Ernest Ater</td>
<td>--</td>
<td>--</td>
<td>295</td>
<td>8</td>
<td>--</td>
<td>--</td>
<td>Trs</td>
<td>2,192</td>
<td>Jan. 1964</td>
<td>N</td>
<td>A,Irr</td>
<td>--</td>
<td>-- Not used for several years; reported yield, 125 gpm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>313</td>
<td>Ernest Wyman</td>
<td>O. R. House</td>
<td>1957</td>
<td>335</td>
<td>10</td>
<td>--</td>
<td>Trs</td>
<td>2,415</td>
<td>198.3</td>
<td>do</td>
<td>T,E</td>
<td>Irr</td>
<td>320</td>
<td>6 Yield of well improved by fracturing method; application rate measured for open discharge, 202 gpm (Aug. 1962); reported yield, 300 gpm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>314</td>
<td>do</td>
<td>--</td>
<td>1957</td>
<td>320</td>
<td>10</td>
<td>--</td>
<td>--</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>T,E</td>
<td>Irr</td>
<td>300</td>
<td>6 Measured yield, 99 gpm (Aug. 1962); reported yield, 200 gpm.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

See footnotes at end of table.
<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Diameter (in.)</th>
<th>Casing Depth (ft)</th>
<th>Water-bearing unit</th>
<th>Altitude above land surface (ft)</th>
<th>Water level below land surface (ft)</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>316</td>
<td>do</td>
<td>--</td>
<td>1958</td>
<td>310</td>
<td>10</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T, E</td>
<td>Irr</td>
<td>300</td>
<td>5</td>
<td>Measured yield, 81 gpm (Aug. 1962); reported yield, 150 gpm.</td>
</tr>
<tr>
<td>401</td>
<td>Royce Mahon</td>
<td>Eulis Compton</td>
<td>1952</td>
<td>196</td>
<td>16</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>59.2</td>
<td>Jan. 1964</td>
<td>T, G</td>
<td>Irr 190</td>
<td>6</td>
<td>Bottom of well in &quot;red beds&quot;; reported yield, 210 gpm.</td>
</tr>
<tr>
<td>402</td>
<td>Ralph Langford</td>
<td>O. R. House</td>
<td>1956</td>
<td>283</td>
<td>6</td>
<td>283</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>C, E</td>
<td>D</td>
<td>273</td>
<td>2</td>
<td>Reported yield, 3-5 gpm; water-bearing sand at 170-283 ft.</td>
</tr>
<tr>
<td>405</td>
<td>Jim Kelley</td>
<td>E. W. Martin</td>
<td>1954</td>
<td>220</td>
<td>14</td>
<td>120</td>
<td>Trs</td>
<td>2,258</td>
<td>59.2</td>
<td>Jan. 1964</td>
<td>T, E</td>
<td>Irr</td>
<td>210</td>
<td>6</td>
<td>Yield influenced by pumping from nearby well; application rate measured for open discharge, 120 gpm (Aug. 1962); reported yield, 350 gpm.</td>
</tr>
<tr>
<td>408</td>
<td>May S. Martin</td>
<td>C. L. Cleaver</td>
<td>1957</td>
<td>237</td>
<td>10</td>
<td>237</td>
<td>Trs</td>
<td>2,255</td>
<td>67.3</td>
<td>do</td>
<td>T, G</td>
<td>Irr</td>
<td>237</td>
<td>6</td>
<td>Reported yield, 800 gpm.</td>
</tr>
<tr>
<td>409</td>
<td>Bill Voss</td>
<td>--</td>
<td>1955</td>
<td>190</td>
<td>8</td>
<td>190</td>
<td>Trs</td>
<td>--</td>
<td>48.2</td>
<td>do</td>
<td>T, E</td>
<td>Irr</td>
<td>185</td>
<td>4</td>
<td>Application rate measured for discharge to sprinkler system, 105 gpm (Aug. 1963); &quot;red beds&quot; reported at 190 ft; reported yield, 70 gpm.</td>
</tr>
<tr>
<td>412</td>
<td>Royce Mahon</td>
<td>O. R. House</td>
<td>1960</td>
<td>180</td>
<td>8</td>
<td>180</td>
<td>Trs</td>
<td>2,258</td>
<td>58.5</td>
<td>do</td>
<td>S</td>
<td>Irr</td>
<td>170</td>
<td>4</td>
<td>First used in 1961; reported yield, 80 gpm.</td>
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<tr>
<td>414</td>
<td>K. L. Taylor</td>
<td>O. Cleaver</td>
<td>1958</td>
<td>257</td>
<td>12</td>
<td>257</td>
<td>Trs</td>
<td>--</td>
<td>82.9</td>
<td>do</td>
<td>T, G</td>
<td>Irr</td>
<td>255</td>
<td>6</td>
<td>Application rate measured for discharge to sprinkler system, 142 gpm (Aug. 1963); yields 400 gpm when nearby wells not operating.</td>
</tr>
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</table>

See footnotes at end of table.
Table 5.--Records of selected water wells, springs, and test wells--Continued

<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Casing Diameter (in.)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level (ft)</th>
<th>Method of Lift</th>
<th>Use of Lift</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>29-35-415</td>
<td>J. B. Mahon</td>
<td>Eulis Compton</td>
<td>1954</td>
<td>165</td>
<td>10 100</td>
<td>Trs</td>
<td>--</td>
<td>58.3</td>
<td>Jan. 1964</td>
<td>T, E</td>
<td>155</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>416</td>
<td>do</td>
<td>O. R. House</td>
<td>1954</td>
<td>200</td>
<td>12 200</td>
<td>Trs</td>
<td>--</td>
<td>78.4</td>
<td>do</td>
<td>T, E</td>
<td>195</td>
<td>6</td>
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<tr>
<td>417</td>
<td>W. Pratt</td>
<td>O. Cleaver</td>
<td>1953</td>
<td>250</td>
<td>14 250</td>
<td>Trs</td>
<td>2,257</td>
<td>70.1</td>
<td>do</td>
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<td>245</td>
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<tr>
<td>418</td>
<td>do</td>
<td>O. R. House</td>
<td>1959</td>
<td>140</td>
<td>12 140</td>
<td>Trs</td>
<td>2,252</td>
<td>55.7</td>
<td>Feb. 1963</td>
<td>T, G</td>
<td>140</td>
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<tr>
<td>419</td>
<td>Bill Voss</td>
<td>do</td>
<td>1955</td>
<td>200</td>
<td>8 200</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T, E</td>
<td>185</td>
<td>4</td>
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</tr>
<tr>
<td>420</td>
<td>do</td>
<td>do</td>
<td>1955</td>
<td>200</td>
<td>8 200</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T, E</td>
<td>185</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>421</td>
<td>Abraham Castro</td>
<td>do</td>
<td>1957</td>
<td>206</td>
<td>10 206</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T, E</td>
<td>180</td>
<td>4</td>
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</tr>
<tr>
<td>422</td>
<td>do</td>
<td>O. L. Williams</td>
<td>1954</td>
<td>206</td>
<td>10 206</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T, G</td>
<td>180</td>
<td>6</td>
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<tr>
<td>423</td>
<td>Bill Voss</td>
<td>Gale &amp; Thompson</td>
<td>1952</td>
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<td>10 180</td>
<td>Trs</td>
<td>188.5</td>
<td>Feb. 1963</td>
<td>T, E</td>
<td>175</td>
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<td></td>
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<tr>
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<td>C. W. Martin</td>
<td>1956</td>
<td>230</td>
<td>10 120</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T, G</td>
<td>220</td>
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<tr>
<td>425</td>
<td>Abraham Castro</td>
<td>C. W. Martin</td>
<td>1962</td>
<td>207</td>
<td>6 207</td>
<td>Trs</td>
<td>2,238</td>
<td>46.6</td>
<td>Jan. 1964</td>
<td>S</td>
<td>174</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>426</td>
<td>Jim Kelley</td>
<td>Ernest Martin</td>
<td>1955</td>
<td>228</td>
<td>12 65</td>
<td>Trs</td>
<td>--</td>
<td>62.4</td>
<td>do</td>
<td>T, G</td>
<td>220</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>427</td>
<td>do</td>
<td>C. W. Martin</td>
<td>1955</td>
<td>228</td>
<td>12 228</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T, G</td>
<td>210</td>
<td>6</td>
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<tr>
<td>428</td>
<td>D. Mahon</td>
<td>N. C. House</td>
<td>1962</td>
<td>190</td>
<td>12 190</td>
<td>Trs</td>
<td>2,272</td>
<td>70.2</td>
<td>Jan. 1964</td>
<td>S</td>
<td>180</td>
<td>4</td>
<td></td>
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See footnotes at end of table.
<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Depth of water (ft)</th>
<th>Diameter of Casing (in.)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level below land surface (ft)</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>430</td>
<td>D. Mahon</td>
<td>do</td>
<td>1960</td>
<td>180</td>
<td>10</td>
<td>180</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>do</td>
<td>S</td>
<td>Irr</td>
<td>180</td>
<td>4</td>
<td>Application rate measured for discharge to sprinkler system, 82 gpm (Mar. 1963); reported yield, 150 gpm.</td>
</tr>
<tr>
<td>431</td>
<td>do</td>
<td>do</td>
<td>1961</td>
<td>185</td>
<td>10</td>
<td>185</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>S</td>
<td>Irr</td>
<td>75</td>
<td>4</td>
<td>Discharge to sprinkler system; reported discharge, 180 gpm.</td>
</tr>
<tr>
<td>432</td>
<td>J. L. Pratt</td>
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<td>--</td>
<td>70</td>
<td>5</td>
<td>--</td>
<td>Trs</td>
<td>2,243</td>
<td>45.9</td>
<td>Jan. 1964</td>
<td>C,W</td>
<td>S</td>
<td>--</td>
<td>2</td>
<td>Never used; reported yield, 150 gpm.</td>
</tr>
<tr>
<td>433</td>
<td>J. B. Mahon</td>
<td>N. C. House</td>
<td>1962</td>
<td>206</td>
<td>--</td>
<td>--</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>N</td>
<td>A,T</td>
<td>--</td>
<td>--</td>
<td>Never used; reported yield, 110 gpm.</td>
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<tr>
<td>435</td>
<td>Jim Kelley</td>
<td>O. R. House</td>
<td>1963</td>
<td>205</td>
<td>12</td>
<td>202</td>
<td>Trs</td>
<td>--</td>
<td>63.4</td>
<td>Jan. 1964</td>
<td>N</td>
<td>A,T</td>
<td>--</td>
<td>--</td>
<td>Used for about 2 months; abandoned; reported yield, 100 gpm.</td>
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<tr>
<td>502</td>
<td>Robinson Green</td>
<td>O. R. House</td>
<td>1959</td>
<td>242</td>
<td>10</td>
<td>--</td>
<td>Trs</td>
<td>2,342</td>
<td>136.5</td>
<td>Feb. 1963</td>
<td>T,G</td>
<td>Irr</td>
<td>--</td>
<td>6</td>
<td>Application rate measured for discharge to sprinkler system, 176 gpm (Mar. 1963); reported yield, 430 gpm.</td>
</tr>
<tr>
<td>503</td>
<td>Lloyd Brans</td>
<td>Rulis Compton</td>
<td>1959</td>
<td>228</td>
<td>10</td>
<td>228</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T,G</td>
<td>Irr</td>
<td>210</td>
<td>6</td>
<td>Reported yield, 400 gpm.</td>
</tr>
<tr>
<td>506</td>
<td>H. C. Taylor</td>
<td>O. R. House</td>
<td>1957</td>
<td>257</td>
<td>10</td>
<td>257</td>
<td>Trs</td>
<td>2,319</td>
<td>116.5</td>
<td>do</td>
<td>T,G</td>
<td>Irr</td>
<td>240</td>
<td>6</td>
<td>Bottom of casing on hard conglomerate; reported yield, 400 gpm.</td>
</tr>
<tr>
<td>* 507</td>
<td>W. A. Taylor</td>
<td>O. Cleaver</td>
<td>1954</td>
<td>280</td>
<td>12</td>
<td>270</td>
<td>Trs</td>
<td>2,338</td>
<td>132.6</td>
<td>do</td>
<td>T,G</td>
<td>Irr</td>
<td>258</td>
<td>6</td>
<td>Application rate measured for discharge to sprinkler system, 295 gpm (Mar. 1963); reported yield, 600 gpm.</td>
</tr>
<tr>
<td>508</td>
<td>C. D. Taylor</td>
<td>O. R. House</td>
<td>1956</td>
<td>207</td>
<td>10</td>
<td>12</td>
<td>Trs</td>
<td>2,268</td>
<td>77.0</td>
<td>do</td>
<td>T,G</td>
<td>Irr</td>
<td>185</td>
<td>5</td>
<td>&quot;Red beds&quot; reported at 201 ft; reported yield, 200 gpm.</td>
</tr>
</tbody>
</table>

See footnotes at end of table.
<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Casing Dia. (in.)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level below land surface (ft)</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>511</td>
<td>Ira Hall</td>
<td>Eulis Compton</td>
<td>1957</td>
<td>210</td>
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<td>210</td>
<td>2,307</td>
<td>104.2</td>
<td>Jan. 1964</td>
<td>T, G</td>
<td>Irr</td>
<td>210</td>
<td>Discharge to sprinkler system, reported yield, 200 gpm.</td>
</tr>
<tr>
<td>513</td>
<td>W. Jacks</td>
<td>N. C. House</td>
<td>1961</td>
<td>274</td>
<td>12</td>
<td>274</td>
<td>2,357</td>
<td>145.7</td>
<td>do</td>
<td>T, G</td>
<td>Irr</td>
<td>--</td>
<td>Reported yield, 600+ gpm; 6/</td>
</tr>
<tr>
<td>516</td>
<td>D. F. Hester</td>
<td>do</td>
<td>1959</td>
<td>--</td>
<td>--</td>
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<td>--</td>
<td>--</td>
<td>--</td>
<td>N, A, T</td>
<td>--</td>
<td>--</td>
<td>Test well for irrigation.</td>
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<tr>
<td>602</td>
<td>Mrs. Emma Hackfeld</td>
<td>O. R. House</td>
<td>--</td>
<td>290</td>
<td>6</td>
<td>290</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>S</td>
<td>Irr</td>
<td>--</td>
<td>Reported yield, 90 gpm.</td>
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<tr>
<td>605</td>
<td>William Hackfeld</td>
<td>do</td>
<td>1961</td>
<td>--</td>
<td>200</td>
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<td>--</td>
<td>--</td>
<td>--</td>
<td>T, G</td>
<td>Irr</td>
<td>120</td>
<td>Discharge to sprinkler system; reported yield, 120 gpm.</td>
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<tr>
<td>607</td>
<td>John Zetzman</td>
<td>Eulis Compton</td>
<td>1958</td>
<td>312</td>
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<td>312</td>
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<td>191.4</td>
<td>Jan. 1964</td>
<td>T, E</td>
<td>Irr</td>
<td>300</td>
<td>Open discharge; casing perforated at 190-312 ft; reported yield, 150 gpm.</td>
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<tr>
<td>609</td>
<td>A. J. Markh</td>
<td>do</td>
<td>1957</td>
<td>298</td>
<td>8</td>
<td>298</td>
<td>2,406</td>
<td>144.7</td>
<td>do</td>
<td>T, E</td>
<td>Irr</td>
<td>280</td>
<td>Measured yield, 266 gpm.</td>
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<tr>
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<td>Robert Hackfeld</td>
<td>do</td>
<td>1961</td>
<td>315</td>
<td>7</td>
<td>283</td>
<td>2,420</td>
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<td>Feb. 1963</td>
<td>T, G</td>
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<tr>
<td>611</td>
<td>Alvin Hackfeld</td>
<td>--</td>
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<td>2,429</td>
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<td>Jan. 1964</td>
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See footnotes at end of table.
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<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Diameter Casing (in.)</th>
<th>Depth Casing (ft)</th>
<th>Diameter Water-bearing unit (in.)</th>
<th>Altitude of land surface (ft)</th>
<th>Method of measurement</th>
<th>Water level (ft below land surface)</th>
<th>Date of measurement</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
</tr>
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<tbody>
<tr>
<td>29-35-612</td>
<td>Arthur Lehman</td>
<td>O. R. House</td>
<td>1962</td>
<td>135</td>
<td>5</td>
<td>135</td>
<td>Ke</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>613</td>
<td>A. J. March</td>
<td>--</td>
<td>--</td>
<td>255</td>
<td>5½</td>
<td>--</td>
<td>Trs</td>
<td>90.8</td>
<td>Jan. 1963</td>
<td>C</td>
<td>D</td>
<td>--</td>
<td>1''</td>
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<td>Unused in 1961 and 1962; reported yield, 130 gpm.</td>
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<td>Application rate measured for discharge to sprinkler system, 93 gpm (Mar. 1963); reported yield, 250 gpm.</td>
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<td>Trs</td>
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<td>Trs</td>
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<td>June 1963</td>
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See footnotes at end of table.
| Well     | Owner               | Driller          | Date completed | Depth of well (ft) | Casing Diameter (in.) | Water-bearing unit | Altitude of land surface (ft) | Water level \( \frac{1}{2} \) Below land surface (ft) | Date of measurement | Method of lift | Use of water | Pump setting below land surface (ft) | Pump column size (in.) | Remarks                        |
|----------|---------------------|------------------|----------------|-------------------|-----------------------|------------------|-----------------------------|----------------------|----------------|-------------|-------------------------------|----------------------|------------------------|
| 718      | George Mohon        | Hopkins Drlg. Co. | --             | 177               | --                    | --               | T              | 2,219               | --                   | N            | A,T         | --                           | --                   | Discharge to sprinkler system; irrigates grain and grass; reported yield, 295 gpm. |
| 719      | T. F. Fowler        | O. R. House      | 1962           | 207               | 17 1/2               | 210              | T              | 2,278               | 77.3                 | Jan. 1964     | T, E         | Irr 200                     | 270                  | Application rate measured for discharge to 38-sprinkler system, 300 gpm (Mar. 1963); pumping level 241 ft; reported yield, 512 gpm. |
| 801      | C. C. Thompson      | T. O. Fannin     | 1952           | 313               | 10                    | 313              | T              | 2,373               | 157.8                 | do            | T, E         | Irr 270                     | 240                  | Application rate measured for discharge to sprinkler system, 426 gpm (Mar. 1963); casing perforated at 150-250 ft; reported yield, 650 gpm. |
| 802      | E. C. Hallmark      | Sam Smith        | 1956           | 250               | 14                    | 250              | T              | 2,343               | 142.0                 | do            | T, G         | Irr 240                     | 270                  | Discharge to sprinkler system; reported yield, 285 gpm. |
| 803      | W. H. Barrett       | Eulis Compton    | 1954           | 274               | 10                    | 274              | T              | --                   | --                   | --            | T, G         | Irr 270                     | 270                  | Application rate measured for discharge to sprinkler system, 379 gpm (Mar. 1963); maximum yield 600 gpm. |
| 804      | do                  | do               | 1957           | 274               | 10                    | 274              | T              | --                   | 147.3                 | Nov. 1962     | T, G         | Irr 270                     | 270                  | Discharge to sprinkler system; reported yield, 285 gpm. |
| 805      | J. A. Mercet        | Ernest Martin    | 1954           | 405               | 8                    | 40               | T              | 2,338               | 26.4                  | do            | T, G         | Irr 40                      | 40                   | Reported yield, 100+ gpm. |
| 807      | A. R. Miles         | O. R. House      | 1962           | 264               | 8                    | 264              | T              | --                   | --                   | T, E         | Irr 245                   | 245                  | Discharge to sprinkler system; irrigates grassland; reported yield, 80 gpm. |
| 802      | do                  | O. R. House      | 1956           | 320               | 12                   | 320              | T              | --                   | --                   | --            | T, E         | Irr 284                     | 284                  | Drilled to 'red bed'; reported yield, 260 gpm. |

See footnotes at end of table.
<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Casing Diameter (in.)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level above land surface (ft)</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
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<td>S</td>
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<td>227</td>
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<td>Trs</td>
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<td>6</td>
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<td>Trs</td>
<td>--</td>
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<td>Trs</td>
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<td>--</td>
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See footnotes at end of table.
Table 5.--Records of selected water wells, springs, and test wells--Continued

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<th>Casing diameter (in.)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water yield</th>
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<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
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<td>Trs</td>
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<td>C, W</td>
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*See footnotes at end of table.*
### Table 5.--Records of selected water wells, springs, and test wells--Continued

<table>
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<th>Well</th>
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<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Casing Diam (ft)</th>
<th>Water-bearing unit</th>
<th>Water level Below land surface (ft)</th>
<th>Method of lift</th>
<th>Date of measurement</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size</th>
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<td>Trs</td>
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<td>Trs</td>
<td>2,385</td>
<td>--</td>
<td>--</td>
<td>T, E</td>
<td>P</td>
<td>178</td>
</tr>
<tr>
<td>504</td>
<td>do</td>
<td>do</td>
<td>1955</td>
<td>160</td>
<td>8</td>
<td>160</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T, E</td>
<td>P</td>
<td>--</td>
</tr>
<tr>
<td>505</td>
<td>do</td>
<td>do</td>
<td>--</td>
<td>154</td>
<td>7</td>
<td>128</td>
<td>Trs</td>
<td>--</td>
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<td>T, E</td>
<td>P</td>
<td>150</td>
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<tr>
<td>506</td>
<td>Roscoe FFA</td>
<td>Grosshans Bros.</td>
<td>1960</td>
<td>200</td>
<td>8</td>
<td>--</td>
<td>Trs</td>
<td>2,385</td>
<td>112.4</td>
<td>Jan. 1964</td>
<td>S</td>
<td>Irr</td>
<td>180</td>
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<tr>
<td>507</td>
<td>Roy Rasco</td>
<td>Grady Hudson</td>
<td>1936</td>
<td>530</td>
<td>8-12</td>
<td>275</td>
<td>Trs</td>
<td>2,390</td>
<td>136.4</td>
<td>do</td>
<td>T, E</td>
<td>Irr</td>
<td>200</td>
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<tr>
<td>510</td>
<td>Jess Smith</td>
<td>E. W. Martin</td>
<td>1936</td>
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<td>7</td>
<td>185</td>
<td>Trs</td>
<td>2,376</td>
<td>118.3</td>
<td>do</td>
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<td>Irr</td>
<td>175</td>
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<td>511</td>
<td>Wilson Hrbacek</td>
<td>O. R. House</td>
<td>1957</td>
<td>182</td>
<td>8</td>
<td>180</td>
<td>Trs</td>
<td>--</td>
<td>118.8</td>
<td>Nov. 1960</td>
<td>S</td>
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<tr>
<td>512</td>
<td>Marion Duncan</td>
<td>Grosshans Bros.</td>
<td>1957</td>
<td>200</td>
<td>8</td>
<td>200</td>
<td>Trs</td>
<td>--</td>
<td>160.2</td>
<td>Jan. 1964</td>
<td>T, E</td>
<td>Irr</td>
<td>185</td>
</tr>
<tr>
<td>513</td>
<td>do</td>
<td>do</td>
<td>1960</td>
<td>200</td>
<td>8</td>
<td>200</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>S</td>
<td>Irr</td>
<td>185</td>
</tr>
<tr>
<td>514</td>
<td>Wilson Hrbacek</td>
<td>O. R. House</td>
<td>1957</td>
<td>182</td>
<td>8</td>
<td>180</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>S</td>
<td>Irr</td>
<td>--</td>
</tr>
</tbody>
</table>

Application rate measured for open discharge, 91 gpm (July 1963); casing perforated at 130-230 ft; pumping level 177.8 ft, (Aug. 1962); reported yield, 135 gpm.

Application rate measured for open discharge, 110 gpm (July 1963); 10-hp motor; reported yield, 135 gpm.

Application rate measured for open discharge, 250 gpm when drilled; current reported yield, 807 gpm.

Yielded 250 gpm when drilled; current reported yield, 55 gpm.

Application rate measured for open discharge, 63 gpm (Aug. 1962); water-bearing sands above 200 ft; casing perforated at 30-200 ft; reported yield, 75 gpm.

Application rate measured for open discharge, 27 gpm (Aug. 1962).

Measured yield, 35 gpm (Aug. 1962); reported yield, 55 gpm.

Measured yield, 45 gpm (Aug. 1962); reported yield, 82 gpm.

Application rate measured for open discharge, 42 gpm (Aug. 1962); 7 1/2-hp motor.

See footnotes at end of table.
Table 5.--Records of selected water wells, springs, and test wells--Continued

<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Casing Diameter (in.)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level (ft)</th>
<th>Method of lift</th>
<th>Date of measurement</th>
<th>Use setting below land surface (ft)</th>
<th>Pump setting below land surface (ft)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>516</td>
<td>do</td>
<td>do</td>
<td>1957</td>
<td>174</td>
<td>8</td>
<td>Tres</td>
<td>--</td>
<td>--</td>
<td>T, E</td>
<td>Irr 170</td>
<td>3 Measured yield, 78 gpm (Aug. 1962); reported yield, 104 gpm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>519</td>
<td>Jess Smith</td>
<td>Grosshans Bros.</td>
<td>1959</td>
<td>185</td>
<td>3</td>
<td>Tres</td>
<td>--</td>
<td>--</td>
<td>T, E</td>
<td>Irr 175</td>
<td>3 Casing perforated at 160-180 ft; reported yield, 75 gpm.</td>
<td></td>
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</tr>
<tr>
<td>602</td>
<td>do</td>
<td>do</td>
<td>1967</td>
<td>165</td>
<td>8</td>
<td>Tres</td>
<td>--</td>
<td>--</td>
<td>T, E</td>
<td>P --</td>
<td>--</td>
<td></td>
<td></td>
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<tr>
<td>603</td>
<td>do</td>
<td>do</td>
<td>1946</td>
<td>180</td>
<td>8</td>
<td>Tres</td>
<td>2,382</td>
<td>95.8</td>
<td>Nov. 1960</td>
<td>N A, P</td>
<td>-- Plugged and abandoned; reported yield, 100 gpm.</td>
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<tr>
<td>608</td>
<td>E. G. Long</td>
<td>--</td>
<td>1961</td>
<td>172</td>
<td>6</td>
<td>Tres</td>
<td>2,389</td>
<td>110.0</td>
<td>Jan. 1964</td>
<td>S Irr 169</td>
<td>3 Occasionally used for irrigation of grass; reported yield, 35 gpm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>609</td>
<td>E. C. Miles</td>
<td>Hopkins Drig. Co.</td>
<td>1963</td>
<td>155</td>
<td>8</td>
<td>Tres</td>
<td>2,378</td>
<td>86.6</td>
<td>do</td>
<td>T, G Irr 130</td>
<td>3 Application rate measured for open discharge, 270 gpm (Aug. 1962); reported yield, 50 gpm.</td>
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<td></td>
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<tr>
<td>701</td>
<td>Max Wright</td>
<td>O. R. House</td>
<td>1956</td>
<td>360</td>
<td>6</td>
<td>Tres</td>
<td>195.4</td>
<td>do</td>
<td>S</td>
<td>Irr 300</td>
<td>5 Application rate measured for open discharge, 88 gpm (Aug. 1962); reported &quot;red bed&quot; encountered at 320-360 ft; reported yield, 100 gpm.</td>
<td></td>
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</tr>
<tr>
<td>702</td>
<td>do</td>
<td>Max Wright</td>
<td>1955</td>
<td>300</td>
<td>16-12</td>
<td>Tres</td>
<td>2,446</td>
<td>188.6</td>
<td>do</td>
<td>T, G Irr 297</td>
<td>6 Application rate measured for open discharge, 98 gpm (Aug. 1962); yielded 300 gpm on test.</td>
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</table>

See footnotes at end of table.
<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Diameter (in.)</th>
<th>Depth unit</th>
<th>Casing</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level (ft)</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>705</td>
<td>Frank Crownover</td>
<td>O. R. House</td>
<td>1957</td>
<td>300</td>
<td>8</td>
<td>300</td>
<td>Trs</td>
<td>2,431</td>
<td>190.7</td>
<td>Jan. 1964</td>
<td>T,E</td>
<td>Irr</td>
<td>280</td>
<td>5</td>
<td>Application rate measured for open discharge, 150 gpm (Aug. 1962); reported yield, 225 gpm.</td>
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</tr>
<tr>
<td>802</td>
<td>do</td>
<td>Eula Compton</td>
<td>1957</td>
<td>190</td>
<td>8</td>
<td>190</td>
<td>Trs</td>
<td>2,426</td>
<td>121.3</td>
<td>Feb. 1963</td>
<td>T,E</td>
<td>Irr</td>
<td>--</td>
<td>4</td>
<td>Application rate measured for open discharge, 33 gpm (Aug. 1962); casing perforated at 120-140 and 160-190 ft; reported yield, 90 gpm.</td>
<td></td>
</tr>
<tr>
<td>803</td>
<td>do</td>
<td>Grosshans Bros.</td>
<td>1958</td>
<td>185</td>
<td>$\frac{1}{2}$</td>
<td>185</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>S</td>
<td>Irr</td>
<td>--</td>
<td>3</td>
<td>Casing perforated at 110-130 and 150-185 ft; pumping level 165.6 ft; reported yield, 45 gpm.</td>
<td></td>
</tr>
<tr>
<td>804</td>
<td>do</td>
<td>do</td>
<td>1958</td>
<td>200</td>
<td>$\frac{1}{2}$</td>
<td>185</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>S</td>
<td>Irr</td>
<td>--</td>
<td>3</td>
<td>Application rate measured for open discharge, 26 gpm (Aug. 1962); casing perforated at 120-140 and 150-185 ft.</td>
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<tr>
<td>805</td>
<td>do</td>
<td>O. R. House</td>
<td>1956</td>
<td>200</td>
<td>$\frac{1}{2}$</td>
<td>185</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>S</td>
<td>A,Irr</td>
<td>--</td>
<td>3</td>
<td>Casing perforated at 40-60 and 140-185 ft; reported yield, 45 gpm.</td>
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<tr>
<td>806</td>
<td>Gulf Pipeline Co.</td>
<td>--</td>
<td>--</td>
<td>254</td>
<td>8</td>
<td>215</td>
<td>Trs</td>
<td>2,421</td>
<td>144.8</td>
<td>Jan. 1964</td>
<td>T,E</td>
<td>A,Ind</td>
<td>--</td>
<td>4</td>
<td>Reported yield, 15 gpm.</td>
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<tr>
<td>808</td>
<td>O. J. Blocker</td>
<td>-- Tyler</td>
<td>1909</td>
<td>160</td>
<td>6</td>
<td>--</td>
<td>Trs</td>
<td>--</td>
<td>144.0</td>
<td>Feb. 1963</td>
<td>C,W</td>
<td>S</td>
<td>--</td>
<td>--</td>
<td>Application rate measured for open discharge, 24 gpm (Aug. 1962); measured yield, 32 gpm.</td>
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</tr>
<tr>
<td>812</td>
<td>E. A. et al</td>
<td>--</td>
<td>--</td>
<td>138</td>
<td>$\frac{1}{2}$</td>
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<td>Trs</td>
<td>2,415</td>
<td>117.3</td>
<td>do</td>
<td>C,W</td>
<td>D</td>
<td>--</td>
<td>$\dagger$</td>
<td>Measured yield, 24 gpm (Aug. 1962); reported yield, 30 gpm.</td>
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See footnotes at end of table.
Table 5.—Results of selected water wells, springs, and test wells—Continued

<table>
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<tr>
<th>Well</th>
<th>Owner</th>
<th>Operator</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Diameter (in.)</th>
<th>Casing</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level</th>
<th>Below land surface (ft)</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>29-36-814</td>
<td>L. S. Howard</td>
<td>O. R. House</td>
<td>1928</td>
<td>185</td>
<td>8</td>
<td>185</td>
<td>Trs</td>
<td>2,422</td>
<td>105.7</td>
<td>Jan. 1964</td>
<td>T, E</td>
<td>Irr</td>
<td>180</td>
<td>4</td>
<td>Motor, 10 hp; reported yield, 150 gpm.</td>
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</tr>
<tr>
<td>815</td>
<td>-</td>
<td>Maurice Horton</td>
<td>1941</td>
<td>140</td>
<td>6</td>
<td>--</td>
<td>Trs</td>
<td>2,631</td>
<td>127.9</td>
<td>Feb. 1963</td>
<td>C, W</td>
<td>D, S</td>
<td>1</td>
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<tr>
<td>818</td>
<td>F. H. Pretsche</td>
<td>--</td>
<td>1955</td>
<td>175</td>
<td>6</td>
<td>175</td>
<td>Trs</td>
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<td>S</td>
<td>Irr</td>
<td>175</td>
<td>2</td>
<td>Application rate measured for open discharge, 20 gpm (Aug. 1962); formerly supplied oil-test rig; reported yield, 55 gpm.</td>
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<tr>
<td>819</td>
<td>Leroy Pretsche</td>
<td>T. P. House</td>
<td>1957</td>
<td>220</td>
<td>6</td>
<td>180</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T, E</td>
<td>Irr</td>
<td>175</td>
<td>3</td>
<td>&quot;Red beds&quot; reported at 180 ft; reported yield, 80 gpm.</td>
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<tr>
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<td>L. S. Howard</td>
<td>N. C. House</td>
<td>1956</td>
<td>185</td>
<td>8</td>
<td>185</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T, E</td>
<td>Irr</td>
<td>175</td>
<td>4</td>
<td>Reported yield, 90 gpm.</td>
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<tr>
<td>901</td>
<td>Mertie Watt</td>
<td>--</td>
<td>1928</td>
<td>315</td>
<td>8</td>
<td>315</td>
<td>Trs</td>
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<td>101.4</td>
<td>1928</td>
<td>N</td>
<td>A, P</td>
<td>--</td>
<td>--</td>
<td>Formerly supplied city of Sweetwater; reported yield, 100 gpm.</td>
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<tr>
<td>902</td>
<td>do</td>
<td>--</td>
<td>1928</td>
<td>400</td>
<td>7</td>
<td>400</td>
<td>Trs</td>
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<td>104.3</td>
<td>1928</td>
<td>N</td>
<td>A, P</td>
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<td>5</td>
<td>Do.</td>
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<tr>
<td>903</td>
<td>do</td>
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<td>1928</td>
<td>180</td>
<td>10</td>
<td>180</td>
<td>Trs</td>
<td>2,420</td>
<td>104.7</td>
<td>Jan. 1964</td>
<td>T, E</td>
<td>Irr</td>
<td>180</td>
<td>5</td>
<td>Formerly supplied city of Sweetwater; reported yield, 125 gpm.</td>
<td></td>
</tr>
<tr>
<td>906</td>
<td>do</td>
<td>--</td>
<td>1928</td>
<td>185</td>
<td>8</td>
<td>--</td>
<td>Trs</td>
<td>--</td>
<td>109.9</td>
<td>do</td>
<td>T, E</td>
<td>Irr</td>
<td>--</td>
<td>4</td>
<td>Application rate measured for open discharge, 122 gpm (Aug. 1962); formerly supplied city of Sweetwater.</td>
<td></td>
</tr>
<tr>
<td>908</td>
<td>do</td>
<td>--</td>
<td>1928</td>
<td>180</td>
<td>8</td>
<td>--</td>
<td>Trs</td>
<td>2,422</td>
<td>102.1</td>
<td>Dec. 1962</td>
<td>N</td>
<td>A, P</td>
<td>--</td>
<td>4</td>
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<td></td>
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<tr>
<td>910</td>
<td>W. W. Shields</td>
<td>Grosshans Bros.</td>
<td>1961</td>
<td>334</td>
<td>8</td>
<td>160</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T, G</td>
<td>Irr</td>
<td>--</td>
<td>4</td>
<td>Application rate measured for open discharge, 46 gpm (Aug. 1962); &quot;red beds&quot; reported at 160 ft.</td>
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<tr>
<td>915</td>
<td>Arlon Orman</td>
<td>Grosshans Bros.</td>
<td>1957</td>
<td>220</td>
<td>8</td>
<td>203</td>
<td>Trs</td>
<td>--</td>
<td>98.8</td>
<td>do</td>
<td>T, E</td>
<td>Irr</td>
<td>200</td>
<td>4</td>
<td>Application rate measured for open discharge, 103 gpm (Aug. 1962).</td>
<td></td>
</tr>
</tbody>
</table>

*See footnotes at end of table.*
<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Diameter (in.)</th>
<th>Water level setting (ft)</th>
<th>Date of measurement</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
</tr>
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<tbody>
<tr>
<td>29-36-917</td>
<td>Gulf Refining Co.</td>
<td>--</td>
<td>1927</td>
<td>170</td>
<td>8</td>
<td>Trs</td>
<td>Dec. 1963</td>
<td>N, A, Ind</td>
<td>4</td>
<td>Formerly supplied refinery; reported yield, 50 gpm.</td>
</tr>
<tr>
<td>918</td>
<td>Woodrow Smith</td>
<td>--</td>
<td>1960</td>
<td>180</td>
<td>6</td>
<td>Trs</td>
<td>Feb. 1961</td>
<td>N, A, Ind</td>
<td>4</td>
<td>Well destroyed; formerly supplied oil-test rig.</td>
</tr>
<tr>
<td>922</td>
<td>Christo Richburg</td>
<td>O. R. House</td>
<td>1963</td>
<td>204</td>
<td>8</td>
<td>Trs</td>
<td>Aug. 1963</td>
<td>S, Irr</td>
<td>3</td>
<td>Application rate measured for discharge to sprinkler system, 50 gpm; pumping level 167.8 ft.</td>
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<tr>
<td>925</td>
<td>Garland Price</td>
<td>Joe Whitworth</td>
<td>1961</td>
<td>240</td>
<td>--</td>
<td>Trs</td>
<td>--</td>
<td>N, A, T</td>
<td>--</td>
<td>Test well for irrigation; reported yield, 80 gpm.</td>
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<tr>
<td>404</td>
<td>Eula Cook</td>
<td>--</td>
<td>1962</td>
<td>150</td>
<td>6</td>
<td>Trs</td>
<td>July 1962</td>
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<td>2</td>
<td>Water reported mineralized, but potable.</td>
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<tr>
<td>407</td>
<td>Texaco Service Station</td>
<td>O. R. House</td>
<td>1961</td>
<td>150</td>
<td>5</td>
<td>Trs</td>
<td>--</td>
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<td>Water reported mineralized, but potable.</td>
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<tr>
<td>703</td>
<td>E. C. Miles</td>
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<td>1961</td>
<td>185</td>
<td>6</td>
<td>Trs</td>
<td>Oct. 1960</td>
<td>--</td>
<td>--</td>
<td>Water reported mineralized, but potable.</td>
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<tr>
<td>704</td>
<td>E. C. Miles</td>
<td>--</td>
<td>1961</td>
<td>204</td>
<td>5</td>
<td>Trs</td>
<td>June 1963</td>
<td>C, W, S</td>
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<tr>
<td>103</td>
<td>F. A. Fuller</td>
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<td>1962</td>
<td>130</td>
<td>5</td>
<td>Trs</td>
<td>2,130</td>
<td>35.9</td>
<td>N, A, D</td>
<td>Yielded 40 gpm on test.</td>
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<td>1961</td>
<td>81</td>
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<td>2,091</td>
<td>32.8</td>
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<td>Yielded 40 gpm on test.</td>
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<td>Trs</td>
<td>2,159</td>
<td>32.1</td>
<td>C, W, D</td>
<td>Yielded 40 gpm on test.</td>
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See footnotes at end of table.
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<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Casing Diameter (in.)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column site (in.)</th>
<th>Remarks</th>
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<td>42</td>
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<td>Trs</td>
<td>2,089</td>
<td>30.6</td>
<td>July 1963</td>
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<tr>
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<td>--</td>
<td>25</td>
<td>5</td>
<td>Trs</td>
<td>2,090</td>
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<td>52</td>
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<td>Trs</td>
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<td>May 1946</td>
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<td>72.5</td>
<td>Do</td>
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<td>A, S</td>
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<td>160</td>
<td>5</td>
<td>Trs</td>
<td>2,180</td>
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<td>May 1963</td>
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<td>Trs</td>
<td>2,122</td>
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<td>S</td>
<td>D, S</td>
<td>1.1/4</td>
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<td>Plainview Baptist Church</td>
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<td>1959</td>
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<td>Trs</td>
<td>2,170</td>
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<td>Do</td>
<td>S</td>
<td>D</td>
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<td>Trs 20</td>
<td>2,142</td>
<td>10.1</td>
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<td>R. B. Morris</td>
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<td>90</td>
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<td>Trs</td>
<td>2,210</td>
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<td>Do</td>
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<td>--</td>
<td>131</td>
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<td>Trs</td>
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<td>75.3</td>
<td>Do</td>
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<td>Trs</td>
<td>2,271</td>
<td>165.0</td>
<td>July 1963</td>
<td>C, W</td>
<td>D</td>
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<td>50</td>
<td>5</td>
<td>Trs</td>
<td>2,200</td>
<td>20.6</td>
<td>June 1963</td>
<td>N</td>
<td>A, S</td>
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<tr>
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<td>62</td>
<td>6</td>
<td>Trs</td>
<td>2,090</td>
<td>45.9</td>
<td>Do</td>
<td>C, E</td>
<td>D, S</td>
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<tr>
<td>502</td>
<td>do</td>
<td>--</td>
<td>1952</td>
<td>40</td>
<td>5</td>
<td>Trs</td>
<td>2,043</td>
<td>20.0</td>
<td>Do</td>
<td>C, W</td>
<td>A, S</td>
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<td>--</td>
<td>99</td>
<td>4</td>
<td>Trs</td>
<td>2,110</td>
<td>69.9</td>
<td>Do</td>
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<th>Owner</th>
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<th>Date</th>
<th>Depth</th>
<th>Casing</th>
<th>Water-bearing unit</th>
<th>Altitude below land surface (ft)</th>
<th>Water level</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column site</th>
<th>Remarks</th>
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<tr>
<td>29-41-601</td>
<td>C. C. Thompson</td>
<td>--</td>
<td>1913</td>
<td>100</td>
<td>1/2</td>
<td>Trs</td>
<td>2,082</td>
<td>74.4</td>
<td>Oct. 1962</td>
<td>C, E D</td>
<td>--</td>
<td>--</td>
<td>Water not potable.</td>
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<tr>
<td>602</td>
<td>W. R. Powell</td>
<td>--</td>
<td>--</td>
<td>108</td>
<td>--</td>
<td>P</td>
<td>2,080</td>
<td>64.1</td>
<td>do</td>
<td>C, E D</td>
<td>--</td>
<td>--</td>
<td>Water hard, but potable.</td>
</tr>
<tr>
<td>603</td>
<td>C. C. Thompson</td>
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<td>1943</td>
<td>43</td>
<td>5</td>
<td>Trs</td>
<td>2,070</td>
<td>29.2</td>
<td>June 1963</td>
<td>C, W D, S</td>
<td>43</td>
<td>--</td>
<td>Water reportedly of good chemical quality; reported yield, 2-3 gpm.</td>
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<tr>
<td>* 701</td>
<td>J. E. Cox</td>
<td>--</td>
<td>1963</td>
<td>131</td>
<td>1/2</td>
<td>Trs</td>
<td>2,137</td>
<td>32.5</td>
<td>July 1963</td>
<td>C, E S</td>
<td>--</td>
<td>--</td>
<td>Reported weak supply.</td>
</tr>
<tr>
<td>* 702</td>
<td>J. C. Robinson</td>
<td>--</td>
<td>1963</td>
<td>120</td>
<td>5</td>
<td>Trs</td>
<td>2,113</td>
<td>66.3</td>
<td>do</td>
<td>C, W S</td>
<td>--</td>
<td>--</td>
<td>Reported yield, 5 gpm.</td>
</tr>
<tr>
<td>803</td>
<td>G. L. Powell</td>
<td>--</td>
<td>--</td>
<td>112+</td>
<td>1/2</td>
<td>Trs</td>
<td>2,118</td>
<td>111.0</td>
<td>do</td>
<td>C, W S</td>
<td>--</td>
<td>--</td>
<td>Water potable; reported yield, 1-2 gpm.</td>
</tr>
<tr>
<td>* 102</td>
<td>James Payne</td>
<td>O. R. House</td>
<td>1962</td>
<td>120</td>
<td>1/2</td>
<td>90 Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>S S</td>
<td>--</td>
<td>--</td>
<td>Reported yield, 30 gpm.</td>
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<tr>
<td>201</td>
<td>Looney School</td>
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<td>--</td>
<td>109</td>
<td>--</td>
<td>Trs</td>
<td>--</td>
<td>91.6</td>
<td>May 1966</td>
<td>C, W P</td>
<td>--</td>
<td>--</td>
<td>Water leaves visible white residue on soil; reported yield, 150 gpm.</td>
</tr>
<tr>
<td>* 205</td>
<td>J. A. Martin</td>
<td>--</td>
<td>1961</td>
<td>139</td>
<td>1/2</td>
<td>Trs</td>
<td>--</td>
<td>88.8</td>
<td>do</td>
<td>-- D, S</td>
<td>--</td>
<td>--</td>
<td>Discharge to sprinkler system; reported yield, 77 gpm.</td>
</tr>
<tr>
<td>206</td>
<td>O. A. Ruffin</td>
<td>O. R. House</td>
<td>1960</td>
<td>175</td>
<td>8 175</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T, E Irr</td>
<td>172</td>
<td>4</td>
<td>Discharge to sprinkler system; reported yield, 77 gpm.</td>
</tr>
<tr>
<td>* 207</td>
<td>J. C. Cook</td>
<td>--</td>
<td>1958</td>
<td>180</td>
<td>8 100</td>
<td>Trs</td>
<td>2,189</td>
<td>78.7</td>
<td>Jan. 1964</td>
<td>T, G Irr</td>
<td>175</td>
<td>4</td>
<td>Discharge to sprinkler system; reported yield, 77 gpm.</td>
</tr>
<tr>
<td>208</td>
<td>W. P. Jarman</td>
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<td>952</td>
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<td>Trs</td>
<td>2,173</td>
<td>71.4</td>
<td>do</td>
<td>N A, D</td>
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</table>

See footnotes at end of table.
Table 5.—Records of selected water wells, springs, and test wells—Continued

<table>
<thead>
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<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Diameter (in.)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level (ft)</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
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<tr>
<td>29-42-209</td>
<td>James Wulfjen</td>
<td>O. R. House</td>
<td>1963</td>
<td>120</td>
<td>9</td>
<td>120</td>
<td>Trs</td>
<td>2,158</td>
<td>66.7</td>
<td>J. G. 1963</td>
<td>T, G</td>
<td>Irr</td>
<td>155</td>
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<tr>
<td>301</td>
<td>J. B. Mahon</td>
<td>I. O. Fannin</td>
<td>1962</td>
<td>160</td>
<td>16</td>
<td>150</td>
<td>Trs</td>
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<td>86.5</td>
<td>Jan. 1964</td>
<td>T, G</td>
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<tr>
<td>302</td>
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<td>E. W. Martin</td>
<td>1953</td>
<td>176</td>
<td>12</td>
<td>160</td>
<td>Trs</td>
<td>2,213</td>
<td>97.4</td>
<td>do</td>
<td>T, G</td>
<td>Irr</td>
<td>150</td>
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<tr>
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<td>170</td>
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<td>80</td>
<td>Trs</td>
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<td>Jan. 1964</td>
<td>T, E</td>
<td>Irr</td>
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<td>W. W. Roland</td>
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<td>1955</td>
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<td>Trs</td>
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<td>65.1</td>
<td>Mar. 1963</td>
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<td>Trs</td>
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<td>T, G</td>
<td>Irr</td>
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<td>Irr</td>
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<td>T, G</td>
<td>Irr</td>
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<td>8</td>
<td>--</td>
<td>Trs</td>
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<td>72.7</td>
<td>do</td>
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<td>A, Irr</td>
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</tr>
<tr>
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<td>1952</td>
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<td>6</td>
<td>155</td>
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<td>D. Barber</td>
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<td>1953</td>
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<td>110</td>
<td>Trs</td>
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<td>C. W. Martin</td>
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<td>Trs</td>
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<td>T, G</td>
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Table 5—Records of selected water wells, springs, and test wells—Continued

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<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Casing Diameter (in.)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level (ft)</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
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</thead>
<tbody>
<tr>
<td>322</td>
<td>Herman Miles</td>
<td>O. R. House</td>
<td>1962</td>
<td>130</td>
<td>3</td>
<td>119</td>
<td>Trs</td>
<td>2,177</td>
<td>22.5</td>
<td>May 1953</td>
<td>T, E</td>
<td>Irr</td>
<td>--</td>
<td>Used for irrigation of grass; water produces visible residue; reported yield, 72 gpm.</td>
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<tr>
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<td>Travis Turner</td>
<td>do</td>
<td>--</td>
<td>160</td>
<td>6</td>
<td>155</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>R</td>
<td>Ind</td>
<td>155</td>
<td>Discharge to earth tank; reported yield, 80 gpm.</td>
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<tr>
<td>402</td>
<td>do</td>
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<td>--</td>
<td>Trs</td>
<td>2,152</td>
<td>67.4</td>
<td>--</td>
<td>S</td>
<td>--</td>
<td>--</td>
<td>Not used since 1960; reported yield, 300 gpm.</td>
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<tr>
<td>502</td>
<td>D. C. Stubblefield</td>
<td>O. R. House</td>
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<td>8</td>
<td>--</td>
<td>Trs</td>
<td>2,105</td>
<td>26.3</td>
<td>do</td>
<td>N</td>
<td>A, Irr</td>
<td>--</td>
<td>Used for irrigation of grass; water produces visible residue; reported yield, 72 gpm.</td>
</tr>
<tr>
<td>503</td>
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<td>--</td>
<td>--</td>
<td>100</td>
<td>8</td>
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<td>Trs</td>
<td>2,105</td>
<td>26.3</td>
<td>do</td>
<td>N</td>
<td>A, Irr</td>
<td>--</td>
<td>Seldom used in 1962 and 1963; reported yield, 300 gpm.</td>
</tr>
<tr>
<td>504</td>
<td>do</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>10</td>
<td>--</td>
<td>Trs</td>
<td>2,105</td>
<td>26.3</td>
<td>do</td>
<td>N</td>
<td>A, Irr</td>
<td>--</td>
<td>Seldom used since 1960; reported yield, 300 gpm.</td>
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<tr>
<td>702</td>
<td>J. Huljen</td>
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<td>70</td>
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<td>Trs</td>
<td>2,133</td>
<td>30.0</td>
<td>Apr. 1961</td>
<td>C, E</td>
<td>D, S</td>
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<td>Reported yield, 100 gpm.</td>
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<tr>
<td>803</td>
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<td>--</td>
<td>90</td>
<td>8</td>
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<td>Trs</td>
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<td>17.5</td>
<td>Mar. 1963</td>
<td>T, E</td>
<td>A, Irr</td>
<td>--</td>
<td>Reported yield, 100 gpm.</td>
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See footnotes at end of table.
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<tr>
<td>29-42-806</td>
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<td>--</td>
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<td>807</td>
<td>Mary Wulfjen</td>
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<td>51, 5</td>
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<td>809</td>
<td>Ed Roach</td>
<td>O. R. House</td>
<td>1962</td>
</tr>
<tr>
<td>901</td>
<td>D. C. Stubblefield</td>
<td>--</td>
<td>121, 6</td>
</tr>
<tr>
<td>902</td>
<td>Forrest Porter</td>
<td>--</td>
<td>1938, 6</td>
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<tr>
<td>903</td>
<td>C. W. Crawford</td>
<td>O. R. House</td>
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<td>M. L. Adrian</td>
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<td>1936, 0, 6</td>
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<td>43-101</td>
<td>C. R. Green</td>
<td>O. R. House</td>
<td>1959, 12, 147</td>
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<td>102</td>
<td>Roscoe Hudgins</td>
<td>E. W. Martin</td>
<td>1958, 10, 210</td>
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<td>103</td>
<td>J. D. Givens</td>
<td>-- Nordyke</td>
<td>1955, 10, 47, 8</td>
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<tr>
<td>104</td>
<td>do</td>
<td>Eula Compton</td>
<td>1955, 10, 201</td>
</tr>
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<td>105</td>
<td>J. R. Mahan</td>
<td>-- Hoseley</td>
<td>1955, 12, 156, 201</td>
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<tr>
<td>106</td>
<td>G. M. Lee</td>
<td>Gay &amp; Thompson</td>
<td>1954, 12, 153, 201</td>
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<td>107</td>
<td>B. B. Lee</td>
<td>--</td>
<td>1955, 10, 201</td>
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<td>108</td>
<td>T. T. Baatler</td>
<td>Tex Clevinger</td>
<td>1955, 12, 198, 2,259</td>
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<td>109</td>
<td>Roscoe Hudgins</td>
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<td>1955, 12, 198, 2,212</td>
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<td>110</td>
<td>Hugh Narrell</td>
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<td>250, 10, 2,258</td>
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Table 5: Records of selected water wells, springs, and test wells—Continued.
Table 5.—Records of selected water wells, springs, and test wells—Continued

<table>
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<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Diameter (in.)</th>
<th>Altitude above land surface (ft)</th>
<th>Water level below land surface (ft)</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump site (in.)</th>
<th>Remarks</th>
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<tr>
<td>113</td>
<td>do</td>
<td>--</td>
<td>Spring</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>(+)</td>
<td>--</td>
<td>Flows</td>
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<td>114</td>
<td>Roscoe Hudgins</td>
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<td>--</td>
<td>130</td>
<td>6</td>
<td>130</td>
<td>Trs 2,196</td>
<td>46.6</td>
<td>Feb. 1961</td>
<td>T, E</td>
<td>Irr</td>
<td>128</td>
<td>6</td>
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<tr>
<td>115</td>
<td>Mrs. S. E. Meadows</td>
<td>N. C. House</td>
<td>1962</td>
<td>150</td>
<td>8</td>
<td>190</td>
<td>Trs 2,237</td>
<td>55.0</td>
<td>Jan. 1964</td>
<td>S</td>
<td>Irr</td>
<td>190</td>
<td>4</td>
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<tr>
<td>116</td>
<td>J. D. Givens</td>
<td>O. R. House</td>
<td>1959</td>
<td>150</td>
<td>10</td>
<td>200+</td>
<td>Trs 2,219</td>
<td>40.7</td>
<td>Mar. 1963</td>
<td>T, E</td>
<td>Irr</td>
<td>150</td>
<td>4</td>
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<td>117</td>
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<td>180</td>
<td>Trs 2,238</td>
<td>70.0</td>
<td>Jan. 1964</td>
<td>T, E</td>
<td>Irr</td>
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<td>5</td>
</tr>
<tr>
<td>118</td>
<td>do</td>
<td>Ken House</td>
<td>1955</td>
<td>164</td>
<td>8</td>
<td>164</td>
<td>Trs --</td>
<td>--</td>
<td>--</td>
<td>T, E</td>
<td>Irr</td>
<td>--</td>
<td>4</td>
</tr>
<tr>
<td>121</td>
<td>J. C. Freeman</td>
<td>Gale &amp; Thompson</td>
<td>1954</td>
<td>130</td>
<td>10</td>
<td>130</td>
<td>Trs --</td>
<td>--</td>
<td>--</td>
<td>T, E</td>
<td>Irr</td>
<td>125</td>
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<tr>
<td>122</td>
<td>T. T. Boal</td>
<td>O. R. House</td>
<td>1963</td>
<td>213</td>
<td>7</td>
<td>173</td>
<td>Trs 2,267</td>
<td>108.5</td>
<td>Mar. 1963</td>
<td>S</td>
<td>Irr</td>
<td>170</td>
<td>4</td>
</tr>
<tr>
<td>124</td>
<td>C. R. Green</td>
<td>O. R. House</td>
<td>1959</td>
<td>222</td>
<td>--</td>
<td>--</td>
<td>Trs --</td>
<td>--</td>
<td>--</td>
<td>N</td>
<td>A, T</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>201</td>
<td>K. L. Taylor</td>
<td>D. V. Markham</td>
<td>1959</td>
<td>160</td>
<td>12</td>
<td>160</td>
<td>Trs 2,264</td>
<td>64.0</td>
<td>Jan. 1964</td>
<td>T, G</td>
<td>Irr</td>
<td>--</td>
<td>6</td>
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See footnotes at end of table.
<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Casing diameter (in.)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level below land surface (ft)</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column or site</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>204</td>
<td>Melvin Baumann</td>
<td>Cleaver</td>
<td>1958</td>
<td>135</td>
<td>8</td>
<td>135</td>
<td>2,266</td>
<td>72.5</td>
<td>do</td>
<td>T, G</td>
<td>Irr</td>
<td>200</td>
<td>6</td>
<td>Reported yield, 250 gpm.</td>
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<tr>
<td>205</td>
<td>Sam Smith</td>
<td>Sam Smith</td>
<td>1958</td>
<td>225</td>
<td>12</td>
<td>220</td>
<td>2,278</td>
<td>79.9</td>
<td>do</td>
<td>T, G</td>
<td>Irr</td>
<td>200</td>
<td>6</td>
<td>Application rate measured for discharge to sprinkler system; 500 gpm (Mar. 1963).</td>
</tr>
<tr>
<td>206</td>
<td>N. C. House</td>
<td></td>
<td>1960</td>
<td>210</td>
<td>10</td>
<td>--</td>
<td>--</td>
<td>77.1</td>
<td>Nov. 1960</td>
<td>N, A, T</td>
<td>Irr</td>
<td>200</td>
<td>6</td>
<td>Test well for irrigation; reported yield, 300 gpm.</td>
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<tr>
<td>208</td>
<td>Armando Baumann</td>
<td>Hopkins Drlg. Co.</td>
<td>1961</td>
<td>132</td>
<td>10</td>
<td>130</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T, G</td>
<td>Irr</td>
<td>130</td>
<td>5</td>
<td>Application rate measured for discharge to sprinkler system; reported yield, 180 gpm.</td>
</tr>
<tr>
<td>209</td>
<td>Edward Baumann</td>
<td>Cleaver</td>
<td>1961</td>
<td>138</td>
<td>10</td>
<td>138</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T, G</td>
<td>Irr</td>
<td>130</td>
<td>5</td>
<td>Application rate measured for discharge to sprinkler system; 117 gpm (Mar. 1963); reported yield, 150 gpm.</td>
</tr>
<tr>
<td>210</td>
<td>K. L. Taylor</td>
<td>Cleaver</td>
<td>1955</td>
<td>140</td>
<td>10</td>
<td>140</td>
<td>2,223</td>
<td>47.7</td>
<td>Jan. 1964</td>
<td>T, G</td>
<td>Irr</td>
<td>140</td>
<td>5</td>
<td>Application rate measured for discharge to sprinkler system; reported yield, 150 gpm.</td>
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<td>Max Wright</td>
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<td>168</td>
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<td>168</td>
<td>2,262</td>
<td>54.9</td>
<td>Jan. 1964</td>
<td>T, E</td>
<td>Irr</td>
<td>168</td>
<td>4</td>
<td>Application rate measured for discharge to sprinkler system; 79 gpm; water-bearing zone at 130-168 ft; reported yield, 100 gpm.</td>
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<tr>
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<td>Sam Smith</td>
<td>1974</td>
<td>180</td>
<td>8</td>
<td>180</td>
<td>2,247</td>
<td>85.2</td>
<td>do</td>
<td>T, G</td>
<td>Irr</td>
<td>175</td>
<td>4</td>
<td>Discharge to sprinkler system; reported yield, 170 gpm.</td>
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<td>do</td>
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<td>1973</td>
<td>150</td>
<td>12</td>
<td>100</td>
<td>2,260</td>
<td>26.4</td>
<td>do</td>
<td>T, E</td>
<td>Irr</td>
<td>110</td>
<td>6</td>
<td>Do.</td>
</tr>
<tr>
<td>304</td>
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<td>Cleaver</td>
<td>1956</td>
<td>150</td>
<td>12</td>
<td>150</td>
<td>2,265</td>
<td>58.7</td>
<td>do</td>
<td>T, G</td>
<td>Irr</td>
<td>160</td>
<td>5</td>
<td>Yield has increased since well was drilled; reported yield, 300 gpm.</td>
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<tr>
<td>305</td>
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<td>--</td>
<td>1960</td>
<td>92</td>
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<td>--</td>
<td>22.8</td>
<td>Nov. 1960</td>
<td>C, W</td>
<td>N</td>
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See footnotes at end of table.
Table 5.--Records of selected water wells, springs, and test wells--Continued

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<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Casing Dia-</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level below land surface (ft)</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
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<tr>
<td>309</td>
<td>N. A. Dunahoo</td>
<td>O. R. House</td>
<td>1948</td>
<td>120</td>
<td>6</td>
<td>130 Trs</td>
<td>2,317</td>
<td>96.6 May 1963</td>
<td>C, E D,S</td>
<td>120</td>
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<td>G. B. Tartt</td>
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<td>1961</td>
<td>195</td>
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<td>2,315</td>
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<td>N, A, Ind</td>
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<td>B. H. Johnson</td>
<td>N. C. House</td>
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<td>195</td>
<td>--</td>
<td>--</td>
<td>2,315</td>
<td>43.7 do</td>
<td>N, A, Ind</td>
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<td>210±</td>
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<td>--</td>
<td>--</td>
<td>92.3 Nov. 1960</td>
<td>S, Irr</td>
<td>170±</td>
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<td>R. Fee</td>
<td>E. W. Martin</td>
<td>1953</td>
<td>115</td>
<td>14</td>
<td>115 Trs</td>
<td>2,161</td>
<td>44.5 Jan. 1964</td>
<td>T, G, IRR</td>
<td>110±</td>
<td>6</td>
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<tr>
<td>403</td>
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<td>1956</td>
<td>200±</td>
<td>6</td>
<td>--</td>
<td>--</td>
<td>-- T, G, IRR</td>
<td>170±</td>
<td>4</td>
<td>--</td>
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<tr>
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<td>Judge Campbell</td>
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<td>230</td>
<td>14</td>
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<td>2,247</td>
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<td>T, G, IRR</td>
<td>220±</td>
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</tr>
<tr>
<td>405</td>
<td>do</td>
<td>do</td>
<td>1956</td>
<td>200±</td>
<td>6</td>
<td>--</td>
<td>--</td>
<td>-- S, Irr</td>
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<td>12</td>
<td>105 Trs</td>
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<td>--</td>
<td>1953</td>
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<td>--</td>
<td>128.8 May 1963</td>
<td>C, W, S</td>
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<td>160±</td>
<td>6</td>
<td>--</td>
<td>--</td>
<td>-- C, W, S</td>
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<td>-- S, Irr</td>
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</tr>
<tr>
<td>412</td>
<td>do</td>
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<td>170±</td>
<td>6</td>
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<td>--</td>
<td>-- S, Irr</td>
<td>--</td>
<td>4</td>
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See footnotes at end of table.
Table 5.—Records of selected water wells, springs, and test wells—Continued

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<thead>
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<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of Well (ft)</th>
<th>Casing Diameter (in.)</th>
<th>Water-bearing Unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level</th>
<th>Date of measurement</th>
<th>Method of measurement</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
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<td>415</td>
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<td>5½</td>
<td>Trs</td>
<td>--</td>
<td>38.0</td>
<td>Jan. 1963</td>
<td>C,W</td>
<td>B,S</td>
<td>--</td>
<td>½</td>
<td></td>
</tr>
<tr>
<td>416</td>
<td>do</td>
<td>--</td>
<td>1956</td>
<td>150</td>
<td>6</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>S</td>
<td>Irr</td>
<td>--</td>
<td>4</td>
<td>Application rate measured for open discharge, 80 gpm (Mar. 1963).</td>
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<tr>
<td>501</td>
<td>Perry Bueles</td>
<td>Eulis Compton</td>
<td>1957</td>
<td>130</td>
<td>12</td>
<td>130</td>
<td>Trs</td>
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<td>44.0</td>
<td>1946</td>
<td>T,G</td>
<td>Irr</td>
<td>125</td>
<td>8</td>
</tr>
<tr>
<td>502</td>
<td>R. J. Hackfield</td>
<td>do</td>
<td>1956</td>
<td>200</td>
<td>10</td>
<td>200</td>
<td>Trs</td>
<td>2,256</td>
<td>75.8</td>
<td>1962</td>
<td>T,G</td>
<td>Irr</td>
<td>180</td>
<td>6</td>
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<tr>
<td>503</td>
<td>A. K. Sheffield</td>
<td>O. R. House</td>
<td>1955</td>
<td>180</td>
<td>8</td>
<td>180</td>
<td>Trs</td>
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<td>80.1</td>
<td>Jan. 1964</td>
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<td>Irr</td>
<td>178</td>
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<tr>
<td>504</td>
<td>do</td>
<td>do</td>
<td>1960</td>
<td>152</td>
<td>10</td>
<td>156</td>
<td>Trs</td>
<td>--</td>
<td>74.6</td>
<td>do</td>
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<td>Irr</td>
<td>--</td>
<td>4</td>
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<tr>
<td>505</td>
<td>Charles Finley</td>
<td>O. L. Williams</td>
<td>1956</td>
<td>233</td>
<td>10</td>
<td>190</td>
<td>Trs</td>
<td>--</td>
<td>50.8</td>
<td>do</td>
<td>T,G</td>
<td>Irr</td>
<td>125</td>
<td>5</td>
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<tr>
<td>506</td>
<td>Alfred Hackfield</td>
<td>Eulis Compton</td>
<td>1960</td>
<td>230</td>
<td>12</td>
<td>134</td>
<td>Trs</td>
<td>2,230</td>
<td>59.8</td>
<td>do</td>
<td>T,G</td>
<td>Irr</td>
<td>144</td>
<td>8</td>
</tr>
<tr>
<td>507</td>
<td>Mrs. Grace Jackson</td>
<td>E. D. Cleaver</td>
<td>1956</td>
<td>117</td>
<td>12</td>
<td>117</td>
<td>Trs</td>
<td>2,226</td>
<td>48.8</td>
<td>Mar. 1964</td>
<td>T,G</td>
<td>Irr</td>
<td>100</td>
<td>6</td>
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<tr>
<td>509</td>
<td>B. H. Johnson</td>
<td>Bill Gale</td>
<td>1957</td>
<td>168</td>
<td>10</td>
<td>168</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T,G</td>
<td>Irr</td>
<td>100</td>
<td>8</td>
</tr>
<tr>
<td>510</td>
<td>Charles Finley</td>
<td>O. R. House</td>
<td>1961</td>
<td>113</td>
<td>10</td>
<td>113</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T,G</td>
<td>Irr</td>
<td>108</td>
<td>5</td>
</tr>
<tr>
<td>511</td>
<td>do</td>
<td>--</td>
<td>1956</td>
<td>115</td>
<td>8</td>
<td>2,225</td>
<td>Trs</td>
<td>47.6</td>
<td>Jan. 1964</td>
<td>T,E</td>
<td>Irr</td>
<td>108</td>
<td>4</td>
<td>Reported yield, 100 gpm.</td>
</tr>
<tr>
<td>512</td>
<td>do</td>
<td>--</td>
<td>1956</td>
<td>110</td>
<td>8</td>
<td>2,225</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T,E</td>
<td>Irr</td>
<td>--</td>
<td>4</td>
</tr>
</tbody>
</table>

*See footnotes at end of table.*
### Table 5.--Records of selected water wells, springs, and test wells--Continued

<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Casing Diameter (in.)</th>
<th>Depth (ft)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level below land surface (ft)</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>29-43-514</td>
<td>Alfred Hackfeld</td>
<td>--</td>
<td>1956</td>
<td>140</td>
<td>8</td>
<td>140</td>
<td>Trs</td>
<td>2,256</td>
<td>73.5</td>
<td>Jan. 1964</td>
<td>T,E</td>
<td>Irr</td>
<td>140</td>
<td>4</td>
<td>Discharge to sprinkler system; casing perforated at 70-110 ft; reported yield, 125 gpm.</td>
</tr>
<tr>
<td>515</td>
<td>C. L. Maynard</td>
<td>O. R. House</td>
<td>1962</td>
<td>143</td>
<td>5</td>
<td>143</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>D, S</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>Reported yield, 12 gpm.</td>
</tr>
<tr>
<td>516</td>
<td>Perry Bowles</td>
<td>N. C. House</td>
<td>1962</td>
<td>114</td>
<td>6</td>
<td>--</td>
<td>Trs</td>
<td>2,237</td>
<td>54.1</td>
<td>Jan. 1963</td>
<td>S</td>
<td>0,8</td>
<td>--</td>
<td>--</td>
<td>Yielded 35 gpm on bailer test.</td>
</tr>
<tr>
<td>518</td>
<td>B. H. Johnson</td>
<td>N. C. House</td>
<td>1962</td>
<td>152</td>
<td>10</td>
<td>152</td>
<td>Trs</td>
<td>2,247</td>
<td>57.0</td>
<td>do</td>
<td>T, G</td>
<td>Irr</td>
<td>145</td>
<td>5</td>
<td>Application rate measured for discharge to sprinkler system, 180 gpm (Aug. 1963); casing slotted at 82-152 ft; reported yield, 230 gpm.</td>
</tr>
<tr>
<td>519</td>
<td>C. L. Maynard</td>
<td>--</td>
<td>--</td>
<td>1000</td>
<td>5½</td>
<td>--</td>
<td>Trs</td>
<td>2,280</td>
<td>92.8</td>
<td>Apr. 1963</td>
<td>C, W</td>
<td>S</td>
<td>--</td>
<td>--</td>
<td>Reported yield, 100± gpm.</td>
</tr>
<tr>
<td>601</td>
<td>B. H. Johnson</td>
<td>Sam Smith</td>
<td>1960</td>
<td>150</td>
<td>8</td>
<td>150</td>
<td>--</td>
<td>2,297</td>
<td>49.1</td>
<td>Jan. 1964</td>
<td>S</td>
<td>Irr</td>
<td>130</td>
<td>4</td>
<td>Application rate measured for open discharge, 51 gpm (Aug. 1962); &quot;red bed&quot; at 210 ft; reported yield, 70 gpm.</td>
</tr>
<tr>
<td>602</td>
<td>Herman Aucutt</td>
<td>O. R. House</td>
<td>1956</td>
<td>220</td>
<td>8</td>
<td>60</td>
<td>Trs</td>
<td>2,363</td>
<td>94.8</td>
<td>do</td>
<td>T, G</td>
<td>Irr</td>
<td>218</td>
<td>4</td>
<td>Application rate measured for irrigation; reported yield, 80 gpm.</td>
</tr>
<tr>
<td>603</td>
<td>Georgia Institute of Technology</td>
<td>--</td>
<td>--</td>
<td>133</td>
<td>5½</td>
<td>--</td>
<td>Trs</td>
<td>2,337</td>
<td>97.1</td>
<td>Dec. 1961</td>
<td>C, W</td>
<td>D</td>
<td>--</td>
<td>1½</td>
<td>Test well for irrigation; reported yield, 80 gpm.</td>
</tr>
<tr>
<td>605</td>
<td>Fred Sauer</td>
<td>--</td>
<td>--</td>
<td>120</td>
<td>5½</td>
<td>--</td>
<td>Trs</td>
<td>2,356</td>
<td>97.0</td>
<td>Jan. 1964</td>
<td>C, W</td>
<td>D, S</td>
<td>--</td>
<td>--</td>
<td>Application rate measured for discharge to sprinkler system, 115 gpm (Apr. 1963); reported yield, 175± gpm.</td>
</tr>
<tr>
<td>606</td>
<td>Herman Aucutt</td>
<td>O. R. House</td>
<td>1962</td>
<td>210</td>
<td>6</td>
<td>220</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>S</td>
<td>Irr</td>
<td>200</td>
<td>--</td>
<td>Reported yield, 2±3 gpm.</td>
</tr>
<tr>
<td>701</td>
<td>Willis Cornutt</td>
<td>O. L. Williams</td>
<td>1958</td>
<td>210</td>
<td>8</td>
<td>210</td>
<td>Trs</td>
<td>2,295</td>
<td>122.0</td>
<td>Jan. 1964</td>
<td>T, E</td>
<td>Irr</td>
<td>210±</td>
<td>--</td>
<td>Application rate measured for discharge to sprinkler system, 115 gpm (Apr. 1963); reported yield, 175± gpm.</td>
</tr>
<tr>
<td>702</td>
<td>L. R. Cornutt</td>
<td>--</td>
<td>--</td>
<td>124</td>
<td>6</td>
<td>--</td>
<td>Trs</td>
<td>2,267</td>
<td>100.0</td>
<td>do</td>
<td>S</td>
<td>D, S</td>
<td>--</td>
<td>--</td>
<td>Reported yield, 2±3 gpm.</td>
</tr>
</tbody>
</table>

See footnotes at end of table.
<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Casing Dia- (in.)</th>
<th>Depth of water-bearing unit</th>
<th>Altitude above land surface (ft)</th>
<th>Water level (ft)</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>29-42-703</td>
<td>Willis Cornutt</td>
<td>O. R. House</td>
<td>1962</td>
<td>175 5½</td>
<td>--</td>
<td>175 5½</td>
<td>--</td>
<td>2,280</td>
<td>--</td>
<td>S</td>
<td>D</td>
<td>--</td>
<td>--</td>
<td>Discharge to sprinkler system; reported yield, 200 gpm.</td>
</tr>
<tr>
<td>801</td>
<td>W. R. Cornutt</td>
<td>O. L. Williams</td>
<td>1958</td>
<td>220 10</td>
<td>--</td>
<td>215 8</td>
<td>Trs</td>
<td>2,300</td>
<td>120.9</td>
<td>Jan. 1964</td>
<td>T,E</td>
<td>Ir 210</td>
<td>4</td>
<td>Gravel packed at 66-106 ft; reported yield, 90 gpm.</td>
</tr>
<tr>
<td>802</td>
<td>Dr. P. M. Gray</td>
<td>Hopkins Drig. Co.</td>
<td>1960</td>
<td>106 8 103</td>
<td>Trs</td>
<td>2,216</td>
<td>12.5</td>
<td>July 1963</td>
<td>N A,T</td>
<td>--</td>
<td>T,E</td>
<td>Ir 210</td>
<td>4</td>
<td>Discharge to sprinkler system; reported yield, 150 gpm.</td>
</tr>
<tr>
<td>803</td>
<td>W. R. Cornutt</td>
<td>O. R. House</td>
<td>--</td>
<td>215 8</td>
<td>--</td>
<td>2,281</td>
<td>31.2</td>
<td>80</td>
<td>--</td>
<td>S</td>
<td>D</td>
<td>2</td>
<td>2</td>
<td>Water has objectionable taste; reported yield, 2-3 gpm.</td>
</tr>
<tr>
<td>805</td>
<td>S. A. Hutchins</td>
<td>Hopkins Drig. Co.</td>
<td>1960</td>
<td>90 5½ 90</td>
<td>Trs</td>
<td>--</td>
<td>27.0</td>
<td>June 1963</td>
<td>S D</td>
<td>80</td>
<td>2</td>
<td>--</td>
<td>6</td>
<td>Yielded 450 gpm on test; yield declined after caving; reported yield, 250 gpm.</td>
</tr>
<tr>
<td>44-101</td>
<td>J. E. Collier</td>
<td>Grosshans Bros.</td>
<td>1959</td>
<td>220 12 200</td>
<td>Trs</td>
<td>2,368</td>
<td>94.7</td>
<td>Jan. 1964</td>
<td>T,E</td>
<td>Ir 215</td>
<td>4</td>
<td>--</td>
<td>4</td>
<td>Discharge to 12-10 gpm sprinkler; reported yield, 230 gpm.</td>
</tr>
<tr>
<td>102</td>
<td>E. O. Mahon</td>
<td>N. C. House</td>
<td>1960</td>
<td>215 7</td>
<td>--</td>
<td>2,336</td>
<td>64.6</td>
<td>do</td>
<td>S</td>
<td>Ir 215</td>
<td>5</td>
<td>--</td>
<td>--</td>
<td>Water-bearing zones at 19 and 90 ft.</td>
</tr>
<tr>
<td>103</td>
<td>do</td>
<td>O. R. House</td>
<td>1960</td>
<td>205 8 140</td>
<td>Trs</td>
<td>2,307</td>
<td>27.7</td>
<td>do</td>
<td>T,E</td>
<td>Ir 215</td>
<td>5</td>
<td>--</td>
<td>--</td>
<td>Oil test: plugged back to about 300 ft.</td>
</tr>
<tr>
<td>105</td>
<td>E. J. Gembler</td>
<td>--</td>
<td>1954</td>
<td>152 10 60</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T,E</td>
<td>Ir 215</td>
<td>4</td>
<td>--</td>
<td>--</td>
<td>NOTES AT END OF TABLE.</td>
</tr>
<tr>
<td>106</td>
<td>E. A. Costphens</td>
<td>--</td>
<td>--</td>
<td>110 8</td>
<td>--</td>
<td>27.2</td>
<td>Feb. 1962</td>
<td>C,W</td>
<td>D</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>WATER-BEARING ZONES AT灯7 AND 90 FT.</td>
</tr>
<tr>
<td>107</td>
<td>J. R. Hawkins</td>
<td>--</td>
<td>1964</td>
<td>114 5</td>
<td>--</td>
<td>47.7</td>
<td>July 1964</td>
<td>C,W</td>
<td>D</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>WATER-BEARING ZONES AT 90-150 FT.</td>
</tr>
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</table>

See footnotes at end of table.
Table 5.--Records of selected water wells, springs, and test wells--Continued

<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Diameter (in.)</th>
<th>Depth (ft)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Below land surface (ft)</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>113</td>
<td>O. A. Rannefeld</td>
<td>do</td>
<td>1957</td>
<td>160</td>
<td>7</td>
<td>--</td>
<td>Trs</td>
<td>--</td>
<td>41.7</td>
<td>do</td>
<td>S</td>
<td>Irr</td>
<td>145</td>
<td>3</td>
<td>Discharge to earth tank; reported yield, 110 gpm.</td>
</tr>
<tr>
<td>114</td>
<td>K. L. Bankhead</td>
<td>do</td>
<td>1956</td>
<td>155</td>
<td>8</td>
<td>70</td>
<td>Trs</td>
<td>2,299</td>
<td>29.4</td>
<td>do</td>
<td>T,G</td>
<td>Irr</td>
<td>140</td>
<td>5</td>
<td>Discharge to sprinkler system; reported yield, 180 gpm.</td>
</tr>
<tr>
<td>115</td>
<td>Edsel Bankhead</td>
<td>do</td>
<td>1958</td>
<td>155</td>
<td>8</td>
<td>150</td>
<td>Trs</td>
<td>2,318</td>
<td>43.1</td>
<td>do</td>
<td>T,G</td>
<td>Irr</td>
<td>--</td>
<td>--</td>
<td>Application rate measured for discharge to sprinkler system, 70 gpm (Mar. 1963); reported yield, 225 gpm.</td>
</tr>
<tr>
<td>116</td>
<td>C. H. Hackfeld</td>
<td>do</td>
<td>1952</td>
<td>232</td>
<td>10</td>
<td>120</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T,G</td>
<td>Irr</td>
<td>140</td>
<td>5</td>
<td>&quot;Red bed&quot; reported at 145 ft; measured yield, 145 gpm (Mar. 1963); reported yield, 225 gpm.</td>
</tr>
<tr>
<td>117</td>
<td>Edsel Bankhead</td>
<td>do</td>
<td>1953</td>
<td>150</td>
<td>8</td>
<td>150</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T,G</td>
<td>Irr</td>
<td>--</td>
<td>--</td>
<td>Application rate measured for discharge to sprinkler system, 70 gpm (Mar. 1963); reported yield, 225 gpm.</td>
</tr>
<tr>
<td>119</td>
<td>do</td>
<td>do</td>
<td>1960</td>
<td>155</td>
<td>6½</td>
<td>50</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>S</td>
<td>Irr</td>
<td>150</td>
<td>3</td>
<td>Discharge to earth tank; reported yield, 65 gpm.</td>
</tr>
<tr>
<td>120</td>
<td>do</td>
<td>do</td>
<td>1956</td>
<td>165</td>
<td>8</td>
<td>35</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T,E</td>
<td>Irr</td>
<td>155</td>
<td>4</td>
<td>Discharge to earth tank; drilled to 220 ft; reported yield, 170 gpm.</td>
</tr>
<tr>
<td>121</td>
<td>Morgan Wright</td>
<td>do</td>
<td>1961</td>
<td>162</td>
<td>7</td>
<td>103</td>
<td>Trs</td>
<td>2,315</td>
<td>37.3</td>
<td>Jan. 1964</td>
<td>S</td>
<td>Irr</td>
<td>138</td>
<td>4</td>
<td>Discharge to earth tank; drilled to 220 ft; reported yield, 170 gpm.</td>
</tr>
<tr>
<td>201</td>
<td>Harlan Reed</td>
<td>Max Wright</td>
<td>1957</td>
<td>156</td>
<td>6</td>
<td>100</td>
<td>Trs</td>
<td>2,341</td>
<td>40.1</td>
<td>Jan. 1964</td>
<td>S</td>
<td>Irr</td>
<td>150</td>
<td>4</td>
<td>Seldom used since 1961; reported yield, 50 gpm.</td>
</tr>
<tr>
<td>203</td>
<td>W. J. Alexander</td>
<td>--</td>
<td>--</td>
<td>60</td>
<td>8</td>
<td>--</td>
<td>Trs</td>
<td>2,419</td>
<td>85.5</td>
<td>Nov. 1960</td>
<td>N</td>
<td>A,Ind</td>
<td>--</td>
<td>--</td>
<td>Formerly supplied oil-test rig.</td>
</tr>
<tr>
<td>205</td>
<td>J. H. Woodard</td>
<td>--</td>
<td>--</td>
<td>64</td>
<td>5½</td>
<td>--</td>
<td>Trs</td>
<td>2,368</td>
<td>19.1</td>
<td>Jan. 1964</td>
<td>N</td>
<td>A,S</td>
<td>--</td>
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See footnotes at end of table.
Table 5.--Records of selected water wells, springs, and test wells--Continued

<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Casing Diameter (in.)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>29-44-208</td>
<td>Skelly Oil Co.</td>
<td>O. R. House</td>
<td>1962</td>
<td>205</td>
<td>8½</td>
<td>Trs</td>
<td>2,417</td>
<td>72.5</td>
<td>July 1962</td>
<td>T,G</td>
<td>Ind</td>
<td>--</td>
<td>4</td>
<td>Used for water-flood operation; reported yield, 123 gpm.</td>
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<tr>
<td>210</td>
<td>Morgan Wright</td>
<td>Hopkins Drilg. Co.</td>
<td>--</td>
<td>--</td>
<td>5½</td>
<td>Trs</td>
<td>2,390</td>
<td>74.5</td>
<td>Mar. 1963</td>
<td>C,W</td>
<td>D</td>
<td>108</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>304</td>
<td>M. D. Jones</td>
<td>O. R. House</td>
<td>1957</td>
<td>204</td>
<td>8</td>
<td>90 Trs</td>
<td>2,426</td>
<td>51.2</td>
<td>Jan. 1964</td>
<td>S</td>
<td>Irr</td>
<td>190</td>
<td>4</td>
<td>Reported yield, 110 gpm.</td>
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<tr>
<td>305</td>
<td>do</td>
<td>do</td>
<td>1951</td>
<td>200</td>
<td>8</td>
<td>200 Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T,E</td>
<td>Irr</td>
<td>190</td>
<td>4</td>
<td>Reported yield, 120 gpm.</td>
</tr>
<tr>
<td>308</td>
<td>L. R. Wright</td>
<td>Hopkins Drilg. Co.</td>
<td>1963</td>
<td>205</td>
<td>8</td>
<td>200 Trs</td>
<td>2,452</td>
<td>112.0</td>
<td>May 1963</td>
<td>S</td>
<td>Irr</td>
<td>200</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>404</td>
<td>do</td>
<td>do</td>
<td>1957</td>
<td>220</td>
<td>12</td>
<td>218 Trs</td>
<td>2,399</td>
<td>70.3</td>
<td>Jan. 1964</td>
<td>T,G</td>
<td>A,Irr</td>
<td>200</td>
<td>5</td>
<td>Gravel-pack envelope, 12-14 inches; reported yield, 225 gpm.</td>
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<tr>
<td>405</td>
<td>-- Brown</td>
<td>Eulis Compton</td>
<td>1953</td>
<td>187</td>
<td>8</td>
<td>187 Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T,G</td>
<td>Irr</td>
<td>187</td>
<td>4</td>
<td>Discharge to sprinkler system; reported yield, 120 gpm.</td>
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<tr>
<td>406</td>
<td>Skelly Oil Co.</td>
<td>O. R. House</td>
<td>1955</td>
<td>225</td>
<td>7</td>
<td>225 Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T,G</td>
<td>Irr</td>
<td>215</td>
<td>4</td>
<td>Water-bearing zones at 150-200 ft; &quot;red bed&quot; reported at 200 ft; reported yield, 90 gpm.</td>
</tr>
<tr>
<td>410</td>
<td>R. I. Haney</td>
<td>O. R. House</td>
<td>1959</td>
<td>190</td>
<td>8</td>
<td>115 Trs</td>
<td>2,383</td>
<td>53.4</td>
<td>do</td>
<td>N</td>
<td>A,Irr</td>
<td>--</td>
<td>--</td>
<td>Caving reported; reported yield, 150+ gpm.</td>
</tr>
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</table>

See footnotes at end of table.
Table 5.--Records of selected water wells, springs, and test wells--Continued

<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft.)</th>
<th>Diameter (in.)</th>
<th>Casing</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft.)</th>
<th>Water level?</th>
<th>Altitude of land surface (ft.)</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft.)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
</tr>
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<tbody>
<tr>
<td>29-44-413</td>
<td>O. C. Gaebler</td>
<td>O. C. Gaebler</td>
<td>1958</td>
<td>160</td>
<td>6</td>
<td>160</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>S</td>
<td>D</td>
<td>135</td>
<td>2</td>
<td>Used to irrigate garden, lawn, and orchard; reported yield, 30-40 gpm.</td>
</tr>
<tr>
<td>501</td>
<td>Shelly Oil Co.</td>
<td>O. R. House</td>
<td>1957</td>
<td>215</td>
<td>12</td>
<td>215</td>
<td>Trs</td>
<td>2,405</td>
<td>72.7</td>
<td>Mar. 1963</td>
<td>T, G</td>
<td>Ind</td>
<td>205</td>
<td>5</td>
<td>Used for water-cloud operation; reported yield, 150 gpm.</td>
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</tr>
<tr>
<td>502</td>
<td>do</td>
<td>do</td>
<td>1962</td>
<td>225</td>
<td>10</td>
<td>225</td>
<td>Trs</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T, G</td>
<td>Ind</td>
<td>200</td>
<td>5</td>
<td>Used for water-flood operation; pumping level 185 ft; reported yield, 285 gpm.</td>
</tr>
<tr>
<td>504</td>
<td>do</td>
<td>do</td>
<td>--</td>
<td>--</td>
<td>135</td>
<td>5</td>
<td>--</td>
<td>Trs</td>
<td>2,477</td>
<td>112.0</td>
<td>Oct. 1962</td>
<td>C, W</td>
<td>S</td>
<td>--</td>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td>505</td>
<td>do</td>
<td>O. R. House</td>
<td>1962</td>
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<td>266</td>
<td>Trs</td>
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<td>118.0</td>
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<td>T, G</td>
<td>Ind</td>
<td>250</td>
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<tr>
<td>510</td>
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<td>do</td>
<td>--</td>
<td>--</td>
<td>130</td>
<td>5/8</td>
<td>--</td>
<td>Trs</td>
<td>--</td>
<td>104.9</td>
<td>Dec. 1963</td>
<td>C, W</td>
<td>S</td>
<td>--</td>
<td>2</td>
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</tr>
<tr>
<td>602</td>
<td>Ross Daniels</td>
<td>--</td>
<td>--</td>
<td>139</td>
<td>6</td>
<td>--</td>
<td>Kt</td>
<td>2,507</td>
<td>121.8</td>
<td>July 1963</td>
<td>C, W</td>
<td>S</td>
<td>--</td>
<td>14</td>
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<td>Reported yield, 2 gpm.</td>
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<tr>
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<td>do</td>
<td>1936</td>
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<td>5</td>
<td>--</td>
<td>Kt</td>
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<td>70.5</td>
<td>do</td>
<td>C, W</td>
<td>D, S</td>
<td>100</td>
<td>14</td>
<td>5</td>
<td>Water hard, but potable; reported yield, 2 gpm.</td>
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</tr>
<tr>
<td>702</td>
<td>Anna Judd</td>
<td>--</td>
<td>--</td>
<td>65</td>
<td>--</td>
<td>6</td>
<td>Kt</td>
<td>2,395</td>
<td>27.6</td>
<td>May 1963</td>
<td>C, W</td>
<td>D</td>
<td>--</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>802</td>
<td>Evelyn Daniels Ranch</td>
<td>--</td>
<td>--</td>
<td>70</td>
<td>4</td>
<td>--</td>
<td>Kt</td>
<td>2,399</td>
<td>33.7</td>
<td>do</td>
<td>C, W</td>
<td>S</td>
<td>--</td>
<td>2</td>
<td>Reported yield, 1-2 gpm.</td>
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<tr>
<td>901</td>
<td>Gus Farrar</td>
<td>O. R. House</td>
<td>1958</td>
<td>290</td>
<td>12</td>
<td>10</td>
<td>Kt</td>
<td>2,577</td>
<td>196.8</td>
<td>Dec. 1963</td>
<td>T, E</td>
<td>Irr</td>
<td>280</td>
<td>5</td>
<td>Formally supplied oil-test rig; deepened and reamed to larger diameter; reported yield, 220 gpm.</td>
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<tr>
<td>903</td>
<td>do</td>
<td>do</td>
<td>1958</td>
<td>290</td>
<td>12</td>
<td>290</td>
<td>Kt</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T, E</td>
<td>Irr</td>
<td>280</td>
<td>5</td>
<td>Irrigates cotton and alfalfa; reported yield, 250 gpm.</td>
</tr>
</tbody>
</table>

See footnotes at end of table.
Table 5.—Records of selected water wells, springs, and test wells—Continued

<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Diameter (in.)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level (ft)</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td>160</td>
<td>6</td>
<td>Kt</td>
<td>2,490</td>
<td>118.8</td>
<td>Oct. 1960</td>
<td>C,W</td>
<td>S</td>
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<td>W. H. MCBurnett</td>
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<td>451</td>
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<td>2,398</td>
<td>36.2</td>
<td>do</td>
<td>C,W</td>
<td>S</td>
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<tr>
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<td>Dr. T. D. Young</td>
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<td>70</td>
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<td>--</td>
<td>2,372</td>
<td>29.3</td>
<td>--</td>
<td>N, A, Ind</td>
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<tr>
<td>202</td>
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<td></td>
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<td>200</td>
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<td>--</td>
<td>2,294</td>
<td>95.2</td>
<td>Mar. 1961</td>
<td>C,W</td>
<td>D</td>
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<tr>
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<td>2,139</td>
<td>55.6</td>
<td>Mar. 1961</td>
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<td>S</td>
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<td>701</td>
<td>Lone Star Cem. Co.</td>
<td>Layne Texas Co.</td>
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<td>257</td>
<td>9</td>
<td>257</td>
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<tr>
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<td>do</td>
<td>1951</td>
<td>262</td>
<td>8</td>
<td>262</td>
<td>Kt</td>
<td>2,561</td>
<td>T,E, A, Ind</td>
<td>-- 3</td>
<td>3</td>
<td>Motor, 5 hp; reported yield, 17 gpm.</td>
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<td>706</td>
<td>Mrs. Gus Farrar</td>
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<td></td>
<td>165</td>
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<td>--</td>
<td>2,936</td>
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<td>1951</td>
<td>195</td>
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<td>2,538</td>
<td>145.4</td>
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<td>Harry Dockery</td>
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<td>2,099</td>
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<td>July 1963</td>
<td>N, A, S</td>
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<td>R. A. Hood</td>
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<td>--</td>
<td>2,113</td>
<td>37.8</td>
<td>Aug. 1963</td>
<td>C,W</td>
<td>D, S</td>
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See footnotes at end of table.
<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Diameter (in.)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level (ft)</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>29-49-301</td>
<td>U. D. Wulfjen</td>
<td>--</td>
<td>--</td>
<td>97±</td>
<td>64±</td>
<td>Trs</td>
<td>2,075</td>
<td>68.4</td>
<td>Aug. 1963</td>
<td>C,W</td>
<td>S</td>
<td>--</td>
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<td></td>
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<tr>
<td>601</td>
<td>C. E. Welch</td>
<td>--</td>
<td>--</td>
<td>54±</td>
<td>5±</td>
<td>P</td>
<td>1,992</td>
<td>30.3</td>
<td>do</td>
<td>N</td>
<td>A,S</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>701</td>
<td>Spade Ranch</td>
<td>--</td>
<td>--</td>
<td>55±</td>
<td>5±</td>
<td>Trs</td>
<td>2,212</td>
<td>33.8</td>
<td>Nov. 1962</td>
<td>N</td>
<td>A,D</td>
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</tr>
<tr>
<td>702</td>
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<td>Spring</td>
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<td>Ca</td>
<td>2,177 (+)</td>
<td>--</td>
<td>--</td>
<td>Flow</td>
<td>D,S</td>
<td>--</td>
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<td></td>
</tr>
<tr>
<td>703</td>
<td>do</td>
<td>1931</td>
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<td>Ca</td>
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<tr>
<td>801</td>
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<td>1964</td>
<td>26</td>
<td>6</td>
<td>Ca</td>
<td>2,170 (+)</td>
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<td>May 1963</td>
<td>C,W</td>
<td>D,S</td>
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<td>B. L. Wulfjen</td>
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<td>--</td>
<td>90±</td>
<td>6±</td>
<td>P</td>
<td>2,112</td>
<td>40.2</td>
<td>Apr. 1961</td>
<td>C,W</td>
<td>A,D</td>
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<tr>
<td>401</td>
<td>--</td>
<td>Holcombe</td>
<td>1961</td>
<td>300</td>
<td>--</td>
<td>P</td>
<td>2,034</td>
<td>47.1</td>
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<td>S</td>
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<td>Collins</td>
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<td>300</td>
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<td>P</td>
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<td>47.1</td>
<td>Nov. 1962</td>
<td>C,W</td>
<td>S</td>
<td>2</td>
<td>2</td>
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<tr>
<td>501</td>
<td>Spade Ranch</td>
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<td>--</td>
<td>70</td>
<td>6</td>
<td>P</td>
<td>1,979</td>
<td>34.3</td>
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<td>D</td>
<td>--</td>
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</tr>
<tr>
<td>601</td>
<td>do</td>
<td>--</td>
<td>--</td>
<td>70</td>
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<td>P</td>
<td>2,070</td>
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<td>S</td>
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<tr>
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<td>--</td>
<td>--</td>
<td>70</td>
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<td>P</td>
<td>2,070</td>
<td>46.6</td>
<td>do</td>
<td>C,W</td>
<td>S</td>
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<tr>
<td>603</td>
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<td>--</td>
<td>--</td>
<td>83</td>
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<td>P</td>
<td>2,083</td>
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<td>C,W</td>
<td>S</td>
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<tr>
<td>901</td>
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<td>1935</td>
<td>34</td>
<td>6</td>
<td>34±</td>
<td>P</td>
<td>2,179</td>
<td>63.7</td>
<td>Apr. 1961</td>
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<td>S</td>
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<tr>
<td>51-102</td>
<td>B. B. Byrne, Jr.</td>
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<td>1948</td>
<td>150±</td>
<td>6</td>
<td>Trs</td>
<td>2,197</td>
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<tr>
<td>103</td>
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<td>--</td>
<td>--</td>
<td>200</td>
<td>5½</td>
<td>P</td>
<td>2,179</td>
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<tr>
<td>106</td>
<td>do</td>
<td>N. C. House</td>
<td>1962</td>
<td>119</td>
<td>5</td>
<td>80-119</td>
<td>Trs</td>
<td>2,210</td>
<td>55.5</td>
<td>May 1963</td>
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<td>2,264</td>
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See footnotes at end of table.
Table 5.--Records of selected water wells, springs, and test wells--Continued.

<table>
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<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Casing diameter (in.)</th>
<th>Water-bearing unit</th>
<th>Altitude of water (ft)</th>
<th>Water level (ft)</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pump setting below land surface (ft)</th>
<th>Remarks</th>
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<td>29-51-102</td>
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<td>--</td>
<td>100</td>
<td>5½</td>
<td>Trs</td>
<td>2,210</td>
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<td>S</td>
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<td>--</td>
<td>--</td>
<td>103½</td>
<td>6½</td>
<td>Trs</td>
<td>2,322</td>
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<td>do</td>
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<td>S</td>
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<td>--</td>
<td>70½</td>
<td>5</td>
<td>Trs</td>
<td>2,249</td>
<td>46.6</td>
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<td>171½</td>
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<td>Kt</td>
<td>2,506</td>
<td>134.5</td>
<td>Aug. 1963</td>
<td>N</td>
<td>S</td>
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<tr>
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<td>V. T. McCabe</td>
<td>--</td>
<td>--</td>
<td>115½</td>
<td>5½</td>
<td>P</td>
<td>2,152</td>
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<td>James Jameson</td>
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<td>100½</td>
<td>5½</td>
<td>P</td>
<td>2,160</td>
<td>96.2</td>
<td>Nov. 1962</td>
<td>C,W</td>
<td>S</td>
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<td>803</td>
<td>J. H. Hail Est.</td>
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<td>--</td>
<td>101½</td>
<td>5½</td>
<td>P</td>
<td>2,221</td>
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<td>Trs</td>
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<td>76.5</td>
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<td>Ind</td>
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<td>904</td>
<td>A. G. Compton et al.</td>
<td>--</td>
<td>--</td>
<td>300½</td>
<td>5½</td>
<td>P</td>
<td>2,323</td>
<td>151.2</td>
<td>Oct. 1962</td>
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<td>--</td>
<td>101½</td>
<td>5½</td>
<td>Trs</td>
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<td>S</td>
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<td>--</td>
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<td>Trs</td>
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<td>A, Ind</td>
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<tr>
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<td>--</td>
<td>155½</td>
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<td>124.6</td>
<td>July 1963</td>
<td>C,W</td>
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<td>124½</td>
<td>5</td>
<td>Kt</td>
<td>2,477</td>
<td>83.8</td>
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<tr>
<td>209</td>
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<td>--</td>
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<td>172½</td>
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<td>Kt</td>
<td>2,546</td>
<td>165.5</td>
<td>do</td>
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<td>A, Ind</td>
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<td>308</td>
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<td>--</td>
<td>1957</td>
<td>260</td>
<td>Kt</td>
<td>2,561</td>
<td>178.8</td>
<td>do</td>
<td>N</td>
<td>A, Ind</td>
<td>--</td>
</tr>
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</table>

See footnotes at end of table.
Table 5.—Records of selected water wells, springs, and test wells—Continued

<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Casing Diameter (in.)</th>
<th>Casing Depth (ft)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level Y</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Setting below land surface (ft)</th>
<th>Pump size (in.)</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>29-52-312</td>
<td>Helen Alexander</td>
<td>--</td>
<td>--</td>
<td>156± 6</td>
<td>--</td>
<td>--</td>
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<td>--</td>
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<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>2</td>
</tr>
<tr>
<td>313</td>
<td>P. L. Wilkes</td>
<td>O. R. House</td>
<td>1962</td>
<td>290</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>N</td>
<td>A,T</td>
<td>--</td>
<td>--</td>
<td>Test well for water-flood operation by Sun Oil Co.; reported yield, 60 gpm.</td>
</tr>
<tr>
<td>314</td>
<td>do</td>
<td>do</td>
<td>1962</td>
<td>225</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>N</td>
<td>A,T</td>
<td>--</td>
<td>--</td>
<td>Yielded 160 gpm on test with pump set at 170 ft.</td>
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<tr>
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<td>Joe Whitworth</td>
<td>1963</td>
<td>300</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>July 1963</td>
<td>N</td>
<td>A,T</td>
<td>--</td>
<td>--</td>
<td>Yielded 195 gpm on test with pump set at 266 ft; yielded 169 gpm with pump set at 246 ft.</td>
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<tr>
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<td>P. L. Wilkes</td>
<td>--</td>
<td>--</td>
<td>183</td>
<td>5 1/2</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1½</td>
</tr>
<tr>
<td>404</td>
<td>R. L. Spires</td>
<td>--</td>
<td>--</td>
<td>215± 6</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
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<td>--</td>
<td>--</td>
<td>--</td>
<td>1½</td>
</tr>
<tr>
<td>405</td>
<td>do</td>
<td>do</td>
<td>--</td>
<td>93</td>
<td>6</td>
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<td>--</td>
<td>--</td>
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<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1½</td>
</tr>
<tr>
<td>412</td>
<td>M. L. Compton</td>
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<td>--</td>
<td>207± 6</td>
<td>6 1/2</td>
<td>207</td>
<td>Kt</td>
<td>2,579</td>
<td>190.4</td>
<td>N</td>
<td>A,Ind</td>
<td>--</td>
<td>--</td>
<td>Reported strong supply; formerly supplied oil-test rig.</td>
</tr>
<tr>
<td>413</td>
<td>R. L. Spires</td>
<td>--</td>
<td>--</td>
<td>225± 6</td>
<td>6 220</td>
<td>Kt</td>
<td>2,590</td>
<td>200.9</td>
<td>do</td>
<td>S</td>
<td>Ind</td>
<td>--</td>
<td>--</td>
<td>Formerly supplied oil-test rig.</td>
</tr>
<tr>
<td>504</td>
<td>Helen Alexander</td>
<td>--</td>
<td>--</td>
<td>60± 6</td>
<td>5 1/2</td>
<td>--</td>
<td>Kt</td>
<td>2,450</td>
<td>60.5</td>
<td>Nov.</td>
<td>1962</td>
<td>C,W</td>
<td>S</td>
<td>Water potable, but hard; reported yield, 2 gpm.</td>
</tr>
<tr>
<td>703</td>
<td>M. L. Compton</td>
<td>--</td>
<td>--</td>
<td>175± 6</td>
<td>--</td>
<td>--</td>
<td>Kt</td>
<td>2,577</td>
<td>174.6</td>
<td>do</td>
<td>C,W</td>
<td>S</td>
<td>--</td>
<td>Water potable, but hard; reported yield, 3 gpm.</td>
</tr>
<tr>
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<td>J. M. McLaughlin</td>
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<td>19± 6</td>
<td>10</td>
<td>Kt</td>
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<td>156.7</td>
<td>do</td>
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<td>S</td>
<td>180</td>
<td>--</td>
<td>Do.</td>
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<tr>
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<td>Eunice Parramore</td>
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<td>--</td>
<td>19± 6</td>
<td>--</td>
<td>--</td>
<td>Kt</td>
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<td>Nov. 1960</td>
<td>C,W</td>
<td>S</td>
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<td>Water potable, but hard; reported yield, 3 gpm.</td>
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</table>

See footnotes at end of table.
Table 5.--Records of selected water wells, springs, and test wells--Continued

<table>
<thead>
<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Casing (lath)</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level below land surface (ft)</th>
<th>Method of measurement</th>
<th>Date of measurement</th>
<th>Use of water</th>
<th>Pump setting below land surface (in.)</th>
<th>Pump column (in.)</th>
<th>Remarks</th>
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<td>J. P. Maddox</td>
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<td>Kt</td>
<td>2,444</td>
<td>68.7</td>
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<td>C,W</td>
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<td>292</td>
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<td>292</td>
<td>Kt</td>
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<td>A,Ind</td>
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<td>4</td>
<td>Drilled to supply plant-construction operations; reported yield, 30 gpm.</td>
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<td>Nov. 1962</td>
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<td>D</td>
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<td>Mrs. E. K. Stone</td>
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<td>--</td>
<td>205</td>
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<td>--</td>
<td>Kt</td>
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<td>67.7</td>
<td>July 1963</td>
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<td>S</td>
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<tr>
<td>105</td>
<td>Lance Sears</td>
<td>--</td>
<td>--</td>
<td>195</td>
<td>6</td>
<td>--</td>
<td>Kt</td>
<td>2,578</td>
<td>144.9</td>
<td>do</td>
<td>C,W</td>
<td>S</td>
<td>--</td>
<td>180</td>
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<tr>
<td>106</td>
<td>Mrs. Gus Farrar</td>
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<td>--</td>
<td>Kt</td>
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<td>112.0</td>
<td>do</td>
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<td>D,S</td>
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<td>Lewis Elliot</td>
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<td>240</td>
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<td>--</td>
<td>Kt</td>
<td>--</td>
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<td>--</td>
<td>S</td>
<td>D</td>
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<td>181</td>
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<td>T,E</td>
<td>A,Ind</td>
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<td>3</td>
<td>Casing slotted at 182-242 ft; reported yield, 19 gpm.</td>
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<td>do</td>
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<td>--</td>
<td>Kt</td>
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<td>do</td>
<td>N</td>
<td>A,Ind</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>204</td>
<td>Santa Fe Railroad</td>
<td>--</td>
<td>--</td>
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<td>168.0</td>
<td>1950</td>
<td>N</td>
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<td>230</td>
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<td>Dec. 1963</td>
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<td>D</td>
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<td>Irr</td>
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<td>--</td>
<td>Kt</td>
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<td>5</td>
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<td>C,W</td>
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See footnotes at end of table.
Table 5.--Records of selected water wells, springs, and test wells--Continued

<table>
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<tr>
<th>Well</th>
<th>Owner</th>
<th>Driller</th>
<th>Date completed</th>
<th>Depth of well (ft)</th>
<th>Diameter (in.)</th>
<th>Casing</th>
<th>Water-bearing unit</th>
<th>Altitude of land surface (ft)</th>
<th>Water level (ft)</th>
<th>Date of measurement</th>
<th>Method of lift</th>
<th>Use of water</th>
<th>Pumping below land surface (ft)</th>
<th>Pump column size (in.)</th>
<th>Remarks</th>
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<tr>
<td>29-53-801</td>
<td>Mrs. A. P. Arledge</td>
<td>--</td>
<td>--</td>
<td>110</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>2,316</td>
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<td>S</td>
<td>--</td>
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</tr>
<tr>
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<td>do</td>
<td>--</td>
<td>--</td>
<td>98</td>
<td>5</td>
<td>--</td>
<td>--</td>
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<td>D,S</td>
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<td>--</td>
<td>--</td>
<td>2,040</td>
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<tr>
<td>104</td>
<td>do</td>
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<td>6</td>
<td>70</td>
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<td>2,027</td>
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<td>S</td>
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<td>S</td>
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<tr>
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<tr>
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<td>--</td>
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<td>5</td>
<td>--</td>
<td>--</td>
<td>2,188</td>
<td>132.7</td>
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<td>--</td>
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<td>5½</td>
<td>--</td>
<td>--</td>
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<td>101.7</td>
<td>May 1963</td>
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<td>D,S</td>
<td>--</td>
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<td>Jahew Jameson</td>
<td>--</td>
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<td>5½</td>
<td>117</td>
<td>Trs</td>
<td>2,350</td>
<td>102.1</td>
<td>May 1963</td>
<td>C,E</td>
<td>D,S</td>
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<td>--</td>
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<td>5</td>
<td>--</td>
<td>Kt,Trs</td>
<td>2,593</td>
<td>215.6</td>
<td>Aug. 1963</td>
<td>C,W</td>
<td>D</td>
<td>215</td>
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<tr>
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<td>J. M. McLaughlin</td>
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<td>--</td>
<td>130</td>
<td>5½</td>
<td>--</td>
<td>Kt</td>
<td>2,593</td>
<td>215.6</td>
<td>Aug. 1963</td>
<td>C,W</td>
<td>D</td>
<td>215</td>
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<td>--</td>
<td>53</td>
<td>--</td>
<td>--</td>
<td>Kt</td>
<td>2,620</td>
<td>55.0</td>
<td>May 1963</td>
<td>C,W</td>
<td>S</td>
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<tr>
<td>201</td>
<td>Mrs. W. F. Blair</td>
<td>--</td>
<td>--</td>
<td>40</td>
<td>5½</td>
<td>--</td>
<td>Kt</td>
<td>2,312</td>
<td>32.7</td>
<td>Oct. 1962</td>
<td>C,W</td>
<td>S</td>
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<td>1½</td>
<td>Caving reported; reported yield, 2 gpm.</td>
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<tr>
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<td>--</td>
<td>89</td>
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<td>--</td>
<td>Kt</td>
<td>2,361</td>
<td>55.3</td>
<td>Aug. 1963</td>
<td>C,W</td>
<td>D,S</td>
<td>--</td>
<td>1½</td>
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</tr>
<tr>
<td>203</td>
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<td>--</td>
<td>141</td>
<td>6</td>
<td>--</td>
<td>--</td>
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<td>2,262</td>
<td>60.6</td>
<td>do</td>
<td>C,W</td>
<td>S</td>
<td>130</td>
<td>2</td>
<td></td>
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</table>

* See Table 8 for chemical analyses.
† See Table 7 for additional water-level measurements.
‡ See Table 6 for drillers' logs.
Table 6.--Drillers' logs of selected water wells and oil tests

<table>
<thead>
<tr>
<th>Thickness (feet)</th>
<th>Depth (feet)</th>
<th>Thickness (feet)</th>
<th>Depth (feet)</th>
</tr>
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<tbody>
<tr>
<td>Well 28-40-505</td>
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<tr>
<td>Standard Oil of Texas, Adams No. 2.</td>
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<td></td>
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</tr>
<tr>
<td>Cellar and soil--  8</td>
<td>8</td>
<td>Gray sand; hole full of salt water-- 10</td>
<td>235</td>
</tr>
<tr>
<td>Red shale---------  27</td>
<td>35</td>
<td>Blue shale-------- 15</td>
<td>250</td>
</tr>
<tr>
<td>Blue shale--------  3</td>
<td>38</td>
<td>Gray sand--------- 5</td>
<td>255</td>
</tr>
<tr>
<td>Gray sand, 80 bbls salt water in 24 hrs----- 7</td>
<td>45</td>
<td>Gray lime-------- 10</td>
<td>265</td>
</tr>
<tr>
<td>Gray sandy shale---  3</td>
<td>48</td>
<td>Blue shale-------- 90</td>
<td>355</td>
</tr>
<tr>
<td>Gray sand---------  17</td>
<td>65</td>
<td>Red shale-------- 5</td>
<td>360</td>
</tr>
<tr>
<td>Gray sand; 137 bbls water in 24 hrs----- 10</td>
<td>75</td>
<td>Blue shale-------- 40</td>
<td>400</td>
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<tr>
<td>Gray sand---------  25</td>
<td>100</td>
<td>Gray sand-------- 55</td>
<td>455</td>
</tr>
<tr>
<td>Red shale---------  95</td>
<td>195</td>
<td>Red shale and anhydrite------ 5</td>
<td>460</td>
</tr>
<tr>
<td>Blue shale--------  30</td>
<td>225</td>
<td>Red shale-------- 85</td>
<td>545</td>
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<tr>
<td>Gray sand---------  45</td>
<td>455</td>
<td>Anhydrite-------- 25</td>
<td>570</td>
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</tbody>
</table>

Well 28-48-201

Standard of Texas, Z. F. Morrison No. 1.

| Surface formation---- 7 | 7 | Red shale--------- 248 | 438 |
| Red shale--------- 93 | 100 | Gray sand, hole full of salt water---- 7 | 445 |
| Blue shale-------- 10 | 110 | Gray water sand----- 8 | 453 |
| Red shale--------- 10 | 120 | Red shale--------- 12 | 465 |
| Blue shale-------- 10 | 130 | Gray water sand----- 10 | 475 |
| Gray sand, 514 bbls salt water in 24 hrs 50 | 180 | Red shale--------- 2 | 477 |
| Gray sand, hole full of salt water----- 10 | 190 | Gray sand; hole full of salt water----- 8 | 485 |

(Continued on next page)
### Well 28-48-401


<table>
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<th>Depth (feet)</th>
<th>Notes</th>
<th>Thickness (feet)</th>
<th>Depth (feet)</th>
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</thead>
<tbody>
<tr>
<td>Soil</td>
<td>3</td>
<td>3</td>
<td>Lime, Brown</td>
<td>10</td>
<td>500</td>
</tr>
<tr>
<td>Caliche</td>
<td>12</td>
<td>15</td>
<td>Shale, gray</td>
<td>65</td>
<td>565</td>
</tr>
<tr>
<td>Red shale</td>
<td>165</td>
<td>180</td>
<td>Sand rock, gray</td>
<td>10</td>
<td>575</td>
</tr>
<tr>
<td>Brown shale</td>
<td>80</td>
<td>260</td>
<td>Shale and shells</td>
<td>20</td>
<td>595</td>
</tr>
<tr>
<td>Sand rock, gray</td>
<td>65</td>
<td>325</td>
<td>Water sand, white</td>
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<td>610</td>
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<tr>
<td>Shale, red</td>
<td>165</td>
<td>490</td>
<td>Shale, red</td>
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### Well 28-64-302


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<th>Depth (feet)</th>
<th>Notes</th>
<th>Thickness (feet)</th>
<th>Depth (feet)</th>
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</thead>
<tbody>
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<td>Topsoil</td>
<td>2</td>
<td>2</td>
<td>Gypsum</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>Caliche</td>
<td>6</td>
<td>8</td>
<td>Lime</td>
<td>18</td>
<td>78</td>
</tr>
<tr>
<td>Red clay</td>
<td>19</td>
<td>27</td>
<td>Sand rock, water</td>
<td>12</td>
<td>90</td>
</tr>
<tr>
<td>Lime</td>
<td>13</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thickness (feet)</td>
<td>Depth (feet)</td>
<td>Thickness (feet)</td>
<td>Depth (feet)</td>
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<tr>
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<td>-----------------</td>
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<td></td>
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<tr>
<td>Well 29-26-801</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Sand</td>
<td>8</td>
<td>Blue clay</td>
<td>38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sand rock, water</td>
<td>47</td>
<td>Sand, hard</td>
<td>72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sand rock</td>
<td>53</td>
<td>Hard gravel rock</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red clay</td>
<td>107</td>
<td>Red bed</td>
<td>2</td>
<td></td>
<td></td>
</tr>
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</table>

| Well 29-33-912 |             |                 |             |
| Owner: Col-Tex Refinery. Driller: -- |
| Gravel         | 30          | Blue clay       | 2           |
| Clay           | 30          | Rock            | 10          |
| Rock (water)   | 40          | Red beds        | 28          |
| Gravel         | 10          |                 | 110         |

| Well 29-34-106 |             |                 |             |
| Topsoil        | 4           | Blue clay       | 24          |
| Sand rock, water | 21         | Red clay        | 21          |
| Hard rock      | 10          | Blue clay       | 7           |
| Blue clay      | 2           | Red clay        | 23          |
| Sand rock      | 8           | Sand rock       | 62          |
| Hard rock      | 2           | Hard rock       | 12          |
| Red clay       | 26          | Red bed         | 222         |
Table 1.

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<th>Depth</th>
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<tbody>
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<td>(feet)</td>
<td>(feet)</td>
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</tbody>
</table>

**Well 29-34-204**


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<th>Blue clay</th>
<th>7</th>
<th>117</th>
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</thead>
<tbody>
<tr>
<td>Sand rock</td>
<td>11</td>
<td>19</td>
<td>Sand rock</td>
<td>38</td>
<td>155</td>
</tr>
<tr>
<td>Red clay</td>
<td>26</td>
<td>45</td>
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<td>5</td>
<td>160</td>
</tr>
<tr>
<td>Blue clay</td>
<td>5</td>
<td>50</td>
<td>Sand</td>
<td>5</td>
<td>165</td>
</tr>
<tr>
<td>Brown clay</td>
<td>15</td>
<td>65</td>
<td>Gravel</td>
<td>13</td>
<td>178</td>
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<tr>
<td>Sand rock, water</td>
<td>25</td>
<td>90</td>
<td>Hard rock</td>
<td>2</td>
<td>180</td>
</tr>
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<td>Hard rock (water at 95 ft)</td>
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<td>Red bed</td>
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**Well 29-34-607**


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<th>170</th>
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<td>20</td>
<td>Sand and gravel</td>
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<td>217</td>
</tr>
<tr>
<td>Sand rock</td>
<td>35</td>
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<td>Blue clay</td>
<td>5</td>
<td>222</td>
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<td>Tight clay, blue</td>
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<td>87</td>
<td>Sand rock</td>
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<td>160</td>
<td>Red</td>
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**Well 29-34-812**


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<td>15</td>
<td>Blue clay</td>
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<td>80</td>
<td>Hard gravel</td>
</tr>
<tr>
<td>Brown clay</td>
<td>25</td>
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<tr>
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<td>115</td>
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</tr>
<tr>
<td>Sand rock</td>
<td>35</td>
<td>150</td>
<td>Red clay</td>
</tr>
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</table>

**Well 29-34-912**


| Top clay | 15 | 15 | Sand | 16 | 108 |
| Tight clay | 20 | 35 | Blue clay | 2 | 110 |
| Sand rock, water | 10 | 45 | Sand | 85 | 195 |
| Sand rock | 43 | 88 | Blue clay | 3 | 198 |
| Blue clay | 4 | 92 | Red clay, bottom | 2 | 200 |

**Well 29-35-302**


| Caliche | 8 | 8 | Sand | 5 | 157 |
| Lime | 18 | 25 | Red | 18 | 175 |
| Sand | 35 | 60 | Sand | 15 | 190 |
| Red clay | 15 | 75 | Water sand | 90 | 280 |
| Sand rock | 6 | 81 | Blue shale | 4 | 284 |
| Dark clay | 9 | 90 | Sand and gravel | 11 | 295 |
| Sand rock | 20 | 110 | Hard rock | 13 | 308 |
| Blue clay | 42 | 152 | | | |
### Table - Driller's Logs of Selected Wells - Continued

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<td>Gravel rock--------</td>
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<tr>
<td>Sand and gravel (water)</td>
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<td>65</td>
<td>Shale, blue-------</td>
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<td>Rocks--------------</td>
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<td>gravel---------------</td>
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<td>Hard gravel rock------</td>
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<tr>
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<td>Brown and blue clay----</td>
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Table 6.--Drillers' logs of selected water wells and oil tests--Continued

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<td>Sand--------------------- 18</td>
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<tr>
<td>Gravel------------------- 15</td>
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<tr>
<td>Sand--------------------- 20</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Well 29-36-103</th>
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</thead>
</table>

| Clay and caliche------ 30 | 30 | Blue sand---------- 10 | 270 |
| Sandy------------- 37 | 67 | Gravel---------- 10 | 280 |
| Red clay--------- 43 | 110 | Hard gravel rock-- 10 | 290 |
| Sand rock--------- 5 | 115 | Gravel---------- 5 | 295 |
| Brown clay------- 25 | 140 | Blue clay-------- 12 | 307 |
| Sand rock, water-- 10 | 150 | Sand----------- 5 | 312 |
| Hard rock-------- 15 | 165 | Blue clay-------- 8 | 320 |
| Red clay-------- 15 | 180 | Sand and gravel-- 12 | 332 |
| Sand, yellow----- 20 | 200 | Blue clay-------- 8 | 340 |
| Hard gravel------ 20 | 220 | Red clay-------- 5 | 345 |
| Sand------------- 40 | 260 |

<table>
<thead>
<tr>
<th>Well 29-36-407</th>
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</thead>
</table>

| Soil------------- 3 | 3 | Red shale--------- 19 | 71 |
| Caliche--------- 19 | 22 | Light brown, shale-- 41 | 112 |
| Light shale----- 30 | 52 | Sandy shale------- 11 | 123 |

(Continued on next page)
<table>
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<tbody>
<tr>
<td><strong>Sandstone</strong></td>
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<tr>
<td><strong>Yellow sand (water sand)</strong></td>
</tr>
<tr>
<td><strong>Lime</strong></td>
</tr>
<tr>
<td><strong>Yellow sand</strong></td>
</tr>
</tbody>
</table>

### Well 29-36-606


| Soil | 3 | 3 | **Blue clay** | 20 | 98 |
| Caliche | 22 | 25 | **Sand, rock, water** | 27 | 125 |
| Dry sand | 7 | 32 | **Hard sand rock** | 25 | 150 |
| Brown clay | 30 | 62 | **Yellow sand** | 5 | 155 |
| Yellow sand | 5 | 67 | **Hard gravel rock** | 13 | 168 |
| Yellow clay | 11 | 78 | **Red clay** | 2 | 170 |

### Well 29-36-701


| Caliche | 12 | 12 | **Red clay** | 32 | 212 |
| Lime rock | 29 | 41 | **Blue clay** | 8 | 220 |
| Soft rock | 2 | 43 | **Sand rock** | 15 | 235 |
| Hard lime | 2 | 45 | **Blue clay** | 5 | 240 |
| Brown sand | 67 | 112 | **Sand rock** | 22 | 262 |
| Blue clay | 3 | 115 | **Hard rock** | 6 | 268 |
| Red clay | 21 | 136 | **Sand and gravel** | 12 | 280 |
| Hard rock | 16 | 152 | **Yellow sand** | 25 | 305 |
| Red clay | 7 | 159 | **Hard rock** | 15 | 320 |
| Sand rock | 21 | 180 | **Red clay** | 40 | 360 |
Table 6.--Drillers' logs of selected water wells and oil tests--Continued

<table>
<thead>
<tr>
<th>Thickness (feet)</th>
<th>Depth (feet)</th>
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**Well 29-36-905**

Owner: M. Watt. Driller: --

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<thead>
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<th>4</th>
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<tr>
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<td>35</td>
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<td>135</td>
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<td>Conglomerate, gravel</td>
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<td>38</td>
<td>Hard and soft rock</td>
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<tr>
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<td>Yellow sand</td>
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<td>Red sandy clay</td>
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<td>Hard sand</td>
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<tr>
<td>Yellow sand rock</td>
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<td>Soft and hard rock</td>
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**Well 29-36-915**


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<td>36</td>
<td>40</td>
<td>Rock and yellow clay</td>
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<tr>
<td>Rock</td>
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<td>Water sand, yellow</td>
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<td>Sand and gravel</td>
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<tr>
<td>Tight brown sand</td>
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**Well 29-41-704**


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(Continued on next page)

- 141 -
<table>
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<table>
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Well 29-42-104


<table>
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</tr>
<tr>
<td>Hard rock</td>
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Well 29-42-304


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<tr>
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<tr>
<td>Red beds</td>
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<table>
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<td>Sand, water</td>
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<td>Red beds</td>
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- 142 -
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Well 29-42-501


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</tr>
<tr>
<td>Shale, blue</td>
<td>33</td>
<td>Red beds</td>
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</tr>
<tr>
<td>Sand, water</td>
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Well 29-42-601


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</tr>
<tr>
<td>Sand rock</td>
<td>42</td>
<td>Sand</td>
<td>25</td>
</tr>
<tr>
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<td>Red</td>
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Well 29-43-103


<table>
<thead>
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</tr>
</thead>
<tbody>
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<td>Shale, blue</td>
<td>13</td>
</tr>
<tr>
<td>Gravel</td>
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<td>Gravel</td>
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<td>Sand rock</td>
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<td>Sand water</td>
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Table 4. Drillers' logs of selected water wells and oil tests—Continued

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<tr>
<td>Owner: Dr. Bruce Johnson. Driller: N. C. House.</td>
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<tr>
<td>Soil--------------4</td>
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<td>Gray sand (hard)------20</td>
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<tr>
<td>Brown sand rock----11</td>
<td>15</td>
<td>Hard sand and gravel--30</td>
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</tr>
<tr>
<td>Yellow sand rock----30</td>
<td>45</td>
<td>Gravel--------------25</td>
<td>175</td>
</tr>
<tr>
<td>Brown sand and gravel--10</td>
<td>55</td>
<td>Conglomerate rock, hard----------------15</td>
<td>190</td>
</tr>
<tr>
<td>Brown shale---------45</td>
<td>100</td>
<td>Red bed----------------5</td>
<td>195</td>
</tr>
</tbody>
</table>

| Well 29-43-506   |              |                  |              |
| Topsoil----------2 | 2 | Sand rock----------17 | 62 |
| Red clay----------8 | 10 | Water sand and gravel-70 | 132 |
| Sand and gravel----2 | 12 | Hard rock----------2 | 134 |
| Caliche-----------16 | 28 | Red bed----------96 | 230 |
| Gray sandy shale---17 | 45 |                  |              |

| Well 29-43-602   |              |                  |              |
| Clay and caliche----20 | 20 | Hard----------------5 | 150 |
| Sand, water----------37 | 57 | Sand----------------8 | 158 |
| Red clay-------------14 | 71 | Blue clay---------5 | 163 |
| Sand-----------------44 | 115 | Sand and gravel-----52 | 215 |
| Hard rock------------10 | 125 | Hard rock----------2 | 217 |
| Sand-----------------20 | 145 | Red clay---------3 | 220 |
Table 6.--Drillers' logs of selected water wells and oil tests--Continued

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Thickness (feet)</th>
<th>Depth (feet)</th>
<th>Thickness (feet)</th>
</tr>
</thead>
</table>

**Well 29-43-802**

Owner: Dr. F. N. Gray. Driller: Hopkins Drilling Company.

| Soil | 2 | Blue clay and shale | 5 | 68 |
| Sandy clay | 6 | Sand and gravel | 4 | 72 |
| Hard sand, sandstone ledges | 8 | Conglomerated gravel | 4 | 76 |
| Yellow sand and clay streaks | 14 | Sandy clay | 6 | 82 |
| Blue clay and sand streaks | 10 | Hard sand and gravel streaks | 17 | 99 |
| Hard sand and soft sandstone | 19 | Conglomerate rock | 3 | 102 |
| Hard sandstone | 4 | Red shale and lime ledges | 4 | 106 |

**Well 29-44-104**


| Clay, tight | 11 | Rock | 55 | 140 |
| Sand rock | 19 | Rock, soft | 5 | 145 |
| Red mud | 48 | Hard | 5 | 150 |
| Rock, water, yellow | 7 | Red, bottom | 5 | 155 |

**Well 29-44-210**


| Surface sand | 4 | Damp sandy shale | 6 | 64 |
| Sandy clay | 4 | Shale, ledges, and sandstone | 4 | 68 |
| Red clay and shale ledges | 50 | Hard sand and sandstone | 30 | 98 |

(Continued on next page)
### Well 29-44-210 -- Continued

<table>
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<th>Layer</th>
<th>Thickness (feet)</th>
<th>Depth (feet)</th>
<th>Sand and gravel, tight (feet)</th>
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<td>Hard sand and sandy ledges</td>
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<tr>
<td>Blue shale and ledges</td>
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<tr>
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<td>2</td>
</tr>
<tr>
<td>Blue and red shale</td>
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### Well 29-44-305


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<td>Gravel</td>
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<td>Yellow sand</td>
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<td>Hard rock</td>
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<td>Hard rock</td>
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<td>Red sand</td>
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<td>Yellow sand and gravel</td>
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<td>Hard rock</td>
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### Well 49-44-505


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(Continued on next page)
Table 6.--Drillers' logs of selected water wells and oil tests--Continued

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Well 49-44-505--Continued

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<td>Blue clay 13</td>
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<td>60</td>
<td>Lime 28</td>
<td>Sand 110</td>
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Well 29-44-901


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<td>Coarse water sand 9</td>
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<td>113</td>
<td>Blue-gray, hard lime 33</td>
<td>Sand, gravel 8</td>
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<tr>
<td>170</td>
<td>Lime, streaks of shale 15</td>
<td>Gray shale 5</td>
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<tr>
<td>180</td>
<td>Yellow sandy lime 10</td>
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Well 29-45-701

Owner: Lone Star Cement. Driller: Layne Texas Company.

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<td>Coarse water sand 9</td>
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<td>Sand, gravel 8</td>
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### Table 6—Drilling Data

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<tr>
<th>Owner</th>
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<tbody>
<tr>
<td>B. B. Byrne.</td>
<td>N. C. House.</td>
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<table>
<thead>
<tr>
<th>Soil</th>
<th>Depth</th>
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<th>Depth</th>
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<tbody>
<tr>
<td>4</td>
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<td>11</td>
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<td>20</td>
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</tr>
<tr>
<td>35</td>
<td>55</td>
<td>Red bed</td>
<td>2</td>
</tr>
</tbody>
</table>

| Blue shale | 5 | 220 |
| Sand and gravel, gray | 5 | 60 |

### Well 29-52-314

<table>
<thead>
<tr>
<th>Owner</th>
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<tbody>
<tr>
<td>P. L. Wilkes.</td>
<td>O. R. House.</td>
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</table>

<table>
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<tbody>
<tr>
<td>8</td>
<td>8</td>
<td>65</td>
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<td>Lime</td>
<td>17</td>
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<td>25</td>
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<td>220</td>
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<td>White lime</td>
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<td>Red shale</td>
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<tr>
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<th>Depth</th>
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### Well 29-58-101

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<td>100</td>
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- 148 -
### Table 6.--Drillers' logs of selected water wells and oil tests--Continued

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<td>Blue and yellow lime---</td>
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</table>
Table 7.--Water levels in selected wells in the irrigation area, winters of 1960-64

<table>
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<td>Date</td>
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Table 7.--Water levels in selected wells in the irrigation area, winters of 1960-64--Continued

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Table 7.--Water levels in selected wells in the irrigation area, winters of 1960-64--Continued

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Table 7.--Water levels in selected wells in the irrigation area, winters of 1960-64--Continued

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Table 8.--Chemical analyses of water from selected wells and springs

(Assays are in parts per million except percent sodium, specific conductance, pH, and sodium adsorption ratio.)

Water-bearing unit: Ca, Quaternary alluvium or Ogallala Formation; KE, Fredericksburg Group; KT, Trinity Group; P, Permian rocks, undifferentiated; Tc, Chiricahua Formation; Trs, Santa Rosa Formation; Trd,承包on Group, undifferentiated.

Laboratory: CL, Commercial laboratory; TSDH, Texas State Department of Health; USGS, United States Geological Survey.

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<th>Sulfate (SO₄)</th>
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### Table 8.--Chemical analyses of water from selected wells and springs--Continued

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<th>Calcium (Ca)</th>
<th>Magnesium (Mg)</th>
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<th>Sulfate (SO₄²⁻)</th>
<th>Chloride (Cl⁻)</th>
<th>Fluoride (F⁻)</th>
<th>Silicate (SiO₃⁻)</th>
<th>Boron (B)</th>
<th>Dissolved solids</th>
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<th>Approximate land-surface elevation</th>
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Table 9.--Oil wells and stratigraphic tests selected as data-control points--Continued

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Table 9—Oil wells and stratigraphic tests selected as data verification points—Continued

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<th>Log type</th>
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Table 9.--Oil wells and stratigraphic tests selected as data-control points--Continued

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