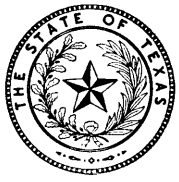
GROUND-WATER CONDITIONS IN MENARD COUNTY, TEXAS



TEXAS WATER COMMISSION
BULLETIN 6519

AUGUST 1965

REPRINTED BY THE TEXAS WATER DEVELOPMENT BOARD
APRIL 1970

TEXAS WATER COMMISSION

Joe D. Carter, Chairman
William E. Berger, Commissioner
0. F. Dent, Commissioner

BULLETIN 6519

GROUND-WATER CONDITIONS IN MENARD COUNTY, TEXAS

R. C. Baker, Geologist, and
0. C. Dale, Engineering Technician
United States Geological Survey
and
G. H. Baum, Geologist
Texas Water Commission

Prepared by the U.S. Geological Survey
and the Texas Water Commission
in cooperation with
the Menard Chamber of Commerce

August 1965
Reprinted by the Texas Water Development Board
April 1970

Published and distributed
by the
Texas Water Commission
Post Office Box 12311
Austin, Texas 78711

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd.)

TABLES

ILLUSTRATIONS

Figures

TABLE OF CONTENTS (Cont'd.)

Plates

GROUND-WATER CONDITIONS IN MENARD COUNTY, TEXAS

ABSTRACT

Throughout most of Menard County, ground water is the principal source of water for all purposes. The water is obtained principally from the Edwards and associated limestones, but also from the Quaternary alluvium, the Trinity Group, and the Paleozoic rocks. Possible sources of fresh water in the deep Paleozoic rocks are largely untested as of 1963.

Most of the water is very hard, but otherwise is suitable for stock watering and domestic use. In general, the water from the Trinity Group is of poorer quality than that in the Edwards and associated limestones.

The movement of water in the Edwards and associated limestones and the Quaternary alluvium is largely from recharge areas at the land surface downward to near the base of the limestones or alluvium, and thence laterally to places of discharge in the larger valleys.

Exploration for oil and gas in Menard County has proceeded over many years, and, starting in 1958, has increased. The first commercial production of oil was in 1946 and to 1963, all the commercial production has been in the northwestern part of the county. The fresh water in the county is subject to pollution from oil and gas operations through improper construction or plugging of oil and gas tests, or through the improper disposal of oil-field brines. However, the available information does not indicate any areas of contamination as of 1963.

GROUND-WATER CONDITIONS IN MENARD COUNTY, TEXAS

INTRODUCTION

Purpose and Scope

Throughout most of Menard County, ground water is the principal source of water for all purposes. Oil production and exploration have increased in the last few years, and, as a result, the oil-field brines produced incident to oil and gas have become a potential source of pollution of the fresh-water supplies. The people of Menard County, recognizing the importance of the ground-water resources, instigated a cooperative project with the Texas Water Commission and the U.S. Geological Survey for the investigation of ground-water conditions in the county to serve as a basis for the protection and conservation of the fresh-water supplies and as a basis for the determination of changes in chemical quality of the water. Water wells were inventoried and water samples for chemical analysis were collected from most of the wells. Water levels were measured in selected wells. Subsurface geologic data were studied to determine possible undeveloped sources of fresh water. The history of oil exploration, oil production, and brine-disposal practices also was studied.

The investigation of ground-water conditions in the northwestern quarter of Menard County was made by Gerald Baum of the Texas Water Commission during June 1961 and April 1962 under the administrative direction of J. J. Vandertulip, Chief Engineer, and L. G. McMillion, Director of the Ground Water Division, Texas Water Commission. The investigation of the rest of the county was made by R. C. Baker and 0. C. Dale of the Geological Survey under the administrative direction of 0. M. Hackett, Chief, and A. G. Winslow, District Geologist, of the Ground Water Branch of the U. S. Geological Survey.

The cooperation and help of many individuals, particularly well owners, and organizations is acknowledged. Appreciation is expressed to T. M. (Buster) Atkinson, Menard; General Crude Oil Co., Abilene; Leonard Lewis Drilling Co., Abilene; Schlumberger Well Surveying Corp., San Angelo; Shaheen and Sons, Abilene; Shell Development Co., San Angelo; Sun Oil Co., Abilene; Wayne Petroleum co., Abilene; the Texas Department of Health, the Texas Highway Department, and the Railroad Commission of Texas; and Mr. Audrey Baker, U. S. Department of Agriculture, Soil Conservation Service, at Menard.

Description of Menard County

Menard County is in central Texas, a few miles southwest of the geographic center of Texas. It is bounded on the south by Kimble County, on the west by Schleicher County, on the north and northeast by Concho and McCulloch Counties,

and on the east by Mason County (Figure 1). The county is nearly rectangular and has an area of 914 square miles.

Menard County lies almost entirely within the Edwards Plateau section of the Great Plains province (Fenneman, 1931, pl. 1). The gently rolling upland is timbered with mesquite, cedar, and oak, and is used largely for grazing; the lowlands along the San Saba River and its tributaries are wooded, principally with pecan trees.

Menard County is drained by the San Saba River which flows generally in an easterly direction across the central part of the county. The river is spring fed and is a perennial stream in the western part of the county; in the eastern part it does not flow during droughts.

The altitude of the land surface in Menard County ranges from about 1,700 feet in the San Saba River valley at the eastern edge of the county to more than 2,400 feet in the southwestern and northwestern parts of the county. Thus, the overall relief is more than 700 feet.

The population of Menard County, according to the U.S. Bureau of the Census, was 2,964 in 1960. The city of Menard, population 1,914, is the county seat and is in the valley of the San Saba River near the center of the county. Other towns include Hext in the east-central part of the county and Fort McKavett in the west-central part. Menard County is served by U.S. Highway 83, State Highway 29, and Gulf, Colorado, and Santa Fe Railroad, which terminates at Menard.

The economy of Menard County is based largely on the raising of sheep, cattle, and goats. The cultivated crops are wheat, oats, broom corn, grain sorghum, forage, cotton, and some truck crops. Pecans, hunting, and tourists also are important sources of income. Other than water and soil, the mineral resources of the county are oil, gas, caliche, gypsum, gravel, and sand.

Menard County has a subhumid climate; the summers are hot and the winters are cool. According to the records of the U.S. Weather Bureau shown in the following table, the normal annual precipitation at Menard for the period 1930-60 was 22.64 inches. Although most of the rain falls during the growing season, generally it is not sufficient for many field crops. The normal annual temperature at San Angelo, 65 miles northwest of Menard, is 66.5°F; the normal monthly temperature ranges from 46.9°F in January to 85.1°F during August.

Normal precipitation at Menard and temperature at San Angelo

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Precipitation (inches) at Menard	1.18	1.17	0.95	2.29	3.29	2.20	2.22	1.92	3.30	1.99	1.01	1.13	22.64
Temperature (°F) at San Angelo	46.9	50.0	56.3	66.6	74.3	82.5	84.8	85.1	78.3	68.8	55.8	48.7	66.5

Figure 1

Map of Texas Showing the Location of Menard County

U.S. Geological Survey and Texas Water Commission in cooperation with the Menard Chamber of Commerce

181

Well-Numbering System

The numbers assigned to wells and springs, oil tests, and a cave in this report conform to the statewide system used by the Texas Water Commission. The system is based on the division of Texas into 1-degree quadrangles bounded by lines of latitude and longitude. Each 1-degree quadrangle is divided into 64 smaller quadrangles, $7\frac{1}{2}$ minutes on a side, each of which is further divided into 9 quadrangles, $2\frac{1}{2}$ minutes on a side. Each of the 1-degree quadrangles in the State has been assigned a 2-digit number for identification. The $7\frac{1}{2}$-minute quadrangles are given 2-digit numbers 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 $7\frac{1}{2}$-minute quadrangle are similarly numbered with 1-digit numbers. Each well inventoried in each $2\frac{1}{2}$-minute quadrangle is assigned a 2-digit number. The well number is determined as follows: From left to right, the first 2 numbers identify the 1-degree quadrangle, the next 2 numbers identify the $7\frac{1}{2}$-minute quadrangle, the fifth number identifies the $2\frac{1}{2}$-minute quadrangle, and the last 2 numbers designate the well within the $2\frac{1}{2}$-minute quadrangle.

In addition to the 7-digit well number, a 2-letter prefix is used to identify the county. The prefixes for Menard County and adjacent counties are as follows:

County	Prefix	County	Prefix
Concho	DZ	Menard	TH
Kimble	RK	Schleicher	WY
McCulloch	SS	Sutton	XS
Mason	SZ	Tom Green	YB

GENERAL GEOLOGY

The rocks cropping out in Menard County are of Paleozoic, Cretaceous, and Quaternary age. Rocks of Precambrian age do not crop out in the county, but underlie the Paleozoic rocks.

Menard County is on the western flank of a broad structural dome known as the Llano uplift. The buried surface of the Precambrian rocks and the Paleozoic formations dip in a generally westerly direction. Pre-Cretaceous erosion has truncated the upper surface of the Paleozoic rocks so that the Cretaceous rocks lie nearly horizontal on the beveled surfaces of the more steeply dipping older rocks.

It was beyond the scope of the investigation to map in detail all the geologic formations that crop out in the county. However, Figure 2 is a generalized geologic map of Menard County showing the outcrop areas of the rocks or groups of rocks that are important to the ground-water resources of the area.

In the following discussion, only those geologic units considered pertinent to the occurrence of fresh ground water in Menard County are included.

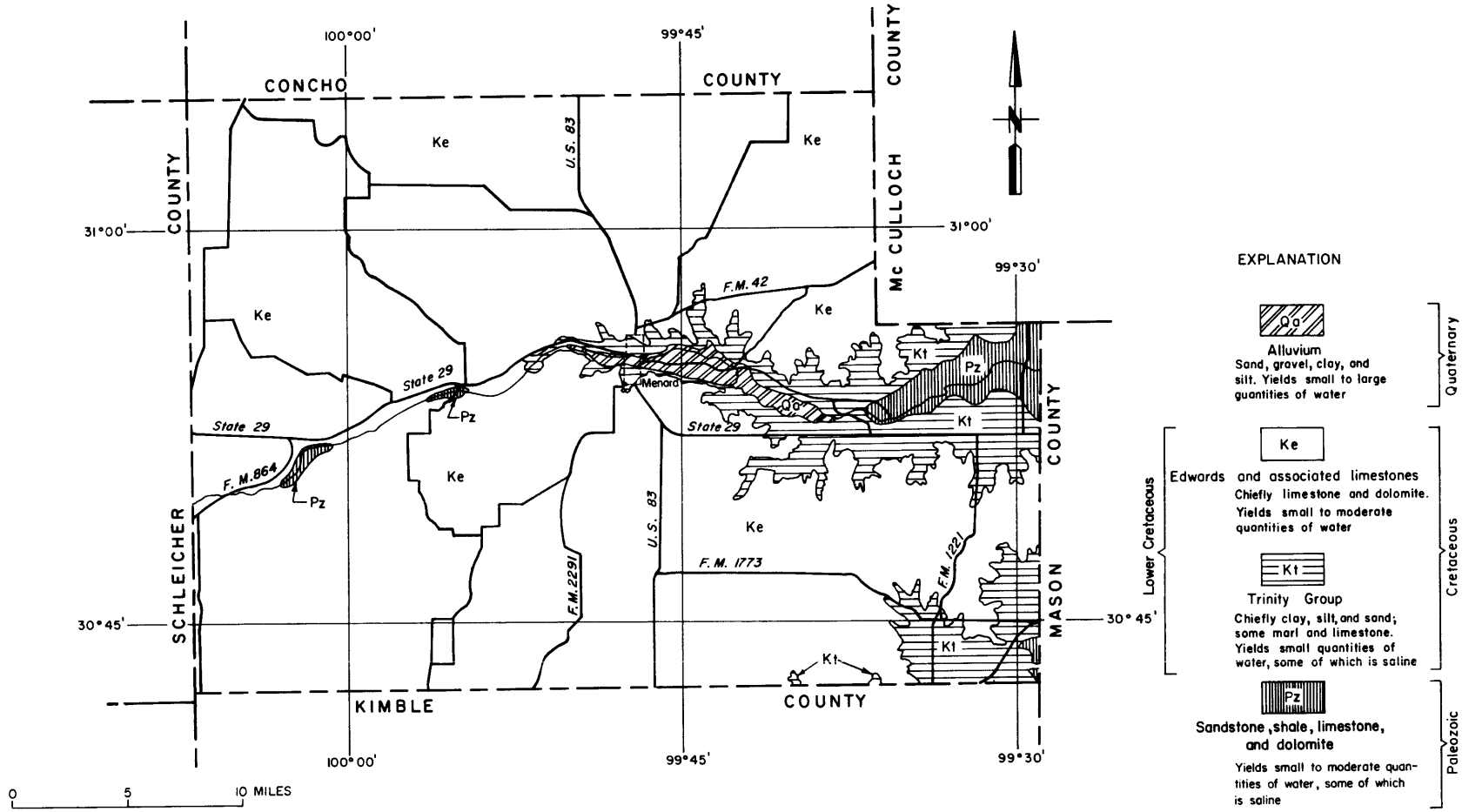


Figure 2

Generalized Geologic Map of Menard County

U.S. Geological Survey and Texas Water Commission in cooperation with the Menard Chamber of Commerce

Base adapted from Army Map Service 1:250,000 series topographic maps and field observations

Contact between Edwards and associated limestones and Trinity Group from Shell Development Co. Other contacts from Plummer (1943), Geologic Map of Texas (1937), and field observations by R.C. Baker

Precambrian Era

Precambrian Basement

Rocks of Precambrian age do not crop out in Menard County, but are found in wells at depths that become progressively greater toward the west. According to Flawn (1956, pl. l), the top of the Precambrian rocks is at an altitude of more than 500 feet above sea level in the southeastern part of the county and at an altitude of more than 3,500 feet below sea level in the northwestern part. The rocks, principally granite, form a basement complex on which younger rocks have been deposited. They are not a source of fresh water in Menard County.

Paleozoic Era

Cambrian System

Rocks of Cambrian age, which overlie the Precambrian rocks in Menard County, are exposed a few miles east of the county. The Cambrian rocks have been divided into the Riley and Wilberns Formations of Late Cambrian age, and these have been divided further into members, of which only the Hickory Sandstone Member of the Riley Formation and the San Saba Limestone Member of the Wilberns Formation may be important as potential sources of fresh ground water.

Hickory Sandstone Member of the Riley Formation

The Hickory Sandstone Member consists chiefly of yellow, brown, and red sandstone and lesser amounts of red and gray clay. It lies unconformably on the irregular surface of the Precambrian basement complex. The Hickory is not exposed in Menard County but underlies all of the county. No wells are known that tap the Hickory, but electric logs of oil tests show that it dips generally toward the west at a fairly uniform rate (Figure 3). The altitude of the top of the Hickory Sandstone Member is about 1,000 feet above sea level in the southeastern part of the county, 1,200 to 1,300 feet below sea level at Menard, and more than 3,000 feet below sea level in the northwestern part of the county. According to Barnes and others (1959, v. 1, p. 27), the Hickory is about 500 feet thick; however, some oil geologists consider the thickness to range from about 100 to 150 feet.

In Mason, McCulloch, and Concho Counties, the Hickory Sandstone Member is an important source of water for irrigation and municipal supplies. At Brady, about 30 miles northeast of Menard, the water from wells that tap the Hickory at depths between 1,800 and 2,114 feet, meets, in most respects, the standards for drinking water as recommended by the U.S. Public Health Service (Mason, 1961, p. 35). The water is low in dissolved-solids content but hard, the hardness ranging from 282 to 397 ppm (parts per million). At Eden, 20 miles north of Menard, wells tapping the Hickory at depths between 3,850 and 4,410 feet yield water having a chloride content of about 400 ppm. On this basis, the Hickory in Menard County may be a potential source of fresh water. Whether the Hickory is capable of yielding water in large quantities cannot be determined on the basis of available data.

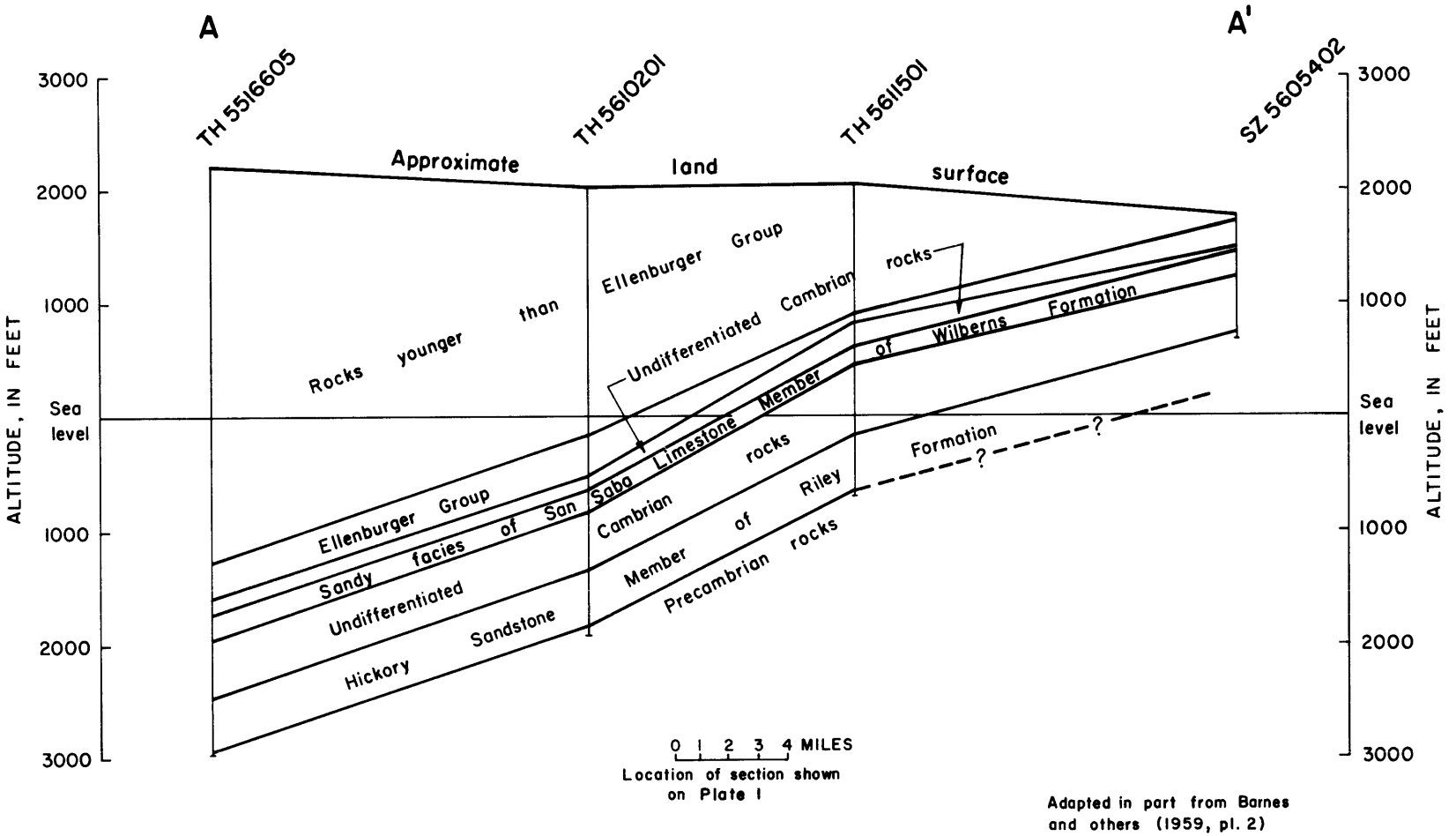


Figure 3

Geologic Section A–A' Showing Potential Aquifers in the Paleozoic Rocks in Menard County

U.S. Geological Survey and Texas Water Commission in cooperation with the Menard Chamber of Commerce

181

San Saba Limestone Member of the Wilberns Formation

The San Saba Limestone Member does not crop out in Menard County but underlies most of the county. The San Saba consists of limestone and sandstone. According to Barnes and others (1959, pl. 2), the lower part of the San Saba in Menard County is predominantly sandstone, having a thickness of nearly 200 feet. This sandstone may be equivalent to the "Upper Cambrian sands," an informal term locally used by drillers of water wells.

It is not known whether any wells in Menard County obtain water from the San Saba; however, the sandstone in the lower part may furnish water at least to Wells TH-56-04-601, TH-56-04-602, and TH-56-04-603 in the eastern part of the county. The water from two of these wells is low in dissolved solids, but is very hard, the hardness exceeding 270 ppm.

Ordovician System

Ellenburger Group

The Ellenburger Group of Early Ordovician age overlies the Cambrian rocks in Menard County and crops out in several small areas near the San Saba River in the eastern part of the county. It underlies most of the county except in an area northwest of Hext where the Ellenburger is absent (Cheney and Goss, 1952, p. 2244).

The Ellenburger consists of fine to coarse-grained limestone and dolomite, parts of which have a fairly high porosity. The thickness of the Ellenburger ranges from 0 in the eastern part of the county to more than 600 feet in the western part. The top of the Ellenburger is more than 2,000 feet below sea level in the western part of the county.

The Ellenburger Group yields small to moderate supplies of water to wells in many places in McCulloch County (Mason, 1961, p. 19). Available data indicate that some wells in eastern Menard County may obtain water from the Ellenburger; however, in most of the county, the water is probably too saline for most uses.

Pennsylvanian System

Rocks of Pennsylvanian age crop out in the valley of the San Saba River east of Menard and underlie younger rocks in most of the remainder of the county. The Pennsylvanian rocks in the eastern part of the county consist chiefly of gray limestone and shale, and may be a source of small amounts of water to some wells. However, the available information is not sufficient to indicate any specific well that obtains water from the Pennsylvanian rocks. In the western part of the county, the Pennsylvanian rocks contain brine and, at some places, commercial quantities of oil.

Permian System

Rocks of Permian age crop out in the valley of the San Saba River in the western part of Menard County and underlie much of the western part of the county, being overlain by the younger Cretaceous and Quaternary deposits. Where exposed, the Permian rocks consist largely of shale. No wells being used in 1963 were known to obtain water from the Permian rocks in Menard County; however, Well TH-56-01-810, abandoned because of the poor quality of the water, flows about 1 gpm (gallon per minute) from Permian rocks.

Mesozoic Era

Cretaceous System

Rocks of Cretaceous age unconformably overlie the Paleozoic rocks and crop out in all of Menard County, except in places along the San Saba River. The Cretaceous rocks have been divided into the Trinity Group, the Fredericksburg Group, and the Washita Group; however, for the purposes of this report, only the Trinity Group and the Edwards and associated limestones of the Fredericksburg and Washita Groups will be discussed.

Trinity Group

The Trinity Group crops out along the San Saba River and in the southeastern part of the county (Figure 2), and underlies the rest of the county except in several relatively small areas where it has been removed by erosion. The Trinity consists largely of multicolored clay, silt, and sand, with some marl and limestone. The unit lies on the gently eastward-sloping surface of the Paleozoic rocks (Figure 4). The Trinity is easily identified in well cuttings by its distinctive blue color in contrast with the light tan of the overlying Edwards and associated limestones. The thickness of the Trinity Group differs from place to place owing to the irregular surface of the older rocks. Where the entire section of the Trinity is present, the thickness ranges from about 50 to more than 200 feet.

The Trinity Group yields small quantities of water to wells in parts of Menard County. In some places, the Trinity yields water that is either insufficient in quantity even for domestic or stock supply or is too highly mineralized.

Edwards and Associated Limestones

The Edwards and associated limestones, locally referred to as the "Edwards limestone," includes the Edwards and Comanche Peak Limestones and the Walnut Clay of the Fredericksburg Group and the Georgetown Limestone of the Washita Group. The Edwards and associated limestones is the surface rock in nearly all the county except in the San Saba River valley east of Menard and in the southeastern part of the county where it has been removed by erosion (Figure 2). The unit consists principally of thick to thin beds of limestone and dolomite, and less prominent beds of marl, flint, and gypsum; it ranges in thickness from 0 to about 250 feet.

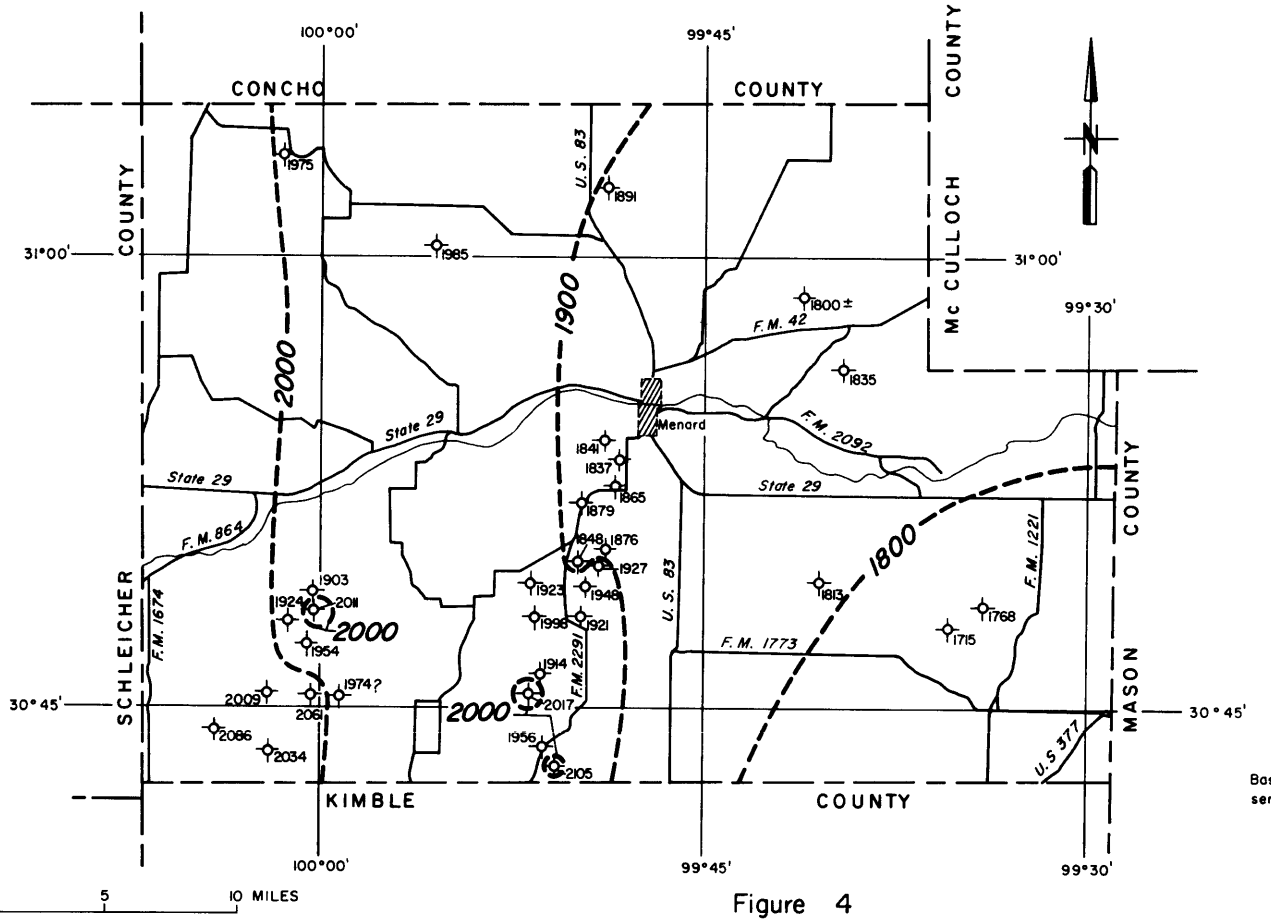


Figure 4

Map Showing Approximate Altitude of the Base of the Cretaceous Rocks in Menard County

U.S. Geological Survey and Texas Water Commission in cooperation with the Menard Chamber of Commerce

181

In many places, the Edwards and associated limestones is moderately honeycombed and cavernous. Many of the caverns are associated with a zone of brecciation about 130 to 140 feet above the base of the unit. The zone of brecciation was caused by the solution of gypsum (Barnes, 1943, p. 35-46). Drillers report that most of the cavities are above the water table.

The Edwards and associated limestones supplies water to most of the wells in the county. Generally, it yields sufficient quantities of water for domestic supply and stock use; two wells obtain sufficient quantities of water from the aquifer for irrigation. In general, the water is hard but otherwise of good chemical quality.

Cenozoic Era

Quaternary System

Alluvium

Alluvial deposits underlie the flood plain and terraces along the streams in Menard County. The alluvium is shown on the geologic map (Figure 2) only in that part of the San Saba River valley that extends from about 2.5 miles west of Menard to about 9 miles east of Menard.

The alluvium consists largely of gravel, sand, and silt, and has a maximum thickness of about 30 feet. In general, the coarsest and most permeable material is in the lower part of the deposit.

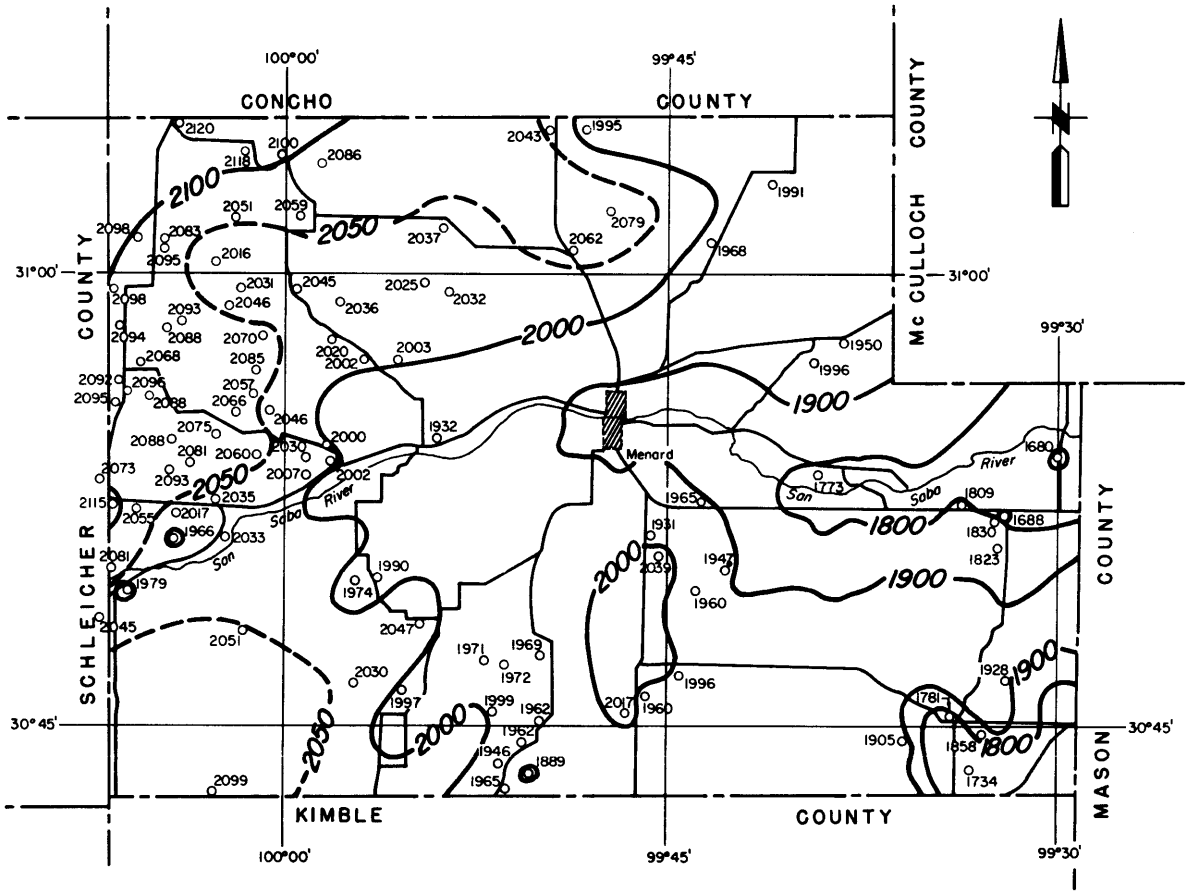
The alluvial deposits are second in importance only to the Edwards and associated limestones as a source of ground water in Menard County. Most of the wells used for irrigation obtain water from the alluvium. In some places, the alluvium yields as much as 500 gpm of water of good quality to wells for municipal and irrigation use.

GROUND WATER IN MENARD COUNTY

The principal sources of ground water in Menard County are the Edwards and associated limestones and the alluvium of Quaternary age. Of the approximately 830 water wells inventoried in the county (Plate 1 and Table l), about 615 produce from the Edwards and associated limestones and about 72 from the alluvium. About 143 wells produce small quantities of water from the Trinity Group and the rocks of Paleozoic age. The source of the water in many of the wells could not be determined definitely because the depths of the wells are not known. Furthermore, many of the wells are not cased and probably tap more than one source of water.

Recharge to the Paleozoic rocks is from precipitation on the outcrop area, largely to the east and southeast of Menard County. The Trinity Group is recharged by the downward movement of water from the overlying Edwards and associated limestones and by precipitation on the outcrop area.

Figure 5 shows the altitudes of water levels in wells in Menard County; most of the wells are in the Edwards and associated limestones. The movement



EXPLANATION

1991
Well used for control
Number indicates the altitude of the water surface in well

1800
Water-level contour
Shows altitude of water level in feet. Contour interval 100 feet with 2050 foot supplementary contour; datum is mean sea level

Base adapted from Army Map Service 1:250,000 series topographic maps and field observations

Figure 5

Map Showing the Altitude of Water Levels in Selected Wells, 1961-63, Menard County

U.S. Geological Survey and Texas Water Commission in cooperation with the Menard Chamber of Commerce

of ground water is at right angles to the contours and from higher altitudes of water level towards lower altitudes. In about the northern three-fourths of the county, the ground water moves toward the San Saba River, and in the southern one-fourth, it moves in a general southerly direction away from the river.

The direction of movement of the water indicates that recharge to the Edwards and associated limestones is largely from precipitation on the outcrop area. The limestone contains fracture systems, which have been enlarged by solution, forming conduits that permit relatively free downward and lateral movement of ground water. Because of the relatively high permeability of the limestone, water entering the limestone moves rapidly downward to the lower part in which all the openings are filled with water, thence laterally toward discharge areas along the stream valleys. The water discharges through seeps and springs near the base of the Edwards and associated limestones except in western Menard County where the springs may be associated with the brecciated zone about 130 feet above the base of the unit. The springs provide most of the perennial flow of the San Saba River and Clear Creek, a tributary entering the San Saba River from the north about 8 miles west of Menard.

Most of the wells that tap the Edwards and associated limestones are drilled to or near the base of the limestone. However, a well that by chance misses the cracks and solution channels may not yield enough water to sustain a pump except for a short time; consequently, the well may be drilled to the Trinity Group, principally to provide a reservoir for the storage of water when the well is idle, but also in the prospect of obtaining additional water from the Trinity.

The alluvium along the San Saba River is recharged largely by precipitation and by the upward or lateral movement of water from the adjoining rocks. The movement of ground water in the alluvial deposits generally is toward the river.

Data are not available to determine the quantity of water pumped from the different sources. Most of the water for municipal supply and irrigation is from the alluvium; whereas, most of the water for domestic use and stock watering is obtained from the Edwards and associated limestones. The quantity of water from the Trinity Group and the Paleozoic rocks undoubtedly is small because only a few small-capacity wells in the county tap these sources.

QUALITY OF WATER

General Requirements

The suitability of water for domestic use and public supply can best be judged by comparing with the drinking water standards prepared by the U.S. Public Health Service (1962, p. 7-8). The recommended maximum concentrations for certain of the chemical constituents, according to these standards, are listed on the following page.

Substance	Concentration (parts per million)
Chloride (Cl)	250
Fluoride (F)	*
Nitrate (NO_3)	45
Sulfate (SO_4)	250
Total dissolved solids	500

* Water high in fluoride content may cause mottling of the teeth of children if used during the calcification of the teeth; however, the upper limit of tolerance depends somewhat on the temperature. According to the U.S. Weather Bureau at San Angelo, the annual average of the maximum daily air temperature is 79.6°F, and it is assumed to be about the same in Menard County. The concentration of fluoride should not average more than the upper limit of 0.8 ppm, based on an annual average of maximum daily air temperatures of 79.3° to 90.5°F. The presence of fluoride in average concentrations greater than 1.4 ppm would be grounds for rejection of the supply (U.S. Public Health Service, 1962, p. 8).

Excessive concentrations of nitrate in water may cause methemoglobinemia ("blue baby" disease). Maxcy (1950, p. 271) concludes that water containing nitrate in excess of 44 ppm should be regarded as unsafe for infant feeding. High concentrations of nitrate in ground water may be an indication of pollution from organic matter.

Water containing sulfate in excess of 250 ppm may have a laxative effect.

Hardness in water is of importance in domestic and public supplies and some industrial uses. Water having 60 ppm, or less, of hardness is rated as soft; water ranging in hardness from 61 to 120 ppm is considered moderately hard; from 121 to 180 ppm, hard; and more than 180 ppm, very hard.

The chemical quality requirements for industrial water supplies have a wide range because the tolerances are different for most every industrial use. In general, water meeting the U.S. Public Health Service Drinking Water Standards is suitable for most industrial uses.

The suitability of water for irrigation depends on the chemical quality of the water and other factors such as methods of application, amount applied, soil texture, infiltration rate, farm management practices, drainage conditions, climate, and crop types.

A diagram for the classification of irrigation waters, proposed by the U.S. Salinity Laboratory Staff (1954, p. 80), is shown in Figure 6 and is based on the salinity hazard as measured by the electrical conductivity of the water,

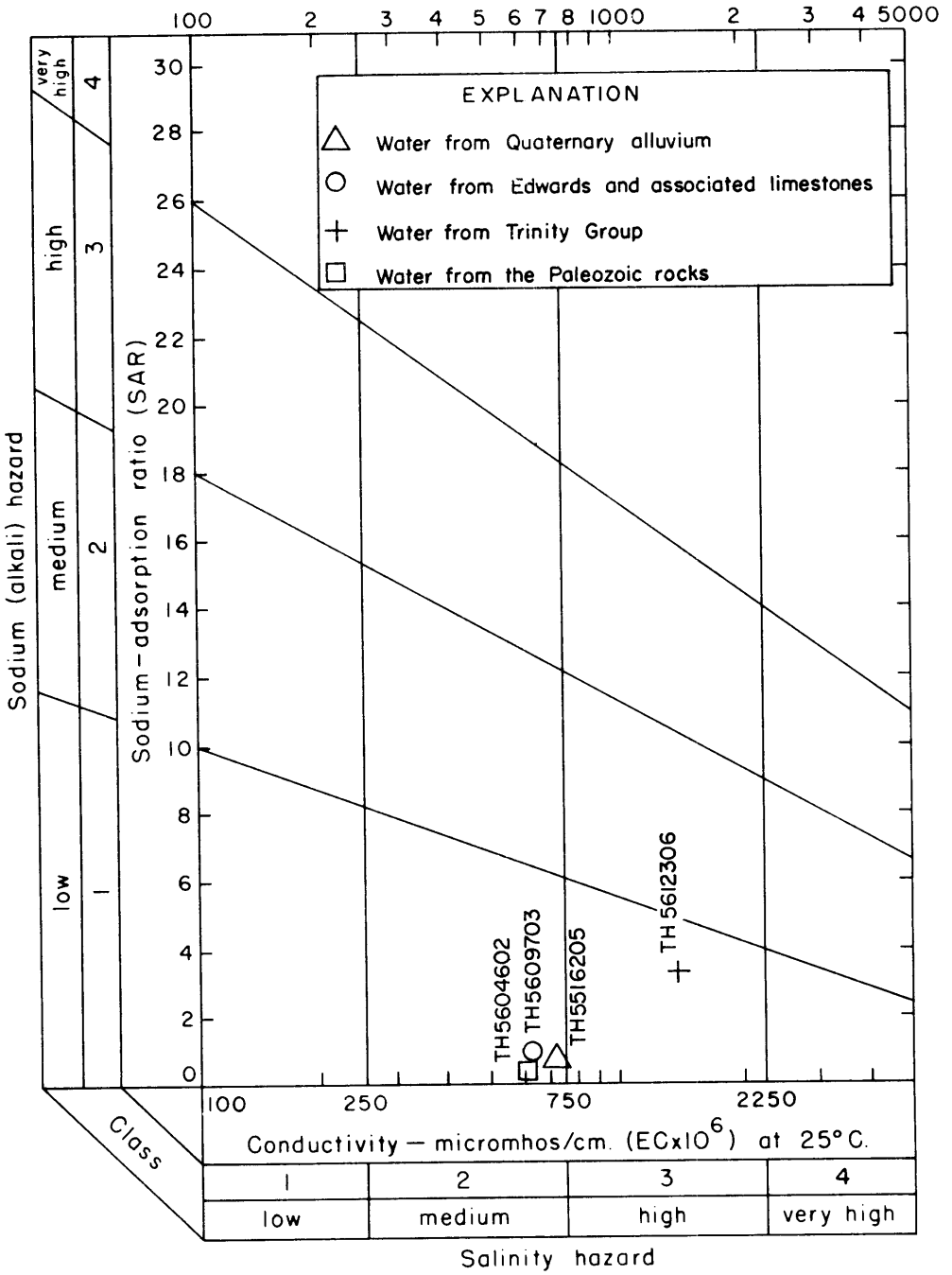


Figure 6

Diagram for the Classification of Irrigation Waters

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

U.S. Geological Survey and Texas Water Commission in cooperation with the Menard Chamber of Commerce

181

and the sodium hazard as measured by the SAR (sodium-adsorption ratio). Wilcox (1955, p. 15) stated that the system of classification of irrigation waters proposed by the Laboratory Staff "... is not directly applicable to supplemental waters used in areas of relatively high rainfall." Wilcox (1955, p. 16) indicated also that, generally, water may be used safely for supplemental irrigation if its conductivity is less than 2,250 micromhos per centimeter at 25°C and its SAR is less than 14. Several analyses, which may be considered representative of the aquifers in Menard County, are plotted on Figure 6.

The chemical analyses of water from 456 wells, 8 springs, and 1 cave in Menard County are given in Table 3. The variation in chloride and dissolved-solids content of the water in the county are shown in Plate 2. The analyses of water from wells in approximately the northwestern one-fourth of the county were made by the U.S. Geological Survey; most of the analyses in the other three-fourths of the county were made by the Texas State Department of Health. In order to make the results of the analyses comparable, the dissolved-solids content is given as the sum of the determined constituents with the bicarbonate being included as carbonate.

Paleozoic Rocks

The chemical quality of water from the Paleozoic rocks in the eastern part of the county is not known definitely because in many wells the depth from which the water is produced is not known. Moreover, many of the wells that tap the Paleozoic rocks probably obtain water from more than one aquifer.

Wells TH-56-04-602 and TH-56-04-603, northeast of Hext and north of the San Saba River probably obtain water from the sandy facies of the San Saba Limestone Member of the Wilberns Formation. The water from these wells is hard, but otherwise is suitable for livestock, domestic use, and irrigation.

In general, the wells near Hext that are more than about 80 feet deep yield water of better quality than those less than 80 feet. The deeper wells apparently tap the Paleozoic rocks; whereas, most of the shallower wells obtain water from the Trinity Group.

Only one well is known that produces water from the Permian rocks that underlie the west-central part of Menard County. Well TH-56-01-810 was drilled to a depth of 260 feet, but was abandoned when the well yielded water of poor quality. However, the well was not plugged and in 1963 continued to flow a small quantity of water. A sample collected during the investigation contained 25,600 ppm of chloride and 47,110 ppm of dissolved solids, indicating that the water in the Permian rocks is not suitable for most purposes.

The rest of the Paleozoic rocks, with the possible exception of the Hickory Sandstone, probably contains saline water throughout at least the western half of the county. This is at least partly indicated by the brine produced with the oil in the northwestern part of the county. A composite sample from three oil wells producing from a depth of about 3,360 feet contained 98,300 ppm dissolved solids and 60,900 ppm chloride.

Trinitv Group

The Trinity Group yields water to several wells in the outcrop area along the San Saba River valley and in the southeastern part of the county. The chemical quality of the water from the Trinity ranges over wide limits. The dissolved-solids content ranged from about 800 to about 2,700 ppm. In most of the wells in the Trinity, the chloride content was less than 250 ppm. In general, the water from the Trinity Group is of poorer quality than that in the Edwards and associated limestones; consequently, wells are completed in the Edwards and associated limestones where possible.

Edwards and Associated Limestones

The chemical quality of water from the Edwards and associated limestones is fairly uniform in most of Menard County, except in two areas in the southwestern part of the county (Plate 2).

In general, the water meets the drinking-water standards proposed by the U.S. Public Health Service. The water is almost uniformly very hard, the water from only one well containing less than 180 ppm hardness. The sulfate and chloride content generally is less than 100 ppm. The fluoride content exceeded 1 ppm in only one sample. The nitrate content in five samples was more than 45 ppm, and in four of the samples, it exceeded 100 ppm. The dissolved-solids content ranged from 200 to 600 ppm.

Most of the water in the Edwards and associated limestones is suitable for irrigation. Chemical analyses show that the water is low in sodium hazard and the SAR generally is less than 1. The medium to very high salinity hazard of some of the water may require soils where leaching is at least moderate and drainage is adequate.

In two areas in the southwestern part of Menard County (Plate 2), the water, which probably is associated with a gypsiferous brecciated zone in the Edwards and associated limestones, is more highly mineralized than the water from the unit elsewhere in the county. The water is very hard, the maximum hardness in 10 samples was 2,300 ppm, and the dissolved-solids content ranged from 751 to 3,120 ppm. The sulfate content was more than 250 ppm; whereas, the chloride content was 165 ppm, or less. The fluoride content was 1.7 ppm, or more, exceeding the limits recommended by the U.S. Public Health Service. The high sulfate content may be attributed to the movement of the water through the brecciated zone in which the gypsum has not been removed entirely by solution.

Quaternary Alluvium

The water from the alluvium south of the San Saba River and extending from about 2.5 miles west of Menard to about 4.5 miles east of Menard is similar in quality to the water from the Edwards and associated limestones, indicating that the water probably is derived from the limestone. The water is very hard and low in dissolved-solids content; in only a few wells did the dissolved-solids content exceed 500 ppm. Nitrate in the water sampled was low. The water generally is suitable for domestic use, public supply, and irrigation.

About 5 to 7 miles east of Menard, the alluvium furnishes water for domestic supply, stock watering, and irrigation. The chemical quality of the water from some of the wells is similar to that from wells in the alluvium upstream; in others the water is more highly mineralized and is somewhat similar to the water in the Trinity Group. The high sodium chloride content of the water, which is characteristic of oil-field brines, suggests that possibly the water in the alluvium is being contaminated by the upward movement of water from underlying formations.

In the western part of the county, the water from wells that tap the alluvium is similar in quality to that from the Edwards and associated limestones.

HISTORY OF OIL AND GAS DEVELOPMENT

Records of about 252 test wells for oil and gas (including producing wells) in Menard County are given in Table 2. According to available data, the first test well was drilled in 1919, and probably not more than 5 test wells were drilled each year during the next 39 years. Beginning in 1958, drilling in the northwestern part of the county increased, and in 1962, the increase in test drilling spread to the rest of the county. During the period 1958 to mid 1960, the number of test wells drilled each year ranged from 13 to 34.

The records of the Texas Railroad Commission (1963) show that the first producing oil field (Morrow) was discovered in 1946, and by January 1, 1963, the Commission recognized 14 oil fields, including the F. and H. (Cisco) field in Menard and Schleicher Counties. Most of the fields produce from rocks of Pennsylvanian age at depths ranging from about 1,900 to 4,100 feet. About 573,000 barrels of oil was produced up to 1963, of which 195,000 barrels was produced in 1962. Production of gas was 39,269 mcf (million cubic feet) during 1962.

PROTECTION OF FRESH WATER AND DISPOSAL OF OIL-FIELD BRINES

The sources of fresh ground water in Menard County are subject to contamination through inadequately constructed or defective oil and gas test wells, inadequately plugged abandoned test wells, or through the improper disposal of oil-field brines. The Oil and Gas Division of the Texas Railroad Commission is responsible for the proper construction, operation, abandonment, and plugging of such wells so as to prevent the contamination of ground water. The Texas Water Commission furnishes information about the ground water to oil operators and to the Railroad Commission in order that the ground water may be protected.

In oil and gas tests, surface casing should be set to the base of the Cretaceous rocks and properly cemented so as to prevent the movement of brines into the fresh-water-bearing rocks. When test wells are abandoned, cement plugs should be placed so that brines cannot move upward into the Cretaceous rocks. Also, if the test well penetrates the Ellenburger Group and underlying rocks, cement plugs should be placed so that brines cannot move downward into strata which possibly carry fresh water.

During the early period of oil production in Menard County, the brine produced with the oil was placed chiefly in unlined earthen pits for disposal.

Most of the pits were in the northwestern part of the county on the outcrop area of the Edwards and associated limestones, which, in many places, is fractured and cavernous. Brine placed in such unlined pits on the outcrop area of the limestones may seep into the ground and contaminate the ground water. The water moves at a relatively fast rate through the Edwards and associated limestones, and brine added to the ground at one place may affect the quality of water in nearby wells in a short period of time and may move for long distances.

According to data obtained from the files of the Texas Water Commission, about 31,000 barrels, or 1,300,000 gallons, of oil-field brine was produced during 1961. Oil production during the same year was about 178,000 barrels. Of the oil-field brine produced in 1961, about 13,300 barrels, or 558,600 gallons, was diverted to disposal pits.

The available information does not indicate any place where salt-water contamination has resulted as yet from the use of unlined pits for the disposal of brines in Menard County. Nevertheless because the use of surface pits for disposal of salt water is a potential source of ground-water pollution, on May 1, 1963, the Texas Railroad Commission, by special order, required all operators conducting oil and gas development and operation in Menard County to discontinue the use of unlined earthen salt-water disposal pits for storage and evaporation of oil-field brines. Although these pits have been or will be abandoned, they may remain a threat to the quality of the ground water.

As of June 1, 1963, one brine disposal well was in operation. The well, TH-42-57-715, was drilled in 1961 to a depth of 1,043 feet; the casing was perforated from 997 to 1,006 feet and from 1,010 to 1,015 feet. During 1961, about 15,000 barrels (630,000 gallons), or about one-half of the brine produced in Menard County, was diverted to this well for disposal. The strata into which the water in Well TH-42-57-715 is disposed rise to the east, and they may have a subcrop against the overlying Cretaceous rocks and the alluvium in eastern Menard County, or may be exposed in the valley of the San Saba River east of Menard. The disposal of brine in the well may increase the hydrostatic pressure in the strata so that ultimately water will be discharged from the strata along the subcrop or may emerge as seeps and springs in the outcrop area.

REFERENCES CITED

Barnes, V. E., 1943, Gypsum in the Edwards Limestone of central Texas: Texas Univ. Pub. 4301, p. 35-46.

Barnes, V. E., and others, 1959, Stratigraphy of the Pre-Simpson Paleozoic subsurface rocks of Texas and southeast New Mexico: Texas Univ. Pub. 5924, v. 1 and 2, 836 p.

Cheney, M. G., and Goss, L. F., 1952, Tectonics of central Texas: Am. Assoc. Petroleum Geologists Bull., v. 36, no. 12, p. 2237-2265.

Darton, N. H., Stephenson, L. W., and Gardner, Julia, 1937, Geologic map of Texas: U.S. Geol. Survey map.

Fenneman, N. M., 1931, Physiography of western United States: New York, McGraw-Hill Book Co., Inc., 534 p.

Flawn, P. T., 1956, Basement rocks of Texas and southeast New Mexico: Texas Univ. Pub. 5605, 265 p.

Mason, C. C., 1961, Ground-water geology of the Hickory Sandstone Member of the Riley Formation, McCulloch County, Texas: Texas Board Water Engineers Bull. 6017, 84 p.

Maxcy, D. F., 1950, Report on the relation of nitrate concentrations in well waters to the occurrence of methemoglobinemia in infants: Natl. Research Council Bull. Sanitary Eng., p. 265-271, App. D.

Plummer, F. B., 1943, The carboniferous rocks of the Llano region of central Texas: Texas Univ. Pub. 4329 [1950], 170 p.

The Railroad Commission of Texas, 1963, Annual report of the Oil and Gas Division, 1962: The Railroad Comm. of Texas, 579 p.

U.S. Public Health Service, 1962, Drinking water standards: Public Health Service Pub. 956, 61 p.

U.S. Salinity Laboratory Staff, 1954, Diagnosis and improvement of saline and alkali soils: U.S. Dept. Agriculture, Agr. Handbook 60, 160 p.

Wilcox, L. V., 1955, Classification and use of irrigation waters: U.S. Dept. Agriculture Circ. 969, 19 p.

Table 2.--Records of oil and gas tests in Menard and Mason Counties

Well	Owner	Operator	Date completed	Depth of well (ft)	Casing		Altitude of land surface (ft)	Section	Block	Survey	Plugging record	Remarks
					Diameter of well (in.)	Length (ft)						
Menard County												
TH-42-57-406	Fritz Volkmann	J. R. McLean & General Crude Oil Co. No. 1	1960	3,368	8-5/8	332	2,264	61	--	G. W. T. & P. Ry. Co.	25 sacks of cement at top of surface casing; steel plate on top of surface casing.	
407	-- Duffy	Shaheen & Sons	1963	3,150	--	--	--	6	C	Fred Speck		
408	Fritz Volkmann	J. R. McLean & General Crude Oil Co.	1960	3,368	--	--	2,264	61	--	G. W. T. & P. Ry. Co.		
409	Victoria L. Davis	Tucker Drilling Co., et al. No. 1	1961	4,010	7	297	2,354	70	--	Fred Speck	15 sacks of cement at 3,800-3,700; 15 sacks at 2,600-2,550; 25 sacks at 375-325; 5 sacks top of surface casing.	
410	Fritz Volkmann	Tucker Drilling Co. & General Crude Oil Co.	1955	4,344	--	--	--	112	--	Owen Baker		
411	do	Tucker Drilling Co. & General Crude Oil Co. No. 1	1961	3,770	8-5/8	308	2,314	112	--	do	15 sacks of cement at 3,660-3,630; 25 sacks at 350-300; 10 sacks at top of surface casing.	
412	Alex Menzies	J. R. McLean No. 1	1960	3,335	8-5/8 5-1/2	418 3,315	2,275	60	--	John Hughes	Producing well.	Water 5 percent; Wilhelm Lane (Canyon) field.
504	-- Menzies	Youngblood & Youngblood & Delca No. 1	1960	3,380	8-5/8	401	2,348	62	4	G. W. T. & P., W. C. Huey	15 sacks of cement at base, and 10 sacks at top of surface casing; cap on top of surface casing.	
505	Alex Menzies	J. R. McLean, et al. No. 11	1960	3,435	8-5/8	313	2,264	62	--	W. C. Huey	10 sacks of cement at bottom, and 10 sacks at top of surface casing; steel plate on top of surface casing.	
506	do	Henry Frost Oil Properties Ltd. No. 6	1963	3,455	8-5/8	366	2,294	62	--	do	25 sacks of cement half in and half out of surface casing. 10 sacks on top of surface casing; steel plate on top of casing.	
507	do	Henry Frost Oil Properties Ltd. No. 8.	1963	3,446	8-5/8	374	2,282	62	--	do	do	
508	do	Henry Frost Oil Properties Ltd. No. 5	1963	3,481	8-5/8	386	2,342	10	--	Hooper & Wade	do	

See footnotes at end of table.

Table 2.--Records of oil and gas tests in Menard and Mason Counties--Continued

Well	Owner	Operator	Date completed	Depth of well (ft)	Casing		Altitude of land surface (ft)	Section	Block	Survey	Plugging record	Remarks
					Diameter of well (in.)	Length (ft)						
TH-42-57-509	Letha Jacoby	Hovgard & Fitzgerald No. 5	1962	3,301	8-5/8	382	--	101	--	Hooper & Wade	125 sacks of cement 390-10; cement to top of surface casing; steel plate on top of casing.	
510	Alex Menzies	J. R. McLean No. 1	1960	3,335	8-5/8 5-1/2	418 3,315	2,275	60	--	John Hughes	Producing well.	Water 5 percent; Wilhelm (Canyon) field.
511	do	J. R. McLean No. 13	1961	3,468	8-5/8 4-1/2	350 3,466	2,290	60	--	do	do	Water 5 percent; Wilhelm Lane (3,300 ft Strawn) field.
512	do	Henry Frost Oil Properties Ltd. No. 2	1962	3,262	8-5/8 4-1/2	357 3,249	2,264	--	--	W. C. Huey	do	No water; Wilhelm Lane (Canyon) field.
513	do	Henry Frost Oil Properties Ltd. No. 4	1963	3,189	8-5/8 4-1/2	390 3,188	2,280	62	--	do	do	Do.
514	do	Henry Frost Oil Properties Ltd. No. 9	1963	3,205	8-5/8 4-1/2	403 3,204	2,297	62	--	do	do	Do.
515	do	J. R. McLean No. 4	1960	3,251	8-5/8 4-1/2	365 3,250	2,280	62	--	do	do	Do.
516	do	J. R. McLean No. 6	1960	3,353	8-5/8 4-1/2	343 3,352	2,257	62	--	do	do	Do.
517	do	J. R. McLean No. 9	1960	3,332	8-5/8 4-1/2	343 3,330	2,257	62	--	do	do	Do.
518	do	J. R. McLean No. 15	1962	3,490	8-5/8 4-1/2	382 3,488	2,266	62	--	do	do	Do.
519	do	J. R. McLean No. 16	1962	3,379	8-5/8 4-1/2	365 3,378	2,285	62	--	do	do	Do.
520	do	Henry Frost Oil Properties Ltd. No. 1	--	--	--	--	--	101	--	Hooper & Wade	do	Wilhelm Lane (Hope Lime) field.
521	Letha Jacoby	Hovgard & Fitzgerald No. 1	--	--	--	--	--	101	--	do	do	Do.
522	do	Hovgard & Fitzgerald No. 2	--	--	--	--	--	101	--	do	do	Do.
523	do	Hovgard & Fitzgerald No. 4	--	--	--	--	--	101	--	do	do	Do.
609	W. S. McKee	Tucker Drilling Co., et al. No. 1	1960	3,562	8-5/8	206	2,281	109	--	do	20 sacks of cement 2,950-2,890; 25 sacks 300-200; 10 sacks top of surface casing.	

See footnotes at end of table.

Table 2.--Records of oil and gas tests in Menard and Mason Counties--Continued

Well	Owner	Operator	Date completed	Depth of well (ft)	Casing		Altitude of land surface (ft)	Section	Block	Survey	Plugging record	Remarks
					Diameter of well (in.)	Length (ft)						
TH-42-57-610	B. K. Neal	Honolulu Oil Corp. No. 1	1959	3,600	8-5/8	415	2,308*	103	--	Hooper & Wade	40 sacks of cement 3,500-3,370; 5 sacks 3,150-2,988.	
708	C. L. Baker	Don Whittaker No. 1	1960	3,900	8-5/8	341	2,233	57	--	G. W. T. RR. Co.	10 sacks of cement at 300; 10 sacks top of surface casing.	
709	Henrietta Harrison	F. E. Shaheen, Sr. No. 1	1960	4,244	8-5/8	361	2,289	2	B	G. H. & S. A. RR.	10 sacks of cement at 350; 10 sacks top of surface casing.	
710	Joe (F.) Wilhelm	General Crude Oil Co. No. 1	1961	3,970	7 4-1/2	453 4,041	2,261*	1	B	do	Producing well.	No water; Nazera (Goen Lime) field.
711	Henrietta Harrison	F. E. Shaheen, Jr. No. 1	1961	3,565	7 4-1/2	366 3,565	2,214	12	--	R. S. Winslow	do	Nazera (3,500 ft Strawn) field.
712	Joe Wilhelm	General Crude Oil Co. No. 3	1960	3,294	7	243	2,286	59	4	G. W. T. & P. RR.	do	Water 40 percent; Wilhelm Lane (Canyon) field.
713	do	General Crude Oil Co. No. 1	1960	3,298	8-5/8 4-1/2	363 3,297	2,278	59	4	do	do	Water 14 percent; Wilhelm Lane (Canyon) field.
714	do	General Crude Oil Co. No. 2	1960	3,305	7 4-1/2	650 3,304	2,243*	59	4	do	do	Water 50 percent; Wilhelm Lane (Canyon) field.
715	do	General Crude Oil Co., SWD.	1961	1,043	--	--	2,276	59	--	do	Disposal well.	Disposes salt water from Wells TH-42-57-711, TH-42-57-712, and TH-42-57-713.
808	Walter Menzies	J. R. McLean, et al. No. 1	1961	3,494	8-5/8	342	2,279	60	--	John Hughes	10 sacks of cement in surface casing; steel plate on top of casing.	
809	Alex Menzies	J. R. McLean No. 12	1961	3,509	8-5/8	348	2,312	60	--	do	10 sacks of cement at bottom and top of surface casing. Steel plate on top of casing.	
810	do	C. C. Winn No. 1	1960	3,347	8-5/8	338	2,278	60	--	do	20 sacks of cement at 340 ft. Steel plate on top of casing.	
811	W. S. Menzies well 1	Wayne Petroleum No. 1	1962	3,463	8-5/8	456	2,314	2	--	J. F. Jenkins	20 sacks of cement at 465-412, and 14-0. Steel plate on top of casing.	
813	Alex Menzies	J. R. McLean No. 3	1960	3,349	8-5/8 4-1/2	362 3,311	2,289	60	--	John Hughes	Producing well.	No water; Wilhelm Lane (Canyon) field.
814	do	J. R. McLean No. 5	1960	3,356	8-5/8 4-1/2	343 3,354	2,280	60	--	do	do	Do.
815	do	J. R. McLean No. 10	1960	3,906	8-5/8 4-1/2	320 3,453	2,293	--	--	do	do	Do.

See footnotes at end of table.

Table 2.--Records of oil and gas tests in Menard and Mason Counties--Continued

Well	Owner	Operator	Date completed	Depth of well (ft)	Casing		Altitude of land surface (ft)	Section	Block	Survey	Plugging record	Remarks
					Diameter of well (in.)	Length (ft)						
TH-42-57-816	Alex Menzies	J. R. McLean No. 7	1960	3,353	8-5/8 4-1/2	334 3,350	2,284	60	--	John Hughes	Producing well.	No water; Wilhelm Lane (Canyon) field.
817	do	J. R. McLean No. 8	1960	3,361	8-5/8 4-1/2	337 3,354	2,301	--	--	do	do	Do.
908	George Kothmann	Honolulu Oil Corp. No. 1	1959	3,342	8-5/8	420	--	95	--	J. H. Gibson	30 sacks of cement at 3,342-3,245; 20 sacks 3,090-3,025; 50 sacks 2,780- 2,618; 30 sacks 1,550-1,455; 20 sacks 422-361; 10 sacks 20-10.	
909	L. B. Granstaff	Skelly Oil Co. No. 4	1962	1,655	5-1/2	458	2,212	66	--	B. S. & F. Grantee	13 sacks of cement at 1,410-1,303; 9 sacks 460-392; 4 sacks 15-0.	
58-606	Gene Whitehead	Davisson & Fitzgerald No. 1	1959	2,715	10-3/4	271	--	7	--	Day Land & Cattle Co.	50 sacks of cement at 271-10.	
607	C. H. Callan	Hovgard & Fitzgerald No. 1	1959	2,381	10-3/4	360	--	17	--	B. S. & F.	110 sacks of cement at 150-10.	
703	Clark Ranch Co.	B. A. Duggy	1944	3,229	--	--	--	3	--	A. B. & M.		
811	Lawrence Ruff	Kelly Bell No. 1	1956	3,033	8-5/8	203	2,171	30	1,633	R. J. Godfrey		Base of Cretaceous rocks at 280; top of Ellenburger Group 2,780.
812	Mrs. Ada Smith	Skelly Oil Co. No. 1	1957	3,075	--	329	2,135	27	--	A. B. & M.		Top of Ellenburger Group 2,640; top of Cambrian sandstone 3,009.
813	Lawrence Ruff	Allison & Prestridge	1962	--	--	--	--	50	--	R. J. Godfrey		
907	Gene Whitehead	Davisson & Fitzgerald No. 2	1960	2,282	10-3/4	238	--	16	--	do	50 sacks of cement at 100-10.	
59-408	Russell Callan	Barnett & Drake	--	2,150	--	--	--	22	--	W. S. Strader		
701	Callan City Co.	Barnett, et al.	1932	1,267	12-1/2	280	2,068	1	--	B. S. & F.		Top of Ellenburger Group 2,060 ft.
710	J. A. Laggett	Harry Baldwin	1941	1,252	12-1/2	160	2,098	1	--	do		Base of Edwards and associated limestones 160 ft.
711	Callan City Co.	J. C. Barnett	1930	2,124	15-1/2	255	2,078	1	--	do		Top of Ellenburger Group 2,390 ft.
712	J. A. Laggett	T. A. Hornady No. 1	1940	1,252	--	--	2,096	1	--	do		
713	do	T. A. Hornady No. 2	1941	1,335	--	--	2,096	1	--	do		

See footnotes at end of table.

Table 2.--Records of oil and gas tests in Menard and Mason Counties--Continued

Well	Owner	Operator	Date completed	Depth of well (ft)	Casing		Altitude of land surface (ft)	Section	Block	Survey	Plugging record	Remarks
					Diameter of well (in.)	Length (ft)						
TH-42-59-714	J. A. Laggett	C. M. Page	1950	180	--	--	2,088	1	--	B. S. & F.		
715	R. Andrews	H. H. Kendrick	1955	1,250	--	--	--	1	--	do		
716	do	do	--	1,335	--	--	--	1	--	do		
807	Andrews & Jackson	Turley & Bentley	1953	2,504	--	--	2,057	5	--	do		Top of Ellenburger Group 2,390 ft.
808	Callan City Co.	Barnett & Drake No. 1	1927	2,207	15-1/2	185	2,130	7	--	do		
809	do	Barnett, et al.	1932	1,305	15-1/2	250	2,124	1	--	do		
810	J. A. Laggett	Walter DeCourey	1950	2,305	--	--	2,124	1	--	do		
43-64-409	J. C. Sorrell, et al.	Lloyd Patton No. 1	1963	4,520	8-5/8 7	450 405	2,408	15	--	J. Pointenent Abstract 1473	15 sacks of cement at bottom of surface casing.	
410	R. A. Tisdale	Tucker Drilling Co.	1957	4,860	--	--	--	13	B	G. H. & S. A. RR. Co.		
510	Elsie S. Allen	-- Priest	--	3,435	--	--	--	133	--	E. L. & R. R. RR. Co.		
511	Speck, et al.	Russell Maguire No. 1	1962	4,510	8-5/8	452	2,292	131	--	do	15 sacks of cement at bottom of hole; 5 sacks top of hole; 10 sacks in and out of surface casing.	
609	John Speck	Sunray Drilling & Oil Co. No. 1	1963	4,224	8-5/8 2-2/8	567 4,223	2,294†	1	--	B. S. & F.	10 sacks of cement at 575-545; 5 sacks at surface.	
610	Whiffen Estate, -- Wilhelm	T. S. Haden	--	4,250	--	--	--	6	--	Fred Speck		
611	John Speck No. 1	Sunray and Continent Oil Co.	1962	4,224	8-5/8 2-7/8	567 4,223	2,292†	1	C	B. S. & F.	Oil well, not producing.	Water 32 percent; Tuckmar N.E. (Strawn) field.
708	John T. Vaughn	Liedtke 160 Ltd. & Giles & Rader No. 1	1960	3,101	8-5/8	465	2,307*	18	2	T. W. & N. G. RR. Co.	Cement plugs 2,270-2,154 and 480-462; 5 sacks top of surface casing.	
806	-- Rodgers	Woodward, Turner & Webb No. 1	1959	4,115	8-5/8	421	2,287	16	2	do	20 sacks of cement at 4,025-3,960; 25 sacks 465-385; 5 sacks top of surface casing.	
807	Mary E. Rogers	J. H. and G. L. Rowsey No. 1	1958	2,863	8-5/8	475	2,249	5	B	G. H. & S. A.	Cement plug 2,863-2,790; 15 sacks of cement at 2,465-2,400; 26 sacks 454-371.	
808	H. W. Speck	Tucker Drilling Co.	1955	3,209	--	--	2,275	2	C	Fred Speck		

See footnotes at end of table.

Table 2.--Records of oil and gas tests in Menard and Mason Counties--Continued

Well	Owner	Operator	Date completed	Depth of well (ft)	Casing		Altitude of land surface (ft)	Section	Block	Survey	Plugging record	Remarks
					Diameter of well (in.)	Length (ft)						
TH-43-64-809	U. E. Rogers	Humble Oil & Refining Co.	1956	5,519	--	--	--	36	--	R. S. Winslow		
810	Elizabeth Holliday	Thomas Drilling Co. No. 1	1962	1,913	7 4-1/2	402 1,910	2,247†	7	2	T. W. & N. G. RR. Co.	Plugged back from 1,903-1,850 with 14 sacks of cement.	
811	U. E. Rogers	Lloyd Patton No. 1	1961	3,956	8-5/8 4-1/2	453 3,956	2,253	6	2	do	Producing well.	Water 2 percent; Tuckmar South (3,700 sand) field.
812	U. E. Rogers "A"	do	1961	3,985	8-5/8 4-1/2	448 3,812	2,267	5	2	do	do	No water; Tuckmar South (3,700 sand) field.
813	U. E. Rogers "B"	do	1962	3,935	8-3/4 4-1/2	459 3,781	2,239	16	2	do	do	Do.
814	Mary E. Rogers	Tucker Drilling Co. No. 1	1954	2,825	8-5/8 5-1/2	476 2,801	2,245	5	B	G. H. & S. A. RR.	Oil well, not producing.	No water; Tuckmar (Cisco) field.
815	Elizabeth Holliday	Thomas Drilling Co. No. 1	1960	1,913	7 4-1/2	402 1,910	2,247†	7	--	T. W. & N. G. RR. Co.	do	Water 88 percent; Tuckmar South (1,900 sandstone) field.
816	Mary Rogers	Wirt Davis No. 1	1961	3,742	8-5/8 4-1/2	453 3,738	2,272†	15	2	do	Producing well.	No water; Tuckmar South (3,700 sandstone) field.
817	U. E. Rogers	Thomas Drilling Co. No. 1	1960	2,010	8-5/8	406	--	15	2	do	5 sacks of cement at top of surface casing.	
912	James Harper	Tucker Drilling Co. No. 2	1958	5,010	8-5/8	312	2,240	3	13	G. H. & S. A. RR. Co.	15 sacks of cement at 5,000-4,970; 20 sacks at 4,050-4,020; 20 sacks at 3,740-3,700; 20 sacks 330-290; 10 sacks top of surface casing.	Resistivity of water in Cambrian sandstone at 75° = 0.037.
913	do	Tucker Drilling Co. No. 1	1958	4,850	8-5/8	334	2,254	13	2	T. W. & N. G. RR. Co.	25 sacks of cement at 3,970-3,870; 25 sacks 3,530-3,430; 30 sacks 390-300; 10 sacks top of surface casing.	
914	R. S. Winslow Estate	Thomas Drilling Co. No. 1	1959	2,016	8-5/8	408	2,188	14	2	do	20 sacks of cement in surface casing.	
915	Albert Brisbain	Tucker Drilling Co. No. 1	1958	4,800	8-5/8	322	2,190	4	B	G. H. & S. A. RR. Co.	25 sacks of cement at 4,550-4,445; 25 sacks at 4,050-3,945; 25 sacks 385-300; 10 sacks of cement at top of surface casing.	
916	Elizabeth Holliday	Thomas Drilling Co. No. 2	1962	4,010	8-5/8	403	2,193	7	2	T. W. & N. G. RR. Co.	30 sacks of cement at 450-350.	
917	Frank W. Speck	Tucker Drilling Co.	1955	4,010	--	--	2,209	3	C	Brooks & Burleson		

See footnotes at end of table.

Table 2.--Records of oil and gas tests in Menard and Mason Counties--Continued

Well	Owner	Operator	Date completed	Depth of well (ft)	Casing		Altitude of land surface (ft)	Section	Block	Survey	Plugging record	Remarks
					Diameter of well (in.)	Length (ft)						
TH-43-64-918	James Harper	Shaheen & Sons	1962	4,003	8-5/8	285	2,201	13	2	T. W. & N. G. RR. Co.	Heavily laden mud and cement.	
55-08-106	L. E. Callan	Tucker Drilling Co. No. 2	1958	4,905	4-1/2	2,700	2,209	1,635	--	Frank	10 sacks of cement at 2,000; 10 sacks at 326-226; 5 sacks at top of surface casing.	
107	J. M. Treadwell	J. M. C. Ritchie & J. S. Reaves	1961	2,651	8-5/8	437	--	3	2	T. W. & N. G. RR. Co.	15 sacks of cement at 450-400; 5 sacks at 40-0.	
108	J. M. Treadwell "A"	Lloyd Patton No. 1	1961	2,700	8-5/8	450	2,316	4	2	do	5 sacks of cement at bottom and 5 sacks at top of surface casing.	
109	J. M. Treadwell	W. S. Day No. 2	1961	2,650	8-5/8	408	2,299	4	2	do	20 sacks of cement at base, and 10 sacks at top of surface casing; steel plate on top of casing.	
110	do	Alfred E. Giles No. 1	1962	2,635	8-5/8	356	2,270	3	--	T. W. & N. G. RR. Co. Abstract 743	10 sacks of cement at 2,635; 20 sacks at 356 to surface.	
111	L. E. Callan	G. L. Rowsey	1958	4,318	8-5/8	368	2,274	311	--	J. Wilhelm	25 sacks of cement at 3,800; 25 sacks 2,600; 30 sacks 418-318; 5 sacks at top of surface pipe.	
112	-- Treadwell	W. S. Day	1958	2,601	8-5/8	464	2,264*	3	2	T. W. & N. G. RR. Co.	50 sacks of cement at bottom of hole; 15 sacks at bottom and 10 sacks at top of surface pipe; steel plate on top of casing.	
114	-- Callan	Bengal Producing Co. No. 1	1958	2,900	13-3/8 4-1/2	480 2,703	2,296	311	--	J. Wilhelm	Producing well.	Water 40 percent; F & H (Cisco) field.
115	-- Callan	Bengal Producing Co. No. 2	1958	2,700	8-5/8 4-1/2	375 2,681	2,311	311	--	do	do	No water; F & H (Cisco) field.
116	J. M. Treadwell	Bengal Producing Co. No. 1	1958	2,700	8-5/8 4-1/2	385 2,698	2,297	3	2	T. W. & N. G. RR. Co.	do	Do.
117	do	Bengal Producing Co. No. 2	1958	2,745	8-5/8 4-1/2	471 2,699	2,323	3	2	do	do	Do.
118	-- Treadwell	Chase Petroleum Co. No. 1	1959	2,600	8-5/8 4-1/2	464 2,594	2,264*	3	2	do	do	Water 5 percent; F & H (Cisco) field.
119	Annie Leveridge	Lloyd Patton No. 1	1959	2,600	8-5/8 4-1/2	478 2,655	2,273	311	--	J. Wilhelm	do	Do.
120	do	Lloyd Patton No. 2	1959	2,619	8-5/8 4-1/2	458 2,660	2,260	311	--	do	do	No water; F & H (Cisco) field.

See footnotes at end of table.

Table 2.--Records of oil and gas tests in Menard and Mason Counties--Continued

Well	Owner	Operator	Date completed	Depth of well (ft)	Casing		Altitude of land surface (ft)	Section	Block	Survey	Plugging record	Remarks
					Diameter of well (in.)	Length (ft)						
TH-55-08-121	Annie Leveridge	Lloyd Patton No. 3	1960	2,625	8-5/8 4-1/2	460 2,625	2,258†	311	--	J. Wilhelm	Producing well.	No water; F & H (Cisco) field.
122	J. M. Treadwell	Lloyd Patton No. 1	1960	2,655	8-5/8 4-1/2	468 2,653	2,270	3	2	T. W. & N. G. RR. Co.	do	Do.
123	do	Lloyd Patton No. 3	1960	2,682	8-5/8 4-1/2	475 2,585	2,295	4	2	do	do	Do.
124	Annie Leveridge "A"	Lloyd Patton No. 2	1961	2,700	8-5/8 4-1/2	446 2,676	2,293	79	--	E. L. & R. R. RR. Co.	do	Do.
125	do	Lloyd Patton No. 3	1962	2,700	8-5/8 4-1/2	432 2,654	2,278	79	--	do	do	Water 31 percent; F & H (Cisco) field.
126	do	Lloyd Patton No. 4	1962	2,700	8-5/8 4-1/2	426 2,604	2,250	79	--	do	do	No water; F & H (Cisco) field.
127	do	Lloyd Patton	1962	2,700	8-5/8 4-1/2	333 2,640	2,248	79	--	do	do	Do.
204	Edith Runge	T. A. Kirk & H. L. Neeb No. 1	1960	3,882	8-5/8	331	2,248	33	--	John H. Gibson	10 sacks of cement at bottom of surface casing.	
205	-- Rogers	Fortune Drilling Corp., et al. No. 1	1959	5,415	8-5/8	331	2,301	5	2	T. W. & N. G. RR. Co.	20 sacks of cement at 4,200-4,100; 20 sacks 350 to base of surface casing; 10 sacks of cement top of surface casing.	
206	U. E. Rogers	J. T. George Drilling Co. No. 1	1963	2,652	8-5/8	370	2,321	5	2	do	15 sacks of cement at 2,150-2,050; 10 sacks of cement at 375-335; 5 sacks 20-0.	
207	Edith Runge	T. A. Kirk & H. L. Neeb No. 1-A	1962	4,203	8-5/8	350	2,220	1,596	--	Henrich Brandes	20 sacks of cement at bottom of surface casing.	
208	M. H. Callan	Lloyd Patton No. 1	1962	2,700	8-5/8	426	2,259	28	--	J. T. Callan	10 sacks of cement at bottom, and 5 sacks at top of surface casing.	
209	Rogers "B"	Fortune Drilling Co. No. 1	1961	3,789	8-5/8 4-1/2	426 3,789	--	5	2	T. W. & N. G. RR. Co.	Producing well.	Water 40 percent; Tuckmar South (3,700 sand) field.
210	M. H. Callan "A"	Lloyd Patton No. 1	1962	2,700	8-5/8 4-1/2	371 2,102	2,267	80	--	J. H. Callan		
307	John Winslow	T. A. Kirk & H. L. Neeb No. 1	1961	3,675	8-5/8	300	2,224	1,590	--	Otto Neuber	10 sacks of cement at bottom and 10 sacks at top of surface casing. Steel plate on top of casing.	
504	-- Tomlinson	Cree Oil Inc. No. 1	1963	4,396	8-5/8 4-1/2	452 4,700	2,169	25	--	John H. Gibson	20 sacks of cement at 475; steel plate on top of casing.	Water 45 percent; F & H East (Cook) field.

See footnotes at end of table.

Table 2.--Records of oil and gas tests in Menard and Mason Counties--Continued

Well	Owner	Operator	Date completed	Depth of well (ft)	Casing		Altitude of land surface (ft)	Section	Block	Survey	Plugging record	Remarks
					Diameter of well (in.)	Length (ft)						
TH-55-08-505	May White	F. Luckenbach	--	--	--	--	--	18	--	Sam Wallick		
607	Turney & Polk	Warren Petroleum Co.	1951	2,318	--	--	--	37	--	John H. Gibson		
608	Marjorie Luckenbach	do	1947	3,726	--	--	--	1,585	--	-- Klein		
609	Joe Russell	-- Furney	1948	4,585	--	--	--	18	--	Sam Wallick		
610	Marjorie Luckenbach	Furney & Polk	1951	2,317	--	--	--	38	--	W. S. Dodd		
611	Joe Russell	Warren Petroleum No. 1	1946	2,509	--	--	--	18	--	Sam Wallick	Abandoned oil well.	
612	do	-- Furney	1948	3,813	--	--	--	18	--	do		
706	Boy Scouts of America	McAlester Fuel Co. & Tucker Drilling Co. No. A-1	1962	4,683	8-5/8	609	--	72	--	Mrs. George Brown Abstract 1667	25 sacks of cement at 4,000-3,920; 20 sacks 622-560; 5 sacks 15-0.	
805	Joe H. Russell	F. E. Shaheen, Jr. No. 1	1962	4,100	8-5/8	174	2,183	1,582	--	Frederick Metzig	Cement plugs at 3,810-3,760; 190-155, and 20-2; steel plate on top of casing.	
806	Sol Mayer	Coastal States Gas Producing Co. No. 2-A	1962	4,116	8-5/8	370	2,433	11	--	John H. Gibson	25 sacks of cement half in and half out of surface casing from 415-320; 10 sacks 300-0; steel plate on top of casing.	
807	do	Coastal States Gas Producing Co. No. 1	1962	4,203	8-5/8 4-1/2	428 4,203	2,233	11	--	do	Producing well.	No water; Shaheen (Goen Lime) field.
808	do	F. E. Shaheen, Jr. No. 1	1961	4,315	8-5/8 5-1/2	395 4,300	2,292	1,580	--	Lorenzo Ziegler	do	Shaheen (3,800 Strawn) field.
16-211	Boy Scouts of America	-- Duffey, et al.	--	4,278	--	--	2,085±	14	--	Philip D. Bonnet		Top of Ellenburger Group at 3,794 ft.
304	M. C. Bevans	Deep Rock Oil Corp. No. 2	1953	3,535	10-3/4	330	2,092	3	--	John H. Gibson		Top of Ellenburger Group 3,430 ft.
305	S. H. Allison	-- Moody	--	5,000	--	--	--	1,473	--	Philip D. Bonnet		
429	L. L. Ball Estate	Thomas & Ludlow No. 1	1919	2,040	15	565	--	20	A	G. H. & S. A. RR. Co.		

See footnotes at end of table.

Table 2.--Records of oil and gas tests in Menard and Mason Counties--Continued

Well	Owner	Operator	Date completed	Depth of well (ft)	Casing		Altitude of land surface (ft)	Section	Block	Survey	Plugging record	Remarks
					Diameter of well (in.)	Length (ft)						
TH-55-16-605	M. C. Bevans	Deep Rock Oil Corp. No. 1	1952	5,148	10-3/4	278	2,212	31	A	G. H. & S. A. RR. Co.		Base of Cretaceous 296; top of Ellenburger 3,470; top of Cambrian sandstone 3,810; top of Hickory Sandstone Member of Riley Formation 4,620; top of Precambrian rocks 5,140.
606	Olivia B. McCutcheon	Wayne Petroleum Co. No. 3-14	1963	--	--	315	2,204	14	A	do		Base of Cretaceous 193?; top of Ellenburger Group 3,380.
607	do	Wayne Petroleum Co. No. 2-13	1963	1,101	5-1/2	263	2,158	13	A	do	15 sacks of cement at 500-390; 5 sacks at 297-260.	Base of Cretaceous 255.
704	Kathrine C. Ball	W. Allison, et al. No. 1	1953	196	--	--	--	20	A	do		
801	Joyce and Wm. Bevans	Tucker Drilling Co. & Jones & Lyons No. 1	1957	3,870	8-5/8	371	2,267	44	A	do		Top of Ellenburger Group 3,605.
804	Owen and Decker Womack	Lauderdale & Straughan Drilling Co., et al. No. 1	1961	4,009	8-5/8	318	--	46	A	do	Cement plugs at bottom and top of surface casing; steel plate on top of casing.	
904	Olivia B. McCutcheon	Wayne Petroleum Co. No. 1-31	1962	1,086	5-1/2	300	2,249	31	A	do	10 sacks of cement at 1,070-990; 20 sacks at 520-350.	Base of Cretaceous rocks 295.
905	William McNamara	Wayne Petroleum Co. No. 1-43	1962	1,034	10-1/2	246	2,244	113	A	do	10 sacks of cement at 980-910; 20 sacks at 510-350.	Base of Cretaceous rocks 235.
906	do	Wayne Petroleum Co. No. 1-A-59	1962	1,037	5-1/2	297	2,308	59	A	do	Cement plugs 1,027-955; 475-275.	Base of Cretaceous rocks 247.
24-206	Owen and Decker Womack	Lauderdale & Straughan Drilling Co., et al. No. 1	1961	4,006	8-5/8	333	2,373†	5	--	B. S. & F.	Cement plugs bottom and top of surface casing; steel plate on top of surface casing.	Base of Cretaceous rocks 250; top of Ellenburger Group 3,800.
305	Wm. and Joyce Bevans McNamara	Lauderdale & Straughan Drilling Co. & Roberts & Hart No. 1	1962	4,107	8-5/8	400	2,351	7	--	T. & N. O. RR. Co.	Cement plug in surface casing; steel plate on top of casing.	Base of Cretaceous rocks 325?; top of Ellenburger Group 3,510.
306	do	Paul D. Crawford No. 1	1960	3,709	8-5/8	416	--	8	--	Charles B. Burbank	60 sacks of cement at 620-400.	Top of Ellenburger Group 3,430.
56-01-106	Arthur Sears	Duffy No. 1	1950	3,603	7	341	2,204	10	2	T. W. & N. G. RR. Co.	10 sacks of cement at 340; 10 sacks top of surface casing.	
107	James Harper	-- Buttram	--	3,225	--	--	--	36	--	R. S. Winslow		

See footnotes at end of table.

Table 2.--Records of oil and gas tests in Menard and Mason Counties--Continued

Well	Owner	Operator	Date completed	Depth of well (ft)	Casing		Altitude of land surface (ft)	Section	Block	Survey	Plugging record	Remarks
					Diameter of well (in.)	Length (ft)						
TH-56-01-108	John M. Winslow	-- Alexander	--	3,208	--	--	--	32	--	R. S. Winslow		
207	Sadie Wilkinson	Sunray Drilling & Oil Co.	--	3,612	--	--	--	55	--	John H. Gibson		
208	do	Sunray Drilling & Oil Co. No. 2	1962	3,544	8-5/8	359	2,206*	55	--	do	26 sacks of cement at 3,220-3,136; 30 sacks 375-250; 5 sacks top of surface casing.	
209	do	Sunray Drilling & Oil Co. No. 1	1962	3,401	8-5/8	466	2,280	2	--	F. W. Wilkinson	25 sacks of cement at 3,200-3,118; 35 sacks 475-325; 10 sacks at top of surface casing.	
210	G. W. Kothmann	F. E. Shaheen, Jr. No. 1	1962	3,287	8-5/8 4-1/2	318 285?	2,274	93	--	John H. Gibson	Producing well.	Ferris (3,250 Lime) field.
309	L. B. Granstaff	H. C. Hood, et al. No. 1	1963	1,680	7	340	2,210	1,517	--	Wilhelm Goss Abstract 187	20 sacks of cement at 1,680-1,600; 30 sacks 430-320; 5 sacks 25-0.	
405	Frank Wilkinson	Jack F. Grimm No. 1	1962	3,645	8-5/8	276	2,199	30	--	W. J. Wilkinson	50 sacks of cement at 300-240; steel plate on top of casing.	
406	Sadie Wilkinson	-- Superior	1950	3,650	--	--	--	27	--	T. & N. O. RR. Co.		
507	do	K & H Operating Co. & Dixon Drilling Co. No. 1	1963	3,403	8-5/8	347	--	27	--	do	35 sacks of cement at 300-400; 5 sacks at top of surface casing.	
508	F. L. Wilkinson	Jack F. Grimm No. 1	1962	3,411	8-5/8	311	2,073*	27	--	do	50 sacks of cement in surface casing; steel plate on top of casing.	
706	S. H. Allison	Sun Oil Co.	1960	3,461	8-5/8	249	2,085	--	--	Julius Harberg Abstract 1469	31 sacks of cement at 2,860-2,760; 31 sacks 300-200; 5 sacks top of surface casing. Steel plate on top of casing.	Top of Ellenburger Group 3,352.
707	do	Tucker Drilling Co. Inc. & Jones & Lyons No. 1	1960	3,475	7-5/8	415	2,125	1,659	--	Jacob La Here	25 sacks of cement at 3,450-3,400; 25 sacks at 465-415; 5 sacks at top of surface casing.	
908	Mrs. Minnie Neal	Rex Outlaw	--	3,104	--	--	1,445	--	--	Julius Rennert		
02-102	L. B. Granstaff	Skelly Oil Co. No. 3	1962	3,090	8-5/8	400	--	61	--	John H. Gibson	Cement plugs at 2,830-2,730, 415-340, and 37-0.	
103	do	Quaker Oil Co. No. 1	--	3,050	--	--	--	61	--	do		

See footnotes at end of table.

Table 2.--Records of oil and gas tests in Menard and Mason Counties--Continued

Well	Owner	Operator	Date completed	Depth of well (ft)	Casing		Altitude of land surface (ft)	Section	Block	Survey	Plugging record	Remarks
					Diameter of well (in.)	Length (ft)						
TH-56-02-104	L. B. Granstaff	Skelly Oil Co. No. 2	1958	3,250	8-5/8	320	2,133*	22	--	T. & N. O. RR. Co.	31 sacks of cement at 2,706-2,605; 31 sacks at 1,090-909; 25 sacks at 360-185; 10 sacks at 30-10.	
406	Ray Bradford	O. N. Beer, et al.	1960	2,680	8-5/8	295	--	1,438	--	Heinrich Meckel	35 sacks of cement at 700; 15 sacks at surface.	Top of Ellenburger Group 2,520.
407	J. M. Bradford	Henry Frost Oil Properties Ltd. No. 1	1962	2,130	8-5/8	202	1,929	1,436	--	Michael Schultz	15 sacks of cement at 2,050; 20 sacks half in and half out bottom of surface casing; 5 sacks top of surface casing; steel plate on top of casing.	
703	Alex Menzies	Phillips "Crowell"	1946	2,350	--	--	--	216	--	Paul Weighold		
804	Pauline Stockton	do	1945	2,150	--	--	--	35	--	John F. Torrey		
805	Norine Martin Lively	Shaheen & Sons No. 1	1962	686	--	--	2,067	32	--	Henry Peters		Base of Edwards and associated limestones 130; base of Cretaceous rocks 230.
806	do	Shaheen & Sons No. 3	1962	740	--	--	1,981	32	--	do		Base of Edwards and associated limestones 80; base of Cretaceous rocks 140.
03-201	Cecil Corbell	-- Forest	1938	1,725	--	--	2,050±	163	--	John H. Gibson		Base of Edwards and associated limestones 95; base of Cretaceous rocks 250.
209	do	Hagerty & Lee No. 1	--	1,267	--	--	--	38	--	Spink		
604	A. H. Murchison	Clements	1937	1,295	10	320	2,073*	80	--	Anton Boeddecker		Base of Edwards and associated limestones 160; base of Cretaceous rocks 228.
907	Damon Kothmann	-- Grafe	--	1,123	--	--	--	74	--	-- Mohr		
908	Dora N. Kothmann	Carpenter & Robbins	1928	414	6-5/8	120	1,915	22	--	R. R. Russell		
909	do	Clark No. 1	--	445	--	--	--	77	--	-- Kuhlmann		
910	do	Clark No. 2	--	660	--	--	--	77	--	do		
04-402	Frank Wilhelm	Hartzell-Nawn, et al. No. 1	--	680	--	--	--	24	--	Frank Wilhelm		
606	do	Sabens & Bevans No. 1	--	410	--	--	--	28	--	Albert Prugel		
804	Lillie Wilhelm	do	--	1,004	--	--	--	79	--	Jacob Brecker		

See footnotes at end of table.

Table 2.--Records of oil and gas tests in Menard and Mason Counties--Continued

Well	Owner	Operator	Date completed	Depth of well (ft)	Casing		Altitude of land surface (ft)	Section	Block	Survey	Plugging record	Remarks
					Diameter of well (in.)	Length (ft)						
TH-56-04-909	Frank Wilhelm	Sabens & Bevans No. 2	--	850	--	--	--	25	--	Indianola RR. Co.		
09-104	G. S. Allison	C. H. Murdich	1944	3,815	15-1/2	214	2,132	248	--	A. Meikoeter		Top of Ellenburger Group 3,200; top of Cambrian sandstone 3,790.
407	Mack Henderson	O. M. Beer, et al.	1960	3,605	8-5/8	125	2,267	33	A	G. H. & S. A. RR. Co.	15 sacks of cement at 2,500; 15 sacks in surface casing.	Top of Ellenburger Group 3,240.
510	Jack E. Allison	Thomas Drilling Corp. No. 1	1959	3,596	8-5/8	405	2,206	251	--	Johann Bradsen		Top of Ellenburger Group 3,080.
511	Cora E. Powell	Fox & Ransdell	1961	2,810	8-5/8	520	2,312	6	A	G. H. & S. A. RR. Co.	10 sacks of cement in surface casing; steel plate on top of casing.	
613	Geo. L. Schneider	Dan E. Whatley No. 1	1962	2,776	8-5/8	277	2,144	1	A	do	25 sacks of cement bottom of well; 15 sacks at 277; 15 sacks in surface casing; steel plate on top of casing.	
706	Mack Henderson	A. A. Schoenfeld No. 1	1963	950	7	325	2,211	39	A	do	12 sacks of cement at 340-300.	
707	Lawrence Williamson	Wayne Petroleum Co. No. 1-60	1963	3,641	8-5/8	372	2,319	60	A	do	25 sacks of cement at 3,150-3,050; 25 sacks at 440-360; 5 sacks at top of surface casing; steel plate on top of casing.	Base of Cretaceous rocks 345?; top of Ellenburger Group 3,220.
809	E. V. LaCouture	A. A. Schoenfeld No. 1	1963	1,118	5-1/2	424	--	38	A	do	15 sacks of cement at 460-420; 10 sacks at 30-0.	
906	H. Meixner	Home Oil Co.	--	1,220	--	--	--	507	--	O. H. Karstendick		
10-109	Paul Martin	-- Russell	--	790	--	--	--	101	--	Henry Mucke		
110	do	--	--	680	--	--	--	5	--	George W. Jones		
201	-- Meta	Phillips No. 1	1962	3,939	--	504	2,035*	501	--	J. W. Bradford		Top of Ellenburger Group 2,190; top of Cambrian sandstone 2,660; top of Hickory Sandstone Member of Riley Formation 3,360; top of Precambrian rocks 3,860.
210	Norene Martin Lively	Shaheen & Sons No. 5	--	--	--	--	--	184	--	Albert Hagemann		

See footnotes at end of table.

Table 2.--Records of oil and gas tests in Menard and Mason Counties--Continued

Well	Owner	Operator	Date completed	Depth of well (ft)	Casing		Altitude of land surface (ft)	Section	Block	Survey	Plugging record	Remarks
					Diameter of well (in.)	Length (ft)						
TH-56-10-211	Norene Martin Lively	Shaheen & Sons No. 4	1962	700	--	--	2,059	205	--	George Franz		Base of Edwards and associated limestones 120; base of Cretaceous rocks 180.
212	do	Shaheen & Sons No. 6	1963	700	--	--	2,068	184	--	Albert Hagemann		Base of Edwards and associated limestones 120; base of Cretaceous rocks 200.
213	do	Shaheen & Sons No. 7	1963	670	--	--	--	183	--	do		Base of Edwards and associated limestones 120; base of Cretaceous rocks 190.
214	C. Albert Martin	Wayne Petroleum Co. No. 1-448	1963	689	5-1/2	196	2,036	448	--	Fisher & Miller	50 sacks of cement at 220-170.	Base of Cretaceous rocks 160.
215	Norene Martin Lively	Shaheen & Sons No. 2	1962	689	--	--	--	183	--	Albert Hagemann		Base of Edwards and associated limestones 170; base of Cretaceous rocks 230.
313	Jacoby Bros.	A. R. Ekholm No. 1	1960	2,182	8-5/8	344	2,198	20	--	H. G. Freeman	25 sacks of cement in top of surface casing; steel plate on top of casing.	
406	C. A. Martin, Jr.	Wayne Petroleum Co. No. 1-502	1963	665	5-1/2	164	2,083	502	--	Martin Albrecht	Cement plugs 194-144; steel plate on top of casing.	Base of Cretaceous rocks 160.
407	do	Wayne Petroleum Co. No. 1-6	1963	710	5-1/2	197	2,188	6	--	M. M. Kennard	Cement plugs 222-172; top surface casing.	Base of Cretaceous rocks 190.
505	Belle Rogers	Wayne Petroleum Co. No. 1-4	1963	618	--	--	2,108	4	--	Lee Murchison	5 sacks of cement 143-193.	Base of Cretaceous rocks 160.
506	Carl Martin, Jr.	Wayne Petroleum Co. No. 1-494	--	--	8-5/8	372	2,108	494	--	Heirs of Adolph Shelton		Base of Cretaceous rocks 187.
507	Lee Murchison	H. F. Wilcox Oil & Gas Co.	1936	3,507	15-1/2	252	2,190*	158	--	Lee Murchison	10 sacks of cement at 210; 5 sacks at 15.	Water-bearing sandstone 2,297-5,000?
508	Carl Martin, Jr.	Wayne Petroleum Co. No. 1-5	1963	618	5-1/2	163	2,056	5	--	George W. Jones	5 sacks of cement at 193-143.	Base of Cretaceous rocks 158.
509	C. Albert Martin	Wayne Petroleum Co. No. 1-94	1963	650	5-1/2	196	2,095	94	--	H. & G. N. RR. Co.	Cement plugs 226-176; top of hole and surface casing.	Base of Cretaceous rocks 168.
706	A. A. Williamson	Wayne Petroleum Co. No. 1-15	1963	2,547	8-5/8	311	2,217	15	--	John A. Gibson	3 sacks of cement at 397-300; steel plate on top of casing.	Base of Cretaceous rocks 200; top of Ellenburger Group 2,380.
707	do	Wayne Petroleum Co. No. 1-6	1963	--	8-5/8	285	2,182	6	--	J. W. Estes		Base of Cretaceous rocks 268.

See footnotes at end of table.

Table 2.--Records of oil and gas tests in Menard and Mason Counties--Continued

Well	Owner	Operator	Date completed	Depth of well (ft)	Casing		Altitude of land surface (ft)	Section	Block	Survey	Plugging record	Remarks
					Diameter of well (in.)	Length (ft)						
TH-56-11-113	S. D. Kothmann	I. A. Stephens No. 1	1952	1,604	--	--	2,079	2	--	John P. Ferrell		
205	E. A. Kothmann	Thomas & Ludlow No. 1	--	--	--	--	--	100	--	John P. Kitchens		
501	Bennie Bradford	American Republics No. 1	1947	2,745	10-3/4	146	2,043	29	--	J. V. Massey		Base of Edwards and associated limestones 146; base of Cretaceous rocks 230; top of Ellenburger Group 1,120; top of Cambrian sandstone 1,400; top of Hickory Sandstone Member of Riley Formation 2,170; top of Precambrian rocks 2,680.
12-201	S. W. Wallace	Stewart Herman No. 1	1959	1,179	--	--	1,853	33	--	Benjamin Morse		Top of Hickory Sandstone Member of Riley Formation 1,106. Water-bearing sandstone at 28-31; 308-345; 387-390; 417-490; 835-845; 925-950; 1,100-1,179.
327	F. Brandenberger	Voss & Bryan, et al. No. 1	1933	804	--	--	1,921	455	--	Edward Henkel		
401	V. W. Crawford	G. A. Bjornson & Dakota Texas Oil Co.	1961	650	--	--	--	12	--	Seth Mabry		
402	John Royal	F. H. Carpenter No. 1	1953	700	--	--	2,050	23	--	A. B. & M.		Base of Edwards and associated limestones 185; base of Cretaceous rocks 335. Water-bearing sandstone 295-335.
501	J. E. Rudder	B. R. Sheffield & Dakota Texas Oil Co. No. 1	1951	2,247	--	--	2,103*	7	--	Tyler TAP RR. Co.		Base of Cretaceous rocks 335; top of Precambrian rocks 2,210.
807	John Royal	Bjornson, et al.	1952	670	--	--	--	23	--	A. B. & M.		
909	W. C. Eckert	--	1953	592	--	--	--	96	--	Isidor Muller		
17-307	Mrs. R. H. Spiller	Liner & Demplos No. 1	--	2,750	--	--	2,242	8	--	T. O. Howell		

See footnotes at end of table.

Table 2.--Records of oil and gas tests in Menard and Mason Counties--Continued

Well	Owner	Operator	Date completed	Depth of well (ft)	Casing		Altitude of land surface (ft)	Section	Block	Survey	Plugging record	Remarks
					Diameter of well (in.)	Length (ft)						
TH-56-18-108	C. R. & Thos. W. Nasworthy	H. M. Naylor Oil Co. No. 1	1958	3,893	9-5/8	426	2,313	14	1,857	Sam I. Zettlemoyer	25 sacks of cement at 2,300; 25 sacks at 2,000; 25 sacks at 400.	Top of Ellenburger Group 2,460; top of Cambrian sandstone 2,970; top of Hickory Sandstone Member of Riley Formation 3,745; top of Precambrian rocks 3,890?
109	C. R. Nasworthy	Wayne Petroleum Co. No. 1-165	1963	2,587	8-5/8	347	2,268	165	--	G. C. & S. F. RR. Co.	6 sacks of cement at 2,000-1,898; 40 sacks at 400-300; 5 sacks top of surface casing. Steel plate on top of casing.	Base of Cretaceous rocks 312.
110	Ruby S. Sieker	Wayne Petroleum Co. No. 1-10	1963	2,501	8-5/8	295	2,287†	10	--	W. A. Choice	10 sacks of cement at 310-280; 10 sacks at 50-0.	Base of Cretaceous rocks 182.
19-305	Mrs. Ollie Noble	C. A. Morris	1954	650	--	--	--	14	--	Eugene Ohlenburger		
					Mason County							
SZ-56-05-402	-- Bradshaw	Carpenter Exploration Co. No. 1	--	1,095	--	--	1,790	46	--	Indianola RR.		Top of Ellenburger Group 35; top of Cambrian sandstone 330; top of Hickory Sandstone Member of Riley Formation 1,050.

* Measurement from drill floor.
† Measurement from Kelly bushing.

Table 3.--Chemical analyses of ground water in Menard and adjacent counties

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

Water-bearing unit: Qa, Quaternary alluvium; Ke, Edwards and associated limestones; Kt, Trinity Group; Pz, Paleozoic rocks.

Well	Owner	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Specific conductance (micromhos at 25 °C)	pH
								Menard County											
1/ TH-42-57-401	Joe Wilhelm	210	Nov. 10, 1961	Ke	15	48	29	16	269	12	24	0.5	6.0	282	239	13	0.4	485	7.0
1/ 402	Mrs. Victoria Davis	260	Nov. 14, 1961	Ke(?)	15	50	29	29	268	19	44	--	5.4	323	244	20	.8	570	7.2
1/ 403	Melvin Wilhelm	235	Nov. 15, 1961	Ke	15	51	24	23	244	12	38	--	11	294	226	18	.7	514	7.2
1/ 405	do	240	do	Ke	20	57	17	32	220	19	48	--	18	319	212	25	1.0	548	7.4
1/ 501	Roy Jacoby	382	do	Ke(?)	12	52	32	42	258	23	69	--	25	382	261	26	1.1	686	7.1
1/ 601	P. K. Neal	--	do	Ke(?)	15	42	28	15	228	14	32	--	7.9	266	220	13	.4	479	7.1
604	J. A. Prugal	180	Mar. 9, 1963	Ke	15	44	29	15	261	15	18	.4	6.8	370	228	--	--	472	7.5
1/ 702	Joe Wilhelm	220	Nov. 10, 1961	Ke	14	41	28	8.2	242	8.6	16	.5	5.2	240	217	8	.2	421	7.0
1/ 703	do	235	do	Ke	15	46	28	14	257	13	19	.5	9.2	271	230	12	.4	469	7.1
1/ 704	do	230	do	Ke	13	49	28	9.7	260	12	19	.5	5.4	265	238	8	.3	464	6.8
1/ 705	Arthur Sears	180	Nov. 14, 1961	Ke	14	48	28	10	266	8.2	18	--	6.4	264	235	9	.3	471	7.1
1/ 706	do	240	do	Ke	12	56	29	11	302	6.6	18	--	2.8	284	258	8	.3	499	7.0
1/ 707	do	90	do	Ke	14	63	28	11	312	7.8	18	--	7.2	302	272	8	.3	529	7.1
1/ *712, *713, *714	Joe Wilhelm	3,363	do	Pz	--	6,880	1,400	29,000	72	42	60,900	--	--	98,300	22,900	73	--	109,000	5.9
1/ 801	Walter Menzies	307	Nov. 15, 1961	Ke	15	44	28	21	254	14	30	--	6.0	283	225	17	.6	497	7.2
1/ 802	do	290	do	Ke	16	51	28	20	278	13	28	--	5.6	299	242	15	.6	519	7.1
1/ 803	Alex Menzies	208	do	Ke	15	55	28	19	280	12	34	--	4.2	305	252	14	.5	540	7.3
1/ 804	Mrs. John Lackey	--	do	Ke	15	44	27	15	246	12	26	--	4.2	264	221	13	.4	477	7.1
1/ 806	George Kothmann	150	do	Ke	15	46	29	17	254	14	30	--	7.8	284	234	14	.5	501	7.4
1/ 807	do	150	do	Ke	13	49	29	15	288	8.8	21	--	.0	278	242	12	.4	491	7.2
1/ 901	do	220	do	Ke	13	62	30	13	336	6.4	16	--	2.2	308	278	9	.3	537	7.2
1/ 902	do	150	do	Ke	13	52	29	9.4	288	8.0	15	--	4.5	273	248	8	.3	483	7.1
1/ 903	do	150	do	Ke	14	59	28	13	304	8.6	18	--	7.2	297	262	9	.3	517	7.3
1/ 905	do	224	do	Ke	13	48	28	8.5	262	9.2	18	--	4.7	258	235	7	.2	466	6.9

See footnotes at end of table.

Table 3.--Chemical analyses of ground water in Menard and adjacent counties--Continued

Well	Owner	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Specific conductance (micromhos at 25 °C)	pH
TH-42-58-201	Daniel Sorrell	200	Feb. 8, 1963	Ke	15	47	31	14	284	15	23	0.3	2.4	297	247	--	--	520	7.2
202	do	175	do	Ke	15	53	31	29	276	23	53	.2	3.1	243	261	--	--	640	7.4
402	Raymond Pfluger	170	do	Ke	18	42	37	15	290	10	26	.2	2.4	298	258	--	0.4	525	8.4
504	Houston Callan	150	Feb. 5, 1963	Ke	18	59	30	24	300	15	36	.3	7.0	337	268	--	--	595	7.9
801	L. B. Ruff	200	Feb. 7, 1963	Ke	16	57	28	14	298	11	23	.1	5.3	301	258	--	--	538	7.5
802	do	160	Feb. 5, 1963	Ke	15	59	31	17	311	13	27	.1	5.3	320	273	--	--	570	7.5
805	Gene Whitehead	225	Feb. 6, 1963	Ke	3.0	35	51	24	327	19	38	.5	a/	335	295	--	--	628	8.4
901	do	160	do	Ke	11	37	38	20	272	16	32	.4	2.0	296	250	--	--	530	8.5
59-401	Russell Callan	170	Mar. 13, 1963	Ke	18	50	33	26	276	19	46	.5	13	342	261	--	--	607	7.5
405	do	110	do	Ke	18	52	31	29	285	21	44	.4	9.0	344	256	--	--	635	7.4
407	do	200	do	Ke	16	49	31	29	276	22	43	.5	11	338	252	--	--	623	7.5
502	do	52	do	Ke	18	52	34	31	287	24	50	.4	7.0	361	270	--	--	635	8.6
504	do	34	do	Ke	21	98	35	67	390	55	97	.7	35	601	386	--	--	1,010	7.7
505	Raymond Andrews	40	Mar. 7, 1963	Ke	16	75	44	77	355	41	126	.4	42	596	368	--	--	1,060	7.4
507	do	80	do	Ke	18	61	33	29	321	19	48	.4	9.0	375	289	--	--	684	7.4
*602	Clay Kitchen	145	Feb. 20, 1963	Ke	18	56	32	42	304	28	58	.4	7.0	390	272	--	--	718	7.9
*603		135		Ke															
*604		100		Ke															
*605		100		Ke															
*606		110		Ke															
*607		85		Ke															
704	Raymond Andrews	140	Mar. 7, 1963	Ke	16	57	30	30	294	19	49	.2	5.5	352	267	--	.8	630	7.0
707	M. S. Leggett	80	Mar. 8, 1963	Ke	15	58	33	50	300	28	79	.3	7.0	318	281	--	--	770	7.4
804	do	144	do	Ke	19	53	32	55	290	26	71	.6	24	424	263	--	--	765	7.6
903	Frank Wilkinson	240	do	Ke	18	53	35	43	311	26	63	.7	a/	392	274	--	--	705	7.5
1/ 43-64-201	Earl Haley	275	Nov. 7, 1961	Ke	10	54	30	16	307	.0	28	.4	.0	289	258	12	.4	519	7.0
1/ 301	Mrs. Ed Speck	285	Nov. 13, 1961	Ke	14	46	28	9.4	256	8.6	20	--	4.2	256	230	8	.3	466	6.9
1/ 302	Melvin Wilhelm	180	Nov. 15, 1961	Ke	14	63	31	7.4	332	6.0	14	--	3.8	302	284	5	.2	534	7.1
1/ 401	Mrs. R. A. Tisdale	330	Oct. 26, 1961	Ke	14	51	24	15	261	7.8	20	--	9.1	269	226	12	.4	483	7.2
1/ 402	do	335	do	Ke	14	49	26	11	260	8.2	16	--	11	263	230	9	.3	472	6.9

See footnotes at end of table.

Table 3.--Chemical analyses of ground water in Menard and adjacent counties--Continued

Well	Owner	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Specific conductance (micromhos at 25 °C)	pH
1/ TH-43-64-403	J. C. Sorrell	280	Nov. 14, 1961	Ke	13	46	30	14	260	10	28	--	8.4	277	238	12	0.4	498	7.1
1/ 404	do	300	Jan. 8, 1962	Ke	16	46	30	13	268	9.6	22	0.5	5.4	274	238	11	.4	485	7.2
1/ 406	D. B. Sorrell	--	do	Ke	14	41	27	21	232	16	33	.5	6.0	272	214	18	.6	477	7.4
1/ 407	J. C. Sorrell	280	do	Ke	14	50	21	14	250	7.2	16	.3	7.6	253	211	13	.4	428	8.0
1/ 408	Leslie Allen	260	do	Ke	12	50	32	11	295	6.2	22	.4	.0	279	256	9	.3	494	7.6
1/ 501	Bella Speck	--	Nov. 7, 1961	Ke(?)	15	44	25	17	235	12	29	.5	3.8	262	213	15	.5	459	6.9
1/ 502	Earl Haley	275	do	Ke	15	52	28	19	274	11	30	.4	8.9	299	244	15	.5	513	6.9
1/ 504	do	275	do	Ke	15	56	29	21	295	13	32	.4	3.8	315	258	15	.6	545	6.9
1/ 505	D. B. Sorrell	--	Jan. 8, 1962	Ke(?)	13	44	31	43	241	27	70	.7	4.8	352	238	28	1.2	633	7.0
1/ 506	H. W. Speck	--	Nov. 13, 1961	Ke(?)	12	47	25	7.6	246	7.0	14	--	9.9	244	220	7	.2	435	7.1
1/ 507	do	--	do	Ke(?)	15	49	25	15	254	14	23	--	4.5	270	226	13	.4	475	7.1
1/ 508	J. C. Sorrell	251	Jan. 8, 1962	Ke	15	46	28	14	254	11	24	.4	7.4	271	230	12	.4	472	7.2
1/ 601	Mrs. Victoria L. Davis	260	June 14, 1961	Ke	16	44	27	19	253	15	22	.5	7.8	275	221	16	.6	479	7.6
1/ 602	John Speck	245	Nov. 7, 1961	Ke	16	44	30	15	249	15	28	.6	6.4	277	234	12	.4	483	7.2
1/ 603	Mrs. Ed Speck	290	Nov. 13, 1961	Ke	15	45	29	13	256	14	23	--	4.2	269	232	11	.4	478	7.2
1/ 604	Mrs. Victoria Davis	240	Nov. 14, 1961	Ke	16	56	30	29	288	17	46	--	8.7	345	263	19	.8	600	7.1
1/ 605	Mrs. Ed Speck	--	Nov. 13, 1961	Ke(?)	13	54	22	11	252	9.4	20	--	6.3	260	225	10	.3	460	6.9
1/ 606	Frank W. Speck	--	do	Ke(?)	14	44	25	12	234	9.6	22	--	6.7	248	213	11	.4	443	6.9
1/ 607	Melvin Wilhelm	220	Nov. 15, 1961	Ke	14	55	28	18	280	9.8	35	--	3.8	302	252	14	.5	530	7.1
1/ 608	do	280	do	Ke	13	52	28	12	276	7.8	24	--	3.0	276	244	10	.3	495	7.0
1/ 701	J. M. Tredwell	225	Oct. 6, 1961	Ke	14	72	19	12	295	8.8	20	--	6.7	298	258	9	.3	506	7.0
1/ 702	do	250	do	Ke	14	69	20	14	296	8.6	20	--	7.1	299	254	11	.4	510	6.9
1/ 704	Troy Vaughn	330	Oct. 26, 1961	Ke	15	45	28	16	252	12	27	--	5.9	273	228	13	.5	493	6.9
1/ 705	do	330	Apr. 4, 1962	Ke	18	50	30	16	282	11	26	--	5.5	296	248	12	.4	528	7.0
1/ 707	do	330?	Oct. 26, 1961	Ke	15	53	27	22	275	13	28	--	15	308	243	16	.6	542	7.2
1/ 801	U. E. Rogers	328	Oct. 18, 1961	Ke	15	46	29	25	260	16	42	--	.5	302	234	19	.7	534	7.0
1/ 802	do	--	do	Ke(?)	14	45	29	25	261	17	38	--	.0	296	232	19	.7	517	7.1

See footnotes at end of table.

Table 3.--Chemical analyses of ground water in Menard and adjacent counties--Continued

Well	Owner	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Specific conductance (micromhos at 25 °C)	pH
1/ TH-43-64-803	U. E. Rogers	200?	Oct. 17, 1961	Ke	15	54	25	20	284	12	25	--	0.0	291	238	15	0.6	501	6.9
1/ 804	do	164	do	Ke	12	75	25	12	337	5.6	24	--	.0	320	290	8	.3	564	6.9
1/ 805	Mrs. Sam Holliday	240	do	Ke	15	43	28	12	263	8.2	15	--	3.8	254	222	10	.4	436	7.1
1/ 901	Charles Speck	284	Nov. 10, 1961	Ke	17	45	29	27	267	17	36	0.7	.2	303	232	20	.8	528	6.9
1/ 903	Mrs. Henry Harrison	225	Nov. 9, 1961	Ke	15	62	30	24	337	9.4	30	.3	.0	337	278	16	.6	578	7.2
1/ 904	Mrs. A. W. Brisbin	250	do	Ke	14	44	30	13	256	12	20	.5	13	272	234	11	.4	479	7.0
1/ 905	do	220	do	Ke	11	52	34	11	326	6.0	13	.4	.0	287	270	8	.3	511	7.1
1/ 906	James Harper	180	Nov. 10, 1961	Ke	14	59	29	11	303	11	15	.4	9.6	298	266	8	.3	511	6.9
1/ 907	do	210	do	Ke	14	48	31	10	298	4.4	12	.5	2.8	270	248	8	.3	471	6.7
1/ 908	Mrs. Henry Harrison	275	Nov. --, 1961	Ke	12	48	31	9.9	285	6.0	20	.6	.2	268	248	8	.3	489	6.8
1/ 909	Mrs. Sam Holliday	153	Nov. 9, 1961	Ke	16	81	26	23	363	14	33	.4	.0	372	309	14	.6	635	6.9
1/ 910	James Harper	160	Nov. 10, 1961	Ke	20	70	36	52	318	38	86	.5	14	472	322	26	1.3	803	7.0
1/ 911	do	160	do	Ke	19	60	34	38	289	38	60	.5	11	402	290	22	1.0	687	7.0
1/ 55-08-101	Mrs. Ray Holland	--	Oct. 18, 1961	Ke(?)	12	65	33	15	361	.6	24	--	.0	328	298	10	.4	580	6.9
1/ 102	Mrs. Annie Leveridge	165	do	Ke	17	54	32	18	270	24	37	--	7.7	323	266	13	.5	556	7.0
1/ 103	Mrs. J. G. Callan	135?	do	Ke(?)	19	80	17	13	304	10	20	--	12	320	270	9	.3	537	7.0
1/ 104	Mrs. Ray Holland	--	Oct. 19, 1961	Ke	13	71	20	12	299	8.4	19	--	6.0	296	259	9	.3	510	6.8
1/ 105	L. E. Callan	180	do	Ke	14	76	20	11	305	9.2	22	--	6.0	308	272	8	.3	525	7.0
1/ 201	M. H. Callan	265	Oct. 18, 1961	Ke	15	48	30	15	262	22	24	--	5.5	288	244	12	.4	494	7.0
1/ 202	do	200	do	Ke	15	46	29	13	259	20	18	--	5.1	273	234	11	.4	468	7.0
1/ 203	Mrs. Edith Runge	240	Nov. 9, 1961	Ke	10	62	34	18	371	.4	20	.5	.0	327	294	12	.5	578	7.0
1/ 301	John M. Winslow	170	Nov. 8, 1961	Ke	14	60	31	18	322	14	26	.3	1.5	323	277	13	.5	559	7.0
1/ 302	do	240	do	Ke	13	57	33	12	331	9.0	16	.4	.0	303	278	9	.3	533	7.0
1/ 303	do	206	do	Ke	15	52	33	8.0	307	6.8	16	.5	.2	282	265	6	.2	501	6.6
1/ 304	Mrs. Jean Moore	260	Nov. 9, 1961	Ke	12	56	30	9.4	309	4.0	18	.4	.0	282	263	7	.3	503	6.7
1/ 401	John M. Tredwell	175	Oct. 6, 1961	Ke	15	48	28	23	254	16	38	--	7.8	301	235	17	.7	526	7.1
1/ 402	do	110	do	Ke	13	75	19	11	308	8.0	16	--	7.0	300	265	8	.3	531	7.0

See footnotes at end of table.

Table 3.--Chemical analyses of ground water in Menard and adjacent counties--Continued

Well	Owner	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Specific conductance (micromhos at 25 °C)	pH
1/ TH-55-08-403	John M. Tredwell	135	Oct. 6, 1961	Ke	13	75	17	15	306	8.0	18	--	6.5	302	257	11	0.4	526	7.0
1/ 405	Joe Russell	85	Oct. 20, 1961	Ke	15	60	26	18	283	19	31	--	.0	308	256	13	.5	529	7.0
1/ 406	John H. Tredwell	--	Oct. 17, 1961	Ke(?)	17	77	32	40	270	26	70	--	80	475	324	21	1.0	793	6.9
1/ 407	do	147	do	Ke	15	70	24	10	295	10	21	--	17	312	273	8	.3	531	6.9
1/ 408	L. E. Callan	180	Oct. 19, 1961	Ke	14	75	19	11	306	8.0	17	--	6.7	301	265	8	.3	512	6.9
1/ 410	Boy Scouts of America	--	do	Ke(?)	13	77	21	16	352	.0	18	--	.0	318	278	11	.4	556	6.9
1/ 502	W. R. Tomlinson	--	do	Ke(?)	15	71	20	12	298	11	18	--	6.3	300	259	9	.3	509	7.2
1/ 503	J. W. White	45	Oct. 25, 1961	Ke	23	98	9.3	7.4	321	12	10	--	11	329	282	5	.2	556	6.6
1/ 601	Joe Russell	55	Oct. 19, 1961	Ke	15	70	17	13	289	7.0	16	--	6.3	286	244	10	.4	482	7.1
1/ 602	Fritz Luckenbach	--	Oct. 25, 1961	Ke(?)	16	67	24	17	315	15	17	--	4.8	316	266	12	.5	552	6.8
1/ 603	J. W. White	--	do	Ke(?)	16	49	27	29	243	39	38	--	4.3	321	234	21	.8	557	7.3
1/ 604	Fritz Luckenbach	--	do	Ke(?)	18	70	45	24	255	144	34	--	5.0	465	360	13	.5	744	7.1
1/ 605	J. W. White	--	Apr. 3, 1962	Ke(?)	13	47	28	10	258	16	18	--	1.9	261	232	9	.3	472	7.2
1/ 701	Boy Scouts of America	--	Oct. 25, 1961	Ke(?)	15	55	29	9.0	281	16	18	--	4.0	284	256	7	.2	503	6.9
1/ 704	W. W. Sheen	230	Nov. 7, 1961	Ke	15	53	29	9.2	278	16	16	0.6	2.8	279	251	7	.3	476	6.8
1/ 801	Joe Russell	90?	Oct. 19, 1961	Ke	15	75	18	10	297	8.2	18	--	7.2	297	261	8	.3	504	6.9
1/ 802	Boy Scouts of America	--	Oct. 25, 1961	Ke(?)	18	52	30	20	265	33	30	--	1.8	315	253	14	.5	548	6.9
1/ 803	do	250	do	Ke	16	49	26	13	264	19	14	--	1.8	269	230	11	.4	468	7.0
1/ 804	do	202	do	Ke	14	55	28	8.5	292	11	12	--	3.0	276	252	7	.2	493	6.9
1/ 901	Joe Russell	65	Oct. 19, 1961	Ke	15	74	18	9.7	297	7.6	16	--	6.8	293	258	8	.3	499	7.2
1/ 902	do	78	do	Ke	14	70	17	10	282	8.2	16	--	6.4	281	244	8	.3	478	7.0
1/ 903	Fritz Luckenbach	--	Oct. 25, 1961	Ke(?)	14	73	18	10	298	7.6	15	--	6.5	291	256	8	.3	512	7.0
1/ 904	Sam Allison	140	Oct. 23, 1961	Ke	14	73	17	14	300	8.6	16	--	6.6	297	252	11	.4	521	6.8
1/ 16-101	Talbert Estate	140	Oct. 5, 1961	Ke	16	62	23	19	274	21	23	--	13	312	249	14	.5	534	7.1
1/ 103	George Lehne	75	do	Qa(?)	14	90	18	22	340	11	37	--	6.5	366	298	14	.6	632	6.7
1/ 105	Boy Scouts of America	220	Oct. 26, 1961	Ke	20	61	32	21	332	13	29	--	4.6	344	284	14	.5	601	7.4
1/ 201	do	220	do	Kt(?)	13	358	258	109	287	1,390	190	--	300	2,760	1,950	11	1.1	3,300	6.6

See footnotes at end of table.

Table 3.--Chemical analyses of ground water in Menard and adjacent counties--Continued

Well	Owner	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Specific conductance (micromhos at 25 °C)	pH
1/ TH-55-16-202	Boy Scouts of America	--	Oct. 26, 1961	Ke(?)	15	98	17	13	333	12	20	--	36	375	314	8	0.3	640	6.5
1/ 203	do	--	do	Kt(?)	10	113	101	50	254	518	41	--	.5	958	698	13	.8	1,340	7.1
1/ 204	H. H. Mears	135	Oct. 20, 1961	Ke	14	74	19	11	302	8.8	18	--	6.3	300	262	9	.3	511	6.9
1/ 205	Robert G. Flutsch	60	July 27, 1960	Qa(?)	20	104	23	20	423	14	22	0.3	4.1	415	354	11	.5	708	6.8
206	do	60	Oct. 20, 1962	Qa(?)	19	105	28	14	438	14	26	.2	a/	421	377	--	--	718	7.4
207	do	60	do	Qa(?)	22	90	31	20	354	26	31	.2	45	439	352	--	--	710	7.4
209	H. H. Mears	58	Oct. 1, 1962	Qa(?)	27	117	31	23	454	28	34	.2	28	511	422	--	--	830	7.2
210	do	68	do	Qa(?)	25	115	39	28	427	61	42	.5	48	568	449	--	--	902	7.3
302	Robert G. Flutsch	37	Oct. 2, 1962	Qa(?)	18	108	31	15	471	12	23	.2	2.4	439	399	--	--	745	7.7
303	Bevans Ranch	--	--	Ke(?)	19	63	36	10	356	14	18	.2	a/	336	307	--	--	570	7.8
402	Mrs. Kathryn Ball	--	Oct. 11, 1962	Ke(?)	12	69	46	17	257	126	30	3.0	a/	430	363	--	--	700	8.1
403	Jake Appleman	146	do	Ke	24	43	33	13	287	6.0	24	.4	a/	284	244	--	--	485	8.1
404	Mrs. Joe Freeman	146	Feb. 7, 1963	Ke	16	113	44	35	331	16	76	.1	177	640	464	--	--	1,040	7.3
405	H. T. Murr	230	do	Ke	16	75	31	12	349	19	23	.6	4.2	353	315	--	--	625	7.4
412	Mrs. Delta Seay	--	do	Ke(?)	15	74	40	17	333	24	40	.6	43	417	347	--	--	718	7.7
501	Bevans Ranch	--	Oct. 12, 1962	Ke(?)	16	130	80	37	284	407	46	1.7	2.4	860	653	--	.6	1,200	7.6
502	Jake Appleman	160	Oct. 25, 1962	Ke	15	56	32	10	290	31	27	.5	a/	314	273	--	--	530	7.5
503	do	160	do	Ke	14	61	37	16	293	51	26	1.0	9.5	360	304	--	--	615	7.6
601	Bevans Ranch	--	Oct. 12, 1962	Ke(?)	26	76	47	36	271	119	63	.5	13	513	383	--	--	843	7.4
602	do	--	do	Ke(?)	17	67	34	10	349	18	19	.3	3.4	341	308	--	--	576	7.4
701	R. H. Flutsch	--	Oct. 11, 1962	Ke(?)	18	54	31	10	235	18	19	.6	8.0	274	262	--	--	515	7.6
702	do	190?	do	Ke	15	59	39	14	222	73	22	1.0	a/	332	305	--	--	595	7.5
703	Mrs. Kathryn Ball	--	do	Ke(?)	13	118	80	26	262	407	24	1.7	a/	799	625	--	.5	1,100	7.6
802	Owen Womack	300	Oct. 12, 1962	Ke	17	55	34	20	242	24	34	.3	1.6	303	275	--	.5	568	7.6
803	J. B. Ranch	--	do	Ke(?)	17	59	36	17	239	56	26	.7	1.6	329	296	--	--	595	7.6
901	Bevans Ranch	--	do	Ke(?)	15	487	263	40	154	2,220	18	3.7	a/	3,120	2,300	--	.4	2,900	7.9
902	J. B. Ranch	400	do	Ke(?)	13	67	82	113	300	360	59	5.0	a/	847	505	--	2.2	1,280	7.3

See footnotes at end of table.

Table 3.--Chemical analyses of ground water in Menard and adjacent counties--Continued

Well	Owner	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Specific conductance (micromhos at 25 °C)	pH
TH-55-16-903	J. B. Ranch	380	Oct. 12, 1962	Ke(?)	18	53	35	23	275	38	40	0.6	3.8	346	275	--	--	590	7.5
24-101	George Lehne	--	Oct. 11, 1962	Ke(?)	12	342	185	26	244	1,470	12	3.2	a/	2,170	1,660	--	0.3	2,270	7.3
102	do	200	--	Ke	15	61	35	10	265	29	18	.4	2.0	299	296	--	--	561	7.7
103	do	160	Oct. 10, 1962	Ke	13	254	138	28	236	968	19	2.3	a/	1,540	1,200	--	.3	1,850	7.4
105	Mrs. Mae Rogers	--	Oct. 11, 1962	Ke(?)	13	99	63	13	303	236	20	.7	a/	594	505	--	.2	895	7.7
106	do	265	do	Ke	12	289	187	25	244	1,270	20	2.0	a/	1,920	1,490	--	.3	2,070	7.5
201	Henry Murr	280	Oct. 10, 1962	Ke	17	96	22	21	199	27	39	.2	133	453	332	--	--	730	7.8
202	J. B. Ranch	550	do	Ke(?)	17	62	28	18	240	27	34	.3	3.2	304	272	--	--	566	7.4
203	Owen Womack	500	Oct. 12, 1962	Ke(?)	17	58	30	16	284	31	28	.3	7.0	327	268	--	--	550	7.5
204	do	250	do	Ke	15	53	32	10	243	20	18	.4	2.2	267	266	--	--	510	7.6
205	G. H. Lopez	303	Oct. 10, 1962	Ke	17	57	38	28	240	44	52	.3	a/	354	297	--	--	644	7.4
301	--	--	Oct. 11, 1962	Ke(?)	23	37	32	14	209	18	24	1.0	2.0	261	226	--	--	464	7.9
302	John D. Murr	280	do	Ke	15	46	31	14	272	16	23	1.1	3.2	283	242	--	--	487	7.6
303	J. B. Ranch	580?	Oct. 12, 1962	Ke(?)	18	58	26	21	228	16	36	.3	4.0	287	251	--	--	537	7.5
304	do	380	--	Ke	19	52	34	53	235	45	69	1.0	3.4	388	268	--	--	703	7.5
1/ 56-01-101	Mrs. Maxine Palmer	200	Nov. 8, 1961	Ke	16	71	21	7.4	304	7.2	12	.3	6.0	290	264	6	.2	496	6.8
1/ 102	Ed L. Mears	160	do	Ke	16	65	25	12	305	8.4	18	.3	6.9	302	265	9	.3	514	6.9
1/ 104	W. J. Wilkinson Estate	200?	Apr. 5, 1962	Ke	15	51	29	13	286	11	18	--	3.6	282	246	10	.4	507	7.2
1/ 201	Ernest Wilkinson	185	Oct. 27, 1961	Ke	14	46	27	7.2	265	5.8	11	--	3.2	244	226	6	.2	445	6.8
1/ 202	W. J. Wilkinson Estate	--	Apr. 5, 1962	Ke(?)	13	56	29	8.5	304	6.0	14	--	3.6	279	259	7	.2	500	7.1
1/ 204	do	200?	do	Ke	13	54	28	5.8	282	7.6	13	--	5.5	266	250	5	.2	479	7.1
1/ 205	do	140	Nov. 8, 1961	Ke	17	86	34	25	318	86	32	.4	16	452	354	13	.6	715	7.1
1/ 206	do	225	Apr. 5, 1962	Ke	15	55	33	7.1	316	6.6	13	--	4.2	289	272	5	.2	512	7.2
1/ 301	Ernest Wilkinson	150	Oct. 27, 1961	Ke	13	83	22	9.4	314	8.4	17	--	35	342	298	6	.2	592	6.7
1/ 302	do	190	do	Ke	12	55	23	7.0	274	5.2	10	--	3.8	251	232	6	.2	457	6.9
1/ 303	Jack Wilkinson	125	do	Ke	14	59	28	14	300	9.2	23	--	6.5	302	262	11	.4	543	6.8
1/ 304	do	190	do	Ke	16	74	34	9.2	391	5.4	13	--	.0	344	324	6	.2	615	6.4

See footnotes at end of table.

Table 3.--Chemical analyses of ground water in Menard and adjacent counties--Continued

Well	Owner	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Specific conductance (micromhos at 25 °C)	pH
1/ TH-56-01-401	W. J. Wilkinson Estate	220	Oct. 23, 1961	Ke	18	57	29	16	300	20	18	--	5.2	311	261	12	0.4	542	6.8
1/ 501	Mrs. F. T. Neal	--	Oct. 27, 1961	Ke(?)	15	53	29	13	295	9.4	18	--	3.2	286	251	10	.4	513	6.8
1/ 503	W. J. Wilkinson Estate	85	Nov. 8, 1961	Ke	16	72	20	9.9	295	8.0	17	0.3	9.3	298	262	8	.3	504	7.0
1/ † 506	--Powell	Cave	Sept. 3, 1962	Ke	15	64	22	15.5	285	10	26	.3	2.8	296	250	11	.4	539	7.0
1/ 601	Jack Wilkinson	175	Oct. 27, 1961	Ke	18	72	19	5.8	300	7.4	4.8	--	12	287	258	5	.2	501	6.9
1/ 701	Sam Allison	50	Oct. 23, 1961	Ke	16	85	19	13	346	8.2	18	--	2.0	331	290	9	.3	579	6.7
1/ 704	do	80	do	Ke	15	83	20	14	342	9.4	18	--	5.8	333	289	10	.4	584	6.8
1/ 705	do	--	do	Ke(?)	15	84	19	18	341	10	23	--	4.3	341	288	12	.5	600	6.8
802	D. Lee Jones	48	Oct. 1, 1962	Ke(?)	27	90	38	30	436	18	48	.5	a/	418	380	--	--	780	7.8
803	Barney Grafa	50	Oct. 10, 1962	Ke(?)	18	112	27	11	471	12	19	.2	a/	431	392	--	--	730	7.3
804	R. R. Harrell	52?	Oct. 1, 1962	Ke(?)	30	102	41	17	513	9.0	27	.4	a/	478	423	--	--	807	7.2
805	Carl J. Miller	30	do	Ke(?)	31	91	38	16	463	5.0	24	.5	a/	433	383	--	--	731	7.2
806	Ben F. Russell	45	do	Ke(?)	41	50	35	76	414	32	29	.9	23	490	268	--	--	765	7.5
807	Barley Bradford	55	Nov. 1, 1962	Ke(?)	22	63	47	71	326	61	119	.2	2.7	546	352	--	--	940	8.0
808	Mrs. Marcus Powell	--	do	Ke(?)	18	20	35	48	166	32	65	.3	a/	320	193	--	--	554	8.9
1/ 809	--	Spring	Aug. 18, 1942	Ke	15	62	20	9.0	288	21	12	.2	.5	278	236	--	--	--	7.9
810	Barley Bradford	260	Oct. 18, 1961	Pz	8.5	1,510	1,040	14,900	193	3,920	25,600	--	--	47,100	8,040	80	72	54,400	6.7
901	Mrs. F. T. Neal	60	July 27, 1960	Ke	14	64	21	19	294	10	20	.4	7.9	301	246	14	.5	520	6.9
902	Mrs. Alice Lee	--	Oct. 1, 1962	Ke(?)	20	105	28	14	434	10	23	.1	5.6	420	377	--	--	710	7.2
903	Carl W. Ruff	38	do	Ke(?)	21	96	32	28	404	21	41	.1	28	466	370	--	--	764	7.6
904	H. E. Parish	128	Oct. 30, 1962	Ke	16	65	32	12	339	8.0	20	.2	6.5	327	294	--	--	560	7.5
905	do	30	do	Qa(?)	25	98	44	25	489	21	32	.3	a/	485	424	--	--	805	7.2
906	do	30	--	Qa(?)	16	85	42	25	449	21	33	.3	a/	443	383	--	--	745	7.4
907	Wylie Tomlinson	50?	Nov. 27, 1962	Qa	21	98	35	28	437	31	38	.2	4.4	470	390	--	--	801	7.8
02-101	Granstaff Ranch	40	Feb. 8, 1963	Ke	20	67	27	11	322	11	21	.2	6.0	321	278	--	.3	565	7.3
201	Wm. F. Volkmann	120	Feb. 6, 1963	Ke	18	56	30	15	300	15	24	.2	2.4	309	262	--	--	543	7.7
207	W. G. Volkmann	Spring	Feb. 9, 1963	Ke	15	81	29	12	376	12	20	.2	4.2	358	321	--	--	660	7.7

See footnotes at end of table.

Table 3.--Chemical analyses of ground water in Menard and adjacent counties--Continued

Well	Owner	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Specific conductance (micromhos at 25 °C)	pH
TH-56-02-301	Wm. F. Volkmann	22	Feb. 6, 1963	Ke(?)	4.0	51	34	21	268	17	34	0.1	31	324	267	--	--	595	7.9
307	Mrs. A. H. Murchison	125	Feb. 7, 1963	Ke	14	86	33	17	417	14	26	.1	4.2	399	352	--	--	695	7.7
405	Ray Bradford	Spring	Apr. 3, 1963	Ke	18	118	29	14	490	12	24	.3	a/	461	414	--	--	797	7.5
601	City of Menard	22	Mar. 23, 1957	Qa	--	73	28	24	318	42	36	.4	3.0	430	300	--	--	721	7.3
605	J. A. Walston	--	Sept.17, 1962	Qa(?)	17	78	23	13	345	14	20	.1	a/	335	291	--	--	580	7.3
606	Harvey Graham	22	Sept.18, 1962	Qa	20	80	27	13	366	13	21	.1	a/	354	309	--	--	607	7.6
607	Frank Munselle	22?	do	Qa	20	81	24	12	356	12	22	.1	a/	346	300	--	--	587	7.5
608	Joe Searcy	--	do	Qa(?)	27	110	39	32	454	50	50	.1	3.1	534	435	--	--	890	7.0
609	C. E. Pearson	17	do	Qa	26	90	30	17	388	23	24	.2	9.0	410	347	--	--	678	7.3
610	George Farrar	20?	Sept.20, 1962	Qa	29	77	30	20	368	23	28	.3	6.0	394	316	--	0.5	650	7.7
611	H. B. Spiller	30?	Oct. 30, 1962	Qa	26	84	35	24	386	23	38	.3	16	436	356	--	--	709	7.3
701	Billy Joe Haney	34	Oct. 4, 1962	Qa	26	130	60	59	649	81	82	.3	a/	757	572	--	--	1,180	7.1
702	Alec Menzie	--	do	Qa(?)	22	131	42	161	235	331	165	.4	83	1,050	500	--	--	1,550	7.6
801	Jim Cameron	--	Oct. 5, 1962	Qa(?)	22	74	25	14	336	11	23	.2	a/	335	285	--	--	565	7.5
802	Pauline Stockton	22	do	Qa	20	80	29	20	378	16	25	1.0	a/	377	318	--	--	638	7.4
803	Mickey D. Crowell	18	do	Qa	20	75	27	18	356	16	24	.3	a/	355	297	--	--	600	7.6
901	Steve Martin	--	Sept.18, 1962	Qa(?)	20	98	29	18	439	13	22	.1	a/	416	364	--	--	712	7.3
902	W. G. Craig	--	do	Qa(?)	17	88	27	14	394	10	22	.2	a/	372	334	--	--	638	7.6
903	John W. Word	20?	do	Qa	22	97	30	17	425	20	24	.3	a/	419	365	--	--	700	7.4
904	Mrs. E. M. Alexander	24?	do	Qa	22	86	32	20	388	23	30	.2	a/	415	347	--	--	704	7.4
905	Alton Williamson	33?	do	Qa	17	71	25	18	334	9.0	23	.1	a/	327	281	--	--	580	7.3
906	do	33?	Sept.19, 1962	Qa	18	70	26	16	331	15	23	.1	5.5	337	280	--	--	570	7.5
907	Dayton Walston	32	do	Qa	21	77	26	14	348	16	22	.1	4.7	352	300	--	--	600	7.4
908	George Farrar	--	Sept.17, 1962	Qa(?)	21	77	25	16	337	10	24	.2	9.0	348	294	--	--	600	7.4
909	Henry Findlay	13	Sept.19, 1962	Qa	22	88	29	16	376	19	27	.3	10	396	338	--	--	667	7.2
910	Mrs. Alice Lee	--	Sept.17, 1962	Qa(?)	23	88	28	19	384	24	28	.2	3.1	402	336	--	--	680	7.5
912	L. B. Sheffield	168	Apr. 17, 1963	Ke	18	55	33	29	306	20	44	.4	1.0	355	272	--	--	635	7.8

See footnotes at end of table.

Table 3.--Chemical analyses of ground water in Menard and adjacent counties--Continued

Well	Owner	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Specific conductance (micromhos at 25 °C)	pH
TH-56-02-915	A. T. Murchison	100	Mar. 9, 1963	Ke	21	55	29	17	279	20	30	0.3	3.5	313	255	--	--	558	8.0
918	do	100	do	Ke	25	43	47	43	266	58	76	.5	a/	329	298	--	--	766	8.5
03-103	Cecil W. Corbell	93	Feb. 20, 1963	Ke	18	58	34	39	309	28	66	.4	2.9	398	283	--	1.0	722	7.5
203	Laverne Clark Estate	40	Mar. 8, 1963	Ke	18	70	39	26	334	20	44	.4	51	432	335	--	--	734	8.2
1/ 301	Fritz Volkmann	110	June 14, 1961	Ke	18	54	30	33	292	20	46	.5	5.2	348	258	22	.9	610	7.2
303	-- Luedecke	200	Mar. 8, 1963	Ke	16	50	33	26	271	22	52	.4	6.0	338	260	--	--	612	8.1
401	Claude Rambo	--	Sept.17, 1962	Kt(?)	27	84	38	25	438	24	31	.3	a/	444	367	--	--	746	7.1
402	Charlotte Rambo	30	Sept.19, 1962	Kt(?)	27	77	46	29	458	25	31	.4	a/	460	378	--	--	772	7.4
403	Jerry Rambo	--	Sept.17, 1962	Kt(?)	25	76	61	56	534	51	48	.5	4.4	585	439	--	--	950	7.6
502	Mrs. A. H. Murchison	135	Feb. 7, 1963	Ke	18	56	33	37	317	23	48	.3	2.0	373	274	--	--	655	7.6
601	Damon Kothman	--	Oct. 2, 1962	Ke	18	61	33	14	343	11	20	.4	a/	326	290	--	--	570	7.7
602	Mrs. A. H. Murchison	160	Feb. 7, 1963	Ke	18	55	33	30	297	22	49	.2	a/	353	279	--	--	635	7.5
701	-- Bougher	--	Sept.19, 1962	Qa	34	134	36	29	565	29	48	.3	a/	588	482	--	--	935	8.1
702	W. F. Mikeska	20	do	Qa	21	89	25	33	356	36	49	.2	a/	428	326	--	--	722	7.4
703	do	45	do	Qa	19	95	28	32	345	42	68	.1	a/	454	352	--	.7	783	7.5
704	L. D. Wilkerson	20?	Sept.20, 1962	Qa	21	93	26	18	383	20	22	.2	4.9	393	338	--	--	678	7.3
705	Mrs. W. C. Edmondson	26?	Sept.17, 1962	Qa	20	75	22	15	336	16	24	.1	a/	337	281	--	--	592	7.1
706	N. N. Lacy	22	Sept.20, 1962	Qa	24	86	23	16	364	16	24	.4	2.7	371	310	--	--	615	7.7
707	Matthews Estate	--	do	Qa(?)	23	73	18	15	305	13	22	.3	3.4	317	255	--	--	535	7.7
708	Otis Lyckman	20	Sept.19, 1962	Qa	31	87	26	17	381	18	23	.3	2.7	392	323	--	--	640	7.9
709	do	--	Sept.20, 1962	Qa(?)	18	76	23	18	346	13	24	.2	a/	342	285	--	--	585	7.8
710	Herman Allen	--	Sept.18, 1962	Qa(?)	18	73	22	15	312	18	24	.3	1.6	325	273	--	--	565	7.4
711	do	--	do	Qa(?)	24	98	23	25	378	28	40	.4	3.4	427	341	--	--	722	7.4
712	do	--	do	Qa(?)	28	95	33	33	394	44	50	.4	12	489	373	--	--	810	7.2
714	do	--	do	Qa(?)	27	87	55	34	390	58	98	.5	9.0	560	444	--	--	958	7.3
717	Boyd J. McDaniel	40	Sept.20, 1962	Qa	24	87	30	16	388	19	27	.3	4.0	399	340	--	.4	670	7.6
719	Herman Allen	--	Sept.18, 1962	Qa(?)	29	79	34	20	366	26	37	.3	3.1	408	335	--	--	685	7.7

See footnotes at end of table.

Table 3.--Chemical analyses of ground water in Menard and adjacent counties--Continued

Well	Owner	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Specific conductance (micromhos at 25 °C)	pH
TH-56-03-720	Damon Kothmann	35	Oct. 2, 1962	Qa	27	75	57	81	540	81	50	0.6	5.3	642	421	--	--	1,020	7.4
801	Lois Arnold	22	do	Qa	30	90	37	29	442	18	45	.3	a/	466	378	--	--	774	7.2
802	P. R. Gilbert	26	do	Qa	36	226	239	676	594	680	--	.6	36	2,180	1,550	--	--	4,800	7.1
803	do	--	do	Qa(?)	42	126	159	725	742	1,170	398	.8	115	3,100	966	--	--	3,960	7.4
804	R. R. Ellis	23	Oct. 3, 1962	Qa	33	268	165	555	465	585	1,030	.6	41	2,910	1,350	--	--	4,250	7.2
805	do	24	do	Qa	34	157	122	374	527	475	520	.5	30	1,970	895	--	5.4	2,900	7.3
806	do	24	do	Qa	22	36	18	35	210	33	26	.3	5.3	278	164	--	--	469	7.5
807	V. W. Crawford	22	do	Qa	25	227	168	444	385	534	936	.3	36	2,560	1,250	--	--	3,800	7.5
808	A. J. McWilliams	44	Apr. 2, 1963	Kt(?)	32	106	118	200	600	417	177	1.2	12	1,360	750	--	--	2,000	7.9
901	Carl Kothmann	--	Oct. 3, 1962	Kt(?)	13	98	68	112	270	300	150	.7	a/	874	522	--	--	1,360	7.7
902	C. W. Kothmann	40	do	Kt(?)	23	77	68	80	458	76	108	.8	57	714	471	--	--	1,160	7.3
903	do	105	do	Kt	11	96	71	149	209	374	198	.1	a/	1,000	533	--	--	1,590	7.7
904	-- Wilkinson	120?	do	Kt(?)	10	126	74	57	232	313	138	1.7	a/	834	617	--	--	1,300	7.7
905	Chas. M. Wilkinson	110?	do	Kt(?)	12	130	73	54	250	308	--	1.5	a/	700	627	--	--	1,280	7.6
04-103	Frank Wilkinson	45	Mar. 8, 1963	Ke	18	68	36	32	346	21	56	.3	7.0	408	318	--	--	726	7.3
602	B. F. Hext	906	Mar. 10, 1963	Pz	16	52	44	12	354	23	17	.5	2.4	341	310	--	.3	630	8.1
603	J. M. Auld, Jr.	700	Apr. 25, 1963	Pz	14	71	22	12	285	32	22	.3	a/	313	270	--	.3	556	7.3
703	Mrs. W. W. Wheeler	--	Oct. 4, 1962	Kt(?)	10	59	48	223	266	192	273	2.7	3.1	941	342	--	--	1,590	7.9
704	R. R. Walston	--	Oct. 3, 1962	Kt(?)	27	152	61	154	490	242	198	1.1	31	1,110	630	--	--	1,700	7.5
801	J. C. Surber	207	Apr. 25, 1963	Pz	16	64	26	21	279	24	36	.5	a/	325	265	--	--	587	8.0
901	Ray Jackson	170	do	Pz	22	80	26	17	327	16	24	.3	36	384	306	--	--	655	7.4
902	Mrs. Ethel Reeves	300	do	Pz	5.0	43	50	38	273	60	72	.9	a/	401	310	--	--	761	8.3
904	Max Ficker	200	do	Pz	20	90	49	49	309	51	157	.3	11	583	425	--	--	1,060	7.3
906	Hollis Hodges	195	do	Pz	22	116	27	34	327	67	98	.5	a/	524	403	--	--	918	7.7
09-101	Sam Allison	--	Oct. 11, 1962	Ke(?)	17	71	24	16	261	24	26	.3	a/	306	277	--	--	568	7.3
102	do	--	do	Ke(?)	21	80	51	31	173	205	56	.6	10	539	410	--	--	855	7.5
103	Jack Allison	--	Oct. 31, 1962	Ke(?)	23	89	30	54	283	69	80	.3	a/	428	347	--	--	860	7.5

See footnotes at end of table.

Table 3.--Chemical analyses of ground water in Menard and adjacent counties--Continued

Well	Owner	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Specific conductance (micromhos at 25 °C)	pH
TH-56-09-201	Woodrow Wilkinson	--	Nov. 1, 1962	Ke(?)	22	44	42	61	232	64	100	0.6	3.1	455	281	--	--	776	8.4
202	Dan Brandenburger	115	do	Ke	16	28	29	12	195	16	24	.1	a/	229	191	--	--	401	8.5
203	W. L. Bankston	--	do	Ke(?)	18	56	38	58	323	26	88	.4	a/	443	294	--	--	776	7.4
204	Dan Brandenburger	106	do	Ke	17	20	18	49	110	42	68	.3	a/	264	124	--	--	490	8.5
205	do	95	do	Ke	37	38	32	12	249	5.0	21	.1	2.9	280	226	--	--	460	8.5
206	Wylie Tomlinson	180	do	Ke	19	68	29	19	310	11	29	.3	27	354	292	--	--	599	7.5
207	do	120	do	Ke	18	68	29	19	321	13	27	.2	26	358	290	--	--	595	7.6
208	C. W. Davis	--	do	Ke(?)	18	62	30	28	299	30	36	.3	11	362	278	--	--	605	7.4
301	Oscar Bradford	222	Oct. 25, 1962	Ke	14	64	39	12	371	9.0	24	.3	a/	344	320	--	--	612	7.4
302	George Schneider	219	Oct. 30, 1962	Ke	16	56	33	19	304	21	29	.3	a/	323	275	--	--	560	7.3
303	H. E. Parish	80	do	Ke	16	56	38	17	352	9.0	21	.3	4.2	233	296	--	--	575	7.8
304	do	80	do	Ke	32	63	46	37	414	18	35	.2	31	466	345	--	--	750	7.3
305	Vernon McWilliams	125	do	Ke	15	65	28	10	328	7.0	18	.1	a/	304	276	--	--	526	7.3
306	Bennie Wright	155	do	Ke	14	57	32	12	327	9.0	18	.2	a/	303	272	--	--	530	7.4
307	George Bradford	--	do	Ke(?)	16	63	32	15	333	6.0	24	.2	4.9	325	289	--	--	565	7.4
308	Mrs. Fred Prugel	--	Oct. 31, 1962	Ke(?)	17	60	35	18	317	18	28	.3	5.1	337	293	--	--	580	7.4
401	Mack Henderson	257	--	Ke	16	113	79	442	585	761	165	4.0	a/	1,870	607	--	7.8	3,130	7.7
402	Jack Allison	--	Oct. 31, 1962	Ke(?)	21	58	37	38	277	60	59	.5	8.0	418	298	--	--	700	7.7
403	do	--	do	Ke(?)	18	58	28	17	275	28	26	.3	8.0	318	258	--	--	535	7.9
404	Bevans Ranch	--	Oct. 12, 1962	Ke(?)	17	73	26	16	309	38	26	.3	2.9	351	288	--	--	580	7.4
405	do	--	do	Ke(?)	17	51	32	18	280	28	30	.4	4.2	318	258	--	--	546	7.6
501	Mack Henderson	300?	Oct. 24, 1962	Ke	18	49	33	32	240	17	73	.4	4.7	345	258	--	--	621	7.6
502	G. T. Hooton	240	do	Ke	15	55	32	13	301	17	20	.4	2.1	302	268	--	--	525	7.8
503	do	240	do	Ke	13	46	29	13	262	10	29	.1	a/	269	234	--	--	506	7.5
504	Cora Powell	--	--	Ke(?)	15	44	32	24	255	33	33	.3	2.7	309	239	--	--	575	8.3
505	W. L. Bankston	--	Nov. 1, 1962	Ke(?)	19	50	31	31	265	43	40	.3	3.1	347	252	--	--	580	8.0
507	John A. Powell	--	do	Ke(?)	14	50	29	8.0	286	2.0	19	.2	3.3	266	242	--	--	460	7.6

See footnotes at end of table.

Table 3.--Chemical analyses of ground water in Menard and adjacent counties--Continued

Well	Owner	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Specific conductance (micromhos at 25 °C)	pH
TH-56-09-508	Jack Allison	--	Oct. 31, 1962	Ke(?)	23	29	29	21	165	32	32	0.3	a/	253	189	--	0.7	445	8.6
509	Mack Henderson	200	Oct. 24, 1962	Ke	14	58	25	14	277	12	24	.2	2.1	285	249	--	--	550	7.5
601	R. V. Westbrook	--	do	Ke(?)	16	44	34	23	271	28	31	.5	a/	309	251	--	--	533	7.5
602	G. T. Hooton	178	do	Ke	18	51	66	19	278	18	32	.3	3.4	344	255	--	--	539	7.6
603	Harold Lively	150	Oct. 25, 1962	Ke	18	48	41	21	266	14	40	.4	4.4	317	256	--	--	558	7.5
604	do	160?	do	Ke	19	51	30	31	265	35	38	.5	4.9	339	253	--	--	575	7.5
605	Jamey Lively	160	do	Ke	18	42	32	16	253	20	25	.3	3.1	284	240	--	--	490	8.4
606	Oscar Bradford	180	do	Ke	16	55	32	20	244	21	28	.3	3.4	317	267	--	--	545	7.6
607	do	220	do	Ke	16	42	33	38	282	30	34	1.0	2.0	335	240	--	--	580	8.0
608	Lee Schneider	214	do	Ke	17	53	35	14	316	12	25	.3	a/	311	274	--	--	550	7.5
609	Oscar Bradford	--	do	Ke(?)	15	89	35	25	267	17	52	.2	129	493	366	--	--	801	7.5
610	Lee Schneider	200?	Oct. 30, 1962	Ke	17	62	31	15	325	12	22	.2	6.0	325	282	--	--	556	7.5
611	George Schneider	200	do	Ke	16	66	32	21	327	27	34	.3	a/	357	295	--	--	600	7.5
701	J. B. Ranch	600	Oct. 12, 1962	Ke(?)	12	56	39	247	376	375	96	5.8	a/	1,020	301	--	--	1,550	7.6
702	Bevans Ranch	--	do	Ke(?)	14	55	37	159	323	245	78	3.8	a/	751	288	--	4.1	1,150	7.7
703	T. P. LaCouture	291	Oct. 19, 1962	Ke	19	57	36	30	261	46	59	.4	3.4	378	289	--	.8	635	7.8
704	Mrs. Lawrence Williamson	--	Oct. 23, 1962	Ke(?)	16	32	29	19	223	18	25	.5	1.1	251	198	--	--	440	8.3
705	Mack Henderson	273	--	Ke	16	51	29	26	275	30	31	.6	2.0	321	249	--	.7	563	7.7
801	J. P. LaCouture	300	Oct. 19, 1962	Ke	16	59	28	19	279	26	34	.3	5.6	325	264	--	--	540	8.2
802	do	260	do	Ke	15	49	33	21	282	24	32	.8	a/	314	259	--	--	536	7.5
803	Owen Womack	--	do	Ke(?)	18	46	33	23	266	19	39	.7	4.2	314	252	--	--	535	7.7
804	Mack Henderson	250?	Oct. 24, 1962	Ke	16	50	30	23	266	20	40	.4	4.2	314	250	--	--	567	7.7
805	J. P. LaCouture	280?	Oct. 19, 1962	Ke	13	55	31	21	300	12	34	.4	a/	314	264	--	--	545	7.4
806	L. J. Rambo	227	Oct. 24, 1962	Ke	15	55	34	14	311	16	24	.4	2.4	313	294	--	--	486	7.5
807	L. L. Hardman	200?	Oct. 19, 1962	Ke	16	52	35	14	320	20	12	.6	a/	306	272	--	--	516	7.4
808	Mrs. Lawrence Williamson	--	Oct. 23, 1962	Ke(?)	14	58	25	14	275	13	23	.3	3.2	282	248	--	--	514	7.4

See footnotes at end of table.

Table 3.--Chemical analyses of ground water in Menard and adjacent counties--Continued

Well	Owner	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Specific conductance (micromhos at 25 °C)	pH
TH-56-09-901	Owen Womack	300?	Oct. 24, 1962	Ke	15	44	31	23	276	23	24	0.7	3.1	300	239	--	--	531	7.6
902	do	337	do	Ke	21	52	38	38	262	43	68	.5	4.2	394	286	--	--	685	7.6
903	do	223	do	Ke	12	42	28	16	235	20	27	.4	2.1	263	221	--	--	467	8.3
904	do	--	do	Ke(?)	16	63	29	12	307	11	24	.3	6.5	313	276	--	--	551	7.5
905	Harold Lively	--	do	Ke(?)	14	44	30	26	261	26	35	.6	2.0	306	231	--	--	535	8.2
10-101	Mrs. Fred Prugel	189	Oct. 31, 1962	Ke	20	55	34	28	306	20	40	.4	4.7	352	275	--	--	596	7.7
202	Paul H. Martin	114	Nov. 29, 1962	Ke	19	76	30	14	344	13	26	.3	28	376	314	--	--	650	7.4
205	Carl Martin, Sr.	110	Apr. 9, 1963	Ke	16	80	22	14	331	11	25	.3	1.0	332	290	--	--	605	7.5
208	Roy Thomerson	150	Apr. 18, 1963	Ke	18	57	33	26	303	29	39	.4	3.0	356	280	--	--	631	7.7
303	W. Roy Jacoby	2,501	Mar. 11, 1963	Ke	18	53	31	14	279	33	21	.4	2.4	309	258	--	--	560	7.4
307	W. L. McInnis	140	Apr. 3, 1963	Ke	18	56	29	20	256	36	34	.5	1.0	321	258	--	--	574	7.6
308	Mrs. S. A. Clark	260	Apr. 2, 1963	Ke	18	66	28	17	309	17	30	.4	2.5	331	280	--	--	592	7.5
401	Carl Martin, Jr.	115	Nov. 29, 1962	Ke	18	73	26	17	320	24	32	.2	6.0	353	291	--	--	615	7.4
501	Norton Matthews	138	Apr. 24, 1963	Ke	18	80	24	19	320	16	36	.4	9.0	357	300	--	--	643	7.3
602	J. D. Vinyard	170	Mar. 11, 1963	Ke	18	59	31	18	299	22	31	.3	4.9	331	274	--	--	586	7.3
701	Owen Womack	300	Oct. 24, 1962	Ke	18	55	34	33	259	31	61	.4	6.0	365	276	--	--	650	7.6
702	A. A. Williamson	250	Nov. 28, 1962	Ke	13	53	36	30	327	38	28	.7	a/	359	282	--	--	636	7.5
703	do	370	do	Ke	16	45	33	20	265	27	31	.4	2.0	304	249	--	--	535	8.3
704	do	300	do	Ke	18	46	34	21	270	22	34	.4	2.2	311	257	--	--	560	8.2
705	do	--	do	Ke(?)	15	59	26	21	255	26	45	.2	10	328	254	--	--	585	7.6
801	do	210	do	Ke	19	78	21	14	312	13	28	.2	18	344	283	--	--	590	7.3
802	Mrs. Jessie Low	240	Nov. 29, 1962	Ke	17	58	30	19	290	15	38	.4	11	331	270	--	--	590	7.4
803	do	240	do	Ke	17	48	32	21	266	12	46	.4	7.0	314	240	--	--	568	8.0
804	do	252	do	Ke	17	52	36	24	297	38	31	.8	4.4	348	276	--	--	600	8.0
805	John Low	160	do	Ke	14	70	25	10	320	8.0	21	.2	5.1	310	274	--	--	555	7.4
806	Mary Haygood	--	do	Ke(?)	18	54	33	17	306	20	29	.4	2.7	324	272	--	--	578	7.4
807	A. A. Williamson	110	--	Ke	18	70	27	19	306	22	35	.2	7.0	348	285	--	--	606	8.2

See footnotes at end of table.

Table 3.--Chemical analyses of ground water in Menard and adjacent counties--Continued

Well	Owner	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Specific conductance (micromhos at 25 °C)	pH
TH-56-10-808	A. A. Williamson	--	Nov. 28, 1962	Ke(?)	19	49	30	18	268	18	32	0.5	3.8	302	247	--	--	535	8.2
1/ 901	R. Q. Landers	260	June 9, 1961	Ke	17	48	28	28	256	15	47	.6	3.8	313	235	21	0.8	561	7.2
903	W. R. Walston	125	Apr. 17, 1963	Ke	14	60	28	28	293	14	37	.4	2.0	319	266	--	--	588	7.6
906	Roger Q. Landers	200	do	Ke	20	49	32	25	262	26	46	.5	1.0	329	252	--	--	587	7.6
907	do	240	do	Ke	20	52	27	24	254	21	45	.6	2.0	317	241	--	--	569	7.6
910	M. M. Compton	235	Apr. 18, 1963	Ke	18	51	37	26	273	54	37	.7	3.0	361	282	--	--	633	7.5
912	M. A. Nixon	185	do	Ke	18	59	34	28	267	49	34	.7	26	384	284	--	--	656	7.8
913	F. C. Word	170	Apr. 21, 1963	Ke	18	68	27	19	305	13	33	.4	8.5	337	280	--	--	599	7.8
11-103	E. B. Kothman	135	Mar. 11, 1963	Ke	16	57	30	22	294	23	33	.4	3.8	330	264	--	--	610	7.9
112	Fritz Luckenbach	100	Apr. 25, 1963	Ke	6.0	37	37	21	287	16	31	.5	a/	290	243	--	--	550	7.9
201	E. A. Kothman	17	Mar. 12, 1963	Kt(?)	24	96	49	32	477	48	53	.4	a/	537	442	--	--	914	7.2
204	Mrs. Marshall Pennington	180	Apr. 2, 1963	Kt	9.0	142	104	240	167	475	485	1.6	a/	1,540	780	--	--	2,500	7.3
302	Henry Phillips	57	Apr. 3, 1963	Kt	11	229	158	210	403	489	610	.8	1.0	1,910	1,220	--	--	3,060	7.8
303	Mrs. J. C. Sutton	80	Apr. 4, 1963	Kt	18	95	78	96	299	180	256	1.1	a/	968	560	--	--	1,520	7.7
304	do	153	do	Kt(?)	16	65	67	113	357	179	145	1.2	a/	759	436	--	--	1,300	8.3
305	Ted Benton	80	Apr. 20, 1963	Kt	18	90	94	121	336	180	295	1.2	a/	969	610	--	--	1,700	7.4
401	Ote Walker	Spring	Mar. 11, 1963	Ke	16	60	27	18	300	12	28	.2	5.5	315	259	--	--	570	8.0
402	Bill Murchison	Spring	Mar. 12, 1963	Ke	18	69	26	19	305	18	34	.2	8.0	342	278	--	--	604	7.8
403	do	160	do	Ke	5.0	42	29	24	b/ 230	26	44	.4	3.8	287	223	--	--	547	8.7
1/ 601	John L. Royal	128	June 14, 1961	Ke	18	46	28	29	270	16	37	.5	1.5	309	230	21	0.8	543	7.3
602	Bennie Bradford	Spring	Apr. 2, 1963	Ke	18	66	27	17	318	14	27	.4	a/	325	275	--	--	585	7.6
702	D. N. Ruff	200	Apr. 18, 1963	Ke	16	56	28	14	294	10	23	.3	a/	292	255	--	--	526	7.8
706	N. J. Etheredge	160	do	Ke	18	60	34	20	301	17	36	.4	9.0	342	287	--	--	612	7.5
708	Andes Murchison	187	do	Ke	18	55	31	18	300	15	31	.4	1.0	317	264	--	--	570	7.3
710	Duwan Ruff	205	Apr. 19, 1963	Ke	18	51	25	15	262	10	23	.3	1.0	272	232	--	--	488	7.4
711	Ben Dichert	120	do	Ke	18	52	27	15	272	8.0	23	.4	2.5	280	242	--	--	505	7.5
801	W. J. Goemann	153	do	Ke	16	56	27	14	284	9.0	22	.3	1.0	285	250	--	--	512	7.8

See footnotes at end of table.

Table 3.--Chemical analyses of ground water in Menard and adjacent counties--Continued

Well	Owner	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Specific conductance (micromhos at 25 °C)	pH
TH-56-11-802	Carl Ruff	200	Apr. 19, 1963	Ke	16	54	27	15	281	11	25	0.3	1.0	287	246	--	--	524	7.5
901	F. W. Kidd	186	do	Ke	16	55	26	15	279	7.0	24	.4	1.0	208	242	--	--	515	7.4
905	Irby McWilliams	127	Apr. 21, 1963	Ke	16	58	26	14	279	10	23	.4	4.5	289	250	--	--	525	7.6
906	Alf McWilliams	130	Apr. 22, 1963	Ke	18	60	26	15	287	11	24	.4	2.5	298	255	--	--	530	7.5
12-202	Alton Looney	60	Apr. 3, 1963	Kt	22	81	77	104	491	112	162	1.0	2.5	800	520	--	--	1,370	7.6
204	Mills Pope	90	Apr. 25, 1963	Ke	18	60	46	23	379	12	42	.6	2.0	387	340	--	--	706	8.0
205	Woody Surber	30	do	Kt	56	276	91	440	278	500	700	3.3	231	2,300	1,060	--	5.9	3,750	7.6
303	Mrs. Ike Daley	210	Oct. 18, 1962	Pz	21	83	29	19	367	16	33	.1	a/	381	326	--	--	640	7.4
304	Hext School	200	do	Pz	19	84	25	21	353	15	34	.1	a/	372	312	--	--	625	7.4
305	E. B. Carriger	212	do	Pz	18	79	29	19	362	13	29	.1	a/	365	317	--	--	616	7.7
306	G. W. Cox	39	do	Kt	36	137	32	162	375	113	265	1.9	16	947	474	--	3.2	1,560	7.5
307	Northcut Estate	200?	do	Pz	22	84	28	32	342	20	39	.5	45	438	327	--	--	705	7.6
308	O. P. Pfeifer	45	do	Kt	26	235	59	324	321	222	621	.9	175	1,820	829	--	--	2,650	7.7
310	A. J. Westbrook	55?	do	Pz(?)	13	125	21	15	421	26	12	.1	72	491	400	--	--	745	7.4
311	J. H. Bowers	150	do	Kt	19	78	29	22	338	19	26	.2	16	375	314	--	--	640	7.5
312	Roy McSherry	--	do	Pz(?)	23	146	22	85	360	63	144	.4	95	755	457	--	--	1,160	7.5
314	Hazel Carriger	70	Nov. 2, 1962	Kt	28	139	35	241	504	156	288	1.4	4.3	1,140	491	--	--	1,750	7.2
315	F. W. Key	200	do	Pz	19	86	27	25	349	20	38	.1	41	428	328	--	--	700	7.4
316	Woody Surber	155	Apr. 26, 1963	Pz	20	77	30	22	346	16	23	.3	24	384	315	--	--	692	7.3
318	Mrs. Ethel Reeves	80	Nov. 2, 1962	Pz	26	93	51	48	442	48	78	.3	22	583	443	--	--	950	7.2
319	C. M. Davis	300	Apr. 25, 1963	Pz	24	96	56	61	406	72	117	.5	30	554	468	--	--	1,130	7.6
321	do	225	do	Kt	18	86	64	101	345	156	157	.7	13	765	476	--	--	1,300	8.1
322	J. S. Conn	85	do	Kt	20	172	70	110	332	219	269	.6	60	1,080	720	--	--	1,820	7.3
323	do	112	do	Kt	24	123	64	121	349	211	231	.7	a/	943	570	--	--	1,580	7.9
404	John Royal	118	Apr. 20, 1963	Ke	18	45	31	21	275	11	33	.5	a/	295	242	--	--	540	7.5
503	Earl Rudder	310	Apr. 24, 1963	Ke	14	73	67	28	321	82	112	.9	a/	537	455	--	--	975	8.1
506	John Speck	85	Apr. 25, 1963	Ke	18	60	31	18	329	8.0	28	.4	a/	325	277	--	--	590	7.9

See footnotes at end of table.

Table 3.--Chemical analyses of ground water in Menard and adjacent counties--Continued

Well	Owner	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Specific conductance (micromhos at 25 °C)	pH
TH-56-12-601	V. R. Peterman	200?	Apr. 25, 1963	Ke	18	90	62	28	392	106	80	0.7	a/	581	481	--	--	990	7.5
701	R. S. Ligon	165	Apr. 20, 1963	Ke	18	66	24	15	310	12	21	.4	a/	308	265	--	--	545	7.5
803	Earl Rudder	200	Apr. 23, 1963	Kt	22	50	88	64	440	122	98	.9	a/	666	485	--	--	1,120	8.2
901	Lorenzo Mogford	75	Apr. 24, 1963	Kt	22	84	41	25	393	40	35	.6	15	460	378	--	0.6	790	7.5
903	Arthur Eckert	200	do	Kt	20	100	51	40	439	82	62	.7	a/	577	459	--	--	992	7.3
13-101	H. O. McWilliams	260	Apr. 25, 1963	Pz	20	112	39	69	371	106	119	.5	1.0	652	439	--	--	1,120	7.4
703	Susie Ralston	200	Apr. 13, 1963	Kt(?)	20	93	61	60	407	89	100	.7	28	653	481	--	--	1,140	7.7
704	Tom Jacoby	140	Apr. 24, 1963	Kt	22	100	56	29	443	91	54	.6	a/	678	480	--	--	978	7.5
17-101	Mrs. Lawrence Williamson	270	Oct. 23, 1962	Ke	14	63	21	21	266	13	32	.1	8.5	304	247	--	--	540	7.6
102	do	270	do	Ke	12	58	26	11	275	17	25	.3	2.4	286	251	--	--	519	7.6
103	do	320	do	Ke	14	58	33	11	309	20	21	.3	a/	309	279	--	--	551	7.5
201	L. L. Hardman	200	Oct. 19, 1962	Ke	18	49	33	38	251	41	65	.6	a/	367	260	--	--	630	7.6
202	Mrs. Lawrence Williamson	--	Oct. 23, 1962	Ke(?)	14	58	18	10	244	7.0	18	.1	8.0	253	216	--	--	452	7.4
301	A. L. Reynolds	--	Oct. 19, 1962	Ke(?)	14	57	27	13	255	29	24	.6	4.4	294	255	--	--	496	8.0
302	Nasworthy & Son	285	Oct. 23, 1962	Ke	17	39	32	20	237	23	35	1.8	2.1	287	230	--	--	505	8.1
303	do	--	do	Ke(?)	15	48	26	13	244	20	27	.4	4.2	273	225	--	--	477	7.5
304	Owen Womack	--	Oct. 24, 1962	Ke(?)	12	47	29	21	249	30	35	.4	a/	296	238	--	--	532	7.5
305	Kitchens Estate	--	Nov. 29, 1962	Ke(?)	15	56	30	25	251	35	48	.3	4.7	337	262	--	--	598	7.7
306	do	333	do	Ke(?)	20	59	32	64	247	72	86	.4	4.3	459	278	--	--	795	7.7
18-101	Nasworthy & Son	300	Oct. 23, 1962	Ke	15	65	22	14	273	16	26	.3	6.0	298	251	--	--	520	7.4
102	A. A. Williamson	250	--	Ke	14	44	32	25	267	47	19	1.2	2.2	315	241	--	--	553	7.5
103	do	300	Nov. 28, 1962	Ke	13	40	34	28	c/ 247	36	44	1.0	2.0	320	240	--	--	570	8.5
105	E. G. Sieker	--	do	Ke(?)	16	45	31	17	256	29	24	1.2	2.9	292	239	--	--	513	7.7
106	Mary S. Crawford	194	do	Ke	16	50	30	18	264	31	26	.8	3.1	305	249	--	--	530	8.1
107	E. G. Sieker	322	do	Ke	14	44	26	8.0	255	10	14	.2	a/	241	217	--	--	435	7.5
201	Hugh Spinks	--	do	Ke(?)	14	43	31	11	259	14	20	.6	3.8	264	231	--	--	478	7.7

See footnotes at end of table.

Table 3.--Chemical analyses of ground water in Menard and adjacent counties--Continued

Well	Owner	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Specific conductance (micromhos at 25 °C)	pH
TH-56-18-202	Hugh Bob Spiller	--	Nov. 28, 1962	Ke(?)	18	47	26	23	221	14	54	0.3	6.5	298	225	--	--	538	7.7
203	Hugh Spinks	--	do	Ke(?)	18	52	35	40	259	23	87	.3	9.0	391	276	--	--	716	7.4
301	Lamar Wilkinson	200	Apr. 17, 1963	Ke	16	46	29	18	257	16	26	.6	7.0	285	235	--	--	509	8.1
305	J. L. Ruff	180	Apr. 18, 1963	Ke	16	65	19	11	281	10	17	.2	2.0	278	240	--	--	495	7.3
306	Chester Simon	308	Apr. 20, 1963	Ke	16	60	22	22	266	10	39	.3	2.5	303	242	--	--	555	7.6
20-201	C. L. Brown	96	Apr. 22, 1963	Kt	22	84	72	58	461	139	84	.9	a/	686	500	--	--	1,130	7.8
204	E. J. Haines	60	do	Kt	24	102	78	77	510	78	163	.9	2.5	781	580	--	--	1,360	7.6
208	L. E. Wells	72	do	Kt	26	456	94	333	366	600	900	.7	41	2,640	1,530	--	--	4,050	7.2
209	Mrs. Emma Rogers	90	do	Kt	20	60	55	52	379	72	75	.7	a/	517	375	--	--	908	7.7
210	J. W. Walker	65	Apr. 23, 1963	Kt	18	67	21	6.0	300	8.0	7.0	.5	5.5	282	255	--	--	492	7.6
301	Jasper Davis	70	do	Kt	22	100	50	54	387	101	95	.7	8.5	623	453	--	--	1,060	7.3
302	J. C. Hight	68	do	Kt	29	103	19	38	287	37	64	.4	58	494	334	--	--	826	7.6
304	H. R. Reichenau	256	do	Kt	18	111	61	61	373	138	126	.5	17	720	530	--	--	1,230	7.6
306	Alvin Hahn	200?	do	Pz	18	113	81	51	432	199	107	.6	a/	780	610	--	--	1,400	7.2
317	Warren Mogford	120	Apr. 24, 1963	Kt(?)	18	77	98	38	487	50	63	.9	150	732	590	--	--	1,230	7.5
21-101	Jess Hight	185	Apr. 23, 1963	Kt	30	150	55	132	429	240	186	.7	76	1,080	600	--	--	1,740	7.3
103	Felix Hahn	200	do	Pz	26	127	33	40	540	23	51	.2	9.0	576	453	--	--	973	7.1
								Concho County											
1/ DZ-42-57-101	Melvin Wilhelm	302	Nov. 15, 1961	Ke	14	51	24	18	252	9.8	30	--	6.8	278	226	15	0.5	489	7.0
43-64-101	J. C. Sorrell	266	Jan. 8, 1962	Ke	17	50	32	13	273	12	32	.5	3.8	244	256	10	.4	522	7.2
								Kimble County											
RK-55-24-401	Milton Morales	--	Oct. 10, 1962	Ke(?)	15	51	28	13	267	19	22	.6	4.3	284	244	--	--	493	7.8
501	G. H. Lopez	270	do	Ke	16	55	35	26	255	38	42	1.0	41	379	278	--	--	620	7.8
56-18-401	E. G. Sieker	287	Nov. 28, 1962	Ke	20	54	33	36	248	20	83	.4	3.1	371	270	--	--	674	7.6
								Schleicher County											
1/ WY-43-64-706	Troy Vaughn	300?	Oct. 26, 1961	Ke(?)	15	55	24	15	269	9.8	23	--	6.4	280	236	12	.4	498	7.0
1/ 55-08-404	John M. Tredwell	240	Oct. 6, 1961	Ke	15	77	20	11	314	9.0	18	--	5.9	310	274	8	.3	525	6.9

See footnotes at end of table.

Table 3.--Chemical analyses of ground water in Menard and adjacent counties--Continued

Well	Owner	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Specific conductance (micromhos at 25 °C)	pH
1/ WY-55-08-703	Winston W. Sheen	175	Nov. 6, 1961	Ke	17	54	30	17	264	24	30	0.6	13	316	258	13	0.5	533	7.0
1/ 16-104	Talbert Estate	75?	Oct. 5, 1961	Ke(?)	14	95	22	24	336	12	60	--	7.8	400	328	14	.6	712	6.9
1/ 401	Catherine Ball	87	July 29, 1960	Ke(?)	15	90	18	25	335	24	31	.3	9.7	378	298	15	.6	637	6.8
24-104	Geo. Lehne	152	--	Ke	14	63	30	11	344	3.0	22	.3	a/	312	282	--	--	550	7.1

a/ Nitrate less than 0.4 ppm.
b/ Includes the equivalent of 7 ppm of carbonate (CO_3).
c/ Includes the equivalent of 5 ppm of carbonate (CO_3).
1/ Analyses by U.S. Geological Survey Quality of Water.
* Composite samples.
† Well TH-56-01-506: Iron (Fe), 0.1; Manganese (Mn), 0.00; Phosphate (PO_4), 0.7; Boron (B), 0.10.