GEOHYDROLOGY AND WATER QUALITY OF THE ROUBIDOUX AQUIFER, NORTHEASTERN OKLAHOMA

By Scott C. Christenson, David L. Parkhurst, and Roy W. Fairchild

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CONVERSION FACTORS

For use of readers who prefer to use metric units, conversion factors for inch-pound units used in this report are listed below:

Multiply	By	To obtain
foot (ft)	0.3048	meter
gallon (gal)	3.785	liter
inch (in)	25.40	millimeter
mile (mi)	1.609	kilometer
square foot per day (ft^2/d)	0.09290	square meter per day
square mile (mi^2)	2.590	square kilometer

Temperature in degrees Celsius (^{o}C) can be converted to degrees Fahrenheit (^{o}F) as follows:

$$^{o}F=1.8\ (^{o}C) + 32$$

Sea Level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

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ABSTRACT

The Roubidoux aquifer is an important source of freshwater for public supplies, commerce, industry, and rural water districts in northeastern Oklahoma. Ground-water withdrawals from the aquifer in 1981 were estimated to be 4.8 million gallons per day, of which about 90 percent was withdrawn in Ottawa County. Wells drilled at the beginning of the 20th century originally flowed at the land surface, but in 1981 water levels ranged from 22 to 471 feet below land surface. A large cone of depression has formed as a result of ground-water withdrawals near Miami. Wells completed in the Roubidoux aquifer have yields that range from about 100 to more than 1,000 gallons per minute.

An aquifer test and a digital ground-water flow model were used to estimate aquifer and confining-layer hydraulic characteristics. Using these methods, the transmissivity of the aquifer was estimated to be within a range of 400 to 700 square feet per day. The leakance of the confining layer was determined to be within a range from 0 to 0.13 per day, with a best-estimate value in a range from 4.3×10^{-8} to 7.7×10^{-8} per day.

Analyses of water samples collected as part of this study and of water-quality data from earlier work indicate that a large areal change in major-ion chemistry occurs in ground water in the Roubidoux aquifer in northeastern Oklahoma. The ground water in the easternmost part of the study unit has relatively small dissolved-solids concentrations (less than 200 milligrams per liter) with calcium, magnesium, and bicarbonate as the major ions. Ground water in the westernmost part of the study unit has relatively large dissolved-solids concentrations (greater than 800 milligrams per liter) with sodium and chloride as the major ions. A transition zone of intermediate sodium, chloride, and dissolved-solids concentrations exists between the easternmost and westernmost parts of the study unit.

Three water-quality problems are apparent in the Roubidoux aquifer in northeast Oklahoma: (1) Contamination by mine water, (2) large concentrations of sodium and chloride, and (3) large radium-226 concentrations.

Many wells in the mining area have been affected by mine-water contamination. At present (1990), all instances of ground-water contamination by mine water can be explained by faulty seals or leaky casings in wells that pass through the zone of mine workings and down to the Roubidoux aquifer. None of the data available to date demonstrate that mine water has migrated from the Boone Formation through the pores and fractures

of the intervening geologic units to the Roubidoux aquifer.

Ground water with large concentrations of sodium and chloride occurs at some depth throughout the study unit. Large concentrations of sodium and chloride make ground water in the Roubidoux aquifer unsuitable as a water supply in the northwestern part of the study unit. In the eastern part of the study unit, chloride concentrations greater than 250 milligrams per liter are found at depths greater than approximately 1,200 to 1,500 feet. Data are too few to determine the depth to ground water with large concentrations of sodium and chloride in the southern and southwestern parts of the study unit.

Large concentrations of gross-alpha radioactivity in ground water occur near the western edge of the transition zone. Generally, ground water with large concentrations of gross-alpha radioactivity was found to exceed the maximum contaminant level for radium-226.

become widely recognized. Parkhurst (1987) published chemical analyses of water samples from the Picher mining area.

Acknowledgments

The authors are indebted to many people throughout the study unit for their cooperation and assistance in obtaining information concerning wells, ground-water withdrawals, use of water, and other pertinent data. Many individuals from municipal water departments, operators of rural water districts, well drillers, and individual well owners provided information.

The cooperation and assistance extended by members of the Oklahoma Geological Survey and the Oklahoma Water Resources Board are especially appreciated. Both agencies were helpful in supplying information and providing many helpful suggestions.

Explanation of the Local Identifier

The location of data-collection sites in this report is illustrated in the diagram below. This method of locating sites is referred to as the "local identifier." The local identifier replaces the standard legal method of locating sites by fractional section, section, township, and range. By the standard legal method, the location of the site indicated by the "x" is described as SE1/4 NW1/4 SW1/4 sec. 9, T.29 N., R.23 E. The local identifier reverses the order and indicates quarter subdivisions of the section by letters. By this method, the location of the site is given as 29N-23E-09 CBD 1. A sequence number ("1" in this example) is added to provide a unique identifier for each site.

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INTRODUCTION

The Roubidoux aquifer in northeastern Oklahoma is used extensively as a source of water for public supplies, commerce, industry, and rural water districts. Recognizing a need for additional information, the Oklahoma Geological Survey initiated a hydrologic study of the Roubidoux aquifer in cooperation with the U.S. Geological Survey.

The term "Roubidoux aquifer" is used in this report to describe those geologic units, including the Roubidoux Formation, in northeastern Oklahoma in which deep wells are completed. The Roubidoux Formation is a distinct geologic unit recognized in the subsurface in Arkansas, Missouri, Kansas, and Oklahoma, and on the surface in Missouri. Wells that are completed in the Roubidoux Formation generally are left open to the overlying Cotter and Jefferson City Dolomites. In addition, wells that are drilled to the Roubidoux Formation are sometimes drilled into the underlying Gasconade Dolomite in order to increase the well's yield. Because the wells with the greatest yield are completed in the Roubidoux Formation, it is inferred that the Roubidoux Formation contributes most of the water.

Purpose and Scope

This report presents the results of a study of the water resources of the Roubidoux aquifer in northeastern Oklahoma. The main objective of the study was to refine and extend knowledge of the geology, hydrology, and water quality of the aquifer. The scope of work included obtaining and interpreting geophysical, geologist's, and driller's logs to define stratigraphic relations; measuring water levels to define the potentiometric surface; analysis of an aquifer test and the development and use of a digital model to determine aquifer and confining layer hydraulic characteristics; and sampling of wells for chemical analysis to determine the water quality of the aquifer.

Previous Investigations

Several investigations of all or parts of the study unit have been made in the past (The term "study unit" is used throughout this report instead of the more conventional "study area." Depth as well as areal extent must be considered in any discussion of the Roubidoux aquifer.). The focus of many of these studies has been the extensive lead and zinc mining in Ottawa County. In the early part of the twentieth century Siebenthal (1908 and 1915), in describing the mineral resources of northeastern Oklahoma, referred to some of the wells extracting water from the Roubidoux Formation and described the hydrogeology of the area. Reed, Schoff, and Branson (1955) conducted an extensive investigation of the ground-water resources of Ottawa County. Marcher and Bingham (1971) described the water resources of much of northeastern Oklahoma as part of the Hydrologic Atlas series of investigations done cooperatively by the Oklahoma Geological Survey and the U.S. Geological Survey. Playton, Davis, and McClaflin (1980) conducted a study of the water within the abandoned lead and zinc mines in the region. Recently, the water in the abandoned mines has come under intense study as the potential for contamination of the Roubidoux aquifer by this water has

DESCRIPTION OF THE STUDY UNIT

The study unit is defined by those counties in northeastern Oklahoma that have wells completed in the Roubidoux aquifer. Those counties include Adair, Cherokee, Craig, Delaware, Mayes, and Ottawa Counties (fig. 1). The surface area of the study unit is about 4,500 square miles.

Physiography and Drainage

The study unit lies along the western flanks of the Ozark uplift and is part of two physiographic provinces. The eastern part of the study unit is within the Ozark Plateaus province, and the western part of the study unit is within the Osage Plains section of the Central Lowland province (Fenneman, 1946). The Ozark Plateau is characterized by rugged topography with deep V-shaped valleys separated by narrow flat-topped ridges. The Osage Plains section of the Central Lowland province is a gently eastward-sloping plain interrupted by low east-facing escarpments and isolated buttes capped by resistant limestone and sandstone.

The highest altitude is about 1,450 feet in the southeastern part of the study unit in Adair County. The lowest altitudes are about 700 feet in the south and west parts of the study unit.

The area is drained by several large streams including the Illinois River, the Neosho River, Spavinaw Creek, and the Spring River. Streams flow westward and southwestward. The drainage is dendritic and, in places, modified trellis.

Climate

The study unit is in a humid climatic zone. Annual precipitation averages about 42 inches, with most precipitation occurring in the spring and early fall. The driest part of the year is November through February. Average annual temperature is approximately 60 degrees Fahrenheit. January is the coolest month of the year and July is the warmest. Graphs showing average monthly temperature and precipitation at Miami, Pryor, Tahlequah, and Vinita are shown in figure 2 (U.S. Department of Commerce, 1973).

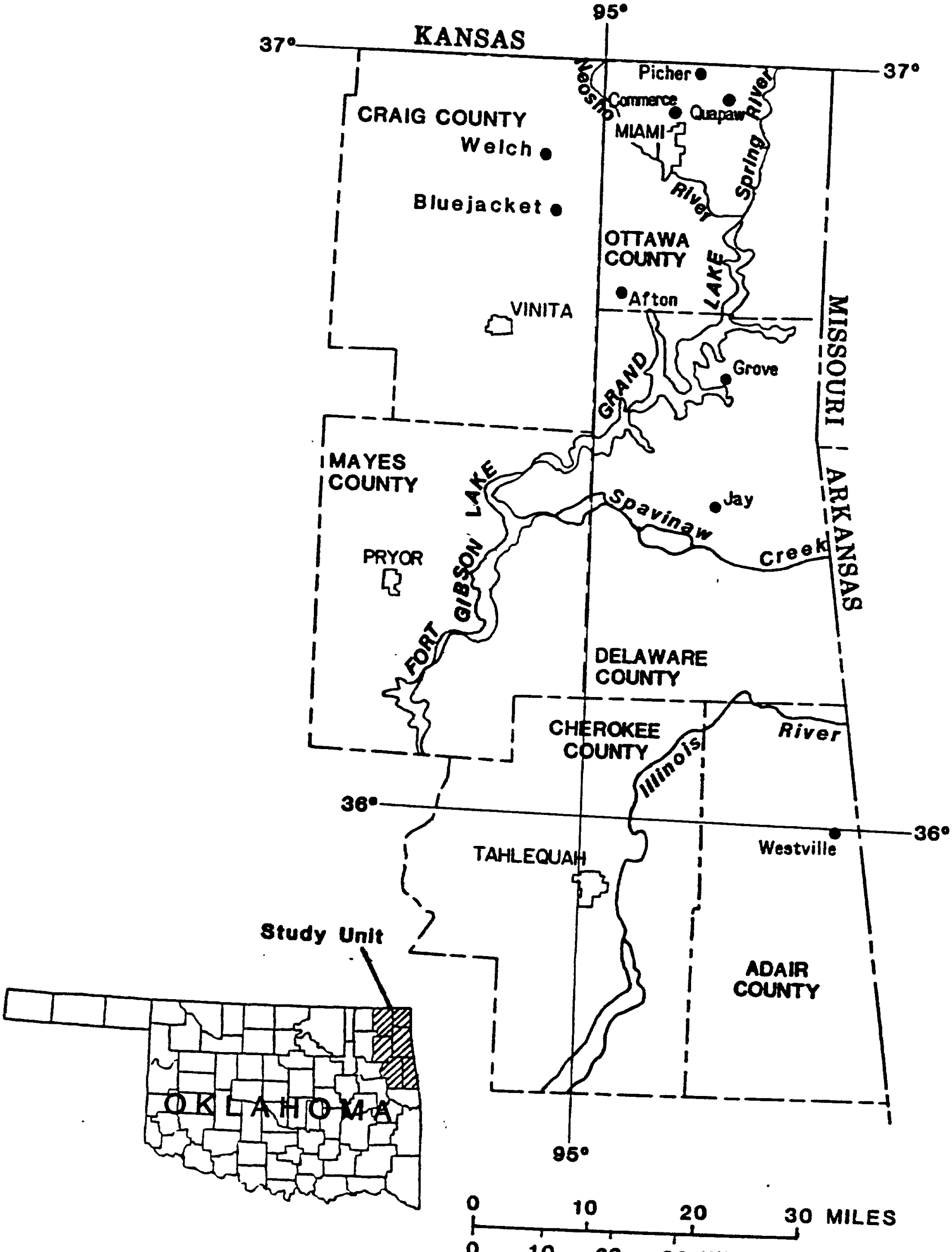

Figure 1.--Location of study unit.

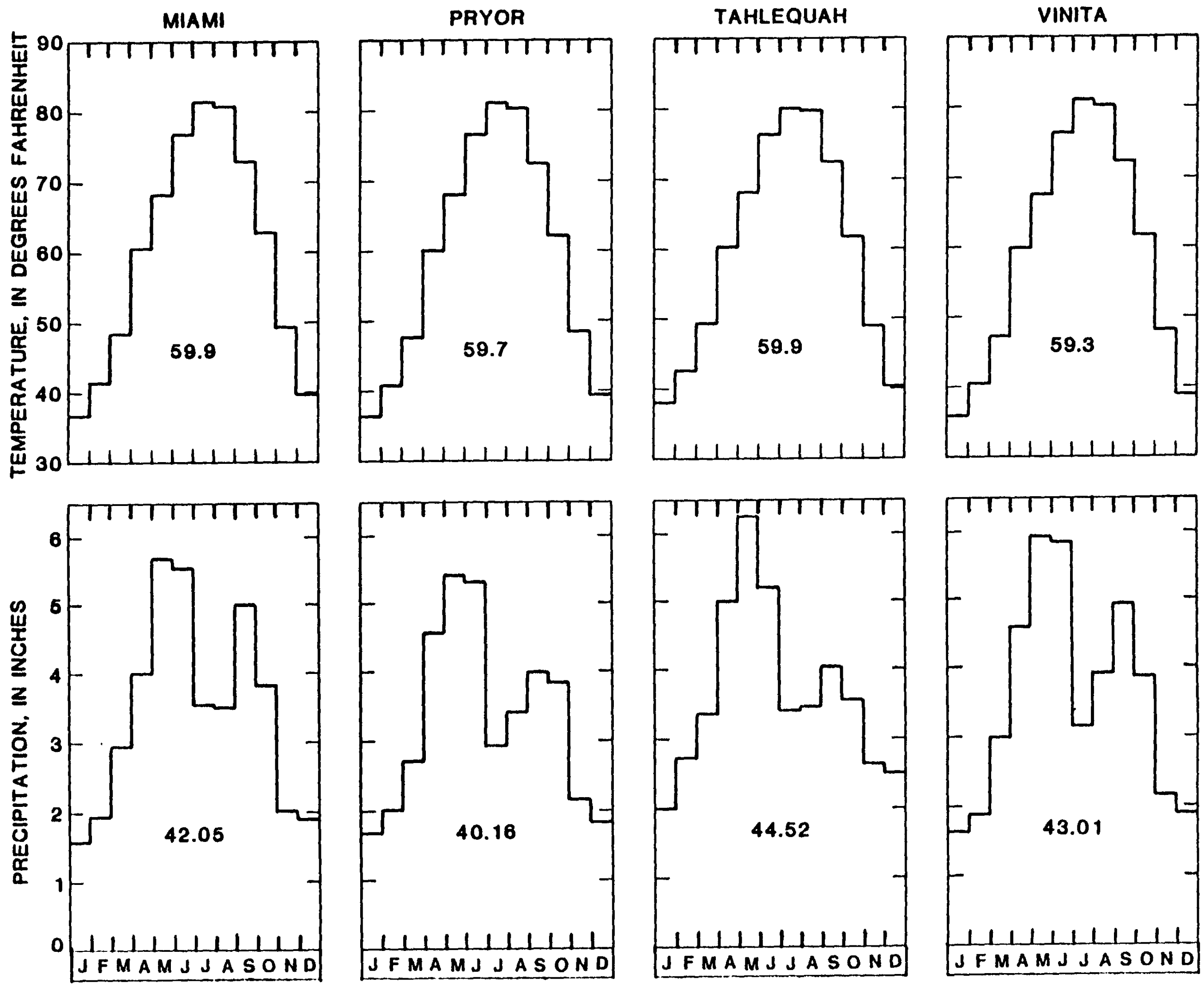

Figure 2.--Average monthly temperature and precipitation at Miami, Pryor, Tahlequah, and Vinita, 1941-70. Number in center of each graph is the average annual temperature or the precipitation at the station.

GEOLOGY

The thickness, lithology, and water-bearing characteristics of the major geologic units in the study unit are listed in table 1. The wells completed in the Roubidoux aquifer that were used as control points in this study are shown in figure 3. The stratigraphic nomenclature used in this report was compiled from both the Oklahoma Geological Survey and the U.S. Geological Survey.

Stratigraphy

The study unit is underlain by Precambrian-age igneous rocks that can be divided into two different units. The Washington volcanic group (Denison, 1981) is dominantly a rhyolite, but andesite is present in some areas. The Spavinaw Granite Group (Denison, 1981) is a granite porphyry. These two units underlie approximately equal areas within the study unit. Small outcrops of Spavinaw Granite are found in Mayes County. In southern Delaware County, granitic rocks are about 3,000 feet below the land surface. These widely ranging depths to Precambrian rocks within small lateral distances indicate that the Precambrian surface is very irregular.

Although Cambrian-age rocks are not present at the surface in the study unit, they have been identified in wells. The lowermost formation of Cambrian age is the Lamotte Sandstone. Based on data from the few wells in the study unit that penetrate the Lamotte Sandstone, it is a poorly sorted mixture of sandstone, shale, and siltstone that is from 0 to 80 feet thick. Because the Precambrian-age Spavinaw Granite Group crops out in Mayes County, the thickness of all younger geologic units in the study unit is 0 at that location. Stratigraphically above the Lamotte Sandstone is the Bonneterre Dolomite. In the study unit, the Bonneterre Dolomite ranges in thickness from 0 to 180 feet. The Bonneterre Dolomite is predominantly a dolomite, which contains chert, pyrite, oolites, glauconite, and sand. The percentage of sand decreases upward from the base of the formation. Overlying the Bonneterre Dolomite are the Eminence and Potosi Dolomites, undivided in this study. The Eminence and Potosi Dolomites are cherty dolomites, ranging in thickness from 0 to 370 feet.

Rocks of Ordovician age overlie the Cambrian rocks. The lowermost Ordovician unit is the Gasconade Dolomite. The Gasconade Dolomite consists of cherty dolomite, sandstone, and sandy dolomite. A basal sandstone, the Gunter Sandstone Member, is composed of about 20 feet of sandstone and sandy dolomite. Many wells in Missouri and Arkansas are completed with the Gunter Sandstone Member as the primary water-contributing geologic unit. The overall thickness of the Gasconade Dolomite in the study unit ranges from 0 to 350 feet and averages 230 feet.

The Roubidoux Formation overlies the Gasconade Dolomite. The Roubidoux Formation consists of cherty dolomite that ranges in thickness from 0 to 300 feet and averages about 175 feet (fig. 4). The top of the Roubidoux Formation ranges from about 100 feet above to nearly 600 feet below sea level in wells in the study unit (fig. 5), which corresponds to depths of 770 to 1,300 feet below land surface. The Roubidoux Formation contains 2 or

Table 1.—*Generalized geologic nomenclature and water-yielding characteristics of rocks in northeastern Oklahoma*

[gal/min, gallons per minute]

System	Geologic unit	Thickness (feet)	Lithologic description	Water-yielding characteristics
Pennsylvanian	Pennsylvanian rocks, undivided	0–230	Shale, siltstone, sandstone, limestone, and a few thin coal seams.	Wells yield from less than 1 to more than 50 gal/min.
Mississippian	Mississippian rocks, undivided	0–175	Limestone, shale, siltstone, and sandstone.	Wells yield from less than 1 to 20 gal/min.
	Boone Formation	0–370	Chert and fine- to coarse-grained gray, light gray, and bluish limestone.	Wells yield generally less than 10 gal/min but may yield as much as 750 gal/min.
	Northview Shale	0–30	Greenish-black or dull-blue shale.	Not water bearing.
	Compton Limestone		Gray, nodular, shaly limestone.	Not water bearing.
Devonian and Mississippian	Chattanooga Shale	0–80	Black, carbonaceous, fissile shale.	Not water bearing.
Ordovician	Ordovician rocks, undivided	0–550	Finely crystalline dolomite, with some thin shale beds and some sand stringers; found in a few wells in the southern part of the study unit.	Water-yielding characteristics not known.
	Cotter Dolomite / Swan Creek sandstone	0–840	Light buff to brown cherty dolomite with several sandy and argillaceous zones; Swan Creek sandstone identified in some wells is sandstone or sandy dolomite at the base.	Wells yield generally less than 10 gal/min but may yield as much as 380 gal/min.
	Jefferson City Dolomite		Light buff, gray and dark brown very cherty dolomite.	Water-yielding characteristics not known.
	Roubidoux Formation	0–300	Light-colored, cherty dolomite with 2 or 3 layers of sandstone 15 to 20 feet thick.	Principal aquifer in northeastern Oklahoma. Wells yield from 100 to over 1,000 gal/min.
	Gasconade Dolomite / Gunter Sandstone Mbr.	0–350	Light-colored, medium to coarsely crystalline, cherty dolomite; Gunter Sandstone Member is sandstone or sandy dolomite at the base.	Not known to yield significant amount of water from beds above Gunter Sandstone Member. Gunter yields moderate amount of water.
Cambrian	Eminence and Potosi Dolomites	0–370	Dark brown and light-colored cherty dolomite.	Water-yielding characteristics not known.
	Bonneterre Dolomite	0–180	Dolomite with chert, pyrite, oolites, and glauconite; with sand decreasing progressively upward from the base of the formation.	Water-yielding characteristics not known.
	Lamotte Sandstone	0–80	Medium- to coarse-grained sandstone, shale, and siltstone.	Not known to yield water to wells in the study unit.
Precambrian	Precambrian basement rocks, undivided	Unknown	Volcanic rocks and granite.	Not water bearing.

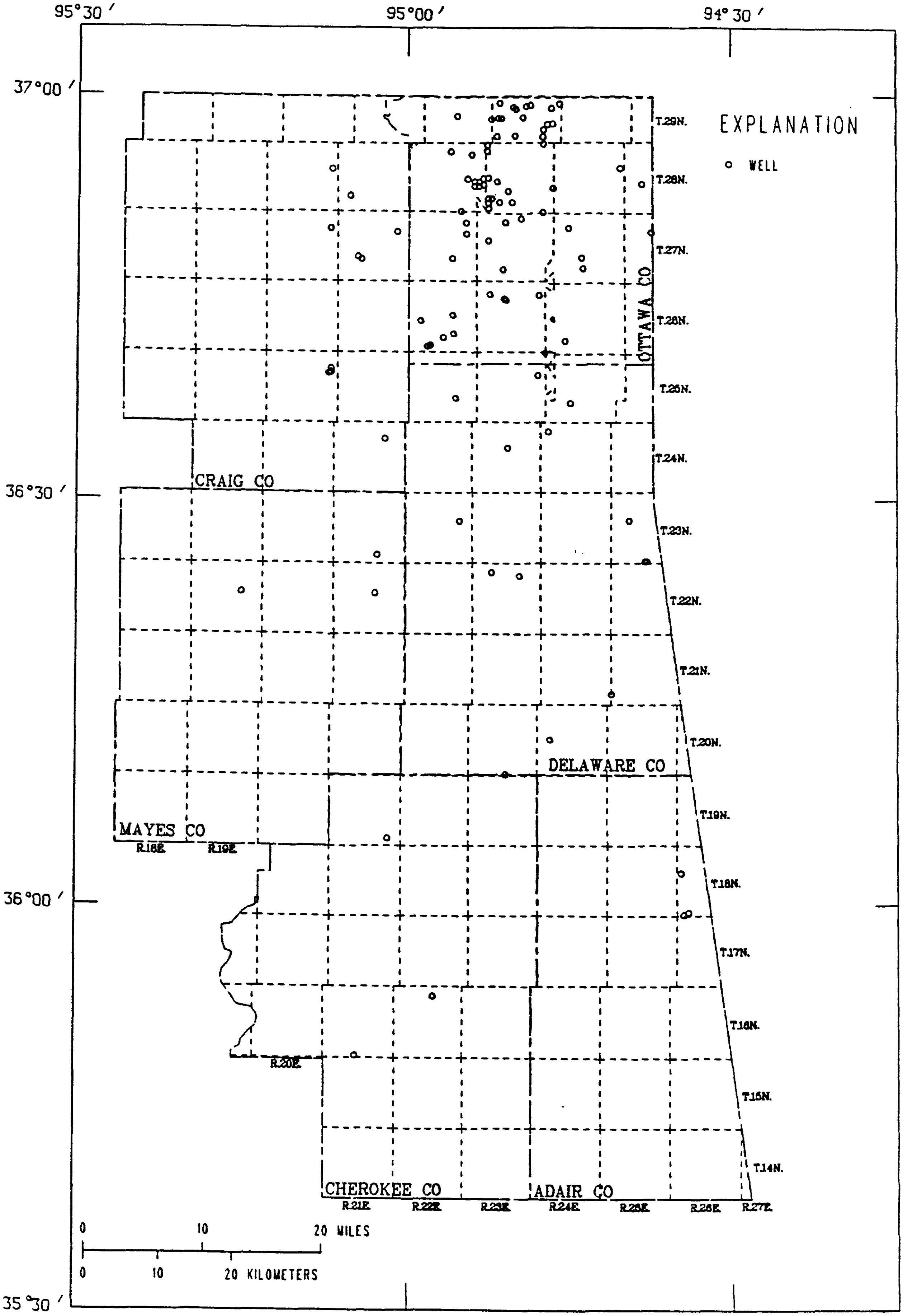

Figure 3.--Locations of wells penetrating the Roubidoux aquifer in northeastern Oklahoma that were used as control points.

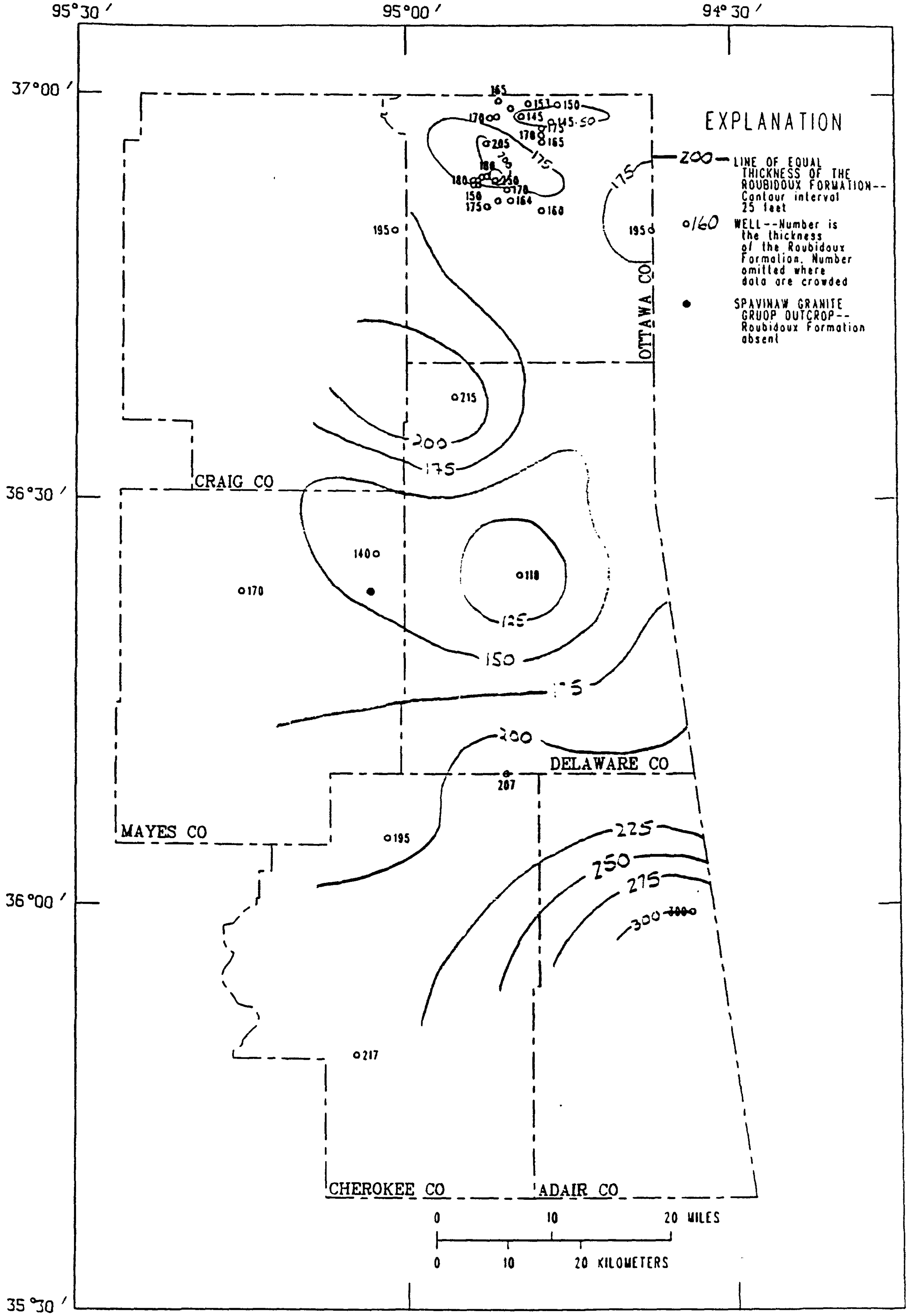

Figure 4.--Thickness of the Roubidoux Formation in northeastern Oklanoma.

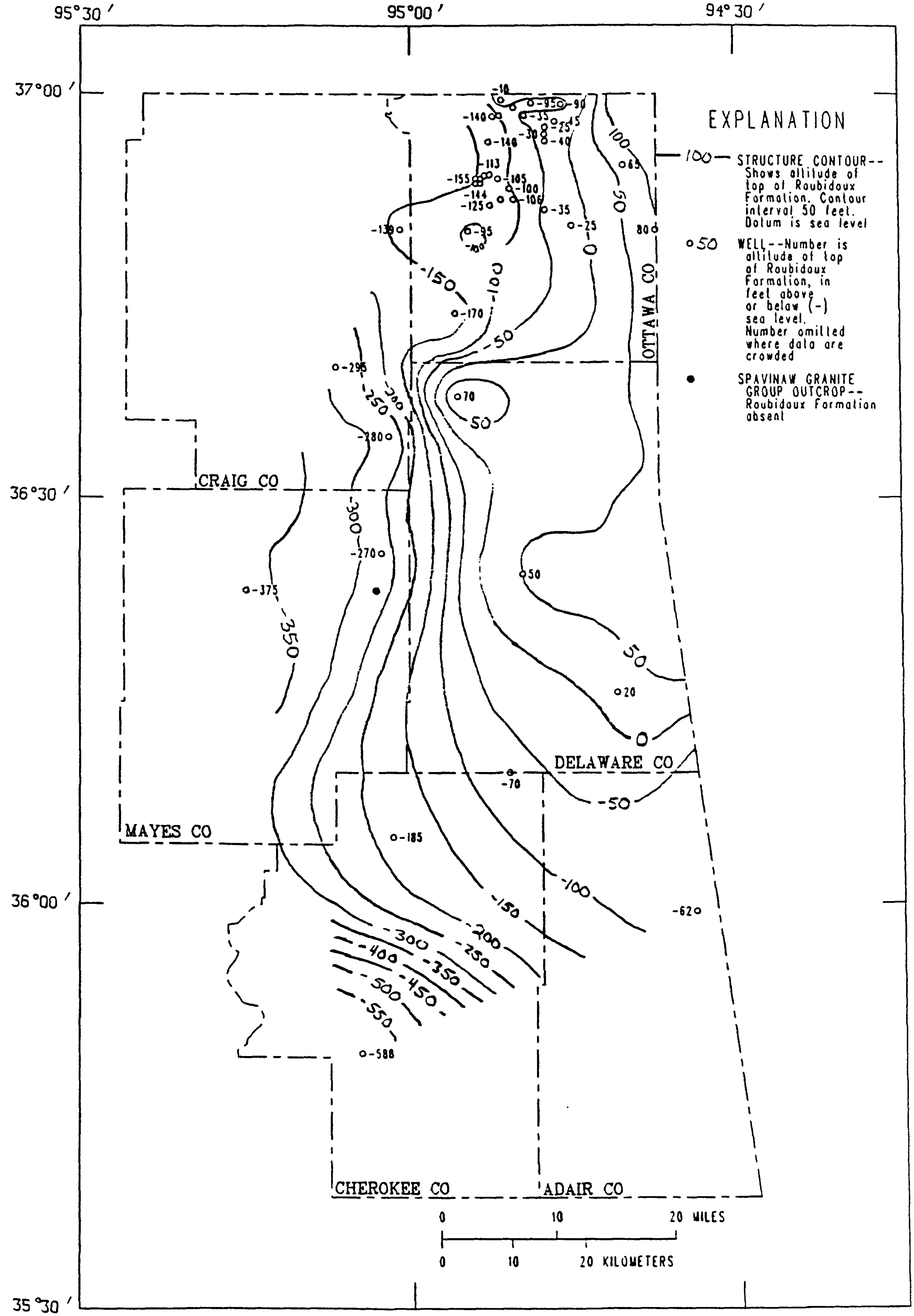

Figure 5.--Altitude of the top of the Roubidoux Formation in northeastern Oklahoma.

3 layers of sandstone, each about 15 to 20 feet thick.

The Cotter and Jefferson City Dolomites, undivided in this study, overlie the Roubidoux Formation. The Cotter and Jefferson City Dolomites are mainly cherty dolomites with sandstone lenses. The combined thickness of the two formations ranges from 0 to 840 feet (fig. 6). The Cotter Dolomite is at the surface in Mayes County but in wells in other parts of the study unit it can be as much as 670 feet below land surface. The Swan Creek sandstone is identified in some wells at the base of the Cotter Dolomite. The Swan Creek sandstone is a sandstone or sandy dolomite, as much as 30 feet thick.

Other geologic units of Ordovician age are identified in a few wells in the southern part of the study unit. These formations, stratigraphically above the Cotter Dolomite, are undivided in this report. These geologic units are identified as the Powell Dolomite, Everton Formation equivalent, Burgen Sandstone, or Tyner Formation in the few wells in which they are found. These units are predominantly a finely crystalline dolomite with some thin shale beds and some sand stringers.

The Chattanooga Shale, of Devonian and Mississippian age, overlies the Ordovician-age geologic units. It is a black carbonaceous shale, ranging in thickness from 0 to 80 feet (fig. 7).

In a few locations, the Northview Shale and the Compton Limestone of Mississippian age overlie the Chattanooga Shale. The Northview Shale is a greenish-black or dull-blue shale, and the Compton Limestone is a shaly limestone. The combined thickness of these two formations is 30 feet or less.

Overlying the Northview Shale is the Boone Formation, a sequence of cherty limestone strata of Mississippian age which crops out in the eastern half of the study unit. The Boone Formation ranges in thickness from 0 to 370 feet. The Boone Formation contains lead and zinc ores that were mined extensively in northeastern Oklahoma, southeastern Kansas, and southwestern Missouri from about 1890 to 1960. Overlying the Boone Formation are other Mississippian formations, undivided for this study. These undivided formations consist of limestone, shale, siltstone, and fine-grained sandstone that range in thickness from 0 to 175 feet in the study unit.

Stratigraphically above the Mississippian-age formations are rocks of Pennsylvanian age, also undivided for this study. These rocks are mostly shales, siltstones, sandstones, limestones, and a few thin coal seams. These formations are less than 230 feet thick, and crop out in the western part of the study unit.

Structure

The study unit is located on the western flank of the Ozark uplift. The regional dip in the western Ozarks generally is westward and averages about 25 feet per mile. Folding and faulting cause local variations in the regional dip.

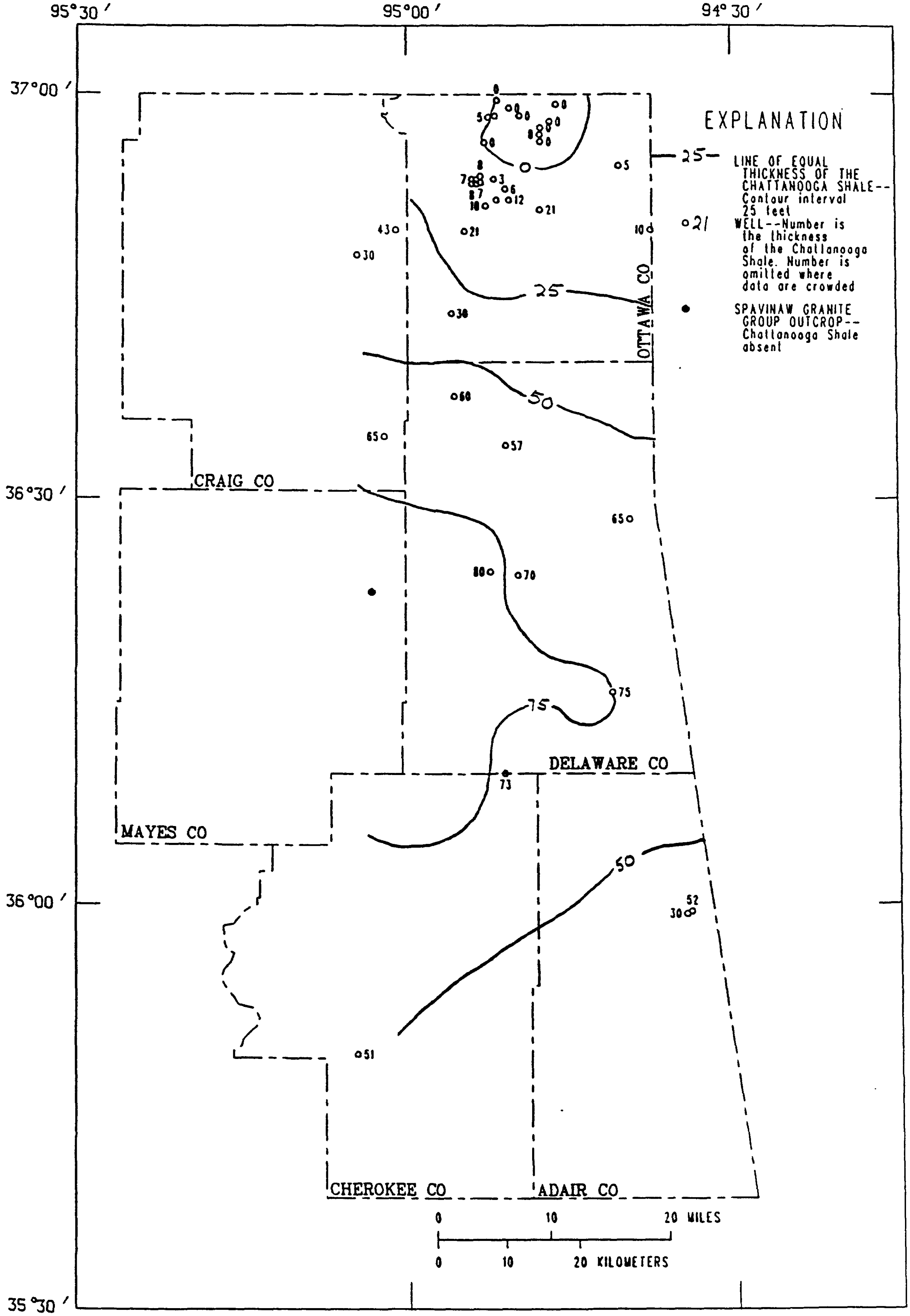

Figure 7.--Thickness of the Chattanooga Shale in northeastern Oklahoma.

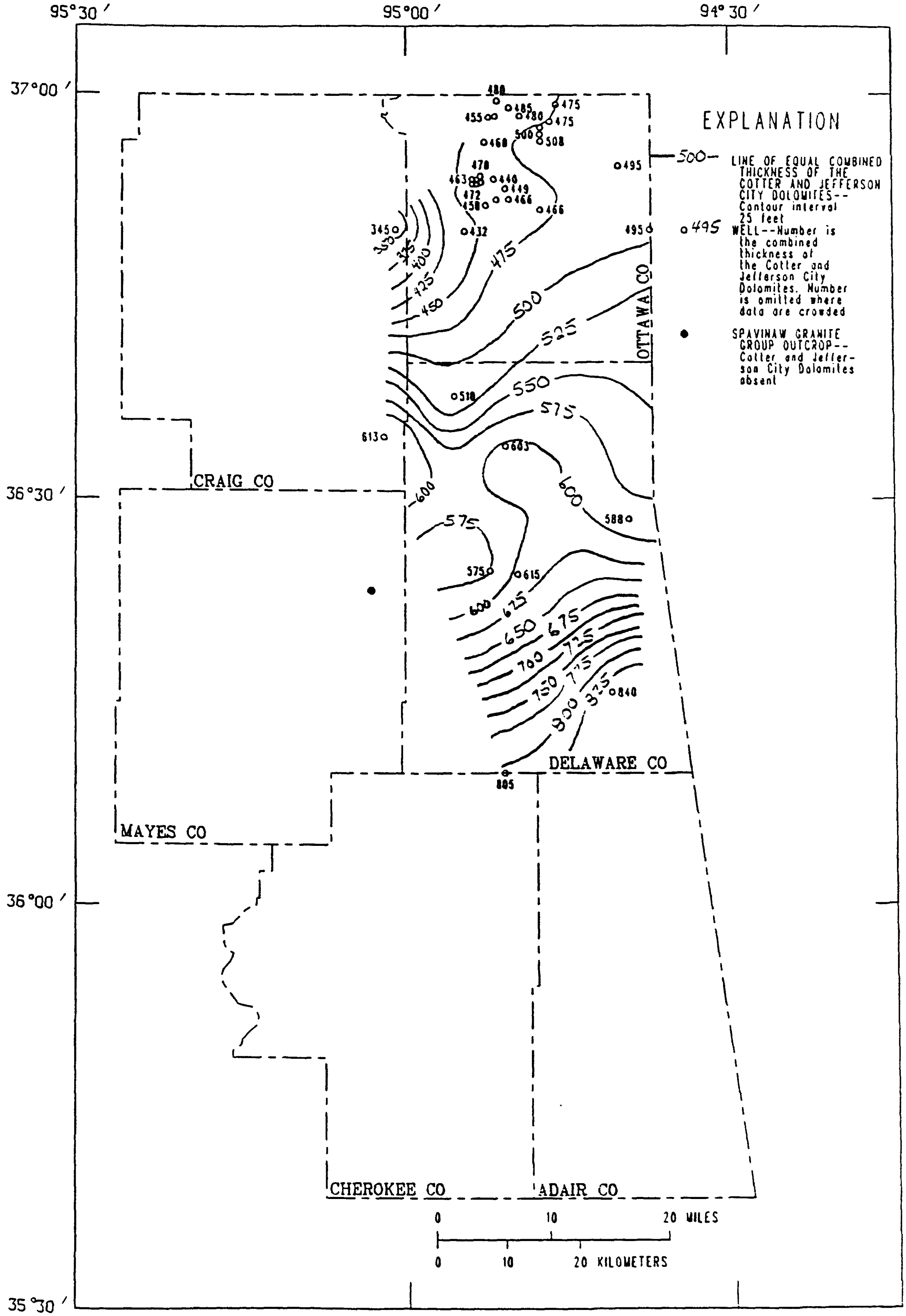

Figure 6.--Thickness of the Cotter and Jefferson City Dolomites in northeastern Oklahoma.

The Seneca graben is a major crustal discontinuity that cuts across the study unit. The Seneca graben trends northeast from the vicinity of Pryor in Mayes County, through southeastern Ottawa County, and extends into southwest Missouri (Miser, 1954). McKnight and Fischer (1970) describe the Seneca graben as a "complex feature in which bounding faults are not continuous" but are associated with several parallel faults with small displacements. The graben block is dropped a maximum of about 150 feet. In places along the Seneca graben, the sedimentary rocks apparently did not break and the bounding faults are replaced with folded sedimentary rocks.

Another crustal discontinuity in the study unit is the Miami trough. The Miami trough is a tectonic feature similar to the Seneca graben, although its surface expression is not as obvious as it does not appear on the geologic map of Oklahoma (Miser, 1954). The Miami trough trends north-northeast from Afton, passing west of Miami and Picher, and extends into Kansas. Similarly to the Seneca graben, the bounding faults are sometimes replaced by folded sedimentary rocks.

GEOHYDROLOGY

The objectives of the geohydrologic part of the Roubidoux aquifer study were to determine the potentiometric surface and the aquifer's hydraulic characteristics. These characteristics include specific yield, transmissivity, storage, and leakance of the confining layer.

Ground-Water Withdrawals

The first wells completed in the Roubidoux aquifer were drilled in northeastern Oklahoma near the beginning of the 20th century. Withdrawals of ground water from the Roubidoux aquifer steadily increased through the mid-1980's. In 1937 the State Mineral Survey (reported in Reed, Schoff, and Branson, 1955) reported the total ground-water withdrawals in Ottawa County to be about 1.75 million gallons per day. Reed, Schoff, and Branson (1955) estimated that in 1944 between 2.25 and 2.50 million gallons per day were withdrawn from the Roubidoux aquifer. They estimated withdrawals at approximately 4 million gallons per day in 1948. The 1981 estimated withdrawal from the Roubidoux aquifer in the study unit was about 4.8 million gallons per day, of which 90 percent was withdrawn in Ottawa County. In that year, approximately 75 percent of the ground water withdrawn from the Roubidoux aquifer in Ottawa County was pumped by the City of Miami and the B.F. Goodrich Company. The B.F. Goodrich Company closed its tire-manufacturing operation in Miami in early 1986, and water use in Ottawa County decreased at that time.

Water Levels

When wells were first completed in the Roubidoux aquifer near the beginning of the 20th century, the wells flowed at the land surface (Siebenthal, 1908). Since then, water levels have declined as a result of ground-water withdrawals. A cone of depression centered around the City of Miami has been created by large withdrawals of water. During 1981, water levels were measured in many of the wells completed in the Roubidoux aquifer in Oklahoma (table 2). Water levels in wells completed in the Roubidoux aquifer range from 22 to 471 feet below land surface in 1981. These water-level data were used to construct the potentiometric surface map shown in figure 8.

A water-table aquifer exists in the shallow geohydrologic units in the study unit, and potentiometric head in the water-table aquifer is much higher than the head in the Roubidoux aquifer. Thus, vertical hydraulic gradients exist between the geohydrologic units in the study unit, and probably within the Roubidoux aquifer. Many of the Roubidoux aquifer wells in which water levels were measured have large open intervals, and many are completed from the top of the Cotter Dolomite to the bottom of the well in the Roubidoux Formation or Gasconade Dolomite. Because head varies in the vertical direction and deep wells are open to large intervals, water levels measured in deep wells are an integrated measurement of a range of head. Although the potentiometric surface shown in figure 8 is considered to be a reasonable approximation of the potentiometric head in the Roubidoux aquifer, at each well shown in figure 8 there is some variation in head with

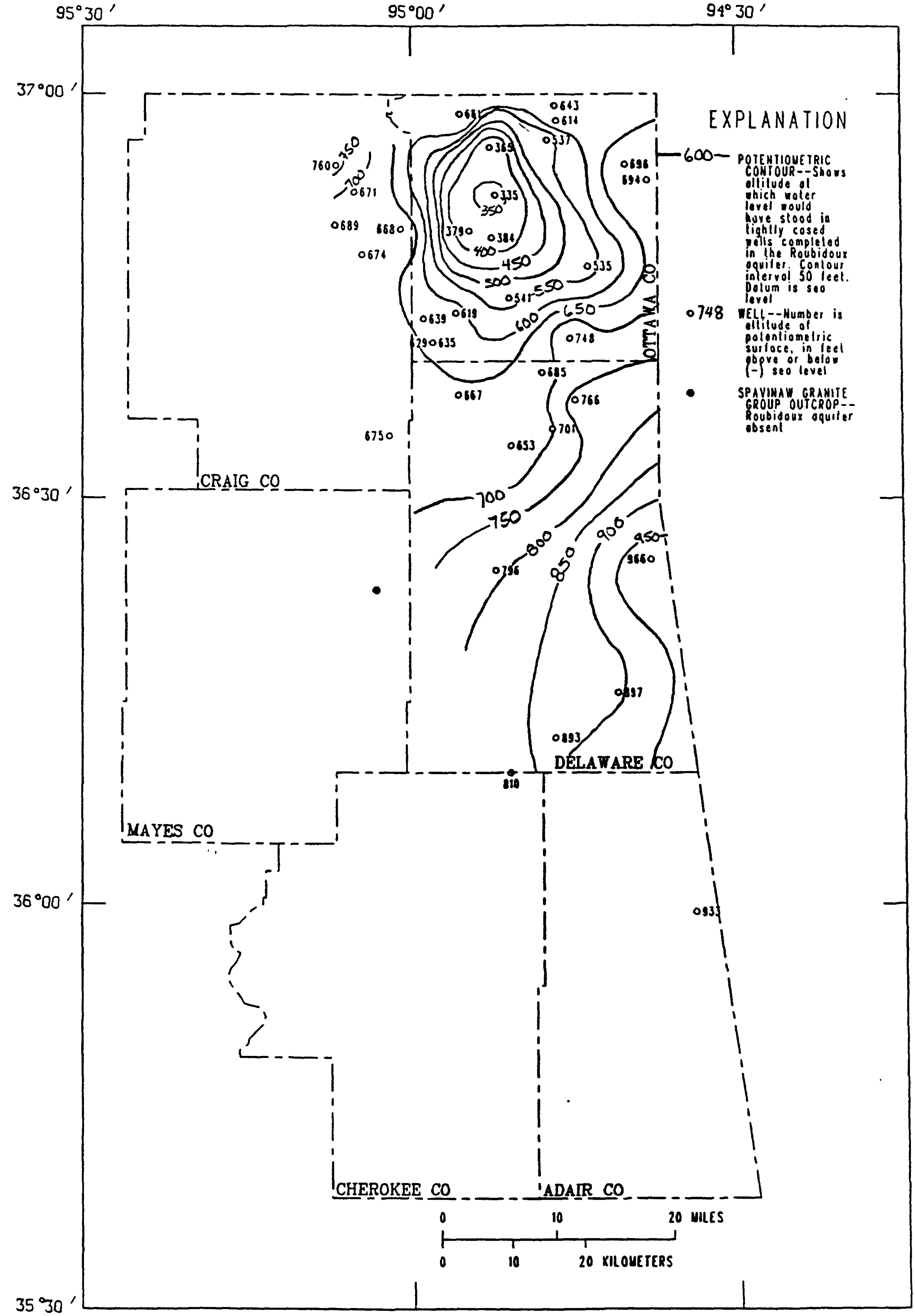

Figure 8.--Altitude of the potentiometric surface in the Roubidoux aquifer, 1981, in northeastern Oklahoma.

depth.

Water levels were measured periodically in selected wells completed in the Roubidoux aquifer to determine seasonal variations and long-term trends. Hydrographs for 2 wells in Craig County and 3 wells in Delaware County are shown in figure 9, and for 5 wells in Ottawa County are shown in figure 10. The water levels in all 10 wells were relatively stable during the 2-year period they were measured. None of the wells exhibited large seasonal variations or substantial trends in water levels.

The long-term trend of the water level in a well completed in the Roubidoux aquifer located in the City of Miami (28N-23E-30 DBC 1) is shown in figure 11. The water level in this well has been monitored sporadically since 1907. The well flowed when it was drilled, and measurements discussed in Reed, Schoff, and Branson (1955) place the water level at 28 feet above land surface prior to 1907. The water level in the well was relatively stable between 1972 and 1986 at an approximate depth of 440 feet below land surface (corresponding to an altitude of 330 feet). Water levels in the well began to rise in 1986, at about the time the B.F. Goodrich Company ceased its manufacturing operation in Miami.

Specific Capacity

Specific capacity is one measure of a well's ability to yield water. Specific capacity is computed by dividing the well yield, commonly measured in gallons per minute, by the drawdown, commonly measured in feet. Specific capacity is a function of the hydraulic characteristics of the well and the geohydrologic units in which the well is completed. In general, larger diameter wells will have a greater specific capacity than smaller diameter wells completed in the same aquifer. For wells of the same diameter and constructed in a similar manner, a well with a greater specific capacity indicates a greater aquifer transmissivity than a well with a lesser specific capacity.

The specific capacity of wells completed in the Roubidoux aquifer range from 0.29 to 18.50 gallons per minute per foot of drawdown (table 3). The wells that were tested for specific capacity were pumped at rates that ranged from 102 to 1,016 gallons per minute. Many factors contribute to the large range in specific capacity:

(1) The specific-capacity tests were not run for the same length of time. Shorter specific-capacity tests give greater specific capacities than longer tests because drawdown commonly increases with time.

(2) The thickness of the Roubidoux aquifer varies at each well. Wells completed in thicker sections of the aquifer may intersect a greater amount of permeable aquifer, which tends to increase the specific capacity of the well.

(3) The rocks constituting the Roubidoux aquifer are fractured. It is not known what percentage of the water moving through the aquifer moves through fractures and what percentage moves through the voids between

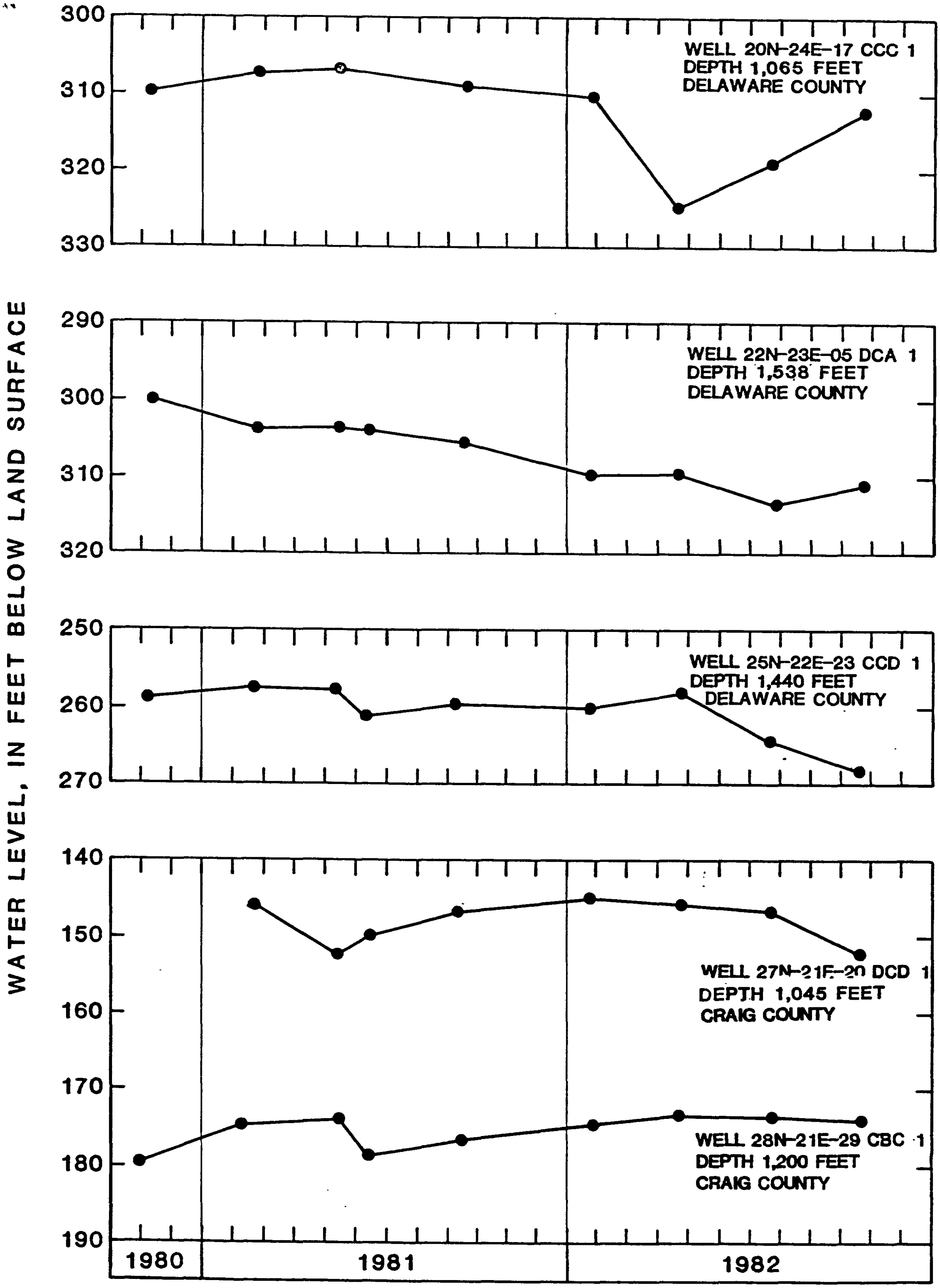

Figure 9.—Hydrographs of selected wells in Craig and Delaware Counties, Oklahoma.

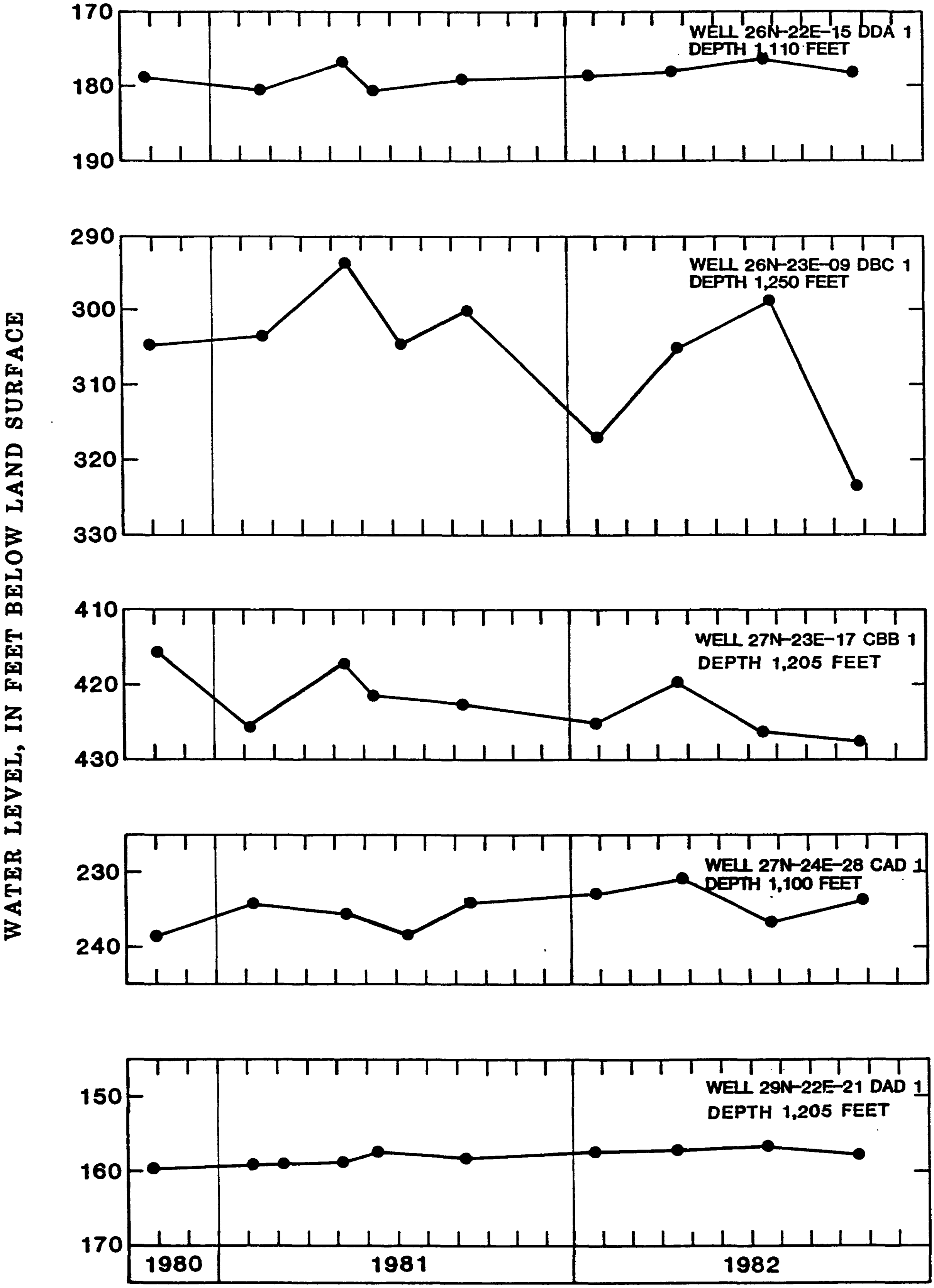

Figure 10.—Hydrographs of selected wells in Ottawa County, Oklahoma.

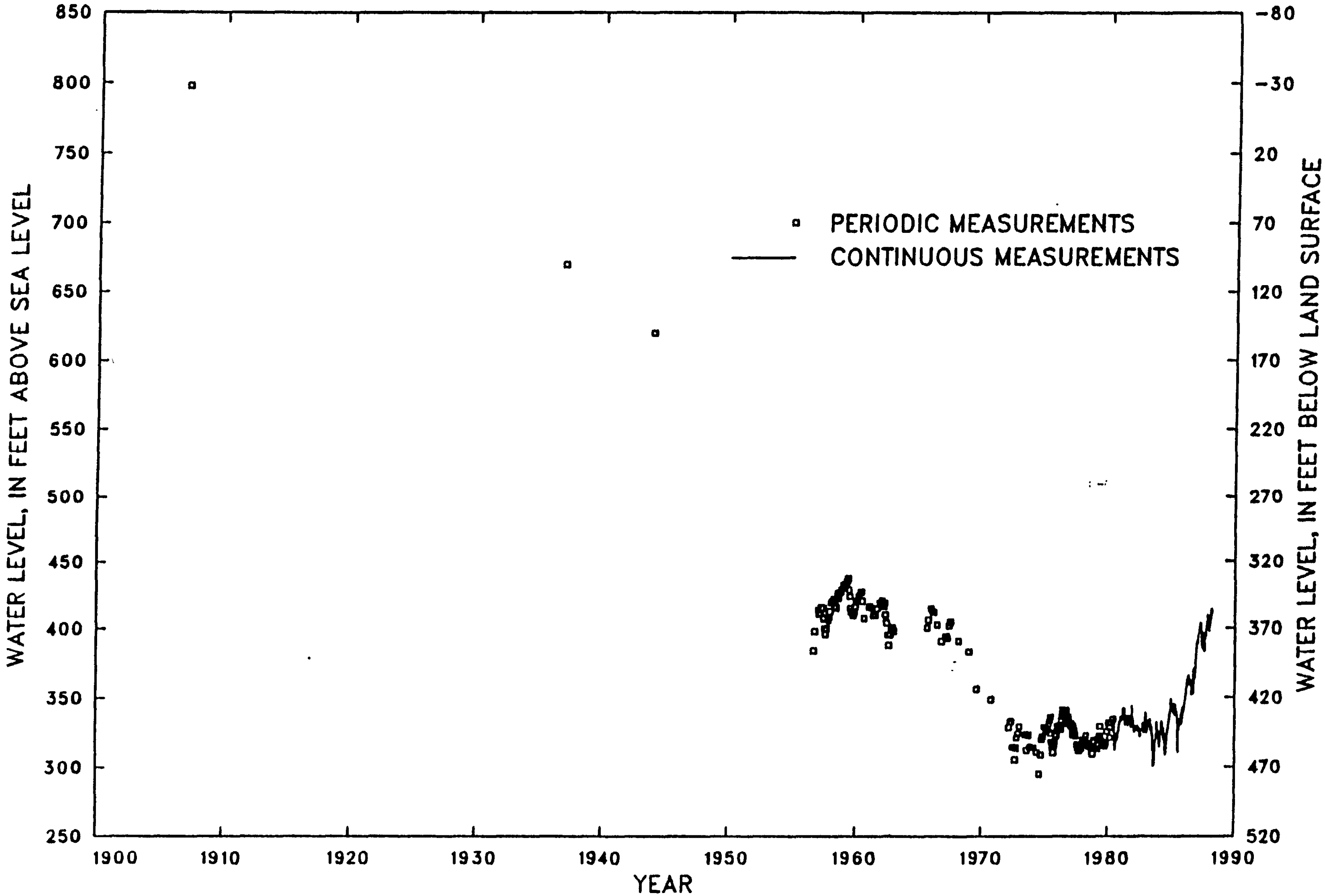

Figure 11.--Hydrograph of well 28N-23E-30 DBC 1
at Miami, Oklahoma

grains. Water moving through fractures tends to increase the effective diameter of the well, which increases the specific capacity.

(4) Well completion techniques are different for each individual well. Many of the wells were acidized and "shot," that is, nitroglycerine was detonated within the well bore to increase fracturing, which increases the effective diameter of the well.

All these factors contribute to the wide range in specific capacities.

Aquifer Test

An aquifer test to determine the transmissivity and storage coefficient of the Roubidoux aquifer was conducted on wells at the B.F. Goodrich Company plant in Miami, Oklahoma, in 1944. The test was conducted by pumping a production well and measuring the decline in water levels in another well at a distance of 2,575 feet. The aquifer test was analyzed by Reed, Schoff, and Branson (1955) using the Theis type-curve solution (Theis, 1935). However, the data did not fit the Theis curve very well. Reed, Schoff, and Branson (1955) speculated that the boundary faults associated with the Miami Trough may serve to reduce the transmissivity of the Roubidoux aquifer, and thus caused the the poor fit between the measured drawdown and the Theis curve. Another possible explanation for why the fit to the Theis type curve was poor is that water was released from storage in the confining layer, which violates an assumption of the Theis type-curve solution.

Since the work of Reed, Schoff, and Branson (1955), a type-curve solution has been developed that accounts for water released from storage in a confining layer (Hantush, 1960, as reported in Reed, 1980). Using this type-curve solution, the 1944 test was analyzed to determine the transmissivity and storage coefficient of the Roubidoux aquifer, and the product of the leakance (the ratio of vertical hydraulic conductivity to the thickness of the confining layer, K'/b') and the storage coefficient of the confining layer (S'). The results are shown below:

Transmissivity:	600 ft^2/day
Storage coefficient:	1.0×10^{-5}
K'S'/b':	1.3×10^{-8} day^{-1}

Drawdowns were calculated by substituting these estimates of the aquifer's properties into the analytical solution in Reed (1980). A comparison between the measured time-drawdown data and the computed time-drawdown values for the B.F. Goodrich aquifer test is shown in figure 12.

The storage coefficient computed above is smaller than would be expected for an aquifer as thick as the Roubidoux. The storage

Table 3.--*Summary of specific capacity of selected wells completed in the Roubidoux aquifer in northeastern Oklahoma*

[gpm, gallons per minute; gpm/ft, (gallons per minute) per foot; --, indicates no data are available]

Local identifier	Well Depth (feet)	Yield (gpm)	Time (hours)	Drawdown (feet)	Specific capacity (gpm/ft)
		ADAIR COUNTY			
18N-26E-31 DAD 1	1,510	150	7.0	296	0.51
		CRAIG COUNTY			
27N-21E-12 CCB 1	1,352	305	20.0	72	4.24
27N-21E-20 DCD 1	1,045	110	48.0	380	0.29
		DELAWARE COUNTY			
20N-24E-17 CCC 1	1,065	260	48.0	250	1.04
21N-25E-31 BBB 1	1,350	135	48.0	200	0.68
22N-23E-05 DCA 1	1,538	102	12.0	330	0.31
22N-23E-11 BBB 1	1,442	200	--	173	1.16
24N-23E-15 BBC 1	1,145	275	48.0	183	1.50
25N-22E-23 CCD 1	1,440	302	12.0	129	2.34
		OTTAWA COUNTY			
26N-22E-15 DDA 1	1,110	110	50.0	325	0.34
27N-23E-17 CBB 1	1,205	192	24.0	84	2.29
27N-25E-09 CAC 1	1,247	407	8.0	263	1.55
28N-23E-20 BCB 1	1,250	1,016	0.5	150	6.77
28N-23E-33 BAB 1	1,526	934	4.0	264	3.54
28N-23E-36 CCC 1	1,190	185	4.0	10	18.50
28N-25E-20 CAA 1	1,418	200	2.0	35	5.71
29N-22E-21 DAD 1	1,205	300	7.5	30	10.00
29N-23E-13 DAC 1	1,115	150	--	138	1.09

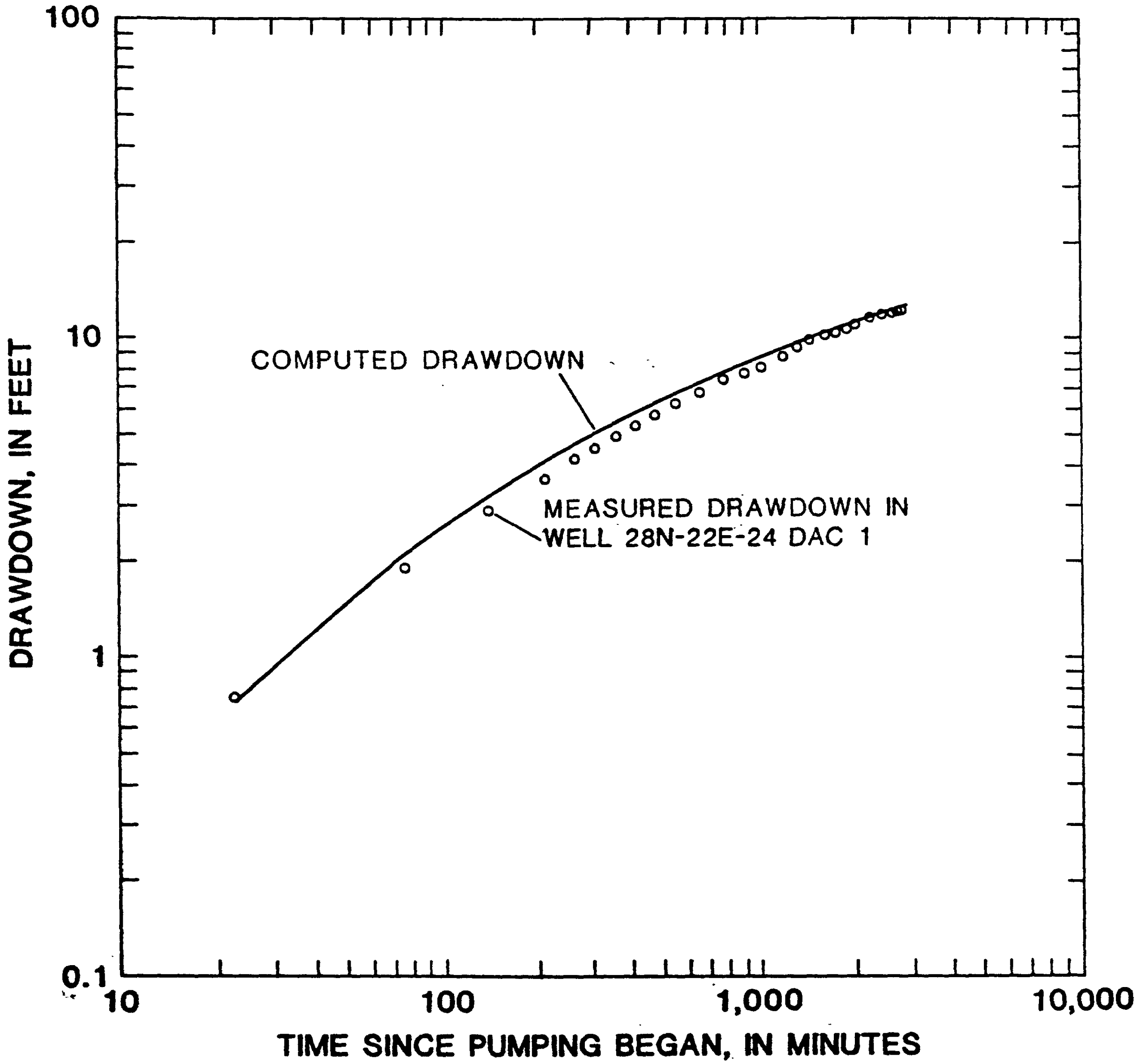

Figure 12.--Measured and computed drawdown for the Roubidoux aquifer test at Miami in 1944.

could not be determined independently. Because the pumping and observation wells are open to the Cotter and Jefferson City Dolomites, it is possible that these geologic units are acting as part of the aquifer. It is also possible that if the Cotter and Jefferson City Dolomites have only small transmissivities, they may be part of the confining layer.

Digital-Model Analysis

Digital-model simulations of the cone of depression in the potentiometric surface in the vicinity of the City of Miami were used to determine the transmissivity of the Roubidoux aquifer and the hydraulic characteristics of the overlying confining layer. Water levels within the cone of depression were relatively stable in 1981 (as indicated by the well located in 28N-23E-30 DBC 1, illustrated in figure 11), which indicates that the flow system in the vicinity of the cone was in an approximate steady-state condition at that time. This steady-state condition simplifies the modeling process by eliminating from the analysis any consideration of storage changes. The digital-model simulations were used to provide an estimate of the transmissivity of the aquifer and to provide a range for the vertical hydraulic conductivity of the confining layer.

Steady-state conditions imply that outflows of water are equal to inflows of water, with no change in the amount of water in storage. In the case of the cone of depression near Miami, outflow is the withdrawal of ground water from wells in and near Miami. The inflow of water could occur by two different processes:

(1) The lateral flow of water through the Roubidoux aquifer to the cone of depression. In this case, water moves laterally through the aquifer from areas of higher head outside of the cone of depression toward the lower head within the cone.

(2) The vertical flow of water into the cone of depression in the Roubidoux aquifer through confining layers from overlying geohydrologic units. Heads in the Roubidoux have been lowered by ground-water withdrawals, and heads are higher in the overlying geohydrologic units (such as the Boone Formation). Water flows downward from the higher heads in the overlying geohydrologic units through the confining layer to the Roubidoux aquifer. Such vertical flow through confining layers is generally referred to as leakage.

The volume of lateral ground-water flow through the aquifer and vertical flow as downward leakage is dependent on the transmissivity of the aquifer, the vertical hydraulic conductivity and thickness of the confining layer, and the distribution of head in the aquifer and the overlying geohydrologic units. Some volume of water probably is entering the cone of depression by both processes, but the proportions are unknown.

A digital ground-water flow model was used to evaluate the various hydraulic factors that control ground-water flow. By adjusting the digital-model parameters that correspond to the hydraulic characteristics of aquifers and confining layers, the distribution of head was simulated. The coefficient of an aquifer can be expressed as:

$$S = (Ssw + Ssa)b \qquad (1)$$

where:

S = aquifer storage coefficient (dimensionless)
Ssw = specific storage due to elasticity of water
Ssa = specific storage due to elasticity of aquifer skeleton
b = the thickness of the aquifer (ft)

This can be written:

$$S = \left(\frac{nAw}{Ew} + \frac{Aw}{Ea}\right)b \qquad (2)$$

where:
n = porosity of the aquifer (dimensionless)
Aw = the specific weight of water (lbs/ft^3)
Ew = the modulus of elasticity of water (lbs/ft^2)
Ea = the modulus of elasticity of the aquifer (lbs/ft^2)

Although the modulus of elasticity of the Roubidoux aquifer is not known, the modulus of elasticity of water has been measured, and it is possible to compute a minimum storage coefficient for an aquifer based on the expansion of the water alone. The specific weight of water is 62.4 lbs/ft^3 and the modulus of elasticity of water is approximately 4.6×10^7 lbs/ft^2. If the porosity of the Roubidoux aquifer is 0.01 (a minimum likely value), the storage coefficient per foot of aquifer, or specific storage, is 1.4×10^{-8} ft^{-1}; if the porosity of the aquifer is 0.3 (the maximum likely value), the specific storage is 4.1×10^{-7} ft^{-1}. The component of storage due to the compression of each foot of aquifer would be added to this number, and multiplied by the thickness of the formation. Therefore, if the Roubidoux aquifer were completely inelastic (a very unlikely possibility) and the second term in equation (2) were zero, the modulus of elasticity of water indicates that the Roubidoux aquifer is between 73.7 (n=0.01) and 2.46 (n=0.3) feet thick. Figure 4 shows the Roubidoux Formation (the principal geohydrologic unit in the Roubidoux aquifer) is over 150 feet thick at the site of the aquifer test. The source of this discrepancy is not understood.

The characteristics of the confining layer (K'S'/b') determined by the 1944 aquifer test were left as a product, because the analytical solution provides no means of determining any of these numbers individually. A range for the leakance of the confining layer (K'/b') can be calculated based on a range of plausible values for the storage coefficient of the confining layer (S'). The storage coefficient could range from 0.3 (the upper limit of porosity) to 1.0×10^{-7} (a storage coefficient based on the modulus of elasticity of water alone), thus the leakance of the confining layer could range from 4.3×10^{-8} to 0.13 day^{-1}. The thickness of the confining layer combinations of digital-model parameters that produced acceptable agreement between computed and measured heads are possible descriptions of the corresponding combinations of aquifer and confining layer hydraulic properties. Realizing that there is no unique solution to the infinite number of possible combinations of aquifer and confining layer characteristics that can produce a given head distribution, the digital model was used to evaluate certain combinations of parameters. Although a digital model does not provide a unique solution, it does provide a range of hydraulic characteristics that are likely to occur in the ground-water flow system.

In some investigations, digital models undergo an extensive calibration and verification process, and the models are used to simulate many aspects of the ground-water flow system. This was not done for the digital model discussed here. No attempt was made to undertake a complete model analysis of the ground-water flow system in northeastern Oklahoma. The objective of the digital-model simulation of the cone of depression near Miami was to establish ranges for the hydraulic properties of the aquifer and confining layer.

The digital-model code used was that of the U.S. Geological Survey's modular finite-difference model (McDonald and Harbaugh, 1984). The digital-model grid was established using 40 columns, 40 rows, and 2 layers. The lower layer represented the Roubidoux aquifer and the upper layer represented the overlying Boone Formation. An intervening confining layer, representing the Chattanooga Shale and possibly including the Cotter and Jefferson City Dolomites, was represented by the leakance between the upper and lower layers, but not by an actual layer in the digital model. Because the Boone Formation receives large amounts of recharge, and discharges most of the recharge to streams, which will maintain heads at a relatively constant level, the upper layer was assigned to be constant head.

The grid spacing in the model in the x and y directions was variable, with a fine mesh in the center of the digital model, which represented the center of the cone of depression, and a grid which became gradually coarser toward the outer region of the zone of simulation. The smallest grid spacing in the center of the zone of simulation was 1 mile, and the largest grid spacing at the edge of the zone of simulation was 4.3 miles.

Various combinations of aquifer characteristics and boundary conditions were assigned to the digital model to simulate the measured head distribution. The goodness of fit between measured and computed heads in the Roubidoux aquifer was measured by the mean head difference between measured and computed heads and the mean of the absolute value of head difference between measured and computed heads at nodes in Ottawa County. Only those nodes that correspond to the area that represents Ottawa County in the flow model were used in the computations, because the density of head data is greatest in that county. Because the goodness of fit terms are awkward to refer to, they are abbreviated as MHD for the mean head difference between measured and computed heads, and MAVHD for the mean of the absolute value of head difference between measured and computed heads.

The MHD was computed by summing the difference between measured and computed head at each node and dividing by the total number of nodes. Ideally, the MHD should be reduced to zero. A zero MHD indicates that deviation between measured and computed heads is, on the average, zero, and that positive differences are balanced by negative differences. The MAVHD was computed by summing the absolute value of the difference between measured and computed heads at each node and dividing by the number of nodes. During the modeling process, the MAVHD should be minimized, indicating that the differences between measured and computed heads are small. Ideally, the MAVHD should be reduced to the estimated error of the measured heads. The estimated error for heads measured in the Roubidoux aquifer in 1981 is large, probably greater than 50 feet. Part of this error is due to the altitude of the wells being estimated from topographic maps, which could introduce an estimated error of plus or minus 10 feet (the contour interval of the map). Many of the wells in which the water levels were measured are operational water-supply wells, and were affected by pumping prior to the water-level measurements from which heads were calculated. Wells pumping close to the well in which the water-level measurements were made also affected the measured heads. An additional error was introduced by the open-borehole nature of wells in the Roubidoux. The measured head in the well were somewhere between the highest and lowest heads of the formations within the open interval in the well, which could vary by many tens of feet in an aquifer with significant vertical flow.

Another condition that ideally should be obtained during the modeling process is that the errors between computed and measured heads should be normally distributed around the mean. This is an indication that the errors are random, not systematic.

Three different conceptual models were tested with the digital-model simulations:

Model 1: Water pumped from the cone of depression is entering the cone only as lateral flow through the Roubidoux aquifer. This conceptual model was tested by setting the leakance of the confining layer equal to zero, which allowed no vertical leakage, and by setting constant-head nodes along the perimeter of the digital model, which allowed an unlimited amount of lateral flow through the Roubidoux aquifer. The transmissivity of the layer that corresponded to the Roubidoux aquifer was adjusted to produce the best fit between measured and computed head distributions.

Model 2: Water pumped from the cone of depression is entering the cone only as vertical flow through the confining layer. This conceptual model was tested by removing the constant-head nodes from the perimeter of the digital model, in effect surrounding the model with an impermeable barrier. Leakance was set to a positive value and adjusted, along with the transmissivity of the aquifer, to obtain the best fit between measured and computed head distribution.

Model 3: Water pumped from the cone of depression is entering the cone by a combination of lateral flow through the Roubidoux aquifer and vertical flow through the confining layer. Constant-head nodes were set around the perimeter of the digital model and leakance was adjusted, along with transmissivity, to obtain the best fit between measured and computed head distribution. By using both constant-head nodes and setting leakance to a positive value, both lateral flow through the Roubidoux and vertical leakage through the confining layer were simulated.

Figure 13 shows that in model 1 (no vertical leakage) an MHD of zero was achieved with the first model using a transmissivity of 700 ft^2/day. Figure 14 shows that a minimum MAVHD of 62.7 feet was achieved with a transmissivity of 660 ft^2/day. Examination of the residuals (the differences between computed and measured heads at each model node) shows that the errors are skewed. A smaller number of nodes with large positive residuals (a positive sign means that computed head is lower than measured head) are balanced by a larger number of nodes with small negative residuals. The negative residuals tend to occur in the center of the cone of depression and the positive differences occur along the periphery.

Although the minimum MAVHD of 62.7 feet is slightly larger than the estimated error in the measured heads of 50 feet, it is close enough to consider model 1 a reasonable representation of the aquifer system. That is, the conceptual model of all the water entering the cone of depression as lateral flow and not as vertical leakage is a plausible model. In addition, the best fit transmissivities from model 1 of 660 and 700 ft^2/day are close to the 600 ft^2/day calculated from the aquifer test at the B.F. Goodrich plant.

The results of model 2 (vertical leakage as the source of water and no lateral flow of water into the cone of depression) are shown in figures 15 and 16. These figures are more complicated than figures 13 and 14 because both the transmissivity of the Roubidoux aquifer and the leakance of the confining layer are being varied. Figure 15 shows that a best-fit MHD of zero was achieved with all values for leakance that were tried. Figure 16 shows that the minimum MAVHD of 59.9 feet was achieved with an aquifer transmissivity of 400 ft^2/day and with a leakance of 7.4×10^{-8} day^{-1}. With an aquifer transmissivity of 400 ft^2/day, the best-fit mean of zero was achieved with a leakance of 7.7×10^{-8} day^{-1}, as shown in figure 15. The residuals are less skewed for model 2 than for model 1. Model 2 is better than model 1 at reproducing the measured heads because the MAVHD is about 3 feet less for model 2 than for model 1 and because the residuals are less skewed. The best-fit transmissivity of 400 ft^2/day for model 2 is close to the 600 ft^2/day transmissivity calculated from the B.F. Goodrich aquifer test.

The results of model 3 are shown in figures 17 and 18. Model 3 is a combination of models 1 and 2, because in model 3 water can enter the cone of depression both as lateral flow and vertical leakage. Figure 17 shows that for all values of aquifer transmissivity and leakance a MHD of zero was achieved. Figure 18 shows that the best-fit minimum MAVHD between measured

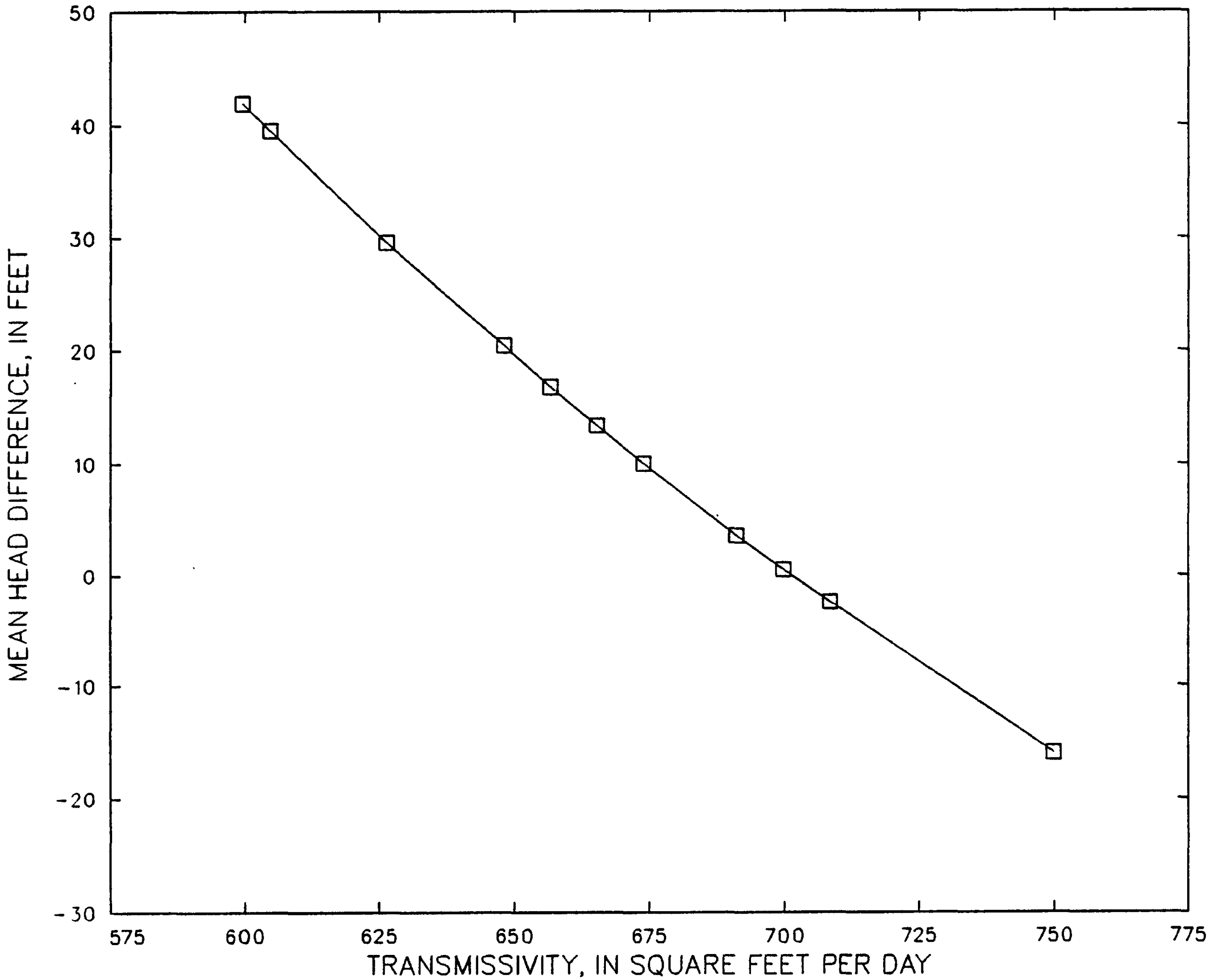

Figure 13.--Relation of transmissivity to mean head difference for model 1 (lateral flow only).

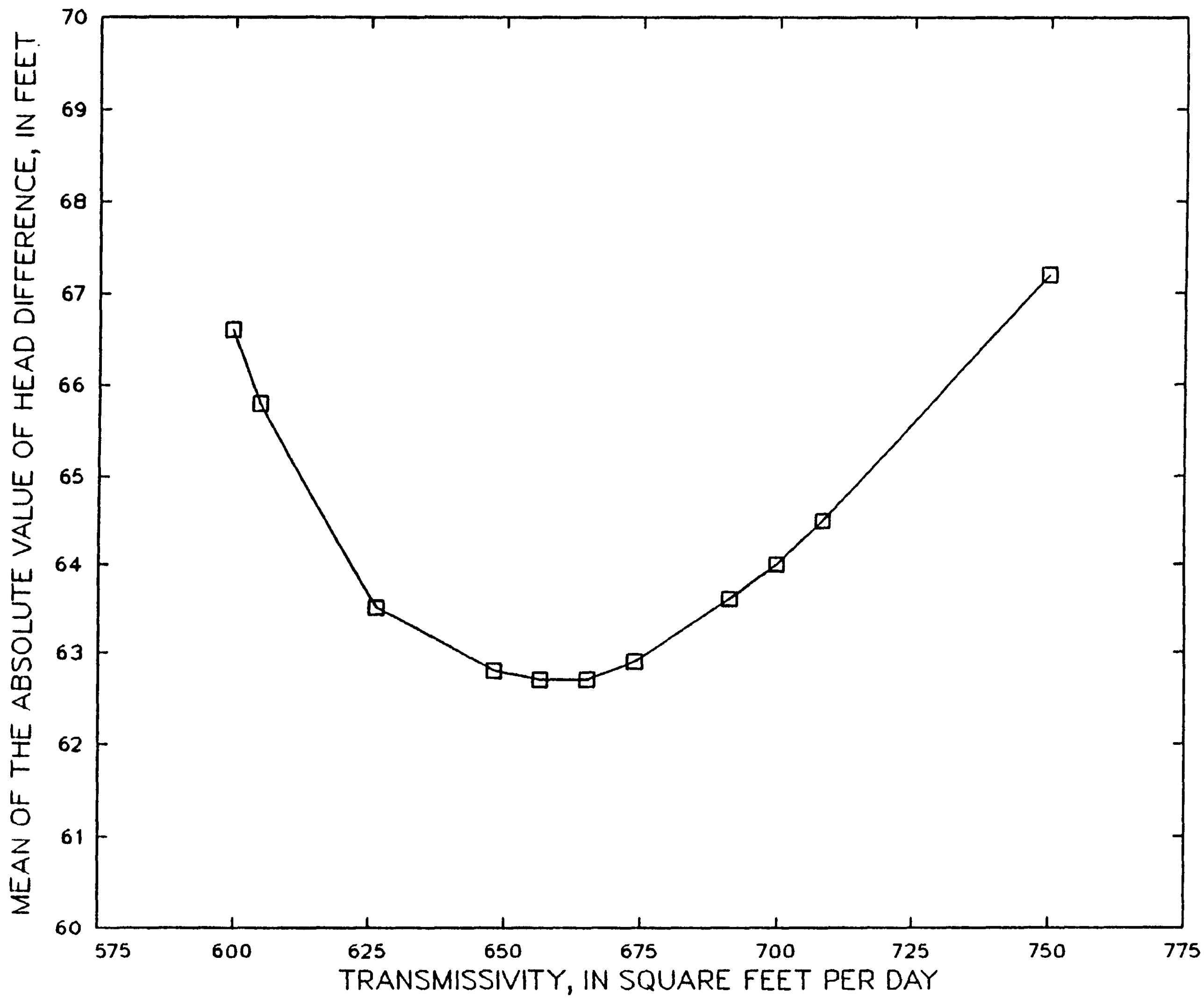

Figure 14.--Relation of transmissivity to the mean of the absolute value of head difference for model 1 (lateral flow only).

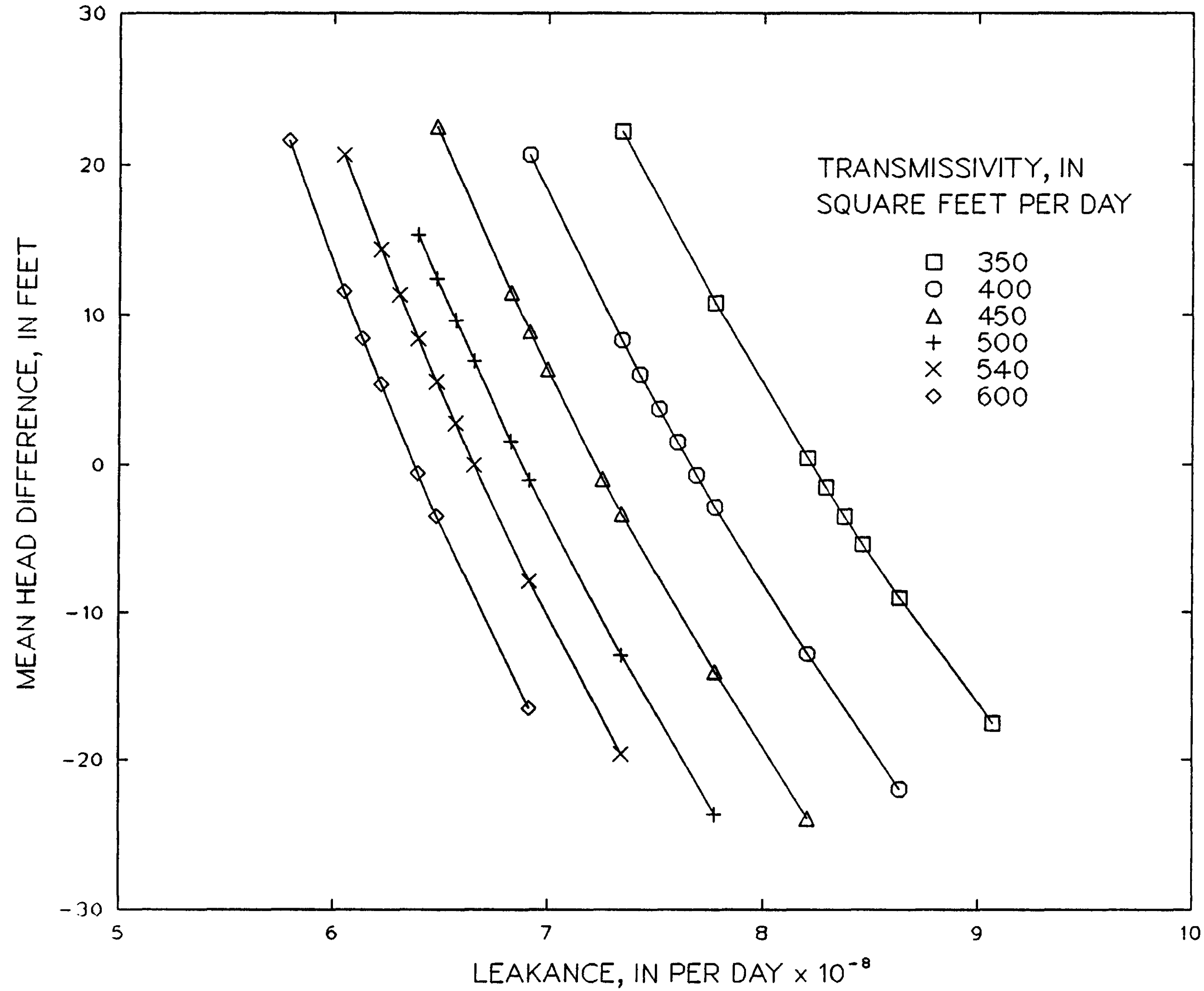

Figure 15.--Relation of transmissivity and leakance to mean head difference for model 2 (vertical flow only).

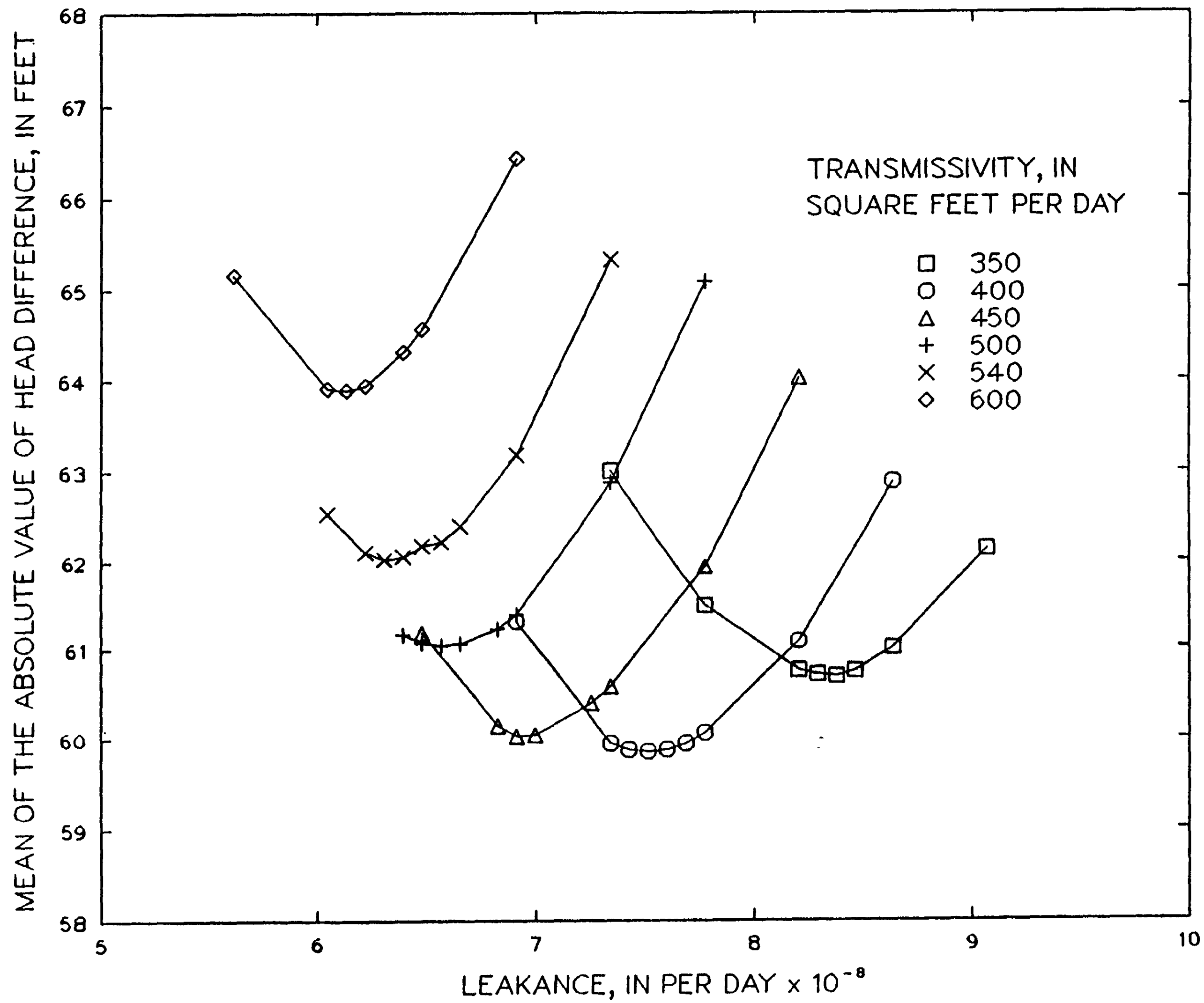

Figure 16.--Relation of transmissivity and leakance to the mean of the absolute value of head difference for model 2 (vertical flow only).

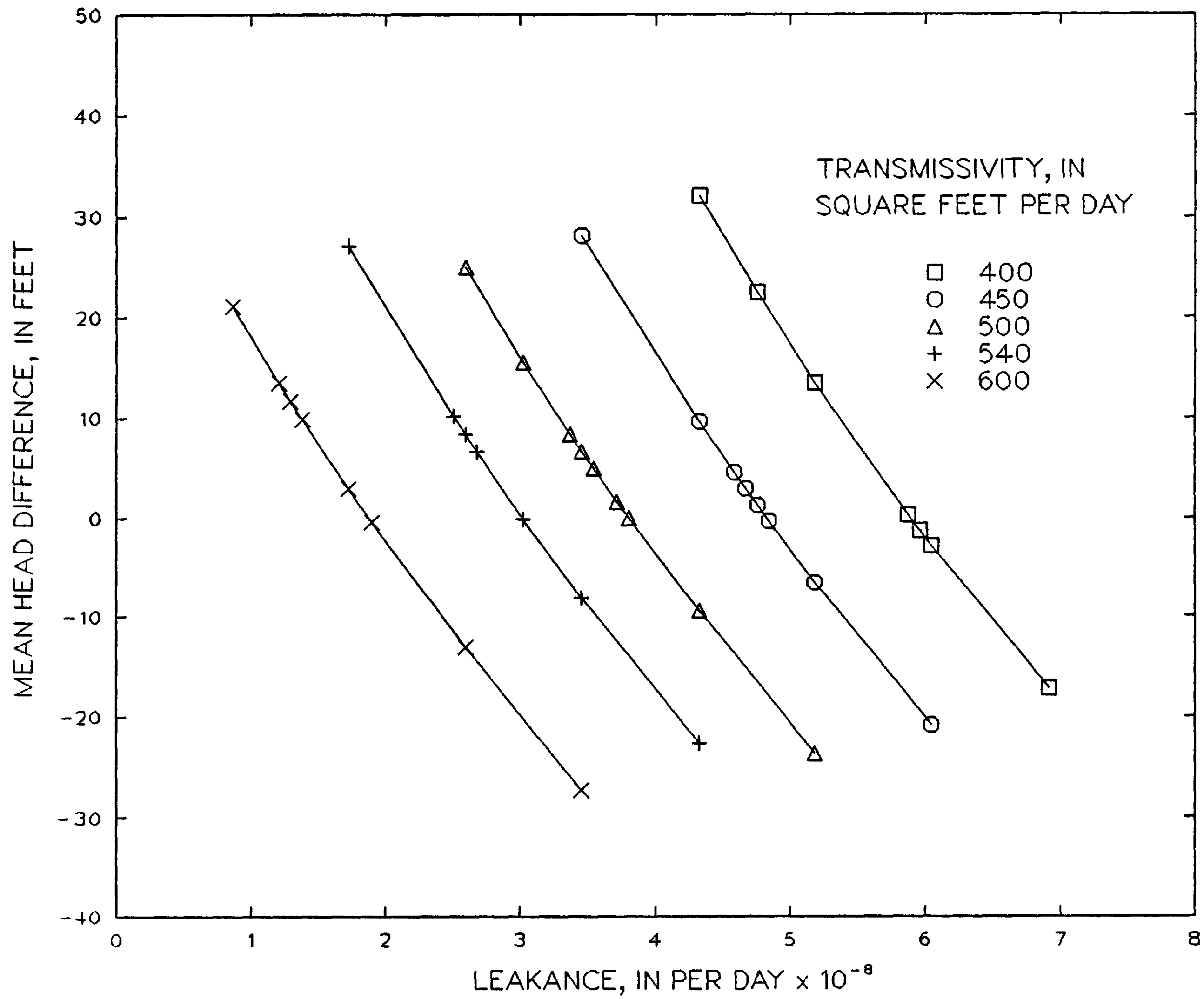

Figure 17.--Relation of transmissivity and leakance to mean head difference for model 3 (lateral and vertical flow)

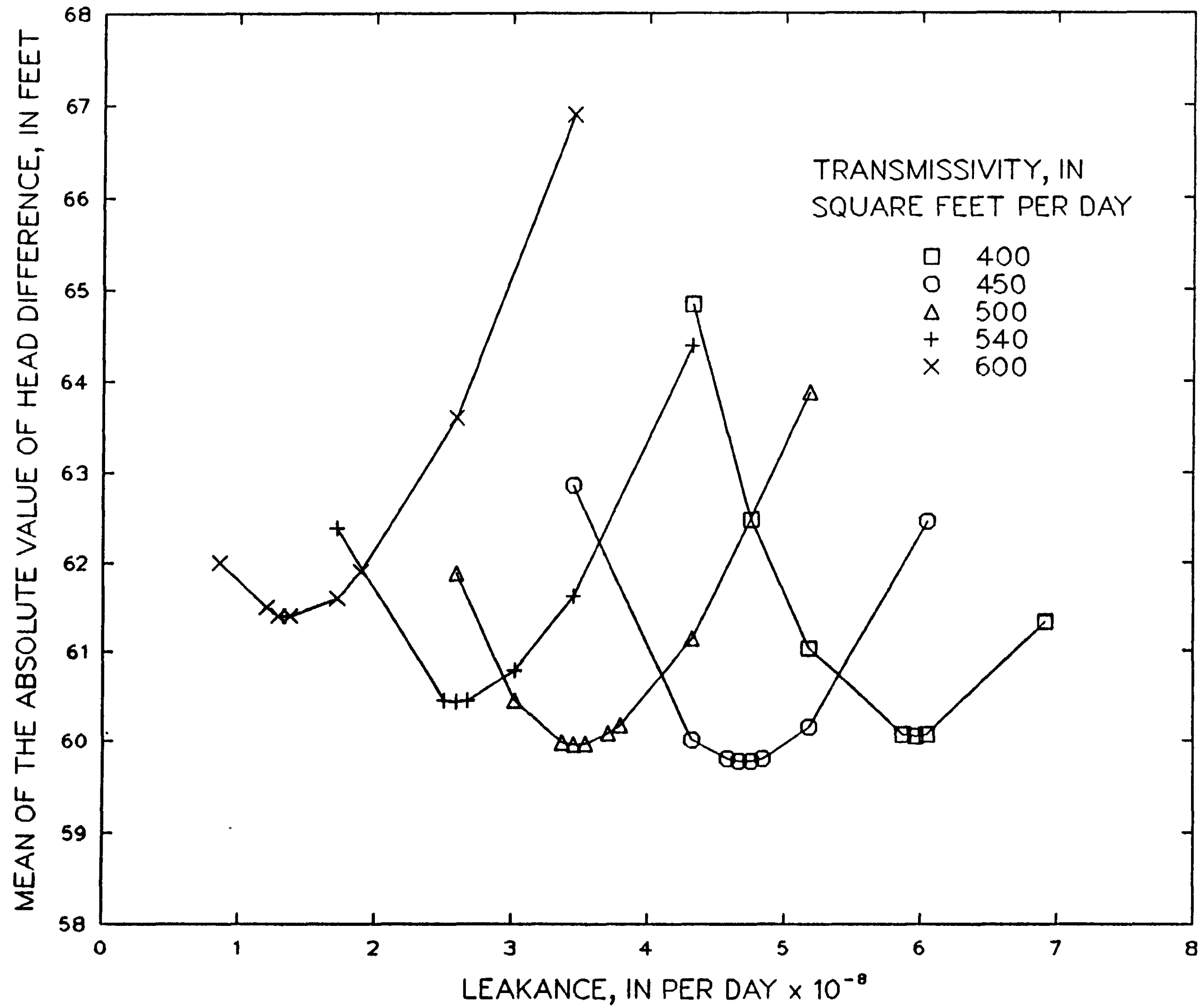

Figure 18.--Relation of transmissivity and leakance to the mean of the absolute value of head difference for model 3 (lateral and vertical flow).

and computed heads was 59.8 feet, obtained with an aquifer transmissivity of 450 ft^2/day and a leakance of 4.7×10^{-8} day^{-1} . With an aquifer transmissivity of 450 ft^2/day, the best-fit MHD of zero was achieved with a leakance of 4.8×10^{-8}, as shown in figure 17. Because the MAVHD is 0.1 foot less for model 3 than for model 2, and the best fits as measured by the MHD and the MAVHD occur at almost the same aquifer and confining layer properties, model 3 is a very slight improvement over model 2 in reproducing the measured heads.

The results of the three different digital-model simulations place limits on the range of aquifer transmissivity and the leakance of the confining layer. In the 3 simulations, the aquifer transmissivity ranged from 400 to 700 ft^2/day, and the leakance ranged from 0 to 7.7×10^{-8} day^{-1}. This narrow range for aquifer transmissivity includes the transmissivity calculated from the B.F. Goodrich aquifer test. Because the aquifer transmissivity calculated by two independent methods was similar, it is inferred that the calculated transmissivities are a good estimate of the transmissivity of the Roubidoux aquifer in Ottawa County.

The leakance calculated from the digital-model simulations ranged from 0 to 7.7×10^{-8} day^{-1} , and the leakance calculated from the aquifer test ranged from 4.3×10^{-8} to 0.13 day^{-1} . Although the total range of leakance for the two methods is very large, the range where the values calculated by the two methods overlap is quite narrow. Only in this narrow range of leakance are the results for the flow model and the aquifer test analysis consistent with the measured data. This range, from 4.3×10^{-8} to 7.7×10^{-8} day^{-1} , is considered to be the best estimate for the leakance of the confining layer.

WATER QUALITY

A preliminary assessment of the chemical composition of water in the Roubidoux aquifer is presented in this section. The following topics are discussed: (1) Available chemical data for ground water, (2) major-ion chemistry of the aquifer, (3) summary statistics of water-quality data, (4) chemical data in comparison to water-quality standards, and (5) water-quality problems in the aquifer.

Available Chemical Data for Ground Water

The chemical data from samples of wells completed in the Roubidoux aquifer were obtained from three sources: (1) U.S. Geological Survey files, (2) the Oklahoma State Department of Health, and (3) the present study.

The U.S. Geological Survey files provided 37 analyses for samples collected from 1942 through 1969. Most of these data were analyses of ground-water samples from industrial and municipal wells. Generally the major ions, iron, and nitrate were analyzed to determine the suitability of the water for drinking-water supplies and industrial purposes.

Nineteen analyses were obtained from the Oklahoma State Department of Health for samples collected from 1977 through 1980. Samples from municipalities and rural water districts were analyzed for major ions and trace elements for which drinking water-regulations have been established. Six additional analyses of ground water from Quapaw's municipal wells were obtained for samples taken in 1981.

There were 208 analyses of ground-water samples collected as part of the present study. One hundred six analyses included only field measurements of pH, specific conductance, and temperature. The remaining 102 samples were analyzed for major ions, trace elements, and (or) radiochemical constituents, as well as for the field-measured parameters. Samples were generally obtained at the well head using the existing pumps. Some samples in 1982 and 1983 were obtained from wells without pumps using a down-hole sampling device. The device was opened by remote control so that samples could be collected from a specific depth within the well. Alkalinity was measured in the field and samples for other constituents were taken and preserved for subsequent laboratory analysis by the use of standard methods (Brown, Skougstad, and Fishman, 1970). The laboratory of the Oklahoma Geological Survey analyzed most of the major-ion and trace-element samples. Radioactive constituents were analyzed by the National Water Quality Laboratory of the U.S. Geological Survey in Denver, Colorado.

Tables 4, 5, and 6 present the data that were used in this report. Table 4 presents the concentrations of common constituents and physical properties of water, table 5 presents the concentrations of trace elements, and table 6 presents the concentrations of radioactive constituents.

Major-Ion Chemistry

The concentrations of major ions are shown on plate 1 along with the dissolved-solids concentrations for selected wells in the study unit. Each small diagram on plate 1 is a water-quality diagram, which displays the concentrations of all the major ions of a water sample in milliequivalents per liter (meq/L). The left side of a water-quality diagram shows, from top to bottom, the concentrations of calcium, magnesium, and sodium plus potassium. The right side shows, from top to bottom, the concentrations of bicarbonate, sulfate, and chloride.

A large change in major-ion chemistry occurs in ground water in the Roubidoux aquifer in northeast Oklahoma. In the easternmost part of the study unit, wells produce ground water with relatively small dissolved-solids concentrations, approximately 100 to 200 milligrams per liter (mg/L). The dominant ions generally are calcium, magnesium, and bicarbonate, which are derived from dissolution of dolomite and limestone in the aquifer. Concentrations of sodium, sulfate, and chloride generally are small.

In the westernmost part of the study unit, wells produce ground water with relatively large dissolved-solids concentrations, about 800 mg/L or greater. The dominant ions are sodium and chloride.

A transition zone in water composition occurs between the easternmost and westernmost parts of the study unit. Wells in the transition zone generally have intermediate chloride concentrations (25 to 250 mg/L or 0.7 to 7 meq/L) and intermediate dissolved-solids concentrations (200 to 800 mg/L). A few wells in this zone have increased sodium concentrations that are not accompanied by equally increased chloride concentrations. Ion-exchange reactions with clays probably are responsible for the increased sodium in these few wells. In the ion-exchange reaction, sodium is replaced by calcium and magnesium on ion-exchange sites in clays.

Sulfate concentrations in ground water generally are small in most of the study unit. Samples from a few wells in the vicinity of Picher and Quapaw had substantial sulfate concentrations. The sulfate concentrations are probably related to the abandoned lead and zinc mines of the Picher field. Water-quality problems related to the abandoned mines are discussed below.

Summary Statistics of Water-Quality Data

Selected statistics were determined from the available data. The most recent analysis for each constituent was used to represent each well. If analyses were available from different sampling depths from a single well, the most recent analysis for each constituent from each sampling depth of the well was included in the calculation of the statistics.

The data for many constituents include values that are reported as less than a specified minimum-reporting level. These values are called censored values. It is common to have several different minimum-reporting levels for a single chemical constituent because of differences in analytical methods. Percentiles below the largest minimum-reporting level can not be calculated accurately using standard methods. A procedure developed by Helsel and Cohn (1988) for calculating percentiles in data with one or more minimum-reporting levels was used to calculate percentiles for any constituent that had censored values. The procedure used a statistical model to calculate any percentiles that were less than the largest minimum-reporting level. In order to use the procedure, it also was necessary to eliminate any zero values. For those constituents with censored values, data that were reported as zero were set equal to the largest minimum-reporting level. If no censored data were present for a constituent, percentiles were calculated by standard methods. No percentiles were calculated if fewer than 20 analyses were available for a constituent.

The number of analyses, the largest minimum-reporting level, the minimum value, selected percentiles, and the maximum value for all of the constituents measured in the study unit are listed in table 7. The table also lists the method used to calculate the percentiles for each constituent. Because the samples are not evenly distributed areally and vertically, the statistics are only an approximate description of the overall water resource.

Many of the minimum values in table 7 are reported as less than the smallest minimum-reporting level for the constituent in the data set. Many percentiles calculated by the method of Helsel and Cohn (1988) are smaller than the smallest minimum-reporting level. The maximum values often greatly exceed the 95th percentile. Many of the maximum values are related to samples of ground water with very large sodium and chloride concentrations or ground water that is affected by the abandoned mines of the Picher mining area.

Comparison of Water-Quality Data to Drinking-Water Standards

Water-quality standards set by the primary and secondary drinking-water regulations of the U.S. Environmental Protection Agency (U.S. Environmental Protection Agency, 1986a and 1986b) are listed in table 8 for 20 inorganic and radiochemical constituents. The primary regulations set maximum contaminant levels (MCL's) to protect public health. The secondary regulations set secondary maximum contaminant levels (SMCL's) for aesthetic reasons related to public acceptance of drinking water. The regulations for MCL's and SMCL's apply only to public water systems and are not enforceable for domestic and other types of wells.

Table 8 lists the number of sites that have been sampled and the number of sites that have had at least one sample that exceeded the water-quality standard. Tabulations for two data sets are presented in table 8: (1) data set 1 included all analyses from all wells and (2) data set 2 excluded

Table 7.—*Summary statistics of selected chemical constituents*

[These statistics were calculated including only the most recent analysis for each constituent for each well. If analyses were available for different sampling depths from the same well, the most recent analysis for each constituent from each sampling depth of the well was included. Constituents and physical parameters: µS/cm, microsiemens per centimeter at 25 degrees Celcius; mg/L, milligrams per liter; µg/L, micrograms per liter; pCi/L, picocuries per liter. Method: 1, no censored data, ordinary percentile calculation; 2, censored data present, percentiles calculated using methods of Helsel and Cohn (1988); 3, no calculation, more than 80 percent of the data were censored; 4, no calculation, less than 20 analyses for the constituent. Largest MRL: largest minimum reporting level (percentiles less than this value were estimated using the methods of Helsel and Cohn (1988), percentiles greater than this value are the same as ordinary percentile calculation); –, no censored data for this constituent. Percentiles: –, indicates no statistic was calculated; Maximum value: –, indicates all data were censored for this constituent]

Constituents and properties	Method	Sample size	Largest MRL	Minimum value	Percentiles 5	25	50	75	95	Maximum value
Specific conductance (µS/cm at 25 deg C)	1	96	–	140	284	369	566	1,086	9,226	125,000
pH (standard units)	1	89	–	5.2	6.6	7.6	7.9	8.0	8.2	9.3
Hardness, total (mg/L as CaCO3)	1	81	–	58	78	123	142	171	291	1,550
Calcium, dissolved (mg/L as Ca)	1	78	–	14	18	29	32	42	83	440
Magnesium, dissolved (mg/L as Mg)	1	78	–	1.1	3.1	11	14	16	26	110
Sodium, total (mg/L as Na)	4	8	10	<10	–	–	–	–	–	60
Sodium, dissolved (mg/L as Na)	1	73	–	1.4	4.4	16	54	110	342	3,200
Sodium plus potassium, dissolved (mg/L as Na)	4	19	–	3.2	–	–	–	–	–	2,830
Potassium, dissolved (mg/L as K)	1	71	–	.4	1.2	2.1	2.8	3.7	8.1	25
Alkalinity, total (mg/L as CaCO3)	1	79	–	119	121	129	143	159	221	594
Alkalinity, total, laboratory (mg/L as CaCO3)	1	61	–	116	117	125	135	152	220	435
Sulfate, dissolved (mg/L as SO4)	1	94	–	3	7.4	13	16	22	97	2,000
Chloride, dissolved (mg/L as Cl)	1	93	1	<1	2.9	15	55	190	2,162	65,000
Fluoride, total (mg/L as F)	4	9	–	.2	–	–	–	–	–	.8
Fluoride, dissolved (mg/L as F)	1	84	–	.1	.1	.4	.7	1.4	4.1	13
Silica, dissolved (mg/L as SiO2)	1	71	–	7.4	8	9	10	10	13	36
Dissolved solids, residue at 180 deg C (mg/L)	1	86	–	88	143	200	290	519	3,994	113,000
Dissolved solids, residue at 105 deg C (mg/L)	4	8	–	153	–	–	–	–	–	718
Nitrogen, nitrate, dissolved (mg/L as N)	1	23	–	0	0	.01	.05	.2	.8	1.0
Nitrogen, nitrite plus nitrate, total (mg/L as N)	4	9	.5	.1	–	–	–	–	–	.1
Aluminum, dissolved (µg/L as Al)	3	80	100	<60	–	–	–	–	–	48,000
Arsenic, total (µg/L as As)	4	8	10	0	–	–	–	–	–	–
Arsenic, dissolved (µg/L as As)	3	64	10	<10	–	–	–	–	–	14
Barium, total (µg/L as Ba)	4	9	100	<100	–	–	–	–	–	100
Cadmium, total (µg/L as Cd)	4	10	2	<1	–	–	–	–	–	2
Cadmium, dissolved (µg/L as Cd)	3	80	4	<1	–	–	–	–	–	710
Chromium, total (µg/L as Cr)	4	9	10	<10	–	–	–	–	–	50
Chromium, dissolved (µg/L as Cr)	3	80	12	<1	–	–	–	–	–	23

Table 7.—*Summary statistics of selected chemical constituents*—Continued

Constituents and properties	Method	Sample size	Largest MRL	Minimum value	Percentiles 5	25	50	75	95	Maximum value
Copper, total recoverable (µg/L as Cu)	4	9	4	<4	–	–	–	–	–	35
Copper, dissolved (µg/L as Cu)	3	80	60	<12	–	–	–	–	–	320
Iron, total (µg/L as Fe)	2	21	100	0	1.1	8.7	37	154	8,030	8,700
Iron, dissolved (µg/L as Fe)	2	80	20	<8	2.7	30	60	160	9,580	260,000
Lead, total (µg/L as Pb)	4	10	20	<5	–	–	–	–	–	25
Lead, dissolved (µg/L as Pb)	3	78	10	<5	–	–	–	–	–	29
Manganese, total (µg/L as Mn)	4	10	20	<10	–	–	–	–	–	70
Manganese, dissolved (µg/L as Mn)	2	80	10	<2	0	.1	1.2	10	1,910	4,400
Mercury, total recoverable (µg/L as Hg)	4	9	.5	<.5	–	–	–	–	–	–
Mercury, dissolved (µg/L as Hg)	3	64	.5	<.5	–	–	–	–	–	.5
Molybdenum, dissolved (µg/L as Mo)	4	9	2	<1	–	–	–	–	–	–
Selenium, total (µg/L as Se)	4	9	5	<1	–	–	–	–	–	–
Silver, total (µg/L as Ag)	4	9	3	<2	–	–	–	–	–	3
Zinc, total (µg/L as Zn)	4	11	2	0	–	–	–	–	–	1,700
Zinc, dissolved (µg/L as Zn)	2	81	20	<10	.5	4.8	26	56	3,560	84,000
Alpha radioactivity, dissolved (pCi/L)	2	64	23.8	<2.9	.2	.8	2.3	6.6	27	57
Alpha radioactivity, suspended (pCi/L)	2	30	.4	.3	.1	.3	.4	.4	2.4	3.2
Alpha radioactivity, dissolved (µg/L as U natural)	2	64	35	<4.2	.2	1.1	3.3	9.8	40	84
Alpha radioactivity, suspended (µg/L as U natural)	3	61	.4	<.4	–	–	–	–	–	4.7
Beta radioactivity, dissolved (pCi/L as Cs-137)	2	64	13	<2	1	2.4	4.2	7.4	21	25
Beta radioactivity, suspended (pCi/L as Sr/Yt-90)	3	64	1.5	<.4	–	–	–	–	–	2.8
Beta radioactivity, suspended (pCi/L as Cs-137)	3	64	1.5	<.4	–	–	–	–	–	2.7
Beta radioactivity, dissolved (pCi/L as Sr/Yt-90)	2	64	12	<2	1	2.3	4	7.1	20	24
Radium-226, dissolved, planchet count (pCi/L)	4	9	–	3.4	–	–	–	–	–	14
Radium-228, dissolved (pCi/L)	4	9	3	<2	–	–	–	–	–	–

Table 8.—*Water-quality standards for inorganic constituents, number of wells that have been sampled, and number of wells with samples that have exceeded the standard*

[Number of wells and number of wells with samples that exceeded water-quality standards are tabulated for two data sets: Data set 1 includes all of the data; Data set 2 excludes analyses with dissolved solids greater than 5,000 milligrams per liter, analyses with specific conductance greater than 5,000 microsiemens per centimeter at 25 degrees Celcius, and analyses from wells in the Picher mining area. Water-quality standard: MCL, maximum contaminant level; SMCL, secondary maximum contaminant level; mg/L, milligrams per liter; ug/L, micrograms per liter; pCi/L, picocuries per liter]

Constiuent	Water-quality standard	Data set 1 Number of wells		Data set 2 Number of wells	
		Sampled	Exceeded water-quality standard	Sampled	Exceeded water-quality standard
pH, field (standard units)	6.5 SMCL	78	4	63	1
pH, field (standard units)	8.5 SMCL	78	4	63	3
Sulfate, dissolved (mg/L as SO4)	250 SMCL	84	3	68	0
Chloride, dissolved (mg/L as Cl)	250 SMCL	83	16	68	14
Fluoride (mg/L as F)	4 MCL	75	4	61	4
Dissolved solids (mg/L)	500 SMCL	77	19	64	16
Nitrate (mg/L as N)	10 MCL	37	0	27	0
Arsenic (ug/L as As)	50 MCL	64	0	53	0
Barium (ug/L as Ba)	1,000 MCL	10	0	6	0
Cadmium (ug/L as Cd)	10 MCL	71	4	56	0
Chromium (ug/L as Cr)	50 MCL	70	2	56	2
Copper (ug/L as Cu)	1,000 SMCL	70	0	56	0
Iron (ug/L as Fe)	300 SMCL	75	16	60	5
Lead (ug/L as Pb)	50 MCL	71	0	56	0
Manganese (ug/L as Mn)	50 SMCL	71	6	56	1
Mercury (ug/L as Hg)	2 MCL	64	0	53	0
Selenium (ug/L as Se)	10 MCL	10	0	6	0
Silver (ug/L as Ag)	50 MCL	10	0	6	0
Zinc (ug/L as Zn)	5,000 SMCL	72	2	57	0
Gross-alpha radioactivity (pCi/L)	15 MCL	64	9	53	9
Radium (pCi/L)	5 MCL	9	7	9	7

analyses with dissolved solids greater than 5,000 mg/L; analyses with specific conductance greater than 5,000 microsiemens per centimeter; and analyses from wells that are within the Picher mining area (all wells in township 29N-23E plus the wells of the City of Commerce). Data set 2 is intended to be more representative of the usable water in the Roubidoux aquifer that has not been affected by human activities.

The tabulation for data set 1 shows that no analyses of any ground-water samples have exceeded the water-quality standards for nitrate, arsenic, barium, copper, lead, mercury, selenium, or silver. The differences between data set 1 and data set 2 are related mostly to the analyses from wells in the mining area. These wells account for the increased number of analyses in data set 1 relative to data set 2 that exceeded the following standards: pH less than 6.5, sulfate, cadmium, iron, manganese, and zinc.

In data set 2, no analyses of ground-water samples exceeded the water-quality standards for sulfate, cadmium, or zinc, in addition to the constituents previously noted. Dissolved-solids and chloride concentrations exceeded the standards in 16 of 64 and 14 of 68 wells sampled, respectively. The large dissolved-solids concentrations were always caused by large concentrations of sodium and chloride. Sodium and chloride concentrations increase across the study unit to the point that water in the westernmost part is unsuitable for most uses. Few, if any, water wells are completed in the Roubidoux aquifer west of Range 20 East (plate 1).

A few analyses exceeded the SMCL's for pH, iron, and manganese (table 8, data set 2). However, the occurrences of these constituents at concentrations that exceed the SMCL's are not common. Furthermore, the SMCL's are not related to health considerations, so the occurrence of these constituents does not pose a hazard to human health.

The MCL for fluoride was exceeded in analyses of ground-water samples from four of 61 wells that were sampled (table 8, data set 2). The 4 wells with fluoride concentrations greater than 4 mg/L are in adjoining townships. Two of the wells were in the town of Bluejacket, T. 27 N., R. 21 E., and the other two were in T. 27 N., R. 22 E., and T. 27 N., R. 23 E. The MCL for chromium was exceeded in analyses of ground-water samples from 2 of 56 wells that were sampled (table 8, data set 2). The two wells with chromium concentrations greater than the MCL were in T. 26 N., R. 23 E. and T. 27 N., R. 22 E. The available data indicate that concentrations of fluoride and chromium that exceed the MCL's may occur in the Roubidoux aquifer, but occurrences are relatively rare.

Relatively large levels of gross-alpha radioactivity occur in the ground water of the Roubidoux aquifer. Gross-alpha radioactivity, including the contribution from uranium, exceeded 15 pCi/L (picocuries per liter) in 9 of 53 wells sampled (table 8, data set 2). The MCL for gross-alpha radioactivity is 15 pCi/L exclusive of the contribution from uranium. Uranium was not analyzed in any of the samples; hence, it is not possible to determine if any of the samples actually exceeded the MCL for gross-alpha radioactivity. If uranium radioactivity contributes a small part of the gross-alpha radioactivity, it is possible that the water from these nine wells exceeded the gross-alpha radioactivity MCL. If uranium radioactivity contributes a large part of gross-alpha radioactivity, ground water that exceeds the gross-alpha radioactivity MCL would be rare.

The MCL for radium is 5 pCi/L for the sum of radium-226 and radium-228 radioactivity. Seven wells that had large gross-alpha radioactivity and two wells that had large censored values for gross-alpha radioactivity were resampled and analyzed for radium-226 (an alpha emitter) and radium-228 (a beta emitter). Concentrations of radium-228 were reported as censored values in all nine samples. However, concentrations of radium-226 exceeded the 5-pCi/L MCL in samples from all seven of the wells that had samples with large uncensored gross-alpha radioactivity.

Water-Quality Problems

Three water-quality problems are apparent in the Roubidoux aquifer in northeast Oklahoma: (1) Contamination by mine water, (2) large concentrations of sodium and chloride, and (3) large concentrations of radium-226. In this section, the spatial occurrence of these problems is discussed.

Mine-Water Contamination

Lead and zinc sulfides were mined from the Boone Formation in the northeast part of the study unit from about 1900 until about 1970. The mines were dewatered during mining operations by extensive pumping, but later filled with water when pumping ceased. The compositions of the mine waters in the Boone Formation are detailed in Playton, Davis, and McClaflin (1980) and in Parkhurst (1987). Sulfate is the dominant anion in the mine waters, and calcium, magnesium, iron, and zinc are the dominant cations. Large concentrations of cadmium, copper, fluoride, lead, manganese, and nickel have been analyzed in some mine water.

Because the hydraulic head in the Boone Formation is higher than the head in the Roubidoux aquifer, water will tend to move from the mine workings in the Boone Formation downward through pores and fractures in the rock units, toward the Roubidoux aquifer. The Chattanooga Shale and the Northview Shale are stratigraphically below the Boone Formation, and have very small vertical hydraulic conductivity. Although they are not impervious, they could slow the downward movement of water. However, the two shale formations are absent in a large part of the the mining area.

Besides flow through the pores and fractures of the rock units, mine water could reach the Roubidoux aquifer through leaky well casings. According to Reed, Schoff, and Branson (1955), about 100 wells were drilled into the Roubidoux aquifer in the mining area to supply water for milling operations. Leaks in the casings at the level of the mine workings would allow movement of mine water down into the Roubidoux aquifer. Movement of this type was demonstrated in two abandoned wells in the mining area, 29N-23E-16 DDD 1 and 29N-23E-32 AAC 1. These wells were logged with a down-hole flowmeter and the data show downward water flow in both wells.

The flow rate in each well was estimated to be less than 2 gallons per minute. The U.S. Environmental Protection Agency has funded work to locate and plug any abandoned wells in the mining area that penetrate the Roubidoux aquifer. Both wells described here were plugged in 1984.

Several municipalities in the mining area have experienced water-quality problems related to the mines. In two of the public-supply wells for the City of Commerce, concentrations of sulfate, iron, zinc, and dissolved solids increased between July 1981 and October 1982. Repairs were made in the casings of these wells and the water quality returned to acceptable limits for public supply. The problems were apparently due to mine water entering the wells through leaks in the casings or through the grout seals of the wells.

Another municipality that has experienced water-quality problems related to the mines is Quapaw. When a water-supply well, 29N-23E-25 BDB 1, was completed in November 1977, the iron concentration in water from the well was about 100 ug/L (micrograms per liter) and the pH was 7.8. By July 1981, the pH was 7.0 and the iron concentrations was 20,000 ug/L. The well was abandoned and plugged. The large iron concentrations and lowered pH indicate mine-water contamination.

The background concentrations of sulfate in the Roubidoux aquifer are relatively low. Three samples from the Picher water-supply wells, which were taken between 1942 and 1951, had sulfate concentrations ranging from 11 to 18 mg/L. These concentrations are similar to the median concentration of 16 mg/L for all of the available data (table 7). Mine-water concentrations of sulfate are large, approximately 3,000 mg/L (Playton, Davis and McClaflin, 1980). If sulfate migrates into the Roubidoux aquifer, it is expected to be conservative (unreactive). Therefore, increasing sulfate concentration is an indicator of mine-water contamination. Samples taken during this study (1981 and 1982) from the Picher water-supply wells had sulfate concentrations ranging from 47 to 92 mg/L. The increase in sulfate concentrations between the early samples and the samples of this study indicate mine-water contamination. Iron concentrations in the samples of this study were slightly greater than the median, but no other trace elements showed increased concentrations. In 1985, one of Picher's three water-supply wells began producing water with large concentrations of sulfate, iron, and dissolved solids. This well was subsequently abandoned and a new well was drilled in a new location.

At present (1990), all instances of ground-water contamination by mine water can be explained by faulty seals or leaky casings in wells that pass through the zone of mine workings and down to the Roubidoux aquifer. All of the wells that have had problems with mine-water contamination are within the perimeter of the mining area. None of the data available to date indicate that mine water has migrated from the Boone Formation through the pores and fractures of the intervening geologic units to the Roubidoux aquifer.

Large Sodium and Chloride Concentrations

In the western part of the study unit, the large concentrations of sodium and chloride in ground water from the Roubidoux aquifer make the water unsuitable for most purposes. Farther west, in central Oklahoma, sodium and chloride concentrations approach the level of halite saturation (approximately 300,000 mg/L dissolved solids) in geologic units equivalent to the geologic units comprising the Roubidoux aquifer. Thus, the increase in dissolved-solids concentration, which was noted earlier in relation to water-quality standards, continues beyond the study unit into central Oklahoma.

In this report the part of the aquifer in which chloride increases from 25 mg/L to 250 mg/L is defined to be the transition zone. The position of this transition zone varies horizontally and vertically within the Roubidoux aquifer. Figure 19 shows a simplified map view of the areas where chloride is less than 25 mg/L or greater than 250 mg/L. The choice of threshold levels is arbitrary, but 250 mg/L was chosen because it is the SMCL for chloride and 25 mg/L was chosen because it is one-tenth of the SMCL.

Figure 19 does not describe the vertical component of the transition zone. Throughout the study unit, a well drilled to sufficient depth will encounter ground water with large concentrations of sodium and chloride. Well 28N-23E-20 BCD 1 in Miami was drilled in 1976 to a depth of 1,511 feet. In 1978, water from the well had a chloride concentration of 711 mg/L. The bottom 300 feet of the well were plugged, and the chloride concentration in the water decreased to 8 mg/L. An observation well in Miami, 28N-23E-30 DBC 1, was sampled with the down-hole sampler. The chloride concentration from the sample at 1,480 feet was 5,600 mg/L and from the sample at 800 feet was 65 mg/L. Data from the down-hole sampler are not completely reliable because it is not known whether the water standing in the well is representative of the formation at the same depth. Well 18N-26E-31 DAD 1 in Westville was drilled to a depth of 1,500 feet. The chloride concentration in water at a depth of 1,500 feet was 250 mg/L; chloride concentration in water at 1,175 feet was 5 mg/L (table 4). Based on the limited information from these three wells, the depth to the bottom of the transition zone is approximately 1,200 to 1,500 feet below land surface in the eastern part of the study unit.

In the northwestern part of the study unit in Craig County, most wells completed in the Roubidoux aquifer have chloride concentrations greater than 250 mg/L. Thus, the transition zone in the Roubidoux aquifer must occur east of these wells. In the northern part of the study unit, it is inferred that the position of the bottom of the transition zone must slope from above the top of the Roubidoux aquifer in eastern Craig County and western Ottawa County to below the base of the Roubidoux aquifer in central Ottawa County.

In the central and southern part of the study unit, there are very few analyses. One analysis of water from a well in Pryor that was completed in the undivided Arbuckle Group had a chloride concentration of 3,925 mg/L (Smith, 1942). The formations comprising the Roubidoux aquifer are stratigraphically equivalent to the upper part of the Arbuckle Group; thus,

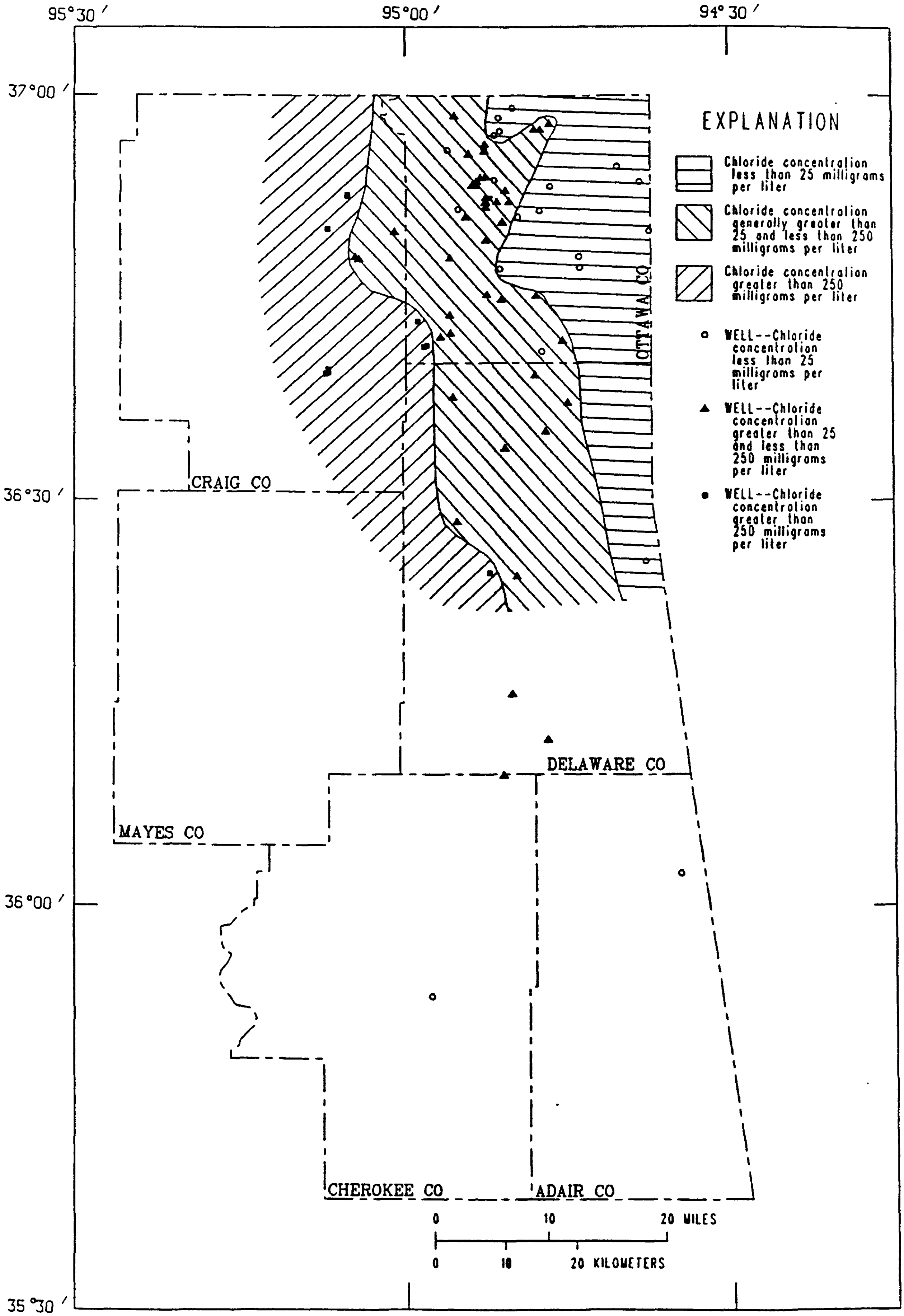

Figure 19.--Locations of wells where chloride concentrations were measured.

chloride concentrations are large in the Roubidoux equivalent in Mayes County. However, there are too few analyses to locate the transition zone in the south-central or south-west part of the study unit.

Occurrence of Radium-226

Water samples from 64 wells in the study unit were analyzed for gross-alpha radioactivity (including uranium). Many measurements are reported as censored (less than the reporting level) values. The wells that had samples that had greater than 15 pCi/L and were not censored generally were located near the western edge of the transition zone (fig. 20). Gross-alpha radioactivity was correlated with chloride concentration, but the data are limited because most of the gross-alpha-radioactivity data were censored.

Spiker (1977) studied public water supplies in Cherokee and Crawford Counties, Kansas, which are adjacent to the study unit. Of the 28 public water supplies Spiker sampled, the radium-226 concentration in 7 exceeded the 5-pCi/L MCL. In Spiker's study, there was a strong correlation between radium-226 concentrations and chloride concentrations in ground water. Keefer and Fenyves (1980) studied radium-226 concentrations in 11 water-supply systems in Ottawa and Craig Counties. All ground-water samples from Afton and some samples from Welch had radium-226 concentrations greater than 5 pCi/L. The data for Afton indicated a correlation between dissolved solids and radium-226 concentrations.

In the present study, samples from nine wells were analyzed for radium-226 and radium-228. All samples had concentrations of radium-226 that were greater than 3.3 pCi/L, and all measurements of radium-228 were reported as censored values. Generally, wells that had large concentrations of gross-alpha radioactivity were found to have concentrations of radium-226 greater than the MCL. Thus, radium-226 is correlated with gross-alpha radioactivity and as previously stated, gross-alpha radioactivity is correlated with chloride and dissolved-solids concentrations. The data of this study are consistent with studies of Spiker (1977) and Keefer and Fenyves (1980) that show that radium-226 is correlated with chloride or dissolved solids.

Radium-226 was measured at seven wells that had samples with gross-alpha radioactivity greater than 15 pCi/L and two wells that had censored values greater than 15 pCi/L. No wells were sampled that had uncensored gross-alpha radioactivity concentrations in the range of 5 to 15 pCi/L. In this concentration range, it is possible that radium-226 exceeds the 5-pCi/L MCL. Thus, inferences made from figure 20 may underestimate the areal extent of ground water that exceeds the radium MCL.

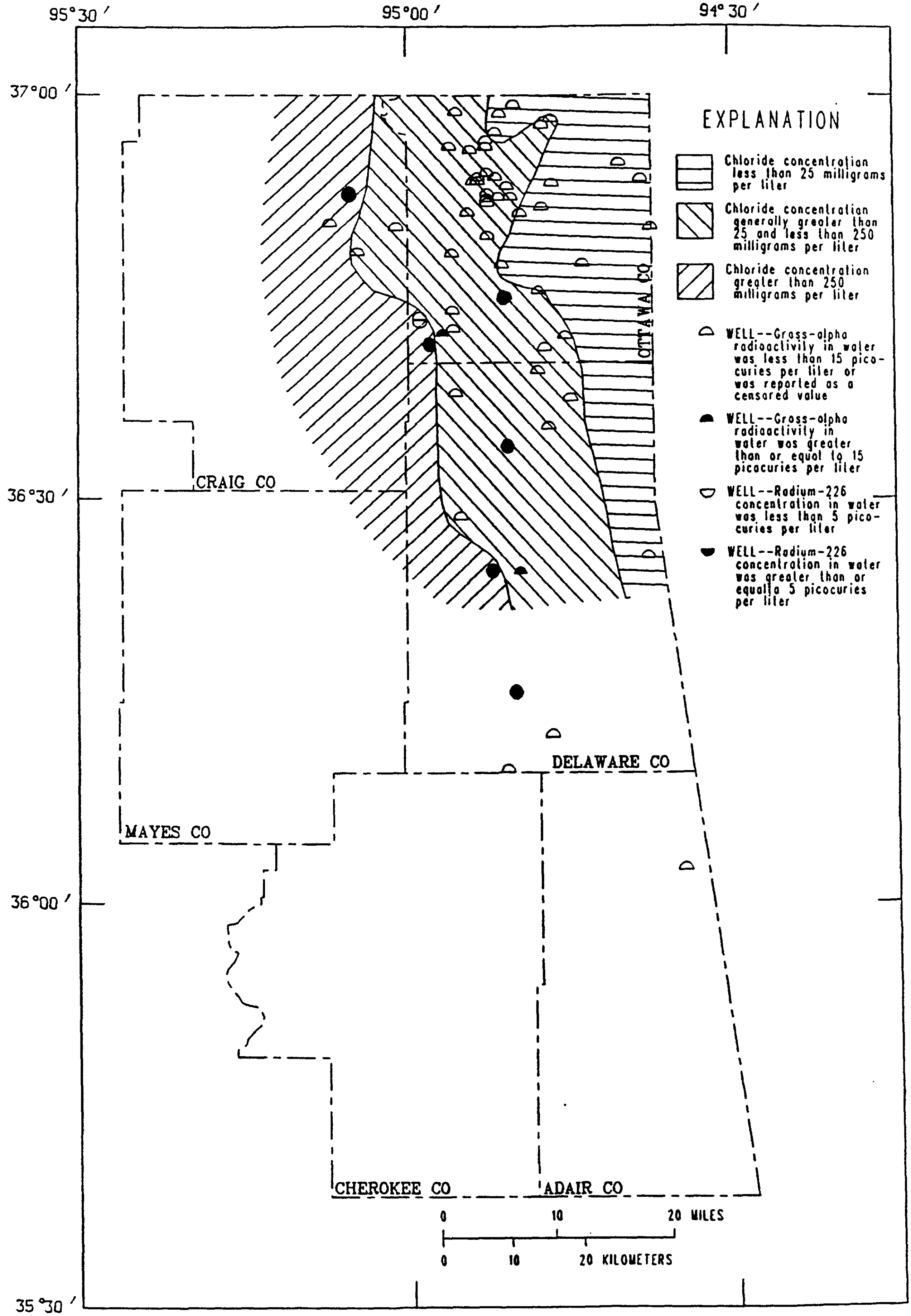

Figure 20.--Locations of wells where gross-alpha radioactivity and radium-226 were measured.

SUMMARY

The Roubidoux aquifer is an important source of freshwater for public supplies, commerce, industry, and rural water districts in northeastern Oklahoma. The Roubidoux aquifer consists of the Roubidoux Formation, the overlying Cotter and Jefferson City Dolomites, and the underlying Gasconade Dolomite. Deep wells in northeastern Oklahoma generally are completed in the Roubidoux Formation and the wells are left open to the overlying Cotter and Jefferson City Dolomites. Some wells are drilled deeper and left open to the underlying Gasconade Dolomite. Because the wells with the greatest yield are completed in the Roubidoux Formation, it is inferred that the Roubidoux Formation contributes most of the water. The top of the Roubidoux Formation in wells in the study unit was at depths of 770 to 1,300 feet below land surface in the study unit.

The Roubidoux Formation consists of a sequence of cherty dolomite and sandstone that ranges in thickness from 0 to 300 feet, and averages about 175 feet. The Cotter and Jefferson City Dolomites are cherty dolomites, with lenses of sandstone, from 0 to 840 feet thick. The Gasconade Dolomite is also a cherty dolomite with sandstone layers, ranging in thickness from 0 to 350 feet thick.

Ground-water withdrawals from the Roubidoux aquifer in 1981 were estimated to be 4.8 million gallons per day, of which about 90 percent was withdrawn in Ottawa County. Wells drilled at the beginning of the 20th century originally flowed at the land surface, but in 1981 water levels ranged from 22 to 471 feet below land surface. A major cone of depression has resulted from ground-water withdrawals near the City of Miami. Wells completed in the Roubidoux aquifer have yields that range from about 100 to more than 1,000 gallons per minute.

An aquifer test and a digital ground-water flow model were used to estimate aquifer and confining-layer hydraulic characteristics. Using these methods, the transmissivity of the aquifer was estimated to be within a range of 400 to 700 $feet^2/day$. The leakance of the confining layer was determined to be within a range from 0 to 0.13 day^{-1}, with a best-estimate value in a range from 4.3×10^{-8} to 7.7×10^{-8} day^{-1}.

As part of the present study, water samples from wells completed in the Roubidoux aquifer were collected and analyzed for major ions, trace elements, and radiochemical constituents. Additional chemical data for ground water were compiled from previous work of the U.S. Geological Survey and from the Oklahoma State Department of Health.

A large change in major-ion chemistry occurs in ground water in the Roubidoux aquifer in northeastern Oklahoma. The ground water in the easternmost part of the study unit has relatively small dissolved-solids concentrations (less than 200 milligrams per liter) with calcium, magnesium, and bicarbonate as the major ions. Ground water in the westernmost part of the study unit has relatively large dissolved-solids concentrations (greater than 800 milligrams per liter) with sodium and chloride as the major ions. A transition zone of intermediate sodium, chloride, and dissolved-solids

concentrations exists between the easternmost and westernmost parts of the study unit.

Descriptive statistics were calculated for each chemical constituent, including percentiles, minimum, and maximum values. Drinking-water standards were compared to the chemical data in two data sets. Data set 1 included chemical data from all wells; data set 2 excluded: (1) Samples with dissolved-solids concentration greater than 5,000 milligrams per liter, (2) ground-water samples that had specific conductance greater than 5,000 microsiemens per centimeter at 25 degrees Celsius, and (3) samples from wells that were within the mining area. Data set 2 is more representative of the usable, uncontaminated ground-water resource.

The water samples from wells in the mining area that were included in data set 1 accounted for most of the analyses that exceeded the standards for pH less than 6.5, sulfate, cadmium, iron, manganese, and zinc. In data set 2, sulfate, nitrate, arsenic, barium, cadmium, copper, lead, mercury, selenium, silver, and zinc concentrations did not exceed the maximum contaminant levels or secondary maximum contaminant levels for any samples. Dissolved-solids and chloride concentrations exceeded standards in 16 of 64 and 14 of 68 wells sampled, respectively (data set 2). Gross-alpha radioactivity exceeded 15 picocuries per liter in 9 of 53 wells sampled (data set 2), but because uranium was not measured, it was not possible to determine if the gross-alpha radioactivity maximum contaminant level was exceeded. Concentrations of radium-226 exceeded the maximum contaminant level for radium in seven of nine wells sampled. The available data indicate that concentrations of fluoride and chromium rarely exceed the maximum contaminant levels in the Roubidoux aquifer.

Three water-quality problems are apparent in the Roubidoux aquifer in northeast Oklahoma: (1) Contamination by mine water, (2) large concentrations of sodium and chloride, and (3) large concentrations of radium-226.

Many wells in the mining area have been affected by mine-water contamination. At present (1990), all instances of ground-water contamination by mine water can be explained by faulty seals or leaky casings in wells that pass through the zone of mine workings and down to the Roubidoux aquifer. None of the available data indicate that mine water has migrated from the Boone Formation through the pores and fractures of the intervening geologic units to the Roubidoux aquifer. Sulfate is an indicator of mine-water contamination.

The transition zone is defined to be where the chloride concentrations in ground water range from 25 milligrams per liter to 250 milligrams per liter. In the northern part of the study unit, it is inferred that the position of the bottom of the transition zone slopes from above the top of the Roubidoux aquifer in eastern Craig County and western Ottawa County to below the base of the Roubidoux aquifer in central Ottawa County. Based on limited information from three wells, the depth to the bottom of the transition zone is approximately 1,200 to 1,500 feet below land surface in the eastern part of the study unit. The data are too few to define the position of the transition zone in the southern part of the study unit.

Large concentrations of gross-alpha radioactivity in ground water occur near the western edge of the transition zone. Generally, wells that had samples with large concentrations of gross-alpha radioactivity had large concentrations of radium-226. Both gross-alpha radioactivity and radium-226 concentrations appear to be correlated with chloride concentrations.

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Table 2.—*Selected information about wells penetrating the Roubidoux aquifer in northeastern Oklahoma that were used as control points*

[Primary use of water: C, commercial; H, domestic; I, irrigation; N, industrial; P, public supply; R, recreation; S, stock; T, institutional; U, unused.]

Local identifier	Well owner	Site identifier	Altitude of land surface (feet above sea level)	Well depth (feet)	Primary use of water	Water level (feet below land surface)	Water-level date
			ADAIR COUNTY				
18N-26E-18 BDC 1	HUDSON FM INC	360225094344001	1,110	1,360	N	—	—
18N-26E-31 DAD 1	WESTVILLE OK	355931094340001	1,123	1,510	P	190.40	08-07-81
18N-26E-31 DCC 1	WESTVILLE, CITY OF	355930094341001	—	1,100	—	100	00-00-47
			CHEROKEE COUNTY				
16N-21E-33 DCA 1	PINE W. H	354856095044501	710	2,093	—	—	—
16N-22E-03 CCB 1	BRACKEN OIL CO	355319094574001	834	1,450	U	—	—
19N-21E-35 AD 1	M&F OIL CO	360502095015201	800	1,935	—	—	—
			CRAIG COUNTY				
24N-21E-11 BDB 1	LEWIS, F.	363439095020901	790	1,948	—	115.1	09-08-81
25N-20E-12 BDD 1	E.OKLA.HOSP.	363950095070201	725	1,139	P	55	03-01-50
25N-20E-12 C 4	E.STATE HOSP.	363930095071504	—	1,139	P	190	05-01-50
25N-20E-12 CAC 3	E.STATE HOSP.	363935095070503	—	1,240	P	—	—
25N-20E-12 CAD 2	E.STATE HOSP.	363935095070202	—	1,080	P	—	—
27N-20E-12 BDD 1	NEILL, C E	365013095070501	900	688	S	219	01-01-60
27N-20E-12 BDD 2	NEILL C E	365016095070501	900	1,090	S	212.50	10-28-80
						211.03	02-04-81
						217.07	05-12-81
						215.10	06-08-81
						207.69	01-25-82
						208.80	04-19-82
27N-21E-12 CCB 1	RWD-3	365000095010101	876	1,352	P	217	08-14-80
						208.03	02-04-81
						208.63	05-12-81
						207.97	09-10-81
						211.39	01-26-82
						207.63	04-20-82
						210.32	07-21-82
						209.02	10-20-82

Table 2.—*Selected information about wells penetrating the Roubidoux aquifer in northeastern Oklahoma that were used as control points*—Continued

Local identifier	Well owner	Site identifier	Altitude of land surface (feet above sea level)	Well depth (feet)	Primary use of water	Water level (feet below land surface)	Water-level date
27N-21E-20 DCD 1	BLUEJACKET OK	364808095043501	820	1,045	P	147.32	06-09-77
						145.85	02-18-81
						152.21	05-11-81
						149.88	06-09-81
						146.92	09-09-81
						145.21	01-25-82
						145.85	04-19-82
						146.45	07-19-82
						152.28	10-19-82
27N-21E-28 BBB 1	BLUEJACKET, OK	364759095041401	785	1,418	—	—	—
28N-20E-13 ACC 1	SHORTER JIM	365440095065701	860	1,501	U	89.59	11-24-80
						99.73	03-16-81
28N-21E-29 CBC 1	WELCH OK	365242095051701	845	1,200	P	178.74	06-07-77
						177.37	10-29-80
						175.26	02-04-81
						173.97	05-12-81
						178.50	06-06-81
						176.57	09-09-81
						174.50	01-25-82
						173.50	04-19-82
						173.80	07-20-82
						174.08	10-21-82
28N-21E-29 CBD 1	WELCH, OK	365240095051501	—	1,250	P	177.37	10-29-80
						175.26	02-04-81
DELAWARE COUNTY							
20N-23E-34 CCA 1	OAKS, OK	360946094504901	1,090	1,375	P	369	11-01-70
						280.26	06-10-81
20N-24E-17 CCC 1	KANSAS OK	361221094463901	1,200	1,065	P	310	11-07-80
						307.34	02-19-81
						307.27	05-13-81
						309.29	09-17-81
						310.12	01-29-82
						325.10	04-23-82
						319.20	07-23-82
						312.48	10-22-82
21N-25E-31 BBB 1	COLCORD OK	361544094410101	1,205	1,350	P	307.58	05-07-81

Table 2.—*Selected information about wells penetrating the Roubidoux aquifer in northeastern Oklahoma that were used as control points*—Continued

Local identifier	Well owner	Site identifier	Altitude of land surface (feet above sea level)	Well depth (feet)	Primary use of water	Water level (feet below land surface)	Water-level date
						302.90	09-15-81
						324.88	01-28-82
						306.42	04-23-82
						335	07-22-82
						321.43	10-22-82
22N-23E-05 DCA 1	RWD-1	362442094520801	1,100	1,538	P	288	06-18-79
						300	11-06-80
						303.51	02-19-81
						303.54	05-13-81
						303.72	06-10-81
						305.62	09-15-81
						309.82	01-29-82
						309.30	04-23-82
						313.52	07-22-82
						310.90	10-22-82
22N-23E-11 BBB 1	JAY, OK	362427094493001	1,070	1,442	P	249	07-27-82
23N-22E-14 ADC 1	LAKEMONT SHORES	362829094550901	940	1,003	R	—	—
23N-25E-17 BDB 1	COMMERCIAL OIL CO	362832094392201	1,045	1,023	—	—	—
23N-25E-33 DDC 1	CURRY, A.	362532094375501	1,080	1,160	S	114	07-09-81
	CURRY	362532094374501	—	1,160	—	—	—
24N-23E-15 BBC 1	SHANGRI-LA RESORT	363357094503701	805	1,145	P	80	03- -70
						174.02	09-04-80
						152.14	06-11-81
24N-24E-06 DCA 1	GROVE OK	363510094464501	850	975	P	149	03-11-81
						154.83	06-11-81
25N-22E-23 CCD 1	BERNICE OK	363740094553101	925	1,440	P	261	03-08-79
						259.10	11-06-80
						257.82	02-19-81
						257.87	05-12-81
						261	06-10-81
						259.81	09-10-81
						260.27	01-28-82
						258.06	04-22-82
						264.10	07-21-82
						268.15	10-21-82
25N-23E-13 AAB 1	HICKORY MEADOWS DEV	363921094474301	775	1,080	P	90.38	06-11-81
25N-24E-28 BBB 1	PRATHER	363718094444501	805	1,600	H	15	02-01-68

Table 2.—*Selected information about wells penetrating the Roubidoux aquifer in northeastern Oklahoma that were used as control points*—Continued

Local identifier	Well owner	Site identifier	Altitude of land surface (feet above sea level)	Well depth (feet)	Primary use of water	Water level (feet below land surface)	Water-level date
26N-23E-09 DBC 1	FAIRLAND OK	364454094504401	845	1,250	P	304.68	10-30-80
						303.55	02-18-81
						293.26	05-14-81
						304.97	07-08-81
						300.02	09-15-81
						317.56	01-27-82
						305.25	04-22-82
						298.56	07-22-82
						323.56	10-21-82
26N-23E-12 BAD 1	OGEECHEE FARMS	364516094473501	835	1,253	I	292	09-13-73
26N-24E-32 ABA 1	KOENIG R J	364155094451001	770	850	H	22.38	07-30-81
27N-22E-01 CCC 1	RWD-2	365103094541501	790	—	P	—	—
27N-22E-12 CCC 1	CO.POOR FARM	364951094542601	850	1,065	P	150	01-01-36
						471.12	07-16-81
27N-22E-27 AAB 1	MCPHERSON	364801094554601	—	950	—	—	—
27N-23E-03 BCC 1	LAKEWOOD SHORES	365100094491701	770	900	P	—	—
27N-23E-04 DCC 1	DE MIER, F.	365042094504701	790	1,033	H	—	—
27N-23E-17 CBB 1	RWD-6	364921094522201	810	1,205	P	430	04-10-79
						415.60	11-05-80
						425.83	02-05-81
						417.52	05-12-81
						421.60	06-09-81
						422.53	09-10-81
						425.70	01-26-82
						419.71	04-20-82
						426.37	07-21-82
						427.89	10-20-82
27N-23E-28 CDC 1	NEWTON, F.	364712094510101	810	1,000	U	256	07-01-46
27N-24E-08 B 1	KENNY S I	365018094451101	850	1,030	—	—	—
27N-24E-21 CD 1	SENECA IND.SCH.	364806094433701	800	1,040	P	100	07-01-46
27N-24E-28 CAD 1	RWD-1	364717094433101	770	1,100	P	235.45	06-26-80
						238.45	11-04-80
						234.63	02-05-81
						235.77	05-13-81
						238.48	07-08-81
						233.99	09-14-81

Table 2.—*Selected information about wells penetrating the Roubidoux aquifer in northeastern Oklahoma that were used as control points*—Continued

Local identifier	Well owner	Site identifier	Altitude of land surface (feet above sea level)	Well depth (feet)	Primary use of water	Water level (feet below land surface)	Water-level date
						39.05	07-09-81
		MAYES COUNTY					
22N-19E-14 BDC 1	RENFRO	362314095150801	700	1,415	—	—	—
22N-21E-15 CAC 2	—	362310095030001	—	—	U	—	—
23N-21E-34 ACA 1	DAVIS	362600095025001	670	1,622	—	—	—
		OTTAWA COUNTY					
25N-23E-01 AAA 1	GRAYS RANCH	364103094470401	760	850	P	—	—
26N-22E-15 DDA 1	NE OK VOC SCHOOL	364349094554501	800	1,110	—	178.98	10-31-80
						180.76	02-19-81
						176.93	05-12-81
						181.65	06-12-81
						179.70	09-09-81
						178.93	01-26-82
						178.15	04-21-82
						176.60	07-22-82
						178.55	10-20-82
26N-22E-20 BCC 1	HELMICK D	364323094585101	790	1,145	H	151.35	03-02-81
						150.85	06-12-81
26N-22E-27 ADD 1	ALBRO ALEEN	364227094554301	805	—	C	—	—
26N-22E-27 CBC 1	GRND VALLEY FM	364211094564101	800	980	S	—	—
26N-22E-32 ACD 1	AFTON, OK	364136094575801	786	991	P	168	07-01-68
						159.20	10-31-80
						150.62	02-17-81
						160.40	05-12-81
						144.90	09-16-81
						158.26	01-26-82
						150.30	04-21-82
						143.23	10-21-82
26N-22E-32 ACD 2	AFTON, OK	364137094575902	784	900	P	168	07-01-68
						155.25	06-11-81
26N-22E-32 ADC 1	AFTON WELL 1	364135094580001	—	991	—	—	—
26N-22E-32 ADC 2	AFTON WELL 2	364135094580002	—	900	—	—	—
26N-22E-32 DBB 1	AFTON, OK	364130094581501	785	1,066	P	—	—
26N-23E-08 BBC 1	SHELL OIL CO.	364520094521501	—	1,100	P	—	—
26N-23E-09 CA 1	FAIRLAND, OK.	364501094505301	835	1,253	P	—	—

Table 2.—*Selected information about wells penetrating the Roubidoux aquifer in northeastern Oklahoma that were used as control points*—Continued

Local identifier	Well owner	Site identifier	Altitude of land surface (feet above sea level)	Well depth (feet)	Primary use of water	Water level (feet below land surface)	Water-level date
						232.73	01-27-82
						231.04	04-21-82
						236.59	07-20-82
						233.88	10-20-82
27N-25E-09 CAC 1	MILNOT CO	364957094371501	850	1,247	N	125	08-31-50
28N-22E-11 ABB 1	ROBINSON, J.	365543094535801	—	1,150	H	—	—
28N-22E-23 BAA 1	DALRYMPLE J	365357094541901	770	826	U	90.50	07-28-82
28N-22E-24 AAB 1	GOODRICH RUBBER CO. WELL 4	365358094525001	788	1,235	N	—	—
28N-22E-24 BCB 1	GOODRICH RUBBER CO. WELL 2	365344094534701	765	1,200	N	219	05-01-44
28N-22E-24 BDA 1	GOODRICH RUBBER CO. WELL 5	365342094531301	792	1,465	I	—	—
28N-22E-24 CAD 1	GOODRICH RUBBER CO. WELL 3	365324094531301	798	1,055	N	249	02- -44
28N-22E-24 CBC 1	GOODRICH RUBBER CO. WELL 1	365323094534001	786	1,200	N	254	08-01-44
28N-22E-24 DAB 1	MCCOY NURSERY	365330094524901	—	1,046	U	—	—
28N-22E-35 DCC 1	ROBINSON, J.	365133094545901	—	1,130	H	200	07-01-46
28N-23E-01 BBB 1	QUAPAW, CITY OF, WELL 4	365633094471001	845	1,350	N	308	08-26-81
28N-23E-06 BAC 1	COMMERCE, CITY OF, WELL 3	365627094522201	810	1,440	P	480	05-13-80
28N-23E-06 BAC 2	COMMERCE, CITY OF, WELL 4	365627094522101	810	1,250	P	—	—
28N-23E-06 CBB 1	COMMERCE, CITY OF, WELL 1	365600094523001	809	1,050	P	200	08-01-42
						443.67	07-07-81
28N-23E-06 CBD 2	COMMERCE, CITY OF, WELL 2	365557094522701	800	1,115	P	—	—
28N-23E-18 CDC 1	GOODRICH RUBBER CO. WELL 6	365402094522201	777	1,145	N	—	—
28N-23E-20 BCB 1	MIAMI, CITY OF, WELL 8	365344094513301	795	1,250	P	—	—
28N-23E-24 DDA 1	SPRINGRIVER RWD	365316094461601	—	1,035	H	367	03-01-54
28N-23E-28 BBB 1	MIAMI, CITY OF, WELL 7	365301094502901	800	1,535	P	—	—
28N-23E-30 CAC 1	MIAMI, CITY OF, WELL 1	365229094522101	790	1,233	H	—	—
28N-23E-30 DBC 1	MIAMI, CITY OF, ICE PLANT WELL	365229094520201	770	1,490	U	-28	00-00-07
						100	- -37
						150	- -44
						385.5	10-02-56
						372	10-22-56
						356.6	01-30-57
						359.5	02-21-57
						358.8	03-26-57
						354.8	04-25-57
						355.2	05-31-57
						355	06-23-57
						362	07-09-57

Table 2.—*Selected information about wells penetrating the Roubidoux aquifer in northeastern Oklahoma that were used as control points*—Continued

Local identifier	Well owner	Site identifier	Altitude of land surface (feet above sea level)	Well depth (feet)	Primary use of water	Water level (feet below land surface)	Water-level date
28N-23E-30 DBC 1	MIAMI, CITY OF, ICE PLANT WELL	365229094520201	770	1,490	U	343	05-22-60
						343	06-22-60
						350	07-19-60
						362.5	09-21-60
						354.5	01-11-61
						354.0	02-23-61
						355.0	04-18-61
						360.5	06-06-61
						360.5	07-19-61
						355.7	08-22-61
						355.5	09-20-61
						351.5	11-22-61
						351.0	12-18-61
						350.0	01-27-62
						351.8	02-21-62
						354.0	04-05-62
						352.0	04-18-62
						360.2	05-22-62
						366.0	06-19-62
						374.5	07-18-62
						382.0	08-21-62
						374.5	09-19-62
						371.0	10-23-62
						369.5	11-21-62
						372.0	12-19-62
						369.5	08-26-65
						364	10-04-65
						356	12-22-65
						357.6	02-02-66
						358.5	03-18-66
						367.5	06-22-66
						379	10-14-66
						376	01-23-67
						376	03-06-67
						377	04-06-67
						368	05-20-67

Table 2.—*Selected information about wells penetrating the Roubidoux aquifer in northeastern Oklahoma that were used as control points*—Continued

Local identifier	Well owner	Site identifier	Altitude of land surface (feet above sea level)	Well depth (feet)	Primary use of water	Water level (feet below land surface)	Water-level date
28N-23E-30 DBC 1	MIAMI, CITY OF, ICE PLANT WELL	365229094520201	770	1,490	U	365.5	07-06-67
						379	03-06-68
						387.0	12-18-68
						414.0	08-08-69
						421.5	10-01-70
						441.6	02-29-72
						437.5	04-04-72
						437.4	05-01-72
						455.73	06-05-72
						455.8	07-07-72
						464.8	08-08-72
						456.45	09-18-72
						448.91	10-05-72
						446.15	11-16-72
						440.9	12-21-72
						446.8	06-23-73
						457.9	07-19-73
						447.1	09-07-73
						455.65	11-07-73
						456	02-12-74
						459.35	05-20-74
						475	07-23-74
						461.1	09-04-74
						450.0	10-04-74
						448.10	11-08-74
						441.27	12-20-74
						443.5	01-29-75
						444.0	02-28-75
						442.8	03-31-75
						438.25	05-01-75
						436.45	05-30-75
						434.1	06-16-75
						445.55	06-30-75
						451.85	07-16-75
						452.35	07-30-75
						455.15	08-18-75
						459.45	08-29-75

Table 2.—*Selected information about wells penetrating the Roubidoux aquifer in northeastern Oklahoma that were used as control points*—Continued

Local identifier	Well owner	Site identifier	Altitude of land surface (feet above sea level)	Well depth (feet)	Primary use of water	Water level (feet below land surface)	Water-level date
28N-23E-30 DBC 1	MIAMI, CITY OF, ICE PLANT WELL	365229094520201	770	1,490	U	455.2	09-16-75
						454.50	09-30-75
						451.90	10-16-75
						446.35	10-31-75
						446.42	11-17-75
						447.57	12-02-75
						443.95	12-17-75
						440.42	12-30-75
						442.45	01-15-76
						442.15	02-02-76
						441.65	02-17-76
						442	03-17-76
						443	04-05-76
						437.65	04-30-76
						436.06	05-05-76
						431.52	05-18-76
						429.1	06-07-76
						433.52	07-01-76
						433.38	07-15-76
						436.37	08-12-76
						429.43	09-07-76
						432.85	09-16-76
						438.65	10-08-76
						436.21	11-02-76
						433.88	11-16-76
						436.32	12-02-76
						439.10	12-15-76
						438.28	01-07-77
						441.34	01-27-77
						439.12	02-17-77
						442.95	03-15-77
						446.70	03-22-77
						440.53	04-06-77
						443.15	04-29-77
						445.55	05-25-77
						447.40	06-09-77
						454.05	07-27-77

Table 2.—*Selected information about wells penetrating the Roubidoux aquifer in northeastern Oklahoma that were used as control points*—Continued

Local identifier	Well owner	Site identifier	Altitude of land surface (feet above sea level)	Well depth (feet)	Primary use of water	Water level (feet below land surface)	Water-level date
28N-23E-30 DBC 1	MIAMI, CITY OF, ICE PLANT WELL	365229094520201	770	1,490	U	363	07-10-57
						370.4	07-23-57
						374	08-21-57
						370	09-25-57
						364	11-06-57
						362	12-01-57
						357.5	01-04-58
						351.0	02-03-58
						350.0	03-07-58
						350.0	03-21-58
						348.0	04-20-58
						354	05-21-58
						355	06-20-58
						346	07-19-58
						344	08-02-58
						348	08-20-58
						343	09-26-58
						343.5	10-21-58
						341.0	11-30-58
						338	01-07-59
						339	02-06-59
						337	02-28-59
						337.0	03-26-59
						335	05-02-59
						333	06-01-59
						341.5	06-22-59
						346.5	07-22-59
						355.5	08-05-59
						358.0	08-18-59
						359.0	09-19-59
						360.5	10-20-59
						358.0	11-25-59
						354.0	12-21-59
						350.5	01-19-60
						348.5	02-19-60
						346	03-19-60
						344.5	04-20-60

Table 2.—*Selected information about wells penetrating the Roubidoux aquifer in northeastern Oklahoma that were used as control points*—Continued

Local identifier	Well owner	Site identifier	Altitude of land surface (feet above sea level)	Well depth (feet)	Primary use of water	Water level (feet below land surface)	Water-level date
28N-23E-30 DBC 1	MIAMI, CITY OF, ICE PLANT WELL	365229094520201	770	1,490	U	434.97	09-07-81
						433.69	06-20-85
						417.98	02-26-86
						406.20	05-07-86
						406.94	06-18-86
						430.32	06-24-86
						407.93	10-09-86
						402.52	11-05-86
						389.18	12-16-86
						377.40	01-27-87
						370.25	03-23-87
						367.59	05-06-87
						380.38	06-30-87
						368.21	10-28-87
						361.10	12-17-87
						350.70	03-16-88
						361	07-12-88
						366	08-22-88
						353.70	11-16-88
						346.10	01-04-89
						337.60	05-10-89
						346.25	07-27-89
						343.74	10-25-89
						340.55	10-31-89
						339.33	11-13-89
						338.49	11-14-89
						341.36	01-11-90
						337.48	02-07-90
						337.91	02-08-90
						334.14	03-30-90
						335.34	05-11-90
						341.29	06-14-90
						357	07-26-90
28N-23E-31 BAB 1	MIAMI, CITY OF, WELL 2	365210094522101	780	1,247	N	—	—
28N-23E-31 BAC 1	MIAMI, CITY OF, WELL 3	365206094522201	780	1,116	P	480	01-01-52
28N-23E-31 CBA 1	MIAMI, CITY OF, WELL 4	365146094522201	770	1,250	P	300	01-01-41
28N-23E-32 BAB 1	MIAMI, CITY OF, WELL 5	365212094511901	780	1,345	P	—	—

Table 2.—*Selected information about wells penetrating the Roubidoux aquifer in northeastern Oklahoma that were used as control points*—Continued

Local identifier	Well owner	Site identifier	Altitude of land surface (feet above sea level)	Well depth (feet)	Primary use of water	Water level (feet below land surface)	Water-level date
28N-23E-33 BAB 1	MIAMI, CITY OF, WELL 6	365213094500701	800	1,526	H	366	05-01-55
28N-23E-36 CCC 1	RWD-4 W-2	365128094471301	915	1,190	P	530	09-25-80
28N-24E-13 ABD 1	RWD-3	365445094400701	965	1,165	P	269.07	07-14-81
28N-25E-20 CAA 1	RWD-5	365335094380701	1,050	1,418	P	350	05-11-78
						356.50	03-17-81
						355.51	05-08-81
						354.53	06-09-81
						354.75	09-09-81
						360.26	01-25-82
						353.52	04-21-82
						355.39	07-20-82
						351.30	10-19-82
29N-22E-21 DAD 1	RWD-7	365833094551901	820	1,205	P	162	11-12-79
						159.61	10-29-80
						159.01	02-04-81
						158.81	03-06-81
						158.32	05-12-81
						157.51	06-09-81
						158.03	09-10-81
						157.36	01-26-82
						157.01	04-20-82
						156.58	07-20-82
						157.80	10-20-82
29N-22E-25 AAA 1	COMMERCE M&R CO	365820094520401	820	1,229	—	—	—
29N-23E-13 DAC 1	SEMPLE C Y	365916094454201	840	1,115	U	212	09-01-38
29N-23E-15 CDB 1	BECK MINING	365920094482501	825	1,073	N	—	—
29N-23E-16 DDD 1	CONSOLIDATED 2, WELL 2	365917094484701	—	1,061	—	44.83	02-16-81
29N-23E-18 DBC 1	GORDON MINE	365934094511401	840	1,176	—	—	—
29N-23E-19 DCC 1	EAGLE-PICHER	365824094512401	820	1,772	U	285	01-01-38
29N-23E-19 DDC 1	CARDIN, OK	365823094510701	—	1,150	P	—	—
29N-23E-20 AAA 1	NETTA MINE	365901094500501	830	1,365	U	—	—
29N-23E-21 BBC 1	PICHER, OK.	365905094494601	822	1,077	P	380	08-01-42
29N-23E-21 BBC 2	PICHER, OK.	365905094494602	822	1,125	P	380	08-01-42
29N-23E-21 BBC 3	PICHER, OK.	365905094494603	822	1,125	P	—	—
29N-23E-21 DCA 1	UNITED ZINC	365825094490501	830	1,040	N	—	—
29N-23E-24 BBA 1	ONTARIO SMELTER	365908094462501	850	1,050	U	104	01-01-18
						206.64	07-14-81
29N-23E-25 AAA 1	EAGLE-PICHER CO	365757094464601	835	1,229	N	236	10-01-45
29N-23E-25 BDC 1	QUAPAW WELL 3	365800094461701	845	1,350	N	230.55	07-07-81
29N-23E-26 CDD 1	QUAPAW WELL 2	365734094471001	840	1,200	—	—	—
29N-23E-31 BDD 1	EAGLE-PICHER	365704094513101	834	1,175	N	325	11-01-41
29N-23E-32 ADD 1	CONSOLIDATED	365722094500401	820	985	U	—	—
29N-23E-35 BDD 1	QUAPAW WELL 1	365734094471101	850	1,325	P	258	07-01-42

Table 2.—*Selected information about wells penetrating the Roubidoux aquifer in northeastern Oklahoma that were used as control points*—Continued

Local identifier	Well owner	Site identifier	Altitude of land surface (feet above sea level)	Well depth (feet)	Primary use of water	Water level (feet below land surface)	Water-level date
28N-23E-30 DBC 1	MIAMI, CITY OF, ICE PLANT WELL	365229094520201	770	1,490	U	455.38	08-16-77
						457.89	09-01-77
						458.03	09-15-77
						455.90	10-03-77
						454.82	10-21-77
						456.25	11-28-77
						450	12-30-77
						450.10	01-23-78
						450.80	02-23-78
						450.21	03-10-78
						451.20	03-21-78
						447.29	04-18-78
						453.85	05-12-78
						452.65	06-07-78
						455.20	07-07-78
						454.60	08-24-78
						455.60	09-14-78
						460.30	10-13-78
						452.20	11-21-78
						450.80	12-19-78
						456.9	02-14-79
						454.80	03-05-79
						449.95	04-02-79
						447.68	05-10-79
						441.0	05-23-79
						450.0	06-11-79
						452.76	07-23-79
						451.74	08-17-79
						454.6	09-27-79
						453.25	10-30-79
						444.60	12-10-79
						438.40	01-24-80
						441.71	02-27-80
						448.85	03-05-80
						438.60	04-03-80
						436.07	06-04-80

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*

[Agency analyzing sample: 1028, U.S. Geological Survey (specific laboratory not identified); 80020, National Water Quality Laboratory of the U.S. Geological Survey; 84041, Oklahoma Geological Survey; 84042, Oklahoma State Department of Health; µS/cm, microsiemens per centimeter at 25 degrees Celcius; mg/L, milligrams per liter; deg. C, degrees Celsius; FET, fixed-endpoint titration; —, indicates no data are available; <, indicates concentration is less than the specified value.]

Local identifier	Date	Time	Site identification number	Agency analyzing sample	Sampling depth (feet)	Specific conductance (µS/cm)	pH (standard units)	Temperature (deg. C)	Hardness total (mg/L as CaCO3)	Acidity (mg/L as CaCO3)	Alkalinity, whole water total, FET, (mg/L as CaCO3)
					ADAIR COUNTY						
18N-26E-18 BDC 1	10-28-81	1300	360225094344001	80020	—	459	7.3	18.5	230	16	200
18N-26E-31 DAD 1	08-20-81	—	355931094340001	1028	—	1,650	—	19.0	—	—	—
					CHEROKEE COUNTY						
16N-22E-03 CCB 1	12-28-82	1330	355319094574001	84041	—	500	6.1	13.5	—	—	—
					CRAIG COUNTY						
24N-21E-11 BDB 1	03-23-83	1330	363439095020901	84041	120	140	7.2	17.0	—	—	—
24N-21E-11 BDB 1	03-23-83	1345	363439095020901	84041	700	1,120	7.8	18.0	—	—	—
24N-21E-11 BDB 1	03-23-83	1450	363439095020901	84041	1,700	125,000	6.3	18.0	—	—	—
25N-20E-12 BDD 1	03-10-50	—	363950095070201	1028	—	2,210	7.9	--	190	—	102
25N-20E-12 BDD 1	09-05-51	—	363950095070201	1028	—	2,350	7.7	—	220	—	165
25N-20E-12 C 4	05-29-50	—	363930095071504	1028	—	2,750	7.3	—	300	—	146
25N-20E-12 CAC 3	04-12-47	—	363935095070503	1028	—	5,390	—	21.5	300	—	149
25N-20E-12 CAD 2	04-12-47	—	363935095070202	1028	—	2,030	—	20.0	180	—	173
27N-20E-12 BDD 1	01-14-69	—	365013095070501	1028	—	1,620	8.2	—	120	—	162
27N-20E-12 BDD 2	10-28-80	1700	365016095070501	1028	—	1,610	8.7	17.5	—	—	—
27N-20E-12 BDD 2	02-04-81	1300	365016095070501	1028	—	1,700	8.0	17.0	140	3.0	—
27N-20E-12 BDD 2	05-12-81	1300	365016095070501	1028	—	1,540	8.2	23.0	—	—	—
27N-20E-12 BDD 2	06-08-81	1400	365016095070501	80020	—	1,500	7.8	28.0	150	4.7	159
27N-20E-12 BDD 2	01-25-82	1230	365016095070501	1028	—	1,550	8.0	19.5	—	—	—
27N-21E-12 CCB 1	05-12-81	1100	365000095010101	1028	—	580	8.0	21.5	—	—	—
27N-21E-12 CCB 1	07-09-81	1030	365000095010101	80020	—	542	7.9	23.5	120	2.1	138
27N-21E-12 CCB 1	01-26-82	1215	365000095010101	1028	—	600	8.0	25.5	—	—	—
27N-21E-12 CCB 1	04-20-82	830	365000095010101	1028	—	644	7.9	20.5	—	—	—
27N-21E-12 CCB 1	07-21-82	900	365000095010101	1028	—	634	8.0	24.5	—	—	—
27N-21E-12 CCB 1	10-20-82	1330	365000095010101	1028	—	618	8.0	20.5	—	—	—
27N-21E-20 DCD 1	02-01-81	1430	364808095043501	1028	—	892	8.2	19.5	—	—	—
27N-21E-20 DCD 1	02-04-81	1430	364808095043501	1028	—	—	—	—	76	2.0	—
27N-21E-20 DCD 1	02-18-81	1130	364808095043501	1028	—	869	8.1	21.5	—	—	—
27N-21E-20 DCD 1	05-11-81	1300	364808095043501	1028	—	856	8.2	23.0	—	—	—
27N-21E-20 DCD 1	06-09-81	1100	364808095043501	80020	—	832	8.1	25.5	84	2.5	174

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Alkalinity, lab (mg/L as CaCO3)	Solids, residue at 180 deg. C, dissolved	Solids, residue at 105 deg. C, dissolved	Calcium, dissolved (mg/L as Ca)	Magnesium dissolved (mg/L as Mg)	Sodium, total recoverable (mg/L as Na)	Sodium, dissolved (mg/L as Na)	Sodium+ potasium, dissolved (mg/L as Na)	Potasium, dissolved (mg/L as K)
						ADAIR COUNTY					
18N-26E-18 BDC 1	10-28-81	1300	200	268	—	88	1.9	—	7.7	—	1.0
18N-26E-31 DAD 1	08-20-81	—	—	—	—	—	—	—	—	—	—
						CHEROKEE COUNTY					
16N-22E-03 CCB 1	12-28-82	1330	—	286	—	—	—	—	5.2	—	—
						CRAIG COUNTY					
24N-21E-11 BDB 1	03-23-83	1330	—	88	—	—	—	—	—	—	—
24N-21E-11 BDB 1	03-23-83	1345	—	668	—	—	—	—	—	—	—
24N-21E-11 BDB 1	03-23-83	1450	—	113,000	—	—	—	—	—	—	—
25N-20E-12 BDD 1	03-10-50	—	—	1,210	—	38	23	—	370	—	27
25N-20E-12 BDD 1	09-05-51	—	—	1,290	—	50	22	—	390	—	11
25N-20E-12 C 4	05-29-50	—	—	1,570	—	68	31	—	450	—	25
25N-20E-12 CAC 3	04-12-47	—	—	—	—	—	—	—	—	—	—
25N-20E-12 CAD 2	04-12-47	—	—	—	—	—	—	—	—	—	—
27N-20E-12 BDD 1	01-14-69	—	—	872	—	—	—	—	—	2,800	—
27N-20E-12 BDD 2	10-28-80	1700	—	—	—	—	—	—	—	—	—
27N-20E-12 BDD 2	02-04-81	1300	152	878	—	33	13	—	270	—	8.1
27N-20E-12 BDD 2	05-12-81	1300	—	—	—	—	—	—	—	—	—
27N-20E-12 BDD 2	06-08-81	1400	155	826	—	34	15	—	290	—	7.9
27N-20E-12 BDD 2	01-25-82	1230	—	—	—	—	—	—	—	—	—
27N-21E-12 CCB 1	05-12-81	1100	—	—	—	—	—	—	—	—	—
27N-21E-12 CCB 1	07-09-81	1030	129	286	—	29	12	—	65	—	4.3
27N-21E-12 CCB 1	01-26-82	1215	—	—	—	—	—	—	—	—	—
27N-21E-12 CCB 1	04-20-82	830	—	—	—	—	—	—	—	—	—
27N-21E-12 CCB 1	07-21-82	900	—	—	—	—	—	—	—	—	—
27N-21E-12 CCB 1	10-20-82	1330	—	—	—	—	—	—	—	—	—
27N-21E-20 DCD 1	02-01-81	1430	—	—	—	—	—	—	—	—	—
27N-21E-20 DCD 1	02-04-81	1430	156	468	—	18	7.6	—	150	—	4.9
27N-21E-20 DCD 1	02-18-81	1130	—	—	—	—	—	—	—	—	—
27N-21E-20 DCD 1	05-11-81	1300	—	—	—	—	—	—	—	—	—
27N-21E-20 DCD 1	06-09-81	1100	159	448	—	19	8.8	—	150	—	4.7

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Bicarbonate, whole water total, FET, (mg/L as CaCO3)	Carbonate whole water total, FET, (mg/L as CaCO3)	Sulfate dis- solved (mg/L as SO4)	Chloride dis- solved (mg/L as Cl)	Fluoride, total (mg/L as F)	Fluoride, dissolved (mg/L as F)	Silica dissolved (mg/L as SiO2)	Nitrogen, nitrate dissolved (mg/L as N)	Nitrogen, nitrate+ nitrite dissolved (mg/L as N)
						ADAIR COUNTY					
18N-26E-18 BDC 1	10-28-81	1300	270	0	15	10	—	0.10	10	—	—
18N-26E-31 DAD 1	08-20-81	—	—	—	—	—	—	—	—	—	—
						CHEROKEE COUNTY					
16N-22E-03 CCB 1	12-28-82	1330	—	—	10	5.8	—	0.10	—	—	—
						CRAIG COUNTY					
24N-21E-11 BDB 1	03-23-83	1330	—	—	3.0	2.7	—	0.10	—	—	—
24N-21E-11 BDB 1	03-23-83	1345	—	—	10	260	—	2.1	—	—	—
24N-21E-11 BDB 1	03-23-83	1450	—	—	690	65,000	—	0.40	—	—	—
25N-20E-12 BDD 1	03-10-50	—	120	0	28	620	—	2.2	12	1.00	—
25N-20E-12 BDD 1	09-05-51	—	200	0	21	620	—	3.6	9.2	0.250	—
25N-20E-12 C 4	05-29-50	—	180	0	28	780	—	2.2	12	0.610	—
25N-20E-12 CAC 3	04-12-47	—	180	—	64	1,800	—	—	—	0.110	—
25N-20E-12 CAD 2	04-12-47	—	210	—	26	550	—	—	—	0.230	—
27N-20E-12 BDD 1	01-14-69	—	200	0	3.2	400	—	—	—	0.180	—
27N-20E-12 BDD 2	10-28-80	1700	—	—	—	—	—	—	—	—	—
27N-20E-12 BDD 2	02-04-81	1300	—	—	8.5	400	—	3.9	—	—	—
27N-20E-12 BDD 2	05-12-81	1300	—	—	—	—	—	—	—	—	—
27N-20E-12 BDD 2	06-08-81	1400	190	0	14	390	—	3.8	11	—	—
27N-20E-12 BDD 2	01-25-82	1230	—	—	—	—	—	—	—	—	—
27N-21E-12 CCB 1	05-12-81	1100	—	—	—	—	—	—	—	—	—
27N-21E-12 CCB 1	07-09-81	1030	170	0	14	78	—	1.3	10	—	—
27N-21E-12 CCB 1	01-26-82	1215	—	—	—	—	—	—	—	—	—
27N-21E-12 CCB 1	04-20-82	830	—	—	—	—	—	—	—	—	—
27N-21E-12 CCB 1	07-21-82	900	—	—	—	—	—	—	—	—	—
27N-21E-12 CCB 1	10-20-82	1330	—	—	—	—	—	—	—	—	—
27N-21E-20 DCD 1	02-01-81	1430	—	—	—	—	—	—	—	—	—
27N-21E-20 DCD 1	02-04-81	1430	—	—	7.3	170	—	4.2	—	—	—
27N-21E-20 DCD 1	02-18-81	1130	—	—	—	—	—	—	—	—	—
27N-21E-20 DCD 1	05-11-81	1300	—	—	—	—	—	—	—	—	—
27N-21E-20 DCD 1	06-09-81	1100	210	0	11	160	—	4.2	12	—	—

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Site identification number	Agency analyzing sample	Sampling depth (feet)	Specific conductance (µS/cm)	pH (standard units)	Temperature (deg. C)	Hardness total (mg/L as CaCO3)	Acidity (mg/L as CaCO3)	Alkalinity, whole water total, FET, mg/L as CaCO3)
27N-21E-20 DCD 1	09-09-81	1100	364808095043501	1028	—	846	8.0	22.5	—	—	—
27N-21E-20 DCD 1	01-25-82	1130	364808095043501	1028	—	838	8.0	21.5	—	—	—
27N-21E-20 DCD 1	04-19-82	1200	364808095043501	1028	—	871	7.9	21.5	—	—	—
27N-21E-20 DCD 1	07-19-82	1400	364808095043501	1028	—	878	7.9	24.5	—	—	—
27N-21E-20 DCD 1	10-19-82	1409	364808095043501	1028	—	943	7.9	22.5	—	—	—
27N-21E-28 BBB 1	04-12-47	—	364759095041401	1028	—	930	—	18.0	78	—	176
28N-20E-13 ACC 1	03-16-81	—	365440095065701	1028	—	9,830	9.2	18.0	—	—	—
28N-20E-13 ACC 1	03-23-83	1700	365440095065701	84041	170	9,120	9.3	16.5	—	—	—
28N-20E-13 ACC 1	03-23-83	1730	365440095065701	84041	1,460	27,000	7.9	16.5	—	—	—
28N-21E-29 CBC 1	10-29-80	900	365242095051701	1028	—	1,820	8.3	21.0	—	—	—
28N-21E-29 CBC 1	02-04-81	1100	365242095051701	1028	—	1,820	8.2	11.0	210	3.0	—
28N-21E-29 CBC 1	05-12-81	1200	365242095051701	1028	—	1,710	8.0	23.0	—	—	—
28N-21E-29 CBC 1	06-09-81	900	365242095051701	80020	—	1,680	7.7	27.5	210	6.9	162
28N-21E-29 CBC 1	09-09-81	1400	365242095051701	1028	—	1,710	7.9	26.0	—	—	—
28N-21E-29 CBC 1	01-25-82	1330	365242095051701	1028	—	1,820	7.9	21.0	—	—	—
28N-21E-29 CBC 1	04-19-82	1400	365242095051701	1028	—	1,830	7.8	22.5	—	—	—
28N-21E-29 CBC 1	06-15-82	1425	365242095051701	80020	—	1,850	7.6	24.5	—	—	—
28N-21E-29 CBC 1	07-20-82	1400	365242095051701	1028	—	1,820	7.8	25.5	—	—	—
28N-21E-29 CBD 1	06-09-81	930	365240095051501	80020	—	1,720	7.9	25.0	220	7.2	154
28N-21E-29 CBD 1	06-15-82	1430	365240095051501	80020	—	1,990	6.9	21.5	—	—	—
28N-21E-29 CBD 1	07-20-82	1400	365240095051501	1028	—	1,820	7.8	25.5	—	—	—
28N-21E-29 CBD 1	10-21-82	1400	365240095051501	1028	—	1,730	7.8	23.0	—	—	—
DELAWARE COUNTY											
20N-23E-34 CCA 1	06-10-81	930	360946094504901	80020	—	561	7.9	21.5	94	13	257
20N-24E-17 CCC 1	11-07-80	830	361221094463901	1028	—	484	8.1	19.0	—	—	—
20N-24E-17 CCC 1	02-19-81	845	361221094463901	1028	—	486	8.0	19.0	—	—	—
20N-24E-17 CCC 1	05-13-81	845	361221094463901	1028	—	527	8.2	19.0	—	—	—
20N-24E-17 CCC 1	06-10-81	800	361221094463901	80020	—	477	8.1	21.5	110	4.7	200
20N-24E-17 CCC 1	09-18-81	835	361221094463901	1028	—	503	8.0	—	—	—	—
20N-24E-17 CCC 1	01-29-82	845	361221094463901	1028	—	469	8.0	18.0	—	—	—
20N-24E-17 CCC 1	04-23-82	830	361221094463901	1028	—	479	7.9	19.0	—	—	—
20N-24E-17 CCC 1	07-23-82	845	361221094463901	1028	—	472	8.0	20.0	—	—	—
20N-24E-17 CCC 1	10-22-82	830	361221094463901	1028	—	487	8.0	18.0	—	—	—
21N-25E-31 BBB 1	11-06-80	1400	361544094410101	1028	—	357	8.3	18.5	—	—	—
21N-25E-31 BBB 1	06-10-81	1045	361544094410101	80020	—	363	8.0	23.0	86	2.5	156
21N-25E-31 BBB 1	09-15-81	1500	361544094410101	1028	—	358	8.2	20.5	—	—	—

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Alka-linity, lab (mg/L as CaCO3)	Solids, residue at 180 deg. C, dissolved	Solids, residue at 105 deg. C, dissolved	Calcium, dissolved (mg/L as Ca)	Magnesium dissolved (mg/L as Mg)	Sodium, total recoverable (mg/L as Na)	Sodium, dissolved (mg/L as Na)	Sodium+ potasium, dissolved (mg/L as Na)	Potasium, dissolved (mg/L as K)
27N-21E-20 DCD 1	09-09-81	1100	—	—	—	—	—	—	—	—	—
27N-21E-20 DCD 1	01-25-82	1130	—	—	—	—	—	—	—	—	—
27N-21E-20 DCD 1	04-19-82	1200	—	—	—	—	—	—	—	—	—
27N-21E-20 DCD 1	07-19-82	1400	—	—	—	—	—	—	—	—	—
27N-21E-20 DCD 1	10-19-82	1409	—	—	—	—	—	—	—	—	—
27N-21E-28 BBB 1	04-12-47	—	—	—	—	18	8.0	—	—	180	—
28N-20E-13 ACC 1	03-16-81	—	—	—	—	—	—	—	—	—	—
28N-20E-13 ACC 1	03-23-83	1700	—	5,300	—	—	—	—	—	—	—
28N-20E-13 ACC 1	03-23-83	1730	—	17,800	—	—	—	—	—	—	—
28N-21E-29 CBC 1	10-29-80	900	—	—	—	—	—	—	—	—	—
28N-21E-29 CBC 1	02-04-81	1100	152	996	—	49	21	—	270	—	8.5
28N-21E-29 CBC 1	05-12-81	1200	—	—	—	—	—	—	—	—	—
28N-21E-29 CBC 1	06-09-81	900	146	954	—	49	22	—	290	—	7.9
28N-21E-29 CBC 1	09-09-81	1400	—	—	—	—	—	—	—	—	—
28N-21E-29 CBC 1	01-25-82	1330	—	—	—	—	—	—	—	—	—
28N-21E-29 CBC 1	04-19-82	1400	—	—	—	—	—	—	—	—	—
28N-21E-29 CBC 1	06-15-82	1425	—	—	—	—	—	—	—	—	—
28N-21E-29 CBC 1	07-20-82	1400	—	—	—	—	—	—	—	—	—
28N-21E-29 CBD 1	06-09-81	930	150	986	—	50	23	—	300	—	8.4
28N-21E-29 CBD 1	06-15-82	1430	—	—	—	—	—	—	—	—	—
28N-21E-29 CBD 1	07-20-82	1400	—	—	—	—	—	—	—	—	—
28N-21E-29 CBD 1	10-21-82	1400	—	—	—	—	—	—	—	—	—
					DELAWARE COUNTY						
20N-23E-34 CCA 1	06-10-81	930	222	324	—	21	10	—	100	—	3.1
20N-24E-17 CCC 1	11-07-80	830	—	—	—	—	—	—	—	—	—
20N-24E-17 CCC 1	02-19-81	845	—	—	—	—	—	—	—	—	—
20N-24E-17 CCC 1	05-13-81	845	—	—	—	—	—	—	—	—	—
20N-24E-17 CCC 1	06-10-81	800	175	278	—	26	11	—	70	—	2.1
20N-24E-17 CCC 1	09-18-81	835	—	—	—	—	—	—	—	—	—
20N-24E-17 CCC 1	01-29-82	845	—	—	—	—	—	—	—	—	—
20N-24E-17 CCC 1	04-23-82	830	—	—	—	—	—	—	—	—	—
20N-24E-17 CCC 1	07-23-82	845	—	—	—	—	—	—	—	—	—
20N-24E-17 CCC 1	10-22-82	830	—	—	—	—	—	—	—	—	—
21N-25E-31 BBB 1	11-06-80	1400	—	—	—	—	—	—	—	—	—
21N-25E-31 BBB 1	06-10-81	1045	140	198	—	20	8.8	—	49	—	1.9
21N-25E-31 BBB 1	09-15-81	1500	—	—	—	—	—	—	—	—	—

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Bicarbonate, whole water total, FET, (mg/L as CaCO3)	Carbonate whole water total, FET, (mg/L as CaCO3)	Sulfate dis- solved (mg/L as SO4)	Chloride dis- solved (mg/L as Cl)	Fluoride, total (mg/L as F)	Fluoride, dissolved (mg/L as F)	Silica dissolved (mg/L as SiO2)	Nitrogen, nitrate dissolved (mg/L as N)	Nitrogen, nitrate+ nitrite dissolved (mg/L as N)
27N-21E-20 DCD 1	09-09-81	1100	—	—	—	—	—	—	—	—	—
27N-21E-20 DCD 1	01-25-82	1130	—	—	—	—	—	—	—	—	—
27N-21E-20 DCD 1	04-19-82	1200	—	—	—	—	—	—	—	—	—
27N-21E-20 DCD 1	07-19-82	1400	—	—	—	—	—	—	—	—	—
27N-21E-20 DCD 1	10-19-82	1409	—	—	—	—	—	—	—	—	—
27N-21E-28 BBB 1	04-12-47	—	210	0	15	190	—	4.4	—	0.00	—
28N-20E-13 ACC 1	03-16-81	—	—	—	—	—	—	—	—	—	—
28N-20E-13 ACC 1	03-23-83	1700	—	—	100	3,100	—	0.30	—	—	—
28N-20E-13 ACC 1	03-23-83	1730	—	—	20	10,000	—	0.80	—	—	—
28N-21E-29 CBC 1	10-29-80	900	—	—	—	—	—	—	—	—	—
28N-21E-29 CBC 1	02-04-81	1100	—	—	12	450	—	2.6	—	—	—
28N-21E-29 CBC 1	05-12-81	1200	—	—	—	—	—	—	—	—	—
28N-21E-29 CBC 1	06-09-81	900	200	0	19	460	—	3.0	12	—	—
28N-21E-29 CBC 1	09-09-81	1400	—	—	—	—	—	—	—	—	—
28N-21E-29 CBC 1	01-25-82	1330	—	—	—	—	—	—	—	—	—
28N-21E-29 CBC 1	04-19-82	1400	—	—	—	—	—	—	—	—	—
28N-21E-29 CBC 1	06-15-82	1425	—	—	—	—	—	—	—	—	—
28N-21E-29 CBC 1	07-20-82	1400	—	—	—	—	—	—	—	—	—
28N-21E-29 CBD 1	06-09-81	930	190	0	23	480	—	2.7	12	—	—
28N-21E-29 CBD 1	06-15-82	1430	—	—	—	—	—	—	—	—	—
28N-21E-29 CBD 1	07-20-82	1400	—	—	—	—	—	—	—	—	—
28N-21E-29 CBD 1	10-21-82	1400	—	—	—	—	—	—	—	—	—
DELAWARE COUNTY											
20N-23E-34 CCA 1	06-10-81	930	310	0	22	30	—	2.6	9.0	—	—
20N-24E-17 CCC 1	11-07-80	830	—	—	—	—	—	—	—	—	—
20N-24E-17 CCC 1	02-19-81	845	—	—	—	—	—	—	—	—	—
20N-24E-17 CCC 1	05-13-81	845	—	—	—	—	—	—	—	—	—
20N-24E-17 CCC 1	06-10-81	800	240	0	16	41	—	0.90	12	—	—
20N-24E-17 CCC 1	09-18-81	835	—	—	—	—	—	—	—	—	—
20N-24E-17 CCC 1	01-29-82	845	—	—	—	—	—	—	—	—	—
20N-24E-17 CCC 1	04-23-82	830	—	—	—	—	—	—	—	—	—
20N-24E-17 CCC 1	07-23-82	845	—	—	—	—	—	—	—	—	—
20N-24E-17 CCC 1	10-22-82	830	—	—	—	—	—	—	—	—	—
21N-25E-31 BBB 1	11-06-80	1400	—	—	—	—	—	—	—	—	—
21N-25E-31 BBB 1	06-10-81	1045	190	0	13	25	—	1.0	14	—	—
21N-25E-31 BBB 1	09-15-81	1500	—	—	—	—	—	—	—	—	—

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Site identification number	Agency analyzing sample	Sampling depth (feet)	Specific conductance (µS/cm)	pH (standard units)	Temperature (deg. C)	Hardness total (mg/L as CaCO3)	Acidity (mg/L as CaCO3)	Alkalinity, whole water total, FET, mg/L as CaCO3)
21N-25E-31 BBB 1	01-28-82	1530	361544094410101	1028	—	346	8.1	22.0	—	—	—
21N-25E-31 BBB 1	06-16-82	1330	361544094410101	80020	—	379	8.0	21.5	—	—	—
21N-25E-31 BBB 1	07-22-82	1000	361544094410101	1028	—	410	8.2	25.0	—	—	—
21N-25E-31 BBB 1	10-22-82	1500	361544094410101	1028	—	361	8.0	20.5	—	—	—
22N-23E-05 DCA 1	11-06-80	1300	362442094520801	1028	—	1,210	8.2	21.0	—	—	—
22N-23E-05 DCA 1	05-13-81	1130	362442094520801	1028	—	1,140	8.2	18.5	—	—	—
22N-23E-05 DCA 1	06-10-81	1200	362442094520801	80020	—	1,140	8.0	20.0	94	2.2	143
22N-23E-05 DCA 1	06-18-82	950	362442094520801	80020	—	1,200	7.4	21.5	—	—	—
22N-23E-05 DCA 1	07-22-82	1200	362442094520801	1028	—	1,210	8.2	22.5	—	—	—
22N-23E-11 BBB 1	07-27-82	—	362427094493001	1028	—	475	7.7	16.5	—	—	—
22N-23E-11 BBB 1	03-21-83	1445	362427094493001	84041	—	415	8.0	20.0	82	—	121
23N-22E-14 ADC 1	06-10-81	1245	362829094550901	80020	—	366	8.0	21.5	68	2.5	148
23N-25E-33 DDC 1	12-18-68	—	362532094374501	1028	—	311	7.9	—	160	—	159
23N-25E-33 DDC 1	07-09-81	1445	362532094374501	80020	—	317	7.6	20.5	170	7.3	159
24N-23E-15 BBC 1	06-11-81	930	363357094503701	80020	—	951	8.0	23.0	110	3.2	144
24N-23E-15 BBC 1	06-17-82	1000	363357094503701	80020	—	967	8.0	23.0	—	—	—
24N-24E-06 DCA 1	03-18-81	—	363510094464501	1028	—	853	8.2	16.0	—	—	—
24N-24E-06 DCA 1	06-11-81	1230	363510094464501	80020	—	784	8.1	24.0	99	1.7	151
25N-22E-23 CCD 1	11-06-80	1400	363740094553101	1028	—	569	8.0	19.0	—	—	—
25N-22E-23 CCD 1	02-19-81	1300	363740094553101	1028	—	544	8.1	20.0	—	—	—
25N-22E-23 CCD 1	05-12-81	1700	363740094553101	1028	—	527	8.0	21.0	—	—	—
25N-22E-23 CCD 1	06-10-81	1500	363740094553101	80020	—	487	8.1	21.0	69	1.7	143
25N-22E-23 CCD 1	09-10-81	1400	363740094553101	1028	—	578	8.0	22.0	—	—	—
25N-22E-23 CCD 1	01-28-82	1430	363740094553101	1028	—	531	8.0	19.5	—	—	—
25N-22E-23 CCD 1	04-22-82	1400	363740094553101	1028	—	593	8.0	19.5	—	—	—
25N-22E-23 CCD 1	07-21-82	1200	363740094553101	1028	—	824	7.9	21.5	—	—	—
25N-22E-23 CCD 1	08-17-82	1115	363740094553101	1028	—	590	7.9	22.0	—	—	—
25N-22E-23 CCD 1	10-21-82	1300	363740094553101	1028	—	570	8.0	20.0	—	—	—
25N-23E-13 AAB 1	06-11-81	1330	363921094474301	80020	—	577	7.6	24.0	140	5.2	166
25N-24E-28 BBB 1	12-15-68	—	363718094444501	1028	—	668	7.8	—	140	—	180
25N-24E-28 BBB 1	07-09-81	1200	363718094444501	80020	—	681	7.2	22.5	110	24	205
					OTTAWA COUNTY						
25N-23E-01 AAA 1	07-15-81	1700	364103094470401	80020	—	555	7.9	21.5	130	2.0	149
26N-22E-15 DDA 1	10-31-80	1000	364349094554501	1028	—	885	8.1	18.5	—	—	—
26N-22E-15 DDA 1	02-19-81	1530	364349094554501	1028	—	864	8.2	20.5	—	—	—
26N-22E-15 DDA 1	06-12-81	1000	364349094554501	80020	—	885	7.9	22.0	140	1.5	141

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Alka-linity, lab (mg/L as CaCO3)	Solids, residue at 180 deg. C, dissolved	Solids, residue at 105 deg. C, dissolved	Calcium, dissolved (mg/L as Ca)	Magnesium dissolved (mg/L as Mg)	Sodium, total recoverable (mg/L as Na)	Sodium, dissolved (mg/L as Na)	Sodium+ potasium, dissolved (mg/L as Na)	Potasium, dissolved (mg/L as K)
21N-25E-31 BBB 1	01-28-82	1530	—	—	—	—	—	—	—	—	—
21N-25E-31 BBB 1	06-16-82	1330	—	—	—	—	—	—	—	—	—
21N-25E-31 BBB 1	07-22-82	1000	—	—	—	—	—	—	—	—	—
21N-25E-31 BBB 1	10-22-82	1500	—	—	—	—	—	—	—	—	—
22N-23E-05 DCA 1	11-06-80	1300	—	—	—	—	—	—	—	—	—
22N-23E-05 DCA 1	05-13-81	1130	—	—	—	—	—	—	—	—	—
22N-23E-05 DCA 1	06-10-81	1200	129	610	—	22	9.4	—	190	—	3.2
22N-23E-05 DCA 1	06-18-82	950	—	—	—	—	—	—	—	—	—
22N-23E-05 DCA 1	07-22-82	1200	—	—	—	—	—	—	—	—	—
22N-23E-11 BBB 1	07-27-82	—	—	—	—	—	—	—	—	—	—
22N-23E-11 BBB 1	03-21-83	1445	—	234	—	20	7.9	—	59	—	2.1
23N-22E-14 ADC 1	06-10-81	1245	133	198	—	16	6.8	—	52	—	2.4
23N-25E-33 DDC 1	12-18-68	—	—	167	—	—	—	—	—	3.2	—
23N-25E-33 DDC 1	07-09-81	1445	151	176	—	66	1.1	—	2.9	—	0.40
24N-23E-15 BBC 1	06-11-81	930	135	518	—	27	11	—	160	—	4.0
24N-23E-15 BBC 1	06-17-82	1000	—	—	—	—	—	—	—	—	—
24N-24E-06 DCA 1	03-18-81	—	—	—	—	—	—	—	—	—	—
24N-24E-06 DCA 1	06-11-81	1230	140	432	—	23	10	—	130	—	3.6
25N-22E-23 CCD 1	11-06-80	1400	—	—	—	—	—	—	—	—	—
25N-22E-23 CCD 1	02-19-81	1300	—	—	—	—	—	—	—	—	—
25N-22E-23 CCD 1	05-12-81	1700	—	—	—	—	—	—	—	—	—
25N-22E-23 CCD 1	06-10-81	1500	128	268	—	16	7.1	—	78	—	3.2
25N-22E-23 CCD 1	09-10-81	1400	—	—	—	—	—	—	—	—	—
25N-22E-23 CCD 1	01-28-82	1430	—	—	—	—	—	—	—	—	—
25N-22E-23 CCD 1	04-22-82	1400	—	—	—	—	—	—	—	—	—
25N-22E-23 CCD 1	07-21-82	1200	—	—	—	—	—	—	—	—	—
25N-22E-23 CCD 1	08-17-82	1115	—	290	—	—	—	—	—	—	—
25N-22E-23 CCD 1	10-21-82	1300	—	—	—	—	—	—	—	—	—
25N-23E-13 AAB 1	06-11-81	1330	162	322	—	45	7.1	—	74	—	2.7
25N-24E-28 BBB 1	12-15-68	—	—	350	—	—	—	—	—	82	—
25N-24E-28 BBB 1	07-09-81	1200	188	358	—	44	1.1	—	87	—	3.4
						OTTAWA COUNTY					
25N-23E-01 AAA 1	07-15-81	1700	140	308	—	31	13	—	69	—	3.0
26N-22E-15 DDA 1	10-31-80	1000	—	—	—	—	—	—	—	—	—
26N-22E-15 DDA 1	02-19-81	1530	—	—	—	—	—	—	—	—	—
26N-22E-15 DDA 1	06-12-81	1000	135	480	—	31	15	—	130	—	4.3

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Bicarbonate, whole water total, FET, (mg/L as CaCO3)	Carbonate whole water total, FET, (mg/L as CaCO3)	Sulfate dis-solved (mg/L as SO4)	Chloride dis-solved (mg/L as Cl)	Fluoride, total (mg/L as F)	Fluoride, dissolved (mg/L as F)	Silica dissolved (mg/L as SiO2)	Nitrogen, nitrate dissolved (mg/L as N)	Nitrogen, nitrate+ nitrite dissolved (mg/L as N)
21N-25E-31 BBB 1	01-28-82	1530	—	—	—	—	—	—	—	—	—
21N-25E-31 BBB 1	06-16-82	1330	—	—	—	—	—	—	—	—	—
21N-25E-31 BBB 1	07-22-82	1000	—	—	—	—	—	—	—	—	—
21N-25E-31 BBB 1	10-22-82	1500	—	—	—	—	—	—	—	—	—
22N-23E-05 DCA 1	11-06-80	1300	—	—	—	—	—	—	—	—	—
22N-23E-05 DCA 1	05-13-81	1130	—	—	—	—	—	—	—	—	—
22N-23E-05 DCA 1	06-10-81	1200	170	0	10	280	—	2.0	10	—	—
22N-23E-05 DCA 1	06-18-82	950	—	—	—	—	—	—	—	—	—
22N-23E-05 DCA 1	07-22-82	1200	—	—	—	—	—	—	—	—	—
22N-23E-11 BBB 1	07-27-82	—	—	—	—	—	—	—	—	—	—
22N-23E-11 BBB 1	03-21-83	1445	—	—	11	49	—	1.2	12	—	—
23N-22E-14 ADC 1	06-10-81	1245	180	0	7.6	26	—	1.7	10	—	—
23N-25E-33 DDC 1	12-18-68	—	190	0	0.30	1.6	—	—	—	0.450	—
23N-25E-33 DDC 1	07-09-81	1445	190	0	3.9	1.7	—	0.10	8.0	—	—
24N-23E-15 BBC 1	06-11-81	930	180	0	10	220	—	1.6	10	—	—
24N-23E-15 BBC 1	06-17-82	1000	—	—	—	—	—	—	—	—	—
24N-24E-06 DCA 1	03-18-81	—	—	—	—	—	—	—	—	—	—
24N-24E-06 DCA 1	06-11-81	1230	180	0	6.8	160	—	1.4	10	—	—
25N-22E-23 CCD 1	11-06-80	1400	—	—	—	—	—	—	—	—	—
25N-22E-23 CCD 1	02-19-81	1300	—	—	—	—	—	—	—	—	—
25N-22E-23 CCD 1	05-12-81	1700	—	—	—	—	—	—	—	—	—
25N-22E-23 CCD 1	06-10-81	1500	170	0	11	68	—	0.30	10	—	—
25N-22E-23 CCD 1	09-10-81	1400	—	—	—	—	—	—	—	—	—
25N-22E-23 CCD 1	01-28-82	1430	—	—	—	—	—	—	—	—	—
25N-22E-23 CCD 1	04-22-82	1400	—	—	—	—	—	—	—	—	—
25N-22E-23 CCD 1	07-21-82	1200	—	—	—	—	—	—	—	—	—
25N-22E-23 CCD 1	08-17-82	1115	—	—	11	86	—	—	—	—	—
25N-22E-23 CCD 1	10-21-82	1300	—	—	—	—	—	—	—	—	—
25N-23E-13 AAB 1	06-11-81	1330	200	0	12	80	—	1.1	9.0	—	—
25N-24E-28 BBB 1	12-15-68	—	220	0	7.9	90	—	—	—	0.020	—
25N-24E-28 BBB 1	07-09-81	1200	250	0	9.3	96	—	1.4	10	—	—
					OTTAWA COUNTY						
25N-23E-01 AAA 1	07-15-81	1700	180	0	13	24	—	1.2	10	—	—
26N-22E-15 DDA 1	10-31-80	1000	—	—	—	—	—	—	—	—	—
26N-22E-15 DDA 1	02-19-81	1530	—	—	—	—	—	—	—	—	—
26N-22E-15 DDA 1	06-12-81	1000	170	0	14	190	—	1.0	10	—	—

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Site identification number	Agency analyzing sample	Sampling depth (feet)	Specific conductance (µS/cm)	pH (standard units)	Temperature (deg. C)	Hardness total (mg/L as CaCO3)	Acidity (mg/L as CaCO3)	Alkalinity, whole water total, FET, mg/L as CaCO3)
26N-22E-15 DDA 1	01-26-82	1400	364349094554501	1028	—	869	8.3	18.5	—	—	—
26N-22E-15 DDA 1	04-21-82	1100	364349094554501	1028	—	913	8.2	20.0	—	—	—
26N-22E-15 DDA 1	07-22-82	1100	364349094554501	1028	—	913	8.4	21.0	—	—	—
26N-22E-15 DDA 1	10-20-82	1100	364349094554501	1028	—	898	8.3	19.5	—	—	—
26N-22E-20 BCC 1	03-02-81	—	364323094585101	1028	—	1,150	8.2	17.5	—	—	—
26N-22E-20 BCC 1	06-12-81	900	364323094585101	80020	—	1,090	8.1	22.0	160	3.2	149
26N-22E-20 BCC 1	06-16-82	900	364323094585101	80020	—	1,140	7.9	19.5	—	—	—
26N-22E-27 ADD 1	07-08-81	830	364227094554301	80020	—	958	7.9	22.5	160	2.4	143
26N-22E-27 CBC 1	06-11-81	1600	364211094564101	80020	—	694	7.8	23.5	140	7.4	171
26N-22E-32 ADC 1	09-06-51	—	364135094580001	1028	—	1,420	7.8	—	170	—	137
26N-22E-32 ADC 1	06-11-81	1500	364135094580001	80020	—	1,410	7.7	24.0	190	4.2	149
26N-22E-32 ADC 1	06-16-82	1005	364135094580001	80020	—	1,560	7.6	21.5	—	—	—
26N-22E-32 ADC 2	10-31-80	1330	364135094580002	1028	—	1,430	7.6	20.5	—	—	—
26N-22E-32 ADC 2	02-17-81	1630	364135094580002	1028	—	1,440	8.7	25.0	—	—	—
26N-22E-32 ADC 2	05-12-81	1530	364135094580002	1028	—	1,390	8.0	21.5	—	—	—
26N-22E-32 ADC 2	06-11-81	1300	364135094580002	80020	—	1,500	7.7	24.0	190	5.2	153
26N-22E-32 ADC 2	09-16-81	1300	364135094580002	1028	—	1,380	8.1	20.0	—	—	—
26N-22E-32 ADC 2	01-27-82	1330	364135094580002	1028	—	1,280	8.0	20.5	—	—	—
26N-22E-32 ADC 2	04-21-82	1300	364135094580002	1028	—	1,390	7.9	20.5	—	—	—
26N-22E-32 ADC 2	06-16-82	1000	364135094580002	80020	—	1,380	7.7	21.0	—	—	—
26N-22E-32 ADC 2	07-21-82	1030	364135094580002	1028	—	1,510	8.0	22.5	—	—	—
26N-22E-32 DBB 1	07-29-44	—	364130094581501	1028	—	—	8.2	—	190	—	138
26N-23E-08 BBC 1	07-25-46	—	364520094521501	1028	—	663	—	—	180	—	166
26N-23E-09 CA 1	07-29-44	—	364501094505301	1028	—	—	8.4	20.0	150	—	135
26N-23E-09 CA 1	09-06-51	—	364501094505301	1028	—	613	8.1	—	140	—	136
26N-23E-09 CA 1	05-03-78	—	364501094505301	84042	—	—	8.2	—	140	—	142
26N-23E-09 CA 1	03-19-80	—	364501094505301	84042	—	—	7.3	—	140	—	112
26N-23E-09 CA 1	07-08-81	945	364501094505301	80020	—	504	7.5	21.5	190	16	221
26N-23E-09 CA 1	06-18-82	800	364501094505301	80020	—	819	7.4	21.5	—	—	—
26N-23E-09 DBC 1	10-30-80	900	364454094504401	1028	—	469	7.6	20.5	—	—	—
26N-23E-09 DBC 1	02-18-81	930	364454094504401	1028	—	592	7.8	19.5	—	—	—
26N-23E-09 DBC 1	05-14-81	1000	364454094504401	1028	—	543	8.0	20.0	—	—	—
26N-23E-09 DBC 1	07-08-81	930	364454094504401	80020	—	560	7.8	23.0	140	4.2	141
26N-23E-09 DBC 1	09-15-81	1000	364454094504401	1028	—	544	8.0	20.5	—	—	—
26N-23E-09 DBC 1	01-27-82	1030	364454094504401	1028	—	602	7.9	20.0	—	—	—
26N-23E-09 DBC 1	04-22-82	1030	364454094504401	1028	—	557	7.8	21.0	—	—	—

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Alka-linity, lab (mg/L as CaCO3)	Solids, residue at 180 deg. C, dissolved	Solids, residue at 105 deg. C, dissolved	Calcium, dissolved (mg/L as Ca)	Magnesium dissolved (mg/L as Mg)	Sodium, total recoverable (mg/L as Na)	Sodium, dissolved (mg/L as Na)	Sodium+ potasium, dissolved (mg/L as Na)	Potasium, dissolved (mg/L as K)
26N-22E-15 DDA 1	01-26-82	1400	—	—	—	—	—	—	—	—	—
26N-22E-15 DDA 1	04-21-82	1100	—	—	—	—	—	—	—	—	—
26N-22E-15 DDA 1	07-22-82	1100	—	—	—	—	—	—	—	—	—
26N-22E-15 DDA 1	10-20-82	1100	—	—	—	—	—	—	—	—	—
26N-22E-20 BCC 1	03-02-81	—	—	—	—	—	—	—	—	—	—
26N-22E-20 BCC 1	06-12-81	900	140	592	—	35	17	—	170	—	5.3
26N-22E-20 BCC 1	06-16-82	900	—	—	—	—	—	—	—	—	—
26N-22E-27 ADD 1	07-08-81	830	135	520	—	38	17	—	130	—	5.7
26N-22E-27 CBC 1	06-11-81	1600	159	370	—	32	14	—	98	—	4.3
26N-22E-32 ADC 1	09-06-51	—	—	758	—	39	18	—	220	—	2.6
26N-22E-32 ADC 1	06-11-81	1500	136	782	—	43	20	—	220	—	6.2
26N-22E-32 ADC 1	06-16-82	1005	—	—	—	—	—	—	—	—	—
26N-22E-32 ADC 2	10-31-80	1330	—	—	—	—	—	—	—	—	—
26N-22E-32 ADC 2	02-17-81	1630	—	—	—	—	—	—	—	—	—
26N-22E-32 ADC 2	05-12-81	1530	—	—	—	—	—	—	—	—	—
26N-22E-32 ADC 2	06-11-81	1300	138	824	—	44	20	—	250	—	6.2
26N-22E-32 ADC 2	09-16-81	1300	—	—	—	—	—	—	—	—	—
26N-22E-32 ADC 2	01-27-82	1330	—	—	—	—	—	—	—	—	—
26N-22E-32 ADC 2	04-21-82	1300	—	—	—	—	—	—	—	—	—
26N-22E-32 ADC 2	06-16-82	1000	—	—	—	—	—	—	—	—	—
26N-22E-32 ADC 2	07-21-82	1030	—	—	—	—	—	—	—	—	—
26N-22E-32 DBB 1	07-29-44	—	—	—	—	43	20	—	—	220	—
26N-23E-08 BBC 1	07-25-46	—	—	374	—	45	16	—	—	86	—
26N-23E-09 CA 1	07-29-44	—	—	—	—	34	16	—	—	66	—
26N-23E-09 CA 1	09-06-51	—	—	320	—	32	15	—	—	71	4.1
26N-23E-09 CA 1	05-03-78	—	—	—	331	—	—	66	—	—	—
26N-23E-09 CA 1	03-19-80	—	—	—	309	—	—	60	—	—	—
26N-23E-09 CA 1	07-08-81	945	204	278	—	56	12	—	41	—	1.7
26N-23E-09 CA 1	06-18-82	800	—	—	—	—	—	—	—	—	—
26N-23E-09 DBC 1	10-30-80	900	—	—	—	—	—	—	—	—	—
26N-23E-09 DBC 1	02-18-81	930	—	—	—	—	—	—	—	—	—
26N-23E-09 DBC 1	05-14-81	1000	—	—	—	—	—	—	—	—	—
26N-23E-09 DBC 1	07-08-81	930	131	306	—	32	15	—	65	—	3.6
26N-23E-09 DBC 1	09-15-81	1000	—	—	—	—	—	—	—	—	—
26N-23E-09 DBC 1	01-27-82	1030	—	—	—	—	—	—	—	—	—
26N-23E-09 DBC 1	04-22-82	1030	—	—	—	—	—	—	—	—	—

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Bicarbonate, whole water total, FET, (mg/L as CaCO3)	Carbonate whole water total, FET, (mg/L as CaCO3)	Sulfate dis- solved (mg/L as SO4)	Chloride dis- solved (mg/L as Cl)	Fluoride, total (mg/L as F)	Fluoride, dissolved (mg/L as F)	Silica dissolved (mg/L as SiO2)	Nitrogen, nitrate dissolved (mg/L as N)	Nitrogen, nitrate+ nitrite dissolved (mg/L as N)
26N-22E-15 DDA 1	01-26-82	1400	—	—	—	—	—	—	—	—	—
26N-22E-15 DDA 1	04-21-82	1100	—	—	—	—	—	—	—	—	—
26N-22E-15 DDA 1	07-22-82	1100	—	—	—	—	—	—	—	—	—
26N-22E-15 DDA 1	10-20-82	1100	—	—	—	—	—	—	—	—	—
26N-22E-20 BCC 1	03-02-81	—	—	—	—	—	—	—	—	—	—
26N-22E-20 BCC 1	06-12-81	900	180	0	96	270	—	1.3	10	—	—
26N-22E-20 BCC 1	06-16-82	900	—	—	—	—	—	—	—	—	—
26N-22E-27 ADD 1	07-08-81	830	170	0	16	220	—	1.2	10	—	—
26N-22E-27 CBC 1	06-11-81	1600	210	0	12	110	—	3.1	8.0	—	—
26N-22E-32 ADC 1	09-06-51	—	170	0	18	350	—	1.8	9.1	0.200	—
26N-22E-32 ADC 1	06-11-81	1500	180	0	18	360	—	1.5	9.0	—	—
26N-22E-32 ADC 1	06-16-82	1005	—	—	—	—	—	—	—	—	—
26N-22E-32 ADC 2	10-31-80	1330	—	—	—	—	—	—	—	—	—
26N-22E-32 ADC 2	02-17-81	1630	—	—	—	—	—	—	—	—	—
26N-22E-32 ADC 2	05-12-81	1530	—	—	—	—	—	—	—	—	—
26N-22E-32 ADC 2	06-11-81	1300	190	0	18	390	—	1.3	10	—	—
26N-22E-32 ADC 2	09-16-81	1300	—	—	—	—	—	—	—	—	—
26N-22E-32 ADC 2	01-27-82	1330	—	—	—	—	—	—	—	—	—
26N-22E-32 ADC 2	04-21-82	1300	—	—	—	—	—	—	—	—	—
26N-22E-32 ADC 2	06-16-82	1000	—	—	—	—	—	—	—	—	—
26N-22E-32 ADC 2	07-21-82	1030	—	—	—	—	—	—	—	—	—
26N-22E-32 DBB 1	07-29-44	—	170	—	16	360	—	—	—	0.630	—
26N-23E-08 BBC 1	07-25-46	—	180	10	16	130	—	—	—	0.050	—
26N-23E-09 CA 1	07-29-44	—	160	—	17	100	—	—	—	0.050	—
26N-23E-09 CA 1	09-06-51	—	170	0	15	100	—	0.70	9.4	0.050	—
26N-23E-09 CA 1	05-03-78	—	—	—	13	110	0.7	—	—	—	<0.100
26N-23E-09 CA 1	03-19-80	—	—	—	10	100	0.7	—	—	—	<0.500
26N-23E-09 CA 1	07-08-81	945	270	0	30	15	—	2.4	8.0	—	—
26N-23E-09 CA 1	06-18-82	800	—	—	—	—	—	—	—	—	—
26N-23E-09 DBC 1	10-30-80	900	—	—	—	—	—	—	—	—	—
26N-23E-09 DBC 1	02-18-81	930	—	—	—	—	—	—	—	—	—
26N-23E-09 DBC 1	05-14-81	1000	—	—	—	—	—	—	—	—	—
26N-23E-09 DBC 1	07-08-81	930	170	0	15	24	—	0.60	10	—	—
26N-23E-09 DBC 1	09-15-81	1000	—	—	—	—	—	—	—	—	—
26N-23E-09 DBC 1	01-27-82	1030	—	—	—	—	—	—	—	—	—
26N-23E-09 DBC 1	04-22-82	1030	—	—	—	—	—	—	—	—	—

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Site identification number	Agency analyzing sample	Sampling depth (feet)	Specific conductance (µS/cm)	pH (standard units)	Temperature (deg. C)	Hardness total (mg/L as CaCO3)	Acidity (mg/L as CaCO3)	Alkalinity, whole water total, FET, mg/L as CaCO3)
26N-23E-09 DBC 1	07-22-82	1000	364454094504401	1028	—	593	8.0	22.0	—	—	—
26N-23E-09 DBC 1	10-21-82	830	364454094504401	1028	—	588	7.9	19.0	—	—	—
26N-23E-12 BAD 1	07-08-81	1040	364516094473501	80020	—	514	7.8	22.5	140	1.9	133
26N-24E-32 ABA 1	07-30-81	1400	364155094451001	80020	—	511	7.2	18.0	220	11	180
27N-22E-01 CCC 1	05-01-78	—	365103094541501	84042	—	—	8.4	—	140	—	137
27N-22E-01 CCC 1	07-16-81	800	365103094541501	80020	—	721	7.7	22.0	150	2.0	133
27N-22E-27 AAB 1	07-09-81	900	364801094554601	80020	—	1,270	7.9	20.0	58	8.2	594
27N-23E-03 BCC 1	07-08-81	1630	365100094491701	80020	—	351	7.5	21.0	130	4.7	149
27N-23E-04 DCC 1	05-01-48	—	365042094504701	1028	—	541	—	—	140	—	121
27N-23E-17 CBB 1	11-05-80	900	364921094522201	1028	—	445	8.0	18.5	—	—	—
27N-23E-17 CBB 1	02-05-81	830	364921094522201	80020	—	504	8.2	16.0	130	2.0	—
27N-23E-17 CBB 1	05-12-81	945	364921094522201	1028	—	441	8.2	17.5	—	—	—
27N-23E-17 CBB 1	06-09-81	1545	364921094522201	80020	—	431	7.9	24.0	130	1.0	134
27N-23E-17 CBB 1	09-10-81	1030	364921094522201	1028	—	439	7.9	19.0	—	—	—
27N-23E-17 CBB 1	01-26-82	1030	364921094522201	1028	—	451	8.1	19.0	—	—	—
27N-23E-17 CBB 1	04-20-82	1000	364921094522201	1028	—	476	7.9	19.0	—	—	—
27N-23E-17 CBB 1	07-21-82	900	364921094522201	1028	—	458	8.2	20.5	—	—	—
27N-23E-17 CBB 1	10-20-82	1000	364921094522201	1028	—	471	7.8	19.0	—	—	—
27N-23E-28 CDC 1	07-08-81	1130	364712094510101	80020	—	897	7.8	20.0	96	18	484
27N-24E-21 CD 1	07-24-46	—	364806094433701	1028	—	276	—	—	140	—	127
27N-24E-28 CAD 1	05-03-78	—	364717094433101	84042	—	—	8.4	—	130	—	137
27N-24E-28 CAD 1	03-10-80	1435	364717094433101	84042	—	—	7.9	—	140	—	139
27N-24E-28 CAD 1	11-04-80	1430	364717094433101	1028	—	297	8.0	19.5	—	—	—
27N-24E-28 CAD 1	02-05-81	1230	364717094433101	1028	—	326	8.2	13.0	150	2.0	—
27N-24E-28 CAD 1	05-13-81	1445	364717094433101	1028	—	301	8.0	19.5	—	—	—
27N-24E-28 CAD 1	07-08-81	1500	364717094433101	80020	—	316	8.0	23.5	140	2.6	133
27N-24E-28 CAD 1	09-14-81	1430	364717094433101	1028	—	306	8.0	20.5	—	—	—
27N-24E-28 CAD 1	01-27-82	1505	364717094433101	1028	—	317	8.0	19.0	—	—	—
27N-24E-28 CAD 1	04-21-82	1500	364717094433101	1028	—	323	8.0	19.0	—	—	—
27N-24E-28 CAD 1	07-20-82	1500	364717094433101	1028	—	332	8.0	23.0	—	—	—
27N-24E-28 CAD 1	10-20-82	1500	364717094433101	1028	—	319	7.9	19.5	—	—	—
27N-25E-09 CAC 1	07-14-81	1030	364957094371501	80020	—	261	8.1	21.0	130	2.0	128
28N-22E-11 ABB 1	07-25-46	—	365543094535801	1028	—	298	—	17.0	120	—	135
28N-22E-11 ABB 1	07-10-81	830	365543094535801	80020	—	454	8.0	26.0	110	3.8	167
28N-22E-23 BAA 1	07-28-82	—	365357094541901	1028	—	750	8.0	16.5	—	—	—
28N-22E-24 AAB 1	08-03-44	—	365358094525001	1028	—	—	8.4	20.0	150	—	124
28N-22E-24 BDA 1	07-16-81	1330	365342094531301	80020	—	412	7.9	27.5	140	2.0	123

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Alka-linity, lab (mg/L as CaCO3)	Solids, residue at 180 deg. C, dissolved	Solids, residue at 105 deg. C, dissolved	Calcium, dissolved (mg/L as Ca)	Magnesium dissolved (mg/L as Mg)	Sodium, total recoverable (mg/L as Na)	Sodium, dissolved (mg/L as Na)	Sodium+ potasium, dissolved (mg/L as Na)	Potasium, dissolved (mg/L as K)
26N-23E-09 DBC 1	07-22-82	1000	—	—	—	—	—	—	—	—	—
26N-23E-09 DBC 1	10-21-82	830	—	—	—	—	—	—	—	—	—
26N-23E-12 BAD 1	07-08-81	1040	126	266	—	31	14	—	57	—	2.8
26N-24E-32 ABA 1	07-30-81	1400	173	324	—	83	3.2	—	22	—	1.2
27N-22E-01 CCC 1	05-01-78	—	—	367	—	—	—	—	80	—	—
27N-22E-01 CCC 1	07-16-81	800	127	402	—	36	15	—	94	—	3.6
27N-22E-27 AAB 1	07-09-81	900	342	792	—	14	5.6	—	320	—	3.7
27N-23E-03 BCC 1	07-08-81	1630	139	188	—	35	11	—	21	—	1.9
27N-23E-04 DCC 1	05-01-48	—	—	287	—	30	16	—	—	61	—
27N-23E-17 CBB 1	11-05-80	900	—	—	—	—	—	—	—	—	—
27N-23E-17 CBB 1	02-05-81	830	124	180	—	30	13	—	46	—	2.8
27N-23E-17 CBB 1	05-12-81	945	—	—	—	—	—	—	—	—	—
27N-23E-17 CBB 1	06-09-81	1545	125	250	—	30	14	—	44	—	2.7
27N-23E-17 CBB 1	09-10-81	1030	—	—	—	—	—	—	—	—	—
27N-23E-17 CBB 1	01-26-82	1030	—	—	—	—	—	—	—	—	—
27N-23E-17 CBB 1	04-20-82	1000	—	—	—	—	—	—	—	—	—
27N-23E-17 CBB 1	07-21-82	900	—	—	—	—	—	—	—	—	—
27N-23E-17 CBB 1	10-20-82	1000	—	—	—	—	—	—	—	—	—
27N-23E-28 CDC 1	07-08-81	1130	435	536	—	22	10	—	190	—	2.6
27N-24E-21 CD 1	07-24-46	—	—	162	—	32	14	—	—	10	—
27N-24E-28 CAD 1	05-03-78	—	—	—	171	—	—	13	—	—	—
27N-24E-28 CAD 1	03-10-80	1435	—	—	166	—	—	13	—	—	—
27N-24E-28 CAD 1	11-04-80	1430	—	—	—	—	—	—	—	—	—
27N-24E-28 CAD 1	02-05-81	1230	124	126	—	35	14	—	12	—	1.9
27N-24E-28 CAD 1	05-13-81	1445	—	—	—	—	—	—	—	—	—
27N-24E-28 CAD 1	07-08-81	1500	125	146	—	32	14	—	13	—	1.9
27N-24E-28 CAD 1	09-14-81	1430	—	—	—	—	—	—	—	—	—
27N-24E-28 CAD 1	01-27-82	1505	—	—	—	—	—	—	—	—	—
27N-24E-28 CAD 1	04-21-82	1500	—	—	—	—	—	—	—	—	—
27N-24E-28 CAD 1	07-20-82	1500	—	—	—	—	—	—	—	—	—
27N-24E-28 CAD 1	10-20-82	1500	—	—	—	—	—	—	—	—	—
27N-25E-09 CAC 1	07-14-81	1030	125	140	—	29	14	—	6.1	—	2.0
28N-22E-11 ABB 1	07-25-46	—	—	183	—	28	13	—	—	20	—
28N-22E-11 ABB 1	07-10-81	830	153	226	—	25	11	—	58	—	3.1
28N-22E-23 BAA 1	07-28-82	—	—	—	—	—	—	—	—	—	—
28N-22E-24 AAB 1	08-03-44	—	—	201	—	32	16	—	16	—	3.0
28N-22E-24 BDA 1	07-16-81	1330	117	232	—	32	14	—	31	—	2.1

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Bicarbonate, whole water total, FET, (mg/L as CaCO3)	Carbonate whole water total, FET, (mg/L as CaCO3)	Sulfate dis- solved (mg/L as SO4)	Chloride dis- solved (mg/L as Cl)	Fluoride, total (mg/L as F)	Fluoride, dissolved (mg/L as F)	Silica dissolved (mg/L as SiO2)	Nitrogen, nitrate dissolved (mg/L as N)	Nitrogen, nitrate+ nitrite dissolved (mg/L as N)
26N-23E-09 DBC 1	07-22-82	1000	—	—	—	—	—	—	—	—	—
26N-23E-09 DBC 1	10-21-82	830	—	—	—	—	—	—	—	—	—
26N-23E-12 BAD 1	07-08-81	1040	160	0	16	74	—	0.50	10	—	—
26N-24E-32 ABA 1	07-30-81	1400	220	0	12	40	—	0.10	12	—	—
27N-22E-01 CCC 1	05-01-78	—	—	—	11	120	0.7	—	—	—	0.100
27N-22E-01 CCC 1	07-16-81	800	160	0	15	150	—	0.80	10	—	—
27N-22E-27 AAB 1	07-09-81	900	720	0	46	89	—	13	9.0	—	—
27N-23E-03 BCC 1	07-08-81	1630	180	0	10	13	—	0.90	10	—	—
27N-23E-04 DCC 1	05-01-48	—	150	0	15	94	—	0.20	—	1.00	—
27N-23E-17 CBB 1	11-05-80	900	—	—	—	—	—	—	—	—	—
27N-23E-17 CBB 1	02-05-81	830	—	—	8.2	58	—	0.80	—	—	—
27N-23E-17 CBB 1	05-12-81	945	—	—	—	—	—	—	—	—	—
27N-23E-17 CBB 1	06-09-81	1545	160	0	14	55	—	0.70	9.0	—	—
27N-23E-17 CBB 1	09-10-81	1030	—	—	—	—	—	—	—	—	—
27N-23E-17 CBB 1	01-26-82	1030	—	—	—	—	—	—	—	—	—
27N-23E-17 CBB 1	04-20-82	1000	—	—	—	—	—	—	—	—	—
27N-23E-17 CBB 1	07-21-82	900	—	—	—	—	—	—	—	—	—
27N-23E-17 CBB 1	10-20-82	1000	—	—	—	—	—	—	—	—	—
27N-23E-28 CDC 1	07-08-81	1130	590	0	21	21	—	5.9	9.0	—	—
27N-24E-21 CD 1	07-24-46	—	140	8	17	10	—	—	—	0.050	—
27N-24E-28 CAD 1	05-03-78	—	—	—	11	12	0.4	—	—	—	<0.100
27N-24E-28 CAD 1	03-10-80	1435	—	—	15	17	0.3	—	—	—	<0.500
27N-24E-28 CAD 1	11-04-80	1430	—	—	—	—	—	—	—	—	—
27N-24E-28 CAD 1	02-05-81	1230	—	—	13	11	—	0.40	—	—	—
27N-24E-28 CAD 1	05-13-81	1445	—	—	—	—	—	—	—	—	—
27N-24E-28 CAD 1	07-08-81	1500	160	0	17	10	—	0.40	10	—	—
27N-24E-28 CAD 1	09-14-81	1430	—	—	—	—	—	—	—	—	—
27N-24E-28 CAD 1	01-27-82	1505	—	—	—	—	—	—	—	—	—
27N-24E-28 CAD 1	04-21-82	1500	—	—	—	—	—	—	—	—	—
27N-24E-28 CAD 1	07-20-82	1500	—	—	—	—	—	—	—	—	—
27N-24E-28 CAD 1	10-20-82	1500	—	—	—	—	—	—	—	—	—
27N-25E-09 CAC 1	07-14-81	1030	160	0	10	2.3	—	0.20	8.0	—	—
28N-22E-11 ABB 1	07-25-46	—	150	7	17	11	—	—	—	0.050	—
28N-22E-11 ABB 1	07-10-81	830	200	0	22	39	—	2.1	9.0	—	—
28N-22E-23 BAA 1	07-28-82	—	—	—	—	—	—	—	—	—	—
28N-22E-24 AAB 1	08-03-44	—	150	—	15	32	—	0.20	11	0.050	—
28N-22E-24 BDA 1	07-16-81	1330	150	0	13	48	—	0.40	11	—	—

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Site identification number	Agency analyzing sample	Sampling depth (feet)	Specific conductance (µS/cm)	pH (standard units)	Temperature (deg. C)	Hardness total (mg/L as CaCO3)	Acidity (mg/L as CaCO3)	Alkalinity, whole water total, FET, mg/L as CaCO3)
28N-22E-24 CAD 1	07-16-81	1430	365324094531301	80020	—	376	7.9	22.5	130	1.0	131
28N-22E-24 CBC 1	07-16-81	1315	365323094534001	80020	—	428	7.8	24.0	140	1.0	126
28N-22E-35 DCC 1	07-26-46	—	365133094545901	1028	—	303	—	17.0	130	—	129
28N-23E-06 BAC 1	07-07-81	900	365627094522201	80020	—	499	7.7	23.0	170	5.2	134
28N-23E-06 BAC 1	10-21-82	1800	365627094522201	84041	900	307	7.9	18.5	—	—	—
28N-23E-06 BAC 1	10-21-82	1830	365627094522201	84041	1,050	890	7.8	18.0	—	—	—
28N-23E-06 BAC 2	10-20-82	1830	365627094522101	84041	750	290	7.9	16.0	—	—	—
28N-23E-06 BAC 2	10-20-82	1900	365627094522101	84041	1,100	452	7.9	16.0	—	—	—
28N-23E-06 BAC 2	03-22-83	920	365627094522101	84041	—	335	7.6	20.0	150	—	120
28N-23E-06 CBB 1	09-03-42	—	365600094523001	1028	—	—	—	—	140	—	120
28N-23E-06 CBB 1	09-06-51	—	365600094523001	1028	—	277	7.9	—	120	—	120
28N-23E-06 CBB 1	03-22-83	900	365600094523001	84041	—	313	7.6	20.0	110	—	129
28N-23E-06 CBD 2	07-07-81	830	365557094522701	80020	—	285	8.0	21.0	120	2.1	138
28N-23E-18 CDC 1	07-16-81	1340	365402094522201	80020	—	519	7.9	27.0	140	2.0	130
28N-23E-20 BCB 1	07-15-81	1030	365344094513301	80020	—	290	8.0	27.5	120	1.0	121
28N-23E-24 DDA 1	05-02-78	—	365316094461601	84042	—	—	8.3	—	130	—	128
28N-23E-24 DDA 1	03-12-80	1130	365316094461601	84042	—	—	8.0	—	130	—	122
28N-23E-24 DDA 1	10-30-80	1145	365316094461601	1028	—	285	8.0	17.5	—	—	—
28N-23E-24 DDA 1	07-15-81	1400	365316094461601	80020	—	342	7.9	26.0	140	1.0	133
28N-23E-28 BBB 1	07-14-81	1700	365301094502901	80020	—	747	8.1	23.5	160	<1.0	126
28N-23E-30 CAC 1	03-30-59	—	365229094522101	1028	—	747	7.8	—	170	—	123
28N-23E-30 CAC 1	07-15-81	900	365229094522101	80020	—	536	7.8	22.0	140	2.0	125
28N-23E-30 DBC 1	10-08-82	1330	365229094520201	84041	—	1,400	7.5	14.5	—	—	—
28N-23E-30 DBC 1	12-08-82	1300	365229094520201	84041	800	485	7.4	14.5	—	—	—
28N-23E-30 DBC 1	12-08-82	1400	365229094520201	84041	1,480	16,800	7.3	15.0	—	—	—
28N-23E-31 BAB 1	05-20-52	—	365210094522101	1028	—	592	7.9	21.0	140	—	121
28N-23E-31 BAB 1	03-30-59	1200	365210094522101	1028	—	308	7.7	—	120	—	130
28N-23E-31 BAB 1	03-30-59	1201	365210094522101	1028	—	316	7.7	—	130	—	131
28N-23E-31 BAC 1	03-30-59	—	365206094522201	1028	—	300	7.8	—	130	—	125
28N-23E-31 BAC 1	07-15-81	1100	365206094522201	80020	—	705	7.9	22.5	140	1.0	130
28N-23E-31 CBA 1	09-03-42	—	365146094522201	1028	—	—	—	—	160	—	125
28N-23E-31 CBA 1	07-15-81	930	365146094522201	80020	—	331	7.9	22.0	140	1.0	125
28N-23E-32 BAB 1	03-30-59	—	365212094511901	1028	—	416	7.7	—	140	—	118
28N-23E-32 BAB 1	12-29-80	1000	365212094511901	1028	—	475	8.0	18.5	—	—	—
28N-23E-32 BAB 1	02-05-81	1445	365212094511901	1028	—	604	8.0	16.5	150	2.0	—
28N-23E-32 BAB 1	07-15-81	1130	365212094511901	80020	—	572	7.9	22.0	79	1.0	128
28N-23E-33 BAB 1	03-30-59	—	365213094500701	1028	—	625	7.8	—	140	—	120

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Alkalinity, lab (mg/L as CaCO3)	Solids, residue at 180 deg. C, dissolved	Solids, residue at 105 deg. C, dissolved	Calcium, dissolved (mg/L as Ca)	Magnesium dissolved (mg/L as Mg)	Sodium, total recoverable (mg/L as Na)	Sodium, dissolved (mg/L as Na)	Sodium+ potasium, dissolved (mg/L as Na)	Potasium, dissolved (mg/L as K)
28N-22E-24 CAD 1	07-16-81	1430	126	208	—	30	13	—	25	—	2.8
28N-22E-24 CBC 1	07-16-81	1315	121	—	—	32	14	—	38	—	2.5
28N-22E-35 DCC 1	07-26-46	—	—	189	—	30	14	—	—	17	—
28N-23E-06 BAC 1	07-07-81	900	125	270	—	41	17	—	36	—	2.8
28N-23E-06 BAC 1	10-21-82	1800	—	178	—	—	—	—	—	—	—
28N-23E-06 BAC 1	10-21-82	1830	—	530	—	—	—	—	—	—	—
28N-23E-06 BAC 2	10-20-82	1830	—	162	—	—	—	—	—	—	—
28N-23E-06 BAC 2	10-20-82	1900	—	255	—	—	—	—	—	—	—
28N-23E-06 BAC 2	03-22-83	920	—	200	—	34	15	—	20	—	2.5
28N-23E-06 CBB 1	09-03-42	—	—	—	—	32	15	—	—	1.8	—
28N-23E-06 CBB 1	09-06-51	—	—	149	—	28	13	—	—	9.6	2.2
28N-23E-06 CBB 1	03-22-83	900	—	166	—	26	12	—	17	—	3.0
28N-23E-06 CBD 2	07-07-81	830	124	150	—	29	12	—	15	—	3.3
28N-23E-18 CDC 1	07-16-81	1340	116	290	—	33	15	—	51	—	2.1
28N-23E-20 BCB 1	07-15-81	1030	116	142	—	28	13	—	11	—	1.7
28N-23E-24 DDA 1	05-02-78	—	—	—	163	—	—	<5.0	—	—	—
28N-23E-24 DDA 1	03-12-80	1130	—	—	153	—	—	<10	—	—	—
28N-23E-24 DDA 1	10-30-80	1145	—	—	—	—	—	—	—	—	—
28N-23E-24 DDA 1	07-15-81	1400	125	174	—	32	15	—	14	—	2.0
28N-23E-28 BBB 1	07-14-81	1700	119	380	—	36	16	—	87	—	2.8
28N-23E-30 CAC 1	03-30-59	—	—	441	—	42	16	—	82	—	3.3
28N-23E-30 CAC 1	07-15-81	900	119	290	—	33	15	—	54	—	2.6
28N-23E-30 DBC 1	10-08-82	1330	—	686	—	—	—	—	—	—	—
28N-23E-30 DBC 1	12-08-82	1300	—	228	—	—	—	—	—	—	—
28N-23E-30 DBC 1	12-08-82	1400	—	9,410	—	—	—	—	3,200	—	—
28N-23E-31 BAB 1	05-20-52	—	—	320	—	32	15	—	63	—	3.0
28N-23E-31 BAB 1	03-30-59	1200	—	191	—	29	11	—	—	22	2.9
28N-23E-31 BAB 1	03-30-59	1201	—	200	—	31	12	—	—	19	2.9
28N-23E-31 BAC 1	03-30-59	—	—	187	—	32	12	—	15	—	2.8
28N-23E-31 BAC 1	07-15-81	1100	122	360	—	33	15	—	86	—	3.4
28N-23E-31 CBA 1	09-03-42	—	—	—	—	37	16	—	—	42	—
28N-23E-31 CBA 1	07-15-81	930	120	166	—	31	14	—	16	—	2.1
28N-23E-32 BAB 1	03-30-59	—	—	242	—	33	13	—	34	—	2.7
28N-23E-32 BAB 1	12-29-80	1000	—	—	—	—	—	—	—	—	—
28N-23E-32 BAB 1	02-05-81	1445	117	278	—	35	15	—	56	—	2.9
28N-23E-32 BAB 1	07-15-81	1130	120	294	—	18	8.2	—	58	—	2.7
28N-23E-33 BAB 1	03-30-59	—	—	351	—	38	12	—	—	68	3.2

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Bicarbonate, whole water total, FET, (mg/L as CaCO3)	Carbonate whole water total, FET, (mg/L as CaCO3)	Sulfate dis- solved (mg/L as SO4)	Chloride dis- solved (mg/L as Cl)	Fluoride, total (mg/L as F)	Fluoride, dissolved (mg/L as F)	Silica dissolved (mg/L as SiO2)	Nitrogen, nitrate dissolved (mg/L as N)	Nitrogen, nitrate+ nitrite dissolved (mg/L as N)
28N-22E-24 CAD 1	07-16-81	1430	160	0	14	30	—	0.80	12	—	—
28N-22E-24 CBC 1	07-16-81	1315	150	0	16	52	—	—	10	—	—
28N-22E-35 DCC 1	07-26-46	—	140	10	16	17	—	—	—	0.050	—
28N-23E-06 BAC 1	07-07-81	900	160	0	38	55	—	0.40	10	—	—
28N-23E-06 BAC 1	10-21-82	1800	—	—	22	5.5	—	0.80	—	—	—
28N-23E-06 BAC 1	10-21-82	1830	—	—	63	160	—	0.50	—	—	—
28N-23E-06 BAC 2	10-20-82	1830	—	—	18	4.6	—	0.70	—	—	—
28N-23E-06 BAC 2	10-20-82	1900	—	—	16	66	—	0.30	—	—	—
28N-23E-06 BAC 2	03-22-83	920	—	—	26	28	—	0.40	9.8	—	—
28N-23E-06 CBB 1	09-03-42	—	150	—	12	7.0	—	0.50	—	0.500	—
28N-23E-06 CBB 1	09-06-51	—	150	0	16	8.0	—	0.50	9.8	0.050	—
28N-23E-06 CBB 1	03-22-83	900	—	—	20	5.5	—	1.1	9.0	—	—
28N-23E-06 CBD 2	07-07-81	830	170	0	17	3.8	—	1.0	10	—	—
28N-23E-18 CDC 1	07-16-81	1340	160	0	16	81	—	0.40	12	—	—
28N-23E-20 BCB 1	07-15-81	1030	150	0	14	8.6	—	0.50	10	—	—
28N-23E-24 DDA 1	05-02-78	—	—	—	11	6.0	0.2	—	—	—	<0.100
28N-23E-24 DDA 1	03-12-80	1130	—	—	15	15	0.2	—	—	—	<0.500
28N-23E-24 DDA 1	10-30-80	1145	—	—	—	—	—	—	—	—	—
28N-23E-24 DDA 1	07-15-81	1400	160	0	14	22	—	0.30	10	—	—
28N-23E-28 BBB 1	07-14-81	1700	150	0	14	150	—	0.50	10	—	—
28N-23E-30 CAC 1	03-30-59	—	150	0	14	150	—	0.50	10	0.020	—
28N-23E-30 CAC 1	07-15-81	900	150	0	15	83	—	0.50	10	—	—
28N-23E-30 DBC 1	10-08-82	1330	—	—	16	330	—	0.70	—	—	—
28N-23E-30 DBC 1	12-08-82	1300	—	—	14	65	—	0.90	—	—	—
28N-23E-30 DBC 1	12-08-82	1400	—	—	13	5,600	—	2.1	—	—	—
28N-23E-31 BAB 1	05-20-52	—	150	0	18	100	—	0.70	10	0.00	—
28N-23E-31 BAB 1	03-30-59	1200	160	0	14	12	—	1.2	8.4	0.020	—
28N-23E-31 BAB 1	03-30-59	1201	160	0	30	14	—	1.2	9.4	0.020	—
28N-23E-31 BAC 1	03-30-59	—	150	0	13	12	—	0.90	8.0	0.050	—
28N-23E-31 BAC 1	07-15-81	1100	160	0	16	130	—	0.70	10	—	—
28N-23E-31 CBA 1	09-03-42	—	150	—	12	78	—	0.50	—	0.590	—
28N-23E-31 CBA 1	07-15-81	930	150	0	14	21	—	0.50	9.0	—	—
28N-23E-32 BAB 1	03-30-59	—	140	0	14	50	—	0.50	9.6	0.00	—
28N-23E-32 BAB 1	12-29-80	1000	—	—	—	—	—	—	—	—	—
28N-23E-32 BAB 1	02-05-81	1445	—	—	9.9	91	—	0.50	—	—	—
28N-23E-32 BAB 1	07-15-81	1130	160	0	16	92	—	0.50	10	—	—
28N-23E-33 BAB 1	03-30-59	—	150	0	13	110	—	0.60	10	0.00	—

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Site identification number	Agency analyzing sample	Sampling depth (feet)	Specific conductance (µS/cm)	pH (standard units)	Temperature (deg. C)	Hardness total (mg/L as CaCO3)	Acidity (mg/L as CaCO3)	Alkalinity, whole water total, FET, mg/L as CaCO3)
28N-23E-33 BAB 1	07-14-81	1615	365213094500701	80020	—	573	8.0	23.5	150	<1.0	123
28N-23E-36 CCC 1	07-15-81	1300	365128094471301	80020	—	336	7.9	25.5	140	2.0	130
28N-24E-13 ABD 1	10-16-68	—	365445094400701	1028	—	—	7.9	—	160	—	120
28N-24E-13 ABD 1	03-12-80	1150	365445094400701	84042	—	—	8.0	—	140	—	146
28N-24E-13 ABD 1	07-14-81	1230	365445094400701	80020	—	287	8.0	22.0	140	2.0	148
28N-25E-20 CAA 1	05-24-79	—	365335094380701	84042	—	—	7.9	—	150	—	137
28N-25E-20 CAA 1	03-12-80	1245	365335094380701	84042	—	—	7.9	—	150	—	139
28N-25E-20 CAA 1	02-18-81	1600	365335094380701	1028	—	294	8.0	20.5	—	—	—
28N-25E-20 CAA 1	03-17-81	1600	365335094380701	1028	—	357	8.0	19.5	—	—	—
28N-25E-20 CAA 1	05-08-81	1500	365335094380701	1028	—	286	7.8	18.5	—	—	—
28N-25E-20 CAA 1	06-09-81	1330	365335094380701	80020	—	283	8.1	24.0	140	1.5	144
28N-25E-20 CAA 1	09-09-81	1630	365335094380701	1028	—	296	7.9	21.0	—	—	—
28N-25E-20 CAA 1	01-25-82	1430	365335094380701	1028	—	305	8.0	17.5	—	—	—
28N-25E-20 CAA 1	04-21-82	910	365335094380701	1028	—	313	7.8	18.0	—	—	—
28N-25E-20 CAA 1	07-20-82	1600	365335094380701	1028	—	297	8.0	23.0	—	—	—
29N-22E-21 DAD 1	10-29-80	1100	365833094551901	1028	—	775	8.6	16.5	—	—	—
29N-22E-21 DAD 1	02-04-81	1615	365833094551901	1028	—	866	8.3	16.0	140	2.0	—
29N-22E-21 DAD 1	03-06-81	900	365833094551901	.1028	—	869	8.3	17.5	—	—	—
29N-22E-21 DAD 1	05-12-81	900	365833094551901	1028	—	877	8.3	18.0	—	—	—
29N-22E-21 DAD 1	06-09-81	1700	365833094551901	80020	—	841	8.2	23.5	150	<1.0	151
29N-22E-21 DAD 1	09-10-81	1130	365833094551901	1028	—	957	7.7	21.5	—	—	—
29N-22E-21 DAD 1	01-26-82	900	365833094551901	1028	—	948	8.3	17.0	—	—	—
29N-22E-21 DAD 1	04-20-82	900	365833094551901	1028	—	955	7.9	19.0	—	—	—
29N-22E-21 DAD 1	07-20-82	830	365833094551901	1028	—	1,010	8.0	22.0	—	—	—
29N-22E-21 DAD 1	10-20-82	900	365833094551901	1028	—	983	8.0	20.0	—	—	—
29N-23E-16 DDD 1	12-26-82	1500	365917094484701	84041	300	4,100	5.9	—	—	—	—
29N-23E-19 DDC 1	05-02-78	—	365823094510701	84042	—	—	8.3	—	130	—	134
29N-23E-19 DDC 1	03-11-80	—	365823094510701	84042	—	—	7.9	—	130	—	127
29N-23E-19 DDC 1	07-14-81	830	365823094510701	80020	—	292	7.9	23.0	140	2.0	126
29N-23E-21 BBC 1	09-03-42	—	365905094494601	1028	—	—	—	20.0	150	—	121
29N-23E-21 BBC 1	09-06-51	—	365905094494601	1028	—	300	8.1	—	130	—	—
29N-23E-21 BBC 1	07-07-81	1415	365905094494601	80020	—	410	7.8	22.5	190	3.1	130
29N-23E-21 BBC 1	07-23-81	1100	365905094494601	1028	—	425	7.9	19.0	180	—	120
29N-23E-21 BBC 1	09-02-82	830	365905094494601	84041	—	429	7.3	22.0	170	1.0	121
29N-23E-21 BBC 2	04-28-48	—	365905094494602	1028	—	303	—	—	140	—	121
29N-23E-21 BBC 2	07-07-81	1420	365905094494602	80020	—	399	7.8	24.0	180	6.1	126

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Alkalinity, lab (mg/L as CaCO3)	Solids, residue at 180 deg. C, dissolved	Solids, residue at 105 deg. C, dissolved	Calcium, dissolved (mg/L as Ca)	Magnesium dissolved (mg/L as Mg)	Sodium, total recoverable (mg/L as Na)	Sodium, dissolved (mg/L as Na)	Sodium+ potasium, dissolved (mg/L as Na)	Potasium, dissolved (mg/L as K)
28N-23E-33 BAB 1	07-14-81	1615	117	300	—	34	15	—	61	—	2.6
28N-23E-36 CCC 1	07-15-81	1300	124	166	—	33	15	—	14	—	1.9
28N-24E-13 ABD 1	10-16-68	—	—	—	170	38	14	—	11	—	1.4
28N-24E-13 ABD 1	03-12-80	1150	—	—	153	—	—	<10	—	—	—
28N-24E-13 ABD 1	07-14-81	1230	136	148	—	31	16	—	5.1	—	1.1
28N-25E-20 CAA 1	05-24-79	—	—	—	184	—	—	—	—	—	—
28N-25E-20 CAA 1	03-12-80	1245	—	—	153	—	—	10	—	—	—
28N-25E-20 CAA 1	02-18-81	1600	—	—	—	—	—	—	—	—	—
28N-25E-20 CAA 1	03-17-81	1600	—	—	—	—	—	—	—	—	—
28N-25E-20 CAA 1	05-08-81	1500	—	—	—	—	—	—	—	—	—
28N-25E-20 CAA 1	06-09-81	1330	135	158	—	32	15	—	4.4	—	1.8
28N-25E-20 CAA 1	09-09-81	1630	—	—	—	—	—	—	—	—	—
28N-25E-20 CAA 1	01-25-82	1430	—	—	—	—	—	—	—	—	—
28N-25E-20 CAA 1	04-21-82	910	—	—	—	—	—	—	—	—	—
28N-25E-20 CAA 1	07-20-82	1600	—	—	—	—	—	—	—	—	—
29N-22E-21 DAD 1	10-29-80	1100	—	—	—	—	—	—	—	—	—
29N-22E-21 DAD 1	02-04-81	1615	146	378	—	32	15	—	110	—	4.3
29N-22E-21 DAD 1	03-06-81	900	—	—	—	—	—	—	—	—	—
29N-22E-21 DAD 1	05-12-81	900	—	—	—	—	—	—	—	—	—
29N-22E-21 DAD 1	06-09-81	1700	184	448	—	32	16	—	120	—	4.5
29N-22E-21 DAD 1	09-10-81	1130	—	—	—	—	—	—	—	—	—
29N-22E-21 DAD 1	01-26-82	900	—	—	—	—	—	—	—	—	—
29N-22E-21 DAD 1	04-20-82	900	—	—	—	—	—	—	—	—	—
29N-22E-21 DAD 1	07-20-82	830	—	—	—	—	—	—	—	—	—
29N-22E-21 DAD 1	10-20-82	900	—	—	—	—	—	—	—	—	—
29N-23E-16 DDD 1	12-26-82	1500	—	—	—	—	—	—	—	—	—
29N-23E-19 DDC 1	05-02-78	—	—	—	166	—	—	6.0	—	—	—
29N-23E-19 DDC 1	03-11-80	—	—	—	163	—	—	<10	—	—	—
29N-23E-19 DDC 1	07-14-81	830	121	156	—	32	15	—	8.6	—	1.8
29N-23E-21 BBC 1	09-03-42	—	—	—	—	34	16	—	—	3.7	—
29N-23E-21 BBC 1	09-06-51	—	119	157	—	29	14	—	12	—	1.9
29N-23E-21 BBC 1	07-07-81	1415	122	222	—	44	19	—	12	—	2.0
29N-23E-21 BBC 1	07-23-81	1100	130	235	—	42	18	—	12	—	2.0
29N-23E-21 BBC 1	09-02-82	830	—	238	—	40	17	—	12	—	2.7
29N-23E-21 BBC 2	04-28-48	—	—	178	—	30	16	—	—	14	—
29N-23E-21 BBC 2	07-07-81	1420	121	226	—	41	18	—	13	—	2.1

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Bicarbonate, whole water total, FET, (mg/L as $CaCO_3$)	Carbonate whole water total, FET, (mg/L as $CaCO_3$)	Sulfate dis- solved (mg/L as SO_4)	Chloride dis- solved (mg/L as Cl)	Fluoride, total (mg/L as F)	Fluoride, dissolved (mg/L as F)	Silica dissolved (mg/L as SiO_2)	Nitrogen, nitrate dissolved (mg/L as N)	Nitrogen, nitrate+ nitrite dissolved (mg/L as N)
28N-23E-33 BAB 1	07-14-81	1615	150	0	13	99	—	0.50	10	—	—
28N-23E-36 CCC 1	07-15-81	1300	160	0	14	21	—	0.30	10	—	—
28N-24E-13 ABD 1	10-16-68	—	140	5	8.0	12	—	0.38	—	0.00	—
28N-24E-13 ABD 1	03-12-80	1150	—	—	11	5.0	0.1	—	—	—	<0.500
28N-24E-13 ABD 1	07-14-81	1230	180	0	12	3.6	—	0.10	9.0	—	—
28N-25E-20 CAA 1	05-24-79	—	—	—	23	7.0	0.2	—	—	—	0.100
28N-25E-20 CAA 1	03-12-80	1245	—	—	15	10	0.1	—	—	—	<0.500
28N-25E-20 CAA 1	02-18-81	1600	—	—	—	—	—	—	—	—	—
28N-25E-20 CAA 1	03-17-81	1600	—	—	—	—	—	—	—	—	—
28N-25E-20 CAA 1	05-08-81	1500	—	—	—	—	—	—	—	—	—
28N-25E-20 CAA 1	06-09-81	1330	180	0	9.3	3.0	—	0.20	10	—	—
28N-25E-20 CAA 1	09-09-81	1630	—	—	—	—	—	—	—	—	—
28N-25E-20 CAA 1	01-25-82	1430	—	—	—	—	—	—	—	—	—
28N-25E-20 CAA 1	04-21-82	910	—	—	—	—	—	—	—	—	—
28N-25E-20 CAA 1	07-20-82	1600	—	—	—	—	—	—	—	—	—
29N-22E-21 DAD 1	10-29-80	1100	—	—	—	—	—	—	—	—	—
29N-22E-21 DAD 1	02-04-81	1615	—	—	8.2	160	—	1.5	—	—	—
29N-22E-21 DAD 1	03-06-81	900	—	—	—	—	—	—	—	—	—
29N-22E-21 DAD 1	05-12-81	900	—	—	—	—	—	—	—	—	—
29N-22E-21 DAD 1	06-09-81	1700	180	0	8.2	190	—	0.70	9.0	—	—
29N-22E-21 DAD 1	09-10-81	1130	—	—	—	—	—	—	—	—	—
29N-22E-21 DAD 1	01-26-82	900	—	—	—	—	—	—	—	—	—
29N-22E-21 DAD 1	04-20-82	900	—	—	—	—	—	—	—	—	—
29N-22E-21 DAD 1	07-20-82	830	—	—	—	—	—	—	—	—	—
29N-22E-21 DAD 1	10-20-82	900	—	—	—	—	—	—	—	—	—
29N-23E-16 DDD 1	12-26-82	1500	—	—	—	—	—	—	—	—	—
29N-23E-19 DDC 1	05-02-78	—	—	—	11	7.0	0.4	—	—	—	<0.100
29N-23E-19 DDC 1	03-11-80	—	—	—	18	2.0	0.4	—	—	—	<0.500
29N-23E-19 DDC 1	07-14-81	830	150	0	16	8.4	—	0.40	10	—	—
29N-23E-21 BBC 1	09-03-42	—	150	—	11	16	—	0.40	—	0.380	—
29N-23E-21 BBC 1	09-06-51	—	140	0	16	16	—	0.30	9.8	0.050	—
29N-23E-21 BBC 1	07-07-81	1415	160	0	68	9.9	—	0.40	10	—	—
29N-23E-21 BBC 1	07-23-81	1100	—	—	74	9.7	—	0.30	8.0	—	—
29N-23E-21 BBC 1	09-02-82	830	—	—	58	10	—	0.40	8.8	—	—
29N-23E-21 BBC 2	04-28-48	—	150	0	18	23	—	0.10	—	0.00	—
29N-23E-21 BBC 2	07-07-81	1420	150	0	63	11	—	0.40	10	—	—

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Site identification number	Agency analyzing sample	Sampling depth (feet)	Specific conductance (µS/cm)	pH (standard units)	Temperature (deg. C)	Hardness total (mg/L as CaCO3)	Acidity (mg/L as CaCO3)	Alkalinity, whole water total, FET, mg/L as CaCO3)
29N-23E-21 BBC 2	09-02-82	831	365905094494602	84041	—	425	7.3	22.0	160	1.0	121
29N-23E-21 BBC 3	07-07-81	1430	365905094494603	80020	—	488	7.8	24.0	220	2.8	133
29N-23E-21 BBC 3	09-02-82	832	365905094494603	84041	—	549	7.3	22.0	210	1.0	128
29N-23E-25 AAA 1	04-15-47	—	365757094464601	1028	—	918	—	21.0	180	—	132
29N-23E-25 BDC 1	10-19-77	800	365800094461701	84042	—	—	7.6	—	170	—	123
29N-23E-25 BDC 1	10-19-77	1200	365800094461701	84042	—	—	7.8	—	160	—	126
29N-23E-25 BDC 1	10-19-77	1600	365800094461701	84042	—	—	8.4	—	160	—	124
29N-23E-25 BDC 1	10-01-79	—	365800094461701	84042	—	—	—	—	150	—	—
29N-23E-25 BDC 1	03-11-80	1515	365800094461701	84042	—	—	7.3	—	290	—	149
29N-23E-25 BDC 1	04-09-81	800	365800094461701	84042	—	913	—	—	—	—	161
29N-23E-25 BDC 1	07-07-81	1100	365800094461701	80020	—	1,430	7.0	21.0	740	59	197
29N-23E-25 BDC 1	07-07-81	1230	365800094461701	80020	—	1,430	7.0	21.0	730	49	216
29N-23E-26 CDD 1	05-02-78	—	365734094471001	84042	—	—	8.4	—	150	—	128
29N-23E-26 CDD 1	03-11-80	1435	365734094471001	84042	—	—	7.9	—	190	—	137
29N-23E-26 CDD 1	07-07-81	1045	365734094471001	80020	—	515	7.8	24.0	250	5.4	144
29N-23E-31 BDD 1	09-12-42	—	365704094513101	1028	—	—	—	21.0	130	—	118
29N-23E-31 BDD 1	07-10-81	930	365704094513101	80020	—	366	7.9	22.0	140	1.9	136
29N-23E-32 ADD 1	04-20-82	1730	365722094500401	84041	210	447	7.6	17.0	220	—	—
29N-23E-32 ADD 1	04-20-82	1750	365722094500401	84041	300	3,640	5.2	16.0	1,600	—	—
29N-23E-35 BDD 1	03-11-42	—	365734094471101	1028	—	—	—	18.0	420	—	180
29N-23E-35 BDD 1	09-06-51	—	365734094471101	1028	—	262	8.0	—	130	—	119

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Alka-linity, lab (mg/L as CaCO3)	Solids, residue at 180 deg. C, dissolved	Solids, residue at 105 deg. C, dissolved	Calcium, dissolved (mg/L as Ca)	Magnesium dissolved (mg/L as Mg)	Sodium, total recoverable (mg/L as Na)	Sodium, dissolved (mg/L as Na)	Sodium+ potasium, dissolved (mg/L as Na)	Potasium, dissolved (mg/L as K)
29N-23E-21 BBC 2	09-02-82	831	—	222	—	36	16	—	12	—	2.4
29N-23E-21 BBC 3	07-07-81	1430	125	280	—	50	22	—	20	—	3.1
29N-23E-21 BBC 3	09-02-82	832	—	308	—	49	21	—	18	—	2.8
29N-23E-25 AAA 1	04-15-47	—	—	—	—	40	20	—	—	120	—
29N-23E-25 BDC 1	10-19-77	800	—	—	210	—	—	—	—	—	—
29N-23E-25 BDC 1	10-19-77	1200	—	—	210	—	—	—	—	—	—
29N-23E-25 BDC 1	10-19-77	1600	—	—	210	—	—	—	—	—	—
29N-23E-25 BDC 1	10-01-79	—	—	—	—	—	—	—	—	—	—
29N-23E-25 BDC 1	03-11-80	1515	—	—	441	—	—	26	—	—	—
29N-23E-25 BDC 1	04-09-81	800	—	—	718	—	—	—	—	—	—
29N-23E-25 BDC 1	07-07-81	1100	165	1,170	—	170	76	—	50	—	3.7
29N-23E-25 BDC 1	07-07-81	1230	171	1,110	—	170	75	—	50	—	3.4
29N-23E-26 CDD 1	05-02-78	—	—	—	191	—	—	5.0	—	—	—
29N-23E-26 CDD 1	03-11-80	1435	—	—	260	—	—	12	—	—	—
29N-23E-26 CDD 1	07-07-81	1045	135	326	—	56	26	—	15	—	2.7
29N-23E-31 BDD 1	09-12-42	—	—	—	—	29	14	—	—	12	—
29N-23E-31 BDD 1	07-10-81	930	126	214	—	33	14	—	19	—	3.9
29N-23E-32 ADD 1	04-20-82	1730	—	—	—	80	4.9	—	1.4	—	1.6
29N-23E-32 ADD 1	04-20-82	1750	—	—	—	440	110	—	51	—	3.8
29N-23E-35 BDD 1	03-11-42	—	—	—	—	110	38	—	—	—	—
29N-23E-35 BDD 1	09-06-51	—	—	142	—	29	14	—	4.4	—	1.5

Table 4.—*Concentrations of common constituents and physical properties of water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Bicarbonate, whole water total, FET, (mg/L as CaCO3)	Carbonate whole water total, FET, (mg/L as CaCO3)	Sulfate dis-solved (mg/L as SO4)	Chloride dis-solved (mg/L as Cl)	Fluoride, total (mg/L as F)	Fluoride, dissolved (mg/L as F)	Silica dissolved (mg/L as SiO2)	Nitrogen, nitrate dissolved (mg/L as N)	Nitrogen, nitrate+nitrite dissolved (mg/L as N)
29N-23E-21 BBC 2	09-02-82	831	—	—	47	11	—	0.40	8.8	—	—
29N-23E-21 BBC 3	07-07-81	1430	160	0	86	24	—	0.30	10	—	—
29N-23E-21 BBC 3	09-02-82	832	—	—	92	19	—	0.30	9.2	—	—
29N-23E-25 AAA 1	04-15-47	—	160	0	19	—	—	0.50	—	0.00	—
29N-23E-25 BDC 1	10-19-77	800	—	—	38	11	0.4	—	—	—	<0.100
29N-23E-25 BDC 1	10-19-77	1200	—	—	34	12	0.3	—	—	—	<0.100
29N-23E-25 BDC 1	10-19-77	1600	—	—	33	11	0.3	—	—	—	<0.100
29N-23E-25 BDC 1	10-01-79	—	—	—	—	15	—	—	—	—	<0.500
29N-23E-25 BDC 1	03-11-80	1515	—	—	160	40	0.2	—	—	—	<0.500
29N-23E-25 BDC 1	04-09-81	800	—	—	2,600	—	—	—	—	—	—
29N-23E-25 BDC 1	07-07-81	1100	240	0	560	78	—	0.20	12	—	—
29N-23E-25 BDC 1	07-07-81	1230	260	0	530	87	—	0.20	14	—	—
29N-23E-26 CDD 1	05-02-78	—	—	—	20	7.0	0.2	—	—	—	<0.100
29N-23E-26 CDD 1	03-11-80	1435	—	—	83	25	0.2	—	—	—	<0.500
29N-23E-26 CDD 1	07-07-81	1045	180	0	95	7.0	—	0.20	11	—	—
29N-23E-31 BDD 1	09-12-42	—	140	—	13	16	—	0.40	—	0.360	—
29N-23E-31 BDD 1	07-10-81	930	170	0	46	22	—	1.0	10	—	—
29N-23E-32 ADD 1	04-20-82	1730	—	—	86	<1.0	—	—	7.4	—	—
29N-23E-32 ADD 1	04-20-82	1750	—	—	2,000	7.6	—	—	36	—	—
29N-23E-35 BDD 1	03-11-42	—	220	—	120	80	—	0.30	—	0.500	—
29N-23E-35 BDD 1	09-06-51	—	140	0	18	4.0	—	0.30	9.7	0.00	—

Table 5.—*Concentrations of trace elements in water from wells completed in the Roubidoux aquifer*

[Agency analyzing sample: 1028, U.S. Geological Survey (specific laboratory not identified); 80020, National Water Quality Laboratory of the U.S. Geological Survey; 84041, Oklahoma Geological Survey; 84042, Oklahoma State Department of Health; µg/L, micrograms per liter; —, indicates no data are available, <, indicates concentration is less than specified value.]

Local identifier	Date	Time	Site identification number	Agency analyzing sample	Sampling depth (feet)	Aluminum, dissolved (µg/L as Al)	Arsenic, total (µg/L as As)	Arsenic, dissolved (µg/L as As)	Barium, total recoverable (µg/L as Ba)	Cadmium, total recoverable (µg/L as Cd)
ADAIR COUNTY										
18N-26E-18 BDC 1	10-28-81	1300	360225094344001	80020	—	<60	—	<10	—	—
CHEROKEE COUNTY										
16N-22E-03 CCB 1	12-28-82	1330	355319094574001	84041	—	<100	—	—	—	—
CRAIG COUNTY										
24N-21E-11 BDB 1	03-23-83	1330	363439095020901	84041	120	<100	—	—	—	—
24N-21E-11 BDB 1	03-23-83	1345	363439095020901	84041	700	<100	—	—	—	—
24N-21E-11 BDB 1	03-23-83	1450	363439095020901	84041	1,700	440	—	—	—	—
25N-20E-12 BDD 1	03-10-50	—	363950095070201	1028	—	—	—	—	—	—
25N-20E-12 BDD 1	09-05-51	—	363950095070201	1028	—	—	—	—	—	—
25N-20E-12 C 4	05-29-50	—	363930095071504	1028	—	—	—	—	—	—
27N-20E-12 BDD 2	02-04-81	1300	365016095070501	1028	—	—	—	<10	—	—
27N-20E-12 BDD 2	06-08-81	1400	365016095070501	80020	—	<60	—	<10	—	—
27N-21E-12 CCB 1	07-09-81	1030	365000095010101	80020	—	<60	—	<10	—	—
27N-21E-20 DCD 1	02-04-81	1430	364808095043501	1028	—	—	—	<10	—	—
27N-21E-20 DCD 1	06-09-81	1100	364808095043501	80020	—	<60	—	<10	—	—
28N-20E-13 ACC 1	03-23-83	1700	365440095065701	84041	170	<100	—	—	—	—
28N-20E-13 ACC 1	03-23-83	1730	365440095065701	84041	1,460	<100	—	—	—	—
28N-21E-29 CBC 1	02-04-81	1100	365242095051701	1028	—	—	—	<10	—	—
28N-21E-29 CBC 1	06-09-81	900	365242095051701	80020	—	<60	—	<10	—	—
28N-21E-29 CBD 1	06-09-81	930	365240095051501	80020	—	<60	—	<10	—	—
DELAWARE COUNTY										
20N-23E-34 CCA 1	06-10-81	930	360946094504901	80020	—	<60	—	<10	—	—
20N-24E-17 CCC 1	06-10-81	800	361221094463901	80020	—	<60	—	<10	—	—
21N-25E-31 BBB 1	06-10-81	1045	361544094410101	80020	—	<60	—	<10	—	—
22N-23E-05 DCA 1	06-10-81	1200	362442094520801	80020	—	<60	—	<10	—	—
22N-23E-11 BBB 1	03-21-83	1445	362427094493001	84041	—	<100	—	<10	—	—
23N-22E-14 ADC 1	06-10-81	1245	362829094550901	80020	—	<60	—	<10	—	—
23N-25E-33 DDC 1	07-09-81	1445	362532094374501	80020	—	<60	—	<10	—	—
24N-23E-15 BBC 1	06-11-81	930	363357094503701	80020	—	<60	—	<10	—	—
24N-24E-06 DCA 1	06-11-81	1230	363510094464501	80020	—	<60	—	<10	—	—
25N-22E-23 CCD 1	06-10-81	1500	363740094553101	80020	—	<60	—	<10	—	—

Table 5.—*Concentrations of trace elements in water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Cadmium, dissolved (µg/L as Cd)	Chromium, total recoverable (µg/L as Cr)	Chromium, dissolved (µg/L as Cr)	Copper, total recoverable (µg/L as Cu)	Copper, dissolved (µg/L as Cu)	Iron, total recoverable (µg/L as Fe)	Iron, dissolved (µg/L as Fe)	Lead, total recoverable (µg/L as Pb)	Lead, dissolved (µg/L as Pb)
					ADAIR COUNTY						
18N-26E-18 BDC 1	10-28-81	1300	<1.0	—	<1	—	<60	—	<20	—	<5
					CHEROKEE COUNTY						
16N-22E-03 CCB 1	12-28-82	1330	8.0	—	<10	—	<12	—	130	—	<5
					CRAIG COUNTY						
24N-21E-11 BDB 1	03-23-83	1330	<4.0	—	<10	—	<12	—	<10	—	<5
24N-21E-11 BDB 1	03-23-83	1345	<4.0	—	<10	—	<12	—	20	—	<5
24N-21E-11 BDB 1	03-23-83	1450	13	—	<10	—	17	—	9,800	—	—
25N-20E-12 BDD 1	03-10-50	—	—	—	—	—	—	100	—	—	—
25N-20E-12 BDD 1	09-05-51	—	—	—	—	—	—	20	—	—	—
25N-20E-12 C 4	05-29-50	—	—	—	—	—	—	0	—	—	—
27N-20E-12 BDD 2	02-04-81	1300	<2.5	—	—	—	<100	—	200	—	<5
27N-20E-12 BDD 2	06-08-81	1400	<1.0	—	2	—	<60	—	180	—	<5
27N-21E-12 CCB 1	07-09-81	1030	<1.0	—	<1	—	<60	—	200	—	<5
27N-21E-20 DCD 1	02-04-81	1430	<2.5	—	—	—	<100	—	80	—	<5
27N-21E-20 DCD 1	06-09-81	1100	<1.0	—	<1	—	<60	—	100	—	<5
28N-20E-13 ACC 1	03-23-83	1700	8.0	—	<10	—	<12	—	<10	—	<5
28N-20E-13 ACC 1	03-23-83	1730	8.0	—	<10	—	<12	—	<10	—	—
28N-21E-29 CBC 1	02-04-81	1100	<2.5	—	—	—	<100	—	200	—	6
28N-21E-29 CBC 1	06-09-81	900	<1.0	—	1	—	<60	—	120	—	<5
28N-21E-29 CBD 1	06-09-81	930	<1.0	—	<1	—	<60	—	60	—	<5
					DELAWARE COUNTY						
20N-23E-34 CCA 1	06-10-81	930	<1.0	—	<1	—	<60	—	290	—	<5
20N-24E-17 CCC 1	06-10-81	800	<1.0	—	<1	—	<60	—	80	—	<5
21N-25E-31 BBB 1	06-10-81	1045	<1.0	—	<1	—	<60	—	40	—	<5
22N-23E-05 DCA 1	06-10-81	1200	<1.0	—	<1	—	<60	—	80	—	<5
22N-23E-11 BBB 1	03-21-83	1445	<1.0	—	<10	—	<12	—	50	—	<5
23N-22E-14 ADC 1	06-10-81	1245	<1.0	—	<1	—	<60	—	100	—	<5
23N-25E-33 DDC 1	07-09-81	1445	<1.0	—	<1	—	<60	—	40	—	<10
24N-23E-15 BBC 1	06-11-81	930	<1.0	—	<1	—	<60	—	70	—	<5
24N-24E-06 DCA 1	06-11-81	1230	<1.0	—	<1	—	<60	—	280	—	<5
25N-22E-23 CCD 1	06-10-81	1500	<1.0	—	<1	—	<60	—	40	—	<5

Table 5.—*Concentrations of trace elements in water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Manganese, total recoverable (µg/L as Mn)	Manganese, dissolved (µg/L as Mn)	Mercury, total recoverable (µg/L as Hg)	Mercury, dissolved (µg/L as Hg)	Molybdenum, dissolved (µg/L as Mo)	Selenium, total recoverable (µg/L as Se)	Silver, total recoverable (µg/L as Ag)	Zinc, total recoverable (µg/L as Zn)	Zinc, dissolved (µg/L as Zn)
ADAIR COUNTY											
18N-26E-18 BDC 1	10-28-81	1300	—	<10	—	<0.5	—	—	—	—	1,300
CHEROKEE COUNTY											
16N-22E-03 CCB 1	12-28-82	1330	—	40	—	—	—	—	—	—	550
CRAIG COUNTY											
24N-21E-11 BDB 1	03-23-83	1330	—	50	—	—	—	—	—	—	37
24N-21E-11 BDB 1	03-23-83	1345	—	30	—	—	—	—	—	—	<10
24N-21E-11 BDB 1	03-23-83	1450	—	2,100	—	—	—	—	—	—	110
25N-20E-12 BDD 1	03-10-50	—	—	—	—	—	—	—	—	—	—
25N-20E-12 BDD 1	09-05-51	—	—	—	—	—	—	—	—	—	—
25N-20E-12 C 4	05-29-50	—	—	—	—	—	—	—	—	—	—
27N-20E-12 BDD 2	02-04-81	1300	—	10	—	<0.5	<1	—	—	—	24
27N-20E-12 BDD 2	06-08-81	1400	—	<10	—	<0.5	—	—	—	—	26
27N-21E-12 CCB 1	07-09-81	1030	—	<10	—	<0.5	—	—	—	—	22
27N-21E-20 DCD 1	02-04-81	1430	—	20	—	<0.5	<1	—	—	—	<20
27N-21E-20 DCD 1	06-09-81	1100	—	<10	—	<0.5	—	—	—	—	<20
28N-20E-13 ACC 1	03-23-83	1700	—	90	—	—	—	—	—	—	10
28N-20E-13 ACC 1	03-23-83	1730	—	2,000	—	—	—	—	—	—	12
28N-21E-29 CBC 1	02-04-81	1100	—	30	—	<0.5	<1	—	—	—	28
28N-21E-29 CBC 1	06-09-81	900	—	<10	—	<0.5	—	—	—	—	<20
28N-21E-29 CBD 1	06-09-81	930	—	<10	—	<0.5	—	—	—	—	<20
DELAWARE COUNTY											
20N-23E-34 CCA 1	06-10-81	930	—	30	—	<0.5	—	—	—	—	32
20N-24E-17 CCC 1	06-10-81	800	—	<10	—	<0.5	—	—	—	—	<20
21N-25E-31 BBB 1	06-10-81	1045	—	<10	—	<0.5	—	—	—	—	<20
22N-23E-05 DCA 1	06-10-81	1200	—	<10	—	<0.5	—	—	—	—	<20
22N-23E-11 BBB 1	03-21-83	1445	—	10	—	<0.5	—	—	—	—	43
23N-22E-14 ADC 1	06-10-81	1245	—	<10	—	<0.5	—	—	—	—	<20
23N-25E-33 DDC 1	07-09-81	1445	—	<10	—	<0.5	—	—	—	—	720
24N-23E-15 BBC 1	06-11-81	930	—	<10	—	<0.5	—	—	—	—	<20
24N-24E-06 DCA 1	06-11-81	1230	—	<10	—	<0.5	—	—	—	—	<20
25N-22E-23 CCD 1	06-10-81	1500	—	<10	—	<0.5	—	—	—	—	<20

Table 5.—*Concentrations of trace elements in water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Site identification number	Agency analyzing sample	Sampling depth (feet)	Aluminum, dissolved (µg/L as Al)	Arsenic, total (µg/L as As)	Arsenic, dissolved (µg/L as As)	Barium, total recoverable (µg/L as Ba)	Cadmium, total recoverable (µg/L as Cd)
25N-22E-23 CCD 1	08-17-82	1115	363740094553101	1028	—	—	—	—	—	—
25N-23E-13 AAB 1	06-11-81	1330	363921094474301	80020	—	<60	—	<10	—	—
25N-24E-28 BBB 1	07-09-81	1200	363718094444501	80020	—	<60	—	<10	—	—
OTTAWA COUNTY										
25N-23E-01 AAA 1	07-15-81	1700	364103094470401	80020	—	<60	—	<10	—	—
26N-22E-15 DDA 1	06-12-81	1000	364349094554501	80020	—	<60	—	<10	—	—
26N-22E-20 BCC 1	06-12-81	900	364323094585101	80020	—	<60	—	<10	—	—
26N-22E-27 ADD 1	07-08-81	830	364227094554301	80020	—	<60	—	<10	—	—
26N-22E-27 CBC 1	06-11-81	1600	364211094564101	80020	—	<60	—	<10	—	—
26N-22E-32 ADC 1	09-06-51	—	364135094580001	1028	—	—	—	—	—	—
26N-22E-32 ADC 1	06-11-81	1500	364135094580001	80020	—	<60	—	<10	—	—
26N-22E-32 ADC 2	06-11-81	1300	364135094580002	80020	—	<60	—	<10	—	—
26N-23E-09 CA 1	05-03-78	—	364501094505301	84042	—	—	<1	—	<100	<1
26N-23E-09 CA 1	03-19-80	—	364501094505301	84042	—	—	<10	—	<100	<2
26N-23E-09 CA 1	07-08-81	945	364501094505301	80020	—	<60	—	<10	—	—
26N-23E-09 DBC 1	07-08-81	930	364454094504401	80020	—	<60	—	<10	—	—
26N-23E-12 BAD 1	07-08-81	1040	364516094473501	80020	—	<60	—	<10	—	—
26N-24E-32 ABA 1	07-30-81	1400	364155094451001	80020	—	<60	—	<10	—	—
27N-22E-01 CCC 1	05-01-78	—	365103094541501	84042	—	—	<1	—	100	<1
27N-22E-01 CCC 1	07-16-81	800	365103094541501	80020	—	<60	—	<10	—	—
27N-22E-27 AAB 1	07-09-81	900	364801094554601	80020	—	<60	—	<10	—	—
27N-23E-03 BCC 1	07-08-81	1630	365100094491701	80020	—	<60	—	<10	—	—
27N-23E-17 CBB 1	02-05-81	830	364921094522201	80020	—	—	—	<10	—	—
27N-23E-17 CBB 1	06-09-81	1545	364921094522201	80020	—	<60	—	<10	—	—
27N-23E-28 CDC 1	07-08-81	1130	364712094510101	80020	—	<60	—	<10	—	—
27N-24E-28 CAD 1	05-03-78	—	364717094433101	84042	—	—	<1	—	<100	<1
27N-24E-28 CAD 1	03-10-80	1435	364717094433101	84042	—	—	<10	—	<100	<2
27N-24E-28 CAD 1	02-05-81	1230	364717094433101	1028	—	—	—	<10	—	—
27N-24E-28 CAD 1	07-08-81	1500	364717094433101	80020	—	<60	—	<10	—	—
27N-25E-09 CAC 1	07-14-81	1030	364957094371501	80020	—	<60	—	<10	—	—
28N-22E-11 ABB 1	07-10-81	830	365543094535801	80020	—	<60	—	<10	—	—
28N-22E-24 AAB 1	08-03-44	—	365358094525001	1028	—	—	—	—	—	—
28N-22E-24 BDA 1	07-16-81	1330	365342094531301	80020	—	<60	—	<10	—	—
28N-22E-24 CAD 1	07-16-81	1430	365324094531301	80020	—	<60	—	<10	—	—
28N-22E-24 CBC 1	07-16-81	1315	365323094534001	80020	—	<60	—	<10	—	—
28N-23E-06 BAC 1	07-07-81	900	365627094522201	80020	—	<60	—	<10	—	—
28N-23E-06 BAC 1	10-21-82	1800	365627094522201	84041	900	390	—	—	—	—
28N-23E-06 BAC 1	10-21-82	1830	365627094522201	84041	1,050	120	—	—	—	—
28N-23E-06 BAC 2	10-20-82	1830	365627094522101	84041	750	<100	—	—	—	—

Table 5.—*Concentrations of trace elements in water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Cadmium, dissolved (µg/L as Cd)	Chromium, total recoverable (µg/L as Cr)	Chromium, dissolved (µg/L as Cr)	Copper, total recoverable (µg/L as Cu)	Copper, dissolved (µg/L as Cu)	Iron, total recoverable (µg/L as Fe)	Iron, dissolved (µg/L as Fe)	Lead, total recoverable (µg/L as Pb)	Lead, dissolved (µg/L as Pb)
25N-22E-23 CCD 1	08-17-82	1115	—	—	—	—	—	—	8	—	—
25N-23E-13 AAB 1	06-11-81	1330	<1.0	—	<1	—	<60	—	40	—	<5
25N-24E-28 BBB 1	07-09-81	1200	<1.0	—	<1	—	<60	—	170	—	<5
OTTAWA COUNTY											
25N-23E-01 AAA 1	07-15-81	1700	<1.0	—	<1	—	<60	—	60	—	<5
26N-22E-15 DDA 1	06-12-81	1000	<1.0	—	<1	—	<60	—	80	—	<5
26N-22E-20 BCC 1	06-12-81	900	<1.0	—	<1	—	<60	—	30	—	<5
26N-22E-27 ADD 1	07-08-81	830	<1.0	—	<1	—	<60	—	20	—	<5
26N-22E-27 CBC 1	06-11-81	1600	<1.0	—	<1	—	<60	—	50	—	<5
26N-22E-32 ADC 1	09-06-51	—	—	—	—	—	—	0	—	—	—
26N-22E-32 ADC 1	06-11-81	1500	<1.0	—	<1	—	<60	—	60	—	<5
26N-22E-32 ADC 2	06-11-81	1300	<1.0	—	<1	—	<60	—	80	—	<5
26N-23E-09 CA 1	05-03-78	—	—	68	—	2	—	920	—	5	—
26N-23E-09 CA 1	03-19-80	—	—	<10	—	<4	—	460	—	25	—
26N-23E-09 CA 1	07-08-81	945	<1.0	—	<1	—	<60	—	810	—	<5
26N-23E-09 DBC 1	07-08-81	930	<1.0	—	<1	—	<60	—	110	—	<5
26N-23E-12 BAD 1	07-08-81	1040	<1.0	—	<1	—	<60	—	60	—	<5
26N-24E-32 ABA 1	07-30-81	1400	<1.0	—	<1	—	<60	—	30	—	<5
27N-22E-01 CCC 1	05-01-78	—	—	50	—	11	—	2,000	—	<5	—
27N-22E-01 CCC 1	07-16-81	800	<1.0	—	<1	—	<60	—	50	—	<5
27N-22E-27 AAB 1	07-09-81	900	<1.0	—	<1	—	<60	—	40	—	<5
27N-23E-03 BCC 1	07-08-81	1630	<1.0	—	<1	—	<60	—	70	—	<5
27N-23E-17 CBB 1	02-05-81	830	<2.5	—	—	—	<100	—	80	—	6
27N-23E-17 CBB 1	06-09-81	1545	<1.0	—	<1	—	<60	—	200	—	<5
27N-23E-28 CDC 1	07-08-81	1130	<1.0	—	<1	—	<60	—	120	—	<5
27N-24E-28 CAD 1	05-03-78	—	—	10	—	3	—	1,200	—	6	—
27N-24E-28 CAD 1	03-10-80	1435	—	11	—	<4	—	<100	—	<20	—
27N-24E-28 CAD 1	02-05-81	1230	<2.5	—	—	—	<100	—	<20	—	<5
27N-24E-28 CAD 1	07-08-81	1500	<1.0	—	<1	—	<60	—	40	—	<5
27N-25E-09 CAC 1	07-14-81	1030	<1.0	—	<1	—	<60	—	60	—	<5
28N-22E-11 ABB 1	07-10-81	830	<1.0	—	<1	—	<60	—	280	—	<5
28N-22E-24 AAB 1	08-03-44	—	—	—	—	—	—	60	—	—	—
28N-22E-24 BDA 1	07-16-81	1330	<1.0	—	<1	—	<60	—	40	—	<5
28N-22E-24 CAD 1	07-16-81	1430	<1.0	—	<1	—	<60	—	70	—	<5
28N-22E-24 CBC 1	07-16-81	1315	<1.0	—	<1	—	<60	—	40	—	<5
28N-23E-06 BAC 1	07-07-81	900	<1.0	—	<1	—	<60	—	80	—	<5
28N-23E-06 BAC 1	10-21-82	1800	<4.0	—	20	—	21	—	4,400	—	26
28N-23E-06 BAC 1	10-21-82	1830	<4.0	—	20	—	18	—	5,400	—	29
28N-23E-06 BAC 2	10-20-82	1830	<4.0	—	20	—	<12	—	1,100	—	<5

Table 5.—*Concentrations of trace elements in water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Manganese, total recoverable (µg/L as Mn)	Manganese, dissolved (µg/L as Mn)	Mercury, total recoverable (µg/L as Hg)	Mercury, dissolved (µg/L as Hg)	Molybdenum, dissolved (µg/L as Mo)	Selenium, total recoverable (µg/L as Se)	Silver, total recoverable (µg/L as Ag)	Zinc, total recoverable (µg/L as Zn)	Zinc, dissolved (µg/L as Zn)
25N-22E-23 CCD 1	08-17-82	1115	—	<2	—	—	—	—	—	—	—
25N-23E-13 AAB 1	06-11-81	1330	—	<10	—	<0.5	—	—	—	—	61
25N-24E-28 BBB 1	07-09-81	1200	—	<10	—	<0.5	—	—	—	—	<20
OTTAWA COUNTY											
25N-23E-01 AAA 1	07-15-81	1700	—	<10	—	<0.5	—	—	—	—	<20
26N-22E-15 DDA 1	06-12-81	1000	—	<10	—	<0.5	—	—	—	—	<20
26N-22E-20 BCC 1	06-12-81	900	—	<10	—	<0.5	—	—	—	—	<20
26N-22E-27 ADD 1	07-08-81	830	—	<10	—	<0.5	—	—	—	—	34
26N-22E-27 CBC 1	06-11-81	1600	—	<10	—	<0.5	—	—	—	—	<20
26N-22E-32 ADC 1	09-06-51	—	—	—	—	—	—	—	—	—	—
26N-22E-32 ADC 1	06-11-81	1500	—	<10	—	<0.5	—	—	—	—	<20
26N-22E-32 ADC 2	06-11-81	1300	—	<10	—	<0.5	—	—	—	—	<20
26N-23E-09 CA 1	05-03-78	—	10	—	<0.50	—	—	<1	<2	20	—
26N-23E-09 CA 1	03-19-80	—	<20	—	<0.50	—	—	<5	3	<2	—
26N-23E-09 CA 1	07-08-81	945	—	<10	—	<0.5	—	—	—	—	<20
26N-23E-09 DBC 1	07-08-81	930	—	<10	—	<0.5	—	—	—	—	26
26N-23E-12 BAD 1	07-08-81	1040	—	<10	—	<0.5	—	—	—	—	34
26N-24E-32 ABA 1	07-30-81	1400	—	<10	—	<0.5	—	—	—	—	1,400
27N-22E-01 CCC 1	05-01-78	—	<10	—	<0.50	—	—	<1	<2	40	—
27N-22E-01 CCC 1	07-16-81	800	—	<10	—	<0.5	—	—	—	—	<20
27N-22E-27 AAB 1	07-09-81	900	—	<10	—	<0.5	—	—	—	—	<20
27N-23E-03 BCC 1	07-08-81	1630	—	<10	—	<0.5	—	—	—	—	30
27N-23E-17 CBB 1	02-05-81	830	—	10	—	<0.5	<1	—	—	—	38
27N-23E-17 CBB 1	06-09-81	1545	—	<10	—	<0.5	—	—	—	—	<20
27N-23E-28 CDC 1	07-08-81	1130	—	<10	—	<0.5	—	—	—	—	28
27N-24E-28 CAD 1	05-03-78	—	<10	—	<0.50	—	—	<1	<2	40	—
27N-24E-28 CAD 1	03-10-80	1435	20	—	<0.50	—	—	<5	<3	60	—
27N-24E-28 CAD 1	02-05-81	1230	—	10	—	<0.5	<1	—	—	—	68
27N-24E-28 CAD 1	07-08-81	1500	—	<10	—	<0.5	—	—	—	—	69
27N-25E-09 CAC 1	07-14-81	1030	—	<10	—	<0.5	—	—	—	—	<20
28N-22E-11 ABB 1	07-10-81	830	—	<10	—	<0.5	—	—	—	—	<20
28N-22E-24 AAB 1	08-03-44	—	—	—	—	—	—	—	—	—	—
28N-22E-24 BDA 1	07-16-81	1330	—	<10	—	<0.5	—	—	—	—	26
28N-22E-24 CAD 1	07-16-81	1430	—	<10	—	<0.5	—	—	—	—	32
28N-22E-24 CBC 1	07-16-81	1315	—	<10	—	<0.5	—	—	—	—	32
28N-23E-06 BAC 1	07-07-81	900	—	<10	—	<0.5	—	—	—	—	<20
28N-23E-06 BAC 1	10-21-82	1800	—	30	—	—	—	—	—	—	3,200
28N-23E-06 BAC 1	10-21-82	1830	—	40	—	—	—	—	—	—	4,700
28N-23E-06 BAC 2	10-20-82	1830	—	20	—	—	—	—	—	—	40

Table 5.—*Concentrations of trace elements in water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Site identification number	Agency analyzing sample	Sampling depth (feet)	Aluminum, dissolved (µg/L as Al)	Arsenic, total (µg/L as As)	Arsenic, dissolved (µg/L as As)	Barium, total recoverable (µg/L as Ba)	Cadmium, total recoverable (µg/L as Cd)
28N-23E-06 BAC 2	10-20-82	1900	365627094522101	84041	1,100	<100	—	—	—	—
28N-23E-06 BAC 2	03-22-83	920	365627094522101	84041	—	<100	—	<10	—	—
28N-23E-06 CBB 1	09-03-42	—	365600094523001	1028	—	—	—	—	—	—
28N-23E-06 CBB 1	09-06-51	—	365600094523001	1028	—	—	—	—	—	—
28N-23E-06 CBB 1	03-22-83	900	365600094523001	84041	—	<100	—	<10	—	—
28N-23E-06 CBD 2	07-07-81	830	365557094522701	80020	—	<60	—	<10	—	—
28N-23E-18 CDC 1	07-16-81	1340	365402094522201	80020	—	<60	—	<10	—	—
28N-23E-20 BCB 1	07-15-81	1030	365344094513301	80020	—	<60	—	<10	—	—
28N-23E-24 DDA 1	05-02-78	—	365316094461601	84042	—	—	<1	—	<100	<1
28N-23E-24 DDA 1	03-12-80	1130	365316094461601	84042	—	—	<10	—	<100	<2
28N-23E-24 DDA 1	07-15-81	1400	365316094461601	80020	—	<60	—	<10	—	—
28N-23E-28 BBB 1	07-14-81	1700	365301094502901	80020	—	<60	—	<10	—	—
28N-23E-30 CAC 1	03-30-59	—	365229094522101	1028	—	—	—	—	—	—
28N-23E-30 CAC 1	07-15-81	900	365229094522101	80020	—	<60	—	<10	—	—
28N-23E-30 DBC 1	10-08-82	1330	365229094520201	84041	—	<100	—	—	—	—
28N-23E-30 DBC 1	12-08-82	1300	365229094520201	84041	800	<100	—	—	—	—
28N-23E-30 DBC 1	12-08-82	1400	365229094520201	84041	1,480	<100	—	—	—	—
28N-23E-31 BAB 1	05-20-52	—	365210094522101	1028	—	—	—	—	—	—
28N-23E-31 BAB 1	03-30-59	1200	365210094522101	1028	—	—	—	—	—	—
28N-23E-31 BAB 1	03-30-59	1201	365210094522101	1028	—	—	—	—	—	—
28N-23E-31 BAC 1	07-15-81	1100	365206094522201	80020	—	<60	—	<10	—	—
28N-23E-31 CBA 1	09-03-42	—	365146094522201	1028	—	—	—	—	—	—
28N-23E-31 CBA 1	07-15-81	930	365146094522201	80020	—	<60	—	<10	—	—
28N-23E-32 BAB 1	03-30-59	—	365212094511901	1028	—	—	—	—	—	—
28N-23E-32 BAB 1	02-05-81	1445	365212094511901	1028	—	—	—	<10	—	—
28N-23E-32 BAB 1	07-15-81	1130	365212094511901	80020	—	<60	—	<10	—	—
28N-23E-33 BAB 1	03-30-59	—	365213094500701	1028	—	—	—	—	—	—
28N-23E-33 BAB 1	07-14-81	1615	365213094500701	80020	—	<60	—	<10	—	—
28N-23E-36 CCC 1	07-15-81	1300	365128094471301	80020	—	<60	—	<10	—	—
28N-24E-13 ABD 1	10-16-68	—	365445094400701	1028	—	—	—	—	—	—
28N-24E-13 ABD 1	03-12-80	1150	365445094400701	84042	—	—	<10	—	<100	<2
28N-24E-13 ABD 1	07-14-81	1230	365445094400701	80020	—	<60	—	<10	—	—
28N-25E-20 CAA 1	05-24-79	—	365335094380701	84042	—	—	<1	—	<100	<2
28N-25E-20 CAA 1	03-12-80	1245	365335094380701	84042	—	—	<10	—	<100	<2
28N-25E-20 CAA 1	06-09-81	1330	365335094380701	80020	—	<60	—	<10	—	—
29N-22E-21 DAD 1	02-04-81	1615	365833094551901	1028	—	—	—	<10	—	—
29N-22E-21 DAD 1	06-09-81	1700	365833094551901	80020	—	<60	—	<10	—	—
29N-23E-16 DDD 1	12-26-82	1500	365917094484701	84041	300	210	—	—	—	—
29N-23E-19 DDC 1	05-02-78	—	365823094510701	84042	—	—	<1	—	<100	<1
29N-23E-19 DDC 1	03-11-80	—	365823094510701	84042	—	—	<0	—	<100	<2
29N-23E-19 DDC 1	07-14-81	830	365823094510701	80020	—	<60	—	<10	—	—

Table 5.—*Concentrations of trace elements in water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Cadmium, dissolved (µg/L as Cd)	Chromium, total recoverable (µg/L as Cr)	Chromium, dissolved (µg/L as Cr)	Copper, total recoverable (µg/L as Cu)	Copper, dissolved (µg/L as Cu)	Iron, total recoverable (µg/L as Fe)	Iron, dissolved (µg/L as Fe)	Lead, total recoverable (µg/L as Pb)	Lead, dissolved (µg/L as Pb)
28N-23E-06 BAC 2	10-20-82	1900	<4.0	—	10	—	22	—	2,200	—	12
28N-23E-06 BAC 2	03-22-83	920	<1.0	—	<10	—	<12	—	20	—	<5
28N-23E-06 CBB 1	09-03-42	—	—	—	—	—	—	0	—	—	—
28N-23E-06 CBB 1	09-06-51	—	—	—	—	—	—	10	—	—	—
28N-23E-06 CBB 1	03-22-83	900	<1.0	—	<10	—	<12	—	50	—	<5
28N-23E-06 CBD 2	07-07-81	830	<1.0	—	<1	—	<60	—	90	—	<5
28N-23E-18 CDC 1	07-16-81	1340	<1.0	—	<1	—	<60	—	40	—	<5
28N-23E-20 BCB 1	07-15-81	1030	<1.0	—	<1	—	<60	—	20	—	<5
28N-23E-24 DDA 1	05-02-78	—	—	24	—	4	—	740	—	5	—
28N-23E-24 DDA 1	03-12-80	1130	—	<10	—	8	—	<100	—	<20	—
28N-23E-24 DDA 1	07-15-81	1400	<1.0	—	<1	—	<60	—	<20	—	<5
28N-23E-28 BBB 1	07-14-81	1700	<1.0	—	<1	—	<60	—	30	—	<5
28N-23E-30 CAC 1	03-30-59	—	—	—	—	—	—	10	—	—	—
28N-23E-30 CAC 1	07-15-81	900	<1.0	—	<1	—	<60	—	70	—	<5
28N-23E-30 DBC 1	10-08-82	1330	6.0	—	<10	—	<12	—	<10	—	<5
28N-23E-30 DBC 1	12-08-82	1300	<4.0	—	<10	—	<12	—	<10	—	<5
28N-23E-30 DBC 1	12-08-82	1400	18	—	<10	—	<12	—	730	—	<5
28N-23E-31 BAB 1	05-20-52	—	—	—	—	—	—	0	—	—	—
28N-23E-31 BAB 1	03-30-59	1200	—	—	—	—	—	100	—	—	—
28N-23E-31 BAB 1	03-30-59	1201	—	—	—	—	—	10	—	—	—
28N-23E-31 BAC 1	07-15-81	1100	<1.0	—	<1	—	<60	—	50	—	<5
28N-23E-31 CBA 1	09-03-42	—	—	—	—	—	—	20	—	—	—
28N-23E-31 CBA 1	07-15-81	930	<1.0	—	<1	—	<60	—	20	—	<5
28N-23E-32 BAB 1	03-30-59	—	—	—	—	—	—	0	—	—	—
28N-23E-32 BAB 1	02-05-81	1445	<2.5	—	—	—	<100	—	40	—	<5
28N-23E-32 BAB 1	07-15-81	1130	<1.0	—	<1	—	<60	—	40	—	<5
28N-23E-33 BAB 1	03-30-59	—	—	—	—	—	—	—	—	—	—
28N-23E-33 BAB 1	07-14-81	1615	<1.0	—	<1	—	<60	—	30	—	<5
28N-23E-36 CCC 1	07-15-81	1300	<1.0	—	<1	—	<60	—	30	—	<5
28N-24E-13 ABD 1	10-16-68	—	—	—	—	—	—	0	—	—	—
28N-24E-13 ABD 1	03-12-80	1150	—	<10	—	4	—	<100	—	<20	—
28N-24E-13 ABD 1	07-14-81	1230	<1.0	—	<1	—	<60	—	70	—	<5
28N-25E-20 CAA 1	05-24-79	—	—	<5	—	—	—	—	—	—	—
28N-25E-20 CAA 1	03-12-80	1245	—	11	—	8	—	<100	—	<20	—
28N-25E-20 CAA 1	06-09-81	1330	<1.0	—	<1	—	<60	—	250	—	<5
29N-22E-21 DAD 1	02-04-81	1615	<2.5	—	—	—	<100	—	100	—	<5
29N-22E-21 DAD 1	06-09-81	1700	<1.0	—	<1	—	<60	—	390	—	<5
29N-23E-16 DDD 1	12-26-82	1500	34	—	<10	—	<12	—	260,000	—	6
29N-23E-19 DDC 1	05-02-78	—	—	6	—	17	—	1,300	—	6	—
29N-23E-19 DDC 1	03-11-80	—	—	<10	—	4	—	<100	—	<20	—
29N-23E-19 DDC 1	07-14-81	830	<1.0	—	<1	—	<60	—	20	—	<5

Table 5.—*Concentrations of trace elements in water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Manganese, total recoverable (µg/L as Mn)	Manganese, dissolved (µg/L as Mn)	Mercury, total recoverable (µg/L as Hg)	Mercury, dissolved (µg/L as Hg)	Molybdenum, dissolved (µg/L as Mo)	Selenium, total recoverable (µg/L as Se)	Silver, total recoverable (µg/L as Ag)	Zinc, total recoverable (µg/L as Zn)	Zinc, dissolved (µg/L as Zn)
28N-23E-06 BAC 2	10-20-82	1900	—	40	—	—	—	—	—	—	100
28IN-23E-06 BAC 2	03-22-83	920	—	<10	—	<0.5	—	—	—	—	15
28N-23E-06 CBB 1	09-03-42	—	—	—	—	—	—	—	—	—	—
28N-23E-06 CBB 1	09-06-51	—	—	—	—	—	—	—	—	—	—
28N-23E-06 CBB 1	03-22-83	900	—	<10	—	<0.5	—	—	—	—	<11
28N-23E-06 CBD 2	07-07-81	830	—	<10	—	<0.5	—	—	—	—	<20
28N-23E-18 CDC 1	07-16-81	1340	—	<10	—	<0.5	—	—	—	—	34
28N-23E-20 BCB 1	07-15-81	1030	—	<10	—	<0.5	—	—	—	—	<20
28N-23E-24 DDA 1	05-02-78	—	<10	—	<0.50	—	—	<1	<2	30	—
28N-23E-24 DDA 1	03-12-80	1130	20	—	<0.50	—	—	<5	<3	10	—
28N-23E-24 DDA 1	07-15-81	1400	—	<10	—	<0.5	—	—	—	—	51
28N-23E-28 BBB 1	07-14-81	1700	—	<10	—	<0.5	—	—	—	—	32
28N-23E-30 CAC 1	03-30-59	—	—	—	—	—	—	—	—	—	—
28N-23E-30 CAC 1	07-15-81	900	—	<10	—	<0.5	—	—	—	—	26
28N-23E-30 DBC 1	10-08-82	1330	—	10	—	—	—	—	—	—	26
28N-23E-30 DBC 1	12-08-82	1300	—	10	—	—	—	—	—	—	83
28N-23E-30 DBC 1	12-08-82	1400	—	290	—	—	—	—	—	—	66
28N-23E-31 BAB 1	05-20-52	—	—	—	—	—	—	—	—	—	—
28N-23E-31 BAB 1	03-30-59	1200	—	—	—	—	—	—	—	—	—
28N-23E-31 BAB 1	03-30-59	1201	—	—	—	—	—	—	—	—	100
28N-23E-31 BAC 1	07-15-81	1100	—	<10	—	<0.5	—	—	—	—	36
28N-23E-31 CBA 1	09-03-42	—	—	—	—	—	—	—	—	—	—
28N-23E-31 CBA 1	07-15-81	930	—	<10	—	<0.5	—	—	—	—	22
28N-23E-32 BAB 1	03-30-59	—	—	—	—	—	—	—	—	0	—
28N-23E-32 BAB 1	02-05-81	1445	—	10	—	<0.5	<1	—	—	—	32
28N-23E-32 BAB 1	07-15-81	1130	—	<10	—	<0.5	—	—	—	—	26
28N-23E-33 BAB 1	03-30-59	—	—	—	—	—	—	—	—	—	100
28N-23E-33 BAB 1	07-14-81	1615	—	<10	—	<0.5	—	—	—	—	30
28N-23E-36 CCC 1	07-15-81	1300	—	<10	—	<0.5	—	—	—	—	26
28N-24E-13 ABD 1	10-16-68	—	0	—	—	—	—	—	—	—	—
28N-24E-13 ABD 1	03-12-80	1150	20	—	<0.50	—	—	<5	<3	80	—
28N-24E-13 ABD 1	07-14-81	1230	—	<10	—	<0.5	—	—	—	—	32
28N-25E-20 CAA 1	05-24-79	—	—	—	—	—	—	<1	—	—	—
28N-25E-20 CAA 1	03-12-80	1245	20	—	<0.50	—	—	<5	<3	40	—
28N-25E-20 CAA 1	06-09-81	1330	—	<10	—	<0.5	—	—	—	—	<20
29N-22E-21 DAD 1	02-04-81	1615	—	40	—	<0.5	<1	—	—	—	<20
29N-22E-21 DAD 1	06-09-81	1700	—	40	—	<0.5	—	—	—	—	<20
29N-23E-16 DDD 1	12-26-82	1500	—	4,400	—	—	—	—	—	—	84,000
29N-23E-19 DDC 1	05-02-78	—	<10	—	<0.50	—	—	<1	<2	140	—
29N-23E-19 DDC 1	03-11-80	—	<20	—	<0.50	—	—	<5	<3	60	—
29N-23E-19 DDC 1	07-14-81	830	—	<10	—	<0.5	—	—	—	—	93

Table 5.—*Concentrations of trace elements in water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Site identification number	Agency analyzing sample	Sampling depth (feet)	Aluminum, dissolved (µg/L as Al)	Arsenic, total (µg/L as As)	Arsenic, dissolved (µg/L as As)	Barium, total recoverable (µg/L as Ba)	Cadmium, total recoverable (µg/L as Cd)
29N-23E-21 BBC 1	09-03-42	—	365905094494601	1028	—	—	—	—	—	—
29N-23E-21 BBC 1	09-06-51	—	365905094494601	1028	—	—	—	—	—	—
29N-23E-21 BBC 1	07-07-81	1415	365905094494601	80020	—	<60	—	<10	—	—
29N-23E-21 BBC 1	07-23-81	1100	365905094494601	1028	—	—	—	0	—	—
29N-23E-21 BBC 1	09-02-82	830	365905094494601	84041	—	<100	—	<10	—	—
29N-23E-21 BBC 2	07-07-81	1420	365905094494602	80020	—	<60	—	<10	—	—
29N-23E-21 BBC 2	09-02-82	831	365905094494602	84041	—	<100	—	<10	—	—
29N-23E-21 BBC 3	07-07-81	1430	365905094494603	80020	—	<60	—	<10	—	—
29N-23E-21 BBC 3	09-02-82	832	365905094494603	84041	—	<100	—	<10	—	—
29N-23E-25 BDC 1	10-19-77	800	365800094461701	84042	—	—	—	—	—	—
29N-23E-25 BDC 1	10-19-77	1200	365800094461701	84042	—	—	—	—	—	—
29N-23E-25 BDC 1	10-19-77	1600	365800094461701	84042	—	—	—	—	—	—
29N-23E-25 BDC 1	10-01-79	—	365800094461701	84042	—	—	—	—	—	—
29N-23E-25 BDC 1	03-11-80	1515	365800094461701	84042	—	—	<10	—	<100	<2
29N-23E-25 BDC 1	02-23-81	—	365800094461701	84042	—	—	—	—	—	8
29N-23E-25 BDC 1	04-09-81	800	365800094461701	84042	—	—	<10	—	—	2
29N-23E-25 BDC 1	07-07-81	1100	365800094461701	80020	—	<60	—	<10	—	—
29N-23E-25 BDC 1	07-07-81	1230	365800094461701	80020	—	<60	—	14	—	—
29N-23E-26 CDD 1	05-02-78	—	365734094471001	84042	—	—	<1	—	<100	<1
29N-23E-26 CDD 1	03-11-80	1435	365734094471001	84042	—	—	<10	—	<100	<2
29N-23E-26 CDD 1	02-19-81	—	365734094471001	84042	—	—	—	—	—	5
29N-23E-26 CDD 1	04-13-81	—	365734094471001	84042	—	—	—	—	—	2
29N-23E-26 CDD 1	07-07-81	1045	365734094471001	80020	—	<60	—	<10	—	—
29N-23E-31 BDD 1	09-12-42	—	365704094513101	1028	—	—	—	—	—	—
29N-23E-31 BDD 1	07-10-81	930	365704094513101	80020	—	<60	—	<10	—	—
29N-23E-32 ADD 1	04-20-82	1730	365722094500401	84041	210	<100	—	—	—	—
29N-23E-32 ADD 1	04-20-82	1750	365722094500401	84041	300	48,000	—	—	—	—
29N-23E-35 BDD 1	03-11-42	—	365734094471101	1028	—	—	—	—	—	—
29N-23E-35 BDD 1	09-06-51	—	365734094471101	1028	—	—	—	—	—	—
29N-23E-35 BDD 1	02-19-81	—	365734094471101	84042	—	—	—	—	—	6
29N-23E-35 BDD 1	04-13-81	—	365734094471101	84042	—	—	—	—	—	<2

Table 5.—*Concentrations of trace elements in water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Cadmium, dissolved (µg/L as Cd)	Chromium, total recoverable (µg/L as Cr)	Chromium, dissolved (µg/L as Cr)	Copper, total recoverable (µg/L as Cu)	Copper, dissolved (µg/L as Cu)	Iron, total recoverable (µg/L as Fe)	Iron, dissolved (µg/L as Fe)	Lead, total recoverable (µg/L as Pb)	Lead, dissolved (µg/L as Pb)
29N-23E-21 BBC 1	09-03-42	—	—	—	—	—	—	30	—	—	—
29N-23E-21 BBC 1	09-06-51	—	—	—	—	—	—	20	—	—	—
29N-23E-21 BBC 1	07-07-81	1415	<1.0	—	<1	—	<60	—	130	—	<5
29N-23E-21 BBC 1	07-23-81	1100	3.0	—	0	—	0	—	330	—	0
29N-23E-21 BBC 1	09-02-82	830	<1.0	—	<10	—	<12	—	230	—	6
29N-23E-21 BBC 2	07-07-81	1420	<1.0	—	<1	—	<60	—	80	—	<5
29N-23E-21 BBC 2	09-02-82	831	<1.0	—	<10	—	<12	—	30	—	5
29N-23E-21 BBC 3	07-07-81	1430	<1.0	—	<1	—	<60	—	150	—	<5
29N-23E-21 BBC 3	09-02-82	832	<1.0	—	<10	—	<12	—	60	—	5
29N-23E-25 BDC 1	10-19-77	800	—	—	—	—	—	<100	—	—	—
29N-23E-25 BDC 1	10-19-77	1200	—	—	—	—	—	150	—	—	—
29N-23E-25 BDC 1	10-19-77	1600	—	—	—	—	—	<100	—	—	—
29N-23E-25 BDC 1	10-01-79	—	—	—	—	—	—	310	—	—	—
29N-23E-25 BDC 1	03-11-80	1515	—	<10	—	35	—	1,900	—	<20	—
29N-23E-25 BDC 1	02-23-81	—	—	—	—	—	—	3,000	—	<20	—
29N-23E-25 BDC 1	04-09-81	800	—	—	—	—	—	8,700	—	<20	—
29N-23E-25 BDC 1	07-07-81	1100	<1.0	—	<1	—	<60	—	20,000	—	<5
29N-23E-25 BDC 1	07-07-81	1230	<1.0	—	<1	—	<60	—	19,000	—	<5
29N-23E-26 CDD 1	05-02-78	—	—	9	—	13	—	1,700	—	5	—
29N-23E-26 CDD 1	03-11-80	1435	—	<10	—	8	—	<100	—	<20	—
29N-23E-26 CDD 1	02-19-81	—	—	—	—	—	—	550	—	<20	—
29N-23E-26 CDD 1	04-13-81	—	—	—	—	—	—	120	—	<20	—
29N-23E-26 CDD 1	07-07-81	1045	<1.0	—	<1	—	<60	—	70	—	<5
29N-23E-31 BDD 1	09-12-42	—	—	—	—	—	—	0	—	—	—
29N-23E-31 BDD 1	07-10-81	930	<1.0	—	<1	—	<60	—	50	—	<5
29N-23E-32 ADD 1	04-20-82	1730	<4.0	—	<10	—	<12	—	<8	—	<5
29N-23E-32 ADD 1	04-20-82	1750	710	—	20	—	320	—	88,000	—	16
29N-23E-35 BDD 1	03-11-42	—	—	—	—	—	—	4,600	—	—	—
29N-23E-35 BDD 1	09-06-51	—	—	—	—	—	—	0	—	—	—
29N-23E-35 BDD 1	02-19-81	—	—	—	—	—	—	320	—	<20	—
29N-23E-35 BDD 1	04-13-81	—	—	—	—	—	—	280	—	<20	—

Table 5.—*Concentrations of trace elements in water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Manganese, total recoverable (µg/L as Mn)	Manganese, dissolved (µg/L as Mn)	Mercury, total recoverable (µg/L as Hg)	Mercury, dissolved (µg/L as Hg)	Molybdenum, dissolved (µg/L as Mo)	Selenium, total recoverable (µg/L as Se)	Silver, total recoverable (µg/L as Ag)	Zinc, total recoverable (µg/L as Zn)	Zinc, dissolved (µg/L as Zn)
29N-23E-21 BBC 1	09-03-42	—	—	—	—	—	—	—	—	—	—
29N-23E-21 BBC 1	09-06-51	—	—	—	—	—	—	—	—	—	—
29N-23E-21 BBC 1	07-07-81	1415	—	<10	—	<0.5	—	—	—	—	<20
29N-23E-21 BBC 1	07-23-81	1100	—	10	—	0	—	—	—	—	30
29N-23E-21 BBC 1	09-02-82	830	—	10	—	<0.5	—	—	—	—	72
29N-23E-21 BBC 2	07-07-81	1420	—	<10	—	<0.5	—	—	—	—	26
29N-23E-21 BBC 2	09-02-82	831	—	<10	—	<0.5	—	—	—	—	24
29N-23E-21 BBC 3	07-07-81	1430	—	<10	—	<0.5	—	—	—	—	20
29N-23E-21 BBC 3	09-02-82	832	—	10	—	<0.5	—	—	—	—	21
29N-23E-25 BDC 1	10-19-77	800	10	—	—	—	—	—	—	—	—
29N-23E-25 BDC 1	10-19-77	1200	10	—	—	—	—	—	—	—	—
29N-23E-25 BDC 1	10-19-77	1600	10	—	—	—	—	—	—	—	—
29N-23E-25 BDC 1	10-01-79	—	—	—	—	—	—	—	—	—	—
29N-23E-25 BDC 1	03-11-80	1515	20	—	<0.50	—	—	<5	<3	590	—
29N-23E-25 BDC 1	02-23-81	—	70	—	—	—	—	—	—	1,600	—
29N-23E-25 BDC 1	04-09-81	800	—	—	—	—	—	—	—	1,700	—
29N-23E-25 BDC 1	07-07-81	1100	—	210	—	<0.5	—	—	—	—	3,300
29N-23E-25 BDC 1	07-07-81	1230	—	100	—	0.5	—	—	—	—	3,600
29N-23E-26 CDD 1	05-02-78	—	20	—	<0.50	—	—	<1	<2	80	—
29N-23E-26 CDD 1	03-11-80	1435	20	—	<0.50	—	—	<5	<3	130	—
29N-23E-26 CDD 1	02-19-81	—	30	—	—	—	—	—	—	5	—
29N-23E-26 CDD 1	04-13-81	—	<20	—	—	—	—	—	—	10	—
29N-23E-26 CDD 1	07-07-81	1045	—	<10	—	<0.5	—	—	—	—	81
29N-23E-31 BDD 1	09-12-42	—	—	—	—	—	—	—	—	—	—
29N-23E-31 BDD 1	07-10-81	930	—	<10	—	<0.5	—	—	—	—	<20
29N-23E-32 ADD 1	04-20-82	1730	—	50	—	—	<2	—	—	—	210
29N-23E-32 ADD 1	04-20-82	1750	—	3,300	—	—	<2	—	—	—	20,000
29N-23E-35 BDD 1	03-11-42	—	—	—	—	—	—	—	—	—	—
29N-23E-35 BDD 1	09-06-51	—	—	—	—	—	—	—	—	—	—
29N-23E-35 BDD 1	02-19-81	—	40	—	—	—	—	—	—	20	—
29N-23E-35 BDD 1	04-13-81	—	30	—	—	—	—	—	—	30	—

Table 6.—*Concentrations of radioactive constituents in water from wells completed in the Roubidoux aquifer*

[pCi/L, picocuries per liter; µg/L, micrograms per liter; U-nat, uranium natural; Cs-137, cesium 137; Ra-226, radium 226; Ra-228, radium-228; Sr/Yt-90, strontium 90/yttrium 90; —, indicates no data are available; <, indicates concentration is less than the specified value. All samples analyzed by the National Water Quality Laboratory of the U.S. Geological Survey.]

Local identifier	Date	Time	Site identification number	Gross alpha, dissolved (pCi/L as U-nat)	Gross alpha, suspended total (pCi/L as U-nat)	Gross alpha, dissolved (µg/L as U-nat)	Gross alpha, suspended total (µg/L as U-nat)
				ADAIR COUNTY			
18N-26E-18 BDC 1	10-28-81	1300	360225094344001	<5.4	—	<7.9	<0.4
				CRAIG COUNTY			
27N-20E-12 BDD 2	06-08-81	1400	365016095070501	<14	0.3	<21	0.5
27N-21E-12 CCB 1	07-09-81	1030	365000095010101	<6.8	—	<10	<0.4
27N-21E-20 DCD 1	06-09-81	1100	364808095043501	<7.5	0.3	<11	<0.4
28N-21E-29 CBC 1	06-09-81	900	365242095051701	23	0.3	34	<0.4
28N-21E-29 CBC 1	06-15-82	1425	365242095051701	—	—	—	—
28N-21E-29 CBD 1	06-09-81	930	365240095051501	<24	0.3	<35	<0.4
28N-21E-29 CBD 1	06-15-82	1430	365240095051501	—	—	—	—
				DELAWARE COUNTY			
20N-23E-34 CCA 1	06-10-81	930	360946094504901	<4.8	3.2	<7.1	4.7
20N-24E-17 CCC 1	06-10-81	800	361221094463901	6.3	0.3	9.2	<0.4
21N-25E-31 BBB 1	06-10-81	1045	361544094410101	17	0.3	25	<0.4
21N-25E-31 BBB 1	06-16-82	1330	361544094410101	—	—	—	—
22N-23E-05 DCA 1	06-10-81	1200	362442094520801	57	1.7	84	2.5
22N-23E-05 DCA 1	06-18-82	950	362442094520801	—	—	—	—
22N-23E-11 BBB 1	03-21-83	1445	362427094493001	21	—	31	<0.4
23N-22E-14 ADC 1	06-10-81	1245	362829094550901	<2.9	0.3	<4.3	<0.4
23N-25E-33 DDC 1	07-09-81	1445	362532094374501	<3.6	—	<5.3	<0.4
24N-23E-15 BBC 1	06-11-81	930	363357094503701	24	0.3	35	<0.4
24N-23E-15 BBC 1	06-17-82	1000	363357094503701	—	—	—	—
24N-24E-06 DCA 1	06-11-81	1230	363510094464501	<7.5	1.2	<11	1.8
25N-22E-23 CCD 1	06-10-81	1500	363740094553101	<3.7	0.3	<5.4	<0.4
25N-23E-13 AAB 1	06-11-81	1330	363921094474301	<7.5	—	<11	<0.4
25N-24E-28 BBB 1	07-09-81	1200	363718094444501	<11	—	<16	<0.4

Table 6.—*Concentrations of radioactive constituents in water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Gross beta, dissolved (pCi/L as Cs-137)	Gross beta, suspended total (pCi/L as Cs-137)	Gross beta, dissolved (pCi/L as Sr/Yt-90)	Gross beta, suspended total (pCi/L as Sr/Yt-90)	Radium-226 dissolved planchet count (pCi/L)	Radium-228 dissolved (pCi/L as Ra-228)
ADAIR COUNTY								
18N-26E-18 BDC 1	10-28-81	1300	<3.2	<0.4	<3.0	<0.4	—	—
CRAIG COUNTY								
27N-20E-12 BDD 2	06-08-81	1400	14	<0.4	14	<0.4	—	—
27N-21E-12 CCB 1	07-09-81	1030	5.3	0.8	5.1	0.8	—	—
27N-21E-20 DCD 1	06-09-81	1100	<5.6	<0.4	<5.4	<0.4	—	—
28N-21E-29 CBC 1	06-09-81	900	15	<0.4	14	<0.4	—	—
28N-21E-29 CBC 1	06-15-82	1425	—	—	—	—	3.4	<2.0
28N-21E-29 CBD 1	06-09-81	930	17	<0.4	16	<0.4	—	—
28N-21E-29 CBD 1	06-15-82	1430	—	—	—	—	6.4	<3.0
DELAWARE COUNTY								
20N-23E-34 CCA 1	06-10-81	930	<3.5	<1.5	<3.3	<1.5	—	—
20N-24E-17 CCC 1	06-10-81	800	3.5	<0.4	3.4	<0.4	—	—
21N-25E-31 BBB 1	06-10-81	1045	9.2	<0.4	8.8	<0.4	—	—
21N-25E-31 BBB 1	06-16-82	1330	—	—	—	—	5.2	<3.0
22N-23E-05 DCA 1	06-10-81	1200	21	0.6	20	0.6	—	—
22N-23E-05 DCA 1	06-18-82	950	—	—	—	—	8.9	<3.0
22N-23E-11 BBB 1	03-21-83	1445	10	<0.4	9.9	<0.4	—	—
23N-22E-14 ADC 1	06-10-81	1245	3.5	<0.4	3.4	<0.4	—	—
23N-25E-33 DDC 1	07-09-81	1445	<2.6	<0.4	<2.4	<0.4	—	—
24N-23E-15 BBC 1	06-11-81	930	15	<0.4	14	<0.4	—	—
24N-23E-15 BBC 1	06-17-82	1000	—	—	—	—	7.5	<3.0
24N-24E-06 DCA 1	06-11-81	1230	<5.2	<0.4	<5.0	<0.4	—	—
25N-22E-23 CCD 1	06-10-81	1500	3.9	<0.4	3.7	<0.4	—	—
25N-23E-13 AAB 1	06-11-81	1330	<4.5	<0.4	<4.5	<0.4	—	—
25N-24E-28 BBB 1	07-09-81	1200	<6.1	<0.4	<5.9	<0.4	—	—

Table 6.—*Concentrations of radioactive constituents in water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Site identification number	Gross alpha, dissolved (pCi/L as U-nat)	Gross alpha, suspended total (pCi/L as U-nat)	Gross alpha, dissolved (μg/L as U-nat)	Gross alpha, suspended total (μg/L as U-nat)
			OTTAWA COUNTY				
25N-23E-01 AAA 1	07-15-81	1700	364103094470401	<6.3	—	<9.3	<0.4
26N-22E-15 DDA 1	06-12-81	1000	364349094554501	14	0.3	21	<0.4
26N-22E-20 BCC 1	06-12-81	900	364323094585101	<16	0.3	<23	<0.4
26N-22E-20 BCC 1	06-16-82	900	364323094585101	—	—	—	—
26N-22E-27 ADD 1	07-08-81	830	364227094554301	14	0.5	20	0.7
26N-22E-27 CBC 1	06-11-81	1600	364211094564101	24	0.3	35	<0.4
26N-22E-32 ADC 1	06-11-81	1500	364135094580001	42	0.3	62	<0.4
26N-22E-32 ADC 1	06-16-82	1005	364135094580001	—	—	—	—
26N-22E-32 ADC 2	06-11-81	1300	364135094580002	28	0.3	41	<0.4
26N-22E-32 ADC 2	06-16-82	1000	364135094580002	—	—	—	—
26N-23E-09 CA 1	07-08-81	945	364501094505301	25	0.3	36	0.4
26N-23E-09 CA 1	06-18-82	800	364501094505301	—	—	—	—
26N-23E-09 DBC 1	07-08-81	930	364454094504401	<6.7	—	<9.8	<0.4
26N-23E-12 BAD 1	07-08-81	1040	364516094473501	<7.5	—	<11	<0.4
26N-24E-32 ABA 1	07-30-81	1400	364155094451001	<7.5	—	<11	<0.4
27N-22E-01 CCC 1	07-16-81	800	365103094541501	<10	—	<15	<0.4
27N-22E-27 AAB 1	07-09-81	900	364801094554601	<14	—	<20	<0.4
27N-23E-03 BCC 1	07-08-81	1630	365100094491701	<3.7	<0.4	<5.4	<0.4
27N-23E-17 CBB 1	06-09-81	1545	364921094522201	12	0.3	17	<0.4
27N-23E-28 CDC 1	07-08-81	1130	364712094510101	<12	—	<17	<0.4
27N-24E-28 CAD 1	07-08-81	1500	364717094433101	<3.6	—	<5.3	<0.4
27N-25E-09 CAC 1	07-14-81	1030	364957094371501	<3.3	0.5	<4.8	0.8
28N-22E-11 ABB 1	07-10-81	830	365543094535801	<5.8	0.4	<8.5	0.6
28N-22E-24 BDA 1	07-16-81	1330	365342094531301	<5.0	—	<7.4	<0.4
28N-22E-24 CAD 1	07-16-81	1430	365324094531301	<6.1	—	<9.0	<0.4
28N-22E-24 CBC 1	07-16-81	1315	365323094534001	<7.5	—	<11	<0.4
28N-23E-06 BAC 1	07-07-81	900	365627094522201	<5.7	—	<8.4	<0.4
28N-23E-06 BAC 2	03-22-83	920	365627094522101	8.2	—	12	<0.4
28N-23E-06 CBB 1	03-22-83	900	365600094523001	5.2	—	7.6	<0.4
28N-23E-06 CBD 2	07-07-81	830	365557094522701	<4.2	—	<6.2	<0.4
28N-23E-18 CDC 1	07-16-81	1340	365402094522201	7.5	—	11	<0.4
28N-23E-20 BCB 1	07-15-81	1030	365344094513301	<3.1	—	<4.6	<0.4
28N-23E-24 DDA 1	07-15-81	1400	365316094461601	<6.3	—	<9.2	<0.4
28N-23E-28 BBB 1	07-14-81	1700	365301094502901	<8.8	—	<13	<0.4
28N-23E-30 CAC 1	07-15-81	900	365229094522101	<6.3	—	<9.3	<0.4

Table 6.—*Concentrations of radioactive constituents in water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Gross beta, dissolved (pCi/L as Cs-137)	Gross beta, suspended total (pCi/L as Cs-137)	Gross beta, dissolved (pCi/L as Sr/Yt-90)	Gross beta, suspended total (pCi/L as Sr/Yt-90)	Radium-226 dissolved planchet count (pCi/L)	Radium-228 dissolved (pCi/L as Ra-228)
OTTAWA COUNTY								
25N-23E-01 AAA 1	07-15-81	1700	5.0	<0.4	4.9	<0.4	—	—
26N-22E-15 DDA 1	06-12-81	1000	9.6	<0.4	9.2	<0.4	—	—
26N-22E-20 BCC 1	06-12-81	900	<9.1	<0.4	<8.7	<0.4	—	—
26N-22E-20 BCC 1	06-16-82	900	—	—	—	—	4.3	<3.0
26N-22E-27 ADD 1	07-08-81	830	7.7	1.5	7.4	1.6	—	—
26N-22E-27 CBC 1	06-11-81	1600	13	<0.4	12	<0.4	—	—
26N-22E-32 ADC 1	06-11-81	1500	25	<0.4	24	<0.4	—	—
26N-22E-32 ADC 1	06-16-82	1005	—	—	—	—	14	<3.0
26N-22E-32 ADC 2	06-11-81	1300	19	<0.4	18	<0.4	—	—
26N-22E-32 ADC 2	06-16-82	1000	—	—	—	—	7.3	<3.0
26N-23E-09 CA 1	07-08-81	945	22	1.9	21	1.9	—	—
26N-23E-09 CA 1	06-18-82	800	—	—	—	—	6.5	<2.0
26N-23E-09 DBC 1	07-08-81	930	5.0	<0.4	4.8	<0.4	—	—
26N-23E-12 BAD 1	07-08-81	1040	<4.5	<0.4	<4.3	<0.4	—	—
26N-24E-32 ABA 1	07-30-81	1400	<5.7	<0.4	<5.4	<0.4	—	—
27N-22E-01 CCC 1	07-16-81	800	5.8	<0.4	5.5	<0.4	—	—
27N-22E-27 AAB 1	07-09-81	900	<10	<0.4	<9.7	<0.4	—	—
27N-23E-03 BCC 1	07-08-81	1630	<2.4	<0.4	<2.3	<0.4	—	—
27N-23E-17 CBB 1	06-09-81	1545	6.4	<0.4	6.1	<0.4	—	—
27N-23E-28 CDC 1	07-08-81	1130	8.4	<0.4	8.0	<0.4	—	—
27N-24E-28 CAD 1	07-08-81	1500	<3.5	<0.4	<3.3	<0.4	—	—
27N-25E-09 CAC 1	07-14-81	1030	8.4	0.5	8.0	0.5	—	—
28N-22E-11 ABB 1	07-10-81	830	4.4	2.7	4.3	2.8	—	—
28N-22E-24 BDA 1	07-16-81	1330	<2.8	<0.4	<2.7	<0.4	—	—
28N-22E-24 CAD 1	07-16-81	1430	4.6	<0.4	4.4	<0.4	—	—
28N-22E-24 CBC 1	07-16-81	1315	<4.9	<0.4	<4.7	<0.4	—	—
28N-23E-06 BAC 1	07-07-81	900	<4.0	<0.4	<3.9	<0.4	—	—
28N-23E-06 BAC 2	03-22-83	920	5.4	<0.4	5.2	<0.4	—	—
28N-23E-06 CBB 1	03-22-83	900	5.4	<0.4	5.1	<0.4	—	—
28N-23E-06 CBD 2	07-07-81	830	3.9	<0.4	3.8	<0.4	—	—
28N-23E-18 CDC 1	07-16-81	1340	<5.7	<0.4	<5.4	<0.4	—	—
28N-23E-20 BCB 1	07-15-81	1030	2.3	<0.4	2.2	<0.4	—	—
28N-23E-24 DDA 1	07-15-81	1400	<4.2	<0.4	<4.0	<0.4	—	—
28N-23E-28 BBB 1	07-14-81	1700	<5.3	<0.4	<5.1	<0.4	—	—
28N-23E-30 CAC 1	07-15-81	900	<3.5	<0.4	<3.4	<0.4	—	—

Table 6.—*Concentrations of radioactive constituents in water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Site identification number	Gross alpha, dissolved (pCi/L as U-nat)	Gross alpha, suspended total (pCi/L as U-nat)	Gross alpha, dissolved (µg/L as U-nat)	Gross alpha, suspended total (µg/L as U-nat)
28N-23E-31 BAC 1	07-15-81	1100	365206094522201	<7.5	—	<11	<0.4
28N-23E-31 CBA 1	07-15-81	930	365146094522201	<3.3	—	<4.8	<0.4
28N-23E-32 BAB 1	07-15-81	1130	365212094511901	11	—	16	<0.4
28N-23E-33 BAB 1	07-14-81	1615	365213094500701	<6.3	—	<9.2	<0.4
28N-23E-36 CCC 1	07-15-81	1300	365128094471301	<6.8	—	<10	<0.4
28N-24E-13 ABD 1	07-14-81	1230	365445094400701	<5.7	—	<8.4	<0.4
28N-25E-20 CAA 1	06-09-81	1330	365335094380701	<2.9	0.3	<4.2	<0.4
29N-22E-21 DAD 1	06-09-81	1700	365833094551901	<10	0.3	<15	<0.4
29N-23E-19 DDC 1	07-14-81	830	365823094510701	<3.4	—	<5.0	<0.4
29N-23E-21 BBC 1	07-07-81	1415	365905094494601	<6.3	<0.4	<9.3	—
29N-23E-21 BBC 2	07-07-81	1420	365905094494602	<5.2	<0.4	<7.7	—
29N-23E-21 BBC 3	07-07-81	1430	365905094494603	<7.5	<0.4	<11	—
29N-23E-25 BDC 1	07-07-81	1100	365800094461701	<21	1.4	<31	2.0
29N-23E-25 BDC 1	07-07-81	1230	365800094461701	<20	0.5	<30	0.8
29N-23E-26 CDD 1	07-07-81	1045	365734094471001	<8.2	—	<12	<0.4
29N-23E-31 BDD 1	07-10-81	930	365704094513101	<4.2	0.5	<6.2	0.8

Table 6.—*Concentrations of radioactive constituents in water from wells completed in the Roubidoux aquifer*—Continued

Local identifier	Date	Time	Gross beta, dissolved (pCi/L as Cs-137)	Gross beta, suspended total (pCi/L as Cs-137)	Gross beta, dissolved (pCi/L as Sr/Yt-90)	Gross beta, suspended total (pCi/L as Sr/Yt-90)	Radium-226 dissolved planchet count (pCi/L)	Radium-228 dissolved (pCi/L as Ra-228)
28N-23E-31 BAC 1	07-15-81	1100	<4.7	<0.4	<4.6	<0.4	—	—
28N-23E-31 CBA 1	07-15-81	930	2.2	<0.4	2.1	<0.4	—	—
28N-23E-32 BAB 1	07-15-81	1130	7.5	<0.4	7.2	<0.4	—	—
28N-23E-33 BAB 1	07-14-81	1615	4.3	<0.4	4.1	<0.4	—	—
28N-23E-36 CCC 1	07-15-81	1300	<4.3	<0.4	<4.1	<0.4	—	—
28N-24E-13 ABD 1	07-14-81	1230	<4.0	<0.4	<3.9	<0.4	—	—
28N-25E-20 CAA 1	06-09-81	1330	<2.0	<0.4	<2.0	<0.4	—	—
29N-22E-21 DAD 1	06-09-81	1700	7.5	<0.4	7.2	<0.4	—	—
29N-23E-19 DDC 1	07-14-81	830	3.3	<0.4	3.1	<0.4	—	—
29N-23E-21 BBC 1	07-07-81	1415	<3.4	<0.4	<3.3	<0.4	—	—
29N-23E-21 BBC 2	07-07-81	1420	<4.1	<0.4	<3.9	<0.4	—	—
29N-23E-21 BBC 3	07-07-81	1430	5.7	<0.4	5.5	<0.4	—	—
29N-23E-25 BDC 1	07-07-81	1100	15	<0.4	15	<0.4	—	—
29N-23E-25 BDC 1	07-07-81	1230	<13	<0.4	<12	<0.4	—	—
29N-23E-26 CDD 1	07-07-81	1045	<4.2	<0.4	<4.1	<0.4	—	—
29N-23E-31 BDD 1	07-10-81	930	3.0	1.1	2.8	1.1	—	—