Geohydrology of the San Agustin Basin, Alamosa Creek Basin upstream from Monticello Box, and upper Gila Basin in parts of Catron, Socorro, and Sierra Counties, New Mexico

By
R.G. Myers, J.T. Everheart, and C.A. Wilson

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BRUCE BABBITT, *Secretary*

U.S. GEOLOGICAL SURVEY

Gordon P. Eaton, *Director*

For additional information write to:

District Chief
U.S. Geological Survey
Water Resources Division
4501 Indian School Rd. NE, Suite 200
Albuquerque, New Mexico 87110

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(In pocket)

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CONVERSION FACTORS AND VERTICAL DATUM

Multiply	By	To obtain
acre	4,047	square meter
acre	0.4047	hectare
acre-foot	1,233	cubic meter
cubic foot per second	0.02832	cubic meter per second
foot	0.3048	meter
foot per mile	0.1894	meter per kilometer
foot per day	0.3048	meter per day
foot squared per day	0.0929	meter squared per day
gallon per minute per foot	0.2070	liter per second per meter
gallon	3.785	liter
gallon per minute	0.06309	liter per second
inch	25.4	millimeter
mile	1.609	kilometer
square mile	2.590	square kilometer

Temperature in degrees Fahrenheit (°F) or degrees Celsius (°C) can be converted as follows:

$$°C = 5/9\ (°F - 32)$$
$$°F = 9/5\ (°C) + 32$$

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

GEOHYDROLOGY OF THE SAN AGUSTIN BASIN, ALAMOSA CREEK BASIN UPSTREAM FROM MONTICELLO BOX, AND UPPER GILA BASIN IN PARTS OF CATRON, SOCORRO, AND SIERRA COUNTIES, NEW MEXICO

By R.G. Myers, J.T. Everheart, and C.A. Wilson

ABSTRACT

The San Agustin Basin, the Alamosa Creek Basin upstream from Monticello Box, and the upper Gila Basin are located in parts of Catron, Socorro, and Sierra Counties in west-central New Mexico. Four major aquifers are within the study area: (1) the San Agustin bolson-fill aquifer; (2) the Datil aquifer; (3) the shallow upland aquifers; and (4) the Alamosa Creek shallow aquifer. Two minor aquifers, the Baca Formation at the northern edge of the San Agustin Basin and a basalt to basaltic andesite unit overlying the Datil Group, yield some water to wells.

Sixty-three vertical electrical-resistivity soundings were used to estimate the depth to bedrock and the saline/freshwater interface in the San Agustin bolson-fill aquifer. The dissolved-solids concentration of ground-water samples ranged from 74 to 23,500 milligrams per liter. The dominant cations varied; the dominant anion of freshwater generally was bicarbonate. Point-of-discharge temperatures of well or spring water that exceed 21 degrees Celsius are associated with faults in the areas of shallow or exposed bedrock. The dissolved-solids concentration of this warm water ranged from 120 to 1,200 milligrams per liter.

INTRODUCTION

The San Agustin (also referred to as San Augustin and San Augustine) Basin is a basin with interior surface-water drainage. The basin was declared an extension of the Rio Grande Ground-Water Basin by the New Mexico State Engineer on May 14, 1976. Complete information is needed on the quantity, quality, and availability of ground water in the basin and adjacent areas for proper management of ground-water resources. The Alamosa Creek Basin upstream from Monticello Box (fig. 1) and southeast of the San Agustin Basin is part of the New Mexico State Engineer's Rio Grande Ground-Water Basin and has surface-water drainage toward the Rio Grande. The upper Gila Basin is part of the New Mexico State Engineer's Gila-San Francisco Ground-Water Basin and has surface-water drainage toward the Colorado River in Arizona. Prior to this study, very little information on ground-water resources had been collected in the San Agustin and Alamosa Creek Basins. The study was begun by the State Engineer in 1977 with the collection of some field data. The U.S. Geological Survey began participating in the study in 1978.

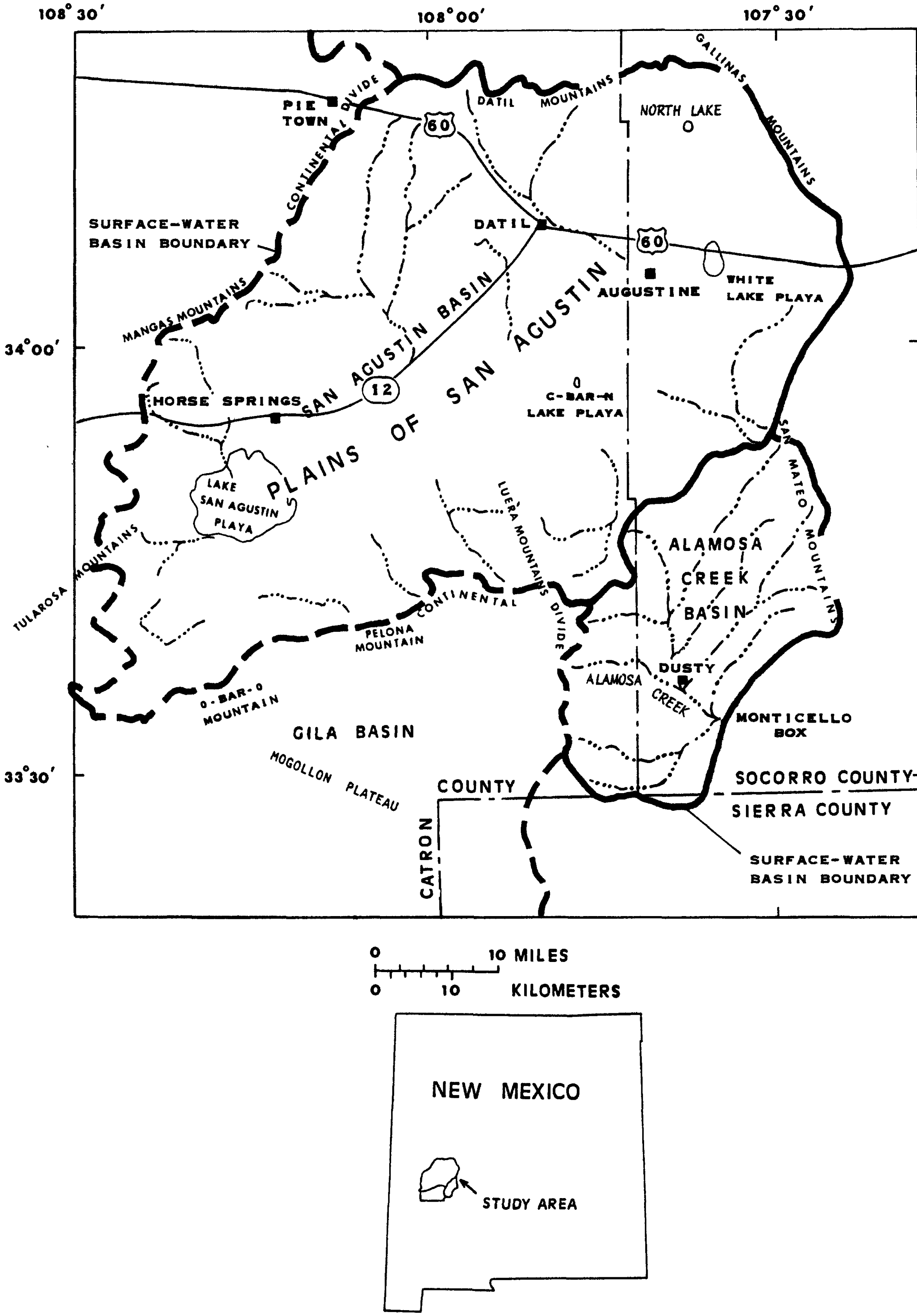


Figure 1.--Location and physiographic features of the study area.

Purpose and Scope

This report presents the results of a reconnaissance study of the hydrology of the San Agustin Basin, the Alamosa Creek Basin upstream from Monticello Box, and the upper Gila Basin (fig. 1); all data collected during the study are included in the report. Water-table maps were constructed for the San Agustin bolson-fill aquifer, Datil aquifer, and Alamosa Creek shallow aquifer to estimate the regional flow systems of the major aquifers within the study area. Surface electrical-resistivity soundings were used to estimate the depth to bedrock and the extent of saline water in the San Agustin bolson-fill aquifer. Aquifer tests were conducted on most of the large production wells in the San Agustin Basin. Numerous water samples were analyzed to determine the general hydrochemical characteristics of the aquifers.

Location and Extent

The study area consists of the San Agustin Basin, Alamosa Creek Basin upstream from Monticello Box, and upper Gila Basin in parts of Catron, Socorro, and Sierra Counties in west-central New Mexico. The location of the study area and its major physiographic features are shown in figure 1.

The San Agustin Basin is a closed basin of about 2,000 square miles. The basin is bounded on the west and south by the Continental Divide, which traverses the Mangas, Tularosa, 0-Bar-0, Pelona, and Luera Mountains; on the north by the Datil and Gallinas Mountains; and on the east by the Gallinas and San Mateo Mountains. The Plains of San Agustin, in the center of the basin, are two elliptical, gently rolling, grass-covered, featureless areas separated by a band of low hills. The altitudes of the plains range from about 6,800 to 7,500 feet above sea level. The surrounding mountains rise to more than 10,000 feet above sea level. The basin contains only intermittent streams.

The Alamosa Creek Basin upstream from Monticello Box has an area of about 400 square miles. The basin is bounded on the northwest by the San Agustin Basin, on the northeast by the San Mateo Mountains, and on the southwest by the Continental Divide. The basin consists of an alluvial valley that has a range in altitude from about 6,200 to 7,000 feet above sea level and is surrounded by mountains that have altitudes as much as 8,500 feet above sea level on the southwest and as much as 10,000 feet above sea level on the northeast. Alamosa Creek at Monticello Box flows out of the basin at an average annual rate of 8.3 cubic feet per second. The flow is derived from several hot and cold springs and runoff from precipitation and snowmelt.

Climate

Precipitation averages 13.25 inches annually in the San Agustin Basin and 13.95 inches annually in the Alamosa Creek Basin. Annual precipitation ranges from less than 10 inches in the lower parts of the San Agustin Basin to more than 20 inches in the surrounding mountains. Annual precipitation ranges from less than 12 inches in the lower parts of the Alamosa Creek Basin to more than 20 inches in the surrounding mountains. Most precipitation occurs in July, August, and September due to thunderstorms. A less intense period of precipitation and snowfall occurs from December to March. Runoff in many arroyos draining into the Plains of San Agustin disappears into the permeable alluvial fill along the edge of the plains.

The mean maximum temperature for Datil, New Mexico (fig. 1), is about 65 degrees Fahrenheit; the mean minimum temperature is about 29 degrees Fahrenheit. January is the coldest month and July is the warmest month. The growing season averages slightly more than 100 days. The major industry is ranching.

Previous Hydrologic Investigations

Bushman and Valentine (1954) published a report containing ground-water data for an area of about 500 square miles in the southwestern part of the Plains of San Agustin. The report contains records for 99 wells and 12 springs, 66 chemical analyses, and three driller's logs.

Cooper (1967) briefly described the geography, geology, and hydrology of the Plains of San Agustin. The geologic units and their hydrologic characteristics are briefly described in a stratigraphic section. Cooper stated that large quantities of ground water are present in the principal aquifer of the bolson-fill deposits.

Blodgett's (1973) master's thesis has been the only study of the hydrology of the San Agustin Basin. Blodgett constructed a water-table contour map of the basin from 26 water-level measurements he collected and from other sources of data. He concluded from the map that subsurface leakage is occurring from the southwestern part of the basin toward the south into the headwaters of the Gila River, and he estimated the quantity on the basis of a hydrologic budget. The report also includes chemical analyses of water from 16 wells and 4 springs.

Everheart (1978) completed a short memorandum report for the New Mexico State Engineer Office. The report contains a list of pending water-rights applications in the Plains of San Agustin.

Well- and Spring-Numbering System

The system of numbering wells and springs in New Mexico (fig. 2) is based on the common subdivision of public lands into sections. The well or spring number, in addition to designating the well or spring, locates its position to the nearest 10-acre tract in the land network. The number is divided by periods into four segments. The first segment denotes the township north or south of the New Mexico base line, the second denotes the range east or west of the New Mexico principal meridian, and the third denotes the section. The fourth segment of the number, which consists of three digits, denotes the 160-, 40- and 10-acre tracts, respectively, in which the well or spring is situated.

For this purpose, the section is divided into four quarters, numbered 1, 2, 3, and 4 in the normal reading order, for the northwest, northeast, southwest, and southeast quarters, respectively. The first digit of the fourth segment gives the quarter section, which is a tract of 160 acres. Similarly, the 160-acre tract is divided into four 40-acre tracts numbered in the same manner, and the second digit denotes the 40-acre tract. Finally, the 40-acre tract is divided into four 10-acre tracts, and the third digit denotes the 10-acre tract. Thus, well 5S.8W.24.341 (fig. 2) is in the NW1/4 of the SE1/4 of the SW1/4, section 24, Township 5 South, Range 8 West. If a well or spring cannot be located accurately within a 40-acre tract, zeros are used for both the second and third digits. The letters a, b, c, and so on are added to the last segment to designate succeeding wells or springs in the same 10-acre tract.

Where sections are irregularly shaped, the well or spring is located on the basis of a regular square section grid that is superimposed on the irregular section with the southeast corner and eastern section lines matching. The well or spring is then numbered by its location in the superimposed square grid.

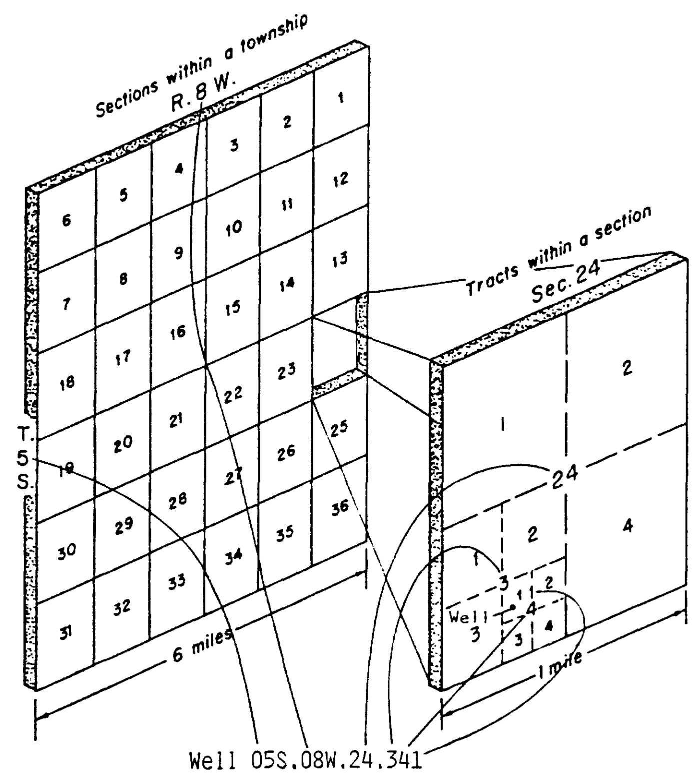


Figure 2.--System of numbering wells and springs in New Mexico.

Acknowledgments

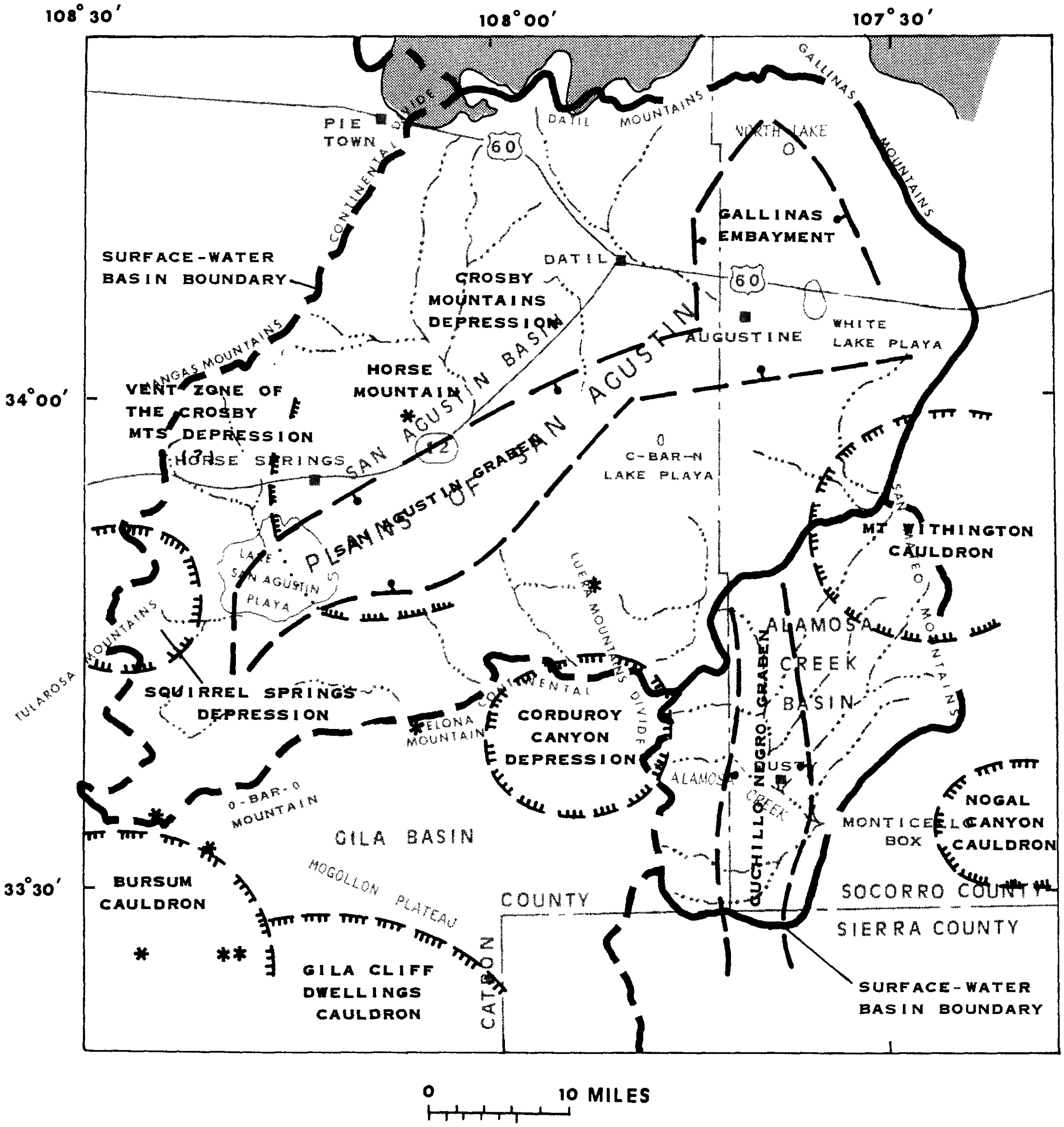
The authors wish to acknowledge the assistance of the numerous individuals and organizations who contributed to this report. Numerous landowners and ranchers shared data and allowed access to their lands, wells, and springs. J. McKinley, manager of the Double H Ranch, gave permission to perform aquifer tests on irrigation wells. The U.S. Bureau of Land Management, Socorro District, provided financial assistance for the chemical analyses of water samples. The U.S. Forest Service in Magdalena and the National Radio Astronomy Observatory allowed access to data and gave permission to conduct aquifer tests on a production well.

GEOHYDROLOGY

Regional Setting and Geologic History

The geology of the San Agustin area is the result of various Cenozoic activities. The area is on the north and northeast edge of the Mogollon Plateau (fig. 3). The break between the Laramide Orogeny and middle Tertiary events in the area is an angular unconformity between the Cretaceous sedimentary rocks and the overlying Tertiary rocks.

The San Agustin Basin (fig. 1) is an intermontane basin on the northern edge of the Mogollon Plateau (fig. 3) in the Datil-Mogollon volcanic field of southwestern New Mexico. Pre-Tertiary sedimentary rocks (fig. 4) crop out in a small area (about 2 acres) southwest of Horse Mountain (fig. 3) in the basin. Pre-Tertiary rocks probably underlie the Quaternary and Tertiary volcanic rocks at varying depths in the study area. Tertiary sedimentary rocks extend north from parts of the northern edge of the basin.



EXPLANATION

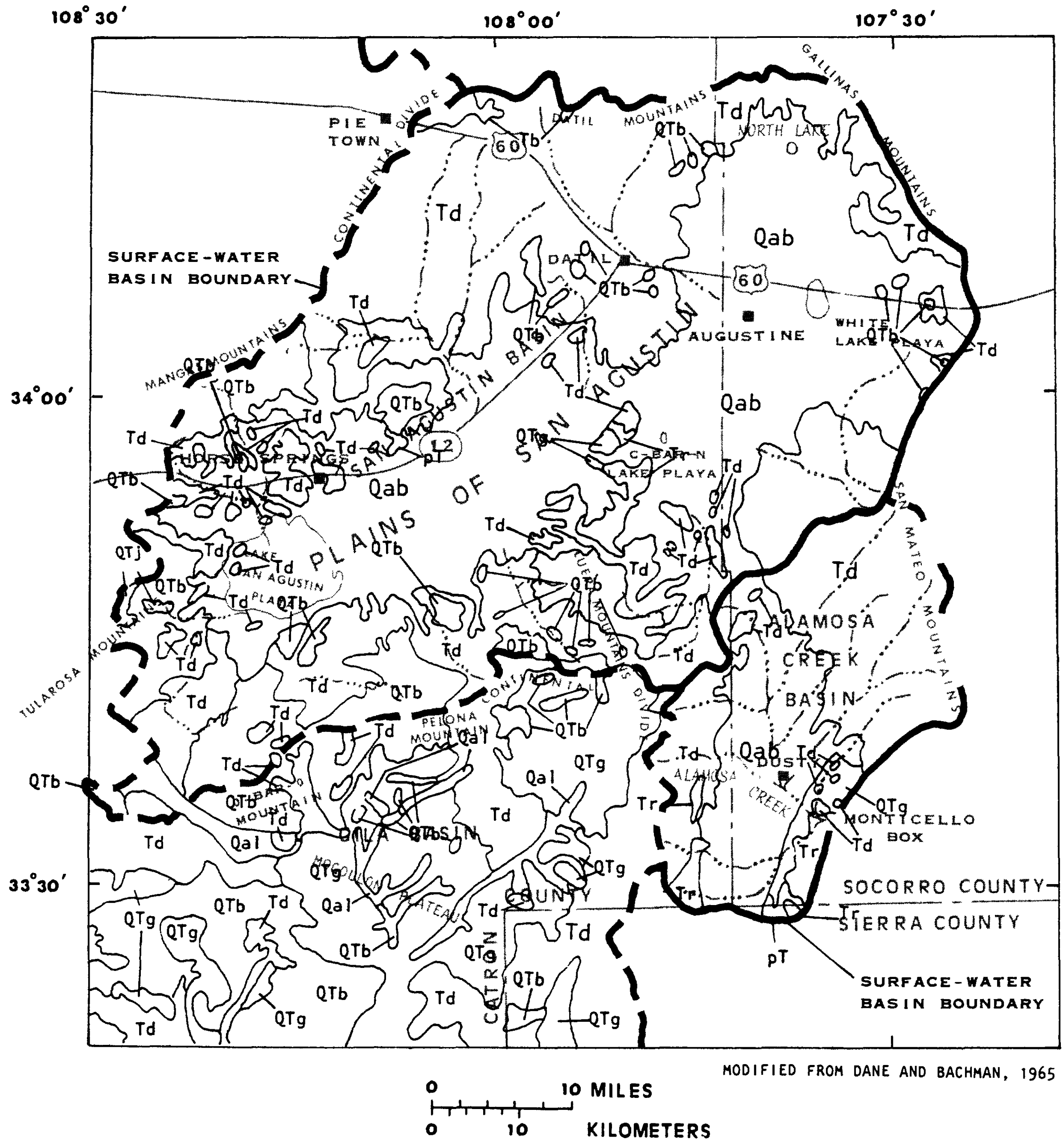
PRE-OLIGOCENE ROCKS

MAJOR FAULT, BURIED--Ball on downthrown side

INFERRED CAULDRON OR VOLCANO-TECTONIC DEPRESSION

BASALTIC VENT (~21 MILLION YEARS AGO)

Figure 3.--Structural features of the study area and vicinity (modified from Bornhorst and Elston, 1978; Elston, 1984; and Ratte and others, 1984).



EXPLANATION

QUATERNARY
- Qal — ALLUVIUM
- Qab — ALLUVIUM, BOLSON FILL, AND OTHER SURFICIAL DEPOSITS

QUATERNARY AND TERTIARY
- QTg — GILA CONGLOMERATE
- QTj — JOHN KERR PEAK FORMATION (Rhodes and Smith, 1976)
- QTb — BASALT AND BASALTIC ANDESITE

TERTIARY
- Td — DATIL GROUP
- Tr — RUBIO PEAK FORMATION
- Tb — BACA FORMATION

CRETACEOUS TO PERMIAN
- pT — PRE-TERTIARY SEDIMENTARY ROCKS

CONTACT

Figure 4.--Surficial geology.

The structural development of the San Agustin area can be divided into middle Tertiary events (43 to 21 million years ago) and Basin and Range faulting (21 million years ago to the present). Middle Tertiary events are represented mainly by volcanic-tectonic structures associated with intrusions and eruptive centers (Elston and others, 1976). This period is dominated by many volcanic extrusions that consist of three overlapping magma suites (Elston and others, 1976): (1) an early calc-alkalic andesite to rhyolite suite (43 to 29 million years ago); (2) a high-silica alkalic rhyolite suite (31 to 21 million years ago); and (3) a basaltic suite that includes basaltic andesite (37 million years ago to the present).

During middle Tertiary events, the cauldrons, depressions, and Mogollon Plateau were formed. The Mogollon Plateau is the surface expression of a granitic pluton that dominates the area south of the Plains of San Agustin (Elston and others, 1973).

Several major depressions and cauldrons occur to the west and south of the plains (fig. 3). These are the Squirrel Springs Depression west of the plains and the Bursum Cauldron, Gila Cliff Dwellings Cauldron, Corduroy Canyon Depression, Mt. Withington Cauldron, and Nogal Canyon Cauldron southwest and southeast of the plains (Bornhorst and Elston, 1978).

Basin and Range faulting followed middle Tertiary events about 21 million years ago. During this time, the San Agustin Graben and the Cuchillo Negro Graben were formed. These grabens are part of an asymmetrical graben system on the border of the Mogollon Plateau. Chapin (1971) believed that the San Agustin Graben is part of a northeast-trending lineament called the San Agustine lineament and that this lineament is a weakly developed limb of the Rio Grande Rift located east of the study area.

After formation of the San Agustin Graben, the structural relief in the western part of the basin is believed to have been 4,000 feet (Stearns, 1962). About one-half of this has eroded away.

The south-trending Cuchillo Negro Graben, about 30 miles long and 7 miles wide, is adjacent to the San Agustin Basin in the southeast part of the study area (fig. 3). The graben extends out of the Alamosa Creek Basin toward the south. This graben is bordered by the Gila Conglomerate of Quaternary and Tertiary age, Tertiary igneous rocks, and pre-Tertiary sedimentary rocks (fig. 4).

The Cuchillo Negro Graben is associated with the Mogollon Plateau and the Rio Grande Rift. An area near Monticello Box on the east side of the graben has produced some uranium and is a possible source of beryllium (Hillard, 1969). This mineralization is associated with volcanic activity and antedates the Quaternary and Tertiary Gila Conglomerate.

The Gallinas Embayment is in the northeastern part of the San Agustin Basin. The structural relation of the embayment to the San Agustin Graben and the Cuchillo Negro Graben (fig. 3) in the southeast part of the study area (Alamosa Creek Basin) is not known. The Gallinas Embayment is delineated by parallel, normal fault zones trending approximately north on the eastern and western sides of the embayment, which converge at a point at the northern end. At one time the area was a physiographic high draining toward the north (Givens, 1957).

The Plains of San Agustin occupy the northeast-trending San Agustin Graben and the Gallinas Embayment, surrounded by highlands of erosional remnants of gently tilted Quaternary and Tertiary volcanic rocks (figs. 3 and 4). The plains are about 54 miles long and have a maximum width of about 21 miles. Normal faults parallel to the graben and embayment walls are common.

Some of the straighter faults in the study area may represent reactivated Laramide and middle Tertiary faults (Elston and others, 1976). The stability of the Mogollon Plateau south of the basin probably is due to the large granitic pluton underneath.

Several large lakes covered parts of the Plains of San Agustin in late Pleistocene time (Stearns, 1962; Weber, 1980). These were Lake San Agustin in the west and White Lake and C-Bar-N Lake in the east (fig. 1). At some time during the late Pleistocene, these lakes were connected (Weber, 1980). Playas (fig. 1) now occupy the lower parts of the former lake beds. The playa surfaces are mostly clay. A playa also exists at North Lake in the northeastern part of the Plains of San Agustin near the Gallinas Mountains (fig. 1).

Lacustrine sedimentary deposits of the Pleistocene Lake San Agustin dominate the southwestern part of the plains. Stearns (1959) believed that the lake was always alkaline. At one time the lake was 34 miles long, 11 miles wide, and 165 feet deep (Stearns, 1962). No evidence of tectonic activity in the graben is younger than the extinct lake (Givens, 1957; Stearns, 1962). Alluvial fans at the mouths of major tributary valleys show evidence of wave erosion in the western part of the graben.

Geologic Units and Water-Yielding Characteristics

Geologic units (Dane and Bachman, 1965) consist of sedimentary and igneous rocks and the bolson and alluvial deposits derived from them (fig. 4). Many of these units have been redefined or mapped in more detail by others (Givens, 1957; Willard, 1957a, 1957b; Willard and Givens, 1958; Stearns, 1962; Willard and Stearns, 1971; Lopez and Bornhorst, 1979; and Osburn and Chapin, 1983). A description of the geologic units and their water-yielding characteristics is given in order from youngest to oldest in the following sections.

The major sources of ground water within the study area are the bolson-fill deposits of the San Agustin Graben and Gallinas Embayment. Alluvial fill in the tributary valleys and in the Cuchillo Negro Graben in the Alamosa Creek Basin yields small to moderate volumes of water to wells. Igneous rocks yield small volumes of water mostly from interbedded volcaniclastic units or fractures. The Baca Formation near the northern edge of the study area may yield small volumes of water to wells.

Quaternary Period

Quaternary alluvium, bolson-fill, and other surficial deposits unconformably overlie all of the units in the San Agustin Graben, Gallinas Embayment, and Cuchillo Negro Graben. The Quaternary unit consists of varying amounts of alluvial, bolson, and other surficial deposits of unconsolidated clay, silt, sand, and gravel derived from the surrounding uplands. Thickness is variable, as much as 4,000 feet or more within the San Agustin Basin. The alluvial, bolson-fill, and other surficial deposits contain the majority of the ground water in the study area and yield moderate to large quantities of water to wells. Water quality ranges from fresh to saline.

Quaternary alluvium in the tributary valleys of the San Agustin Graben, Gallinas Embayment, and Cuchillo Negro Graben unconformably overlies the older units. The unit consists of unconsolidated clay, silt, sand, and gravel in varying proportions and usually has a thickness of less than 100 feet. This unit yields small to moderate quantities of water to wells within the study area.

Quaternary and Tertiary Period

The Gila Conglomerate of Quaternary and Tertiary age underlies the Quaternary alluvial and bolson deposits and overlies a Quaternary and Tertiary basalt to basaltic andesite unit and the Datil Group and Rubio Peak Formation of Tertiary age in the southern part of the study area. Unconformities occur at the top and base of the unit. The Gila Conglomerate consists of locally derived, mostly buff-colored volcanic sandstone and conglomerate. Some interbedded, thin rhyolite tuff occurs in the southwest part of the study area (Willard and Stearns, 1971). Thickness is variable, as much as 2,000 or more feet (Cooper, 1967). In the southeast part of the study area, these beds are the equivalent, in part, to the Winston beds of Hillard (1969) and include the Santa Fe Group (Willard, 1957a). This unit yields small to moderate quantities of water to wells within the study area.

The Quaternary and Tertiary basalt to basaltic andesite unit underlies the Quaternary and Tertiary Gila Conglomerate and overlies the Datil Group (Willard, 1957a, 1957b; Willard and Givens, 1958; Willard and Stearns, 1971). The upper part of this unit is sometimes interlayered with the Gila Conglomerate. Unconformities occur at the top and base of this unit. The unit occurs throughout the study area as black to medium-gray or reddish-brown aphanitic, usually vesicular, basalt to basaltic andesite flows and some interbedded rhyolite and local volcaniclastic rocks with a variable thickness of as much as 2,500 feet (Stearns, 1962). Scattered crystals of iddingsite are present. Occurring locally as a flow breccia, this unit yields small amounts of water to wells within the study area.

Tertiary Period

The Tertiary John Kerr Peak Formation of Rhodes and Smith (1976) of Miocene age occurs in a small part of the highlands along the west edge of the study area. The unit is termed Quaternary and Tertiary rhyolite by Dane and Bachman (1965). The unit underlies the Quaternary and Tertiary Gila Conglomerate and overlies the Datil Group (Stearns, 1962; Willard and Stearns, 1971). Unconformities occur at the top and base of this unit. It consists mainly of the John Kerr Peak Quartz Latite (Smith, 1976) and associated breccia, pyroclastic, and sedimentary deposits (Rhodes and Smith, 1976). It may yield small volumes of water to wells within the study area.

The Datil Formation of Dane and Bachman (1965) was raised to group rank by Weber (1971) and redefined by Osburn and Chapin (1983). The undivided Datil Group underlies the Quaternary and Tertiary basalt to basaltic andesite unit and Gila Conglomerate and overlies the Rubio Peak Formation of Tertiary age in the central and southern parts of the study area, Tertiary Baca Formation in the northern part of the study area, and Triassic sedimentary rocks southwest of Horse Mountain. An angular unconformity occurs at the top and base of the Datil Group. The Datil Group consists of intertonguing volcanic flows, pyroclastic rocks, and volcaniclastic rocks that range in composition from rhyolite to andesite. The formation is as much as 5,000 feet thick (Cooper, 1967). The Datil Formation yields small volumes of water to wells from igneous rocks and small to moderate volumes from volcaniclastic rocks within the study area.

The Tertiary Rubio Peak Formation underlies the Datil Group and overlies the Cretaceous sedimentary rocks and the San Andres Limestone and Yeso Formation of Permian age in the central and southern parts of the study area. Angular unconformities probably exist at the top and base of the formation (Willard, 1957a). It occurs along both sides of the Cuchillo Negro Graben and locally on the south side of the San Agustin Basin. The rocks consist of black to greenish-black basaltic andesite and andesite with local occurrences of porphyritic, reddish-brown, banded latite. Some small areas of this formation are highly altered (Willard, 1957a). Thickness ranges from 0 to 700 feet (Cooper, 1967). The formation occasionally yields small volumes of water to wells in the study area.

The Tertiary Baca Formation underlies the Tertiary Datil Group and overlies the Mesaverde Group of Cretaceous age in the northern part of the study area. An angular unconformity exists between the Datil Group and the Baca Formation. The formation crops out along the northern edge of the study area. It consists of interbedded red, sandy mudstone and fine- to medium-grained arkose. Grain size becomes finer from east to west and no volcanic fragments are in the unit (Givens, 1957). The formation ranges from about 540 to 700 feet in thickness (Givens, 1957; Cooper, 1967). The Baca Formation yields small volumes of water to wells in the study area.

Cretaceous Period

Some undivided Cretaceous sedimentary rocks of undetermined thickness underlie the Tertiary Rubio Peak Formation and overlie the San Andres Limestone and Yeso Formation of Permian age in the southeast part of the study area. These rocks occur in two small outcrops on the east side of the Cuchillo Negro Graben (Dane and Bachman, 1965). An angular unconformity exists between the Rubio Peak Formation and these rocks. The Cretaceous rocks are not known to yield water to wells within the study area.

Triassic Period

Triassic sedimentary rocks underlie the Datil Group and Baca Formation of Tertiary age or Mesaverde Group of Cretaceous age and overlie the San Andres Limestone of Permian age. An angular unconformity is between Triassic rocks and the Datil Group in some areas. The light-gray to orange or red sandstone occurs in a small outcrop southwest of Horse Mountain and is about 114 feet thick (Stearns, 1962). The rocks are not known to yield water to wells within the study area.

Permian Period

The San Andres Limestone and Yeso Formation of Permian age form one undivided unit that underlies Triassic sandstone and overlies the Abo Sandstone in a small area southwest of Horse Mountain in the western part of the study area. The unit also underlies the Tertiary Rubio Peak Formation and undivided Cretaceous sedimentary rocks along both sides of the Cuchillo Negro Graben. The outcrop of the San Andres Limestone and Yeso Formation sequence near Horse Mountain includes the Glorieta Sandstone, which underlies the San Andres Limestone and overlies the Yeso Formation. An angular unconformity is present between the Tertiary Rubio Peak Formation and the San Andres Limestone and Yeso Formation sequence. The unit consists of fossiliferous gray limestone; light-gray to white, medium-grained sandstone; and a lower series of interbedded limestone, sandstone, dolomite, and gypsum 700 or more feet thick (Stearns, 1962; Dane and Bachman, 1965; Willard and Stearns, 1971). The unit is not known to yield water to wells within the study area, although it yields water to wells elsewhere in New Mexico.

The Abo Sandstone underlies the San Andres Limestone and Yeso Formation sequence and overlies the Madera Limestone and Sandia Formation in the southeast part of the study area. Small outcrops of undetermined thickness occur on the east side of the southern part of the Cuchillo Negro Graben in the Alamosa Creek Basin (Dane and Bachman, 1965). The formation consists of dark-red to brown interbedded shale, siltstone, sandstone, or conglomerate. The Abo Sandstone does not yield water to wells within the study area, although it yields small quantities of water to wells elsewhere in New Mexico.

Pennsylvanian Period

The Madera Limestone and Sandia Formation of Pennsylvanian age underlie the Abo Sandstone in the southeast part of the study area. Small outcrops of these rocks occur on the east side of the southern part of the Cuchillo Negro Graben south of the Alamosa Creek Basin (Dane and Bachman, 1965). These rocks are not known to yield water to wells within the study area.

Soils

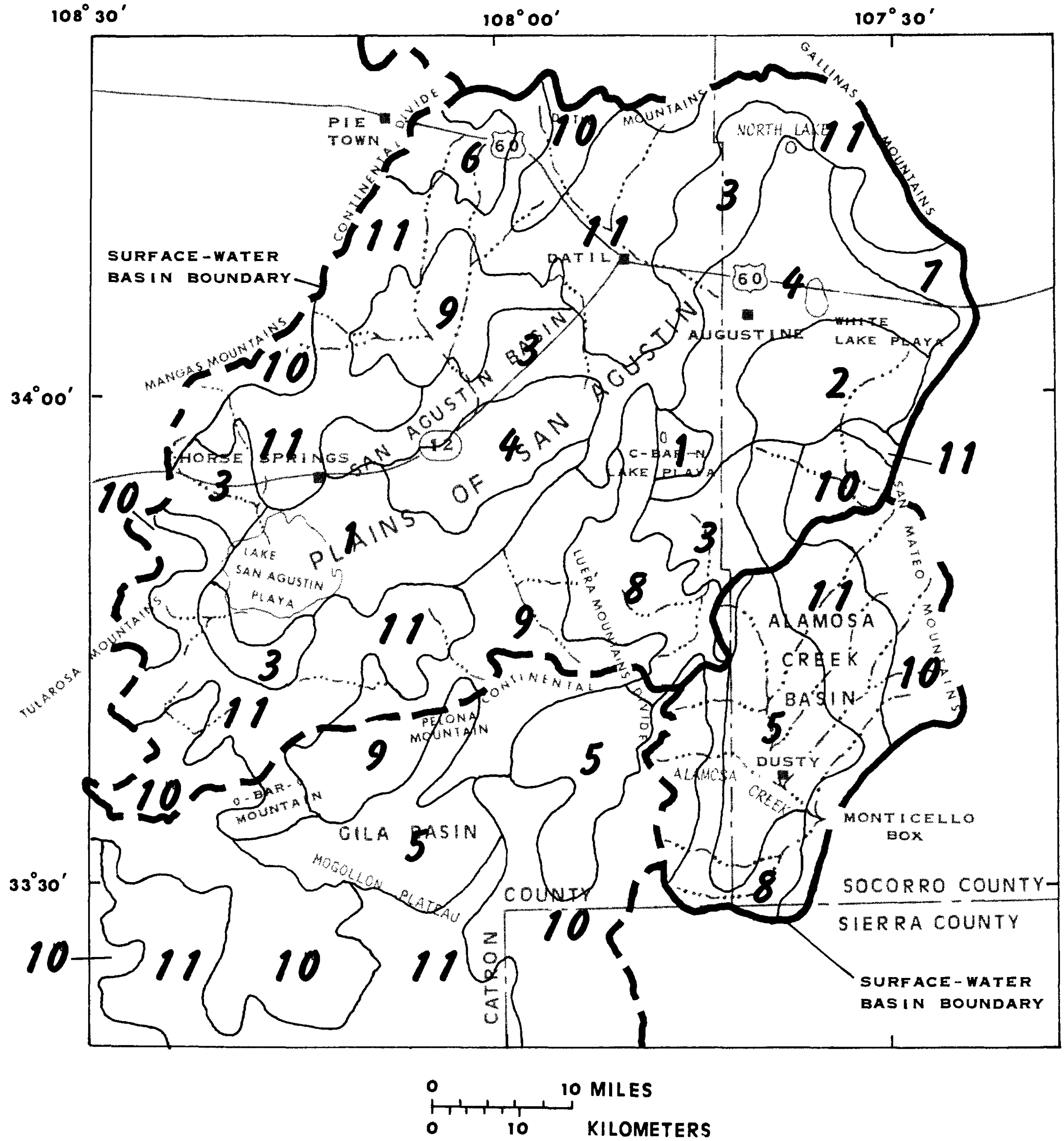
Soils in the study area (fig. 5; table 1) can be divided into two major groups: (1) generally poorly to moderately drained, moderately dark to dark-colored soils less than 60 inches in depth on the uplands, and (2) generally poorly drained or moderately to well-drained, moderately dark colored soils greater than 60 inches in depth on the lowlands of the Plains of San Agustin (Maker and others, 1972a, 1972b, 1972c, 1978). The moderately to well-drained soils in the lowlands of the plains allow runoff from the highlands to percolate rapidly into the ground at the edges of the plains. During periods of high runoff, some water from the uplands will accumulate in the playas (fig. 1). Most of this water probably represents local accumulation of precipitation from the lowlands except during periods of high runoff. The thickness of the poorly drained soils in the playa areas probably inhibits percolation of ponded water to the ground water and evaporation of ground water. The material underlying the poorly drained soils is a clayey alluvium.

Aquifer Characteristics Determined from Geophysical Studies

Geophysical studies in the Plains of San Agustin area include vertical electrical-resistivity soundings, gravity data from previous regional studies (Cordell and others, 1978; Birch, 1980) and a small number of borehole-geophysical logs.

Surface Electrical-Resistivity Soundings

Vertical electrical-resistivity soundings provided data for the interpretation of the structural, lithologic, and hydrologic character of the Plains of San Agustin. The soundings allowed for coverage of large areas in a short time at a reasonable cost. They were used for determination of the structural setting of the San Agustin Graben (fig. 3) and for evaluation of subsurface lithology and ground-water salinity.



SOIL CLASSIFICATION

(Description in table 1)

1. Torrerts-Torriorthents
2. Calciorthids-Haplargids
3. Haplargids-Torriorthents
4. Haplargids-Torripsamments
5. Haplargids-Rough Broken Land
6. Haplargids
7. Haplargids-Argiustolls-Rock Land
8. Argiustolls-Haplustolls-Rock Land
9. Argiustolls-Haplargids-Rock Land
10. Argiborolls-Cryoborolls-Ustorthents
11. Haplustolls-Argiustolls-Rock Land

Figure 5.--Soil types (modified from Maker and others, 1978).

The symmetrical Schlumberger spread configuration was used in the electrical-resistivity work. Soundings were made by introducing an electric current into the ground at the end points of a measured symmetrical spread layout and measuring the voltage loss between two points near the center of the array. A series of current impulse measurements formed a sounding curve that was analyzed to obtain a hypothetical sequence of layers, each having a given thickness and estimated resistivity. Use of electrical-resistivity methods for hydrologic investigations is described in detail by Zohdy and others (1974).

Sixty-three vertical electrical-resistivity soundings were made at selected sites in the Plains of San Agustin (pl. 1) by the U.S. Geological Survey in 1979. Sites were selected so that the results from the soundings could be integrated with information collected from nearby wells in order to strengthen the geophysical interpretation. Ten geohydrologic sections (pl. 2) were constructed from a combination of vertical electrical-resistivity soundings, a surficial geologic map (fig. 4), lithologic data from test holes and wells, and chemical analyses of water samples.

Depth to the bedrock beneath the bolson fill and the location of faults (fig. 6; pl. 2) were determined from collation and interpretation of geologic, lithologic (from test holes and wells), and vertical electrical-resistivity soundings data and are partially shown in the geohydrologic sections on plate 2. In general, the bedrock units have apparent resistivity values greater than 25 ohm-meters. These depth determinations were used to construct the contours of the bedrock surface in figure 6.

The configuration of the bedrock surface can be divided into two major areas corresponding to the eastern and western plains, which are separated by a band of low hills or a ridge that is between the two elliptical plain areas. This could be the result of an extension of the long, north-trending fault along the eastern side of the Luera Mountains. The band of low hills and outcrops (fig. 4) would represent the upthrown block. The fault may be continuous along the western side of the Gallinas Embayment. The western plains consist of two subsurface depressions separated by a ridge. Thickness of the bolson fill in the western depression is about 4,600 feet, whereas thickness in the eastern depression is about 3,300 feet. The minimal thickness of the bolson fill covering the ridge between these two depressions is about 2,900 feet. A buried cross fault cuts the western end of the graben.

Several depressions, ridges, and troughs exist in the eastern plains; more data are required to determine the exact configuration of this bedrock surface. This area is complicated by the presence of north- and east-trending faults. Bedrock is shallower in the eastern plains than in the western plains. The maximum thickness of bolson fill as determined by the vertical electrical-resistivity soundings is about 2,600 feet.

Gravity Anomalies

A complete Bouguer anomaly map from Cordell and others (1978) with a contour interval of 5 milligals is presented in figure 7. The configuration of the gravity anomalies caused by low-density bolson fill delineating the San Agustin Graben, Gallinas Embayment, and Cuchillo Negro Graben is similar to data interpretations of the vertical electrical-resistivity soundings (fig. 6) and geologic data (fig. 4). The ridges in the bedrock indicated by the vertical electrical-resistivity soundings data also are present in figure 6. Gravity anomalies due to low density of the volcaniclastic rocks of the Datil Group, Gila Conglomerate, and alluvium also are shown in figure 7 and correspond with the geologic data shown in figure 4.

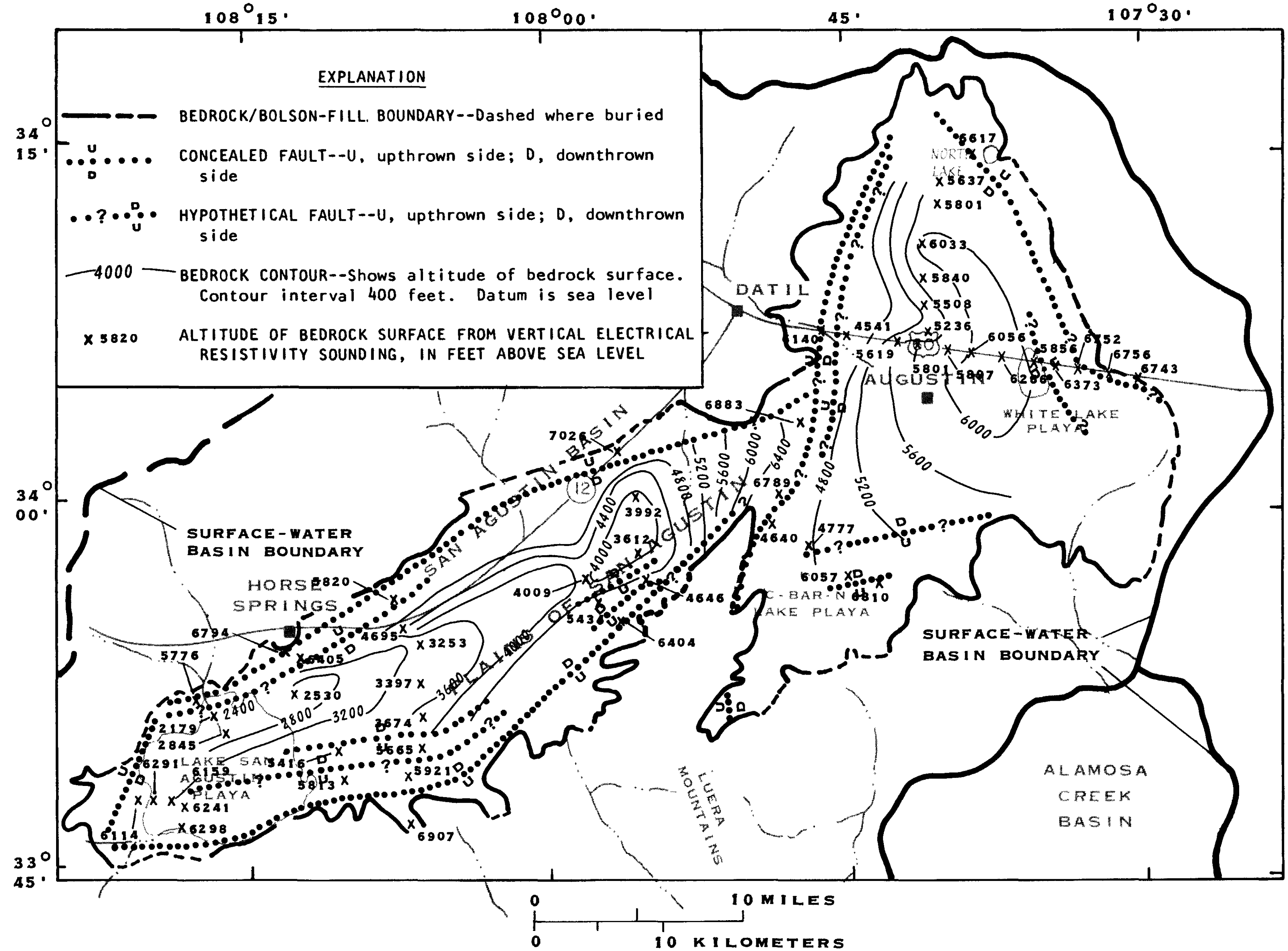
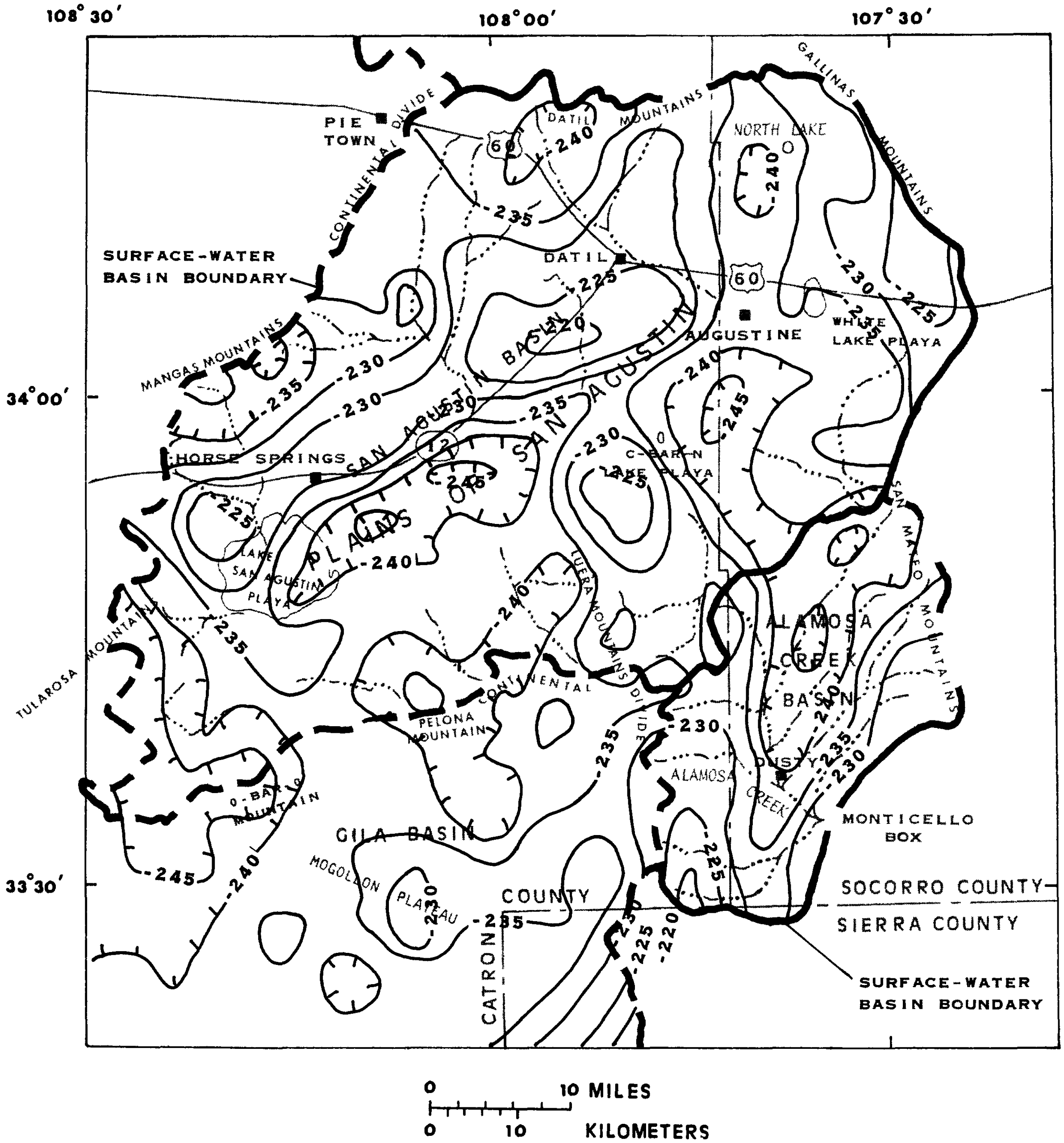


Figure 6.--Altitude of the bedrock surface in the Plains of San Agustin.



EXPLANATION

-240 GRAVITY CONTOUR--Hachures indicate area of low gravity. Contour interval 5 milligals

Figure 7.--Complete Bouguer anomaly map (modified from Cordell and others, 1978).

Ground-Water Hydrology

Four major aquifers are in the study area: (1) the bolson-fill aquifer in the San Agustin Basin; (2) the Datil aquifer extending throughout the study area; (3) the shallow upland aquifers located throughout the higher parts of the study area; and (4) the Alamosa Creek shallow aquifer in the Alamosa Creek Basin. Some other geologic units are known to yield small quantities of water to wells in the study area. These include the Quaternary basalt to basaltic andesite (Blodgett, 1973) overlying the Datil Group and the Baca Formation along the northern edge of the study area. Lack of lithologic logs and well depth information makes it difficult to determine which lithologic units are penetrated by wells in the area.

Records of wells and springs in the study area are listed in tables 2 and 3. On-site specific-conductance measurements and point-of-discharge temperature measurements of water from selected wells and springs are listed in table 4. The results of chemical analyses of water from selected wells and springs are listed in tables 5, 6, and 7.

Concentrations of the various chemical constituents depend mostly on the mineral composition and physical properties of the rocks and soils with which the water comes into contact and the length of time that the water is in contact with them. Temperature of water also is a contributing factor to the chemical characteristics of water in some areas.

The uplands surrounding and draining into the San Agustin Basin and the Alamosa Creek Basin are almost all volcanic or volcaniclastic rocks that range in composition from rhyolite to basalt. The bolson fill and alluvial fill in the grabens of the basins are derived from these uplands.

Specific conductance, expressed as microsiemens per centimeter at 25 degrees Celsius, reflects the ability of water to conduct an electrical current and usually indicates the degree of salinity. The specific conductance of water from selected wells and springs (table 4) ranged from 130 to 41,200 microsiemens per centimeter at 25 degrees Celsius.

The ratio, 0.57, of the specific-conductance values determined in the laboratory to the sums of dissolved solids calculated from the chemical analyses (table 5) can be used to infer the dissolved-solids concentration in water from measurements of specific conductance made at a sampling site. The dissolved-solids concentration of sampled water ranged from 74 to 23,500 milligrams per liter.

The dominant cations for all waters vary from calcium to sodium plus potassium. The dominant anion of freshwater usually is bicarbonate. These chemical characteristics are typical of ground water in igneous rock aquifers or aquifers of alluvial fill derived from igneous rocks, which comprise the majority of the uplands, bolson fill, and alluvial fill. Anomalies are found in four areas: (1) the North Lake area (fig. 1) where sulfate is equal to or greater than bicarbonate; (2) Welty's Salty well (6S.8W.8.432, table 5) where chloride and sulfate are dominant; (3) the Ojo Caliente Springs area (8S.7W.31.241, table 5) in the Alamosa Creek Basin, where chloride is dominant and sulfate increases but does not exceed bicarbonate; and (4) the Lake San Agustin playa (fig. 1) where sodium, chloride, and sulfate are dominant.

San Agustin Bolson-Fill Aquifer

The San Agustin bolson-fill aquifer consists of alluvial and bolson-fill deposits and the Gila Conglomerate in the San Agustin Graben. The bolson-fill aquifer varies in thickness and is as much as 4,600 feet thick as determined from vertical electrical-resistivity soundings.

The bolson-fill aquifer in the San Agustin Basin is the major aquifer in the study area. The approximate altitude of the water table is shown in figure 8. Several irrigation wells completed in the aquifer produce as much as 975 gallons per minute. Most of the wells are less than 650 feet deep, and water levels normally are less than 600 feet below land surface.

The San Agustin bolson-fill aquifer is recharged by (1) precipitation on those areas having permeable soils (fig. 5; table 1); (2) runoff from the uplands infiltrating into the permeable material around the edge of the plains; (3) shallow upland aquifers; and (4) the Datil Group. Except for the southwest end of the graben, no closures of water-table contours are at the south side of the graben (fig. 8), indicating movement of ground water into the Datil Group. The water-table contours of the bolson fill along the northern side of the graben are quite similar to those in the Datil Group (see fig. 11), indicating that water from the Datil Group is moving into the bolson fill in these areas.

The hydraulic gradient in the water table of the bolson-fill aquifer in the eastern elliptical plain area of the Plains of San Agustin is less than 5 feet per mile and the direction of flow ranges from south to southwest. The gradient steepens to about 10 feet per mile in the ridge area that separates the eastern and western elliptical plain areas, and flow is toward the southwest. In the western elliptical plain area, the gradient decreases to less than 2 feet per mile toward the San Agustin playa area. The hydraulic gradient at the edges of the bolson fill along the northern side of the western end of the Plains of San Agustin ranges from 65 to 440 feet per mile, and the direction of flow varies between south and east.

The role of large desiccation features (fractures) in the Lake San Agustin playa is unknown. Rapid erosion along the fractures indicates that ponded surface water enters the fractures rapidly. Water lines and algae lines on the sides of the fractures indicate standing water at various levels in the fractures from time to time. Further study would be needed to determine (1) if the water is prevented from reaching the water table due to absorption by the freshly exposed clay surfaces in the fractures and due to evaporation, or (2) if the fractures are deep enough to allow some percolation to the water table. Further study also would be needed to determine if the playa may discharge some ground water by evaporation.

Aquifer tests were conducted on five irrigation wells completed in the San Agustin bolson-fill aquifer in the North Lake area (fig. 1) and a production well (3S.8W.1.310, table 2) completed in the San Agustin bolson-fill aquifer about 12 miles south of the North Lake area. Long-term aquifer tests were not possible because the wells were not pumped constantly for a sufficient length of time. The wells selected represent the largest use and production of water by individual wells within the study area. Other irrigation wells were either unused or used very little at the time of the study. Lack of well-completion data, permission from well owners, and time required for testing wells prevented conducting aquifer tests on domestic and stock wells. Also most wells are inadequate for aquifer testing because the pumps are wind powered.

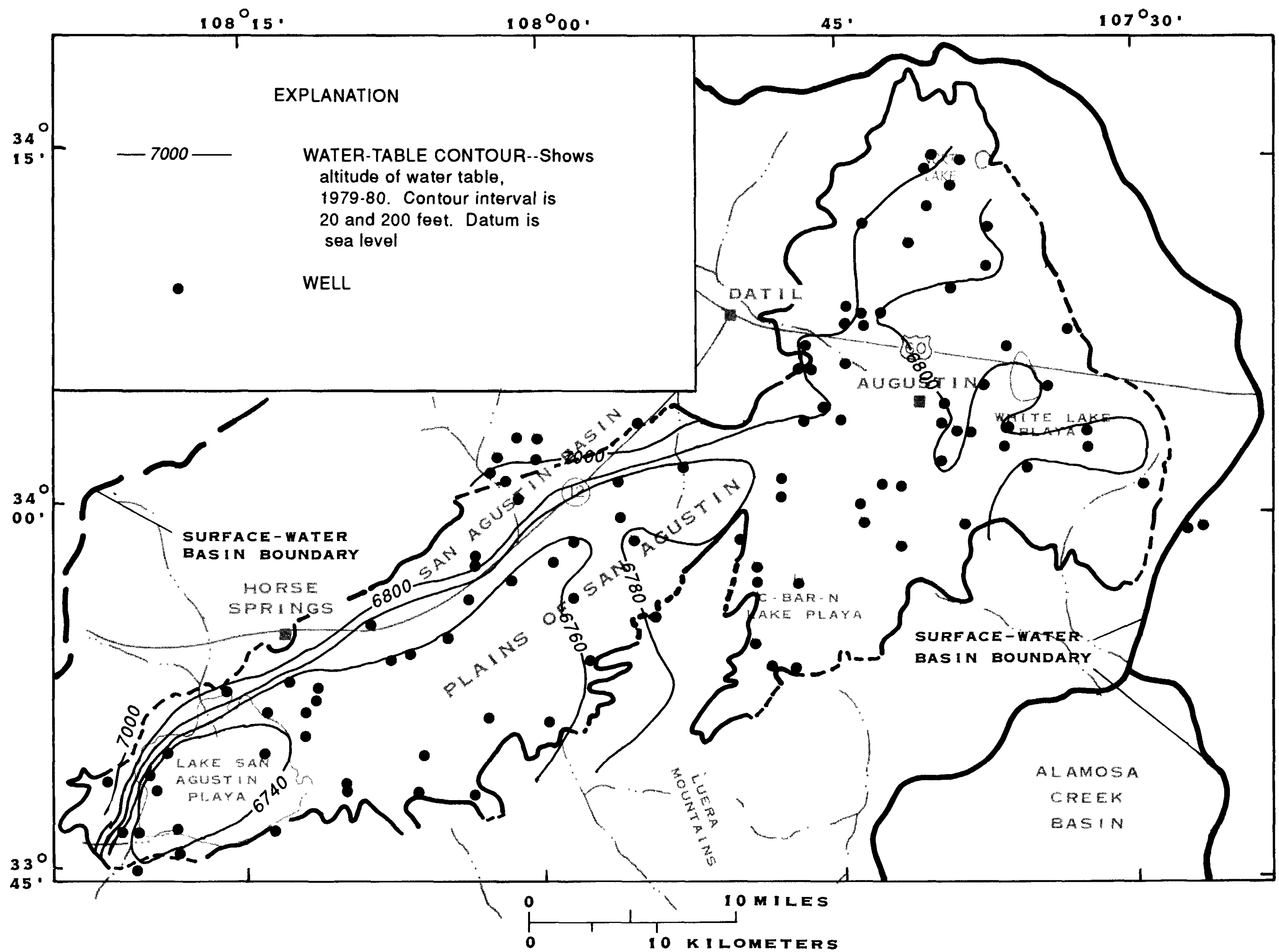


Figure 8.--Approximate altitude of the water table in the San Agustin bolson-fill aquifer within the Plains of San Agustin.

Transmissivity is the rate of flow through a vertical cross section of a unit width and the total aquifer thickness when the hydraulic gradient is one. Transmissivity is expressed here in feet squared per day. The modified nonequilibrium and Theis recovery formulas (Ferris and others, 1962) were used to determine transmissivity. The transmissivity values determined from the aquifer tests of the six wells are given in the following table:

Well number	Test type	Duration (minutes)	Transmissivity (feet squared per day)	Specific capacity (gallons per minute per foot)
1S.8W.2.241	Recovery	158	20,900	16.95
1N.8W.36.341	Recovery	121	46,000	16.80
1S.8W.2.424	Recovery	101	48,400	90.00
1N.8W.35.413	Drawdown	480	21,700	31.60
	Recovery	101	22,700	No data
1N.8W.35.242	Recovery	80	42,800	No data
3S.8W.1.310	Drawdown	100	2,300	5.70
	Recovery	100	2,400	No data

The specific capacity of a well is the yield of the well per unit of drawdown expressed in this report as gallons per minute per foot of drawdown. Specific capacities of the five irrigation wells in the North Lake area and the production well are given in the preceding table. Specific capacity ranges from 5.70 gallons per minute per foot at the production well site to between 16.80 and 90.00 gallons per minute per foot in the North Lake area.

Lack of sufficient aquifer-test data and well logs makes accurate estimation of water in storage difficult. Several new test holes throughout the area, however, could allow accurate estimates to be made. Because storage coefficient is almost equal to specific yield in an unconfined aquifer, it is possible to estimate storage coefficient by estimating specific yield from existing well-log data using values from Johnson (1967). The estimated specific yield and storage coefficient for various areas within the Plains of San Agustin are given in the following table:

Area	Estimated specific yield (percent)	Estimated storage coefficient
East elliptical area		
Central	17.5	0.175
Borders[1]	19.3	.193
West elliptical area		
West central	12.4	.124
West borders[2]	13.6	.136
East central	13.0	.130
East borders[1]	14.3	.143

[1]As much as 200 feet of saturated thickness.

[2]As much as 600 feet of saturated thickness in some areas.

Specific yields and storage coefficients for the eastern elliptical area were determined from the lithologic logs of irrigation wells in the North Lake area (fig. 1) and the production well (3S.8W.1.310) about 12 miles to the south. Specific yields and storage coefficients for the western elliptical area were based on a well at 5S.13W.14.210 (Bushman and Valentine, 1954) and the Oberlin College test well to a depth of 2,000 feet at 5S.13W.28.244. Adjustments were made for the borders and eastern part of the area assuming an increase in sediment grain size away from the playa and site of the deeper part of the Pleistocene Lake San Agustin. A few other driller's logs were considered and rejected because of inaccuracies in the lithologic terminology.

Maximum specific conductance of water in the aquifer is about 41,200 microsiemens (tables 4 and 5). The volume of saturated alluvial material containing freshwater (dissolved-solids concentrations less than 1,000 milligrams per liter) was estimated from figure 9. The volume of freshwater in storage was estimated by multiplying the estimated storage coefficients by the volume of sediments containing freshwater. An estimated total of 53.5 million acre-feet of freshwater may be stored in the alluvial fill of the Plains of San Agustin. This is the sum of the estimated 34.4 million acre-feet in the eastern elliptical area and 19.1 million acre-feet in the western elliptical area.

The volume of saturated alluvial material in the western part of the Plains of San Agustin that contains saline water (dissolved-solids concentrations greater than 1,000 milligrams per liter) was estimated from figures 5 and 10 and plate 2. The quantity of saline water in storage was estimated by multiplying the estimated storage coefficient (0.124) by the volume of sediments containing saline water. An estimated total of 8.9 million acre-feet of saline water may be stored in the alluvial fill of this area, which is the site of the alkaline Pleistocene Lake San Agustin.

Estimates of freshwater and saline water in storage are somewhat large. The decrease in porosity and permeability that may occur with an increase in depth was not taken into account.

The Lake San Agustin playa anomalies of large dissolved-solids, sulfate, and chloride concentrations could be the result of one or more of the following factors: (1) residual water from the alkaline Pleistocene Lake San Agustin; (2) lack of deep, subsurface drainage from the basin in this area to surrounding basins; and (3) water from or in contact with Permian and Triassic sedimentary rocks at depth on the upthrown blocks of the graben boundary faults. Evidence for the third contributing factor is the small outcrop of Permian and Triassic sedimentary rocks near Horse Mountain (fig. 3). The large sodium concentration probably is due to cation exchange of calcium with clays in the bolson-fill.

Vertical electrical-resistivity soundings (pl. 1) and specific conductance and chemical analyses of water samples (tables 4 and 5) were used to delineate zones of water quality within the Plains of San Agustin (pl. 2). These water-quality zones are defined as follows:

(1) Freshwater zone I contains ground water having a dissolved-solids concentration less than 500 milligrams per liter in sandy sediments or volcaniclastic rocks. Resistivity values exceed 25 ohm-meters.

(2) Freshwater zone II contains ground water having a dissolved-solids concentration that ranges between 500 and 1,000 milligrams per liter in clayey sediments. Resistivity values range from 17 to ±25 ohm-meters.

(3) Slightly saline water zone contains ground water having a dissolved-solids concentration that ranges between 1,000 and 3,000 milligrams per liter in sand and clay. Resistivity values range from 7 to ±17 ohm-meters.

(4) Saline water zone contains ground water having a dissolved-solids concentration in excess of 3,000 milligrams per liter in sand and clay. Resistivity values are less than 7 ohm-meters. The saline water is restricted to the topographic low of the San Agustin Basin and the site of the Pleistocene Lake San Agustin.

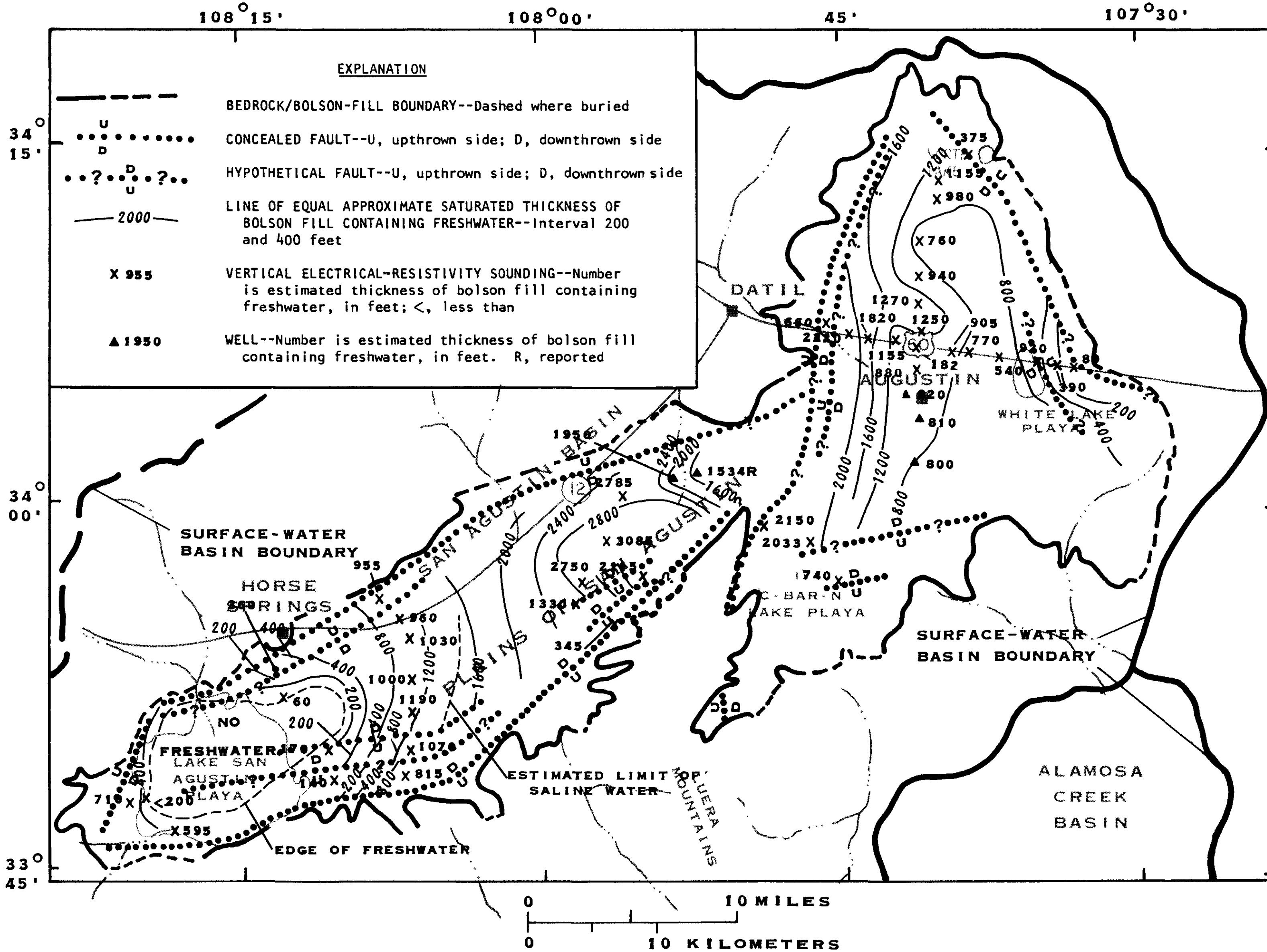


Figure 9.--Approximate saturated thickness of San Agustin bolson-fill aquifer containing freshwater in the Plains of San Agustin.

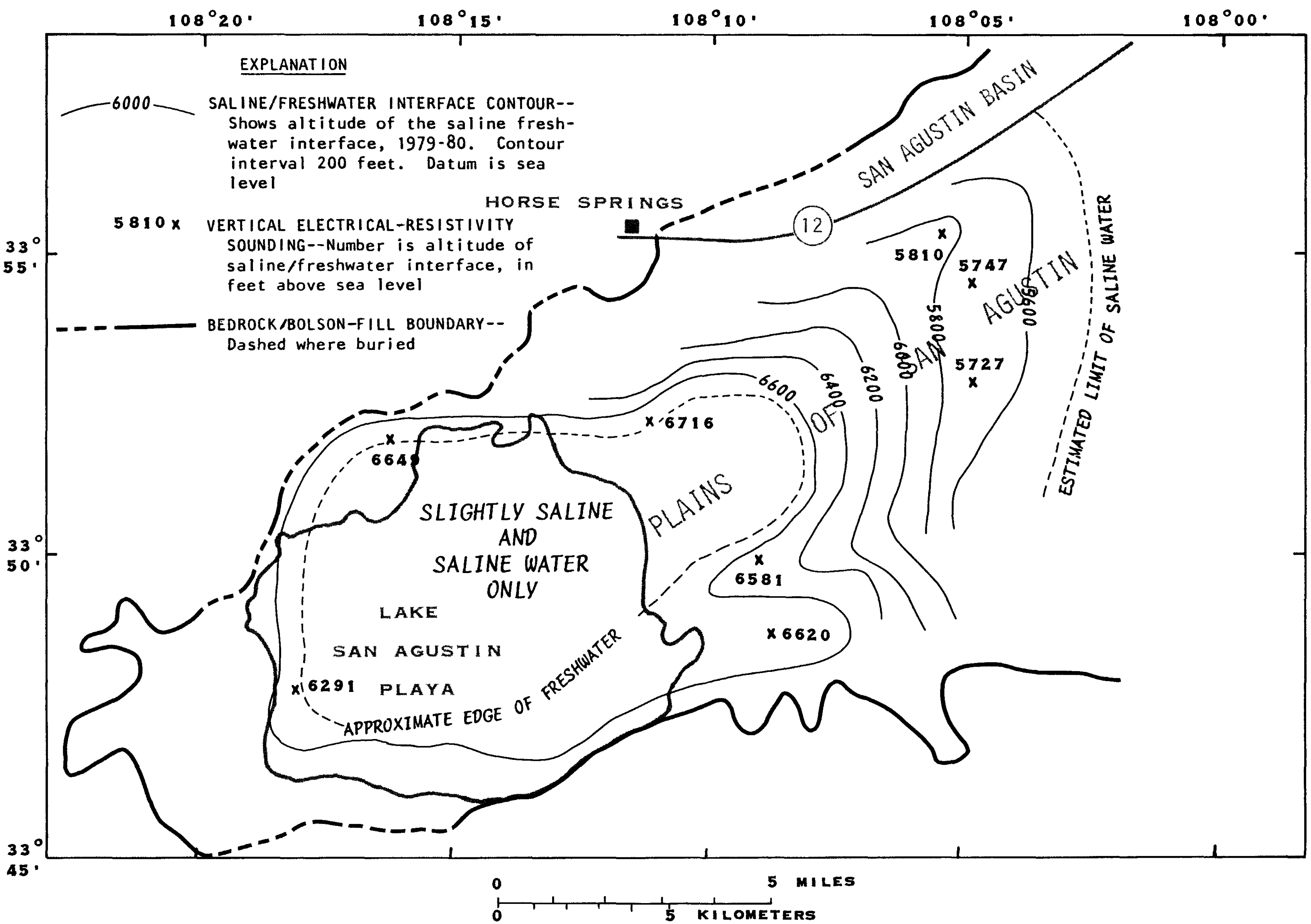


Figure 10.--Approximate altitude of the saline/freshwater interface in the Plains of San Agustin.

Mercury is present in some ground water in the study area (table 6). The maximum concentration of 0.0032 milligram per liter exceeds the U.S. Environmental Protection Agency's (1986) maximum contaminant level of 0.002 milligram per liter. The most likely source of the mercury is from the extensive Quaternary and Tertiary volcanic activity that occurred throughout the study area. Mercury usually is associated with the final stages of magmatic evolution and accompanying hydrothermal activity. No human activities are known to cause the presence of mercury.

Datil Aquifer

The Datil aquifer in the San Agustin Basin, Alamosa Creek Basin, and upper Gila Basin yields less than 10 gallons per minute of water to wells completed in the volcaniclastic units interbedded with volcanic flows and tuffs of the Datil Group. Due to a lack of lithologic logs, the relation among the various volcaniclastic units is not known. Some wells yield more than 10 gallons per minute. Many shallow upland aquifers yield water from both the alluvium and the Datil Group. Numerous springs in the uplands probably represent perched water within the Datil Group.

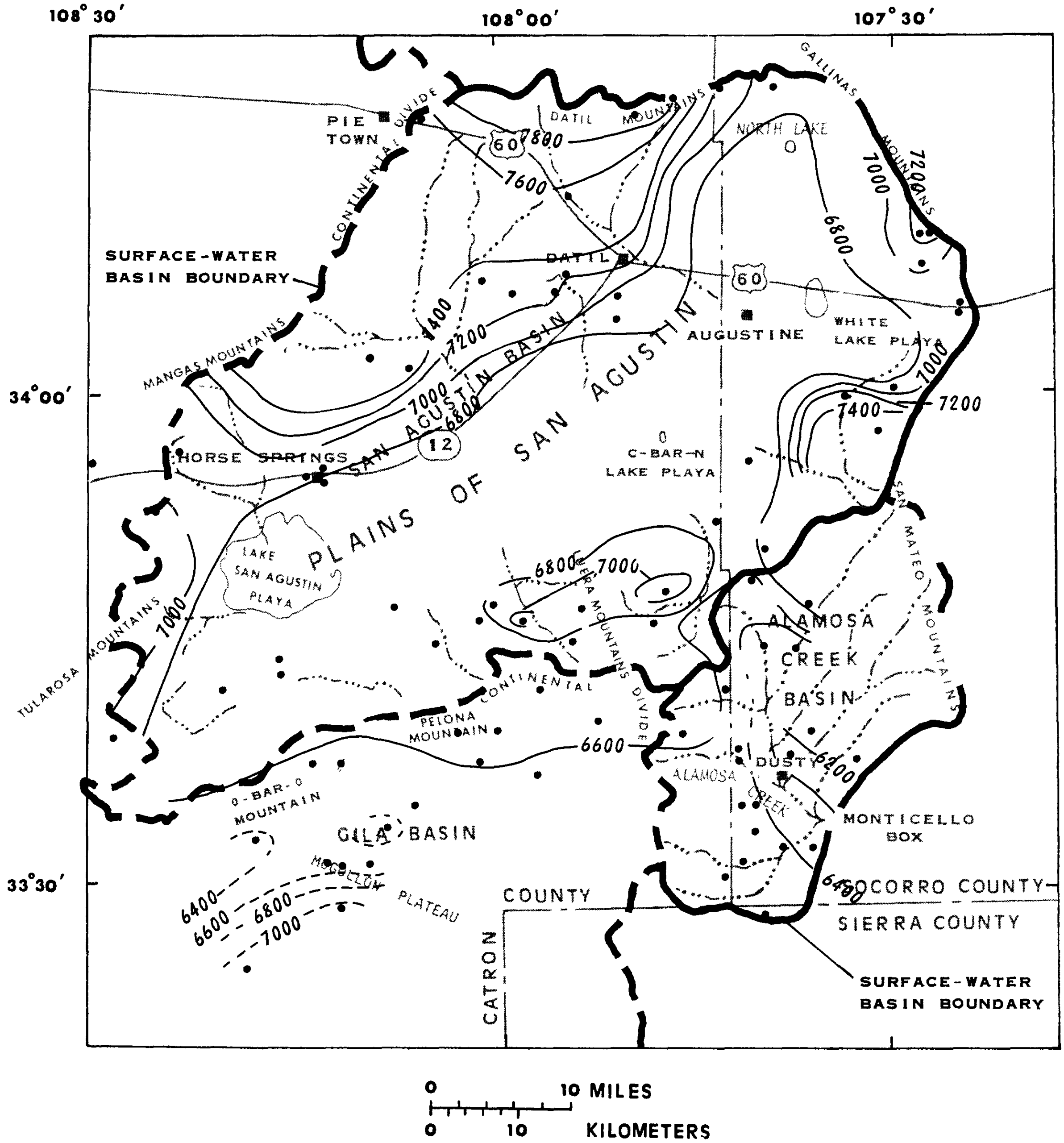
Recharge occurs from (1) precipitation directly on the outcrops in the mountains surrounding the Plains of San Agustin; (2) ground-water flow from the shallow upland aquifers to the Datil aquifer; and (3) ground-water flow from the bolson fill in the San Agustin Graben to the Datil aquifer south of the Plains of San Agustin. The approximate altitude of the water table for wells that penetrate more than 100 feet of the Datil Group is shown in figure 11. Water levels normally are less than 1,270 feet below land surface. Most of the deeper water levels are south of the Plains of San Agustin.

The hydraulic gradient of the water table in the upland recharge areas of the Datil aquifer varies considerably. The gradient is about 80 feet per mile in the Luera Mountains area, about 110 feet per mile in the southern Gallinas Mountains, about 250 feet per mile in the western Datil Mountains, and about 360 feet per mile in the northern San Mateo Mountains. Between the Mangas Mountains and the Datil Mountains the hydraulic gradient ranges from 60 to 135 feet per mile. The hydraulic gradient averages about 20 feet per mile from the southern part of the San Agustin Basin west of the Luera Mountains toward O-Bar-O Canyon and Railroad Canyon (southeast of Pelona Mountain) in the Gila Basin to the south. In the Alamosa Creek Basin, the hydraulic gradient in the Datil aquifer ranges from about 35 feet per mile at the edges of the basin to about 100 feet per mile toward the lowest part of the basin in the Monticello Box area.

Maximum specific conductance of water from wells completed in the Datil aquifer is about 600 microsiemens (approximately 340 milligrams per liter dissolved solids) for those areas not affected by geothermal activity. Welty's Salty well (6S.8W.8.432, table 4) yields warm water and is in an area of shallow volcanic rocks and a probable deep fault. The well probably is finished in the Datil Group. The water temperature from the discharge pipe is 35 degrees Celsius. Water yielded from the well probably represents geothermal, older, and deeper circulating water than water from the surrounding wells. This would account for the dissolved-solids concentration of 1,400 milligrams per liter and dominant ions of sulfate and chloride.

Shallow Upland Aquifers

The shallow upland aquifers are composed of Quaternary alluvial fill and, in some instances, the upper part of the underlying bedrock in the mountainous drainage areas. The alluvial fill normally is less than 50 feet thick. Wells usually penetrate less than 150 feet of alluvial fill and underlying material, which usually is the Datil Group. Wells completed in the shallow upland aquifers usually yield less than 10 gallons per minute, but occasionally will yield more. Water levels in wells in many of these aquifers are less than 75 feet below land surface. In some areas, the water table intersects the land surface to form springs.



EXPLANATION

——7000—— WATER-TABLE CONTOUR--Shows altitude of water table, 1979-80. Dashed where approximately located. Contour interval 200 feet. Datum is sea level

• WELL

Figure 11.--Approximate altitude of the water table in the Datil aquifer.

Recharge is mostly from precipitation and may include some flow from the Datil aquifer. Water in the shallow upland aquifers moves toward the bolson-fill aquifer in the Plains of San Agustin or the shallow aquifer in the Alamosa Creek Basin. Maximum specific conductance of water in these aquifers is about 1,100 microsiemens (approximately 630 milligrams per liter dissolved solids). Evaporation from the shallow water table in some areas leads to an increase in dissolved-solids concentration downgradient.

Alamosa Creek Shallow Aquifer

The shallow aquifer in the Alamosa Creek Basin upstream from Monticello Box usually consists of less than 50 feet of Quaternary alluvium and underlying Gila Conglomerate. Wells yield 2 to 100 gallons per minute of water. Wells completed in this aquifer normally are less than 150 feet in depth and water levels are mostly less than 90 feet below land surface. The approximate altitude of the water table is shown in figure 12.

Recharge to the aquifer is from precipitation and percolation of mountain runoff and ground-water flow from the shallow upland aquifers. Some recharge may occur as flow from the Datil aquifer in the surrounding uplands.

The hydraulic gradient (fig. 12) of the shallow aquifer in the Alamosa Creek Basin ranges from about 140 to 400 feet per mile around the edges to about 40 to 80 feet per mile in the lower part of the basin. The direction of flow is toward the Monticello Box area. At Monticello Box, the water table intersects land surface as warm and cold springs that flow into Alamosa Creek.

Two pairs of wells were inventoried for this study in the Alamosa Creek Basin. One well of each pair is finished in the Datil aquifer and the other well is finished in the shallow aquifer:

Well location	Geologic source	Depth to water below land surface (feet)
7S.8W.2.311a	Datil Group	548.56
7S.8W.2.311b	Shallow alluvium	40 (estimated)
7S.8W.4.342	Datil Group	511.2
7S.8W.4.344	Shallow alluvium	49.5

The hydraulic-head difference between the two aquifers in this area ranges from about 460 to about 510 feet. It is difficult to determine the actual relation between these two aquifers due to a lack of lithologic information, such as impermeable volcanic flows interbedded in the volcaniclastic rocks of the Datil aquifer.

Maximum specific conductance for water from the shallow aquifer is about 450 microsiemens (260 milligrams per liter dissolved solids). The Ojo Caliente Springs (8S.7W.31.241, table 5) produce water having point-of-discharge temperatures of at least 27.5 degrees Celsius. The dominance of chloride and increased sulfate could be the result of geothermal circulation in the Quaternary and Tertiary Gila Conglomerate or older, deeper water moving along faults.

Geothermal Potential

Though an in-depth study of the geothermal potential of the San Agustin study area is beyond the scope of this investigation, it is mentioned briefly as a subject for possible future study. A geothermal potential exists, as indicated by several wells that produce water with point-of-discharge temperatures that equal or exceed 21 degrees Celsius (fig. 13). The temperatures shown in figure 13 were measured at the discharge pipe of a well or the point of discharge for a spring. Temperatures at depth probably are much higher.

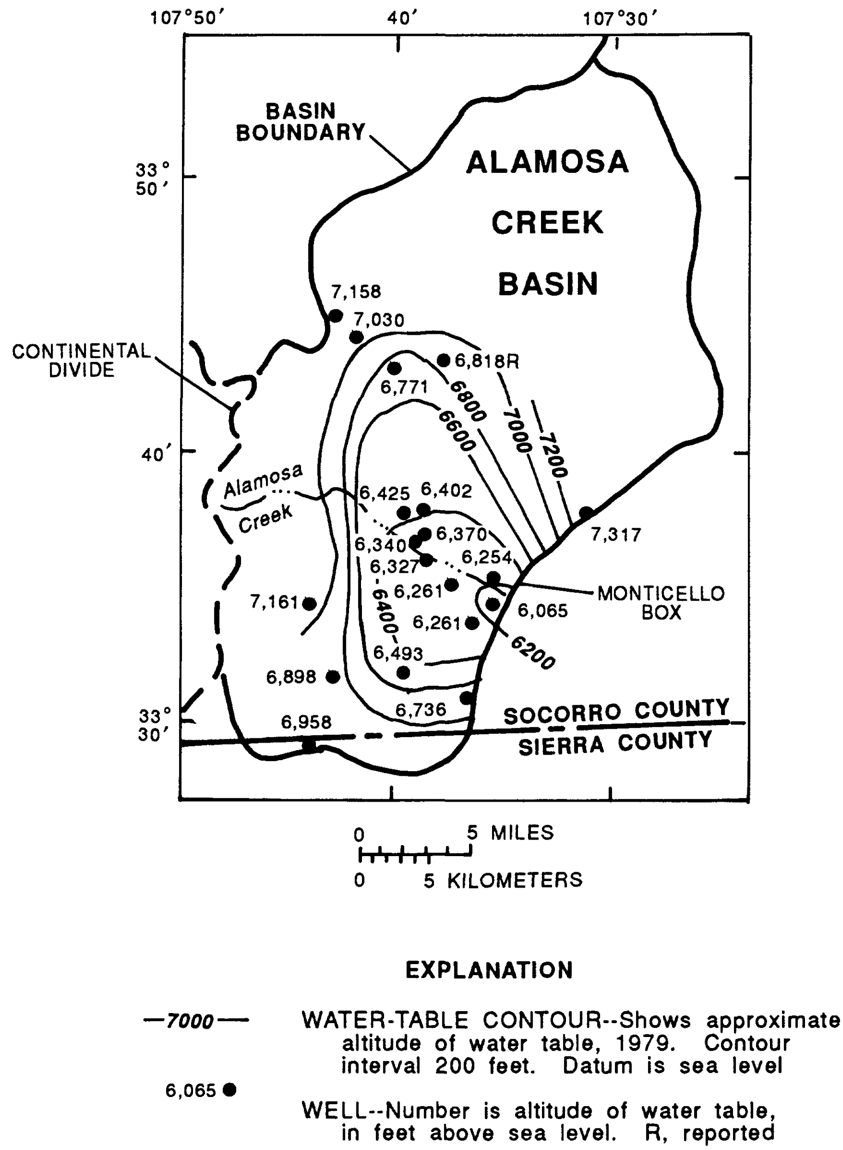
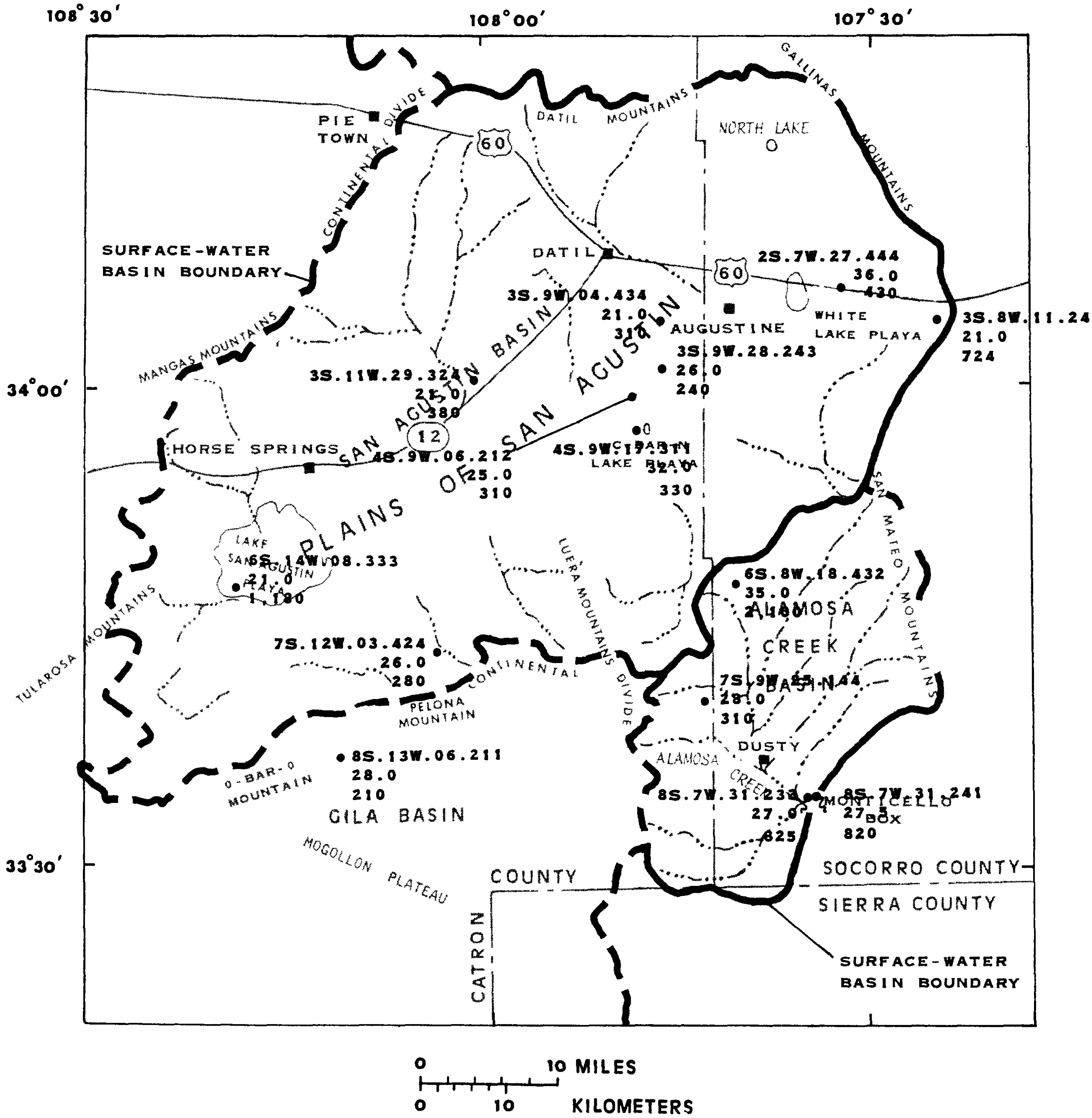


Figure 12.--Approximate altitude of the water table in the Alamosa Creek shallow aquifer.



EXPLANATION

•	WELL
(spring symbol)	SPRING
8S.13W.06.211	WELL OR SPRING LOCATION NUMBER
28.0	POINT-OF-DISCHARGE TEMPERATURE, IN DEGREES CELSIUS, FOR WELL OR SPRING WATER
210	SPECIFIC CONDUCTANCE, IN MICROSIEMENS PER CENTIMETER AT 25 DEGREES CELSIUS, FOR WELL OR SPRING WATER

Figure 13.--Wells and springs with a point-of-discharge temperature equal to or greater than 21 degrees Celsius.

The warm water usually occurs in areas of shallow or outcropping Quaternary and Tertiary volcanic rocks and faults. Water quality generally is fresher than most other geothermal water; specific conductance (fig. 13) ranges from 210 to 2,100 microsiemens (about 120 to 1,200 milligrams per liter dissolved solids).

Water containing a small dissolved-solids concentration probably represents heating of the local waters by the underlying warm bedrock because there is little difference between the chemical characteristics of water from warm-water and normal wells. An example of this locally heated water is from the C Bar N well (4S.9W.17.311) and the Español well (4S.9W.8.132) (tables 4-7; pl. 2). Water from the C Bar N well has a point-of-discharge temperature of 32 degrees Celsius and from the Español well has a point-of-discharge temperature of 17 degrees Celsius. Both wells yield water that has dominant ions of sodium and bicarbonate. Field specific-conductance values are similar to those for water from other wells completed in the bolson-fill aquifer. The field specific conductance for water from the C Bar N well was 330 microsiemens (about 190 milligrams per liter dissolved solids) and for water from the Español well was 400 microsiemens (about 230 milligrams per liter dissolved solids).

Warm water having large concentrations of dissolved solids from some wells probably represents deep, circulating water in the bedrock or along faults in the bedrock. An example of this type of water is in Welty's Salty well (6S.8W.8.432) finished in the Datil aquifer with a point-of-discharge water temperature of 35 degrees Celsius (table 4). Water from Welty's Salty well is different than water from other wells completed in the Datil aquifer: its field specific conductance of 2,100 microsiemens (about 1,200 milligrams per liter dissolved solids) is higher and its dominant ions are sulfate and chloride rather than sodium and bicarbonate.

SUMMARY

The San Agustin Basin, which has an area of about 2,000 square miles, is a basin that has interior surface-water drainage. The Alamosa Creek Basin upstream from Monticello Box, which is southeast of the San Agustin Basin, has an area of about 400 square miles and is part of the Rio Grande Basin. The headwaters of the Gila River in the Gila Basin are southwest of the San Agustin Basin. The upper Gila Basin is southwest of the San Agustin Basin.

Four major aquifers are within the study area: (1) the San Agustin bolson-fill aquifer; (2) the Datil aquifer; (3) the shallow upland aquifers; and (4) the Alamosa Creek shallow aquifer. Two minor aquifers, a basalt to basaltic andesite unit overlying the Datil Group and the Baca Formation along the northern edge of the San Agustin Basin, produce some water. Water-table contour maps were constructed for the San Agustin bolson-fill aquifer, Datil aquifer, and Alamosa Creek shallow aquifer. Sixty-three vertical electrical-resistivity soundings were used to estimate the depth to bedrock and the saline/freshwater interface in the San Agustin bolson-fill aquifer.

The dissolved-solids concentration of water samples ranges from 74 to 23,500 milligrams per liter. The dominant cations for all waters vary; the dominant anion of freshwater generally is bicarbonate.

Point-of-discharge temperatures of well or spring water that are greater than 21 degrees Celsius are associated with faults in the areas of shallow or exposed bedrock. The dissolved-solids concentration of warm water ranges from 120 to 1,200 milligrams per liter. Two types of geothermal water exist: (1) local water heated by underlying warm bedrock that is chemically the same as nongeothermal water from nearby wells, and (2) water from underlying bedrock circulating along faults.

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Table 1.--Soil types in the San Agustin study area

Soil classification	Location (figure 5)	Drainage	Soil depth (inches)	Substratum	Slope (percent)
1. Torrerts-Torriorthents	Western part of the Plains of San Agustin and small part in basin center	Very poor	60+	Clayey alluvium	0-1
2. Calciorthids-Haplargids	Southern part of the eastern part of the Plains of San Agustin	Moderate and some poor	10+	Soft caliche to eolian and alluvial sediments	Most 0-10, some to 25
3. Haplargids-Torriorthents	North, west, and southeast edges of the Plains of San Agustin	Moderate with some poor	60+	Very gravelly alluvium	1-9
4. Haplargids-Torripsamments	Eastern part of the Plains of San Agustin	Moderate to well except in playa areas	60+	Coarse to fine-grained sediments	0-8
5. Haplargids-Rough Broken Land	South of the Plains of San Agustin	Very poor to poor	20+	Weakly cemented, gravelly caliche to loamy and gravelly sediments	2-30
6. Haplargids	Northwestern corner of the study area	Poor to moderate	20+	Soft caliche to alluvial and eolian sediments	
7. Haplargids-Argiustolls-Rock Land	Northeast edge of the study area	Poor to moderate	60+	Felsic igneous rocks to gravelly alluvium	0-35, some to 75
8. Argiustolls-Haplustolls-Rock Land	South-central part of the Plains of San Agustin extending in a narrow strip to the southeast corner of the study area	Poor to moderate	7-20	Felsic igneous rocks	20+
9. Argiustolls-Haplargids-Rock Land	North-central and south-central parts of the study area	Poor to moderate	6-40	Basalt	0-30, some more
10. Argiborolls-Cryoborolls-Ustorthents	Mountainous areas throughout the study area	Poor to moderate	15-60	Igneous rocks and conglomerate	10+
11. Haplustolls-Argiustolls-Rock Land	Mountainous areas throughout the study area	Poor to moderate	7-20	Felsic igneous rocks	20+

Table 2.--Records of selected wells in the San Agustin study area

EXPLANATION

A	Abandoned	N	None
C	Commercial/industrial	O	Not equipped
D	Domestic	P	Projected
E	Estimated	R	Reported
F	Interpolated	S	Stock
G	Gasoline engine	T	Turbine
H	Hand pump	W	Windmill
I	Irrigation	Qab	Quaternary alluvium and bolson fill
J	Pump jack	Qal	Quaternary alluvium
K	Submersible	Td	Tertiary Datil Group
M	Electric motor	--	No data

Table 2.--Records of selected wells in the San Agustin study area--Continued

Location	Well name	Well owner	Depth of well (feet)	Casing diameter (inches)	Altitude of land surface (feet)	Geologic source	Water level: Depth below land surface (feet)	Water level: Date measured	Method of lift	Use of water
1N.8W.19.144	Rincon	Double H Ranch	--	6.75	7,575	Td	386.58	12/15/77	W	S
1N.8W.23.423	Ramsey	Double H Ranch	375R	5	7,155	Td	352.34	04/19/79	W	S
1N.8W.28.232	Road	Double H Ranch	500R	6	7,221	Td?	424.90	04/19/79	K/M	S
1N.8W.35.123E	Irri. #6	Double H Ranch	--	--	7,050	Qab	239.27	12/15/77	T	I
1N.8W.35.311E	Irri. #4	Double H Ranch	--	--	7,055	Qab	238.05	12/15/77	T	I
1N.8W.36.323E	Irri. #2	Double H Ranch	--	--	7,010	Qab	218.36	12/15/77	T	I
1N.9W.27.113P	Antelope	Choate/U.S Forest Service	340R	6	8,295	Td	270.03	05/09/80	W	S
1N.9W.31.322	Double Tanks	Choate/U.S.Forest Service	300R	6.5	7,961	Td	77.87	06/18/80	W	S
1N.10W.26.444P	Blue Place	Choate/U.S.Forest Service		6	8,036	Qal	12.19	06/18/80	W	S
1N.10W.32.432P	Little Tom	Choate/U.S.Forest Service	100R	4	8,300	--	35.2	05/07/80	W	S
1N.10W.35.343P	Sawmill	Choate/U.S.Forest Service	--	6	7,990	--	34.35	06/25/80	W	S
1N.11W.25.312P	Hay Canyon	Choate/U.S.Forest Service	100R	6	8,184	Qal	16.43	05/17/80	W	S
1N.11W.27.342P	--	O.E. Malmstrom	--	--	8,015	--	41.38	06/25/80	--	--
1N.11W.34.122aP	Double Circle Headquarters	O.E. Malmstrom	--	--	8,010	--	--	06/25/80	J/M	D/S
1N.11W.34.122bP	--	O.E. Malmstrom	31.5	4	7,985	--	Dry	06/25/80	--	--
1N.12W.13.131	West Sawtooth	Malmstrom/U.S.Forest Service	--	6	8,173	--	116.73	06/26/80	W	--
1N.12W.33.442	North Forest	--	--	7	7,715	Td	181.94	07/05/79	W	S
2N.8W.27.211	RG-34071	Jay Taylor Cattle	74R	6.625	6,500	Qal	32R	04/18/?	--	--
2N.12W.10.131	RG-33214	John McKinley	735R	6.625	7,000	--	412R	03/08/81	--	--
2N.12W.22.140	RG-33028	Rufas Cholt	680R	5	7,530	--	640R	08/02/79	--	--
2N.12W.25.000	RG-36146	Orvile Malmstrom	750R	--	--	--	Dry	06/07/81	--	--
3N.13W.24.222	RG-30046	Phillips Uranium	180R	2	7,240	--	80R	04/12/78	--	--
3N.13W.25.240	RG-33334	M.E. Phaul Partners	305R	6.625	7,000	--	165R	10/02/79	--	--
1S.7W.18.224P	Little	Double H Ranch	--	--	7,070	Qab	200R	--	--	--
1S.7W.30.111P	3 Section	Double H Ranch	--	6.625	7,012	Qab	213.16	12/14/77	K/M	S
1S.8W.2.241	Irri. #1	Double H Ranch	--	--	--	Qab	205.68	12/15/77	T	I
1S.8W.2.424	Irri. #3	Double H Ranch	--	--	7,005	Qab	211.41	12/15/77	T	I
1S.8W.6.123	Deep	Double H Ranch	670R	6	7,370	Td	--	04/19/79	W	S
1S.8W.10.341P	Antelope	Double H Ranch	--	8	7,014	Qab	217.62	12/15/77	K/M	S
1S.8W.21.11P	West Chavez	Double H Ranch	--	6.375	7,052	Qab	283	12/15/77	K	--
1S.8W.25.110	RG-32328-3	Mountain States Construction	385	6.625	--	Qab	198R	08/07/79	--	--
1S.8W.35.441P	East Chavez	Double H Ranch	--	7	6,988	Qab	185.02	12/14/77	W	S
1S.9W.13.343	Box Car or K and R	T. Barnett	--	6	7,285	Qab	485.3	05/06/80	W/J	S
1S.9W.25.110	RG-28779	Walter Olmstead	500R	6	--	Qab	457R	07/16/77	--	--
1S.9W.28.214	Barrett House	--	--	--	7,431	--	520R	05/06/80	K/M	D

Table 2.--Records of selected wells in the San Agustin study area--Continued

Location	Well name	Well owner	Depth of well (feet)	Casing diameter (inches)	Altitude of land surface (feet)	Geologic source	Water level: Depth below land surface (feet)	Water level: Date measured	Method of lift	Use of water
1S.10W.3.434	Cold Water	Choate/U.S.Forest Service	300R	6	7,880	--	64.67	06/25/80	W	S
1S.10W.6.412	Lavender	Choate/U.S.Forest Service	80R	6	8,121	--	48.96	05/07/80	W	S
1S.10W.16.143	Buck	Choate/U.S.Forest Service	100R	6	7,830	--	107.09	05/08/80	W	--
1S.10W.20.142	--	Cleaveland	--	6	7,690	Qal	14.03	05/07/80	K/M	S
1S.10W.20.331	--	Cleaveland	--	6	7,620	Qal	15.4	05/07/80	--	--
1S.10W.22.242	Vega	Choate	100R	3.75	7,575	Qal	3.49	06/25/80	W	S
1S.10W.29.122	--	Cleaveland	--	6	7,595	Qal	23.73	05/07/80	K/M	I
1S.10W.29.143	--	--	--	5	7,640	Td	73.97	07/05/79	K/M	D
1S.10W.29.241	Stewart	--	--	4.5	7,555	Qal	3.12	07/05/79	W	S
1S.10W.29.314	Harvey's	--	--	6.75	7,680	Td	100.65	07/05/79	G	S
1S.10W.29.442	Vega	--	--	6	7,545	Qal	18.18	07/05/79	W	N
1S.10W.31.223	House	Gallaher	60-80R	6	7,715	--	12.4	12/05/79	K/M	D
1S.10W.31.224	--	R.D. Gallaher	--	6	7,700	--	15.35	12/05/79	--	S
1S.10W.33.211	Baldwin Cabin	--	--	6.375	7,505	Qal	26.36	07/05/79	W	S
1S.10W.34.433	Medley	--	--	6.75	7,425	Qal	2.98	07/05/79	W	S
1S.11W.1.312	Whitehouse	--	--	6.5	7,908	Qal	6.45	07/05/79	W	S
1S.11W.4.143	Driveway	Lunger/U.S.Forest Service	99R	6	7,815	Qal	45.10	06/18/80	J/G	S
1S.11W.8.234	Slash	Slash	--	6	7,735	Qal	--	06/18/80	W	S
1S.11W.16.333	--	--	--	--	7,660	Qal	32.11	12/06/79	W	--
1S.11W.20.324	North	Gallaher	80R	6	7,615	Qal	25.65	12/06/79	W	S
1S.11W.22.144	Flying V#2	U.S.Forest Service	80R	--	7,880	Qal	27.3	12/06/79	--	--
1S.11W.29.113	Raino	U.S.Forest Service	--	--	7,590	Qal	28.18	12/06/79	W	S
1S.11W.33.231a	Flying V#1a	R.D.Gallaher/U.S. Forest Service	--	6	7,685	Qal	21.8	12/05/79	W	S
1S.11W.33.231b	Flying V#1b	R.D.Gallaher/U.S. Forest Service	--	6	7,687	Qal	24.31	12/05/79	W	S
1S.12W.25.413	Refrigerator Place	--	--	6	7,577	Qal	25.11	06/18/80	W	S
2S.4W.26.342	Prickett	--	--	--	--	--	--	--	--	--
2S.4W.26.344	Beowquist	--	--	--	--	--	--	--	--	--
2S.5W.20.444	Montosas High	Montosas Cattle Company	200R	5	6,962	Qal	132.04	04/25/79	W	S
2S.5W.32.113	Cedar	Montosas Cattle Company	550R	6	7,126	--	376.91	04/25/79	W	S
2S.6W.8.232	Pinon	Montosas Cattle Company	180R	6	7,452	Td	174.47	04/25/79	W	S
2S.6W.9.424	Gibson	Montosas Cattle Company	500R	5	7,407	Td	176.25	04/25/79	N	N
2S.6W.20.441a	--	Montosas Cattle Company	190R	6	7,194	Td	121.8	04/20/79	M/K	S
2S.6W.20.441bP	New	Montosas Cattle Company	--	8.375	7,190	Td	109.5	12/14/77	N	S
2S.6W.23.243	Pine	Montosas Cattle Company	480	5	7,309	--	440R	04/25/79	W	S
2S.7W.11.431	Deep	Montosas Cattle Company	380R	6	7,235	Qab	340R	--	J/G	S

Table 2.--Records of selected wells in the San Agustin study area--Continued

Location	Well name	Well owner	Depth of well (feet)	Casing diameter (inches)	Altitude of land surface (feet)	Geologic source	Water level: Depth below land surface (feet)	Water level: Date measured	Method of lift	Use of water
2S.7W.12.444	Pat	Montosas Cattle Company	440R	6	7,434	--	373.3	04/20/79	W	S
2S.7W.17.133	High Lonesome	Bruton/Montosas	--	7	6,981	Qab	180.25	12/14/77	W	S
2S.7W.27.444	Warm	Jack Bruton	275R	6	7,021	Qab	218.09	04/25/79	W	--
2S.7W.30.242	Arrow Head	Jack Bruton	180R	6	6,956	Qab	157.75	05/10/79	W	--
2S.7W.31.113	White Lake	Jack Bruton	--	6	6,959	Qab	160.9	05/10/79	W	--
2S.7W.34.442	East	Jack Bruton	200R	6	6,986	Qab	--	02/25/77	W	S
2S.8W.04.321	Little Chavez	Double H Ranch	--	--	--	Qab	--	--	K/M	--
2S.8W.6.314	--	Walter Olmstead	--	--	7,075	Qab	276.62	05/01/80	K/M	--
2S.8W.6.431E	--	Walter Olmstead	360R	12.75	7,068	Qab	267.93	11/15/78	N	I
2S.8W.7.344	--	A. Guin	280R	--	7,075	Qab	279R	--	W	S
2S.8W.21.413	New Augustin	Double H Ranch	200R	--	7,011	Qab	--	06/30/80	K/M	S
2S.8W.30.330	RG-32328	Mountain States Construction	400R	6.625	--	Qab	184R	05/23/79	--	--
2S.8W.35.222	Garcia	Jack Bruton	--	6	6,968	Qab	167.79	05/09/79	W	--
2S.9W.1.323	HQ	A. Guin	300R	--	7,102	Qab	280R	--	K/M	D/S
2S.9W.12.343	--	A. Guin	282R	--	7,108	Qab	281R	--	W	S
2S.9W.13.444	--	A. Guin	350	--	--	Qab	280R	--	W	S
2S.9W.15.111	Schuller	T. Barnett	--	5	7,179	Qab	381.73	05/06/80	J/G	S
2S.9W.22.321	--	T. Barnett	--	6	7,166	Qab	200R	05/06/80	K/M	S
2S.9W.22.443	RG-31422	John Hand	414R	6.625	7,130	Qab	340.05	07/10/79	K	S
2S.9W.24.224a	--	--	--	5.5	7,078	Qab	279.72	05/01/80	K/M	S
2S.9W.24.224b	--	--	--	6.5	--	Qab	--	--	--	--
2S.9W.31.124	Vanier	John Hand	--	6	7,230	--	430.7	05/23/79	W	S
2S.9W.33.122	Snake	John Hand	--	6	7,135	--	339.4	05/23/79	W	--
2S.9W.35.444	Chadwick	John Benton	260.5	--	7,056	Qab	254.35	07/04/80	--	--
2S.10W.3.221	New	--	--	8.875	7,433	Qal	7.14	07/05/79	K/M	S
2S.10W.3.414	RG-35431	Stephen McCary	81R	6.625	6,500	Qal	30R	01/30/81	--	--
2S.10W.8.311	Sawmill	Wellborn Brothers/U.S. Forest Service	120	4	7,710	Qal	63.92	06/26/80	W	--
2S.10W.8.413	Jonnies	Wellborn Brothers/U.S. Forest Service	--	6	7,660	Qal	34.19	06/26/80	W	--
2S.10W.9.333	--	Darwin Sweetner	20R	--	7,603	Qal	--	06/26/80	K/M	D
2S.10W.10.222	Datil	U.S. Bureau of Land Management	--	6	7,420	--	81.98	06/26/80	K/M	D
2S.10W.11.333	--	A. J. Johnson	--	7	7,418	Qal	30.88	06/27/80	W	--
2S.10W.11.420	RG-37014	Eligio Gutierrez	155R	5.5	7,200	Qal	75R	10/27/81	--	--
2S.10W.15.223	--	A. J. Johnson	--	6	7,442	Qal	28.03	06/27/80	K/M	D/S
2S.10W.15.224	Armijo	A. J. Johnson	--	5	7,425	Qal	17.67	06/27/80	W	S

Table 2.--Records of selected wells in the San Agustin study area--Continued

Location	Well name	Well owner	Depth of well (feet)	Casing diameter (inches)	Altitude of land surface (feet)	Geologic source	Water level: Depth below land surface (feet)	Water level: Date measured	Method of lift	Use of water
2S.10W.21.223	--	Wellborn Brothers	90R	6	7,483	Qal	13.18	07/04/80	W	S
2S.10W.21.241	--	Wellborn Brothers	220R	--	7,480	--	200R	07/04/80	K/M	S
2S.10W.29.123	New Tipton	Wellborn Brothers	833R	6	7,559	Td	358.8	06/26/80	W	--
2S.10W.29.212	Old Tipton	Wellborn Brothers	150	7	7,558	--	117.87	06/26/80	W	S
2S.10W.31.313	Agua Fria	Wellborn Brothers	611R	6	7,593	Td	357.6	06/26/80	W	S
2S.10W.34.144	Bob's	Wellborn Brothers	--	6	7,266	--	119.9	06/26/80	W	--
2S.11W.6.212	Old Gallaher	--	--	--	7,490	Qal	20.49	12/06/79	W	S
2S.11W.18.144	Last Chance	P. Lunger	--	6	7,481	--	54.26	06/17/80	W	S
2S.11W.29.244	Sugar Loaf	P. Lunger	320R	6	7,606	Td	219.19	06/17/80	W	S
2S.11W.34.222	Sugar Loaf	Wellborn Brothers	--	6	7,608	Td	348.4	06/26/80	J/G	S
2S.12W.19.244	--	B. A. Rifenbark	21.25	5.5	7,390	--	Dry	09/13/79	W	N
2S.12W.25.144	Headquarters	P. B. Lunger	--	6.875	7,240	Qal	13.08	11/27/78	W	S
2S.12W.25.431	Bull Pasture	P. B. Lunger	--	8.625	7,226	Qal	13.53	11/27/78	W	S
2S.12W.26.411	Hoot Owl	P. Lunger	--	--	7,280	--	--	06/17/80	W	--
2S.12W.29.433	Shipping	J. L. Sanchez	75R	6	7,242	Qal	42.08	06/16/80	W	S
2S.12W.30.124	--	B. A. Rifenbark	42	--	7,450	--	Dry	09/13/79	N	N
2S.12W.31.323	Middle	J. L. Sanchez	60R	6	7,359	Qal	31.85	06/17/80	W	S
2S.12W.32.241	House	J. L. Sanchez	103R	12	7,210	Qal	26.79	06/16/80	K/M	--
2S.12W.32.243	--	J. L. Sanchez	50R	12	7,198	Qal	23.90	11/16/78	T	I
2S.12W.32.421	Farm Mill	J. L. Sanchez	75R	6	--	Qal	--	06/16/80	W	S
2S.12W.35.442	H Cross	P. B. Lunger	--	6.5	7,179	Qal	19.33	11/27/78	W	S
2S.13W.24.311	--	B. A. Rifenbark	95R	5.5	7,580	--	67.99	09/13/79	K	D/S
2S.13W.24.331	East	E. McMasters	--	6	7,585	Qal	85.00	10/31/79	W	S
2S.13W.25.242	--	B. A. Rifenbark	200R	5.5	7,453	Qal	27.58	09/13/79	--	--
2S.13W.25.311	--	B. A. Rifenbark	95R	5.5	7,580	--	67.99	09/13/79	K/M	D/S
2S.13W.27.213a	Moore	E. McMasters	--	6	7,698	--	67.33	10/04/79	W	S
2S.13W.27.213b	--	E. McMasters	--	6	7,700	--	69.15	10/04/79	--	--
2S.13W.32.413	Little Allegre	E. McMasters	--	6	7,805	--	--	11/01/79	W	S
2S.13W.35.311	Middle	E. McMasters	--	6	7,514	Qal	21.97	10/04/79	--	S
2S.13W.35.433a	--	E. McMasters	102R	--	7,454	--	41.04	10/04/79	--	--
2S.13W.35.433b	--	E. McMasters	--	--	7,456	--	--	10/04/79	W	D/S
2S.13W.35.433c	--	E. McMasters	--	6	7,460	--	81.41	10/04/79	W	S
2S.13W.36.142	West Mill	J. L. Sanchez	225R	6	7,480	--	45.02	06/17/80	W	--
2S.15W.27.331	--	U.S. Forest Service	--	6	8,200	--	--	07/06/79	J	N
3S.5W.2.422	Box Car	R. Dunlap, Cat Mountain	--	7	6,725	--	89.05	07/12/78	W	S

Table 2.--Records of selected wells in the San Agustin study area--Continued

Location	Well name	Well owner	Depth of well (feet)	Casing diameter (inches)	Altitude of land surface (feet)	Geologic source	Water level: Depth below land surface (feet)	Water level: Date measured	Method of lift	Use of water
3S.5W.14.443	Driveway	R. Dunlap, Cat Mountain	--	6.75	6,895	--	386.28	07/12/78	W	S
3S.5W.19.323P	Steel Tank	R. Dunlap, Cat Mountain	--	8.75	6,970	Qal	31.44	07/13/78	K/M	S
3S.5W.27.311	Deep	R. Dunlap, Cat Mountain	--	7.5	6,872	--	546.9	07/12/78	W	S
3S.5W.31.223	--	R. Dunlap, Cat Mountain	--	7.875	6,845	Qal	26.87	07/12/78	W	S
3S.6W.2.113a	HQ	Montosas Cattle Company	368	6	7,165	Td	298.28	04/25/79	--	--
3S.6W.2.113b	HQ (New)	Montosas Cattle Company	420R	--	7,165	Td	--	--	K/M	D/S
3S.6W.5.122	Highway 60	Montosas Cattle Company	333R	--	7,055	--	--	04/20/79	K/M	S
3W.6W.11.241	Divide	R. Dunlap, Cat Mountain	--	--	7,120	Td	210.03	07/13/78	K/M	S
3S.6W.21.111	Grey	R. Dunlap, Cat Mountain	--	6.625	7,035	Qab	228.53	07/14/78	W	S
3S.6W.29.122	Plains	R. Dunlap, Cat Mountain	--	6	7,074	--	Dry	07/14/78	N	N
3S.6W.35.312	Upper Mare	R. Dunlap, Cat Mountain	--	--	7,017	Qab	67.85	07/13/78	W	S
3S.6W.36.312	--	R. Dunlap, Cat Mountain	--	5	6,933	Qab	68.62	06/24/80	W	S
3S.7W.1.222	Buck	Montosas Cattle Company	230	6	7,008	Qab	209.11	04/25/79	W	S
3S.7W.5.443	Davis	Jack Bruton	--	5	7,005	Qab	203.4	05/10/79	W	--
3S.7W.8.231	CC Camp	Jack Bruton	--	6	7,027	Qab	227.72	05/10/79	W	--
3S.7W.12.423	Ranch House	Winter Brothers	200R	8	7,005	Qab	208.27	05/09/80	K/M	D/S
3S.7W.16.433	Driveway	Winter Brothers	355R	6	7,124	Qab	322.21	05/08/80	W	S
3S.7W.26.233	Antelope	R. Dunlap, Cat Mountain	--	6	7,160	Qab	--	06/24/80	W	S
3S.8W.1.310E	VLA Main	VLA	--	10	6,975	Qab	174.3	05/02/80	--	C
3S.8W.1.414	--	VLA	245	8	6,975	Qab	176.71	05/02/80	--	C
3S.8W.2.431	Lorenzo	John Benton	192R	5	6,972	Qab	173	07/04/80	G/J	S
3S.8W.5.222	Old Augustin	John Benton	220R	6	7,000	Qab	--	07/04/80	K/M	D/S
3S.8W.9.231	Clements	John Benton	--	--	6,982	Qab	--	--	K/M	--
3S.8W.14.423	Bone Moncho	Jack Bruton	--	6	7,045	Qab	243.1	05/08/79	W	--
3S.8W.20.211	Estafeta	Jack Bruton	--	5	6,959	Qab	168.62	05/08/79	W	S
3S.8W.21.124	Headquarters	Jack Bruton	--	6	6,994	Qab	240.1	02/25/77	K	D/S
3S.8W.30.100E	Irrigation	Jack Bruton	350R	9	6,960	Qab	167.60	02/24/77	N	I
3S.8W.31.111	South Garcia	Jack Bruton	--	6	6,945	Qab	162.3R	05/08/79	W	--
3S.8W.36.222	Gose	Jack Bruton	620-650R	8	7,378	Qab	583.2	05/06/80	J/G	S
3S.9W.1.212	Heinz	John Benton	240R	6	7,035	Qab	236.61	07/04/80	W	S
3S.9W.3.221	Rock House	John Benton	272	6	7,060	Qab	261.34	07/04/80	W	D/S/I
3S.9W.7.442	Lutz	John Hand	--	7	7,156	Qab	300-330	05/23/79	G	--
3S.9W.11.212	Benton	John Benton	282R	6	7,027	Qab	--	07/04/80	W	S
3S.9W.19.412	McClure	John Hand	--	5	7,078	Qab	298.75	05/24/79	W	--
3S.9W.21.221	House	John Hand	--	6	7,024	Qab	227.62	05/24/79	K	D

Table 2.--Records of selected wells in the San Agustin study area--Continued

Location	Well name	Well owner	Depth of well (feet)	Casing diameter (inches)	Altitude of land surface (feet)	Geologic source	Water level: Depth below land surface (feet)	Water level: Date measured	Method of lift	Use of water
3S.9W.28.243	New	John Hand	--	7	6,990	Qab	193.20	05/24/79	W	--
3S.9W.29.332	Testhole	(Blodgett, 1973, p. 7,8,12)	300							
3S.10W.5.214	Rockhouse	West Wellborn Brothers	178	6	7,303	Qab	147.88	06/26/80	W	S
3S.10W.7.311	--	Gutierrez	250R	--	7,180	Qab	--	06/30/80	--	--
3S.10W.7.312	--	Gutierrez	180R	7	7,160	Qab	146.0	06/30/80	K/M	D
3S.10W.11.314	Five Troughs	John Benton	432	7	7,240	Td	284.0	07/04/80	W	S
3S.10W.19.222	New	H. Sanchez	313R	5	7,050	Qab	284.6	12/04/79	K/M	--
3S.10W.22.444	Montoya	John Benton	303R	--	7,024	Qab	280-290R	07/04/80	W	S
3S.10W.28.224	Headquarters	H. Sanchez	305R	--	6,990	Qab	240R	--	K/M	D/S
3S.10W.31.212	Cloud Place	H. Sanchez	200R	4.5	6,938	Qab	172.0	08/01/79	W	A
3S.11W.8.331	Agua Fria	P. Lunger	--	6	7,216	Qab	211.48	06/17/80	W	S
3S.11W.9.424	Up Henderson	Wellborn Brothers	212	6	7,197	Qab	190.67	06/25/80	W	S
3S.11W.12.242	Home	Wellborn Brothers	160	--	7,216	--	--	06/27/80	K/M	D/S
3S.11W.13.131	--	Wellborn Brothers	600R	6	7,160	--	Dry	06/25/80	--	A
3S.11W.16.424	Broken	Wellborn Brothers	128	8	7,109	Qab	101.47	06/25/80	W	--
3S.11W.18.311	Deep	Wellborn Brothers	478	6	7,210	Qab	195.44	06/25/80	W	--
3S.11W.19.231	--	Wellborn Brothers	--	6	7,100	Qab	124.78	06/25/80	W	--
3S.11W.19.414	--	--	--	6	7,058	Qab	139.79	11/27/78	W	S
3S.11W.25.344	East Section	Wellborn Brothers	--	5	6,929	Qab	164.02	06/27/80	W	S
3S.11W.26.112	Henderson 2 Section	--	190	--	6,987	Qab	Dry	06/27/80	--	--
3S.11W.27.342	West Section	Wellborn Brothers	500R	--	6,949	Qab	183.48	06/27/80	W	S
3S.11W.29.324	--	Wellborn Brothers	--	--	6,999	Qab	180.5	06/25/80	W	--
3S.11W.30.333	--	Wellborn Brothers	--	--	7,007	--	18.71	06/30/80	W	S
3S.11W.31.342	--	Emery	--	6	6,994	Qal	30.84	07/20/77	W	--
3S.12W.1.242	--	Wellborn Brothers	60	6	7,278	--	38.0	06/25/80	W	S
3S.12W.1.242	Buck Canyon	P. Lunger	--	--	7,280	--	37.76	06/17/80	W	S
3S.12W.10.433a	--	P. H. Conner	--	8.5	7,096	Qal	8.1	09/12/79	W	S
3S.12W.10.433b	--	P. H. Conner	--	--	7,096	Qal	8.38	09/12/79	W	S
3S.12W.11.231	--	Wellborn Brothers	--	--	7,134	Qal	29.38	06/25/80	G/J	--
3S.12W.11.322	--	--	40	6	7,102	Qal	30.16	06/25/80	W	--
3S.12W.20.144	--	T. P. Ranch	--	5.5	7,390	Qal	43.17	11/28/79	N	N
3S.12W.23.121	--	E. McMasters	60R	6	7,070	Qal	49.90	06/15/80	W	--
3S.12W.23.222	--	E. McMasters	140R	6	7,078	Qal	50.08	06/15/80	W	--
3S.12W.23.224	--	E. McMasters	--	6	7,070	--	--	06/15/80	M/K	D/S
3S.12W.23.424	--	--	--	6.625	7,045	Qal	14.80	11/27/78	W	S

Table 2.--Records of selected wells in the San Agustin study area--Continued

Location	Well name	Well owner	Depth of well (feet)	Casing diameter (inches)	Altitude of land surface (feet)	Geologic source	Water level: Depth below land surface (feet)	Water level: Date measured	Method of lift	Use of water
3S.12W.24.312a	--	P. H. Conner	--	5	7,036	Qal	19.87	09/12/79	W	N
3S.12W.24.312b	--	P. H. Conner	--	9	7,036	Qal	19.34	09/12/79	N	N
3S.12W.24.431	--	P. H. Conner	--	5.5	7,055	Qal	30.89	11/27/78	W	N
3S.12W.25.211a	--	P. H. Conner	43R	5.5	7,029	Qal	19.68	09/12/79	W	I/C
3S.12W.25.211b	--	P. H. Conner	60R	--	7,030	Qal	--	09/12/79	W	I/C
3S.12W.25.211c	--	P. H. Conner	100R	--	7,030	Qal	--	09/12/79	W	I/C
3S.12W.25.211d	--	P. H. Conner	60R	--	7,030	Qal	--	09/12/79	K/M	I/C
3S.12W.25.213a	--	P. H. Conner	60R	7.25	7,025	Qal	21.15	09/12/79	N	N
3S.12W.25.213b	--	P. H. Conner	30R	--	7,025	Qal	--	09/12/79	--	--
3S.12W.25.213c	--	P. H. Conner	190R	--	7,038	Qal	--	09/12/79	W	D/S
3S.12W.28.111	Line Camp	T. P. Ranch	--	6	7,570	Td	105.1	11/07/79	W	S
3S.12W.29.424	--	T. P. Ranch	--	6	7,790	Td	--	11/07/79	W	S
3S.13W.10.233	Section 10	Hutcherson	--	6	7,450	Qal	42.04	10/03/79	W	S
3S.13W.11.333	--	Hutcherson	--	6	7,425	Qal	30.40	10/03/79	--	--
3S.13W.20.412	RG-36370	Tom Merlan	70R	6.625	7,000	--	45R	08/29/81	--	--
3S.13W.22.114	--	Hutcherson	--	5	7,590	Qal	52.04	10/02/79	W	S
3S.13W.22.412	--	Hutcherson	17.05	6.5	7,590	--	Dry	10/02/79	--	--
3S.13W.23.333	--	Hutcherson	--	4.5	7,554	Qal	33.10	09/26/79	N	--
3S.13W.26.111	--	Hutcherson	--	5	7,548	Qal	62.68	09/26/79	W	S
3S.13W.27.224	--	Hutcherson	--	5.5	7,590	Qal	40.70	09/26/79	W	S
3S.13W.27.434	--	Hutcherson	--	6	7,696	--	66.73	09/26/79	J	S
4S.5W.7.224	North Pino	B. Dunlap, Cat Mountain	--	7	6,790	--	167.12	07/13/78	W	S
4S.6W.9.124	Home	B. Dunlap, Cat Mountain	--	6	7,244	--	148.95	06/23/80	W	--
4S.6W.10.244	Lower Castillo	B. Dunlap, Cat Mountain	--	6	7,119	--	96.1	06/23/80	W	S
4S.6W.13.224	Pino	B. Dunlap, Cat Mountain	--	6.75	6,950	--	214.36	07/13/78	W	S
4S.6W.16.213	Upper Castillo	B. Dunlap, Cat Mountain	--	6	7,395	--	312.58	06/23/80	W	S
4S.6W.18.423	Monica Cabin	U.S. Forest Service	--	4	7,485	Qal	23.81	05/09/80	K/M	--
4S.7W.1.343	Little Slash	B. Dunlap, Cat Mountain	--	6	7,345	Td	544.02	07/13/78	K/M	D/S
4S.7W.4.331a	Old Durfee	Winter Brothers	45R	6	7,503	Qal	16.5	05/08/80	W	S
4S.7W.331b	--	Winter Brothers	117	8	7,503	Td	109.24	05/08/80	--	--
4S.7W.21.132	Durfee Canyon	Winter Brothers	110	8.5	7,770	Qal	12.2	05/07/80	W	S
4S.7W.22.241	Bolander	Winter Brothers	600R	6	7,696	--	--	--	G	S
4S.7W.23.131	--	R. Dunlap, Cat Mountain	300R	6	7,660	Td	212.95	06/23/80	W	--
4S.8W.2.442	Fox	Jack Bruton	575R	8	7,335	--	520R	--	W/G	S
4S.8W.4.331	White	Jack Bruton	--	4	7,074	Qab	278.64	02/24/77	W	S

Table 2.--Records of selected wells in the San Agustin study area--Continued

Location	Well name	Well owner	Depth of well (feet)	Casing diameter (inches)	Altitude of land surface (feet)	Geologic source	Water level: Depth below land surface (feet)	Water level: Date measured	Method of lift	Use of water
4S.8W.14.321	Sexton	Winter Brothers	540R	9	7,326	--	--	--	W/G	S
4S.8W.25.321	Point of Rocks	Winter Brothers/ U.S. Government	42R	8	7,484	Qal	39.3	05/07/80	W	S
4S.8W.32.413	Kellog	Winter Brothers	600R	--	7,312	Td	596.8	05/07/80	W	S
4S.9W.4.210	RG-34144	Marvin Ake	163R	6.625	--	Qab	134R	06/18/80	--	--
4S.9W.6.212	House, RG-37026	Marvin Ake	400R	6.625	7,083	Qab	350R	10/02/81	K/M	D/S
4S.9W.8.132	Española	Marvin Ake	--	6	6,899	Qab	112.41	10/28/77	J	S
4S.9W.12.133	Old Sand	Jack Bruton	--	5	6,940	Qab	--	--	W	S
4S.9W.15.333	New Sand	Marvin Ake	140R	6.5	6,904	Qab	119.06	07/14/78	W	S
4S.9W.17.311	C Bar N	Marvin Ake	--	--	6,895	Qab	102.52	02/22/77	T	S
4S.9W.32.333	Woods	Marvin Ake	--	7	6,911	Qab	122.58	02/24/77	W	S
4S.10W.1.224	--	Marvin Ake	--	6.625	7,096	Qab	315.66	01/23/80	--	--
4S.10W.5.333	--	M. Harriet Jr.	--	--	6,899	Qab	130.04	08/29/79	W/M	S
4S.10W.20.434	--	M. Harriet Jr.	--	--	6,873	--	--	--	W	--
4S.10W.28.224	--	Marvin Ake	--	7	6,930	Qab	148.64	10/28/77	W	S
4S.10W.32.333	Sheep	M. Harriet Jr.	--	3	6,892	--	127.97	02/23/77	W	S
4S.11W.2.333	--	Lee Coker	--	6	6,914	Qab	161.08	07/21/77	W	S
4S.11W.10.433	--	Lee Coker	--	6	6,918	Qab	163.77	07/21/77	W	S
4S.11W.17.333	Driveway	Lee Coker	--	8	6,932	Qab	173.33	07/21/77	W	--
4S.11W.23.121	Navajo	M. Harriet Jr.	--	8	6,897	Qab	133.72	09/25/80	W	S
4S.11W.29.200	RG-29979	Ester Gutierrez	178	6.625	--	Qab	150R	05/06/78	--	--
4S.12W.3.212	McMasters	E. McMasters	165	6	7,485	--	114.78	06/15/80	W	S
4S.12W.12.413	--	Adrian Sanchez	--	8	6,957	Qab	92.8	07/20/77	W	--
4S.12W.12.414	--	O'Dell	--	6	6,953	Qab	97.84	07/20/77	W	--
4S.12W.24.122	James	Farr Cattle Company	150R	6	6,927	Qab	163.91	09/29/77	W	S
4S.12W.29.122	Johnson	--	--	--	6,872	--	--	--	M	--
4S.12W.30.421	--	J. J. Carilo	--	6	6,839	Qab	78.62	07/20/77	W	--
4S.12W.34.232	H.B.	Farr Cattle Company	120R	--	--	Qab	--	--	--	S
4S.12W.35.111	Stockyard	Farr Cattle Company	140R	6	6,884	Qab	127.73	09/29/77	W	S
4S.13W.27.112	--	Hutcherson	--	6	6,975	Qal	22.84	07/22/77	W	--
4S.13W.27.332	--	Armijo	--	6	6,928	Qal	51.31	07/08/77	W	--
4S.13W.27.341	--	Armijo	--	6	6,928	Qal	48.87	07/08/77	W	--
4S.13W.29.331a	--	P. Armijo	--	--	6,985	Qal	26.2	07/--/77	W	--
4S.13W.29.331b	--	Armijo	--	6	7,000	Qal	21.54	07/--/77	W	D
4S.13W.30.144a	--	D. Lucero	--	6	7,100	Qal	38.96	07/--/77	W	D
4S.13W.30.144b	--	Siaz	--	8	7,085	Qal	28.92	07/--/77	H	--

Table 2.--Records of selected wells in the San Agustin study area--Continued

Location	Well name	Well owner	Depth of well (feet)	Casing diameter (inches)	Altitude of land surface (feet)	Geologic source	Water level: Depth below land surface (feet)	Water level: Date measured	Method of lift	Use of water
4S.13W.30.444a	--	AA Sanchez	--	6	6,981	Qal	21.25	07/08/77	M	D
4S.13W.33.242	--	Armijo	--	8	6,932	Td	78.07	07/08/77	W	--
4S.14W.17.310	RG-29346	Leo R. Aragon	505R	--	--	--	--	10/27/77	--	--
4S.14W.34.212	Patterson Canyon	--	--	--	--	--	--	--	--	--
4S.15W.26.334	--	--	--	6.5	7,155	Td	268.69	10/25/77	W	S
4S.16W.35.134	--	--	--	--	6.950	Td	128.10	10/25/77	W	S
5S.8W.33.220E	RG-32616	G. L. Morris	915R	6.5	7,565	Td	760.2	08/24/79	--	D/S
5S.9W.1.111	Satathite Pl.	Marvin Ake	--	--	6,950	--	152.00	10/28/77	W	S
5S.9W.3.221	--	Marvin Ake	--	6	6,921	Qab	131.76	10/28/77	W	S
5S.9W.4.212	--	Marvin Ake	174	6.75	6,915	Qab	129.17	05/06/80	K/M	S
5S.9W.16.421P	--	Luera Ranch	--	6	6,959	--	166.36	10/28/77	N	S
5S.9W.23.230E	--	Marvin Ake	--	--	6,985	--	199.42	10/28/77	T	I
5S.9W.23.233	--	Marvin Ake	--	6.125	6,998	--	201.04	09/21/79	J/M	D/S
5S.9W.24.441	Frenchman's	G. L. Morris	--	--	7,075	Td	279.16	12/07/77	M/K	--
5S.10W.9.232	Headquarters	M. Harriet Jr.	98R	6	--	Qab	--	08/29/79	M/K	D/S
5S.11W.1.300	Middle	M. Harriet Jr.	--	7	6,863	Qab	103.26	02/23/77	W	S
5S.11W.19.113	Ocho Juan	Farr Cattle Company	150R	6	6,838	Qab	79.73	09/28/77	W	S
5S.11W.22.212P	Eloisa	M. Harriet Jr.	--	6	6,853	Qab	94.6	02/23/77	W	S
5S.12W.4.134	John	Farr Cattle Company	250R	6	6,842	Qab	84.82	09/29/77	W	S
5S.12W.5.142	Josephine	Farr Cattle Company	100R	6	6,837	Qab	77.48	09/29/77	W	S
5S.12W.9.444P	Homstead	Farr Cattle Company	150R	--	--	Qab	--	--	W	D/S
5S.12W.12.214	Chamisal	Farr Cattle Company	200R	--	--	Qab	--	--	--	S
5S.12W.34.434a	Crawford	H Dug Farr Cattle Company	--	6	6,813	Qab	56.01	09/23/77	J/M	D/S
5S.12W.34.434b	Crawford	South Farr Cattle Company	--	6	6,813	Qab	56.04	09/23/77	W	D/S
5S.12W.34.434c	Crawford	North Farr Cattle Company	--	--	6,813	Qab	--	--	--	--
5S.13W.4.241	--	Farr Cattle Company	--	6	6,866	Td	80.66	09/24/80	W	S
5S.13W.5.131	--	Farr Cattle Company	--	6	6,965	Td	118.88	11/29/78	W	D/S
5S.13W.5.212	--	Farr Cattle Company	150	8.625	6,905	--	55.06	11/29/78	N	I
5S.13W.9.244	--	Farr Cattle Company	--	6.5	6,795	Qab	41.88	12/14/78	W	S
5S.13W.14.122	--	Farr Cattle Company	200	16	6,804	Qab	50.35	12/14/78	W	I/S
5S.13W.14.322	--	Farr Cattle Company	--	6	6,803	Qab	48.04	12/14/78	--	--
5S.13W.20.123	--	Farr Cattle Company	90	8	6,782	Qab	25.93	07/05/80	W	S
5S.13W.22.112	--	Farr Cattle Company	--	6.75	6,798	Qab	46.98	12/14/78	W	S
5S.13W.24.333	--	Farr Cattle Company	270R	--	--	Qab	--	--	--	--
5S.13W.27.422	--	Farr Cattle Company	--	6	6,791	Qab	46.64	12/14/78	W	S

Table 2.--Records of selected wells in the San Agustin study area--Continued

Location	Well name	Well owner	Depth of well (feet)	Casing diameter (inches)	Altitude of land surface (feet)	Geologic source	Water level: Depth below land surface (feet)	Water level: Date measured	Method of lift	Use of water
5S.13W.28.244(G-G')	Test hole		3,000							
5S.13W.32.332	--	Soto Lee	1,100R	6	6,778	Qab	43.65	06/13/79	--	--
5S.14W.5.131	--	Wilford J. Kelley	--	6	6,930	Qal	52.1	07/22/77	W	--
5S.14W.6.311	--	Soto Lee	--	8	6,964	--	89.31	10/04/77	W	S
5S.14W.9.322P	--	Soto Lee	--	--	6,866	Qal	6.0R	--	--	--
5S.14W.13.134	--	Soto Lee	--	8.5	6,804	Qab	5.95	10/03/77	W	S
5S.14W.22.233	--	Soto Lee	--	--	6,794	--	21.22	10/21/77	N	N
5S.14W.28.311	--	Aragon	--	6	6,885	--	133.84	10/21/77	W	S
5S.14W.33.113	--	Aragon	--	--	6,810	Qab	84.56	10/21/77	W	S
5S.15W.16.131	--	Soto Lee	--	6.5	7,410	Td	327.03	10/04/77	W	S
6S.7W.15.140P	--	--	--	4	7,660	Qal	13.42	01/21/80	G	S
6S.8W.8.432	--	H. Welty	--	7	7,235	Td	718.7	05/05/80	J/M	S
6S.8W.24.411	--	H. Welty	280R	6.75	7,100	Td	236.86	01/21/80	G	S
6S.8W.31.222	--	H.Welty	100R	7	7,050	Qal	20.02	04/13/78	N	D/S
6S.9W.17.133P	--	Luera Ranch	350R	8	7,460	Td	304	12/07/77	J/M	S/D
6S.9W.25.444	--	H. Welty	100R	6	7,180	Qal	22.01	04/13/78	J/M	S/D/I
6S.9W.30.222P	--	Luera Ranch	--	6	7,482	Td	801.26	04/11/78	J	S
6S.10W.20.200E	Park Farr	Cattle Company	169R	--	7,960	Td	1,153.2	09/22/77	N	--
6S.10W.31.132	1150 Farr	Cattle Company	1,150R	--	7,545	Td	842R	09/22/77	W	S
6S.11W.9.124	Hay Pasture	Farr Cattle Company	400R	6	7,077	Td	277.48	09/22/77	W	S
6S.11W.20.221E	Park Farr	Cattle Company	1,690R	--	7,960	Td	1,153.2	09/22/77	N	N
6S.11W.27.114	Old Ranch	Farr Cattle Company	358R	7	7,340	Td	288.42	09/22/77	W/K/M	S/D
6S.11W.30.324	Concelio	Farr Cattle Company	400R	6	7,110	Td	337.25	09/27/77	W	S
6S.12W.9.134	Thurgood	Farr Cattle Company	100R	3.5	6,826	Qab	73.12	09/28/77	W	S
6S.12W.12.131P	Taylor Place	Farr Cattle Company	150R	7	6,827	Qab	69.60	09/27/77	W	S
6S.12W.19.334	Cowley	Farr Cattle Company	357R	6	7,063	Td	303.33	09/28/77	W	S
6S.12W.28.224	Shaw Canyon	Farr Cattle Company	612R	6	7,062	Td	--	--	--	--
6S.13W.11.243	Fullerton West Place	Farr Cattle Company	100R	6	6,803	Qab	51.94	09/28/77	W	S
6S.13W.11.244	Fullerton East Place	Farr Cattle Company	100R	6.5	6,804	Qab	51.44	09/28/77	W	S
6S.13W.20.122	--	Soto Lee	--	--	6,783	Qab	33.28	10/20/77	W	S
6S.14W.6.231	--	Aragon	--	6.5	6,815	Qab	79.96	10/20/77	W	S
6S.14W.7.334	Ranch Head-quarters	Lee York	120R	6	6,820	Qab	84.83	10/05/77	K	S/D
6S.14W.8.333	--	Lee York	400-500R	5	6,783	Qab	46.02	10/04/77	W	S
6S.14W.19.213	--	Soto Lee	--	6	6,801	Qab	67.02	10/04/77	W	S

Table 2.--Records of selected wells in the San Agustin study area--Continued

Location	Well name	Well owner	Depth of well (feet)	Casing diameter (inches)	Altitude of land surface (feet)	Geologic source	Water level: Depth below land surface (feet)	Water level: Date measured	Method of lift	Use of water
6S.14W.21.433	--	Lee York	--	6	6,798	Qab	58.63	10/20/77	W	S
6S.14W.26.234	--	--	--	--	--	--	--	--	W	S
6S.14W.28.332a	--	Soto Lee	--	6	6,808	Qab	66.97	10/05/77	W	S/D
6S.14W.28.332b	--	Soto Lee	--	6	6,808	Qab	66.51	10/05/77	W	S/D
6S.14W.31.211	--	Lee York/Soto Lee	--	--	6,805	Qab	63.44	10/20/77	W	S
6S.14W.1.441	--	R. Aragon	90R	6	7,040	Qab	24.05	10/05/77	W	S/D
6S.15W.20.211a	--	Lee York	105R	5	7,250	--	68.16	10/04/77	W	S
6S.15W.20.211b	--	Lee York	58	6x8	7,250	--	26.34	10/04/77	--	--
6S.15W.24.111	--	Lee York/Soto Lee	--	6	6,915	Qab	170.93	10/20/77	W	S
7S.7W.15.300	RG-27571	U.S. Forest Service	101	6.625	--	--	18	--	--	--
7S.8W.2.311a	--	H. Welty	580R	7	6,858	Td	548.56	01/21/80	G	S
7S.8W.2.311b	--	H. Welty	--	4	6,858	Qal	40E	01/21/80	N	A
7S.8W.4.342	--	H. Welty	580R	6.5	6,820	Td	511.2	11/17/78	J/M	S/D
7S.8W.4.344	--	H. Welty	100R	--	6,820	Qal	49.5	04/13/78	N	A
7S.8W.21.314	--	H. Welty	250R	6	6,630	--	230.90	05/01/78	J/M	S
7S.8W.33.330	RG-25078	Drew Henderson	140R	6.625	--	Qal	30R	07/14/74	--	--
7S.9W.24.131	--	C. W. McCracken	764-780R	6	7,050	Td	463.33	05/12/78	W	S
7S.9W.25.144	RG-23303	C. W. McCracken	800	6.625	--	Td	720	--	--	S/D
7S.9W.33.433	--	C. W. McCracken	--	--	--	--	--	05/04/78	J	S
7S.10W.29.343	--	Adobe Ranch	400R	--	--	--	--	--	--	--
7S.10W.33.343	Divide	Adobe Ranch	--	--	7,660	Td	980R/E	10/27/77	--	--
7S.10W.35.411	--	Adobe Ranch	1,700R	--	--	Td	270R	--	--	--
7S.11W.23.334	North Garcia	Adobe Ranch	--	--	7,510	Td	814R/E	10/27/77	--	--
7S.12W.3.444	Chimney	Farr Cattle Company	750R	7	7,320	Td	613.62	09/28/77	K/M	S
7S.14W.3.143	Gringo	H. Lassater	--	6	6,865	--	126.53	10/05/77	W	S
7S.14W.5.322	--	H. Lassater	--	6	--	--	--	--	W	S
7S.14W.11.231	Sawmill	H. Lassater	--	6	6,955	--	215.41	10/05/77	W	S
7S.14W.14.343	Graveyard	H. Lassater	--	6.5	7,069	Td	332.46	10/27/77	W	S
7S.14W.16.133	Headquarters	H. Lassater	--	10.125	6,925	Qal	30.58	12/12/77	J/M	S/D
7S.14W.19.424E	--	H. Lassater	466E	4	7,120	Td	390.81	12/09/77	N	S
8S.7W.11.124P	--	U.S. Forest Service	49	4x4	7,330	Qal	12.7	05/11/79	N	N
8S.7W.16.232P	--	Sullivan & Son	780R	6	7,035	Td	758R	--	J/G	S
8S.7W.30.313P	--	Sullivan & Son	90R	6.5	6,336	Qal	82.05	04/12/78	W	S
8S.7W.31.223P	Spring Canyon	Sullivan & Son	90R	6	6,155	Qal	89.77	05/12/78	G/J	S
8S.8W.1.243	--	H. Welty	412R	6	6,620	Td	333.55	11/15/78	J/M	S/D

Table 2.--Records of selected wells in the San Agustin study area--Continued

Location	Well name	Well owner	Depth of well (feet)	Casing diameter (inches)	Altitude of land surface (feet)	Geologic source	Water level: Depth below land surface (feet)	Water level: Date measured	Method of lift	Use of water
8S.8W.7.132	Thomas Place	W. Johnson	--	6	6,810	--	Dry	05/04/78	N	N
8S.8W.7.211E	RG-30142	W. Johnson	667R	4	6,970	Td	526.36	12/13/78	W	W
8S.8W.9.211	--	Wm. McCracken	--	6	6,470	Qal	44.99	04/12/78	W	S
8S.8W.9.220	RG-25149	H. Welty	101	6.625	--	--	54	--	--	--
8S.8W.10.314	--	W. Johnson	124R	12	--	Qal	35	04/12/78	T	I
8S.8W.10.341a	--	W. Johnson	--	6	6,423	--	--	--	W	S/D
8S.8W.10.341b	--	W. Johnson	--	6.75	6,430	--	28.04	04/12/78	N	A
8S.8W.13.442	Headquarters	Sullivan & Son	270R	4	6,525	--	--	--	G	--
8S.8W.14.133E	--	C. W. McCraken	450R	--	6,414	Td	350R	--	N	A
8S.8W.15.100	RG-22137	W. Johnson	105R	6.625	--	Qal	21R	02/11/75	--	--
8S.8W.15.244	--	Wm. McCracken	--	5	6,414	Qal	43.98	--	--	--
8S.8W.15.314	--	W. Johnson	--	--	6,375	--	None	05/03/78	N	A
8S.8W.15.343	--	W. Johnson	72.5	8	6,360	Qal	19.72	12/13/78	--	--
8S.8W.18.234	Rock Springs	W. Johnson	550R	6.75	6,834	Td	404.04	05/04/78	W	S
8S.8W.22.000	--	W. Johnson	120R	--	--	--	--	--	--	--
8S.8W.22.000	Dodds	W. Johnson	110R	--	--	Qal	40-50R	--	--	--
8S.8W.22.100	RG-22136	W. Johnson	165	--	--	Qal	19	--	--	--
8S.8W.22.132	--	W. Johnson	--	3.5	6,350	Qal	22.65	05/03/78	N	--
8S.8W.23.300	RG-25606	W. Johnson	125	6.625	--	Qal	48	--	--	--
8S.8W.26.232	--	W. Johnson	25R	6	6,280	Qal	18.68	05/10/78	W	S
8S.8W.31.424	Badger	W. Johnson	400R	6.625	6,825	Td	345.26	05/02/78	W	S
8S.8W.32.443	Ridge	W. Johnson	430R	6.75	6,825	Td	356.83	05/02/78	W	S
8S.9W.4.342	Wahoo Canyon	W. Johnson	575R	6.625	7,145	Td	405.95	05/04/78	W	S
8S.9W.35.244E	--	W. Johnson	100R	10	7,210	Qal	49.28	05/02/78	W	S
8S.11W.5.223	Dry Lake	Adobe Ranch	--	--	7,455	Td	768R/E	10/27/77	--	--
8S.11W.18.321	Garcia	Adobe Ranch	--	--	7,350	Td	655R/E	--	--	--
8S.11W.23.212	Gibson	Adobe Ranch	--	--	7,685	Td	1,260R/E	10/27/77	--	--
8S.11W.30.313	--	E. T. Sullivan	90R	6.5	6,336	--	82.05	04/12/78	W	S
8S.12W.2.213	Pelona	Adobe Ranch	1,340R	--	7,821	Td	1,141R/E	--	--	--
8S.12W.32.211	Railroad	Adobe Ranch	--	--	7,170	Td	600R/E	--	--	--
8S.13W.16.122	Coyote	Boyd Ranch	1,350	--	7,528	Td	983R	--	T	S/D
8S.13W.18.133	Main	Boyd Ranch	1,080R	5.375	7,610	Td	1,021.75R	09/02/43	T	S/D
8S.16W.2.441	Collins Park	--	600R	5	7,492	Td	599E	12/05/79	--	--
9S.7W.6.412	--	--	--	--	6,390	Qal	29.2	05/11/78	N	N

Table 2.--Records of selected wells in the San Agustin study area--Continued

Location	Well name	Well owner	Depth of well (feet)	Casing diameter (inches)	Altitude of land surface (feet)	Geologic source	Water level: Depth below land surface (feet)	Water level: Date measured	Method of lift	Use of water
9S.7W.7.144	Allison	Raymond Greer	80R	6	6,550	Qal	20.67	05/11/78	W	S
9S.7W.8.121	--	Sullivan & Son	--	6	6,717	Qal	44.0	05/11/78	W	S
9S.7W.18.312	Bennie Mill	E. A. Meadows East	190R	6	6,720	--	62.7	04/06/79	W	--
9S.7W.34.323	RG-27649	Casper Montoya	284R	6.625	--	--	256R	02/09/77	--	--
9S.8W.1.331P	Headquarters	Raymond Greer	120R	6	6,310	Qal	48.70	05/10/78	W/K/M	S/D
9S.8W.3.213	Falco	Raymond Greer	120R	6	6,466	--	82.39	05/10/78	W	S
9S.8W.8.223E	Knisely	Raymond Greer	--	7	6,735	Td	247.36	05/10/78	W	S
9S.8W.13.123	Rattle Snake	Raymond Greer	336R	6	6,620	Td	243.22	05/11/78	W	S
9S.8W.15.224	Windy Gap	Raymond Greer	336R	6	6,620	Td	182.95	05/11/78	W/G	S
9S.8W.16.143	Silver	Raymond Greer	120R	7	6,594	Qal	100.93	05/10/78	W	S
9S.8W.19.221	Lightening	Raymond Greer	300R	6	6,727	Td	234.56	05/10/78	W	S
9S.8W.24.221	McReedy	E. A. Meadows East	--	6	6,797	Qal	61.0	04/06/79	W	--
9S.8W.26.241	--	E. A. Meadows East	450R	6	7,052	--	245E	--	K/M	--
9S.8W.28.121	Folsby	Dr. B. Sage	125R	6	6,647	--	132.62	03/29/79	W	S
9S.8W.30.333	Midway	Dr. B. Sage	460R	6	6,832	--	307.64	03/29/79	W	S
9S.8W.34.112	Iron Mountain	Dr. B. Sage	250-300R	6	6,997	--	--	--	W	--
9S.8W.35.431	--	E. A. Meadows/U.S. Bureau of Land Management	--	6	7,350	--	124.6	04/06/79	G/J	--
9S.9W.4.244	White Saddle	W. Johnson	300R	6.75	7,436	--	126.89	05/03/78	W	S
9S.9W.11.122	H over H	W. Johnson	100R	6.5	7,210	--	47.44	05/03/78	W	S
9S.9W.13.313	Uncle Sam	Raymond Greer	100R	6	6,905	Qal	7.14	05/10/78	W	S
9S.9W.25.111	Antelope	Dr. B. Sage	300R	--	6,982	Td	465E	--	W	--
9S.9W.35.211	Evan	Dr. B. Sage	100R	6	6,980	Qal	21.70	04/05/79	W	S
9S.11W.13.131	Little Mill	Adobe Ranch	230R	--	7,238	--	211R/E	10/27/77	--	--
9S.11W.14.341	Corduray	Adobe Ranch	--	--	7,230	--	115R/E	10/27/77	--	--
9S.11W.15.?00	Sand	Adobe Ranch	--	--	--	--	72R/E	--	--	--
9S.11W.21.341P	Lower Adams	Adobe Ranch	--	--	--	Td	390R	--	--	--
9S.11W.21.?00	Upper Adams	Adobe Ranch	--	--	--	Td	400R/E	--	--	--
9S.12W.7.444	Mule Canyon	Adobe Ranch	--	--	7,180	--	345R/E	--	--	--
9S.12W.15.233	Bear Canyon	Adobe Ranch	--	--	7,280	--	680R/E	--	--	--
9S.12W.23.000	Kennedy	Adobe Ranch	576R	--	--	--	500R/E	--	--	--
9S.12W.31.232	--	Tom Orasman	150R	4	6,980	Qal	146R	01/15/80	W/M	--
9S.12W.32.122	Bear Canyon	Slash Ranch	400R	5	7,013	--	360R	12/17/79	--	--
9S.13W.1.441a	Shipping Pen	Slash Ranch	320R	--	7,002	--	280R	--	--	S
9S.13W.1.441b	New Shipping Pens	Slash Ranch	408R	6	7,001	Td	335.04	12/17/79	K/M	--
9S.13W.20.324	Crutchfield	Slash Ranch	701R	--	7,122	Td	620R	12/05/79	K/M	S/D

Table 2.--Records of selected wells in the San Agustin study area--Concluded

Location	Well name	Well owner	Depth of well (feet)	Casing diameter (inches)	Altitude of land surface (feet)	Geologic source	Water level: Depth below land surface (feet)	Water level: Date measured	Method of lift	Use of water
9S.13W.21.221	Acker	Slash Ranch	475R	6	6,962	Td	435.4	12/17/79	N	N
9S.13W.23.212	Post Office	Slash Ranch	429R	6	6,915	Td	373.31	12/05/79	--	--
9S.13W.26.412	Black Spring	Slash Ranch	140R	--	6,887	--	--	--	W	--
9S.14W.9.124	--	Jim Blair	1,000R	5	7,295	Td	960R	01/15/80	O	D
10S.8W.3.134	RG-33161	Double Arrow	700R	--	--	--	--	12/30/79	--	--
10S.8W.9.132	Bureau of Land Management	E. A. Meadows East	439R	7	6,842	Td	357	04/04/79	K/M	S
10S.8W.13.123	--	E. A. Meadows East	--	4	7,521	Qal	11.6	04/06/79	W	--
10S.8W.14.312	RG-21210	Double Arrow	560R	6.625	--	--	--	09/06/77	--	--
10S.8W.18.432	Buster	Dr. B. Sage	100R	6	6,580	Qal	48.1	04/04/79	W	--
10S.8w.20.113	Pee Wee	E. A. Meadows East	100R	--	6,553	Qal	58.58	04/04/79	W	S
10S.8W.20.313	Blue	E. A. Meadows East	100R	6	6,518	Qal	58.43	04/04/79	J/M	--
10S.8W.21.224	--	E. A. Meadows East	424R	6	6,915	Qal	337.46	04/06/79	J/G	--
10S.8W.27.232	RG-28235	Jay W. Cox	299R	6.625	--	--	--	04/25/77	--	--
10S.9W.5.113	RG-33561 Exploration	William I. Buhler	138R	6.625	--	--	6R	12/01/79	--	--
10S.9W.5.132a	RG-25173-S-3	Buhler & Lanford	80R	6.625	--	--	5R	07/31/76	--	--
10S.9W.5.141a	RG-33478 Exploration	Buhler & Landford	68R	6.625	--	--	6R	11/14/79	--	--
10S.9W.5.141b	RG-25173-S-4	William I. Buhler	32R	8.625	--	--	9R	07/14/77	--	--
10S.9W.5.141c	RG-25173-S-4 Exploration-1	William I. Buhler	60R	6.625	--	--	8R	07/18/77	--	--
10S.9W.5.220a	RG-25173-S-2	Buhler & Lanford	80R	6.625	--	--	--	07/15/76	--	--
10S.9W.5.220b	RG-25173-S	Buhler & Lanford	150R	5.625	--	--	12R	07/15/76	--	--
10S.9W.6.223	RG-33052	U.S. Forest Service	50R	6	7,000	--	10R	--	--	--
10S.9W.6.330	RG-33416	Sterling Carter	40R	6R	--	--	20R	10/09/79	W	S
10S.9W.12.143	Irrigation	Dr. B. Sage	125R	12R	6,715	Qal	16.44	04/05/79	K/M	I
10S.9W.17.320	RG-33418	Sterling Carter	60R	6R	--	--	50R	10/09/79	W	S
10S.9W.18.000	RG-33410	Sterling Carter	80R	6R	--	--	40R	10/09/79	W	S
10S.9W.23.420	RG-33414	Sterling Carter	80R	6R	--	--	80R	10/09/79	W	S
10S.9W.26.420	RG-33419	Sterling Carter	40R	6R	--	--	30R	10/09/79	W	S
10S.9W.30.420	RG-33408	Sterling Carter	40R	6FR	--	--	30R	10/09/79	W	S
10S.10W.11.220	RG-33415	Sterling Carter	20R	6R	--	--	5R	10/09/79	W	--
10S.12W.6.332	Lake	Slash Ranch	--	--	6,842	Qal	15R	12/17/79	W	--
10S.12W.18.114	Headquarters New	Slash Ranch	--	--	6,797	Qal	15.01	12/17/79	K/M	D
10S.13W.4.221	Birthday	Slash Ranch	500R	--	7,441	Td	430R	12/17/79	--	--
10S.13W.10.244	Hughton	Slash Ranch	40R	--	6,992	Qal	17.42	01/15/80	W	--
10S.14W.29.413	Indian Spring	Slash Ranch	650R	--	7,680	Td	590R	12/17/79	W	S
11S.9W.1.140	RG-33409	Sterling Carter	30R	6R	--	--	20R	10/09/79	W	S

Table 3.--Records of selected springs in the San Agustin study area

[F, interpolated; P, projected; Qal, Quaternary alluvium; Td, Tertiary Datil Group; --, no data]

Location	Spring name	Spring owner	Altitude of land surface (feet)	Geologic source	Estimated yield (gallons per minute)	Date observed
1N.2W.8.123	--	--	5,240F	--	--	--
1N.2W.26.211	Tortola	--	5,480F	--	--	--
1N.4W.5.142	Fall	--	6,360F	--	--	--
1N.4W.6.314	Red Rock	--	6,680F	--	--	--
1N.4W.6.344	--	--	6,780F	--	--	--
1N.4W.7.321	Cottonwood	--	6,940F	--	--	--
1N.4W.7.344	--	--	7,040F	--	--	--
1N.4W.8.444	Tub	--	6,220F	--	--	--
1N.4W.20.321	Balata	--	7,040	--	--	--
1N.4W.29.114	Cedar	--	7,000	--	--	--
1N.5W.8.441	Abbe	--	6,680F	--	--	--
1N.5W.12.434	Little Bear	--	7,240	--	--	--
1N.5W.13.114	Lumber House #2	--	7,140F	--	--	--
1N.5W.13.234	Lumber House #1	--	7,360F	--	--	--
1N.5W.23.121	Scott	--	7,080	--	--	--
1N.5W.9.112	Bird	--	6,600	--	--	--
1N.6W.2.312	Montoya	--	6,520F	--	--	--
1N.6W.3.424	Spring	--	6,540F	--	--	--
1N.6W.10.421	Spring	--	6,660F	--	--	--
1N.6W.13.223	Spring	--	6,620F	--	--	--

Table 3.--Records of selected springs in the San Agustin study area--Continued

Location	Spring name	Spring owner	Altitude of land surface (feet)	Geologic source	Estimated yield (gallons per minute)	Date observed
1N.6W.14.334	Reid	--	6,820	--	--	--
1N.6W.22.421	Burro	--	6,840F	--	--	--
1N.6W.24.334	Spring	--	6,800	--	--	--
1N.6W.26.314	Spring	--	6,940F	--	--	--
1N.6W.26.322	Spring	--	6,900	--	--	--
1N.6W.27.442	Dove	--	6,960F	--	--	--
1N.9W.30.341P	Hidden	Choate/U.S. Forest Service	8,110F	Td	0.5	06/18/80
1N.10W.21.431P	Gooseberry Canyon	Choate/U.S. Forest Service	8,755F	Td	0.07	06/24/80
1N.10W.23.311	Skeleton	Choate/U.S. Forest Service	8,420F	Td	--	06/24/80
1N.10W.26.442P	Blue	Choate	8,078F	--	5	06/18/80
1N.10W.30.411P	Davenport	Choate/U.S. Forest Service	8,347F	Td	0.33	05/07/80
1N.15W.10.232	Rito	--	7,020F	--	--	--
1N.15W.15.441	San Ignacio	--	7,040F	--	--	--
1N.15W.26.144	Nutria	--	7,100	--	--	--
1N.16W.35.412	Tanque de Caballo	--	7,400	--	--	--
2N.2W.17.332	--	--	6,320F	--	--	--
2N.2W.20.124	--	--	6,200	--	--	--
2N.4W.7.142	Lopez	--	5,705F	--	--	--
2N.4W.9.143	Riley	--	5,600	--	--	--
2N.4W.29.343	Cement Trough	--	5,960F	--	--	--

Table 3.--Records of selected springs in the San Agustin study area--Continued

Location	Spring name	Spring owner	Altitude of land surface (feet)	Geologic source	Estimated yield (gallons per minute)	Date observed
2N.4W.31.132	Bluff	--	6,260F	--	--	--
2N.5W.2.332	El Chupadero	--	5,800	--	--	--
2N.5W.11.142	Spring	--	5,815F	--	--	--
2N.5W.12.314	Barranco	--	5,815F	--	--	--
2N.5W.13.114	La Rosa	--	5,885F	--	--	--
2N.5W.15.231	La Jara	--	5,920F	--	--	--
2N.5W.21.324	Rafael	--	6,210F	--	--	--
2N.5W.22.122	Hijadero	--	6,000	--	--	--
2N.5W.23.344	Palo Blanco	--	6,160F	--	--	--
2N.5W.27.244	Carrizozo	--	6,260F	--	--	--
2N.5W.28.342	Cottonwood	--	6,400	--	--	--
2N.5W.34.234	Barrel	--	6,400	--	--	--
2N.6W.15.144	Richard	--	6,100	--	--	--
2N.6W.17.424	Alamo	--	6,200	--	--	--
2N.6W.25.244	--	--	6,370F	--	--	--
2N.6W.26.241	--	--	6,210F	--	--	--
2N.6W.36.231	--	--	6,300F	--	--	--
2N.15W.5.213	Mariano	--	7,193	--	--	--
2N.16W.13.143	Cole	--	7,250F	--	--	--
2N.16W.23.414	Baca	--	7,300	--	--	--
2N.17W.20.421	--	--	6,900	--	--	--
3N.14W.9.324	Techado	--	7,440F	--	--	--
3N.15W.22.111	Cottonwood	--	7,300	--	--	--
3N.15W.36.431	Pine Canyon	--	7,710F	--	--	--
1S.4W.9.431	Bear	--	6,450F	--	--	--

Table 3.--Records of selected springs in the San Agustin study area--Continued

Location	Spring name	Spring owner	Altitude of land surface (feet)	Geologic source	Estimated yield (gallons per minute)	Date observed
1S.4W.18.131	Threemile	--	6,870F	--	--	--
1S.6W.23.414	McGee	--	7,320	--	--	--
1S.6W.26.313	Gallinas	--	7,420F	--	--	--
1S.9W.6.223	Chavez	Choate	8,012F	--	0.25	05/09/80
1S.10W.14.213	Norman	Choate	7,650F	--	--	06/25/80
1S.10W.18.424	--	Choate/U.S. Forest Service	7,770F	--	4	06/26/80
1S.10W.20.121	--	--	--	--	--	11/18/80
1S.10W.20.213	Thompson	Cleaveland	7,810F	Td	--	05/07/80
1S.10W.22.124	Drag A	Choate	7,620F	Qal	--	05/08/80
1S.11W.1.133	--	--	--	--	--	--
1S.11W.27.421	Road Spring/U.S. Geological Survey	U.S. Forest Service/ Gallaher	7,895F	Td	0.1	12/05/79
1S.15W.17.231	--	--	7,540F	--	--	--
1S.15W.18.441P	--	--	7,640F	--	--	--
1S.15W.19.241	--	--	7,800	--	--	--
2S.3W.30.344	Oak	--	7,850F	--	--	--
2S.11W.14.213	--	--	--	--	--	--
2S.13W.15.234	Allison Spring	E. McMasters	--	--	--	--
2S.13W.22.113	Sawmill Spring	E. McMasters	7,895F	Td	--	11/05/79
2S.13W.28.122	Oak Springs	E. McMasters	7,805F	Td	1.25	10/31/79
2S.16W.2.312	--	--	7,920F	--	--	--

Table 3.--Records of selected springs in the San Agustin study area--Continued

Location	Spring name	Spring owner	Altitude of land surface (feet)	Geologic source	Estimated yield (gallons per minute)	Date observed
2S.20W.7.431	Cow	--	7,600	--	--	--
3S.12W.27.422	--	E. McMasters	--	--	50 Reported	06/15/80
3S.12W.29.141	Headquarter Spr.	T. P. Ranch	--	Td	1	11/07/79
3S.12W.30.223	Lower Sherman	T. P. Ranch	--	Td	1.5	11/28/79
3S.12W.30.241	Upper Sherman	T. P. Ranch	--	Td	1	11/28/79
4S.7W.32.114	Old Morris Place	U.S. Government	7,777F	--	--	05/07/80
4S.7W.36.444	--	--	8,220F	--	--	02/24/81
4S.13W.6.124	--	U.S. Forest Service	7,620	--	--	04/26/79
4S.13W.6.222	Stream	U.S. Forest Service	--	--	674	04/26/79
5S.7W.12.413P	East Bear Trap Cpg	--	8,540F	--	--	02/24/81
5S.7W.13.111P	--	--	8,430F	--	--	02/24/81
5S.10W.27.223	Luera	--	7,580	--	--	12/--/80
5S.13W.7.244	--	Farr Cattle Company	6,838F	--	2	11/29/78
5S.14W.9.412	--	--	--	--	--	--
5S.16W.3.143	--	--	--	--	2.5	11/29/78
7S.12W.15.434	--	--	7,885F	--	--	--
8S.7W.31.233	--	--	--	--	--	07/02/80
8S.7W.31.241	Ojo Caliente	--	--	--	--	12/13/78
8S.8W.35.222	--	Sullivan & Son	6,260F	--	0.5	04/18/79
8S.8W.35.222	--	Chas Sullivan	6,260F	--	0.5	04/18/79

Table 3.--Records of selected springs in the San Agustin study area--Concluded

Location	Spring name	Spring owner	Altitude of land surface (feet)	Geologic source	Estimated yield (gallons per minute)	Date observed
9S.7W.6.423	Alum	--	6,416	--	0.25	04/18/79
9S.13W.36.132	Black Spring	--	6,970F	--	--	03/03/81
9S.14W.15.234	--	--	7,280F	--	--	--
9S.14W.24.121	--	--	7,190F	--	--	--
10S.8W.3.424	Piñon Spring	--	7,520F	--	--	02/26/81
10S.11W.32.133	--	--	7,080F	--	--	--
10S.12W.7.333	Main Spring	Slash Ranch	6,800F	--	--	01/15/80
10S.12W.7.333	Slash Ranch Spring	Slash Ranch	6,800F	--	--	03/03/81
10S.12W.7.333	--	--	6,800F	--	--	--
10S.12W.10.442	--	--	6,985	--	--	03/03/81
10S.14W.32.134	Little Turkey	--	8,200F	--	--	03/02/81
11S.12W.2.413	--	--	6,680F	--	--	--
11S.12W.2.432	--	--	6,680F	--	--	--
11S.12W.5.321	--	--	6,470	--	--	--
11S.12W.5.421	--	--	6,470	--	--	03/03/81
11S.12W.10.222	--	--	6,440F	--	--	--
11S.12W.34.434	--	--	6,440F	--	--	--
11S.14W.5.342	West	Double Spring	7,315F	--	--	03/02/81
11S.14W.5.413	East Spring	Double Spring	7,365F	--	--	03/02/81

Table 4.--On-site specific-conductance and temperature measurements of water from selected wells and springs in the San Agustin study area

[gal/min, gallons per minute; --, no data; <, less than]

Location	Specific conductance (microsiemens per centimeter at 25 degrees Celsius)	Temperature (degrees Celsius)	Discharge of well or spring and remarks
1N.8W.19.144	290	18.5	1.5 gal/min
1N.8W.28.232	280	16.0	3 gal/min
1N.9W.27.113	210	17.0	1 gal/min
1N.9W.30.341	480, 490	--	<1.0 gal/min, springs
1N.9W.31.322	400	17.0	
1N.10W.21.431	210	17.0	0.7 gal/min
1N.10W.23.311	560	17.0	Spring
1N.10W.26.442	460	17.0	5 gal/min, spring
1N.10W.26.444	470	15.0	
1N.10W.30.411	200	--	0.33 gal/min, spring
1N.11W.25.312	380	11.5	2 gal/min
1N.12W.13.131	400	--	Tank sample
1N.16W.3.214	1,040	24.0	
1S.8W.2.241	520	20.5	
1S.8W.6.123	280	--	Water in recently filled storage tank
1S.8W.10.341	470	17.0	
1S.8W.21.111	240	17.5	
1S.9W.6.223	190	--	<0.25 gal/min, sample from box top
1S.9W.13.343	205	20.0	0.5 gal/min
1S.9W.28.214	230	--	Water from tap in house
1S.10W.3.434	500	13.0	
1S.10W.6.412	250	--	Tank sample
1S.10W.14.213	580	17.0	Spring
1S.10W.16.143	300	--	Tank sample
1S.10W.18.424	580	12.5	Spring
1S.10W.20.121	515	9.5	Spring
1S.10W.20.142	320	12.0	
1S.10W.20.213	280	--	Water from tap in house
1S.10W.29.241	450	13.5	
1S.10W.33.211	950	14.0	
1S.10W.34.433	730, 680	13.0, 12.5	1.5 to 2 gal/min
1S.11W.1.321	695	13.0	
1S.11W.8.232	640	14.0	

Table 4.--On-site specific-conductance and temperature measurements of water from selected wells and springs in the San Agustin study area--Continued

Location	Specific conductance (microsiemens per centimeter at 25 degrees Celsius)	Temperature (degrees Celsius)	Discharge of well or spring and remarks
1S.11W.20.324	750	8.5	2 gal/min
1S.11W.22.144	750	11.5	1 gal/min
1S.11W.27.421	490	--	0.13 gal/min, spring
1S.11W.33.231a	875	12.0	2.5 gal/min
1S.12W.25.413	1,100	14.5	
2S.4W.26.342	580	18.0	
2S.4W.26.344	600	18.0	
2S.5W.20.444	460	17.0	2.5 gal/min
2S.5W.32.113	420	18.0	1 gal/min
2S.6W.20.441a	400	--	Tank sample
2S.6W.23.243	470	15.5	<1 gal/min
2S.7W.11.431	280	--	Water in recently filled storage tank
2S.7W.12.444	450	--	Slow turnover
2S.7W.17.133	320	--	Water in recently filled storage tank
2S.7W.27.444	430	36.0	<3 gal/min
2S.7W.30.242	370	--	Earth tank sample
2S.7W.34.442	410	17.5	3 gal/min
2S.8W.4.321	230	16.5	
2S.8W.7.344	150	--	Trough sample, well unused
2S.8W.21.413	220	18.5	Pressure tank valve sample
2S.9W.15.111	290	--	Tank sample
2S.9W.22.321	300	20.0	5 gal/min
2S.9W.22.443	320	15.0	Temperature is approximate
2S.9W.24.224a	240	15.5	
2S.9W.31.124	330	--	Stock tank sample
2S.9W.33.122	340	18.5	0.75 gal/min
2S.10W.8.311	540	18.5	
2S.10W.29.123	330	--	No temperature, pumping too slow
2S.10W.29.212	370	--	Full tank sample
2S.10W.31.313	320	28.0	No confidence in temperature
2S.10W.34.144	420	16.5	
2S.11W.6.212	875	9.5	

Table 4.--On-site specific-conductance and temperature measurements of water from selected wells and springs in the San Agustin study area--Continued

Location	Specific conductance (microsiemens per centimeter at 25 degrees Celsius)	Temperature (degrees Celsius)	Discharge of well or spring and remarks
2S.11W.29.244	290	--	Tank sample
2S.12W.26.411	460	--	No temperature, not pumping enough
2S.12W.29.433	510	20.5	
2S.12W.31.323	460	--	Tank sample
2S.12W.32.421	820	15.0	
2S.13W.22.113	210	9.5	Spring
2S.13W.24.331	380	13.0	2.5 gal/min
2S.13W.25.242	600	17.0	2 gal/min
2S.13W.25.311	540	17.0	
2S.13W.27.213a	500	13.5	1.25 gal/min
2S.13W.28.122	270	11.0	1.25 gal/min, spring
2S.13W.32.413	320	--	Tank sample
2S.13W.35.311	450	14.5	1 gal/min
3S.6W.2.113b	780	--	House sample
3S.6W.5.122	240	--	Fresh tank sample
3S.6W.11.231	680	--	Tank sample
3S.6W.11.241	725	21.0	
3S.6W.36.312	310	--	Tank sample
3S.7W.1.222	240	--	Water in recently filled storage tank
3S.7W.8.231	272	20.0	Fresh tank sample
3S.7W.12.423	210	--	Tank sample
3S.7W.16.433	330	15.0	
3S.8W.1.310	310	20.0	
3S.8W.5.222	240	20.0	
3S.8W.9.231	290	--	Tank sample
3S.8W.14.323	300	16.0	5 gal/min
3S.8W.20.211	250	16.5	House sample
3S.8W.31.111	240	16.0	4 gal/min
3S.8W.36.222	360	--	Tank sample
3S.9W.1.212	260	--	
3S.9W.4.434	310	21.0	5 gal/min
3S.9W.7.442	420	18.0	3 gal/min
3S.9W.11.221	260	--	
3S.9W.19.412	235	18.0	2.2 gal/min

Table 4.--On-site specific-conductance and temperature measurements of water from selected wells and springs in the San Agustin study area--Continued

Location	Specific conductance (microsiemens per centimeter at 25 degrees Celsius)	Temperature (degrees Celsius)	Discharge of well or spring and remarks
3S.9W.21.221	310	18.0	
3S.9W.28.243	240	26.0	
3S.10W.5.214	360	18.5	
3S.10W.7.312	390	--	Pressure tank sample
3S.10W.19.222	230	--	Tank sample
3S.10W.22.444	220	18.0	No confidence in temperature
3S.10W.28.224	220	--	Tank sample
3S.11W.8.331	380	--	Tank sample
3S.11W.12.242	440	18.0	
3S.11W.19.231	4,200	17.5	
3S.11W.29.324	380	21.0	Slow pumping
3S.11W.30.333	440	14.0	No confidence in temperature
3S.12W.1.242	450	--	Tank sample
3S.12W.10.433a	850	13.0	10 gal/min
3S.12W.10.433b	850	13.0	2.5 gal/min
3S.12W.11.322	900	15.0	
3S.12W.23.121	600	16.5	
3S.12W.25.211a	975	13.0	
3S.12W.25.211b	975	13.0	
3S.12W.27.422	290	17.5	Spring
3S.12W.28.111	320	--	Tank sample
3S.12W.29.141	240	11.0	<1 gal/min, spring
3S.12W.30.223	290	11	1.5 gal/min, spring
3S.12W.30.241	300	9.5	1 gal/min, spring
3S.13W.10.233	580	14.5	
3S.13W.26.111	490	14.0	3 gal/min
3S.13W.27.434	520	--	Tank sample
4S.6W.10.244	680	17.5	
4S.6W.16.213	400	20.0	
4S.7W.4.331a	220	14.0	
4S.7W.21.132	140	11.5	
4S.7W.22.241	320	--	Tank sample
7W.23.131	290	--	Tank sample
4S.7W.23.131	240	17.5	
4S.7W.32.114	130	19.0	Spring

Table 4.--On-site specific-conductance and temperature measurements of water from selected wells and springs in the San Agustin study area--Continued

Location	Specific conductance (microsiemens per centimeter at 25 degrees Celsius)	Temperature (degrees Celsius)	Discharge of well or spring and remarks
4S.8W.4.331	360	17.0	2.5 gal/min
4S.8W.14.321	350	17.0	Fresh tank sample
4S.8W.25.321	170	13.0	
4S.8W.32.413	320	18.5	Slow pumping
4S.9W.6.212	310	20.0	
4S.9W.8.132	400	17.0	
4S.9W.12.133	460	18.0	5 gal/min
4S.9W.17.311	330	32.0	
4S.10W.5.333	360	15.0	5 gal/min
4S.10W.20.434	400	--	Tank sample
4S.10W.32.333	430	--	Tank sample
4S.11W.23.121	350	--	Tank sample
4S.12W.3.212	300	--	Tank sample
4S.12W.29.122	360	19.0	
4S.12W.30.421	450	--	Pressure tank sample
4S.13W.6.124	220	17.0	Spring
4S.13W.30.144	300	17.0	
4S.13W.30.444b	530	--	House sample
4S.13W.33.242	570	17.0	
4S.14W.34.212	408	19.0	
5S.9W.24.441	310	20.0	
5S.10W.9.232	660	17.0	
5S.10W.27.223	393	--	Spring
5S.11W.1.311	700	--	
5S.11W.22.212	860	--	Slow pumping, no temperature
5S.12W.4.134	330	17.0	
5S.12W.9.444	420	16.0	
5S.12W.34.434a	460	15.0	
5S.13W.4.241	480	16.0	
5S.13W.5.131	470	--	Not pumping
5S.13W.7.244	420	18.5	1 gal/min, spring
5S.13W.9.244	610	14.0	
5S.13W.14.122	320	--	Tank sample
5S.13W.14.322	360	--	
5S.13W.20.123	3,300	18.5	Dipped sample

Table 4.--On-site specific-conductance and temperature measurements of water from selected wells and springs in the San Agustin study area--Continued

Location	Specific conductance (microsiemens per centimeter at 25 degrees Celsius)	Temperature (degrees Celsius)	Discharge of well or spring and remarks
5S.13W.22.112	2,000	14.5	
5S.13W.24.333	410	18.0	
5S.13W.27.422	1,620	15.0	
5S.13W.32.322	41,200	4.5	Dipped sample (rusty color)
5S.14W.5.133	470	--	Tank sample
5S.14W.9.412	250	19.0	Spring
5S.16W.3.143	240	20.0	Spring
6S.8W.8.432	2,100	35.0	
6S.11W.27.114	280	20.0	
6S.12W.9.114	470	--	
6S.13W.11.243	800	19.0	
6S.13W.11.244	550	15.0	
6S.13W.20.122	1,200	20.0	
6S.14W.7.334	330	15.0	
6S.14W.8.333	1,180	21.0	
6S.14W.21.433	380	19.0	
6S.14W.26.234	900	--	Fresh tank sample
6S.14W.28.332a	280	--	Tank sample
6S.15W.1.431	280	--	House sample
6S.15W.20.211b	200	10.0	
7S.8W.4.344a	250	16.0	
7S.8W.28.141	200	--	
7S.9W.25.144	310	28.0	
7S.12W.3.424	280	26.0	
7S.14W.3.143	420	--	Tank sample
7S.14W.5.322	280	20.0	Fresh sample
7S.14W.11.231	360	--	Tank sample
7S.14W.14.343	820	--	Fresh tank sample
7S.14W.16.133	180	15.0	
7S.14W.17.244	180	15.0	
7S.15W.34.213	220	18.0	
8S.7W.30.313	310	17.0	3 gal/min
8S.7W.31.223	825	27.0	Spring
8S.7W.31.241	870	27.5	Spring

Table 4.--On-site specific-conductance and temperature measurements of water from selected wells and springs in the San Agustin study area--Concluded

Location	Specific conductance (microsiemens per centimeter at 25 degrees Celsius)	Temperature (degrees Celsius)	Discharge of well or spring and remarks
8S.8W.10.341a	450	14.0	1 to 2 gal/min
8S.8W.13.442	340	--	Tank sample
8S.8W.35.222	450	14.5	0.5 gal/min, spring
8S.13W.16.211	210	28.0	
8S.13W.18.131	510	19.5	
9S.7W.6.423	900	16.0	Spring
9S.7W.7.144	550	19.0	
9S.7W.18.312	590	18.0	0.5 gal/min
9S.8W.1.331	410	--	
9S.8W.3.213	700	14.0	1 gal/min
9S.8W.8.223	290	17.0	
9S.8W.13.123	370	17.0	
9S.8W.15.244	340	--	
9S.8W.16.143	340	15.0	5 gal/min
9S.8W.24.221	620	--	
9S.8W.26.241	340	12.0	
9S.8W.28.121	330	14.5	1.5 gal/min
9S.8W.30.333	425	16.5	1.5 gal/min
9S.8W.34.112	410	17.0	2 gal/min
9S.9W.13.313	320	10.5	0.75 gal/min
9S.9W.35.211	700	15.0	
9S.13W.20.324	320	--	
10S.8W.9.132	220	17.5	
10S.8W.13.123	410	13.0	
10S.8W.18.432	420	14.5	1.25 gal/min
10S.8W.20.313	410	--	3 gal/min
10S.9W.12.143	480	14.5	
10S.12W.7.333	--	8.5	Spring
10S.13W.10.244	--	11.5	3 gal/min

Table 5.--Water-quality analyses for selected wells and springs in the San Agustin study area

[Concentrations in milligrams per liter; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; <, less than; --, no data]

Location	Date of sample	Specific conductance, laboratory (µS/cm)	pH, laboratory (units)	Temperature, water (°C)	Hardness (as $CaCO_3$)	Non-carbonate hardness	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)
1N.9W.27.113	05/09/80	234	7.9	17.0	71	0	26.0	1.5	21	1.1	--	--
1S.8W.2.241	07/10/79	552	8.0	20.5	180	61	49.0	13.0	48	3.7	140	--
1S.10W.34.433	08/28/80	934	7.8	13.0	360	0	91.0	32.0	64	0.5	--	--
1S.11W.33.231a	05/08/80	919	7.9	12.5	440	0	120.0	34.0	41	0.8	--	--
2S.4W.26.342	06/05/80	556	7.8	18.0	200	65	54.0	17.0	34	1.8	--	--
2S.4W.26.344	06/03/80	599	7.8	18.0	230	84	64.0	18.0	40	5.6	--	--
2S.7W.27.444	05/07/79	419	8.2	36.0	27	0	8.4	1.5	82	1.7	120	--
2S.8W.21.413	08/30/79	208	8.4	--	28	0	8.5	1.6	37	1.1	120	--
2S.9W.33.122	09/22/80	345	7.7	18.0	110	0	31.0	7.0	31	1.9	--	--
2S.10W.10.222	09/22/80	532	7.7	18.0	180	0	57.0	8.7	47	0.8	--	--
2S.13W.28.122	10/31/79	356	Deleted	11.0	83	0	20.0	8.1	49	2.0	--	--
3S.6W.11.241	05/28/80	721	7.7	21.0	290	88	79.0	22.0	38	2.3	--	--
3S.7W.8.231	05/28/80	285	8.1	20.0	50	0	15.0	3.1	41	1.4	--	--
3S.8W.1.310	08/21/79	298	8.1	20.0	74	0	21.0	5.2	38	1.2	140	0
3S.8W.21.124	08/31/79	281	6.8	16.5	--	--	--	--	--	--	--	--
3S.9W.7.442	08/30/79	395	8.0	18.0	31	0	11.0	0.8	78	0.6	140	0
3S.9W.11.212	09/26/80	188	7.9	15.0	84	0	24.0	5.9	26	1.8	--	--
3S.9W.21.221	08/30/79	313	8.1	18.0	75	0	17.0	8.0	27	1.3	--	0
3S.9W.28.243	08/02/79	240	8.3	26.0	42	0	13.0	2.4	40	0.7	140	--
3S.11W.12.242	06/27/80	457	8.0	18.0	190	36	48.0	16.0	28	2.2	--	--
3S.12W.29.141	05/01/80	308	7.9	--	110	0	32.0	7.4	20	2.2	--	--
3S.12W.30.223	05/01/80	--	--	11.5	--	--	--	--	--	--	--	--
3S.12W.30.241	11/28/79	307	Deleted	9.5	110	0	33.0	7.8	22	1.6	--	--
4S.6W.16.213	06/23/80	456	8.1	20.0	130	0	37.0	9.9	46.0	1.9	--	--
4S.9W.6.212	08/21/79	260	8.9	25.0	8	0	2.7	0.2	59.0	0.6	100	18
4S.9W.8.132	07/13/79	445	8.5	17.0	24	0	6.7	1.7	80.0	1.2	172	--
4S.9W.12.133	05/08/79	292	7.9	18.0	80	0	22.0	6.0	6.5	2.1	190	--
4S.9W.17.311	07/13/79	367	8.8	32.0	3	0	0.9	0.1	65.0	2.7	120	--
4S.10W.5.333	08/29/79	348	8.1	--	130	0	29.0	13.0	27.0	1.5	30	0
4S.12W.29.122	07/11/79	399	8.2	19.0	120	0	31.0	11.0	28.0	5.9	--	--
4S.13W.6.222	04/26/79	196	7.6	17.0	85	29	19.0	9.0	6.5	2.2	76	0
4S.14W.34.212	08/07/80	240	8.3	26.0	160	0	39.0	14.0	19.0	3.9	--	--
5S.9W.24.441	08/23/79	304	8.1	20.0	86	0	29.0	3.2	35.0	4.4	134	0
05S.10W.9.232	08/29/79	682	7.9	17.0	240	53	57.0	24.0	43.0	1.1	230	0
5S.10W.27.223	11/28/79	393	Deleted	--	140	0	41.0	10.0	19.0	1.1	--	--
5S.12W.9.444	08/30/79	412	8.1	16.0	140	0	37.0	11.0	35.0	2.2	170	0
5S.12W.34.434a	07/12/79	476	7.7	15.0	65	0	17.0	5.5	70.0	1.4	Deleted	--
5S.13W.4.241	08/30/79	470	8.1	16.0	130	0	31.0	13.0	57.0	1.0	240	0
5S.13W.9.244	08/30/79	635	6.9	14.0	11	0	3.1	0.7	150.0	0.5	294	16
5S.13W.20.123	07/05/80	3,280	8.0	18.5	--	--	--	--	--	--	--	--
5S.13W.22.112	08/30/79	1,960	8.4	14.5	38	0	7.0	5.1	410.0	2.7	280	--

Table 5.--Water-quality analyses for selected wells and springs in the San Agustin study area--Continued

Location	Date of sample	Alkalinity (total as $CaCO_3$)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Silica (SiO_2)	Dissolved solids (sum)	Nitrate (NO_2+NO_3)	Boron (B)	Iron (Fe)	Manganese (Mn)
1N.9W.27.113	05/09/80	100	5.5	5.5	0.2	32	156	0.62	0.01	0.02	0.003
1S.8W.2.241	07/10/79	--	150.0	7.8	0.7	46	391	0.90	0.08	0.01	0.001
1S.10W.34.433	08/28/80	410	53.0	26.0	0.4	34	548	0	0.08	0.11	0.13
1S.11W.33.231a	05/08/80	440	57.0	16.0	0.3	34	569	0.13	0.04	0.02	0.01
2S.4W.26.342	06/05/80	140	100.0	18.0	0.6	24	342	1.50	0.08	0.01	0.001
2S.4W.26.344	06/03/80	150	130.0	14.0	0.6	23	402	3.60	0.11	0.06	0.001
2S.7W.27.444	05/07/79	--	50.0	24.0	3.2	54	291	1.60	0.14	0.20	0
2S.8W.21.413	08/30/79	--	9.5	0.4	0.4	22	145	1.20	0.04	0.01	0
2S.9W.33.122	09/22/80	140	7.6	15.0	0.3	33	215	0.69	0.06	0.04	0.02
2S.10W.10.222	09/22/80	210	23.0	23.0	0.7	35	332	2.20	0.12	0.01	0.002
2S.13W.28.122	10/31/79	160	11.0	8.9	0.7	25	225	0.99	0.03	0.05	0.01
3S.6W.11.241	05/28/80	200	130.0	28.0	1.1	32	468	3.30	0.09	0.27	0.003
3S.7W.8.231	05/28/80	97	22.0	11.0	0.6	35	196	1.90	0.10	0.14	0.004
3S.8W.1.310	08/21/79	--	22.0	7.7	0.7	38	207	1.20	0.07	0.01	0
3S.8W.21.124	08/31/79	60	14.0	9.1	1.1	39	--	10.00	--	--	--
3S.9W.7.442	08/30/79	--	53.0	14.0	1.0	19	<250	0.52	0.18	0.67	0.01
3S.9W.11.212	09/26/80	110	28.0	8.4	0.4	24	188	0.80	0.04	0.03	0.001
3S.9W.21.221	08/30/79	100	13.0	19.0	0.5	23	185	3.70	0.05	0.06	0.01
3S.9W.28.243	08/02/79	--	14.0	8.9	0.5	28	180	0.77	0.07	0.12	0.001
3S.11W.12.242	06/27/80	150	24.0	37.0	0.8	37	298	3.30	0.08	0.08	0.05
3S.12W.29.141	05/01/80	130	5.7	8.7	0.1	55	212	0.52	0	0.02	0.003
3S.12W.30.223	05/01/80	140	--	--	--	--	--	--	--	--	--
3S.12W.30.241	11/28/79	140	11.0	15.0	0.2	60	238	0.71	0.02	0.01	0.001
4S.6W.16.213	06/23/80	190	23.0	19.0	1.3	35	297	2.20	0.06	0.01	0.003
4S.9W.6.212	08/21/79	--	14.0	19.0	1.4	48	215	0.58	0.07	0.20	0
4S.9W.8.132	07/13/79	--	37.0	27.0	0.7	33	277	2.40	--	0.01	0.003
4S.9W.12.133	05/08/79	--	27.0	15.0	2.0	33	292	4.50	0.21	0.05	0.01
4S.9W.17.311	07/13/79	--	23.0	13.0	1.4	53	222	0.90	0.001	0.05	0.001
4S.10W.5.333	08/29/79	--	14.0	18.0	0.4	32	<232	4.00	0.03	0.04	0.01
4S.12W.29.122	07/11/79	140	14.0	22.0	0.2	52	256	1.60	0.08	0	0.001
4S.13W.6.222	04/26/79	--	32.0	6.1	0.2	34	143	0	0.05	0.11	0.01
4S.14W.34.212	08/07/80	200	14.0	8.9	0.5	41	180	0.77	0.07	1.20	0.05
5S.9W.24.441	08/23/79	--	16.0	5.1	1.3	58	226	0.98	0.08	0.01	0
05S.10W.9.232	08/29/79	--	59.0	61.0	1.1	46	<418	2.70	0.09	0.03	0.002
5S.10W.27.223	11/28/79	170	12.0	19.0	0.2	34	240	0.25	0.02	0.02	0.003
5S.12W.9.444	08/30/79	--	21.0	2.6	0.4	19	135	1.60	0.05	0.06	0
5S.12W.34.434a	07/12/79	230	20.0	16.0	1.2	26	297	0.35	--	0.30	0.03
5S.13W.4.241	08/30/79	--	22.0	32.0	1.1	37	321	1.90	0.09	0.02	0.01
5S.13W.9.244	08/30/79	--	17.0	32.0	1.7	1.2	405	23.00	0.16	0.32	0.008
5S.13W.20.123	07/05/80	290	260.0	670.0	3.5	110	--	1.30	--	--	--
5S.13W.22.112	08/30/79	--	190.0	380.0	1.4	44	<1,180	0.002	1.5	0.05	0.008

Table 5.--Water-quality analyses for selected wells and springs in the San Agustin study area--Continued

Location	Date of sample	Specific conduct-ance, labor-atory (µS/cm)	pH, labor-atory (units)	Temper-ature, water (°C)	Hardness (as $CaCO_3$)	Non-car-bonate hardness	Calcium (Ca)	Magne-sium (Mg)	Sodium (Na)	Potas-sium (K)	Bicar-bonate (HCO_3)	Carbon-ate (CO_3)
5S.13W.27.422	08/30/79	<996	<9.0	15.0	2	0	0.8	0.1	370.0	1.2	340	120
5S.13W.32.322	06/13/79	41,200	6.9	--	--	--	--	--	--	--	--	--
5S.14W.9.412	08/23/79	236	8.2	19.0	83	0	19.0	8.6	15.0	1.8	130	0
5S.16W.3.143	11/29/78	235	8.0	20.0	78	0	21.0	6.3	21.0	2.7	--	--
6S.8W.8.432	08/24/79	2,150	7.9	35.0	440	350	160.0	11.0	290.0	29.0	120	0
6S.13W.11.243	08/30/79	803	8.2	19.0	130	0	39.0	8.9	130.0	3.8	--	--
6S.13W.11.244	08/30/79	563	7.7	15.0	63	0	12.0	7.9	100.0	3.0	--	--
6S.13W.20.122	08/30/79	1,240	8.0	20.0	100	0	28.0	7.8	220.0	8.4	--	--
6S.14W.7.334	08/22/79	3054	5.4	15.0	120	0	29.0	11.0	19.0	3.3	160	0
6S.14W.8.333	08/22/79	1,280	8.7	21.0	19	0	45.0	2.0	280.0	4.0	--	--
6S.14W.21.433	08/30/79	398	8.1	19.0	63	0	17.0	5.0	60.0	2.6	130	0
6S.15W.20.211b	08/22/79	192	7.6	10.0	89	35	23.0	7.6	6.7	2.0	66	0
7S.8W.4.344a	03/30/79	239	8.0	16.0	100	0	34.0	4.1	11.0	3.4	--	--
7S.8W.28.141	08/31/79	187	8.2	--	84	0	28.0	3.4	7.6	2.8	--	--
7S.9W.25.144	08/24/79	267	8.8	28.0	19	0	6.9	.5	5.6	0.5	110	4
7S.12W.3.424	07/11/79	293	8.0	26.0	96	0	34.0	2.6	23.0	1.3	180	--
7S.14W.16.133	08/22/79	199	7.5	15.0	82	39	23.0	6.0	8.4	3.3	52	0
7S.15W.34.213	08/22/79	198	8.1	18.0	66	0	23.0	2.1	20.0	0.5	110	0
8S.7W.31.233	07/02/80	867	8.0	27.0	110	1	42.0	1.5	140.0	5.7	--	--
8S.7W.31.241	12/13/78	922	7.9	27.5	110	10	40.0	1.5	140.0	5.4	--	--
8S.13W.16.211	08/23/78	191	8.5	28.0	75	0	25.0	3.0	18.0	1.2	86	6
8S.13W.18.131	08/23/79	517	8.0	19.5	160	79	53.0	7.0	40.0	1.5	100	0
9S.7W.6.423	04/18/79	945	7.9	16.0	--	--	--	--	--	--	--	--
9S.8W.3.213	04/21/79	--	7.8	14.0	--	--	--	--	--	--	--	--
9S.8W.8.223	04/11/79	314	8.0	17.0	120	1	40.0	5.2	18.0	1.5	--	--
9S.13W.20.324	01/15/80	334	Deleted	--	83	0	31.0	1.3	36.0	1.2	--	--
10S.8W.9.132	04/04/79	219	8.3	17.5	20	0	7.6	0.2	45.0	0.5	--	--
10S.9W.12.143	04/05/79	514	7.8	14.5	240	71	75.0	13.0	16.0	1.4	--	--

Table 5.--Water-quality analyses for selected wells and springs in the San Agustin study area--Concluded

Location	Date of sample	Alkalinity (total as $CaCO_3$)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Silica (SiO_2)	Dissolved solids (sum)	Nitrate (NO_2+NO_3)	Boron (B)	Iron (Fe)	Manganese (Mn)
5S.13W.27.422	08/30/79	--	140.0	150.0	6.7	38	996	0.07	0.80	0.04	0.002
5S.13W.32.322	06/13/79	25	100.0	16,000.0	--	--	--	--	--	--	--
5S.14W.9.412	08/23/79	--	7.3	4.2	0.7	40	<163	0.51	0.02	0.01	0.005
5S.16W.3.143	11/29/78	110	4.3	4.4	0.5	40	170	0.84	0.04	0	0.001
6S.8W.8.432	08/24/79	--	580.0	280.0	3.6	29	<1,440	0.02	0.19	0.18	0.20
6S.13W.11.243	08/30/79	160	96.0	81.0	3.2	51	514	0.84	0.54	0.15	0.03
6S.13W.11.244	08/30/79	130	59.0	32.0	3.4	21	345	6.3	0.55	0.05	0.02
6S.13W.20.122	08/30/79	210	150.0	160.0	2.9	45	757	1.8	0.30	0.25	0.02
6S.14W.7.334	08/22/79	--	11.0	7.7	0.5	39	<206	1.4	0.02	0.02	0.003
6S.14W.8.333	08/22/79	460	3.2	120.0	1.1	36	757	0.04	0.28	0.34	0.02
6S.14W.21.433	08/30/79	--	13.0	50.0	0.8	31	245	0.35	0.05	0.02	0
6S.15W.20.211b	08/22/79	--	34.0	2.3	0.5	35	<145	0.1	0.03	0.38	0.05
7S.8W.4.344a	03/30/79	110	5.5	4.0	0.2	49	180	0.48	0.03	0.01	0
7S.8W.28.141	08/31/79	75	11.0	3.0	0.2	40	145	0.84	0.03	0.08	0
7S.9W.25.144	08/24/79	--	18.0	4.8	3.8	34	186	0.62	0.06	0.04	0
7S.12W.3.424	07/11/79	--	10.0	4.8	2.4	44	212	0.29	--	0.04	0.002
7S.14W.16.133	08/22/79	--	45.0	4.2	0.2	33	<153	0.59	0.03	0.01	0
7S.15W.34.213	08/22/79	--	6.9	3.6	3.3	43	159	0.31	0.03	0.67	0
8S.7W.31.233	07/02/80	110	94.0	140.0	1.5	40	533	0.35	0.10	0.01	<0.001
8S.7W.31.241	12/13/78	96	100.0	150.0	2.9	38	537	0.24	0.09	<0	<0.001
8S.13W.16.211	08/23/78	--	7.9	4.5	1.7	43	<157	0.95	0.03	0.08	0
8S.13W.18.131	08/23/79	--	23.0	86.0	2.1	39	304	0.53	0.06	0.02	0
9S.7W.6.423	04/18/79	--	270.0	9.2	1.2	26	--	--	--	--	--
9S.8W.3.213	04/21/79	--	39.0	130.0	--	--	--	--	--	--	--
9S.8W.8.223	04/11/79	120	19.0	5.5	0.2	29	199	1.8	0.60	0.04	0.002
9S.13W.20.324	01/15/80	110	52.0	12.0	3.8	46	253	0.74	--	--	--
10S.8W.9.132	04/04/79	92	6.6	3.6	0.7	26	152	1.4	0.11	0.01	0.002
10S.9W.12.143	04/05/79	170	80.0	7.1	0.2	29	326	0.38	0.03	0.03	0.006

Table 6.--Trace elements in water from selected wells and springs in the San Agustin study area

[Concentrations in micrograms per liter; <, less than; -- no data]

Location	Date	Arsenic (As)	Barium (Ba)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Selenium (Se)	Silver (Ag)	Zinc (Zn)
1N.9W.27.113	05/09/80	3	10	<1	0	5	0	0	1	0	260
1S.8W.2.241	07/10/79	3	--	2	10	<10	<10	--	--	--	<3
1S.10W.34.433	08/28/80	2	60	<1	0	0	0	0	0	0	80
1S.11W.33.231a	05/08/80	3	100	<1	0	17	0	0	1	0	110
2S.4W.26.342	06/05/80	1	50	<1	0	0	3	0	2	0	1,600
2S.4W.26.344	06/03/80	0	30	1	0	3	3	0.2	2	0	200
2S.7W.27.444	05/07/79	8	--	0	0	0	0	0.1	--	--	30
2S.8W.21.413	08/30/79	4	--	0	20	0	0	0.1	--	--	9
2S.9W.33.122	09/22/80	2	6	<1	0	14	1	0	0	0	840
2S.10W.10.222	09/22/80	8	20	<1	0	4	0	0	1	0	480
2S.13W.28.122	10/31/79	2	--	<1	10	<10	<10	0	--	--	9
3S.6W.11.241	05/28/80	3	50	2	0	7	0	0.2	5	0	590
3S.7W.8.231	05/28/80	4	10	<1	30	11	0	0.1	3	0	60
3S.8W.1.310	08/21/79	4	--	0	10	0	0	0	--	--	40
3S.8W.21.124	08/31/79	--	--	--	--	--	--	--	--	--	--
3S.9W.7.442	08/30/79	4	--	0	0	0	0	1.2	--	--	680
3S.9W.11.212	09/26/80	2	9	<1	20	6	2	0	1	0	70
3S.9W.21.221	08/30/79	3	--	0	10	0	0	2.4	--	--	40
3S.9W.28.243	08/02/79	3	--	<1	10	<10	20	0.2	--	--	40
3S.11W.12.242	06/27/80	3	10	2	0	40	31	0.4	1	0	310
3S.12W.29.141	05/01/80	1	20	<1	0	3	0	0.2	1	0	270
3S.12W.30.223	05/01/80	1	20	1	0	2	0	0.2	1	0	<3
3S.12W.30.241	11/28/79	1	--	<1	0	<10	69	0	--	--	8
4S.6W.16.213	06/23/80	4	9	<1	0	5	2	0	2	0	90
4S.9W.6.212	08/21/79	8	--	0	20	0	0	0.1	--	--	20

Table 6.--Trace elements in water from selected wells and springs in the San Agustin study area--Continued

Location	Date	Arsenic (As)	Barium (Ba)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Selenium (Se)	Silver (Ag)	Zinc (Zn)
4S.9W.8.132	07/13/79	7	--	<1	20	<10	<10	0.2	--	--	--
4S.9W.12.133	05/08/79	3	--	0	0	0	0	0	--	--	290
4S.9W.17.311	07/13/79	8	--	<1	10	<10	<10	0.1	--	--	<3
4S.10W.5.333	08/29/79	2	--	0	20	0	0	1.3	--	--	--
4S.12W.29.122	07/11/79	2	--	<1	10	<10	<10	0.1	--	--	30
4S.13W.6.222	04/26/79	0	--	0	20	0	0	--	--	--	--
4S.14W.34.212	08/07/80	1	10	5	10	28	16	0.1	0	0	3,700
5S.9W.24.441	08/23/79	3	--	0	0	0	0	0.1	--	--	40
5S.10W.9.232	08/29/79	2	--	<1	0	11	<10	0.1	--	--	80
5S.10W.27.223	11/28/79	--	--	--	--	--	--	--	--	--	6
5S.12W.9.444	08/30/79	2	--	0	10	0	0	1.8	--	--	60
5S.12W.34.434a	07/12/79	4	--	2	0	<10	<10	0	--	--	--
5S.13W.4.241	08/30/79	5	--	0	20	0	0	2.4	--	--	--
5S.13W.9.244	08/30/79	--	--	--	--	--	--	--	--	--	--
5S.13W.20.123	07/05/80	--	--	--	--	--	--	--	--	--	--
5S.13W.22.112	08/30/79	5	--	<1	0	<10	<10	3.0	--	--	20
5S.13W.27.422	08/30/79	16	--	<1	0	<10	<10	2.0	--	--	30
5S.13W.32.322	06/13/79	--	--	--	--	--	--	--	--	--	--
5S.14W.9.412	08/23/79	1	--	<1	0	<10	<10	0	--	--	4
5S.16W.3.143	11/29/78	2	10	8	11	2	32	0	1	0	4
6S.8W.8.432	08/24/79	15	--	0	10	0	0	2.2	--	--	750
6S.13W.11.243	08/30/79	--	--	--	--	--	--	--	--	--	--
6S.13W.11.244	08/30/79	--	--	--	--	--	--	--	--	--	--
6S.13W.20.122	08/30/79	--	--	--	--	--	--	--	--	--	--
6S.14W.7.334	08/22/79	1	--	3	10	<10	<10	0	2	--	70

Table 6.--Trace elements in water from selected wells and springs in the San Agustin study area--Concluded

Location	Date	Arsenic (As)	Barium (Ba)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Selenium (Se)	Silver (Ag)	Zinc (Zn)
6S.14W.8.333	08/22/79	--	--	--	--	--	--	--	--	--	--
6S.14W.21.433	08/30/79	1	--	0	10	0	0	3.2	--	--	130
6S.15W.20.211b	08/22/79	1	--	0	0	0	0	2.3	--	--	40
7S.8W.4.344a	03/30/79	1	--	0	0	0	0	0.1	--	--	50
7S.8W.28.141	08/31/79	1	--	0	0	0	0	1.7	--	--	70
7S.9W.25.144	08/24/79	4	--	0	0	0	0	2.6	--	--	10
7S.12W.3.424	07/11/79	1	--	3	0	<10	<10	0	--	--	--
7S.14W.16.133	08/22/79	1	--	0	10	0	0	0.1	--	--	1,400
7S.15W.34.213	08/22/79	1	--	0	0	0	0	0.2	--	--	190
8S.7W.31.233	07/02/80	9	3	<1	0	0	0	0.1	0	0	<3
8S.7W.31.241	12/13/78	9	4	<1	2	0	2	0	0	0	<3
8S.13W.16.211	08/23/79	2	--	0	10	0	0	0	--	--	30
8S.13W.18.131	08/23/79	1	--	0	0	0	0	0.2	--	--	310
9S.7W.6.423	04/18/79	--	--	--	--	--	--	--	--	--	--
9S.8W.3.213	04/12/79	--	--	--	--	--	--	--	--	--	--
9S.8W.8.223	04/11/79	1	--	1	0	<10	21	0	--	--	160
9S.13W.20.324	01/15/80	--	--	--	--	--	--	--	--	--	--
10S.8W.9.132	04/04/79	7	--	<1	10	<10	<10	0	--	--	30
10S.9W.12.143	04/05/79	--	--	--	--	--	--	--	--	--	--

Table 7.--Radiochemical analyses of water from selected wells and springs in the San Agustin study area

[pCi/L, picocuries per liter; µg/L; micrograms per liter; --, no data; <, less than]

Location	Date	Dissolved gross alpha as U-natural (pCi/L)	Dissolved gross alpha as U-natural (µg/L)	Dissolved gross beta as Cs-137 (pCi/L)	Dissolved gross beta as Sr90/Y90 (pCi/L)	Dissolved uranium (U) (µg/L)
1N.9W.27.113	05/09/80	6.0	8.8	1.9	1.9	3.8
1S.8W.2.214	07/10/79	--	14.0	5.2	4.7	2.2
1S.10W.34.433	08/28/80	6.8	10.0	<4.1	<3.9	8.5
1S.11W.33.231a	05/08/80	9.5	14.0	<4.3	<4.1	7.0
2S.4W.26.342	06/05/80	4.6	6.8	<2.5	<2.4	5.8
2S.4W.26.344	06/03/80	6.3	9.3	2.5	2.4	6.3
2S.7W.27.444	05/07/79	--	--	--	--	--
2S.8W.21.413	08/30/79	--	2.1	3.6	3.7	<0.5
2S.9W.33.122	09/22/80	4.6	6.8	1.6	1.5	1.0
2S.10W.10.222	09/22/80	25.0	37.0	6.5	6.2	7.4
2S.13W.28.122	10/31/79	--	--	--	--	--
3S.6W.11.241	05/28/80	5.0	7.3	<3.4	3.2	3.4
3S.7W.8.231	05/28/80	10.0	15.0	2.8	2.7	5.1
3S.8W.1.310	08/21/79	--	17.0	3.0	2.7	3.7
3S.8W.21.124	08/31/79	--	--	--	--	--
3S.9W.7.442	08/30/79	--	<3.2	3.3	3.4	1.6
3S.9W.11.212	09/26/80	2.1	3.1	1.6	1.5	0.7
3S.9W.21.221	08/30/79	--	--	--	--	--
3S.9W.28.243	08/02/79	--	6.0	2.1	1.9	1.5
3S.11W.12.242	06/27/80	5.2	7.7	3.2	3.1	2.4
3S.12W.29.141	05/01/80	<1.9	<2.8	3.9	3.7	1.0
3S.12W.30.223	05/01/80	--	--	--	--	--
3S.12W.30.241	11/28/79	--	--	--	--	--
4S.6W.16.213	06/23/80	--	--	--	--	--
4S.9W.6.212	08/21/79	--	9.7	3.2	3.0	4.3
4S.9W.8.132	07/13/79	--	26.0	4.7	4.4	--
4S.9W.12.133	05/08/79	--	--	--	--	--
4S.9W.17.311	07/13/79	--	12.0	2.7	2.5	5.5
4S.10W.5.333	08/29/79	--	<4.6	3.7	3.4	1.8
4S.10W.5.333	08/29/79	--	4.2	3.2	3.3	1.8
4S.12W.29.122	07/11/79	--	7.7	5.5	5.0	3.2
4S.13W.6.222	04/26/79	--	--	--	--	--
4S.14W.34.212	08/07/80	<2.7	<4.0	3.3	3.2	<0.6
5S.9W.24.441	08/23/79	--	8.0	8.6	7.8	3.0
5S.10W.9.232	08/29/79	--	<7.7	6.0	5.5	1.4

Table 7.--Radiochemical analyses of water from selected wells and springs in the San Agustin study area--Concluded

Location	Date	Dis-solved gross alpha as U-natural (pCi/L)	Dis-solved gross alpha as U-natural (µg/L)	Dis-solved gross beta as Cs-137 (pCi/L)	Dis-solved gross beta as Sr90/Y90 (pCi/L)	Dis-solved uranium (U) (µg/L)
5S.10W.27.223	11/28/79	--	--	--	--	--
5S.12W.9.444	08/30/79	--	<3.8	3.6	3.3	1.8
5S.12W.34.434a	07/12/79	--	<4.0	2.9	2.7	--
5S.13W.4.241	08/30/79	--	7.9	15.0	2.9	3.3
5S.13W.9.244	08/30/79	--	--	--	--	--
5S.13W.20.123	07/05/80	--	--	--	--	--
5S.13W.22.112	08/30/79	--	<20.0	<7.5	<7.0	3.0
5S.13W.27.422	08/30/79	--	<18.0	<6.1	<5.7	2.1
5S.13W.32.322	06/13/79	--	--	--	--	--
5S.14W.9.412	08/23/79	--	<1.6	4.8	4.6	0.8
5S.16W.3.143	11/29/78	--	--	--	--	1.9
6S.8W.8.432	08/24/79	--	<30.0	38.0	35.0	<0.5
6S.13W.11.243	08/30/79	--	--	--	--	--
6S.13W.11.244	08/30/79	--	--	--	--	--
6S.13W.20.122	08/30/79	--	--	--	--	--
6S.14W.7.334	08/22/79	--	<4.5	3.1	2.8	1.4
6S.14W.8.333	08/22/79	--	--	--	--	--
6S.14W.21.433	08/30/79	--	5.9	5.3	4.9	1.6
6S.15W.20.211b	08/22/79	--	<2.4	5.5	4.9	<0.5
7S.8W.4.344a	03/30/79	--	--	--	--	--
7S.8W.28.141	08/31/79	--	3.8	3.1	2.8	0.9
7S.9W.25.144	08/24/79	--	8.1	7.4	6.8	6.5
7S.12W.3.424	07/11/79	--	31.0	5.3	4.8	--
7S.14W.16.133	08/22/79	--	<2.4	9.3	8.8	<0.5
7S.14W.16.133	08/22/79	--	<2.4	5.6	5.7	11.0
7S.15W.34.213	08/22/79	--	7.4	6.7	6.3	1.7
8S.7W.31.233	07/02/80	14.0	21.0	<4.2	<4.1	6.8
8S.7W.31.241	12/13/78	--	22.0	5.3	4.8	5.7
8S.13W.16.211	08/23/79	--	<3.2	4.4	4.5	1.1
8S.13W.18.131	08/23/79	--	14.0	7.2	6.7	3.2
9S.7W.6.423	04/18/79	--	--	--	--	--
9S.8W.3.213	04/12/79	--	--	--	--	--
9S.8W.8.223	04/11/79	--	--	--	--	--
9S.13W.20.324	01/15/80	--	--	--	--	--
10S.8W.9.132	04/04/79	--	--	--	--	--
10S.9W.12.143	04/05/79	--	--	--	--	--

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