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GROUND-WATER RESOURCES AND WATER USE IN SOUTHERN NAVAJO COUNTY ARIZONA

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GROUND-WATER RESOURCES AND WATER USE IN SOUTHERN NAVAJO COUNTY, ARIZONA

By

Larry J. Mann

ABSTRACT

The main source of water in the 3,400-square-mile area of southern Navajo County is the ground water in storage in the Coconino aquifer, which underlies the entire area. About 76 percent of the water supply is from the Coconino aquifer, about 6 percent is from the Pinetop-Lakeside aquifer and from the alluvium along the large stream channels and flood plains, about 15 percent is from surface water, and about 3 percent is imported.

The Coconino aquifer consists of the Coconino Sandstone, the uppermost part of the underlying Supai Formation, and the overlying Kaibab Limestone. Most ground water withdrawn from the aquifer is for agricultural and industrial uses, and, in general, water levels have declined less than 5 feet. The Pinetop-Lakeside aquifer is present only in the southeastern part of the area and includes, from oldest to youngest, sedimentary rocks, rim gravel, and basaltic rocks. The sedimentary and basaltic rocks supply water to the Pinetop-Lakeside recreational area, where the water in some wells has been polluted by sewage effluent. The water in the Pinetop-Lakeside aquifer is hydraulically separated from the water in the underlying Coconino aquifer. The alluvium consists of unconsolidated sand, silt, gravel, and clay and generally is not more than 150 feet thick. Although the alluvium yields sufficient quantities of water for agricultural use in places, most wells furnish only enough water for domestic or livestock supplies.

In general, the ground water in the southern part of the area is of good chemical quality; however, the water in the northern part of the area generally contains large concentrations of dissolved solids—mainly sodium, chloride, and bicarbonate. In the northernmost part of the area water in the Coconino aquifer is unsuitable for human or livestock consumption, irrigation, and most industrial uses.

INTRODUCTION

Southern Navajo County is a rapidly growing area in northeastern Arizona that includes prime recreational areas. More than 85 percent of the water supply is from ground-water storage, and most of this is from the regional Coconino aquifer. The water-resources appraisal of southern Navajo County was prompted by the increasing demand for water of sufficient quantity and suitable chemical quality to meet growing municipal, agricultural, and industrial requirements. The study was requested by the Navajo County Board of Supervisors and was made by the U.S. Geological Survey in cooperation with the Arizona Water Commission.

Purpose of the Investigation and Scope of the Report

The purpose of this investigation was to determine the availability, chemical quality, and use of water and to identify the possible sources of pollution of the shallow ground water in southern Navajo County. The report describes (1) the occurrence, availability, movement, and chemical quality of water in the main aquifers; (2) the amount and effects of water-resources development and use in 1972; and (3) the possible sources and extent of bacteriological pollution of water in the Pinetop-Lakeside area.

Location of the Area

Southern Navajo County occupies about 3,400 square miles in northeastern Arizona (fig. 1). The area is bounded on the north by the Navajo Indian Reservation and on the south by the Fort Apache Indian Reservation; the county line comprises the east and west boundaries. The area is mainly in the Plateau uplands water province; however, a small part along the southern boundary is in the Central highlands water province (fig. 1). The main population centers are Winslow, Holbrook, Pinetop, Lakeside, Show Low, and Snowflake. The Pinetop-Lakeside area is a prime summer recreational area in the southeastern part of southern Navajo County and includes the parts of Tps. 8 and 9 N., Rs. 22 and 23 E., that are not in the Fort Apache Indian Reservation (fig. 1).

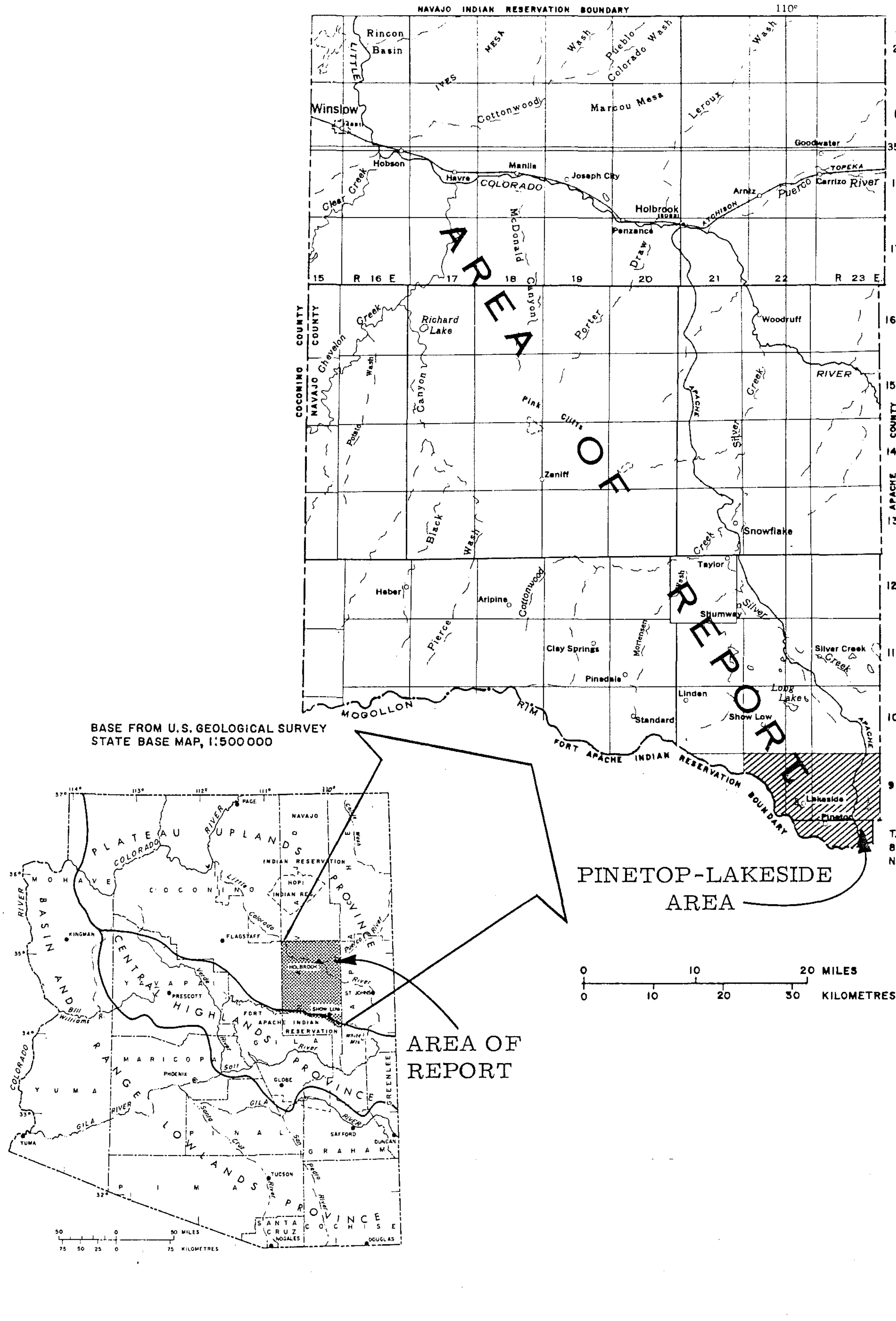
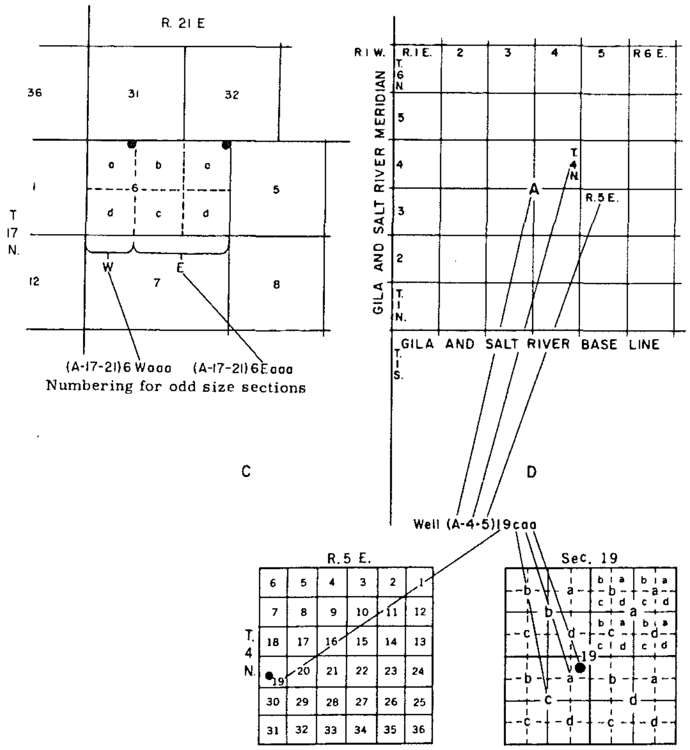


FIGURE 1. --AREA OF REPORT AND ARIZONA'S WATER PROVINCES.



The well numbers and letters used by the Geological Survey in Arizona are in accordance with the Bureau of Land Management's system of land subdivision. The land survey in Arizona is based on the Gila and Salt River meridian and base line, which divide the State into four quadrants. These quadrants are designated counterclockwise by the capital letters A, B, C, and D. All land north and east of the point of origin is in A quadrant, that north and west is in B quadrant, that south and west in C quadrant, and that south and east in D quadrant. The first digit of a well number indicates the township, the second the range, and the third the section in which the well is situated. The lowercase letters a, b, c, and d after the section number indicate the well location within the section. The first letter denotes a particular 160-acre tract, the second the 40-acre tract, and the third the 10-acre tract. These letters are also assigned in a counterclockwise direction, beginning in the northeast quarter. If the location is known within the 10-acre tract, three lowercase letters are shown in the well number. In the example shown in figure 2, well number (A-4-5)19caa designates the well as being in the $NE\frac{1}{4}NE\frac{1}{4}SW\frac{1}{4}$ sec. 19, T. 4 N., R. 5 E. Where there is more than one well within a 10-acre tract, consecutive numbers beginning with 1 are added as suffixes.

When a section is more than 1 mile in any dimension, the section number applies as usual. The oversized section is divided so that a full square-mile unit of the section is adjacent to a normal section within the same township; the remainder is considered as a separate unit of land. Appropriate N., S., E., or W. letters are assigned to the units, depending upon where they lie in relation to the full square-mile unit. A well would be designated as shown in figure 2 with the appropriate letter following the section number in which the well is located.

FIGURE 2.--WELL-NUMBERING SYSTEM IN ARIZONA.

Methods of Investigation

The fieldwork on which this report is based was started in July 1971 and was completed in April 1973; an inventory was made of most irrigation wells and of many domestic and livestock wells and springs. All well and spring locations are described in accordance with the well-numbering system used in Arizona, which is explained and illustrated in figure 2. Ground-water pumpage data were collected from private companies and other Federal and State agencies; pumpage for irrigation use was computed from power-consumption records on the basis of measurements of well discharge per unit of power consumption. Most of the hydrologic data collected during and prior to this investigation and pertinent data collected by other agencies are given in the tables in this report.

For purposes of this study, the number of observation wells was increased from two to five in order to monitor daily water-level fluctuations, and the number of wells in which periodic water-level measurements are made was increased from 12 to 40. About 60 well-discharge and 25 spring-flow measurements were made, and water samples were collected from 75 wells, 4 springs, and 7 streamflow sites for chemical analysis. Water samples from streams and springs in the Pinetop-Lakeside area were collected for analysis to determine the amount of coliform bacteria present. Additional coliform data for wells and public-supply systems were obtained from the Arizona Department of Health Services.

Lithologic and drillers' logs of wells were examined to determine the water-yielding potential of the rock units. The approximate extent of each water-yielding unit was defined by reconnaissance geologic mapping. The mapping was done on aerial photographs and then was transferred to a planimetric base at a scale of 1:125, 000 for the entire area and at a scale of 1:62, 500 for the Pinetop-Lakeside area. The altitudes of wells and springs were obtained from U.S. Geological Survey topographic maps at scales of 1:24, 000 or 1:62, 500.

Reporting of Data

For use of those readers who may prefer to use metric units rather than English units, the conversion factors for the terms used in this report are as follows:

Multiply English units	By	To obtain metric units
inches (in)	25.4	millimetres (mm)
feet (ft)	.3048	metres (m)
miles (mi)	1.609	kilometres (km)
acres	.4047	hectares (ha)
square miles (mi^2)	2.590	square kilometres (km^2)
acre-feet (acre-ft)	.001233	cubic hectometres (hm^3)
gallons per minute (gal/min)	.06309	litres per second (l/s)

The Survey has been reporting water-quality data in metric units for several years; therefore, the water-quality data given in tables 2, 3, and 5 are given in milligrams per litre (mg/l), number of coliform colonies per 100 millilitres of water, degrees Celsius (°C), and micromhos per centimetre at 25°C. The terms "parts per million" and "milligrams per litre" are almost synonymous for water containing as much as 5,000 to 10,000 mg/l of dissolved solids. The exact amount is dependent on the nature of the dissolved material. The Survey has set 7,000 mg/l dissolved solids as the point above which the difference in parts per million and milligrams per litre becomes significant. In order to convert data from one system to the other, a density factor must be applied to the analytical results of all water containing more than 7,000 mg/l of dissolved solids. Temperature data given in tables 2 and 5 can be converted to degrees Fahrenheit (°F) as shown on the following page.

Previous Investigations

Hydrologic studies by several investigators were helpful in evaluating the ground-water resources in southern Navajo County. The ground-water resources in the Holbrook region were first evaluated by Harrell and Eckel (1939) and later by Babcock and Snyder (1947) and by Babcock (1948). Johnson (1962) discussed the geology and ground-water resources in the Snowflake-Hay Hollow area, and Feth and Hem (1963) described the springs in the Mogollon Rim region. Useful well data were obtained from a paper by Peirce and Scurlock (1972). The geology was described in detail by Wilson, Moore, and O'Haire (1960), Bahr (1962), Finnell (1966), Peirce and Gerrard (1966), Scurlock (1971), and McKay (1972). Studies on the geology and on the occurrence, availability, and chemical quality of ground water in two adjacent areas—the central part of Apache County (Akers, 1964) and southern Coconino County (McGavock, 1968)—were beneficial to this investigation.

°F	°C	°F	°C	°F	°C
32	0	63	17	94	34
33	1	64	18	95	35
34	1	65	18	96	36
35	2	66	19	97	36
36	2	67	19	98	37
37	3	68	20	99	37
38	3	69	21	100	38
39	4	70	21	101	38
40	4	71	22	102	39
41	5	72	22	103	39
42	6	73	23	104	40
43	6	74	23	105	41
44	7	75	24	106	41
45	7	76	24	107	42
46	8	77	25	108	42
47	8	78	26	109	43
48	9	79	26	110	43
49	9	80	27	111	44
50	10	81	27	112	44
51	11	82	28	113	45
52	11	83	28	114	46
53	12	84	29	115	46
54	12	85	29	116	47
55	13	86	30	117	47
56	13	87	31	118	48
57	14	88	31	119	48
58	14	89	32	120	49
59	15	90	32	121	49
60	16	91	33	122	50
61	16	92	33		
62	17	93	34		

Acknowledgments

The author gratefully acknowledges the many well drillers, water companies, and residents of southern Navajo County who granted permission to work on their property and who furnished many of the well data. Mr. D. L. Thornburg of the Arizona Public Service Co.

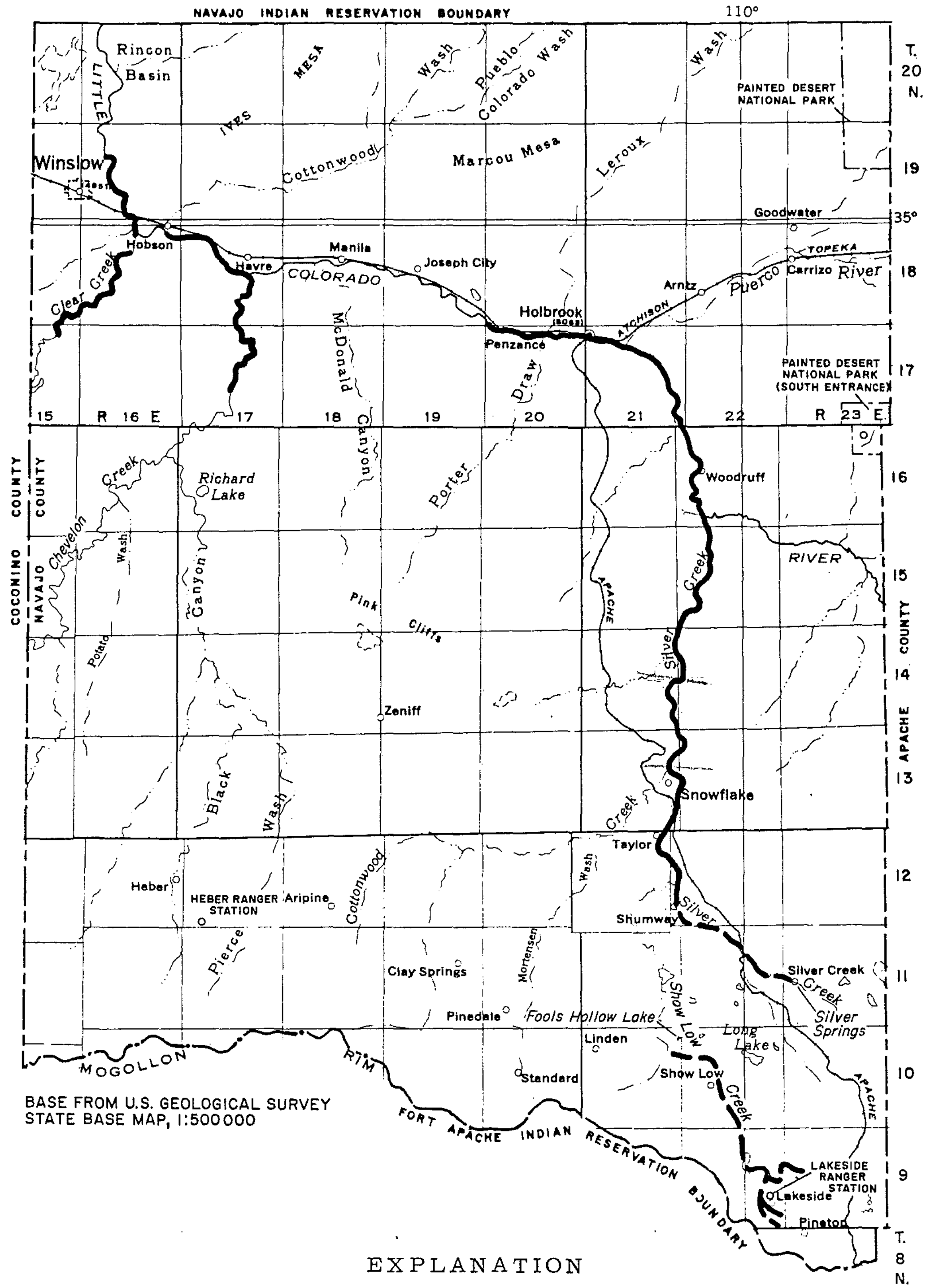
provided chemical-quality and drill-hole data for test holes and wells at the Cholla Power Plant near Joseph City. Mr. R. A. Anderson of Southwest Forest Industries provided water-level, pumpage, and subsurface data for wells in the Snowflake Paper and Pulp Mill well field near Taylor. Special thanks are due Mr. J. R. Scurlock of the Arizona Oil and Gas Conservation Commission for furnishing oil and mineral exploration test-hole data and to Mr. W. H. Shafer of the Arizona Department of Health Services for furnishing chemical-quality and coliform-bacteria data.

GEOHYDROLOGIC SETTING

Southern Navajo County is in the high plateau country of northeastern Arizona; altitudes range from about 6,800 to 7,650 feet above mean sea level near the Mogollon Rim in the southern part of the area and from about 5,000 to 5,500 feet in the northern part of the area. The main streams that drain the area are the Little Colorado River and its major tributary the Puerco River. The Little Colorado River flows generally northwestward from its headwaters in the White Mountains to its junction with the Puerco River and continues to join the Colorado River in northern Arizona (fig. 1). The Little Colorado is perennial in most of its reach between Silver Creek and Winslow (fig. 3).

The slope of the land surface is northward toward the Little Colorado and Puerco Rivers except in the northernmost part of the area, where the slope is southward toward the rivers. In the southern and central parts of the area the northward slope of the land surface is parallel to the dip of the sedimentary rocks. Near the center of the area, the northward dip is interrupted by the Holbrook anticline, which originates about 20 miles southeast of Winslow and extends about 60 miles southwestward to the east boundary of the area (pl. 1). The sedimentary rocks have been uplifted as much as 400 feet near Dry Lake and Snowflake. The Dry Lake syncline parallels the Holbrook anticline along its south flank, and many sinkholes are present along both features.

The most striking topographic features are the Mogollon Rim and the foothills of the White Mountains. The Mogollon Rim escarpment has a relief of about 2,000 feet and terminates the plateau along its south edge; the steep south-facing slopes of the rim form the demarcation line between the Plateau uplands and Central highlands water provinces. The mountainous terrain in the southeastern part of the



EXPLANATION

PERENNIAL FLOW IS MAINTAINED BY GROUND-WATER DISCHARGE FROM THE BASALTIC ROCKS

PERENNIAL FLOW IS MAINTAINED BY GROUND-WATER DISCHARGE FROM THE COCONINO AQUIFER

10 0 10 20 MILES

10 0 10 20 KILOMETRES

FIGURE 3.--PERENNIAL REACHES OF STREAMS IN SOUTHERN NAVAJO COUNTY.

area forms the foothills of the White Mountains, which are a few miles southeast of the study area (fig. 1); the altitude of the foothills is as much as 7,650 feet above mean sea level.

The Mogollon Rim acts as a barrier to the movement of airmasses that bring in moisture from the Gulf of Mexico and the Pacific Ocean. As a result, more precipitation falls along the Mogollon Rim than in areas farther north. The orographic effect of the Mogollon Rim is indicated by the difference in the amount of normal annual precipitation near the rim—20 to 30 inches—and the amount in the northern part of the area—about 8 inches—(University of Arizona, 1965a, 1965b). The average annual temperature ranges from about 49°F at the Heber Ranger Station to about 56°F at Winslow (U.S. Environmental Data Service, 1967-72).

A small part of the precipitation that falls on the land surface infiltrates downward into the underlying strata and eventually becomes ground water. Most of the recharge is from snowmelt along the Mogollon Rim; summer storms generally are of short duration and high intensity, which commonly result in rapid runoff and comparatively little recharge.

Southern Navajo County is underlain by a bedded sequence of sedimentary and basaltic rocks and alluvial deposits that is 3,500 to 4,500 feet thick. The uppermost part of the Supai Formation is the lowermost unit that is tapped by wells. It is 450 to 1,300 feet thick (Peirce and Gerrard, 1966, p. 5) and is composed mainly of siltstone and sandstone that contain beds of halite, gypsum, and anhydrite (pl. 1). The Coconino Sandstone overlies the Supai Formation, is 250 to 850 feet thick, and yields water to wells in most of the area (pl. 1). The Moenkopi Formation crops out in most of the area, but the underlying Kaibab Limestone and Coconino Sandstone are exposed only in several deep canyons and in the western part of the area (pl. 1). A 1,400-foot-thick sequence of Upper Cretaceous sedimentary rocks, Quaternary and Tertiary rim gravel, and Quaternary basaltic rocks overlies the Coconino Sandstone in the southeastern part of the area (pl. 1). The more permeable rocks in the sequence yield water to wells only where they are underlain by nearly impermeable rocks; elsewhere, the water moves downward into the Coconino aquifer. The rim gravel overlies the sedimentary rocks in the southern part of the area, and the Quaternary alluvium overlies the sedimentary rocks along the channels and flood plains of the Little Colorado and Puerco Rivers and their major tributaries (pl. 1). The alluvium is an important source of ground water in places along the rivers.

The Coconino aquifer—which is composed of the upper part of the upper member of the Supai Formation, the Coconino Sandstone, and the Kaibab Limestone—is the main source of ground water in the area (pl. 1). However, in the southeastern part of the area the sedimentary rocks, basaltic rocks, and, in places, the rim gravel that form the Pinetop-Lakeside aquifer furnish substantial ground-water supplies (pl. 1). An aquifer is a formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs (Lohman and others, 1972, p. 2).

In the Coconino aquifer ground-water movement is northward from the area of recharge near the Mogollon Rim and is parallel to the regional dip of the sedimentary rocks (pl. 1). Part of the water is discharged to springs and seeps along the main stem and tributaries of the Little Colorado River. Ground-water discharge from the Coconino aquifer maintains the perennial flow in the lower reaches of Silver, Chevelon, and Clear Creeks and in much of the Little Colorado River (fig. 3).

Water in the Coconino aquifer is unconfined in most of the area but is confined by the siltstone beds in the overlying Moenkopi Formation north of the Little Colorado River, from Snowflake southeast to the Apache County line, and near Woodruff Butte (pl. 2B). In some places the potentiometric surface—the level to which water will stand in a tightly cased well (Lohman and others, 1972, p. 11)—is as much as 500 feet above the top of the aquifer. Water will flow naturally from the well when the potentiometric surface is higher than the land surface. Flowing wells are not uncommon near Hay Hollow, Shumway, Holbrook, and Joseph City.

The ground water in the Pinetop-Lakeside aquifer is perched on shale beds in the lower part of the Upper Cretaceous sedimentary rocks and is not hydraulically connected to the water in the underlying Coconino aquifer. The direction of ground-water movement in the Pinetop-Lakeside aquifer is northwestward from the areas of recharge in the White Mountains and is parallel to the regional dip of the sedimentary rocks. Ground water is discharged to springs along the tributaries of Show Low or Corduroy Creeks, or it infiltrates downward into the underlying Coconino aquifer. Corduroy Creek, which drains to the Salt River, is not in the study area.

Water in the Pinetop-Lakeside aquifer is unconfined, and unsaturated zones may exist between two saturated zones. Water levels in wells may vary considerably and depend on the thickness of the aquifer penetrated by the well. The depth to water is greater in wells that penetrate the entire thickness of the sedimentary and basaltic rocks than in wells that penetrate only the top of the rock sequence.

Water in the alluvium is unconfined and generally moves parallel to local stream gradients. The alluvium along the Puerco and Little Colorado Rivers receives its recharge from streamflow; however, the alluvium along the Little Colorado River near Holbrook and Joseph City probably receives much of its recharge from upward leakage of ground water from the underlying Coconino aquifer.

In the southern part of the area the ground water generally contains less than 350 mg/l of dissolved solids, and individual constituents are not present in amounts that preclude the use of the water for most applications. In the northern part of the area, however, the ground water generally contains from 500 to 10,000 mg/l of dissolved solids.

COCONINO AQUIFER

The Coconino aquifer underlies all of southern Navajo County and is the deepest source of water that has been developed in the area. Although the Coconino Sandstone is the main water-bearing unit of the aquifer, the uppermost beds of the underlying Supai Formation and, in places, the overlying Kaibab Limestone are hydraulically connected to the Coconino Sandstone and yield water to wells (pl. 1). In the Supai Formation siltstone beds that underlie the aquifer may prevent the ground water from draining into deeper formations.

The Coconino Sandstone is fine to medium grained, light yellowish gray to pale orange, and is weakly to well cemented by quartz, iron oxide, and calcite. The quartz grains are well sorted, subangular to rounded, and frosted; quartz overgrowths constitute the most common cement. The degree of cementation varies considerably from place to place and vertically throughout the unit, which accounts for the wide range in productivity of the unit. The Coconino Sandstone is exposed extensively in the central part of the area, where it exhibits large-scale crossbeds. In the lower part of the section the sandstone probably is massive and flat bedded, similar to the exposures south of the Mogollon Rim. The Coconino thickens toward the west and is about 250 feet thick near Show Low and about 500 feet thick south of Heber near the Mogollon Rim; it thickens toward the northwest and is about 400 feet thick near Snowflake and about 850 feet thick near Winslow.

The contact between the Coconino Sandstone and the underlying Supai Formation is poorly defined in most of southern Navajo County. The contact is exposed only south of the Mogollon Rim, where it is well marked by the difference in lithology between the brownish-red siltstone or sandy siltstone of the Supai Formation and the near-white fine-grained sandstone of the Coconino. The contact becomes less well marked toward the north, as indicated by drillers' and electric logs of the few wells that are known to penetrate strata underlying the Coconino. In the western and central parts of the area, the uppermost beds of the Supai Formation are mainly sandstone and silty sandstone that locally are interbedded with siltstone; the beds are in hydraulic connection with the overlying Coconino Sandstone. In the northern and western parts of the area, a reddish-brown sandstone that is very similar lithologically—except for color—to the Coconino Sandstone overlies a siltstone that clearly is a part of the Supai. The reddish-brown sandstone beds are hydraulically connected to the Coconino Sandstone, and, for purposes of this report, they are considered as the lower part of the Coconino Sandstone.

The Kaibab Limestone is jointed, locally fractured, and contains sandstone beds that are lithologically similar to those of the Coconino Sandstone. The Kaibab ranges in thickness from 0 to 200 feet and thins to the northeast (pl. 1); drillers' logs indicate that the thickness ranges from 0 to about 35 feet near the east boundary of the area, near Joseph City, and near Holbrook, where the formation is in hydraulic connection with the Coconino Sandstone and yields water to wells. Although the Kaibab is not saturated in the western part of the area, it is highly permeable and allows water to move downward to the underlying Coconino. Because the Kaibab is hydraulically connected to the Coconino Sandstone in the eastern part of the area and because it readily accepts and transmits water to the Coconino Sandstone in the western part, it is considered as the upper unit of the Coconino aquifer in this report.

Occurrence of Ground Water

The Coconino Sandstone is partly to completely saturated in most of southern Navajo County but is dry or nearly dry in two structurally high areas—along the crest of the Holbrook anticline near Dry Lake and in an area of about 40 square miles near Heber (pl. 2). Wells in the structurally high areas obtain their water from the siltstone and sandstone beds in the uppermost part of the Supai Formation. In the southern and central parts of the area the Coconino aquifer is partly saturated, and the water is unconfined—that is, water levels in the wells that tap the aquifer do not rise above the top of the saturated strata. In the northern and eastern parts of the area ground water is under confined or artesian conditions (pl. 2B); the water is confined by the less permeable Moenkopi Formation, and the head ranges from zero near the Little Colorado River to about 500 feet in two places near the east boundary of the area. The artesian area that extends southeast from Snowflake to Silver Creek is associated with the Dry Lake syncline (pl. 2). In the area of the syncline, which has a closure of about 250 feet between Snowflake and Shumway, the head is about 150 feet above the top of the aquifer (pl. 2). The artesian water near Woodruff is the result of a structural depression in which the Coconino Sandstone and other sedimentary rocks are downwarped as much as 450 feet (pl. 2). The lowest part of the depression probably is about a mile southeast of Woodruff Butte, where the head is about 360 feet (pl. 2).

The static water level—a water level that is not being affected by pumping—in wells that penetrate the Coconino aquifer ranges from more than 1,000 feet below the land surface in the nonartesian areas to several feet above the land surface in the artesian areas (table 4). Where the Coconino Sandstone is dry (pl. 2B), water generally is obtained between 800 and 900 feet below the land surface in the uppermost siltstone and sandstone beds of the Supai Formation.

Recharge and Movement of Ground Water

Ground water in the Coconino aquifer is derived chiefly from the infiltration of precipitation and streamflow. The main area of recharge is near the Mogollon Rim, where 20 to 30 inches of precipitation falls annually. Much of the water that infiltrates to the permeable sedimentary and basaltic rocks is recharged to the aquifer (pl. 1). The rate of infiltration is large in relation to that in the rest of the area, where rather impermeable siltstone and mudstone beds of the Moenkopi and Chinle Formations overlie the aquifer (pl. 1).

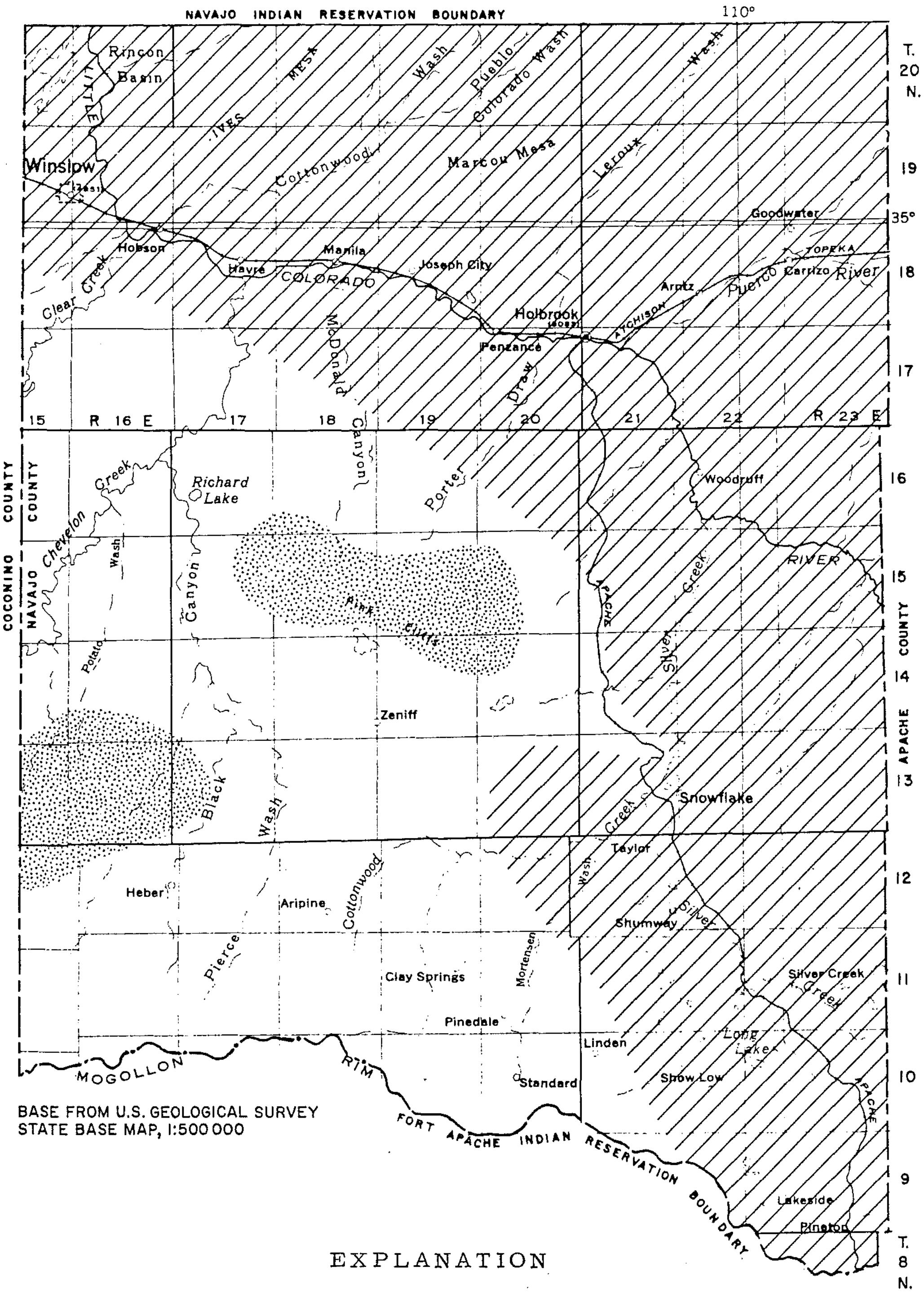
Surface water infiltrates downward through the coarse alluvium in the stream channels and lake bottoms and eventually reaches the water table, which in most places is from 100 to 500 feet below the land surface. Part of the perennial flow in Silver Creek near Snowflake is recharged to the aquifer; the flow is derived mainly from Silver Springs, which are about 11 miles southeast of Shumway (fig. 3). The springs issue at the contact between the basaltic rocks and the underlying siltstone and mudstone beds of the Moenkopi Formation. Water from wells that are allowed to flow near Shumway also augments the flow of the creek. Silver Creek is a losing stream in a 13-mile reach that extends north from Snowflake; however, the streambed intersects the water table in the adjoining reach that extends northward to the mouth of Silver Creek, and the creek is a gaining stream in this reach.

Seepage from the reservoir formed by Lone Pine Dam on Show Low Creek contributes to the recharge of the Coconino aquifer (pl. 1). The reservoir was constructed to store irrigation water for use in conjunction with the flow of Silver Creek; however, the highly permeable Kaibab Limestone forms the floor of the reservoir, and almost all the stored water infiltrates to the water table, which is about 80 feet below the reservoir floor. In the area between Snowflake and Show Low, seepage from several other manmade and natural reservoirs may recharge the Coconino aquifer.

Ground water in the Coconino aquifer moves northward from the area of recharge near the Mogollon Rim; some of the water is discharged to springs and wells, but most of the water leaves the area as underflow across the north boundary. The movement of water in the aquifer is controlled mainly by the regional dip of the sedimentary rocks. The altitude and configuration of the level at which water will stand in wells that tap the Coconino aquifer are shown by contour lines on plate 1. Few wells tap the aquifer in the area north of the Little Colorado River, and major revisions of the contours may be required when additional water-level data become available. Ground water moves northward and northeastward in the southern part of the area and northwestward in the northern and northeastern parts. The hydraulic gradient ranges from about 80 feet per mile near the Mogollon Rim south of Heber to less than 10 feet per mile near Holbrook (pl. 1).

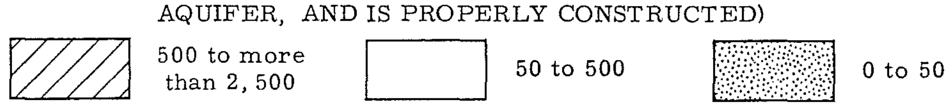
Well Yields

Wells that penetrate the Coconino aquifer furnish water for public, domestic, irrigation, industrial, and livestock supplies. Pumping rates vary considerably—from a few gallons per minute for domestic and livestock wells to as much as 2,800 gal/min for irrigation wells (table 4)—and depend on the type of supply required. Industrial and irrigation wells generally yield between 500 and 2,000 gal/min. The largest well yields generally are obtained in areas where nearly all the aquifer is saturated or where artesian conditions prevail. All the industrial complexes and major agricultural areas that depend on ground water from the Coconino aquifer are in areas where wells yield more than 500 gal/min (fig. 4).



EXPLANATION

POTENTIAL WELL YIELD, IN GALLONS PER MINUTE (NOTE: THE VALUES OF POTENTIAL WELL YIELD ARE BASED ON THE ASSUMPTION THAT THE WELL IS LOCATED FAVORABLY, IS SUFFICIENTLY DEEP TO TAP THE COCONINO AQUIFER, AND IS PROPERLY CONSTRUCTED)



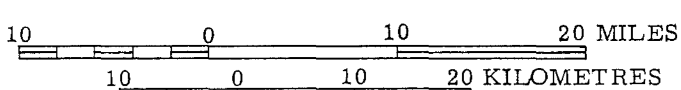


FIGURE 4.--POTENTIAL YIELD OF WELLS THAT TAP THE COCONINO AQUIFER IN SOUTHERN NAVAJO COUNTY.

Chemical Quality of Water

Ground water in the southern part of the area is of good chemical quality; however, the water in the northern part generally contains large concentrations of dissolved solids—mainly sodium and chloride (pl. 3A). In the southern part of the area the water in the Coconino aquifer contains less than 350 mg/l of dissolved solids and generally is a calcium magnesium bicarbonate type (pl. 3A). In the northern part of the area the dissolved-solids concentrations in water in the upper part of the aquifer range from about 500 mg/l to as much as 68,240 mg/l; the dominant ions in solution are sodium and chloride (pl. 3A). The dissolved-solids concentrations in the water in the lower part of the aquifer increase greatly with increasing depth, and the dominant ions in solution are again sodium and chloride.

The south-to-north transition in the chemical quality of the water is irregular. A zone of water in the upper part of the aquifer in the central part of the area between the Havre railroad siding and Zeniff is similar in chemical quality to that of the water in the northern part (pl. 3A). The dissolved-solids concentration in the water in this zone ranges from 500 to about 4,500 mg/l; however, the dissolved solids in the water increase with increasing depth.

The water changes from a calcium magnesium bicarbonate type in the southern part of the area to a sodium chloride type in the central part. The change generally is coincident with an increase in dissolved solids (pl. 3A). In the southern part of the area the dominance of calcium, magnesium, and bicarbonate in the water probably is the result of the solution of these ions as the water moves downward to the water table through the carbonate beds in the Kaibab Limestone. In the central part of the area the dominance of sodium and chloride in the water probably is the result of the solution of these ions as water moves through the halite beds in the uppermost part of the Supai Formation; the halite beds underlie most of the area from Zeniff northward to the Little Colorado River (pl. 3A). The many sinkholes along the axes of the Holbrook anticline and Dry Lake syncline probably are the result of the solution of the halite beds by moving ground water (Bahr, 1962, p. 118).

In places south of Holbrook and Joseph City the water in the lower part of the Coconino aquifer and that in the underlying siltstone beds in the Supai Formation contain large amounts of dissolved solids and chloride. The water in test hole (A-17-20)26dbc, which was drilled to a depth of 800 feet by the U.S. Bureau of Reclamation, was sampled for chemical analysis during drilling. The test hole penetrated the Coconino Sandstone at 40 feet and siltstone of the Supai Formation at 680 feet below the land surface (U.S. Bureau of Reclamation, written commun., 1969). Water samples collected between 297 and 446 feet, 436 and 546 feet, and 544 and 615 feet contained from 375 to 476 mg/l of dissolved solids and from 50 to 52 mg/l of chloride; a bailer sample collected at 722 feet contained 16,300 mg/l of dissolved solids and 8,790 mg/l of chloride (table 5).

Larger dissolved-solids and sodium and chloride concentrations in water in the lower part of the aquifer have been reported by the Arizona Public Service Co. for test holes 1 and 2, which were drilled to depths of 840 and 900 feet, respectively, in sec. 27, T. 18 N., R. 19 E. The test holes penetrated the top of the Coconino Sandstone at 270 and 260 feet, respectively, and siltstone of the Supai Formation at about 830 and 870 feet, respectively (Arizona Public Service Co., written commun., 1973). Analyses of water samples collected at about 50-foot intervals indicate that the water in the lower 180 to 190 feet of the aquifer contains 825 to 10,000 mg/l of chloride; whereas, water in the upper part of the aquifer contains 184 to 450 mg/l of chloride (Arizona Public Service Co., written commun., 1973). Analyses of water samples from test hole 3, which was drilled in sec. 21 about a mile northwest of test hole 1, indicate that the lower part of the aquifer contains relatively fresh water compared with that from the lower part of the aquifer in test holes 1 and 2. Test hole 3 was drilled to a depth of 1,005 feet and penetrated the top of the Coconino Sandstone at 260 feet and siltstone of the Supai at 990 feet below the land surface (Arizona Public Service Co., written commun., 1974). Chloride concentrations of more than 250 mg/l were not present in the water samples until the siltstone of the Supai was tapped (Arizona Public Service Co., written commun., 1974). The irregularity of the top of the saltwater zone may be the result of the movement of salty water into the Coconino aquifer from underlying strata via local fractures in the siltstone of the Supai Formation.

Water in the Moenkopi Formation commonly contains large concentrations of dissolved solids. In the northern part of the area many wells that tap the Coconino aquifer are open to the overlying Moenkopi, and contamination of water in the aquifer is the result of the solution of ions in the Moenkopi. In places where the water in the aquifer is confined, the solution occurs when water from the aquifer rises in the well bore and comes in contact with the Moenkopi. Water samples from many wells that are open to both the Coconino aquifer and the Moenkopi Formation contain large concentrations of dissolved solids—mainly sodium, sulfate, and chloride. In most instances it is difficult to determine whether the sample is representative of water in the Coconino aquifer or whether the sample has been contaminated by water from the Moenkopi Formation.

Suitability of water for domestic and public supplies.--The State of Arizona has adopted certain mandatory and recommended limits established by the U.S. Public Health Service (1962) for different chemical constituents that are contained in water used for domestic and public supplies. In the northern part of the area the chemical constituents in most water from the Coconino aquifer exceed some of the recommended limits.

The U.S. Public Health Service (1962) has recommended that water for drinking purposes should contain no more than 500 mg/l of dissolved solids. Water that contains a larger dissolved-solids concentration is used, however, if better water is not available. Recommended limits for some of the chemical constituents are given below.

Constituent	Concentration (mg/l)
Iron (Fe)	0.3
Sulfate (SO_4)	250
Chloride (Cl)	250
Nitrate (NO_3)	45

Although the chemical constituents in several public and domestic water supplies in the northern part of the area exceed some of the above recommended limits, better water is not available. The recommended limits for sulfate, chloride, and dissolved solids are exceeded in the water from many domestic wells and in the public water supplies at Holbrook, Joseph City, and Winslow.

Fluoride concentrations in water in the Coconino aquifer generally are within acceptable limits (table 5). The U.S. Public Health Service (1962) recommends lower, optimum, and upper limits for fluoride based on the annual average of maximum daily air temperature. The concentration of fluoride in drinking water should not average more than the upper limit, and average concentrations greater than twice the optimum values constitute grounds for rejection of the supply. The optimum limit for fluoride in water at Holbrook and Winslow is 1.1 mg/l, and that for water at Snowflake, Show Low, and Heber is 1.2 mg/l.

Suitability of water for irrigation.--The suitability of water for irrigation is dependent on the ratio of sodium to calcium and magnesium and the amount of dissolved solids in the water and on soil type and the type of crops to be grown. In the ground water in southern Navajo County the main chemical characteristics that are harmful to plant growth are the dissolved-solids concentrations or salinity and the ratio of sodium to calcium and magnesium. The dissolved-solids concentrations are most critical where they accumulate in the root zones of plants because of inadequate leaching.

The possible dangers from excessive concentrations of sodium in irrigation water include the breakdown of soil structure and the nutritional disturbance in crops. A useful parameter in evaluating the sodium hazard in irrigation water is the sodium-adsorption ratio (SAR) formulated by the U.S. Salinity Laboratory Staff (1954). The SAR is defined by the equation

$$SAR = \frac{(Na^{+})}{\sqrt{\frac{(Ca^{+2}) + (Mg^{+2})}{2}}},$$

in which the concentrations of the constituents are expressed in milliequivalents per litre.

The salinity hazard can be critical to plant growth. The common test for salinity hazard in irrigation water is to measure the specific conductance. Specific conductance is a measure of the ability of the ions in solution to conduct an electrical current and is an indication of the amount of dissolved solids in the water. For irrigation water, 2,250 micromhos per centimetre is the approximate upper limit of specific conductance if there is adequate leaching in the root zone; however, under favorable conditions and careful controls, more highly mineralized water is used successfully to grow crops, as noted below.

The salinity hazard is medium to high and the sodium hazard is low to medium for most of the irrigation water from the Coconino aquifer (pl. 3B); however, water having a very high salinity hazard and a high to very high sodium hazard is used successfully for the irrigation of salt-tolerant crops north of Joseph City. The leaching characteristics and the gypsum in the soil make the use of this type of water feasible.

PINETOP-LAKESIDE AQUIFER

In the Pinetop-Lakeside area the Upper Cretaceous sedimentary rocks, the Quaternary and Tertiary rim gravel, and the overlying Quaternary basaltic rocks form the Pinetop-Lakeside aquifer, which is hydraulically separated from the underlying Coconino aquifer (pls. 1 and 4A). Well data indicate that the sedimentary rocks, rim gravel, and basaltic rocks are hydraulically connected and function as a single aquifer. The Moenkopi and Chinle Formations and the shale beds in the sedimentary rocks are poorly permeable and retard the downward percolation of ground water into the underlying Coconino aquifer. Where these impermeable beds are absent, the Pinetop-Lakeside aquifer generally is dry.

The sedimentary rocks consist of pale-yellowish-gray to yellowish-brown and pale-red fine- to coarse-grained feldspathic sandstone interbedded with dark- to medium-gray and olive-brown to reddish-brown shale and lenticular olive-gray to green silty limestone. In most of the area the sedimentary rocks are overlain by rim gravel or basaltic rocks. The rim gravel is an unconsolidated to semiconsolidated deposit of bouldery gravel, coarse-grained sand and sandstone, silt, and mudstone. The basaltic rocks consist mainly of fractured basalt flows and cinder cones and beds (pl. 1). The basaltic rocks overlie a stripped surface eroded on the northward-dipping Moenkopi and Chinle Formations, the sedimentary rocks, and the rim gravel (pls. 1 and 4A).

The sedimentary rocks and the basaltic rocks are the main sources of ground water in the Pinetop-Lakeside area and are tapped by many domestic, public-supply, and irrigation wells. Elsewhere, these rocks furnish water to a few scattered domestic and livestock wells and small public-supply systems.

Occurrence of Ground Water

In the Pinetop-Lakeside area ground water is obtained from fractured basalt flows and cinder beds in the basaltic rocks, the rim gravel, and the permeable sandstone beds in the sedimentary rocks. The base of the shale beds that perch water in the Pinetop-Lakeside aquifer is from 50 to 150 feet above the saturated part of the Coconino aquifer; the lower 100 to 200 feet of shale and the unsaturated part of the Coconino aquifer yield little or no water to wells in the Pinetop-Lakeside area.

The depth to water in wells that penetrate the Pinetop-Lakeside aquifer ranges from less than 25 feet below the land surface near Rainbow Lake in the southwestern part of the area to about 600 feet near Twin Knolls in the northern part of the area; in the northern and eastern parts of the area the depth to water probably is more than 600 feet below the land surface, although well data are not available to substantiate greater depth. The depth to water in the developed areas near Pinetop and Lakeside generally is less than 150 feet (pl. 4B). The depth to water in wells that penetrate only the upper part of the aquifer generally is less than the depth to water in wells that penetrate the entire sequence of sedimentary and basaltic rocks. The clay layers between fractured basalt flows and the shale beds between the permeable sandstone beds in the sedimentary rocks retard the downward movement of water from one permeable zone to another. The water level may decline as much as 50 feet where permeable strata are penetrated during the drilling of wells. West of Scott Reservoir the Pinetop-Lakeside aquifer does not yield usable quantities of water to wells, and the few existing wells are reported to obtain their water from the underlying Coconino aquifer (pl. 4B). In this area the only available driller's log is for well (A-9-22)15bcd; the log shows that the sedimentary rocks are composed mostly of clay-size grains and that the basaltic rocks are above the water table (table 6).

Recharge and Movement of Ground Water

Ground water in the Pinetop-Lakeside aquifer is derived from the infiltration of snowmelt, rainfall, and surface water in lakes and streams. The rate of infiltration is dependent on the degree of fracturing in the basaltic rocks and on the permeability of the sedimentary rocks. The basaltic rocks crop out in most of the area and form the upper part of the aquifer (pl. 4A). Most of the recharge to the sedimentary rocks infiltrates through the overlying basalt.

The lateral movement of ground water in the Pinetop-Lakeside aquifer is northwestward from the areas of recharge in the White Mountains. The contours that show the altitude of water levels in wells that tap the upper part of the Pinetop-Lakeside aquifer are shown in plate 4A and are representative of water levels in most wells in the area. The water levels in some wells, however, may be as much as 100 feet higher or as much as 150 feet lower than those in nearby wells, depending on the depth of the well. Ground water that does not infiltrate downward to the Coconino aquifer issues as springs and seeps along the tributaries of Show Low or Corduroy Creeks or is discharged by wells.

The springs and seeps along the tributaries of Show Low Creek generally issue from the basaltic rocks, and the springs along the tributaries of Corduroy Creek issue from the sedimentary rocks (pl. 4A). Springs in the basaltic rocks issue from the contact between the clay lenses and the basalt flows or from the contact between the sedimentary rocks and the basaltic rocks; springs in the sedimentary rocks issue at the contact between the sandstone beds and the shale beds.

Three major springs that issue from the basaltic rocks—Big, Adair, and Porter Springs—were measured periodically to determine the seasonal fluctuations and long-term changes in flow since the springs were first measured in 1953. No long-term trends in discharge are evident from the sparse data available; however, the measurements reveal large seasonal fluctuations in the discharge from some springs (table 1). In 1971 and 1972 Pinetop Springs ceased to flow, which probably was caused by drought rather than an overdraft from the pumping of wells; the springs also ceased to flow in 1954 after an extended dry period, when no significant amount of ground water was being withdrawn from the aquifer. Northeast of Pinetop, Pat Mullen, Whitcom, Chipmunk, and Thompson Springs generally flow only in response to precipitation (pl. 4A); the springs were virtually dry in August 1971 after a dry period; however, in April 1972 snowmelt increased the combined flow of the springs to about 85 gal/min.

Well Yields

Wells that obtain their water from the Pinetop-Lakeside aquifer yield from less than 5 gal/min to as much as 350 gal/min. Most wells are used for domestic supplies and yield from 5 to 20 gal/min. Yields from public-supply and irrigation wells range from 20 to 350 gal/min and mainly are dependent on the depth of the well and the type of material penetrated. Most wells obtain their water from the basaltic rocks or from the underlying sedimentary rocks, and only a few wells tap both units. Well yields generally are greater from the basaltic rocks than from the sedimentary rocks (table 4).

Yields from most wells that tap the basaltic rocks range from 5 to 100 gal/min, although in places the rocks yield as much as 350 gal/min of water to wells. The large variation in well yields from the basaltic rocks can be seen by comparing wells (A-8-23)10baa and (A-8-23)10bad. The wells are about 800 feet apart, are irrigation wells drilled by the same driller using the same method, completely penetrate the basaltic rocks at about the same depth, and the static

Table 1.--Discharge measurements at selected springs in the Pinetop-Lakeside area

[See figure 2 for description of location system]

Location	Name	Discharge		Remarks
		Date measured	Gallons per minute	
(A-8-23)4aac	Pinetop Springs	6-19-46	350	
		2-19-52	265	
		8- 1-53	240	
		-54	0	Measured by the Arizona Game and Fish Department.
		7-12-71	0	
		4- 4-72	50	
		6-27-72	0	
		9- 7-72	0	
(A-9-22)25ddc	Adair Spring	2-20-52	630	Probably includes flow from Walnut Spring, which is three-quarters of a mile south of Adair Spring.
		5-22-52	340	
		4- 6-72	315	
		6-28-72	202	
		7-27-72	147	
		9- 7-72	109	
		10- 4-72	99	
		11- 1-72	162	
(A-9-22)36bbd	Big Spring	2-20-52	1,100	
		5-22-52	1,030	
		8- 1-53	1,060	
		10-10-54	1,230	
		7-13-71	801	
		4- 4-72	896	
		6-28-72	1,060	
		7-27-72	927	
		9- 6-72	995	
		10- 4-72	1,070	
		11- 1-72	794	
(A-9-23)18adb	Porter Spring	6-16-52	300	
		7-13-71	146	
		4- 4-72	195	
		6-28-72	197	
		7-27-72	209	
		9- 7-72	200	
		10- 5-72	184	
		11- 1-72	224	

water levels are about the same (tables 4 and 6). Well (A-8-23)10baa yields only 15 gal/min, and well (A-8-23)10bad yields about 165 gal/min (table 4). The difference in well yields probably is the result of local variations in the degree of fracturing in the basaltic rocks.

Most wells that tap the sedimentary rocks yield less than 50 gal/min of water; however, yields of as much as 250 gal/min have been reported. Most wells that obtain their water from the sedimentary rocks tap only the upper 150 to 250 feet of the unit, and larger well yields probably can be obtained from wells that penetrate deeper into the sedimentary rocks (table 6).

Quality of Water

The suitability of water for municipal, agricultural, and industrial uses in the Pinetop-Lakeside area is dependent on its chemical and bacteriological quality. As a part of this investigation, the chemical quality of the ground water in the Pinetop-Lakeside aquifer and the chemical and bacteriological quality of the streamflow were evaluated. The streamflow is naturally discharged from and may be recharged to the aquifer. Water samples were collected from wells that tap the sedimentary and basaltic rocks, from springs that discharge from the basaltic rocks, and from streams that flow over sedimentary and basaltic rocks.

Chemical quality of ground water.--Ground water in the Pinetop-Lakeside aquifer is suitable for most uses and contains small to medium quantities of dissolved solids—mainly calcium, magnesium, and bicarbonate. Although a calcium magnesium bicarbonate type water is present in most of the area, sodium and sulfate types are present in places (pl. 4C).

The chemical quality of water in the basaltic rocks generally is slightly better than that of the water in the sedimentary rocks. Based on 18 chemical analyses, the average dissolved-solids concentration in water from the basaltic rocks is 164 mg/l; based on 13 chemical analyses, the average dissolved-solids concentration in water from the sedimentary rocks is 256 mg/l. In water in the basaltic rocks and sedimentary rocks hardness as calcium carbonate ranges from about 20 to 200 mg/l and from about 100 to 300 mg/l, respectively. Water from well (A-9-22)22dbc, which taps the sedimentary rocks, contains

643 mg/l dissolved solids and has a hardness of 560 mg/l; however, similarly large concentrations do not occur in the water from other wells in the area (table 5).

The dissolved-solids concentrations in water in the Pinetop-Lakeside aquifer increase from the area of recharge in the southeast to the northwest (pl. 4C). The water from wells near Pinetop contains about 200 mg/l dissolved solids; whereas, the water to the northwest contains about 330 mg/l. This increase in dissolved-solids concentrations probably is a natural phenomenon and not the result of pollution by man.

Concentrations of iron in water in the Pinetop-Lakeside aquifer are well within the accepted limits of 300 $\mu g/l$ (micrograms per litre) established by the U.S. Public Health Service (1962). The iron concentrations generally range from 0 to 200 $\mu g/l$. More than 300 $\mu g/l$ of iron was present in only one water sample; the sample was collected from a storage tank and probably is not representative of water in the aquifer (table 5). The average fluoride concentration in water from wells that penetrate the sedimentary and basaltic rocks is 0.23 mg/l, which is considerably less than the lower limit of 0.9 mg/l recommended by the U.S. Public Health Service (1962).

Chemical quality of streamflow.--The chemical quality of the streams that flow over the sedimentary and basaltic rocks is closely similar to that of the water from the major springs in the area (table 2). The water is of good chemical quality and is suitable for most uses. Dissolved-solids concentrations range from about 100 to 142 mg/l, and no significant deterioration in quality is evident between upstream and downstream sites.

Streamflow and spring-flow samples were collected for chemical analysis at several sites along Billy, Walnut, Porter, and Show Low Creeks to determine the chemical constituents present in the water and, particularly, the amount of organic nitrogen present in the summer when the potential for pollution is greatest. Organic nitrogen includes all nitrogenous organic compounds and is present in all surface water as the result of the inflow of nitrogenous products from the watershed and the normal biological life of the stream. Generally, the concentration of organic nitrogen in unpolluted water is low, and the concentrations of less than 1 mg/l at the sampling sites indicate that the streams are healthy (table 2).

Table 2.--Chemical analyses of water from selected springs and streamflow sites in the Pinetop-Lakeside area

[Laboratory analyses by Arizona Department of Health Services; field analyses by U.S. Geological Survey. Analytical results in milligrams per litre except as indicated]

Location	Date of collection	Estimated flow, in cubic feet per second	Field temperature (°C)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Organic nitrogen (N) Kjeldhal method	Total phosphate (PO_4)	Dissolved solids	Field specific conductance (micromhos at 25°C)	pH		Field dissolved oxygen
															Field determination	Laboratory determination	
(A-8-23)4baa1	8-23-72	<0.1	11.0	25	12	5	122	9	2	<1	<1	<0.04	142	240	7.1	7.2	7.5
4baa2	8-23-72	< .1	18.0	19	7	6	90	6	2	<1	<1	< .04	117	175	7.4	7.6	6.5
(A-9-22) 3bba	8-23-72	< .3	23.0	20	10	5	94	7	2	<1	<1	< .04	125	190	8.3	8.1	7.8
10bba	8-23-72	5	23.0	17	7	4	76	8	3	<1	<1	< .04	109	170	9.2	8.6	9.0
14dda	8-23-72	8	23.0	12	5	3	62	3	10	<1	<1	< .04	<100	110	8.4	8.1	9.4
15acd	8-23-72	5	25.5	14	5	4	72	6	1	<1	<1	< .04	<100	135	8.7	8.2	7.5
23dbc	8-23-72	5	20.5	23	10	7	116	4	4	<1	<1	< .04	125	200	9.5	9.1	2.0
25ccc	8-23-72	< .5	21.0	22	8	6	102	6	1	<1	<1	< .04	125	190	8.4	8.3	8.0
25ddc	8-23-72	< .5	11.0	20	8	6	98	7	3	<1	<1	< .04	125	210	7.1	7.1	8.4
36bbd	8-23-72	2	13.0	23	9	7	108	6	2	<1	<1	< .04	134	210	7.0	7.5	6.8
(A-9-23)32dbd	8-23-72	< .1	23.0	25	9	7	122	6	1	<1	<1	< .04	134	220	8.4	8.4	7.5

Bacteriological quality of water.--Bacteriological quality is a principal factor that governs the use of water for public and domestic supplies. In the Pinetop-Lakeside area several public and domestic water supplies have been polluted by coliform bacteria (Arizona Department of Health Services, oral commun., 1971). The pollution generally occurs at intervals that closely follow the arrival of summer residents and vacationists. Most of the existing sewage-disposal facilities consist of septic tanks and sewage ponds. During the summer, many of these facilities become overloaded and inefficient in the treatment of human waste.

Coliform organisms have long been used as indicators of sewage pollution. Members of the coliform group may come from soil, water, and vegetation as well as from feces (Slack and others, 1973, p. 35). During the period July 1, 1972, to June 30, 1973, samples were collected for bacteriological analysis from 10 water systems supplied by ground water in the Pinetop-Lakeside area; the analyses indicated that all the systems were polluted intermittently by coliform bacteria (Arizona Department of Health Services, written commun., 1974). Each system consists of one to six wells that tap the Pinetop-Lakeside aquifer, and from one to three wells in each system are near heavily developed areas where many septic tanks or large sewage ponds are used for sewage treatment. In most places the wells and the leaching fields for several septic tanks are in the highly fractured basaltic rocks; one public-supply well is within 50 feet of a septic-tank leaching field.

The potential for bacteriological pollution of ground water is greatest in the developed areas that are underlain by the fractured basaltic rocks in which the water table is less than 50 feet below the land surface (pl. 4B). The water in the basaltic rocks is most susceptible to pollution owing to fracturing and the resultant rapid movement of water. In such areas, effluent from septic tanks and sewage ponds seeps easily and quickly into the shallow ground water. Analyses of water from wells that are completely sealed off from the shallow ground water by cement plugs that surround the casing to depths of 50 to 100 feet below the land surface do not show coliform bacteria.

The infiltration of sewage effluent probably is the main source of pollution of the shallow wells that tap the Pinetop-Lakeside aquifer; however, the infiltration of polluted surface water also could affect the bacteriological quality of the water in the aquifer. A sampling network was established along the major drainages and irrigation ditches to determine the seasonal and upstream-to-downstream variability in coliform bacteria in surface water; the coliform-sampling sites generally were at established streamflow and spring-flow chemical-quality sampling sites (pl. 4C). Water samples for coliform analysis were collected when the streamflow was being furnished entirely by spring discharge, which eliminated the possibility of dilution of the bacteria by storm runoff. The samples were collected from springs at the headwaters and at several points along Porter, Billy, Walnut, and Show Low Creeks.

The water samples were collected by the U. S. Geological Survey on April 26, May 18, and August 24, 1972, and were analyzed by the Arizona Department of Health Services (table 3); the samples collected on April 26 were analyzed for total coliforms, and those collected on May 18 and August 24 were analyzed for total and fecal coliforms. Except in the sample collected from the Rainbow Lake irrigation ditch about 3 miles below the diversion, no total coliforms were detected in the samples collected on April 26; however, the samples collected on May 18, shortly after the arrival of some of the summer residents and vacationists, showed an increase in the counts of total coliforms at about half the sampling sites. Fecal pollution was detected at five sites—the tributary to Billy Creek near Pinetop, Billy Creek above Thompson Creek, Rainbow Lake irrigation ditch about 1 mile below the diversion, Show Low Creek above Show Low Lake, and Walnut Creek above Big Springs. The "less than 10" counts of fecal and total coliform that were reported at many of the sites indicate that no bacterial growth was detected in a 10-millilitre part of a 100-millilitre sample (table 3). The streamflow samples collected on August 24 near the end of the summer vacation season showed substantial increases in counts of fecal and total coliform bacteria. The spring-flow samples that were collected on May 18 and August 24 showed no evidence of fecal pollution; however, total coliforms were reported in the sample collected at Adair Spring on May 18.

The source of fecal coliform in the streamflow during the summer cannot be definitely established; however, it is recent pollution by fecal waste from warm-blooded animals. The source may be livestock waste because all the streams and irrigation ditches flow through summer pastureland.

ALLUVIAL AQUIFERS

The Quaternary alluvium is a locally important source of ground water in the channels and flood plains of the Puerco and Little Colorado Rivers and their major tributaries (pl. 1). In the small

Table 3.--Coliform-bacteria analyses of water from selected springs and streamflow sites in the Pinetop-Lakeside area.

[Analyses by the Arizona Department of Health Services. Analytical results in number of coliform colonies per 100 millilitres of water. Less than 10 (<10) indicates that no coliform-bacteria growth was detected in a 10-millilitre part of a 100-millilitre sample]

Location	Date of collection	Total coliform	Fecal coliform	Remarks
(A-8-23)4bab1	4-26-72	0	---	Billy Creek below Pinetop Fish Hatchery.
	5-18-72	<10	<10	
	8-24-72	0	0	
(A-8-23)4bab2	4-26-72	0	---	Tributary to Billy Creek near Pinetop.
	5-18-72	850	330	
	8-24-72	600	40	
(A-9-22)10bba	4-26-72	0	---	Show Low Creek below Show Low Lake.
	5-18-72	80	<10	
	8-24-72	8,100	12	
(A-9-22)14dcc	4-26-72	0	---	Billy Creek above Show Low Creek.
	5-18-72	40	<10	
	8-24-72	2,500	32	
(A-9-22)14dda	4-26-72	0	---	Porter Creek above Show Low Creek.
	5-18-72	<10	<10	
	8-24-72	13,000	48	
(A-9-22)15acb	4-26-72	0	---	Show Low Creek above Show Low Lake.
	5-18-72	70	10	
	8-24-72	3,400	16	
(A-9-22)21aaa	4-26-72	100	---	Rainbow Lake irrigation ditch about 3 miles below diversion.
	5-18-72	70	<10	
	8-24-72	3,600	104	
(A-9-22)22abc	4-26-72	0	---	Rainbow Lake irrigation ditch about 1 mile below diversion.
	5-18-72	40	30	
(A-9-22)23dbc	4-26-72	0	---	Walnut Creek below Rainbow Lake.
	5-18-72	<10	<10	
	8-24-72	800	0	
(A-9-22)25daa	4-26-72	0	---	Billy Creek near Springer Mountain.
	5-18-72	<10	<10	
	8-24-72	6,000	0	
(A-9-22)36aaa	4-26-72	0	---	Adair Spring.
	5-18-72	40	<10	
	8-24-72	0	0	
(A-9-22)36bbb	4-26-72	0	---	Walnut Creek above Big Springs.
	5-18-72	20	10	
	8-24-72	2,300	112	
(A-9-22)36bbd	4-26-72	0	---	Big Spring.
	5-18-72	<10	<10	
	8-24-72	0	0	
(A-9-23)18adb	4-26-72	0	---	Porter Springs.
	5-18-72	<10	<10	
	8-24-72	0	0	
(A-9-23)31daa	4-26-72	0	---	Billy Creek near Blue Ridge Mountain.
	5-18-72	<10	<10	
(A-9-23)32dbd	4-26-72	0	---	Billy Creek above Thompson Creek.
	5-18-72	790	310	

developed areas along the Puerco River the water in the underlying Coconino aquifer is of poorer chemical quality than that of the water in the alluvium. The unconsolidated alluvium is composed of poorly sorted sand, silt, gravel, and clay, and the unit generally is not more than 150 feet thick (pl. 1). Although the alluvium yields sufficient quantities of water for agricultural use in a few areas, most wells furnish only enough water for domestic or livestock supplies.

An extensive inventory of the domestic and livestock wells that obtain their water from the alluvium was not made during this investigation because many are either sand points driven into the upper part of the alluvium or are dug wells. Well yields and the chemical quality of the water in the upper part of the alluvium may be significantly different from those in the lower part.

The occurrence and availability of ground water in the alluvium are governed by the thickness and lithology of the unit. The sand and gravel deposits near the base of the unit yield considerably more water to wells than the overlying silt and clay. Where the alluvium is silty, well yields generally are less than 50 gal/min and are sufficient only for domestic or livestock supplies. The alluvium yields from about 1,700 gal/min of water to irrigation wells that tap the gravel deposits to less than 5 gal/min to livestock wells that tap the silty deposits; most irrigation and public-supply wells along the Puerco River yield from 300 to 600 gal/min.

In most places the underlying Moenkopi Formation confines water in the alluvium. The infiltration of streamflow is the main source of recharge to the alluvium along the Puerco and Little Colorado Rivers and their major tributaries. The streams are ephemeral and recharge occurs only during periods of storm runoff. Water in the alluvium along the Little Colorado River near Holbrook and Joseph City is hydraulically connected with water in the underlying Coconino aquifer, where the Moenkopi Formation is eroded away and the alluvium is in direct contact with the Coconino (pl. 1). In some places water levels in wells that tap the Coconino may be several feet above those in wells that tap the alluvium. The upward leakage of water from the Coconino aquifer is discharged into the alluvium and contributes to the perennial flow of the Little Colorado River near Joseph City. The depth to water in the alluvium generally is from 20 to 40 feet below the land surface.

The chemical quality of water in the alluvium generally is poor. The dissolved-solids concentrations range from 594 to 2,140 mg/l, and the dominant constituents are sodium, chloride, and bicarbonate;

hardness as calcium carbonate ranges from 39 to 465 mg/l (table 5). Although the water in the alluvium is classed as marginal to unsuitable for public and domestic supplies, it is used where water of better quality cannot be obtained from the Coconino aquifer, mainly in the northern part of the area along the Puerco River.

WATER USE

In 1972 about 50,300 acre-feet of water was used in southern Navajo County, of which about 1,700 acre-feet was imported ground water. In 1972 the use of surface water was limited owing to the uneven areal distribution of perennial streams, the lack of dams to impound floodwater, and the high sediment concentrations in floodwater in many of the large drainages in the northern part of the area. About 15 percent of the annual water use is supplied by surface water, and the remaining 85 percent is supplied by ground water.

In 1972 about 41,200 acre-feet of ground water—all pumpage figures in this report are rounded to three significant places—was withdrawn from the aquifers in southern Navajo County. The Coconino aquifer furnished about 38,400 acre-feet of ground water or about 93 percent of the total withdrawal; about 1,760 acre-feet of water was withdrawn from the Pinetop-Lakeside aquifer, and about 1,000 acre-feet was withdrawn from the alluvium along the major drainages in the northern part of the area. Of the 38,400 acre-feet of water withdrawn from the Coconino aquifer, about 60 percent was used for irrigation; 35 percent for industry; and 5 percent for public, livestock, and domestic supplies. Water withdrawn from the Pinetop-Lakeside aquifer is used for public, domestic, and irrigation supplies, and most of the water from the alluvium is used for irrigation and public supplies.

Surface-Water Diversions

Most streams in southern Navajo County are ephemeral. The only perennial streams are Show Low Creek above Fools Hollow Lake, Silver Creek below Silver Springs, parts of the Little Colorado River below Silver Creek, and the lower reaches of Chevelon and Clear Creeks (fig. 3).

Several reservoirs have been built on Show Low Creek to impound water for recreational, agricultural, and industrial uses (pl. 1). In 1972 the diversions for irrigation from Rainbow Lake, Scott Reservoir, and Show Low Lake—combined capacity of 8,576 acre-feet (U.S. Geological Survey, 1973, p. 38)—on Show Low Creek and its tributaries were estimated to be about 2,300 acre-feet. The diversions for irrigation from White Mountain Lake (formerly Daggs Reservoir)—capacity of 10,045 acre-feet (Arizona Interstate Stream Commission, 1967, p. 39)—on Silver Creek below Silver Springs were estimated to be about 4,000 acre-feet.

The only significant surface-water diversions on the Little Colorado River are near Joseph City and Woodruff. The Joseph City Irrigation District diverts an estimated 500 to 700 acre-feet of water per year from the Little Colorado River. The water is diverted directly from the river and is used only during periods of low flow, when sediment concentrations are small. The Woodruff Irrigation District pumps water from the Little Colorado River near Woodruff. Although the exact amount of water pumped is unknown, it probably was not more than 100 acre-feet in 1972.

The amount of surface water diverted for irrigation from Chevelon and Clear Creeks is believed to be negligible. Small amounts of water are diverted for livestock and irrigation uses and for a small Arizona Game and Fish Department reservoir, which is maintained as a part of a waterfowl refuge near Winslow. Although an accurate estimate of the amount of water diverted from Clear and Chevelon Creeks cannot be made, it probably was not more than 300 acre-feet in 1972.

Ground-Water Withdrawal and Its Effects

In southern Navajo County ground-water development is mainly along the Little Colorado River and Silver Creek. The depth and the chemical quality of the ground water govern development, especially for agricultural and industrial uses; development of ground water for public supplies is not as dependent on the depth to water as it is on the chemical quality. The soil in the valleys along Silver Creek and the Puerco and the Little Colorado Rivers is suitable for farming, and the pumping lifts make it economically feasible to use ground water for irrigation where the water is of suitable chemical quality. The valleys are attractive to industry because of the available water supply and their proximity to two railroads.

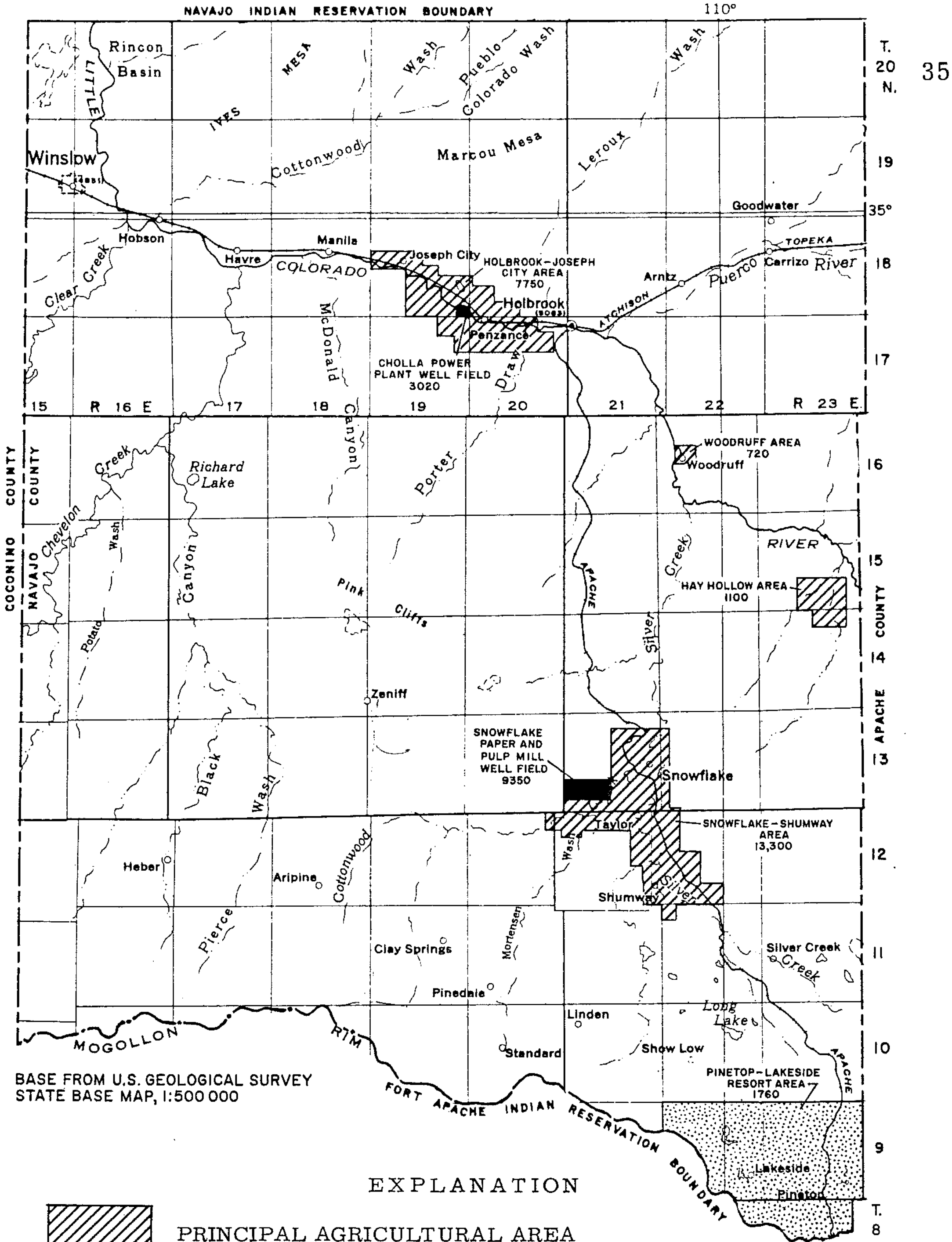
The main agricultural areas are the Snowflake-Shumway area, the Hay Hollow area, the Holbrook-Joseph City area, and the Woodruff area; the two main water-using industrial complexes are near Joseph City and Snowflake (fig. 5). The Pinetop-Lakeside summer resort area is another place of major ground-water development (fig. 5). Although the volume of ground water pumped is rather small, the economic return per unit volume is appreciable.

Snowflake-Shumway and Hay Hollow areas.--In these areas ground water is obtained directly from the Coconino aquifer by pumping wells and indirectly by flowing wells and springs that discharge into Silver Creek near Shumway. In 1953 about 6,500 acre-feet of water was pumped from the Coconino aquifer; about 4,500 acre-feet of the pumpage was used for irrigation, and about 500 acre-feet was used for public, domestic, livestock, and industrial supplies (Johnson, 1962, p. 32-33). In addition, between 1,200 and 1,500 acre-feet of water was discharged by flowing wells near Shumway and Hay Hollow. Most of the water from the flowing wells was diverted for irrigation during the growing season and was lost as surface flow during the nongrowing season.

The amount of water withdrawn from the Coconino aquifer increased from about 6,500 acre-feet in 1953 to about 24,800 acre-feet in 1972 owing to the growing demands of agriculture, public-supply systems, and industries. In 1972 about 13,300 acre-feet of the water pumped from the Coconino aquifer was used for irrigation in the Snowflake-Shumway area; about 1,100 acre-feet was used for irrigation in the Hay Hollow area; about 9,350 acre-feet was used for industry by the Snowflake Paper and Pulp Mill; and about 1,000 acre-feet was used for public, domestic, livestock, recreation, and other industrial purposes.

As a result of the ground-water withdrawal in the Snowflake-Shumway area, water-level declines of from 5 to 50 feet occurred in a 60-square-mile area from spring 1951 to spring 1973 (fig. 6). The largest water-level decline is in the Snowflake Paper and Pulp Mill well field northwest of Taylor. Pumping from irrigation wells near Shumway, Taylor, and Snowflake has caused declines of from 5 to 30 feet. Water levels measured at the end of the pumping season may be as much as 30 feet lower than water levels measured the following spring.

Water-level declines range from 10 to 20 feet in the Hay Hollow area. The extent of the area of decline is not known, but it may be several square miles. Many wells drilled prior to 1955 flowed at the surface for several years; however, in 1972 only one well flowed during the nongrowing season. The depth to water in most wells in the Hay Hollow area is from 20 to 30 feet greater at the end of the pumping season than it is the following spring.



EXPLANATION

PRINCIPAL AGRICULTURAL AREA

APPROXIMATE LOCATION OF INDUSTRIAL WELL FIELD

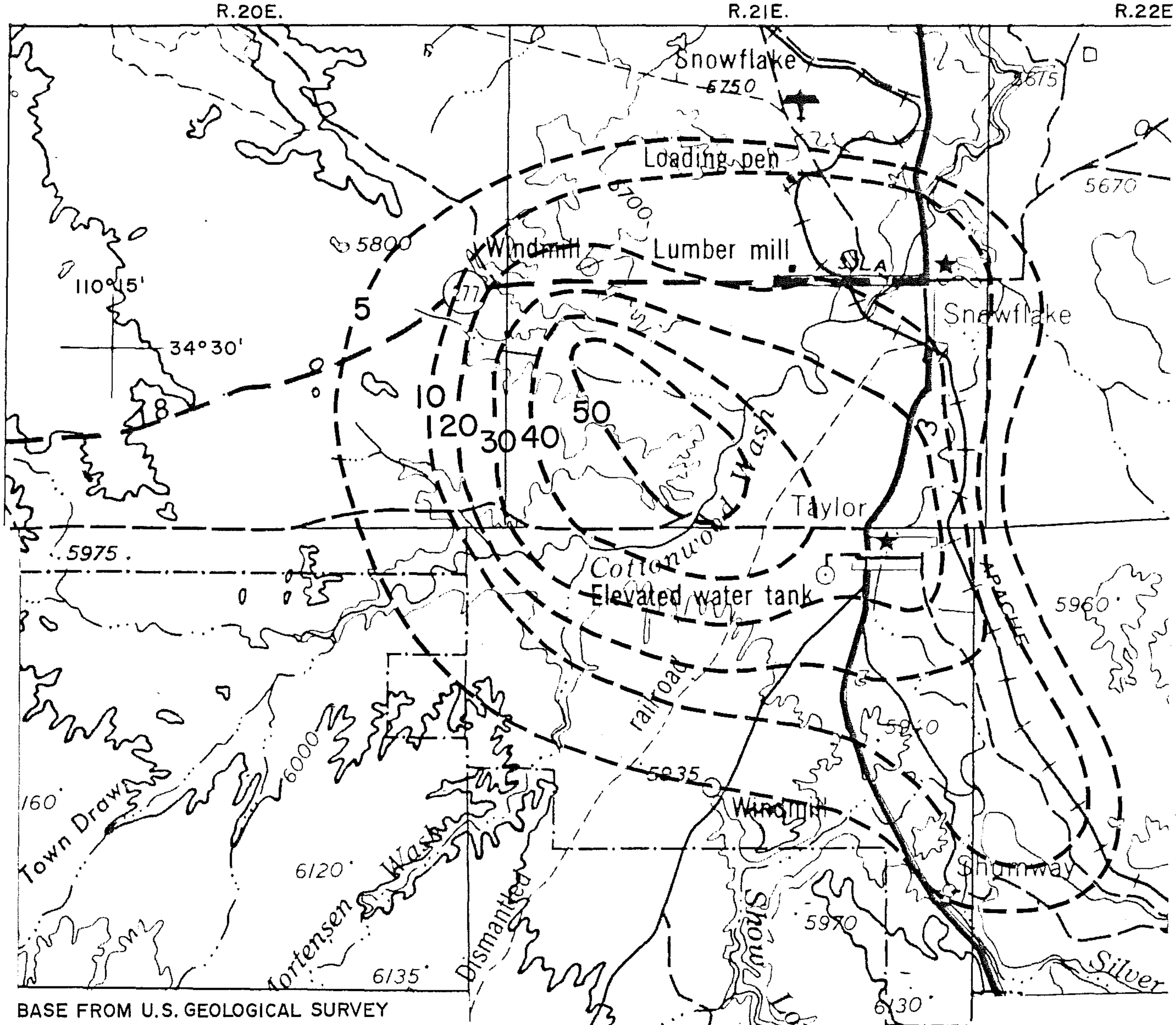
PINETOP-LAKESIDE RESORT AREA

13,300 APPROXIMATE AMOUNT OF GROUND WATER PUMPED, IN ACRE-FEET, IN 1972

10 0 10 20 MILES

10 0 10 20 KILOMETRES

FIGURE 5.--AREAS OF MAJOR GROUND-WATER DEVELOPMENT IN SOUTHERN NAVAJO COUNTY.



EXPLANATION

—50— APPROXIMATE LINE OF EQUAL WATER-LEVEL DECLINE—INTERVAL 5 AND 10 FEET

0 5 MILES

0 5 KILOMETRES

CONTOUR INTERVAL 200 FEET

FIGURE 6.--WATER-LEVEL DECLINES, SPRING 1951 TO SPRING 1973, IN THE SNOWFLAKE-SHUMWAY AREA.

According to Peirce and Gerrard (1966), the southern margin of the halite deposits in the Supai Formation transects the Snowflake-Shumway area near Taylor and is about 12 miles south of Hay Hollow (pl. 3A). Although no deterioration in the chemical quality of the water in the Coconino aquifer has been documented in the Snowflake-Shumway and Hay Hollow areas, solution of the halite by moving ground water probably would occur if the deposits were not completely insulated by the nearly impermeable siltstone beds in the Supai Formation.

Holbrook-Joseph City area.--The flow from many springs and seeps that formed large marshes was the original means of ground-water discharge from the Coconino aquifer in the Holbrook-Joseph City area. These natural discharge points prompted early settlers to develop the springs and to drill wells; in recent years many deep wells have been drilled in the area.

In 1946 the Coconino aquifer was supplying about 4, 300 acre-feet of ground water to flowing and nonflowing wells in the Holbrook-Joseph City area; the water was used mainly for the irrigation of about 1, 600 acres of farmland (Babcock and Snyder, 1947, p. 8-9). About 3, 700 acre-feet of the water was uncontrolled discharge from flowing wells, and most of this water was allowed to flow to the Little Colorado River and was lost during periods when it could not be used for irrigation. Only 600 acre-feet of the water was obtained from pumping wells. In addition to the water obtained from the flowing and nonflowing wells, an undetermined amount was discharged from the Coconino aquifer to the springs and seeps in the marshy areas. The largest spring noted in 1946 was in sec. 35, T. 18 N., R. 19 E.; the estimated flow was 400 gal/min (Babcock and Snyder, 1947, p. 17-18). Many smaller springs and seeps were noted in the marshy area near Obed Meadow about 2 miles south of Joseph City, and an undetermined amount of this spring flow was either lost to the atmosphere by evapotranspiration or recharged to the alluvium along the Little Colorado River. The amount of flow from these springs was not estimated or measured.

The amount of water withdrawn from the Coconino aquifer increased from about 4, 300 acre-feet in 1946 to about 11, 500 acre-feet in 1972. About 7, 750 acre-feet of the water pumped in 1972 was used for irrigation, about 3, 020 acre-feet was used for the operation of the Cholla Power Plant east of Joseph City, and about 700 acre-feet was used for public and domestic supplies. The Cholla Power Plant was put into operation in 1962 and uses an average of about 3, 500 acre-feet of ground water per year.

As a result of the increase in pumpage, much of the natural discharge from the springs and flowing wells has ceased, and many springs and wells flow only in the winter when there is no pumping for irrigation. From spring 1962 to spring 1971, water levels declined about 17 feet in the Cholla Power Plant wells (Guyton and Associates, 1971, p. 15). Water levels measured during the pumping season show declines of 10 to 50 feet at Joseph City and of 10 to 20 feet near Holbrook, but water-level measurements made in the spring before the start of the pumping season indicate that less than 5 feet of decline occurred from 1950 to 1972. Water levels in some wells in the Holbrook-Joseph City area have shown no decline since about 1950.

In the Holbrook-Joseph City area the chemical quality of the water in the Coconino aquifer is a greater hinderance to additional development of ground water than the water-level declines. The chemical quality of the water is marginal for irrigation use in the northern part of the area, especially north of Joseph City in the N. $\frac{1}{2}$ secs. 16 and 17, T. 18 N., R. 19 E. Chemical analyses of water from the Coconino aquifer show a deterioration in the quality of water during the pumping season (table 5). For example, the water from well (A-18-19)8ddd contained 3,280 mg/l dissolved solids in March 1966 and was abandoned as a source of irrigation water. The dissolved-solids concentration in water from well (A-18-19)16bbc increased from about 2,300 to 2,900 mg/l during the 1968 pumping season, and analyses of water from other wells north of Joseph City show a deterioration in quality during the pumping season and from year to year. The lowering of water levels for extended periods during the pumping season permits the salty water in the Coconino aquifer to move southward into areas of withdrawal and also permits the salty water in the lower part of the aquifer to move upward.

Woodruff area.--The Woodruff area is a small farming community about 10 miles southeast of Holbrook (fig. 5). During the 1972 pumping season, about 720 acre-feet of water was withdrawn from the Coconino aquifer for irrigation use. The water contains from 600 to 800 mg/l dissolved solids and is acceptable for most uses. Irrigation wells generally yield from 500 to 700 gal/min of water, but larger yields can be obtained. Water-level declines or changes in the chemical quality of water have not been measured in wells that tap the Coconino aquifer in the Woodruff area.

Pinetop-Lakeside resort area.--In 1972 about 150 wells obtained water from the Pinetop-Lakeside aquifer, which is the main source of ground water in the Pinetop-Lakeside area; most of the wells are concentrated in the small part of the area near Pinetop and Lakeside. In 1971 about 1,520 acre-feet of ground water was withdrawn from the aquifer, and in 1972 about 1,760 acre-feet was withdrawn. The water is used mainly for public-supply, irrigation, and domestic purposes.

In the summer water-level declines range from less than 5 feet to about 75 feet. Water-level declines of more than 20 feet generally occur only near public-supply or irrigation wells or where the saturated parts of the aquifer are discontinuous. In areas where the water is used mainly for domestic supplies seasonal water-level declines generally are not more than 15 feet; no long-term water-level declines have been recorded in the area.

Between 80 and 90 percent of the ground water pumped from the Pinetop-Lakeside aquifer is from the basaltic rocks, and the rest is from the sedimentary rocks. In addition to the ground water withdrawn by wells, about 2,250 acre-feet per year is discharged from the basaltic rocks by the three major springs—Big, Adair, and Porter Springs. The spring discharge is collected in reservoirs and is used for irrigation during the summer. In 1972 the combined discharge from wells and major springs in the Pinetop-Lakeside aquifer was about 4,000 acre-feet.

Other areas.--A few small areas along the Puerco River and the Winslow area are the only other places in southern Navajo County where significant quantities of ground water are used by agriculture or industry. Only a few scattered irrigation, domestic, and livestock wells and the small public-supply systems near Show Low and Heber are present in the undeveloped areas in southern Navajo County. In 1972 an estimated 1,000 acre-feet of water was pumped in the undeveloped areas.

In the Winslow area ground water is obtained from wells that tap the Coconino aquifer and from a few dug and drilled wells that tap the alluvium. Winslow obtains about 1,700 acre-feet of water per year from a well field in Coconino County about 7 miles southwest of Winslow. An additional 400 acre-feet of water per year is obtained from wells that tap the Coconino aquifer or the alluvium along the Little Colorado River; this water is used for irrigation, domestic, and livestock supplies in the Winslow area. The chemical quality of the water in the Coconino and alluvial aquifers is considered to be fair to marginal for most uses, and no long-term water-level declines have been measured in the area.

Most of the ground water pumped from the alluvium along the Puerco River is used for irrigation, but a small part is used for public-supply, livestock, and domestic purposes. The amount of water pumped probably is not more than 1, 000 acre-feet per year. The chemical quality of the water in the alluvium is considered to be fair to marginal for most uses. Water-level declines have not been measured in the wells along the Puerco River.

SUMMARY

The main source of water in southern Navajo County is the ground water in storage in the Coconino aquifer, which underlies the entire area. About 76 percent of the water supply is from the Coconino aquifer, about 6 percent is from the Pinetop-Lakeside aquifer and from the alluvium along the large stream channels and flood plains, about 15 percent is from surface water, and about 3 percent is imported. The Coconino has the greatest potential for future development of any of the aquifers in southern Navajo County.

The Coconino aquifer consists of the Coconino Sandstone, the uppermost part of the underlying Supai Formation, and the overlying Kaibab Limestone. The Coconino Sandstone is the main water-bearing unit in the aquifer and yields water to wells in all but two structurally high areas—along the crest of the Holbrook anticline and near Heber. Wells in the structurally high areas obtain their water from the siltstone and sandstone beds in the uppermost part of the Supai Formation. In the southern and central parts of the area water in the Coconino aquifer is unconfined; in the northern and eastern parts of the area the ground water is under confined conditions and may rise as much as 500 feet above the top of the aquifer.

The Pinetop-Lakeside aquifer—which includes the sedimentary rocks, rim gravel, and basaltic rocks—is present only in the southeastern part of the area, and the alluvium is present along the large stream channels and flood plains in the northern part of the area; these units overlie the Coconino aquifer. The ground water in the Pinetop-Lakeside aquifer and that in the alluvium is unconfined.

The depth to water in the Coconino aquifer ranges from more than 1, 000 feet below the land surface in the nonartesian mountainous areas near the Mogollon Rim to several feet above the land surface in the artesian areas along Silver Creek and the Little Colorado River. The depth to water generally is from 0 to 200 feet below the land surface along Silver Creek and the Little Colorado River and increases with increasing land-surface altitude in all directions away from the streams. The depth to water in the Pinetop-Lakeside aquifer ranges from less than 25 feet below the land surface near Rainbow Lake to more than 600 feet in the northern and eastern parts of the area; the depth to water in wells that penetrate only the upper part of the aquifer generally is less than the depth to water in wells that penetrate the entire sequence of sedimentary and basaltic rocks. The depth to water in the alluvium along the large stream channels in the northern part of the area generally is from 20 to 40 feet below the land surface; however, the depth to water probably is less along the perennial reaches of the streams.

In southern Navajo County well yields vary considerably—from a few gallons per minute for domestic and livestock wells to as much as 2, 800 gal/min for irrigation wells. The largest yields are from wells that tap the Coconino aquifer, and irrigation and industrial wells generally yield between 500 and 2, 000 gal/min. Irrigation and public-supply wells that tap the Pinetop-Lakeside aquifer yield from 20 to 350 gal/min of water. Most wells obtain their water from the basaltic rocks or from the underlying sedimentary rocks, and only a few wells tap both units. Although the alluvium yields as much as 1, 700 gal/min of water to irrigation wells along the Little Colorado and Puerco Rivers, most irrigation and public-supply wells that tap this unit yield from 300 to 600 gal/min.

In general, the ground water in the southern part of the area is of good chemical quality and is acceptable for most uses; however, the water in the northern part of the area is of marginal chemical quality and that in the northernmost part is unsuitable for most uses. In the southern part of the area water in the Pinetop-Lakeside and Coconino aquifers generally contains from about 100 to 350 mg/l dissolved solids—mainly calcium, magnesium, and bicarbonate. The salinity hazard is medium to high and the sodium hazard is low to medium for most water from the Coconino aquifer; the water is used successfully for the irrigation of most crops grown in the southern part of the area. In the central and northern parts of the area the dissolved-solids concentrations in water in the Coconino and alluvial aquifers generally range from about 500 to 10, 000 mg/l; however, concentrations of as much as 68, 240 mg/l are present in water in the Coconino aquifer. The dominant ions in solution in water in the Coconino and alluvial aquifers are sodium, chloride, and bicarbonate. In the northern part of the area the salinity hazard is high to very high and the sodium hazard is medium to very high for the water from the Coconino aquifer; however, the water is used to irrigate salt-tolerant crops where the soil drainage is adequate.

Although the water in the Pinetop-Lakeside aquifer is chemically suitable for public and domestic purposes, several of the supplies have been polluted periodically by coliform bacteria; however, no evidence of widespread pollution was found during this study. Only analyses of water from shallow wells that are near septic tanks or sewage ponds indicate pollution by coliform bacteria, and analyses of water from wells that are completely sealed off from the shallow ground water do not show coliform bacteria. If the 1972 sewage-treatment methods are continued, however, the potential for widespread bacteriological pollution will increase as the population increases.

In 1972 about 41,200 acre-feet of ground water was withdrawn from the aquifers in southern Navajo County. The Coconino aquifer furnished about 38,400 acre-feet of ground water or about 93 percent of the total withdrawal; about 1,760 acre-feet of water was withdrawn from the Pinetop-Lakeside aquifer, and about 1,000 acre-feet was withdrawn from the alluvium. In addition, about 1,700 acre-feet of water per year is imported from a well field in Coconino County for use by Winslow.

In southern Navajo County water levels fluctuate seasonally in response to pumping, but in the last 25 years the net change has been negligible. Although the water levels in several wells that tap the Coconino aquifer in the Snowflake-Shumway area have declined as much as 50 feet, the decline generally is between 5 and 30 feet. Water-level declines near Holbrook, Joseph City, and Woodruff generally are less than 5 feet, and the decline ranges from 10 to 20 feet near Hay Hollow. No long-term water-level declines have been measured in wells that tap the Pinetop-Lakeside or alluvial aquifers.

The Coconino aquifer is the best potential source for the development of additional ground-water supplies in southern Navajo County. Moderate to large quantities of ground water containing less than 2,000 mg/l dissolved solids probably can be developed in the Coconino aquifer in about 65 percent of the area; however, the depth to water in about 35 percent of the area is more than 500 feet, which may restrict the development of the aquifer for some uses. The salty water zone that underlies the fresh-water zone in the Coconino aquifer near Holbrook and Joseph City may hinder ground-water development; however, proper well construction and adequate well spacing will minimize the possibility of deterioration in the quality of the water.

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APPENDIX ——— BASIC DATA

Table 4.--Records of selected wells in southern Navajo County

Location: See page 8 for description of well-numbering and location system.
Land-surface altitude: Determined from U.S. Geological Survey topographic maps.
First casing perforation: OE, open end; OHB, open hole below.
Water-bearing strata: Where more than one unit is listed, the unit listed first is the main source of water.
Static water level: R, reported.
Bail or pump-test data: E, estimated; R, reported.

Use of water: D, domestic; I, irrigation; Ind, industrial; PS, public supply; S, livestock; U, unused.
Well log: T, driller's log of well included in table 6.
Chemical analyses: T, chemical analysis included in table 5.
Remarks: FC, field determination of specific conductance, in micromhos per centimetre at 25°C; ST, field determination of specific conductance was measured after water stood in a storage tank for an undetermined length of time.

Location	Date completed (month, year)	Reported depth of well (feet)	First casing perforation (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water-bearing strata	Static water level		Bail or pump-test data			Use of water	Well log	Chemical analysis	Remarks
						Feet below land surface	Date measured	Rate (gal/min)	Drawdown (feet)	Duration of test (hours)				
(A-8-22)1abb	-------	---------	----------	6,780	Sedimentary rocks	69	9-16-71	-------	-------	--------	U	------	------	
(A-8-23)1bcd	7-70	330	140	7,280	Basaltic rocks	115R	7-20-70	-------	-------	--------	PS	T	------	Pinetop Lakes 1.
1dbc	5-66	363	272	7,318	Basaltic rocks	137R 167	5-31-66 7-22-71	220R	10R	--------	PS, I	T	T	Ponderosa Water Co. 2.
2cba	7-64	223	160	7,210	Basaltic rocks	80R	7- -64	200R	-------	72R	PS, Ind	T	T	Southwest Forest Industries 2.
3ccb	10-71	353	83	7,180	Basaltic rocks	11	11- 3-71	50	269	2.50	I	T	------	Pinetop Lakes 3; observation well; FC, 220.
4abd	6-70	275	----------	7,125	Sedimentary rocks and basaltic rocks	65	7-20-71	-------	-------	--------	D	------	T	
4baa	1951	500	----------	7,085	Sedimentary rocks and basaltic rocks	35R 24	12- 7-51 11-24-71	-------	-------	--------	U	------	T	Plugged back from 870 feet.
4bcb	1955	250	210	7,030	Sedimentary rocks	168	7-14-71	26R	27R	--------	PS	------	T	Pinetop Water Co. 1.
4bcc	1959	350	200	7,045	Sedimentary rocks	193	7-14-71	-------	-------	--------	PS	T	T	Pinetop Water Co. 2; deepened from 250 feet in 1969.
5abb1	5-49	193	----------	6,950	Basaltic rocks	--------	----------	-------	-------	--------	U	T	------	
5abb2	7-54	200	100	6,950	Basaltic rocks	100R	7- -54	16R	-------	--------	I	T	------	FC, 280 (ST).
5aca	1954	210	----------	6,950	Sedimentary rocks	126	7-12-71	-------	-------	--------	D	------	------	
5acd	10-64	272	150	6,970	Sedimentary rocks	130	10- -64	250R	-------	24R	PS	T	T	Pinetop Water Co. 4; deepened from 222 feet in 1970.
5ada	7-55	215	55	7,000	Sedimentary rocks	110R 134	7- 9-55 8-24-71	100R	-------	--------	D, S	T	------	
5bbb	9-71	220	150	6,930	Basaltic rocks and sedimentary rocks	94	10-14-71	-------	-------	--------	I	T	------	FC, 540.
5bda	8-69	312	152	6,925	Sedimentary rocks	100	7-14-71	225R	33R	80R	PS	T	T	Pinetop Water Co. 6.
5ddc	4-72	600	----------	7,075	Sedimentary rocks	330	4-25-72	45	40	13	PS	T	T	Arizona Water Co. Pine Lake well; plugged back from 735 feet.
6dac	-------	---------	----------	6,920	Sedimentary rocks	82	7-12-71	-------	-------	--------	U	------	------	
9aca	1956	350	190	7,145	Basaltic(?) rocks	85R	9-17-58	300R	-------	--------	I	------	------	White Mountain Country Club 1.
9acc1	-------	185	----------	7,150	Basaltic rocks	89R	-70	70R	-------	--------	PS	------	T	Arizona Water Co. White Mountain 1.
9acc2	-------	185	----------	7,150	Basaltic rocks	88	7-21-71	-------	-------	--------	PS	------	T	Arizona Water Co. White Mountain 2.

Table 4.--Records of selected wells in southern Navajo County—Continued

Location	Date completed (month, year)	Reported depth of well (feet)	First casing perforation (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water-bearing strata	Static water level: Feet below land surface	Static water level: Date measured	Bail or pump-test data: Rate (gal/min)	Bail or pump-test data: Drawdown (feet)	Bail or pump-test data: Duration of test (hours)	Use of water	Well log	Chemical analysis	Remarks
(A-8-23)9bab	1957	210	85	7,105	Basaltic(?) rocks	89	10-15-71	350R	-------	-------	I	------	------	White Mountain Country Club 2; FC, 155.
10baa	5-72	357	60	7,175	Basaltic rocks	81	5- 9-72	15R	-------	-------	I	T	------	Pinetop Lakes 5.
10bad	11-70	385	118	7,190	Basaltic rocks	88R	11-20-70	165R	237R	3.50R	PS, I	T	T	Pinetop Lakes 2; observation well.
10bbb	12-71	375	73	7,182	Basaltic rocks	27	12-14-71	145	63	8	I	T	T	Pinetop Lakes 4.
11abc	8-64	290	----------	7,270	Basaltic rocks	100R 115	8-29-64 7-22-71	350	8	2	I	T	T	Ponderosa Water Co. 1.
11bdb	1-64	292	140	7,255	Basaltic rocks	80	2- -64	200R	-------	-------	PS, I	T	T	Southwest Forest Industries 1.
11cca	2-64	291	160	7,280	Basaltic rocks	121	8- 3-71	50R	-------	-------	U	------	------	Southwest Forest Industries; observation well.
12aaa	11-70	375	160	7,350	Basaltic rocks	160R 196	11- 2-70 7-22-71	280R	75R	8R	PS	T	T	Ponderosa Water Co. 3.
(A-9-21)1bac1	-------	---------	----------	6,545	Sedimentary rocks	106	5-10-72	-------	-------	-------	U	------	------	
1bac2	1966	580	----------	6,540	Coconino Sandstone	545R	8-16-71	-------	-------	-------	PS	------	------	Summer Pines Well; originally drilled to 630 feet.
1bac3	-------	130	----------	6,525	Sedimentary rocks	89	5-10-72	-------	-------	-------	D	------	------	
(A-9-22)4abc	1965	200	135	6,585	Sedimentary rocks	164	5-10-72	92R	25R	12R	PS	T	T	Ellsworth Heights well.
4caa	-------	700	600	6,605	Coconino Sandstone	571	7-21-71	150R	20R	24R	PS	------	T	Navapache Hospital.
4cbd	1956	650	610	6,600	Coconino Sandstone	579	7-20-71	-------	-------	-------	PS	------	T	
8aab	-------	755	----------	6,635	Coconino Sandstone	585R	----------	-------	-------	-------	PS	------	T	Pine View well.
9bca	1950	675	----------	6,600	Coconino Sandstone	555	10-28-71	-------	-------	-------	D	------	------	
9ccc	1962	680	600	6,650	Coconino Sandstone	591	7-21-71	50R	1.5R	24R	PS	------	T	Arizona Water Co. Wagon Wheel well.
9dbc	-------	670	565	6,600	Coconino Sandstone	590R	----------	206	-------	-------	PS	------	T	Scott's Pine Meadow well.
10cbb	1953	650	600	6,610	Coconino Sandstone	570	7-20-71	-------	-------	-------	PS	------	T	Show Low Lake Co-op well.
10ccb	-------	---------	----------	6,625	Coconino Sandstone	582	9- 1-71	16R	-------	-------	U	------	T	Observation well.
14adb	-------	750	----------	6,730	Coconino Sandstone	670R	7- -72	-------	-------	-------	PS	------	T	Porter Creek subdivision well.
14dad	-------	725	----------	6,720	Coconino Sandstone	670R	-45	-------	-------	-------	PS	------	------	FC, 480 (ST).
15bcd	7-71	665	625	6,680	Coconino Sandstone	612	7-13-71	-------	-------	-------	D	T	T	
15ccd	-------	300(?)	----------	6,660	Sedimentary rocks	35	9-23-71	-------	-------	-------	D	------	------	FC, 620.
15dcb1	1953	708	648	6,640	Coconino Sandstone	595	8- 3-71	100R	-------	-------	D	------	T	
15dcb2	6-72	125	75	6,640	Sedimentary rocks	50	6-20-72	-------	-------	-------	S	T	------	
16acd	1959	680	----------	6,660	Coconino Sandstone	605R	-59	-------	-------	-------	U	------	------	

Table 4.--Records of selected wells in southern Navajo County—Continued

Location	Date completed (month, year)	Reported depth of well (feet)	First casing perforation (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water-bearing strata	Static water level		Bail or pump-test data			Use of water	Well log	Chemical analysis	Remarks
						Feet below land surface	Date measured	Rate (gal/min)	Drawdown (feet)	Duration of test (hours)				
(A-9-22)22aac	-------	---------	----------	6,720	Sedimentary rocks	103	9-22-71	-------	-------	--------	PS	------	------	FC, 360.
22acc	1946	127	----------	6,705	Sedimentary rocks	82	9-23-71	-------	-------	--------	D	------	------	
22add	-------	150	----------	----------	Sedimentary rocks	--------	-----------	-------	-------	--------	PS	------	------	FC, 370.
22baa	1956	180	----------	6,650	Sedimentary rocks	46	10-28-71	-------	-------	--------	D	------	------	FC, 560.
22bab	5-61	145	85	6,670	Sedimentary rocks	60R	5-11-61	12R	0	--------	D	T	T	Observation well.
22cda	1946	130	100	6,715	Sedimentary rocks	60	9-22-71	-------	-------	--------	D	T	------	FC, 350.
22dbc	7-64	120	80	6,710	Sedimentary rocks	64	9-22-71	20R	-------	--------	D	------	T	
23bbc	1954	160	----------	6,710	Sedimentary rocks	88	9-14-71	15R	-------	--------	D	------	------	FC, 360.
23bcc	-------	183	103	6,750	Sedimentary rocks	131	9-23-71	-------	-------	--------	I	------	------	FC, 380.
23cba1	1956	100	----------	6,720	Sedimentary rocks	33	8-25-71	-------	-------	--------	D	T	------	
23cba2	8-69	150	----------	6,725	Sedimentary rocks	48	8-25-71	15E	60	0.25	D	------	------	
23cbd	-------	125	----------	6,735	Sedimentary rocks	69	7-21-71	25R	-------	--------	PS	------	T	Arizona Water Co. Gardner well.
23cdb	1960	104	80	6,725	Sedimentary rocks	55	7- 1-71	12.50	15	.50	D	------	------	
23dac	4-71	101	----------	6,725	Basaltic rocks	13	9- 2-71	30R	-------	--------	D	T	T	
23dbc	1964	100	----------	6,710	Sedimentary rocks	13	8-26-71	-------	-------	--------	D	------	------	FC, 600.
23dbd	1960	100	----------	6,725	Basaltic rocks	18	8-26-71	-------	-------	--------	PS	------	------	FC, 415.
23ddc	-------	42	----------	6,725	Basaltic rocks	20R	9- 1-71	-------	-------	--------	I	------	------	
24bca	-------	180	----------	6,725	Basaltic rocks	77	9-22-71	15R	-------	--------	U	T	------	
24cac	1960	118	65	6,745	Sedimentary rocks and basaltic rocks	53	9-21-71	-------	-------	--------	D	T	------	FC, 390 (ST).
24cbb	1968	112	OHB 3	6,735	Basaltic rocks	49	9-14-71	17R	-------	--------	D	------	------	FC, 510.
24ccb	1966	103	----------	6,720	Basaltic rocks	47	7-21-71	70	-------	--------	PS	------	T	Arizona Water Co. Peterson well.
24dcc	4-70	207	----------	6,810	Sedimentary rocks	82	9-15-71	20R	9.0R	2R	D	------	------	FC, 460 (ST).
25aca	10-69	164	115	6,810	Sedimentary rocks	46R 73	10-25-69 9-15-71	10R	-------	--------	D	T	------	FC, 470.
25acb	7-70	150	120	6,810	Basaltic rocks and rim gravel	68	9-14-71	-------	-------	--------	D	------	------	FC, 520.
25acc	-------	110	----------	6,810	Basaltic rocks	68	9- 1-71	-------	-------	--------	U	------	------	
25acd	7-70	148	108	6,815	Rim gravel and basaltic rocks	58R	7- 4-70	-------	-------	--------	D	------	T	
25ada	-------	300	100	6,880	Rim gravel and basaltic rocks	167R 197	----------- 7-21-71	13	-------	--------	PS	------	------	Arizona Water Co. Moonridge well.
25bda	12-68	150	80	6,810	Basaltic rocks	66	10-28-71	25R	-------	--------	I	T	------	

Table 4.--Records of selected wells in southern Navajo County—Continued

Location	Date completed (month, year)	Reported depth of well (feet)	First casing perforation (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water-bearing strata	Static water level: Feet below land surface	Static water level: Date measured	Bail or pump-test data: Rate (gal/min)	Bail or pump-test data: Drawdown (feet)	Bail or pump-test data: Duration of test (hours)	Use of water	Well log	Chemical analysis	Remarks
(A-9-22)25cad	1950	80	OHB 60	6,780	Sedimentary rocks	60R	6- -72	12R	-------	--------	PS	------	------	Arizona Water Co. Summer Home well; originally drilled to 160 feet.
25ccb	1960	97	OHB 17	6,760	Basaltic rocks	30	8-25-71	20R	-------	--------	PS	T	------	Wonderland Acres 2.
25cdc	1969	250	----------	6,755	Basaltic rocks and sedimentary rocks	64	8-25-71	30R	-------	--------	PS	T	T	Wonderland Acres 3.
25cdd	1960	150	OHB 12	6,760	Basaltic rocks	24	8-25-71	30R	-------	--------	U	------	------	
25dad	1964	130	----------	6,830	Basaltic(?) rocks	70	7-13-71	-------	-------	--------	D	------	------	
25ddd	1920	169	OHB 17	6,820	Basaltic rocks	68	8-25-71	5	-------	--------	PS	T	------	Well deepened from 149 feet; observation well.
26aaa	1932	275	----------	6,725	Basaltic rocks and sedimentary(?) rocks	22	9- 1-71	-------	-------	--------	PS	------	------	FC, 480.
26ada1	-------	65	----------	6,755	Basaltic rocks	19R	----------	-------	-------	--------	PS	------	T	
26ada2	1950	220	20	6,755	Basaltic rocks and rim(?) gravel	24	9- 2-71	-------	-------	--------	U	T	------	
26adb	1-70	95	----------	6,740	Basaltic rocks	18	9- 1-71	-------	-------	--------	D	------	------	FC, 500 (ST).
26bbb	-------	128	----------	6,745	Sedimentary rocks	56	8-26-71	-------	-------	--------	U	------	------	Observation well.
26cab	-------	120	----------	6,725	Basaltic rocks and sedimentary(?) rocks	--------	----------	-------	-------	--------	D	------	------	FC, 780.
26cac	6-71	232	80	6,730	Basaltic rocks and sedimentary rocks	32	9-21-71	-------	-------	--------	D	T	------	FC, 430.
26cbc	11-72	750	500	6,720	Coconino Sandstone	626	5- -73	110R	7R	32	PS	T	------	Arizona Water Co. Larson Road well.
26cda1	-------	260	----------	6,740	Sedimentary rocks	59R	-71	125	-------	--------	PS	------	T	Arizona Water Co. Sandy Forty 1.
26cda2	5-70	300	100	6,740	Sedimentary rocks	52R	5-15-70	-------	-------	--------	PS	T	T	Arizona Water Co. Sandy Forty 2.
26dcc	1949	215	----------	6,750	Sedimentary rocks	81	9-16-71	50R	-------	--------	PS	------	------	FC, 400.
26dcd	1971	---------	----------	6,755	Sedimentary rocks	63	9-16-71	-------	-------	--------	D	------	------	
27ada	1-69	120	80	6,720	Sedimentary rocks	62	10-28-71	-------	-------	--------	I	------	------	
35aaa	7-58	100	----------	6,720	Sedimentary rocks	8	8-26-71	-------	-------	--------	PS	------	------	Mountainaire subdivision; FC, 390.
35aac	8-70	150	110	6,730	Sedimentary rocks and basaltic rocks	16R	8-14-70	-------	-------	--------	D	T	------	
35aba	1960	100	60	6,750	Sedimentary rocks and basaltic rocks	32	9-16-71	15R	-------	--------	D	------	------	FC, 690.
35abc	8-70	100	80	6,750	Basaltic rocks	34	9-21-71	10R	-------	--------	D	T	------	FC, 800.
35abd	9-70	228	60	6,750	Basaltic rocks and sedimentary rocks	33	9-15-71	30	-------	--------	D	T	------	FC, 750.
36cbb	11-64	200	40	6,745	Sedimentary rocks	32R	12-11-64	80R	-------	--------	U	T	T	Observation well.

Table 4.--Records of selected wells in southern Navajo County—Continued

Location	Date completed (month, year)	Reported depth of well (feet)	First casing perforation (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water-bearing strata	Static water level: Feet below land surface	Static water level: Date measured	Bail or pump-test data: Rate (gal/min)	Bail or pump-test data: Drawdown (feet)	Bail or pump-test data: Duration of test (hours)	Use of water	Well log	Chemical analysis	Remarks
(A-9-22)36cbc	1953	180	----------	6,755	Sedimentary rocks	35 50	-53 10-27-71	35R	-------	--------	D	T	------	
36cca	-------	220	----------	6,750	Sedimentary rocks	59	7-21-71	30R	-------	--------	PS	------	T	Arizona Water Co. Woodland Park well.
36cdd	-------	---------	----------	6,790	Sedimentary rocks	82	9-16-71	-------	-------	--------	U	------	------	
(A-9-23)4dbd	1962	905	700	7,080	Basaltic rocks and sedimentary rocks	632	9- 2-71	15R	-------	--------	PS	T	T	Porter Mountain Estates well.
5dcc	10-60	780	500	6,995	Sedimentary rocks	582	9-15-71	15R	-------	--------	D	T	T	
22ddb	1961	130	----------	7,170	Basaltic rocks	69R 72	-61 10-27-71	-------	-------	--------	PS	------	T	Sky Hi Retreat well.
23bda1	-------	150	----------	7,240	Basaltic rocks	135	4- -72	-------	-------	--------	D	------	------	
23bda2	-------	250	----------	7,240	Basaltic rocks	170	4- -72	-------	-------	--------	D	T	------	
31bbd	-------	---------	----------	6,880	Basaltic rocks	82	9- 1-71	-------	-------	--------	I	------	------	
31bcb	1947	125	----------	6,880	Basaltic(?) rocks	46	8-25-71	-------	-------	--------	PS	------	------	
32cdc	1950	70	50	6,980	Basaltic rocks	24	8- 3-71	-------	-------	--------	D	------	T	Observation well.
32dbc	-------	236	94	6,990	Basaltic rocks	80R 102	8- -69 7-14-71	85R	29R	48R	PS	T	T	Pinetop Water Co. 5.
32dcb	1952	165	80	7,000	Basaltic rocks	94	7-20-71	-------	-------	--------	D	------	T	
32dcc	-------	200	109	7,015	Basaltic rocks	50R 57.3	5-19-55 9-18-72	65R	-------	--------	U	T	T	Pinetop Water Co. 3.
32ddd	5-72	180	140	7,080	Basaltic rocks and rim gravel	77	6- 6-72	-------	-------	--------	D	T	------	
34aba	-------	418	----------	7,175	Basaltic rocks	162	8-25-71	65R	205R	6.50R	I	T	T	Deepened from 350 feet.
34abd1	10-62	250	----------	7,180	Basaltic rocks	40	8-25-71	-------	20R	--------	D	T	T	
34abd2	6-67	355	220	7,200	Basaltic rocks	71	8-25-71	-------	-------	--------	I	------	------	FC, 220.
(A-10-19)15bbb	1-67	1,840	69	6,980	Sedimentary(?) rocks	79	6-13-72	-------	-------	--------	U	------	------	Tenneco oil test.
(A-10-20)3bbb	9-72	500	390	6,460	Coconino Sandstone	395R	9- 6-72	-------	-------	--------	D, I	------	------	
4cbb	1967	495	----------	6,415	Coconino Sandstone	349	6- 8-72	200R	-------	--------	D, I	------	------	
8dac	1-72	600	500	6,454	Coconino Sandstone	390	4- 3-72	-------	-------	--------	D	------	T	
12abd	9-71	500	420	6,400	Coconino Sandstone	408	9-24-71	-------	-------	--------	D	------	------	
20aba	1-65	525	450	6,540	Coconino Sandstone	449	6-15-72	-------	-------	--------	PS	T	------	Pinedale Estates well.
(A-10-21)3caa	5-72	300	200	6,122	Coconino Sandstone	193	5-11-72	-------	-------	--------	D	------	------	FC, 475.
3ccc	8-68	260	220	6,160	Coconino Sandstone	199R 209	8-29-68 5-10-72	-------	-------	--------	PS	T	T	Russo 2.
3dbb1	1963	260	----------	6,075	Coconino Sandstone	143	5-10-72	-------	-------	--------	PS	------	------	Russo 1; FC, 480 (ST).

Table 4.--Records of selected wells in southern Navajo County—Continued

Location	Date com-pleted (month, year)	Reported depth of well (feet)	First cas-ing perfo-ration (feet be-low land surface)	Land-surface altitude (feet above mean sea level)	Water-bearing strata	Static water level		Bail or pump-test data			Use of water	Well log	Chem-ical anal-ysis	Remarks
						Feet below land surface	Date measured	Rate (gal/min)	Draw-down (feet)	Dura-tion of test (hours)				
(A-10-21)3dbb2	1966	240	----------	6,090	Coconino Sandstone	160R	-66	-------	-------	--------	D	------	------	
5dcc	12-60	400	270	6,280	Coconino Sandstone	285R	1-24-61	135R	13R	6R	D, I	------	------	FC, 530.
6dcb	8-71	370	330	6,280	Coconino Sandstone	300	9-15-71	-------	-------	--------	D	------	------	
8bba	-------	365	----------	6,255	Coconino Sandstone	284	5-10-72	-------	-------	--------	D	------	------	FC, 585 (ST).
9dbd	9-71	316	260	6,238	Coconino Sandstone	255	5-11-72	-------	-------	--------	D	T	------	
10baa	4-69	305	245	6,175	Coconino Sandstone	243	6-5-72	-------	-------	--------	PS	T	T	
14cac	9-68	435	----------	6,338	Coconino Sandstone	359	5-10-72	195R	-------	--------	PS	------	T	
24ddc	-------	450	----------	6,400	Coconino Sandstone	402	5-11-72	20R	-------	--------	PS	------	T	Park Valley subdivision.
(A-10-22)9cbd	-------	500	----------	6,349	Coconino Sandstone	439	4- 4-72	-------	-------	--------	S	T	------	
17abb	1971	80	40	6,330	Sedimentary rocks	47	5-10-72	-------	-------	--------	U	T	------	
18dcd	1935	385	----------	6,348	Coconino Sandstone	372	4-12-60	-------	-------	--------	U	------	------	
20dad	-------	600	----------	6,405	Coconino Sandstone	420R	-----------	600	-------	--------	PS	------	T	Show Low 4.
22dcb	-------	605	----------	6,530	Coconino Sandstone	548	6-28-72	-------	-------	--------	S	------	------	
30aba	5-67	750	550	6,485	Coconino Sandstone	523	3-27-69	480	27	20	PS	T	T	Show Low 5.
32acb	9-70	575	525	6,515	Coconino Sandstone	512R	9-14-70	43	-------	--------	PS	------	T	Timberline Park well.
32dab	-------	130	----------	6,430	Sedimentary rocks	64	1-11-72	15R	-------	.50R	D	------	------	FC, 410 (ST).
32dcd	-------	488	----------	6,482	Coconino Sandstone	458R	-60	2R	-------	--------	PS	------	------	
32ddc	-------	110	----------	6,475	Sedimentary rocks	83	5-11-72	-------	-------	--------	D	------	------	FC, 455 (ST).
(A-10-23)12adb	8-64	350	310	6,583	Basaltic rocks	233R	8- -64	-------	-------	--------	S	------	------	
14cdd	11-63	640	600	6,842	Basaltic rocks	579	11-14-63	10R	0	12	S	------	------	FC, 460.
16bbb	-------	375	----------	6,538	Basaltic rocks	309R	-----------	-------	-------	--------	S	------	------	
(A-11-18)2cdd	1964	530	460	6,540	Coconino Sandstone	460R	-64	-------	-------	--------	D	------	------	
(A-11-19)2dbd	-------	---------	----------	6,240	Coconino Sandstone	427	6-15-72	-------	-------	--------	S	------	------	
11bcc	1965	510	510	6,310	Coconino Sandstone	404	6- 7-72	100R	-------	--------	D, I	------	------	
13dbd	12-55	465	----------	6,430	Coconino Sandstone	415R	1-23-56	-------	-------	--------	D, S	------	------	
14abb	1922	470	----------	6,335	Coconino Sandstone	390R	-22	-------	-------	--------	PS	------	T	Clay Springs well.
15dcd	5-72	430	330	6,395	Coconino Sandstone	314	5-11-72	-------	-------	--------	I	T	------	
24dda	9-72	500	460	6,455	Coconino Sandstone	425R	9-22-72	-------	-------	--------	D, Ind	------	------	
(A-11-20)2aad	1965	560	----------	6,272	Coconino Sandstone	524	4- 5-72	-------	-------	--------	S	------	------	
31dda	9-59	495	450	6,536	Coconino Sandstone	452R	-59	22R	0R	.25R	D, S	------	------	
32baa	4-72	450	340	6,385	Coconino Sandstone	324	5-11-72	-------	-------	--------	I	T	------	

Table 4.--Records of selected wells in southern Navajo County—Continued

Location	Date completed (month, year)	Reported depth of well (feet)	First casing perforation (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water-bearing strata	Static water level		Bail or pump-test data			Use of water	Well log	Chemical analysis	Remarks
						Feet below land surface	Date measured	Rate (gal/min)	Drawdown (feet)	Duration of test (hours)				
(A-11-20)32cba	1942	420	410	6,455	Coconino Sandstone	405R	-42	10R	-------	-------	PS	------	T	Pinedale well.
(A-11-21)17bac	8-63	390	-------	6,109	Coconino Sandstone	338	8- -63	60R	5R	5R	S	T	T	
(A-11-22)6bcd	1959	372	-------	5,819	Coconino Sandstone	80R 81	-59 2-15-72	560	-------	-------	I	------	------	FC, 460.
10cdc	-------	250	-------	5,995	Moenkopi(?) Formation	48R	-------	-------	-------	-------	PS	------	------	White Mountain Lake 4.
14cca	-------	200	120	6,080	Moenkopi(?) Formation	87	5-25-72	65R	-------	-------	PS	T	T	White Mountain Lake 3.
15adb	-------	300	-------	6,005	Moenkopi(?) Formation	96	5-25-72	50R	-------	-------	PS	T	T	White Mountain Lake 1.
15ddd	-------	185	-------	6,103	Moenkopi(?) Formation	114	5-25-72	65R	-------	-------	PS	T	T	White Mountain Lake 2.
17bcb	-------	-------	-------	6,098	Coconino Sandstone	279	4-19-72	-------	-------	-------	U	------	------	
19bad	12-62	450	410	6,240	Coconino Sandstone	407	4-19-72	7R	0R	6R	S	T	------	FC, 625.
23baa	1971	650	-------	6,138	Coconino Sandstone	314	5-25-72	-------	-------	-------	PS	------	------	White Mountain Lake 5.
33aaa	12-43	485	448	6,326	Coconino Sandstone	438	11-22-53	-------	-------	-------	S	------	------	
35dbc	1968	525	-------	6,340	Coconino Sandstone	449	9-15-72	50R	-------	-------	PS	------	T	
(A-11-23)3bba	2-39	464	-------	6,126	Coconino Sandstone, Kaibab(?) Limestone, and Moenkopi(?) Formation	340R	-39	18R	-------	-------	S	T	T	
6abb	3-45	357	OHB 285	6,186	Moenkopi Formation	232	11-20-53	-------	-------	-------	S	------	------	FC, 375.
14cba	5-44	240	-------	6,376	Moenkopi(?) Formation	-------	-------	-------	-------	-------	S	------	------	
19bcd	4-41	55	-------	6,107	Basaltic rocks	10R	3- -51	-------	-------	-------	D, S	T	------	Originally drilled to 100 feet.
31dbb	2-72	360	295	6,382	Moenkopi(?) Formation	292	9-14-72	42R	-------	15R	U	T	T	
32dcd	5-40	218	-------	6,377	Basaltic rocks	165R	5- -40	21R	-------	-------	S	T	------	FC, 125.
(A-12-15)36ddc	6-69	600	OHB 30	6,960	Coconino Sandstone	535	6-13-72	-------	-------	-------	D, S	T	T	
(A-12-16)10adb	1967	740	OHB 20	6,605	Coconino Sandstone	694	6- 5-72	15R	-------	-------	D	------	------	
13ccc	-------	423	OHB 412	6,450	Coconino Sandstone	397R	-------	8R	-------	-------	U	------	------	
20dba	3-65	845	-------	6,860	Coconino Sandstone	713R	3- -65	70R	22R	12R	PS	T	T	Heber Job Corps well.
24bba	1961	600	-------	6,450	Coconino Sandstone	390R	-61	47R	-------	-------	PS	------	T	Heber well.
25cad	1965	605	425	6,520	Coconino Sandstone	427	11-21-72	40R	-------	-------	PS	------	------	
(A-12-17)13bdb	1938	560	-------	6,390	Coconino Sandstone	515R	6- -72	-------	-------	-------	D	------	------	FC, 425.
18ddd	1-67	730	OHB 41	6,686	Coconino Sandstone	650R	3- 3-71	20R	-------	6R	S	------	T	Oil test well; plugged back from 1,502 feet.
21bcb	-------	700	-------	6,570	Coconino Sandstone	550R	-------	70R	-------	-------	PS	------	T	Zane Grey well.
32cad	7-69	740	585	6,637	Coconino Sandstone	544	10- 2-69	115	22	24	D	------	------	Heber Ranger Station well.
32ddc	-------	600	-------	6,635	Coconino Sandstone	535	6-21-72	87R	37R	-------	PS	------	T	Arizona Water Co. Overgaard well.

Table 4.--Records of selected wells in southern Navajo County—Continued

Location	Date completed (month, year)	Reported depth of well (feet)	First casing perforation (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water-bearing strata	Static water level		Bail or pump-test data			Use of water	Well log	Chemical analysis	Remarks
						Feet below land surface	Date measured	Rate (gal/min)	Drawdown (feet)	Duration of test (hours)				
(A-12-17)33bdd	1966	600	----------	6,565	Coconino Sandstone	486	6-21-72	400R	-------	--------	PS	------	T	Arizona Water Co. Pine Meadows well.
(A-12-18)2cdc	-------	560	----------	6,246	Coconino Sandstone	510R	-64	-------	-------	--------	S	------	------	
9ccc	-------	660	610	6,420	Coconino Sandstone	596R	4- 6-65	7R	1R	8.50R	S	T	------	
10dcd	-------	500	----------	6,320	Coconino Sandstone	450R	-----------	-------	-------	--------	S	------	------	
13bad	1948	490	----------	6,251	Coconino Sandstone	395	11-23-53	-------	-------	--------	S	------	------	
35acc	-------	500	----------	6,380	Coconino Sandstone	450R	-----------	-------	-------	--------	D	------	------	
(A-12-19)4add	12-55	485	----------	6,075	Coconino Sandstone	431	6- 5-72	-------	-------	--------	S	T	------	
20bbb	8-64	550	510	6,240	Coconino Sandstone	495R	8- -64	-------	-------	--------	S	T	------	
(A-12-20)2ddd	-------	235	----------	5,761	Coconino Sandstone	201	3-27-73	12R	-------	--------	S	T	------	
7adb	-------	330	----------	5,915	Coconino Sandstone	275R	-----------	-------	-------	--------	S	------	------	
29ddd	1965	540	----------	6,217	Coconino Sandstone	485	6- 5-72	-------	-------	--------	S	------	------	
34dbc	7-61	530	490	6,212	Coconino Sandstone	484R 484	7-25-61 4- 5-72	7.5R	<5	5	S	------	------	FC, 410.
(A-12-21)1bbb	1969	350	50	5,614	Coconino Sandstone	56	1-12-72	2,800	-------	--------	I	------	T	
2bdc	2-45	200	150	5,672	Coconino Sandstone	84R 117	2- -45 3-21-73	680	30	--------	I	T	------	FC, 385.
2dcd	12-58	250	150	5,655	Coconino Sandstone	75 75	12-28-58 3-21-73	600	13.6	2	I	T	------	
5acd	3-72	217	193	5,740	Coconino Sandstone	192	11-22-72	-------	-------	--------	D	T	------	
6aaa	7-59	320	170	5,728	Coconino Sandstone	--------	-----------	1,600R	-------	--------	I	------	------	
6aba1	12-51	240	----------	5,744	Coconino Sandstone	161	4- -52	382	-------	--------	U	T	------	FC, 451.
6aba2	7-72	320	200	5,744	Coconino Sandstone	193	3-26-73	-------	-------	--------	I	T	------	Replacement well.
6abb	1966	360	210	5,747	Coconino Sandstone	180 194.2	-66 3-26-73	700	-------	--------	I	------	------	FC, 405.
6ddc	-------	340	----------	5,756	Coconino Sandstone	202	2-24-72	580	-------	--------	I	------	------	FC, 450.
8cca	-------	---------	----------	5,761	Coconino Sandstone	153 161	11-23-53 3-26-73	-------	-------	--------	S	------	------	
12aab	1956	250	150	5,668	Coconino Sandstone	55 83	4- 7-60 3-21-73	750	-------	--------	I	------	------	FC, 470.
12ddc	-------	123	----------	5,665	Coconino Sandstone	34 43	8-24-50 3-21-73	-------	-------	--------	I	------	------	
21abb	-------	---------	----------	5,838	Coconino Sandstone	191	4- 5-72	-------	-------	--------	S	------	------	FC, 450.
22bbc	-------	210	----------	5,792	Coconino Sandstone	142 147	11-22-53 3-26-73	-------	-------	--------	S	------	T	

Table 4.--Records of selected wells in southern Navajo County—Continued

Location	Date completed (month, year)	Reported depth of well (feet)	First casing perforation (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water-bearing strata	Static water level: Feet below land surface	Static water level: Date measured	Bail or pump-test data: Rate (gal/min)	Bail or pump-test data: Drawdown (feet)	Bail or pump-test data: Duration of test (hours)	Use of water	Well log	Chemical analysis	Remarks
(A-12-21)24bbc	-------	200	----------	5,706	Coconino Sandstone	57 61	3-11-69 2-25-72	615	-------	--------	I	------	------	FC, 560.
29dcb	-------	---------	----------	5,889	Coconino Sandstone	186	4- 5-72	-------	-------	--------	S	------	------	FC, 510.
(A-12-22)2adb	-------	410	----------	5,995	Coconino Sandstone	387	2-15-72	-------	-------	--------	S	------	T	
4cdd	-------	260	OHB 20	5,741	Coconino Sandstone	143	2- 9-72	-------	-------	--------	S	-----	T	
7Edcc	5-72	---------	----------	5,743	Coconino Sandstone	115	5-24-72	-------	-------	--------	I	------	------	
18Ecad	2-64	289	100	5,697	Coconino Sandstone	62	2-25-72	-------	-------	--------	U	T	------	
19Eadd	9-63	320	90	5,733	Coconino Sandstone	84	2-23-72	1,380	-------	--------	I	T	------	FC, 220.
19Wccc	7-51	200	----------	5,653	Coconino Sandstone	Flowing	3- 1-73	1,270	-------	--------	I	------	------	FC, 470.
24bdd2	-------	209	----------	5,890	Coconino Sandstone	203	10- 3-72	-------	-------	--------	S	------	------	FC, 320.
30Eadd	-------	---------	----------	5,727	Coconino Sandstone	58	3-21-73	540	-------	--------	I	------	------	FC, 330.
30Ebac	1971	450	----------	5,763	Coconino Sandstone	90R	-71	-------	-------	--------	I	------	------	
30Ebcd	-------	427	OHB 300	5,773	Coconino Sandstone	84R 91	2- -46 5-13-57	513	-------	--------	U	------	------	
30Edbb	-------	---------	----------	5,778	Coconino Sandstone	94	3-21-73	-------	-------	--------	I	------	------	FC, 340.
30Wbcb	7-51	235	OHB 200	5,671	Coconino Sandstone	Flowing Flowing	6- -51 3-21-73	1,900+	54	40	I	------	T	
31Wbcb	1964	350	50	5,705	Coconino Sandstone	6 7	-64 3-21-73	2,640	-------	--------	I	------	T	
33bdb	4-64	350	210	5,815	Coconino Sandstone	94	2-23-72	320	-------	--------	I	T	------	FC, 275.
(A-12-23)3ccb	4-42	375	----------	5,942	Coconino Sandstone and Moenkopi Formation	320	11-21-53	15R	-------	--------	S	------	T	
20ccb	4-38	240	195	5,955	Coconino(?) Sandstone	220	11-21-53	20R	-------	--------	S	------	------	FC, 240.
(A-13-15)14dca	10-71	1,100	OHB 20	6,830	Supai Formation and Coconino Sandstone	910R	10- -71	14R	-------	--------	D, S	T	------	
(A-13-16)34bdb2	1968	875	----------	6,560	Coconino Sandstone	740R	-68	-------	-------	--------	U	------	------	
(A-13-17)5caa	3-64	843	803	6,377	Coconino Sandstone	794	3-15-64	28R	15R	7	S	T	T	
(A-13-18)2daa	6-46	492	452	5,975	Coconino Sandstone	442	6-29-46	10R	-------	--------	S	------	------	
3bba	1971	600	----------	6,025	Coconino Sandstone	500	9-21-72	-------	-------	--------	S	------	------	
20bcd	1963	625	565	6,212	Coconino Sandstone	555R	-63	-------	-------	--------	D	------	------	FC, 375.
28bac	-------	452	----------	6,245	Coconino Sandstone	412R	----------	-------	-------	--------	S	------	------	
(A-13-19)18ccc	-------	500	----------	6,042	Coconino Sandstone	424	2- 5-55	-------	-------	--------	S	------	------	
27caa	-------	515	----------	6,060	Coconino Sandstone	463	12-24-63	-------	-------	--------	S	------	------	
27cdc	1961	560	500	6,085	Coconino Sandstone	491	6-23-72	50R	-------	--------	PS	------	T	

Table 4.--Records of selected wells in southern Navajo County—Continued

Location	Date completed (month, year)	Reported depth of well (feet)	First casing perforation (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water-bearing strata	Static water level: Feet below land surface	Static water level: Date measured	Bail or pump-test data: Rate (gal/min)	Bail or pump-test data: Drawdown (feet)	Bail or pump-test data: Duration of test (hours)	Use of water	Well log	Chemical analysis	Remarks
(A-13-19)36bdb	-------	439	----------	6,005	Coconino Sandstone	396R	----------	18R	-------	--------	D, S	T	------	
(A-13-20)3dda	3-52	3,140	----------	5,972	Coconino Sandstone	545R	3- -52	-------	-------	--------	U	------	------	Aztec 1 oil test.
4cdb	-------	485	----------	5,932	Coconino Sandstone	435R	----------	-------	-------	--------	S	------	------	
13ddd	9-56	609	485	5,790	Coconino Sandstone	260R 290	9-10-56 7-14-72	-------	-------	--------	U	------	------	Southwest test hole 5; observation well.
17cdb	-------	516	----------	5,985	Coconino Sandstone	473R	----------	-------	-------	--------	D	------	------	
29ccd	-------	525	445	6,005	Coconino Sandstone	433	6-23-72	-------	-------	--------	PS	T	T	
(A-13-21)8dbb	-------	---------	----------	5,691	Coconino Sandstone	190	9-21-72	-------	-------	--------	S	------	------	FC, 530 (ST).
10cda	9-56	416	267	5,632	Coconino Sandstone	123 131	6- 8-64 4- 5-72	-------	-------	--------	S	T	T	Southwest test hole 6.
10dcb	1966	350	200	5,626	Coconino Sandstone	128	2-23-72	1,200	-------	--------	I	------	------	FC, 520.
11cdb	1971	300	100	5,595	Coconino Sandstone	98	2-23-72	1,450	-------	--------	I	------	------	FC, 480.
13ddd1	-------	285	----------	5,604	Coconino Sandstone	65R	8- -43	900R	8R	--------	U	------	------	
13ddd2	11-61	300	220	5,604	Coconino Sandstone	71 79	11-16-61 2-23-72	550	-------	--------	I	T	------	Replacement well.
14cbd1	6-44	160	OHB 95	5,597	Coconino Sandstone	67	4-23-52	600R	30R	--------	U	T	------	
14cbd2	-------	---------	----------	5,605	Coconino Sandstone	95	4-15-66	-------	-------	--------	I	------	------	Replacement well; observation well.
15add	-------	120	----------	5,608	Coconino Sandstone	86 118	6-10-58 4-16-63	-------	-------	--------	S	------	------	
16ddc	-------	135	----------	5,627	Coconino Sandstone	94 97	6-10-58 9-14-72	-------	-------	--------	S	------	------	
18ddd	-------	250	----------	5,741	Coconino Sandstone	209	1- 5-55	-------	-------	--------	S	------	------	
23cbc1	-------	252	235	5,610	Coconino Sandstone	45 87	8- -44 3-21-73	1,100R	18R	--------	U	T	------	
23cbc2	-------	---------	----------	5,614	Coconino Sandstone	92	3-21-73	690	-------	--------	I	------	T	
24ccb	5-51	328	----------	5,618	Coconino Sandstone	60 90	4-24-52 2- 7-72	550	-------	--------	I	T	------	FC, 686; observation well.
25bab	9-71	310	230	5,600	Coconino Sandstone	70	3- 7-72	1,000	-------	--------	I	T	------	FC, 710.
25bcb	-------	200	----------	5,600	Coconino Sandstone	--------	----------	340	-------	--------	I	------	T	
26aab	-------	300	----------	5,665	Coconino Sandstone	118	9-14-50	-------	-------	--------	PS	------	T	Snowflake 1 well.
26adb1	12-68	400	304	5,686	Coconino Sandstone	147	1-14-69	960	26	30.50	U	T	------	Snowflake 2 well.
26adb2	6-72	440	380	5,685	Coconino Sandstone	154	6- 9-72	-------	-------	--------	PS	------	T	Snowflake 3 well; replacement well for 2.
29bbb	8-60	700	312	5,735	Coconino Sandstone	--------	----------	1,200R	-------	--------	Ind	------	------	Southwest 1.
29bbc	6-56	700	----------	5,724	Coconino Sandstone	177R	6-10-58	-------	-------	--------	U	T	T	Southwest test hole 2.

Table 4.--Records of selected wells in southern Navajo County—Continued

Location	Date completed (month, year)	Reported depth of well (feet)	First casing perforation (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water-bearing strata	Static water level		Bail or pump-test data			Use of water	Well log	Chemical analysis	Remarks
						Feet below land surface	Date measured	Rate (gal/min)	Drawdown (feet)	Duration of test (hours)				
(A-13-21)29bda	6-56	726	272	5,727	Coconino Sandstone	173R	6-18-56	-------	-------	--------	U	------	------	Southwest test hole 1.
29bdd	1-61	744	310	5,736	Coconino Sandstone	--------	-----------	1,350R	-------	--------	Ind	------	------	Southwest 2.
29dcc	3-61	705	309	5,734	Coconino Sandstone	--------	-----------	1,710R	-------	--------	Ind	------	------	Southwest 3.
29dda	8-56	671	548	5,740	Coconino Sandstone	183	6-10-58	-------	-------	--------	U	------	T	Southwest test hole 3; observation well.
32ccb	1945	300	----------	5,723	Coconino Sandstone	132R 185	-45 2-24-72	670	-------	--------	I	------	T	Well deepened from 212 feet; FC, 470.
33aba	3-64	666	209	5,656	Coconino Sandstone	--------	-----------	1,700R	-------	--------	Ind	------	------	Southwest 5.
33bba	5-61	694	310	5,744	Coconino Sandstone	--------	-----------	1,420R	-------	--------	Ind	------	------	Southwest 4.
34add	4-65	300	----------	5,685	Coconino Sandstone	125	4- -65	-------	-------	--------	I	T	------	
34ccd	3-49	162	----------	5,672	Coconino Sandstone and Kaibab(?) Limestone	65R 130	3- -49 3- 8-72	-------	-------	--------	I	T	T	
34dcc2	2-46	254	----------	5,658	Coconino Sandstone	99	12- 4-64	435	-------	--------	I	T	------	Observation well.
36bbb	1954	332	232	5,600	Coconino Sandstone	44 72	4- 8-60 4- 5-72	-------	-------	--------	I	------	------	
(A-13-22)3bba	-------	440	OHB 20	5,797	Coconino Sandstone	375	10-23-53	-------	-------	--------	S	------	------	
(A-13-22)10cca	1931	280	OHB 15	5,721	Coconino Sandstone and Moenkopi(?) Formation	240R	6- -72	-------	-------	--------	D, S	------	T	
19bbb	1960	255	----------	5,602	Coconino Sandstone	80	1-13-72	-------	-------	--------	D	------	------	FC, 920.
28bdc	-------	---------	----------	5,697	Coconino Sandstone	148	2-15-72	-------	-------	--------	S	------	------	
30bcd	1960	300	166	5,654	Coconino Sandstone	91 109	4- 8-60 3-21-73	880	-------	--------	I	------	------	FC, 240; observation well.
(A-13-23)9acb2	-------	200	----------	5,652	Moenkopi(?) Formation	83	9-14-72	-------	-------	--------	S	------	------	
11dab	-------	350	----------	5,802	Coconino Sandstone	303R	-----------	-------	-------	--------	S	T	------	
23dab	11-51	405	----------	5,918	Coconino Sandstone	293	11- -53	-------	-------	--------	S	------	------	
(A-14-16)8dcb	-------	984	----------	6,205	Coconino Sandstone and Supai(?) Formation	682	6-14-66	-------	-------	--------	D	------	T	
9dbb	-------	1,038	----------	6,205	Coconino Sandstone and Supai(?) Formation	800R	-----------	-------	-------	--------	PS	------	T	
34bcb	1971	960	----------	6,425	Coconino Sandstone and Supai(?) Formation	900	-71	-------	-------	--------	S	------	T	
(A-14-17)18bbb	11-68	800	710	6,070	Coconino Sandstone	607	6-20-72	-------	-------	--------	PS	T	T	
(A-14-18)5adc	1947	550	----------	5,881	Coconino Sandstone	530R	-----------	-------	-------	--------	S	------	T	
(A-14-19)7ccc	-------	430	----------	5,841	Coconino Sandstone	408	10-17-72	-------	-------	--------	U	T	------	
23acb	-------	440	----------	5,894	Coconino Sandstone	400R	-----------	-------	-------	--------	S	------	------	

Table 4.--Records of selected wells in southern Navajo County—Continued

Location	Date completed (month, year)	Reported depth of well (feet)	First casing perforation (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water-bearing strata	Static water level: Feet below land surface	Static water level: Date measured	Bail or pump-test data: Rate (gal/min)	Bail or pump-test data: Drawdown (feet)	Bail or pump-test data: Duration of test (hours)	Use of water	Well log	Chemical analysis	Remarks
(A-14-19)30aaa	1952	475	----------	5,877	Coconino Sandstone	413	10-17-72	-------	-------	--------	S	------	------	
(A-14-20)30caa	-------	400	----------	5,831	Coconino Sandstone	370	9-21-72	-------	-------	--------	D, S	------	T	
33daa	-------	---------	----------	6,005	Coconino Sandstone	533	11- -53	-------	-------	--------	U	------	T	
36aaa	-------	412	----------	5,831	Coconino Sandstone	386	7-14-72	-------	-------	--------	S	------	------	
(A-14-21)19bba	-------	447	----------	5,797	Coconino Sandstone	357R	-----------	-------	-------	--------	S	T	------	
24ada	-------	240	OHB 33	5,535	Coconino Sandstone	198	12-14-71	-------	-------	--------	S	------	------	
27ddd	6-72	350	310	5,710	Coconino Sandstone	282	6- 9-72	-------	-------	--------	S	------	------	
35ada	12-70	370	----------	5,670	Coconino Sandstone	235R	7- -71	100	-------	--------	S	------	------	FC, 270.
(A-14-22)6bdd	-------	---------	----------	5,507	Coconino Sandstone	230	11-23-71	-------	-------	--------	S	------	------	
7bdc	-------	270	----------	5,535	Coconino Sandstone	213	12-14-71	-------	-------	--------	S	T	------	
13cbc	1971	420	----------	5,697	Coconino Sandstone and Moenkopi(?) Formation	394	9- 6-72	-------	-------	--------	S	------	------	FC, 1,000 (ST).
(A-14-23)2bda	9-51	525	425	5,398	Coconino Sandstone	47 55	10-16-51 3-22-72	1,100	16	--------	I	T	------	
2cbc	2-38	325	280	5,390	Coconino Sandstone	22 46	12- -50 3-22-72	-------	-------	--------	S	T	------	
8dcb	1972	410	----------	5,605	Coconino Sandstone	289	10- 3-72	-------	-------	--------	D	------	------	
9abb	-------	---------	----------	5,533	Coconino Sandstone and Moenkopi(?) Formation	130	4- 5-72	-------	-------	--------	S	------	------	FC, 3,000 (ST).
19dcd	-------	365	----------	5,630	Coconino Sandstone and Moenkopi(?) Formation	273	10-25-53	-------	-------	--------	S	------	------	FC, 2,680.
32ccd	5-40	340	OHB 304	5,725	Coconino Sandstone and Moenkopi(?) Formation	283	10-25-53	21R	-------	--------	S	T	------	FC, 1,480.
(A-15-15)12bbc	-------	---------	----------	5,918	Coconino Sandstone	718	12- 2-66	-------	-------	--------	S	------	T	
(A-15-16)6daa	10-72	833	----------	5,845	Coconino Sandstone and Supai Formation	690R	10-17-72	9R	-------	--------	D, S	T	------	
15ddc	-------	900	----------	5,912	Coconino Sandstone and Supai Formation	732	6-14-66	-------	-------	--------	D, S	------	T	
35aac	1948	915	----------	5,975	Coconino Sandstone and Supai Formation	662	10-17-72	-------	-------	--------	S	------	T	
(A-15-17)31dcc	-------	---------	----------	5,917	Coconino Sandstone	550	6-20-72	-------	-------	--------	PS	------	------	
34dac	-------	647	----------	5,901	Coconino Sandstone	576	2- 7-55	-------	-------	--------	D, S	T	------	
(A-15-18)19aaa	12-43	940	OHB 745	6,115	Supai Formation	839	5-11-73	-------	-------	--------	U	------	------	Oil test; originally drilled to 3,850 feet.
(A-15-19)21ab	-------	1,986	----------	5,972	Coconino(?) Sandstone	679R	-----------	-------	-------	--------	U	------	------	Hopi 1 oil test.
(A-15-20)19dda	-------	639	----------	5,802	Coconino Sandstone	600R	-----------	-------	-------	--------	S	------	------	FC, 2,100.

Table 4.--Records of selected wells in southern Navajo County—Continued

Location	Date completed (month, year)	Reported depth of well (feet)	First casing perforation (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water-bearing strata	Static water level: Feet below land surface	Static water level: Date measured	Bail or pump-test data: Rate (gal/min)	Bail or pump-test data: Drawdown (feet)	Bail or pump-test data: Duration of test (hours)	Use of water	Well log	Chemical analysis	Remarks
(A-15-21)2aac	-------	---------	----------	5,344	Coconino Sandstone	200	11-22-71	-------	-------	--------	S	------	------	FC, 610.
8ddc	-------	400	----------	5,504	Coconino Sandstone	351	11-22-71	-------	-------	--------	U	------	T	
21dac	-------	---------	----------	5,651	Coconino Sandstone	401	11-22-71	-------	-------	--------	S	------	------	
32acb	-------	430	OHB 8	5,653	Coconino Sandstone and Moenkopi(?) Formation	361	11-22-71	-------	-------	--------	S	------	T	
36bcb	-------	340	OHB 46	5,538	Coconino Sandstone	267	11-22-71	12R	-------	--------	S	------	T	
(A-15-22)2cdd	-------	350	OHB 300	5,287	Coconino Sandstone	102	3-21-72	-------	-------	--------	S	T	------	FC, 980.
(A-15-22)10dba	8-71	300	180	5,358	Coconino Sandstone	175	11-23-71	-------	-------	--------	S	T	T	
32dda	-------	---------	----------	5,401	Coconino Sandstone	136	11-23-71	-------	-------	--------	S	------	------	
34abc	-------	---------	----------	5,427	Coconino Sandstone	159	11-23-71	-------	-------	--------	S	------	------	
36acb	-------	---------	----------	5,467	Coconino Sandstone	174	3-22-72	-------	-------	--------	S	------	------	
(A-15-23)3bbb	1956	270	OE 270	5,275	Coconino Sandstone	Flowing	12-22-71	-------	-------	--------	I, S	------	T	
14bda	-------	<100	----------	5,294	Moenkopi Formation	35	3-20-72	-------	-------	--------	U	------	------	
17dab	-------	300	----------	5,336	Coconino Sandstone	44	3-20-72	-------	-------	--------	S	------	T	
22abb	1966	432	----------	5,374	Coconino Sandstone	61	3-20-72	-------	-------	--------	S	------	------	FC, 650 (ST).
26bdd	3-52	530	OHB 316	5,328	Coconino Sandstone	Flowing	3-20-72	725	-------	--------	I	T	------	FC, 630.
26cba1	-------	482	OHB 344	5,328	Coconino Sandstone	6 19	8-23-50 3-21-72	-------	-------	--------	I	T	------	
26cba2	-------	500	----------	5,331	Coconino Sandstone	Flowing	8- -50	-------	-------	--------	D	------	------	
26cdc	-------	482	OHB 344	5,355	Coconino Sandstone	21	3-20-72	-------	-------	--------	I	------	------	
27ddb	5-52	600	300	5,335	Coconino Sandstone and Kaibab Limestone	20 17	7-31-53 3-21-72	1,100	-------	--------	I	T	T	Observation well.
28dcc	-------	425	OHB 280	5,352	Coconino Sandstone and Kaibab Limestone	8 30	8-23-50 3-20-72	740	-------	--------	I	------	------	FC, 530; observation well.
28ddd	-------	297	280	5,340	Coconino Sandstone and Kaibab Limestone	3	8-31-50	-------	-------	--------	D	T	------	
34aad	-------	430	363	5,352	Coconino Sandstone and Kaibab Limestone	5 30	8-23-50 3-20-72	750R	-------	--------	I	T	T	
34bad	10-72	---------	----------	5,368	Coconino Sandstone and Kaibab Limestone	48	3-20-73	-------	-------	--------	I	------	------	
34dcc	1-39	385	OHB 280	5,372	Coconino Sandstone	14R	1- -39	720	65	--------	I	T	------	FC, 550.
35cdb	10-72	460	300	5,388	Coconino Sandstone	56	3-20-73	-------	-------	--------	I	------	------	
(A-16-15)2Sbbc	-------	---------	----------	5,498	Coconino Sandstone	388	9-20-72	-------	-------	--------	S	------	------	
13dab	6-64	705	----------	5,608	Coconino Sandstone	574	8-16-66	43	-------	87	Ind	------	------	

Table 4.--Records of selected wells in southern Navajo County—Continued

Location	Date completed (month, year)	Reported depth of well (feet)	First casing perforation (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water-bearing strata	Static water level: Feet below land surface	Static water level: Date measured	Bail or pump-test data: Rate (gal/min)	Bail or pump-test data: Drawdown (feet)	Bail or pump-test data: Duration of test (hours)	Use of water	Well log	Chemical analysis	Remarks
(A-16-15)23ada	-------	---------	----------	5,681	Coconino Sandstone	--------	----------	-------	-------	--------	S	------	------	FC, 530.
(A-16-16)2Scab	5-48	570	OHB 13	5,538	Coconino Sandstone	473	9-19-72	-------	-------	--------	S	------	T	
(A-16-17)8cab	3-50	615	OHB 13	5,608	Coconino Sandstone	560	3- 4-50	-------	-------	--------	S	T	T	
11dcc	8-49	550	OHB 20	5,535	Coconino Sandstone	480R	8- -49	-------	-------	--------	D, S	------	T	
27bca	1958	815	OHB 20	5,739	Coconino Sandstone and Supai Formation	662	10-17-72	10R	-------	--------	S	T	T	
(A-16-18)2bdd	-------	---------	----------	5,460	Coconino Sandstone	--------	----------	-------	-------	--------	S	------	T	
9acd1	1959	---------	OHB 40	5,675	Coconino(?) Sandstone and Supai Formation	608	9-27-72	-------	-------	--------	S	------	T	
28dcb	1968	750	OHB 20	5,754	Coconino(?) Sandstone and Supai Formation	670R	7-31-69	-------	-------	--------	S	------	T	
(A-16-19)4bbc	-------	328	----------	5,340	Coconino Sandstone	--------	----------	-------	-------	--------	S	T	T	
36cbc	-------	800	----------	5,695	Coconino Sandstone and Supai Formation	610	5- 8-68	-------	-------	--------	U	------	T	
(A-16-20)5adc	7-59	4,003	----------	5,450	Coconino(?) Sandstone	355R	7- -59	-------	-------	--------	U	------	------	Pan American Petroleum oil test.
14ddd	-------	480	----------	5,530	Moenkopi(?) Formation and Coconino Sandstone	445	5- 9-69	-------	-------	--------	S	------	------	
16bac	-------	450	----------	5,435	Coconino Sandstone	355	7-22-70	-------	-------	--------	S	T	T	
28bdb	-------	470	----------	5,525	Coconino Sandstone	438	2- 8-56	-------	-------	--------	S	------	------	
(A-16-21)1aca	-------	---------	----------	5,150	Coconino Sandstone	36	3- 8-72	-------	-------	--------	I	------	------	
16ddd	-------	---------	----------	5,340	Coconino Sandstone	222	11-22-71	-------	-------	--------	S	------	------	
17abd	-------	365	----------	5,405	Coconino Sandstone	301	5-10-72	-------	-------	--------	U	------	------	
31abb	-------	---------	----------	5,425	Coconino Sandstone	304	6-11-58	-------	-------	--------	S	------	------	
33ddd	10-59	362	OHB 100	5,456	Coconino Sandstone	319	10-14-72	22R	0	0.5R	S	T	------	FC, 700.
(A-16-22)9bdd	-------	---------	----------	5,205	Coconino Sandstone	71	2-23-72	975	-------	--------	I, S	------	------	FC, 2,450.
10adb	1972	221	180	5,290	Coconino Sandstone	166	9-12-72	-------	-------	--------	D	T	------	
11daa1	1971	470	240	5,360	Coconino Sandstone	223	2-23-72	750R	-------	--------	I	------	------	
11daa2	1971	275	235	5,360	Coconino Sandstone	220R	-71	-------	-------	--------	D	------	------	
14adb	8-72	309	269	5,400	Coconino Sandstone	273	9-12-72	-------	-------	--------	D	------	T	
17bca	10-70	140	----------	5,175	Coconino Sandstone	47	2-14-72	510	22	3	I	------	------	FC, 1,100.
17bda	1962	400	----------	5,150	Coconino Sandstone	43	2-14-72	510	-------	--------	I	------	------	FC, 1,350.
17ccd	1962	450	----------	5,180	Coconino Sandstone	55	9-24-64	750	-------	--------	I	------	T	
17cdc	7-72	160	OHB 20	5,175	Coconino Sandstone	59	10- 4-72	150E	-------	--------	I	T	------	

Table 4.--Records of selected wells in southern Navajo County—Continued

Location	Date completed (month, year)	Reported depth of well (feet)	First casing perforation (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water-bearing strata	Static water level: Feet below land surface	Static water level: Date measured	Bail or pump-test data: Rate (gal/min)	Bail or pump-test data: Drawdown (feet)	Bail or pump-test data: Duration of test (hours)	Use of water	Well log	Chemical analysis	Remarks
(A-16-22)18aad	1968	100	50	5,170	Coconino Sandstone	47R	-68	-------	-------	--------	I	T	------	
25cdc	-------	---------	----------	5,254	Coconino Sandstone and Moenkopi(?) Formation	55	3-21-72	-------	-------	--------	S	------	------	FC, 3,200.
29ddd	1971	---------	----------	5,265	Coconino Sandstone	125	11-23-71	-------	-------	--------	S	------	T	
(A-16-23)1bdc	1934	1,023	----------	5,465	Coconino Sandstone and Chinle and Moenkopi Formations	121	-34	25	<70R	4	U	------	------	Well destroyed.
15bad	1968	500	OHB 490	5,395	Coconino Sandstone	140	12-22-71	-------	-------	--------	S	T	T	
21ccb	-------	300	----------	5,360	Moenkopi Formation	54	12-17-71	-------	-------	--------	S	------	------	FC, >8,000.
30Ebcd	12-65	960	OHB 740	5,320	Coconino Sandstone and Supai Formation	137	12-16-71	-------	-------	--------	S	------	------	
34abd	11-71	1,006	OHB 775	5,315	Coconino Sandstone and Supai Formation	8R	----------	-------	-------	--------	U	------	------	
(A-17-16)17aaa	-------	---------	----------	5,336	Coconino Sandstone	340	9-19-72	-------	-------	--------	S	------	T	
25daa	3-50	627	OHB 7	5,442	Coconino Sandstone	425	9-19-72	20R	-------	--------	S	T	------	FC, 1,620 (ST).
(A-17-18)3ddb	-------	---------	----------	5,035	Coconino Sandstone and Moenkopi(?) Formation	69	5- 6-66	-------	-------	--------	S	------	T	
16dbb	12-68	300	OHB 8	5,165	Coconino Sandstone	162	5- 9-69	-------	-------	--------	S	T	------	
17bdb	-------	---------	----------	5,145	Coconino Sandstone	133	5- 6-66	-------	-------	--------	S	------	T	
(A-17-19)2cda	1967	495	OHB 320	5,060	Coconino Sandstone	55	3- 6-68	2,850	31	336	I	------	T	
2dbd	6-68	115	OHB 16	5,055	Coconino Sandstone	45	6-12-68	-------	-------	--------	D	------	T	
4ccc	-------	---------	----------	5,040	Coconino Sandstone	34	2-21-68	-------	-------	--------	S	------	T	
6cbd	-------	---------	----------	5,110	Coconino Sandstone and Moenkopi(?) Formation	105	5- 1-68	-------	-------	--------	S	------	T	
12acb	1962(?)	450	----------	5,090	Coconino Sandstone	55	6-12-68	400	66	18	I	------	T	
12bba	-------	---------	----------	5,085	Coconino Sandstone	47	4-24-68	-------	-------	--------	S	------	------	
12bcc	-------	650	----------	5,100	Coconino Sandstone	62	6-12-68	750	-------	--------	I	------	T	
12cbd	1962	475	----------	5,125	Coconino Sandstone	69	6-12-68	600R	-------	--------	I	------	------	
14cdc	-------	220	----------	5,195	Coconino Sandstone and Moenkopi(?) Formation	167	4-23-68	-------	-------	--------	S	------	T	
28ccb	-------	280	----------	5,295	Coconino Sandstone	235	4-24-68	-------	-------	--------	S	------	T	
(A-17-20)3bbc	1950	500	----------	5,080	Coconino Sandstone and Moenkopi(?) Formation	34	9-28-64	400E	-------	--------	I	------	T	
3bbd	10-72	480	OHB 130	5,075	Coconino Sandstone	33	11-20-72	-------	-------	--------	I	T	------	
5cccl	-------	450	----------	5,090	Coconino Sandstone	39	3- 6-68	355	-------	--------	I	------	T	

Table 4.--Records of selected wells in southern Navajo County—Continued

Location	Date completed (month, year)	Reported depth of well (feet)	First casing perforation (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water-bearing strata	Static water level: Feet below land surface	Static water level: Date measured	Bail or pump-test data: Rate (gal/min)	Bail or pump-test data: Drawdown (feet)	Bail or pump-test data: Duration of test (hours)	Use of water	Well log	Chemical analysis	Remarks
(A-17-20)5ccc2	5-54	200	---------	5,090	Coconino Sandstone	39	3- 6-68	-------	-------	--------	U	------	------	
5cdd	1955	102	OHB 20	5,060	Coconino Sandstone	9	3-19-73	400R	-------	--------	I	T	------	
5ddc1	-------	225	OHB 20	5,045	Coconino Sandstone	Flowing	----------	-------	-------	--------	I	------	------	
5ddc2	-------	225	OHB 20	5,045	Coconino Sandstone	Flowing	----------	-------	-------	--------	I	------	------	
6acb	2-48	403	OHB 8	5,040	Coconino Sandstone	7	7-30-53	730	15	24	I	T	T	Observation well.
6acc	-------	---------	---------	5,040	Coconino Sandstone	9	4-25-67	1,200	-------	--------	I	------	T	
6ddb	-------	70	---------	5,060	Coconino Sandstone	21	3-19-73	280	-------	--------	I	------	------	FC, 950.
6ddd	-------	200	---------	5,090	Coconino Sandstone and Moenkopi Formation	40	3- 4-68	230	-------	--------	I	------	------	FC, 1,750.
7adb	10-72	250	OHB 7	5,110	Coconino Sandstone	72R	10-16-72	-------	-------	--------	D	T	------	
7bad	7-72	200	OHB 10	5,085	Coconino Sandstone	44R	8-25-72	-------	-------	--------	D	------	------	
8ada	-------	300	---------	5,060	Coconino Sandstone	Flowing	3-19-73	-------	-------	--------	D	------	------	
8add	-------	200	---------	5,070	Coconino Sandstone	6	3-19-73	-------	-------	--------	I	------	------	FC, 770.
8bbb	-------	300(?)	---------	5,075	Coconino Sandstone	--------	----------	-------	-------	--------	I	------	------	
8bdb	-------	200	---------	5,065	Coconino Sandstone	9	3-19-73	650	-------	--------	I	------	T	
9bac	-------	100	---------	5,070	Coconino Sandstone	Flowing	2-27-73	-------	-------	--------	S	T	------	
9bdc	1960	165	---------	5,080	Coconino Sandstone	33	3-19-73	-------	-------	--------	U	------	------	FC, 663.
10acd1	-------	17	---------	5,070	Coconino Sandstone	0	3-19-73	-------	-------	--------	U	------	------	Well originally drilled to 200(?) feet.
10acd2	-------	>200	---------	5,070	Coconino Sandstone	0	3-19-73	-------	-------	--------	U	------	------	
10add	-------	200	---------	5,075	Coconino Sandstone	5	3-19-73	150R	-------	--------	I	------	------	
10bcc	1969	102	---------	5,075	Coconino Sandstone	13R	-69	60	-------	--------	D, I	------	------	FC, 800.
10bdc1	-------	---------	---------	5,070	Coconino Sandstone	--------	----------	-------	-------	--------	D, I	------	------	
10bdc2	-------	---------	---------	5,070	Coconino Sandstone	--------	----------	-------	-------	--------	I	------	------	
10bdd	1961	100	OHB 4	5,082	Coconino Sandstone	12	10- 2-64	100	-------	--------	I	------	------	FC, 825.
10caa1	1935	125	OHB 65	5,080	Coconino Sandstone	10	-33	450	-------	.50	PS	------	T	
10caa2	1935	120	OHB 65	5,080	Coconino Sandstone	14	8-27-51	700	16	5.50	PS	------	------	
10caa3	1957	110	90	5,080	Coconino Sandstone	14	----------	1,000	6	5.50	PS	------	------	
10cab1	-------	---------	---------	5,075	Coconino Sandstone	--------	----------	-------	-------	--------	I	------	------	
10cab2	1940	300	---------	5,075	Coconino Sandstone	18	3-19-73	800R	-------	--------	I	------	------	
10cac	-------	---------	---------	5,075	Coconino Sandstone	--------	----------	-------	-------	--------	I	------	------	
10cad	2-42	215	OHB 6	5,100	Coconino Sandstone	51	6-10-44	-------	-------	--------	U	------	------	Observation well.

Table 4.--Records of selected wells in southern Navajo County—Continued

Location	Date completed (month, year)	Reported depth of well (feet)	First casing perforation (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water-bearing strata	Static water level		Bail or pump-test data			Use of water	Well log	Chemical analysis	Remarks
						Feet below land surface	Date measured	Rate (gal/min)	Drawdown (feet)	Duration of test (hours)				
(A-17-20)10cba	1964	85	OHB 45	5,075	Coconino Sandstone	19	3-19-63	-------	-------	--------	D	------	------	
10ccb	11-69	150	OHB 50	5,110	Coconino Sandstone	63	3-19-73	-------	-------	--------	U	------	------	
10dac	1940	300	OHB 20	5,075	Coconino Sandstone	13	3-19-73	750	-------	--------	I	------	T	
10dba	1940	95	---------	5,060	Coconino Sandstone	13	11- 7-69	-------	-------	--------	U	------	------	Observation well.
11acc1	1952	---------	---------	5,080	Coconino Sandstone	18R	-52	-------	-------	--------	I	------	------	
11acc2	9-64	300	OHB 10	5,080	Coconino Sandstone	19	10- 2-72	400	-------	--------	I	------	------	FC, 1,450.
11adc	-------	---------	---------	5,090	Coconino Sandstone	31	9-29-64	-------	-------	--------	I	------	------	
11bcd1	-------	---------	---------	5,085	Coconino Sandstone	30	10- 2-72	-------	-------	--------	I	------	------	
11bcd2	1969	175	OHB 30	5,085	Coconino Sandstone	28	3-19-73	-------	-------	--------	I	------	------	
11bdd	-------	200	OHB 20	5,075	Coconino Sandstone	18	3-19-73	520	-------	--------	I	------	------	FC, 1,500.
11cba	-------	130	---------	5,085	Coconino Sandstone	34	10- 2-64	-------	-------	--------	U	------	------	
11cbd	6-71	265	OHB 80	5,078	Coconino Sandstone	37	3-19-73	450R	-------	--------	I	------	------	FC, 880.
11dac	7-64	400	---------	5,110	Coconino Sandstone	60R	7- -64	500E	-------	--------	I	------	T	
21bbb	1927	4,675	---------	5,270	Coconino(?) Sandstone	185R	-27	-------	-------	--------	U	------	------	Great Basin oil test.
21cdd	-------	195	---------	5,200	Coconino Sandstone	137	5- 9-69	-------	-------	--------	S	T	------	
26dbc	12-69	570	OHB 310	5,360	Coconino Sandstone	297	12- 2-69	-------	-------	--------	U	------	T	Plugged back from 800 feet.
(A-17-21)6dab1	-------	1,100	---------	5,078	Coconino Sandstone and Supai Formation	--------	---------	-------	-------	--------	Ind	------	------	Airtex 1.
6dab2	-------	1,140	---------	5,077	Coconino Sandstone and Supai Formation	--------	---------	-------	-------	--------	Ind	------	------	Airtex 2.
10cba	4-54	285	---------	5,165	Coconino Sandstone	54	4-14-66	-------	-------	--------	U	T	T	
13abd	-------	---------	---------	5,235	Coconino Sandstone and Moenkopi(?) Formation	133	12-21-71	-------	-------	--------	S	------	------	FC, 5,800.
16adb	5-54	180	OHB 26	5,210	Coconino Sandstone	100	3-10-72	-------	-------	--------	D, S	T	T	
35dbd	-------	250	---------	5,155	Coconino Sandstone	40	3-10-72	1,570	-------	--------	S	------	------	FC, 850.
(A-17-22)17dbd	5-54	240	OHB 215	5,310	Coconino Sandstone	203	12-21-71	-------	-------	--------	S	T	T	
22bcc	5-63	388	351	5,425	Coconino Sandstone	345R	5-11-63	-------	-------	--------	U	T	T	
(A-18-16)31adb	-------	---------	---------	5,200	Coconino Sandstone	266	9-19-72	-------	-------	--------	S	------	T	
35cac	-------	409	---------	5,174	Coconino Sandstone	244R	----------	-------	-------	--------	D, S	T	------	FC, 1,080.
(A-18-17)5caa	8-57	---------	---------	4,885	Alluvium and Coconino(?) Sandstone	11	8-12-57	200	13	6	U	------	T	
5ddd	3-67	109	OHB 106	4,895	Coconino Sandstone	45R	3-15-67	>50	-------	--------	S	T	------	FC, 7,500.
6ccb	3-67	106	87	4,873	Coconino Sandstone	8	3- 9-67	50	-------	--------	D, S	------	T	

Table 4.--Records of selected wells in southern Navajo County—Continued

Location	Date completed (month, year)	Reported depth of well (feet)	First casing perforation (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water-bearing strata	Static water level		Bail or pump-test data			Use of water	Well log	Chemical analysis	Remarks
						Feet below land surface	Date measured	Rate (gal/min)	Drawdown (feet)	Duration of test (hours)				
(A-18-17)12cba	3-70	330	320	4,951	Coconino Sandstone and Moenkopi(?) Formation	52R	3- 7-70	-------	-------	--------	PS	T	T	
14aad	-------	---------	----------	4,917	Alluvium	--------	----------	-------	-------	--------	S	------	T	
(A-18-18)7ddc	-------	---------	----------	4,925	Alluvium	12	1-10-67	-------	-------	--------	S	------	T	
9bdd	1-71	300	OHB 250	4,945	Coconino Sandstone	20R	1- -71	-------	-------	--------	PS	T	------	
9cda	1-70	260	OHB 219	4,935	Coconino Sandstone and Moenkopi(?) Formation	12R	1-10-70	-------	-------	--------	U	T	------	
10ada	-------	270	----------	4,965	Coconino Sandstone	38	5- 8-68	-------	-------	--------	D, S	------	T	
10ccb1	-------	29	----------	4,940	Alluvium	14	1-10-67	-------	-------	--------	U	------	T	
10ccb2	1959	250	OHB 140	4,940	Coconino Sandstone and Moenkopi(?) Formation	--------	----------	-------	-------	--------	PS	T	------	FC, 3,500.
15aab	8-02	305	OHB 130	4,955	Coconino Sandstone	20R	8- -02	58R	-------	--------	U	------	------	Well abandoned.
34daa	1930(?)	---------	----------	4,955	Coconino Sandstone	Flowing	7-16-69	-------	-------	--------	S	------	T	
(A-18-19)8ddd	1-47	470	OHB 315	5,048	Coconino Sandstone	94R	1- 7-47	531	<26R	--------	I	T	T	
16ada	10-47	500	OHB 356	5,053	Coconino Sandstone	84R 93	10- 9-47 3- 4-68	500	8	8	I	T	T	
16bbc	3-62	465	290	5,045	Coconino Sandstone	84	2-20-68	1,080	-------	--------	U	------	T	
16bcb	1958	400	380	5,040	Coconino Sandstone	72	4- 2-68	225	-------	--------	I	------	T	
16caa1	1947	491	OHB 342	5,020	Coconino Sandstone	30	12-18-53	750E	50	3.25	PS	T	T	
16caa2	9-55	500	OHB 312	5,020	Coconino Sandstone	43R	9- -55	-------	-------	--------	PS	T	T	
16caa3	7-47	480	OHB 308	5,023	Coconino Sandstone and Moenkopi(?) Formation	36R	12- -53	200E	5R	--------	D, S	T	T	
16cac	-------	325	----------	5,020	Coconino Sandstone and Moenkopi(?) Formation	36R	12-17-53	-------	-------	--------	PS	------	T	
16ccc	1966	425	----------	4,995	Coconino Sandstone	9	3- 5-68	647	-------	--------	I	------	T	
16cdc	1947	357	OHB 272	4,990	Coconino Sandstone	3	12-18-53	450R	<20R	--------	I	T	T	
16dac	1934(?)	325	267	5,017	Coconino Sandstone	30	12-18-53	80	15	--------	U	T	T	
16ddb1	12-46	400	OHB 307	5,030	Coconino Sandstone	40	11-16-66	-------	-------	--------	U	T	------	Observation well.
16ddb2	5-54	450	OHB 265	5,015	Coconino Sandstone	31	11-16-66	800	6	1	I, S	------	T	
17aac	3-54	502	OHB 295	5,045	Coconino Sandstone and Moenkopi(?) Formation	74	4-25-67	975	-------	--------	I	------	T	
17aad	1964	500	310	5,045	Coconino Sandstone and Moenkopi(?) Formation	90R	12-21-64	>1,100	-------	--------	I	T	T	
17ada	3-71	426	OHB 294	5,045	Coconino Sandstone	-------	----------	1,250R	-------	--------	I	------	T	
17adc	1961	500	OHB 300	5,015	Coconino Sandstone	43	4- 3-68	1,350	-------	--------	I	------	T	

Table 4.--Records of selected wells in southern Navajo County—Continued

Location	Date completed (month, year)	Reported depth of well (feet)	First casing perforation (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water-bearing strata	Static water level		Bail or pump-test data			Use of water	Well log	Chemical analysis	Remarks
						Feet below land surface	Date measured	Rate (gal/min)	Drawdown (feet)	Duration of test (hours)				
(A-18-19)17bdb	1962	136	OHB 116	5,000	Coconino Sandstone	36R	-62	-------	-------	--------	S	------	------	
17cbc	9-72	390	OHB 290	4,980	Coconino Sandstone	22R	9- 7-72	600R	40R	48R	PS	T	T	
17cda	1937	328	OHB 190	4,975	Coconino Sandstone	Flowing	3- 5-68	50R	-------	--------	PS	------	T	
17daa	1947	435	OHB 300	5,015	Coconino Sandstone	33R	-47	-------	-------	--------	D, S	T	T	
18acd	1969	305	OHB 280	4,980	Coconino Sandstone	40R	-69	-------	-------	--------	D, S	------	------	
18daa	4-70	325	255	4,975	Coconino Sandstone	6	4-21-70	60	0	3	PS	------	T	
22cbb	1967	---------	----------	5,000	Coconino Sandstone	28	4-20-67	250	-------	--------	I	------	T	
23dbd	1959	550	OHB 200	5,030	Coconino Sandstone	31	4-27-66	1,600R	33R	--------	U	T	T	Arizona Public Service Co. 1; observation well.
26bad	1962	---------	----------	5,010	Coconino Sandstone	26	3- 5-68	-------	-------	--------	U	------	------	Arizona Public Service Co. 4.
26bba	1962	595	345	5,010	Coconino Sandstone	20R	7- -62	1,100	-------	--------	Ind	------	------	Arizona Public Service Co. 2.
28ccd1	-------	250	----------	5,015	Coconino Sandstone	1	3- 5-68	-------	-------	--------	I	------	------	
28cdb2	-------	250	----------	5,010	Coconino Sandstone	Flowing	3- 5-68	-------	-------	--------	U	------	------	
28cdc	-------	250	----------	5,010	Coconino Sandstone	Flowing	3- 5-68	-------	-------	--------	I	------	------	
28cdd	-------	250	----------	5,010	Coconino Sandstone	8	5- 1-68	1,400	-------	--------	I	------	T	
28ddd	-------	450	----------	5,005	Coconino Sandstone	5R	----------	700E	-------	--------	I	------	T	
33ada	-------	---------	----------	5,015	Coconino Sandstone	8	3- 7-68	25R	-------	--------	S	------	T	
34caa	-------	---------	----------	5,020	Coconino Sandstone	7	3- 5-68	-------	-------	--------	D, S	------	T	
35adb	10-47	450	OHB 55	5,017	Coconino Sandstone	Flowing	3- 3-54	187	15	5.50	U	T	T	Originally drilled to 197 feet in June 1947.
36ccc	1962	350	OHB 60	5,045	Coconino Sandstone	15	7- -62	1,100R	45R	--------	Ind	------	------	Arizona Public Service Co. 5.
36ccd	1962	350	OHB 150	5,045	Coconino Sandstone	25	7- -62	1,600R	36R	--------	Ind	T	------	Arizona Public Service Co. 6.
(A-18-20)12bad	-------	---------	----------	5,121	Alluvium	15	----------	3	-------	--------	S	------	------	FC, 1,050.
30ccd	1939	145	OHB 10	5,050	Coconino Sandstone	48	7-16-69	200R	-------	--------	D, S	------	------	FC, 2,220.
31aac	1955	120	----------	5,120	Coconino Sandstone	85	-55	-------	-------	--------	PS	------	T	FC, 2,690.
31dab	-------	380	OHB 50	5,075	Coconino Sandstone	52	4-25-68	255	-------	--------	I	------	------	FC, 1,850.
33ccd	12-68	200	OHB 85	5,080	Coconino Sandstone	35R	12-16-68	-------	-------	--------	D	------	------	
33dbc	1947	208	----------	5,130	Coconino Sandstone	40R	-58	75	-------	--------	I	------	T	
(A-18-21)6acc	-------	150	----------	5,132	Alluvium	13	12-19-72	-------	-------	--------	S	------	------	FC, 2,100.
12aad	1959	750	----------	5,310	Coconino Sandstone	317R	-56	-------	-------	--------	U	------	T	
18bca	-------	30	----------	5,160	Alluvium	9R	----------	-------	-------	--------	S	------	------	
26cdc	-------	40	----------	5,125	Alluvium	--------	----------	-------	-------	--------	U	------	------	

Table 4.--Records of selected wells in southern Navajo County—Continued

Location	Date completed (month, year)	Reported depth of well (feet)	First casing perforation (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water-bearing strata	Static water level		Bail or pump-test data			Use of water	Well log	Chemical analysis	Remarks
						Feet below land surface	Date measured	Rate (gal/min)	Drawdown (feet)	Duration of test (hours)				
(A-18-21)29abd	7-62	335	---------	5,260	Chinle Formation or Moenkopi Formation	124	6-18-62	25	10	0.50	U	------	------	FC, 2,000.
30dcb	------	150	---------	5,260	Chinle Formation or Moenkopi Formation	34R	-34	-------	-------	-------	S	------	------	Water reported to be salty.
34dca	------	80	---------	5,100	Alluvium	18	10-14-64	-------	-------	-------	S	------	------	
(A-18-22)7baa	------	---------	---------	5,290	Chinle Formation	-------	----------	-------	-------	-------	U	------	------	Well abandoned; water reported to be very salty.
15ccc	------	120	---------	5,180	Alluvium(?)	15R	8-22-60	-------	-------	-------	U	------	------	Water reported to be of good quality.
16aab1	6-58	113	90	5,170	Alluvium	15R	6- 4-58	700R	69R	-------	PS	T	T	
16aab2	------	136	---------	5,175	Alluvium	15R	----------	700R	-------	-------	PS	------	T	
16bda	12-68	100	20	5,285	Alluvium	30R	12-23-68	-------	-------	-------	S	T	------	FC, >8,000.
(A-18-23)3bba	1-73	410	OHB 0	5,290	Coconino Sandstone	140R	2- 5-73	-------	-------	-------	U	------	------	FC, >8,000.
6cac	4-58	165	30	5,250	Alluvium	35	1-11-67	500	43.1	5	I	T	T	
6cdc2	1965	170	---------	5,250	Alluvium	27	1-11-67	500R	-------	-------	U	T	------	Observation well.
6dcd	9-66	165	---------	---------	Alluvium	28	1-11-67	500R	-------	-------	I	------	------	
10dda	------	100	---------	5,265	Alluvium	15	10-14-64	-------	-------	-------	D	------	T	
11cdb	------	148	---------	5,265	Alluvium	15R	----------	-------	-------	-------	D, I	------	------	
12cbc1	------	160	---------	5,270	Alluvium	37R	10-15-64	-------	-------	-------	I	------	T	
12cbc2	------	150	---------	5,270	Alluvium	37R	10-15-64	-------	-------	-------	U	------	------	
12cbc3	------	160	---------	5,270	Alluvium	37	10-15-64	900R	-------	-------	D, I	------	------	
(A-19-15)26dad	12-53	303	OHB 40	4,900	Coconino Sandstone and Kaibab Limestone	48R	12-20-53	>800	-------	-------	I	T	T	
26ddd	7-72	227	OHB 6	---------	Coconino Sandstone and Kaibab(?) Limestone	54R	7- 1-72	-------	-------	-------	U	------	------	
36aba	3-71	400	OHB 90	4,885	Coconino Sandstone	70R	4- -71	300R	34R	24R	Ind	------	T	
(A-19-16)6acb	------	185	OHB 165	4,830	Coconino Sandstone	46	4-30-65	-------	-------	-------	D, I	------	T	
6ccc	6-72	197	OHB 153	4,830	Coconino Sandstone	16	6-27-72	-------	-------	-------	D	T	------	
6cda	1963	282	OHB 165	4,830	Coconino Sandstone			-------	-------	-------	I	------	T	
6cdb	------	195	OHB 143	4,830	Coconino Sandstone	41R	4-30-65	-------	-------	-------	D	------	T	
20bac	5-64	244	---------	4,845	Coconino Sandstone	-------	----------	-------	-------	-------	I	------	------	
28ddd	------	150	---------	4,850	Coconino Sandstone	-------	----------	-------	-------	-------	U	------	T	
36dba	11-57	610	OHB 72	4,890	Coconino Sandstone and Moenkopi(?) Formation	36	7-10-72	-------	-------	-------	Ind	------	T	
(A-19-17)1dbc	1969	642	605	5,075	Moenkopi(?) Formation	600R	-69	-------	-------	-------	S	T	------	FC, 7,500.

Table 4.--Records of selected wells in southern Navajo County—Continued

Location	Date completed (month, year)	Reported depth of well (feet)	First casing perforation (feet below land surface)	Land-surface altitude (feet above mean sea level)	Water-bearing strata	Static water level		Bail or pump-test data			Use of water	Well log	Chemical analysis	Remarks
						Feet below land surface	Date measured	Rate (gal/min)	Drawdown (feet)	Duration of test (hours)				
(A-19-17)5ddd	4-66	680	OHB 675	5,165	Coconino Sandstone	390	5- 2-66	-------	-------	--------	S	T	T	
(A-19-18)12cca	11-69	96	----------	5,040	Alluvium	Dry R	12-12-69	-------	-------	--------	------	T	------	Well abandoned.
16ddd	1946	100	----------	5,007	Alluvium	39	12-12-69	-------	-------	--------	S	------	------	FC, 2,100.
19bcb	1946	100	----------	4,976	Alluvium	40	12-12-69	-------	-------	--------	S	------	------	FC, 2,900.
35cbd	1969	410	----------	5,080	Chinle Formation and Moenkopi(?) Formation	86	-69	-------	-------	--------	S	T	------	
(A-19-22)1ccc	1-55	1,182	----------	5,682	Coconino(?) Sandstone	1,000R	2- 6-55	-------	-------	--------	U	------	T	Oil test.
(A-19-23)33dba	1958	80	OHB 50	5,270	Alluvium	14R	-58	-------	-------	--------	PS	------	T	
33dcc	1-73	80	50	5,275	Alluvium	30	2- 9-73	-------	-------	--------	PS	------	------	FC, 1,950.
(A-20-16)8dcd	-------	65	20	4,810	Alluvium	<10R	----------	-------	-------	--------	S	------	------	
16cbc	1950	50	20	4,810	Alluvium	8R	----------	-------	-------	--------	S	------	------	
24ddd	11-62	562	----------	4,935	Coconino Sandstone	200R	11-23-62	-------	-------	--------	S	------	------	FC, 6,000.
28ddd	1957	135	20	4,820	Alluvium	8R	-57	1,700R	27R	--------	I	------	T	
(A-20-18)6dcd	3-70	730	OHB 708	5,458	Chinle(?) Formation	Dry R	3-11-70	-------	-------	--------	U	T	------	Well abandoned.
30cad	1-70	1,000	OHB 860	5,250	Coconino(?) Sandstone	-------	----------	-------	-------	--------	S	------	------	
(A-20-19)31db	1969	105	94	5,073	Alluvium	30R	1-21-70	-------	-------	--------	S	T	------	

Table 5.--Chemical analyses of water from selected wells and springs in southern Navajo County

[Analyses by U.S. Geological Survey except as indicated. Analytical results in milligrams per liter except as indicated. Dissolved solids represent the sum of determined constituents using the carbonate equivalent of the bicarbonate ion in Geological Survey analyses. Remarks: AES, analysis by University of Arizona Agricultural Experimental Station; ASHL, analysis by Arizona State Health Laboratory; ATL, analysis by Arizona Testing Laboratories; CL, analysis by Curtis Laboratory; GSL, analysis by Bureau of Indian Affairs, Gallup Soils Laboratory; USSL, analysis by U.S. Salinity Laboratory, Riverside, Calif.; WFC, analysis by Western Filter Co.; ST, sample collected from a storage tank; tap, sample collected from a water tap]

Well or spring location	Date of collection	Temperature (°C)	Silica (SiO_2)	Dissolved iron (Fe), ug/l	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrite and Nitrate (N)	Orthophosphate (PO_4)	Boron (B), ug/l	Dissolved solids		Hardness as $CaCO_3$		Percent sodium	Sodium-adsorption ratio (SAR)	Specific conductance (micromhos at 25°C)	pH	Remarks
																	Milligrams per liter	Tons per acre-foot	Calcium, magnesium	Noncarbonate					
(A-8-23)																									
1dbc	4-26-72	------	-----	------	17	9	11	----	96	0	<1	7	0.05	----	------	------	117	0.16	80	1	23	0.5	167	8.3	ASHL.
2cba	8- -64	------	21	0	14	5	18	----	66	0	20	14	0	----	------	------	158	.21	56	2	41	1.0	--------	8.6	ATL.
	8- 3-71	------	20	10	11	6.0	13	1.8	102	0	1.5	1.3	.10	0.18	0.12	------	106	.14	52	0	34	.8	143	6.4	
4abd	7-20-71	14.0	22	10	32	16	12	1.9	200	0	.3	2.7	.10	.27	.12	------	187	.25	150	0	15	.4	313	6.8	
4baa	12- 7-51	10.0	11	------	35	15	0.9		169	0	6.6	2.0	.20	----	------	------	156	.21	149	10	1	.0	274	--	
4bcb	11- -57	------	-----	------	22	10	15	----	112	4	4	3	<.01	----	------	------	155	.21	96	4	25	.7	--------	---	ASHL.
	7-14-71	13.4	29	20	37	15	10	1.8	183	0	1.8	3.4	.1	.44	.06	------	190	.26	150	4	12	.4	298	7.7	
4bcc	1- -61	------	-----	------	29	11	11	----	139	0	<1	4	.22	----	------	------	170	.23	118	4	17	.4	--------	---	ASHL.
	7-14-71	13.5	22	10	29	12	12	2.6	189	0	0	4.5	.2	.05	.03	------	176	.24	120	0	17	.5	299	7.7	
5acd	9- -65	------	-----	------	34	16	14	----	168	0	6	8	<.1	----	------	------	214	.29	152	14	17	.5	370	---	ASHL.
	8-22-72	------	-----	------	72	15	15	----	262	0	<6	17	.21	----	------	------	264	.36	242	27	12	.4	417	8.0	ASHL.
5bda	7-14-71	13.0	21	10	29	10	15	2.3	179	0	2.0	6.2	.1	.15	.03	------	174	.24	110	0	22	.6	300	7.7	
5ddc	6-27-72	13.5	21	20	24	10	16	2.2	159	0	7.0	5.0	.3	.21	0	------	165	.22	100	0	25	.7	259	8.1	
9acc1,2	7-21-71	15.0	26	20	15	7.6	6.3	2.0	99	0	1.3	1.5	.2	.16	.18	------	110	.15	69	0	16	.3	147	7.0	Composite sample from two wells pumping simultaneously.
10bad	12-11-70	------	25	10	21	9.5	12	1.9	138	0	1.5	1.8	.1	.15	.06	------	141	.19	91	0	22	.5	197	7.8	
10bbb	8-22-72	------	-----	------	38	4	7	----	122	0	6	4	.08	----	------	------	142	.19	112	12	12	.3	217	7.3	ASHL.
11abc	7-22-71	12.0	28	20	13	7.9	6.3	4.3	97	0	3.0	1.4	.2	.18	.31	------	113	.15	65	0	16	.3	147	7.2	
11bdb	2- -64	------	26	0	21	2	53		95	0	80	8	----	----	------	------	285	.39	62	0	66	2.9	--------	7.8	ATL.
	8- 3-71	------	27	10	15	7.7	5.7	1.8	95	0	1.5	1.7	.1	.17	.21	------	108	.15	69	0	15	.3	143	7.0	
12aaa	8-22-72	------	-----	------	17	7	4	----	76	0	7	2	.07	----	------	------	------	------	72	9	11	.2	122	7.4	ASHL.
(A-9-22)																									
4abc	5- -72	------	-----	------	88	18	6	----	224	0	9	32	.51	----	------	------	------	.39	294	110	4	.2	454	7.8	ASHL.
4caa	7-21-71	15.0	12	10	79	19	4.4	1.1	238	0	85	5.3	.2	.04	0	------	323	.44	280	80	3	.1	511	7.1	
4cbd	7-20-71	------	12	20	49	13	3.7	1.6	177	0	48	3.5	.2	.02	0	------	218	.30	180	31	4	.1	355	7.0	
8aab	4- -69	------	-----	------	43	27	6	----	160	0	63	6	.18	----	------	------	250	.34	220	88	6	.2	400	---	ASHL.
9ccc	9- -60	------	-----	------	75	20	6	----	182	0	80	5	.26	----	------	------	319	.43	272	120	5	.2	--------	---	
	7-21-71	------	12	210	74	19	4.4	1.3	240	0	77	5.4	.2	.05	0	------	312	.42	260	66	4	.1	487	7.0	
9dbc	10- -67	------	-----	------	77	4	5	----	164	0	50	6	.2	----	------	------	260	.35	208	74	5	.2	421	---	ASHL.

Table 5.--Chemical analyses of water from selected wells and springs in southern Navajo County—Continued

Well or spring location	Date of collection	Temperature (°C)	Silica (SiO_2)	Dissolved iron (Fe), ug/l	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrite and Nitrate (N)	Orthophosphate (PO_4)	Boron (B), ug/l	Dissolved solids: Milligrams per liter	Dissolved solids: Tons per acre-foot	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Percent sodium	Sodium-adsorption ratio (SAR)	Specific conductance (micromhos at 25°C)	pH	Remarks
(A-9-22)																									
10cbb	7-20-71	------	13	20	62	17	3.6	1.3	242	0	32	3.1	0.2	0	0	------	251	0.34	220	26	3	0.1	406	7.0	
10ccb	3- -68	------	------	------	62	13	4	----	164	4	54	4	.2	----	------	------	250	.34	215	74	4	.1	400	---	ASHL.
14adb	10-15-71	------	17	20	67	18	8.5	1.6	276	0	45	4.3	.2	.09	.03	------	298	.41	240	15	7	.2	492	7.2	
15bcd	10-20-71	14.5	12	0	71	14	3.8	1.3	272	0	32	6.3	.2	.19	.03	------	275	.37	230	12	3	.1	478	7.1	
15dcb1	8- 3-71	15.0	13	820	68	14	3.9	1.2	252	0	22	3.0	.3	0	0	------	250	.34	230	21	4	.1	435	6.4	
22bab	8- -66	------	22	0	81	23	16		354	0	10	20	.6	----	------	------	347	.47	296	6	----	.4	588	7.7	Tap.
22dbc	10-15-71	13.5	17	40	170	33	22	.7	344	0	69	160	.4	.37	.06	------	643	.87	560	280	8	.4	1,260	7.3	
23cbd	8-23-72	------	------	------	41	16	19	----	196	0	< 6	8	.29	----	------	------	210	.29	172	8	20	.6	333	8.3	ASHL.
23dac	7- -71	------	------	------	38	21	10	----	170	5	9	9	.07	----	------	------	234	.32	182	42	11	.3	370	---	ASHL.
24ccb	7-21-71	14.0	31	70	54	23	21	2.8	289	0	7.8	12	.2	2.8	.09	------	307	.42	230	0	16	.6	479	7.1	
25acd	1- -71	------	------	------	55	16	19	1.6	118	3.3	104	16	1.37	----	------	0.12	305	.41	203	106	17	.6	490	---	GSL; tap.
25cdc	1-11-72	------	26	10	37	19	17	4.1	244	0	4.5	6.2	.1	.12	.03	------	234	.32	170	0	17	.6	373	7.8	ST.
26ada1	3-10-51	10.0	26	------	38	32	18		283	0	9.1	15	.4	----	------	------	280	.38	226	0	15	.5	485	---	
26cda1	7- -65	------	------	------	31	21	13	----	164	0	7	5	.1	----	------	------	225	.31	164	30	15	.4	357	---	ASHL.
26cda2	8-23-72	------	------	------	38	19	19	----	194	0	6	8	.27	----	------	------	225	.31	176	14	19	.6	357	8.1	ASHL.
36aaa	4- 6-72	12.0	27	10	19	11	6.3	1.6	117	0	5.8	4.6	.1	.38	.18	------	135	.18	93	0	13	.3	200	7.2	Adair Spring.
36bbd	7-13-71	12.0	27	20	17	10	6.8	1.6	111	0	2.5	2.6	.1	----	.21	------	124	.60	84	0	15	.3	188	7.2	Big Spring.
36cbb	1-11-72	------	22	20	63	23	21	3.1	305	0	7.8	25	.6	.96	0	------	320	.44	250	2	15	.6	552	7.5	
36cca	3- -61	------	------	------	39	23	31	----	243	2	11	8	.54	----	------	------	367	.50	191	0	26	1.0	--------	---	ASHL.
	7-21-71	------	17	1,100	36	14	18	3.3	195	0	4	16	.3	0	.03	------	206	.28	150	0	21	.6	349	7.1	ST.
(A-9-23)																									
4dbd	2- -63	------	------	------	14	8	11	----	92	------	5	3	.2	----	------	------	100	.14	68	0	26	.6	--------	---	ASHL.
	10-15-71	15.0	27	0	14	10	10	2.8	122	0	1.8	3.1	.1	.31	.06	------	130	.18	76	0	21	.5	201	7.5	
5dcc	10-15-71	12.0	33	10	23	16	11	3.0	172	0	4.8	5.4	.1	.50	.09	------	183	.25	120	0	16	.4	285	7.5	
18adb	7-13-71	12.2	35	20	15	8.7	6.2	2.2	99	0	4.0	2.1	.1	----	.12	------	123	.11	73	0	15	.3	105	7.0	Porter Springs.
22ddb	5- 1-72	------	------	------	35	21	15	----	164	10	10	5	.10	----	------	------	210	.29	176	40	----	.5	333	8.6	ASHL.
32cdc	8- 3-71	12.0	22	200	25	15	12	1.5	161	0	8.0	7.2	.2	1.7	.03	------	180	.24	120	0	17	.5	290	6.9	
32dbc	8- -69	------	------	------	17	8	6	----	88	0	7	3	.04	----	------	------	125	.17	76	4	15	.3	178	---	ASHL.
	7-14-71	12.5	27	100	14	8.2	6.1	1.6	96	0	1.8	1.7	.1	.16	.21	------	109	.15	69	0	16	.3	156	7.0	

Table 5. --Chemical analyses of water from selected wells and springs in southern Navajo County—Continued

Well or spring location	Date of collection	Temperature (°C)	Silica (SiO_2)	Dissolved iron (Fe), ug/l	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrite and Nitrate (N)	Orthophosphate (PO_4)	Boron (B), ug/l	Dissolved solids: Milligrams per liter	Dissolved solids: Tons per acre-foot	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Percent sodium	Sodium-adsorption ratio (SAR)	Specific conductance (micromhos at 25°C)	pH	Remarks
(A-9-23)																									
32dcb	7-20-71	13.5	27	10	18	9.7	7.3	1.9	122	0	25	2.6	0.2	0.21	0.15	------	130	0.18	85	0	15	0.3	201	6.8	
32dcc	11- -62	------	------	------	16	9	6	----	84	0	5	3	.1	----	------	------	122	.17	76	8	14	.3	161	---	ASHL.
	7-14-71	13.5	27	10	14	8.2	6.3	1.8	97	0	.8	2	.1	.21	.15	------	109	.15	69	0	16	.3	158	7.1	
34aba	10-15-71	15.5	18	10	5.0	1.5	30	1.7	104	0	2.3	2.4	.1	.12	.15	------	113	.15	19	0	76	3.0	162	8.2	
34abd1	10-15-71	12.5	29	10	19	14	7.3	.6	143	0	2.0	3.4	0	.18	.12	------	147	.20	110	0	13	.3	228	6.7	
(A-10-20)																									
8dac	4- 4-72	15.0	12	10	84	28	4.8	1.6	314	0	80	8.1	.1	.12	.03	------	374	.51	320	67	3	.1	618	7.1	
(A-10-21)																									
3ccc	6-14-72	15.5	13	10	67	21	5.7	1.2	291	0	18	9.9	0	.49	.06	------	281	.38	250	15	5	.2	488	7.4	
10baa	4-16-72	------	------	------	73	16	5	----	208	0	20	8	.17	----	------	------	278	.38	250	77	4	.2	435	7.8	ASHL.
14cac	10-20-72	------	------	------	69	22	3	----	210	0	50	6	.23	----	------	------	278	.38	264	91	2	.1	435	8.0	ASHL.
24ddc	1- -62	------	------	------	71	22	7	----	222	0	58	6	.2	----	------	------	307	.42	270	86	5	.2	--------	---	ASHL.
	6-14-72	15.5	11	10	76	28	4.4	1.3	311	0	58	6.0	0	0	0	------	338	.46	300	50	3	.1	578	7.4	
(A-10-22)																									
20dad	10- -60	------	------	------	66	23	8	----	205	5	51	7	.25	----	------	------	313	.43	260	91	6	.2	--------	---	ASHL.
	11-21-72	16.0	14	9	64	24	6.9	1.6	267	0	53	5.4	.3	.13	.03	20	302	.41	260	40	5	.2	497	6.8	
30aba	8-22-72	------	------	------	73	30	4	----	244	0	48	6	.18	----	------	------	308	.42	308	106	3	.1	476	8.1	ASHL.
32acb	5- -71	------	------	------	61	13	4	----	194	0	24	8	.14	----	------	------	325	.44	206	47	4	.1	500	---	ASHL.
(A-11-19)																									
14abb	8- -62	------	------	------	84	22	4	----	250	0	53	5	.2	----	------	------	326	.44	300	95	3	.1	--------	---	ASHL.
	11-21-72	------	12	9	75	28	4.0	1.3	302	0	56	5.1	.3	.9	.03	10	332	.45	300	55	3	.1	558	6.8	
(A-11-20)																									
32cba	11-21-72	------	12	9	58	22	4.1	1.3	264	0	22	4.6	.1	.13	0	10	255	.35	240	19	4	.1	439	6.9	
(A-11-21)																									
17bac	6-14-72	16.0	9.1	10	73	24	7.0	1.4	267	0	74	9.7	0	0	.03	------	330	.45	280	62	5	.2	544	7.4	
(A-11-22)																									
14cca	10- -67	------	------	------	11	6	8	----	71	------	6	3	.1	----	------	------	110	.15	52	0	25	-------	152	9.2	ASHL.
15adb	10- -67	------	------	------	17	9	7	----	92	1	7	3	.2	----	------	------	135	.18	80	4	16	-------	196	8.4	ASHL.
15ddd	10- -67	------	------	------	13	7	7	----	78	------	6	4	.1	----	------	------	115	.16	62	0	20	-------	156	8.4	ASHL.
35dbc	4-23-72	------	------	------	75	18	10	----	256	0	9	4	.09	----	------	------	325	.44	264	51	8	.3	500	7.6	ASHL.

Table 5. --Chemical analyses of water from selected wells and springs in southern Navajo County—Continued

Well or spring location	Date of collection	Temperature (°C)	Silica (SiO_2)	Dissolved iron (Fe), ug/l	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrite and Nitrate (N)	Orthophosphate (PO_4)	Boron (B), ug/l	Dissolved solids: Milligrams per liter	Dissolved solids: Tons per acre-foot	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Percent sodium	Sodium-adsorption ratio (SAR)	Specific conductance (micromhos at 25°C)	pH	Remarks
(A-11-23)																									
3bba	11-21-53	18.0	19	------	21	10	12		124	------	8.4	6.0	0.2	----	------	------	139	0.19	94	0	22	0.5	222	---	
20dcd	4- 6-72	16.0	29	10	12	7.1	8.5	3.2	95	0	2.9	2.9	0	0.17	0.12	------	113	.15	59	0	23	.5	153	7.6	Silver Springs.
31dbb	2-10-72	------	-----	------	17	12	9	----	94	0	12	6	.39	----	------	------	142	92	92	15	17	-------	217	7.2	ASHL.
(A-12-15)																									
36ddc	6- 8-72	12.0	8.3	20	52	29	2.3	.7	312	0	3.7	3.1	.1	1.1	0	------	258	.35	250	0	2	.1	471	7.4	
(A-12-16)																									
20dba	3- -66	------	-----	------	53	45	8	----	300	0	11	4	.2	----	------	------	380	.52	321	71	5	.2	588	---	ASHL.
24bba	5- -65	------	-----	------	48	25	4	----	218	0	<1	4	.3	----	------	------	235	.32	224	45	4	.1	--------	---	ASHL.
	6-20-72	13.5	9.1	70	48	27	2.7	.6	273	0	5.3	2.9	0	.62	.09	------	233	.32	230	7	2	.1	418	7.8	
(A-12-17)																									
18ddd	6-20-72	------	11	10	55	26	4.3	1.9	294	0	20	3.4	0	.07	.03	------	267	.36	240	3	4	.1	481	8.0	
21bcb	5- -57	------	-----	------	59	23	2	----	238	------	--------	4	.1	----	------	------	248	-----	244	47	2	.1	--------	---	ASHL.
	6-21-72	------	11	0	58	26	2.5	.8	279	0	20	4.3	0	.13	0	------	260	.35	250	23	2	.1	463	7.6	
32ddc	4-25-72	------	-----	------	60	22	----	----	214	0	9	4	.09	----	------	------	264	.36	240	65	----	-------	417	7.9	ASHL.
33bdd	5- -69	------	-----	------	44	25	3	----	108	0	8	12.0	.05	----	------	------	240	.33	216	125	3	.1	385	---	ASHL.
(A-12-21)																									
1bbb	1-12-72	14.5	26	0	57	34	21	5.2	293	0	83	8.7	.2	.74	0	40	383	.52	280	42	14	.5	603	7.4	
22bbc	3-10-51	16.5	12	------	59	22	6.2		274	------	17	5.0	.4	1.2	------	------	258	.35	238	13	5	.2	457	---	
(A-12-22)																									
2adb	9- 8-72	------	15	4,800	36	13	14	2.9	38	0	140	12	1.1	15	.03	------	324	.44	140	110	17	.5	403	6.0	
4cdd	6-14-51	17.0	21	------	18	10	10		106	0	13	5	.2	----	------	------	130	.18	86	0	21	.5	203	---	
30Wbcb	7-30-51	16.5	31	------	35	21	15		230	0	9.9	4	.2	----	------	------	231	.31	174	0	16	.5	369	---	
	1-12-72	17.5	31	10	41	25	12	5.5	269	0	12	3.3	.1	.31	0	40	264	.36	210	0	11	.4	431	7.6	
31Wbcb	1-12-72	18.0	30	10	58	31	12	5.9	346	0	16	3.3	.1	.19	0	40	327	.44	270	0	9	.3	546	7.3	
(A-12-23)																									
3ccb	6-12-58	16.0	12	------	106	53	170		0	0	675	97	.5	----	------	------	1,130	1.54	482	482	43	3.4	--------	3.6	
(A-13-17)																									
5caa	6-20-72	17.0	10	0	56	30	2.5	.8	310	0	18	4.1	0	.37	0	------	275	.37	260	9	2	.1	499	7.6	
(A-13-19)																									
27cdc	7- -61	------	-----	------	50	21	6		184	------	32	6	.08	----	------	------	275	.37	212	61	6	-------	--------	---	ASHL.
	6-23-72	16.5	12	0	52	21	5.8	1.2	242	0	32	5.8	.1	.53	.03	------	251	.34	220	18	5	.2	432	8.1	

Table 5.--Chemical analyses of water from selected wells and springs in southern Navajo County—Continued

Well or spring location	Date of collection	Temperature (°C)	Silica (SiO_2)	Dissolved iron (Fe), ug/l	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrite and Nitrate (N)	Orthophosphate (PO_4)	Boron (B), ug/l	Dissolved solids: Milligrams per liter	Dissolved solids: Tons per acre-foot	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Percent sodium	Sodium-adsorption ratio (SAR)	Specific conductance (micromhos at 25°C)	pH	Remarks
(A-13-20)																									
29ccd	6- -65	------	-----	------	41	16	4		160	------	9.0	3	0.4	----	------	------	187	0.25	168	38	5	0.1	286	---	ASHL.
	6-23-72	17.0	12	10	44	16	2.4	1.0	201	0	9.1	2.1	.1	0.99	0.03	------	190	.26	180	11	3	.1	329	8.0	
(A-13-21)																									
10cda	9-28-56	15.0	29	------	26.2	14.2	80	----	129	0	28.9	114	-----	----	------	------	------	-----	124	18	58	3.1	663	7.8	CL.
23cbc2	8-17-72	15.5	21	10	56	17	14	3.0	214	0	53	9.8	.3	.74	.03	------	283	.38	210	34	12	.4	463	7.3	
25bcb	1-12-72	15.0	22	10	30	16	13	4.6	175	0	33	7.9	.1	.15	0	40	214	.29	140	0	16	.5	328	7.3	
26aab	7-19-46	15.0	-----	------	66	24	26		305	------	46	13	.2	----	------	------	328	.45	263	13	18	.7	566	---	
26adb2	7- -72	------	-----	------	24	30	14	----	150	0	53	10	.17	----	------	------	250	.34	182	61	14	.5	400	7.6	ASHL.
29bbc	10- 7-56	16	12.5	-----	52	20	15	----	244	0	31.1	8.0	-----	----	------	------	403	.55	212	12	13	.4	423	7.2	CL.
29bdb	7- 9-56	------	10.0	-----	53	22	19	----	244	0	48.2	10.0	-----	----	------	------	422	.57	223	23	16	.6	450	7.9	CL.
29dda	9-22-56	15.5	12.0	-----	54	22	16	----	259	0	34.5	9.0	-----	----	------	------	423	.58	226	13	13	.5	459	8.1	CL.
32ccb	8-23-50	16.5	15	------	64	22	9.7		256	------	45	8.0	.1	----	------	------	292	.40	250	40	8	.3	485	---	
34ccd	8-24-50	15.5	25	------	47	23	17		264	------	19	7.0	.2	----	------	------	269	.37	212	0	15	.5	441	---	
(A-13-22)																									
10cca	9- 5-72	14.5	9.6	950	150	45	14	3.2	289	0	350	13	.7	.01	0	------	729	.99	560	320	5	.3	1,060	7.1	
(A-14-16)																									
8dcb	7- -66	------	-----	------	70	39	12	----	263	------	85	10	.2	----	------	------	415	.56	340	120	7	.3	645	---	ASHL.
34bcb	6-19-72	16.5	9.7	10	56	32	2.5	.8	330	0	8.8	3.9	.1	.38	.06	------	278	.38	270	1	2	.1	513	7.7	
(A-14-17)																									
18bbb	8- -69	------	-----	------	63	19	4	----	232	------	8	9.0	.3	----	------	------	290	.39	238	45	3	.1	454	---	ASHL.
(A-14-18)																									
5adc	4- -68	------	-----	------	65	29	111	----	195	0	124	164	-----	.62	------	------	689	.94	281	122	46	2.9	980	7.6	AES.
(A-14-20)																									
30caa	9-21-72	16.5	13	20	53	29	290	2.1	219	0	90	430	.3	.38	.03	------	1,020	1.39	250	72	71	8.0	1,870	7.7	
33daa	7-10-51	19.0	12	------	107	50	170		221	------	493	102	.6	----	------	------	1,050	1.43	472	292	44	3.4	1,550	---	
(A-15-15)																									
12bbc	11-22-66	16.0	13	200	48	21	8.3		244	0	18	5.0	.2	----	------	------	234	.32	208	7	8	.2	401	7.7	
(A-15-16)																									
15ddc	6-14-66	25.5	12	0	50	30	2.1		278	0	14	7.0	0	----	------	------	252	.34	248	20	2	.1	449	7.6	
35aac	6-23-72	16.5	11	0	51	28	4.4	.9	279	0	15	5.2	0	.68	.03	------	256	.35	240	14	4	.1	461	7.9	

Table 5.--Chemical analyses of water from selected wells and springs in southern Navajo County—Continued

Well or spring location	Date of collection	Temperature (°C)	Silica (SiO_2)	Dissolved iron (Fe), ug/l	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrite and Nitrate (N)	Orthophosphate (PO_4)	Boron (B), ug/l	Dissolved solids: Milligrams per liter	Dissolved solids: Tons per acre-foot	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Percent sodium	Sodium-adsorption ratio (SAR)	Specific conductance (micromhos at 25°C)	pH	Remarks
(A-15-21)																									
8ddc	2-14-34	------	-----	------	71	31	118		252	0	120	162	0.4	----	------	------	626	0.85	305	-----	46	2.9	---------	--	
	6-11-46	16.5	-----	------	71	28	121		260	0	110	160	.3	----	------	------	620	.84	292	79	----	-------	1,100	--	
32acb	6-11-58	17.0	12	------	296	99	134		300	0	930	156	1.0	----	------	------	1,780	2.42	1,150	900	20	1.7	2,260	7.0	
36bcb	9-12-72	18.0	20	60	37	13	74	2.9	180	0	50	83	.2	0.59	0.03	------	371	.50	150	0	52	2.7	638	7.7	
(A-15-22)																									
10dba	9- 5-72	18.0	4.2	30	66	74	59	7.5	204	0	350	71	.6	0	0	------	733	1.00	470	300	21	1.2	1,150	8.2	
(A-15-23)																									
3bbb	12-22-72	17.0	9.3	20	100	29	350	7.6	182	0	200	500	.5	.02	.06	70	1,370	1.86	370	220	67	7.9	2,430	7.8	
17dab	11-20-53	16.5	12	------	65	24	32		168	0	124	44	.2	----	------	------	385	.52	260	123	21	.9	644	--	
27ddb	11-18-66	------	9.4	------	65	14	35		108	0	138	43	.3	----	------	------	358	.49	218	130	26	1.0	598	7.0	
34aad	9- 1-50	17.0	12	------	49	19	27		139	------	92	34	.6	----	------	------	302	.41	200	87	23	.8	502	--	
(A-16-16)																									
2Scab	12-17-65	------	-----	------	42	20	60		199	0	21	94	.1	----	------	------	335	.46	188	25	41	1.9	620	7.9	ST.
(A-16-17)																									
8cab	9-27-72	17.0	11	20	41	19	42	1.3	217	0	28	56	.2	.56	0	------	308	.42	180	3	33	1.4	559	7.6	
11dcc	9-27-72	17.0	9.9	20	43	25	120	1.3	208	0	68	180	.2	.43	0	------	552	.75	210	40	55	3.6	1,010	7.6	
27bca	7-24-69	------	15	20	88	42	910	3.8	152	0	330	1,400	.2	.04	0	------	2,860	3.87	390	270	83	20	4,930	7.9	ST.
(A-16-18)																									
2bdd	4-23-68	16.0	14	0	46	44	201		248	0	94	305	.3	----	------	------	826	1.12	296	92	60	5.1	1,510	7.2	
9acd1	9- 6-72	17.5	9.9	30	94	54	1,000	3.4	179	0	370	1,500	.2	.76	.03	------	3,120	4.24	460	310	83	20	5,470	8.0	
28dcb	7-24-69	19.0	9.7	10	80	28	940	4.4	217	0	27	1,500	.4	.90	.03	------	2,700	3.67	310	140	86	23	5,500	7.9	
(A-16-19)																									
4bbc	6-18-46	17.0	-----	------	82	39	769		225	0	273	1,110	-----	----	------	------	2,390	3.25	365	180	82	18	4,130	--	
	4-23-68	16.0	15	0	78	37	759		236	0	240	1,100	.9	----	------	------	2,350	3.19	348	154	83	18	4,190	7.1	
36cbc	5- 8-68	------	12	0	668	190	2,820		276	0	2,620	3,980	5.4	----	------	------	10,400	14.1	2,450	2,220	71	25	15,200	6.8	Dip sample.
(A-16-20)																									
16bac	6-15-65	15.5	-----	------	72	35	113		303	0	120	138	.2	----	------	------	------	------	322	74	43	2.7	1,110	7.7	
(A-16-22)																									
14adb	9-12-72	19.0	8.7	40	210	51	780	14	364	0	1,600	350	2.0	.03	.03	------	3,200	4.35	730	440	69	13	4,230	7.3	
17ccd	5-17-68	16.0	14	20	84	29	83		236	0	177	91	.6	----	------	------	595	.80	328	134	35	2.8	981	7.2	
29ddd	9- 5-72	18.0	4.3	30	56	25	63	3.6	148	0	160	75	.3	.02	0	------	460	.63	240	120	36	1.8	776	8.2	

Table 5.--Chemical analyses of water from selected wells and springs in southern Navajo County—Continued

Well or spring location	Date of collection	Temperature (°C)	Silica (SiO_2)	Dissolved iron (Fe), ug/l	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrite and Nitrate (N)	Orthophosphate (PO_4)	Boron (B), ug/l	Dissolved solids: Milligrams per liter	Dissolved solids: Tons per acre-foot	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Percent sodium	Sodium-adsorption ratio (SAR)	Specific conductance (micromhos at 25°C)	pH	Remarks
(A-16-23)																									
15bad	12-22-71	19.5	10	40	96	23	1,200	12	331	0	270	1,800	1.7	0.03	0.06	------	3,580	4.87	330	63	88	29	6,390	7.5	
(A-17-16)																									
17aaa	12-14-65	------	-----	------	29	31	114		257	0	29	147	.2	----	------	------	477	.65	201	0	55	3.5	874	7.9	ST.
(A-17-17)																									
22ccc	7- 8-66	19.0	14	0	114	38	152		166	0	300	230	.1	----	------	------	930	1.26	442	306	43	3.1	1,530	7.4	Spring O on Chevelon Creek; 0.5 pint per minute.
(A-17-18)																									
3ddb	12-14-65	15.5	-----	------	88	56	915		218	0	330	1,360	.3	----	------	------	2,860	3.89	450	272	82	19	4,990	7.5	
	7-21-70	------	12	------	74	51	928	3.4	182	0	225	1,340	.6	----	------	------	2,720	3.70	395	246	84	28	4,510	8.2	
17bdb	12-14-65	------	-----	------	38	42	277		202	0	109	421	.2	----	------	------	987	1.34	270	105	69	7.4	1,790	7.5	
(A-17-19)																									
2cda	1-12-68	18.0	15	30	55	31	140		256	0	114	169	.6	----	------	------	651	.89	264	54	54	3.8	1,140	7.3	
2dbd	6-12-68	18.0	15	20	63	32	138		268	0	126	167	.7	----	------	------	674	.92	288	68	51	3.5	1,170	7.5	Bailer sample.
4ccc	12-14-65	14.5	-----	------	81	41	146		287	0	198	175	.4	----	------	------	782	1.06	372	137	46	3.3	1,310	7.5	
6cbd	5- 1-68	------	14	0	464	73	452		214	0	642	1,130	1.1	----	------	------	2,880	3.92	1,460	1,280	40	5.2	4,780	7.1	ST.
12acb	6-12-68	18.0	15	80	57	34	124		220	0	138	161	.7	----	------	------	638	.87	282	102	49	3.2	1,130	7.3	
12bcc	8-17-72	16.0	12	50	72	43	140	2.5	232	0	230	180	.5	.01	.12	------	794	1.08	360	170	46	3.2	1,321	7.4	
14cdc	4-23-68	14.0	14	0	85	56	138		268	0	257	180	.6	----	------	------	863	1.17	442	222	40	2.9	1,440	7.2	
28ccb	4-24-68	16.0	3.7	20	16	11	544		129	0	166	700	.8	----	------	------	1,500	2.04	84	0	93	24	2,800	6.7	Dip sample.
(A-17-20)																									
3bbc	9-13-72	17.5	11	40	120	46	290	3.1	206	0	300	460	.4	.01	.03	------	1,330	1.81	490	320	56	5.7	2,320	7.7	
5ccc1	7-23-68	17.0	18	20	42	27	104		204	0	83	132	.7	----	------	------	507	.69	216	49	51	3.1	909	7.5	
6acb	7-24-68	17.0	15	10	45	27	89		200	0	88	114	.6	----	------	------	477	.65	224	60	46	2.6	858	7.4	
6acc	7-24-68	17.0	14	10	42	26	84		198	0	68	113	.4	----	------	------	445	.61	210	48	46	2.5	839	7.4	
8bdb	9-12-72	17.0	11	30	39	26	100	2.1	201	0	83	130	.5	.01	.03	50	491	.67	200	40	51	3.0	885	7.7	
10caa1	4- -67	------	-----	------	72	35	60	----	186	------	155	68	.6	----	------	------	569	.77	327	171	29	1.4	--------	---	ASHL.
	3- -69	------	-----	------	37	16	53	----	152	------	130	60	.1	----	------	------	450	.61	260	34	42	1.4	714	---	
10dac	9- 6-72	17.0	12	90	90	59	94	2.5	241	0	280	140	.5	.26	.03	150	798	1.09	470	270	30	1.9	1,280	7.3	
11dac	9- 6-72	17.0	14	40	150	130	170	6.1	238	0	740	270	.6	2.8	.12	140	1,610	2.19	910	710	29	2.5	2,360	7.6	

Table 5. --Chemical analyses of water from selected wells and springs in southern Navajo County—Continued

Well or spring location	Date of collection	Temperature (°C)	Silica (SiO_2)	Dissolved iron (Fe), ug/l	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrite and Nitrate (N)	Orthophosphate (PO_4)	Boron (B), ug/l	Dissolved solids: Milligrams per liter	Dissolved solids: Tons per acre-foot	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Percent sodium	Sodium-adsorption ratio (SAR)	Specific conductance (micromhos at 25°C)	pH	Remarks
(A-17-20)																									
26dbc	11- 4-69	------	13	------	38	23	57	2.3	186	------	89	52	0.4	----	------	0.01	383	0.52	190	37	39	1.8	635	7.9	USSL; zone tested 554 to 615 feet.
	11- 5-69	------	13	------	38	24	53	2.3	185	------	82	52	.4	----	------	.02	375	.51	194	42	37	1.7	626	7.9	USSL; zone tested 436 to 546 feet.
	11- 6-69	------	13	------	39	22	80	2.7	203	------	119	54	.4	----	------	0	476	.65	188	22	47	2.5	724	8.0	USSL; zone tested 297 to 446 feet.
	11-25-69	------	9	------	436	62	5,560	11	209	0	1,070	8,790	.4	----	------	.14	16,300	22.2	1,340	1,170	90	66	24,800	7.4	USSL; bailer sample from 722 feet.
(A-17-21)																									
10cba	4-18-54	------	-----	------	------	-------	----	----	268	------	-------	3,320	-----	----	------	------	------	------	--------	-----	----	--------	10,700	---	Bailer sample.
16adb	4-18-54	------	4.5	------	124	43	119		279	------	305	140	.8	----	------	------	874	1.19	486	258	35	2.3	1,400	---	ST.
(A-17-22)																									
17dbd	4-30-65	------	-----	------	132	45	1,110		182	0	215	1,810	.9	----	------	------	3,490	4.75	515	366	82	21	6,090	7.5	ST.
22bcc	5- 3-63	------	-----	------	298	43	197	----	261	0	710	285	-----	----	------	------	1,660	2.26	924	707	32	2.8	2,300	7.0	WFC.
(A-18-16)																									
30dd	7- 7-66	17.0	13	0	50	24	178		222	0	32	280	.1	----	------	------	686	.93	224	42	63	5.2	1,280	7.7	Spring I on Clear Creek; 0.5 pint per minute.
31adb	6-30-66	18.0	12	0	50	24	201		224	0	31	317	0	----	------	------	745	1.01	226	42	66	5.8	1,400	7.6	
31bbb	7- 7-66	20.0	14	0	46	27	576		160	0	50	920	.2	----	------	------	1,710	2.33	228	97	85	17	3,200	7.8	Spring K on Clear Creek; 0.5 pint per minute.
(A-18-17)																									
5caa	8-22-57	15.0	15	------	96	53	1,680		245	10	385	2,470	.8	----	------	------	4,830	6.57	548	240	89	34	8,330	8.5	
6ccb	3- 8-67	------	18	------	276	39	726		274	------	680	1,060	.6	----	------	------	2,930	3.98	850	626	65	11	4,500	7.2	
12cba	3- 3-70	------	-----	------	320	58	1,100	----	164	------	830	1,760	.66	----	------	------	4,454	6.06	1,040	903	70	15	6,670	---	ASHL.
14aad	1-10-67	------	18	------	52	12	522		256	0	210	627	.8	----	------	------	1,570	2.14	180	0	86	17	2,800	7.5	
(A-18-18)																									
7ddc	1-10-67	------	13	------	146	24	604		204	0	420	820	.7	----	------	------	2,140	2.91	465	298	74	1.2	3,600	7.4	
10ada	1-10-67	------	11	------	66	32	405		272	0	194	525	.4	----	------	------	1,370	1.86	295	72	75	10	2,440	7.4	
10ccb1	1-10-67	------	3.3	------	16	19	224		374	0	4	156	.4	----	------	------	594	.81	48	0	80	14	1,070	7.3	
34daa	7-16-69	16.0	13	10	40	35	400	4.8	156	0	250	540	.3	0.36	0	------	1,360	1.85	240	120	78	11	2,300	8.2	

Table 5. --Chemical analyses of water from selected wells and springs in southern Navajo County—Continued

Well or spring location	Date of collection	Temperature (°C)	Silica (SiO_2)	Dissolved iron (Fe), ug/l	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrite and Nitrate (N)	Orthophosphate (PO_4)	Boron (B), ug/l	Dissolved solids: Milligrams per liter	Dissolved solids: Tons per acre-foot	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Percent sodium	Sodium-adsorption ratio (SAR)	Specific conductance (micromhos at 25°C)	pH	Remarks
(A-18-19)																									
8ddd	12-17-53	17.0	10	------	76	34	759		256	------	179	1,120	0.7	----	------	------	2,310	3.14	330	120	83	18	4,230	---	
	6-15-65	16.0	-----	------	684	76	----	----	207	0	680	1,960	.5	----	------	------	------	-----	2,020	1,850	----	-------	7,000	7.0	Sampled after pumping 5 minutes.
	3- 3-66	------	22	0	96	40	1,100		268	0	255	1,640	.8	----	------	------	3,280	4.46	405	186	86	24	5,730	7.7	Sampled after pumping 100 minutes.
16ada	11-19-53	16.5	11	------	66	30	589		243	------	195	825	.6	----	------	------	1,840	2.50	288	89	82	15	3,220	---	
	11-24-53	17.0	12	------	64	32	569		241	------	186	805	.6	----	------	------	1,790	2.43	291	94	81	15	3,180	---	Sampled after pumping 8 hours.
	7- 1-54	------	-----	------	------	-------	----	----	241	------	-------	825	-----	----	------	------	------	-----	-------	-----	----	-------	3,250	---	
	6-15-65	17.0	-----	------	66	31	592		236	0	176	850	.6	----	------	------	------	-----	290	97	82	15	3,330	7.6	
16bbc	1-12-68	17.0	12	70	81	41	959		270	0	235	1,410	.8	----	------	------	2,870	3.90	370	149	85	22	5,110	7.5	
	3-19-68	17.0	15	20	70	36	752		268	0	205	1,080	.8	----	------	------	2,290	3.11	322	103	84	18	4,100	7.4	Sampled after pumping 4 hours.
	5- 1-68	17.0	14	0	78	38	902		270	0	218	1,320	.9	----	------	------	2,700	3.67	350	129	88	21	4,860	7.3	Sampled after pumping 3 weeks.
	6-20-68	18.0	13	20	82	39	958		270	0	228	1,410	.8	----	------	------	2,860	3.89	365	144	85	22	5,170	7.1	Sampled after pumping 4 weeks.
	7-16-68	18.0	13	20	84	39	974		274	0	235	1,430	.8	----	------	------	2,910	3.96	370	146	85	22	5,240	7.4	Sampled after pumping 8 weeks.
	8-28-68	16.0	13	20	81	40	946		268	0	232	1,390	.8	----	------	------	2,830	3.85	366	197	85	21	5,090	7.5	Sampled after pumping 3 months.
16bcb	3- 3-66	------	14	0	53	34	444		264	0	165	600	.6	----	------	------	1,440	1.96	270	54	78	12	2,520	7.7	
	11-16-66	16.5	11	------	60	27	429		256	0	170	570	.6	----	------	------	1,390	1.89	260	50	78	12	2,460	7.3	
	7-17-68	17.0	13	10	55	32	445		262	0	162	605	.7	----	------	------	1,440	1.96	270	56	78	12	2,640	7.1	
	8-17-72	------	-----	------	60	32	460	----	281	0	170	650	-----	----	------	------	1,659	2.26	281	51	78	12	2,600	7.9	AES.
16caa1	12-18-53	15.0	11	------	58	32	391		258	------	171	520	.4	----	------	------	1,310	1.78	276	64	75	10	2,320	---	
	1-12-68	17.0	13	30	55	33	393		256	0	162	530	.9	----	------	------	1,310	1.78	274	64	76	10	2,400	7.3	
16caa2	8- 1-55	16.5	-----	------	------	-------	----	----	146	0	-------	1,060	-----	----	------	------	------	-----	2,190	2,070	----	-------	6,070	7.0	Bailer sample.
	8- 5-55	16.5	-----	------	------	-------	----	----	165	0	-------	1,040	-----	----	------	------	------	-----	1,850	1,720	----	-------	5,430	7.0	Bailer sample.
	8-22-55	16.5	12	------	56	52	389		248	0	163	585	.6	----	------	------	1,380	1.88	354	150	71	9.0	2,410	7.7	
16caa3	12-17-53	14.5	9.9	------	177	38	492		231	------	496	675	.7	----	------	------	2,010	2.73	598	408	64	8.8	3,260	---	
	3- 3-66	------	14	0	274	40	596		244	0	745	830	.6	----	------	------	2,620	3.56	850	651	60	8.9	4,130	7.5	
16cac	12-17-53	15.0	11	------	592	45	649		292	------	1,700	750	1.5	----	------	------	3,900	5.30	1,660	1,420	46	6.9	5,010	---	
16ccc	8-21-67	------	22	10	55	35	436		264	0	160	598	.7	----	------	------	1,440	1.96	280	64	77	11	2,630	7.5	
16cdc	12-18-53	15.0	12	------	55	34	209		245	------	137	270	.4	----	------	------	842	1.15	277	76	62	5.5	1,480	---	
16dac	6-12-46	18.5	-----	------	66	31	508		237	------	170	725	.4	----	------	------	1,620	2.20	292	98	79	13	2,850	---	
16ddb2	4-26-54	------	12	------	437	49	772		293	------	1,370	920	1.8	----	------	------	3,710	5.05	1,290	1,050	56	9.3	5,230	---	Bailer sample.
	5- 8-54	------	20	------	------	-------	----	----	208	------	-------	725	-----	----	------	------	------	-----	-------	-----	----	-------	2,900	---	Bailer sample.
	5- 8-54	------	-----	------	57	25	508		240	------	163	695	1.0	----	------	------	1,570	2.14	245	48	82	14	2,850	---	Bailer sample.
	5- 9-54	------	-----	------	60	30	526		244	------	170	735	1.0	----	------	------	1,640	2.23	273	73	81	14	2,980	---	Sampled after pumping 1 day.
	6-15-65	16.0	-----	------	64	32	----	----	242	0	182	835	.5	----	------	------	------	-----	292	94	----	-------	--------	7.6	

Table 5.--Chemical analyses of water from selected wells and springs in southern Navajo County—Continued

Well or spring location	Date of collection	Temperature (°C)	Silica (SiO_2)	Dissolved iron (Fe), ug/l	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrite and Nitrate (N)	Orthophosphate (PO_4)	Boron (B), ug/l	Dissolved solids		Hardness as $CaCO_3$		Percent sodium	Sodium-adsorption ratio (SAR)	Specific conductance (micromhos at 25°C)	pH	Remarks
																	Milligrams per liter	Tons per acre-foot	Calcium, magnesium	Non-carbonate					
(A-18-19)																									
17aac	2- 1-54	------	13	------	195	43	346		248	------	961	141	1.2	----	------	------	1,830	2.49	664	460	53	5.8	2,510	---	Bailer sample.
	2- 2-54	------	-----	------	------	-------	----	----	211	------	2,000	145	-----	----	------	------	------	-----	1,710	-----	----	-------	3,820	---	Bailer sample.
	2- 8-54	------	17	------	652	121	769		199	------	2,500	722	1.0	----	------	------	4,890	6.65	2,120	1,960	44	7.3	6,080	---	Bailer sample.
	2-12-54	------	13	------	437	66	370		236	------	1,640	180	1.1	----	------	------	2,830	3.85	1,020	1,170	37	5.0	3,450	---	Bailer sample.
	3-15-54	16.0	11	------	56	33	299		251	------	149	400	.4	----	------	------	1,070	1.46	275	70	70	7.8	1,950	---	
	6-15-65	16.0	-----	------	58	32	----	----	257	------	164	660	.4	----	------	------	------	-----	276	66	----	-------	2,730	---	
17aad	6-20-68	18	14	60	89	41	1,130		280	0	248	1,680	.8	----	------	------	3,340	4.54	392	163	88	25	6,000	7.3	
	8-17-72	------	-----	------	100	49	1,350	----	293	0	290	1,920	-----	----	------	------	------	-----	--------	-----	----	28	6,300	7.7	AES.
17ada	6-16-72	17.5	10	10	63	34	530	3.5	263	0	180	780	.4	0	0.03	------	1,730	2.35	300	82	79	13	3,130	7.5	
	8-17-72	16.0	10	20	64	35	540	3.0	255	0	180	790	.6	0	0	------	1,750	2.38	300	95	79	13	3,150	7.6	
	8-17-72	------	-----	------	66	36	534	----	264	0	180	766	-----	----	------	------	1,852	2.52	313	96	79	13	2,900	7.7	AES.
17adc	4- 3-68	16.0	14	20	50	32	309		256	0	142	405	.7	----	------	------	1,080	1.47	258	48	72	8.4	1,940	7.5	
	8-17-72	------	-----	------	55	33	313	----	256	0	150	404	-----	----	------	------	1,219	1.66	273	63	71	8.2	--------	7.6	AES.
17cbc	9- 7-72	------	-----	------	51	31	174	----	198	0	116	190	.37	----	------	------	600	.82	300	92	60	4.4	1,000	7.8	
17cda	4-30-54	------	11	------	46	28	179		247	------	132	195	1.8	----	------	------	714	.97	230	28	63	5.1	1,250	---	
17daa	2-12-54	------	10	------	50	32	278		257	------	144	352	.8	----	------	------	994	1.35	256	46	70	7.6	1,770	---	
	6-15-65	------	-----	------	50	30	----	----	251	0	144	345	.5	----	------	------	------	-----	248	43	----	-------	1,760	7.8	Tap.
18daa	4-21-70	14.5	11	10	26	26	190	2.9	207	0	120	210	.8	.01	0	------	689	.94	170	2	70	6.3	1,220	8.3	
22cbb	6-12-68	17.0	13	40	60	30	494		244	0	185	675	.8	----	------	------	1,580	2.15	272	72	80	13	2,870	7.7	
	7-21-70	17.0	10	------	47	33	610	3.2	207	0	184	855	.8	----	------	------	1,840	2.50	254	84	84	17	3,320	8.2	
23dbd	1-12-68	17.0	3.7	40	34	51	278		98	0	90	380	.6	----	------	------	839	1.14	106	26	67	12	1,570	7.2	
28cdd	7-12-68	16.0	15	10	54	31	146		256	0	118	175	.6	----	------	------	666	.91	264	54	55	3.9	1,160	7.5	
28ddd	6-12-68	17.0	14	10	50	31	153		228	0	115	196	.7	----	------	------	672	.91	252	65	57	4.2	1,200	7.4	
33ada	1-12-68	18.0	14	40	56	35	136		270	0	113	171	.6	----	------	------	659	.90	286	64	51	3.5	1,180	7.2	
	7-21-70	17.0	13	------	46	34	141	1.8	228	0	113	168	.6	----	------	------	629	.86	256	69	55	3.8	1,100	8.1	
34caa	6-12-68	18.0	14	10	52	31	134		238	0	88	186	.5	----	------	------	622	.85	258	63	53	3.6	1,160	7.2	Tap.
35adb	3- 2-54	16.0	14	------	50	31	228		214	0	112	322	.5	----	------	------	864	1.18	252	77	66	6.2	1,550	---	
(A-18-20)																									
31aac	5- 1-68	------	14	0	134	56	342		212	0	296	585	.8	----	------	------	1,530	2.08	564	390	57	6.3	2,690	7.1	Tap.
33dbc	7-16-59	------	-----	------	127	50	342	----	210	------	300	555	-----	----	------	------	1,584	2.15	524	351	59	6.5	--------	---	AES.
	7-26-72	17.0	11	10	110	47	330	3.2	204	0	280	540	.5	0	.03	------	1,420	1.93	470	300	60	6.6	2,490	7.7	
(A-18-21)																									
12aad	11-28-59	------	38	------	536	326	25,635	----	754	0	950	40,000	.5	----	------	------	68,240	92.8	3,360	2,060	95	190	--------	7.9	ATL.
(A-18-22)																									
16aab1	10- -59	------	-----	------	44	7	550	----	460	15	178	500	.95	----	------	------	1,650	2.24	140	0	90	20	--------	---	ASHL.
	10- -63	------	-----	------	32	10	575	----	489	------	94	545	.70	----	------	------	1,586	2.16	122	0	91	23	2,820	---	ASHL.

Table 5. --Chemical analyses of water from selected wells and springs in southern Navajo County—Continued

Well or spring location	Date of collection	Temperature (°C)	Silica (SiO_2)	Dissolved iron (Fe), ug/l	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrite and Nitrate (N)	Orthophosphate (PO_4)	Boron (B), ug/l	Dissolved solids: Milligrams per liter	Dissolved solids: Tons per acre-foot	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Percent sodium	Sodium-adsorption ratio (SAR)	Specific conductance (micromhos at 25°C)	pH	Remarks
(A-18-22)																									
16aab2	2- -60	------	-----	------	15	0.5	235	----	353	15	125	32	1.22	----	------	------	675	0.92	39	0	93	16	--------	---	ASHL.
(A-18-23)																									
6cac	8-29-65	------	-----	------	32	6.3	469		442	0	200	395	1.6	----	------	------	1,540	2.09	106	0	91	20	2,270	8.0	
10dda	10-14-64	18.0	18	------	18	6.6	317		532	45	122	82	1.7	----	------	------	875	1.19	72	0	91	16	1,410	8.9	
12cbc1	10-15-64	15.0	21	------	80	13	567		500	0	243	578	1.4	----	------	------	1,750	2.38	252	0	83	16	2,970	8.0	
(A-19-15)																									
26dad	1-21-54	------	8.0	------	53	38	628		261	0	120	924	.2	----	------	------	2,040	2.77	288	75	83	16	--------	7.6	ATL.
36aba	4- -71	------	-----	------	64	26	386	----	198	------	65	690	.33	----	------	------	1,420	1.93	270	104	76	10	2,380	---	ASHL.
(A-19-16)																									
6acb	4-30-65	------	-----	------	78	25	430		272	0	162	595	.6	----	------	------	1,380	2.26	296	73	76	11	2,560	7.6	ST.
6cda	4-30-65	14.5	-----	------	57	26	623		254	0	200	840	.7	----	------	------	2,200	3.00	248	40	84	13	3,390	7.4	
6cdb	4-30-65	------	-----	------	51	27	621		246	0	190	840	.6	----	------	------	2,190	2.98	236	34	85	18	3,370	7.6	ST.
28ddd	6-13-66	------	-----	------	105	49	918	----	283	------	300	1,360	.3	----	------	------	3,020	4.11	464	232	81	19	--------	---	AES.
36dba	6-16-72	17.0	10	10	150	64	1,000	7.2	267	0	520	1,500	.2	0.01	0.03	------	3,380	4.60	640	420	77	17	5,870	7.5	
(A-19-17)																									
5ddd	4-15-66	------	-----	------	522	70	2,660		251	0	1,360	4,080	.5	----	------	------	8,820	12.0	1,590	1,390	78	29	13,500	7.6	Bailer sample.
	5- 2-66	18.0	-----	------	200	.8	1,340		50	0	488	3,790	.5	----	------	------	6,580	8.94	500	462	85	82	12,100	---	
(A-19-22)																									
1ccc	1- 2-55	------	-----	------	601	128	----	----	157	------	------	4,430	------	----	------	------	------	------	2,030	1,900	----	-------	13,800	---	Bailer sample from 1,085 feet.
	1- 3-55	------	-----	------	655	142	----	----	243	------	------	5,720	------	----	------	------	------	------	2,220	2,020	----	-------	16,900	---	Bailer sample from 1,125 feet.
(A-19-23)																									
33dba	3-13-69	------	13	0	12	4.1	452		391	19	166	355	1.7	----	------	------	1,220	1.66	47	0	96	29	2,090	8.7	
(A-20-16)																									
28ddd	12-13-58	------	-----	------	94	19	377	----	234	0	260	470	------	----	------	------	1,460	1.99	308	121	72	9.3	--------	---	AES.
	7-18-66	------	-----	------	94	24	377	----	258	0	240	490	.3	----	------	------	1,480	2.01	334	122	71	9.0	--------	---	
(A-20-17)																									
22cbd	7-18-66	------	-----	------	12	10	227	----	391	7	80	100	2.4	----	------	------	829	1.13	72	0	87	12	--------	---	AES; Rincon Spring.

Table 6.--Modified drillers' logs of selected wells in southern Navajo County

	Thickness (feet)	Depth (feet)
(A-8-23)1bcd		
QUATERNARY:		
Basaltic rocks:		
Malpais, black, hard	59	59
Clay and broken rock	6	65
Malpais, black, hard	65	130
Malpais, fractured; small amount of water	10	140
Malpais, black, hard	50	190
Malpais, fractured; water	2	192
Malpais, black, hard	28	220
Shale, blue	20	240
Malpais, brown, hard	12	252
Shale, blue	10	262
Malpais, black, hard	13	275
UPPER CRETACEOUS:		
Sedimentary rocks:		
Clay, yellow	25	300
Shale, blue	30	330
(A-8-23)1dbc		
QUATERNARY:		
Basaltic rocks:		
Malpais, black	20	20
Malpais, red	4	24
Malpais, black; little water at 140 feet	131	155
Malpais, red	37	192
Malpais, black; more water at 245 feet	119	311
Malpais, red	6	317
Sand, red; more water at 337 feet	20	337
Cinders and gravel	15	352
UPPER CRETACEOUS:		
Sedimentary rocks:		
Clay, red and black; water found	11	363
(A-8-23)2cba		
QUATERNARY:		
Surficial material:		
Clay	8	8
Basaltic rocks:		
Malpais	32	40
Malpais; some water at 85 feet	55	95
Malpais	20	115
Malpais, red and brown	5	120
Malpais, black	40	160
Clay, yellow	6	166
Malpais, hard	14	180
Shale, blue	4	184
Malpais, black	11	195
Malpais, red, broken; increase in water 195 to 205 feet	10	205
UPPER CRETACEOUS:		
Sedimentary rocks:		
Shale, red	10	215
Shale, black or blue mud	8	223
(A-8-23)3ccb		
QUATERNARY:		
Basaltic rocks:		
Malpais boulders, hard	12	12
Basalt, very hard; first water at 32 feet, bailed at 50 gal/min	30	42
Basalt, badly broken with clay fill in cracks	5	47
Basalt, hard	9	56
Basalt, broken and cavey	3	59
Basalt, medium to medium-hard	9	68
Basalt, hard	33	101
Clay, light-brown	8	109
Basalt, medium-hard	22	131
Basalt, hard	8	139
Basalt, very hard	15	154
Clay and gravel	4	158
Basalt, hard	39	197
Basalt, soft	21	218
Basalt, red, hard	11	229
Basalt, black, hard	33	262
Basalt, red, hard	29	291
Basalt, black, hard	39	330
UPPER CRETACEOUS:		
Sedimentary rocks:		
Clay, orange and cream	12	342
Shale of Dakota(?) Sandstone, orange, pink, white, and red	11	353
(A-8-23)4bcc		
No log	250	250
UPPER CRETACEOUS:		
Sedimentary rocks:		
Shale, blue	30	280
Shale, sandy	17	297
Shale, blue	53	350
(A-8-23)5abb1		
QUATERNARY:		
Basaltic rocks:		
Malpais	171	171
UPPER CRETACEOUS:		
Sedimentary rocks:		
Clay	22	193

Table 6.--Modified drillers' logs of selected wells in southern Navajo County—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
(A-8-23)5abb2					
QUATERNARY:			UPPER CRETACEOUS:		
Surficial deposits:			Sedimentary rocks:		
Surface clay	12	12	Clay	30	200
Basaltic rocks:					
Malpais	158	170			
(A-8-23)5acd					
QUATERNARY:			Sandstone; water 130-165 feet	60	165
Alluvium:			Shale, gray	16	181
Topsoil	10	10	Sandstone, with water	16	197
UPPER CRETACEOUS:			Shale, blue	5	202
Sedimentary rocks:			Sandstone, with water	4	206
Clay, red	30	40	Shale, blue	16	222
Clay, yellow	65	105	No log	50	272
(A-8-23)5ada					
QUATERNARY:			Clay, yellow, and shale	45	125
Alluvium:			Sand and gravel	35	160
Clay	50	50	Slight sand and gravel	20	180
QUATERNARY AND TERTIARY:			UPPER CRETACEOUS:		
Rim gravel:			Sedimentary rocks:		
Sand and gravel	30	80	Shale, blue	35	215
(A-8-23)5bbb					
QUATERNARY:			UPPER CRETACEOUS:		
Alluvium:			Sedimentary rocks:		
Surface soil	10	10	Quicksand, soft	10	145
Clay, light tan, soft	20	30	Clay, yellow, soft	15	160
Basaltic rocks:			Clay, red, soft	10	170
Lava and clay, hard	20	50	Clay, red, firm	5	175
Lava and clay, softer contents; first water strata at 90-100 feet with more water at 100-105 feet	55	105	Clay, red	5	180
Clay, red	5	110	Shale, gray and rock	10	190
Lava and red clay mixture	25	135	Sand, gravel and rock; with water-bearing strata	20	210
			Clay, red	10	220
(A-8-23)5bda					
QUATERNARY:			UPPER CRETACEOUS:		
			Sedimentary rocks:		
Basaltic rocks:			Clay, red, mixed with sand	103	153
			Sand, very coarse	7	160
Malpais	15	15	Sand	10	170
Topsoil mixed with fine malpais	35	50	Clay, blue, mixed with sand	10	180
			Clay, blue	132	312
(A-8-23)5ddc					
QUATERNARY:			PERMIAN:		
Basaltic rocks:			Coconino Sandstone:		
Malpais; water at 135 feet, bailed 12 gal/min	145	145	Sandstone, white; lost water. Plugged bottom 135 feet of hole with mud. Water level at 330 feet after plugging	5	735
UPPER CRETACEOUS:					
Sedimentary rocks:					
Clay, interbedded with beds of sandstone	585	730			

Table 6.--Modified drillers' logs of selected wells in southern Navajo County—Continued

(A-8-23)10baa

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Basaltic rocks:		
Soil and boulders	4	4
Basalt, black, hard; small stream of water at 26 feet	50	54
Basalt, soft, broken	15	69
Basalt, medium-hard	9	78
Basalt, hard, broken	30	108
Basalt, soft, with clay and boulders; some water	5	113
Basalt, hard, broken	9	122
Basalt, very hard	55	177
Basalt, soft, with clay and boulders	4	181
Bentonite and clay	23	204
Basalt, hard, broken, caving badly	31	235
Basalt, hard	43	278
Basalt, red, hard, broken	18	296
Basalt, black, hard	8	304
Basalt, red and brown, hard	27	331
Basalt, red and black, hard; brown clay in seams of rock	24	355
UPPER CRETACEOUS:		
Sedimentary rocks:		
Shale and clay of Dakota(?) Sandstone	2	357

(A-8-23)10bad

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Basaltic rocks:		
Boulders and clay; losing water	29	29
Basalt, hard; first good stream of water	9	38
Clay and boulders	4	42
Basalt, medium-hard	19	61
Basalt, soft; possible water stream 61-73 feet	13	74
Basalt, medium-hard	43	117
Cinders and clay, brown	4	121
Basalt, medium-hard	3	124
Basalt, hard	11	135
Basalt, very hard	33	168
Clay and boulders, brown	6	174
Basalt, hard	12	186
Basalt, medium-hard; caving badly; possible water at 186-208 feet	26	212
Conglomerate, hard; surface stream failing. Water level dropped	4	216
Basalt, hard	14	230
Basalt, hard with softer layers; possible water from 230 to 243 feet	47	277
Basalt, very hard	35	312
Basalt, red and black, broken; possible water	6	318
Basalt, very hard	19	337
Basalt, broken; possible water	4	341
Basalt, very hard	39	380
UPPER CRETACEOUS:		
Sedimentary rocks:		
Blue clay of Dakota(?) Sandstone	5	385

(A-8-23)10bbb

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Basaltic rocks:		
Boulders	8	8
Basalt, very hard, broken; water at 32 feet	48	56
Silt, red and brown, with cinders and boulders	13	69
Basalt, medium-hard	24	93
Basalt, hard	43	136
Basalt, very hard	32	168
Basalt, blue	6	174
Bentonite, white	22	196
Basalt, medium-hard	47	243
Basalt, hard	23	266
Basalt, red, medium-hard, with thin layers of sand and clay	27	293
Basalt, hard	43	336
Basalt, with thin layers of clay	8	344
Basalt, hard	19	363
UPPER CRETACEOUS:		
Sedimentary rocks:		
Dakota(?) Sandstone, white, pink, gray, and brown	12	375

(A-8-23)11abc

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Basaltic rocks:		
Malpais, black	117	117
Malpais, red	38	155
Malpais, black, hard; water	20	175
Malpais, black; broken	20	195
Malpais, broken; more water	12	207
Malpais, black	10	217
Malpais, black, hard	56	273
UPPER CRETACEOUS:		
Sedimentary rocks:		
Shale, red	14	287
Shale, black	3	290

(A-8-23)11bdb

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Surficial material:		
Clay	8	8
Basaltic rocks:		
Malpais, hard	147	155
Malpais, red; some water	5	160
Malpais, hard	10	170
Malpais, red, broken; some water at 170 feet	22	192
Malpais, hard; some water at 195 feet	3	195
Malpais, hard	65	260
UPPER CRETACEOUS		
Sedimentary rocks:		
Sandstone; no water	10	270
Shale, black	22	292

Table 6.--Modified drillers' logs of selected wells in southern Navajo County—Continued

(A-8-23)12aaa

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
QUATERNARY:			Basalt, broken, and clay	7	170
Basaltic rocks:			Basalt, hard	24	194
Boulders	6	6	Basalt, red, medium-hard	24	218
Basalt, hard	12	18	Basalt, hard thin layers; thin layers of broken basalt	43	261
Basalt, broken	4	22	Basalt, black, very hard	21	282
Basalt, hard; badly broken, large cracks from 24 to 35 feet	13	35	Clay, blue, and broken rock; water every few feet from 163 to 286 feet	4	286
Basalt, very hard	7	42	Basalt, black, hard	43	329
Boulders, cinders and clay	11	53	Clay, orange, and boulders	2	331
Basalt, medium-hard	12	65	Basalt, medium-hard and broken in spots	22	353
Basalt, hard, broken; lost drilling water 86-90 feet	25	90	UPPER CRETACEOUS:		
Basalt, very hard	7	97	Sedimentary rocks:		
Basalt, badly broken	15	112	Clay, gray	11	364
Basalt, hard	13	125	Clay, gray and orange, of Dakota(?) Sandstone	11	375
Basalt, hard, broken; lost drilling water; small stream at 163 feet	38	163			

(A-9-22)4abc

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
QUATERNARY AND TERTIARY:			Shale, black	55	110
Rim gravel:			Shale, gray	25	135
Clay and cobblestone	20	20	Sandstone; water bearing	30	165
UPPER CRETACEOUS:			Shale, brown	35	200
Sedimentary rocks:					
Shale, red	35	55			

(A-9-22)15bcd

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
QUATERNARY:			Clay, gray, gummy	190	500
Basaltic rocks:			PERMIAN:		
Malpais	45	45	Coconino Sandstone:		
UPPER CRETACEOUS:			Sandstone, red	165	665
Sedimentary rocks:					
Clay, red	265	310			

(A-9-22)15dcb2

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
QUATERNARY:			UPPER CRETACEOUS:		
Basaltic rocks:			Sedimentary rocks:		
Malpais	57	57	Clay, orange; first water at 60 feet	68	125

(A-9-22)22bab

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
UPPER CRETACEOUS:			Sandstone and clay	95	145
Sedimentary rocks:					
Clay	50	50			

(A-9-22)22cda

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
UPPER CRETACEOUS:			Coal bed	1	91
Sedimentary rocks:			Hardpan	1	92
Clay, blue, and yellow sandstone, in alternating layers	90	90	Sandstone, yellow	38	130

(A-9-22)23cba1

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
UPPER CRETACEOUS:			Shale, blue, and clay	25	100
Sedimentary rocks:					
Clay, red	75	75			

Table 6.--Modified drillers' logs of selected wells in southern Navajo County— Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
(A-9-22)23dac					
QUATERNARY:			UPPER CRETACEOUS:		
Basaltic rocks:			Sedimentary rocks:		
Cinders and topsoil	3	3	Clay, red	1	101
Malpais; water at 32, 66, and 87 feet	97	100			
(A-9-22)24bca					
QUATERNARY:			Clay, brown, fine, and gravel;		
Basaltic rocks:			about 15 gal/min water	5	160
Topsoil and boulders	5	5	Malpais	20	180
Malpais; 2-3 gal/min water at 80-90 feet	150	155			
(A-9-22)24cac					
QUATERNARY:			Cinders	30	60
Surficial material:			UPPER CRETACEOUS:		
Clay	20	20	Sedimentary rocks:		
Basaltic rocks:			Clay; water at 65, 92, and 102 feet	42	102
Malpais, soft	10	30	Sandstone, yellow-orange	16	118
(A-9-22)25aca					
QUATERNARY:			UPPER CRETACEOUS:		
			Sedimentary rocks:		
Basaltic rocks:			Clay	28	93
			Sandstone; water at this point	19	112
Topsoil	2	2	Clay	8	120
			Sandstone	13	133
Lava; seep at 65 feet	63	65	Clay and shale	31	164
(A-9-22)25acb					
QUATERNARY:			Gravel; first sign of water	30	85
Surficial material:			Sandy gravel	20	105
Topsoil	16	16	Sandy clay with malpais rock; second		
Basaltic rocks:			water strata at 105 feet	40	145
Malpais rock	28	44	Gravel; third water strata at		
QUATERNARY AND TERTIARY:			145 feet	5	150
Rim gravel:					
Sand	11	55			
(A-9-22)25bda					
QUATERNARY:			Malpais, solid	50	70
Basaltic rocks:			Malpais, broken; water, 20 gal/min	20	90
Malpais, broken	20	20	Malpais, solid	60	150
(A-9-22)25ccb					
QUATERNARY:			Malpais, solid	80	97
Basaltic rocks:					
Soil and float	17	17			
(A-9-22)25cdc					
QUATERNARY:			Sandstone, yellow	15	150
Basaltic rocks:			Clay, yellow	5	155
Malpais	15	15	Sandstone, brown;		
Malpais; some water at 35-40 feet	85	100	third water	38	193
Malpais, soft; second water			Shale, blue-black	5	198
at 105 feet	10	110	Sandstone, gray	17	215
Black cinders	20	130	Limestone, hard	15	230
UPPER CRETACEOUS:			Sandstone, gray, with shale		
Sedimentary rocks:			layers	12	242
Clay; no water	5	135	Shale, gray	8	250

Table 6.--Modified drillers' logs of selected wells in southern Navajo County—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
(A-9-22)25ddd					
QUATERNARY:			Malpais	132	149
Basaltic rocks:			Malpais, blue	20	169
Topsoil and malpais float	17	17			
(A-9-22)26ada2					
QUATERNARY:			QUATERNARY AND TERTIARY:		
Basaltic rocks:			Rim gravel:		
Malpais, blue	200	200	River gravel; swampy smell	20	220
(A-9-22)26cac					
QUATERNARY:			Cinders and volcanic ash	8	110
Alluvium:			UPPER CRETACEOUS:		
Topsoil	1	1	Sedimentary rocks:		
Red clay	16	17	Clay, blue	15	125
Basaltic rocks:			Sandstone, gray	35	160
Lava, malpais	34	51	Layers of soapstone and blue clay;		
Volcanic ash	29	80	coal bed at about 180 feet	72	232
Lava, malpais	22	102			
(A-9-22)26cbc					
QUATERNARY:			Clay, red	42	105
Surficial material:			Coal	7	112
Topsoil	3	3	Clay, blue	253	365
UPPER CRETACEOUS:			PERMIAN:		
Sedimentary rocks:			Coconino Sandstone:		
Clay, brown	27	30	Sandstone	195	560
Clay, blue	33	63	Sand	190	750
(A-9-22)26cda2					
UPPER CRETACEOUS:			Shale, blue	20	100
Sedimentary rocks:			Sandstone; water bearing	35	135
Sandy topsoil	5	5	Shale, black	25	160
Sandy shale	5	10	Sandy shale	30	190
Shale, blue	30	40	Sandstone	60	250
Shale, gray	40	80	Shale, black	50	300
(A-9-22)35aac					
QUATERNARY:			Volcanic ash, red	10	83
Surficial material:			UPPER CRETACEOUS:		
Topsoil	2	2	Sedimentary rocks:		
Basaltic rocks:			Clay, blue	27	110
Basalt, black	71	73	Sandstone	40	150
(A-9-22)35abc					
QUATERNARY:			Clay; hit water at 40 feet,		
Alluvium:			12-foot rise	15	50
Clay	30	30	Malpais rock	30	80
Basaltic rocks:			Clay and cinders; water	20	100
Malpais	5	35			
(A-9-22)35abd					
QUATERNARY:			Lava	39	132
Alluvium:			UPPER CRETACEOUS:		
Topsoil	1	1	Sedimentary rocks:		
Clay, yellow	8	9	Clay, blue, and coal	8	140
Basaltic rocks:			Sandstone, blue-gray	70	210
Lava	80	89	Sandstone, gray, and trace		
Volcanic ash, red	4	93	of gravel	18	228

Table 6.--Modified drillers' logs of selected wells in southern Navajo County—Continued

	Thick-ness (feet)	Depth (feet)		Thick-ness (feet)	Depth (feet)
(A-9-22)36cbb					
QUATERNARY:			Shale, black	22	96
Alluvium:			Clay, blue	16	112
Alluvial fill	18	18	Sandstone and clay, decomposed	15	127
Basaltic rocks:			Clay, blue	7	134
Basalt	18	36	Shale, green	22	156
UPPER CRETACEOUS:			Clay, blue	6	162
Sedimentary rocks:			Sandstone and clay;		
Sand and clay; water bearing	6	42	water bearing	25	187
Clay, red; water bearing	14	56	Shale, blue	7	194
Clay, blue	18	74	Clay, blue	6	200
(A-9-22)36cbc					
QUATERNARY:			Clay, red	10	55
Alluvium:			Clay, blue	20	75
Alluvial fill	18	18	Shale, blue	25	100
Basaltic rocks:			Sandstone and clay	25	125
Malpais, 5 feet, and clay	18	36	Shale, gray	25	150
UPPER CRETACEOUS:			Shale and clay, blue	30	180
Sedimentary rocks:					
Sandy clay and black alkali	9	45			
(A-9-23)4dbd					
QUATERNARY:			UPPER CRETACEOUS:		
Basaltic rocks:			Sedimentary rocks:		
Malpais	700	700	Clay, red, gummy (shale)	98	830
			Clay, red, gummy, and gravel	20	850
QUATERNARY AND TERTIARY:			Clay, red, small amount of sand	30	880
Rim gravel:			Shale, buff	15	895
Red clay, sand and gravel,			Sandstone, buff, some very fine	5	900
some boulders	32	732	Shale, red, white, and green	5	905
(A-9-23)5dcc					
QUATERNARY:			UPPER CRETACEOUS:		
Basaltic rocks:			Sedimentary rocks:		
Basalt, black	300	300	Clay, yellow	220	720
Basalt, red; basalt dry	200	500	Clay, blue	60	780
(A-9-23)23bda2					
QUATERNARY:			Cinders, red	4	112
Basaltic rocks:			Malpais	33	145
Soil and malpais boulders	3	3	Clay and cinders	11	156
Malpais	32	35	Malpais	34	190
Cinders, red	15	50	Clay and cinders	5	195
Malpais	27	77	Malpais	40	235
Cinders, black	8	85	Cinders	9	244
Malpais	23	108	Malpais	6	250
(A-9-23)32dbc					
QUATERNARY:			Malpais, broken without fractures	25	210
Basaltic rocks:			UPPER CRETACEOUS:		
Malpais, broken	8	8	Sedimentary rocks:		
Malpais, broken and fractured	82	90	Shale, black to gray;		
Malpais, broken; water at 92 feet	95	185	no water	26	236
(A-9-23)32dcc					
QUATERNARY:			Basaltic rocks:		
Surficial material:			Malpais	70	85
Surface clay and boulders	15	15	Malpais with streaks of cinders	115	200

Table 6.--Modified drillers' logs of selected wells in southern Navajo County—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
(A-9-23)32ddd					
QUATERNARY:			QUATERNARY AND TERTIARY:		
			Rim gravel:		
Basaltic rocks:			Clay, red	10	164
			Gravel; more water	10	174
Malpais; water at 70 feet	154	154	Clay and gravel	6	180
(A-9-23)34aba					
QUATERNARY:			Malpais	4	284
Basaltic rocks:			Clay and cinders	13	297
Malpais	155	155	Malpais	6	303
Clay and gravel	30	185	Clay and cinders	25	328
Malpais	30	215	Malpais, black, hard	37	365
Clay and cinders	18	233	Malpais, soft, and red cinders	17	382
Malpais	9	242	Conglomerate; rock, sand and gravel,		
Cinders	23	265	bailed 40 gal/min with no noticeable		
Malpais	6	271	drawdown	2	384
Clay	9	280	Malpais, black, hard	34	418
(A-9-23)34abd1					
QUATERNARY:			Malpais, solid	132	162
Basaltic rocks:			Clay; water	48	210
Malpais boulders	30	30	Malpais, solid	40	250
(A-10-20)20aba					
QUATERNARY:			PERMIAN:		
Surficial material:			Kaibab Limestone:		
Sand and gravel	15	15	Limestone, white and gray	60	120
UPPER CRETACEOUS(?):			Coconino Sandstone:		
Sedimentary rocks:			Sandstone, white and yellow;		
Clay	30	45	first water at 450 feet	405	525
Sandstone, red	15	60			
(A-10-21)3ccc					
PERMIAN:			Coconino Sandstone:		
Kaibab Limestone:			Sandstone; first water		
Limestone	62	62	at 205 feet	198	260
(A-10-21)9dbd					
QUATERNARY:			PERMIAN:		
Surficial material:			Coconino Sandstone:		
Soil	1	1	Sandstone	243	261
TRIASSIC:			Sandstone; water	55	316
Moenkopi Formation:					
Clay, red	17	18			
(A-10-21)10baa					
QUATERNARY AND TERTIARY:			PERMIAN:		
Rim gravel:			Coconino Sandstone:		
Sand, gravel, and red clay	20	20	Sandrock, hard	90	210
TRIASSIC(?):			Sand, cavey	95	305
Moenkopi(?) Formation:					
Shale, red	100	120			

Table 6.--Modified drillers' logs of selected wells in southern Navajo County—Continued

(A-10-22)9cbd

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Basaltic rocks:		
Topsoil and malpais boulders	4	4
Malpais	11	15
UPPER CRETACEOUS:		
Sedimentary rocks:		
Clay, brown	15	30
Clay, yellow	10	40
Sandy clay, red	50	90
Sand and gravel	10	100
Clay, brown	50	150
Clay, blue	30	180
Clay, yellow	60	240
PERMIAN:		
Kaibab Limestone:		
Limestone, white	60	300
Coconino Sandstone:		
Sandstone	200	500

(A-10-22)17abb

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Basaltic rocks:		
Soil and boulders	17	17
Malpais	10	27
UPPER CRETACEOUS:		
Sedimentary rocks:		
Clay	10	37
Sandstone	43	80

(A-10-22)30aba

	Thickness (feet)	Depth (feet)
UPPER CRETACEOUS:		
Sedimentary rocks:		
Clay and shale, yellow	103	103
Clay, shale and sand, yellow	79	182
Sandy shale, red	93	275
Shale, gray	75	350
Sandy shale, red	25	375
PERMIAN:		
Coconino Sandstone:		
Sandstone, yellow	125	500
Sandstone, yellow	75	575
Sandstone, light-yellow, cavey, water	110	685
Sandstone, light-red, solid	65	750

(A-11-19)15dcd

	Thickness (feet)	Depth (feet)
QUATERNARY AND TERTIARY:		
Rim gravel:		
Topsoil	10	10
UPPER CRETACEOUS:		
Sedimentary rocks:		
Clay, red	13	23
Clay, yellow	25	48
Sandy clay, yellow	23	71
PERMIAN:		
Coconino Sandstone:		
Sandstone, first water at 315 feet	359	430

(A-11-20)32baa

	Thickness (feet)	Depth (feet)
QUATERNARY AND TERTIARY:		
Rim gravel:		
Topsoil	3	3
UPPER CRETACEOUS(?):		
Sedimentary rocks:		
Clay, red	57	60
PERMIAN:		
Kaibab Limestone:		
Limestone	15	75
Coconino Sandstone:		
Sandstone, first water at 320 feet	375	450

(A-11-21)17bac

	Thickness (feet)	Depth (feet)
QUATERNARY AND TERTIARY:		
Rim gravel:		
Soil	3	3
Gravel and clay	15	18
Clay	42	60
Sandy clay	10	70
PERMIAN:		
Coconino Sandstone:		
Sandstone, cracks 110-120 feet	50	120
Sandstone, hard	20	140
Sandstone, cracked 140-190 feet, and broken 190-222 feet	82	222
Sandstone	38	260
Sandstone, yellow	70	330
Sandstone, broken	20	350
Sandstone; water	20	370
Sandstone, solid	20	390

(A-11-22)14cca

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Basaltic rocks:		
Malpais	69	69
TRIASSIC(?):		
Chinle(?) Formation:		
Shale	20	89
Sand and gravel	11	100
Moenkopi(?) Formation:		
Shale	20	120
Sandrock	5	125
Shale	45	170
Sandrock	15	185
Shale	15	200

Table 6.--Modified drillers' logs of selected wells in southern Navajo County— Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
(A-11-22)15adb					
QUATERNARY:			Sandrock	16	146
Basaltic rocks:			Shale	48	194
Malpais	115	115	Sandrock	16	210
TRIASSIC:			Shale	10	220
Chinle and Moenkopi Formations, undifferentiated:			No log	80	300
Shale	15	130			
(A-11-22)15ddd					
QUATERNARY:			Sand and gravel	17	128
Basaltic rocks:			Moenkopi Formation:		
Malpais	89	89	Shale	28	156
TRIASSIC:			Sandrock	19	175
Chinle Formation:			Shale	5	180
Shale	22	111	Sandrock	5	185
(A-11-22)19bad					
QUATERNARY:			Moenkopi(?) Formation:		
Basaltic rocks:			Clay	180	260
Malpais	20	20	PERMIAN:		
Cinders	10	30	Kaibab Limestone:		
Malpais	40	70	Clay and lime	10	270
TRIASSIC(?):			Lime	10	280
Chinle(?) Formation:			Coconino Sandstone:		
Sand and gravel	10	80	Sandstone	170	450
(A-11-23)3bba					
QUATERNARY:			Shale, red and blue	14	326
Surficial material:			Sandstone, brown	5	331
Surface soil	7	7	Sandstone, red	4	335
TRIASSIC:			Shale, red	6	341
Moenkopi Formation:			Sandstone, brown	6	347
Clay, brown	146	153	Shale, red and blue	43	390
Shale, red	14	167	PERMIAN:		
Sandstone, brown	15	182	Kaibab(?) Limestone:		
Shale, red	79	261	Shale, with soft white sandstone		
Sandstone, brown	15	276	streaks	21	411
Shale, red and blue	11	287	Coconino Sandstone:		
Sandstone, brown; seep of salty			Sandstone, buff; water	27	438
water, 2 gal/min, not enough to			Sandstone, white; water	7	445
drill with	25	312	Sandstone, buff; water	19	464
(A-11-23)19bcd					
QUATERNARY:			Malpais, hard	18	58
Surficial material:			UPPER CRETACEOUS(?):		
Soil	6	6	Sedimentary rocks:		
Basaltic rocks:			Sandy shale, dark-yellow, soft	17	75
Malpais, broken, and soil	6	12	Sandy shale, light-yellow, soft	10	85
Malpais; seep at 18 feet	24	36	Sandstone, yellow, soft	15	100
Malpais, red, and black cinders;					
water at 40 and 44 feet	4	40			
(A-11-23)31dbb					
QUATERNARY:			Cinders, red	12	197
Surficial material:			Malpais rock	37	234
Topsoil, clay, rock,			UPPER CRETACEOUS(?):		
and sand	15	15	Sedimentary rocks:		
Basaltic rocks:			Clay, yellow	61	295
Malpais rock	82	97	Sandstone	55	350
Clay, red	13	110	Shale, blue-gray	7	357
Malpais rock	75	185	Clay, yellow, and gravel	3	360

Table 6.--Modified drillers' logs of selected wells in southern Navajo County— Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
(A-11-23)32dcd					
QUATERNARY:			Malpais; 1 gpm at 153 feet, seep at 176 feet	57	176
Basaltic rocks:			Malpais, hard	20	196
Soil and malpais boulders	6	6	Malpais, soft; well pumps 21 gal/min with water at 165-foot level	7	203
Malpais	84	90	Malpais	15	218
Clay, red	6	96			
Malpais	19	115			
Clay, red	4	119			
(A-12-15)36ddc					
QUATERNARY:			PERMIAN:		
Surficial material:			Coconino Sandstone:		
Clay, sand and rock	8	8	Sandstone, white to buff turning red towards bottom of hole; hit first water at about 540 feet	592	600
(A-12-16)20dba					
UPPER CRETACEOUS:			Coconino Sandstone:		
Sedimentary rocks:			Sandstone, pale-yellow to pale-orange, fine- to medium-grained	660	840
Sandstone, orange, fine- to medium-grained, somewhat oxidized	20	20	Supai Formation:		
PERMIAN:			Siltstone, moderate-orange to pink, sandy	5	845
Kaibab Limestone:					
Limestone, pink, sandy	160	180			
(A-12-18)9ccc					
QUATERNARY AND TERTIARY:			Clay	40	180
Rim gravel:			PERMIAN:		
Sand and gravel	20	20	Kaibab Limestone:		
Gravel	40	60	Limestone	70	250
Clay	50	110	Coconino Sandstone:		
Sandy clay	10	120	Sandstone	410	660
Sand and gravel	20	140			
(A-12-19)4add					
QUATERNARY AND TERTIARY:			PERMIAN:		
Rim gravel:			Coconino Sandstone:		
Soil and gravel	10	10	Sandstone, water at 435 feet	305	485
TRIASSIC:					
Moenkopi Formation:					
Shale	170	180			
(A-12-19)20bbb					
QUATERNARY AND TERTIARY:			PERMIAN:		
Rim gravel:			Kaibab Limestone:		
Topsoil	10	10	Limestone	70	200
Clay	60	70	Coconino Sandstone:		
Sandy clay	60	130	Sandstone	350	550
(A-12-20)2ddd					
QUATERNARY:			Coconino Sandstone:		
Surficial material:			Sandstone, white	27	120
Surface soil	9	9	Sandstone, buff and white	77	197
TRIASSIC:			Sandstone, white; water, 12 gal/min, water level 197 feet	38	235
Moenkopi Formation:					
Shale, red	23	32			
PERMIAN:					
Kaibab Limestone:					
Limestone, sandy	61	93			

Table 6.--Modified drillers' logs of selected wells in southern Navajo County—Continued

(A-12-21)2bdc

	Thickness (feet)	Depth (feet)
QUATERNARY AND TERTIARY:		
Rim gravel:		
Soil and caliche	4	4
Sand and gravel	14	18
TRIASSIC:		
Moenkopi Formation:		
Clay, red	70	88
Sandstone and gravel	2	90
Clay, red and blue	20	110
Shale, red, hard	4	114
Clay, brown	14	128
Gravel; about 10 gal/min water	2	130
Shale, red	26	156
Sandstone, red; about 30 gal/min water	8	164
Shale, red	21	185
PERMIAN:		
Coconino Sandstone:		
Sandstone, white; about 1,000 gal/min water	15	200

(A-12-21)2dcd

	Thickness (feet)	Depth (feet)
QUATERNARY AND TERTIARY:		
Rim gravel:		
Sand and clay	15	15
Dirt, sand and gravel	15	30
Clay	18	48
Sand and gravel; water	7	55
TRIASSIC:		
Moenkopi Formation:		
Clay, color differs	105	160
PERMIAN:		
Coconino Sandstone:		
Sandstone	90	250

(A-12-21)5acd

	Thickness (feet)	Depth (feet)
QUATERNARY AND TERTIARY:		
Rim gravel:		
Soil and sand	6	6
Boulders, sand, clay and gravel	17	23
Clay, gray	28	51
TRIASSIC:		
Moenkopi Formation:		
Sandstone, brown, broken; lost drilling water	21	72
Shale, brown; first water at 72 feet	17	89
Shale, red and brown, with thin layers of sandstone	22	111
Shale, red, hard	32	143
PERMIAN:		
Coconino Sandstone:		
Sandstone, yellow to cream, caves in spots; first big water at 198 feet	74	217

(A-12-21)6aba1

	Thickness (feet)	Depth (feet)
TRIASSIC:		
Moenkopi Formation:		
Sandstone, gray	14	14
Shale, red; water at 64 feet	131	145
PERMIAN:		
Coconino Sandstone:		
Sandstone, water strata at 174 feet	95	240

(A-12-21)6aba2

	Thickness (feet)	Depth (feet)
TRIASSIC:		
Moenkopi Formation:		
Shale	130	130
PERMIAN:		
Kaibab Limestone:		
Limestone	10	140
Coconino Sandstone:		
Sandstone, white; first water at 205 feet	180	320

(A-12-22)18Ecad

	Thickness (feet)	Depth (feet)
TRIASSIC:		
Moenkopi Formation:		
Clay	3	3
Sandstone, yellow	15	18
PERMIAN:		
Coconino Sandstone:		
Sandstone, white	40	58
Sand and broken sandstone, white	2	60
Sand, white	30	90
Sandstone, white, very solid	4	94
Sand, white	16	110
Sandstone, white, some sand	9	119
Sand, white, with thin layers of sandstone	126	245
Sand, white, and broken white sandstone, some yellow	15	260
Sand, white, with layers of sandstone	10	270
Sandstone, with some sand	15	285
Sandy	4	289

(A-12-22)19Eadd

	Thickness (feet)	Depth (feet)
TRIASSIC:		
Moenkopi Formation:		
Clay, red	17	17
Limestone, brown	2	19
Clay, red	35	54
Limestone, brown	3	57
Clay, red	25	82
PERMIAN:		
Coconino Sandstone:		
Sandstone, yellow, broken, with thin layers of fine white sand	238	320

Table 6.--Modified drillers' logs of selected wells in southern Navajo County—Continued

(A-12-22)33bdb

	Thickness (feet)	Depth (feet)
TRIASSIC:		
Moenkopi Formation:		
Clay, red	2	2
Sandstone, yellow, soft	12	14
Shale and clay, red	181	195
Shale and clay, blue	7	202
Sandstone, yellow, soft	8	210
PERMIAN:		
Coconino Sandstone:		
Sandstone, white, extremely hard	55	265
Sand, white, clean	12	277
Sandstone, broken, and yellow sand	73	350

(A-13-15)14dca

	Thickness (feet)	Depth (feet)
UPPER CRETACEOUS:		
Sedimentary rocks:		
Sandstone, pink with thin layers of red and brown shale	85	85
PERMIAN:		
Kaibab Limestone:		
Limestone	170	255
Coconino Sandstone:		
Sandstone, yellow and white; about 1 gal/min of water at 819 feet	667	922
Supai Formation:		
Silty sandstone, reddish, sticky; hit water at 922 feet	78	1,000
Sandstone, reddish, not as silty	100	1,100

(A-13-17)5caa

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Surficial material:		
Soil	2	2
TRIASSIC:		
Moenkopi Formation:		
Sandstone, red	10	12
Shale, brown	18	30
PERMIAN:		
Kaibab Limestone:		
Lime, sandy	75	105
Sandstone	25	130
Lime and sandstone	50	180
Sandstone, yellow	40	220
Coconino Sandstone:		
Sandstone, gray	70	290
Sand, dry; had to cement	15	305
Sand, dry, hard streaks	80	385
Sandstone, very hard	255	640
Sandstone, gray and yellow	30	670
Sandstone, yellow	110	780
Sandstone, gray; water, raised to 794 feet	27	807
Sand, water in cracks	36	843

(A-13-19)36bdb

	Thickness (feet)	Depth (feet)
TRIASSIC:		
Moenkopi Formation:		
Sandy shale, red	104	104
PERMIAN:		
Kaibab Limestone:		
Sandy limestone, buff	36	140
Coconino Sandstone:		
Sandstone, buff; requires mud to hold drilling water	60	200
Sandstone, buff, cavey; loses water	95	295
Sandstone, buff; casing follows	106	401
Sandstone, white	17	418
Shale, white	10	428
Sandstone, white; water. Water level 396 feet	11	439

(A-13-20)29ccd

	Thickness (feet)	Depth (feet)
TRIASSIC:		
Moenkopi Formation:		
Sandstone, red	60	60
PERMIAN:		
Kaibab Limestone:		
Limestone	50	110
Coconino Sandstone:		
Sandstone	415	525

(A-13-21)10cda

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Surficial material:		
Surficial deposits	14	14
PERMIAN:		
Kaibab(?) Limestone:		
Lime	3	17
Coconino Sandstone:		
Sand, white, hard	6	23
Sand, white and yellow, soft	7	30
Sand, hard, soft streaks	71	101
Sand, soft, hard streaks	13	114
Sand, hard, soft streaks	16	130
Sand, soft, hard streaks	8	138
Sand, hard, soft streaks	56	194
Sand, soft, hard streaks	13	207
Sand, hard	6	213
Sand, soft, hard streaks	16	229
Sand, soft	8	237
Sand, hard, soft streaks	23	260
Sand, soft	7	267
Sand, hard, soft streaks	36	303
Sand, soft	14	317
Sand, hard	17	334
Sand, soft	35	369
Sand, hard, soft streaks	14	383
Sand, soft, hard streaks	23	406
Supai Formation:		
Shale and sandstone, red	10	416

Table 6.--Modified drillers' logs of selected wells in southern Navajo County—Continued

(A-13-21)13ddd2

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
TRIASSIC:			PERMIAN:		
Moenkopi Formation:			Coconino Sandstone:		
Shale and sandstone, red, very cavey	175	175	Sandstone, white; artesian water at 175 feet, rose to 71 feet	125	300

(A-13-21)14cbd1

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
QUATERNARY AND TERTIARY:			Shale, red	40	135
Rim gravel:			Clay, yellow and blue	7	142
Fill	82	82	PERMIAN:		
TRIASSIC:			Coconino Sandstone:		
Moenkopi Formation:			Sand; good water	18	160
Sandstone, red; water	13	95			

(A-13-21)23cbc1

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
TRIASSIC:			Sandy shale, hard	44	190
Moenkopi Formation:			Clay, yellow	26	216
Sandstone, red	32	32	PERMIAN:		
Shale, red	28	60	Kaibab Limestone:		
Sandstone, white; some water	6	66	Limestone	8	224
Shale, red, with blue streaks	54	120	Coconino Sandstone:		
Shale, red	26	146	Sandstone; water	28	252

(A-13-21)24ccb

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
QUATERNARY AND TERTIARY:			Shale	102	212
Rim gravel:			Sandstone	13	225
Sand, gravel and clay	60	60	PERMIAN:		
Conglomerate	5	65	Kaibab Limestone:		
Clay, brown; some boulders	33	98	Lime	20	245
TRIASSIC:			Coconino Sandstone:		
Moenkopi Formation:			Sandstone	83	328
Sandstone, brown	12	110			

(A-13-21)25bab

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
QUATERNARY AND TERTIARY:			PERMIAN:		
Rim gravel:			Kaibab Limestone:		
Boulders and dirt	25	25	Limestone	25	180
TRIASSIC:			Coconino Sandstone:		
Moenkopi Formation:					
Sandstone; first water	10	35	Sandstone; third water at 235 feet	55	235
Shale	45	80			
Sandstone; second water	10	90			
Shale and sandstone	65	155	Sandstone; more volume of water at 275 feet. Water standing at 77 feet	75	310

(A-13-21)26adb1

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
QUATERNARY AND TERTIARY:					
Rim gravel:			Shale, red, hard; bit drifted badly in bottom 5 feet	30	168
Boulders, gravel and sand	6	6	Shale, gray	6	174
TRIASSIC:			Shale, red; hole caved	12	186
Moenkopi Formation:			Shale, red	22	208
Shale, red	2	8	Sandstone and shale, red, thinly layered	6	214
Sandstone, red, broken; lost drilling water	21	29	Rock, red, sloping	3	217
Shale, red	32	61	Sandstone and shale, red, broken, thinly layered	35	252
Sandstone, brown	23	84	Rock, red, hard	13	265
Shale, brown and purple	6	90	Shale, tan	2	267
Shale, red, and sandstone, thinly layered	12	102	Shale, gray	17	284
Shale, red	12	114	PERMIAN:		
Sandy shale, red	4	118	Coconino Sandstone:		
Sandstone, brown	7	125	Sandstone, white	84	368
Shale, red, and layers of broken, gray, hard rock	13	138	Sandstone, white, broken	3	371
			Sandstone, white	14	385
			Sandstone, white, soft	15	400

Table 6.--Modified drillers' logs of selected wells in southern Navajo County—Continued

(A-13-21)29bbc

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Surficial material:		
Soil	2	2
TRIASSIC:		
Moenkopi Formation:		
Sand, shale and rock streaks	11	13
Sand, rock	6	19
Shale, hard, and sandstone	196	215
Sandy shale, sand streaks	21	236
PERMIAN:		
Kaibab Limestone:		
Sandy lime, hard streaks	8	244
Sand	3	247
Lime	3	250
Coconino Sandstone:		
Sand, white, soft	10	260
Sand, white, hard	18	278
Sand, white, soft, hard streaks	12	290
Sand, hard	8	298
Sand, white, soft	11	309
Sand, hard	19	328
Sand, white, soft, hard streaks	8	336
Sand, white, hard	7	343
Sand, white, soft	16	359
Sand, hard, soft streaks	16	375
Sand, white, soft	11	386
Sand, hard	4	390
Sand, soft, hard streaks	24	414
Sand, soft, hard streaks	14	428
Sand, hard	6	434
Sand, soft, hard streaks	11	445
Sand, hard	3	448
Sand, soft, hard streaks	19	467
Sand, hard, soft streaks	24	491
Sand, white, soft, hard streaks, some yellow sand	64	555
Sand, soft, hard streaks	11	566
Sand, soft	9	575
Sand, hard	12	587
Sand, soft, hard streaks	26	613
Sand, hard	14	627
Sand, soft, hard streaks	5	632
Sand, hard	7	639
Sand, soft	8	647
Sand, soft and hard streaks	36	683
Supai Formation:		
Clay, red and blue	4	687
Sandstone and clay	13	700

(A-13-21)34add

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Surficial material:		
Topsoil	10	10
TRIASSIC:		
Moenkopi Formation:		
Shale, red	230	240
PERMIAN:		
Coconino Sandstone:		
Sandstone	60	300

(A-13-21)34ccd

	Thickness (feet)	Depth (feet)
TRIASSIC:		
Moenkopi Formation:		
Clay and shale, red	48	48
Sandstone, red	62	110
Shale, blue	22	132
PERMIAN:		
Kaibab Limestone:		
Lime, gray	16	148
Coconino Sandstone:		
Sandstone, white; water	14	162

(A-13-21)34dcc2

	Thickness (feet)	Depth (feet)
QUATERNARY AND TERTIARY:		
Rim gravel:		
Surface soil	20	20
Boulders and clay	8	28
TRIASSIC(?):		
Moenkopi(?) Formation:		
Shale, red	14	42
Boulders and sandstone	6	48
Shale, red	17	65
Boulders, clay and gravel; small water strata at 84 feet	30	95
TRIASSIC:		
Moenkopi Formation:		
Sandstone, red	13	108
Shale, red	32	140
Sandstone, red	28	168
Sandstone, gray	11	179
Sandstone, red	15	194
Shale, red and blue	28	222
PERMIAN:		
Coconino Sandstone:		
Sandstone	32	254

(A-13-23)11dab

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Surficial material:		
Soil	4	4
TRIASSIC:		
Chinle Formation:		
Clay, red	2	6
Clay, red and gravel	9	15
Conglomerate, brown	29	44
Moenkopi Formation:		
Sandstone, brown	3	47
Clay, red and blue, and brown sandstone	236	283
PERMIAN:		
Coconino Sandstone:		
Sandstone	35	318
Sandstone, white; water strata. Water level 303 feet	9	327
Sandstone, yellow	23	350

Table 6.--Modified drillers' logs of selected wells in southern Navajo County—Continued

(A-14-17)18bbb

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
PERMIAN:			Sandstone, red	25	710
Kaibab Limestone:			Sandstone, yellow; water bearing	90	800
Limestone, yellow	194	194			
Coconino Sandstone:					
Sandstone, yellow	491	685			

(A-14-19)7ccc

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
QUATERNARY:			PERMIAN:		
Alluvium:			Kaibab Limestone:		
Topsoil and loose shale	35	35	Limestone	30	125
TRIASSIC:			Coconino Sandstone:		
Moenkopi Formation:			Sandstone, white	295	420
Shale, red, Moenkopi	19	54	Sandstone, white, loose; water bearing, water rose to 405 feet	10	430
Shale, red, and sandstone	41	95			

(A-14-21)19bba

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
QUATERNARY:			Limestone, buff	29	102
Surficial material:			Limestone, white	71	173
Surface soil and clay	21	21	Coconino Sandstone:		
TRIASSIC:			Sandstone, yellow	47	220
Moenkopi Formation:			Sandstone, white	50	270
Limestone, red	19	40	Sandstone, white and buff	153	423
Shale, red	18	58	Sandstone, buff; water, 10 gal/min good quality; level 357 feet	14	437
Sandstone, brown	10	68	Sandstone, white	10	447
PERMIAN:					
Kaibab Limestone:					
Shale and limestone, white	5	73			

(A-14-22)7bdc

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
TRIASSIC:			PERMIAN:		
Moenkopi(?) Formation:			Coconino Sandstone:		
Clay and sandstone	15	15	Sandstone, hard	205	245
Boulders	15	30	Sandstone, broken; water	25	270
Running sand	10	40			

(A-14-23)2bda

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
QUATERNARY:			Sand, brown; water	10	107
Surficial material:			Shale	205	312
Topsoil	5	5	PERMIAN:		
TRIASSIC:			Coconino Sandstone:		
Chinle and Moenkopi Formations undivided:			Sandstone	213	525
Shale	92	97			

(A-14-23)2cbc

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
QUATERNARY:			Limestone, gray	10	140
Alluvium:			Shale, red	3	143
Sand and gravel	14	14	Conglomerate sandstone	7	150
TRIASSIC:			Sandstone gray and red clay	55	205
Moenkopi Formation:			Sandstone, red, coarse	10	215
Shale, red	26	40	Clay and sandstone, red	75	290
Sandstone, red	20	60	PERMIAN:		
Shale, red	10	70	Coconino Sandstone:		
Sandstone, blue, gray, white	33	103	Sandstone, gray, coarse	10	300
Shale, red	27	130	Sandstone, coarse; water flows	25	325

Table 6.--Modified drillers' logs of selected wells in southern Navajo County—Continued

	Thickness (feet)	Depth (feet)
(A-14-23)32ccd		
QUATERNARY:		
Surficial material:		
Soil	2	2
Fine sand	1	3
TRIASSIC:		
Moenkopi Formation:		
Sand shale, red	11	14
Sandstone, brown	6	20
Sandstone, gray	6	26
Sandy lime, yellow	15	41
Sandstone, brown	5	46
Shale, red	47	93
Sandstone, brown	4	97
Shale, red and blue	16	113
Sandstone, brown; water seep	26	139
Shale, red and blue	11	150
Sandstone, red	2	152
Shale, red	45	197
Sandstone, brown	2	199
Shale, red	31	230
Sandy shale, brown	11	241
PERMIAN:		
Kaibab(?) Limestone:		
Sandy lime, white	5	246
Coconino Sandstone:		
Sandstone, white	16	262
Sandstone, light-brown	43	305
Sandstone, white; water	6	311
Sandstone, blue-gray	29	340
(A-15-16)6daa		
QUATERNARY:		
Surficial material:		
Soil	1	1
PERMIAN:		
Kaibab Limestone:		
Limestone, yellow	17	18
Sandy lime, white	23	41
Lime, light-brown	18	59
Shale and lime, red, broken	50	109
Lime, gray and brown, hard	59	168
Coconino Sandstone:		
Sandstone, broken	205	373
Sandstone, tan and gray, hard	76	449
Coconino, cream and white	31	480
Sandstone, gray	70	550
Sandstone, pink	50	600
Sandstone, white	50	650
Sandstone, brown	40	690
Sandstone, red	72	762
Sandstone, red, very hard	48	810
Sandstone; water	12	822
Supai Formation:		
Shale and sandstone, red	5	827
Shale, red; water	6	833
(A-15-17)34dac		
QUATERNARY:		
Surficial material:		
Surface soil	20	20
TRIASSIC:		
Moenkopi Formation:		
Shale, red	30	50
Shale, yellow	32	82
Sandy shale, red	43	125
Shale, red	23	148
PERMIAN:		
Kaibab Limestone:		
Limestone	37	185
Coconino Sandstone:		
Sandstone	417	602
Sandstone, buff; water strata, seep	3	605
Sandstone, yellow	15	620
Sandstone, buff; water strata	8	628
Sandstone, yellow	19	647
(A-15-22)2cdd		
TRIASSIC:		
Moenkopi Formation:		
Shale, red	30	30
Shale and limestone, red	10	40
Shale and limestone, red, in layers	260	300
PERMIAN:		
Coconino Sandstone:		
Sandstone; water bearing	10	310
Sandstone, white	40	350
(A-15-22)10dba		
QUATERNARY:		
Surficial material:		
Topsoil	3	3
TRIASSIC:		
Moenkopi Formation:		
Shaley sandstone, red	17	20
Sandstone, red	40	60
Sandstone, brown	100	160
PERMIAN:		
Coconino Sandstone:		
Sandstone, white; water	20	180
Sandstone, white	120	300
(A-15-23)26bdd		
QUATERNARY:		
Alluvium:		
Topsoil	12	12
Gravel and shale; water at 98 feet, 6 gal/min	86	98
TRIASSIC:		
Moenkopi Formation:		
Shale, red	192	290
PERMIAN:		
Kaibab Limestone:		
Lime	22	312
Coconino Sandstone:		
Sandstone	218	530

Table 6.--Modified drillers' logs of selected wells in southern Navajo County—Continued

(A-15-23)26cba1

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Alluvium:		
Surface silt, red clay and gravel	107	107
TRIASSIC:		
Moenkopi Formation:		
Sandstone, brown	10	117
Shale	35	152
Sandstone and shale, brown, in alternating layers	102	254
PERMIAN:		
Coconino Sandstone:		
Sandstone, white, hard	19	273
Sandstone, soft	135	408
Sandstone; large amount of water flowing	7	415
Sandstone, yellow	67	482

(A-15-23)27ddb

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Alluvium:		
Topsoil	12	12
TRIASSIC:		
Moenkopi Formation:		
Shale, red	268	280
Sandstone, red	23	303
Sand	7	310
PERMIAN:		
Kaibab Limestone:		
Lime	6	316
Coconino Sandstone:		
Sand	284	600

(A-15-23)28ddd

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Alluvium:		
Surface soil, gravel and red shale; water at 37 and 42 feet. Water level 28 feet	42	42
TRIASSIC:		
Moenkopi Formation:		
Shale, red and blue; 5 gal/min salt water	25	67
Sandstone, red; 3 gal/min salt water	9	76
Shale, red and blue, sandstone streaks	32	108
Sandstone, brown	3	111
Shale, red and blue	7	118
Sandstone, brown	5	123
Shale, red and blue	58	181
Sandstone, brown	7	188
Shale, red and blue	14	202
Sandstone, brown	11	213
Shale, red and blue	32	245
Sandstone, red	17	262
PERMIAN:		
Kaibab(?) Limestone:		
Shale, white, pyrites of iron	7	269
Coconino Sandstone:		
Sandstone, white; good water, water rises and flows 30 gal/min	16	285
Sandstone, white, hard	7	292
Sandstone, white; water strata flows 45 gal/min. Water will rise 8 feet and flow 12 gal/min	5	297

(A-15-23)34aad

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Alluvium:		
Surface silt	55	55
Gravel; water level 40 feet, poor quality	13	68
TRIASSIC:		
Moenkopi Formation:		
Clay, red	28	96
Sandstone, brown	22	118
Shale, blue	2	120
Sandstone, brown	14	134
Shale, red and blue	14	148
Sandstone, brown	21	169
Shale, red and blue	61	230
Sandstone, brown	6	236
Shale, red and blue	64	300
Sandstone, brown	10	310
Shale, red and blue	6	316
Shale, light-gray-blue	4	320
PERMIAN:		
Coconino Sandstone:		
Sandstone, light-gray, hard	4	324
Sandstone, white, soft	12	336
Sandstone, white, hard	6	342
Sandstone, white; well flowing	8	350
Sandstone, white, hard	28	378
Sandstone, blue-white, soft	10	388
Sandstone, buff; water flowing 175 gal/min	42	430

(A-15-23)34dcc

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Alluvium:		
Soil	18	18
TRIASSIC:		
Moenkopi Formation:		
Shale, red	11	29
Sandstone, red	4	33
Shale, red and blue, mottled	8	41
Sandstone, red; may carry a little salty water, water rises to 28 feet, 60 gallons in 10 hours	5	46
Shale, blue	9	55
Sandstone, brown; seep of salt water	7	62
Shale, red and blue, mottled	116	178
Sandstone, brown	4	182
Shale, red and blue	11	193
Sandstone, red	16	209
Shale, red and blue	36	245
Sandstone, red; water seep, ½ gal/min rises to 88 feet	6	251
Sandstone, brown	14	265
PERMIAN:		
Coconino Sandstone:		
Sandstone, gray	8	273
Sandstone, white, soft; water strata, depth to water 9 feet, produces 30 gal/min with no drawdown	9	282
Sandstone, buff; depth to water dropped to 14 feet at 321 feet	88	370
Sandstone, white; water, could not lower by pumping 30 gal/min	15	385

Table 6.--Modified drillers' logs of selected wells in southern Navajo County—Continued

(A-16-17)8cab

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Surficial material:		
Surface soil	2	2
PERMIAN:		
Kaibab Limestone:		
Limestone	63	65
Coconino Sandstone:		
Sandstone	475	540
Sandstone, red; water strata 570-572 feet, seep, and 590-594 feet	75	615

(A-16-17)27bca

	Thickness (feet)	Depth (feet)
PERMIAN:		
Kaibab Limestone:		
Sandy limestone, cream and white	170	170
Coconino Sandstone:		
Sandstone, white and cream, fine; small amount of water 790-800 feet	630	800
Supai(?) Formation:		
Fine silty sandstone, pink and cream; more water 800-815 feet may be salty	15	815

(A-16-19)4bbc

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Surficial material:		
Surface soil	3	3
TRIASSIC:		
Moenkopi Formation:		
Shale, red	19	22
Sandstone, red	7	29
Shale, red	6	35
PERMIAN:		
Kaibab Limestone:		
Limestone, buff, sandy	27	62
Coconino Sandstone:		
Sandstone, buff	23	85
Sandstone, yellow	178	263
Sandstone, buff	15	278
Sandstone, white; seep of water	2	280
Sandstone, buff	17	297
Sandstone, white; water	10	307
Sandstone, buff; water level 280 feet	21	328

(A-16-20)16bac

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Surficial material:		
Surface soil	2	2
TRIASSIC:		
Moenkopi Formation:		
Sandy shale, red	32	34
Shale, red	7	41
PERMIAN:		
Kaibab Limestone:		
Sandy limestone, white	6	47
Coconino Sandstone:		
Sandstone, buff	133	180
Sandstone, white	55	235
Sandstone, buff, yellow and gray; water 1 gal/min	147	382
Sandstone, white	2	384
Sandstone, buff	38	422
Sandstone, white; water strata	7	429
Sandstone, buff; water level 360 feet; 10 gal/min	21	450

(A-16-21)33ddd

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Surficial material:		
Topsoil	3	3
TRIASSIC:		
Moenkopi Formation:		
Clay and sandstone	9	12
Sandstone	16	28
Shale, red	12	40
Sandstone	6	46
Shale, red	10	56
Sandstone	17	73
Shale, red	6	79
Sandstone	7	86
Shale, red	4	90
PERMIAN:		
Coconino Sandstone:		
Sandstone, white	250	340
Sandstone, yellow; water	22	362

(A-16-22)10adb

	Thickness (feet)	Depth (feet)
TRIASSIC:		
Moenkopi Formation:		
Shale, red	160	160
PERMIAN:		
Coconino Sandstone:		
Sandstone, white	61	221

(A-16-22)17cdc

	Thickness (feet)	Depth (feet)
TRIASSIC:		
Moenkopi Formation:		
Shale and sand, red	10	10
PERMIAN:		
Coconino Sandstone:		
Sandstone, fracture at 80 feet to bottom	150	160

Table 6.--Modified drillers' logs of selected wells in southern Navajo County—Continued

	Thickness (feet)	Depth (feet)
(A-16-22)18aad		
QUATERNARY:		
Surficial material:		
Sand	3	3
PERMIAN:		
Coconino Sandstone:		
Sandstone, white, solid	44	47
Sandstone, white, fractured	53	100
(A-16-23)15bad		
TRIASSIC:		
Chinle Formation:		
Shale, blue and gray	150	150
Shale, reddish-brown and purple	150	300
Moenkopi Formation:		
Sandstone, brown, and alternating layers of shale	180	480
PERMIAN:		
Coconino Sandstone:		
Sandstone, white and yellow	20	500
(A-17-16)25daa		
QUATERNARY:		
Surficial material:		
Surface soil, seven rocks	3	3
PERMIAN:		
Kaibab Limestone:		
Limestone	32	35
Coconino Sandstone:		
Sandstone, lower part reddish; water strata at 460-465 and 580-585 feet. Water level 413 feet and well pumps 20 gal/min with rig	592	627
(A-17-18)16dbb		
TRIASSIC:		
Moenkopi Formation:		
Shale, red	5	5
Sandstone, red	10	15
PERMIAN:		
Coconino Sandstone:		
Sandstone, white; hit water at 170 feet and rose to 160 feet	285	300
(A-17-20)3bbd		
QUATERNARY:		
Alluvium:		
Sand	75	75
TRIASSIC:		
Moenkopi Formation:		
Shale, red	38	113
PERMIAN:		
Coconino Sandstone:		
Sandstone	17	130
Sandstone, yellowish-white	350	480
(A-17-20)5cdd		
QUATERNARY:		
Surficial material:		
Surface soil	4	4
TRIASSIC:		
Moenkopi Formation:		
Shale, red	9	13
Sandstone, red	6	19
Shale, red	5	24
Sandstone, red	5	29
Sandy shale, red; salty water 9 feet from surface	8	37
Sandstone, red	5	42
Shale, red and blue	7	49
PERMIAN:		
Kaibab(?) Limestone:		
Shale, light-blue to grayish	4	53
Coconino Sandstone:		
Sandstone, white; water 3.5 feet below surface, pumps 150 gal/min with 21.5-foot drawdown	9	62
Sandstone, buff	40	102
(A-17-20)6acb		
QUATERNARY:		
Alluvium:		
Surface soil	7	7
PERMIAN:		
Kaibab Limestone:		
Limestone	1	8
Coconino Sandstone:		
Sandstone; water in cracks from 11-80 feet, water level 9 feet	72	80
Sandstone, hard	13	93
Sandstone; water strata	3	96
Sandstone, hard	51	147
Sandstone; water strata	6	153
Sandstone, hard	8	161
Sandstone; water strata	7	168
Sandstone, hard	63	231
Sandstone; water strata	3	234
Sandstone, hard	20	254
Sandstone; water strata	12	266
Sandstone, hard	76	342
Sandstone; water strata, best in well	36	378
Sandstone, pinkish-buff color, very hard	25	403

Table 6.--Modified drillers' logs of selected wells in southern Navajo County—Continued

(A-17-20)7adb

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Surficial material:		
Fill	5	5
TRIASSIC:		
Moenkopi Formation:		
Shale, red	44	49
PERMIAN:		
Coconino Sandstone:		
Sandstone, white	181	230
No log	20	250

(A-17-20)9bac

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Alluvium:		
Soil	20	20
TRIASSIC:		
Moenkopi Formation:		
Sandstone, red	20	40
Clay, yellow	6	46
PERMIAN:		
Coconino Sandstone:		
Sandstone, white; dry	12	58
Sandstone, white; well flowing	42	100

(A-17-20)21cdd

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Surficial material:		
Surface soil	1	1
TRIASSIC:		
Moenkopi Formation:		
Shale, red	11	12
Sandstone, red	14	26
PERMIAN:		
Coconino Sandstone:		
Sandstone, white	13	39
Sandstone, buff	8	47
Sandstone, white; water level 164 feet	122	169
Sandstone, white; water strata, good quality	6	175
Sandstone, buff; 12 gal/min	20	195

(A-17-21)10cba

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Alluvium:		
Sand and gravel	20	20
TRIASSIC:		
Moenkopi Formation:		
Sandstone, red	26	46
Sand and salt	6	52
PERMIAN:		
Coconino Sandstone:		
Sandstone, white; dry	18	70
Sandstone, white; water	82	152
Sandstone, white, very dense	38	190
Sandstone, fractured; more water, increase in salt	20	210
Sandstone, dense	45	255
Sandstone, very white, fractured; increase in salt	7	262
Sandstone, white, hard; water level 53 feet. Water unfit for use, abandoned well	23	285

(A-17-21)16adb

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Surficial material:		
Surface sand	4	4
TRIASSIC:		
Moenkopi Formation:		
Sandstone and shale, red	19	23
PERMIAN:		
Coconino Sandstone:		
Sandstone, white; dry	99	122
Sandstone, white; water	30	152
Sandstone, white, vertical fractures; abundant water	28	180

(A-17-22)17dbd

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Surficial material:		
Surface sand	4	4
TRIASSIC:		
Moenkopi Formation:		
Sandstone and siltstone	26	30
Shale, red and green, lenses of sandstone	75	105
Shale, red	19	124
Shale, red, sticky	41	165
Sandstone, red	25	190
Shale, red	8	198
PERMIAN:		
Coconino Sandstone:		
Sandstone, white	42	240

Table 6.--Modified drillers' logs of selected wells in southern Navajo County— Continued

	Thickness (feet)	Depth (feet)
(A-17-22)22bcc		
QUATERNARY:		
Surficial material:		
Sandy clay	3	3
TRIASSIC:		
Chinle Formation:		
Shale and sandstone, red to dark-brown, hard, and in alternating layers	127	130
Shale, dark-brown and red, hard	5	135
Sandrock, dark-brown, hard with streaks of shale	105	240
Shale, brown, with streaks of limestone	10	250
Shale, brown, with streaks of clay	7	257
Shale, red and brown, with layers of sandrock	7	264
Shale and sandrock, hard, with chunks of petrified wood	8	272
Moenkopi Formation:		
Shale, red and brown with streaks of sandstone	23	295
Shale, hard, with sandstone, light-gray	5	300
Sandstone and shale, red rock layers	30	330
Sandstone, light-brown, hard, and shale, red, hard, in alternating layers	20	350
Sandstone, light-brown, and red sandrock with streaks of clay	10	360
PERMIAN:		
Coconino Sandstone:		
Sandstone, white to light-gray, fine	9	369
Sandstone, white, hard	10	379
Sandstone, layered, very hard	1	380
Sandstone, light-gray	8	388
(A-18-16)35cac		
PERMIAN:		
Kaibab Limestone:		
Lime and shale, yellow	6	6
Sandy limestone, buff	56	62
Coconino Sandstone:		
Sandstone, buff and white	122	184
Sandstone, gray	12	196
Sandstone, buff and white, $1\frac{1}{2}$ gal/min of good quality water. Water level 244 feet	9	287
Sandstone, buff	77	364
Sandstone, white	13	377
Sandstone, buff	32	409
(A-18-17)5ddd		
QUATERNARY:		
Alluvium:		
Sand and fine gravel	75	75
Coarse gravel	2	77
TRIASSIC:		
Moenkopi Formation:		
Sandstone and shale	27	104
PERMIAN:		
Coconino Sandstone:		
Sandstone	5	109
(A-18-17)12cba		
QUATERNARY:		
Alluvium:		
Sand and topsoil	20	20
Sand	40	60
TRIASSIC:		
Moenkopi Formation:		
Moenkopi, red	40	100
Moenkopi, brown	70	170
PERMIAN:		
Kaibab(?) Limestone:		
Hard gray rock	20	190
Coconino Sandstone:		
Sandstone	140	330
(A-18-18)9bdd		
QUATERNARY:		
Alluvium:		
Soil, sand, gravel and clay	160	160
TRIASSIC:		
Moenkopi Formation:		
Clay and sandstone, brown and red	65	225
PERMIAN:		
Coconino Sandstone:		
Sandstone, white and yellow	75	300
(A-18-18)9cda		
QUATERNARY:		
Alluvium:		
Brown sand and some clay sand	15	15
Sand, light-brown; some water	15	30
Clay, blue	12	42
Sand, brown; some water	8	50
Sandy clay, blue	20	70
Large gravel sand, brown, coarse; heavy flow of water	35	105
Sand, brown, coarse, and small gravel	10	115
Sand, brown, coarse	5	120
Sand, dark-brown, some gravel	5	125
Sand, brown, packed	5	130
Sand, dark-brown, some gravel	5	135
TRIASSIC:		
Moenkopi Formation:		
Sandstone, red	3	138
Clay, red	5	143
Shale, red	19	162
Sandstone, brown	46	208
PERMIAN:		
Coconino Sandstone:		
Sandstone, yellow and white; water bearing	52	260

Table 6.--Modified drillers' logs of selected wells in southern Navajo County—Continued

(A-18-18)10ccb2

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Alluvium:		
Clay, sand and gravel; water	135	135
TRIASSIC:		
Moenkopi Formation:		
Clay and shale, red, hard	5	140
Sandstone and shale, red, hard	85	225
PERMIAN:		
Coconino Sandstone:		
Sandstone, yellow, hard; water	25	250

(A-18-19)8ddd

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Alluvium:		
Surface soil, sandy loam	32	32
TRIASSIC:		
Moenkopi Formation:		
Shale, red	7	39
Sandstone, red	7	46
Shale, red and blue	17	63
Sandstone, red	7	70
Shale, red and blue	16	86
Sandstone, red	3	89
Shale, red and blue	157	246
Sandstone, red	12	258
Shale, red and blue	18	276
Sandstone, red	7	283
Shale, red and blue	13	296
Sandstone, red; water on joints of Moenkopi	12	308
PERMIAN:		
Kaibab(?) Limestone:		
Limestone; water level at 93 feet	3	311
Coconino Sandstone:		
Sandstone; water not too salty, water strata 326-331 feet, water level 92 feet; water strata 382-390 feet, water level 90 feet; water strata 427-435 feet, water level 94 feet	159	470

(A-18-19)16ada

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Alluvium:		
Silt, sand and gravel; water strata from 80-137 feet, approximately 20 gal/min, water level 75 feet, water highly mineralized and cased off at 147 feet	137	137
TRIASSIC:		
Moenkopi Formation:		
Shale, red	15	152
Sandstone, red	1	153
Shale, red and blue	71	224
Sandstone, red; water in seams, 4 gal/min	28	252
Shale, red	7	259
Sandstone, brown	3	262
Shale, yellowish	2	264
Sandstone, brown	34	298
PERMIAN:		
Coconino Sandstone:		
Sandstone; water strata, water level 90 feet	5	303
Sandstone, tight	13	316
Sandstone, buff; water strata, water level 90 feet	11	327
Sandstone, white	31	358
Sandstone, blue-white	3	361
Sandstone, white; water strata	12	373
Sandstone, white	88	461
Sandstone, buff; water strata, water level 87 feet	6	467
Sandstone, white; water level after casing 84 feet	33	500

(A-18-19)16caa1

	Thickness (feet)	Depth (feet)
QUATERNARY:		
Alluvium:		
Surface soil	15	15
TRIASSIC:		
Moenkopi Formation:		
Shale, red and blue	13	28
Sandstone, red	3	31
Shale, red and blue	1	32
Sandstone, red	36	68
Shale, red and blue; water seep at 75 feet, salty, rose to 35 feet	20	88
Sandstone, red	19	107
Shale, red and blue	29	136
Sandstone, brown	22	158
Shale, red and blue	102	260
Sandstone, brown	20	280
Shale, red; water at 278 feet	13	293
PERMIAN:		
Kaibab Limestone:		
Limestone	5	298
Shale, blue-white and decomposed limestone	3	301
Coconino Sandstone:		
Sandstone, light-buff	32	333
Sandstone; water strata, water level 35.5 feet	4	337
Sandstone, buff, hard, tight	39	376
Sandstone, blue-white; water strata	16	392
Sandstone, pyrite from 398-403 feet	11	403
Sandstone, white	20	423
Sandstone, blue-white; water strata, water level 35 feet	7	430
Sandstone, white	32	462
Sandstone, blue-white; water strata, water level 34 feet	7	469
Sandstone, white; water level 32 feet after casing	21	490
No log	1	491

Table 6.--Modified drillers' logs of selected wells in southern Navajo County—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
(A-18-19)16caa2					
QUATERNARY:			PERMIAN:		
Alluvium:			Coconino Sandstone:		
Dry sand	15	15	Sandstone, white; cased to		
TRIASSIC:			315 feet and cemented	22	315
Moenkopi Formation:			Sandstone, white, alternating hard		
Shale and clay	65	80	and soft; water	165	480
Sandstone, red	13	93	Sandstone, white, highly fractured,		
Shale and clay	55	148	large amount of water,		
Clay, soft, very sticky	122	270	open hole below 315 feet	20	500
Sandstone, light-brown	23	293			
(A-18-19)16caa3					
QUATERNARY:			Sandstone, red	25	220
Alluvium:			Shale, red	58	278
Soil and sand	23	23	Sandstone, red	19	297
TRIASSIC:			PERMIAN:		
Moenkopi Formation:			Coconino Sandstone:		
Sandstone, gray	30	53	Sandstone, white; lots of		
Shale, red and blue; first hit very salty			water, water level 38 feet	44	341
water at 67 feet, second water hit at			Sandstone; no change		
84 feet, about 20-30 gal/min	142	195	in water level	139	480
(A-18-19)16cdc					
QUATERNARY:			Shale, red	3	253
Alluvium:			Shale, blue	1	254
Surface soil and clay	17	17	PERMIAN:		
Silt; surface water at 17 feet	3	20	Kaibab Limestone:		
Clay	12	32	Limestone; water strata		
Sand and gravel; water level 11 feet	140	172	at 262 feet, water level 9 feet	16	270
TRIASSIC:			Coconino Sandstone:		
Moenkopi Formation:			Sandstone; water strata		
Shale, red, soft	4	176	283, 287, 330, and 339 feet,		
Shale, red, tight	44	220	water level 3 feet	87	357
Sandstone, red; water in seams,					
water level 10 feet	30	250			
(A-18-19)16dac					
QUATERNARY:			Shale, red and blue	36	132
Alluvium:			Shale, red	46	178
Topsoil	2	2	Sandstone, red	10	188
Sandy loam	3	5	Shale, red; 24 gal/min	49	237
Gravel	3	8	Sandstone, red	14	251
Sandy silt	9	17	Shale, red	3	254
TRIASSIC:			PERMIAN:		
Moenkopi Formation:			Kaibab(?) Limestone:		
Shale, red and blue	30	47	Shale, yellow and blue	3	257
Shale, brown; water rose to			Coconino Sandstone:		
32 feet, 6 gal/min	5	52	Sandstone	51	308
Shale, red and blue	33	85	Sandstone, white; 5 gal/min	13	321
Sandstone, brown	11	96	Sandstone, white	4	325
(A-18-19)16ddb1					
TRIASSIC:			Sandstone, brown; water salty,		
Moenkopi Formation:			water level 43 feet	16	256
Shale, red and blue	14	14	Shale, red	9	265
Sandstone, red	12	26	PERMIAN:		
Shale, red and blue	8	34	Kaibab Limestone:		
Sandstone, red	5	39	Limestone; seep water		
Shale, red and blue	29	68	on joint with Moenkopi, water		
Sandstone, red; water on joint of			level 42 feet	33	298
sandstone and shale	5	73	Coconino Sandstone:		
Shale, red and blue	150	223	Sandstone; water strata at		
Sandstone, red	10	233	315-318, water level 37 feet, and		
Shale, red and blue	7	240	354-367, water level 37 feet	102	400

Table 6.--Modified drillers' logs of selected wells in southern Navajo County—Continued

	Thickness (feet)	Depth (feet)
(A-18-19)17aad		
QUATERNARY:		
Alluvium:		
Sand and clay fill	85	85
TRIASSIC:		
Moenkopi Formation:		
Sandstone, red	20	115
Shale, red and gray	82	187
Sandstone, red; water	41	228
Shale, blue	59	287
Sandstone, red	11	298
PERMIAN:		
Coconino Sandstone:		
Sandstone	12	310
Sandstone; water	190	500
(A-18-19)17cbc		
QUATERNARY:		
Alluvium:		
Sand	110	110
Clay and gravel	70	180
TRIASSIC:		
Moenkopi Formation:		
Shale, red and gray	10	190
Shale, blue and gray	100	290
PERMIAN:		
Coconino Sandstone:		
Sandstone	100	390
(A-18-19)17daa		
QUATERNARY:		
Alluvium:		
Soil; little water, good	20	20
TRIASSIC:		
Moenkopi Formation:		
Shale, red; some water, poor	280	300
PERMIAN:		
Coconino Sandstone:		
Sandstone; water more abundant below 400 feet	135	435
(A-18-19)23dbd		
QUATERNARY:		
Alluvium:		
Topsoil and clay	20	20
Sand and gravel, from 88-138 feet gravel is clean and well-rounded; water poor	118	138
TRIASSIC:		
Moenkopi Formation:		
Sandstone, red, with one shale break	62	200
PERMIAN:		
Coconino Sandstone:		
Sandstone	150	350
No log	200	550
(A-18-19)35adb		
QUATERNARY:		
Alluvium:		
Clay fill	8	8
Quicksand	42	50
TRIASSIC:		
Moenkopi Formation:		
Moenkopi	35	85
PERMIAN:		
Coconino Sandstone:		
Sandstone	107	192
Sandstone, white, hard, tight	78	270
Sandstone, light-buff; water strata	8	278
Sandstone, white	17	295
Sandstone, dark-buff	7	302
Sandstone, white	33	335
Sandstone, light-buff; water strata	7	342
Sandstone, white	24	366
Sandstone, dark-buff	14	380
Sandstone, light-buff; water strata	13	393
Sandstone, dark-buff	24	417
Sandstone, white	4	421
Sandstone, dark-buff	3	424
Sandstone, white	6	430
Sandstone, light-buff; water strata	10	440
Sandstone, dark-buff	5	445
Sandstone, light-buff	5	450
(A-18-19)36ccd		
TRIASSIC:		
Moenkopi Formation:		
Moenkopi	38	38
PERMIAN:		
Coconino Sandstone:		
Sandstone, very hard	32	70
Sandstone, light-brown, hard	30	100
Sandstone; water level 14 feet, 652 mg/l total dissolved solids, not much water	15	115
Sandstone, gray, softer	30	145
Sandstone; bailed 150 gal/min with no drawdown, 660 mg/l total dissolved solids	92	237
Sandstone, 676 mg/l total dissolved solids	23	260
Sandstone; static water level 25 feet, pumped 150(?) gal/min for 2 hours with 2.1-foot drawdown, 683 mg/l total dissolved solids	72	332
Sandstone, thin layer of black carbon material	18	350

Table 6.--Modified drillers' logs of selected wells in southern Navajo County—Continued

(A-18-22)16aab1

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
QUATERNARY:			Sand and some gravel	70	92
Alluvium:			Clay	18	110
Clay, topsoil	6	6	Gravel and rock	1	111
Sand, fine	5	11	Clay, yellow	2	113
Clay	11	22			

(A-18-22)16bda

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
QUATERNARY:			TRIASSIC:		
Alluvium:			Chinle Formation:		
Clay fill	20	20	Clay, blue-gray	20	100
Sand and gravel	60	80			

(A-18-23)6cac

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
QUATERNARY:			Gravel, coarse	63	120
Alluvium:			Clay	18	138
Topsoil	10	10	Gravel, coarse	19	157
Clay, soft, with streaks of sandy clay	47	57	Clay	10	167

(A-18-23)6cdc2

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
QUATERNARY:			Medium to good sand	5	125
Alluvium:			Clay	4	129
Topsoil	10	10	Sand and gravel, coarse, some		
Clay, soft	50	60	clay streaks	29	158
Good sand and gravel, some clay streaks	30	90	Rock, hard, loose	3	161
Gravel, coarse, very loose, some clay	30	120	Clay, dark	10	171

(A-19-15)26dad

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
QUATERNARY:			PERMIAN:		
Surficial material:			Kaibab Limestone:		
Topsoil	10	10	Limestone, yellow	40	75
TRIASSIC:			Coconino Sandstone:		
Moenkopi Formation:			Sandstone, light-yellow;		
Sandy shale, red	25	35	first water	228	303

(A-19-16)6ccc

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
QUATERNARY:			Shale, brown	37	132
Surficial material:			Shale, brown; lost drilling water	6	138
Fill	18	18	PERMIAN:		
TRIASSIC:			Kaibab Limestone:		
Moenkopi Formation:			Lime	7	145
Shale, soft	24	42	Coconino Sandstone:		
Shale and sandstone in streaks	18	60	Sandstone	7	152
Shale, very hard	35	95	Sandstone, white	45	197

(A-19-17)1dbc

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
QUATERNARY:			Sandy shale, brown	22	120
Alluvium:			Sandy shale, light-gray	110	230
Clay and sand	10	10	Shale, red	250	480
TRIASSIC:			Shale, brown	103	583
Chinle and Moenkopi Formations undifferentiated:			Sandstone, red	32	615
Shale, gray	33	43	Sand, brown; water	3	618
Shale, brown	11	54	Sandstone, red	7	625
Shale, gray	38	92	Sand, brown; water	3	628
Shale, brown	2	94	Sandstone, brown	14	642
Sandstone, brown	4	98			

Table 6.--Modified drillers' logs of selected wells in southern Navajo County—Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
(A-19-17)5ddd					
QUATERNARY:			Shale, blue	21	276
Surficial material:			Shale, red	14	290
Surface sand	4	4	Shale, gray	18	308
Sandy clay and gravel	18	22	Shale, red	34	342
TRIASSIC:			Shale, blue	16	358
Chinle Formation:			Shale, red	16	374
Shale, blue	54	76	Moenkopi Formation:		
Shale, gray	46	122	Sandstone, brown	24	398
Shale, red	10	132	Shale, red; small seep at about 500 feet	137	535
Shale, blue	16	148	Sandstone	120	655
Sandy shale; small seep at 220 feet	76	224	PERMIAN:		
Shale, red	5	229	Coconino Sandstone:		
Shale, gray	6	235	Sandstone; water	25	680
Shale, red	20	255			
(A-19-18)12cca					
QUATERNARY:			Gravel and blow sand, brown; well dry	1	96
Alluvium:					
Blow sand, brown	95	95			
(A-19-18)35cbd					
TRIASSIC:			Moenkopi Formation:		
Chinle Formation:			Sandstone, red	6	220
Clay, red	10	10	Shale, red and blue	32	252
Clay, blue	18	28	Sandstone, red	3	255
Shale, red	10	38	Shale, red and blue	8	263
Shale, blue	12	50	Sandstone, red	6	269
Shale, gray	17	67	Shale, red and blue	12	281
Shale, red	19	86	Sandstone, red	12	293
Sandstone, brown; water, 3 gal/min	6	92	Shale, red	7	300
Shale, brown	4	96	Sandstone, red	20	320
Sandstone, brown	24	120	Shale, red and white quartz	20	340
Shale, red	24	144	Sand, red, coarse	5	345
Sandstone, red	5	149	Shale and gravel, red and blue	65	410
Shale and gravel, red and blue	65	214			
(A-20-18)6dcd					
QUATERNARY:			Shale, red	5	125
Surficial material:			Shale, gray	95	220
Topsoil	2	2	Shale, brown	45	265
TRIASSIC:			Shale, purple	50	315
Chinle Formation:			Shale, light-red	85	400
Shale, red	38	40	Shale, red	250	650
Shale, gray	80	120	Shale, gray; well dry	80	730
(A-20-19)31db					
QUATERNARY:			Clay, brown	13	74
Alluvium:			Sand, brown	9	83
Clay, brown	38	38	Clay, brown	11	94
Sand, brown, coarse	3	41	Gravel, small; water	3	97
Clay, brown	14	55	Sand, brown, coarse; water	3	100
Sand, brown	6	61	Clay, white	5	105