AQUIFER-CHARACTERISTIC AND WATER-CHEMISTRY DATA FROM WELLS ON OR NEAR NAVAJO TRIBAL LANDS IN THE ZUNI RIVER BASIN AND WHITEWATER ARROYO DRAINAGE, WEST-CENTRAL NEW MEXICO

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[In pocket]

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CONVERSION FACTORS

For the convenience of readers who may want to use International System of Units (SI), the data may be converted by using the following factors.

Multiply inch-pound units	By	To obtain SI units
foot	0.3048	meter
mile	1.609	kilometer
acre-foot	1,233	cubic meter
gallon per minute	3.785	liter per minute
gallon per minute per foot	12.418	liter per minute per meter
ton per acre-foot	0.0007357	megagram per cubic meter
foot per day	0.3048	meter per day
foot squared per day	0.09290	meter squared per day

Temperature in degrees Celsius (°C) can be converted to degrees Fahrenheit (°F) by the equation:

$$°F = 9/5\ (°C) + 32$$

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

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ABSTRACT

Three stratigraphic units: the alluvium, the Gallup Sandstone, and the Dakota Sandstone have favorable water-bearing characteristics and are present throughout most of the Navajo tribal lands in the Zuni River basin and Whitewater Arroyo drainage, west-central New Mexico. Reported well yields are: less than 10 to 500 gallons per minute for the alluvial aquifer; 4 to 260 gallons per minute for the Gallup Sandstone; and 1 to 300 gallons per minute for the Dakota Sandstone.

Baseline diagrams of water-chemistry data for seven wells completed in the alluvium show that hardness exceeded the U.S. Environmental Protection Agency recommended drinking-water standard in water from one well, and concentrations of iron and manganese exceeded the standard in water from another well. For 12 wells completed in the Gallup Sandstone, concentrations of dissolved solids, hardness, sodium, sulfate, iron, and manganese exceeded the recommended standard in water from one to five wells. For 10 wells completed in the Dakota Sandstone, concentrations of dissolved solids, hardness, sodium, sulfate, iron, and manganese exceeded the recommended standard in water from two to six wells. Concentrations of dissolved solids and boron did not exceed the recommended standard for livestock-water supply in water from any well. Specific conductance and sodium-adsorption ratio exceeded the recommended standard for irrigation-water supply in water from three to eight wells in the Gallup and Dakota Sandstone; however, in the alluvium, the sodium-adsorption ratio exceeded the recommended standard in water from one well and boron exceeded the recommended standard in water from another well.

INTRODUCTION

The U.S. Bureau of Indian Affairs requires compilation of aquifer-characteristic and water-chemistry data, for "shallow" wells (completed no deeper than about 1,500 feet below land surface), on or near Navajo tribal lands in the Zuni River basin and Whitewater Arroyo drainage in west-central New Mexico (fig. 1). The U.S. Bureau of Indian Affairs may use the data to indicate the suitability of water for domestic, irrigation, livestock, municipal, or industrial use; or for legal determinations concerning the impacts of water-resource development in this part of the Navajo Nation. The U.S. Geological Survey and the U.S. Bureau of Indian Affairs entered into a cooperative hydrologic study to describe aquifer characteristics and water chemistry within the area of interest.

Purpose and Scope

The purpose of this report is to provide aquifer-characteristic and water-chemistry data from shallow wells for Navajo tribal lands in the Zuni River basin and Whitewater Arroyo drainage, west-central New Mexico. The report includes aquifer-characteristic data for the alluvium, Gallup Sandstone, and Dakota Sandstone compiled from previous studies of the area. Also included are water-chemistry data (1933-88) for shallow wells in the study area from the U.S. Geological Survey's computerized National Water Information System (NWIS) data base, the Navajo Nation Division of Natural Resources, and the Indian Health Service at Black Rock, New Mexico (fig. 1). The U.S. Environmental Protection Agency computerized data-storage system does not contain any information that was not in the other files. Water-chemistry data collected by U.S. Geological Survey personnel in 1987-88 for 21 selected wells that withdraw water from the alluvium, Gallup Sandstone, or Dakota Sandstone served to expand the data base and provide up-to-date water-chemistry information.

U.S. Geological Survey personnel searched the files of the New Mexico State Engineer Office, the Navajo Nation Division of Natural Resources, and the U.S. Geological Survey in order to compile a list of wells generally less than 1,500 feet deep (table 1). Some wells are included that were outside but near Navajo tribal lands to provide continuity of data. The distribution of wells is shown on plate 1A.

Description of the Study Area

The study area, in west-central New Mexico (fig. 1), consists of the Navajo tribal lands in the Zuni River basin and Whitewater Arroyo drainage west of the Continental Divide. The Navajo tribal lands north of the Zuni tribal lands are often described as "checkerboard" lands because land ownership is split up by section; land in about every other section is Indian-owned, which creates a checkerboard pattern on an ownership map. Navajo tribal lands east of Zuni lands belong to the Ramah Navajo tribe. Because aquifers are continuous across political borders, data were collected and are presented from nearby lands that were not under Navajo ownership.

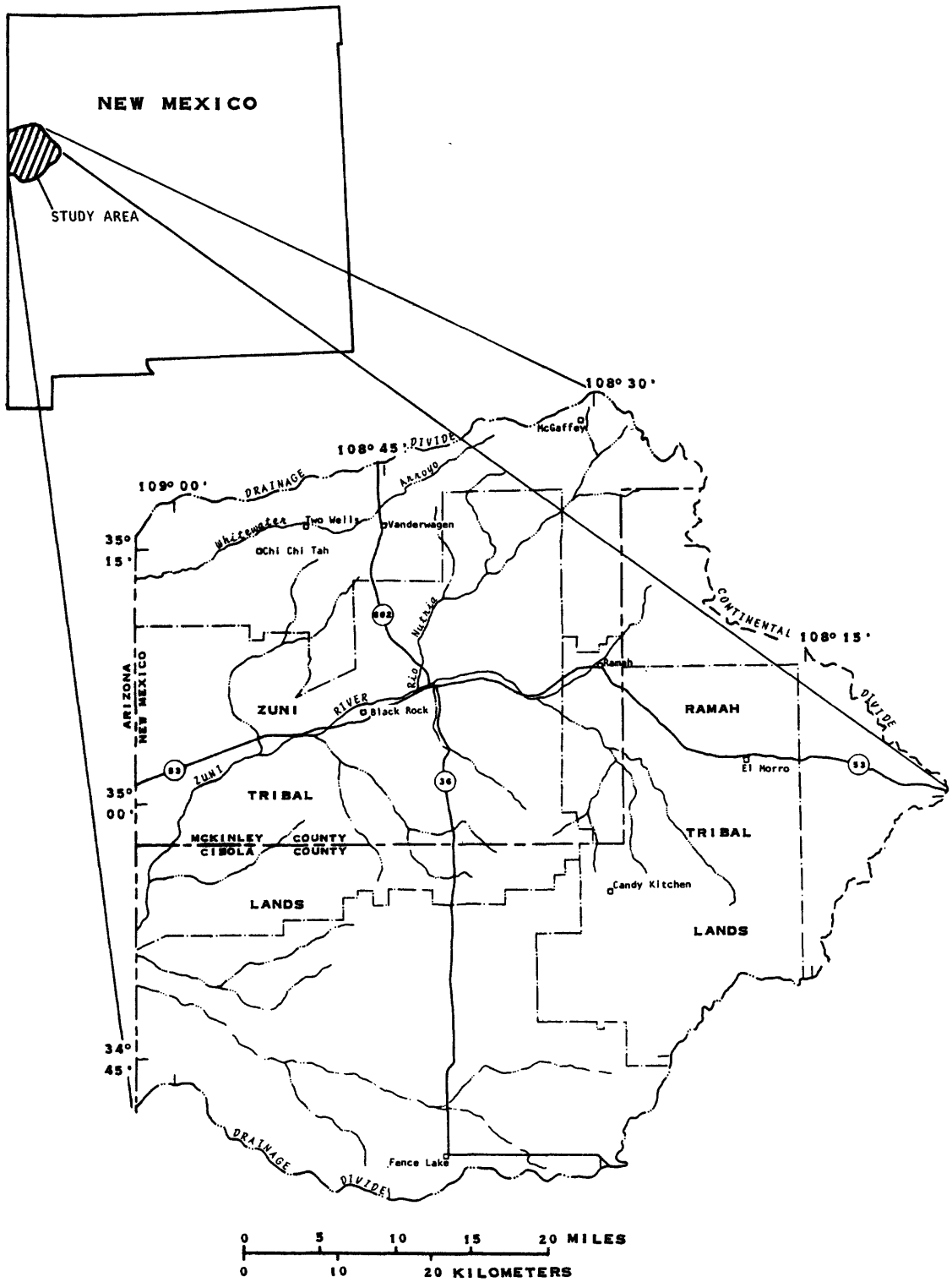

Figure 1.--Location of the study area.

AQUIFER CHARACTERISTICS

The most dependable and readily available supply of water in the study area is ground water. Wells within the study area are generally located near populated areas and scattered ranches.

Shallow stratigraphic units that provide most of the ground-water supply are: alluvium, basalt flows, Gallup Sandstone, Mancos Shale, Dakota Sandstone, Zuni Sandstone, Wingate Sandstone, Chinle Formation, San Andres Limestone, and Glorieta Sandstone (Orr, 1987). A discussion of these units can be found in Orr (1987).

Three stratigraphic units of interest to the U.S. Bureau of Indian Affairs, which are present throughout most of the area and have favorable water-bearing characteristics (DeWilde, 1971; Orr, 1987), are the alluvium, Gallup Sandstone, and Dakota Sandstone. For these units, table 2 presents a range of well yields and aquifer characteristics reported in previous studies. Reported well yields for the alluvium range from less than 10 (Orr, 1987) to 125 gallons per minute (Summers, 1972). Alluvial wells located in buried channel deposits have yielded as much as 200 to 500 gallons per minute (Orr, 1987). A yield of 200 gallons per minute for a short duration (no more than 20 days) was reported (Salt River Project, 1983) for the Salt River Project located near Fence Lake (fig. 1). Reported well yields for the Gallup Sandstone range from 4 to 5 gallons per minute (Orr, 1987) to 11 to 260 gallons per minute (West, 1961). Reported well yields for the Dakota Sandstone range from 1 to 32 gallons per minute (Orr, 1987) to about 300 gallons per minute (Salt River Project, 1983). Values of transmissivity reported are 2 feet squared per day (Summers, 1972) for the Gallup Sandstone, and range from 1 to 7 feet squared per day (Orr, 1987) to 709 feet squared per day (Salt River Project, 1983) for the Dakota Sandstone. Storage coefficient reported in table 2 for the alluvium is 6.1×10^{-5} to 3.1×10^{-4} (Salt River Project, 1983).

WATER-CHEMISTRY CHARACTERISTICS

The chemical composition of natural water determines its suitability for use. The primary uses of water in the study area are for public-drinking, livestock, and irrigation supply.

A baseline diagram is a visual representation of selected constituents of a water-chemistry analysis (Dulas, 1978). It quickly shows whether constituents of an analysis fall above or below referenced guidelines. It also shows how much each constituent is above or below the guideline. In this report baseline diagrams indicate the suitability of water for public-drinking, livestock, and irrigation supply for wells in the alluvium (pl. 1B), the Gallup Sandstone (pl. 1C), and the Dakota Sandstone (pl. 1D). Baseline diagrams are presented for every well within the three stratigraphic units that included an analysis for the constituents of interest. The baseline (horizontal line) represents the maximum acceptable level (100 percent) of chemical-constituent concentrations in public-drinking water set by the U.S. Environmental Protection Agency (1986); in livestock-drinking water recommended by the National Academy of Sciences-National Academy of Engineering (1972); and in irrigation water recommended by the U.S. Salinity Laboratory Staff (1954) and Hem (1985). Lines extending vertically from the baseline represent the percentage of deviation from the baseline. Lines below the baseline indicate percent of deviation below the referenced standard, whereas lines above the baseline indicate percent of deviation above the referenced standard.

The baseline diagrams are based on a small number of selected chemical constituents and properties. More than 150 inorganic and organic chemical constituents currently have U.S. Environmental Protection Agency recommended public drinking-water standards, and new standards are being developed for additional chemical constituents. The baseline diagrams show seven inorganic chemical constituents and one property to indicate suitability of water as a public-drinking supply; two inorganic constituents to indicate suitability of water as a livestock supply; and two constituents and one property to indicate suitability of water as an irrigation supply. For all samples analyzed, concentrations of arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver were less than the U.S. Environmental Protection Agency (1986) maximum contaminant levels.

Concentrations of the selected constituents exceeded recommended standards for drinking-water supply, livestock-water supply, and irrigation-water supply in water from the indicated number of wells out of 7 alluvial wells, 12 Gallup Sandstone wells, and 10 Dakota Sandstone wells:

Constituent	Number of wells in which water exceeded standard		
	Alluvium	Gallup Sandstone	Dakota Sandstone
Public drinking-water-supply criteria:			
Dissolved solids		5	6
Nitrate			
Hardness	1	2	2
Sodium		3	5
Sulfate		2	5
Fluoride			
Iron	1	3	2
Manganese	1	1	4
Livestock water-supply criteria:			
Dissolved solids			
Boron			
Irrigation water-supply criteria:			
Specific conductance		3	6
Sodium-adsorption ratio	1	7	8
Boron	1		1

Concentrations of dissolved solids and boron did not exceed the recommended standards for livestock-water supply in water from any of the wells.

Water-chemistry data collected between November 1987 and June 1988 at 21 wells are listed in table 3. Also listed in table 3 are historical water-chemistry data collected prior to November 1987 for wells in the study area.

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U.S. Salinity Laboratory Staff, 1954, Diagnosis and improvement of saline and alkaline soils: United States Department of Agriculture Handbook 60, 160 p.

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Table 1.--Location and completion data for shallow wells

[--, no data]

EXPLANATION OF AQUIFER CODES

110AVMB - Cenozoic, Quaternary, alluvium, bolson deposits, and other surface deposits;

112LGUN - Cenozoic, Quaternary, Pleistocene, Laguna basalt flow;

121BDHC - Cenozoic, Tertiary, Miocene and Pliocene, Bidahochi Formation;

210MNCS - Mesozoic, Cretaceous, Mancos Shale;

211CRVC - Mesozoic, Upper Cretaceous, Crevasse Canyon Formation of Mesaverde Group;

211DKOT - Mesozoic, Upper Cretaceous, Dakota Sandstone;

211DLCOC - Mesozoic, Upper Cretaceous, Dilco Coal Member of Crevasse Canyon Formation of Mesaverde Group;

211GLLP - Mesozoic, Upper Cretaceous, Gallup Sandstone;

211MRSN - Mesozoic, Upper Jurassic, Morrison Formation;

211MVRD - Mesozoic, Upper Cretaceous, Mesaverde Group;

221ENRD - Mesozoic, Upper Jurassic, Entrada Sandstone, upper sandy member of San Rafael Group;

221ZUNIS - Mesozoic, Upper Jurassic, Zuni Sandstone;

231CHNL - Mesozoic, Upper Triassic, Chinle Formation;

231RCKP - Mesozoic, Upper Triassic, Rock Point Member of Wingate Sandstone;

231WNGT - Mesozoic, Upper Triassic, Wingate Sandstone;

310GLRT - Paleozoic, Permian, Glorieta Sandstone Member of San Andres Formation;

310YESO - Paleozoic, Permian, Yeso Formation;

313SADG - Paleozoic, Permian, Guadalupian, San Andres Limestone and Glorieta Sandstone;

313SADY - Paleozoic, Permian, Guadalupian, San Andres Limestone and Yeso Formation, undivided;

318ABO U - Paleozoic, Lower Permian, Leonardian, Abo Sandstone (upper tongue);

400PCMB - Precambrian, Precambrian Erathem.

Table 1.--Location and completion data for shallow wells--Continued

Owner	Well number on plate 1A	Latitude and longitude (degrees, minutes, and seconds)		Completion data: Date drilled	Completion data: Depth of well (feet)	Completion data: Primary source of water (aquifer code)
--	1	343749	1083356	--	250	--
--	2	343755	1082339	--	--	211MVRD
--	3	343755	1082340	--	760	--
--	4	343820	1082700	--	100	211MVRD
--	5	343820	1082846	--	300	211MVRD
--	6	343824	1083403	--	250	--
--	7	343842	1082934	--	900	211DKOT
--	8	343852	1083404	--	430	210MNCS
--	9	343857	1083138	--	800	211DKOT
--	10	343902	1083034	--	254	--
--	11	343903	1082236	--	362	211MVRD
--	12	343905	1081820	--	--	--
--	13	343915	1081822	--	--	211DKOT
--	14	343916	1081822	--	--	211DKOT
--	15	343953	1082503	--	381	210MNCS
--	16	343957	1081516	--	--	211MVRD
--	17	344101	1082125	--	--	211MVRD
--	18	344236	1083216	--	228	--
--	19	344237	1083130	--	10	110AVMB
Ramah29	20	344337	1081657	-85	625	--
Moleras	21	344505	1080949	08-26-86	700	--
--	22	344514	1081408	--	450	--
Ramah09	23	344513	1081723	01-08-59	650	211GLLP
Ramah26	24	344644	1081950	12-14-83	753	--
Ramah13	25	344903	1083146	08-03-53	590	211GLLP
--	26	344903	1083146	--	95	211MVRD
Ramah10	27	344930	1082252	03-01-57	700	211GLLP
Ramah11	28	344931	1082702	09-17-35	289	211GLLP
Ramah08	29	344933	1081749	08-20-35	536	211GLLP
Ramah21B	30	345045	1082200	08-01-73	790	211DKOT
Ramah12	31	345112	1083107	11-20-58	460	211GLLP
--	32	345137	1083414	--	665	211DKOT
--	33	345318	1082425	--	465	--
--	34	345320	1082426	--	--	313SADG
Lovis	35	345323	1082748	-70	325	211GLLP

Table 1.--Location and completion data for shallow wells--Continued

Owner	Well number on plate 1A	Latitude and longitude (degrees, minutes, and seconds)		Completion data: Date drilled	Completion data: Depth of well (feet)	Completion data: Primary source of water (aquifer code)
Ramah05	36	345332	1082450	07-28-54	465	211GLLP
Ramah07	37	345356	1081751	--	551	211DKOT
--	38	345410	1083048	--	265	211MVRD
Ramah04	39	345412	1082512	02-04-59	441	211GLLP
Ramah06	40	345511	1082021	01-12-35	361	211DKOT
Ramah20	41	345601	1081632	05-11-72	538	--
--	42	345710	1082628	--	820	211DKOT
BIArnch	43	345710	1082628	--	500	--
--	44	345753	1083036	--	125	211GLLP
Millers	45	345754	1083018	--	125	211GLLP
--	46	345834	1082007	--	--	110AVMB
--	47	345845	1082031	--	--	110AVMB
Bond	48	345925	1083055	-71	306	211GLLP
COA-21	49	345937	1083451	--	24	110AVMB
--	50	345942	1081621	--	--	110AVMB
Ramah03	51	345947	1082439	02-04-59	280	--
--	52	345957	1082441	--	280	110AVMB
Henios	53	350012	1082333	--	150	--
LDS	54	350012	1082423	--	165	--
--	55	350013	1082252	--	--	110AVMB
--	56	350113	1082100	--	275	211DKOT
--	57	350117	1082158	--	145	211DKOT
--	58	350148	1082402	--	180	231WNGT
--	59	350159	1082036	--	185	231WNGT
--	60	350212	1082056	--	225	110AVMB
--	61	350212	1082128	--	473	231CHNL
--	62	350216	1082248	--	300	231WNGT
--	63	350217	1082056	--	405	--
--	64	350223	1081529	--	--	110AVMB
--	65	350232	1082229	--	--	231RCKP
--	66	350235	1082004	--	222	231WNGT
--	67	350235	1082232	--	231	231RCKP
--	68	350236	1081923	--	550	221ZUNIS
--	69	350236	1081925	--	310	--
--	70	350240	1081950	--	--	--

Table 1.--Location and completion data for shallow wells--Continued

Owner	Well number on plate 1A	Latitude and longitude (degrees, minutes, and seconds)		Completion data: Date drilled	Completion data: Depth of well (feet)	Completion data: Primary source of water (aquifer code)
--	71	350242	1081914	--	1,410	--
--	72	350242	1081938	--	230	--
--	73	350243	1082035	--	165	--
--	74	350243	1082111	--	--	--
--	75	350245	1082019	--	136	--
--	76	350245	1082146	--	200	221ZUNIS
--	77	350246	1081950	--	196	110AVMB
--	78	350246	1081958	--	157	231WNGT
--	79	350247	1081627	--	--	112LGUN
--	80	350254	1082239	--	213	110AVMB
Ramah21	81	350254	1082239	10-21-75	480	--
--	82	350308	1081827	--	--	112LGUN
--	83	350318	1083256	--	--	211DKOT
--	84	350324	1082858	--	193	110AVMB
ECW-13	85	350328	1083246	--	707	211DKOT
RL&C.CO	86	350405	1082219	-71	352	231WNGT
Ramah19	87	350443	1082247	09-02-67	388	110AVMB
Ramah01	88	350446	1083000	02-14-57	235	110AVMB
--	89	350522	1082640	--	565	211DKOT
--	90	350532	1082618	--	1,092	221ENRD
--	91	350537	1082243	--	--	110AVMB
--	92	350538	1082618	--	--	313SADG
--	93	350543	1082257	--	--	110AVMB
ECW-22	94	350649	1083811	--	282	211GLLP
--	95	350716	1082912	--	--	110AVMB
--	96	350722	1082842	--	--	110AVMB
--	97	350722	1082856	--	--	211DKOT
--	98	350729	1082855	--	--	211DKOT
--	99	350730	1084713	--	1,175	310GLRT
--	100	350748	1082647	--	102	110AVMB
--	101	350758	1082623	--	59	110AVMB
--	102	350801	1082923	--	325	211DKOT
--	103	350802	1082933	--	772	211DKOT
--	104	350808	1082939	--	120	--
--	105	350808	1082955	--	112	110AVMB

Table 1.--Location and completion data for shallow wells--Continued

Owner	Well number on plate 1A	Latitude and longitude (degrees, minutes, and seconds)		Completion data: Date drilled	Completion data: Depth of well (feet)	Completion data: Primary source of water (aquifer code)
	106	350817	1082527	--	--	110AVMB
RamahHS	107	350818	1083134	-61	227	211DKOT
16P-577	108	350822	1084532	05-21-73	600	--
--	109	350836	1082603	--	120	110AVMB
ECW-10	110	350925	1083759	--	760	211DKOT
--	111	350931	1082747	--	182	231WNGT
--	112	351015	1082807	--	--	110AVMB
ECW-14	113	351019	1083504	--	438	211GLLP
--	114	351022	1085604	--	500	221ZUNIS
--	115	351024	1082807	--	--	110AVMB
--	116	351029	1082651	--	52	110AVMB
--	117	351035	1082651	--	49	110AVMB
--	118	351116	1082947	--	280	211MVRD
16K-331	119	351131	1085122	02-03-53	94	110AVMB
--	120	351143	1082858	--	--	110AVMB
Chahate	121	351157	1083501	--	93	110AVMB
RWP-28	122	351201	1083306	--	105	211CRVC
--	123	351207	1083330	--	105	211DLCOC
Solomon	124	351216	1083456	--	134	211CRVC
Sanchez	125	351233	1082644	--	--	231CHNL
Nutria	126	351241	1083911	-63	450	211GLLP
Sanchez	127	351242	1082940	--	--	110AVMB
Clawson	128	351300	1082515	07-23-71	203	231CHNL
16T-565	129	351313	1085235	08-27-72	300	--
16T-556	130	351314	1090152	--	293	--
16T-566	131	351318	1084657	08-27-71	900	221MRSN
--	132	351330	1083932	--	583	211DLCOC
16T-546	133	351407	1085136	08-01-67	86	--
Bond	134	351428	1082622	--	--	231CHNL
16T-567	135	351430	1084433	08-26-71	635	211GLLP
--	136	351432	1083327	--	--	211DLCOC
Bond	137	351442	1082651	--	100	110AVMB
Chichilgeetho	138	351454	1085420	-34	21	110AVMB
Chichilgeetho	139	351454	1085420	-52	62	110AVMB
16T-545	140	351505	1090032	07-07-67	541	--

Table 1.--Location and completion data for shallow wells--Continued

Owner	Well number on plate 1A	Latitude and longitude (degrees, minutes, and seconds)		Completion data: Date drilled	Completion data: Depth of well (feet)	Completion data: Primary source of water (aquifer code)
16T-574	141	351532	1084437	08-02-73	749	211GLLP
--	142	351634	1083006	--	--	--
--	143	351647	1083932	--	100	211GLLP
Jones	144	351653	1085910	04- -55	508	121BDHC
Jones	145	351653	1085910	10- -58	600	--
16T-557	146	351656	1090002	02-09-71	565	--
--	147	351722	1084521	--	44	
Navarre	148	351734	1082348	-64	250	310YESO
Vanderwagen	149	351745	1085542	--	770	--
16T-576	150	351818	1085525	--	--	--
16T-568	151	351823	1085151	09-15-71	832	211DKOT
16T-511	152	351825	1084950	10-18-60	500	211GLLP
16T-580	153	351853	1084827	01- -73	497	211GLLP
--	154	351855	1082440	--	--	--
Grubisich	155	351906	1082535	--	385	318ABO U
--	156	351906	1082644	--	--	110AVMB
Grubisich	157	351907	1082534	--	--	110AVMB
16T-599	158	351915	1084527	09-01-79	1,400	211GLLP
Grubisich	159	351916	1082539	--	85	110AVMB
16T-564	160	351918	1083641	09-18-71	640	211CRVC
--	161	351921	1082737	--	--	110AVMB
Navarre	162	351927	1082718	--	135	318ABO U
Grubisich	163	351930	1082559	--	150	318ABO U
16T-615	164	351946	1085633	--	--	--
Navarre	165	352000	1082626	--	25	110AVMB
16T-570	166	352000	1083848	11-09-71	1,143	211GLLP
Jekielek	167	352012	1082644	--	75	110AVMB
Radosevich	168	352018	1082902	11-26-76	262	400PCMB
Radosevich	169	352018	1082902	--	190	--
Radosevich	170	352018	1082902	07-26-55	80	110AVMB
16T-543	171	352022	1084950	04-18-67	591	--
--	172	352039	1084313	--	--	--
--	173	352137	1082913	--	--	110AVMB
--	174	352149	1082835	--	--	110AVMB
--	175	352150	1082834	--	--	--

Table 1.--Location and completion data for shallow wells--Concluded

Owner	Well number on plate 1A	Latitude and longitude (degrees, minutes, and seconds)		Completion data: Date drilled	Completion data: Depth of well (feet)	Completion data: Primary source of water (aquifer code)
--	176	352233	1083042	--	--	313SADY
--	177	352251	1082841	--	--	310YESO
--	178	352302	1082933	--	--	--

Table 2.—Geologic data for the alluvium, Gallup Sandstone, and Dakota Sandstone and aquifer characteristics

[gal/min, gallons per minute; ft/d, feet per day; ft^2/d, feet squared per day; (gal/min)/ft, gallons per minute per foot of drawdown. --, no data]

System or period	Stratigraphic unit	Data reference	Lithology	Aquifer characteristics				
				Yield (gal/min)	Hydraulic conductivity (ft/d)	Transmissivity (ft^2/d)	Specific capacity (gal/min)/ft	Storage coefficient
Quaternary	Alluvium	DeWilde, 1971	Fine to coarse-grained sand, silt, and gravel	25 or less	--	--	--	--
Quaternary	Alluvium	Summers, 1972	Sand, gravel, silt, and clay	125	8.4	353	1.2	--
Quaternary	Alluvium	Salt River Project, 1983	Unconsolidated valley fill	200 for periods of no more than 20 days	--	1,139 to 1,293	5.7	6.1×10^{-5} to 3.1×10^{-4}
Quaternary	Alluvium	Orr, 1987	Sand, gravel, silt, and clay deposited along surface drainages	Generally less than 10	--	--	--	--
	Buried channel deposits		Channel deposits of sand, gravel, silt, and clay underlying basalt	200 to 500	--	--	--	--

Table 2.--Geologic data for the alluvium, Gallup Sandstone, and Dakota Sandstone and aquifer characteristics--Continued

System or period	Stratigraphic unit	Data reference	Lithology	Aquifer characteristics: Yield (gal/min)	Hydraulic conductivity (ft/d)	Transmissivity (ft^2/d)	Specific capacity (gal/min)/ft	Storage coefficient
Cretaceous	Gallup Sandstone	West, 1961	Light-gray, buff, and pale-red, very fine to very coarse grained sandstone, and thin to thick beds of shale	11 to 260	--	--	0.08 to 4.7	--
Cretaceous	Gallup Sandstone	DeWilde, 1971	Yellowish-tan sandstone, interbedded with dark-gray shale and coal	Less than 10	--	--	--	--
Cretaceous	Gallup Sandstone	Summers, 1972	Sandstone and shale with beds of coal; sandstone ranges from clear, light-colored, medium-grained cliff formers to fine-grained, dark-gray, carbonaceous, silty sandstone	10	0.13	2.0	0.04	--

Table 2.—Geologic data for the alluvium, Gallup Sandstone, and Dakota Sandstone and aquifer characteristics—Continued

System or period	Stratigraphic unit	Data reference	Lithology	Aquifer characteristics				
				Yield (gal/min)	Hydraulic conductivity (ft/d)	Transmissivity (ft^2/d)	Specific capacity (gal/min)/ft	Storage coefficient
Cretaceous	Gallup Sandstone	Orr, 1987	Nonmarine and littoral sandstone, shale, and coal	4 to 5	—	—	0.20	—
Cretaceous	Dakota Sandstone	West, 1961	Light-gray to buff, fine- to medium-grained quartz sandstone and some beds of shale and coal	6 to 25	—	—	0.02 to 2.3	—
Cretaceous	Dakota Sandstone	DeWilde, 1971	White to light-gray sandstone, weathering to buff to light brown; consists of two massive sandstone units separated by a siltstone-shale-coal unit	10 to 15	—	—	—	—
Cretaceous	Dakota Sandstone	Summers, 1972	Yellow or gray sandstone, interbedded with coal and shale	15	0.08 to 0.16	7.1 to 13.4	0.04 to 0.11	—

Table 2.—Geologic data for the alluvium, Gallup Sandstone, and Dakota Sandstone and aquifer characteristics—Concluded

System or period	Stratigraphic unit	Data reference	Lithology	Aquifer characteristics: Yield (gal/min)	Hydraulic conductivity (ft/d)	Transmissivity (ft^2/d)	Specific capacity (gal/min)/ft	Storage coefficient
Cretaceous	Dakota Sandstone	Salt River Project, 1983	—	About 300	—	709	0.85	—
Cretaceous	Dakota Sandstone	Orr, 1987	Intertidal to fluvial sandstone, shale, and coal	1 to 32	0.07	1 to 7	0.07	—

Table 3.--Water-chemistry data for shallow wells

[deg. C, degrees Celsius; gal/min, gallons per minute; acre-ft, acre-feet; mg/L, milligrams per liter; --, no data; uS/cm, microsiemens per centimeter at 25 degrees Celsius; ug/L, micrograms per liter; pCi/L, picocuries per liter; E, estimated; noncarb wh wat tot fld, noncarbonate whole water total field; wat wh tot fet, water whole total fixed end-point titration; wat dis tot fet, water dissolved total fixed end-point titration; fet-fld, fixed end-point titration-field; wat dis tot it, water dissolved total incremental titration; M, presence of material verified but not quantified; dis it, dissolved incremental titration; wat dis incr t, water dissolved incremental titration; wh fet, whole fixed end-point titration; <, less than. See table 1 for explanation of aquifer codes. The five-digit codes shown in parentheses in the column headings are parameter codes that uniquely identify a specific constituent. These standard codes, used to identify the data stored in the files of National Water Information System, are identical to those used in the U.S. Environmental Protection Agency data system STORET. The U.S. Environmental Protection Agency assigns and approves all requests for new codes. Data from the U.S. Geological Survey, the Navajo Nation Division of Natural Resources, and the Indian Health Service in Black Rock, N. Mex.]

Table 3.--Water-chemistry data for shallow wells--Continued

Well number on plate 1A	Latitude-longitude identification number	Aquifer code	Date	Time	Flow rate, instantaneous (gal/min) (00059)	Solids, dissolved (tons per acre-ft) (70303)	Solids, sum of constituents, dissolved (mg/L) (70301)
7	343842108293401	211DKOT	06-13-88	1330	--	0.49	351
19	344237108313001	110AVMB	11-21-80	1015	2.0	0.25	184
25	344903108314601	211GLLP	07-02-53	--	--	2.20	1,620
			07-17-53	--	3.5	--	--
			07-29-53	--	7.9	2.04	1,500
			03-29-88	1615	--	0.57	430
26	344903108314602	211MVRD	07-29-53	--	7.9	--	--
28	344931108270201	211GLLP	11-17-87	1230	--	0.37	278
29	344933108174901	211GLLP	03-29-88	1400	--	0.28	211
31	345112108310701	211GLLP	11-17-87	1415	--	0.58	427
32	345137108341401	211DKOT	01-06-81	1150	4.0	1.13	835
33	345318108242501	--	07-28-54	1200	E12	--	--
		--	07-28-54	1230	E12	0.34	250
34	345320108242601	313SADG	05-14-75	--	--	0.91	676
36	345332108245001	211GLLP	11-17-87	0950	--	0.35	258
38	345410108304801	211MVRD	01-08-81	0920	10	0.53	390
40	345511108202101	211DKOT	07-14-69	--	--	--	--
			11-17-87	1600	--	2.57	1,970
42	345710108262801	211DKOT	06-16-88	1515	--	0.51	392
44	345753108303601	211GLLP	07-28-72	--	--	0.72	566
45	345754108301801	211GLLP	05-19-88	1630	--	1.17	801
51	345947108243901	--	07-14-69	1200	--	--	--
			10-25-72	--	--	0.51	220
			12-04-73	--	--	0.62	354
			09-21-78	--	--	0.66	372
			02-28-81	1300	--	0.63	486
			01-15-87	--	--	0.51	377
60	350212108205601	110AVMB	09-02-62	--	--	0.37	273
67	350235108223201	231RCKP	04-25-59	--	23	0.38	277
76	350245108214601	221ZUNIS	02- -60	--	38	0.36	266
			01-05-81	1500	10	0.35	255
80	350254108223901	110AVMB	09-21-78	--	--	0.72	409
82	350308108182701	112LGUN	01-05-81	1410	5.0	0.37	271
83	350318108325601	211DKOT	07-31-72	--	--	1.47	1,120

Table 3.--Water-chemistry data for shallow wells--Continued

Well number on plate 1A	Latitude-longitude identification number	Date	Specific conductance (uS/cm) (00095)	Specific conductance, lab (uS/cm) (90095)	pH (standard units) (00400)	pH, lab (standard units) (00403)	Temperature water (deg. C) (00010)	Nitrogen, nitrate, dissolved (mg/L as N) (00618)	Nitrogen, nitrate, dissolved (mg/L as NO_3) (71851)
7	343842108293401	06-13-88	550	585	8.72	8.73	15.5	--	0.01
19	344237108313001	11-21-80	320	348	7.50	7.90	14.0	--	--
25	344903108314601	07-02-53	2,110	--	--	--	--	0.00	0.0
		07-17-53	2,040	--	--	--	--	--	--
		07-29-53	2,090	--	--	--	14.5	0.360	1.6
		03-29-88	680	674	8.78	9.18	14.0	--	0.0
26	344903108314602	07-29-53	2,070	--	--	--	13.5	--	--
28	344931108270201	11-17-87	450	442	9.35	8.98	5.0	--	0.03
29	344933108174901	03-29-88	355	363	7.45	7.93	13.0	--	0.0
31	345112108310701	11-17-87	660	712	9.27	9.18	5.5	--	0.03
32	345137108341401	01-06-81	1,400	1,360	8.80	8.50	15.0	--	--
33	345318108242501	07-28-54	452	--	--	--	18.0	--	--
		07-28-54	398	--	--	--	14.5	0.050	0.22
34	345320108242601	05-14-75	1,010	--	8.30	--	--	--	--
36	345332108245001	11-17-87	420	407	9.51	8.79	11.5	--	0.08
38	345410108304801	01-08-81	900	885	9.50	9.30	15.0	--	--
40	345511108202101	07-14-69	2,000	--	--	--	--	--	--
		11-17-87	2,500	2,530	7.76	7.12	12.0	--	0.0
42	345710108262801	06-16-88	--	667	9.09	8.98	--	--	--
44	345753108303601	07-28-72	850	--	9.00	--	20.0	0.140	0.62
45	345754108301801	05-19-88	--	1,320	8.62	8.44	15.0	--	0.0
51	345947108243901	07-14-69	650	--	--	-	--	--	--
		10-25-72	--	640	--	9.00	--	--	1.9
		12-04-73	--	750	--	8.30	--	--	0.12
		09-21-78	--	740	--	8.25	--	--	0.14
		02-28-81	728	--	--	--	--	--	--
		01-15-87	--	733	--	6.73	--	--	--
60	350212108205601	09-02-62	431	--	7.60	--	24.0	2.50	11
67	350235108223201	04-25-59	430	--	7.80	--	--	1.50	6.6
76	350245108214601	02- -60	422	--	8.30	--	--	0.900	4.0
		01-05-81	440	432	8.30	8.00	14.0	--	--
80	350254108223901	09-21-78	--	960	--	8.50	--	--	--
82	350308108182701	01-05-81	455	446	7.80	7.90	14.5	--	--
83	350318108325601	07-31-72	1,780	--	8.80	--	16.0	0.140	0.62

Table 3.--Water-chemistry data for shallow wells--Continued

Well number on plate 1A	Latitude-longitude identification number	Date	Nitrogen, NO_2+NO_3 total (mg/L as N) (00630)	Nitrogen, NO_2+NO_3 dissolved (mg/L as N) (00631)	Phosphorus, dissolved (mg/L as P) (00666)	Hardness, total (mg/L as $CaCO_3$) (00900)	Hardness, noncarb wh wat tot fld (mg/L as $CaCO_3$) (00902)	Alkalinity, wat wh tot fet field (mg/L as $CaCO_3$) (00410)	Alkalinity, methyl orange (mg/L) (00411)	Alkalinity, wat dis tot fet lab (mg/L as $CaCO_3$) (00421)	Alkalinity, carbonate fet-fld (mg/L $CaCO_3$) (00430)
7	343842108293401	06-13-88	--	--	0.010	15	0	250	--	--	--
19	344237108313001	11-21-80	--	0.010	--	160	0	--	--	--	--
25	344903108314601	07-02-53	--	--	--	650	360	287	--	--	--
		07-17-53	--	--	--	66	0	673	--	--	--
		07-29-53	--	--	--	680	370	312	--	--	--
		03-29-88	--	--	0.00	22	0	240	--	--	--
26	344903108314602	07-29-53	--	--	--	--	0	282	--	--	--
28	344931108270201	11-17-87	--	--	0.00	14	0	234	--	--	--
29	344933108174901	03-29-88	--	--	0.020	120	0	160	--	--	--
31	345112108310701	11-17-87	--	--	0.010	10	0	296	--	--	--
32	345137108341401	01-06-81	0.150	0.100	--	17	0	--	--	--	--
33	345318108242501	07-28-54	--	--	--	--	0	197	--	--	--
		07-28-54	--	--	--	39	0	180	--	--	--
34	345320108242601	05-14-75	--	--	0.060	410	190	223	--	--	--
36	345332108245001	11-17-87	--	--	0.00	26	0	208	--	--	--
38	345410108304801	01-08-81	--	0.040	--	6	6	--	--	--	--
40	345511108202101	07-14-69	--	--	--	--	0	--	--	--	--
		11-17-87	--	--	0.00	570	350	224	--	--	--
42	345710108262801	06-16-88	--	--	--	14	0	183	--	--	--
44	345753108303601	07-28-72	--	--	0.060	10	0	276	--	--	--
45	345754108301801	05-19-88	--	--	0.00	57	0	266	--	--	--
51	345947108243901	07-14-69	--	--	--	--	0	--	--	--	--
		10-25-72	--	--	--	25	25	--	230	--	--
		12-04-73	--	--	--	220	220	--	170	--	--
		09-21-78	--	--	--	200	200	--	--	166	--
		02-28-81	--	--	--	210	42	--	--	--	170
		01-15-87	--	--	--	220	220	--	--	--	--
60	350212108205601	09-02-62	--	--	--	130	0	180	--	--	--
67	350235108223201	04-25-59	--	--	--	110	0	164	--	--	--
76	350245108214601	02- -60	--	--	--	130	0	180	--	--	--
		01-05-81	--	1.90	--	120	0	--	--	--	--
80	350254108223901	09-21-78	--	--	0.010	94	94	--	--	190	--
82	350308108182701	01-05-81	1.90	1.90	--	140	0	--	--	--	--
83	350318108325601	07-31-72	--	--	M	10	0	325	--	--	--

Table 3.--Water-chemistry data for shallow wells--Continued

Well number on plate 1A	Latitude-longitude identification number	Date	Alkalinity, wat dis tot it field (mg/L as $CaCO_3$) (39087)	Calcium, dissolved (mg/L as Ca) (00915)	Magnesium, dissolved (mg/L As Mg) (00925)	Sodium, dissolved (mg/L as Na) (00930)	Sodium, percent (00932)	Sodium-adsorption ratio (00931)	Sodium plus potassium, dissolved (mg/L as Na) (00933)	Potassium, dissolved (mg/L as K) (00935)	Bicarbonate, water dis it field (mg/L as HCO_3) (00453)
7	343842108293401	06-13-88	--	4.0	1.2	140	95	16	--	1.6	277
19	344237108313001	11-21-80	--	30	20	8.5	10	0.3	--	4.1	--
25	344903108314601	07-02-53	--	170	54	--	--	--	280	--	--
		07-17-53	--	-	--	--	--	--	--	--	--
		07-29-53	--	180	56	--	--	--	230	--	--
		03-29-88	--	6.0	1.7	160	94	15	--	1.2	261
26	344903108314602	07-29-53	--	--	--	--	--	--	--	--	--
28	344931108270201	11-17-87	--	3.6	1.2	100	94	12	--	0.78	215
29	344933108174901	03-29-88	--	37	6.3	30	34	1	--	7.0	200
31	345112108310701	11-17-87	268	3.6	0.24	160	97	23	--	0.39	268
32	345137108341401	01-06-81	--	5.0	1.7	310	97	34	--	1.5	--
33	345318108242501	07-28-54	--	--	--	--	--	--	--	--	--
		07-28-54	--	11	2.8	--	--	--	82	--	--
34	345320108242601	05-14-75	--	110	34	60	24	1	--	4.0	--
36	345332108245001	11-17-87	--	4.8	3.4	85	86	7	--	2.4	195
38	345410108304801	01-08-81	--	1.9	0.30	210	99	39	--	0.70	--
40	345511108202101	07-14-69	--	--	--	--	--	--	--	--	--
		11-17-87	186	150	48	400	60	8	--	8.2	271
42	345710108262801	06-16-88	--	4.0	0.97	140	95	17	--	0.78	192
44	345753108303601	07-28-72	--	2.0	1.2	200	97	28	--	1.0	--
45	345754108301801	05-19-88	--	14	5.4	270	91	16	--	2.7	300
51	345947108243901	07-14-69	--	--	--	--	--	--	--	--	--
		10-25-72	--	6.0	2.4	140	92	13	--	1.2	--
		12-04-73	--	56	19	78	43	2	--	2.4	--
		09-21-78	-	52	18	80	46	3	--	2.7	--
		02-28-81	--	51	21	92	48	3	--	3.1	--
		01-15-87	--	51	23	83	44	2	--	4.0	--
60	350212108205601	09-02-62	--	33	12	--	--	--	46	--	--
67	350235108223201	04-25-59	--	31	7.9	--	--	--	55	--	--
76	350245108214601	02- -60	--	36	10	--	--	--	42	--	--
		01-05-81	--	30	11	41	42	2	--	2.9	--
80	350254108223901	09-21-78	--	18	12	140	75	6	--	5.1	--
82	350308108182701	01-05-81	--	36	12	43	40	2	--	2.0	--
83	350318108325601	07-31-72	--	0.14	2.4	380	98	52	--	5.0	--

Table 3.--Water-chemistry data for shallow wells--Continued

Well number on plate 1A	Latitude-longitude identification number	Date	Bicarbonate, water wh fet field (mg/L as HCO_3) (00440)	Carbonate, water dis it field (mg/L as CO_3) (00452)	Carbonate, wat dis incr t lab, as CO_3 (mg/L) (29809)	Carbonate water wh fet field (mg/L as CO_3) (00445)	Chloride, dissolved (mg/L as Cl) (00940)	Sulfate, dissolved (mg/L as SO_4) (00945)	Fluoride, dissolved (mg/L as F) (00950)	Silica, dissolved (mg/L as SiO_2) (00955)
7	343842108293401	06-13-88	--	15	0	--	12	40	1.7	--
19	344237108313001	11-21-80	--	--	--	--	2.9	0.80	2.1	13
25	344903108314601	07-02-53	350	--	--	0	10	920	0.10	12
		07-17-53	820	--	--	93	4.0	--	0.80	--
		07-29-53	380	--	--	0	10	820	0.20	10
		03-29-88	--	19	0	--	5.9	110	0.88	--
26	344903108314602	07-29-53	320	--	--	14	10	--	--	--
28	344931108270201	11-17-87	--	32	0	--	4.5	26	0.32	--
29	344933108174901	03-29-88	--	0	0	--	10	24	0.11	--
31	345112108310701	11-17-87	--	42	0	--	5.0	79	1.2	--
32	345137108341401	01-06-81	--	--	--	--	57	250	4.4	6.7
33	345318108242501	07-28-54	240	--	--	0	8.0	--	--	--
		07-28-54	220	--	--	0	5.0	30	0.50	12
34	345320108242601	05-14-75	250	--	--	11	19	300	0.50	--
36	345332108245001	11-17-87	--	36	21	--	3.4	34	0.37	--
38	345410108304801	01-08-81	--	--	--	--	6.6	160	1.9	7.7
40	345511108202101	07-14-69	--	--	--	--	--	--	--	--
		11-17-87	--	0	0	--	15	1,200	0.61	--
42	345710108262801	06-16-88	--	17	23	--	5.1	130	0.60	--
44	345753108303601	07-28-72	270	--	--	33	8.9	150	0.90	--
45	345754108301801	05-19-88	--	13	0	--	17	330	1.2	--
51	345947108243901	07-14-69	--	--	--	--	--	--	--	--
		10-25-72	--	--	--	--	14	55	0.64	--
		12-04-73	--	--	--	--	7.1	190	0.82	--
		09-21-78	--	--	--	--	8.9	210	0.68	--
		02-28-81	210	--	--	0	15	200	0.63	--
		01-15-87	--	--	--	--	5.0	210	0.63	--
60	350212108205601	09-02-62	220	--	--	0	16	18	0.20	29
67	350235108223201	04-25-59	200	--	--	0	23	24	0.20	29
76	350245108214601	02-[illegible]-60	220	--	--	2	14	17	0.30	34
		01-05-81	--	--	--	--	18	16	0.30	31
80	350254108223901	09-21-78	--	--	--	--	23	210	0.66	--
82	350308108182701	01-05-81	--	--	--	--	13	16	0.30	26
83	350318108325601	07-31-72	340	--	--	28	170	330	3.8	--

Table 3.--Water-chemistry data for shallow wells--Continued

Well number on plate 1A	Latitude-longitude identification number	Date	Arsenic, dissolved (ug/L as As) (01000)	Barium, dissolved (ug/L as Ba) (01005)	Boron, dissolved (ug/L as B) (01020)	Cadmium, dissolved (ug/L as Cd) (01025)	Chromium, dissolved (ug/L as Cr) (01030)	Iron, total recoverable (ug/L as Fe) (01045)	Iron, dissolved (ug/L as Fe) (01046)	Lead, dissolved (ug/L as Pb) (01049)
7	343842108293401	06-13-88	<1	55	980	<1	<1	--	20	<1
19	344237108313001	11-21-80	--	--	130	--	--	--	40	--
25	344903108314601	07-02-53	--	--	--	--	--	--	--	--
		07-17-53	--	--	--	--	--	--	--	--
		07-29-53	--	--	--	--	--	--	--	--
		03-29-88	<1	20	560	<1	<1	--	20	14
26	344903108314602	07-29-53	--	--	--	--	--	--	--	--
28	344931108270201	11-17-87	<1	15	0	<1	<1	--	440	<1
29	344933108174901	03-29-88	1	200	280	<1	<1	--	580	6
31	345112108310701	11-17-87	<1	25	260	<1	<1	--	20	<1
32	345137108341401	01-06-81	--	--	560	--	--	--	50	--
33	345318108242501	07-28-54	--	--	--	--	--	--	--	--
		07-28-54	--	--	--	--	--	--	--	--
34	345320108242601	05-14-75	--	--	0	--	--	--	3,500	--
36	345332108245001	11-17-87	<1	50	0	<1	<1	--	15	<1
38	345410108304801	01-08-81	--	--	380	--	--	--	50	--
40	345511108202101	07-14-69	--	--	--	--	--	--	--	--
		11-17-87	2	880	390	<1	<1	--	8,300	<1
42	345710108262801	06-16-88	2	30	840	<1	<1	--	20	3
44	345753108303601	07-28-72	--	--	420	--	--	--	180	--
45	345754108301801	05-19-88	<1	160	960	<1	<1	--	10	<1
51	345947108243901	07-14-69	--	--	--	--	--	--	--	--
		10-25-72	--	--	590	--	--	--	180	--
		12-04-73	--	--	190	--	--	--	--	--
		09-21-78	--	--	80	--	--	--	--	--
		02-28-81	--	--	--	--	--	<250	--	--
		01-15-87	1	140	270	0	1	--	250	1
60	350212108205601	09-02-62	--	--	--	--	--	--	--	--
67	350235108223201	04-25-59	--	--	--	--	--	--	0	--
76	350245108214601	02- -60	--	--	--	--	--	--	--	--
		01-05-81	--	--	40	--	--	--	20	--
80	350254108223901	09-21-78	--	--	140	--	--	--	30	--
82	350308108182701	01-05-81	--	--	30	--	--	--	30	--
83	350318108325601	07-31-72	--	--	660	--	--	--	M	--

Table 3.--Water-chemistry data for shallow wells--Continued

Well number on plate 1A	Latitude-longitude identification number	Date	Mercury, dissolved (ug/L as Hg) (71890)	Selenium, dissolved (ug/L as Se) (01145)	Silver, dissolved (ug/L as Ag) (01075)	Potassium 40, dissolved (pCi/L as K40) (82068)	Elevation of land-surface datum (feet above sea level) 72000)	Total depth of hole (feet) (72001)	Depth to top of water-bearing zone (feet) (72002)	Total depth of well (feet) (72008)
7	343842108293401	06-13-88	<0.2	<2	<1.0	--	7,330	--	--	--
19	344237108313001	11-21-80	--	--	--	--	7,196	10	--	10.00
25	344903108314601	07-02-53	--	--	--	--	7,200	--	65	95.00
		07-17-53	--	--	--	--	7,200	--	480	530.00
		07-29-53	--	--	--	--	7,200	--	--	589.00
		03-29-88	<0.2	<2	<1.0	--	7,200	--	--	589.00
26	344903108314602	07-29-53	--	--	--	--	--	--	--	--
28	344931108270201	11-17-87	<0.2	<2	<1.0	--	7,330	--	--	--
29	344933108174901	03-29-88	<0.2	<2	<1.0	--	7,595	--	--	536.00
31	345112108310701	11-17-87	<0.2	<2	<1.0	--	7,300	--	--	460.00
32	345137108341401	01-06-81	--	--	--	1.1	7,090	665	--	665.00
33	345318108242501	07-28-54	--	--	--	--	--	--	372	465.00
		07-28-54	--	--	--	--	--	--	372	465.00
34	345320108242601	05-14-75	--	--	--	--	--	--	--	--
36	345332108245001	11-17-87	<0.2	<2	<1.0	--	7,452	--	--	446.00
38	345410108304801	01-08-81	--	--	--	0.50	7,235	--	--	265.00
40	345511108202101	07-14-69	--	--	--	--	7,306	--	--	361.00
		11-17-87	<0.2	<2	<1.0	--	7,306	--	--	361.00
42	345710108262801	06-16-88	<0.2	<2	<1.0	--	7,275	--	--	820.00
44	345753108303601	07-28-72	--	--	--	--	7,160	--	--	125.00
45	345754108301801	05-19-88	<0.2	<2	<1.0	--	--	--	--	125.00
51	345947108243901	07-14-69	--	-	-	--	--	--	--	280.00
		10-25-72	--	-	--	--	--	--	--	280.00
		12-04-73	--	--	-	--	--	--	-	280.00
		09-21-78	--	--	--	--	--	--	--	280.00
		02-28-81	--	--	--	--	--	--	--	280.00
		01-15-87	0.2	2	2.0	--	--	--	--	280.00
60	350212108205601	09-02-62	--	--	--	--	--	--	--	225.00
67	350235108223201	04-25-59	--	-	--	--	7,160	--	--	231.00
76	350245108214601	02- -60	--	--	--	--	7,161	--	--	200.00
		01-05-81	--	--	--	--	7,162	202	--	202.00
80	350254108223901	09-21-78	--	--	--	--	7,137	--	--	213.00
82	350308108182701	01-05-81	--	--	--	--	7,278	--	--	--
83	350318108325601	07-31-72	--	--	--	--	7,069	--	--	707.00

Table 3.--Water-chemistry data for shallow wells--Continued

Well number on plate 1A	Latitude-longitude identification number	Aquifer code	Date	Time	Flow rate, instantaneous (gal/min) (00059)	Solids, dissolved (tons per acre-ft) (70303)	Solids, sum of constituents, dissolved (mg/L) (70301)	Solids, residue at 180 deg. C, dissolved (mg/L) (70300)
85	350328108324601	211DKOT	05-18-88	1530	--	1.97	1,420	1,450
87	350443108224701	110AVMB	10-18-68	--	--	0.42	149	312
			08-30-71	-	--	0.37	136	273
89	350522108264001	211DKOT	06-27-88	1130	--	0.74	568	545
92	350538108261801	313SADG	09-30-75	--	--	0.46	343	340
94	350649108381101	211GLLP	06-14-88	1000	--	2.16	1,680	1,590
99	350730108471301	310GLRT	02-27-80	1400	100	1.21	889	--
104	350808108293901	--	09-29-64	--	15	0.59	425	436
105	350808108295501	110AVMB	09-29-64	--	8.0	0.60	427	441
107	350818108313401	211DKOT	11-18-87	1445	--	1.18	867	868
109	350836108260301	110AVMB	01-07-81	0900	2.0	0.37	273	--
110	350925108375901	211DKOT	05-18-88	1130	--	1.67	1,200	1,230
114	351022108560401	221ZUNIS	09-05-79	--	--	0.26	189	--
119	351131108512201	110AVMB	03-30-88	1030	--	0.27	162	200
132	351330108393201	211DLCOC	04-01-76	--	--	0.47	654	342
133	351407108513601	--	08-03-67	--	--	0.47	184	346
135	351430108443301	211GLLP	11-19-87	1300	-	0.41	168	302
137	351442108265101	110AVMB	06-14-88	1310	--	0.33	239	242
140	351505109003201	--	07-07-67	--	--	0.38	165	282
			11-19-69	--	-	--	--	284
141	351532108443701	211GLLP	07-02-73	--	--	0.94	391	690
143	351647108393201	211GLLP	08-01-72	--	--	0.86	813	632
146	351656109000201	--	02-01-71	--	--	--	--	319
			05-03-71	--	--	0.46	165	336
147	351722108452101	--	12-05-33	--	--	0.21	156	--
151	351823108515101	211DKOT	11-20-87	1030	--	0.38	305	281
153	351853108482701	211GLLP	11-19-87	1000	--	0.54	377	394
167	352012108264401	110AVMB	06-14-88	1208	--	0.32	215	237
169	352018108290202	--	06-14-88	0950	--	0.47	184	344
171	352022108495001	--	04-18-67	--	--	0.38	240	276
			11-04-68	--	--	0.33	133	242

Table 3.--Water-chemistry data for shallow wells--Continued

Well number on plate 1A	Latitude-longitude identification number	Date	Specific conductance (uS/cm) (00095)	Specific conductance, lab (uS/cm) (90095)	pH (standard units) (00400)	pH, lab (standard units) (00403)	Temperature water (deg. C) (00010)	Nitrogen, nitrate, dissolved (mg/L as N) (00618)	Nitrogen, nitrate, dissolved (mg/L as NO_3) (71851)	Nitrogen, nitrate, dissolved (mg/L as NO_2) (71856)
85	350328108324601	05-18-88	--	2,650	--	8.64	--	--	0.23	0.01
87	350443108224701	10-18-68	--	490	--	8.40	--	--	0.74	--
		08-30-71	--	460	--	8.50	--	--	0.12	--
89	350522108264001	06-27-88	810	856	8.11	8.61	--	--	0.0	0.0
92	350538108261801	09-30-75	550	--	8.00	--	32.0	0.140	0.62	--
94	350649108381101	06-14-88	2,200	2,460	8.12	8.87	--	--	0.02	0.01
99	350730108471301	02-27-80	1,270	--	7.20	--	21.0	--	--	--
104	350808108293901	09-29-64	702	--	7.50	--	--	0.810	3.6	--
105	350808108295501	09-29-64	705	--	7.30	--	--	0.750	3.3	--
107	350818108313401	11-18-87	1,190	1,180	7.27	6.89	12.0	--	0.47	0.01
109	350836108260301	01-07-81	800	771	8.50	8.00	6.0	--	--	--
110	350925108375901	05-18-88	--	1,980	--	7.77	--	--	0.02	0.01
114	351022108560401	09-05-79	304	--	8.10	--	19.5	--	--	--
119	351131108512201	03-30-88	298	325	7.66	7.73	13.0	--	2.4	0.0
132	351330108393201	04-01-76	660	--	7.90	--	--	--	M	--
133	351407108513601	08-03-67	--	560	--	7.80	--	--	1.4	--
135	351430108443301	11-19-87	520	520	--	7.28	--	--	0.02	0.09
137	351442108265101	06-14-88	409	406	7.54	7.47	15.0	--	0.01	0.0
140	351505109003201	07-07-67	--	510	--	9.30	--	--	3.1	--
		11-19-69		480		8.90			6.2	
141	351532108443701	07-02-73	--	970	--	8.60	--	--	1.9	--
143	351647108393201	08-01-72	1,190	--	8.20	--	16.0	0.140	0.62	--
146	351656109000201	02-01-71	--	540	--	9.40	--	--	0.62	--
		05-03-71	--	540	--	9.50	--	--	1.2	--
147	351722108452101	12-05-33	--	--	--	--	8.0	2.20	9.7	--
151	351823108515101	11-20-87	488	463	8.91	8.53	15.0	--	0.0	0.0
153	351853108482701	11-19-87	600	654	6.82	6.74	10.0	--	0.0	0.0
167	352012108264401	06-14-88	405	401	7.48	7.38	15.5	--	3.8	0.0
169	352018108290202	06-14-88	550	563	6.61	7.77	11.0	--	1.8	0.01
171	352022108495001	04-18-67	--	470	--	9.50	--	--	--	--
		11-04-68	--	400	--	8.30	--	--	0.12	--

Table 3.--Water-chemistry data for shallow wells--Continued

Well number on plate 1A	Latitude-longitude identification number	Date	Nitrogen, NO_2+NO_3 dissolved (mg/L as N) (00631)	Phosphorus, dissolved (mg/L as P) (00666)	Hardness, total (mg/L as $CaCO_3$) (00900)	Hardness, noncarb wh wat tot fld (mg/L as $CaCO_3$) (00902)	Alkalinity, wat wh tot fet field (mg/L as $CaCO_3$) (00410)	Alkalinity, methyl orange (mg/L) (00411)	Alkalinity, wat dis tot it field (mg/L as $CaCO_3$) (39086)	Alkalinity, wat dis tot it field (mg/L as $CaCO_3$) (39087)
85	350328108324601	05-18-88	--	0.00	78	0	277	--	284	--
87	350443108224701	10-18-68	--	0.040	160	160	--	210	--	--
		08-30-71	--	--	120	120	--	190	--	--
89	350522108264001	06-27-88	--	0.00	160	0	234	--	236	-
92	350538108261801	09-30-75	--	M	290	71	217	--	--	--
94	350649108381101	06-14-88	--	0.00	82	0	303	--	304	--
99	350730108471301	02-27-80	0.030	--	390	320	71	--	--	--
104	350808108293901	09-29-64	--	--	360	79	279	--	--	--
105	350808108295501	09-29-64	--	--	360	71	287	--	--	--
107	350818108313401	11-18-87	--	0.00	660	360	300	--	300	261
109	350836108260301	01-07-81	1.20	--	68	68	--	--	--	--
110	350925108375901	05-18-88	--	0.00	160	0	339	--	338	--
114	351022108560401	09-05-79	1.40	--	110	0	130	--	--	--
119	351131108512201	03-30-88	--	0.060	150	4	142	--	145	--
132	351330108393201	04-01-76	--	0.060	240	0	303	--	--	--
133	351407108513601	08-03-67	--	0.010	240	250	--	220	--	--
135	351430108443301	11-19-87	--	0.00	200	200	--	--	--	182
137	351442108265101	06-14-88	--	0.020	230	20	207	--	208	--
140	351505109003201	07-07-67	--	--	10	10	--	170	--	--
		11-19-69	--	--	--	8	--	170	--	--
141	351532108443701	07-02-73	-	0.020	15	15	-	250	-	
143	351647108393201	08-01-72	--	M	490	130	360	--	--	--
146	351656109000201	02-01-71	--	0.010	--	8	--	170	--	--
		05-03-71	--	--	8	8	--	160	--	--
147	351722108452101	12-05-73			130	44	82	-	--	
151	351823108515101	11-20-87	--	0.050	15	0	206	--	210	--
153	351853108482701	11-19-87	--	0.00	310	39	273	--	278	254
167	352012108264401	06-14-88	--	0.060	210	24	182	--	182	--
169	352018108290202	06-14-88	--	0.060	260	260	3	--	2	--
171	352022108495001	04-18-67	--	--	33	33	--	89	--	--
		11-04-68	--	--	120	120	--	160	--	-

Table 3.--Water-chemistry data for shallow wells--Continued

Well number on plate 1A	Latitude-longitude identification number	Date	Magnesium, dissolved (mg/L as Mg) (00925)	Sodium, dissolved (mg/L as Na) (00930)	Sodium, percent (00932)	Sodium-adsorption ratio (00931)	Sodium plus potassium, dissolved (mg/L as Na) (00933)	Potassium, dissolved (mg/L as K) (00935)	Bicarbonate, water dis it field (mg/L as NCO_3) (00453)	Bicarbonate, wat dis incr t lab, as HCO_3 (mg/L) (29806)	Bicarbonate, water wh fet field (mg/L as HCO_3) (00440)
85	350328108324601	05-18-88	5.6	470	92	24	--	3.9	324	260	--
87	350443108224701	10-18-68	15	49	40	2	--	2.5	--	--	--
		08-30-71	17	53	48	2	--	3.9	--	--	--
89	350522108264001	06-27-88	15	140	65	5	--	2.0	288	240	--
92	350538108261801	09-30-75	25	12	8	0.3	--	2.0	--	--	250
94	350649108381101	06-14-88	1.7	560	93	28	--	4.7	308	270	--
99	350730108471301	02-27-80	27	120	40	3	130	9.1	--	--	--
104	350808108293901	09-29-64	20	--	--	--	19	--	--	--	340
105	350808108295501	09-29-64	20	--	--	--	20	--	--	--	350
107	350818108313401	11-18-87	34	23	7	0.4	--	0.78	366	320	--
109	350836108260301	01-07-81	7.3	150	83	8	--	1.0	--	--	--
110	350925108375901	05-18-88	14	350	83	13	--	4.7	412	370	--
114	351022108560401	09-05-79	8.2	24	31	1	25	1.2	--	--	--
119	351131108512201	03-30-88	5.1	4.6	6	0.2	--	1.2	177	170	--
132	351330108393201	04-01-76	22	55	17	2	--	270	--	--	370
133	351407108513601	08-03-67	8.5	29	20	0.8	--	1.7	--	--	--
135	351430108443301	11-19-87	10	32	26	1	--	3.1	--	220	--
137	351442108265101	06-14-88	4.1	0.0	0	0	--	0.0	254	240	--
140	351505109003201	07-07-67	0.61	110	--	16	--	--	--	--	--
		11-19-69	--	110	--	17	--	0.39	--	--	--
141	351532108443701	07-02-73	1.2	220	97	26	--	1.6	--	--	--
143	351647108393201	08-01-72	74	160	41	3	--	8.0	--	--	400
146	351656109000201	02-01-71	--	120	--	20	--	1.2	--	--	--
		05-03-71	0.61	120	--	20	--	--	--	--	--
147	351722108452101	12-05-33	8.7	8.0	--	0.3	--	--	--	--	100
151	351823108515101	11-20-87	1.5	110	93	13	--	2.4	222	230	--
153	351853108482701	11-19-87	15	18	11	0.5	--	3.5	339	310	--
167	352012108264401	06-14-88	19	6.9	7	0.2	--	1.2	222	210	--
169	352018108290202	06-14-88	7.1	21	15	0.6	--	2.0	2	280	--
171	352022108495001	04-18-67	4.3	91	83	7	--	6.3	--	--	--
		11-04-68	9.1	38	39	2	--	7.1	--	--	--

Table 3.--Water-chemistry data for shallow wells--Continued

Well number on plate 1A	Latitude-longitude identification number	Date	Carbonate, water dis it field (mg/L as CO_3) (00452)	Carbonate, wat dis incr t lab, as CO_3 (mg/L) (29809)	Carbonate, water wh fet field (mg/L as CO_3) (00445)	Chloride, dissolved (mg/L as Cl) (00940)	Sulfate, dissolved (mg/L as SO_4) (00945)	Fluoride, dissolved (mg/L as F) (00950)	Silica, dissolved (mg/L as SiO_2) (00955)	Arsenic, dissolved (ug/L as As) (01000)	Barium, dissolved (ug/L as Ba) (01005)
85	350328108324601	05-18-88	11	19	--	300	450	2.5	--	<1	170
87	350443108224701	10-18-68	--	--	--	16	27	0.17	--	--	--
		08-30-71	--	--	--	16	26	0.27	--	--	--
89	350522108264001	06-27-88	0	27	--	11	220	0.28	--	<1	190
92	350538108261801	09-30-75	--	--	7	7.5	84	0.40	--	--	--
94	350649108381101	06-14-88	31	0	--	390	500	2.9	--	<1	130
99	350730108471301	02-27-80	--	--	--	34	540	0.60	4.4	2	20
104	350808108293901	09-29-64	--	--	0	13	81	0.30	13	--	--
105	350808108295501	09-29-64	--	--	0	13	81	0.30	12	--	--
107	350818108313401	11-18-87	0	0	--	23	400	0.33	--	<1	350
109	350836108260301	01-07-81	--	--	--	52	31	0.60	11	--	--
110	350925108375901	05-18-88	0	0	--	11	580	0.36	--	<1	310
114	351022108560401	09-05-79	--	--	--	7.2	11	0.30	21	--	--
119	351131108512201	03-30-88	0	0	--	4.6	10	0.13	--	3	650
132	351330108393201	04-01-76	--	--	M	11	53	0.98	--	--	--
133	351407108513601	08-03-67	--	--	--	29	31	0.55	--	--	--
135	351430108443301	11-19-87	--	0	--	43	16	0.16	--	<1	400
137	351442108265101	06-14-88	0	0	--	4.1	18	0.18	--	2	750
140	351505109003201	07-07-67	--	--	--	17	33	0.35	--	--	--
		11-19-69	--	--	--	9.9	16	0.45	--	--	--
141	351532108443701	07-02-73	--	--	--	43	120	0.72	--	--	--
143	351647108393201	08-01-72	--	--	19	60	200	0.60	--	--	--
146	351656109000201	02-01-71	--	--	--	12	28	0.60	--	--	--
		05-03-71	--	--	--	8.2	33	0.66	--	--	--
147	351722108452101	12-05-33	--	--	0	20	24	0.0	--	--	--
151	351823108515101	11-20-87	17	0	--	10	54	0.35	--	3	50
153	351853108482701	11-19-87	0	0	--	28	48	0.12	--	<1	380
167	352012108264401	06-14-88	0	0	--	7.8	19	0.25	--	2	350
169	352018108290202	06-14-88	0	0	--	32	24	0.82	--	5	370
171	352022108495001	04-18-67	--	--	--	22	110	0.55	--	--	--
		11-04-68	--	--	--	3.9	41	0.30	--	--	--

Table 3.--Water-chemistry data for shallow wells--Continued

Well number on plate 1A	Latitude-longitude identification number	Date	Boron, dissolved (ug/L as B) (01020)	Cadmium, dissolved (ug/L as Cd) (01025)	Chromium, dissolved (ug/L as Cr) (01030)	Iron, total recoverable (ug/L as Fe) (01045)	Iron, dissolved (ug/L as Fe) (01046)	Lead, dissolved (ug/L as Pb) (01049)	Manganese, dissolved (ug/L as Mn) (01056)
85	350328108324601	05-18-88	1,900	<1	<1	--	15	<1	6
87	350443108224701	10-18-68	--	--	--	--	70	--	--
		08-30-71	--	--	--	--	--	--	--
89	350522108264001	06-27-88	550	<1	<1	--	20	<1	82
92	350538108261801	09-30-75	M	--	--	--	M	--	--
94	350649108381101	06-14-88	980	<1	<1	--	10	<1	6
99	350730108471301	02-27-80	--	16	0	--	800	0	340
104	350808108293901	09-29-64	--	--	--	10	0	--	--
105	350808108295501	09-29-64	--	--	--	140	50	--	--
107	350818108313401	11-18-87	0	<1	<1	--	1,200	<1	260
109	350836108260301	01-07-81	280	--	--	--	20	--	2
110	350925108375901	05-18-88	960	<1	<1	--	10	<1	220
114	351022108560401	09-05-79	--	--	--	--	60	--	20
119	351131108512201	03-30-88	280	<1	<1	--	25	<1	<4
132	351330108393201	04-01-76	190	--	--	--	M	--	--
133	351407108513601	08-03-67	250	--	--	--	70	--	--
135	351430108443301	11-19-87	0	<1	<1	--	1,600	<1	48
137	351442108265101	06-14-88	1,300	<1	<1	--	1,900	2	480
140	351505109003201	07-07-67	500	--	--	--	230	--	--
		11-19-69	250	--	--	--	190	--	--
141	351532108443701	07-02-73	180	--	--	--	140	--	--
143	351647108393201	08-01-72	200	--	--	--	0	--	--
146	351656109000201	02-01-71	360	--	--	--	270	--	--
		05-03-71	360	--	--	--	350	--	--
147	351722108452101	12-05-33	--	--	--	--	--	--	--
151	351823108515101	11-20-87	0	<1	<1	--	10	<1	10
153	351853108482701	11-19-87	0	<1	<1	--	<10	<1	34
167	352012108264401	06-14-88	690	<1	<1	--	15	<1	4
169	352018108290202	06-14-88	550	<1	<1	--	15	<1	<4
171	352022108495001	04-18-67	--	--	--	--	40	--	--
		11-04-68	--	--	--	--	110	--	--

Table 3.--Water-chemistry data for shallow wells--Concluded

Well number on plate 1A	Latitude-longitude identification number	Date	Mercury, dissolved (ug/L as Hg) (71890)	Selenium, dissolved (ug/L as Se) (01145)	Silver, dissolved (ug/L as Ag) (01075)	Potassium 40, dissolved (pCi/L as K-40) (82068)	Elevation of land-surface datum (feet above sea level) (72000)	Total depth of hole (feet) (72001)	Total depth of well (feet) (72008)	Water level below land surface (feet) (72019)
85	350328108324601	05-18-88	<0.2	<2	<1.0	--	--	--	707.00	--
87	350443108224701	10-18-68	--	--	--	--	7,150	--	388.00	--
		08-30-71	--	--	--	--	7,150	--	388.00	--
89	350522108264001	06-27-88	<0.2	<2	<1.0	--	7,070	--	565.00	--
92	350538108261801	09-30-75	--	--	--	--	7,096	--	--	--
94	350649108381101	06-14-88	<0.2	<2	<1.0	--	--	--	282.00	--
99	350730108471301	02-27-80	0	0	0	--	6,441	--	1,175.00	--
104	350808108293901	09-29-64	--	--	--	--	--	--	120.00	40.00
105	350808108295501	09-29-64	--	--	--	--	--	--	112.00	20.00
107	350818108313401	11-18-87	<0.2	<2	<1.0	--	--	--	227.00	--
109	350836108260301	01-07-81	--	--	--	0.70	7,130	120	120.00	--
110	350925108375901	05-18-88	<0.2	<2	<1.0	--	--	--	760.00	--
114	351022108560401	09-05-79	--	--	--	--	7,020	--	500.00	227.10
119	351131108512201	03-30-88	<0.2	<2	<1.0	--	--	--	94.00	--
132	351330108393201	04-01-76	--	--	--	--	6,868	--	583.00	--
133	351407108513601	08-03-67	--	--	-	--	--	--	86.00	--
135	351430108443301	11-19-87	<0.2	<2	<1.0	--	--	--	635.00	--
137	351442108265101	06-14-88	<0.2	<2	<1.0	--	--	--	100.00	--
140	351505109003201	07-07-67	--	--	--	--	--	--	541.00	--
		11-19-69	--	-		--	-	--	541.00	-
141	351532108443701	07-02-73	--	--	--	--	--	--	749.00	--
143	351647108393201	08-01-72	--	--	--	--	6,860	--	100.00	--
146	351656109000201	02-01-71	--	--	--	--	--	--	565.00	--
		05-03-71	--	--	--	--	--	--	565.00	--
147	351722108452101	12-05-33	--	--	--	--	--	--	44.00	35.00
151	351823108515101	11-20-87	<0.2	<2	<1.0	--	--	--	832.00	--
153	351853108482701	11-19-87	<0.2	<2	<1.0	--	--	--	497.00	--
167	352012108264401	06-14-88	<0.2	<2	<1.0	--	--	--	75.00	--
169	352018108290202	06-14-88	<0.2	<2	<1.0	--	7,922	--	190.00	--
171	352022108495001	04-18-67	--	--	--	--	--	--	591.00	--
		11-04-68	--	-		--	--	--	591.00	

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