Geophysical Logs and Hydrologic Data for Eight Wells in the Coyote Spring Valley Area, Clark and Lincoln Counties, Nevada

By David L. Berger, Kathryn C. Kilroy, and Donald H. Schaefer

U.S. GEOLOGICAL SURVEY

Open-File Report 87-679

Prepared in cooperation with the
STATE OF NEVADA, the
LAS VEGAS VALLEY WATER DISTRICT, and the
U. S. BUREAU OF RECLAMATION

Carson City, Nevada

1988

DEPARTMENT OF THE INTERIOR

DONALD PAUL HODEL, Secretary

U.S. GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information
write to:

U.S. Geological Survey
Room 227, Federal Building
705 North Plaza Street
Carson City, NV 89701

Copies of this report may be
purchased from:

U.S. Geological Survey
Books and Open-File Reports Section
Federal Center
Box 25425
Denver, CO 80225

CONTENTS

ILLUSTRATIONS

TABLES

CONVERSION FACTORS AND ABBREVIATIONS

"Inch-pound" units of measure used in this report may be converted to metric (International System) units by using the following factors:

Multiply	*By*	*To obtain*
Cubic foot per minute (ft^3/min)	0.02832	Cubic meter per minute (m^3/min)
Foot (ft)	0.3048	Meter (m)
Foot per minute (ft/min)	0.3048	Meter per minute (m/min)
Gallon (gal)	3.785	Liter (L)
Gallon per day (gal/day)	3.785	Liter per day (L/day)
Gallon per minute (gal/min)	0.06309	Liter per second (L/s)
Inch (in.)	25.40	Millimeter (mm)
Mile (mi)	1.609	Kilometer (km)
Square mile (mi^2)	2.590	Square kilometer (km^2)

For temperature, degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) by using the formula °F = [(1.8)(°C)] + 32.

ALTITUDE DATUM

In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929), which is derived from a general adjustment of the first-order leveling networks of both the United States and Canada.

GEOPHYSICAL LOGS AND HYDROLOGIC DATA FOR EIGHT WELLS IN THE COYOTE SPRING VALLEY AREA, CLARK AND LINCOLN COUNTIES, NEVADA

By David L. Berger, Kathryn C. Kilroy, and Donald H. Schaefer

ABSTRACT

Geophysical logs, drilling operations, pump-test data, and water-quality determinations are presented for eight wells in the Coyote Spring Valley area of southeastern Nevada. The wells are in an area where thick units of Paleozoic carbonate rock are overlain by Tertiary semiconsolidated basin-fill deposits and Quaternary alluvial deposits. Data collected by the U.S. Geological Survey were augmented with data from previous investigations; however, complete sets of logs and other data are not available for all eight wells. Geophysical data presented include natural-gamma, neutron, gamma-gamma density, caliper, water-temperature, acoustic, single-point resistance, long- and short-normal resistivity, and spontaneous-potential logs. Drilling penetration rates, lithologic columns, and well construction are also summarized and presented. Measurements of drawdown and recovery during and after constant-discharge pumping periods are also included. Also presented are results of chemical and physical analyses for major-ion chemistry, trace constituents, stable and radioactive isotopes, temperature, pH, specific conductance, and dissolved oxygen.

INTRODUCTION

In 1985, the U.S. Geological Survey began investigating the geology and hydrology in southern Nevada to better understand the regional carbonate-rock aquifer systems. This study, known as the Nevada Carbonate Aquifers Program (NCAP), is being made in cooperation with the State of Nevada, the Las Vegas Valley Water District, and the U.S. Bureau of Reclamation.

As part of the NCAP, geophysical, lithologic, hydrologic, and geochemical data were collected from eight wells: three wells drilled by the Geological Survey in 1985, four drilled by the U.S. Air Force for the Nevada-Utah MX missile-siting investigation, and one well that apparently was drilled as a stock well prior to 1958. Figure 1 shows the location of all eight wells, and table 1 lists identifying information for each well.

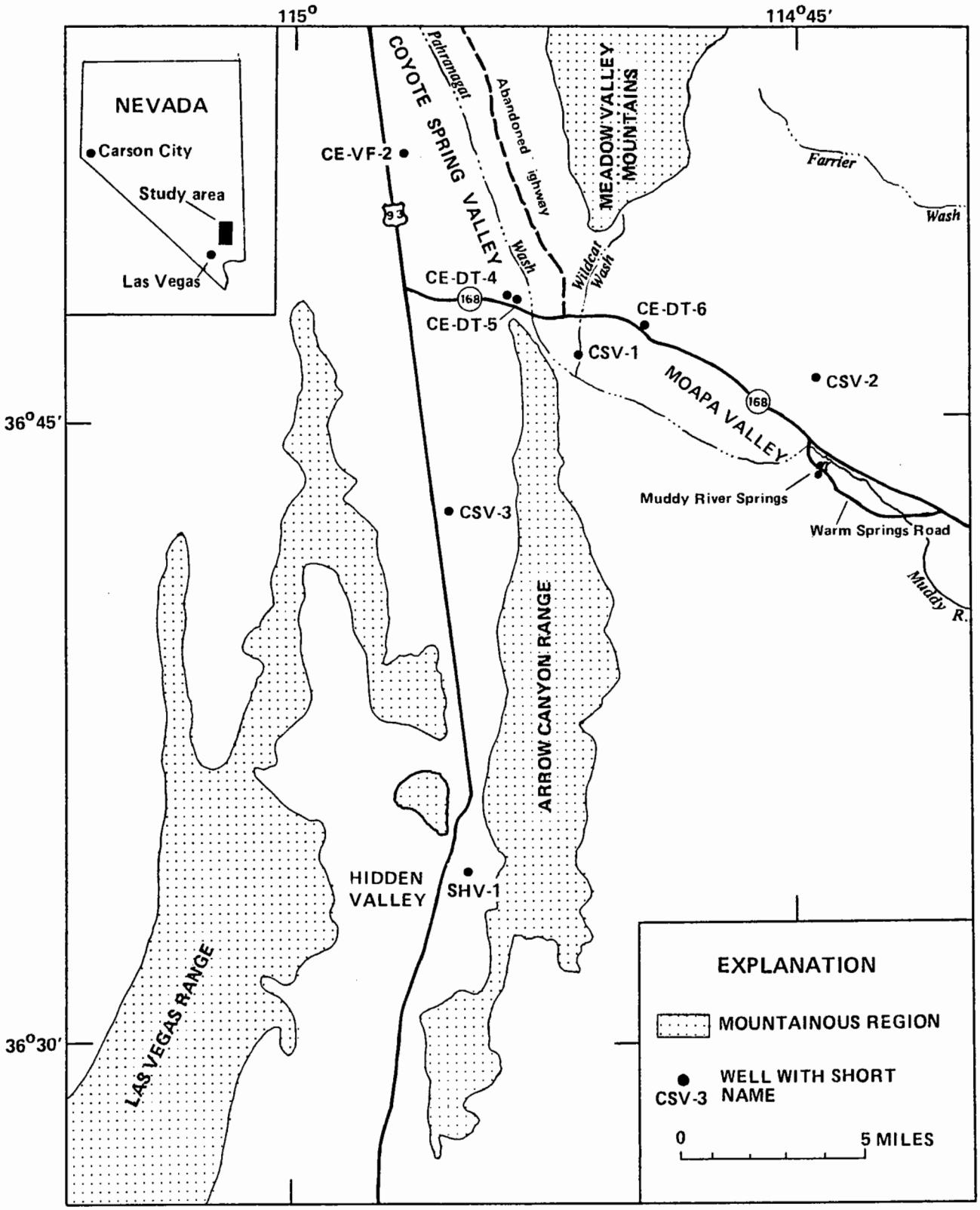

FIGURE 1.--Location of wells in study area.

TABLE 1.--*Well locations, water levels, and other information for the eight wells and for one additional observation well in the study area*

Short well name[1]	Local site identification[1]	Latitude and longitude (degrees, minutes, seconds)		Date of construction	Land-surface altitude (feet above sea level)	Well depth (feet below land surface)	Water level		
							Date	Feet below land surface	Source of measurement[2]
CSV-1	219 S13 E64 31DAAD1	36 46 01	114 51 43	10-16-85	2,158.6	765	11-11-85	343.90	USGS
							12-17-85	344.70	USGS
							09-11-87	343.44	USGS
CSV-2	219 S13 E65 28BDAC1	36 46 50	114 43 20	10-26-85	2,185.9	478	10-27-85	391.80	USGS
							12-30-85	390.21	USGS
							06-07-86	390.76	USGS
							09-11-87	390.94	USGS
CSV-3	210 S14 E63 28ACDC1	36 41 27	114 55 30	11-24-85	2,414.3	780	12-20-85	585.00	USGS
							02-19-86	587.50	USGS
							09-13-87	589.45	USGS
CE-DT-4	210 S13 E63 23DDDC1	36 47 43	114 53 31	11-20-80	2,172.6	669	12-12-80	354.00	ERTEC
							06-28-81	352.30	ERTEC
							03-14-85	351.77	USGS
							12-04-85	350.00	USGS
							09-11-87	351.79	USGS
							09-13-87	351.75	USGS
CE-DT-5	210 S13 E63 23DDDD1	36 47 41	114 53 28	04-14-81	2,169.1	628	05-06-81	352.40	ERTEC
							07-04-81	348.50	ERTEC
							08-13-81	349.20	ERTEC
							03-14-85	347.84	USGS
							12-03-85	348.50	USGS
							09-11-87	348.72	USGS
							09-13-87	348.86	USGS
CE-DT-6	210 S13 E64 35ACAA1	36 46 04	114 47 13	05-21-81	2,274.6	937	06-03-81	458.00	ERTEC
							06-06-81	457.00	ERTEC
							07-11-81	457.40	ERTEC
							08-11-81	457.80	ERTEC
							03-14-85	457.37	USGS
							06-18-85	457.34	USGS
							09-11-87	459.16	USGS
							09-13-87	459.47	USGS
CE-VF-1	210 S12 E63 29DDCC1	36 52 32	114 55 44	11-13-80	2,464.2	714	01-28-86	542.98	USGS
							01-29-86	543.00	USGS
							02-05-86	542.80	USGS
							02-06-86	542.70	USGS
							09-13-87	548.55	USGS
CE-VF-2	210 S12 E63 29DABC1	36 52 27	114 55 44	12-15-80	2,466.9	1,221	07-11-81	611.70	ERTEC
							09-29-81	609.00	ERTEC
							02-05-85	603.10	USGS
							11-25-85	602.00	USGS
							01-28-86	604.62	USGS
							01-29-86	604.10	USGS
							02-04-86	604.30	USGS
SHV-1	217 S16 E63 09DDAB1	36 33 08	114 55 30	unknown	2,648.8	920	12-30-85	833.20	USGS
							09-13-87	831.00	USGS

[1] In this table, each site is identified by a short well name, the local (Nevada) site-identification system, and by latitude and longitude. Except for this table, only the short well name (for example, SHV-1) is used in the report, for convenience. The local site-identification system is based on an index of hydrographic areas in Nevada (Rush, 1968) and on the rectangular subdivision of the public lands referenced to the Mount Diablo base line and meridian. Each number consists of four units separated by spaces: The first unit is the hydrographic area number. The second unit is the township, preceded by an N or S to indicate location north or south of the base line. The third unit is the range, preceded by an E to indicate location east of the meridian. The fourth unit consists of the section number and letters designating the quarter section, quarter-quarter section, and so on (A, B, C, and D indicate the northeast, northwest, southwest, and southeast quarters, respectively), followed by a number indicating the sequence in which the well was recorded. For example, well 217 S16 E63 09DDAB1 is in Hidden Valley (hydrographic area 217). It is the first well recorded in the NW¼ of the NE¼ of the SE¼ of the SE¼ of section 9, Township 16 South, Range 63 East, Mount Diablo base line and meridian.

[2] ERTEC, Ertec Western, Inc.; USGS, U.S. Geological Survey.

The wells are in an area encompassing approximately 400 mi^2; it includes Coyote Spring Valley, Hidden Valley, and the Muddy River Springs area. This area lies within the southern portion of the Basin and Range Province. Tertiary basin-fill deposits and Quaternary alluvial deposits overlie thick units of Paleozoic carbonate rock. Five wells in this study area are completed in the carbonate-rock aquifer.

The data were collected for future analysis to determine *in-situ* hydrogeologic conditions of the carbonate-rock aquifer, and thereby increase the understanding of regional flow systems in southern Nevada.

The authors thank the residents of nearby Moapa Valley for their assistance in completing the field work. A special thanks is given to Robert Plummer for his hospitality. We also acknowledge the support and cooperation of the U.S. Air Force for the use of their data from the exploratory MX project.

METHODOLOGY

Drilling Operations

U.S. Geological Survey Test Wells

The Geological Survey drilled three test wells: CSV-1, CSV-2, and CSV-3 during October, November, and December 1985. The drilling was done by hydraulic-rotary and air-foam methods. Table 2 lists data on drill bit sizes, casing, and drilling fluid used at these sites. Drill cuttings were collected at 10-foot intervals and where lithologic changes occurred. A solution containing a lithium bromide concentration of 20 milligrams per liter (mg/L) constituted the water part of the drilling fluid at each site. When chemical samples were later collected, a sufficient volume of water was first pumped from the aquifer so that the bromide tracer was reduced to low, natural concentrations. At each site, the surface casing was sealed and enclosed with a 5-foot section of 12-inch-diameter galvanized pipe, which was then cemented in place and capped with steel flat stock and locked.

Existing Wells

During 1980 and 1981, Ertec Western, Inc. (formerly Fugro National, Inc.) made hydrologic investigations in the Coyote Spring Valley area for the U.S. Air Force. Four deep exploratory wells were drilled and analyzed by geophysical logs, aquifer tests, and lithologic identification to assess ground-water potential as part of MX missile siting investigations. Ertec Western, Inc. (1981) has published data for two of these wells (CE-DT-4 and CE-DT-5). Some of the information presented in this report is from that published reference, while the remainder is from field notes and other documents provided by the U.S. Air Force and Ertec. A brief summary on location and drilling operations of the

four MX wells is presented in the section on geohydrologic data in this report. Table 2 lists the bit sizes, casing information, and type of drilling fluid used at the MX sites. During drilling, lithologic samples were collected at 5-foot intervals, at apparent formation changes, and wherever changes were observed in drilling conditions. Upon completion of drilling, spontaneous-potential, resistivity, natural gamma, 3-d velocity, and 3-diameter-caliper logs were run in the wells. In addition, video logs were run in CE-DT-4, CE-DT-5 and CE-DT-6. An abandoned stock well (SHV-1) was also investigated and the data are presented in the section on geohydrologic data in this report.

TABLE 2.--*Summary of drilling and construction information for the eight wells*

Short well name	Drilled interval (feet)	Bit diameter (inches)	Casing			Drilling fluid
			Interval[1] (feet)	Diameter (inches)	Type	
CSV-1	0 - 28	12.25	0 - 330	2.0	PVC[2]	Freshwater bentonite mud
	28 - 245	9.88	0 - 765	4.0	PVC	
	245 - 765	7.88				
CSV-2	0 - 95	9.88	0 - 17	10.0	PVC	Air foam
	95 - 478	8.75				
CSV-3	0 - 780	7.88	0 - 10	10.0	PVC	Freshwater bentonite mud
			0 - 756	6.0	PVC	
CE-DT-4	0 - 20	17.50	0 - 50	10.0	Steel	Freshwater bentonite mud
	20 - 50	13.75				air foam
	50 - 669	9.88				
CE-DT-5	0 - 125	26.00	0 - 125	20.0	Steel	Quick gel;
	125 - 628	17.50				various additives
CE-DT-6	0 - 87	17.50	0 - 87	12.75	Steel	Freshwater bentonite mud
	87 - 934	9.88	87 - 325	8.63	Steel	
CE-VF-2	0 - 860	17.50	0 - 860	10.0	Steel	Freshwater bentonite mud
	860 - 1,221	9.88				
SHV-1	Unknown	Unknown	0 - 40	6.0	Steel	Unknown

[1] Remainder of hole is uncased. CSV-1, perforated interval 290-330 feet, 2-inch casing; perforated interval 645-765 feet, 4-inch casing. CSV-3, perforated interval 736-756 feet, 6-inch casing.

[2] PVC, polyvinylchloride.

Geophysical Logs

The geophysical well-log data collected by the Geological Survey were recorded simultaneously on an analog strip chart and a digital magnetic cassette. All well logs are referenced with zero depth at land surface. Table 3 lists the types of logs and depth intervals for each test well. Graphs of the logs are presented in the section on geohydrologic data in this report. Calibrations for the neutron and gamma-gamma tools are available at the Geological Survey Carson City office. The MX geophysical logs may be obtained from either the Nevada State Engineer or the U.S. Geological Survey, Carson City, Nev.

Water-Quality Analyses

Water-quality samples were collected by the Geological Survey during 1986 at wells CSV-2, CE-DT-6, CE-VF-2, and SHV-1. Previous water-quality samples were collected by the Geological Survey in 1980 and 1981 at CE-DT-4 and CE-DT-5. All samples were analyzed at the U.S. Geological Survey Central Laboratory in Denver, Colo. In addition, isotope analyses were performed at the Central Laboratory for carbon-13, carbon-14, and tritium; at the U.S. Geological Survey Research Laboratory in Reston, Va., for deuterium and oxygen-18; and at the Global Geochemistry Corporation Laboratory in Canoga Park, Calif., for sulfur-34. Results of the above analyses are presented in table 4. The data include major-ion chemistry, trace constituents, stable and radioactive isotopes, temperature, pH, specific conductance, and dissolved oxygen.

Wells CSV-2 and CE-VF-2 were pumped a total of 130,000 and 64,000 gallons, respectively, before sampling. Well SHV-1 was bailed three well volumes before sampling; however, the bromide concentration of the (ground water) sample was still above background concentrations of the area, making this sample questionable. Well CE-DT-6 is used as a water-supply well for the Moapa Valley Water District and, therefore, was pumping for several months before it was sampled. Wells CE-DT-4 and CE-DT-5 were drilled and tested as part of the MX project, so both wells were pumping for several days before they were sampled. Samples from all the MX wells are good representatives of water in the aquifer.

Aquifer Tests

Water-level drawdowns and recoveries were observed during aquifer tests on five wells that penetrate carbonate bedrock. These tests were carried out between 1980 and 1986 by Hydro Search, Inc.; Ertec Western, Inc.; and the Geological Survey. Results of these tests are presented in tables 5-13 and in figures 6, 7, 13, 14, 17, 18, 22, 23, 26, and 27 in the section on geohydrologic data in this report.

Table 1 includes water-level data for the eight wells studied. Currently (1987), the Geological Survey is operating a continuous water-level recorder in well CE-DT-4. Water-level information obtained during aquifer tests is also reported in the section on geohydrologic data in this report.

TABLE 3.--*Summary of geophysical well logs presented in this report*

Short well name	Date logged	Source[1]	Suite of logs performed	Logged interval (feet)	Location of logs (figure number)[2]
CSV-1	11-20-85	USGS, Denver	Natural gamma	0 - 750	3
			Neutron	295 - 750	3
			Gamma-gamma density	250 - 750	3
			Water temperature	344 - 750	3
CSV-2	11-19-85	USGS, Denver	Natural gamma	0 - 466	5
			Neutron	0 - 466	5
			Gamma-gamma density	0 - 466	5
			Caliper	0 - 466	5
			Water temperature	392 - 478	5
			Acoustic	392 - 466	5
CSV-3	12-20-85	USGS, Santa Barbara	Natural gamma	0 - 760	9
			Caliper	0 - 760	9
			Spontaneous potential	580 - 760	10
			Resistivity, long-normal	580 - 760	10
			Resistivity, short-normal	580 - 760	10
			Single-point resistance	580 - 760	10
	2-19-86	USGS, Denver	Neutron	400 - 760	9
			Water temperature	590 - 760	9
	2-20-86		Gamma-gamma density	0 - 760	9
CE-DT-4	12-11-80	ERTEC	Natural gamma	0 - 669	*
			Spontaneous potential	353 - 669	*
			Resistivity	353 - 669	*
	12-03-85	USGS, Denver	Natural gamma	10 - 660	12
			Caliper	40 - 660	12
			Water temperature	350 - 580	12
	12-04-85		Neutron	10 - 660	12
			Gamma-gamma density	10 - 660	12
CE-DT-5	05-06-81	ERTEC	Natural gamma	0 - 628	*
			Spontaneous potential	350 - 628	*
			Resistivity	350 - 628	*
	11-30-81	USGS, Denver	Water temperature	350 - 409	16
CE-DT-6	12-05-85	USGS, Denver	Water temperature	458 - 933	20
			Caliper	320 - 933	20
CE-VF-2	11-22-81	ERTEC	Natural gamma	0 -1,221	*
			Spontaneous potential	0 -1,221	*
			Resistivity	0 -1,221	*
	11-25-85	USGS, Denver	Water temperature	600 -1,050	25
	11-26-85		Natural gamma	10 -1,012	25
			Caliper	850 -1,007	25
			Acoustic	844 -1,009	25
	12-04-85		Neutron	350 -1,009	25
	12-05-85		Gamma-gamma density	10 -1,008	25
SHV-1	12-30-85	USGS, Santa Barbara	Natural gamma	0 - 890	28
			Single-point resistance	820 - 890	28
	02-20-86	USGS, Denver	Water temperature	800 - 890	28
	02-22-86		Neutron	0 - 890	28
			Gamma-gamma density	0 - 866	28
			Caliper	0 - 890	28

[1] ERTEC, Ertec Western, Inc.; USGS, U.S. Geological Survey.

[2] Asterisk indicates geophysical well logs available, but not presented in this report.

TABLE 4.--*Water-quality data for selected wells in Coyote Spring Valley area*

[All concentrations are dissolved values, and are reported in milligrams per liter unless stated otherwise.
Abbreviations: °C, degrees Celsius; N, nitrogen; P, phosphorus]

Short well name	Date sampled	Temperature (degrees Celsius)	pH (units)	Specific conductance (microsiemens per centimeter at 25 °C)	Dissolved oxygen	Calcium	Magnesium	Sodium	Potassium	Bicarbonate	Carbonate	Chloride	Sulfate
CSV-2	01-26-86	27.0	7.39	995	4.0	60	27	100	10	276	0	61	160
CE-DT-4	12-23-80	34.0	7.35	980	3.5	46	19	84	11	294	0	35	110
CE-DT-5	07-22-81	35.5	7.15	720	2.3	46	20	78	11	300	0	34	100
CE-DT-6	09-28-86	33.5	7.16	980	3.7	58	25	87	10	271	0	53	160
CE-VF-2	02-05-86	34.0	7.40	800	2.9	47	21	81	11	303	0	34	90
SHV-1	03-28-86	25.0	7.80	820	3.8	33	30	86	12	245	0	64	90

Short well name	Fluoride	Nitrate plus nitrite (as N)	Phosphorus (as P)	Silica	Micrograms per liter: Barium	Beryllium	Cadmium	Cobalt	Copper	Iron	Lead	Manganese	Molybdenum	Strontium	Vanadium	Zinc
CSV-2	2.3	0.49	0.01	30	47	<0.5	<1	<3	<10	8	<10	9	<10	990	<6	310
CE-DT-4	1.9	0.34	0.01	33	70	<1	<1	<3	<10	28	32	36	<10	780	<6	5
CE-DT-5	1.9	-	-	33	70	<1	<1	<3	<10	<10	<10	5	<10	860	<6	<3
CE-DT-6	2.1	0.46	0.01	30	53	<0.5	<1	<3	<10	6	<10	<1	<10	870	<6	8
CE-VF-2	1.7	0.45	0.01	34	84	<0.5	<1	<3	<10	6	<10	15	<10	710	<6	360
SHV-1	1.2	1.9	0.04	27	99	<0.5	<1	<3	<10	350	<10	300	<10	3,900	<6	14

Short well name	Micrograms per liter: Lithium	Boron	Permil: Deuterium[a]	Oxygen-18[a]	Carbon-13[b]	Carbon-14 (percent modern carbon)	Tritium (picocuries per liter)	Sulfur-34 (permil)[c]
CSV-2	150	-	-98.0	-12.85	-	-	-	-
CE-DT-4	140	300	-102.0	-13.0	-10.6	7.6	-	-
CE-DT-5	130	310	-99.5	-12.9	-14.4	7.5	2	12.96
CE-DT-6	140	-	-97.0	-12.95	-	-	-	-
CE-VF-2	110	-	-101.0	-12.95	-	-	-	-
SHV-1	120	-	-90.5	-11.20	-	-	-	-

[a] Values are reported relative to the Vienna Standard Mean Ocean Water.
[b] Values are reported relative to the Peedee Belemnite Standard.
[c] Values are reported relative to the Canyon Diablo Meteorite Standard.

GEOHYDROLOGIC DATA FROM THE EIGHT WELLS

CSV-1

Well CSV-1 is in Moapa Valley, Clark County, and is approximately 1.5 miles south of the intersection of State Route 168 and an abandoned highway (figure 1). The well site is near the intersection of Wildcat Wash and Pahranagat Wash east of the northern edge of the Arrow Canyon Range.

The Geological Survey began drilling on October 10, 1985. The drill penetrated 765 feet of basin-fill sediments and reached ground water at approximately 344 feet below land surface. The drilling penetration rate and lithologic log are shown in figure 2. A shift in the natural gamma and neutron logs near 550 feet indicated possible bedrock and gave reason to attempt a core sample from the well bottom; however, no sample was recovered due to core-barrel damage. The well was cased with two polyvinyl chloride (PVC) piezometers: a 2-inch-diameter piezometer and a 4-inch-diameter piezometer (table 2). A bentonite plug was installed at a depth interval of 362 to 369 feet to prevent leakage along the 4-inch casing. The annulus was then filled with clean gravel pack from 362 feet to the surface plug. Geophysical logs for this well are presented in figure 3.

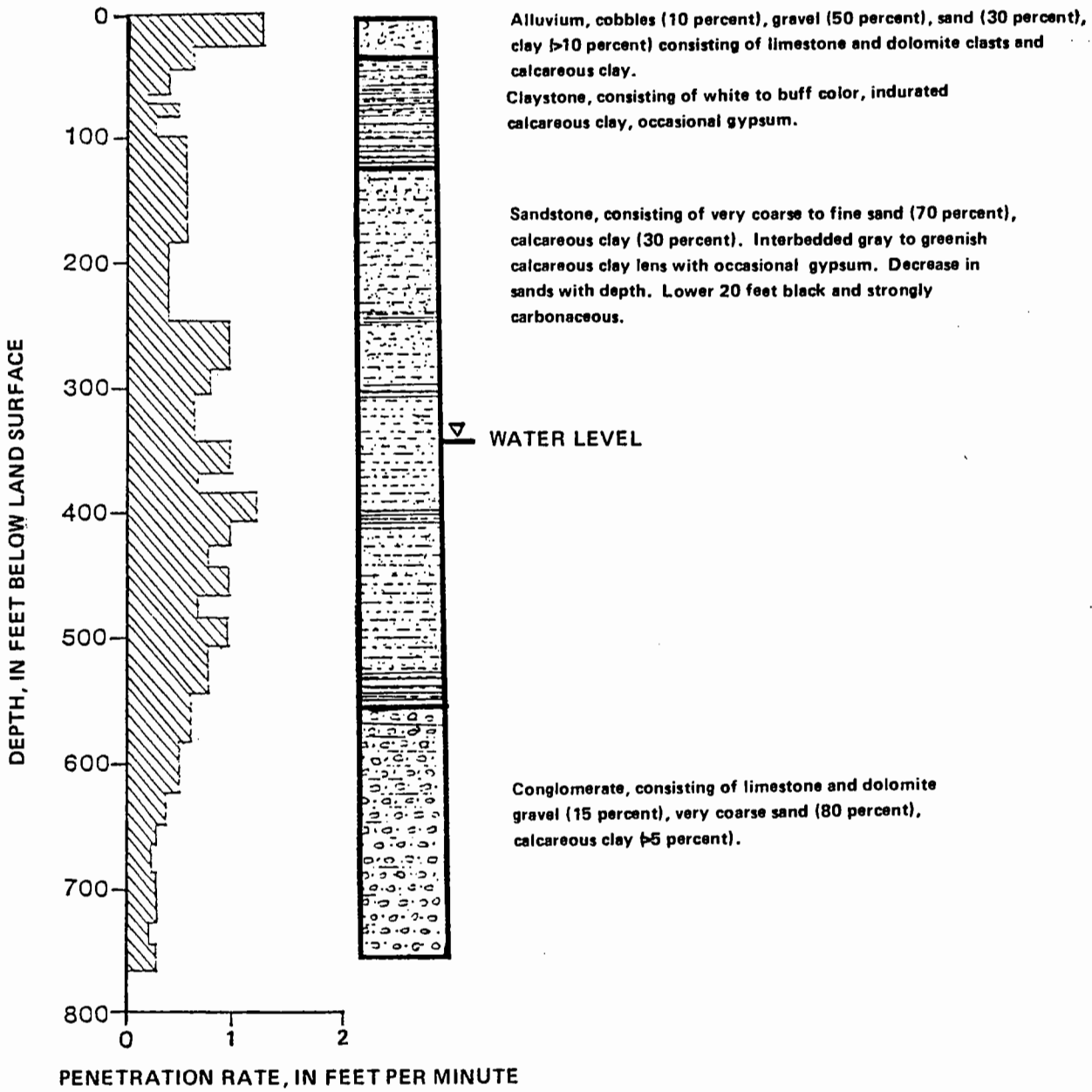

FIGURE 2.--Drilling penetration rate and lithology for U.S. Geological Survey test well CSV-1.

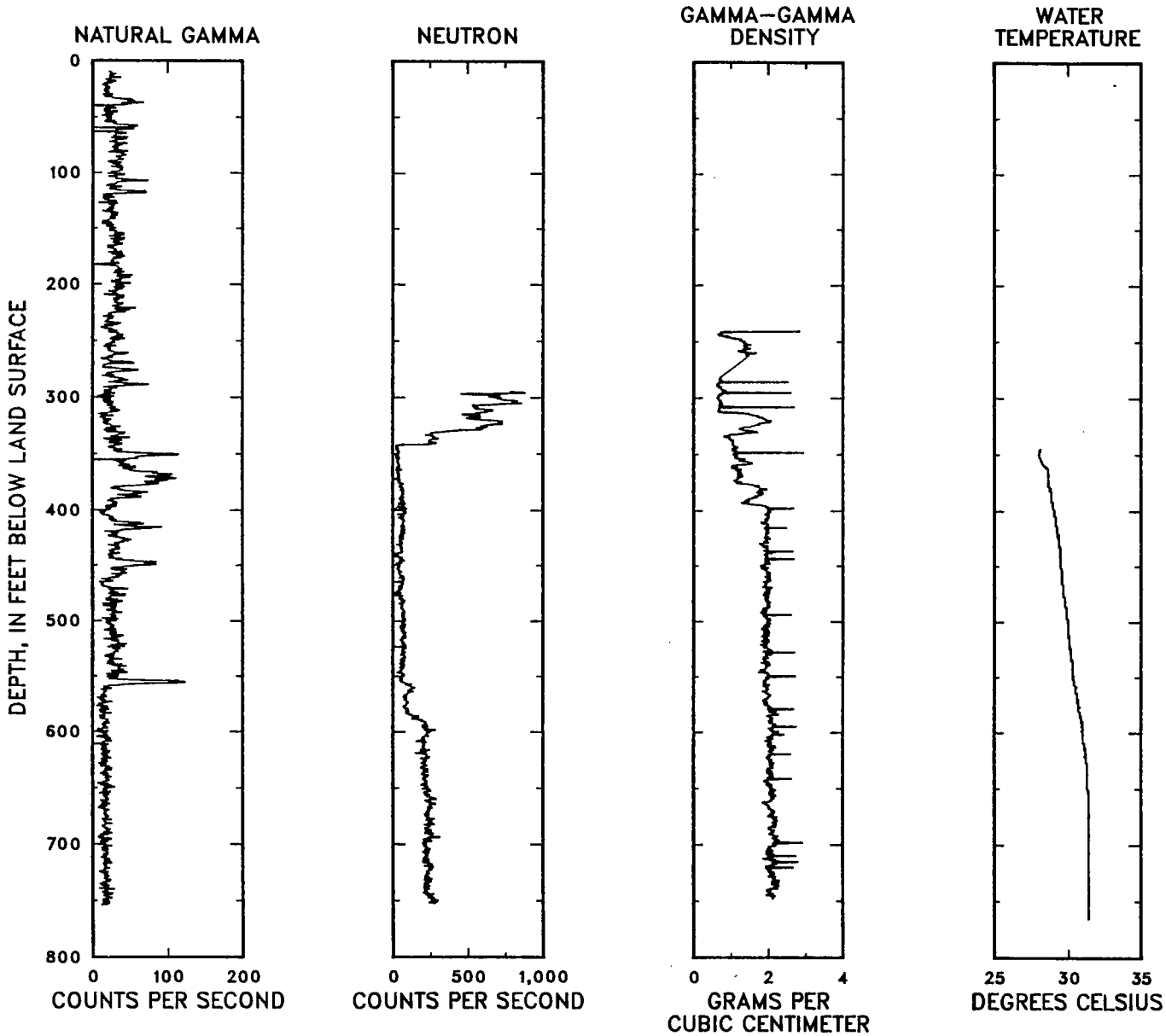

FIGURE 3.--Natural gamma, neutron, gamma-gamma density, and water-temperature logs for U.S. Geological Survey test well CSV-1.

CSV-2

Well CSV-2 is in Moapa Valley, Clark County, and is approximately 3.2 miles north of the intersection of State Route 168 and Warm Springs Road (figure 1). The well site is in an unnamed drainage on the southwestern flank of the Meadow Valley Mountains and south of Farrier Wash.

The U.S. Geological Survey began drilling on October 23, 1985. Limestone bedrock was penetrated at 17 feet and the water table was reached at approximately 390 feet below land surface. Drilling continued through the limestone section until October 26, when the 8-foot-long drill bit and stem broke off at a depth of 478 feet, after penetrating a large fracture and dropping several feet. Numerous attempts to retrieve the bit and stem were unsuccessful. The well was cased to bedrock with 10-inch-diameter PVC. The drilling penetration rate and lithologic log are shown in figure 4. Geophysical logs are presented in figure 5.

An aquifer test for CSV-2 was made by the Geological Survey in June 1986. Prior to this test, the well was developed by pumping for 2 days at approximately 5,500 gal/d. A 20-horsepower, 6-inch-diameter submersible pump with a 3-inch-diameter discharge pipe was used for the test. The intake was set at 430 feet. A combined total-discharge and sweep-hand flow meter was installed in-line to measure well discharge. Discharge was piped 60 feet from the well to a small wash that transported flow from the site. Water levels were measured in the well with a recording pressure transducer set at 420 feet and calibrated on site. The drawdown test lasted 21 hours with a constant discharge of about 100 gal/min. Total recovery was observed within 1 hour of stopping the pump. Tables 5 and 6 and figures 6 and 7 present the test data.

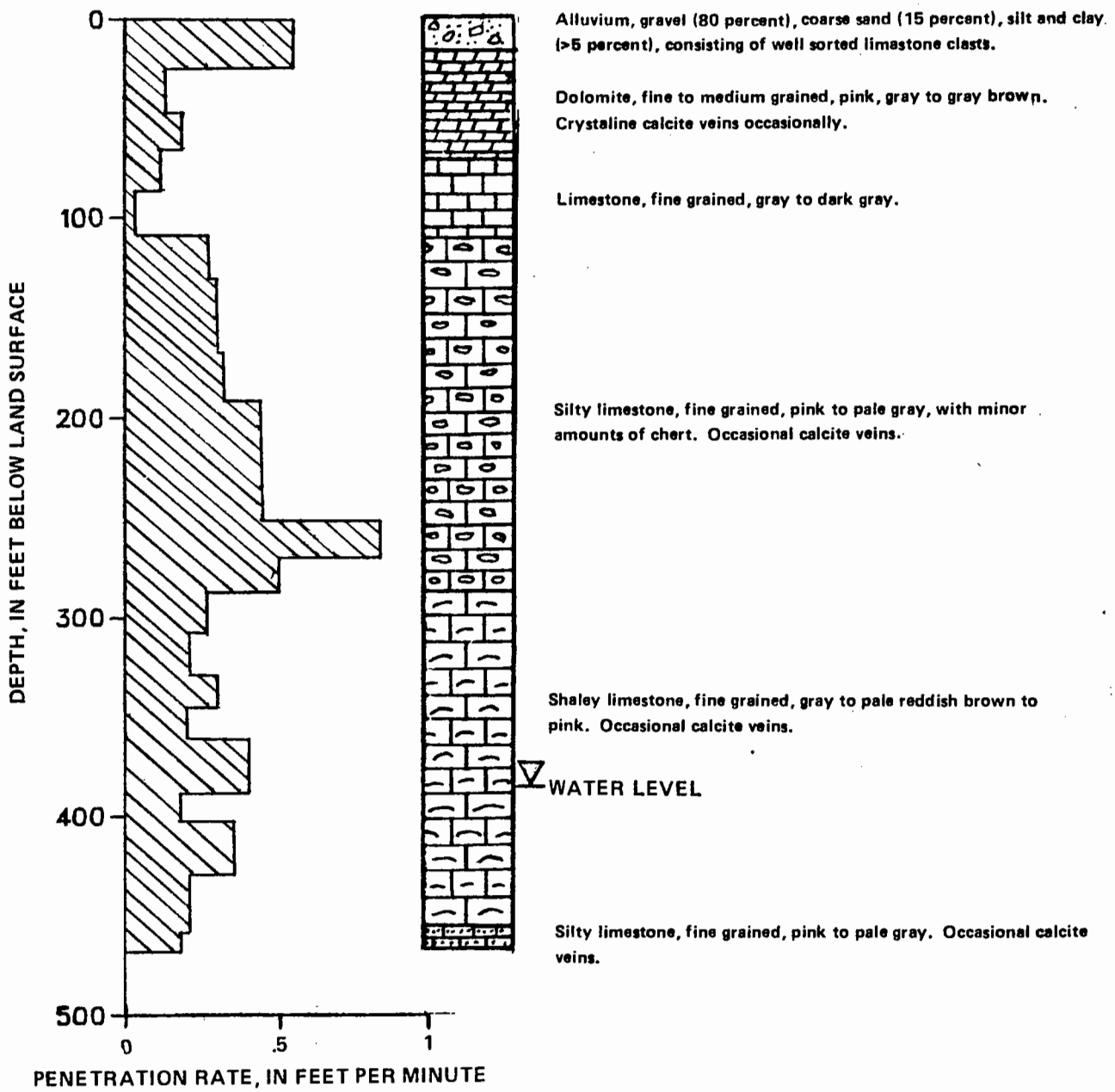

FIGURE 4.--Drilling penetration rate and lithology for U.S. Geological Survey test well CSV-2.

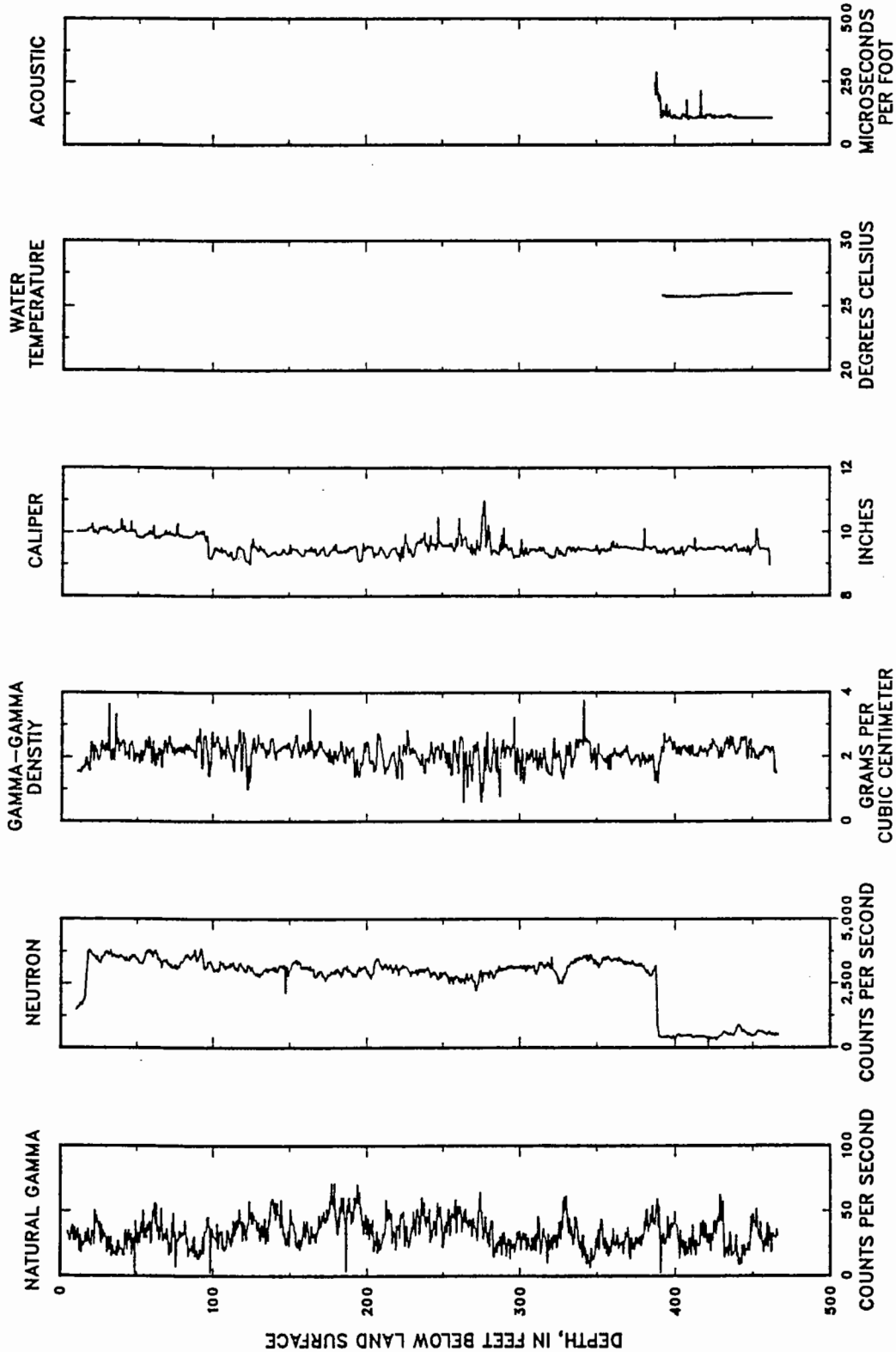

FIGURE 5.--Natural gamma, neutron, gamma-gamma density, caliper, water-temperature, and acoustic logs for U.S. Geological Survey test well CSV-2.

TABLE 5.--*Water levels during a 21.5-hour, constant-discharge aquifer test at U.S. Geological Survey test well CSV-2, June 7-8, 1986. Static water level is 390.76*

[Time, minutes since pumping began; water level, feet below land surface; drawdown, calculated drawdown of water levels in feet below static water level; pumping rate, spot-checked during test (average pumping rate from flow totalizer was 100.5 gallons per minute)]

Time (minutes)	Water level (feet)	Draw-down (feet)	Pumping rate (gallons per minute)	Time (minutes)	Water level (feet)	Draw-down (feet)	Pumping rate (gallons per minute)
0.00	390.8	0.0	Pump on	0.52	400.7	9.9	
0.01	392.0	1.2	100	0.59	401.6	10.8	
0.03	391.4	0.6		0.66	402.3	11.5	
0.04	391.9	1.1		0.74	403.0	12.2	
0.06	392.3	1.5		0.81	403.7	12.9	
0.07	392.7	1.9		0.88	404.2	13.4	
0.09	393.1	2.3		0.96	404.8	14.0	
0.10	393.5	2.7		1.03	405.3	14.5	100
0.12	393.9	3.1		1.11	405.8	15.0	
0.13	394.3	3.5		1.18	406.2	15.4	
0.16	394.9	4.1		1.25	406.7	15.9	
0.18	395.3	4.5		1.33	407.1	16.3	
0.19	395.6	4.8		1.40	407.4	16.6	
0.21	395.9	5.1		1.47	407.8	17.0	
0.22	396.1	5.3		1.55	408.1	17.3	
0.24	396.4	5.6		1.62	408.4	17.6	
0.25	396.7	5.9		1.70	408.6	17.8	
0.26	397.0	6.2		1.77	408.9	18.1	
0.28	397.2	6.4		1.84	409.2	18.4	
0.29	397.5	6.7		1.92	409.4	18.6	
0.31	397.8	7.0		1.99	409.7	18.9	
0.32	398.0	7.2		2.06	409.9	19.1	
0.34	398.2	7.4		2.14	410.1	19.3	
0.35	398.5	7.7		2.21	410.3	19.5	
0.37	398.7	7.9		2.29	410.4	19.6	
0.38	398.9	8.1		2.36	410.5	19.7	
0.40	399.1	8.3		2.43	410.7	19.9	
0.41	399.3	8.5		2.51	410.8	20.0	
0.43	399.5	8.7		2.58	410.9	20.1	
0.44	399.7	8.9		2.65	411.1	20.3	

TABLE 5.--*Water levels during a 21.5-hour, constant-discharge aquifer test at U.S. Geological Survey test well CSV-2, June 7-8, 1986*--Continued

Time (minutes)	Water level (feet)	Draw-down (feet)	Pumping rate (gallons per minute)	Time (minutes)	Water level (feet)	Draw-down (feet)	Pumping rate (gallons per minute)
3.10	411.8	21.0		29.59	417.1	26.3	100
3.54	412.4	21.6		34.01	417.4	26.6	
3.98	412.9	22.1		38.44	417.6	26.8	
4.42	413.3	22.5		42.86	417.8	27.0	
4.87	413.6	22.8		47.29	417.9	27.1	
5.31	413.9	23.1	101	51.71	418.0	27.2	
5.75	414.2	23.4		56.14	418.1	27.3	
6.19	414.5	23.7		60.56	418.2	27.4	101
6.64	414.7	23.9		64.98	418.3	27.5	
7.08	415.0	24.2		69.41	418.4	27.6	
7.52	415.2	24.4		73.83	418.4	27.6	
7.96	415.4	24.6		78.26	418.5	27.7	
8.41	415.6	24.8		82.68	418.5	27.7	
8.85	415.7	24.9		87.11	418.6	27.8	
9.29	415.8	25.0		91.53	418.6	27.8	103
9.73	416.0	25.2		104.81	418.7	27.9	
10.18	416.1	25.3	100	118.08	418.9	28.1	101
10.62	416.2	25.4		150.00	419.0	28.2	101
11.06	416.2	25.4		180.00	419.2	28.4	102
11.50	416.3	25.5		210.00	419.5	28.7	101
11.89	416.4	25.6		240.00	419.6	28.8	
12.77	416.5	25.7		270.00	419.9	29.1	102
13.66	416.6	25.8		300.00	419.9	29.1	99
14.54	416.7	25.9		330.00	420.0	29.2	100
15.43	416.8	26.0	103	360.00	420.0	29.2	101
16.31	416.9	26.1		390.00	420.1	29.3	101
17.20	417.0	26.2		420.00	420.2	29.4	100
18.08	417.1	26.3		423.00	420.8	30.0	pump off
18.97	417.1	26.3					30 seconds
19.85	417.2	26.4		440.00	420.5	29.7	99
20.74	417.2	26.4		480.00	420.6	29.8	99
22.95	416.8	26.0		510.00	420.4	29.6	103
25.16	416.8	26.0	100	540.00	420.5	29.7	101
27.37	417.0	26.2		570.00	420.5	29.7	102

TABLE 5.--*Water levels during a 21.5-hour, constant-discharge aquifer test at U.S. Geological Survey test well CSV-2, June 7-8, 1986*--Continued

Time (minutes)	Water level (feet)	Draw-down (feet)	Pumping rate (gallons per minute)	Time (minutes)	Water level (feet)	Draw-down (feet)	Pumping rate (gallons per minute)
600.00	420.5	29.7	99	960.00	420.9	30.1	101
630.00	420.3	29.5	101	990.00	420.8	30.0	100
660.00	420.3	29.5	99	1020.00	420.8	30.0	101
690.00	420.6	29.8	100	1050.00	420.8	30.0	100
720.00	420.8	30.0	99	1080.00	420.8	30.0	101
750.00	420.8	30.0	100	1110.00	420.7	29.9	100
780.00	420.6	29.8	100	1140.00	420.6	29.8	101
810.00	420.6	29.8	101	1170.00	420.4	29.6	101
840.00	420.6	29.8	100	1200.00	420.5	29.7	100
870.00	420.8	30.0	100	1230.00	420.6	29.8	101
900.00	420.8	30.0	101	1260.00	420.6	29.8	100
930.00	420.9	30.1	102	1290.00	420.6	29.8	pump off

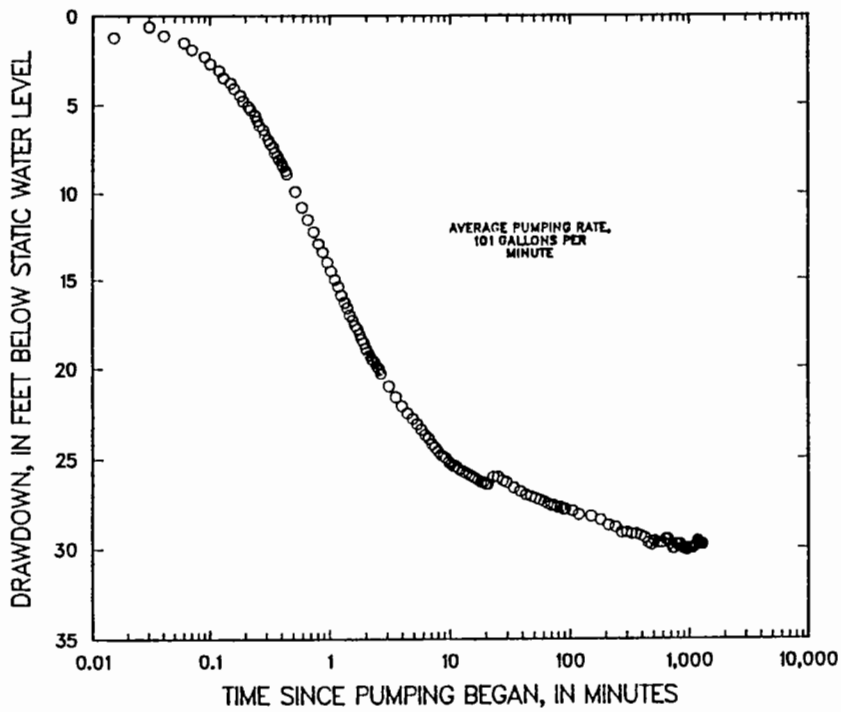

FIGURE 6.--Drawdown versus time at U.S. Geological Survey test well CSV-2, June 7-8, 1986.

TABLE 6.--*Water levels during recovery from a 21.5-hour, constant-discharge aquifer test at U.S. Geological Survey test well CSV-2, June 8, 1986*

[Time, minutes since pumping ended; water level, feet below land surface; residual drawdown, calculated drawdown of water levels remaining below static water level]

Time (minutes)	Water level (feet)	Residual drawdown (feet)	Time (minutes)	Water level (feet)	Residual drawdown (feet)
0.02	420.3	29.5	0.59	403.4	12.6
0.03	419.7	28.9	0.66	401.7	10.9
0.04	419.2	28.4	0.74	400.2	9.4
0.06	418.6	27.8	0.81	398.8	8.0
0.07	418.2	27.4	0.88	397.6	6.8
0.09	417.6	26.8	0.96	396.5	5.7
0.10	417.1	26.3	1.03	395.5	4.7
0.13	416.5	25.7	1.11	394.6	3.8
0.15	416.0	25.2	1.18	393.9	3.1
0.16	415.6	24.8	1.25	393.3	2.5
0.18	415.0	24.2	1.33	392.8	2.0
0.19	414.5	23.7	1.40	392.4	1.6
0.21	414.1	23.3	1.47	392.2	1.4
0.22	413.6	22.8	1.55	392.0	1.2
0.24	413.2	22.4	1.62	391.8	1.0
0.25	412.7	21.9	1.70	391.7	0.9
0.27	412.2	21.4	1.77	391.7	0.9
0.28	411.7	20.9	1.92	391.6	0.8
0.29	411.3	20.5	2.06	391.5	0.7
0.31	410.8	20.0	2.21	391.5	0.7
0.32	410.4	19.6	2.36	391.4	0.6
0.34	409.9	19.1	2.51	391.4	0.6
0.35	409.5	18.7	2.65	391.4	0.6
0.37	409.1	18.3	3.10	391.3	0.5
0.38	408.7	17.9	3.54	391.2	0.4
0.40	408.2	17.4	3.98	391.2	0.4
0.41	407.8	17.0	4.42	391.2	0.4
0.43	407.5	16.7	4.87	391.1	0.3
0.44	407.1	16.3	5.31	391.1	0.3
0.52	405.1	14.3	6.19	391.1	0.3

TABLE 6.--*Water levels during recovery from a 21.5-hour, constant-discharge aquifer test at U.S. Geological Survey test well CSV-2, June 8, 1986*--Continued

Time (minutes)	Water level (feet)	Residual drawdown (feet)	Time (minutes)	Water level (feet)	Residual drawdown (feet)
7.08	391.0	0.2	24.78	390.9	0.1
7.96	391.0	0.2	27.43	390.9	0.1
8.85	391.0	0.2	30.09	390.8	0.0
11.45	391.0	0.2	32.74	390.8	0.0
14.16	390.9	0.1	35.40	390.8	0.0
16.81	390.9	0.1	44.25	390.8	0.0
19.47	390.9	0.1	53.10	390.8	0.0
22.12	390.9	0.1	60.03	390.8	0.0

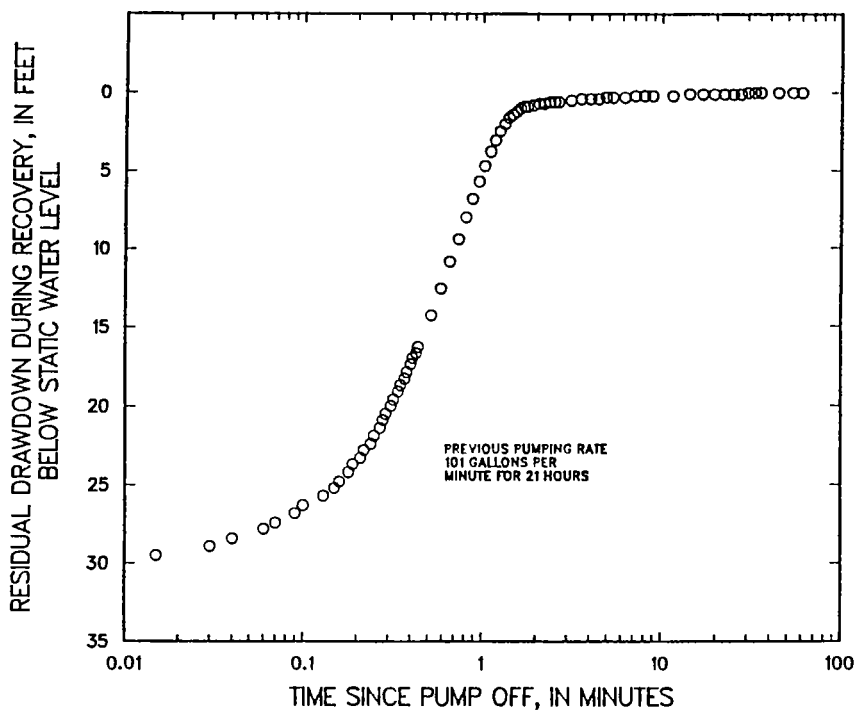

FIGURE 7.--Residual drawdown versus time at U.S. Geological Survey test well CSV-2, June 8, 1986.

CSV-3

Well CSV-3 in Coyote Spring Valley, Clark County, is adjacent to U.S. Highway 93, approximately 7 miles south of the intersection of U.S. Highway 93 and State Route 168 (figure 1). The well site is in the southernmost part of Coyote Spring Valley, between the Las Vegas Range and the Arrow Canyon Range.

The Geological Survey began drilling on November 6, 1985. Drilling-fluid circulation was lost at 430 feet due to a highly permeable and unconsolidated zone identified as a washout on the caliper log. Four thousand gallons of bentonite drilling mud was used as a sealer, but circulation was not regained. On December 18, 1985, a second episode of drilling was started using a 200-gallon mixture of Suprafoam[1] and Supramud to prevent circulation loss. At 515 feet, fluid circulation was lost which required thickening of the drilling fluid. On December 22, a total depth of 780 feet was attained, penetrating basin-fill deposits. The water table was reached about 580 feet below land surface. The hole later collapsed at a depth of 320 feet, and after reopening, 6-inch PVC was installed to a depth of 756 feet with 20 feet of perforated screen at the bottom. A 10-inch diameter, 7-foot section of PVC surface casing was cemented in place. The drilling penetration rate and lithology log are shown in figure 8. Geophysical well logs are shown in figures 9 and 10.

---

[1] The use of trade or product names in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

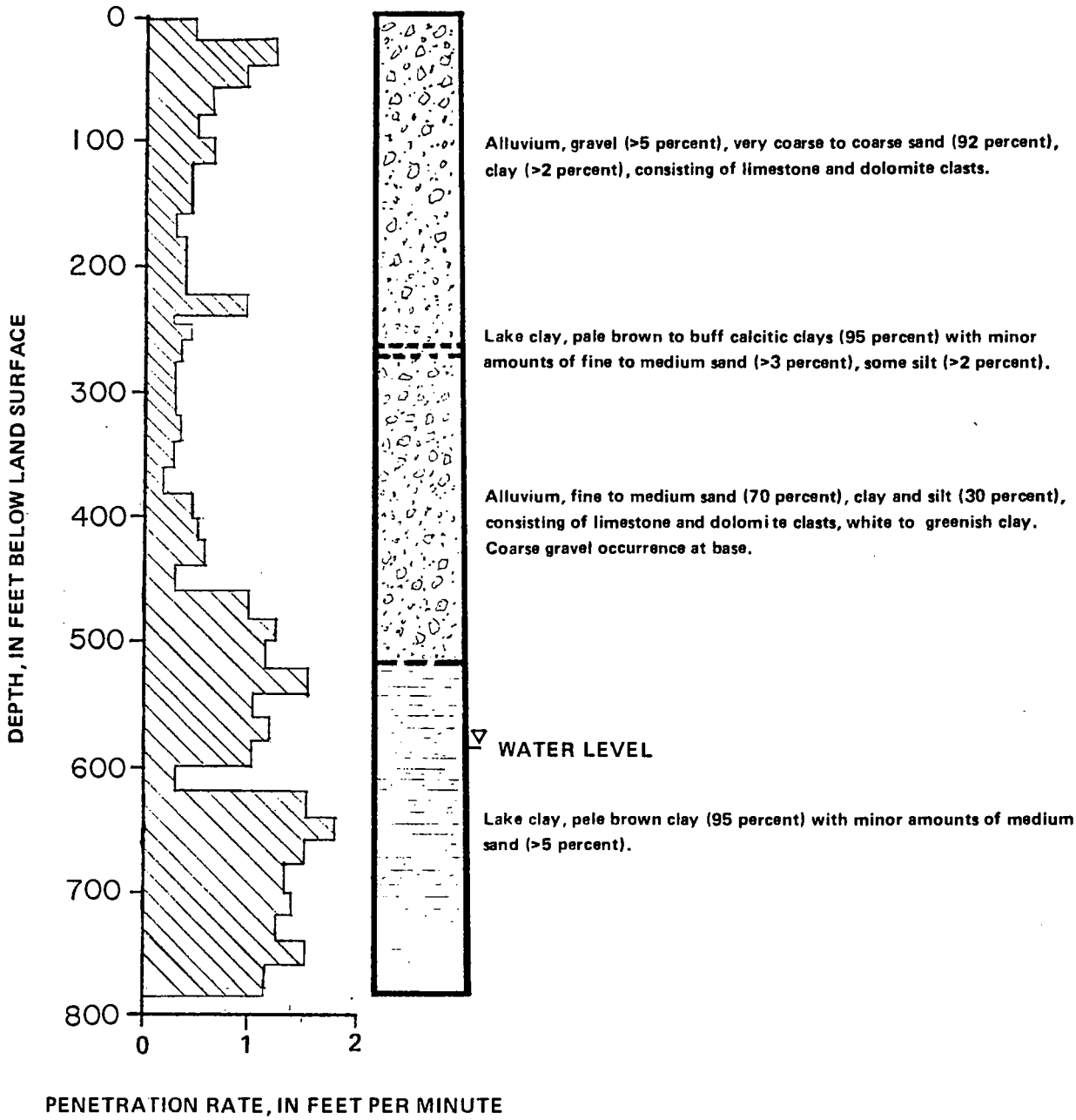

FIGURE 8.--Drilling penetration rate and lithology for U.S. Geological Survey test well CSV-3.

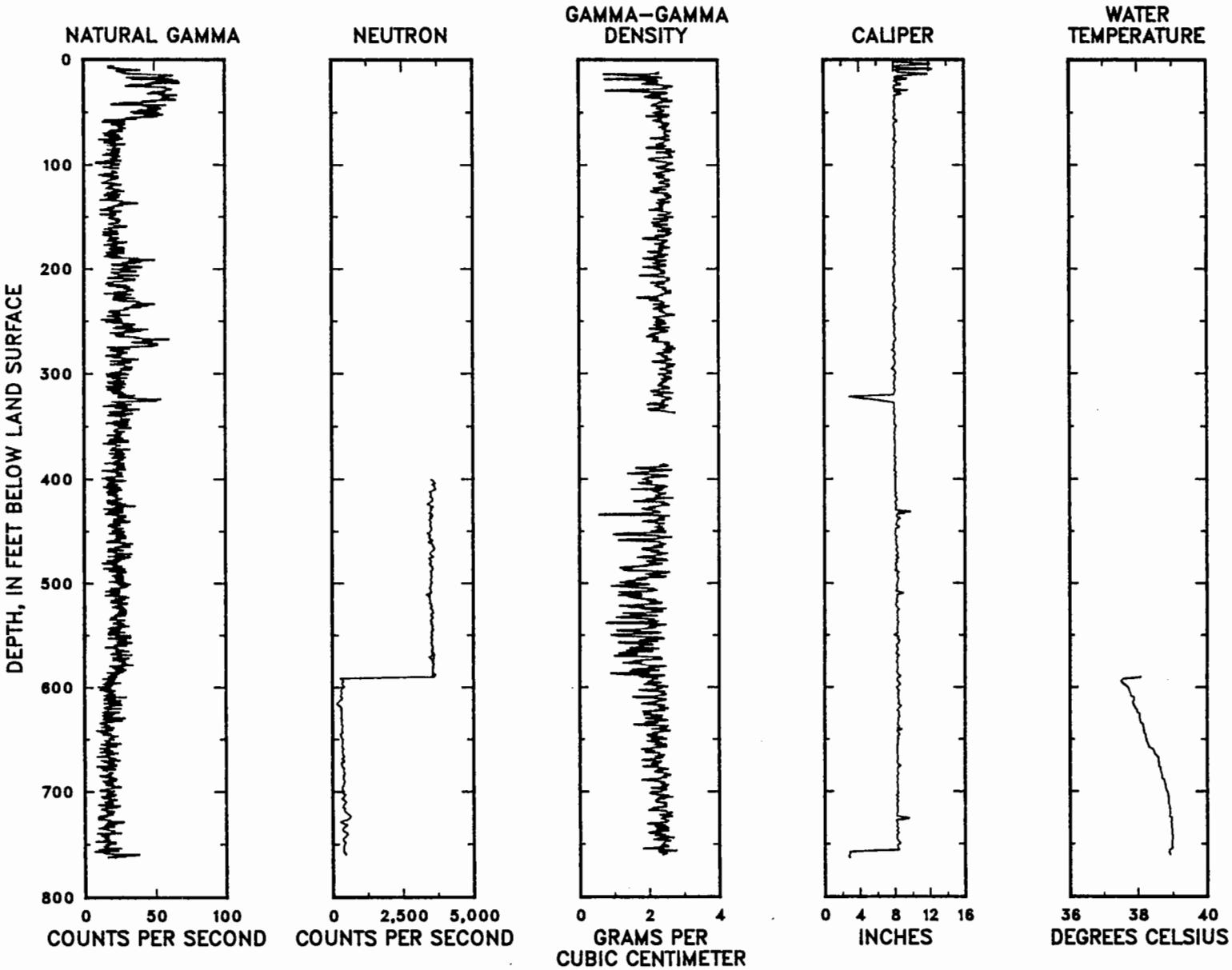

FIGURE 9.--Natural gamma, neutron, gamma-gamma density, caliper, and water-temperature logs for U.S. Geological Survey test well CSV-3.

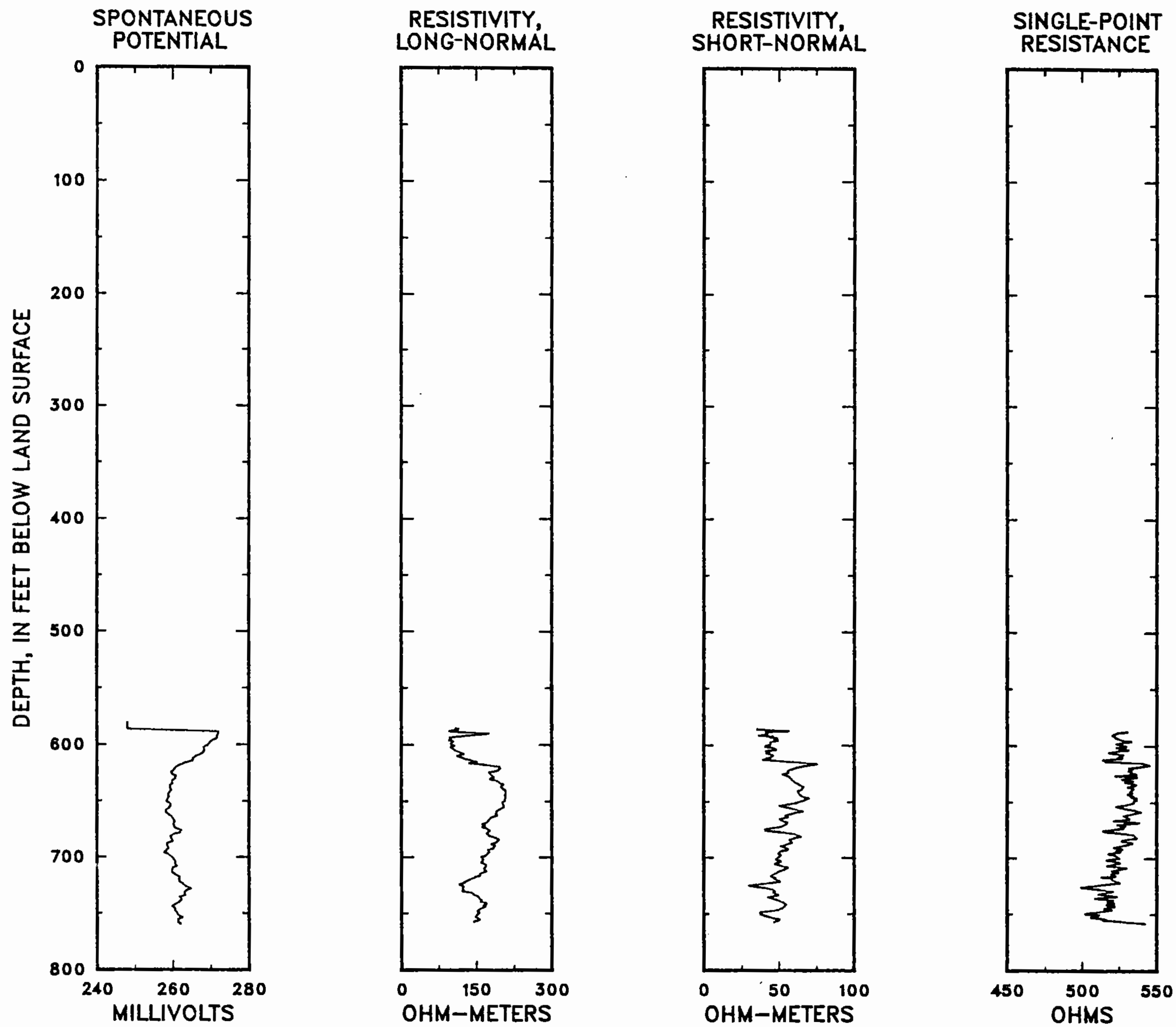

FIGURE 10.--Spontaneous potential, resistivity (long-normal and short-normal), and single-point resistance logs for U.S. Geological Survey test well CSV-3.

CE-DT-4

Wells CE-DT-4 and CE-DT-5 are in Coyote Spring Valley, Clark County, and are adjacent to State Route 168 approximately 3 miles east of the intersection of U.S. Highway 93 and State Route 168 (figure 1). CE-DT-4 is located approximately 300 feet west of CE-DT-5. The well sites are in the southeasterly draining Pahranagat Wash and just north of the Arrow Canyon Range.

Drilling began on CE-DT-4 on November 20, 1980. Limestone bedrock was penetrated at 30 feet below land surface, and a total depth of 669 feet was attained on December 6, 1980, when circulation loss terminated the drilling. The water table was reached at 352 feet below land surface. Due to vertical deviation of the well, cement was installed from 20 feet to the surface, drilled with a 7-7/8-inch-diameter milltooth tricone bit, and reamed with a 17-1/2-inch-diameter button bit. Three feet of 16-inch casing was set at the surface to facilitate sampling. Ten-inch-diameter surface casing was installed from 0 to 50 feet; the remainder of the hole was uncased. The drilling penetration rate and lithologic log are shown in figure 11. Figure 12 shows the geophysical well logs for the hole.

Well CE-DT-4 was tested in December 1980 by Hydro Search, Inc. The well was developed by surging five times with the drill-rig airlift at 1,100 ft^3/min before a pump was set. Details of the pump setup are not available. The test lasted 3 days and 5 hours, and the discharge rate was about 530 gal/min (figure 13). Recovery occurred within 2 minutes after the pump was turned off and only a few water-level measurements were made (figure 14). Water-level drawdowns during pumping and recoveries after the pump stopped are shown in table 7. CE-DT-4 was also used as an observation well when aquifer tests were made at CE-DT-5.

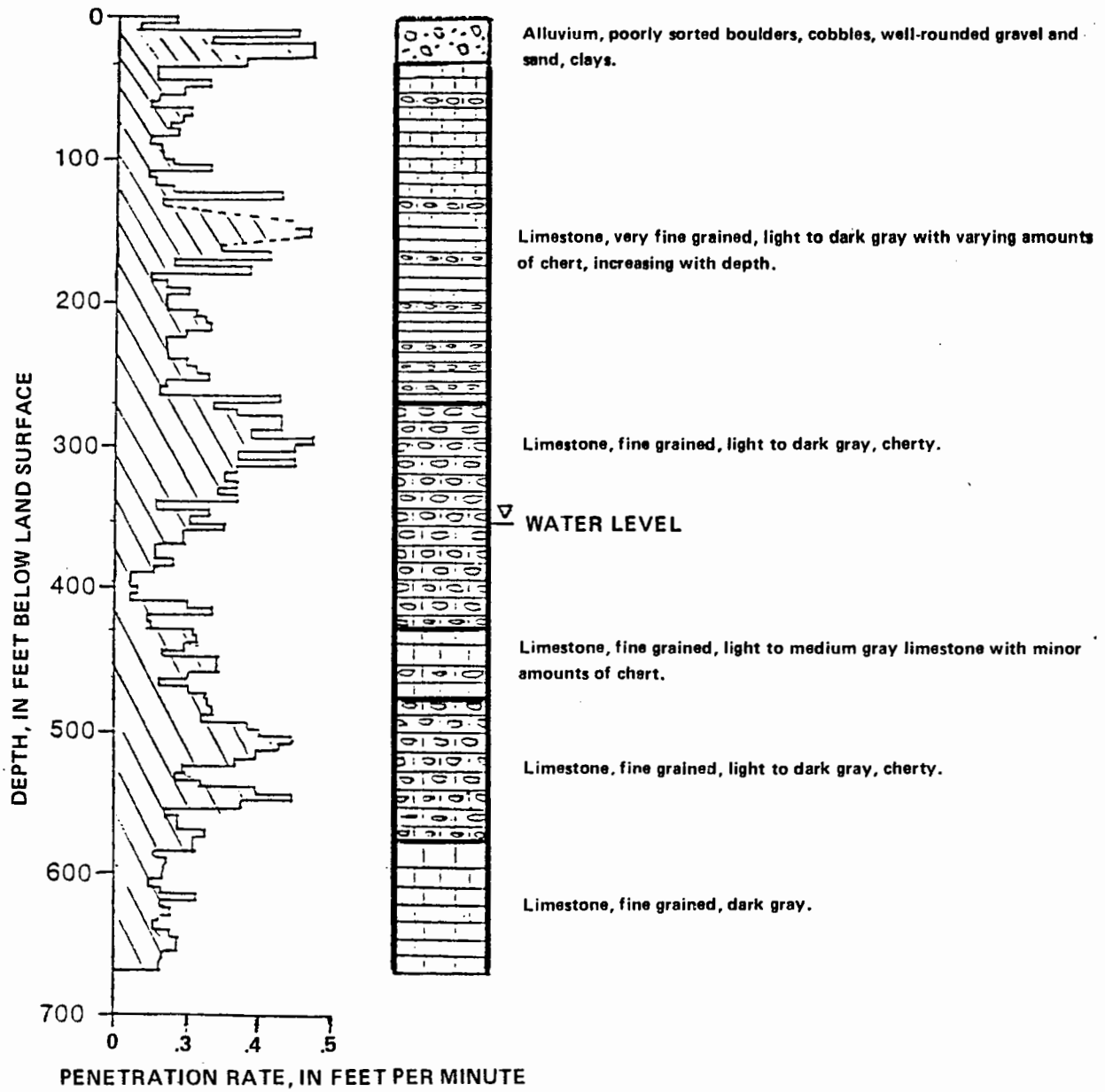

FIGURE 11.--Drilling penetration rate and lithology for MX test well CE-DT-4.

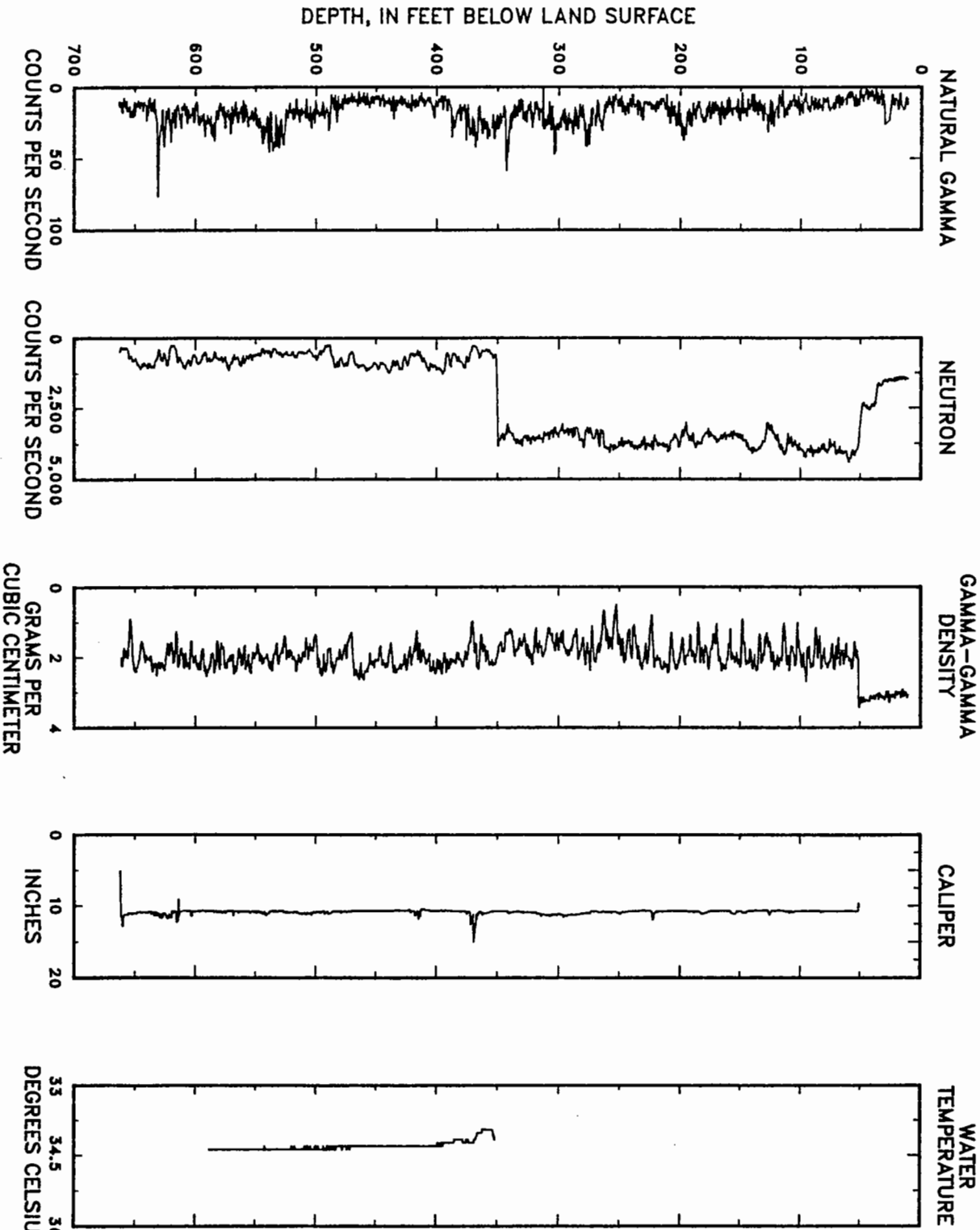

FIGURE 12.--Natural gamma, neutron, gamma-gamma density, caliper, and water temperature logs for MX test well CE-DT-4.

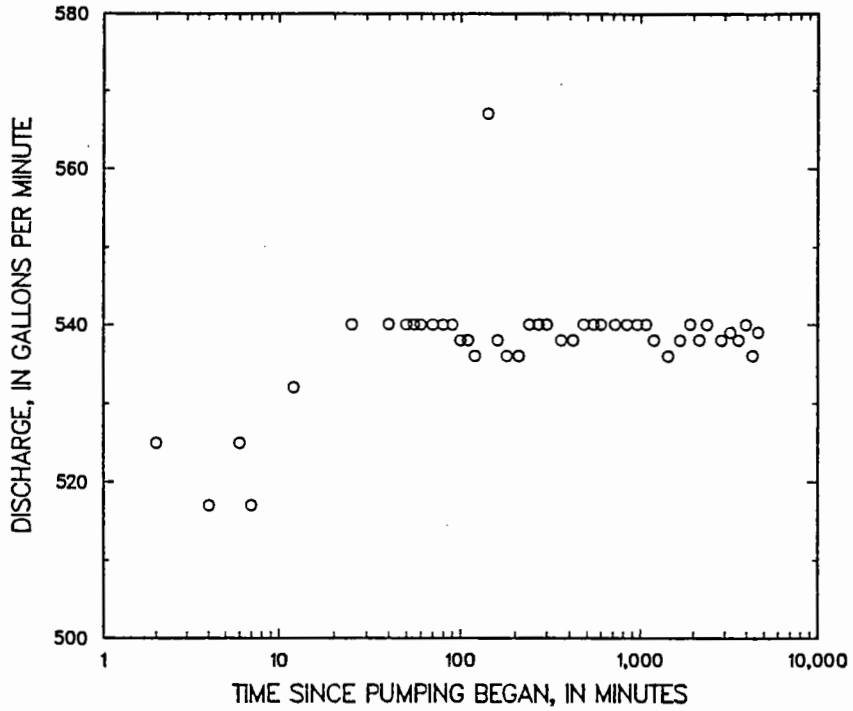

FIGURE 13.--Discharge versus time at MX test well CE-DT-4, December 20-23, 1980.

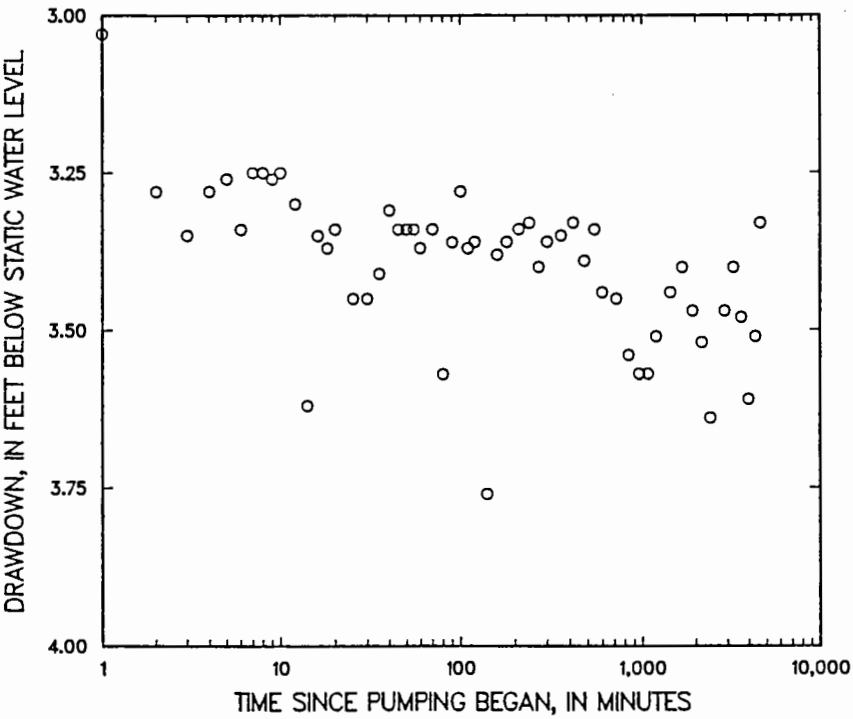

FIGURE 14.--Drawdown versus time at MX test well CE-DT-4, December 20-23, 1980.

TABLE 7.--*Water levels during and after a 77-hour, constant-discharge aquifer test at MX test well CE-DT-4, December 20-23, 1980.*[1] *Static water level is 352.85 feet below land surface*

[Time, minutes since pumping began; water level, depth below land surface; drawdown, calculated drawdown of water levels in feet below static water level; residual drawdown, calculated drawdown of water levels remaining below static water level]

Time (minutes)	Water level (feet)	Drawdown (feet)	Pumping rate (gallons per minute)	Time (minutes)	Water level (feet)	Drawdown (feet)	Pumping rate (gallons per minute)
0	352.85	0.00	Pump on	120	356.21	3.36	536
1	355.88	3.03		140	356.61	3.76	567
2	356.13	3.28	525	160	356.23	3.38	538
3	356.20	3.35		180	356.21	3.36	536
4	356.13	3.28	517	210	356.19	3.34	536
5	356.11	3.26		240	356.18	3.33	540
6	356.19	3.34	525	270	356.25	3.40	540
7	356.10	3.25	517	300	356.21	3.36	540
8	356.10	3.25		360	356.20	3.35	538
9	356.11	3.26		420	356.18	3.33	538
10	356.10	3.25		480	356.24	3.39	540
12	356.15	3.30	532	545	356.19	3.34	540
14	356.47	3.62		600	356.29	3.44	540
16	356.20	3.35		720	356.30	3.45	540
18	356.22	3.37		841	356.39	3.54	540
20	356.19	3.34		960	356.42	3.57	540
25	356.30	3.45	540	1080	356.42	3.57	540
30	356.30	3.45		1200	356.36	3.51	538
35	356.26	3.41		1440	356.29	3.44	536
40	356.16	3.31	540	1680	356.25	3.40	538
45	356.19	3.34		1920	356.32	3.47	540
50	356.19	3.34	540	2160	356.37	3.52	538
55	356.19	3.34	540	2400	356.49	3.64	540
60	356.22	3.37	540	2880	356.32	3.47	538
70	356.19	3.34	540	3240	356.25	3.40	539
80	356.42	3.57	540	3602	356.33	3.48	538
90	356.21	3.36	540	3960	356.46	3.61	540
100	356.13	3.28	538	4320	356.36	3.51	536
110	356.22	3.37	538	4620	356.18	3.33	539
				Pump stopped at 4620 minutes.			

TABLE 7.--*Water levels during and after a 77-hour, constant-discharge aquifer test at MX test well CE-DT-4, December 20-23, 1980*[1]--Continued

Time (minutes)	Water level (feet)	Residual drawdown (feet)	Time (minutes)	Water level (feet)	Residual drawdown (feet)
4621	353.15	0.30	4626	352.80	-0.05
4621.5	352.88	0.03	4627	352.83	-0.02
4622	352.85	0.00	4628	352.84	-0.01
4622.5	352.82	-0.03	4629	352.87	0.02
4623.25	352.82	-0.03	4630	352.87	0.02
4624	352.83	-0.02	4635	352.87	0.02
4625	352.84	-0.01	4640	352.87	0.02

[1] From Ertec Western, Inc., written communication, 1981.

CE-DT-5

See section on well CE-DT-4 for location of this well. Drilling began on CE-DT-5 on April 13, 1981. It was completed on May 6, 1981, at a total depth of 628 feet. Limestone bedrock was reported at 110 feet and the water table was reached at 350 feet below land surface. The well was cased with 20-inch-diameter steel casing and cemented to 126 feet. Frequent loss of circulation of drilling fluid was recorded. Two zones of significant circulation loss were encountered at 387 feet and 571 feet. The upper zone was cemented off and drilling continued through the lower zone until it became apparent that significant saturated fractures were penetrated. The drilling penetration rate and lithologic log for this well are show in figure 15. A temperature log is shown in figure 16.

Well CE-DT-5 was tested during August and September of 1981. The well was developed by bailing 37 times. The bailer held 30.8 gallons. A vertical turbine pump with 10-inch-diameter discharge pipe was used in testing the well. The intake was set at 500 feet. Discharge was measured with orifice plates and a piezometer tube, and was piped 200 feet to an alluvial channel. Water levels were measured in the well and at observation well CE-DT-4 with a recording pressure transducer. Periodic checks were made by electric sounder and barometer to correct for atmospheric-induced drift. Water levels at six other observation wells and discharge at six springs were monitored daily but no effects due to pumping were discerned. The test, which was the eighth in a series of constant and step discharge tests, lasted 30 days and 3 hours, with a 3-hour shutdown for maintenance 13 days and 14 hours into the test. The initial increase in drawdown between 0.07 and 0.60 minutes, as shown in figure 17, represents the filling of the pump column before water from the formation was pumped. Table 8 and figure 17 present data from MX test well CE-DT-5, and table 9 and figure 18 present data from observation well CE-DT-4 during the testing at CE-DT-5.

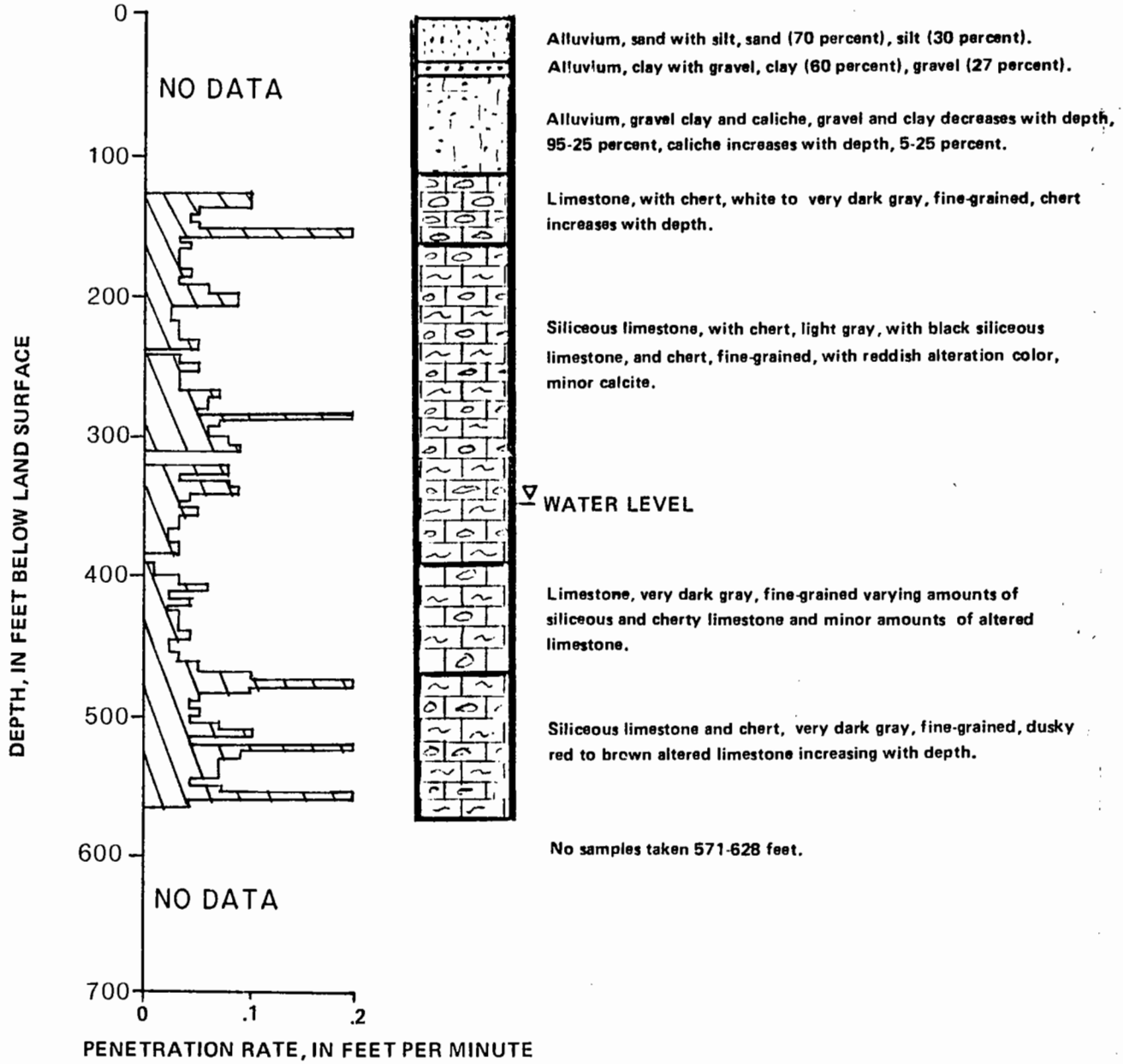

FIGURE 15.--Drilling penetration rate and lithology for MX test well CE-DT-5.

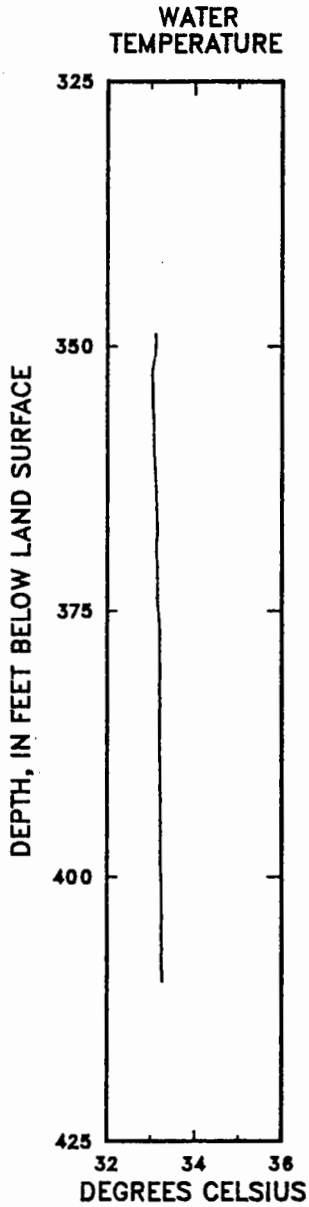

FIGURE 16.--Water-temperature log for MX test well CE-DT-5.

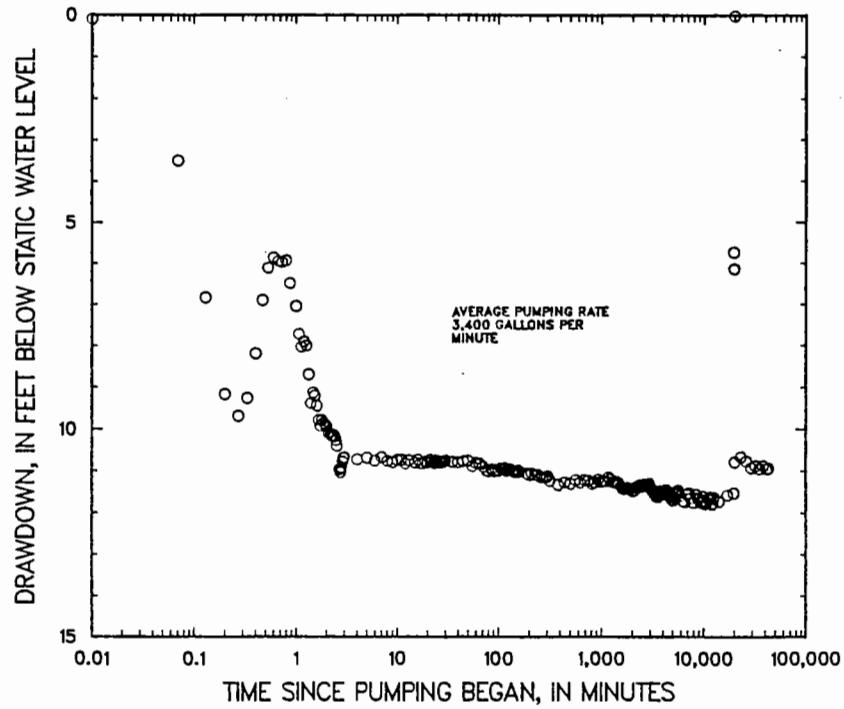

FIGURE 17.--Drawdown versus time at pumped MX test well CE-DT-5, August 28 to September 27, 1981.

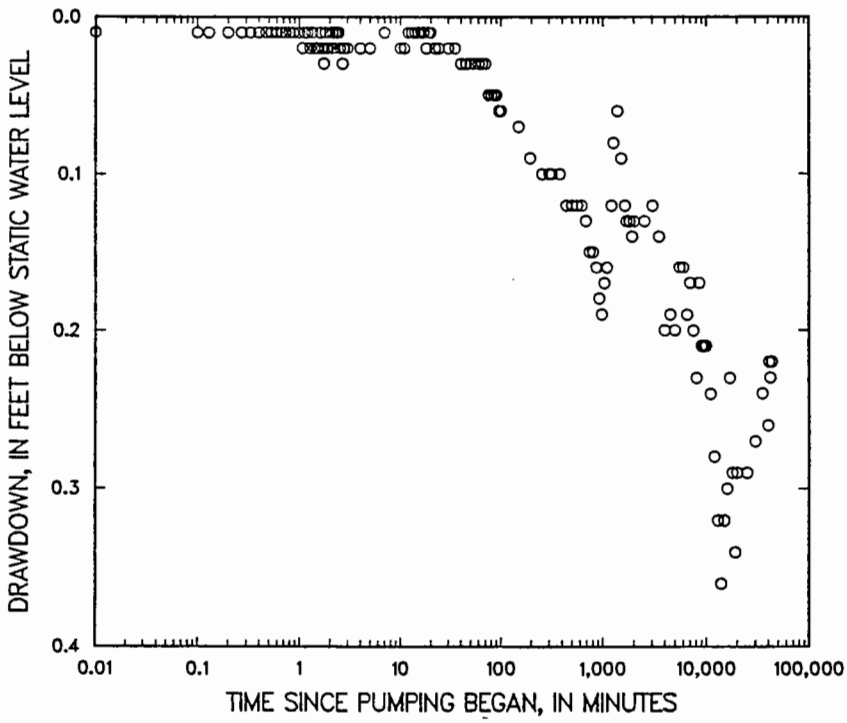

FIGURE 18.--Drawdown versus time at MX test well CE-DT-4, during pumping at MX test well CE-DT-5, August 28 to September 27, 1981.

TABLE 8.--*Water levels during a 30-day, constant-discharge aquifer test at MX test well CE-DT-5, August 28 to September 28, 1981.*[1] *Static water level is 349.5. Pumping rate was reported to be constant at 3,400 gallons per minute*

[Time, minutes since pumping began; water level, depth in feet below land surface; drawdown, calculated drawdown of water levels below static water level]

Time (minutes)	Water level (feet)	Drawdown (feet)	Time (minutes)	Water level (feet)	Drawdown (feet)
0.0	349.50	0.00 (pump on)	2.0	359.44	9.94
0.0	349.60	0.10	2.1	359.61	10.11
0.1	353.01	3.51	2.1	359.61	10.11
0.1	356.33	6.83	2.2	359.67	10.17
0.2	358.67	9.17	2.3	359.68	10.18
0.3	359.19	9.69	2.3	359.65	10.15
0.3	358.77	9.27	2.4	359.69	10.19
0.4	357.70	8.20	2.5	359.77	10.27
0.5	356.41	6.91	2.5	359.91	10.41
0.5	355.62	6.12	2.7	360.47	10.97
0.6	355.36	5.86	2.7	360.54	11.04
0.7	355.45	5.95	2.8	360.43	10.93
0.7	355.48	5.98	2.9	360.29	10.79
0.8	355.43	5.93	2.9	360.19	10.69
0.9	355.99	6.49	3.0	360.19	10.69
1.0	356.55	7.05	4.0	360.23	10.73
1.1	357.23	7.73	5.0	360.19	10.69
1.1	357.54	8.04	6.0	360.26	10.76
1.2	357.41	7.91	7.0	360.18	10.68
1.3	357.51	8.01	8.0	360.27	10.77
1.3	358.21	8.71	9.0	360.30	10.80
1.4	358.89	9.39	10.0	360.24	10.74
1.5	358.64	9.14	11.0	360.24	10.74
1.5	358.71	9.21	12.0	360.33	10.83
1.6	358.95	9.45	13.0	360.25	10.75
1.7	359.29	9.79	15.0	360.31	10.81
1.7	359.43	9.93	16.0	360.24	10.74
1.8	359.30	9.80	17.0	360.33	10.83
1.9	359.36	9.86	18.0	360.33	10.83
1.9	359.42	9.92	19.0	360.29	10.79

TABLE 8.--*Water levels during a 30-day, constant-discharge aquifer test at MX well CE-UT-5, August 28 to September 28, 1981*[1]--Continued

Time (minutes)	Water level (feet)	Drawdown (feet)	Time (minutes)	Water level (feet)	Drawdown (feet)
20.0	360.31	10.81	155.0	360.50	11.00
21.0	360.24	10.74	160.0	360.53	11.03
22.0	360.29	10.79	186.0	360.57	11.07
23.0	360.33	10.83	196.0	360.61	11.11
24.0	360.26	10.76	211.0	360.57	11.07
25.0	360.31	10.81	226.0	360.61	11.11
26.0	360.29	10.79	241.0	360.60	11.10
27.0	360.31	10.81	256.0	360.66	11.16
28.0	360.29	10.79	271.0	360.66	11.16
29.0	360.29	10.79	286.0	360.66	11.16
30.0	360.26	10.76	301.0	360.64	11.14
35.0	360.29	10.79	316.0	360.74	11.24
40.0	360.30	10.80	381.0	360.84	11.34
45.0	360.27	10.77	441.0	360.78	11.28
50.0	360.26	10.76	501.0	360.81	11.31
55.0	360.39	10.89	561.0	360.72	11.22
60.0	360.32	10.82	621.0	360.78	11.28
65.0	360.34	10.84	681.0	360.72	11.22
70.0	360.41	10.91	741.0	360.74	11.24
75.0	360.50	11.00	801.0	360.81	11.31
80.0	360.52	11.02	861.0	360.78	11.28
85.0	360.47	10.97	921.0	360.71	11.21
90.0	360.52	11.02	981.0	360.77	11.27
95.0	360.48	10.98	1041.0	360.75	11.25
100.0	360.51	11.01	1101.0	360.75	11.25
105.0	360.44	10.94	1161.0	360.66	11.16
110.0	360.48	10.98	1221.0	360.70	11.20
115.0	360.44	10.94	1281.0	360.78	11.28
120.0	360.52	11.02	1341.0	360.79	11.29
125.0	360.50	11.00	1401.0	360.77	11.27
130.0	360.47	10.97	1461.0	360.80	11.30
135.0	360.52	11.02	1521.0	360.89	11.39
140.0	360.54	11.04	1581.0	360.93	11.43
145.0	360.52	11.02	1641.0	360.94	11.44
150.0	360.54	11.04	1701.0	360.93	11.43

TABLE 8.--*Water levels during a 30-day, constant-discharge aquifer test at MX well CE-DT-5, August 28 to September 28, 1981*[1]--Continued

Time (minutes)	Water level (feet)	Drawdown (feet)	Time (minutes)	Water level (feet)	Drawdown (feet)
1761.0	360.91	11.41	3861.0	361.05	11.55
1821.0	360.91	11.41	3921.0	361.07	11.57
1881.0	360.94	11.44	3981.0	361.00	11.50
1941.0	360.99	11.49	4041.0	361.02	11.52
2001.0	360.99	11.49	4101.0	360.99	11.49
2061.0	360.96	11.46	4161.0	360.96	11.46
2121.0	360.96	11.46	4221.0	361.07	11.57
2181.0	360.88	11.38	4281.0	361.02	11.52
2241.0	360.88	11.38	4341.0	360.96	11.46
2301.0	360.84	11.34	4401.0	361.05	11.55
2361.0	360.86	11.36	4461.0	361.05	11.55
2431.0	360.85	11.35	4521.0	361.00	11.50
2481.0	360.88	11.38	4581.0	361.09	11.59
2541.0	360.87	11.37	4641.0	361.10	11.60
2601.0	360.82	11.32	4701.0	361.12	11.62
2661.0	360.88	11.38	4761.0	361.19	11.69
2721.0	360.89	11.39	4821.0	361.19	11.69
2781.0	360.84	11.34	4881.0	361.21	11.71
2841.0	360.88	11.38	4941.0	361.18	11.68
2901.0	360.81	11.31	5001.0	361.20	11.70
2961.0	360.93	11.43	5061.0	361.20	11.70
3021.0	360.96	11.46	5121.0	361.12	11.62
3081.0	361.02	11.52	5241.0	361.01	11.51
3141.0	360.96	11.46	5301.0	361.05	11.55
3201.0	361.00	11.50	5421.0	361.03	11.53
3261.0	361.09	11.59	5541.0	361.01	11.51
3321.0	361.07	11.57	5601.0	360.96	11.46
3381.0	361.12	11.62	5721.0	361.03	11.53
3441.0	361.05	11.55	4841.0	361.08	11.58
3501.0	361.09	11.59	5901.0	361.09	11.59
3561.0	361.05	11.55	6201.0	361.22	11.72
3621.0	361.12	11.62	6501.0	361.25	11.75
3681.0	361.00	11.50	6801.0	361.06	11.56
3741.0	360.98	11.48	7101.0	361.03	11.53
3801.0	361.01	11.51	7401.0	361.15	11.65

TABLE 8.--*Water levels during a 30-day, constant-discharge aquifer test at MX well CE-DT-5, August 28 to September 28, 1981*[1]--Continued

Time (minutes)	Water level (feet)	Drawdown (feet)	Time (minutes)	Water level (feet)	Drawdown (feet)
7701.0	361.25	11.75	14001.0	361.23	11.73
8001.0	361.26	11.76	17001.0	361.08	11.58
8301.0	361.06	11.56	19581.0	361.03	11.53 (pump off)
8601.0	361.15	11.65	19599.0	355.23	5.73 (engine maintenance)
8901.0	361.16	11.66			
9201.0	361.26	11.76	19764.0	349.52	0.02 (pump on)
9501.0	361.21	11.71	19765.0	355.64	6.14
9801.0	361.11	11.61	19995.0	360.29	10.79
10101.0	361.30	11.80	23001.0	360.17	10.67
10401.0	361.29	11.79	26001.0	360.27	10.77
10701.0	361.25	11.75	29001.0	360.43	10.93
11001.0	361.16	11.66	32001.0	360.38	10.88
11301.0	361.18	11.68	35001.0	360.45	10.95
11601.0	361.13	11.63	38001.0	360.38	10.88
11901.0	361.30	11.80	41001.0	360.46	10.96
12201.0	361.27	11.77	42441.0	360.44	10.94
12501.0	361.14	11.64			

[1] From Ertec Western, Inc., 1981.

TABLE 9.--*Water levels at observation test well CE-VT-4 during a 30-day, constant-discharge aquifer test at test well CE-VT-5, August 28 to September 27, 1981.*[1] *Pumping rate at well CE-VT-5 reported to be 3,400 gallons per minute. Static water level is 352.30 feet below land surface*

[Time, minutes since pumping began; water level, depth below land surface; drawdown, calculated drawdown of water levels below static water level; residual drawdown, calculated drawdown of water levels remaining below static water level]

Time (minutes)	Water level (feet)	Drawdown (feet)	Time (minutes)	Water level (feet)	Drawdown (feet)
0.00	352.30	0.00 (pump on)	1.93	352.31	0.01
0.07	352.30	0.00	2.00	352.31	0.01
0.13	352.30	0.00	2.07	352.32	0.02
0.20	352.30	0.00	2.13	352.31	0.01
0.27	352.31	0.01	2.20	352.32	0.02
0.33	352.31	0.01	2.27	352.31	0.01
0.40	352.30	0.00	3.00	352.32	0.02
0.47	352.31	0.01	10.0	352.32	0.02
0.53	352.32	0.00	20.0	352.31	0.01
0.60	352.30	0.00	30.0	352.32	0.02
0.67	352.31	0.01	100.0	352.32	0.02
0.73	352.31	0.01	196.0	352.39	0.09
0.80	352.31	0.01	301.0	352.40	0.10
0.87	352.31	0.01	981.0	352.49	0.19
0.93	352.31	0.01	2001.0	352.43	0.13
1.00	352.31	0.01	3021.0	352.42	0.12
1.07	352.32	0.02	3981.0	352.50	0.20
1.13	352.31	0.01	5001.0	352.50	0.20
1.20	352.30	0.00	5901.0	352.44	0.14
1.27	352.32	0.02	7101.0	352.45	0.15
1.33	352.31	0.01	8001.0	352.53	0.23
1.40	352.32	0.02	8961.0	352.50	0.20
1.47	352.32	0.02	10101.0	352.54	0.24
1.53	352.32	0.02	11001.0	352.54	0.24
1.60	352.31	0.01	12021.0	352.58	0.28
1.67	352.32	0.02	14001.0	352.66	0.36
1.73	352.33	0.03	17061.0	352.53	0.23
1.80	352.31	0.01	19599.0	352.63	0.33 (pump off)
1.87	352.32	0.02			

TABLE 9.--*Water levels at observation test well CE-UT-4, during a 30-day, constant-discharge aquifer test at test well CE-UT-5, August 28 to September 27, 1981*[1]--Continued

Time (minutes)	Water level (feet)	Residual drawdown (feet)	Time (minutes)	Water level (feet)	Residual drawdown (feet)
23001.0	352.56	0.26	35021.0	352.54	0.24
26021.0	352.63	0.33	38021.0	352.52	0.22
29021.0	352.59	0.29	41021.0	352.52	0.22
32021.0	352.52	0.22			

[1] From Ertec Western, Inc., 1981.

CE-DT-6

Well CE-DT-6 is in Moapa Valley, Clark County, adjacent to State Route 168 approximately 6.7 miles east of CE-DT-5 (figure 1). The well site is in the southern portion of the Meadow Valley Mountains and was drilled as an observation well for use during aquifer tests at CE-DT-5. Limestone bedrock and the water table were reached at 78 and 457.4 feet below the land surface, respectively.

Drilling began on May 21, 1981, and was completed on June 3, 1981. A total depth of 937 feet was attained. Eighty-seven feet of 12-3/4-inch surface casing was cemented into place and 8-5/8-inch well casing was installed from land surface to the bedrock. The drilling penetration rate and lithologic log are shown in figure 19. Temperature and caliper logs are shown in figure 20.

Water levels measured from October 28, 1985, to January 28, 1986, for this well are presented in graphic form in figure 21. The Geological Survey made a 66-hour constant-discharge aquifer test December 6-12, 1986. Drawdown data are listed in table 10 and shown in figure 22. Recovery data are listed in table 11 and shown in figure 23. Water levels were measured with a recording pressure transducer calibrated onsite. Total recovery occurred within 5 minutes after the pump was turned off.

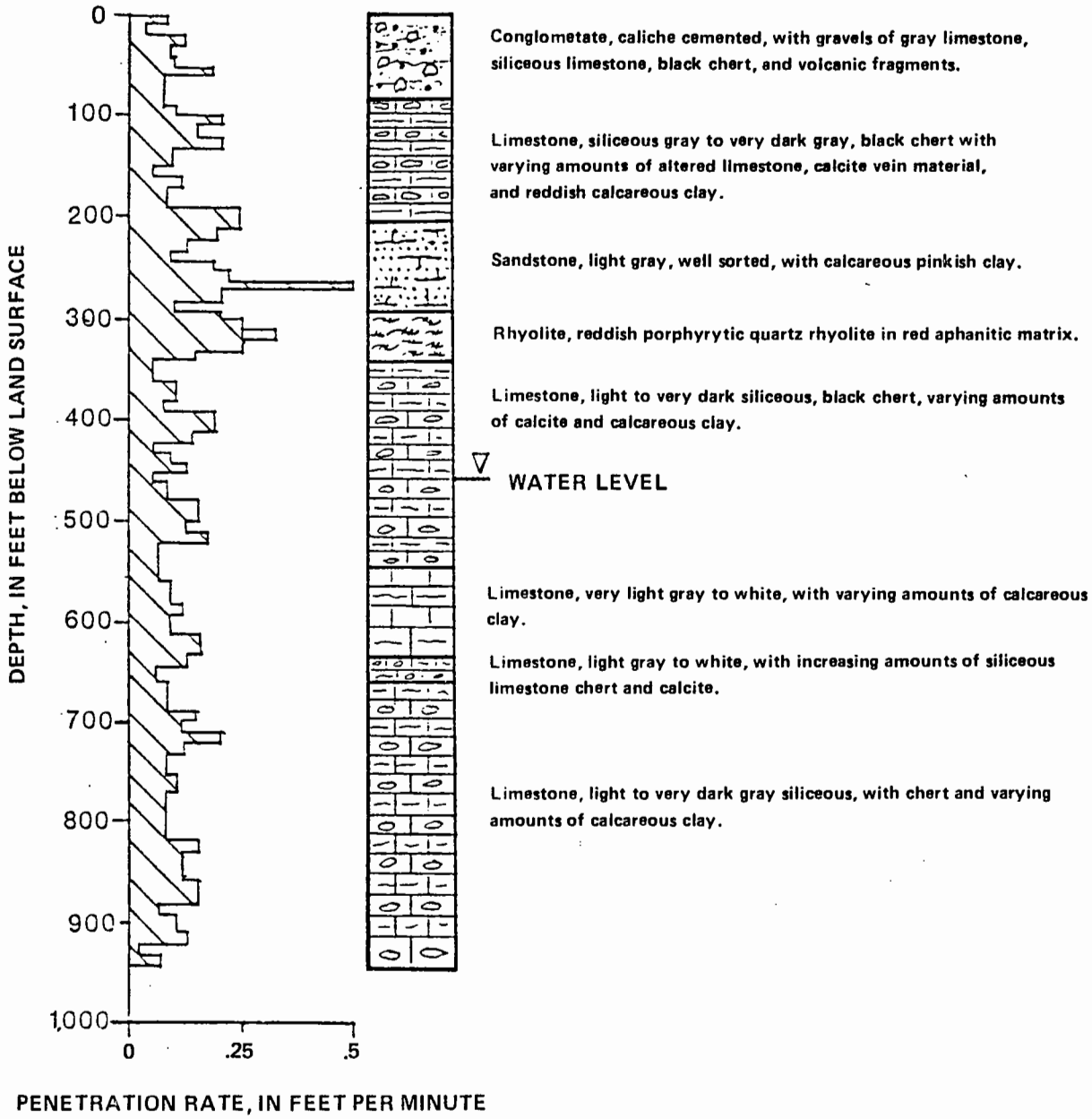

FIGURE 19.--Drilling penetration rate and lithology for MX test well CE-DT-6.

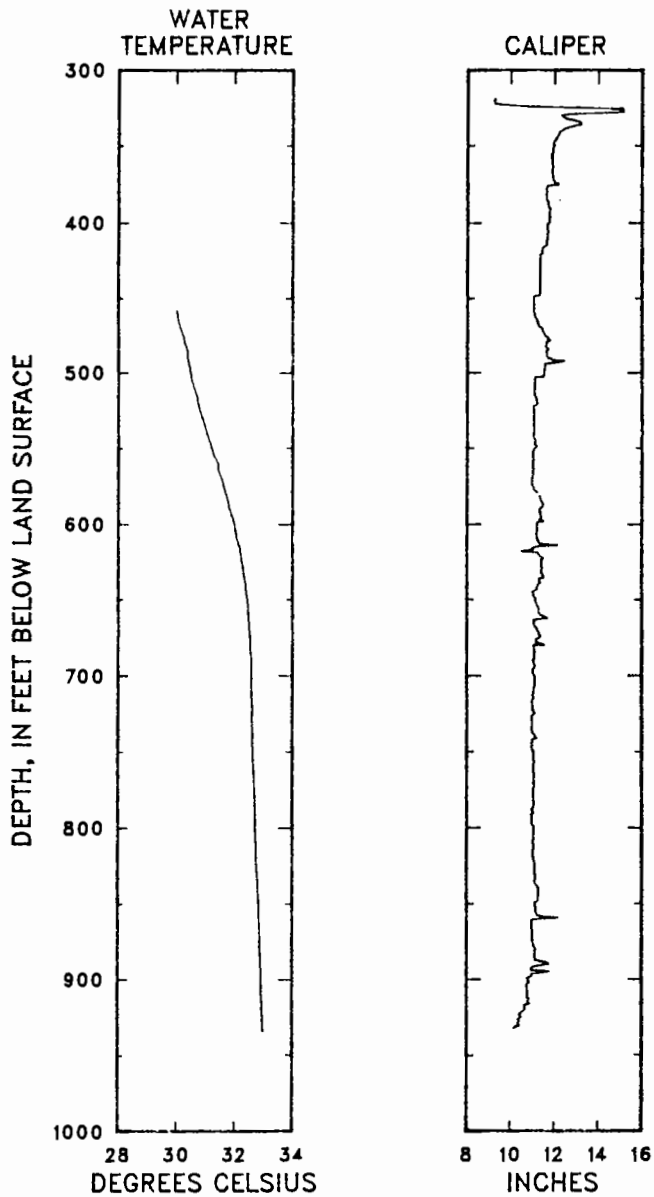

FIGURE 20.--Water temperature and caliper logs for MX test well CE-DT-6.

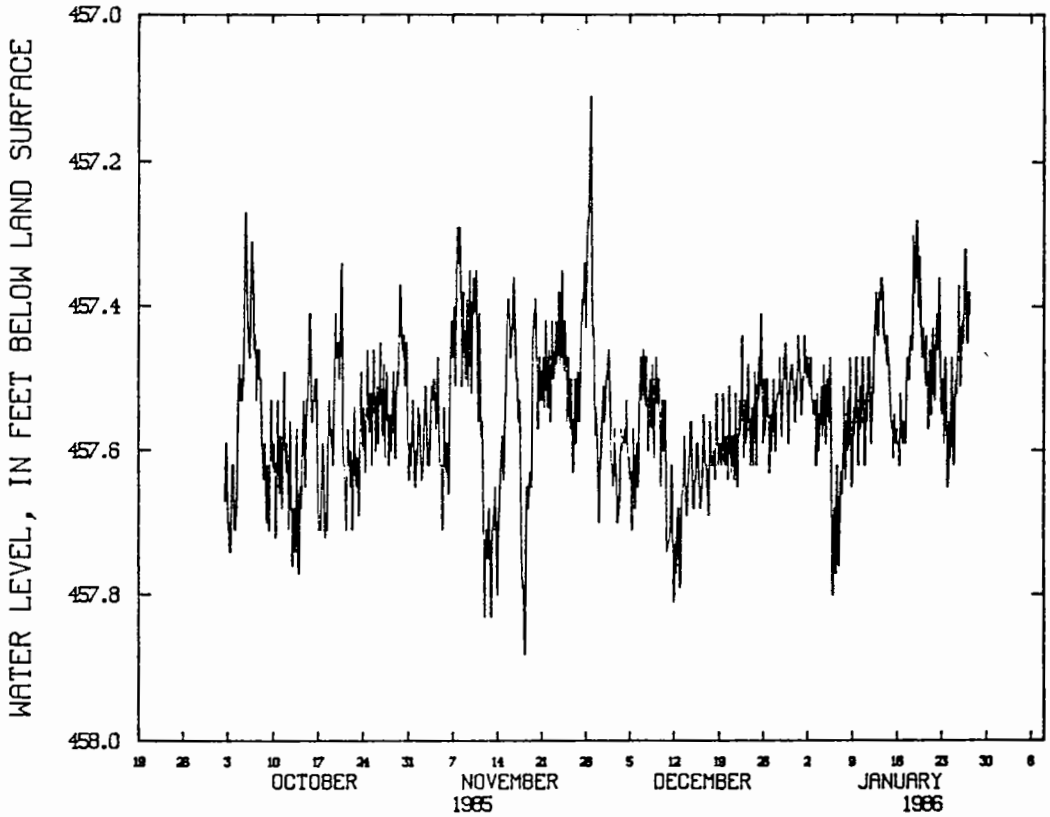

FIGURE 21.--Data from continuous water-level recording transducer at MX test well CE-DT-6 for October 28, 1985, to January 28, 1986.

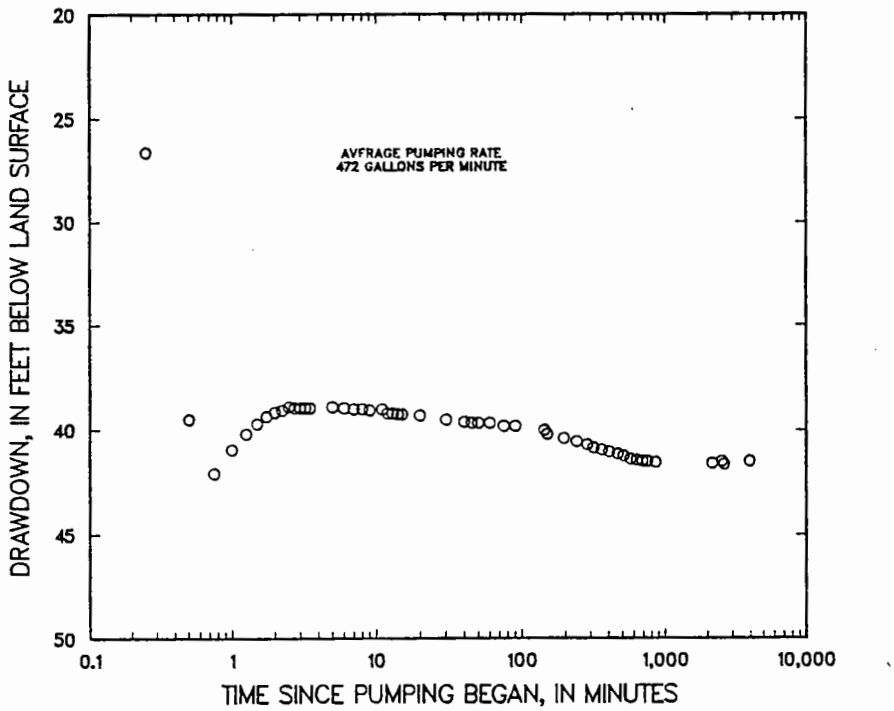

FIGURE 22.--Drawdown versus time at MX test well CE-DT-6, December 9-12, 1986.

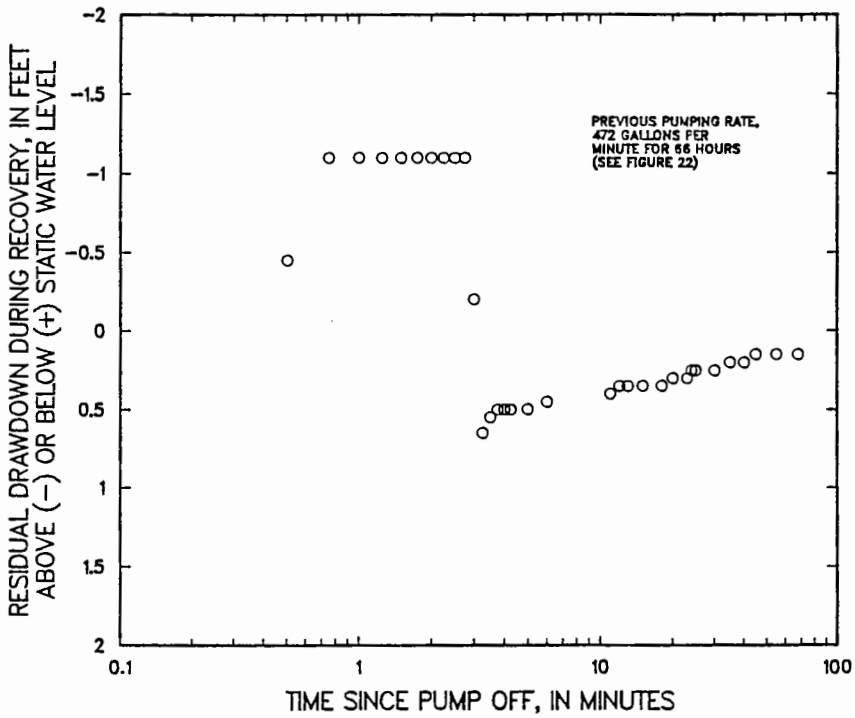

FIGURE 23.--Residual drawdown versus time at MX test well CE-DT-6, December 12, 1986.

TABLE 10.--*Water levels during a 66-hour, constant-discharge aquifer test at MX test well CE-UT-6, December 9-12, 1986. Static water level is 457.3 feet*

[Time, minutes since pumping began; water level, depth below land surface; drawdown, calculated drawdown of water levels in feet below static water level; pumping rate, spot-checked during test (average pumping rate during entire test determined from flow totalizer was 472.0 gallons per minute)]

Time (minutes)	Water level (feet)	Draw-down (feet)	Pumping rate (gallons per minute)[1]	Time (minutes)	Water level (feet)	Draw-down (feet)	Pumping rate (gallons per minute)[1]
0.00	457.30	0.00		30.00	496.80	39.50	462
0.25	483.95	26.65		40.00	496.90	39.60	
0.50	496.80	39.50		45.00	496.95	39.65	500
0.75	499.40	42.10		50.00	496.95	39.65	
1.00	498.25	40.95		60.00	496.95	39.65	450
1.25	497.50	40.20		75.00	497.10	39.80	
1.50	497.00	39.70		90.00	497.10	39.80	466
1.75	496.65	39.35		113.00	497.30	40.00	478
2.00	496.45	39.15		150.00	497.50	40.20	
2.25	496.35	39.05		195.00	497.70	40.40	
2.50	496.20	38.90		240.00	497.85	40.55	
2.75	496.25	38.95		285.00	498.00	40.70	
3.00	496.25	38.95		315.00	498.15	40.85	
3.25	496.25	38.95		360.00	498.25	40.95	
3.50	496.25	38.95		405.00	498.35	41.05	
5.00	496.20	38.90	630	465.00	498.45	41.15	
6.00	496.25	38.95	480	510.00	498.55	41.25	
7.00	496.30	39.00		570.00	498.70	41.40	
8.00	496.30	39.00		630.00	498.75	41.45	
9.00	496.35	39.05		690.00	498.80	41.50	
11.00	496.30	39.00		750.00	498.80	41.50	
12.00	496.50	39.20		855.00	498.85	41.55[a]	
13.00	496.50	39.20		2160.00	498.90	41.60	
14.00	496.55	39.25		2520.00	498.80	41.50	
15.00	496.55	39.25	428	2609.00	498.95	41.65	483
20.00	496.60	39.30		3963.00	498.80	41.50	472

[1] This well does not have a foot valve; therefore when the pump is first turned on the pumping rate is high until the discharge pipe fills with water up to the surface.

[a] After 900 minutes, recorded water levels remained within 0.5 feet of 498.85 feet but fluctuated "randomly" about that level, perhaps due to variations in recorder power supply, barometric pressure, or pumping rate.

TABLE 11.--*Water levels during recovery from a 66-hour, constant-discharge aquifer test at MX test well CE-DT-6, December 12, 1986*

[Time, minutes since pumping ended; water level, feet below land surface; residual drawdown, calculated drawdown of water levels remaining below static water level]

Time (minutes)	Water level (feet)	Residual drawdown (feet)[1]	Time (minutes)	Water level (feet)	Residual drawdown (feet)[1]
0.25	479.70	22.40	5.00	457.80	0.50
0.50	456.85	-0.45	6.00	457.75	0.45
0.75	456.20	-1.10	11.00	457.70	0.40
1.00	456.20	-1.10	12.00	457.65	0.35
1.25	456.20	-1.10	13.00	457.65	0.35
1.50	456.20	-1.10	15.00	457.65	0.35
1.75	456.20	-1.10	18.00	457.65	0.35
2.00	456.20	-1.10	20.00	457.60	0.30
2.25	456.20	-1.10	23.00	457.60	0.30
2.50	456.20	-1.10	24.00	457.55	0.25
2.75	456.20	-1.10	25.00	457.55	0.25
3.00	457.10	-0.20	30.00	457.55	0.25
3.25	457.95	0.65	35.00	457.50	0.20
3.50	457.85	0.55	40.00	457.50	0.20
3.75	457.80	0.50	45.00	457.45	0.15
4.00	457.80	0.50	55.00	457.45	0.15
4.25	457.80	0.50	68.00	457.45	0.15

[1] This well does not have a foot valve; consequently, when the pump is turned off, an initial slug of water is delivered to the well as the water in the discharge pipe drains down through the pump (minus values).

CE-VF-2

Well CE-VF-2 in Coyote Spring Valley, Lincoln County, is adjacent to U.S. Highway 93, approximately 4 miles north of the intersection of U.S. Highway 93 and State Route 168 (figure 1). The well site is east of Pahranagat Wash in Coyote Spring Valley.

Drilling began on December 15, 1980, and was completed sometime before April 1981 (exact date not known). The reported total depth is 1,221 feet and the water table was near 611 feet below land surface. Dolomitic limestone bedrock was penetrated at 850 feet. The well is cased with 10-inch-diameter blank casing from 0 to 860 feet and is uncased from 860 to 1,221 feet. The casing was set with cement from the surface to 50 feet and from 840 to 860 feet. Nongraded gravel pack was placed in the annulus from 50 to 840 feet. The drilling penetration rate and lithologic log for CE-VF-2 are shown in figure 24, and geophysical well logs are shown in figure 25. Another well, CE-VF-1, was drilled as an observation well approximately 300 feet north of CE-VF-2. A reported depth of 714 feet was attained, bottoming in basin-fill deposits. The water level is 593 feet below land surface, indicating a vertical gradient between CE-VF-2 and CE-VF-1.

Well CE-VF-2 was tested by the Geological Survey in February of 1986. The well was developed initially in 1981 by bailing 25 bails per day for 5½ days (16.5 gallons per bail). The pump, flow-meter assembly, and pressure transducer used in 1986 were the same as those used in the test at CSV-2. The pump intake was set at 707 feet and the discharge was piped 80 feet away from the site. The well was pumped at 77 gal/min for 14 hours, and recovery took 2 hours. The pump stopped unexpectedly due to mechanical failure and, as a result, the exact time for the beginning of the recovery portion of the test is uncertain within 1 to 4 minutes. The initial recovery measurements exhibit a great deal of scatter due to rapid oscillations of the water in the well or to problems with the pressure transducer or recorder. Despite these initial difficulties, the long-term recovery of water levels was accurately measured. See tables 12 and 13 and figures 26 and 27. Measurements of water levels in an observation well 300 feet away, CE-VF-1, showed no change during the 14-hour test. The observation well does not penetrate the carbonate aquifer.

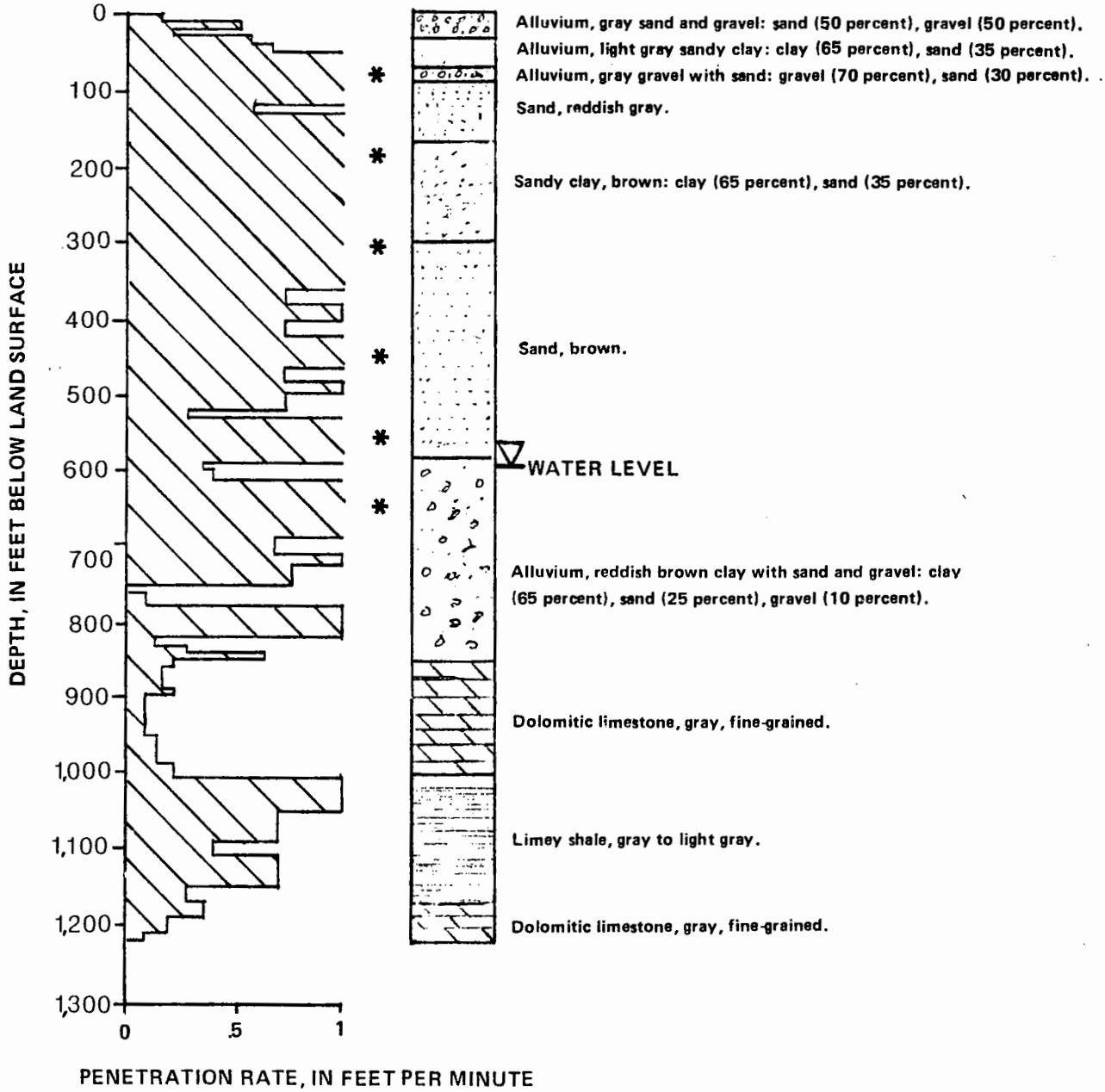

FIGURE 24.--Drilling penetration rate and lithology for MX test well CE-VF-2. Asterisk indicates penetration rate exceeding 1.0 foot per minute.

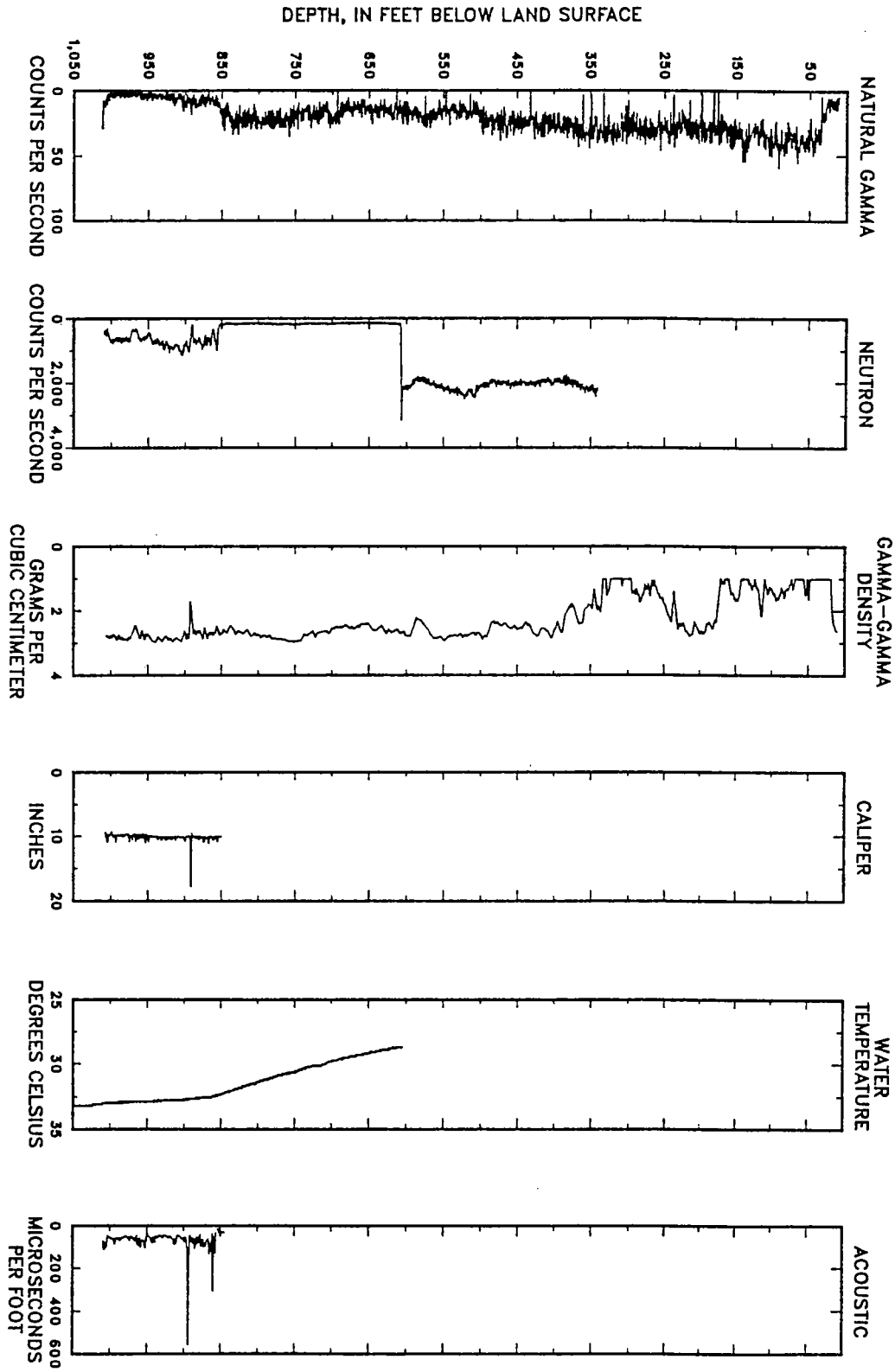

FIGURE 25.--Natural gamma, neutron, gamma-gamma density, caliper, water-temperature, and acoustic logs for MX test well CE-VF-2.

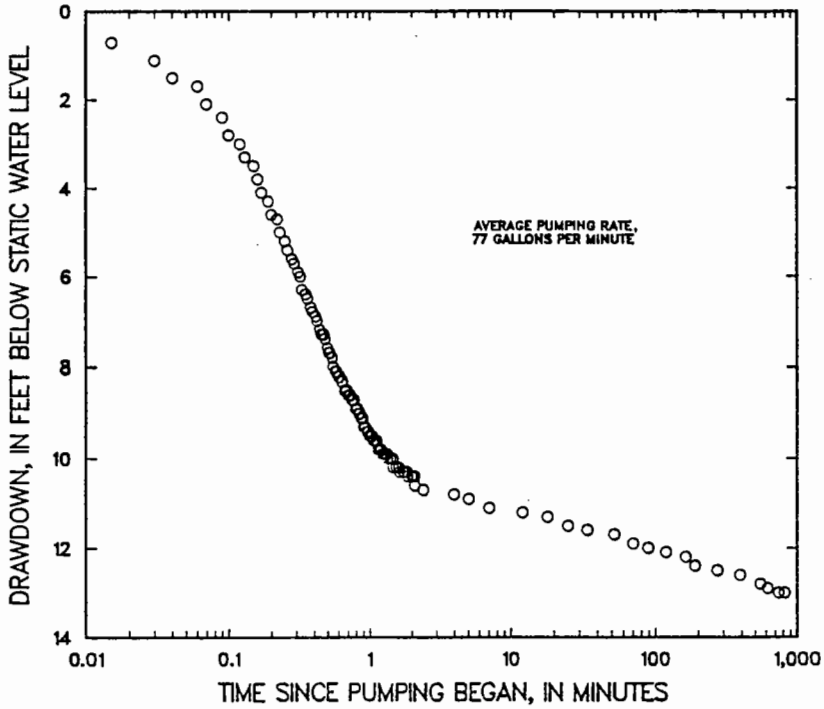

FIGURE 26.--Drawdown versus time at MX test well CE-VF-2, February 6, 1986.

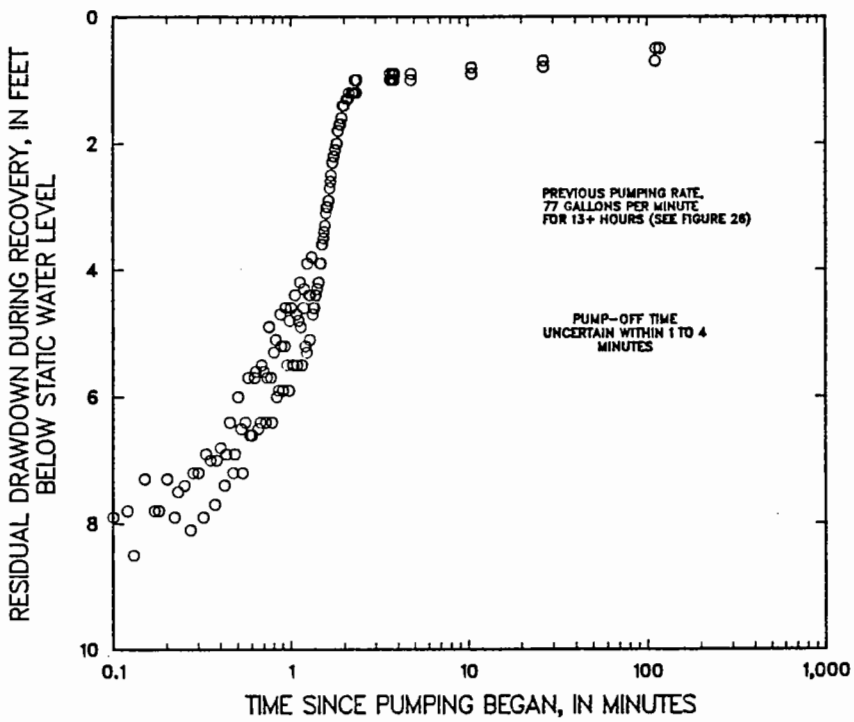

FIGURE 27.--Residual drawdown versus time at MX test well CE-VF-2, February 6, 1986.

TABLE 12.--*Water levels during a 14-hour, constant-discharge aquifer test at MX test well CE-VF-2, February 6, 1986. Static water level is 604.3 feet*

[Time, minutes since pumping began; water level, feet below land surface; drawdown, calculated drawdown of water levels in feet below static water level; pumping rate, spot-checked during test (average pumping rate during entire test determined from flow totalizer was 76.8 gallons per minute)]

Time (minutes)	Water level (feet)	Draw-down (feet)	Pumping rate (gallons per minute)	Time (minutes)	Water level (feet)	Draw-down (feet)	Pumping rate (gallons per minute)
0.00	604.3	0.0	pump on	0.44	611.5	7.2	
0.02	605.0	0.7		0.45	611.6	7.3	
0.03	605.4	1.1		0.47	611.6	7.3	
0.04	605.8	1.5		0.48	611.7	7.4	
0.06	606.0	1.7		0.50	611.9	7.6	
0.07	606.4	2.1		0.51	612.0	7.7	
0.09	606.7	2.4		0.52	612.0	7.7	
0.10	607.1	2.8		0.54	612.1	7.8	
0.12	607.3	3.0		0.55	612.3	8.0	
0.13	607.6	3.3		0.57	612.4	8.1	
0.15	607.8	3.5		0.58	612.4	8.1	
0.16	608.1	3.8		0.60	612.5	8.2	
0.17	608.4	4.1		0.61	612.5	8.2	
0.19	608.6	4.3		0.63	612.6	8.3	
0.20	608.9	4.6		0.64	612.6	8.3	
0.22	609.0	4.7		0.66	612.8	8.5	
0.23	609.3	5.0		0.67	612.8	8.5	
0.25	609.5	5.2		0.69	612.8	8.5	
0.26	609.7	5.4		0.70	612.9	8.6	
0.28	609.9	5.6		0.71	612.9	8.6	
0.29	610.0	5.7		0.73	612.9	8.6	
0.31	610.2	5.9		0.74	613.0	8.7	
0.32	610.3	6.0		0.76	613.0	8.7	
0.33	610.6	6.3		0.77	613.0	8.7	
0.35	610.7	6.4		0.79	613.2	8.9	
0.36	610.8	6.5		0.80	613.2	8.9	
0.38	611.0	6.7		0.82	613.2	8.9	
0.39	611.1	6.8		0.83	613.3	9.0	
0.41	611.2	6.9		0.85	613.3	9.0	
0.42	611.3	7.0		0.86	613.4	9.1	

TABLE 12.--*Water levels during a 14-hour, constant-discharge aquifer test at MX test well CE-VF-2, February 6, 1986*--Continued

Time (minutes)	Water level (feet)	Draw-down (feet)	Pumping rate (gallons per minute)	Time (minutes)	Water level (feet)	Draw-down (feet)	Pumping rate (gallons per minute)
0.88	613.4	9.1		1.63	614.6	10.3	
0.89	613.4	9.1		1.75	614.6	10.3	
0.90	613.6	9.3		1.85	614.6	10.3	
0.92	613.6	9.3		1.87	614.7	10.4	
0.93	613.6	9.3		2.00	614.7	10.4	
0.95	613.7	9.4		2.09	614.7	10.4	
0.96	613.7	9.4		2.10	614.9	10.6	
0.98	613.7	9.4		2.42	615.0	10.7	76
0.99	613.8	9.5		3.99	615.1	10.8	
1.01	613.8	9.5		5.05	615.2	10.9	
1.02	613.8	9.5		7.07	615.4	11.1	78
1.04	613.8	9.5		12.03	615.5	11.2	80
1.05	613.9	9.6		18.01	615.6	11.3	
1.08	613.9	9.6		25.03	615.8	11.5	75
1.12	613.9	9.6		34.04	615.9	11.6	75
1.14	614.1	9.8		52.03	616.0	11.7	76
1.18	614.1	9.8		70.05	616.2	11.9	
1.21	614.1	9.8		89.07	616.3	12.0	78
1.23	614.2	9.9		118.01	616.4	12.1	78
1.28	614.2	9.9		163.06	616.5	12.2	77
1.33	614.2	9.9		190.08	616.7	12.4	77
1.34	614.3	10.0		272.04	616.8	12.5	78
1.40	614.3	10.0		390.03	616.9	12.6	76
1.46	614.3	10.0		545.05	617.1	12.8	76
1.47	614.5	10.2		616.07	617.2	12.9	78
1.55	614.5	10.2		741.00	617.3	13.0	78
1.62	614.5	10.2		819.00	617.3	13.0	78
				pump off at approximately 830 minutes			

TABLE 13.--*Water levels during recovery from a 14-hour, constant-discharge aquifer test at MX test well CE-VF-2, February 6-7, 1986*

[Time, arbitrary time since pumping ended (arbitrary because pump-off time is uncertain within 1 to 4 minutes); water level, feet below land surface; residual drawdown, calculated drawdown of water levels remaining below static water level]

Time (minutes)	Water level (feet)	Residual drawdown (feet)	Time (minutes)	Water level (feet)	Residual drawdown (feet)
0.025	612.5	8.2	0.52	610.8	6.5
0.03	612.4	8.1	0.53	611.5	7.2
0.05	612.9	8.6	0.55	610.7	6.4
0.07	612.0	7.7	0.57	610.0	5.7
0.08	612.5	8.2	0.58	610.9	6.6
0.10	612.2	7.9	0.60	610.9	6.6
0.12	612.1	7.8	0.62	610.0	5.7
0.13	612.8	8.5	0.63	609.9	5.6
0.15	611.6	7.3	0.65	610.8	6.5
0.17	612.1	7.8	0.67	610.7	6.4
0.18	612.1	7.8	0.68	609.8	5.5
0.20	611.6	7.3	0.70	609.9	5.6
0.22	612.2	7.9	0.72	610.7	6.4
0.23	611.8	7.5	0.73	610.0	5.7
0.25	611.7	7.4	0.75	609.2	4.9
0.27	612.4	8.1	0.77	610.0	5.7
0.28	611.5	7.2	0.78	610.7	6.4
0.30	611.5	7.2	0.80	609.6	5.3
0.32	612.2	7.9	0.82	609.4	5.1
0.33	611.2	6.9	0.83	610.3	6.0
0.35	611.3	7.0	0.85	610.2	5.9
0.37	612.0	7.7	0.87	609.0	4.7
0.38	611.3	7.0	0.88	609.5	5.2
0.40	611.1	6.8	0.90	610.2	5.9
0.42	611.7	7.4	0.92	609.5	5.2
0.43	611.2	6.9	0.93	608.9	4.6
0.45	610.7	6.4	0.95	609.8	5.5
0.47	611.5	7.2	0.97	610.2	5.9
0.48	611.2	6.9	0.98	609.1	4.8
0.50	610.3	6.0	1.00	608.9	4.6

TABLE 13.--*Water levels during recovery from a 14-hour, constant-discharge aquifer test at MX test well CE-VF-2, February 6-7, 1986*--Continued

Time (minutes)	Water level (feet)	Residual drawdown (feet)	Time (minutes)	Water level (feet)	Residual drawdown (feet)
1.02	609.8	5.5	1.60	607.3	3.0
1.03	609.8	5.5	1.62	607.2	2.9
1.05	608.7	4.4	1.63	607.2	2.9
1.07	609.0	4.7	1.65	607.0	2.7
1.08	609.8	5.5	1.67	606.9	2.6
1.10	609.1	4.8	1.68	606.8	2.5
1.12	608.5	4.2	1.70	606.6	2.3
1.13	609.2	4.9	1.72	606.6	2.3
1.15	609.8	5.5	1.73	606.5	2.2
1.17	608.9	4.6	1.75	606.5	2.2
1.18	608.6	4.3	1.77	606.4	2.1
1.20	609.5	5.2	1.78	606.4	2.1
1.22	609.6	5.3	1.80	606.3	2.0
1.23	608.2	3.9	1.82	606.3	2.0
1.25	608.7	4.4	1.83	606.1	1.8
1.27	609.4	5.1	1.85	606.1	1.8
1.28	608.7	4.4	1.87	606.0	1.7
1.30	608.1	3.8	1.88	606.0	1.7
1.32	609.0	4.7	1.90	606.0	1.7
1.33	608.9	4.6	1.92	605.9	1.6
1.35	608.9	4.6	1.93	605.9	1.6
1.37	608.7	4.4	1.95	605.7	1.4
1.38	608.7	4.4	2.00	605.7	1.4
1.40	608.6	4.3	2.05	605.6	1.3
1.42	608.5	4.2	2.10	605.6	1.3
1.43	608.5	4.2	2.12	605.5	1.2
1.45	608.2	3.9	2.20	605.5	1.2
1.47	608.2	3.9	2.25	605.5	1.2
1.48	607.9	3.6	2.28	605.3	1.0
1.50	607.9	3.6	2.30	605.5	1.2
1.52	607.8	3.5	2.33	605.5	1.2
1.53	607.7	3.4	2.35	605.3	1.0
1.55	607.6	3.3	3.58	605.3	1.0
1.57	607.4	3.1	3.60	605.2	0.9
1.58	607.3	3.0	3.62	605.3	1.0

TABLE 13.--*Water levels during recovery from a 14-hour, constant-discharge aquifer test at MX test well CE-VF-2, February 6-7, 1986*--Continued

Time (minutes)	Water level (feet)	Residual drawdown (feet)	Time (minutes)	Water level (feet)	Residual drawdown (feet)
3.72	605.3	1.0	4.78	605.2	0.9
3.73	605.2	0.9	10.42	605.2	0.9
3.75	605.3	1.0	10.43	605.1	0.8
3.77	605.3	1.0	26.32	605.1	0.8
3.78	605.2	0.9	26.33	605.0	0.7
3.80	605.3	1.0	110.33	605.0	0.7
3.82	605.3	1.0	111.33	604.8	0.5
3.85	605.2	0.9	117.33	604.8	0.5
4.77	605.3	1.0			

SHV-1

Well SHV-1 in Hidden Valley, Clark County, is adjacent to U.S. Highway 93, approximately 16.5 miles south of the intersection of U.S. Highway 93 and State Route 168 (figure 1).

This well was drilled sometime before 1958 on U.S. Bureau of Land Management land, apparently for use as a stock well, and is now abandoned. The well was plugged above the water table until the Geological Survey redrilled it to a depth of 920 feet in December 1985. The water table is 832.3 feet below the land surface. The caliper log indicates 5-inch-diameter casing to a depth of 45 feet and 6-inch uncased hole below. The drilling history and well construction are unknown. Geophysical well logs of this well are shown in figure 28.

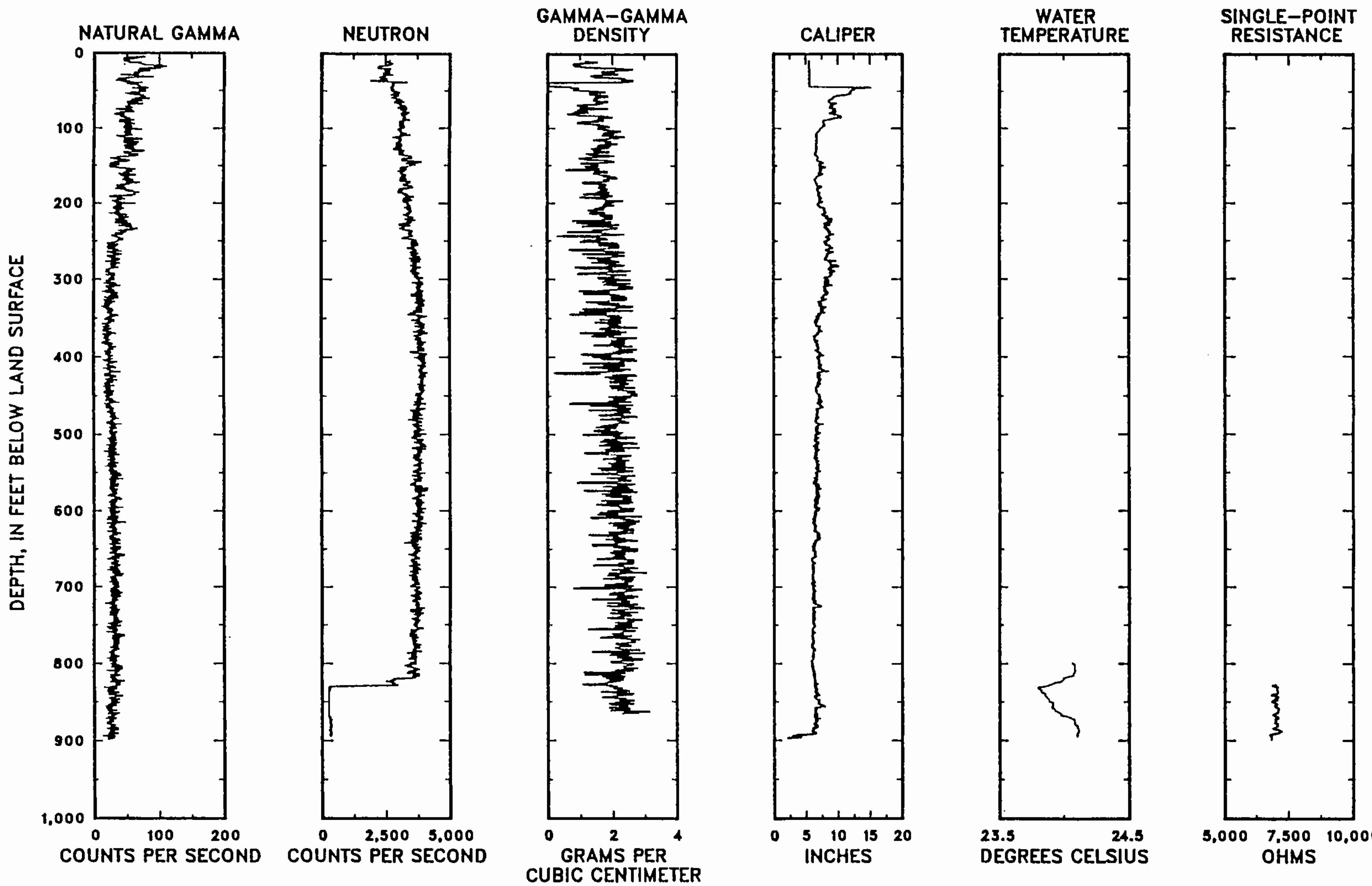

FIGURE 28.--Natural gamma, neutron, gamma-gamma density, caliper, water-temperature, and single-point resistance logs for test well SHV-1.

REFERENCES CITED

Ertec Western, Inc., 1981, Water resources program, results of regional carbonate aquifer testing, Coyote Spring Valley, Nevada: Long Beach, Calif., Department of the Air Force, MX Siting Investigation Water Resources Report E-TR-57, 190 p.

Rush, F. E., 1968, Index of hydrographic areas in Nevada: Nevada Division of Water Resources Information Report 6, 38 p.