ANNUAL WATER-RESOURCES REVIEW, WHITE SANDS MISSILE RANGE, NEW MEXICO, 1984

By R. R. Cruz

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WHITE SANDS MISSILE RANGE

Albuquerque, New Mexico

1985

UNITED STATES DEPARTMENT OF THE INTERIOR

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CONTENTS

ILLUSTRATIONS

ILLUSTRATIONS - Concluded

TABLES

CONVERSION FACTORS

In this report, values for measurements are given in inch-pound units only. The following table contains factors for converting to International System (SI) units.

Multiply inch-pound units	By	To obtain SI units
foot	0.3048	meter
mile	1.609	kilometer
gallon	3.785	liter
acre-foot	1,233	cubic meter

ANNUAL WATER-RESOURCES REVIEW,

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ABSTRACT

Hydrologic data were collected at White Sands Missile Range in 1984. The total ground-water withdrawal in 1984 was 685,275,000 gallons. The Post Headquarters well field produced 650,821,000 gallons in 1984. Six new wells were drilled at White Sands Missile Range in 1984. Nineteen water samples were collected for major chemical-constituent, trace-element, or radiochemical analysis in 1984. Depth-to-water measurements in the Post Headquarters supply wells showed seasonal fluctuations as well as continued long-term declines.

INTRODUCTION

This report presents water-resources data that were collected at White Sands Missile Range (fig. 1) during 1984 by personnel of the U.S. Geological Survey and White Sands Missile Range. Ground-water pumpage, water-level measurements, chemical-quality data, and well-drilling data summarized in this report were obtained as a result of the continuing water-resources hydrologic-data-collection program sponsored by the Engineering and Housing Directorate, White Sands Missile Range.

This report is the seventeenth Annual Water-Resources Review prepared for the White Sands Missile Range. The 1968 report and subsequent annual reports are available for inspection at the District Office of the U.S. Geological Survey, Water Resources Division, Albuquerque, New Mexico.

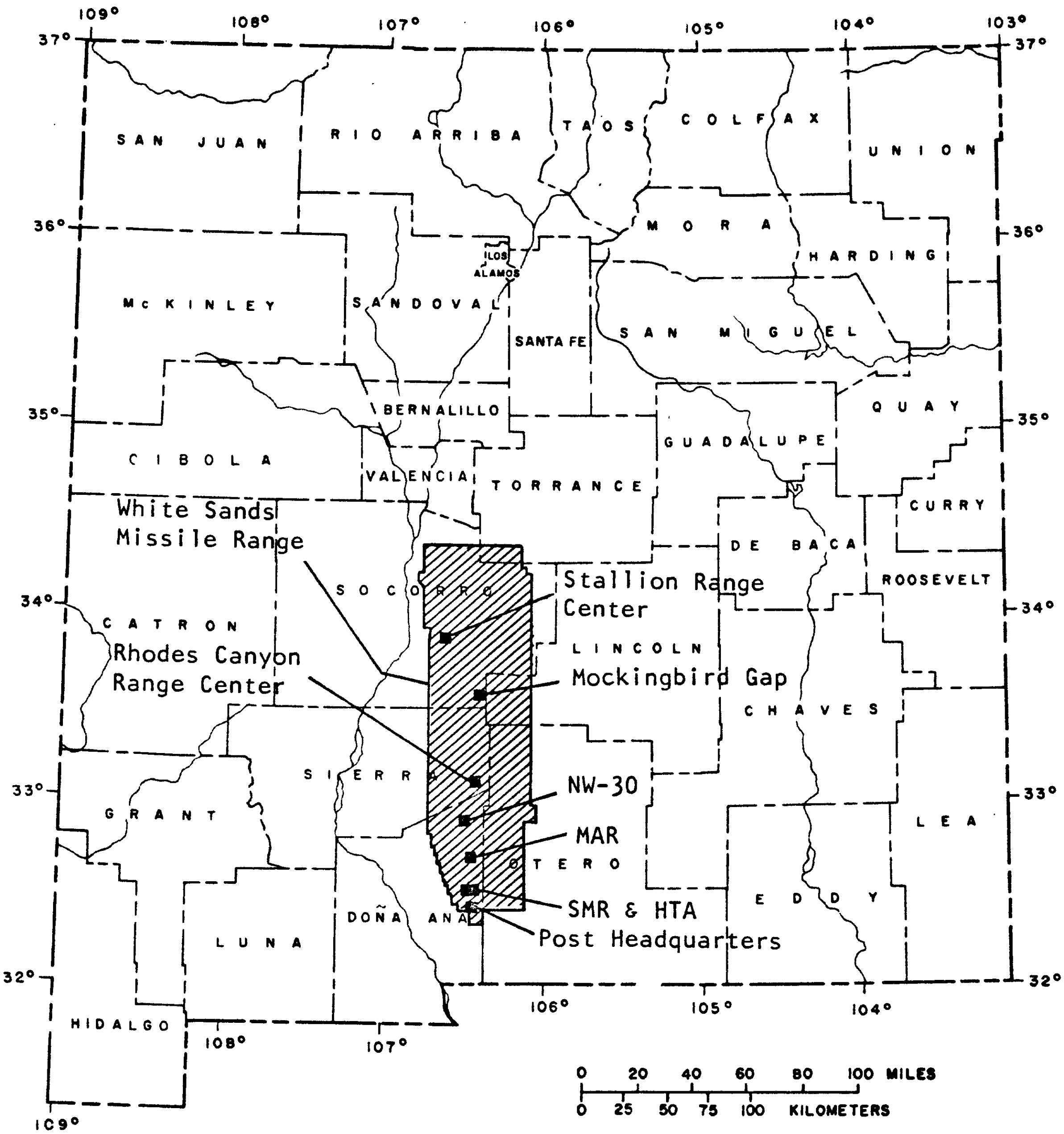
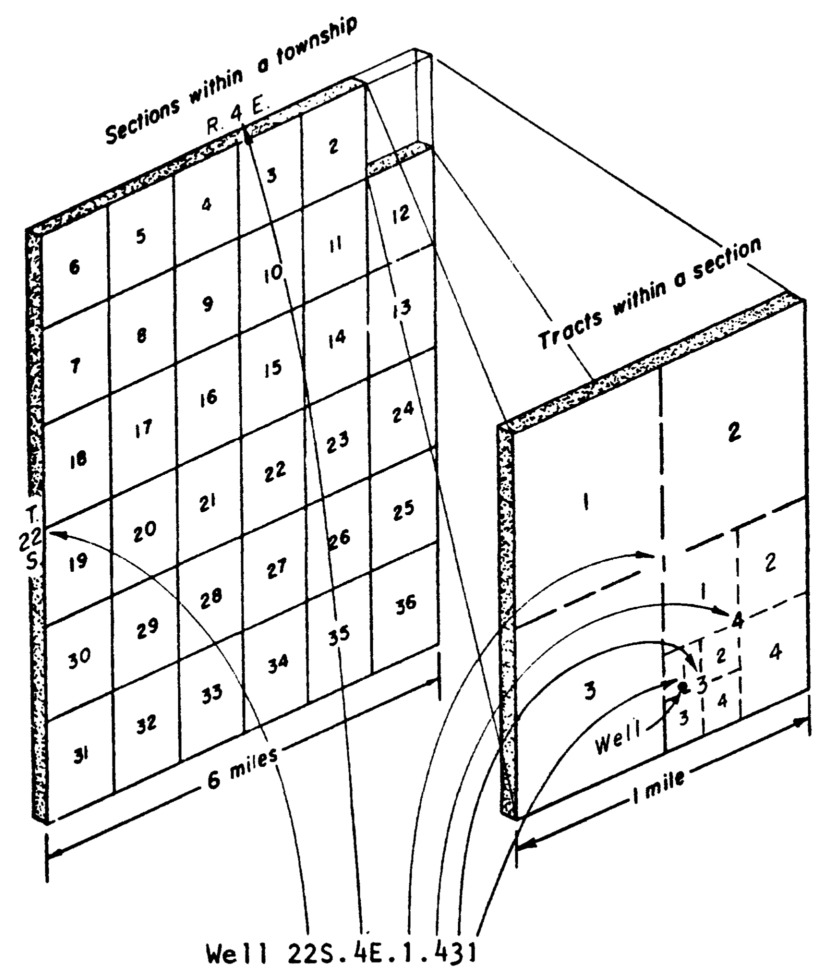


Figure 1.-- White Sands Missile Range and areas of hydrologic observations.

Well-Numbering System

Wells are located according to the system of common subdivision of sectionized land used throughout the State by the U.S. Geological Survey. The number of each well consists of four segments separated by periods and locates the well's position to the nearest 10-acre tract of land. The segments denote, respectively, the township south of the New Mexico base line, the range east of the New Mexico principal meridian, the section, and the particular 10-acre tract within the section.

The fourth segment of the number consists of three digits denoting, respectively, the quarter section or approximate 160-acre tract, the quadrant (approximately 40 acres in size) of the quarter section, and the quadrant (approximately 10 acres in size) of the 40-acre tract in which the well is located. The system of numbering quarter sections and quadrants, which is done in reading order, as well as the usual numbering of sections within a township is shown below. For example, well 22S.4E.1.431 is located in the NW¼ of the SW¼ of the SE¼, section 1, Township 22 South, Range 4 East. If more than one well has the same location number, the letter "a" is assigned to the second well, the letter "b" to the third well and so on.



DATA-COLLECTION PROGRAM

The program to collect hydrologic data at the White Sands Missile Range has been continuous since 1953. The original program consisted of water-level measurements in five wells in the Post Headquarters area. Over the years, the program has expanded to keep up with the expansion of the White Sands Missile Range facilities. Six new wells were drilled on the White Sands Missile Range in 1984 (table 1). Currently the hydrologic data-collection program consists of semiannual depth-to-water measurements in 93 wells (tables 2-4) from Stallion Range Center on the north to about 6 miles south of the Post Headquarters area (figs. 1-5).

Ground-water withdrawal is measured at 17 supply wells in the Post Headquarters and Range areas. The total gallons pumped per year from the Post Headquarters well field for 1970-84 and a hydrograph of water levels in test well T-8 are shown in figure 6.

Nineteen water samples for analysis other than laboratory specific conductance and pH were collected in 1984 (tables 5-7). Seven water samples were analyzed for major chemical constituents (table 5), five for major chemical constituents and trace elements (table 6), and seven for radiochemicals (table 7). Water-level data and specific conductance for water from the Post Headquarters supply wells for the period of record are shown in figures 7, 8, and 9.

Ground-Water Pumpage

Total ground-water pumpage* at the White Sands Missile Range in 1984 was 685,275,000 gallons. The Post Headquarters well field produced 650,821,000 gallons, the Hazardous Test Area well (HTA-1) produced 145,000 gallons, the Small Missile Range well (SMR-1) produced 947,800 gallons, the Multifunction Array Radar wells (MAR-1 and MAR-2) produced 23,701,700 gallons, and the Stallion Range Center wells (SRC-1 and SRC-2) produced 9,659,000 gallons in 1984. Total pumpage was 28.3 million gallons less in 1984 than in 1983.

*The pumpage figures used in this report are to be considered as preliminary figures and may be subject to revision.

Table 1.—Wells drilled on the White Sands Missile Range, 1984

Well number	Location	Date drilled (month-day-year)	Hole diameter and depth drilled (inches-feet)	Casing diameter (inches-type-depth)	Slot or screen interval (depth in feet below land surface)
T-34	22S.5E.28.234	2-11-84	9 7/8 400	4 PVC 400	200-380 slot
BLM	22S.4E.15.331	2-23-84	6 295	4 PVC 295	125-285 slot
HTA-3	21S.4E.14.114	5-23-84	6 163	4 PVC 160	60- 80 screen 80-110 slot 110-120 screen 120-150 slot
NT-2	21S.3E. 2.311	7-11-84	7 7/8 0-330 6 1/4 330-400	4 PVC 400	90-210 slot 230-250 slot 270-290 slot 310-330 slot 350-390 slot
T-35	22S.5E.28.142a	9-8-84	9 7/8 302	4 PVC 300	200-300 slot
T-37	22S.5E.28.142b	9-19-84	9 7/8 320	4 PVC 313	203-303 slot

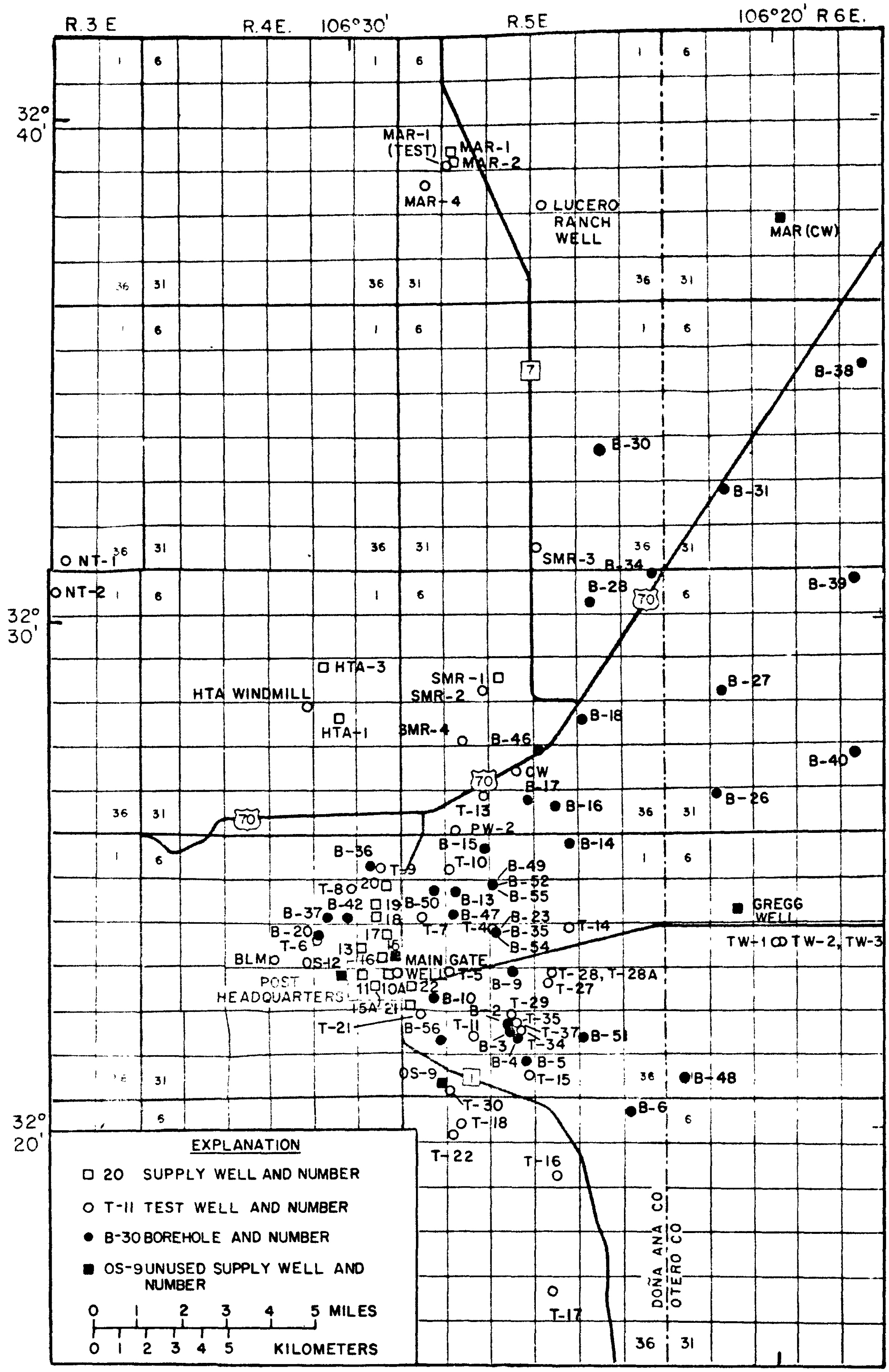


Figure 2.--Location of supply wells, test wells, and boreholes in the Post Headquarters and adjacent areas.

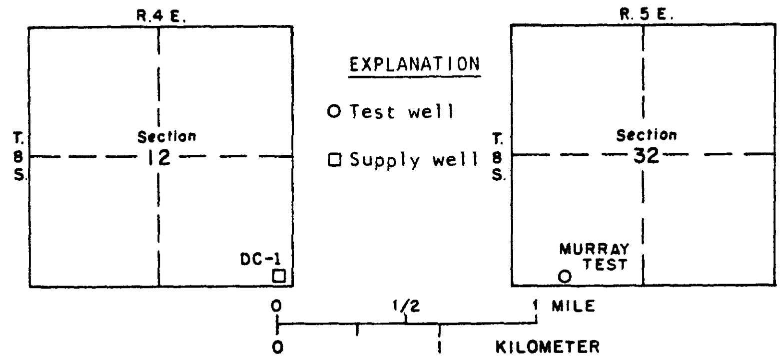


Figure 3.--Location of wells in the Mockingbird Gap area.

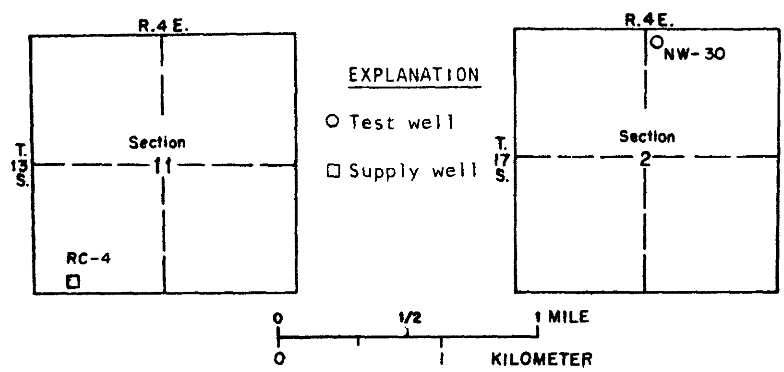


Figure 4.--Location of wells in the Rhodes Canyon and NW-30 areas.

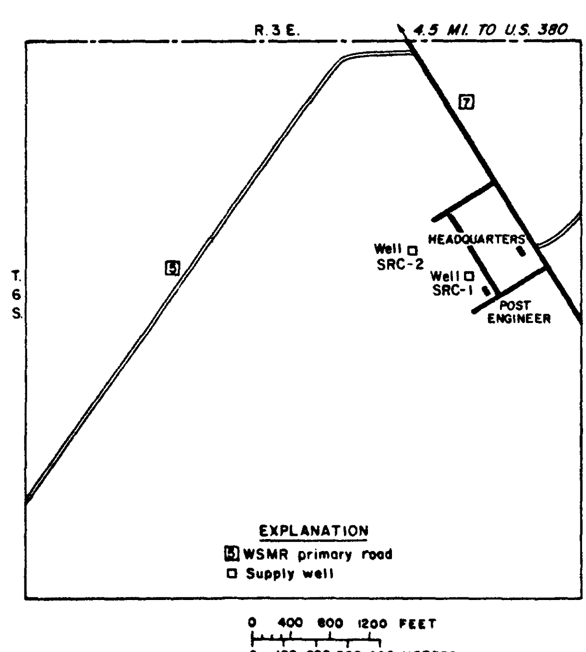


Figure 5.--Location of supply wells at the Stallion Range Center.

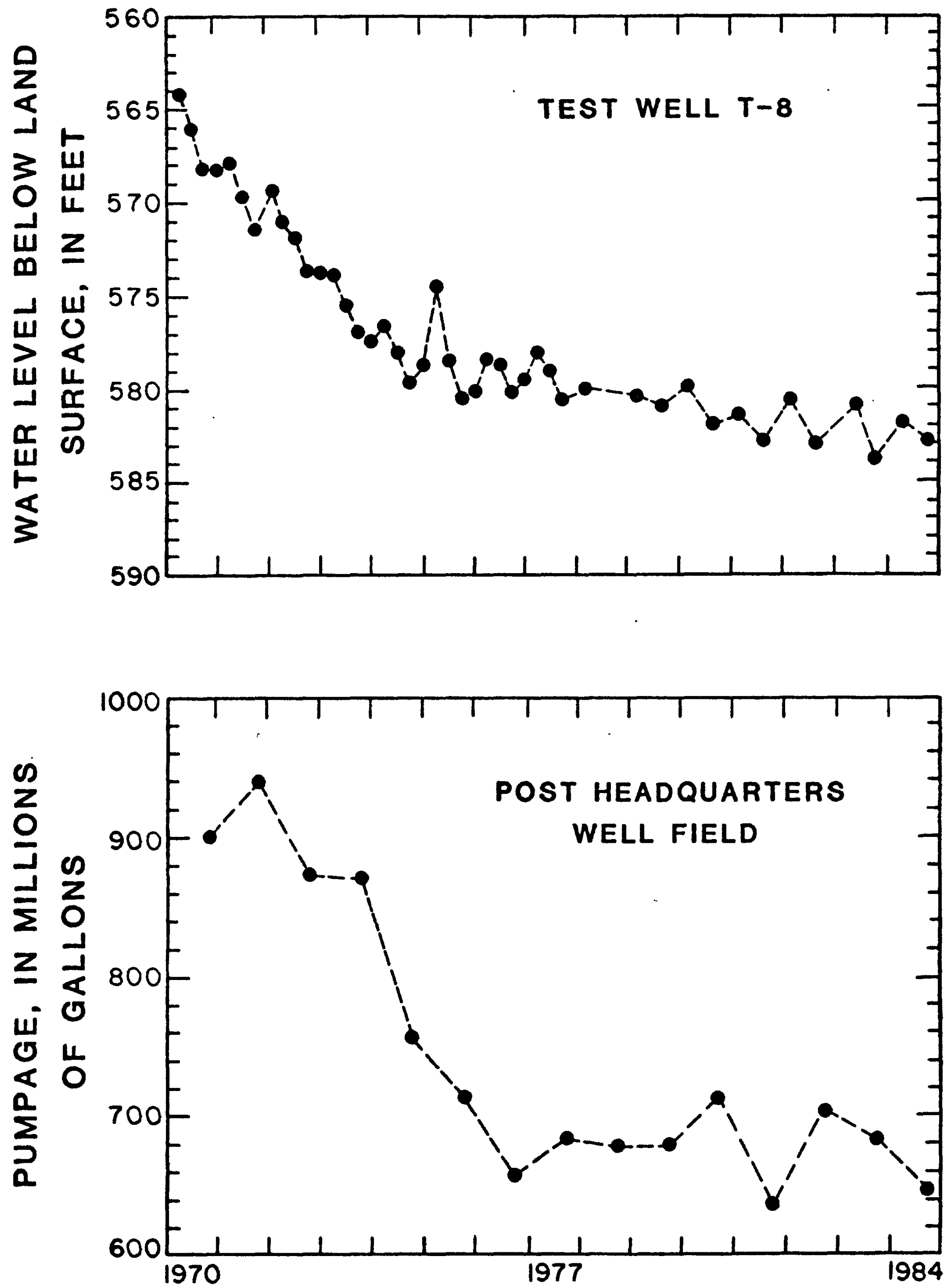


Figure 6.--Yearly pumpage from the Post Headquarters well field and water levels in test well T-8, 1970-84.

Water-Level Measurements in Supply Wells

Semiannual depth-to-water measurements were made in 10 supply wells in the Post Headquarters area and 3 supply wells in the Range areas (table 2). Hydrographs of water levels in the 10 supply wells in the Post Headquarters well field for period of record available are shown in figures 7 through 9. The Small Missile Range (SMR-1) and the Multifunction Array Radar (MAR-1 and 2) supply wells were not measured semiannually in 1984 because of continued pumping. SMR-1 and MAR-2 have one measurement each and MAR-1 does not have any. The two 1984 depth-to-water measurements in these wells are comparable with the 1983 measurements.

Table 2.—Depth to water in supply wells, Post Headquarters and Range areas, 1984

Well number	Location	Winter 1984 (feet below land surface)	Summer 1984 (feet below land surface)
10A	22S.4E.24.212a	427.55	431.20
11	22S.4E.24.112	402.00*	346.00*
13	22S.4E.13.311	--	300.00*
16	22S.4E.13.432	446.00*	460.00*
17	22S.4E.13.241	443.20	451.86
18	22S.4E.12.434	428.44	438.83
19	22S.4E.12.414	454.45	460.03
20	22S.4E.12.214	517.85	519.35
21	22S.5E.19.323	357.04	359.22
22	22S.5E.19.141	377.12	381.12
HTA-1	21S.4E.23.233	65.99	66.65
SMR-1	21S.5E.16.132	297.75	--
MAR-2	19S.5E.17.334	--	221.86
SRC-1	6S.3E.05.232	211.40	210.00
SRC-2	6S.3E.05.234	215.20	214.60

* Air line reading

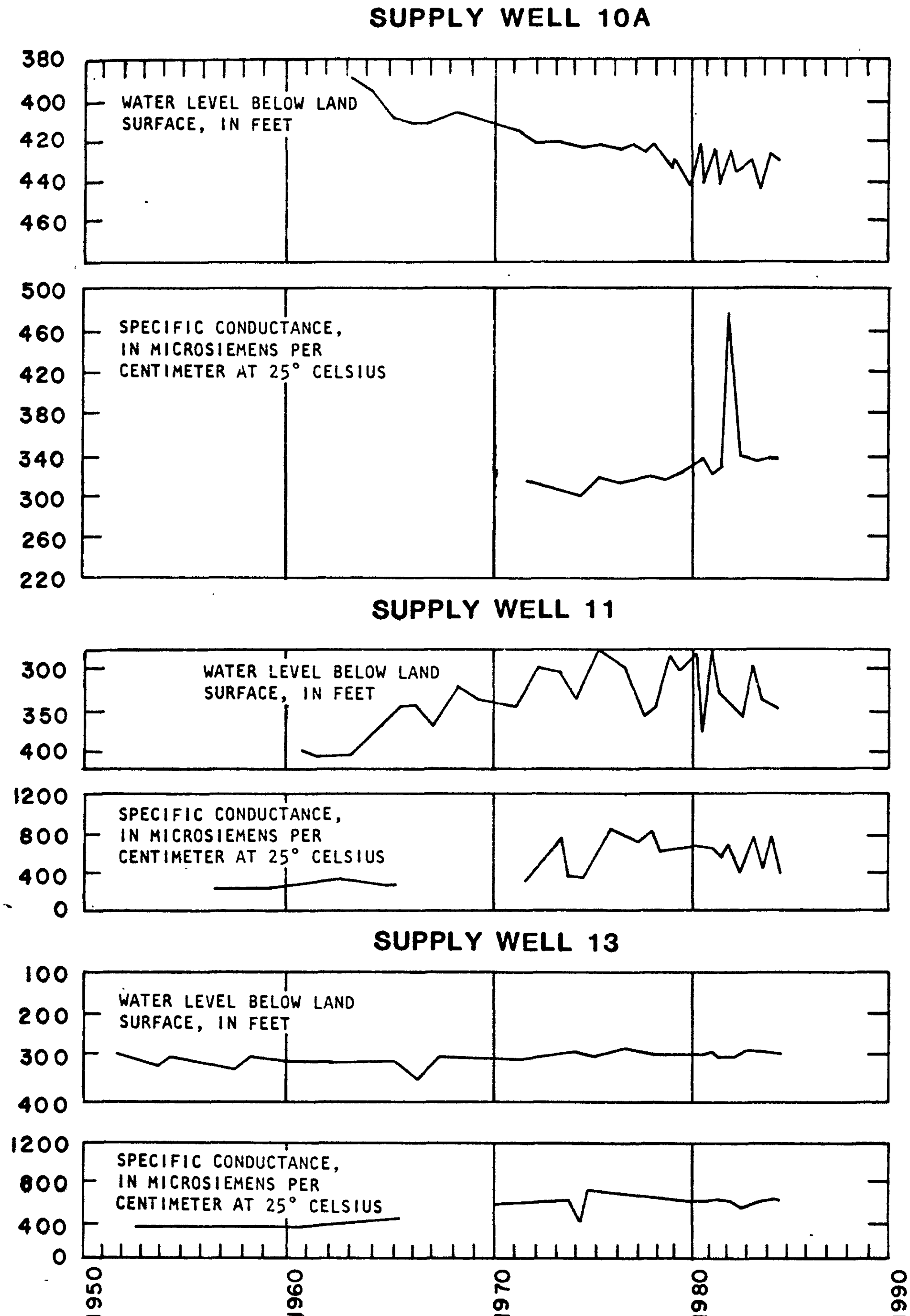


Figure 7.--Water levels and specific conductance for period of record available in supply wells 10A, 11, and 13.

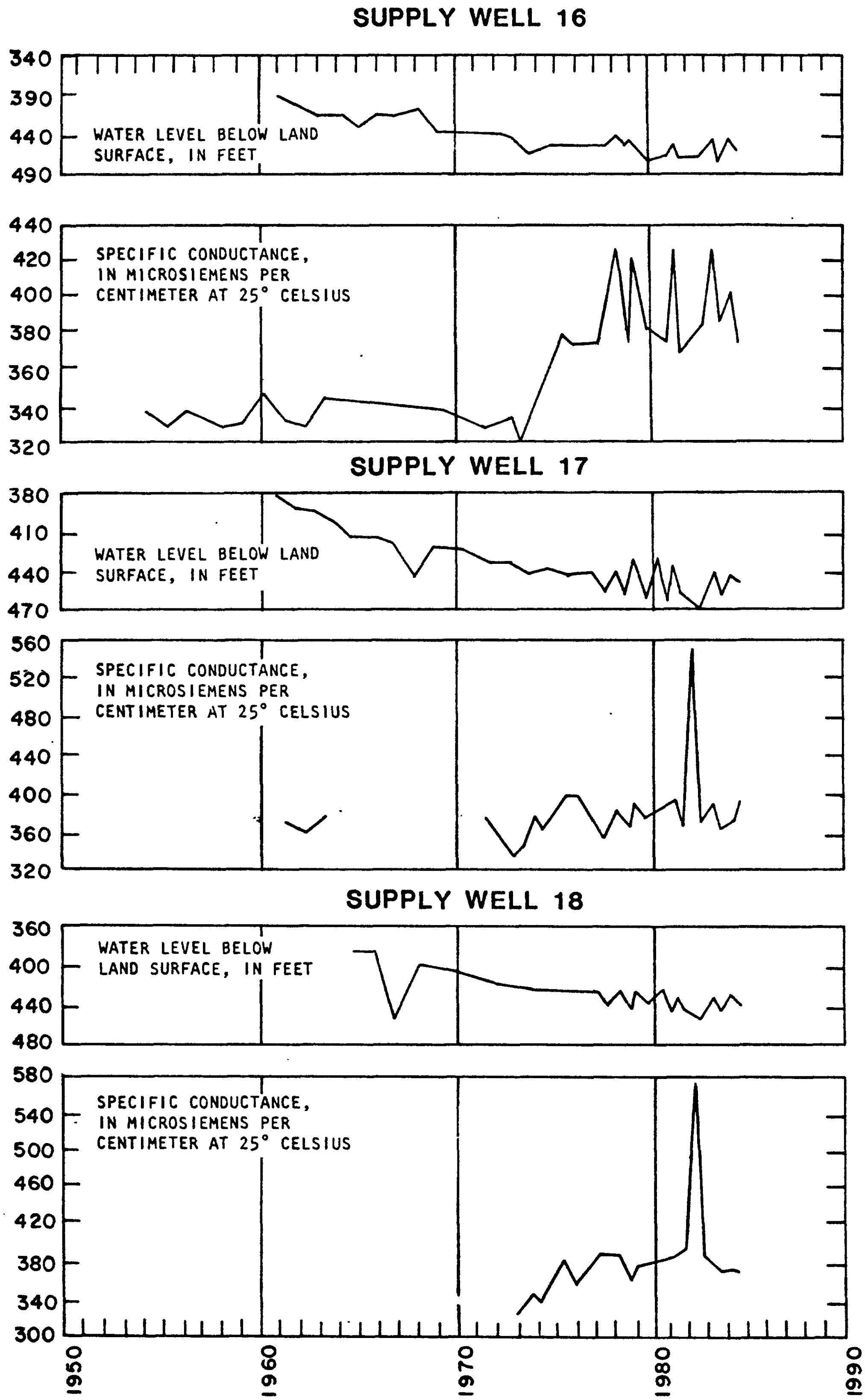


Figure 8.--Water levels and specific conductance for period of record available in supply wells 16, 17, and 18.

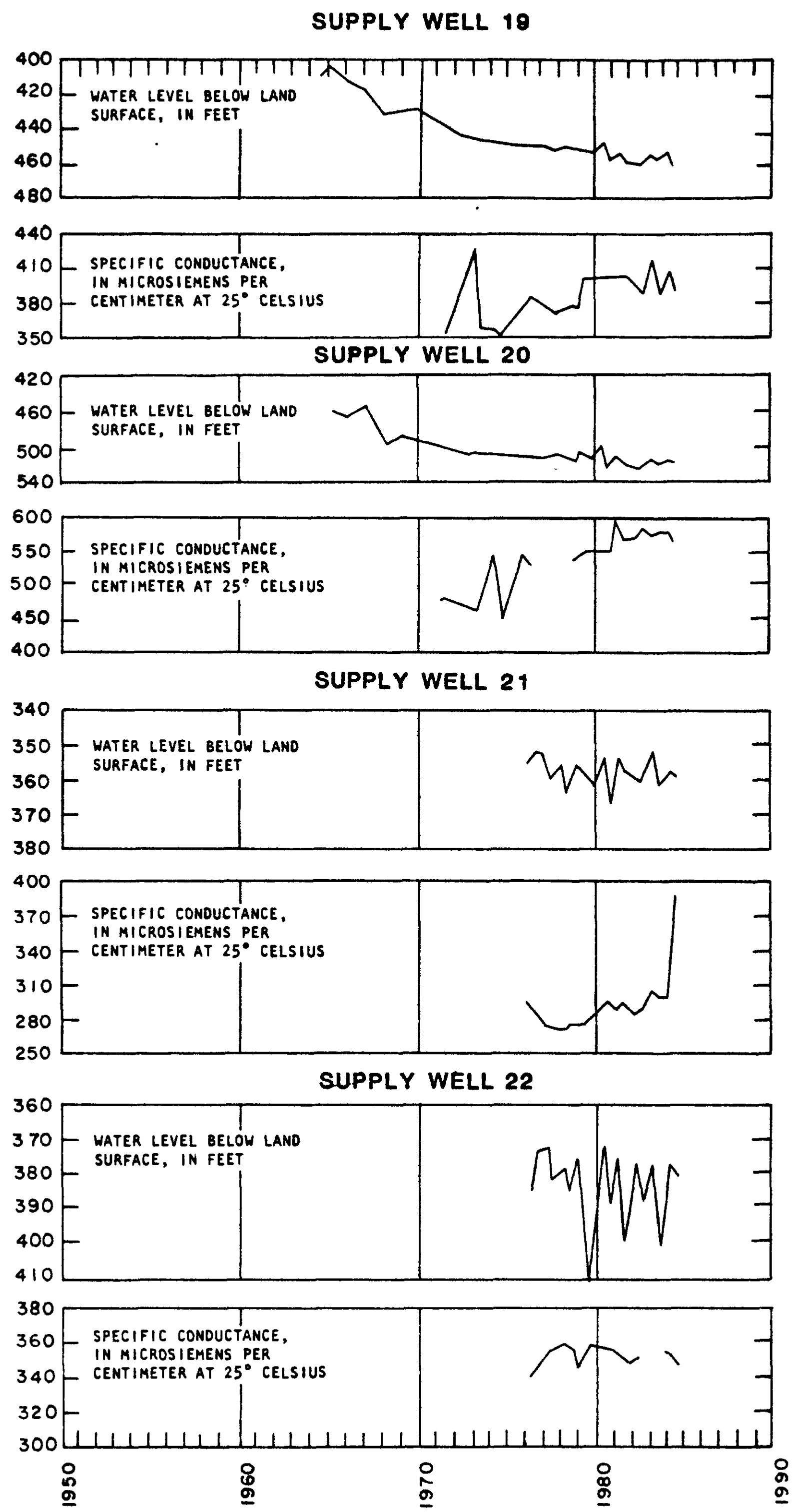


Figure 9.-- Water levels and specific conductance for period of record available in supply wells 19, 20, 21, and 22.

Water-Level Measurements in Test Wells, Observation Wells, and Boreholes

Semiannual depth-to-water measurements were made in 41 test and observation wells in 1984 (table 3). Four of the test wells (T-7, T-8, T-10, and T-11) in the Post Headquarters area are equipped with continuous water-level recorders; hydrographs of water levels in these wells are shown in figure 10. The seasonal fluctuations ranged from a 0.68-foot water-level rise in test well T-6 to a 10.79-foot water-level decline in old supply well 15 in 1984 (table 3). Test well T-6 is about 1 mile west of the Post Headquarters well field and OS-15 is about in the center of the well field.

Table 3.—Depth to water in test and observation wells, Post Headquarters and Range areas, 1984

Well number	Location	Winter 1984 (feet below land surface)	Summer 1984 (feet below land surface)
T-4	22S.5E.16.111	226.76	226.80
T-5	22S.5E.20.111	277.03	277.11
T-6	22S.4E.14.133	193.71	193.03
T-7	22S.5E.07.342	362.30	371.95
T-8	22S.4E.11.224	581.71	583.05
T-9	22S.4E.01.431	375.18	374.56
T-10	22S.5E.05.313	273.40	273.82
T-11	22S.5E.29.412	272.04	272.29
T-13	21S.5E.32.222	213.03	213.39
T-14	22S.5E.15.221	132.33	132.26
T-15	22S.5E.33.244	179.58	179.55
T-16	23S.5E.10.413	183.79	183.11
T-17	23S.5E.27.142	242.44	242.35
T-18	23S.5E.05.321	238.33	238.27
OS-9	22S.5E.31.424	244.33	244.51
OS-12	22S.4E.23.214	233.39	234.86
OS-15	22S.4E.13.424	423.80	434.59
Gregg	22S.6E.08.414	214.33	214.54
HTA (wm)	21S.4E.22.222	42.99	43.60
SMR-2	21S.5E.17.424	320.85	320.90
SMR-3	20S.5E.34.133	295.75	300.58
SMR-4	21S.5E.20.344	289.21	289.29
MAR-1 (test)	19S.5E.17.333	222.23	223.13
MAR-4	19S.5E.19.231	304.25	304.46
NW30-1	17S.4E.02.211	--	213.17

Table 3.--Depth to water in test and observation wells, Post Headquarters and Range areas, 1984 - Concluded

Well number	Location	Winter 1984 (feet below land surface)	Summer 1984 (feet below land surface)
Murray	8S.5E.32.334	177.39	177.53
Lucero Ranch	19S.5E.22.334	171.20	171.17
CW	21S.5E.28.411	154.15	154.44
T-21	22S.5E.30.122	316.89	317.55
T-22	23S.5E.05.144	189.48	189.40
T-27	22S.5E.22.141	162.60	162.49
T-28A	22S.5E.22.122a	155.23	155.19
T-29	22S.5E.28.122	149.87	152.23
T-30	22S.5E.32.334	213.98	214.18
T-34	22S.5E.28.234	187.28	187.38
TW-1	22S.6E.16.233	229.13	229.29
TW-2	22S.6E.16.234	235.59	235.80
TW-3	22S.6E.16.234a	--	232.40
NT-1	20S.3E.35.341	126.88	130.63
BLM	22S.4E.15.331	65.79	65.77
DC-1	8S.4E.02.444	255.18	255.03

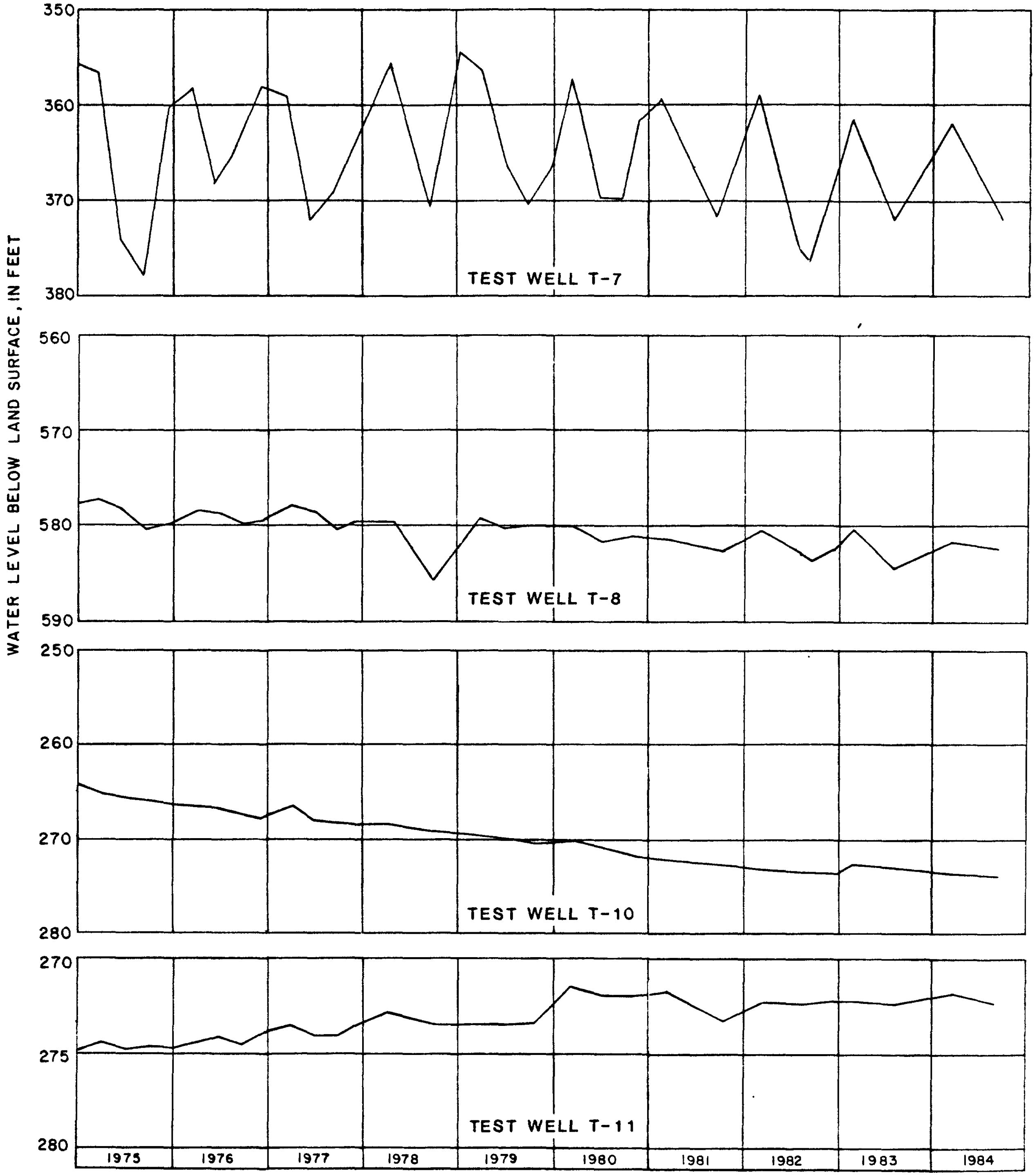


Figure 10.--Water levels in test wells T-7, T-8, T-10, and T-11.

Semiannual depth-to-water measurements were made in 37 boreholes in 1984 (table 4). Two (B-37 and B-42) of the four boreholes west of the Post Headquarters continued to show a rise in water level. Water-level declines were observed in all of the boreholes less than 2½ miles east of the Post Headquarters well field.

Table 4.—Depth to water in boreholes, Post Headquarters and adjacent areas, 1984

Borehole number	Location	Winter 1984 (feet below land surface)	Summer 1984 (feet below land surface)
B-2	22S.5E.28.124	194.56	195.53
B-3	22S.5E.28.142	201.82	202.42
B-4	22S.5E.28.233	196.33	196.29
B-5	22S.5E.33.223	187.68	187.51
B-6	23S.5E.01.113	133.78	133.79
B-9	22S.5E.21.211	225.08	225.14
B-10	22S.5E.19.414	306.20	307.08
B-13	22S.5E.08.141	244.13	244.46
B-14	22S.5E.03.221	112.39	112.51
B-15	22S.5E.05.242	174.35	174.46
B-16	21S.5E.34.213	109.45	109.57
B-17	21S.5E.33.242	111.68	111.81
B-18	21S.5E.23.134	104.57	104.63
B-20	22S.4E.14.134	349.00	349.38
B-23	22S.5E.16.111	223.83	225.23
B-26	21S.6E.32.114	141.06	141.26
B-27	21S.6E.17.314	119.76	119.94
B-28	21S.5E.02.341	135.35	140.39
B-30	20S.5E.23.213	89.69	89.58
B-31	20S.6E.29.123	123.22	123.44
B-34	21S.5E.01.221	126.35	126.37
B-36	22S.4E.01.323	212.08	212.26
B-37	22S.4E.11.344	390.50	389.79
B-38	20S.6E.11.234	129.78	129.85
B-39	21S.6E.02.142	156.29	156.38

Table 4.—Depth to water in boreholes, Post Headquarters and adjacent areas, 1984 - Concluded

Borehole number	Location	Winter 1984 (feet below land surface)	Summer 1984 (feet below land surface)
B-40	21S.6E.26.142	188.50	188.62
B-42	22S.4E.11.444	373.06	371.90
B-46	21S.5E.27.113	135.95	136.01
B-47	22S.5E.08.334	274.20	274.41
B-48	22S.6E.31.322	204.63	204.58
B-49	22S.5E.09.113	201.18	200.54
B-50	22S.5E.07.242	306.39	306.63
B-51	22S.5E.26.312	146.44	146.42
B-52	22S.5E.09.113	210.75	210.97
B-54	22S.5E.16.111	228.80	229.09
B-55	22S.5E.09.113	214.83	214.90
B-56	22S.5E.30.424	276.25	276.34

Chemical Quality

Seven water samples from supply wells were collected for major chemical-constituent analyses in 1984 (table 5). Five water samples from test wells were collected for major chemical-constituent and trace-element analyses in 1984 (table 6). Seven water samples from supply wells were collected for radiochemical analyses (table 7). Long-term specific conductance for water from the Post Headquarters supply wells is shown in figures 7, 8, and 9. Monthly pH measurements and specific conductance are shown in figures 11-13.

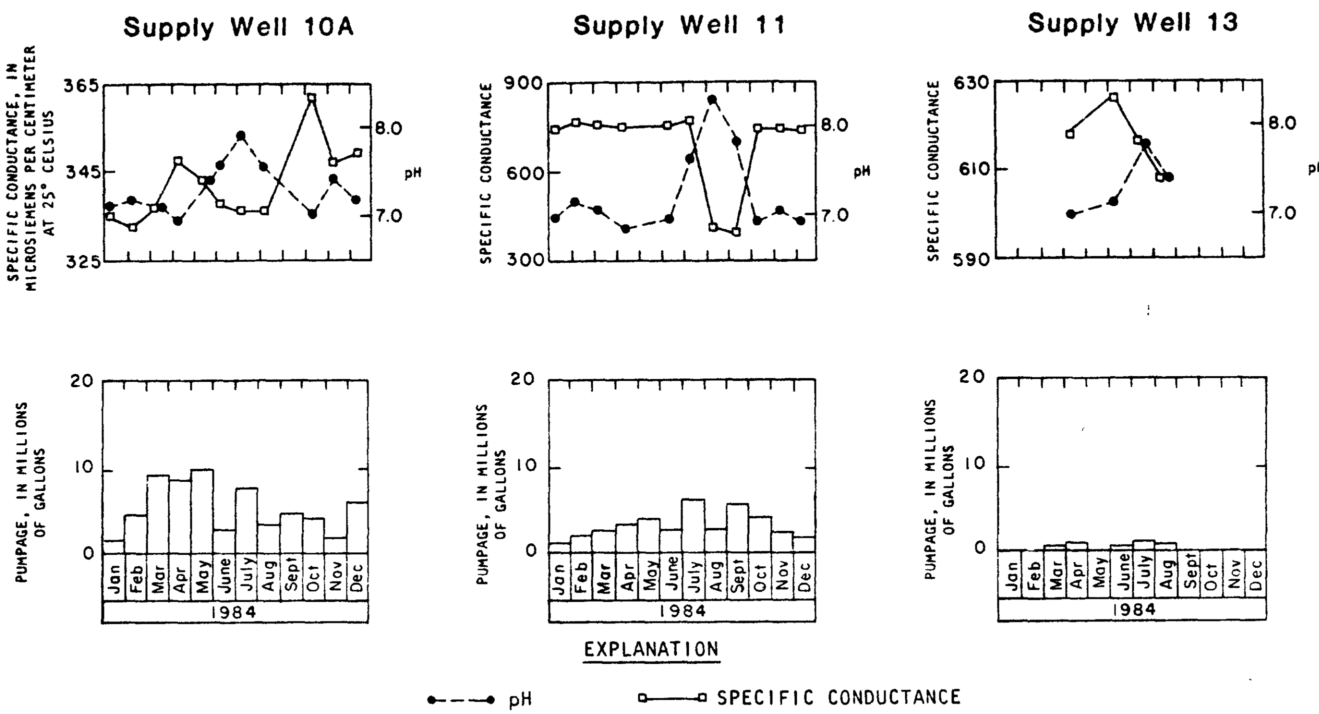


Figure 11.--Monthly specific conductance, pH, and pumpage for supply wells 10A, 11, and 13.

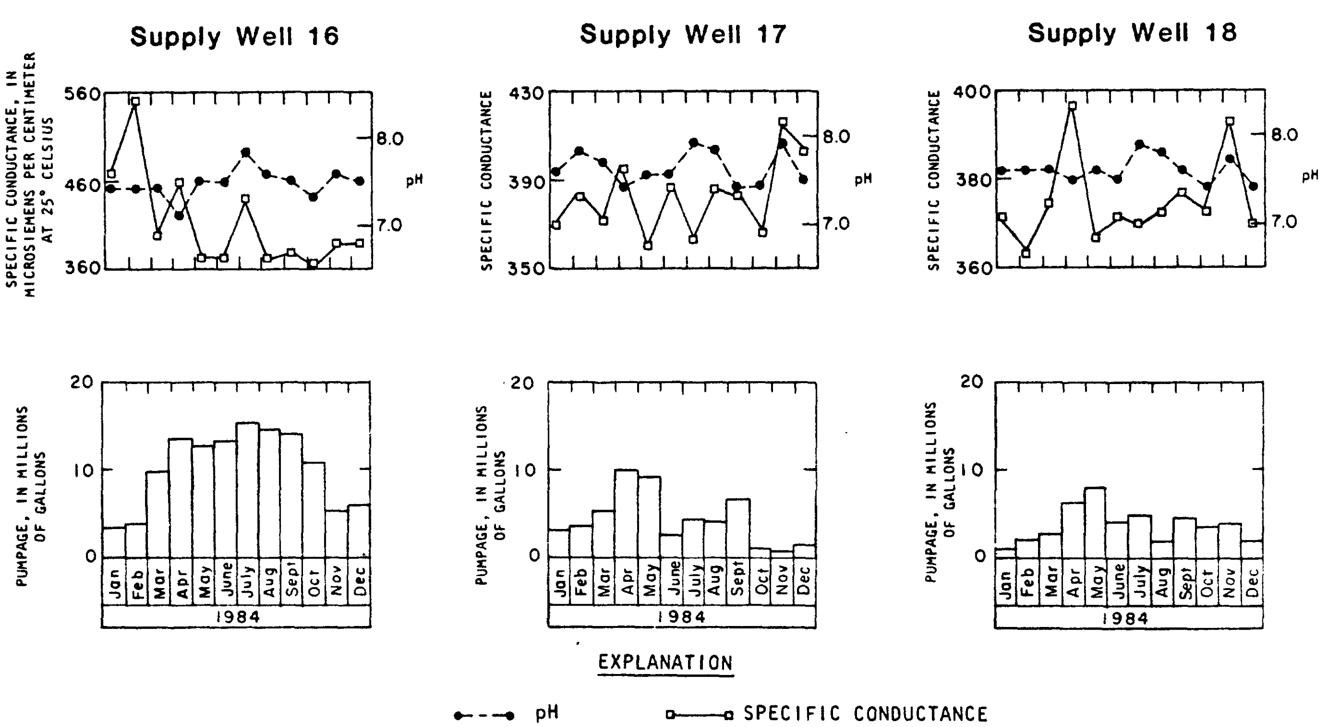


Figure 12.--Monthly specific conductance, pH, and pumpage for supply wells 16, 17, and 18.

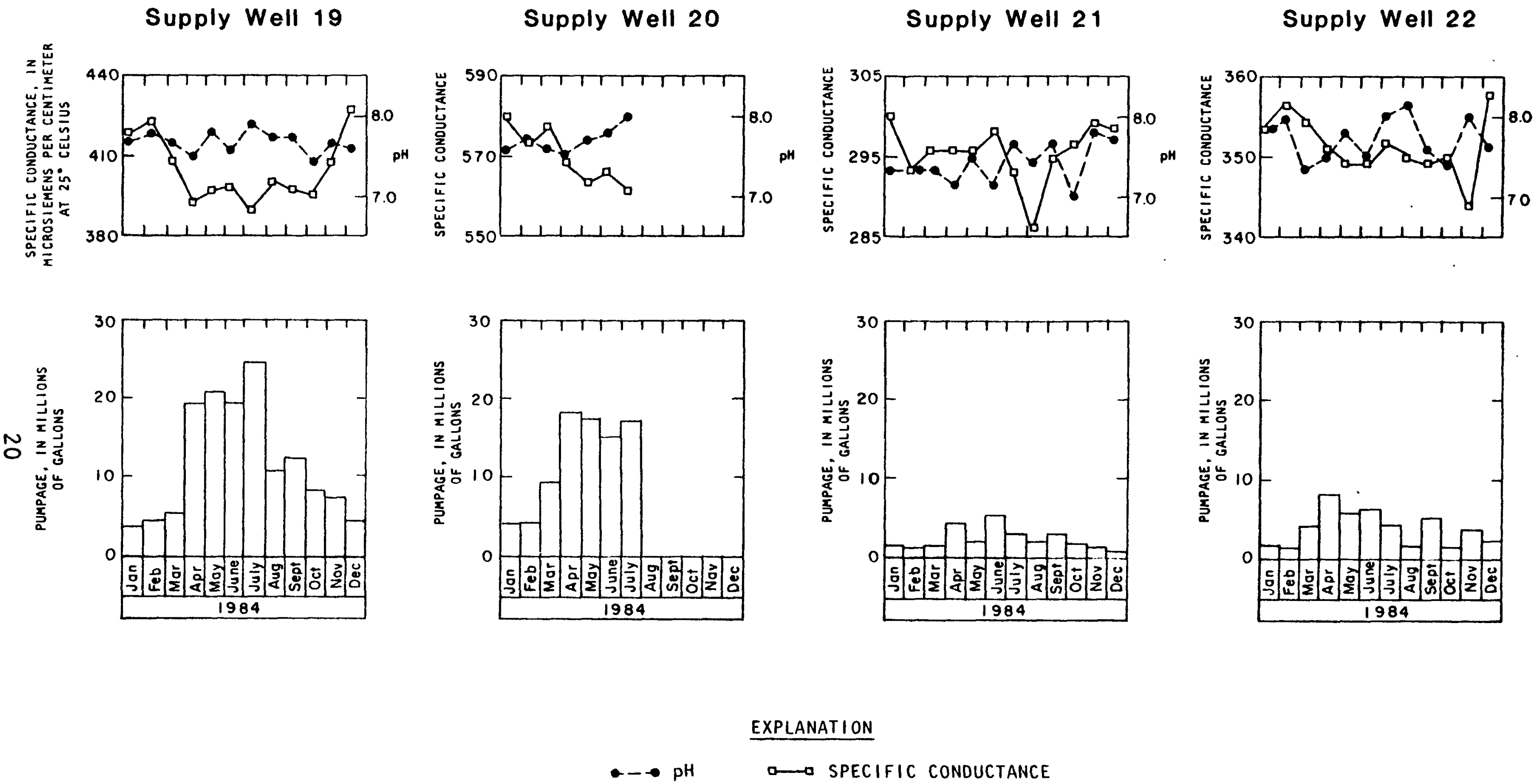


Figure 13.--Monthly specific conductance, pH, and pumpage for supply wells 19, 20, 21, and 22.

Table 5.--Major chemical-constituent analyses of water from selected supply wells, Post Headquarters area, White Sands Missile Range, 1984

[uS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; deg C, degrees Celsius]

Well	Location	Date of sample	Specific conductance lab (uS/cm)	pH lab	Nitrogen, NO_2+NO_3 dissolved (mg/L as N)	Calcium, dissolved (mg/L as CA)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Sodium-adsorption ratio	Percent sodium	Potassium, dissolved (mg/L as K)
SW-10A	22S.4E.24.212a	84-03-19	339	8.0	1.4	33	7.5	22	.9	29	1.8
Do.	do.	84-08-16	366	7.5	2.3	39	8.3	22	.9	26	2.0
SW-11	22S.4E.24.112	84-03-19	760	7.7	9.9	90	22	35	.9	19	2.9
Do.	do.	84-08-16	416	8.3	1.4	44	8.4	31	1	31	2.2
SW-16	22S.4E.13.432	84-03-19	402	8.1	2.4	40	8.3	27	1	30	2.0
Do.	do.	84-08-16	369	7.8	1.1	37	6.3	32	1	37	1.9
SW-21	22S.5E.19.323	84-08-13	301	7.5	1.6	28	7.6	20	.9	30	1.7

Well	Date of sample	Chloride, dissolved (mg/L as Cl)	Sulfate, dissolved (mg/L as SO_4)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Phosphorus, dissolved (mg/L as P)	Solids, sum of constituents, dissolved (mg/L)	Solids, residue at 180 deg C, dissolved (mg/L)	Hardness (mg/L as $CaCO_3$)	Hardness noncarbonate (mg/L as $CaCO_3$)	Alkalinity lab (mg/L as $CaCO_3$)	Temperature (deg C)
SW-10A	84-03-19	13	47	.40	43	.010	230	228	110	16	97	25.0
Do.	84-08-16	22	51	.30	43	--	240	230	130	45	87	--
SW-11	84-03-19	24	150	.40	41	.030	480	515	320	129	187	22.0
Do.	84-08-16	16	66	.60	35	--	270	268	140	33	112	--
SW-16	84-03-19	17	57	.40	39	.020	260	259	130	24	110	25.0
Do.	84-08-16	11	51	.40	34	--	240	233	120	7	112	--
SW-21	84-08-13	12	33	.40	47	--	200	--	100	16	85	--

Table 6.--Major chemical-constituent and trace-element analyses of water from selected wells, White Sands Missile Range, 1984

[uS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; deg C, degrees Celsius; ug/L, micrograms per liter]

Well	Location	Date of sample	Specific conductance lab (uS/cm)	pH lab (standard units)	Nitrogen, NO_2+NO_3 dissolved (mg/L as N)	Phosphorus, dissolved (mg/L as P)	Hardness (mg/L as $CaCO_3$)	Hardness noncarbonate (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)
T-34	22S.5E.28.234	84-09-11	731	7.8	8.3	<.010	270	194	86	14	35
BLM	22S.4E.15.331	84-03-19	478	7.3	.55	.010	170	9	50	12	30
HTA-3	21S.4E.14.114	84-05-24	839	7.5	3.8	<.010	320	89	93	22	64
MAR (cw)	19S.6E.28.221	84-11-21	10200	8.2	3.8	--	1700	1580	69	370	2000
RC-4	13S.4E.11.334	84-03-02	1020	8.1	5.8	.010	480	292	100	56	40

Well	Sodium-adsorption ratio	Percent sodium	Potassium, dissolved (mg/L as K)	Chloride, dissolved (mg/L as Cl)	Sulfate, dissolved (mg/L as SO_4)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Alkalinity lab (mg/L as $CaCO_3$)	Arsenic, dissolved (ug/L as As)	Barium, dissolved (ug/L as Ba)	Boron, dissolved (ug/L as B)	Cadmium, dissolved (ug/L) as Cd)
T-34	1	22	2.9	91	110	.20	36	80	1	130	50	<1
BLM	1	27	1.9	14	59	1.0	47	166	<1	55	20	<1
HTA-3	2	30	.80	--	140	6.1	25	235	<1	42	30	<1
MAR (cw)	21	72	27	670	5700	.60	22	120	--	--	850	--
RC-4	.8	15	2.5	60	260	.80	27	191	<1	27	80	<1

Table 6.--Major chemical-constituent and trace-element analyses of water from selected wells, White Sands Missile Range, 1984 - Concluded

Well	Chromium, dissolved (ug/L as Cr)	Copper, dissolved (ug/L as Cu)	Iron, dissolved (ug/L as Fe)	Lead, dissolved (ug/L as Pb)	Lithium, dissolved (ug/L as Li)	Manganese, dissolved (ug/L as Mn)	Mercury, dissolved (ug/L as Hg)	Selenium, dissolved (ug/L as Se)	Silver, dissolved (ug/L as Ag)	Strontium, dissolved (ug/L as Sr)	Zinc, dissolved (ug/L as Zn)	Solids, sum of constituents, dissolved (mg/L)
T-34	<10	< 1	130	< 1	20	2	< .1	2	< 1	650	14	420
BLM	<10	3	< 3	< 1	19	< 1	< .1	< 1	< 1	310	16	310
HTA-3	<10	< 1	4	< 1	38	< 1	< .1	< 1	< 1	280	220	--
MAR (cw)	--	--	--	--	220	--	--	--	--	3300	--	8900
RC-4	<10	11	< 3	< 1	24	3	< .1	1	< 1	1700	200	660

Well	Solids, residue at 180 deg C, dissolved (mg/L)	Temperature (deg C)
T-34	509	23.5
BLM	316	24.0
HTA-3	538	20.5
MAR (cw)	9930	21.0
RC-4	705	28.5

Table 7.—Radiochemical analyses of water from selected supply wells, White Sands Missile Range, 1984

[deg C, degrees Celsius; ug/L, micrograms per liter; U-nat, uranium, natural; pCi/L, picocuries per liter; Cs-137, cesium 137; Sr/Yt-90, strontium/yttrium 90; U, uranium]

Well	Location	Date of sample	Temperature (deg C)	Gross alpha, dissolved (ug/L as U-nat)	Gross beta, dissolved (pCi/L as Cs-137)	Gross beta, dissolved (pCi/L as Sr/Yt-90)	Radium 226, dissolved, radon method (pCi/L)	Uranium natural, dissolved (ug/L as U)
SW-10A	22S.4E.24.212a	84-08-21	26.0	< 6.1	3.4	3.0	.14	2.1
SW-11	22S.4E.24.112	84-08-21	24.0	< 13	6.3	5.4	.25	6.4
SW-21	22S.5E.19.323	84-08-21	25.5	< 4.7	< 2.2	< 1.9	.14	.8
SW-22	22S.5E.19.141	84-08-21	28.5	< 5.9	3.6	3.1	.12	3.1
HTA-1	21S.4E.23.233	84-08-17	22.5	< 14	< 6.0	< 5.1	.10	4.2
SMR-1	21S.5E.16.132	84-08-17	27.0	< 16	< 6.2	< 5.3	.16	8.0
MAR-1	19S.5E.17.331	84-08-17	25.0	47	8.2	7.1	.26	34

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