UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ANNUAL WATER-RESOURCES REVIEW,

WHITE SANDS MISSILE RANGE, NEW MEXICO, 1981

By R. R. Cruz

Open-File Report 82-757

Prepared in cooperation with

WHITE SANDS MISSILE RANGE

Albuquerque, New Mexico

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UNITED STATES DEPARTMENT OF THE INTERIOR

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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
Fahrenheit	(°F-32)/1.8	Celsius
inch	25.4	millimeter
foot	0.3048	meter
mile	1.609	kilometer
gallon	0.003785	cubic meter
acre-foot	1233	cubic meter

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 "Mean Sea Level." NGVD of 1929 is referred to as sea level in this report.

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ABSTRACT

Ground-water data were collected in 1981 at White Sands Missile Range in south-central New Mexico. The total amount of water pumped at White Sands Missile Range was approximately 59 million gallons less than in 1980; however, the five supply wells in the Range areas adjacent to the Post Headquarters area produced approximately 16.2 million gallons more in 1981 than in 1980. Depth-to-water measurements in the Post Headquarters supply wells continued to show seasonal declines.

INTRODUCTION

This report presents water-resources information that was collected at White Sands Missile Range during 1981 by personnel of the U.S. Geological Survey. Ground-water pumpage, water-level measurements, and chemical-quality data summarized in this report were obtained as a result of the continuing water-resources hydrologic-data collection program sponsored by the Facilities Engineering Directorate, White Sands Missile Range.

The 1968 report and subsequent annual reports are open-file reports and are available for inspection at the District Office of the U.S. Geological Survey, Water Resources Division, in Albuquerque, New Mexico.

DATA-COLLECTION PROGRAM

The program to collect hydrologic data at White Sands Missile Range (fig. 1) has been continuous since 1953. The original program consisted of water-level observations in five test wells in the Post Headquarters area. Over the years the program has expanded to include water-level observation points and chemical-quality sampling points in seven Range areas (Gregg, Hazardous Test, Small Missile Range, Multifunction Array Radar, NW-30 Tracking Station, Mockingbird Gap, and Stallion Range Center) and more extensive coverage in and around the Post Headquarters. In 1981, the program consisted of semiannual water-level measurements in 16 supply wells, 28 test and observation wells, and 39 boreholes (figs. 2, 3, and 4). In addition, 23 water samples were collected for laboratory specific-conductance measurements; 19 samples were collected for major and various trace-element chemical constituent analysis, and 2 of these samples were analyzed for radiochemicals.

Ground-water pumpage

Total ground-water pumpage* at White Sands Missile Range in 1981, according to records provided by the Facilities Engineering Directorate, was 665,945,000 gallons. The Post Headquarters well field produced 638,961,000 gallons; Stallion Range Center wells (SRC-1 and -2) produced 8,861,000 gallons; and Multifunction Array Radar wells (MAR-1 and -2), Small Missile Range well (SMR-1), and Hazardous Test Area well (HTA-1) together produced 18,123,000 gallons in 1981. The total pumpage at White Sands Missile Range in 1981 was approximately 59 million gallons less than in 1980. Pumpage by month and total gallons pumped per year in the Post Headquaters well field for 1967-81 are shown in figure 5.

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

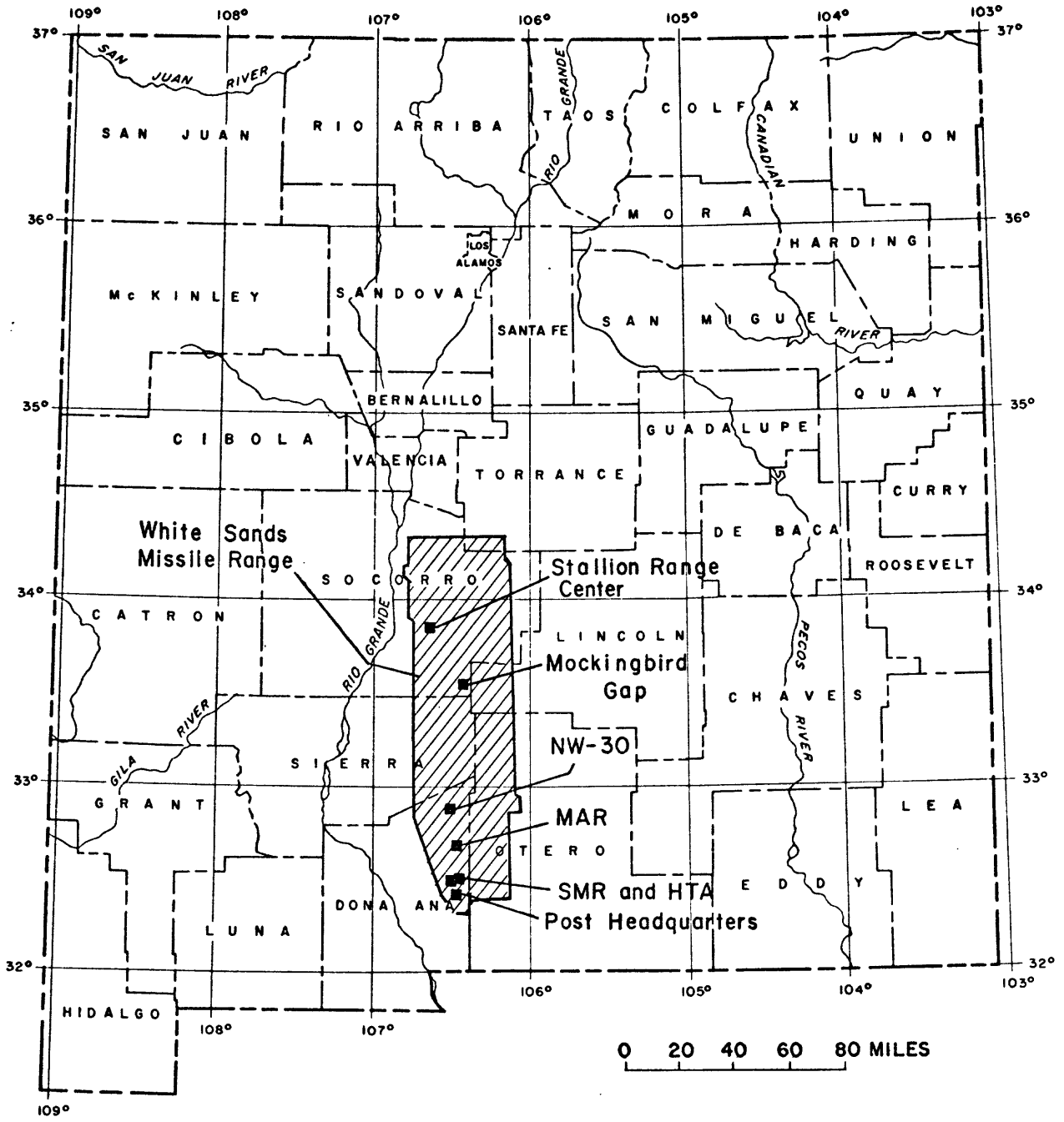

Figure 1. White Sands Missile Range and areas of hydrologic observations.

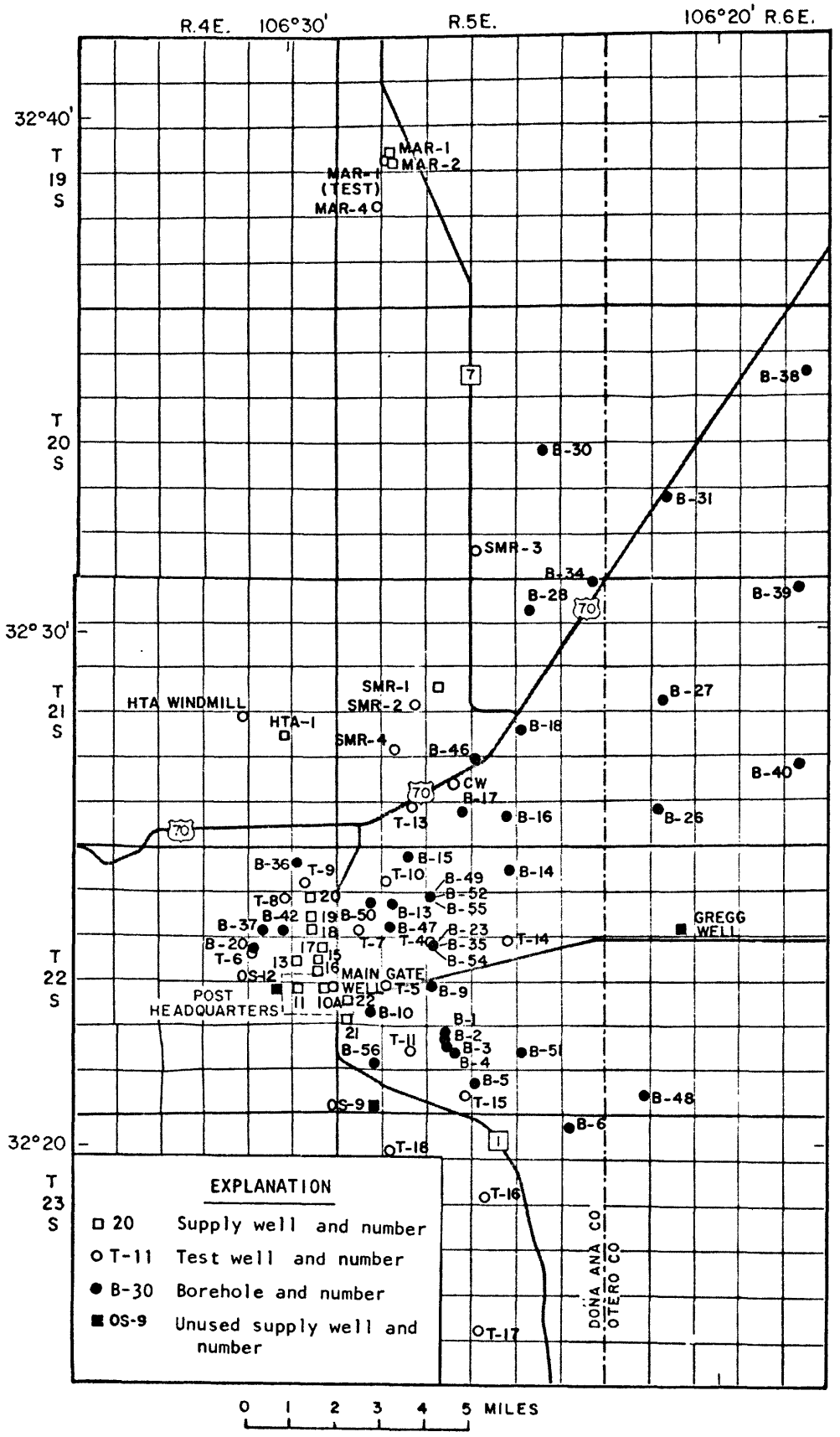

Figure 2. Location of supply wells, test wells, observation wells, and boreholes in the Post Headquarters and adjacent areas.

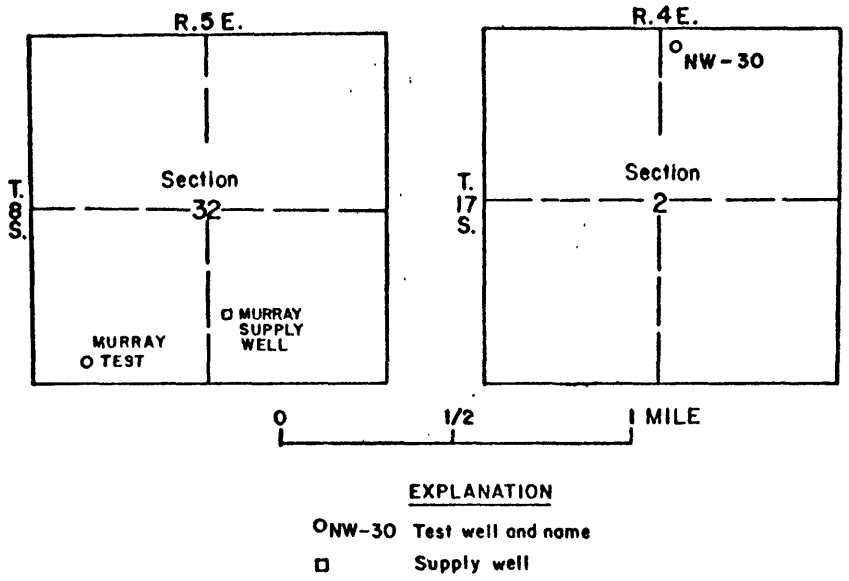

Figure 3. Location of wells in Mockingbird Gap and NW-30 areas.

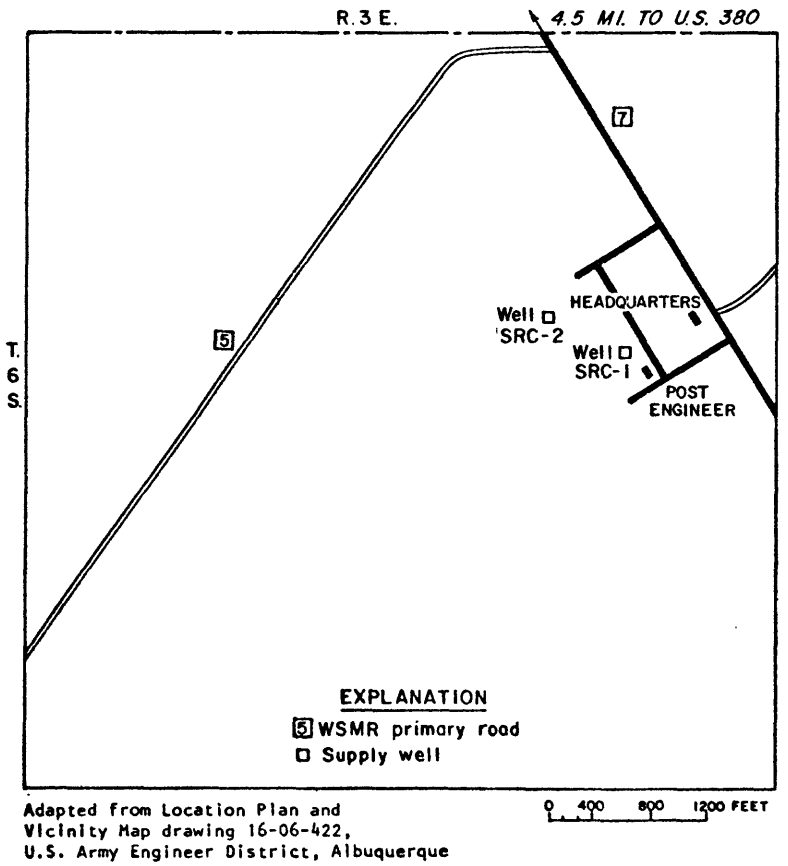

Figure 4. Location of supply wells, Stallion Range Center.

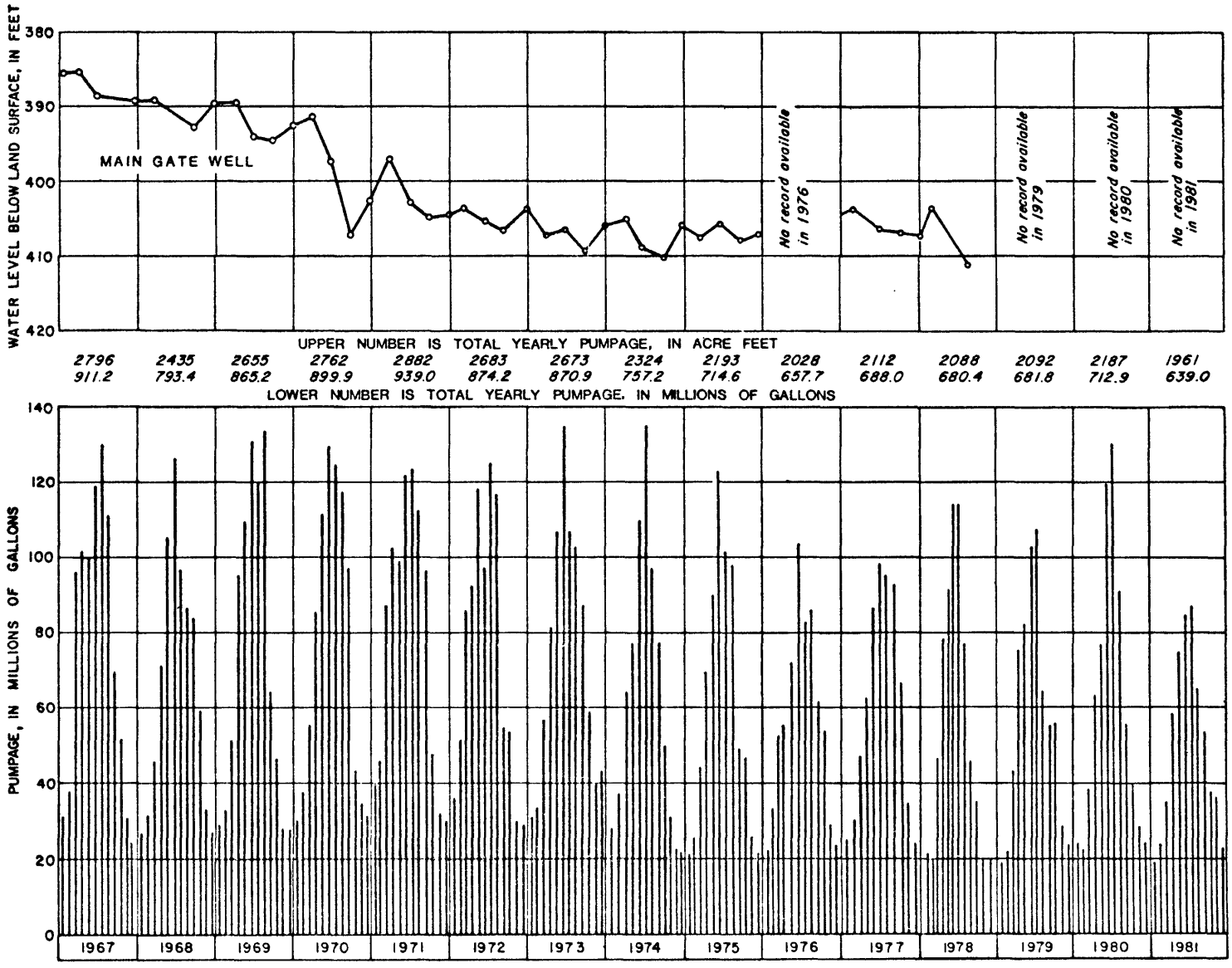

Figure 5. Monthly and yearly pumpage in the Post Headquarters well field and water-level fluctuations in the Main Gate well, 1967-81.

Water-level measurements in supply wells

Semiannual depth-to-water measurements were made in ten supply wells in the Post Headquarters area and in six supply wells in the Range areas (table 1). Seasonal water-level declines in the Post Headquarters area ranged from 5.19 feet (steel tape measurement) in supply well 20 to 69.56 feet (air-line reading) in supply well 11. Supply well 15 in the Post Headquarters area was not used in 1981, and depth-to-water measurements could not be obtained. The seasonal water-level fluctuations in all of the supply wells in the Post Headquarters well field are shown in figures 6-8.

Table 1. Depth to water in supply wells, Post Headquarters and Range areas

Well	Winter 1981 (feet below land surface)	Summer 1981 (feet below land surface)
Headquarters area		
10A	424.60	442.42
11	274.44*	344.00*
13	290.84	300.33
15	-	-
16	450.26*	466.00*
17	438.74	460.93
18	427.80	440.40
19	453.16	458.42
20	512.50	517.69
21	354.56	361.20
22	373.87	402.79
Range areas		
HTA-1	59.86	60.73
SMR-1	294.24	294.40
MAR-1	213.64	213.77
MAR-2	219.27	220.01
SRC-1	214.00	214.00
SRC-2	209.00	208.60

* Air-line reading

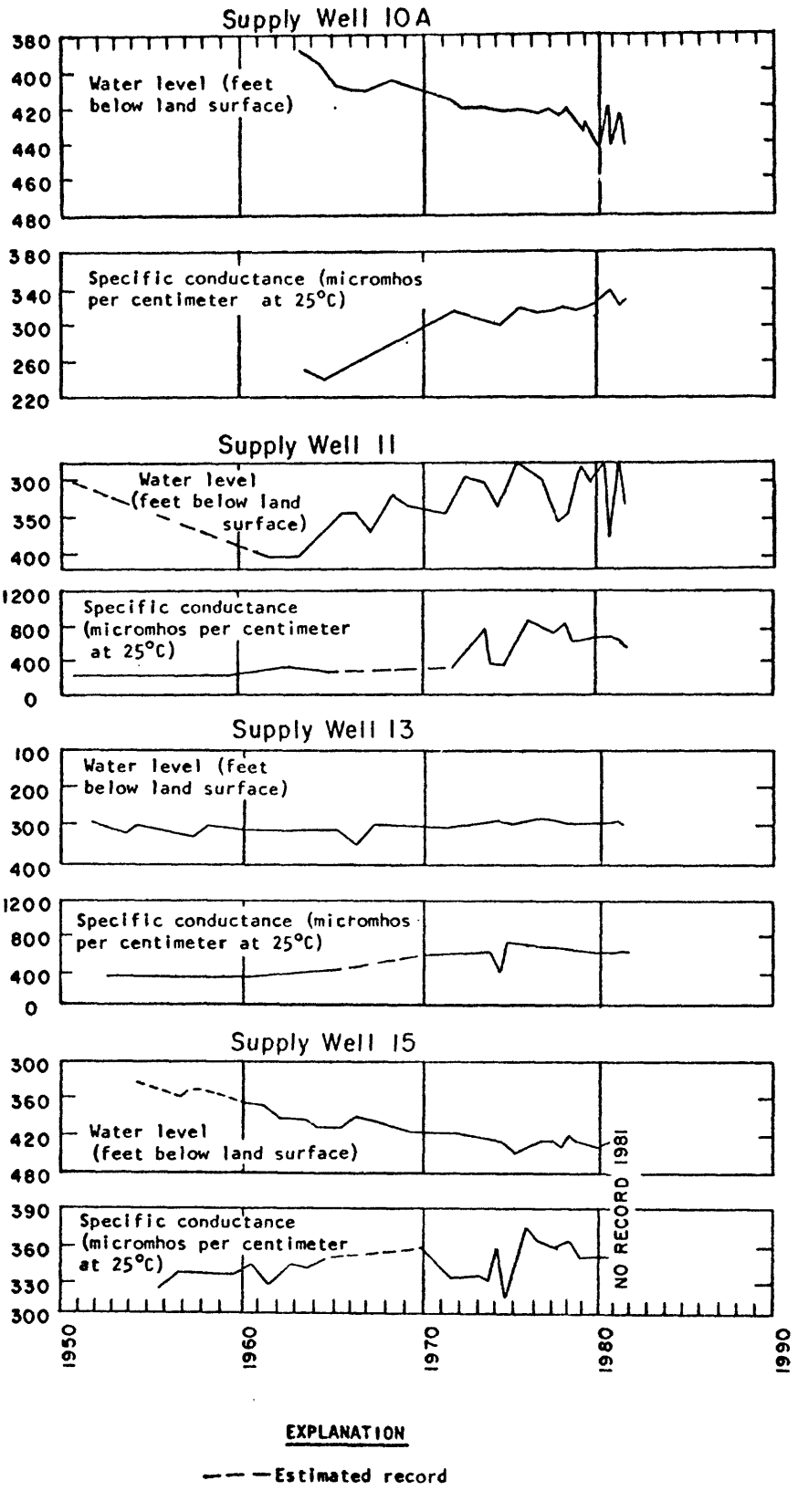

Figure 6. Water levels and specific-conductance values for period of record available in supply wells 10A, 11, 13, and 15.

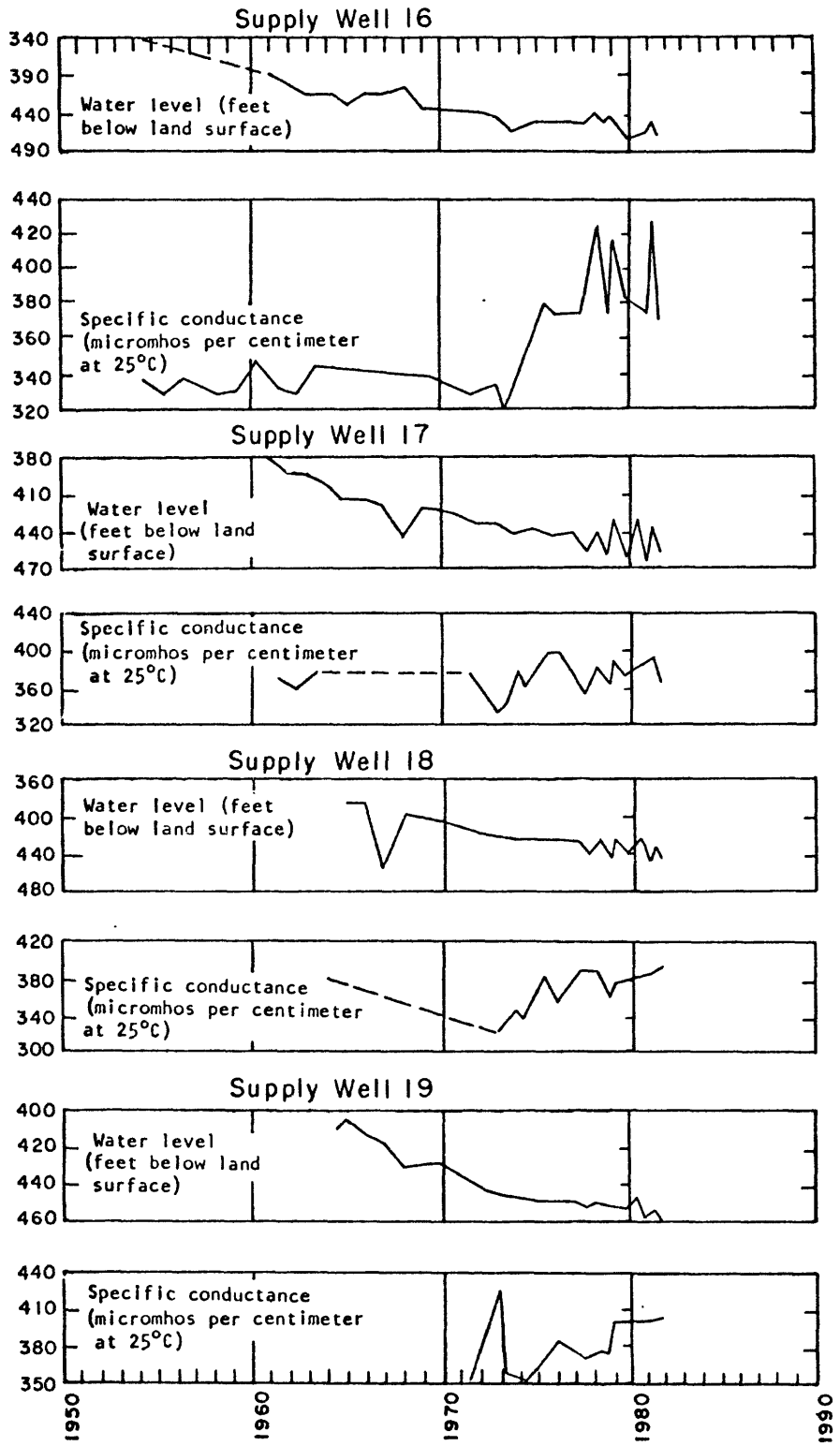

Figure 7. Water levels and specific-conductance values for period of record available in supply wells 16, 17, 18, and 19.

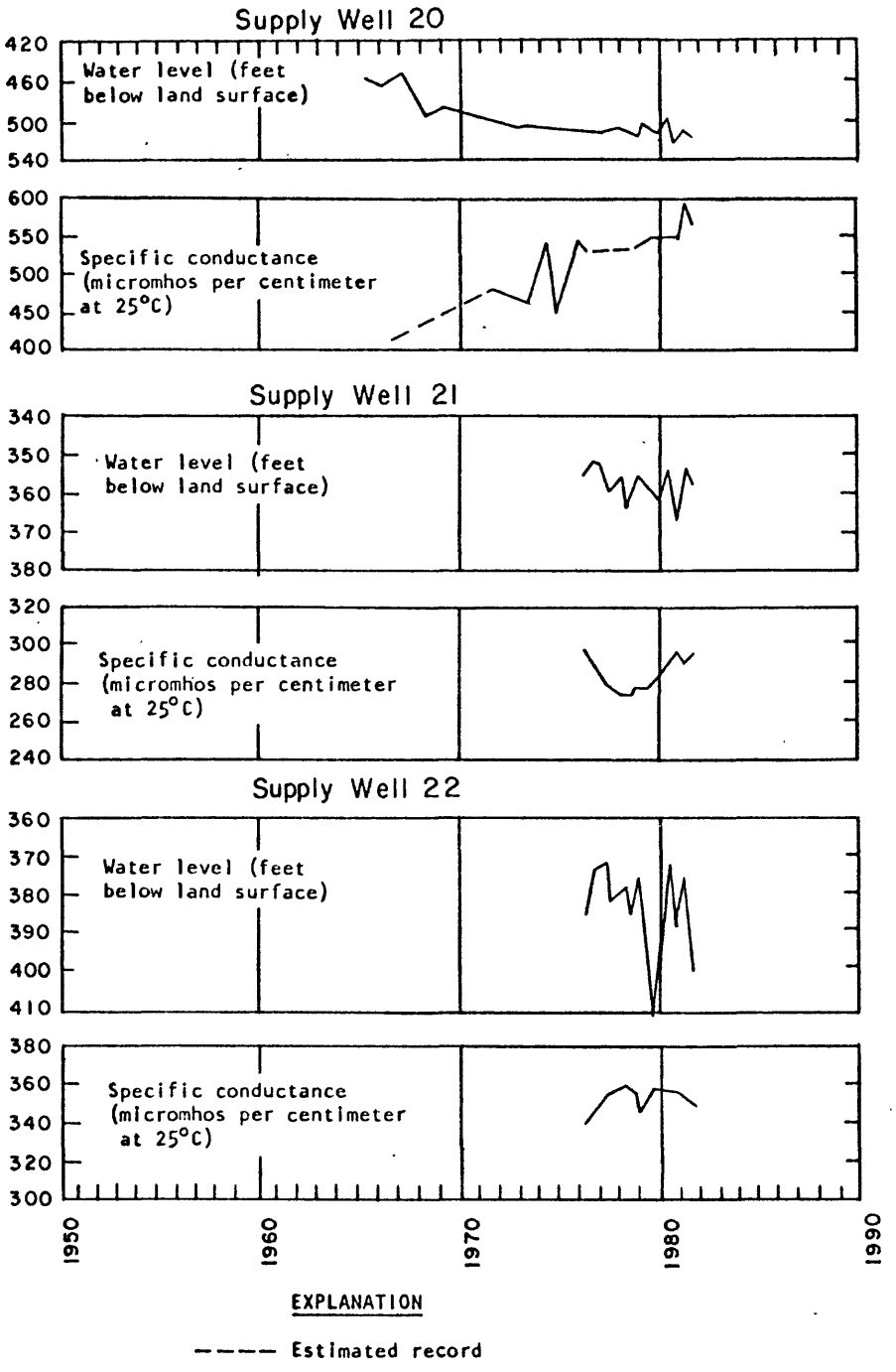

Figure 8. Water levels and specific-conductance values for period of record available in supply wells 20, 21, and 22.

Water-level measurements in test wells, observation wells, and boreholes

Semiannual depth-to-water measurements were made during February and August 1981 in 28 test and observation wells (table 2) and 39 boreholes (table 3). Four of the test wells in the Post Headquarters area are equipped with continuous recorders; hydrographs of these test wells are shown in figure 9.

Table 2. Depth to water in test and observation wells, Post Headquarters and Range areas

Well number	Winter 1981 (feet below land surface)	Summer 1981 (feet below land surface)
T-4	226.21	226.57
T-5	276.01	276.41
T-6	203.56	201.83
T-7	359.90	371.01
T-8	581.35	582.72
T-9	397.60	394.00
T-10	270.97	271.74
T-11	272.81	273.09
T-13	216.85	218.36
T-14	132.21	132.11
T-15	178.41	178.30
T-16	185.33	186.42
T-17	242.19	242.32
T-18	239.25	238.95
Gate	Dry	Dry
OS-9	245.77	244.44
OS-12	236.44	233.88
Gregg	214.05	214.40
HTA (windmill)	39.54	40.30
CW	154.39	153.64
SMR-2	318.78	318.96
SMR-3	294.73	295.14
SMR-4	287.44	287.45
MAR-1 (test)	220.42	221.48
MAR-4	303.29	303.05
NW-30	212.57	212.56
Murray	177.23	177.20
Lucero Ranch	-	171.01

Table 3. Depth to water in boreholes, Post Headquarters and adjacent areas

Well number	February 1981 (feet below land surface)	August 1981 (feet below land surface)
B-1	192.93	192.80
B-2	196.24	195.81
B-3	203.29	203.23
B-4	197.56	197.50
B-5	188.10	187.90
B-6	134.07	133.86
B-9	225.07	225.40
B-10	305.73	306.50
B-12	294.64	-
B-13	242.08	242.41
B-14	112.13	112.07
B-15	172.87	173.02
B-16	109.01	109.10
B-17	111.23	111.38
B-18	103.90	104.10
B-20	347.87	348.99
B-23	224.28	224.74
B-26	141.19	140.98
B-27	119.69	119.74
B-28	140.02	140.13
B-30	89.57	89.53
B-31	123.29	123.36
B-34	126.27	125.87
B-36	211.39	211.10
B-37	402.35	399.20
B-38	129.74	129.76
B-39	156.21	156.21
B-40	188.50	188.63
B-42	384.39	383.13
B-46	135.54	135.55
B-47	272.79	273.44
B-48	204.53	204.53
B-49	199.20	199.24
B-50	304.10	304.37
B-51	146.76	146.71
B-52	210.28	210.35
B-54	229.96	230.05
B-55	214.25	214.49
B-56	279.10	277.84

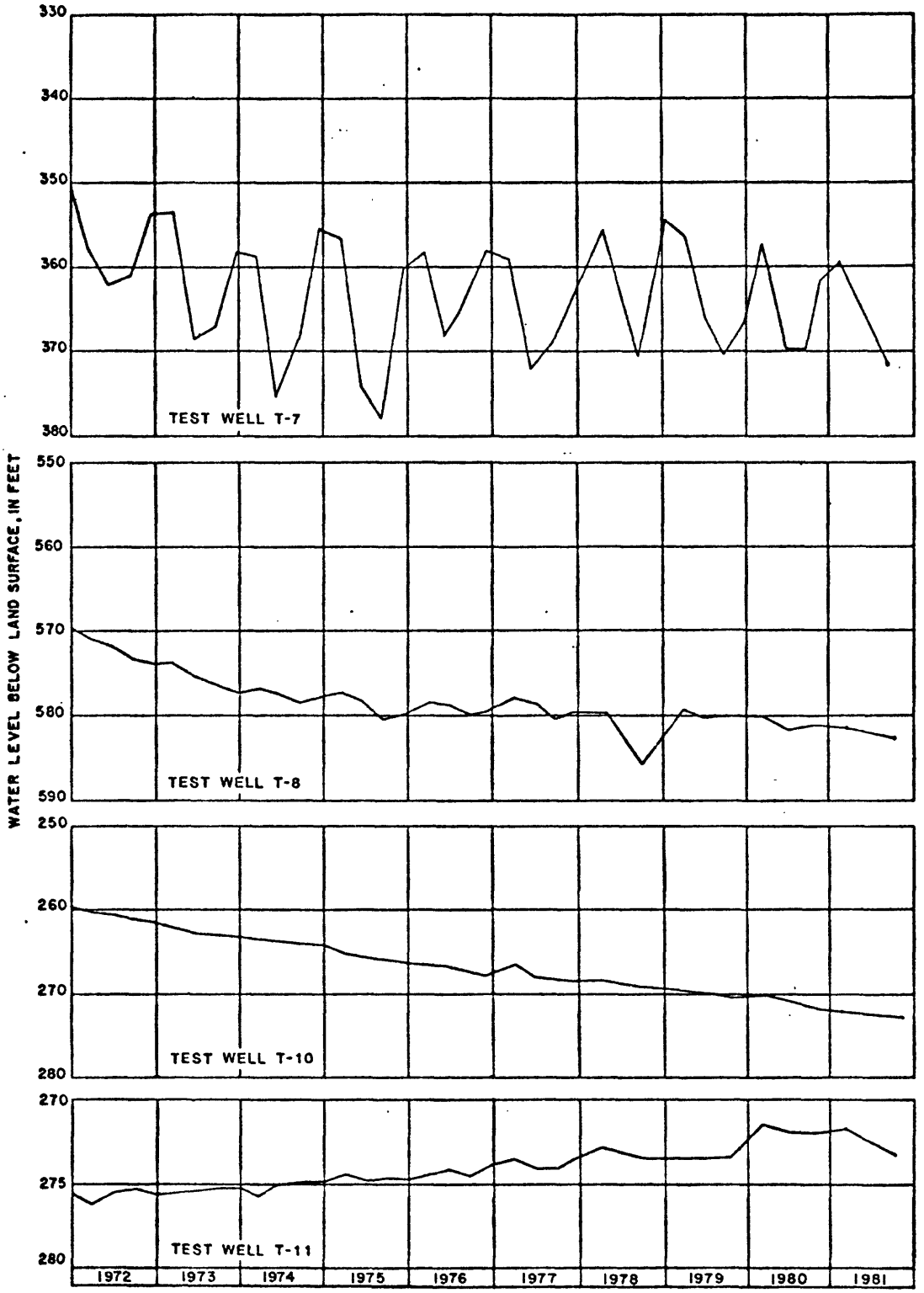

Figure 9. Water level fluctuations in test wells T-7, T-8, T-10, and T-11 for 1972-81.

Chemical quality

Forty-one water samples were collected from supply, test, and observation wells in 1981. Laboratory specific conductances for 27 wells (and SRC product water) are shown in table 4. Specific-conductance and pH values for selected wells in the Post Headquarters and adjacent areas are shown in figure 10. Nineteen water samples were collected for major chemical constituent and various trace-element analysis (table 5). Three of the nineteen water samples were also analyzed for total organic carbon and two for radiochemical values.

All of the water samples collected from test wells in 1981 were obtained by placing a pump in the wells and pumping water from the wells. The volume of water pumped from each well was equal to, or greater than, the calculated water column standing in each well under static conditions. The supply wells were pumped for at least 1 hour before the water samples were collected.

MISCELLANEOUS OBSERVATIONS

Water samples pumped from test wells T-16, T-17, and T-18 were clouded by black material. These samples were analyzed for total organic carbon in addition to major chemical constituents. The analyses showed the organic carbon concentration of the water in T-16, T-17, and T-18 to be low, ranging from 0.9 milligram per liter in T-18 to 5.2 milligrams per liter in T-17 (table 5). However, the concentrations of manganese were 130 micrograms per liter in T-18 and 170 micrograms per liter in T-17; precipitated manganese oxide may have been the black material observed in the water samples.

The specific conductance of the water sample collected from test well T-15 on July 29, 1981, was 280 micromhos. The conductance of the water samples collected from December 1968 to February 1981 was greater than 500 micromhos. After 15 minutes of pumping water from test well T-15, the discharge decreased from 8 gallons per minute to 5 gallons per minute and there was sand in the water. The well stopped producing sand and the discharge returned to 8 gallons per minute after 2 hours of pumping. This well was never test pumped or completely developed when drilled because large quantities of sand were bailed out with the water during the attempt to develop the well in 1968.

The specific conductance of the water sample collected in August 1981 from MAR-1 supply well was 1,010 micromhos. The specific conductance in August 1980 was 928 micromhos. This supply well and all of the supply wells in the Range areas adjacent to the Post Headquarters were pumped much more in 1981 than they were in 1980.

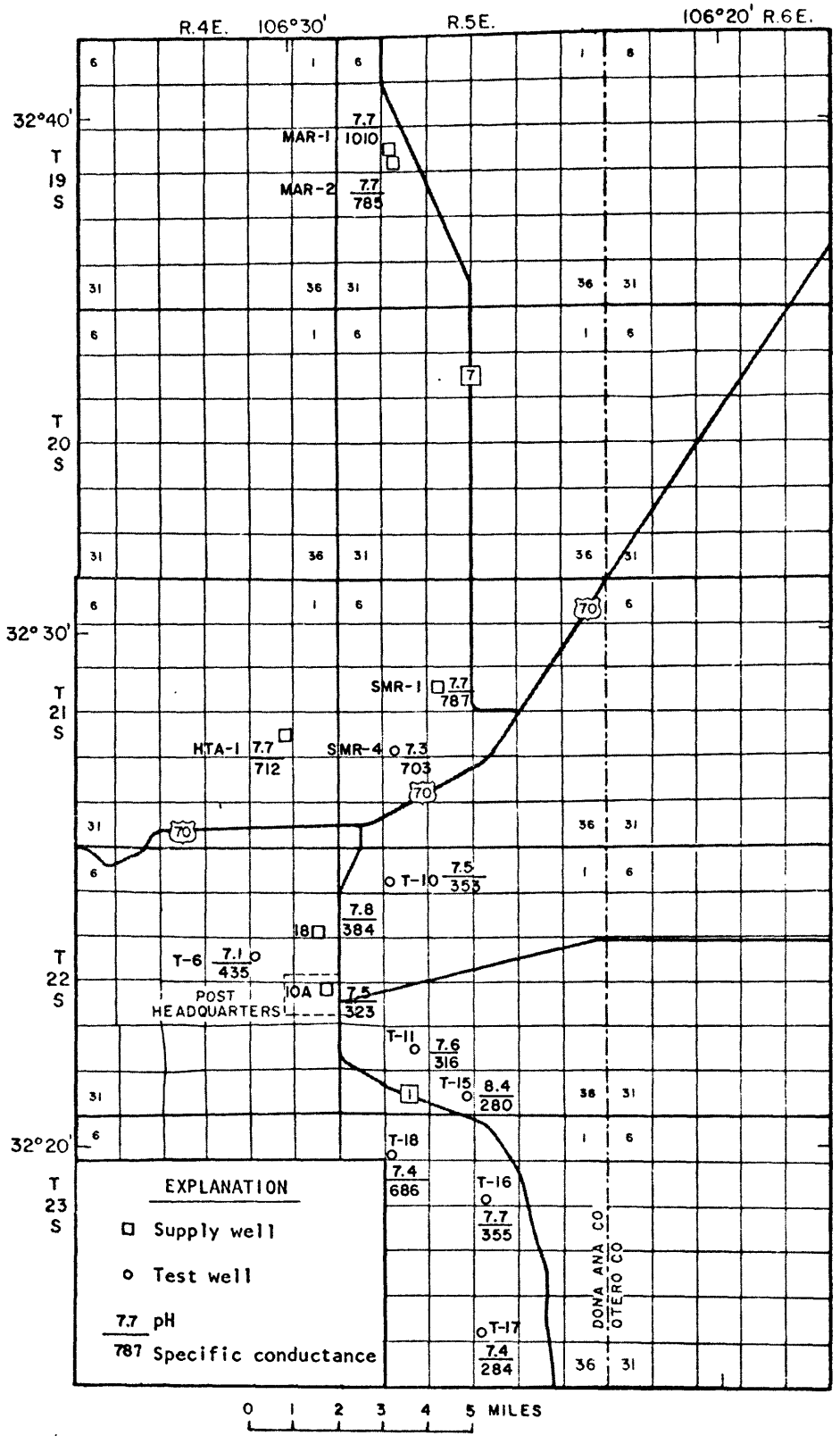

Figure 10. Specific-conductance values and pH values of water from selected wells, Post Headquarters and Range areas, 1981.

Table 4. Specific-conductance values of water samples collected from supply wells, test wells, and observation wells, 1981

Well number	Specific-conductance value (laboratory) (micromhos per centimeter at 25°C)	
	winter	summer
Supply wells		
10A	326	330
11	670	556
13	627	604
15	-	-
16	427	370
17	387	370
18	391	394
19	398	402
20	607	562
21	281	286
22	-	346
HTA-1	709	584
SMR-1	780	842
MAR-1	886	1020
MAR-2	-	799
SRC-1	3420	3420
SRC-2	3420	3430
SRC-(product water)	493	446
Test and observation wells		
T-6	-	444
T-7	-	343
T-9	-	907
T-10	-	353
T-11	-	311
T-15	-	286
T-16	-	343
T-17	-	289
T-18	-	703
SMR-4	-	720

Table 5. Major chemical constituents, radiochemical, and trace-element analyses of water from selected wells, White Sands Missile Range

Part I.—Major chemical constituents

WELL	DATE OF SAMPLE	SPECIFIC CONDUCTANCE (UMHO)	PH (UNITS)	TEMPERATURE (DEG C)	HARDNESS (MG/L AS $CaCO_3$)	HARDNESS, NONCARBONATE (MG/L $CaCO_3$)	CALCIUM, DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM ADSORPTION RATIO	PERCENT SODIUM
SW-10A	81-02-17	323	7.5	24.0	110	20	32	7.1	22	0.9	30
SW-11	81-02-15	653	7.2	23.0	250	140	72	18	30	0.8	20
SW-13	81-02-17	619	7.3	23.0	230	84	67	16	36	1.0	25
SW-16	81-02-15	422	7.5	25.0	150	50	43	9.4	25	0.9	27
SW-18	81-02-15	384	7.8	26.5	110	10	34	6.0	37	1.5	42
HTA-1	81-08-04	712	7.7	25.5	250	--	79	13	50	1.4	30
SMR-1	81-08-04	787	7.7	26.0	360	--	68	45	26	0.7	14
MAR-1	81-08-05	1010	7.7	25.5	450	--	94	53	39	0.9	16
MAR-2	81-08-05	785	7.7	24.0	320	--	65	39	43	1.2	22
T-6	81-07-29	435	7.1	24.5	170	--	48	11	27	1.0	26
T-7	81-08-06	340	8.0	27.0	100	--	33	4.2	31	1.4	40
T-9	81-08-05	875	7.8	28.0	330	--	94	22	47	1.2	24
T-10	81-08-04	353	7.5	27.0	120	--	36	8.1	24	1.0	29
T-11	81-08-04	316	7.6	26.5	100	--	32	5.8	22	1.0	31
T-15	81-07-29	280	8.4	27.0	79	--	29	1.5	25	1.2	40
T-16	81-07-30	355	7.7	--	120	--	38	6.8	24	1.0	30
T-17	81-07-30	284	7.4	26.5	81	--	28	2.8	26	1.3	40
T-18	81-07-31	686	7.4	30.0	93	--	32	3.2	110	5.1	71
SMR-4	81-08-06	703	7.3	28.5	250	--	73	16	49	1.4	30

Table 5. Major chemical constituents, radiochemical, and trace-element analyses of water from selected wells, White Sands Missile Range

Part I.—Major chemical constituents - concluded

WELL	CARBON, ORGANIC, TOTAL (MG/L AS C)	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)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	NITROGEN, NO_2+NO_3 DISSOLVED (MG/L AS N)	PHOSPHORUS, ORTHO, DISSOLVED (MG/L AS P)	PHOSPHATE, ORTHO, DISSOLVED (MG/L AS PO_4)
SW-10A	--	2.0	12	48	0.3	43	226	1.3	0.010	0.03
SW-11	--	2.8	25	150	0.3	43	433	5.7	--	--
SW-13	--	2.7	18	120	0.4	39	424	7.8	0.030	0.09
SW-16	--	2.1	20	58	0.3	41	271	3.1	--	--
SW-18	--	1.8	11	57	0.3	33	246	1.2	--	--
HTA-1	--	1.7	27	120	3.0	31	446	4.4	0.030	0.09
SMR-1	--	2.0	30	150	1.1	27	498	1.1	0.020	0.06
MAR-1	--	2.2	53	260	0.4	24	648	1.8	0.050	0.15
MAR-2	--	2.2	34	150	0.4	24	484	1.4	0.090	0.28
T-6	--	2.0	13	57	0.7	48	294	.69	0.000	0.00
T-7	--	1.9	11	46	0.3	34	224	1.1	0.000	0.00
T-9	--	3.8	82	200	2.0	24	538	2.1	0.000	0.00
T-10	--	1.9	12	45	0.3	40	245	1.2	0.010	0.03
T-11	--	1.9	10	45	0.2	40	210	.89	0.000	0.00
T-15	--	2.3	12	47	0.2	51	208	.70	0.000	0.00
T-16	1.5	1.5	12	44	0.6	41	242	1.8	0.010	0.03
T-17	5.2	2.1	18	35	0.5	21	187	.70	0.010	--
T-18	0.9	3.2	43	150	4.5	26	445	.11	0.010	0.03
SMR-4	--	2.9	35	160	2.0	37	470	2.4	0.000	0.00

Table 5. Major chemical constituents, radiochemical, and trace element analyses of water from selected wells, White Sands Missile Range

Part II.—Radiochemical and trace element analyses

WELL	DATE OF SAMPLE	BORON, DIS-SOLVED (UG/L AS B)	IRON, DIS-SOLVED (UG/L AS FE)	LITHIUM, DIS-SOLVED (UG/L AS LI)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	STRON-TIUM, DIS-SOLVED (UG/L AS SR)	GROSS ALPHA, DIS-SOLVED (UG/L AS U-NAT)	GROSS BETA, DIS-SOLVED (PCI/L AS CS-137)	GROSS BETA, DIS-SOLVED (PCI/L AS SR/Y-90)
SW-10A	81-02-17	10	--	6	--	260	3.2	1.4	1.3
SW-11	81-02-15	10	--	9	--	560	--	--	--
SW-13	81-02-17	10	--	8	--	530	6.5	2.6	2.6
SW-16	81-02-15	10	--	9	--	330	--	--	--
SW-18	81-02-15	10	--	10	--	350	--	--	--
HTA-1	81-08-04	30	10	--	2	--	--	--	--
SMR-1	81-08-04	30	10	--	2	--	--	--	--
MAR-1	81-08-05	40	10	--	2	--	--	--	--
MAR-2	81-08-05	50	10	--	1	--	--	--	--
T-6	81-07-29	20	10	--	4	--	--	--	--
T-7	81-08-06	20	10	--	1	--	--	--	--
T-9	81-08-05	40	10	--	28	--	--	--	--
T-10	81-08-04	20	10	--	2	--	--	--	--
T-11	81-08-04	20	10	--	1	--	--	--	--
T-15	81-07-29	20	10	--	4	--	--	--	--
T-16	81-07-30	30	10	--	2	--	--	--	--
T-17	81-07-30	20	10	--	170	--	--	--	--
T-18	81-07-31	100	36	--	130	--	--	--	--
SMR-4	81-08-06	30	10	--	7	--	--	--	--

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