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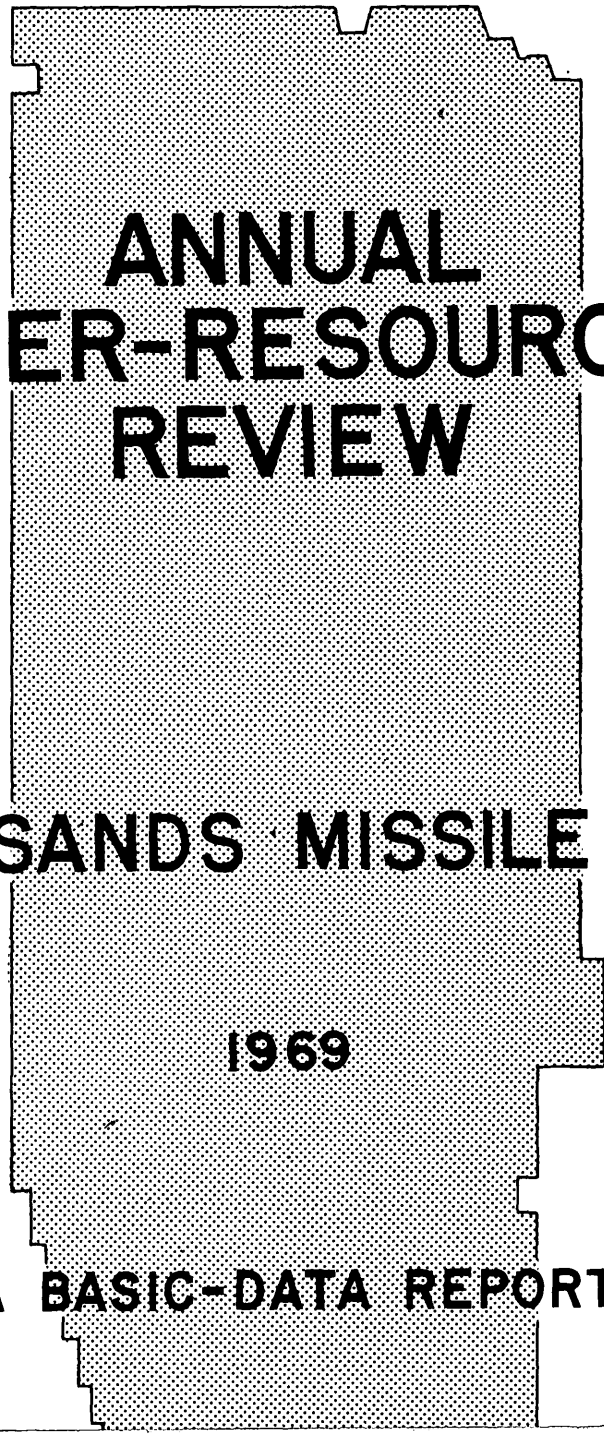
ANNUAL WATER-RESOURCES REVIEW



WHITE SANDS MISSILE RANGE

1969

A BASIC-DATA REPORT

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Albuquerque, New Mexico

Annual water-resources review

White Sands Missile Range

1969

- a basic-data report -

By

Fred E. Busch

Open-file report

Prepared by the U.S. Geological Survey, Water Resources Division
in cooperation with White Sands Missile Range

August 1970

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Annual water-resources review

White Sands Missile Range

1969

Basic-data report

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Introduction

This report presents information on the water resources of the White Sands Missile Range that was collected during the period January 1969 to January 1970 by personnel of the U.S. Geological Survey, Water Resources Division. Data on ground-water pumpage and resulting water-level fluctuation, chemical quality, precipitation, surface-water runoff, and miscellaneous items of interest are summarized in the report. Most data were obtained as a result of the continuing water-resources basic-data collection program sponsored by the Post Engineer, White Sands Missile Range.

Observations of test drilling on the Missile Range are conducted under a related water-resources exploration program. The test-drilling program that was started in late 1968 near the Post Headquarters area and at Rhodes Canyon Range Camp was completed in 1969, as was a new nonpotable water-supply well at Stallion Range Center. Details of the drilling and testing of these wells were described by Lyford (1970a and 1970b). Summary records of the wells are given in this report under "miscellaneous observations."

Continuing observations

The program to collect basic data on the water resources of White Sands Missile Range has been continuous since 1953. It has been expanded from the original program which involved water-level observation in 5 test wells in the Post Headquarters area to the present program which includes periodic measurements in 11 supply wells and 22 test wells, semi-annual water sampling in 7 test wells, and operation and monitoring of 23 rain gages and 2 runoff stations in widely-scattered areas on the missile range (fig. 1). In addition, non-recurring, or specialized events, other than test-drilling activities are considered a part of the program. Water samples were collected in supply wells 13 and 15 at the request of the Post Engineer, Utilities Division. This was a special event which may not be repeated in the near future.

This report is the third annual water-resources review prepared for information of White Sands Missile Range. Reports prior to 1967 were in letter form.

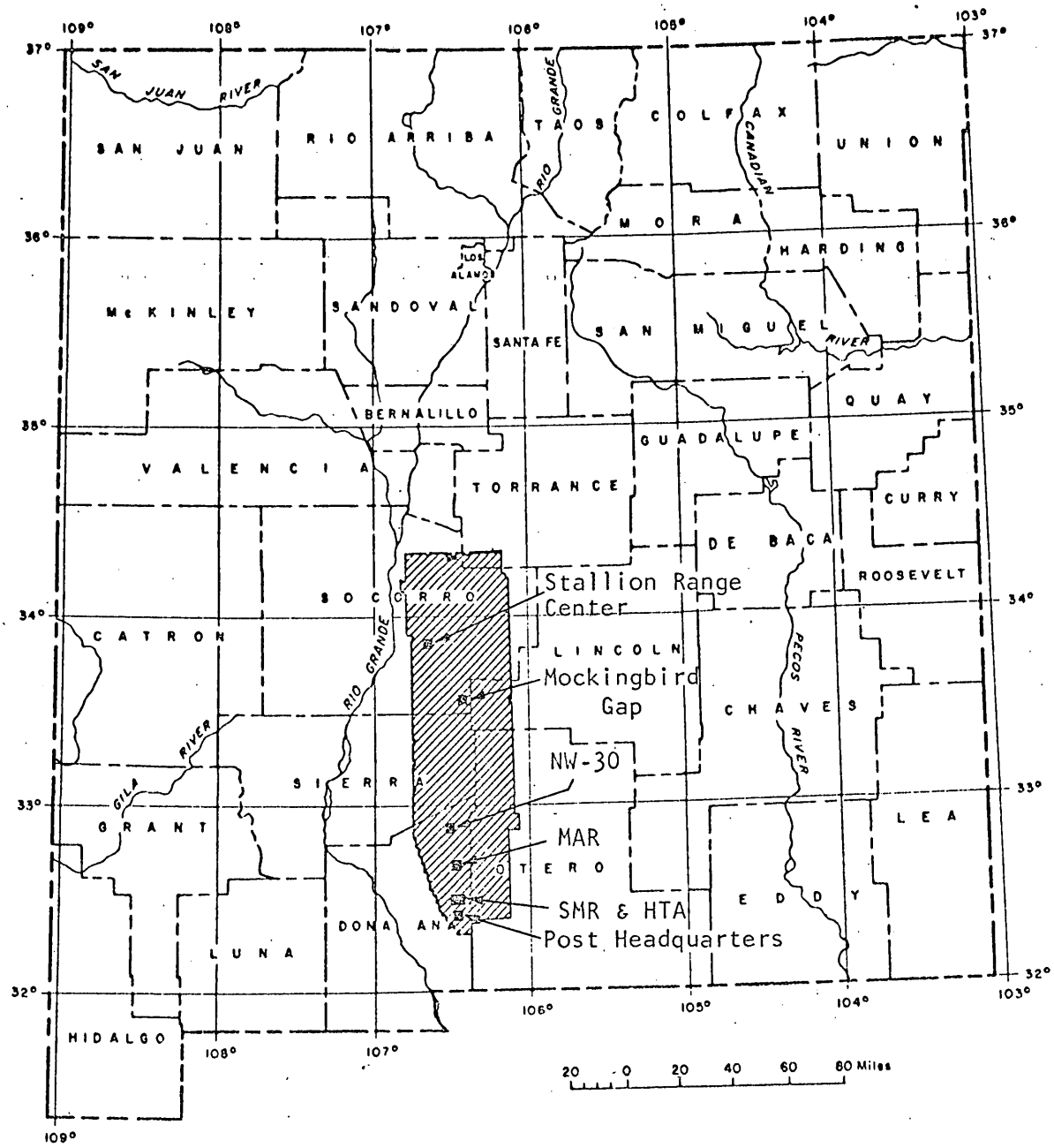

Figure 1.--Areas of hydrologic observations on White Sands Missile Range, New Mexico.

Pumpage

Total ground-water pumpage at White Sands Missile Range in 1969, according to records furnished by the Post Engineer, Utilities Division, was 870,645,500 gallons. The Post Headquarters well field produced 863,151,000 gallons; MAR wells 1 and 2, 5,346,100 gallons, and SMR well 1, 2,148,400 gallons. The pumpage in 1969 was 70,227,000 gallons more than in 1968.

Figure 2 shows pumpage by month and total gallons pumped per year 1953-69 in the Post Headquarters well field. The fluctuation of water level in the Main Gate well (fig. 7), is also illustrated by a hydrograph plotted above the pumpage graph.

Figure 3 is a graph showing combined monthly pumpage of supply wells 17, 18, 19, and 20 in the Post Headquarters well field and water-level fluctuation in test well T-7 (fig. 7). These supply wells are the northernmost wells in the well field (fig. 5), and in 1969 supplied more than half of the total monthly pumpage from the well field. Test well T-7 is located about 0.7 mile east of the supply wells. Water-level fluctuations in test well T-7 (fig. 3) are principally the result of withdrawals from the northern part of the well field. Graphs on figure 4 show water-level fluctuations in test wells T-8, T-10, and T-11. Hourly water-level fluctuations are recorded in these test wells.

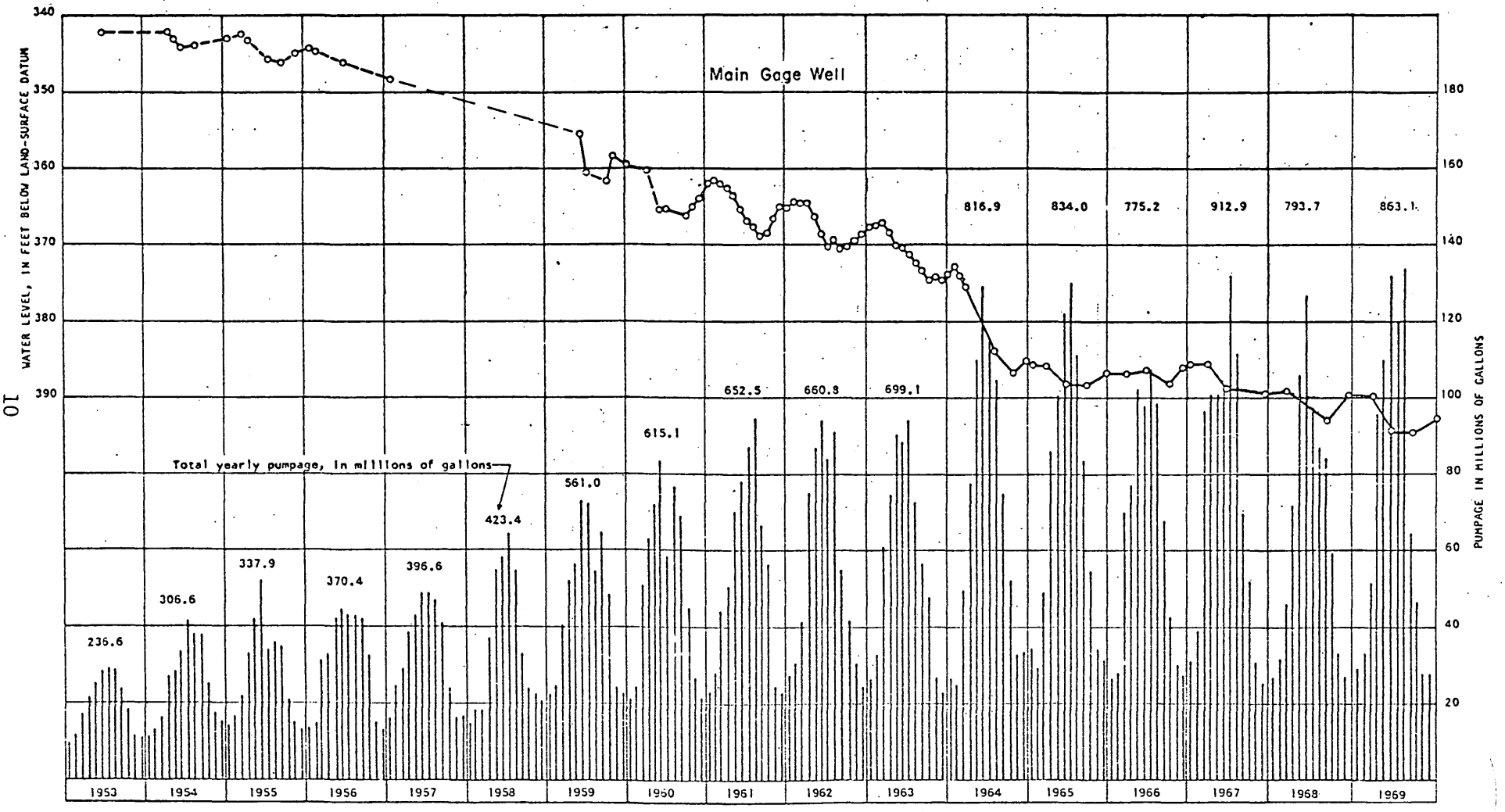

Figure 2.--Water-level fluctuation in the Main Gate well and total monthly and yearly pumpage in the Post Headquarters well field.

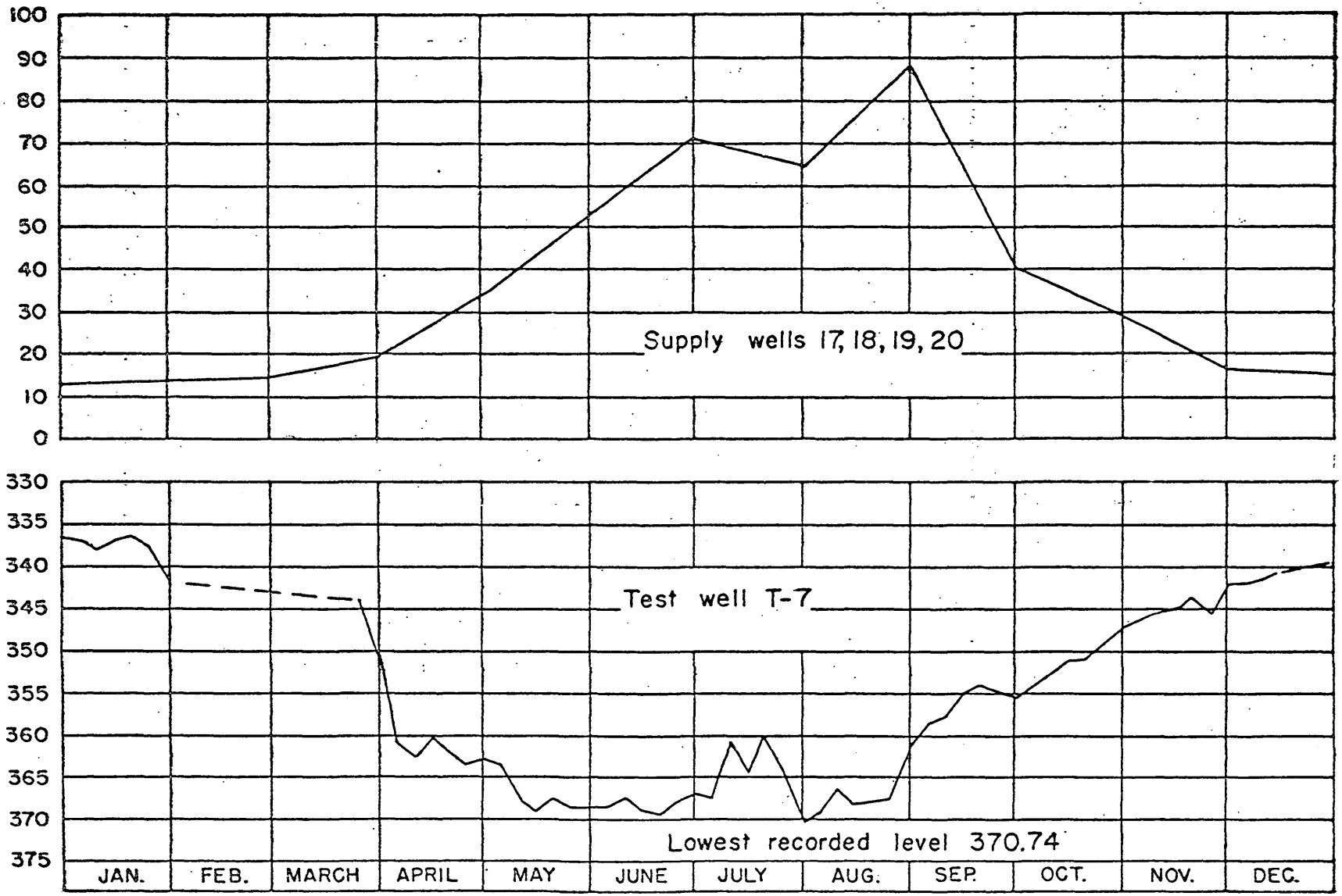

Figure 3.--Water-level fluctuation in test well T-7 and combined monthly pumpage of supply wells 17, 18, 19, and 20, Post Headquarters well field, 1969.

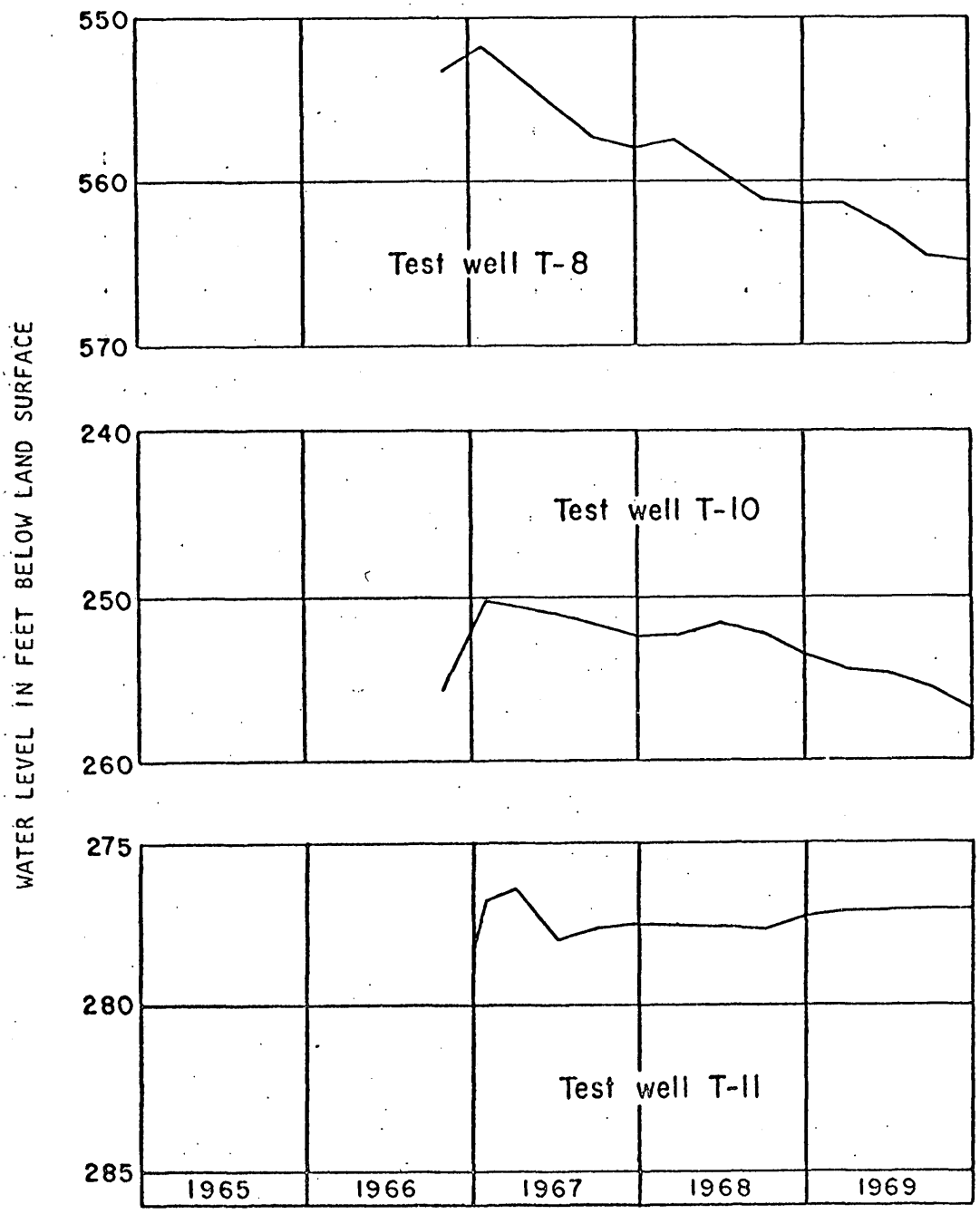

Figure 4.--Water-level fluctuations in test wells T-8, T-10, and T-11 for period of available record.

Water-level fluctuation in supply wells

Depth-to-water measurements made in 9 supply wells in the Post Headquarters well field (fig. 5), 2 supply wells in the MAR area and 1 supply well in the SMR area (fig. 6), in January and December 1969 are given in table 1. The change in ground-water storage that has occured as the result of pumping the supply wells is reflected as net change in the depth to water in the wells between January 1969 and December 1969.

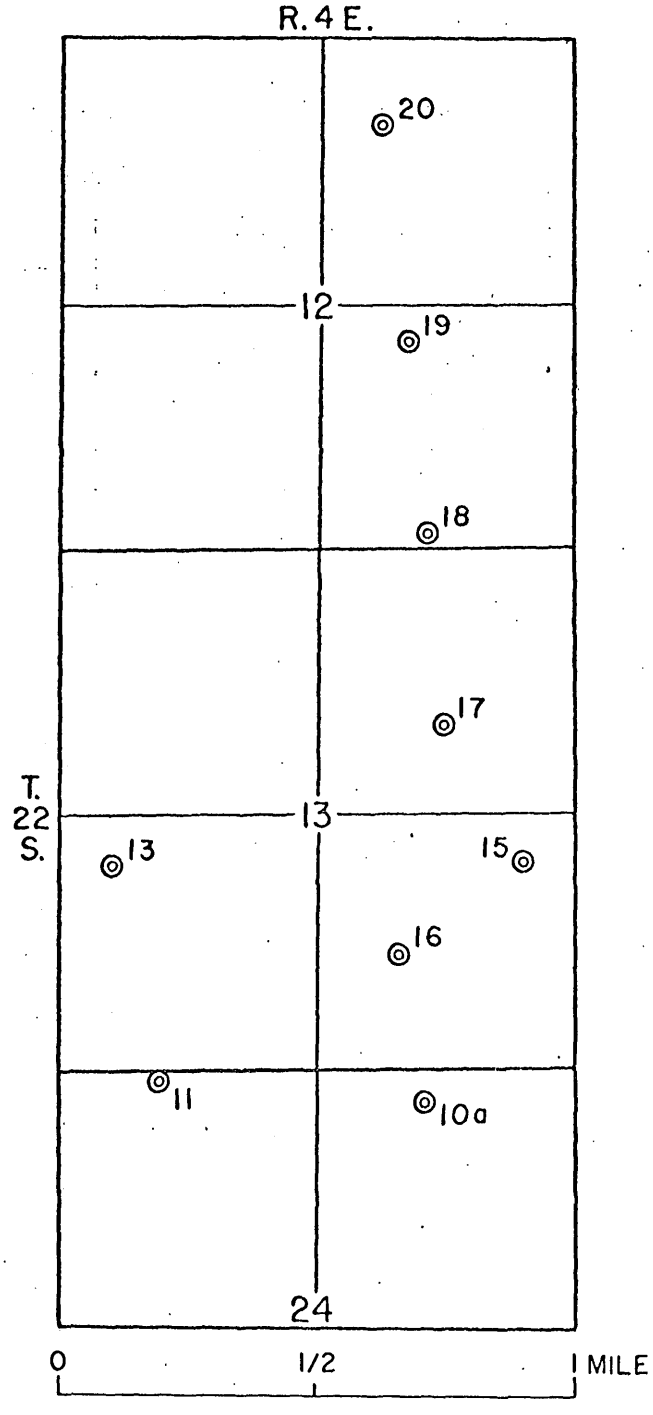

Figure 5.--Location of supply wells,

Post Headquarters well field.

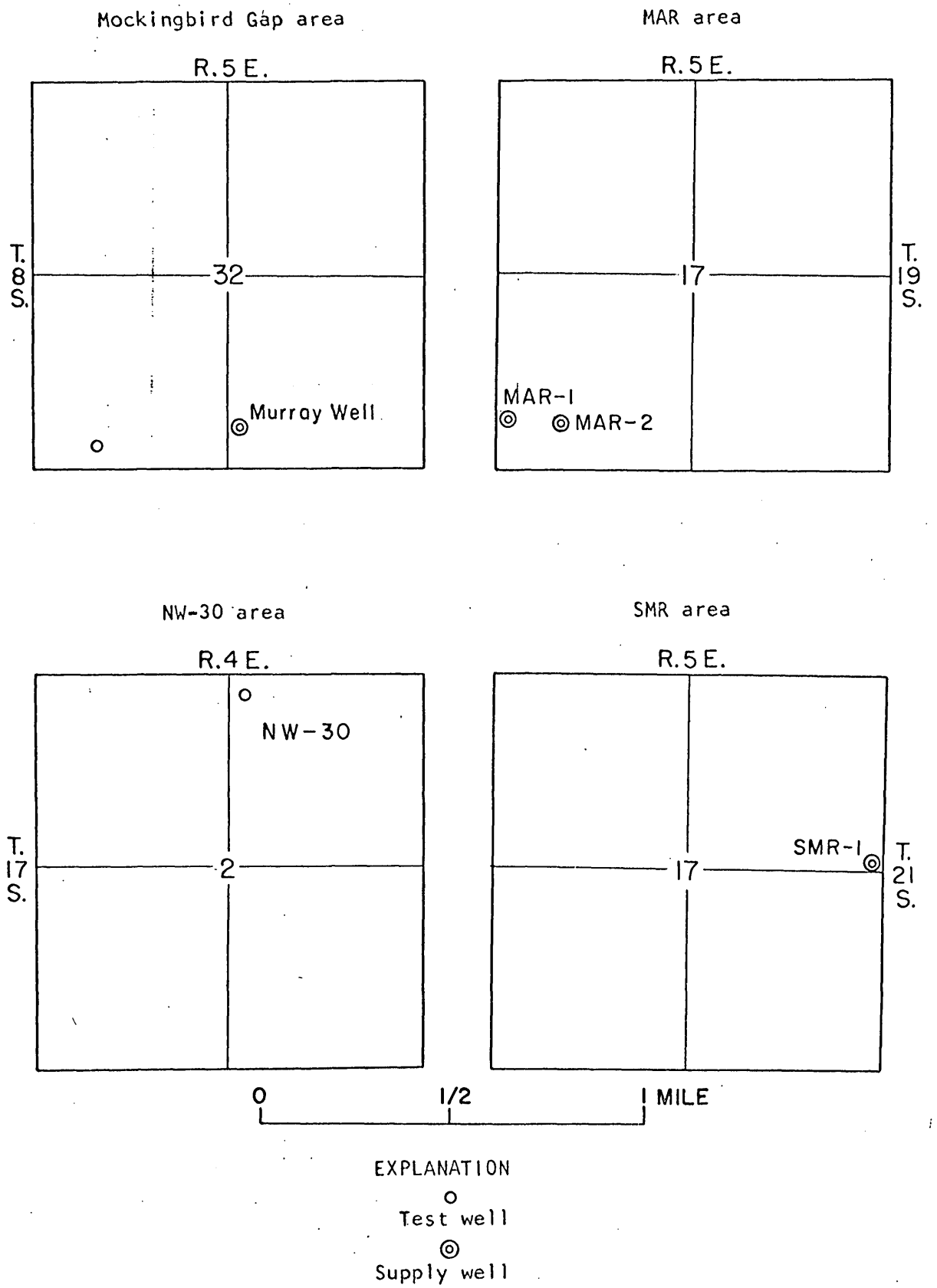

Figure 6.--Location of test wells and supply wells in Mockingbird Gap, MAR, NW-30, and SMR areas

Table 1.--Depth to water, below land surface, in supply wells

Well[1] no.	Depth to water, in feet[2] January 1969	Depth to water, in feet[2] December 1969	Net change Water-level rise (+) or decline (-), in feet January to December 1969
10a	410	411	- 1
11	330	---	---
13	317	320	- 3
15	420	420	0
16	430	---	---
17	418	421	- 3
18	405	407	- 2
19[3]	428	427	+ 1
20	488	490	- 2
MAR 1	213.90	---	---
MAR 2	213.60	---	---
SMR 1	287.84	288.24	- .40

1/ Wells not pumped for 24 hours prior to measurements.
2/ Measurements made with steel tape.
3/ Out of service the first five months of 1969.

Water-level fluctuation in test wells

Depth-to-water measurements made at quarterly intervals during 1969 in the Post Headquarters area (fig. 7) are given in table 2. Measurements were made in 12 wells at the Post Headquarters area; four wells south of the Headquarters area which were added to the observation well net during 1969; two wells in HTA area; three wells in the SMR area; two wells in the MAR area; one well in the NW-30 area; one well in the Mockingbird area. Four of the test wells in the Post Headquarters area were equipped with continuous recording gages. Hydrographs prepared from measurements and recording gages on the Main Gate well and test well T-7 are shown on figures 2 and 3 respectively. The change in water level between measurements made at comparable dates in 1968 and in 1969 is shown in table 2.

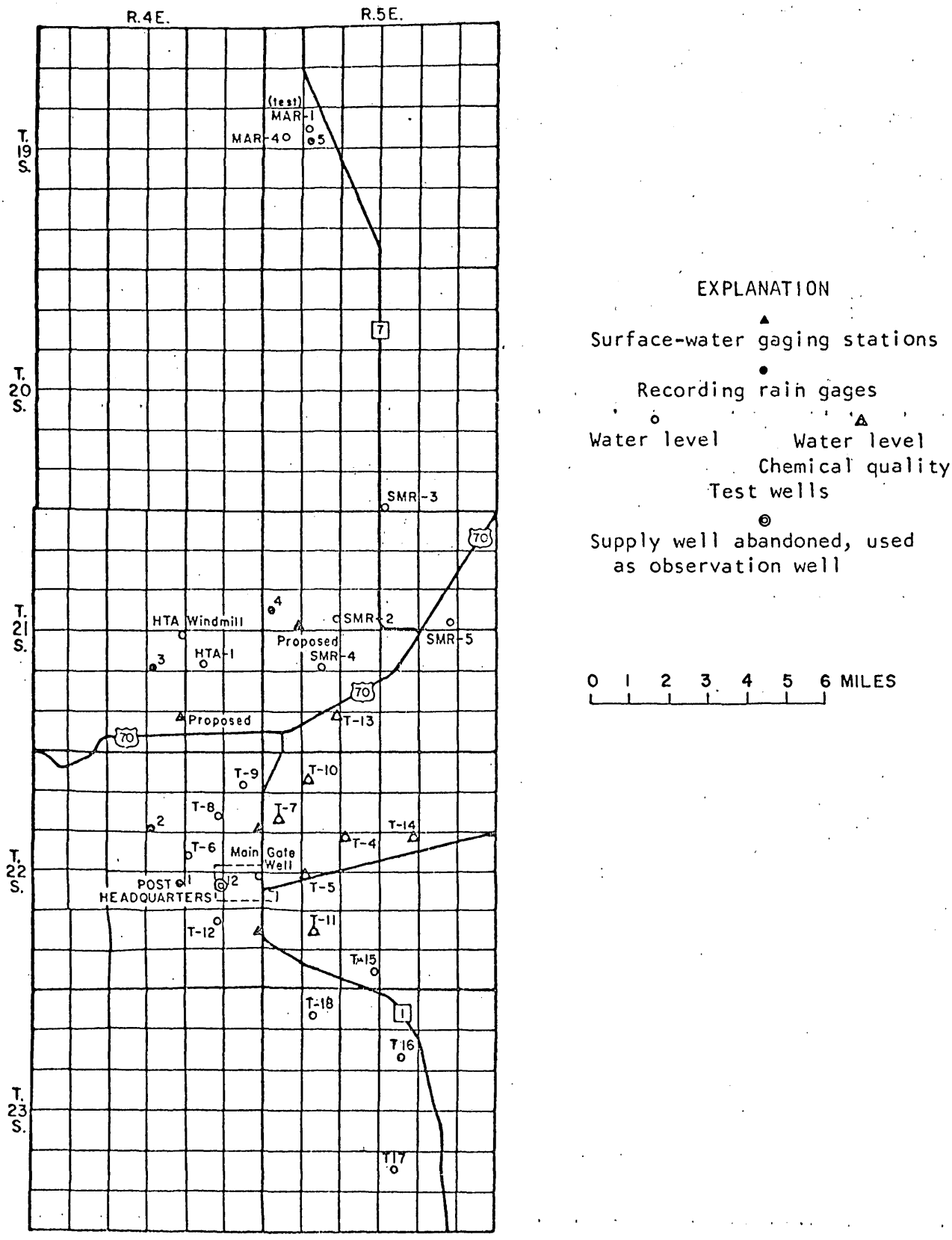

Figure 7.--Location of gaging stations, recording rain gages, and test wells at Post Headquarters and adjacent areas.

Table 2.--Depth to water in test wells

Well no.	Date of measurement (1969)	Depth to water, in feet below land surface	Change in water level* 1968-69	Remarks
T-4	March 25	224.90	-0.32	
	June 25	224.93	- .15	
	Sept. 23	224.75	0	
	Dec. 17	225.03	- .10	
T-5	March 26	272.77	- .23	
	June 25	272.75	+ .27	
	Sept. 23	272.60	+ .19	
	Dec. 17	273.42	- .45	
T-6	March 25	207.04	-2.62	
	June 26	207.17	- .97	
	Sept. 25	206.40	+ .61	
	Dec. 19	207.04	+ .13	
T-7	March 25	341.59	-3.17	Equipped with recorder
	June 25	367.83	-8.98	
	Sept. 23	354.69	-2.00	
	Dec. 16	341.40	-1.37	
T-8	March 25	561.34	-3.79	Equipped with recorder
	June 24	562.83	-3.56	
	Sept. 23	564.72	-3.66	
	Dec. 16	564.56	-3.20	
T-9	March 25	383.19	-1.79	
	June 24	383.45	-1.44	
	Sept. 23	386.28	-3.88	
	Dec. 18	384.88	-2.64	
T-10	March 25	254.55	-2.35	Equipped with recorder
	June 25	254.86	-3.21	
	Sept. 23	255.50	-3.29	
	Dec. 16	255.83	-1.98	
T-11	March 24	277.30	+ .26	Equipped with recorder
	June 24	277.16	+ .44	
	Sept. 23	277.17	+ .45	
	Dec. 16	277.10	+ .30	

* Water-level rise (+) or decline (-), in feet.

Table 2.-- Depth to water in test wells - Continued

Well no.	Date of measurement (1969)	Depth to water, in feet below land surface	Change in water level* 1968-69	Remarks
T-13	March 25	208.62	-0.07	
	June 25	209.00	+ .35	
	Sept. 23	210.60	-1.96	
	Dec. 17	206.74	+1.80	
T-14	March 26	131.56	- .26	
	June 26	131.50	- .40	
	Sept. 23	131.60	- .05	
	Dec. 17	131.60	- .05	
T-15	March 25	179.30	-	Well completed
	June 24	179.25	-	in late 1968.
	Sept. 23	179.15	-	
	Dec. 17	179.24	-	
T-16	June 24	186.85	-	Well completed
	Sept. 23	186.90	-	in 1969.
	Dec. 17	186.68	-	
T-17	June 24	242.16	-	Well completed
	Sept. 23	241.99	-	in 1969.
	Dec. 17	242.05	-	
T-18	July 23	257.20	-	Well completed
	Sept. 23	246.97	-	in 1969.
	Dec. 17	246.75	-	
Old Supply Well 12	March 26	267.98	- .08	
	June 26	267.75	+ .10	
	Sept. 25	265.27	+2.53	
	Dec. 18	263.65	+5.10	
HTA 1	June 19	78.53	-	Well equipped
	Sept. 24	78.45	-	with submers-
	Dec. 16	78.69	- .02	ible pump.
HTA windmill	Dec. 17	47.95	+ .40	

*Water-level rise (+) or decline (-), in feet.

Table 2.--Depth to water in test wells - Concluded

Well no.	Date of measurement (1969)	Depth to water, in feet below land surface	Change in water level* 1968-69	Remarks
SMR 2	March 25	309.10	-2.07	
	June 23	309.10	-2.08	
	Sept. 24	308.50	+ .15	
	Dec. 18	309.33	-3.08	
SMR 3	March 25	297.32	- .32	Well equipped with turbine pump - unable to measure after June 1969.
	June 23	297.33	- .23	
SMR 4	March 25	275.52	-1.02	
	June 26	275.50	- .75	
	Sept. 24	279.00	-4.20	
	Dec. 18	276.17	-1.04	
MAR 1 test	March 25	221.25	-1.51	
	June 23	221.30	- .50	
	Sept. 24	220.90	- .15	
MAR 4	March 25	303.85	- .60	
	June 23	307.80	-3.80	
	Sept. 24	303.82	- .08	
Murray test well	March 28	175.45	+ .90	
	June 23	175.35	-	
Main Gate well	March 25	389.79	- .76	Equipped with recorder
	June 24	394.35	-3.85	
	Sept. 23	394.40	-1.39	
	Dec. 10	392.46	-3.31	
NW-30	March 28	210.95	-	
	June 23	210.95	-	
	Sept. 25	210.18	+1.82	

*Water-level rise (+) or decline (-), in feet.

Chemical quality

The water-sampling program was expanded in 1968 to include seven test wells (T-4, T-5, T-7, T-10, T-11, T-13, and T-14) to monitor any change in chemical quality of ground water that may occur in the area east of the Post Headquarters well field (fig. 7). Two additional water samples were collected during 1969 in supply wells 13 and 15. Chemical analyses of water samples collected in June and December 1969 are given in tables 3 and 4.

Table 3.--Chemical analyses of water from test wells,

Post Headquarters area, 1969

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WATER RESOURCES DIVISION

Analyses by Geological Survey, United States Department of the Interior

(milligrams per liter)

TEST WELL	T-4	T-4	T-5	T-5	T-7	T-7
LABORATORY NO.	66113	66933	66114	66941	66115	66936
Date of collection	6-25-69	12-17-69	6-25-69	12-17-69	6-25-69	12-17-69
Depth sampled (feet)	275	325	350	345	965	500
Silica (SiO_2)	20	21	30	35	20	28
Iron (Fe)	-	-	-	-	-	-
Manganese (Mn)	-	-	-	-	-	-
Calcium (Ca)	18	18	36	36	14	28
Magnesium (Mg)	2.7	2.6	5.8	7.2	0.5	2.7
Sodium (Na)	27	36	29	25	81	39
Potassium (K^+)						
Bicarbonate (HCO_3)	70	91	107	110	95	123
Carbonate (CO_3)	0	0	0	0	0	0
Sulfate (SO_4)	41	41	56	57	90	44
Chloride (Cl)	9.9	12	15	14	28	7.9
Fluoride (F)	0.4	0.4	0.8	0.4	0.8	0.5
Nitrate (NO_3)	0.4	1.0	9.0	4.0	0.7	6.8
Dissolved solids						
Calculated	153	177	235	233	282	217
Residue on evaporation at 180°C						
Hardness as $CaCO_3$	56	57	114	118	37	81
Noncarbonate hardness as $CaCO_3$						
Alkalinity as $CaCO_3$	0	0	0	28	0	0
Specific conductance (micromhos at 25°C)	238	242	360	373	439	341
pH	7.3	7.9	7.8	7.9	7.3	7.7
Color	-	-	-	-	-	-
SAR	1.6	21	12	1.0	5.8	1.9

GPO 830-357

Table 3.--Chemical analyses of water from test wells,

Post Headquarters area, 1969 - Continued

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WATER RESOURCES DIVISION

Analyses by Geological Survey, United States Department of the Interior

(milligrams per liter)

TEST WELL	T-10	T-10	T-11	T-11	T-13	T-13
LABORATORY NO.	66116	66937	66117	66934	66118	66939
Date of collection	6-25-69	12-17-69	6-25-69	12-17-69	6-25-69	12-17-69
Depth sampled (feet)	300	350	350	400	300	350
Silica (SiO_2)	23	22	38	15	37	33
Iron (Fe)	-	-	-	-	-	-
Manganese (Mn)	-	-	-	-	-	-
Calcium (Ca)	34	32	34	32	52	53
Magnesium (Mg)	7.5	7.8	4.9	5.6	12	12
Sodium (Na) + Potassium (K)	26	35	24	23	37	37
Bicarbonate (HCO_3)	134	155	117	123	150	152
Carbonate (CO_3)	0	0	0	0	0	0
Sulfate (SO_4)	43	44	43	40	81	80
Chloride (Cl)	11	10	7.6	5.6	30	29
Fluoride (F)	0.4	0.4	0.5	0.4	1.2	1.1
Nitrate (NO_3)	0.0	1.6	4.5	3.5	6.5	1.0
Dissolved solids Calculated	211	229	214	185	331	330
Residue on evaporation at 180°C	116	113	105	104	178	180
Hardness as $CaCO_3$	0	0	9	3	55	56
Noncarbonate hardness as $CaCO_3$						
Alkalinity as $CaCO_3$						
Specific conductance (micromhos at 25°C)	339	348	316	316	508	522
pH	7.3	7.8	7.2	7.9	7.4	7.5
Color						
SAR	1.0	1.4	1.0	1.0	1.2	1.2

GPO 830-857

Table 3.--Chemical analyses of water from test wells,

Post Headquarters area, 1969 - Concluded

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WATER RESOURCES DIVISION

Analyses by Geological Survey, United States Department of the Interior

(milligrams per liter)

TEST WELL	T-14					
LABORATORY NO.	66935					
Date of collection	12-17-69					
Depth sampled (feet)	300					
Silica (SiO_2)	2.9					
Iron (Fe)	-					
Manganese (Mn)	-					
Calcium (Ca)	18					
Magnesium (Mg)	2.4					
Sodium (Na)						
Potassium (K)	543					
Bicarbonate (HCO_3)	107					
Carbonate (CO_3)	0					
Sulfate (SO_4)	384					
Chloride (Cl)	530					
Fluoride (F)	0.7					
Nitrate (NO_3)	0.4					
Dissolved solids						
Calculated	1,530					
Residue on evaporation at 180°C						
Hardness as $CaCO_3$	56					
Noncarbonate hardness as $CaCO_3$	-					
Alkalinity as $CaCO_3$	0					
Specific conductance (micromhos at 25°C)	2,580					
pH	8.2					
Color	32					

GPO 830-857

Table 4.--Chemical analyses of water from supply wells,

Post Headquarters area, 1969

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WATER RESOURCES DIVISION

Analyses by Geological Survey, United States Department of the Interior

(milligrams per liter)

SUPPLY WELL	13	15				
LABORATORY NO.	66938	66940				
Date of collection	12-16-69	12-16-69				
Depth sampled (feet)	260	560				
Silica (SiO_2)	38	33				
Iron (Fe)	-	-				
Manganese (Mn)	-	-				
Calcium (Ca)	59	38				
Magnesium (Mg)	14	11				
Sodium (Na)						
Potassium (K)	21	38				
Bicarbonate (HCO_3)	143	132				
Carbonate (CO_3)	0	0				
Sulfate (SO_4)	60	52				
Chloride (Cl)	27	9.1				
Fluoride (F)	0.5	0.5				
Nitrate (NO_3)	38	4.3				
Dissolved solids						
Calculated	328	251				
Residue on evaporation at 180°C						
Hardness as $CaCO_3$	205	98				
Noncarbonate hardness as $CaCO_3$	88	0				
Alkalinity as $CaCO_3$						
Specific conductance (micromhos at 25°C)	526	355				
pH	7.4	7.8				
Color						
SAR	0.6	1.7				

GPO 830-357

Sewage effluent

At the request of the Post Engineer, two water samples of the sewage effluent were collected and analyzed for chemical constituents; the one for minor elements was done by spectrographic analyses. The results are listed in table 5. The samples were collected at the discharge point for sewage effluent at the Post Sewage Plant.

Table 5.--Chemical analyses of water from sewage effluent,

Post Headquarters area, 1969

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WATER RESOURCES DIVISION

Analyses by Geological Survey, United States Department of the Interior

(milligrams per liter)

SEWAGE EFFLUENT LABORATORY NO.	66932					
Date of collection	12-18-69					
Silica (SiO_2)	46					
Iron (Fe)						
Manganese (Mn)						
Total phosphorus as PO_4	18					
Calcium (Ca)	37					
Magnesium (Mg)	13					
Sodium (Na)	82					
Potassium (K)	17					
Bicarbonate (HCO_3)	110					
Carbonate (CO_3)	0					
Sulfate (SO_4)	134					
Chloride (Cl)	41					
Fluoride (F)	2.4					
Nitrate (NO_3)	25					
Boron	0.18					
Dissolved solids						
Calculated	470					
Residue on evaporation at 180°C	480					
Hardness as $CaCO_3$	144					
Noncarbonate hardness as $CaCO_3$						
Alkalinity as $CaCO_3$						
Specific conductance (micromhos at 25°C)	763					
pH	7.7					
Color	150					

GPO 830-857

Table 5.--Chemical analyses of water from sewage effluent

Post Headquarters area, 1969 - Concluded

U.S. DEPT. OF THE INTERIOR--GEOLOGICAL SURVEY
Statement of Water Analysis--Spectrographic

Source: Sewage effluent
Location: White Sands Missile Range, New Mexico
Latitude: _____ Longitude: _____

____¼ ____¼ ____¼ Sec.____ T.____ R.____ Field/Office No. 2408

Well Type: _____ Use: _____
Depth (ft): _____ Cased to (ft): _____
Diam. (in.): _____ Date drilled: _____
Water level (ft): _____
Discharge (gpm): _____
W.B.F.: _____

Altitude (ft above msl): _____
Owner: _____

Date col. 12-18-69 Time 1300
Col. by: _____
Field detns: Temp (°C) _____ pH _____
Sp cond (μmhos/cm at 25°C) _____
Appearance: _____
Remarks: Filtered; 4 ml HNO_3 added.

Element	μg/l	Element	μg/l
Aluminum (Al)	250	Silver (Ag)	30
Barium (Ba)	40	Strontium (Sr)	350
Beryllium (Be)	<2	Tin (Sn)	<10
Bismuth (Bi)	<10	Titanium (Ti)	13
Boron (B)	280	Vanadium (V)	<10
Cadmium (Cd)	<95	Ytterbium (Yb)	--
Chromium (Cr)	260	Yttrium (Y)	--
Cobalt (Co)	<10	Zinc (Zn)	<600
Copper (Cu)	270	Zirconium (Zr)	--
Gallium (Ga)	ND		
Germanium (Ge)	<40		
Iron (Fe)	2,200		
Lanthanum (La)	--		
Lead (Pb)	14		
Lithium (Li)	5		
Manganese (Mn)	13		
Molybdenum (Mo)	10		
Nickel (Ni)	<10		
Rubidium (Rb)	10		
Scandium (Sc)	--		

Dissolved solids
R.O.E. at 180°C 632 mg/l

Acidified (HNO_3, ~~HCl~~) sample

--Not determined
< Less than figure shown
* By atomic absorption spectrophotometry

ND Specifically sought, not detected
X Semiquantitative estimate in the digit order shown

Plate Nos. 802 and 803 Date 1-21-70 Analysts P.R.B., and D.G.
Date checked 1-21-70 by [illegible]

GPO 854-998

Precipitation

In 1969 measurements of precipitation were made in 18 non-recording and five recording rain gages in the Post Headquarters and MAR areas (fig. 7). Locations of non-recording gages are not shown because these gages are subject to re-location owing to construction activities on the Missile Range, or for the purpose of obtaining more complete coverage. Monthly measurements and yearly totals of precipitation recorded by these gages are listed in table 6.

Table 6.--Precipitation record, 1969

No.	Location	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total	Remarks
	White Sands Missile Range														
	Nonrecording gages														
	T. 21 S., R. 4 E.														
17	SE¼NE¼SE¼ Sec.10	0	0	0.32	0	0	0.10	2.25	1.10	3.55	1.85	0	0.91	10.08	
18	NE¼NW¼SE¼ Sec.14	0	0	.15	0	0	.11	1.75	1.24	2.75	1.95	0	.72	8.67	
15	SW¼SW¼NE¼ Sec.21	0	0	.18	0	0	.10	1.24	.50	3.35	1.90	0	.63	7.90	
16	NE¼NE¼NE¼ Sec.22	0	0	.21	0	0	.11	2.00	.80	3.55	1.95	0	.80	9.42	
14	NE¼NE¼SE¼ Sec.25	0	0	0	0	0	.20	1.55	.18	3.50	1.05	0	.83	7.31	
13	NE¼NE¼SW¼ Sec.27	0	0	.15	0	0	.11	1.30	.50	4.25	1.65	0	.80	8.76	
11	NW¼NW¼NW¼ Sec.32	0	0	.20	0	0	-	-	-	-	-	-	-	0.20	Destroyed in June.
12	NE¼NW¼SW¼ Sec.32	0	0	.16	0	0	.14	1.70	.50	2.82	1.70	0	.72	7.74	
10	SE¼SE¼SW¼ Sec.32	0	0	.10	0	0	.12	1.45	1.00	-	-	-	1.00	3.67	No record Sept.-Nov.
9	NE¼NE¼SW¼ Sec.33	0	0	.17	0	0	.12	1.40	.48	2.87	1.55	0	.63	7.22	
	T. 21 S., R. 5 E.														
21	SE¼SE¼NE¼ Sec.17	0	0	.03	0	0	.10	1.60	.50	2.30	.80	0	.70	6.03	SMR
	T. 22 S., R. 4 E.														
8	SE¼NW¼NW¼ Sec. 2	0	0	.16	0	0	.22	1.55	.48	2.92	.75	0	.70	6.78	
7	NE¼NE¼NW¼ Sec.10	0	0	.19	0	0	.20	1.35	.32	-	-	-	-	2.06	Road washed out Sept
6	NW¼NW¼SW¼ Sec.11	0	0	.08	0	0	.20	1.48	.32	3.65	.92	0	.60	7.25	
4	NE¼NE¼NE¼ Sec.22	0	0	.20	0	0	.18	1.55	1.00	3.65	1.40	0	1.00	8.98	
	T. 22 S., R. 5 E.														
3	NE¼SW¼SW¼ Sec.25	0	0	.08	0	0	.10	2.25	1.00	3.95	1.00	0	1.00	9.38	
	T. 22 S., R. 4 E.														
1	E¼SE¼SE¼ Sec.11	0	0	.10	0	0	.20	1.25	.20	3.95	.90	0	.70	7.30	
	T. 23 S., R. 5 E.														
2	NW¼NW¼SW¼ Sec. 5	0	0	0	0	0	0	2.25	.32	3.82	1.00	0	0	7.39	
	Recording gages														
No.	**Location**														
	T. 19 S., R. 5 E.														
5	SW¼SW¼SW¼ Sec.17	0	0	.15	0	0	.11	1.25	0	1.85	1.72	0	1.00	5.86	
	T. 21 S., R. 5 E.														
4	SE¼SE¼NW¼ Sec.18	0	0	.21	0	0	.07	1.38	1.16	2.25	1.70	0	1.07	7.84	
	T. 21 S., R. 4 E.														
3	NE¼NE¼SE¼ Sec.22	0	0	.21	0	0	.05	1.60	.73	4.30	1.05	0	1.04	8.98	
2	NE¼NE¼SW¼ Sec. 9	0	0	1.33	0	0	.06	1.75	1.07	3.89	1.38	0	1.09	10.57	
	T. 22 S., R. 4 E.														
1	SE¼NW¼NW¼ Sec.23	0	0	.26	0	0	.07	1.48	.92	3.83	1.45	0	1.00	8.68	

Surface-water runoff

Measurements of runoff made at the two gaging stations in the Post Headquarters area are given below:

Location	USGS Station no.	Discharge events, 1969 (Date)	(cfs-days)
One mile north of main gate on WSMR Primary Route No. 1	8-4862.5	7-9	2.80
		8-31	63.60
	Total discharge cfs-days . .		66.40
	Total acre-feet		132.00
One and a half miles south of main gate on WSMR Primary Route No. 1	8-4862.6	6-3	3.00
		7-9	1.20
		8-25	.19
		8-30	.25
		8-31	43.60
	Total discharge cfs-days . .		48.24
	Total acre-feet		96.00

Miscellaneous observations

Test drilling

Drilling was started late in 1968 on five test wells south of the Post Headquarters area and one test well at Rhodes Canyon Range Camp about 50 miles north of the Headquarters area. One test well, T-15, was completed in December 1968. A summary record of this well is contained in the 1968 Water Resources Review. Summary records of test wells T-16, T-17, T-18 (fig. 7) and RC-3 (fig. 8) follow.

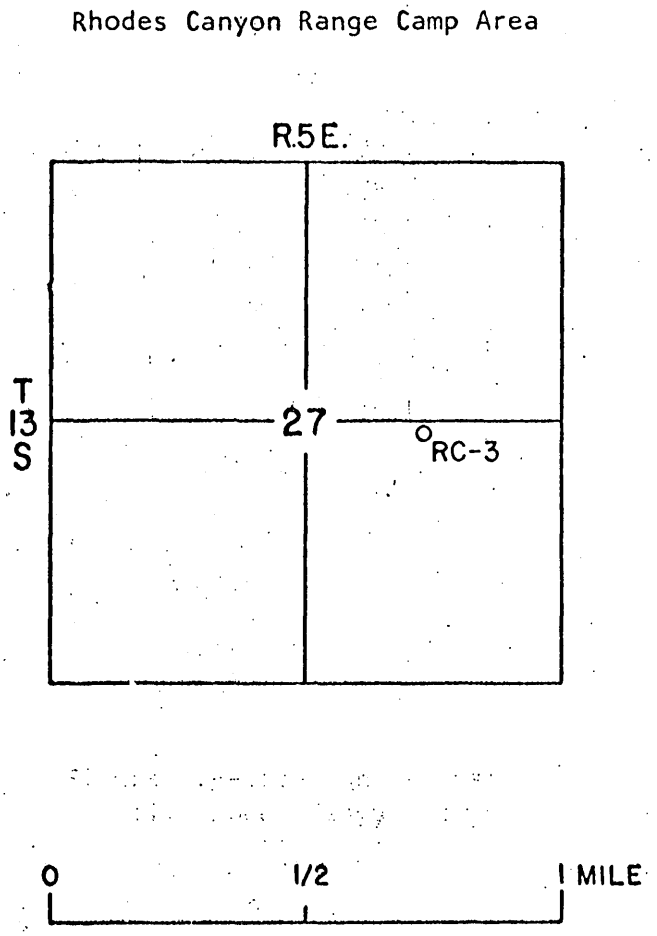

Figure 8.--Location of test well, Rhodes Canyon Range Camp area.

Test well T-16

Location: SW¼NW¼SE¼ sec. 10, T. 23 S., R. 5 E.

Altitude: 3,980 feet

The well was drilled to a depth of 2,007 feet and electric logs were made in the hole. Two water samples were collected with an open-hole packer set at 628 and 1,360 feet. Results of chemical analyses of water samples and interpretation of the electric logs indicated that water in the aquifer was potable above a depth of about 800 feet. A concrete plug was then set in the hole from 710-30 feet and the well cased with an 8-inch casing and gravel packed. The well was test pumped for 8 hours at a rate of 175 gpm (gallons per minute) with a drawdown of 16.2 feet. A water sample was collected during the pumping test. The static water level was 190 feet below land surface on June 24, 1969. The chemical quality of water sampled is summarized below:

(Chemical constituents are in milligrams per liter)

	Packer set at 1,360 feet	Packer set at 628 feet	Collected during pumping test
Date collected ---	3-11-69	3-12-69	3-28-69
Sulfate ----------	3,360	59	48
Chloride ---------	13,200	20	16
Dissolved solids -	26,000	239	240

The test well was retained as an observation well.

Test well T-17

Location: NE¼SE¼NW¼ sec. 27, T. 23 S., R. 5 E.

Altitude: 4,020 feet

The well was drilled to a depth of 2,500 feet and electric logs were made in the hole. Two water samples were collected with an open-hole packer set at 1,023 feet and at 1,709 feet. Results of chemical analyses of water samples and interpretation of the electric logs indicated that water in the aquifer was potable above a depth of about 1,250 feet. A concrete plug was then set in the hole from 564-84 feet and the well cased with 8-inch casing and gravel packed. The well was test pumped for 8 hours at an average rate of 115 gpm with a drawdown of 20.2 feet. A water sample was collected during the pumping test. The static water level was at 240.0 feet below land surface on June 24, 1969. The chemical quality of water sampled is summarized below:

(Chemical constituents are in milligrams per liter)

	Packer set at 1,709 feet	Packer set at 1,023 feet	Collected during pumping test
Date collected ---	4-25-69	4-26-69	5-10-69
Sulfate ----------	720	66	42
Chloride ---------	3,540	26	11
Dissolved solids -	6,840	290	207

The test well was retained as an observation well.

Test well T-18

Location: NW¼NE¼SW¼ sec. 5, T. 23 S., R. 5 E.

Altitude: 4,065 feet

The well was drilled to a depth of 894 feet and electric logs were made in the hole. Monzonite bedrock was penetrated from 780 to 894 feet. One water sample was collected with an open-hole packer set at 505 feet. Results of chemical analyses of water samples and interpretation of the electric logs indicated that water in the aquifer was to, and probably within, the bedrock. A concrete plug was then set in the hole from 704-24 feet and the well cased with 8-inch casing and gravel packed. The well was test pumped for 8 hours at an average rate of 51.5 gpm with a drawdown of 56.2 feet. A water sample was collected during the pumping test. The static water level was at 257.20 feet below land surface on July 24, 1969. The chemical quality of water sampled is summarized below:

(Chemical constituents are in milligrams per liter)

	Packer set at 505 feet	Collected during pumping test
Date collected	5-24-69	5-29-69
Sulfate	128	119
Chloride	36	43
Dissolved solids	444	409

The test well was retained as an observation well.

Test well RC-3

Location: NW¼NE¼SE¼ sec. 27, T. 13 S., R. 5 E.

Altitude: 4,014 feet

The well was drilled to a depth of 750 feet and electric logs were made in the hole. Three water samples were collected with an open-hole packer set at 490, 390, and 257 feet. Results of chemical analyses of water samples and interpretation of the electric logs indicated that water in the aquifer was entirely saline. Thus the well was plugged and abandoned. The chemical quality of water sampled is summarized below:

(Chemical constituents are in milligrams per liter)

	Packer set at 490 feet	Packer set at 390 feet	Packer set at 257 feet
Date collected ---	6-11-69	6-12-69	6-12-69
Sulfate ----------	6,120	5,940	5,280
Chloride ---------	84,500	103,000	11,950
Dissolved solids	147,000	177,000	27,100

Supply-well drilling

A supply well to supplement water from the existing well was drilled at Stallion Range Center in 1969. Water from the two wells (fig. 9) is nonpotable and will be used as feed water for a desalting unit which will supply the Center with potable water. A summary record of the well is listed below.

Supply well SRC-2

Location: SE¼SW¼NE¼ sec. 5, T. 6 S., R. 3 E.

Altitude: 4,953 feet

The well was drilled to a depth of 800 feet and cased to 720 feet with 12-inch steel casing and packed with gravel. The well was test pumped for 12 hours at a rate of 141 gpm with a drawdown of 175 feet. One water sample was collected with an open-hole packer set at 636 feet. A second sample was collected during the pumping test on the well. The chemical quality of water samples collected is summarized below.

(Chemical constituents are in milligrams per liter)

	Packer set at 636 feet	Collected during pumping test
Date collected	7-3-69	7-21-69
Sulfate	2,360	2,130
Chloride	58	46
Dissolved solids	3,460	3,100

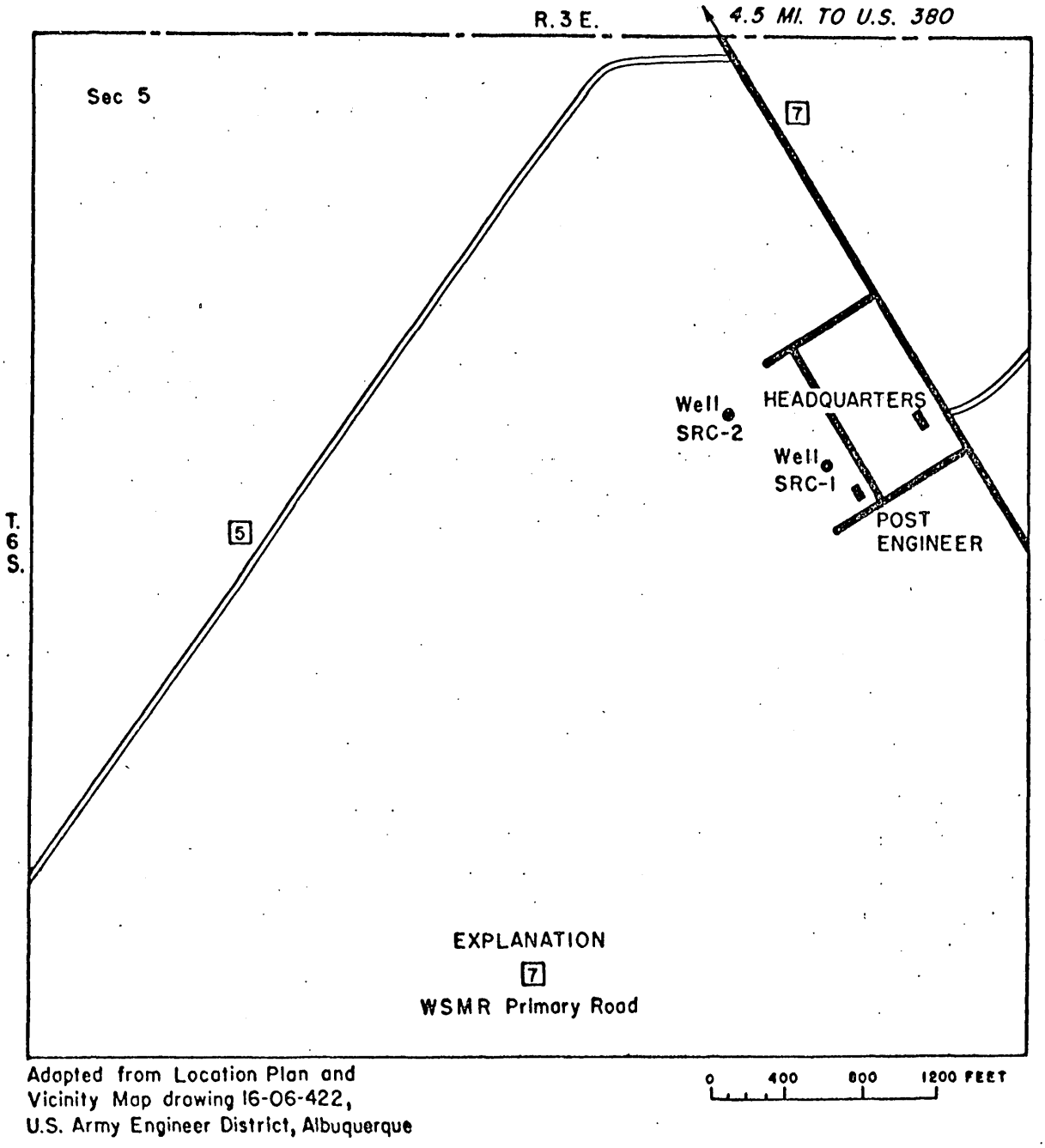

Figure 9.--Location of supply wells, Stallion Range Center.

References cited

Lyford, F. P., 1970a, Test wells T-15, T-16, T-17, T-18, and RC-3, White Sands Missile Range, Dona Ana and Socorro Counties, New Mexico: U.S. Geol. Survey open-file rept., 46 p., 14 figs.

_____ 1970b, Water supply well SRC-2, Stallion Range Center, White Sands Missile Range, Socorro County, New Mexico: U.S. Geol. Survey open-file rept., 26 p., 8 figs.