UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Ground Water Branch

GROUND-WATER INVENTORY FOR 1958

EDWARDS AIR FORCE BASE, CALIFORNIA

By

L. C. Dutcher

Prepared at the request of the
Department of the Air Force

Not reviewed for conformance with
stratigraphic nomenclature and editorial
standards of the Geological Survey

60-40

Long Beach, California
1959

CONTENTS

No illustrations.

See 1959 report.

9/3/68

ILLUS

1. All illustrations are at end of report. Page number given is first principal reference to plate in text.

TABLES

GROUND-WATER INVENTORY FOR 1958, EDWARDS AIR FORCE BASE, CALIFORNIA

By L. C. Dutcher

SUMMARY

This report presents the hydrologic findings at Edwards Air Force Base for 1958. The findings are summarized, as follows:

1. Status of existing supply wells.--The supply wells presently used are as follows:

Main Base wells 9/9-6A1 (MB-5), 6L1 (MB-1), 18C1 (MB-7), 9/10-24C1 (MB-9), 24E1 (MB-11), 24F1 (MB-6A), 24G1 (MB-8)

Telemeter Station well 9/10-8P1 (TS-10)

North Base wells 10/9-7A1 (NB-1) and 7A2 (NB-2)

East Camp wells 9/8-6H1 (EC-2) and 6H2 (EC-1)

South Tract well 8/10-2W1 (ST-A)

Base recreational wells 9/10-16F1 (Graham Ranch) and 9/10-34P3, 34Q1 and 34Q2 (Red Barn)

In addition, wells 10/9-4D2 (NB-4) and 11/9-32Q1 (NB-3) have been drilled and tested; these wells presumably will be used for Base supply in the near future. (See pl. 1 for well locations and table 1 for cross index of well numbers.)

Eleven wells that formerly were used on lands purchased in 1953-54 were destroyed, mostly by acts of vandalism, or became dry during 1958.

2. New wells.--North Base supply well 10/9-4D2 (NB-4) was drilled in 1958 to a depth of 500 feet. Well 9/10-34P3 was drilled at the Red Barn recreational area to a depth of 350 feet.

3. Ground-water pumpage.--The total pumpage for all purposes during 1958 was about 4,160 acre-feet. The pumpage for Base supply alone was about 3,360 acre-feet, ranging from a low of about 37,400,000 gallons (115 acre-feet) in February to about 139,900,000 gallons (430 acre-feet) in September. Pumpage records for irrigation and other use outside the Base are not available for 1958. Snyder (1955) estimated the net off-Base draft in 1951 to be about 168,000 acre-feet, and presumably it has increased since that time. Off-Base pumpage in North Muroc basin in 1958 is not known; although relatively small, it is increasing rapidly.

4. Water-level fluctuations.--Except for a small decline in the northern part, water levels in most of North Muroc basin were virtually unchanged since 1952. In the East Camp area, water levels in observation wells continued to decline at an average rate of about 1.8 feet per year. In the Main Base area water levels continued to decline at an average rate of about 1.9 feet per year. Seasonal fluctuations of water levels in wells decreased in the southern part of the area compared to those recorded in prior years, but increased near the Main Base well field where an elongate pumping depression has developed in and around the well field. Near Rosamond and Buckhorn Lakes water levels continued to decline at an average annual rate of about 2 feet. In the farmed area of Lancaster basin, outside the Base boundary, the water-level decline continued at an average rate between about 4 and 7 feet per year--the amount depending on the proximity of the well to the area of large-scale pumping.

5. Ground water in storage.--In the East Camp, Main Base, and Rosamond storage units the estimated depletion of ground water in storage from March 1952 to March 1958 was about 46,000 acre-feet--an average rate of about 7,700 acre-feet per year. In the North Muroc storage unit the estimated depletion of ground water in storage was crudely 2,000 acre-feet since 1952. Thus, of the estimated total ground water in storage (1,500,000 acre-feet in the upper 200 feet of saturated deposits) the estimated total depletion of about 48,000 acre-feet is only about 3 percent of the available supply in that depth range.

6. Quality of water.--Chemical analyses of water collected periodically from Base wells do not indicate a deterioration of chemical quality in the Main Base, East Camp, or South Tract wells. However, they do show a progressive increase in the chloride content, beginning in 1956, at North Base well 10/9-7A2 (NB-2) where the chloride content reached 350 ppm (parts per million) in April 1958 and at well 10/9-7A1 (NB-1) where the chloride content reached 246 ppm in January 1958. On the other hand, the water quality in the central part of the basin near wells 10/9-4D1 (TW-4) and 11/9-32Q1 (NB-3) is of good chemical quality and, although the wells are presently unused, is suitable for Base supply.

INTRODUCTION

Purpose and Scope of the Continuing Inventory

This report for the 1958 calendar year is the second continuing inventory on ground-water conditions at Edwards Air Force Base, Los Angeles, Kern, and San Bernardino Counties, Calif., prepared by the U. S. Geological Survey at the request of Edwards Air Force Base. These continuing reports extend the collection and analysis of basic data for the period 1950-54, which were presented in the comprehensive report and appendixes on the geology and ground-water appraisal of the Base (Dutcher and Hiltgen, 1954 and 1955; Dutcher and Worts, 1958) and the first continuing-inventory report for 1954-57 (Dutcher, 1958). The overall purpose of the continuing program is to collect the necessary geologic and hydrologic data to keep the Air Force advised as to the current water-supply conditions on the Base.

Specifically, the scope of the program requested by the Air Force is as follows: (1) Continue periodic water-level measurements in key observation wells on the Base, principally to ascertain the status of ground water in storage; (2) continue to assemble periodic analyses of waters from Base wells to determine any changes in quality of ground water, particularly to detect signs of deterioration due to return of sewage effluent, vertical circulation of water of inferior quality from the shallow water bodies, or migration of water of poor quality toward the Base wells from local areas near the margins of the basins; also, to collect periodic water samples from key wells to extend and augment the Base sampling program, as funds permit; (3) continue as

technical adviser on water-supply problems at Edwards Air Force Base; and (4) prepare a report incorporating the findings made during the continuing inventory, including a summary of ground-water pumpage, status of the water supply and estimates of ground water in storage, presentation of a water-level contour map and hydrographs, tabulation of water-level measurements, chemical analyses, and other basic data collected.

The work has been carried on by the Geological Survey, U. S. Department of the Interior, under the immediate supervision of Fred Kunkel, Geologist in Charge, Long Beach subdistrict office, and under the general supervision of H. D. Wilson, Jr., District Engineer in charge of ground-water investigations in California.

Well-Numbering System

Prior to the work done by the Geological Survey in the Edwards Air Force Base area two principal well-numbering systems were in use. One was a "location" number used by the Los Angeles County Flood Control District based on an arbitrary grid network. The other system was used by the California Department of Water Resources and was based on the location of the well in reference to the rectangular system for the subdivision of public land. For example, in their number 7N 12W 34A, the first number and letter indicate the township (T. 7 N.), the second number and letter indicate the range (R. 12 W.), the third number indicates the section (sec. 34). Within each section the wells are numbered alphabetically as indicated by the final digit.

The well-numbering system used by the Geological Survey in the Edwards Air Force Base area investigation conforms to that used in all recent ground-water investigations made by the Geological Survey in California. It has also been adopted as official by the State Department of Water Resources and by the California Water Pollution Control Board.

The wells are assigned numbers according to their locations in the rectangular system for the subdivision of public land. For example, in the number 8/11-35J2, the part of the number preceding the bar indicates the township (T. 8 N.), the part between the bar and the hyphen is the range (R. 11 W.), the number between the hyphen and the letter is the section (sec. 35), and the letter indicates the 40-acre subdivision of the section as shown in the accompanying diagram.

D	C	B	A
E	F	G	H
M	L	K	J
N	P	Q	R

Within each 40-acre tract the wells are numbered serially as indicated by the final digit. Thus, well 8/11-35J2 is the second well to be listed in the $NE\frac{1}{4}SE\frac{1}{4}$ sec. 35. Because all of the wells in the Edwards Air Force Base and vicinity are in the northwest quadrant of the San Bernardino base and meridian lines, the foregoing abbreviations of the township and range are sufficient.

The well-numbering system is also used in modified form as a convenient means of locating a feature described in the text. For example, and area or feature within the $NW\frac{1}{4}SW\frac{1}{4}$ sec. 7, T. 9 N., R. 10W., may be identified as 9/10-7M.

Table 1 is a cross index of Base and Geological Survey well numbers.

Table 1.--Cross index of Base and Geological Survey well numbers

Base number	Abbreviated Base number[1]	USGS number	Basin and ground-water storage unit
			Lancaster basin
Main Base well 1	MB-1	9/9-6L1	Main Base (adjacent)
3	MB-3	9/9-6E1	Main Base (adjacent)
5	MB-5	9/9-6A1	Main Base (adjacent)
6	MB-6	9/10-12R1	Main Base (adjacent)
6A	MB-6A	9/10-24F1	Main Base
7	MB-7	9/9-18C1	Main Base
8	MB-8	9/10-24G1	Main Base
9	MB-9	9/10-24C1	Main Base
11	MB-11	9/10-24E1	Main Base
Telemeter Station well 10	TS-10	9/10-8F1	---
South Tract well A	ST-A	8/10-2F1	Main Base
East Camp well 1	EC-1	9/8-6H2	East Camp
2	EC-2	9/8-6H1	East Camp
			North Muroc basin
North Base well 1	NB-1	10/9-7A1	North Muroc
2	NB-2	10/9-7A2	North Muroc
3	NB-3	11/9-32Q1	North Muroc
4	NB-4	10/9-4D2	North Muroc
Test well 4	TW-4	10/9-4D1	North Muroc

1. Symbol shown in parentheses on plates and in text.

Summary of Geologic and Hydrologic Features of the Base and Vicinity

The detailed geologic and hydrologic features of the principal ground-water basins and areas of Edwards Air Force Base and vicinity were presented in a separate report (Dutcher and Worts, 1958), and less comprehensive data were released in two interim reports (Worts, 1952; and Worts, Hiltgen, Chase, and Brown, 1953). The pertinent features of the ground-water basins and areas are summarized below in order of their size, and the basins are shown on plate 1 (in pocket).

Geology

Edwards Air Force Base is in the northeastern part of Antelope Valley, a large topographic and structural depression, the sides of which, except locally, are formed by mountains and hills composed of consolidated crystalline rocks; the valley floor is underlain by unconsolidated alluvial and lacustrine deposits (pl. 1). Except for a very minor amount of recharge, the supply of water available to Edwards Air Force Base is derived from ground water stored in the unconsolidated deposits of the valley.

The unconsolidated deposits comprise alluvial, playa, shoreline, and lacustrine deposits of Pleistocene and Recent age, and windblown sand of Recent age (Dutcher and Worts, 1958). The younger and older alluvial deposits are the important aquifers, being the source of water for all Base supply wells, the irrigation wells outside the Base boundary, and for nearly all other wells in the area. The playa, shoreline, and windblown sand deposits are largely above the water table and yield virtually no water to wells.

Ground-Water Basins

Ground water in the alluvial deposits beneath Edwards Air Force Base is contained principally in Lancaster and North Muroc basins, which are separated by Rogers Lake barrier (pl. 1). Minor supplies occur in the Gloster area at the northwest edge of the Base. Lancaster basin is the largest basin in the area and extends from the bordering mountains and hills on the east, south, and west to the Rosamond Hills and North Muroc basin on the north. The supply wells in the Main Base, East Camp, and South Tract areas pump ground water from Lancaster basin, as do several hundred irrigation wells south of the Base boundary.

To appraise the water supply available to the Air Force, much of that part of Lancaster basin within Edwards Air Force Base has been divided into three ground-water storage units which, from east to west, are called the East Camp, Main Base, and Rosamond storage units (Dutcher and Worts, 1958). Together these storage units comprise an area of about 69,000 acres. Beneath most of the Main Base and Rosamond storage units the saturated deposits are fine grained in the upper 100 feet and cause the water in the coarser grained deposits beneath to be confined or semiconfined and largely separate from the shallow water in the upper part. The ground water in storage within a depth zone extending downward 200 feet from the 1952 spring-high water level and available for use by the Air Force and others was more than a million acre-feet.

However, this large amount of ground water in storage is not a direct measure of the amount available for use by the Base, because a substantial part is moving and will continue to move southward to the area of large-scale pumping for irrigation outside the Base boundary. Snyder (1955) estimated that through 1951 the cumulative overdraft (amount that discharge has exceeded recharge) of ground water in Antelope Valley, mainly in Lancaster basin, was about 1,800,000 acre-feet. Thus, the gradually diminishing supply of ground water in storage in Lancaster basin is critical to the Air Force and is discussed in greater detail in the section on ground water in storage.

North Muroc basin is immediately north of the northeastern part of Lancaster basin. They are separated by Rogers Lake barrier, a ridge of consolidated bedrock of imperfectly known extent and depth nearly completely buried by alluvial and playa deposits beneath Rogers Lake (pl. 1). The North Base wells pump water from North Muroc basin, as do many small domestic wells and a few large-capacity wells outside the Base boundary which are used for public and industrial supply. The Base boundary crosses North Muroc basin nearly along U. S. Highway 466.

The North Muroc storage unit occupies about 25,000 acres beneath the central part of North Muroc basin (pl. 1). Beneath most of the storage unit the water-bearing deposits are relatively thin, and the ground water in storage within a depth zone extending downward 150 feet below the 1952 spring-high water level and available for use by the Air Force and others was estimated to be about 450,000 acre-feet, of which about 70 percent, or about 300,000 acre-feet, was within the Base (Dutcher and Worts, 1958).

SUMMARY OF TECHNICAL ASSISTANCE TO THE BASE

As a part of the comprehensive study and the inventory program for 1958, the Geological Survey furnished technical advice on water-supply problems at the Base, as follows:

1. Supplied data on water wells to Mr. J. F. McPherson, U. S. Attorney, for use during court trials concerning the payment for private lands acquired by the Air Force.

2. At informal conferences at the Base during April 1958 the Geological Survey suggested that Main Base well 7 be equipped with a pump of larger capacity to increase the yield to more than the 370 gpm (gallons per minute) then being obtained. The installation of a larger capacity pump and motor at the well later resulted in a yield of about 900 gpm with moderate drawdown.

3. At a conference on May 15, 1958, at the request of Major Wilson, Air Installations, ground water and geology in the vicinity of Haystack Butte (not shown on pl. 1) east of Rogers Lake were discussed. The Air Force advised that a new facility proposed for the area would require a water supply of approximately 300 gpm. Because the area near the Butte is underlain by bedrock at the surface or at shallow depth, it was concluded that it appeared unlikely that a well could be drilled near the Butte to supply water at the rate of 300 gpm. It was suggested that well 9/8-18F1, nearly 8 miles west of Haystack Butte, should be test-pumped to determine whether sufficient water could be obtained for the new facility. Also, it was suggested that exploratory test wells might be drilled northeast of the Butte to determine the availability of ground water.

4. At a conference on May 20, 1958, at the offices of the U. S. Army, Corps of Engineers, in Los Angeles, the author gave technical advice concerning the location and drilling of North Base well 4 and assisted in preparing technical specifications for development and test-pumping of North Base wells 3 and 4. The data for these very productive wells are presented in tables 2, 4, and 8. (See also pl. 2.)

5. Letter of November 20, 1958, from the Geological Survey to the Commanding Officer, Edwards Air Force Base, concerning the locations of sites for the disposal of toxic products at the proposed new facility near Haystack Butte. At a subsequent conference at the Long Beach Geological Survey office, Lt. R. J. Oglukian, Project Officer, was informed that two feasible means of disposing of water containing toxic waste might be used in the area northeast of the Butte. These possibilities include: (1) Disposal into deep wells drilled into the older continental rocks of Tertiary age which underlie the area about 3 miles east of the Butte; and (2) disposal in open-air sumps or shallow ponds dug into the surficial alluvial and windblown deposits near the Butte. The latter method probably would be the cheaper and more satisfactory means of disposal.

Because of the probability of contaminating ground water in the East Camp area or North Muroc basin it was suggested that disposal of toxic waste products not be undertaken in the drainage area tributary to Rogers Lake.

6. Letter of January 5, 1959, from Col. P. C. McBride, Deputy Chief of Staff/Installations, to the Geological Survey requesting technical advice concerning the drilling of proposed shallow wells near the high-speed test track at South Tract. The proposed recharge wells were to be used for the purpose of conserving water used during the testing operations and to drain water to the deeper water-bearing zones from the local semiperched water bodies that underlie the area at shallow depth.

A conference was held to discuss the matter and the author discussed some of the difficulties that usually are encountered when wells are used to recharge ground water. The common difficulties are sanding, plugging with algae, corrosion, and entrapment of air. All the above occurrences result in a declining capacity of the recharge wells to accept water. The strong possibility that water of poor quality is contained in the shallow zone was also discussed.

It was concluded at the conference that drainage of the shallow water bodies is not feasible or warranted unless the semiperched water bodies that underlie the area hamper the construction of facilities at the site. Construction difficulties resulting from the semiperched water reportedly have not been encountered.

Although the proposal to recharge the water used during the tests is commendable, it was concluded that the construction of wells to recharge the very small amount of water used at the site might not be economical in view of the cost of wells and water treatment facilities.

It was also concluded that shallow surface ponds might be constructed to collect the water used during the tests. These could be placed in natural depressions near the margin of Rogers Lake. Thus, some water might percolate from the sandy ponds and return to ground water.

YIELD AND PHYSICAL CONDITION OF THE BASE SUPPLY WELLS

The first indication of most of the mechanical difficulties that may affect high-capacity wells is a reduction in the yield, or specific capacity[1/] of the well. Such a reduction in yield reflects an increase in the head loss that occurs as water enters the well, and may be caused by accumulation in the well of sand that has passed through the perforations; by encrustations of the perforations and cementation of the adjacent formation by deposits of carbonates, sulfates, silica, and iron oxide; by growth of micro-organisms in the formation around the well; or by failure of the casing. Most of these detrimental processes are further aggravated by the increase in head loss that they produce, and therefore tend to be self-intensifying. For this reason, a moderate initial decline in well yield may be followed by accelerating deterioration and ultimate failure of the well. Thus, in order to maintain a check on the condition of the Base supply wells, periodic measurements of drawdown and pumping rate are required.

1. The specific capacity of a well is the discharge of the well, in gallons per minute, divided by the drawdown of the water level in the well from the nonpumping level, in feet.

Data for the Base supply wells are shown on plate 2 together with a diagrammatic electric-log section for part of the area near the Main Base well field. In general, all the Base supply wells now appear to be in excellent condition, except for well 9/10-24C1 (MB-9) discussed below. Well 9/10-24F1 (MB-6A) is in good condition, but its yield could be increased by installing a larger pump and motor.

The well data indicate that the best producing well at the Base is 9/8-6H1 (EC-2) which has a specific capacity of about 134 gpm (gallons per minute) per foot of drawdown. In general, specific capacities of most of the remaining wells range from about 9 to 50 gpm per foot of drawdown, but Main Base well 9 (9/10-24C1) has a specific capacity of only 3.4. On the basis of an examination of the electric log for well 9/10-24C1 (pl. 2) and the available information on the interval perforated in the well, it is probable that the well casing has not been properly perforated in that section which penetrates the upper part of the older alluvium.

Data collected during the drilling and test-pumping at wells 9/10-24E1 (MB-11), 10/9-4D1 (TW-4), 4D2 (NB-4), and 11/9-32Q1 (NB-3) indicate that most of the water from these wells is pumped from the upper sand and gravel beds in the older alluvium. During 1957, prior to the drilling and test-pumping of the wells listed above, well 9/10-24C1 (MB-9) was reperforated throughout the interval from 300 to 700 feet. The yield was increased only a small amount--from about 150 gpm with a large drawdown to about 470 gpm with a large drawdown. In view of the data collected at wells 9/10-24E1 (MB-11), 10/9-4D1 (TW-4), 4D2 (NB-4), and 11/9-32Q1 (NB-3), since the reperforation at well 9/10-24C1 (MB-9), and based on an examination of the electric log for well 24C1, it still appears possible that well 9/10-24C1 (MB-9) might produce considerably more water if it had been properly perforated and developed at the time of construction. Before use of the well is discontinued and a replacement well drilled, as has been discussed, it appears desirable to have photographs taken of the entire well casing below the water table. If the photographs indicate a lack of proper perforations through the interval from about 190 to 300 feet below land surface, it is suggested that further efforts be made during the winter months to rehabilitate the well.

WATER WELLS INVENTORIED DURING 1958

One new supply well, 10/9-4D2 (NB-4), was drilled and test-pumped in North Muroc basin during 1958. New pumping equipment was installed at well 9/9-18C1 (MB-7) during the latter part of the year to increase the yield from about 370 gpm to about 900 gpm. In addition, one new well, 9/10-34P3, was drilled, equipped, and placed in use at the Red Barn recreational area (pl. 1). Old wells 9/10-34Q1 and 34Q2 were also equipped with pumps and placed in use in that area.

Data on the above wells and additional data for old wells are given in table 2. Data on wells previously canvassed are contained in appendixes A and B (Dutcher and Hiltgen, 1954 and 1955). Data for Base supply wells are shown on plate 2.

Table 2.--Data on new or changed wells on Edwards Air Force Base, 1958

Type of well: D drilled; G rotary drilled and gravel packed.

Type of pump and power: L lift; N none; T turbine; number given is horsepower of electric motor.

Use of well: Bs Base supply; Dc duck club; Un unused.

Measuring point: Epb edge of pump base; Hpb hole in pump base; Nc notch in casing; Tap top of access pipe; Tc top of casing; Tp top of pit.

Other data available: C chemical analysis given in table 8, L log of well given in table 4; W water-level measurements given in table 6.

USGS number	Date of observation	Status of well	Well data: Year completed	Depth (ft.)	Type, diameter (in.)	Pump type and power	Yield (gpm)	Specific capacity	Use	Measuring point		Altitude of lsd (feet)	Water level: Depth below lsd (feet)	Other data available
											(feet)			
8/11-1Q1	5-1-58	Unused		49.5	D 8	N N			Un	Tc	1.3	2,300	38.19	
12H1	5-1-58	Unused		95.3	D 14	N N			Un	Tc	-.1	2,308	47.32	
12R2	5-2-58	Unused	1948	84.8	D 10	N N			Un	Tap	.75	2,312	53.49	
15E2	5-2-58	Unused	1950	189.6	D 10	N N			Un	Tap	.4	2,298	28.23	
15Q1	5-2-58	Unused	1952	179.2	D 12	N N			Un	Nc	1.0	2,307	87.20	W
18L1	5-2-58	Unused		195.3	D 7	N N			Un	Tc	0	2,297	3.56	C,W

18Q1	5-2-58	Unused		268.2	D	7	N	N			Un	Tc	0	2,298	53.40	W
8/12-14R1	5-2-58	Unused	1949	187.7	D	12	N	N			Un	Tap	1.0	2,291	26.15	W
22B1	5-2-58	Unused		29.1	D	6	N	N			Un	Tc	0	2,295	15.12	
23J1	5-2-58	Unused	1948	58.8	D	8	N	N			Un	Tc	0	2,299	14.99	
9/8-18F1	5-15-58	Unused		419.4	D	12	N	N			Un	Tc	0	2,397.2	136.38	W
9/9-1B1	5-15-58	Unused		26.0		6	N	N			Un	Tc	.6	2,277.0	20.12	W
10R1	5-15-58	Unused	1937	106.0	D	9	N	N			Un	Tc	.5	2,280	27.83	W
9/9-12F1	5-15-58	Unused			D	8	L	N			Un	Tc	.5	2,289.3	30.11	W
12Q1	5-15-58	Unused		93.2	D	8	N	N			Un	Tc	0	2,346.0	87.98	W
14H1[1/]	5-15-58	Unused			D		T	N			Un	Epb	1.0	2,330.0	72.76	W
18C1	11-?-58	Main Base 7	1944	360	G	14	T	100	900	51	Bs	Hpb	1.0	2,280.3		C
26P1	5-15-58	Unused			D	14	T	N			Un	Tc	1.0	2,353.3	94.80	W
9/10-32H1	5-1-58	Unused		54.1	D	8					Un	Tp	0	2,290	41.53	
34L1	6-9-59	Unused	1922	440		8	N	N			Un	Tap	.23	2,290	52.07	
34P3	6-9-59	New well	1957	350	G	8	T	20	210		Dc	Nc	.5	2,295	(c)	L
34Q1	6-9-59	Pump installed	1946	210	G	12	T	10			Dc	Tc	2.0	2,295	a50.48	
34Q2	6-9-59	Pump installed	1946	270	G	12	T	10			Dc	Epb	1.0	2,295	(c)	

Footnotes at end of table.

USGS number	Date of observation	Status of well	Well data						Measuring point (feet)		Altitude of lsd (feet)	Water level: Depth below lsd (feet)	Other data available
			Year completed	Depth (ft.)	Type, diameter (in.)	Pump type and power	Yield (gpm)	Sp. cap.	Use					
9/11-36J1	5-1-58	Unused		109.9	D 10				Un	Tap	1.26	2,288	28.30	
36N1	5-1-58	Unused			D 10				Un	Tc	1.8	2,295	44.32	
36N2	5-1-58	Unused		113.1	D 12				Un	Tap	2.62	2,297	29.56	
10/9-4D2	5-15-59	Unused	1958	500	G 14	N N	1,500		Un	Tap	1.0	2,307.5	98.13	C,L
11/9-32Q1	10-16-57	Unused	1957	450	G 14	N N	1,500		Un	Tap	.7	2,302.5	93.95	C

1. Formerly number 9/9-14-1.
a. Pumping nearby.
c. Pumping.

Fieldwork at the Base during 1958 resulted in the discovery that 11 wells, formerly used or at which water-level measurements could be obtained, became dry or were destroyed. These are listed in table 3. (For locations, see appendix A, Dutcher and Hiltgen, 1955, pl. 1A.)

Logs for the two new wells drilled on the Base during 1958 are given in table 4.

Table 3.--Eleven wells on the Base which are known to have been destroyed or became dry during 1958

USGS number	USGS number
8/9-4G1	8/10-2M1
4N2	9M1
4N5	8/11-15E3
4P1	8/12-22R2
4P2	9/10-34P1
6R1	

Table 4.--Logs of wells drilled on the Base, 1958

9/10-34P3. Drilled for the Edwards Air Force Base Rod and Gun Club by Evans Bros. Drilling Co. Rotary well, 8-inch casing. Altitude of land-surface datum about 2,295 ft. Materials classified by G. E. Kremser, Air Installations.

Material	Thickness (feet)	Depth (feet)
Clay, tough, sandy, blue	132	132
Clay and streaks of sand	3	135
Clay and sand and clay	10	145
Sand and some clay	40	185
Sand, fine to coarse	35	220
Sand, fine to coarse; streaks of clay	20	240
Sand, fine to coarse	40	280
Sand, fine to coarse	20	300
Sand, fine to coarse and a little clay	50	350

10/9-4D2 (NB-4). Drilled by Evans Bros. Drilling Co. in August 1958. Rotary gravel-pack well. Altitude of land-surface datum 2,306.9 ft. Materials classified by Corps of Engineers, U. S. Army.

Sand, light-brown, fine- to coarse-grained	40	40
Clay, streaks of fine sand	13	53
Sand, fine- to coarse-grained	122	175
Sand, fine- to coarse-grained, slightly cemented	10	185
Sand, fine- to coarse-grained	25	210
Sand, fine- to coarse-grained, occasional streaks of clay	5	215
Sand, fine- to coarse-grained	19	234
Sand and clay, slightly gravelly at 255 ft	61	295
Sand and occasional streaks of clay	30	325
Sand, clayey	60	385
Clay, sandy	10	395
Sand and streaks of clay, well-cemented at 426 ft, 452 ft, and at 470 ft	95	490
Sand, cemented	10	500

Casing record: Cased zero to 500 ft; 14-inch.
Perforated: 150-500 ft, horizontal-louver type.
Water sample: Sample collected during test-pumping (see table 8).
Yield: Final test, August 11, 1958, pumped 1,500 gpm (gallons per minute), drawdown was 71 ft; pumped 1,250 gpm, drawdown was 56 ft; pumped 500 gpm, drawdown was 16.5 ft. Specific capacity thus ranged from about 30 to about 21 gpm per foot of drawdown.

PUMPAGE OF GROUND WATER

Pumpage for Base Use

Ground-water pumpage for Base use during 1958 is shown in table 5. Available records of Base pumpage for the period July 1947 through August 1956 are shown in the comprehensive report (Dutcher and Worts, 1958, table 6), and those for August 1956 through December 1957 are shown in the continuing report for 1954-57 (Dutcher, 1958, table 5). The pumpage from Main Base wells 9/9-6A1, 6L1, 18C1, 9/10-24C1, 24E1, 24F1, and 24G1 (MB-5, 1, 7, 9, 11, 6A, and 8, respectively) was metered at the individual wells; the pumpage from North Base wells 10/9-7A1 and 7A2 (NB-1 and 2) was estimated; the pumpage from East Camp wells 9/8-6H1 and 6H2 (EC-2 and 1) was metered; pumpage from South Tract well 8/9-2F1 (ST-A) was estimated for part of the period, as was that from Telemeter Station well 9/10-8P1 (TS-10). Pumpage from wells at the recreational areas at Graham Ranch and the Red Barn was estimated. The records were supplied by the Air Installations Office.

Table 5.--Base pumpage from wells, 1958

Records supplied by Air Installations Office

Basin and well field	1958	
	1,000 gallons	acre-feet[1]
Lancaster basin		
Main Base wells 6A, 7, 8, 9, 11	a833,000	2,560
Main Base wells 1 and 5	a57,000	175
East Camp wells 1 and 2	206,000	632
Recreation area wells[2]	240,000	750
Subtotal	b1,336,000	4,100
North Muroc basin		
North Base wells 1 and 2	--	c30
Undifferentiated[3]		
Lancaster and North Muroc basins	18,900	28
Total	1,355,000	4,160

1. One acre-foot equals 325,851 gallons.
2. Pumpage is crudely estimated; the water is not used for Base supply and the pumpage is not shown on plate 3.
3. Includes pumpage from North Base wells 1 and 2, Telemeter Station well 10 and South Tract wells.

a. Records of pumpage during August are not available, values include estimated pumpage for the month.
b. Metered and estimated total for the year.
c. Records incomplete; total estimated by the Geological Survey.

Plate 3 shows the distribution of monthly pumpage for the period July 1947 through February 1954 and July 1955 through December 1958. For the period July 1955 through December 1958 the available records of monthly pumpage are shown for the Main Base, North Base, and East Camp well fields, and from other wells. Records of monthly pumpage from individual wells were not kept prior to July 1955, during the period September through November 1956, or during August 1958. Records of total pumpage are not available for the period February 1954 through June 1955. The annual pumpage for the period February 1954 through June 1955 has been estimated, as is all the pumpage except at East Camp for August 1958 (pl. 3).

Table 5 shows that the total pumpage, metered and estimated, in 1958 was nearly 4,160 acre-feet. Of the total, about 3,420 acre-feet was for Base supply and nearly 750 acre-feet was for use at the Graham Ranch and Red Barn recreational areas. The table shows that pumpage from Lancaster basin was greatly increased from that during 1957 (see also Dutcher, 1958, table 5). The increase is partly due to the additional pumpage at the Graham Ranch and Red Barn recreational areas. In 1958 the total pumpage from all areas was nearly 1,380 acre-feet more than in 1957 and nearly 1,730 acre-feet greater than in 1956.

In 1958 monthly pumpage ranged from a minimum of about 37,400,000 gallons (115 acre-feet) in February to a maximum of nearly 139,900,000 gallons (430 acre-feet) in September (pl. 3). The bulk of the peak production in September, about 332 acre-feet or 77 percent, was from Main Base wells 9/9-18C1, 9/10-24C1, 24E1, 24F1, and 24G1 (MB-7, 9, 11, 6A, and 8, respectively).

Pumpage from the Main Base well field in 1958 was about 2,739 acre-feet; from East Camp about 632 acre-feet; from North Base about 30 acre-feet; and from the South Tract, the Telemeter Station, and others was about 28 acre-feet. The Base plans to maintain records of monthly pumpage for all wells. In view of the serious water problems in the farmed part of Lancaster basin south of the Base, it appears desirable to meter all pumpage from the Base wells, including those at the recreational areas at the Graham Ranch and the Red Barn.

Pumpage for Agricultural and Other Use

Estimates of pumpage in Lancaster basin outside Edwards Air Force Base for agricultural or other use are not available for 1958. Based on the measurements of water levels in wells which have declined constantly, however, the net draft of ground water outside the Base may have continued the 1951 rate of about 160,000 to 170,000 acre-feet per year, or at about the same, or somewhat greater, rate than that shown by Snyder (1955).

Records of pumpage in North Muroc basin outside Edwards Air Force Base are not available. Numerous new wells have been drilled recently in the area, however, and pumpage for domestic and industrial use has greatly increased (Dutcher, 1959). Thus, it is likely that groundwater flow from beneath the Base will occur at an increasing rate during the coming years. In the future it may be desirable to estimate the annual subsurface outflow across the Base boundary to determine the longevity of the Air Force supply.

FLUCTUATIONS OF WATER LEVELS IN WELLS

During 1958 periodic measurements of water levels were made in 86 observation wells at Edwards Air Force Base and vicinity. (For the well data, see Dutcher and Hiltgen, 1954 and 1955; Dutcher, 1958, table 2; Dutcher, 1959; and table 2 of this report.) Automatic water-level recorders were operated at five of these wells. The measurements are shown in table 6. These records extend the records contained in the appendixes (Dutcher and Hiltgen, 1954 and 1955). For the data and locations for new wells in North Muroc basin outside the Base boundary see plate 1 and the report by Dutcher (1959) containing data on water wells in that area.

For the principal water-producing areas of Lancaster and North Muroc basins records of selected wells for 1958 have been used to extend the records for prior years in hydrograph form. These are shown on plates 4 through 8 and are discussed in the following pages. Also discussed in this section of the report is the water-level contour map for March 1958 (pl. 1). The nonpumping levels in nearly 100 wells were used for control in constructing the contours shown on the map. The levels in shallow or deep wells that do not tap the principal water-bearing zone were not used for control.

North Muroc Basin

In North Muroc basin periodic water-level measurements were made in 16 observation wells (table 6). One water-level recorder was operated by the Geological Survey in the basin during the year. The hydrographs of selected wells are shown on plate 4.

In general, the graphs indicate a very small decline in water levels for the period 1951-58. The graph for well 11/9-17N1 shows a continuing decline during 1958; the overall record shows a slight decline in progress since 1954. The decline at this well probably is caused by large-scale pumping for irrigation in the Koehn Lake area to the north (Dutcher and Worts, 1958, pl. 6).

The seasonal range in water-level fluctuations also has been very small and, based on records from continuous water-level recorders operated at wells 11/9-13L1 and 36C2 by the U. S. Borax and Chemical Corp., probably is not larger than 1 or 2 feet.

The water-level contours shown on plate 1 represent the 1958 conditions in the basin. The water levels at individual wells are nearly the same as in 1952. However, there are small differences in the positions of the contours shown on plate 1 of this report and those shown on plate 6 of the comprehensive report (Dutcher and Worts, 1958) and on plate 1 of the 1954-57 continuing report (Dutcher, 1958). The differences result mainly from using additional and more precise surveyed altitudes at several wells recently drilled in the basin to determine the altitude of the water level for use in drawing contour maps for 1957 and 1958. However, it will be necessary to obtain surveyed altitudes at nearly all the wells before a detailed water-level contour map for this area of relatively flat hydraulic gradient can be drawn.

The contours and the arrows showing direction of ground-water flow indicate, in general, that in 1958 water was moving north and northwest across the basin from the area on the south and east to the adjoining areas on the north. Locally, water was moving from the adjoining hills and uplands on the north and east into the basin and moving across the basin or east toward the community of Boron where a local shallow pumping depression may be developing. The hydraulic gradient and direction of ground-water movement in 1958 were virtually the same as in 1952 (Dutcher and Worts, 1958, pl. 6).

East Camp Area

In the East Camp storage unit and vicinity (pl. 1) periodic water-level measurements were made in 12 observation wells (tables 2 and 6). The hydrographs of selected wells are shown on plate 5.

In general, the graphs indicate a nearly steady water-level decline beginning with the earliest available records in 1941. For 1958 the weighted areal decline in the East Camp storage unit was about 1.8 feet; the average decline during 1958 was about 1.5 feet. The decline at supply well 9/8-6H1 (EC-2) was about 4 feet, caused mainly by the pumping of about 630 acre-feet of water from this well and supply well 6H2 (EC-1) nearby.

The seasonal range in water-level fluctuations has been minor, ranging from about 2 feet per year at well 9/8-6H1 (EC-2) prior to 1957 to only a few tenths of a foot at well 9/10-36G1. Based on the 1957-58 measurements at well 9/8-6H1, the seasonal fluctuations in the vicinity of the East Camp well field may be increased greatly in the future because of the increased seasonal pumping.

The water-level contours on plate 1 represent the 1958 conditions in the East Camp area. The contours show that water was flowing northwest from the northern part of the East Camp storage unit across Rogers Lake barrier to North Muroc basin. In the southern part of the storage unit, ground-water flow was west and north-northwest toward the small pumping depression centering around the Main Base supply wells in sec. 24, T. 9 N., R. 10 W.

Main Base Area

In the Main Base storage unit and vicinity (pl. 1) periodic water-level measurements were made in 21 observation wells (tables 2 and 6). The hydrographs of selected wells are shown on plate 6.

In general, the graphs indicate that the water levels are highest in the winter or spring, decline during the summer and autumn, and rise again during the winter or spring; they also show that an overall decline has been in progress since 1941 when the first measurements were made at well 8/10-2P1. Record-low levels were reached in November 1958. The average water-level decline in the Main Base area for 1958 was about 2.2 feet; the weighted average areal water-level decline was about 1.9 feet.

The seasonal range in water-level fluctuations has been relatively large, ranging from about 19 feet at well 8/10-4G1 in 1952 to only a few feet at well 8/10-2P1 until 1957 when pumping from nearby well 8/10-2M2 was started for construction of the new high-speed test track. As shown on plate 6 and by the locations of these wells on plate 1, the seasonal fluctuations have decreased during recent years in the southwestern part of the Main Base storage unit (well 8/10-4G1) and increased in the areas near the Main Base well field in sec. 24, T. 9 N., R. 10 W., and near the Red Barn recreational area (well 9/10-34H1) where pumping for fish and duck ponds began in 1957.

The water-level contours for March 1958 show that water was moving north and northwest in the Main Base storage unit toward the elongate pumping depression centering around the Main Base well field and the Graham and Buchler ranches in sec. 16, T. 9 N., R. 10 W. Also, ground water was moving north across Rogers Lake barrier to North Muroc basin. At the southwest margin of the Main Base storage unit, however, the ground-water flow was toward the large pumping depression centered beneath sec. 34, T. 8 N., R. 11 W., outside the Base.

The ground-water divide shown on plate 1 separates the areas beneath which ground water was flowing north toward the Base wells and south toward the farmed area. The approximate position of the ground-water divide, as drawn on the basis of relatively few water-level measurements in wells, is entirely within Edwards Air Force Base, and ground-water flow across the entire south and west boundaries of the Base in Lancaster basin was tributary to the large pumping depression beneath the farmed area. Thus, ground water in storage within the Base continued to be depleted as the result of pumping for irrigation outside the Base boundary. North of the ground-water divide the hydraulic gradient ranged from less than 2 to more than 15 feet per mile but to the south the gradient toward the large pumping depression south of the Base was as much as 30 feet per mile.

Rosamond and Buckhorn Lakes Area

The hydrographs for two wells, 8/10-8N1 and 8/12-22M1 (pl. 7), which tap the deep water-bearing zone depict the differences in head between the deep and principal zones (Dutcher and Worts, 1958). Also, measurements at well 8/12-18L1 which taps a semiperched water body were made to show the differences in head between that zone and the principal water-bearing zone penetrated by well 8/12-18Q1 nearby (table 6). The other graphs on plate 7 are for wells that penetrate the principal water-bearing zone. In 1958 the head of water in the principal zone tapped by well 8/10-8N2 ranged from 26 to 36 feet higher than that in the zone tapped by well 8/10-8N1 nearby. A record-low level was reached in November 1958 in only one of the wells (8/11-14N1). However, the autumn-low levels were higher than in previous years at the other wells, primarily because the wells formerly used for irrigation have not been pumped since 1954. Consequently, in wells that penetrate the principal water-bearing zone on the Base the seasonal fluctuation of water levels has been reduced.

The average water-level decline in observation wells in the Rosamond storage unit for 1958 was about 2.1 feet; the weighted average water-level decline was about 2 feet during the year.

The seasonal range in water-level fluctuations in years prior to 1954 was relatively large, being more than 20 feet at a few wells but averaging about 15 feet. However, beginning in 1954 the seasonal water-level fluctuations in the principal zone have decreased--the decrease in general being greatest at wells farthest from the south Base boundary. The decrease is illustrated by the graph for well 9/11-36L1 where the seasonal fluctuation was about 15 feet in 1951 and 1952 but had diminished to only about 5 feet in 1957. A very marked decrease in seasonal water-level fluctuations also occurred at well 8/10-8N2 in 1957.

The water-level contours for March 1958 show that ground water north of the ground-water divide was flowing toward the pumping depression centering around the old Graham and Buchler ranches in sec. 16, T. 9 N., R. 10 W. (pl. 1). South of the divide the direction of movement beneath the Base was southeast and south toward the large pumping depression centered in sec. 34, T. 8 N., R. 11 W., in the heavily farmed area. At the extreme west edge of the area, however, the direction of flow was west toward a pumping depression, the center of which is not shown on plate 1, in the farmed area southwest of the town of Rosamond. Subsurface flow from the Rosamond Lake storage unit to the farmed area on the south continued during 1958, and ground water in storage in the storage unit continued to be depleted by pumping for irrigation outside the Base. The hydraulic gradient ranged from nearly 20 feet per mile locally in the south part of the area to only about 2 to 3 feet per mile beneath the northern part of Rosamond Lake.

Farmed Area in Lancaster Basin

In the farmed area in Lancaster basin south and west of Edwards Air Force Base periodic water-level measurements were made in 25 observation wells (table 6). These measurements were made primarily for control in drawing the water-level contours in the area underlain by the large pumping depression centering around sec. 34, T. 8 N., R. 11 W. However, measurements were made at four wells which tap the deep water-bearing zone and at two shallow wells which penetrate semi-perched water in the deposits overlying the principal water body. These measurements were not used for drawing the contours (pl. 1). The hydrographs of three selected wells that penetrate the principal water-bearing zone are shown on plate 8.

In general, as in the Main Base and Rosamond Lake areas, the graphs indicate very large seasonal fluctuations of water levels and an overall decline for the period 1951-58. Primarily because the irrigation wells have not been pumped since 1954 in the area presently within Edwards Air Force Base, record-low levels were not reached during 1958 at two of the wells for which graphs are shown on plate 8. However, the water level at well 8/10-28B1 declined to a record-low level in November as shown on plate 8. Also, in many wells farther south record-low levels were reached during the year. The water levels in March 1958 in wells near the Base show that the annual decline continues to be moderate and is nearly the same as for years prior to 1957. This decline continued because the wells are in or near the area of large-scale pumping for irrigation. The water-level decline in wells penetrating the principal water body averaged about 4 feet during 1958.

The seasonal range in water-level fluctuations has varied greatly; the largest seasonal fluctuations occur in wells nearest the areas of greatest pumping, generally those near the center of the large pumping depression. Seasonal fluctuations during prior years have exceeded 75 feet at those wells. Farther from the areas where wells are closely spaced and pumped heavily the seasonal fluctuations are smaller and in isolated wells located several miles from areas of large-scale pumping seasonal fluctuations are very small. In 1958 the seasonal water-level fluctuation at well 8/11-23R2 probably was about 40 feet, at well 8/10-19N4 about 20 feet, but at well 8/10-28B1 only about 5 feet (pl. 8).

The water-level contours for March 1958 show that ground water was flowing south from beneath the Base and from all the surrounding area toward the large pumping depression centered beneath sec. 34, T. 8 N., R. 11 W. The contours also indicate that a pumping depression has developed in the area southwest of the town of Rosamond and outside the area shown on plate 1. If the pumping depression in that area increases only slightly in size, ground-water flow in the western part of the Rosamond storage unit will be reversed and water will start moving westward toward the depression.

STATUS OF GROUND WATER IN STORAGE, MARCH 1958

The estimates of ground water in storage in 1952 in the ground-water storage units of Edwards Air Force Base were presented in the comprehensive report (Dutcher and Worts, 1958), are included in this report in the section on geologic and hydrologic features, and are summarized in table 7. A knowledge of the supply of ground water in storage is necessary for the long-term planning of Base development and use of water in future years. Table 7 shows the estimated depletion of ground water in storage during the period 1952-58.

Table 7.--Status of ground water in storage on and near Edwards Air Force Base, 1952-58

Basin and storage unit[1]	Estimated ground water in storage in 1952[2] (acre-feet)	Estimated ground-water depletion 1952-58[2] (acre-feet)	Estimated ground-water depletion 1957-58[2] (acre-feet)
Lancaster basin:			
East Camp	310,000	14,000	2,600
Main Base	440,000	19,000	2,400
Rosamond	340,000	13,000	1,900
Subtotal	1,100,000	b46,000	6,900
North Muroc basin:			
North Muroc	a450,000	2,000	1,000
Total	1,500,000	48,000	7,900

1. Storage units and estimates of ground water in storage from Dutcher and Worts (1958, pl. 12 and table 10).
2. Rounded to two significant figures.
a. Approximately 70 percent within Base.
b. See point plot on plate 9.

The table shows that in Lancaster basin the ground water in storage in March 1958 was about 46,000 acre-feet less than in 1952. The weighted areal average water-level decline for the 6-year period 1953-58 in the East Camp storage unit was about 9.5 feet or nearly 1.6 feet per year; in the Main Base storage unit was about 14.1 feet or 2.3 feet per year; in the Rosamond storage unit about 13 feet or about 2.1 feet per year; in the North Muroc storage unit less than 1.8 feet or less than 0.3 foot per year.

Plate 9 shows the estimated total depletion of ground water in storage since 1952 in East Camp, Main Base, and Rosamond storage units. The rate of depletion for the 12-year period 1941-52 averaged about 7,000 acre-feet per year; for the 6-year period 1953-58, nearly 7,700 acre-feet. If the latter rate of depletion continues, the supply in the upper 200 feet of these three storage units in Lancaster basin would last until roughly the year 2100 (Dutcher and Worts, 1958, fig. 1). (See also pl. 9 of this report.)

RETURNED SEWAGE EFFLUENT

In the Main Base storage unit near the Main Base well field, mainly in sec. 24, T. 9 N., R. 10 W., and near the Rocket Engine Test Laboratory (Edwards Air Force Base, Auxiliary No. 1) northeast of the East Camp storage unit, the Air Force has designed the sewage-treatment plants so that treated sewage effluent is discharged into sewage disposal ponds. These ponds in the Main Base area overlie playa deposits of low permeability, and near the laboratory they are on fan deposits of relatively low permeability. Even so, probably some of the treated sewage effluent percolates to ground water.

Monthly records of the amount of treated sewage discharged at the Main Base and East Camp plants were supplied by the Air Installations Office. During 1958 about 279,000,000 gallons (856 acre-feet) of treated sewage was discharged at the Main Base plant; about 6,924,000 gallons (21 acre-feet) was discharged at the East Camp plant. About 31 percent of the total pumpage from the Main Base wells was discharged into the shallow ponds as sewage effluent. However, only about 3 percent of the water pumped for use at East Camp was discharged as sewage effluent; the remainder was presumably consumed or returned to ground water in North Muroc basin after being used to cool rocket motors at the static test stations and for other purposes. The amount of water that presumably flows northward into Muroc Basin after use for cooling at the rocket test station is unknown and the resulting quantity of recharge to the basin, if any, is also unknown.

The chemical quality of the treated sewage effluent is unknown because analyses of the effluent have not been made. It is important that analyses of the effluent be made for comparison with samples of water pumped from the Base supply wells. Such comparison may indicate whether any of the treated sewage effluent percolates to ground water. Arrangements have been made at the Air Installations Office to collect samples of the treated effluent twice each year. One sample from the lagoons and one from the discharge outfall will be collected at each plant to determine the quality and the nature of the changes, if any, that occur in the lagoons.

CHEMICAL QUALITY OF GROUND WATER

Purpose of Periodic Sampling

As a part of the continuing inventory, samples from 10 wells were collected and analyzed by the Geological Survey in 1958, the results are shown in table 8. In addition, 12 samples from Base supply wells were collected by the Air Force and analyzed by the Geological Survey, Quality of Water Branch, and 2 samples from new wells were collected by the drilling contractor and analyzed by the Carl Wilson Laboratory; these analyses are also shown in table 8.

Table 8.--Chemical analyses of water from Base wells

Constituents: Values preceded by the letter a were calculated by the Ground Water Branch, U. S. Geological Survey.

Analyzing laboratory: CW, Carl Wilson Laboratory, Los Angeles, Calif.; QW, U. S. Geological Survey, Quality of Water Branch, Sacramento, Calif., where preceded by AF the sample was collected by the Air Force, where preceded by GW the sample was collected by the Ground Water Branch.

Well number	8/10-2F1 (3T-A)	8/10-8N1	8/10-8N2	8/11-18L1
Constituents in parts per million				
Silica (SiO_2)	25			
Iron (Fe)	.10			
Calcium (Ca)	31	5.4	33	-
Magnesium (Mg)	9.1	.1	12	-
Sodium (Na)	50	94	55	2,950
Potassium (K)	3.9	2.8	3.9	60
Bicarbonate (HCO_3)	164	221	206	3,260
Carbonate (CO_3)	0	0	0	212
Sulfate (SO_4)	72	a29	a75	-
Chloride (Cl)	11	5.2	6.0	2,890
Fluoride (F)	.4	1.4	.5	2.4
Nitrate (NO_3)	1.1	-	-	-
Boron (B)	0	-	-	-
Dissolved solids	291	-	-	-
Sum of determined constituents	a285	a247	a286	a7,720
Hardness as $CaCO_3$	115	14	133	8
Percent sodium (%Na)	48	92	46	99
Specific conductance (micromhos at 77°F)	438	421	489	12,500
pH	8.1	7.7	7.5	8.7
Temperature (°F)	68	78	78	-
Date collected	6-25-58	5-1-58	4-30-58	5-3-58
Depth of well in feet	150	700	240	200
Analyzing laboratory (Lab.)	AFQW	GWQW	GWQW	GWQW
Laboratory number (No.)	26457	25928	25929	25932

Well number	9/8-6H1 (EC-2)	9/8-6H2 (EC-1)		9/9-6A1 (MB-11)	9/9-6L1 (MB-1)	9/9-18C1 (MB-7)
Constituents in parts per million						
SiO_2	39		35	34	34	29
Fe	.16		.04	0	.01	.02
Ca	20	29	28	30	37	30
Mg	7.8	16	10	5.8	8.1	2.7
Na	228	237	243	49	71	49
K	4.0	4.0	4.0	1.2	1.5	3.0
HCO_3	298	324	312	141	141	137
CO_3	0	0	0	0	0	0
SO_4	132	a191	159	65	79	59
Cl	121	135	136	15	53	16
F	2.0	1.6	2.0	.4	.7	.2
NO_3	6.7	-	10	1.0	.5	.6
B	1.0	-	1.0	.1	.1	.2
Dissolved S.	715	-	793	273	363	268
Sum	709	a774	782	270	354	257
Hardness	82	138	111	93	126	86
%Na	85	78	82	51	55	54
Micromhos	1,150	1,260	1,270	406	565	395
pH	7.8	7.4	7.7	7.5	7.8	7.7
°F	68	78	-	66	68	68
Date	6-25-58	4-9-58	6-25-58	6-24-58	6-24-58	6-22-58
Depth	467	354		199	147	360
Lab.	AFQW	GWQW	AFQW	AFQW	AFQW	AFQW
No.	26462	25671	26459	26469	26458	26464

Well number	9/10-8P1 (TS-10)	9/10-16C1	9/10-16P1	9/10-24C1 (MB-9)	
Constituents in parts per million					
SiO_2	27				29
Fe	.17				.03
Ca	47	509	91	16	22
Mg	9.8	165	8.0	3.4	1.5
Na	134	640	99	88	99
K	3.6	19	2.6	1.8	2.6
HCO_3	222	80	69	165	164
CO_3	0	0	0	0	0
SO_4	121	a720	a226	a74	80
Cl	96	1,810	133	24	45
F	2.0	-	-	.6	.5
NO_3	2.5	-	-	-	.4
B	.5	-	-	-	.4
Dissolved S.	569	-	-	-	367
Sum	553	a3,900	a594	a289	361
Hardness	158	1,950	260	54	61
%Na	64	41	45	77	77
Micromhos	917	6,430	997	478	573
pH	7.7	7.1	7.1	7.1	7.8
°F	69	75	-	67	64
Date	6-24-58	5-2-58	5-2-58	4-10-58	6-24-58
Depth	137.1	147.9	530	750	
Lab.	AFQW	GWQW	GWQW	GWQW	AFQW
No.	26467	25931	25930	25672	26466

	9/10-24E1 (MB-11)	9/10-24F1 (MB-6A)		9/10-24G1 (MB-8)	
Constituents in parts per million					
SiO_2	29		28		27
Fe	.03		.99		.03
Ca	22	24	24	26	32
Mg	1.5	5.4	24	4.6	2.7
Na	99	49	47	49	59
K	2.6	2.6	2.7	2.7	2.8
HCO_3	164	140	138	143	138
CO_3	0	0	0	0	0
SO_4	80	a68	50	a63	62
Cl	45	4	7.3	7.5	35
F	.5	.4	.3	.4	.3
NO_3	.4	-	.4		.6
B	.4	-	.1		.5
Dissolved S.	367	-	239		304
Sum	361	a223	a253	a223	290
Hardness	61	82	70	84	91
%Na	77	55	58	55	58
Micromhos	573	329	351	357	463
pH	7.8	7.0	7.9	7.0	7.7
°F	68	68	63	68	64
Date	6-24-58	4-10-58	6-24-58	4-10-58	6-24-58
Depth	700	430		750	
Lab.	AFQW	GWQW	AFQW	GWQW	AFQW
No.	26468	25675	26463	25674	26465

Well number	10/9-4D2 (NB-4)	10/9-7A1 (NB-1)	10/9-7A2 (NB-2)		11/9-32Q1 (NB-3)
Constituents in parts per million					
SiO_2	7	38	37		8
Fe	0	.20	.08		0
Ca	3.0	14	23	21	9.0
Mg	2.0	3.9	6.0	7.7	3.0
Na	129	300	384	362	155
K		3.6	4.5	3.5	
HCO_3	188	298	275	288	239
CO_3	13	0	0	0	0
SO_4	70	95	132	a133	82
Cl	31	246	400	350	62
F	1.0	2.0	2.0	3.0	1.0
NO_3	1.0	2.3	2.1	-	1.0
B	0	.5	.7	-	0
Dissolved S.		871	1,140	-	
Sum	a350	852	1,130	a1,020	a439
Hardness	16	31	82	84	35
%Na	95	92	90	90	91
Micromhos	-	1,470	1,980	1,780	-
pH	8.3	8.1	7.6	7.1	8.1
°F	-	66	66	69	-
Date	8-9-58	1-7-58	1-7-58	4-9-58	8-2-58
Depth	500	150	200		450
Lab.	CW	AFQW	AFQW	GWQW	CW
No.	-	26460	26461	25673	-

The principal purpose of periodic sampling of water from wells is to detect changes in the quality of water due to return to ground water of treated sewage effluent of higher dissolved solids or increased boron content, vertical circulation of water of inferior quality from the shallow water bodies, or migration of water of poor quality toward the Base wells from local areas near the margins of the basins.

Records of chemical analyses made prior to 1955 are included in the reports by Dutcher and Hiltgen (1954 and 1955) and Dutcher and Worts (1958). Records of chemical analyses made during the period 1956-57 are included in the first continuing report (Dutcher, 1958). Records of chemical analyses for new wells in the North Muroc basin are included in a data report by Dutcher (1959).

Quality of Water from Base Wells

In 1958 there was an increase in the chloride content of the water samples collected from wells 10/9-7A1 (NB-1), 7A2 (NB-2), and 9/9-6L1 (MB-1). There was little or no change in chloride content of water from the other Base supply wells (table 8).

The chloride content for selected supply wells has been plotted on plate 10 to show graphically the changes in North Muroc basin and the East Camp and Main Base areas. From January 1956 to April 1958 the chloride content at well 10/9-7A2 (NB-2) increased from 227 ppm (parts per million) to 350 ppm, and at well 10/9-7A1 (NB-1) the chloride content increased from 160 ppm to 246 ppm during the period January 1956 to January 1958. The increased chloride content, beginning in 1956, may be due to migration of water of inferior quality to the Base wells from the nearby fan deposits (Dutcher and Worts, 1958). The chloride content at well 7A2 is considerably greater than the 250 ppm which is the upper limit recommended by the U. S. Public Health Service (1946) for use by interstate carriers.

For the period 1953 through 1958 the chloride content of the water at wells 8/9-6H1 and 6H2 (EC-2 and 1) remained relatively unchanged from that of earlier years and ranged between 121 and 155 ppm. During the same period, however, the chloride content of water from well 9/10-24G1 (MB-8) declined from 86 ppm in June 1953 to only 7.5 ppm in April 1958. The chloride content of a sample collected during June was 35 ppm. The reason for the decrease and somewhat erratic fluctuation of chloride content is obscure; it may be due to the water of lower chloride content moving to the well from the principal water-bearing zone to the southeast. On the other hand, it appears likely that the length of time that the pump has been operating prior to collecting the sample has an important bearing on the chloride content of the water analyzed. As explained in the comprehensive report (Dutcher and Worts, 1958, p. 190) the pump in the well should be operated for an extended period before a water sample is collected for analysis. During the period 1953 to June 1958 the chloride content at well 9/9-6L1 (MB-1) increased about 45 ppm. Possibly a part of the water now pumped at the well is derived from the nearby fan deposits.

Table 8 and plate 10 show that the water pumped at the Main Base wells during 1958 continued to be excellent for Base supply and is the best available to the Base, except that from wells 10/9-4D2 and 11/9-32Q1 (NB-4 and 3) which is of equally good quality. The water produced by the East Camp wells is higher in dissolved solids than that from other wells but is suitable for Base use.

REFERENCES CITED

Dutcher, L. C., 1958, Ground-water inventory for 1954-57, Edwards Air Force Base, Calif.: U.S. Geol. Survey typewritten rept., 63 p.

_____ 1959, Data on water wells in the Fremont Valley area, Kern County, Calif.: U.S. Geol. Survey rept., 123 p.

Dutcher, L. C., and Hiltgen, W. J., 1954, Appendix B, Tables of basic data for wells outside Edwards Air Force Base: U.S. Geol. Survey mimeo. rept.

_____ 1955, Appendix A, Tables of basic data for wells on Edwards Air Force Base: U.S. Geol. Survey mimeo. rept.

Dutcher, L. C., and Worts, G. F., Jr., 1958, Geology and ground-water appraisal of Edwards Air Force Base and vicinity, California: U.S. Geol. Survey typewritten rept., 220 p.

Snyder, J. H., 1955, Ground water in California; the experience of Antelope Valley: California Univ., Div. Agr. Sci., Giannini Foundation Ground Water Studies no. 2, 170 p.

Worts, G. F., Jr., 1952, Progress memorandum on the ground-water investigation of Edwards Air Force Base, Calif.: U.S. Geol. Survey mimeo. rept., 19 p.

Worts, G. F., Jr., Hiltgen, W. J., Chase, G. H., and Brown, R. S., 1953, Second progress memorandum on the ground-water investigation of Edwards Air Force Base, Calif.: U.S. Geol. Survey mimeo. rept., 36 p.

U.S. Public Health Service, 1946, Drinking water standards: Public Health Reports, v. 61, no. 11, p. 371-384.

Table 6.--Records of water levels in wells, Edwards Air Force Base and vicinity, 1958

Records by U. S. Geological Survey. For uniformity in reference, footnotes are the same as those used in appendixes for the comprehensive report (Dutcher and Hiltgen, 1954 and 1955). Water levels are in feet below land-surface datum; depth of well and altitude are with reference to land-surface datum.

7/10-2E1. Depth 403 ft. Altitude about 2,412 ft. Records available: 1951-54, 1956-58. Mar. 12, 1958, 164.26; Nov. 6, a182.82.

7/10-5F1. Depth 384 ft. Altitude about 2,392 ft. Records available: 1956-58. Mar. 12, 1958, 154.16; Nov. 6, 170.52.

7/10-5N3. Depth 980 ft. Altitude about 2,398 ft. Records available: 1945-47, 1949, 1951-53, 1956-58. Mar. 12, 1958, 165.63; Apr. 10, 166.32; May 15, 215.87; Nov. 6, 189.70.

7/11-1Q1. Depth unknown. Altitude about 2,385 ft. Records available: 1958. Mar. 12, 1958, 179.49; Nov. 6, 181.78.

7/11-6A1. Depth 130 ft. Altitude about 2,351 ft. Records available: 1951-53, 1956-58. Mar. 11, 1958, 74.74; Nov. 6, 75.71.

8/9-4P1. Depth 127.3 ft. Altitude 2,305.1 ft. Records available: 1941-54, 1956-58. Highest water level 21.1 Dec. 6, 1941; lowest, dry at 35.0 ft Nov. 5, 1958. Mar. 11, 1958, 33.39; Apr. 9, 33.90; May 15, 34.03; Nov. 5, h35.0.

8/10-2P1. Depth 234.9 ft. Altitude about 2,310 ft. Records available: 1941-54, 1956-58. Highest water level 4.8 Apr. 24, 1941; lowest 48.47 Nov. 6, 1958. Mar. 11, 1958, 42.12; Apr. 9, 42.19; May 15, 45.48; Nov. 6, 48.47.

8/10-4G1. Depth 91.4 ft. Altitude about 2,300 ft. Records available: 1950-54, 1956-58.

Date	Water level	Date	Water level	Date	Water level
Mar. 11, 1958	47.59	Apr. 30, 1958	48.50	Nov. 6, 1958	56.60
Apr. 10	47.65	May 15	48.70		

a. Pumping nearby.
h. Dry at depth indicated.

8/10-8N1. Depth 740 ft. Altitude about 2,316 ft. Records available: 1953-54, 1956-58. Mar. 11, 1958, 74.60; Apr. 10, 75.43; May 15, 79.94; Nov. 6, 90.73.

8/10-8N2. Depth 240 ft. Altitude about 2,316 ft. Records available: 1951-54, 1956-58. Mar. 11, 1958, 51.97; Apr. 10, 50.59; May 15, 54.19; Nov. 6, 54.78.

8/10-8R3. Depth 230 ft. Altitude about 2,318 ft. Records available: 1947-49, 1951, 1954, 1956-58.

Date	Water level	Date	Water level	Date	Water level
Mar. 11, 1958	50.09	June 17, 1958	51.60	Nov. 3, 1958	52.22
Apr. 10	50.32	July 17	51.95	Dec. 9	52.03
30	e51.01	Aug. 19	52.16		
May 15	51.22	Sept. 19	52.43		

8/10-9P1. Depth 250 ft. Altitude about 2,321 ft. Records available: 1951-54, 1956-58. Mar. 11, 1958, 45.07; Apr. 10, 45.21; May 15, 45.55; Nov. 6, 46.47.

8/10-14E1. Depth 250 ft. Altitude about 2,333 ft. Records available: 1956-58. Mar. 11, 1958, 50.64; Apr. 10, 50.78; May 15, 51.24; Nov. 6, 52.38.

8/10-19N3. Depth formerly 700 ft, presently 282.4 ft. Altitude about 2,337 ft. Records available: 1951, 1956-58. Mar. 11, 1958, 101.67; Apr. 10, 102.23; measurements discontinued.

8/10-19N4. Depth 198.4 ft. Altitude about 2,338 ft. Records available: 1951-54, 1956-58. Mar. 11, 1958, 102.24; Apr. 10, 102.83; May 15, 116.43; Nov. 6, 111.52.

8/10-19Q1. Depth 690 ft. Altitude about 2,342 ft. Records available: 1939-42, 1944-48, 1950-58. Highest water level 29.7 Apr. 9, 1941, lowest 147.56 July 16, 1957. Mar. 11, 1958, 91.88; Apr. 10, 90.92; May 15, 93.58; Nov. 6, 104.51.

8/10-23F1. Depth 250 ft. Altitude about 2,350 ft. Records available: 1951-54, 1956-58. Mar. 11, 1958, 74.44; Nov. 6, 77.93.

8/10-28B1. Depth 245 ft. Altitude about 2,358 ft. Records available: 1951-54, 1956-58. Mar. 11, 1958, 94.99; Apr. 10, 95.79; May 15, 98.50; Nov. 6, 99.83.

e. Recorder installed.

8/10-32Q1. Depth 343 ft. Altitude about 2,383 ft. Records available: 1951-52, 1956-58. Mar. 12, 1958, 132.81; measurements discontinued.

8/11-13F2. Depth 156.8 ft. Altitude about 2,313 ft. Records available: 1958. May 2, 1958, 65.79.

8/11-14N1. Depth 337.7 ft. Altitude about 2,312 ft. Records available: 1951-54, 1956-58. Mar. 11, 1958, 66.07; Apr. 10, 65.87; May 15, 66.31; Nov. 6, 68.13.

8/11-14R2. Depth 205 ft. Altitude about 2,317 ft. Records available: 1952-54, 1956-58. Mar. 11, 1958, 87.01; Nov. 6, 90.54.

8/11-15Q1. Depth 179.2 ft. Altitude about 2,307 ft. Records available: 1952, 1954, 1958. Nov. 6, 1952, 77.98; May 3, 1954, 84.96; May 2, 1958, 87.20.

8/11-17A1. Depth 30 ft. Altitude about 2,295 ft. Records available: 1951-52, 1958. Mar. 11, 1958, 15.90; measurements discontinued.

8/11-18L1. Depth 195.3 ft. Altitude about 2,297 ft. Records available: 1951-52, 1958. May 2, 1951, 1.55; Mar. 4, 1952, 1.50; Nov. 6, 1.52; May 2, 1958, 3.56.

8/11-18Q1. Depth 268.2 ft. Altitude about 2,298 ft. Records available: 1951-52, 1958. May 2, 1951, 23.58; Mar. 4, 1952, 28.78; Nov. 6, 37.32; May 2, 1958, 53.40.

8/11-22N3. Depth 144.2 ft. Altitude about 2,317 ft. Records available: 1937, 1939-54, 1956-58. Mar. 11, 1958, 103.27; Apr. 10, 102.28; May 15, 104.68; Nov. 6, 104.28.

8/10-23R2. Depth 293.2 ft. Altitude about 2,331 ft. Records available: 1951-54, 1956-58. Mar. 11, 1958, 126.93; Apr. 10, 116.58; May 15, 149.80; Nov. 6, 126.92.

8/11-27R1. Depth 288 ft. Altitude about 2,341 ft. Records available: 1951-54, 1956-58. Mar. 11, 1958, 144.58; Nov. 6, 155.99.

8/11-34D2. Depth 250.5 ft. Altitude about 2,340 ft. Records available: 1951-53, 1956-58. Mar. 11, 1958, 143.00; Nov. 6, 143.40.

8/11-34R2. Depth unknown. Altitude about 2,358 ft. Records available: 1951-52, 1956-58. Mar. 11, 1958, 161.41; Nov. 6, 170.74,

8/12-2Q1. Depth 260 ft. Altitude about 2,283 ft. Records available: 1951-54, 1956-58. Mar. 10, 1958, 10.85; Nov. 4, 19.17.

8/12-4K1. Depth 265.3 ft. Altitude about 2,307 ft. Records available: 1943-47, 1949-54, 1956, 1958. Mar. 10, 1958, 33.88; Nov. 4, h45.0; measurements discontinued.

8/12-11R2. Depth 437 ft. Altitude about 2,282 ft. Records available: 1952, 1957-58. Mar. 10, 1958, 26.56; Nov. 4, 36.68.

8/12-14R1. Depth 187.7 ft. Altitude about 2,291 ft. Records available: 1951-52, 1958. Nov. 9, 1951, 28.34; Nov. 4, 1952, c109.12; May 2, 1958, 26.15.

8/12-22M1. Depth 298.5 ft. Altitude about 2,302 ft. Records available: 1943-54, 1956-58. Highest level, flowing, Mar. 1, 1945; lowest, 34.22, Oct. 17, 1956. Mar. 10, 1958, 19.63; Apr. 10, 18.94; May 15, 21.95; Nov. 4, 31.09.

9/8-6H1 (EC-2). Depth 467 ft. Altitude about 2,387 ft. Records available: 1951-54, 1956-58. Mar. 11, 1958, 123.56; Apr. 9, 124.32; May 15, 124.90; Nov. 5, a126.69.

9/8-18F1. Depth 419.4 ft. Altitude 2,397.2 ft. Records available: 1948, 1951-53, 1958.

Date	Water level	Date	Water level	Date	Water level
Jan. 22, 1948	i125.8	Nov. 15, 1951	128.68	Mar. 13, 1953	129.84
Oct. 18, 1951	128.61	May 6, 1952	129.05	May 15, 1958	136.38

9/9-1B1. Depth 26.0 ft. Altitude 2,277.0 ft. Records available: 1951-58. Oct. 18, 1951, 11.49; Nov. 15, 11.71; May 15, 1958, 20.12.

9/9-2Q1. Depth 122.8 ft. Altitude 2.274.8 ft. Records available: 1948, 1951-53, 1956-58. Mar. 11, 1958, 19.13; Apr. 9, 19.34; May 15, 19.71; Nov. 5, 21.26.

9/9-6E1 (MB-3). Depth 103.7 ft. Altitude 2,290.2 ft. Records available: 1948, 1951-53, 1956-58. Mar. 11, 1958, 42.87; Apr. 9, 42.90; May 15, 42.79; Nov. 5, 43.10.

a. Pumping nearby.

c. Pumping.
h. Dry at depth indicated.
i. Measurement by U. S. Corps of Engineers.

9/9-10R1. Depth 106.0 ft. Altitude about 2,280 ft. Records available: 1951-53, 1958.

Date	Water level	Date	Water level	Date	Water level
Oct. 17, 1951	18.14	May 6, 1952	17.59	May 15, 1958	27.83
Nov. 15	17.94	Apr. 24, 1953	19.26		

9/9-12F1. Depth unknown. Altitude 2,288.8 ft. Records available: 1951-53, 1958.

Oct. 17, 1951	21.26	May 6, 1952	21.99	May 15, 1958	30.11
Nov. 15	21.32	Mar. 13, 1953	22.54		

9/9-12Q1. Depth 93.2 ft. Altitude 2,346.0 ft. Records available: 1951, 1958. Oct. 17, 1951, 78.96; May 15, 1958, 87.98.

9/9-14H1 (formerly 9/9-14-1). Depth unknown. Altitude 2,330.0 ft. Records available: 1958. May 15, 1958, 72.76.

9/9-18C1 (MB-7). Depth 360 ft. Altitude 2,280.3 ft. Records available: 1948, 1952, 1956-58. Mar. 12, 1958, 29.85; Apr. 10, 31.23; May 15, 34.82.

9/9-26F1. Depth unknown. Altitude 2,353.3 ft. Records available: 1958. May 15, 1958, 94.80.

9/9-27H2. Depth 200 ft. Altitude about 2,280 ft. Records available: 1957-58. Mar. 11, 1958, 23.14; Apr. 9, 23.32; May 15, 23.76; Nov. 5, 25.51.

9/10-12R1 (MB-6). Depth 186.6 ft. Altitude 2,280.0 ft. Records available: 1948, 1951-54, 1956-58. Highest water level 11.1, Jan. 22, 1948; lowest level 40.39, Sept. 19, 1958.

Mar. 12, 1958	29.37	June 17, 1958	34.26	Sept. 19, 1958	40.39
Apr. 10	29.58	July 17	38.32	Nov. 3	37.73
May 15	33.44	Aug. 19	39.48	Dec. 9	35.19

9/10-16C1. Depth 147.9 ft. Altitude about 2,333 ft. Records available: 1952-54, 1957-58. Mar. 10, 1958, 55.04; Apr. 10, 1958, 55.35; May 14, 55.57; Nov. 6, 56.65.

9/10-16C2. Depth 217 ft. Altitude about 2,328 ft. Records available: 1951-54, 1956-58. Mar. 10, 1958, 80.27; Apr. 10, 80.56; Nov. 6, 80.78.

9/10-16M1. Depth 140.7 ft. Altitude about 2,325 ft. Records available: 1951-54, 1956-58. Highest water level 86.88, Mar. 10, 1958; lowest, 115.20, Sept. 18, 1951. Mar. 10, 1958, 86.88; Nov. 6, 88.48.

9/10-16N1. Depth 396 ft. Altitude about 2,325 ft. Records available: 1954, 1956-58. Mar. 10, 1958, 90.69; Apr. 10, 90.76; May 14, 90.39; Nov. 6, 90.24.

9/10-16P1. Depth 532 ft. Altitude about 2,322 ft. Records available: 1952-54, 1956-58. Mar. 10, 1958, 84.08; Apr. 10, 82.64; Nov. 6, 84.43.

9/10-22J1. Depth 120 ft. Altitude about 2,285 ft. Records available: 1957-58.

Date	Water level	Date	Water level	Date	Water level
Feb. 11, 1958	e37.70	May 15, 1958	38.23	Aug. 19, 1958	41.49
Mar. 12	37.20	June 17	39.86		
Apr. 9	37.01	July 17	40.96		

9/10-24C1 (MB-9). Depth 750 ft. Altitude about 2,285 ft. Records available: 1952-53, 1958. Mar. 12, 1958, 71.56; May 15, 88.2.

9/10-24E1 (MB-11). Depth 700 ft. Altitude about 2,280 ft. Records available: 1958. Mar. 12, 1958, 29.38; May 15, b80.68; Nov. 5, a40.82.

9/10-24F1 (MB-6A). Depth 530 ft. Altitude 2,281.2 ft. Records available: 1948, 1951-52, 1956-58. Mar. 12, 1958, 38.16; May 15, 49.53.

9/10-24G1 (MB-8). Depth 750 ft. Altitude about 2,280 ft. Records available: 1951-52, 1956-58. Mar. 12, 1958, 37.33; May 15, 48.70.

9/10-24N1. Depth 127.4 ft. Altitude about 2,273 ft. Records available: 1951-52, 1956-58. Highest water level 6.35 Mar. 20, 1951; lowest, 35.43, July 17, 1958.

Mar. 12, 1958	25.38	May 15, 1958	32.41	July 17, 1958	35.43
Apr. 10	25.31	June 17	34.94	Nov. 5	(f)

9/10-28F2. Depth 140.8 ft. Altitude about 2,300 ft. Records available: 1957-58. Mar. 10, 1958, 46.35; Apr. 9, 45.97; May 14, 46.34; June 17, 46.56, Nov. 6, 47.97.

a. Pumping nearby.
b. Pumped recently.
e. Recorder installed.
f. Recorder removed.

9/10-34D1. Depth 268 ft. Altitude about 2,285 ft. Records available: 1952, 1956-58. Mar. 10, 1958, 35.03; Apr. 9, 34.96; May 14, 37.03; Nov. 5, 43.11.

9/10-34H1. Depth 192 ft. Altitude about 2,285 ft. Records available: 1951-52, 1957-58.

Date	Water level	Date	Water level	Date	Water level
Mar. 11, 1958	24.52	June 17, 1958	28.35	Nov. 3, 1958	30.21
Apr. 9	24.70	July 17	29.26	Dec. 9	28.21
29	e25.31	Aug. 19	29.83		
May 15	26.52	Sept.19	30.87		

9/11-36L1. Depth unknown. Altitude about 2,290 feet. Records available: 1951-54, 1956-58. Highest water level 25.22 Apr. 10, 1951; lowest,45.68, Nov. 6, 1958. Mar. 10, 1958, 41.53; Apr. 10, 40.87; May 14, 40.74; Nov. 6, 45.68.

9/12-21D3. Depth 107.2 ft. Altitude about 2,350 ft. Records available: 1951-54, 1956-58.

Feb. 3, 1958	70.78	Mar. 10, 1958	70.40	Nov. 4, 1958	73.88
Mar. 7	70.58	Apr. 10	70.25		

9/12-23N1. Depth unknown. Altitude about 2,294 ft. Records available: 1951-53, 1956-58. Mar. 10, 1958, 25.00; Nov. 4, 27.05.

9/12-27J1. Depth 150 ft. Altitude about 2,298 ft. Records available: 1951, 1958. Mar. 29, 1951, 9.33; Mar. 10, 1958, 21.71; Nov. 4, 22.47.

9/12-35N1. Depth 280 ft. Altitude about 2,295 ft. Records available: 1956-58. Mar. 10, 1958, 17.43; Nov. 4, 18.94.

10/9-4D1 (TW-4). Depth 500 ft. Altitude about 2,312 ft. Records available: 1957-58.

Mar. 11, 1958	95.10	Aug. 7, 1958a	e97.31	Dec. 9, 1958	95.22
Apr. 9	95.17	Nov. 5	95.16		
May 14	95.12	6	95.20		

10/9-7A2 (NB-2). Depth 200 ft. Altitude 2,276.9 ft. Records available: 1948, 1951-52, 1956-58. May 14, 1958, 65.94; Nov. 5, 65.95.

a. Pumping nearby.
e. Recorder installed.

10/9-24A2. Depth unknown. Altitude about 2.292 ft. Records available: 1954, 1956-58. Mar. 11, 1958, 72.37; Apr. 9, 72.45; May 15, 72.41, Nov. 5, 72.48.

10/9-31C1. Depth 146.8 ft. Altitude about 2,280 ft. Records available: 1951-52, 1957-58. Mar. 11, 1958, 40.00; Apr. 9, 40.03; May 14, 40.00; Nov. 5, 39.98.

10/9-36G1. Depth 93.5 ft. Altitude 2,282.4 ft. Records available: 1951-54, 1956-58. Highest water level, 29.99, Jan. 25, 1951; lowest, 36.46, Nov. 5, 1958. Mar. 11, 1958, 35.67; Apr. 9, 35.81; May 15, 35.87; Nov. 5, 36.46.

11/8-20H1. D. W. Swanson. Depth 213.9 ft. Altitude about 2,380 ft. Records available: 1951-53, 1958. Mar. 13, 1953, 165.77; Jan. 15, 1958, 166.11.

11/8-29K1. U. S. Borax and Chemical Corp., well 41. Depth 495 ft. Altitude 2,355 ft. Records available: 1958. Jan. 15, 1958, 139.24.

11/8-32G1. Depth 156.0 ft. Altitude about 2,340 ft. Records available: 1951-54, 1956-58.

Date	Water level	Date	Water level	Date	Water level
Feb. 3, 1958	128.81	Apr. 9, 1958	128.86	Nov. 5, 1958	128.97
Mar. 10	128.86	May 14	128.89		

11/8-35D1. H. B. Hays, Desert Lake well. Depth 606 ft. Altitude about 2,380 ft. Records available: 1958. Jan. 15, 1958, 167.44.

11/9-17N1 (formerly 17M1). Depth 184.6 ft. Altitude about 2,324 ft. Records available: 1951-58. Mar. 4, 1958, 130.67; Nov. 5, 130.90.

11/9-24B1. U. S. Borax and Chemical Corp. Depth 150.4 ft. Altitude 2,343.6 ft. Records available: 1952-53, 1958.

Apr. 21, 1952	131.29	Apr. 21, 1953	129.88	Jan. 16, 1958	133.11
Nov. 3	131.27				

11/9-25L1. U. S. Borax and Chemical Corp. Depth 480 ft. Altitude 2,321.9 ft. Records available: 1956, 1958. Mar. 6, 1956, 110.48; Jan. 16, 1958, 111.00.

11/9-28C1. Harry Levy. Depth 186.9 ft. Altitude about 2,305 ft. Records available: 1958. Jan. 16, 1958, 87.34.

11/9-30H1. W. MacClanaghan. Depth 270 ft. Altitude about 2,310 ft. Records available: 1958. Jan. 28, 1958, 93.20.

11/9-31D1. Depth 200 ft. Altitude about 2,328 ft. Records available: 1951-52, 1956-58. Mar. 4, 1958, 115.81; Mar. 10, 115.74; Nov. 5, 116.06.

11/9-34A1. Depth 193.5 ft. Altitude about 2,303 ft. Records available: 1951-52, 1955-58.

Date	Water level	Date	Water level	Date	Water level
Feb. 3, 1958	93.83	Apr. 9, 1958	93.92	Nov. 5, 1958	94.19
Mar. 10	93.91	May 14	93.92		

11/9-36A1. U. S. Borax and Chemical Corp., well 28. Depth 610 ft. Altitude 2,323.6 ft. Records available: 1956, 1958. Mar. 6, 1956, 111.50; Jan. 16, 1958, 111.64.

11/9-36R1. Depth 298 ft. Altitude about 2,315 ft. Records available: 1954, 1956, 1958. May 5, 1954, 98.25; July 27, 1956, 98.45; Jan. 16, 1958, 98.49.