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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Water Resources Division

GROUND-WATER INVENTORY FOR 1965,
EDWARDS AIR FORCE BASE, CALIFORNIA

By

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GROUND-WATER INVENTORY FOR 1965, EDWARDS AIR FORCE BASE, CALIFORNIA

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SUMMARY AND CONCLUSIONS

The water supply for Edwards Air Force Base is ground water pumped from wells. Because recharge to the ground-water supply is very small, constant surveillance of the quantity and quality of the water stored in the underground basin is maintained. This report is the ninth annual inventory made at the request of the Department of the Air Force. The results of the current study are summarized below.

1. Pumpage.--Pumpage by the base for all uses during the calendar year 1965 was about 7,480 acre-feet, most of which was pumped from the Main Base, East Camp, and North Base wells.

2. Water-level fluctuations.--In the Main Base, East Camp, Rosamond, and North Muroc storage units, water levels declined about 0.5 to 5.5 feet during the period April 1, 1965, through March 31, 1966.

3. Ground water in storage.--Ground water in storage beneath and adjacent to the base in 1952 was estimated by Dutcher (1958, p. 40) to be 1,500,000 acre-feet. Depletion of ground water in storage during the period April 1, 1965, through March 31, 1966, was about 10,200 acre-feet. Depletion during the period 1952-66 is about 145,500 acre-feet, an average of about 10,400 acre-feet per year.

4. Quality of water.--Chemical analyses of water, collected annually from the principal base-supply wells, indicate no appreciable deterioration of quality for the period April 1, 1965, through March 31, 1966. However, some deterioration occurred at well NB-2 (10N/9W-7A2).

The chloride content in water from well NB-2 (10N/9W-7A2), as indicated by a sample collected in 1964, was 960 ppm (parts per million). The chloride content of a sample collected in 1965 was 1,310 ppm, an increase of 350 ppm. Experience has shown that the chloride content in water from this well is related to the length of time the well is idle prior to pumping for sampling.

5. Condition of wells.--On March 8, 1966, tests were made at wells NB-3 (11N/9W-32Q1) and NB-4 (10N/9W-4D2) to determine their specific capacities. The results indicated no apparent change in specific capacities, and therefore no rehabilitation of the wells is necessary.

PURPOSE AND SCOPE OF THE CONTINUING INVENTORY

This report is the ninth annual inventory of ground-water conditions at Edwards Air Force Base, Los Angeles, Kern, and San Bernardino Counties, Calif. It was prepared by the U.S. Geological Survey in cooperation with the Air Force. The area of investigation is shown in figure 1.

The geology and ground-water resources of the Edwards Air Force Base area were described by Dutcher and Worts (1958). Basic data are contained in a report by Dutcher and others (1962).

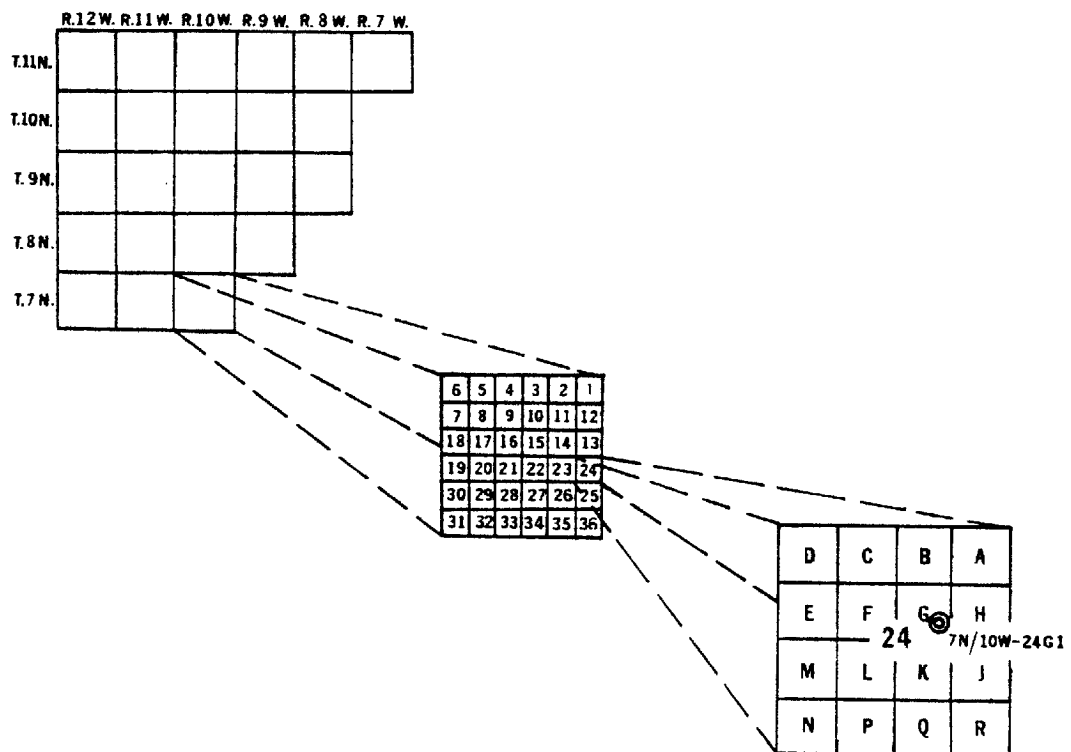
The continuing inventory, submitted annually since 1958, has as its purpose the collection, analysis, and interpretation of hydrologic data necessary to keep the Air Force advised of current water-supply conditions on the base.

The scope of the program requested by the Air Force is as follows: (1) To continue periodic water-level measurements in key observation wells on the base to estimate the quantity of ground water in storage; (2) to continue to interpret chemical analyses of water from base wells to detect any changes in chemical quality of ground water and, in particular, to detect any deterioration of quality due to return of sewage effluent, downward movement of water of inferior quality from the shallow water bodies, or migration of water of poor quality from local areas near the margins of the basins toward the base wells; and, as funds permit, to collect water samples periodically from key wells to supplement the base sampling program; (3) to continue as technical adviser on water-supply problems at Edwards Air Force Base; and (4) to prepare a brief annual report incorporating the findings made during the continuing inventory, including a summary of pumpage, an estimate of ground water in storage, hydrographs of water-level measurements, chemical analyses, and other basic data.

The work was done by the U.S. Geological Survey, Water Resources Division, under the immediate supervision of L. C. Dutcher, chief of the Garden Grove subdistrict office, and under the general supervision of Walter Hofmann, district chief in charge of water-resources investigations in California.

WELL-NUMBERING SYSTEM

Wells are numbered according to their location in the rectangular system for subdivision of public land. That part of the number preceding the slash (as in 7N/10W-24G1) indicates the township (T. 7 N.); the number following the slash indicates the range (R. 10 W.); the number following the hyphen indicates the section (sec. 24); the letter following the section number indicates the 40-acre subdivision of the section according to the lettered diagram below. The final digit is a serial number for wells in each 40-acre subdivision. The area covered by the report lies entirely in the northwest quadrant of the San Bernardino base line and meridian.



For well numbers where the letter Z has been substituted for the letter designating the 40-acre tract, the Z indicates that the well is plotted from unverified location descriptions; the indicated sites of such wells were visited but no evidence of a well could be found.

Table 1 is a cross index of the well numbers used by the U.S. Air Force and those used by the U.S. Geological Survey.

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

Base number or name		Abbreviated base number ¹	USGS number	Basin and ground- water storage unit	Use
<u>Lancaster basin</u>					
Main Base well	1	MB-1	9N/9W-6L1	Main Base (adjacent)	(b)
	3	MB-3	9N/9W-6E1	Main Base (adjacent)	(b)
	5	MB-5	9N/9W-6A1	Main Base (adjacent)	(b)
	6	MB-6	9N/10W-12R1	Main Base (adjacent)	(c)
	6A	MB-6A	9N/10W-24F1	Main Base	(a)
	7	MB-7	9N/9W-18C1	Main Base	(a)
	8	MB-8	9N/10W-24C1	Main Base	(a)
	9	MB-9	9N/10W-24C1	Main Base	(a)
	11	MB-11	9N/10W-24E1	Main Base	(a)
Well C-2		C-2	9N/10W-16C2	---	(a)
Telemeter Station well 10		TS-10	9N/10W-8P1	---	(b)
South Track well	A	ST-A	8N/10W-2F1	Main Base	(b)
	D	ST-D	8N/10W-2N2	Main Base	(b)
	E	ST-E	8N/10W-1C1	Main Base	(a)
East Camp well	1	EC-1	9N/8W-6H2	East Camp	(a)
	2	EC-2	9N/8W-6H1	East Camp	(a)
	3	EC-3	9N/8W-6J1	East Camp	(a)
NASA well	1	NASA-1(B)	9N/9W-14P2	East Camp	(a)
	2	NASA-2(C)	9N/9W-23B1	East Camp	(a)
	3	NASA-3(D)	9N/9W-13N1	East Camp	(a)
	4	NASA-4(A)	9N/9W-15J1	East Camp	(a)
<u>North Muroc basin</u>					
North Base well	1	NB-1	10N/9W-7A1	North Muroc	(a)
	2	NB-2	10N/9W-7A2	North Muroc	(a)
	3	NB-3	11N/9W-32Q1	North Muroc	(a)
	4	NB-4	10N/9W-4D2	North Muroc	(a)
	5	NB-5	10N/9W-5B1	North Muroc	(a)
Test well 4		TW-4	10N/9W-4D1	North Muroc	(c)
Graham Ranch wells			9N/10W-16P1	---	(d)
			9N/10W-34P3	---	(d)
Red Barn well		20	9N/10W-34Q1	---	(b)
Red Barn well 1		21	9N/10W-34Q2	---	(d)
Red Barn well 2		22	9N/10W-34P3	---	(d)

1. Symbol used in text.
a. Supply well.
b. Unused well.

c. Recorder well.
d. Recreational well.

PUMPAGE

The metered pumpage for the base during the calendar year 1965 totaled 6,690 acre-feet (fig. 2). In addition, monthly records show that pumpage ranged from a July high of 282,450,000 gallons (867 acre-feet) to a December low of 92,517,000 gallons (284 acre-feet). Pumpage for all uses by the base in 1965, including both metered and estimated pumpage from the several ground-water basins and storage units, is shown in table 2. Pumpage records for irrigation and other uses outside the base in 1965 are not available.

Table 2.--Pumpage from base-supply wells for calendar year 1965

Basin and well field	Pumpage ¹	
	1,000 gallons	Acre-feet ²
<u>Lancaster basin</u>		
Main Base wells 6A, 7, 8, 9, and 11	1,065,000	3,270
East Camp wells 1, 2, and 3	392,000	1,200
NASA wells 1, 2, 3, and 4	175,000	536
Recreation wells ³	250,000	767
Well C-2	783	2.4
South Track well E	1,920	5.9
	<hr/>	
Subtotal:	1,880,000	5,780
<u>North Muroc basin</u>		
North Base wells 1, 2, 3, 4, and 5	553,000	1,700
	<hr/>	
Total:	2,430,000	7,480

¹All values rounded to three significant figures, or the nearest 0.1 acre-foot.

²One acre-foot equals 325,851 gallons.

³Pumpage is estimated; the water is not used for base supply, and the pumpage is not shown in figure 2.

WATER-LEVEL FLUCTUATIONS

Water levels were measured biannually in nearly 100 wells on and near the base. Recorders were operated on four wells to obtain continuous records of water-level fluctuations. Water-level records are on file in the office of the Geological Survey in Garden Grove, Calif., and are available on request.

The water-level-contour map (fig. 3) shows three principal pumping depressions near Edwards Air Force Base. Two pumping depressions are about 10 miles east of Lancaster; a third depression is near wells 9N/10W-24E1 and 24F1 in the Main Base well field.

In most of the area, ground-water levels start to decline in the early spring and continue to decline until about September when a recovery begins, as shown by the hydrographs in figure 4. For the period of record, the highest annual water level in most wells has been lower than the highest level for the previous year. Similarly, the lowest annual water level also has been lower each succeeding year.

During the period April 1, 1965, through March 31, 1966, the decline of water levels in the North Muroc storage unit ranged from 0.41 to 2.89 feet, based on water levels in wells 10N/9W-24A2 and 10N/9W-4D1. In the East Camp area the decline ranged from 1.34 to 3.10 feet, and in the Rosamond storage unit the decline ranged from 0.55 to 4.00 feet. In the Main Base storage unit the decline ranged from 0.46 to 5.60 feet.

GROUND WATER IN STORAGE, 1965-66

The quantity of ground water in storage in 1952 in the ground-water storage units of Edwards Air Force Base (fig. 3) was estimated by Dutcher (1958, p. 40). Table 3 shows the estimated yearly depletion for the period 1952-66, using the same assumptions and data sources.

The estimated depletion of ground water between April 1, 1965, and March 31, 1966, is about 10,200 acre-feet (table 3) in the East Camp, Main Base, Rosamond, and North Muroc storage units. This depletion is 5,600 acre-feet less than that for the 1964-65 period.

The total depletion for 1952-66, as shown by table 3, is about 145,500 acre-feet. Depletion in the East Camp, Main Base, and Rosamond storage units for the same period was 127,300 acre-feet and 18,200 acre-feet in the North Muroc storage unit (table 3 and fig. 5).

Table 3.---Status of ground water in storage, Edwards Air Force Base, 1952-66

Basin and storage unit ¹	Estimated ground water in storage in 1952 ¹ (acre-foot)	Estimated ground-water depletion, in acre-feet ²							
		1952-60 ³	1960-61 ⁴	1961-62 ⁵	1962-63 ⁵	1963-64 ⁵	1964-65 ⁶	1965-66	Total 1952-66
<u>Lancaster basin</u>									
East Camp	310,000	20,100	4,100	3,200	5,100	4,000	4,100	3,500	44,100
Main Base	440,000	27,100	4,000	2,600	5,100	3,800	5,000	2,800	50,400
Rosamond	340,000	18,800	2,500	1,700	3,000	2,000	3,500	1,300	32,800
Subtotal:	1,100,000	b66,000	10,600	7,500	13,200	9,800	12,600	7,600	b127,300
<u>North Muroc basin</u>									
North Muroc	a450,000	4,000	4,000	1,000	2,000	1,400	3,200	2,600	18,200
Total:	1,500,000	70,000	14,600	8,500	15,200	11,200	15,800	10,200	145,500

¹Storage units and estimates of ground water in storage from Dutcher and Worts (1958, pl. 12 and table 10).

²Estimates were made from water-level measurements obtained in the spring of the year.

³Estimates of depletion from Dutcher (1958, p. 40, and 1959, p. 47) and Moyle (1960, p. 25).

⁴Estimates of depletion from Moyle 1961, p. 38).

⁵Estimates of depletion from Weir (1962, p. 18; 1963, p. 19, and 1965, p. 20).

⁶Estimates of depletion from Giessner and Robson (1965, p. 18).

a. Approximately 70 percent within the base.

b. See points plotted in figure 5.

CHEMICAL QUALITY OF WATER

Water samples have been collected annually from base wells for chemical analysis. Except in the area of wells 9N/10W-16C2 (C-2), 10N/9W-7A2 (NB-2), and 9N/8W-6H2 (EC-1), the analyses indicated no significant changes in the chemical quality of the water on the base. The quality of the water from well 9N/10W-16C2 continued to show an improvement in 1965. The quality of the water from well 10N/9W-7A2 deteriorated somewhat in 1965. The sodium and the chloride contents increased from 610 ppm and 960 ppm to 790 ppm and 1,310 ppm, respectively. This deterioration is also reflected by the chloride content of water from well 10N/9W-7A1 (fig. 6). The chloride content of water from well 10N/9W-7A2 usually increases when the well has not been pumped for several days prior to sampling. The nitrate content of the water from supply well 9N/8W-6H2 decreased from 20 ppm in 1964 to 7.6 ppm in 1965.

Chemical analyses of water samples collected from wells 9N/9W-13N1, 14P2, 15J1, and 23B1 in 1965 show a marked increase in sodium, carbonate, bicarbonate, and sulfate when compared with chemical analyses of water samples collected in 1964. This increase in the chemical concentrations for those constituents is due to a rust preventative which was added to the water. These wells are not used as a source of domestic supply, and therefore the change in chemical quality is not considered significant.

Records of chemical analyses made prior to 1965 are tabulated in reports by Dutcher and others (1962, table 7, p. 184-209), Dutcher and Worts (1958, table 9, p. 189), Dutcher (1959, table 8, p. 52-56), Moyle (1960, table 6, p. 29-31, and 1961, table 5, p. 40-42), Weir (1962, table 5, p. 21-22, 1963, table 5, p. 22-23, and 1965, table 4, p. 23-24), and Giessner and Robson (1965, table 4, p. 21-22).

CONDITION OF WELLS

Specific-capacity tests were made at wells 11N/9W-32Q1 (NB-3) and 10N/9W-4D2 (NB-4) on March 8, 1966. A comparison of the results of these tests with the results of tests made during February 1964 indicates no significant change in the specific capacities.

Drawdown tests to determine the specific capacities of base-supply wells will be made during 1966. If the tests show a marked decrease in specific capacities, then rehabilitation of the wells may be necessary.

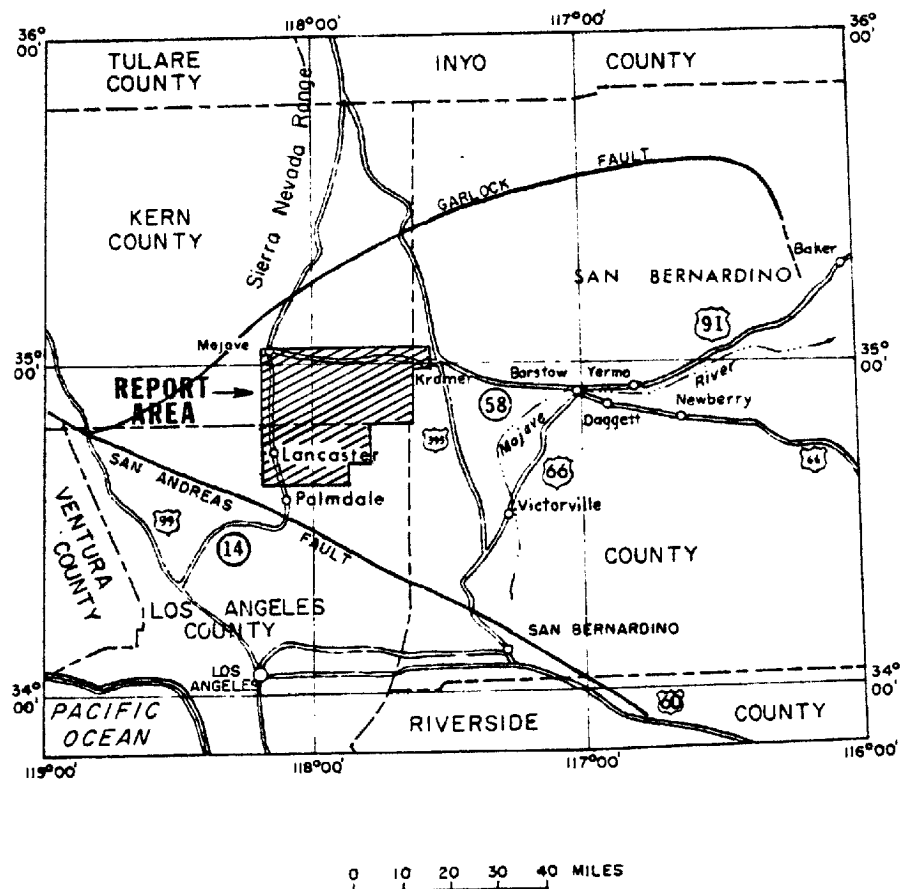
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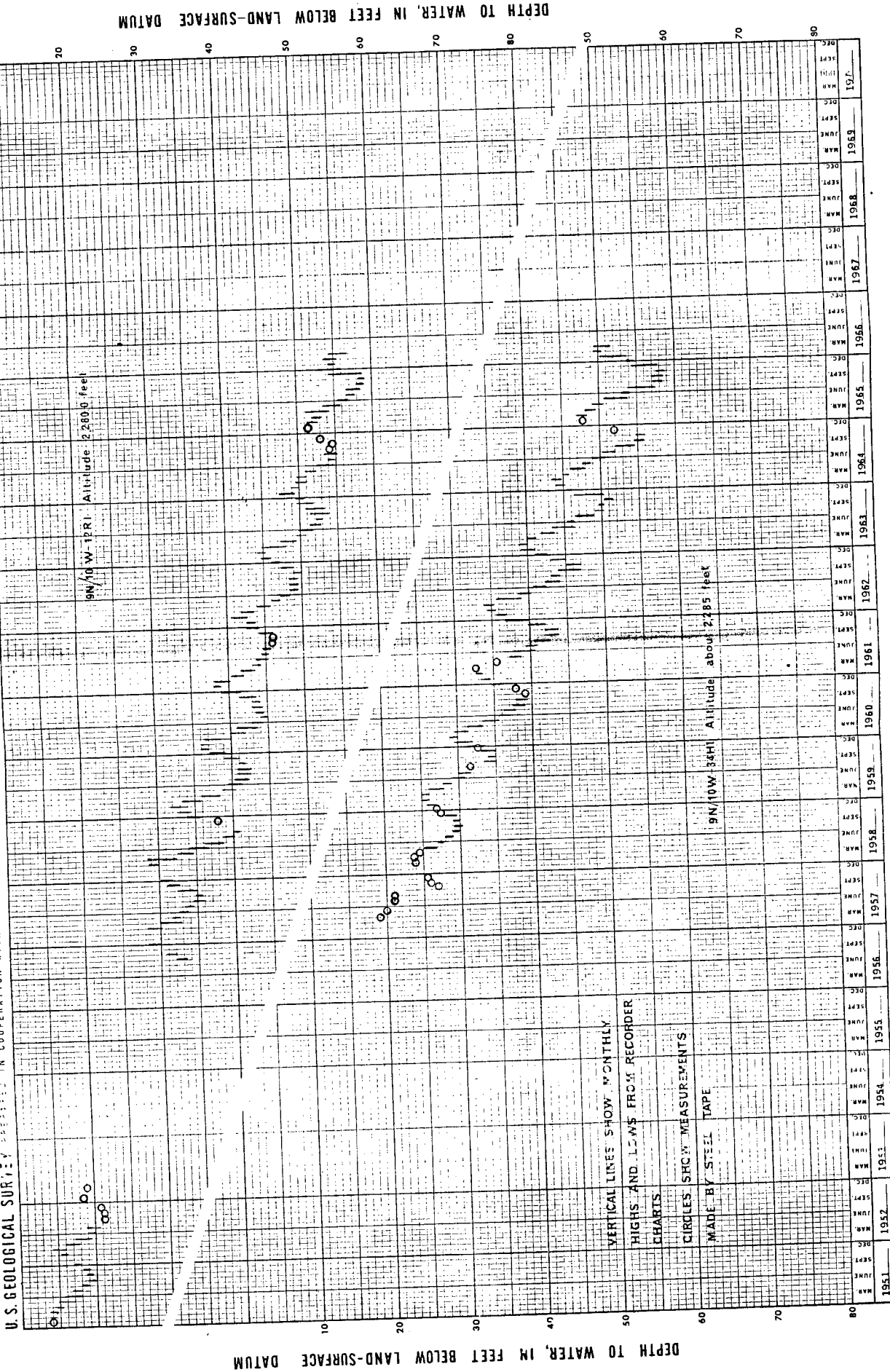


MAP OF PART OF SOUTHERN CALIFORNIA SHOWING
AREA OF THIS REPORT

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FIGURE 4

U.S. GEOLOGICAL SURVEY PREPARED IN COOPERATION WITH THE DEPARTMENT OF THE AIR FORCE



HYDROGRAPHS OF WELLS 9N/10W-12RI AND 9N/10W-34HI

