

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY  
Water Resources Division

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GROUND-WATER CONDITIONS DURING 1965,  
SOUTH VANDENBERG AREA,  
VANDENBERG AIR FORCE BASE, CALIFORNIA

By

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Prepared in cooperation with the  
Department of the Air Force

OPEN-FILE REPORT

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SUMMARY

The water supply for the South Vandenberg area, Vandenberg Air Force Base, is obtained from three supply wells on the base. Two of these wells, located in the Lompoc Terrace ground-water basin, supply most of the water used in the South Vandenberg area. About 75 million gallons of water was pumped from this basin during the 1965 fiscal year. The third supply well, located in the Lompoc Plain, pumped about 3.5 million gallons of water during the same period.

Hydrographs of wells in the Lompoc Terrace ground-water basin show that a gradual water-level decline began in 1958 and that this trend continued through the 1965 fiscal year.

Wells in the Lompoc Plain are monitored to record any significant change in water levels which may occur as a result of ground-water extraction. The hydrographs of these wells indicate that no appreciable net change in water levels has occurred in this area.

The quantity of ground water in storage in the Lompoc Terrace ground-water basin was estimated by Evenson (1963, p. 15) to be 70,000 acre-feet. The present water levels indicate that no significant change has occurred in the quantity of ground water in storage since the Navy began developing a ground-water supply in this area in 1958.

Water samples were recently collected from two of the supply wells to determine the concentration of the chemical constituents. The results of these analyses are not yet available, but no significant changes in ground-water quality are expected.

## PURPOSE AND SCOPE OF THE CONTINUING INVENTORY

In March 1958, the District Public Works Office, Eleventh Naval District, San Diego, Calif., requested the Geological Survey to investigate the possibility of developing a ground-water supply for the U.S. Naval Missile Facility, Point Arguello, Calif. (now known as the South Vandenberg area, Vandenberg Air Force Base, Calif., fig. 1). This investigation required a review of earlier studies, collection of water samples for chemical analysis, preparation of a geologic map, selection of test-well sites, supervision of test-well drilling, and construction and development of a supply well.

This work was completed in 1958, and a report was later published (Evenson and Miller, 1963).

The present report is the sixth of an annual series evaluating ground-water conditions since completion of the comprehensive study in 1958. The purpose of these annual reports is to present an analysis and interpretation of the hydrologic data necessary to keep the Air Force advised of current water-supply conditions.

The scope of the continuing ground-water program includes:

- (1) Annual estimates of ground-water pumpage, (2) a water-level measuring program to determine water-level fluctuations and changes in the quantity of ground water in storage, (3) a periodic sampling of ground water from wells to determine any changes in the chemical quality, (4) technical assistance on water-supply problems, and (5) an annual report summarizing and evaluating ground-water conditions in the South Vandenberg area.

The work on the 1964-65 program 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

The well-numbering system used in this report conforms to that used by the Geological Survey in California since 1940. It has been adopted as official by the California Department of Water Resources and by the California Water Pollution Control Board.

Wells are assigned numbers according to their location in the rectangular subdivision of public land. For example, the well number 7N/35W-33J2 (fig. 2) was assigned to Supply Well 1; the number preceding the slash (/) indicates the township (T. 7 N.), the number between the slash and the hyphen indicates the range (R. 35 W.), San Bernardino base and meridian lines, the number between the hyphen and the letter indicates the section (sec. 33), and the letter indicates the 40-acre subdivision of the section 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 subdivision, the wells are numbered serially as indicated by the final digit. Thus, well 7N/35W-33J2 is the second well to be listed in the NE $\frac{1}{4}$ SE $\frac{1}{4}$  sec. 33.

## GROUND-WATER PUMPAGE

The ground-water supply for the South Vandenberg area (fig. 2) is pumped from three wells, one in the Lompoc Plain (7N/35W-21L4) and two in the Lompoc Terrace ground-water basin (7N/35W-33J2 and 33J3). These three wells are capable of meeting South Vandenberg's estimated water requirement of 0.6 to 1.6 mgd (million gallons per day). In the 1965 fiscal year, these wells produced a total of 78.4 million gallons of water (table 1), 7.5 million gallons more than was produced in the previous year.

Since the development of the area by the military in 1958, most of the ground water extracted has been from the Lompoc Terrace ground-water basin. The total quantity of ground water pumped from this basin, for the period October 1958 through June 1965, was 382.5 million gallons (1,174 acre-feet).

In the 1965 fiscal year, 74.9 million gallons (230 acre-feet) was pumped from the basin, 5.9 million gallons more than was pumped in the previous year.

The total quantity of ground water pumped from the Lompoc Plain area for the period October 1958 through June 1965 was 44.7 million gallons (138 acre-feet). In the 1965 fiscal year, 3.5 million gallons (11 acre-feet) was pumped from the basin, 1.6 million gallons more than was pumped in the previous year.

Table 1.—Ground water pumpage from the South Vandenberg area,  
 Vandenberg Air Force Base, Calif.,  
 October 1958 through June 1965

Period <sup>2/</sup>	Pumpage by area in millions of gallons <sup>1/</sup>			Total pumpage
	Lompoc Plain	Lompoc Terrace ground-water basin		
	7N/35W-21L4	7N/35W-33J2	7N/35W-33J3	
	Supply well 2	Supply well 1	Supply well 3	
Oct. 1958 to June 1960	a10	a40	—	a50
July 1960 to May 1961	6.2	72.1	—	78.3
June 1961 to June 1962	21.2	30.7	30.2	82.1
July 1962 to June 1963	1.9	35.5	30.1	67.5
July 1963 to June 1964	1.9	37.5	31.5	70.9
July 1964 to June 1965	3.5	40.9	34.0	78.4
<b>Total:</b>	<b>44.7</b>	<b>256.7</b>	<b>125.8</b>	<b>427.2</b>

1. One million gallons equals 3.07 acre-feet.
2. Dates are inclusive.
- a. Estimated.

## WATER-LEVEL FLUCTUATIONS AND GROUND WATER IN STORAGE

Water levels are measured periodically in 17 wells to determine the water-level fluctuations and changes in the quantity of ground water in storage. Several of these wells are equipped with water-level recorders which provide continuous records of water-level fluctuations. These water-level records are on file in the office of the Geological Survey in Garden Grove, Calif., and copies are available on request.

A water-level rise or decline usually indicates an increase or decrease in the quantity of ground water in storage. The hydrographs in figures 3, 4, and 5 show a slight decline in water levels for the 1958-65 period. This decline is primarily a result of pumpage, but does not represent a significant depletion in the 70,000 acre-feet of ground water in storage in 1958, as estimated by Evenson (1963). To date, the quantity of ground water withdrawn from the Lompoc Terrace totals 1,174 acre-feet, only 1.7 percent of the calculated 70,000 acre-feet in storage.

### Lompoc Terrace Ground-Water Basin

The Lompoc Terrace ground-water basin contains two aquifers, described by Evenson and Miller (1963, p. 16), which yield water to supply wells 7N/35W-33J2 and 33J3. The lower aquifer, composed of gravel, contains ground water under artesian head, and the upper aquifer, composed of sand and gravel, contains ground water under water-table conditions.

Water levels in the Lompoc Terrace area are measured periodically in 10 observation wells, 8 of which are within the Lompoc Terrace ground-water basin. Five of these 8 observation wells are perforated in the lower aquifer, the remaining 3 are perforated in the upper aquifer. Two wells, one perforated in the upper aquifer and one perforated in the lower aquifer, are equipped with water-level recorders.

The hydrograph of well 7N/35W-33R1 (perforated in the lower aquifer) shows a water-level decline of about 4 feet since 1958 (fig. 3). The hydrograph of well 7N/35W-33J1 (perforated in the upper aquifer) shows a water-level decline of about 10 feet in the same period. This difference in water-level decline may indicate that supply well 1 (7N/35W-33J2, perforated in both aquifers) obtains more water from the upper aquifer than from the lower aquifer. The abrupt water-level fluctuations shown by the hydrograph of supply well 1 are caused by frequent pumping from this well and from supply well 3 (7N/35W-33J3, fig. 2).

Hydrographs of wells 7N/35W-28R1 and 7N/35W-35D2 (both perforated in the lower aquifer) show a water-level decline of 2 to 3 feet since 1963 (fig. 4). A more gradual decline is shown by the hydrograph of well 7N/35W-28K2. This well is perforated in the upper aquifer and a water-level decline of 3 feet has occurred since 1958. The water level in well 7N/35W-32N1 (perforated in the upper aquifer) has risen about 4 feet since 1958. The reason for this rise is not known. The hydrograph of well 7N/35W-31J1 (perforated in the lower aquifer) shows that the water level does not readily recover after a period of pumping. This slow water-level recovery may indicate that in this region the lower aquifer does not yield water readily to wells.

### Lompoc Plain

Water levels are measured periodically in seven wells in the Lompoc Plain. The water levels in most of these wells fluctuate in response to pumping from offbase irrigation wells in the Lompoc Plain (fig. 5). Because of this fluctuation, the water-level trend is difficult to determine, but the hydrograph of well 7N/35W-22N2 seems to indicate a net decline of about 2 feet since 1958. However, this decline is not apparent in the water-level records from the other six wells in the Lompoc Plain. Sea-water intrusion does not appear to be occurring at this time, but surveillance of water levels will be maintained to assure that any intrusion does not go unnoticed.

During the period 1958-65, ground water pumped from the Lompoc Plain by the military has produced no permanent lowering of the water level. Consequently, the use of ground water in this area by the Air Force has had no appreciable effect on the availability of ground water for other users in the Lompoc Plain.

## QUALITY OF WATER

The water-sample analyses shown in table 2 indicate that the quality of water from observation wells in the South Vandenberg area has not changed significantly during the 1958-63<sup>1/</sup> period of record. However, the chloride content of water from supply wells 2 and 3, as shown in figure 6, has been slowly increasing. From 1957 to 1964 the chloride content of water from supply well 2 increased about 50 ppm (parts per million) to a present high of about 535 ppm. This is more than twice the 250 ppm maximum allowed by the U.S. Department of Health, Education, and Welfare (1962, p. 7). The chloride content of water from supply well 3 has increased about 50 ppm in the past 4 years to a present high of about 230 ppm. Should this trend continue, the chloride content of water from this well in 1966 will exceed the upper limits allowed by the Public Health Service. Since 1958, the chloride content of water from supply well 2 has varied as much as 90 ppm, but no definite trend is indicated and the water is within the Public Health Service limits. Large changes in the ground-water quality probably will not occur unless water of different chemical composition is introduced into the ground-water basin. Such a condition could exist if sea-water intrusion were to occur. Therefore, water from wells in the area will be sampled and analyzed periodically to determine if the chemical quality has deteriorated. To date, the chemical analyses do not indicate that sea-water intrusion is occurring.

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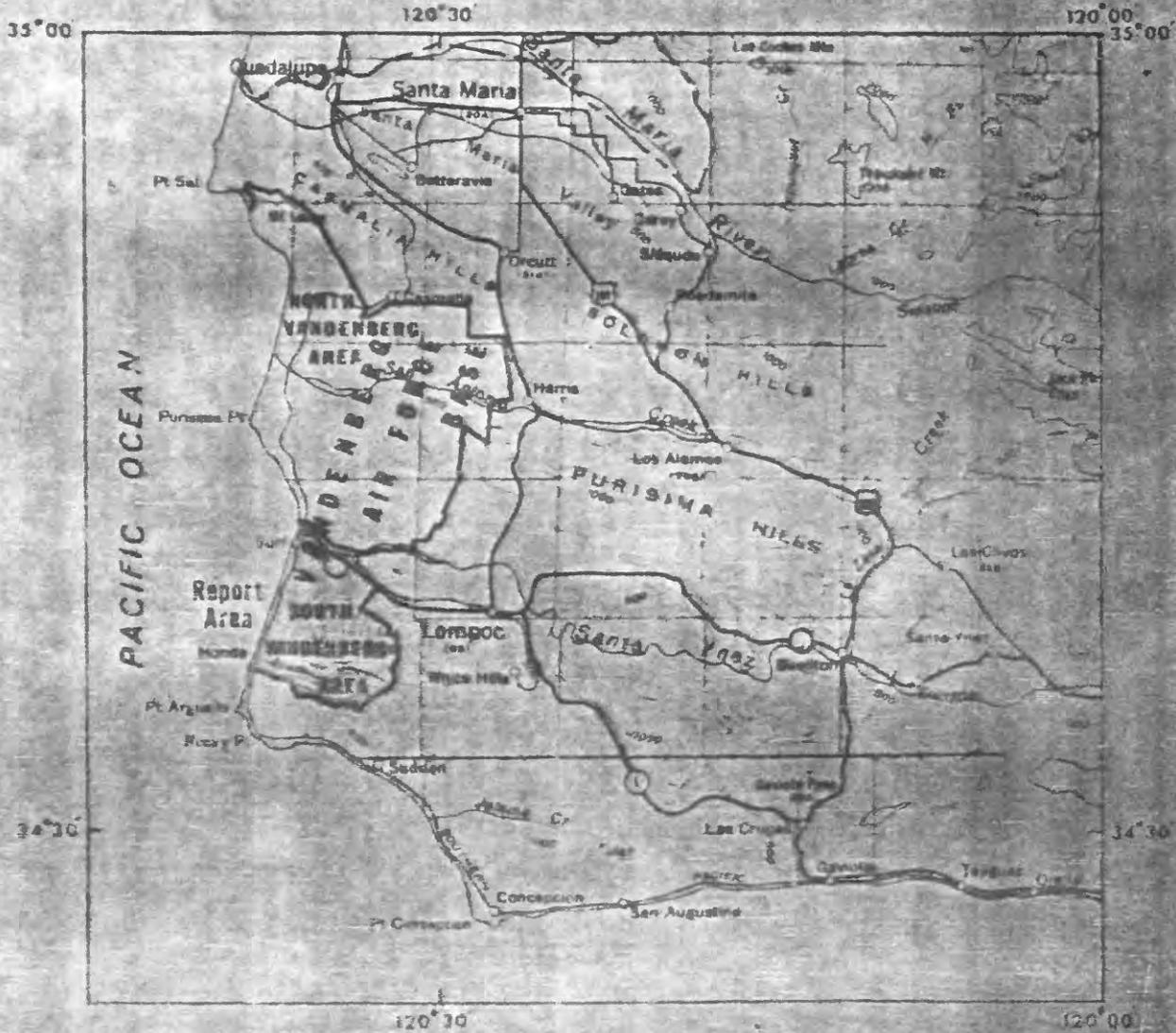
1. The chemical analyses for wells sampled in the 1965 fiscal year were not available at the time this report was prepared.

Table 2.--Partial chemical analyses of water from wells in the South Vandenberg area, Vandenberg Air Force Base, Calif.

Well number	Date sample: collected	Chloride :(parts per million)	Specific conductance :(micromhos at 25°C)
TN/35W-18J1	9-22-60	1,500	5,620
	10-10-61	1,490	5,200
	9-21-62	1,520	5,100
	10-15-63	1,710	5,200
	9-29-64	1,590	4,600
TN/35W-22N2	7-22-58	296	1,720
	11-16-59	265	1,280
	4-13-60	258	1,210
	11- 9-61	244	1,270
TN/35W-27F1	10- 7-60	204	1,070
	12-13-63	218	1,110
TN/35W-27P1	12-12-63	187	910
TN/35W-28K2	5-13-58	272	1,210
	5- 7-59	250	1,010
	12-12-63	252	1,170
TN/35W-28R1	12-11-63	71	464
TN/35W-30G1	4-14-58	460	2,620
	12-12-63	518	2,390
TN/35W-31J1	12-11-63	238	945
TN/35W-32N1	7-25-58	300	1,600
	11- 8-61	268	1,460
TN/35W-33J1	6-24-58	175	890
	3-12-59	190	915
	4-13-60	132	575
	11- 8-61	152	729
	12-12-63	154	725
TN/35W-33P1	5- 5-58	215	1,600
	11-17-59	222	1,150
	4-13-60	220	1,400
	11- 2-61	200	1,250
	12-12-63	200	1,100

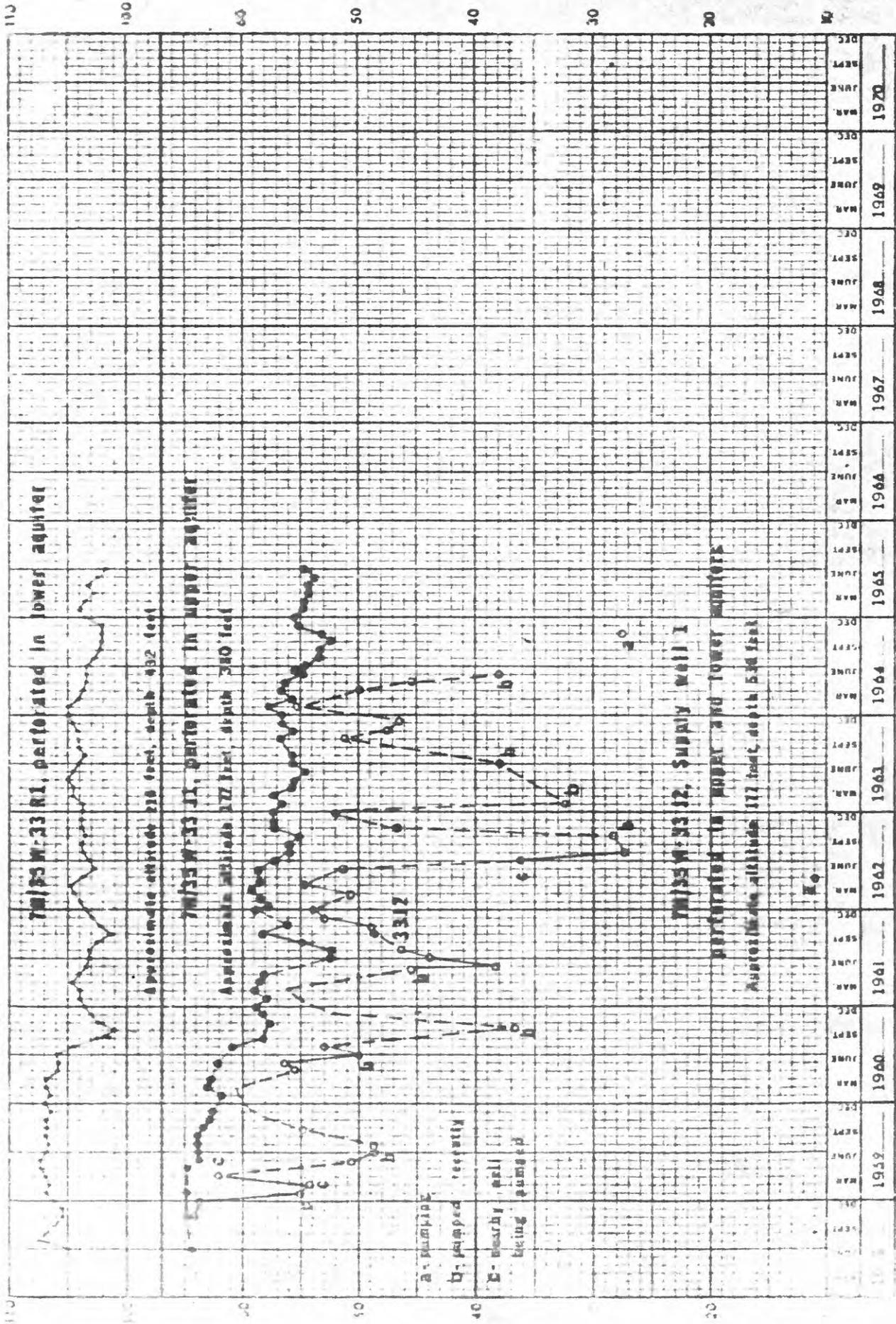
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- Evenson, R. E., 1963, Results of test drilling, Naval Missile Facility, Point Arguello, Santa Barbara County, California, 1962-63: U.S. Geol. Survey open-file rept., 18 p.
- Evenson, R. E., and Miller, G. A., 1963, Geology and ground-water features of Point Arguello Naval Missile Facility, Santa Barbara County, California: U.S. Geol. Survey Water-Supply Paper 1619-F, 35 p.
- U.S. Department of Health, Education, and Welfare, Public Health Service, 1962, Public Health Service Drinking Water Standards, 1962: Public Health Service Pub. 956, 61 p.

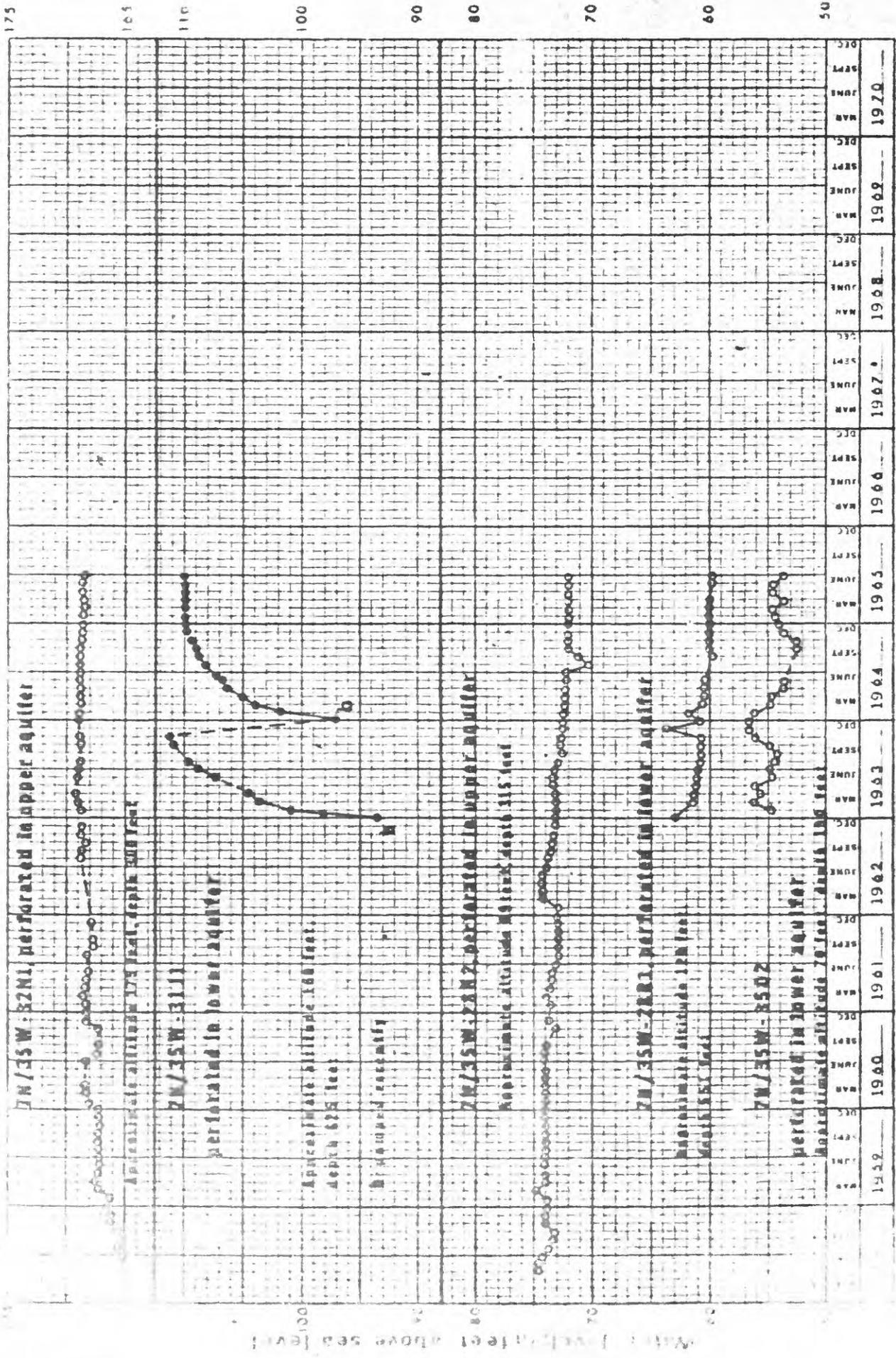


Map of part of Santa Barbara County, California, showing area described in this report

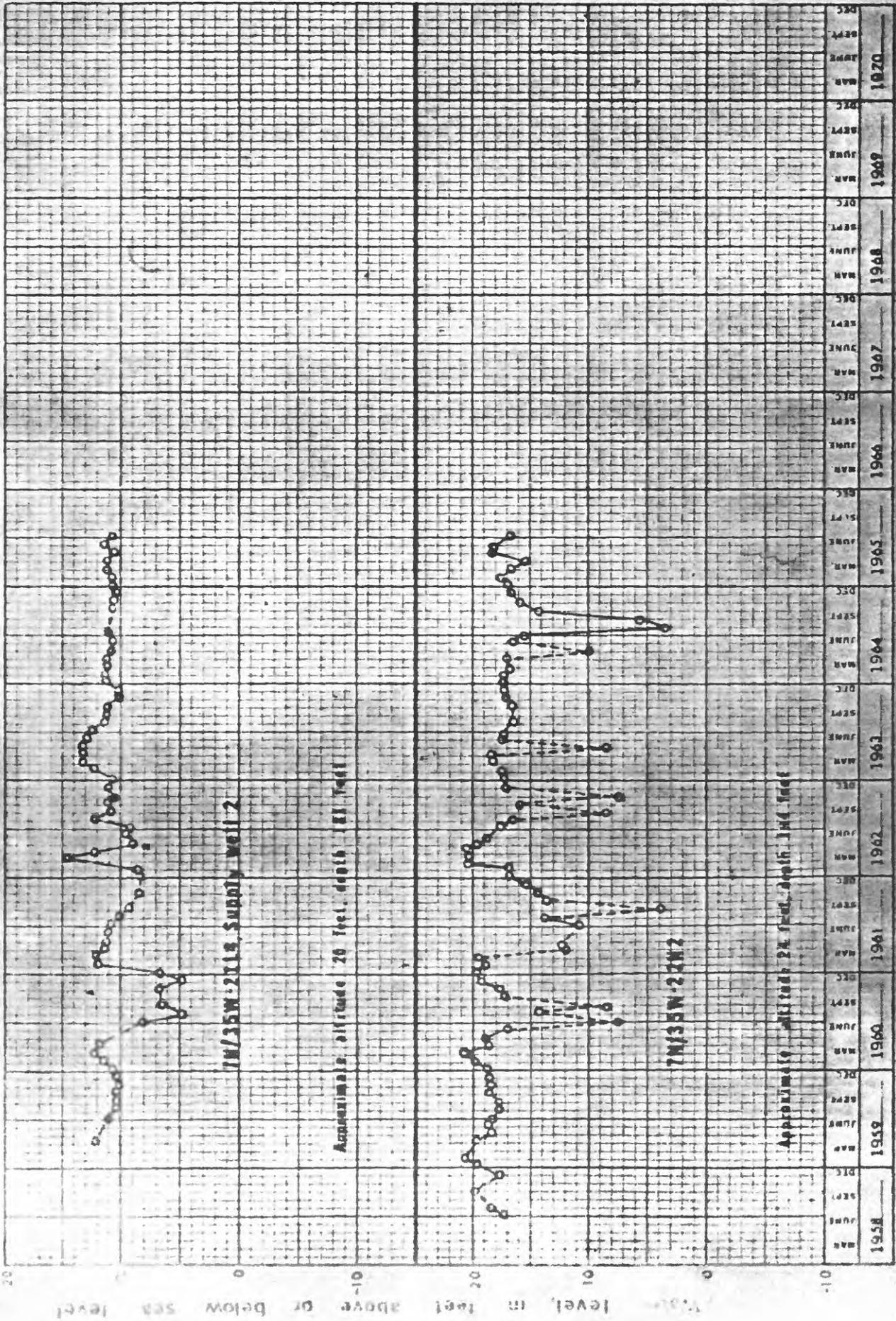




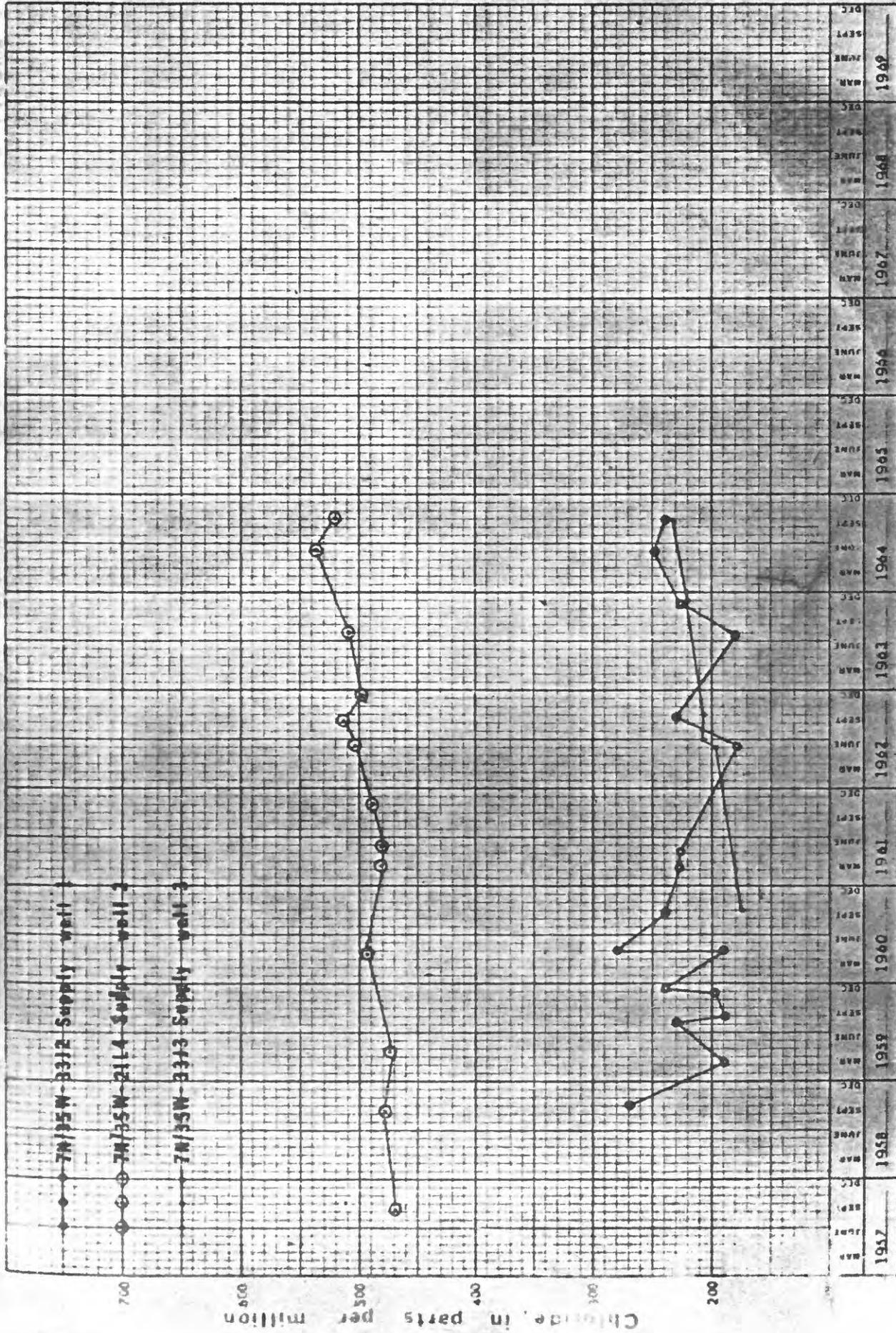
HYDROGRAPHS OF THREE WELLS IN THE LOMPOC TERRACE GROUND-WATER BASIN



HYDROGRAPHS OF FIVE WELLS IN THE LOMPOC TERRACE GROUND-WATER BASIN

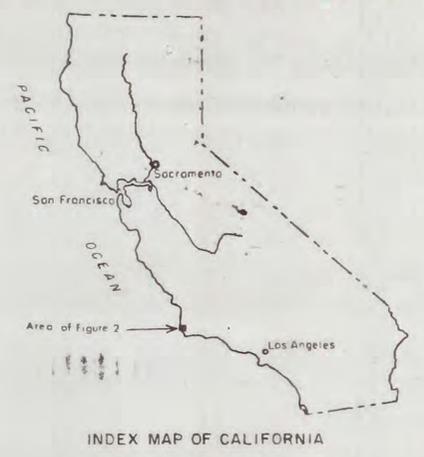


HYDROGRAPHS OF TWO WELLS IN THE LOMPOC PLAIN

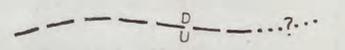


CHLORIDE CONTENT OF WELL WATER

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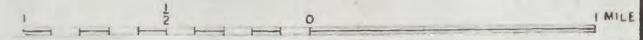
EXPLANATION



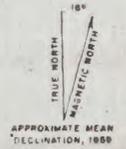
Fault  
 Dashed where approximately located; dotted where concealed  
 Question marks indicate probable fault  
 D, downthrown side; U, upthrown side  
 Marks approximate north and south limits of Lompoc Terrace ground-water basin

- ⊙ J3 Base supply well
- OD1 Water well
- MI Destroyed well

Prepared in cooperation with the Department of the Air Force



CONTOUR INTERVAL 40 FEET  
 DOTTED LINES REPRESENT 10 FOOT CONTOURS  
 DATUM IS MEAN SEA LEVEL



Base from U.S. Geological Survey 7 1/2-minute topographic quadrangle Surf, 1959  
 Dashed section lines projected for reference

MAP OF PART OF THE SOUTH VANDENBERG AREA, VANDENBERG AIR FORCE BASE, CALIFORNIA, SHOWING GENERAL FEATURES AND LOCATION OF WELLS

R 35 W R 34 W 34° 37' 30" 120° 30' 120° 30'  
 Faults mapped by Evenson and Miller (1963) OK