WATER LEVELS

IN OBSERVATION WELLS IN

Santa Barbara County

CALIFORNIA

1963

UNITED STATES DEPARTMENT OF THE INTERIOR
Geological Survey
WATER RESOURCES DIVISION
Prepared in cooperation with
THE SANTA BARBARA COUNTY WATER AGENCY
December 1964

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WATER LEVELS IN OBSERVATION WELLS IN SANTA BARBARA COUNTY, CALIFORNIA, 1963

By

K. S. Muir

OPEN-FILE REPORT

Prepared in cooperation with the
Santa Barbara County Water Agency

Santa Barbara, California
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By K. S. Muir

INTRODUCTION

The U.S. Geological Survey, in cooperation with the Santa Barbara County Water Agency, continued the study of the ground-water resources of Santa Barbara County (fig. 1) in 1963. As part of the study, the Geological Survey made monthly water-level measurements in 247 wells; 17 of which were equipped with automatic water-level recorders. These measurements and measurements made by the Santa Maria Valley Water Conservation District are included in this report. In addition, the U.S. Bureau of Reclamation measured the water levels in wells along the Santa Ynez River between Cachuma Dam and Rucker Crossing, but the measurements have not been included herein.

The following table shows the scope of the observation-well program in Santa Barbara County in 1963.

Area	Number of wells measured 1/	Number of water-level recorders operated
Carpinteria Basin	20	0
Santa Barbara-Summerland Basin	5	1
Goleta Basin	28	0
Ellwood-Gaviota area	11	0
Santa Ynez River valley	95	13
San Antonio Creek valley	4	0
Santa Maria Valley	67	3
Cuyama Valley	17	0
Total	247	17

1. Includes wells equipped with automatic water-level recorders.

INDEX MAP SHOWING SANTA BARBARA COUNTY,

CALIFORNIA

In addition to the observation-well program, the Geological Survey is preparing interpretive reports on the ground-water conditions in the Ellwood-Gaviota area, the Lompoc and Santa Ynez upland areas of the Santa Ynez River basin, the Santa Barbara-Summerland area, and the Santa Maria Valley. The basic data from which these reports are being prepared can be consulted at the Santa Barbara office of the Geological Survey.

This report was prepared by the Geological Survey, Water Resources Division, under the general supervision of Fred Kunkel, district geologist in charge of ground-water investigations in California, and under the immediate supervision of C. P. Zones, geologist in charge of the Santa Barbara subdistrict office.

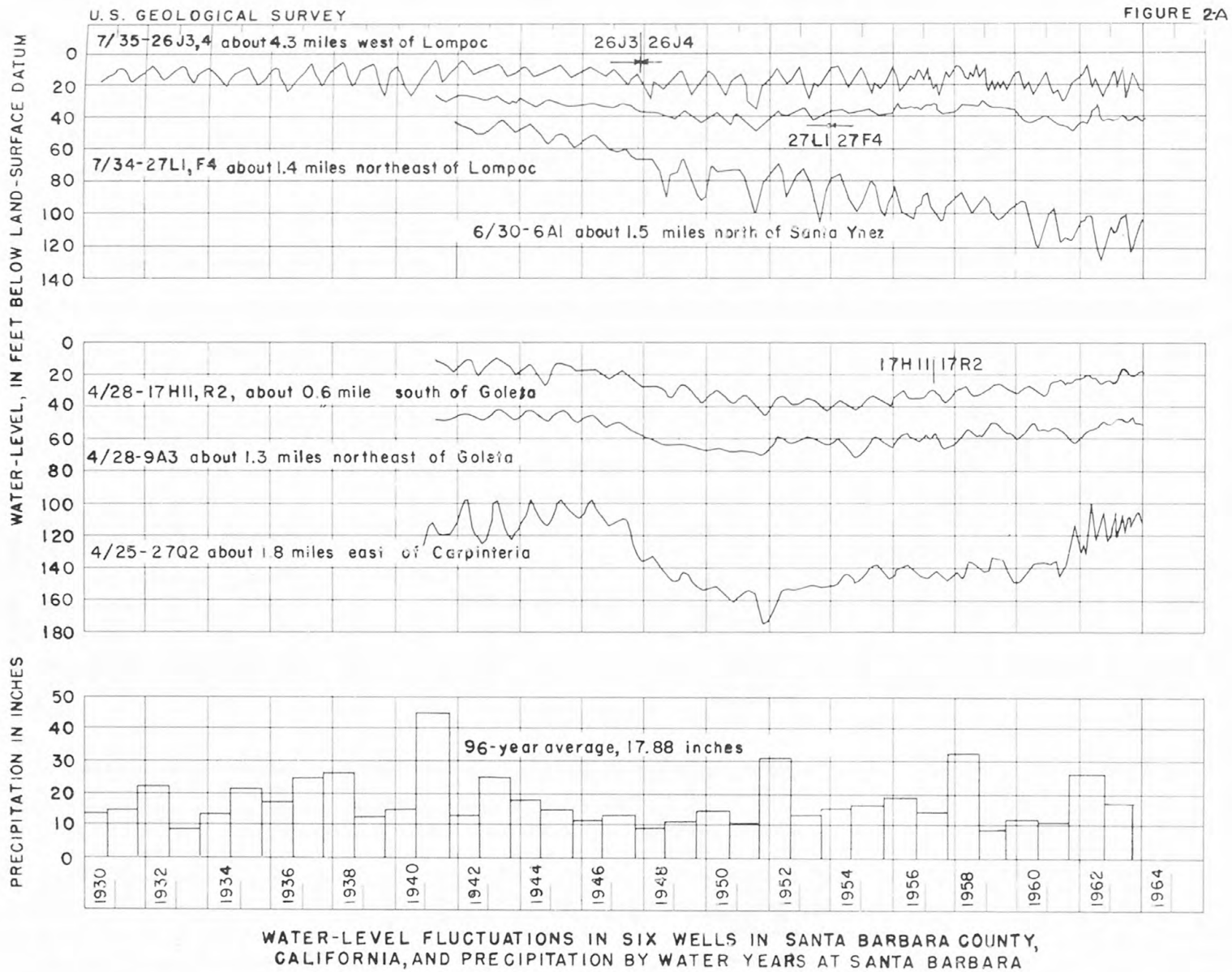
Measurements for the period 1941-55 were published in U.S. Geological Survey water-supply papers; measurements for the period 1956-62 were released locally in duplicated form. A report by G. A. LaRocque, Jr., and others (1950) contains descriptions of 2,246 wells in the ground-water basins of the county in 1942. It also contains many water-level measurements made before 1942 by the city of Santa Barbara, the Santa Maria Valley Water Conservation District, the San Joaquin Power Division of the Pacific Gas and Electric Co., the Union Sugar Co., the Union Oil Co., and other organizations and individuals.

Comprehensive reports on the geology and ground-water resources of the Santa Ynez River basin (Upson, Thomasson, and others, 1951; Wilson, 1959), the south-coast basins (Upson and others, 1951), the Santa Maria Valley area (Worts, 1951), the Cuyama Valley (Upson and Worts, 1951) and the San Antonio Creek valley (Muir, 1964) were published as Geological Survey water-supply papers. A report on stream runoff and ground-water storage capacity of the Santa Ynez River valley (Troxell and Wilson, 1952) was released to the open file in October 1952. A complete bibliography of reports of investigations made by the Water Resources Division, U.S. Geological Survey, in Santa Barbara County since 1940 is included in this report.

GENERAL HYDROLOGIC CONDITIONS

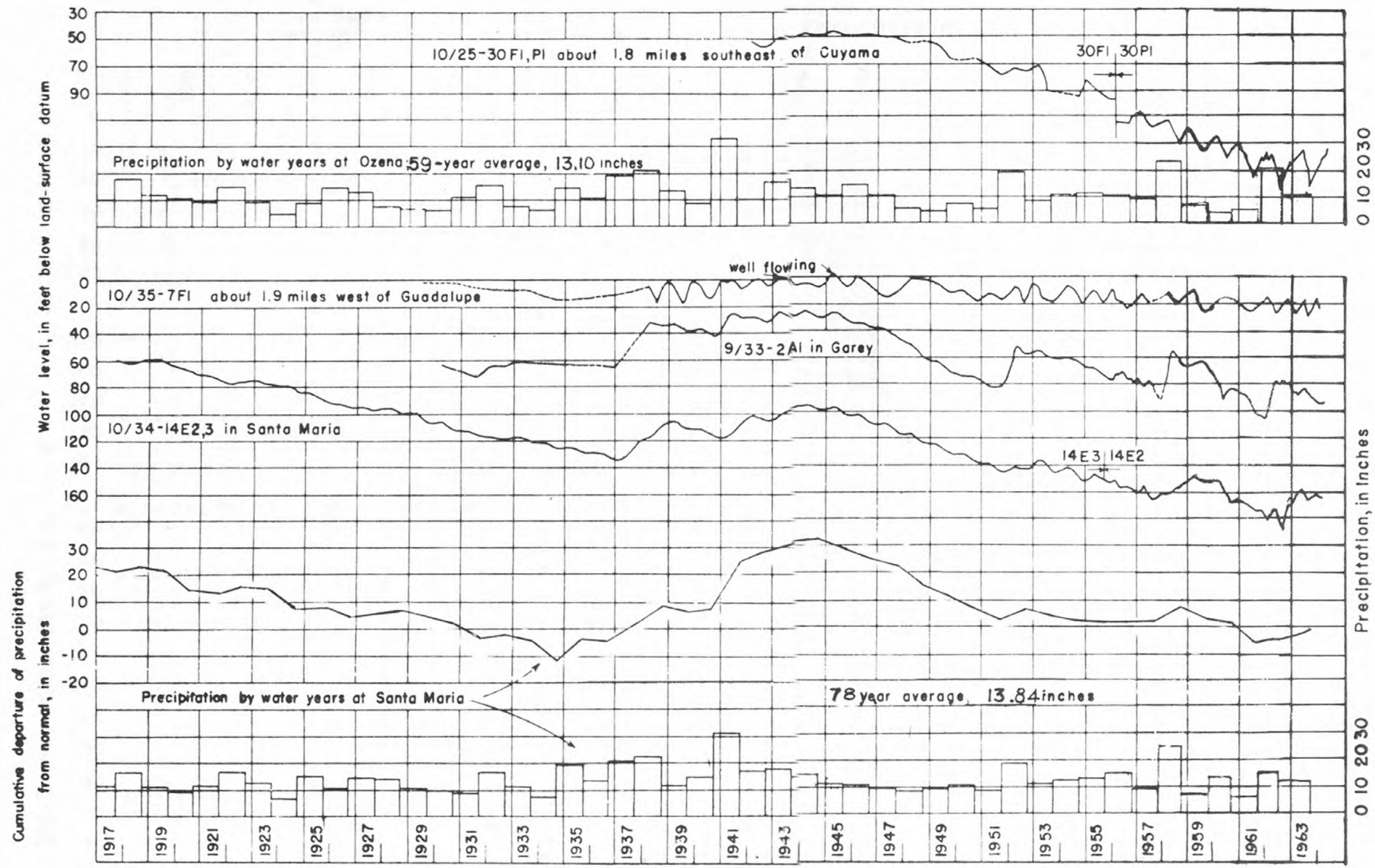
The climate in Santa Barbara County is characterized by a short rainy season in the winter and a long dry season in the summer, when almost all the streams are also dry. The extended dry period during the summer makes it necessary to use supplemental water for irrigation of the crops grown in the valleys. Almost all the water is pumped from the ground-water reservoirs which underlie the agricultural lands. In most areas domestic supplies also are obtained from these underground reservoirs, although the city of Santa Barbara and the Carpinteria, Goleta, Montecito, and Summerland County Water Districts depend largely upon surface water stored behind Cachuma, Gibraltar, and Juncal Dams, on the Santa Ynez River. However, ground water is used by these agencies during prolonged periods of drought.

Replenishment of the ground-water reservoirs depends almost entirely on winter precipitation. Between 1945 and 1963 annual precipitation generally was below normal and, as a result, replenishment of most of the basins was insufficient to meet requirements. Ground-water levels during this period declined substantially. The above-average rainfall in the winters of 1951-52, 1957-58, and 1961-1962 caused temporary cessations of this downward trend (figs. 2-A and 2-B).



WATER-LEVEL FLUCTUATIONS IN SIX WELLS IN SANTA BARBARA COUNTY, CALIFORNIA, AND PRECIPITATION BY WATER YEARS AT SANTA BARBARA

FIGURE 2-B



FLUCTUATIONS OF WATER LEVELS IN FOUR WELLS IN SANTA BARBARA COUNTY, CALIFORNIA, AND PRECIPITATION BY WATER YEARS AT OZENA AND SANTA MARIA AND CUMULATIVE DEPARTURE OF PRECIPITATION FROM NORMAL AT SANTA MARIA

The south-coast communities, through the Santa Barbara County Water Agency and the U.S. Bureau of Reclamation, have united to solve their water-shortage problem by building Cachuma Dam and a distribution system for the conservation and use of floodwater of the Santa Ynez River. Since April 1956 water from Cachuma reservoir has been supplied to the south-coast communities to augment their local water supplies.

The construction of Twitchell Dam on the Cuyama River near the Santa Maria Valley was completed in 1958 by the U.S. Bureau of Reclamation. Regulated releases of floodwater impounded by the dam will be used to recharge the ground-water reservoir in the Santa Maria plain.

PRECIPITATION

Precipitation in Santa Barbara County occurs principally as rain and differs greatly from place to place because of the orographic effect of the mountain ranges. Precipitation in the county ranges from about 6 inches in the Cuyama Valley to 30 inches or more in the higher parts of the Santa Ynez and San Rafael Mountains.

Data obtained from the U.S. Weather Bureau show precipitation was below average during the water year ending September 30, 1963. At Santa Barbara, in the southeast corner of the county, a total of 16.71 inches (1.17 inches less than the 96-year average) was recorded; at Santa Maria, in the northwest corner of the county, 12.24 inches (1.59 inches less than the 78-year average) was recorded for the year.

Figures 2-A and 2-B show precipitation at 3 stations, water-level fluctuations in 10 wells, and the cumulative departure from normal precipitation at Santa Maria. These graphs illustrate the relationship between precipitation and ground-water levels. During wet years water-level rise indicates ground-water replenishment. During dry years water-level decline indicates ground-water depletion.

FLUCTUATIONS OF WATER LEVELS

From about 1945 through 1951 ground-water levels throughout Santa Barbara County declined steadily as a result of increased water use and below-average precipitation. Ground-water depletion was more serious in some basins than in others, depending on the magnitude of the withdrawal and the replenishment. In the winter of 1951-52 above-average precipitation almost wholly replenished those basins in which depletion was small, whereas in the basins with large depletion only a small part of the ground water was replenished. Precipitation in the winter of 1961-62 was above normal, and water levels rose in most of the basins. The water levels resumed a downward trend following below-normal precipitation in the winter of 1962-63. Water-level response to withdrawal of water in excess of replenishment is almost immediate in some areas and delayed a year or longer in others.

Because the ground-water basins are hydrologically separated, the water-level fluctuations in each basin are discussed separately in the following section. Figures 3-11 show the location of observation wells in Santa Barbara County.

Carpinteria Basin

A supplemental water supply imported from Cachuma reservoir has resulted in a reduction of the draft on ground water in the Carpinteria Basin, and, consequently, water levels were higher in the spring of 1963 than in the spring of 1962. The water-level rise in the area of confined ground water in the central and western parts of the basin averaged about 1 foot, and in the area of recharge along the base of the foothills it averaged about 2 feet. The hydrograph of well 4N/25W-27Q2 (fig. 2-A) is representative of water-level fluctuations in the area of confined water. Figure 3 shows the location of observation wells in the Carpinteria Basin.

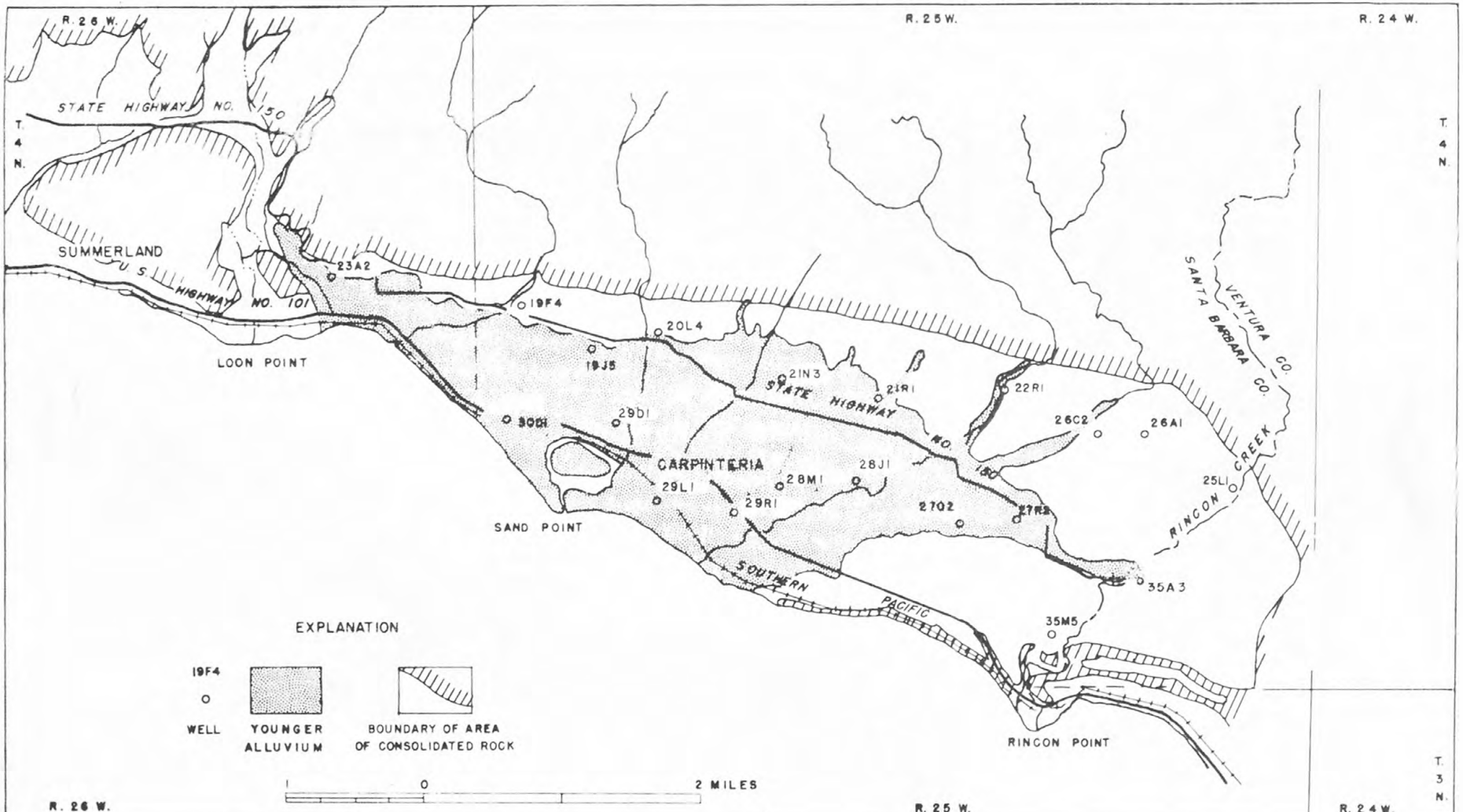
Ground-water samples were collected and analyzed during 1963 to determine the status of sea-water intrusion into the basin. The analyses of water from three key wells showed no significant increase in chloride concentration from 1962 to 1963.

Santa Barbara-Summerland Basin

Measurements by the U.S. Geological Survey in observation wells in the Santa Barbara-Summerland Basin showed no change in water levels from the spring of 1962 to the spring of 1963.

Figure 4 shows the location of observation wells in the Santa Barbara-Summerland Basin.

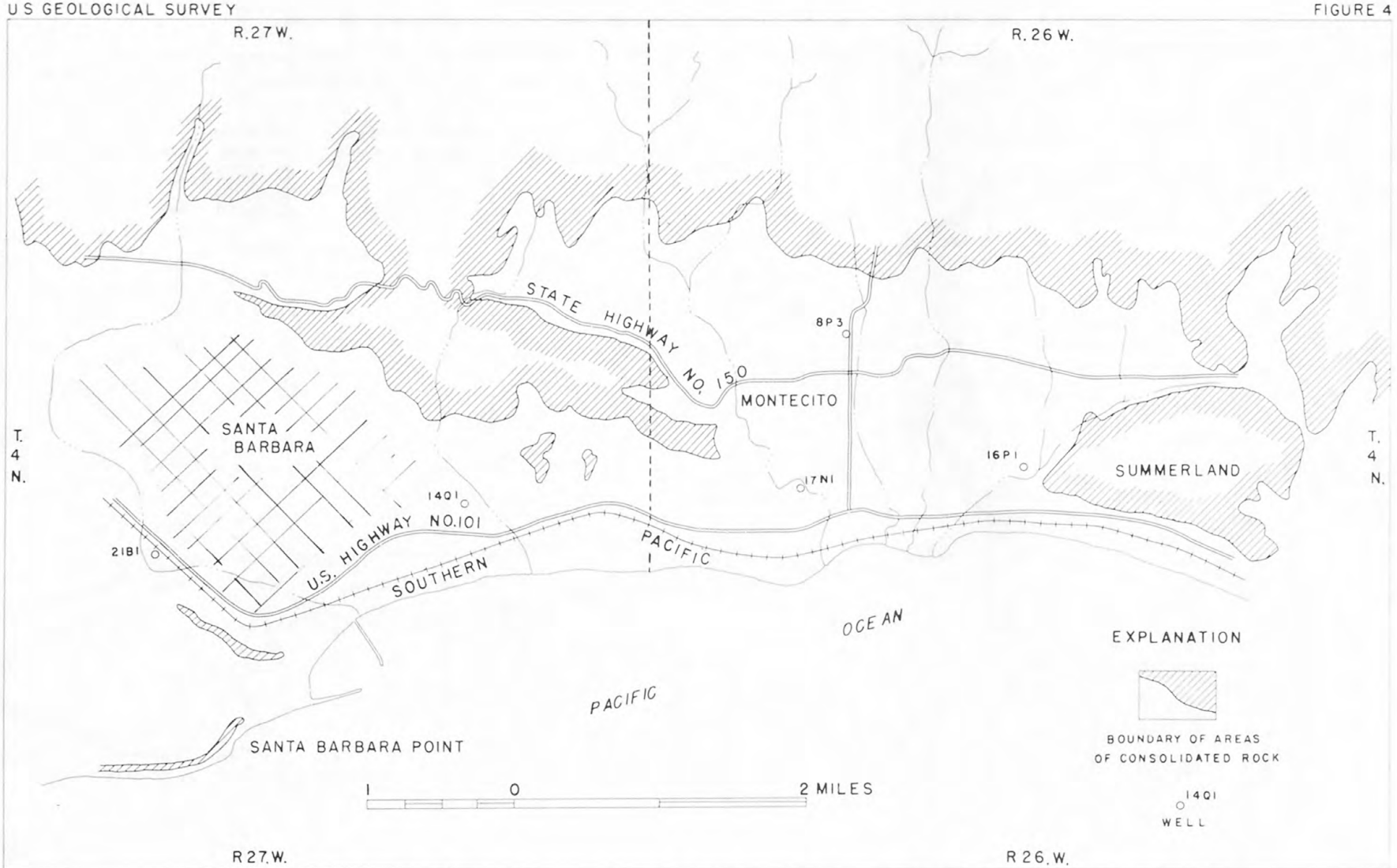
FIGURE 3



MAP OF CARPINTERIA BASIN SHOWING LOCATION OF OBSERVATION WELLS, 1963

U S GEOLOGICAL SURVEY

FIGURE 4



MAP OF SANTA BARBARA-SUMMERLAND BASIN SHOWING LOCATION OF OBSERVATION WELLS, 1963

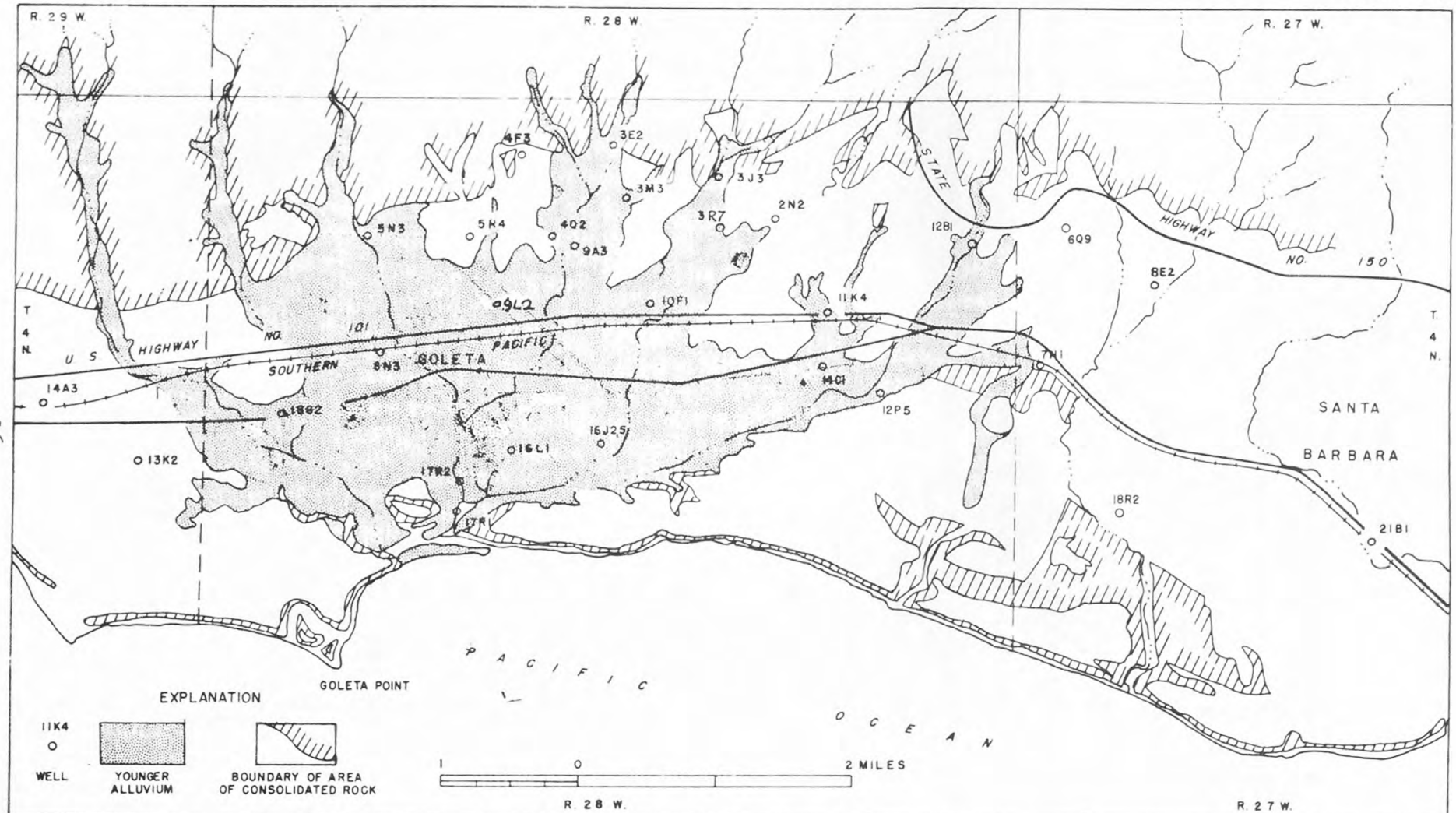
Goleta Basin

A general rise in water levels in the Goleta Basin reflects the reduction of withdrawals of ground water as water from Cachuma reservoir is imported to the basin.

In the area of confined ground water--almost all the central alluvial plain of the Goleta Basin--water levels in the spring of 1963 averaged about 3 feet higher than in the spring of 1962. Within the recharge area along the base of the foothills, water levels in the spring of 1963 ranged from about 6 feet higher to 3 feet lower than in the spring of 1962, and averaged about 2 feet higher. In a hydrologically separate area in the western end of the basin, the water levels rose an average of 3 feet from the spring of 1962 to the spring of 1963.

The hydrograph of well 4N/28W-17R2 shows water-level fluctuations in the area of confined water, and the hydrograph of well 4N/28W-9A3 shows water-level fluctuations in the area of recharge (fig. 2-A). Figure 5 shows the location of observation wells in the Goleta Basin. Analyses of water from selected wells along the coast in this basin showed no increase in chloride concentration from 1962 to 1963.

FIGURE 5



MAP OF GOLETA BASIN SHOWING LOCATION OF OBSERVATION WELLS, 1963

Ellwood-Gaviota Area

In 1963 the U.S. Geological Survey began measuring water levels in 11 observation wells in the Ellwood-Gaviota area. No prior water-level measurements are available for comparison to determine changes.

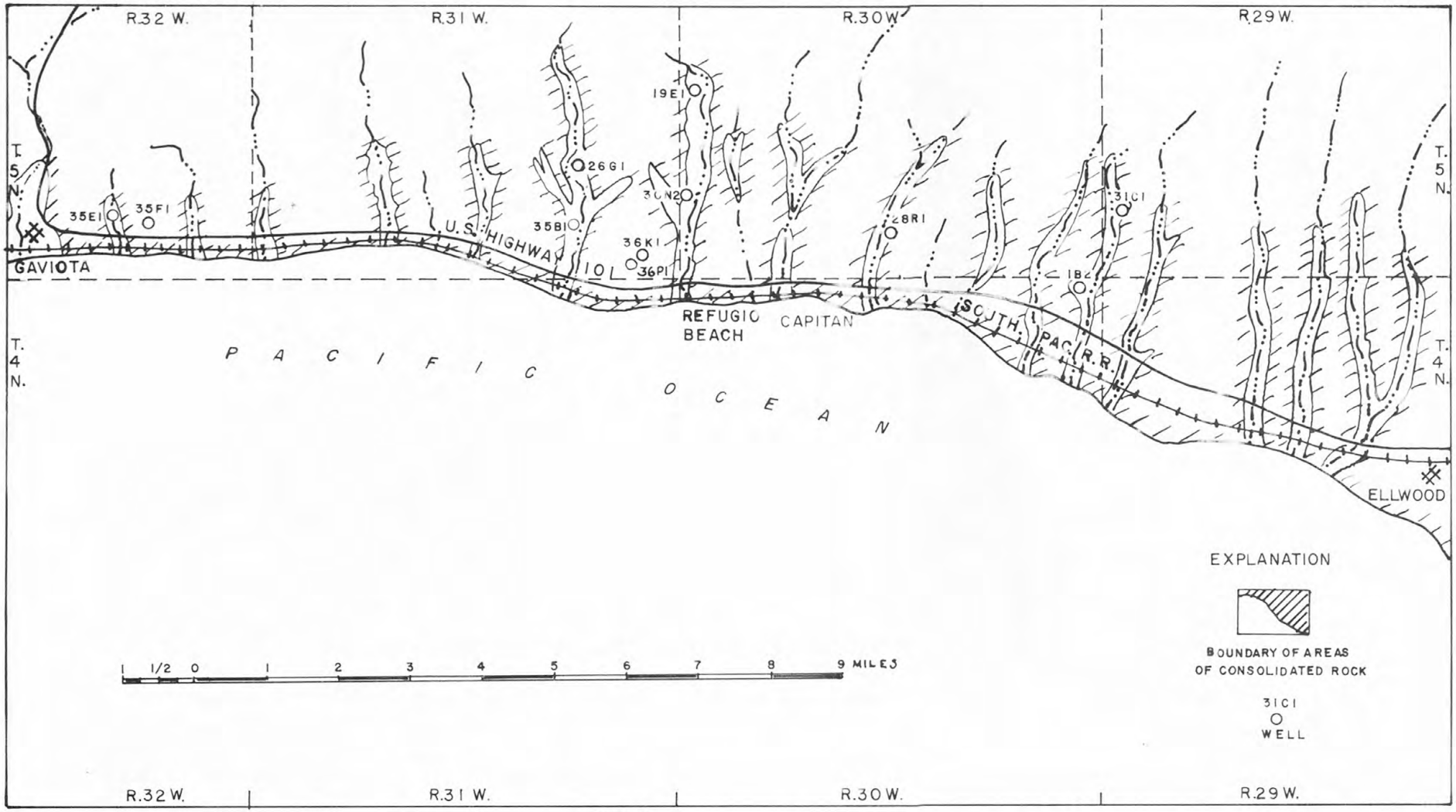
Figure 6 shows the location of observation wells in the Ellwood-Gaviota area.

Santa Ynez River Valley

For this report the Santa Ynez River valley is divided into three areas: The Lompoc plain, the alluvial deposits between San Lucas and Robinson bridges, and the Santa Ynez upland.

The areas and the location of wells are shown on two illustrations: Figure 7 shows the location of the wells in the Lompoc plain and in the alluvial deposits adjacent to the river upstream from Robinson bridge to well 6N/33W-11M1; figure 8 shows the location of wells in the alluvial deposits upstream from well 6N/33W-11M1 near Santa Rosa dam site to San Lucas bridge and in the Santa Ynez upland.

FIGURE 6

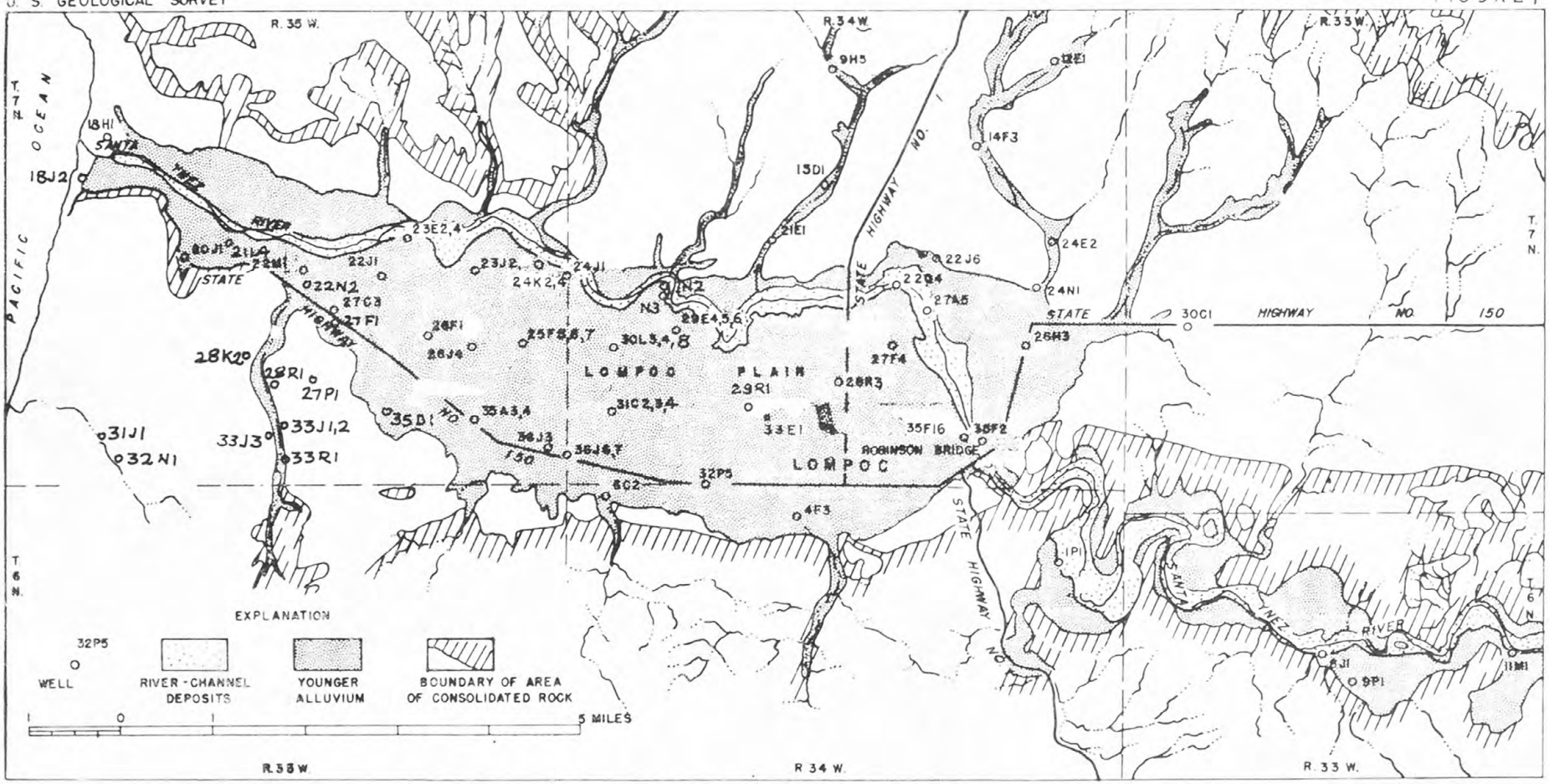


AREA

MAP OF ELLWOOD–GAVIOTA AREA SHOWING LOCATION OF OBSERVATION WELLS, 1963

U. S. GEOLOGICAL SURVEY

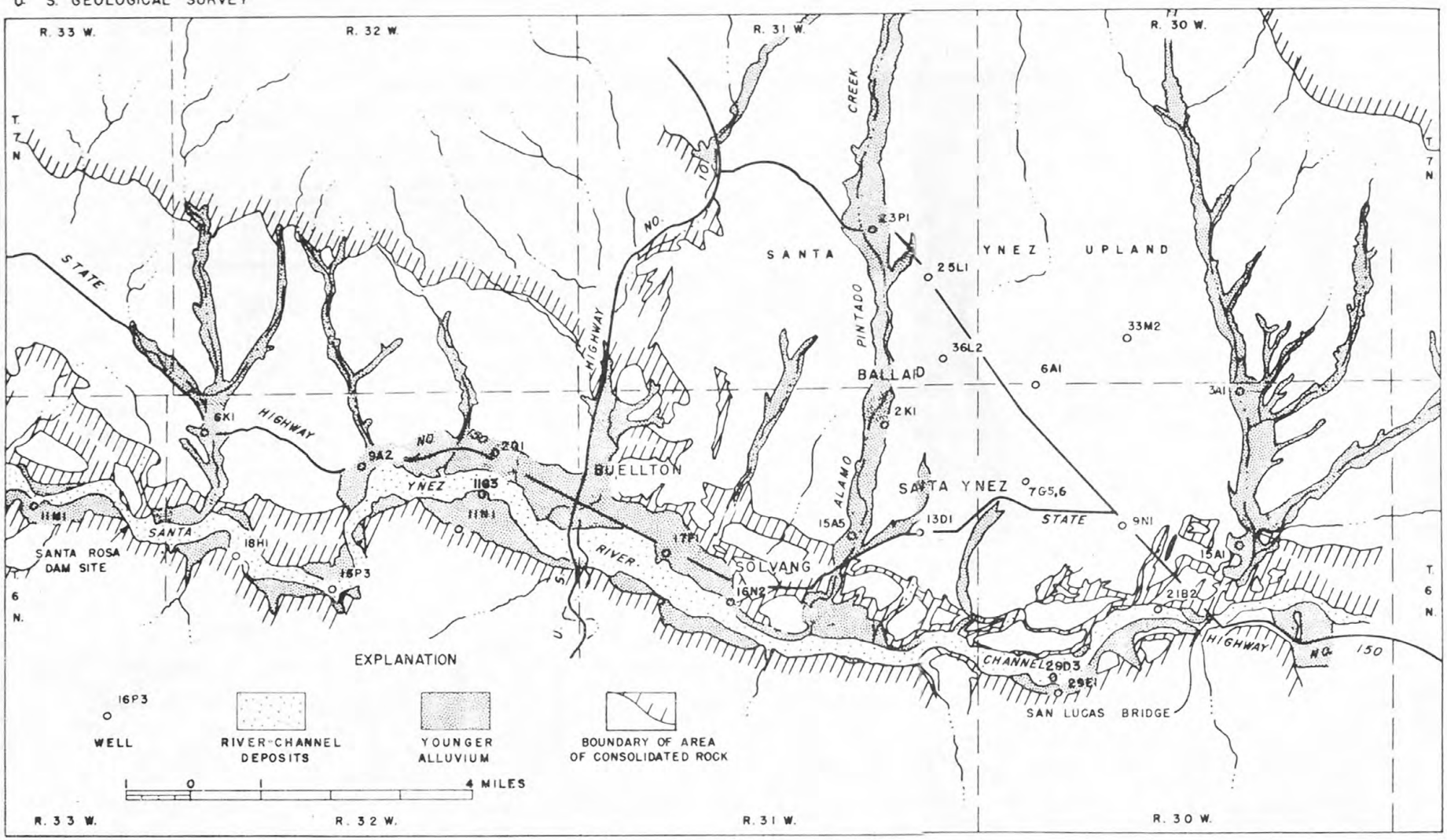
FIGURE 7



MAP OF LOMPOC PLAIN AND VICINITY SHOWING LOCATION OF OBSERVATION WELLS, 1963

U. S. GEOLOGICAL SURVEY

FIGURE 8



MAP OF SANTA YNEZ UPLAND AND ALLUVIAL DEPOSITS BETWEEN SAN LUCAS BRIDGE AND SANTA ROSA DAM SITE SHOWING LOCATION OF OBSERVATION WELLS, 1963

Lompoc Plain

Water levels in the Lompoc plain were lower in the spring of 1963 than in the spring of 1962. The average decline in water levels in the recharge area at the eastern end and in the area at the southern end of the plain was about 1 foot. In the area of confined water in the western part of the plain the water-level decline averaged about 2 feet.

The hydrograph of well 7N/35W-26J4 (fig. 2-A) shows water-level fluctuations in the area of confined water, and the hydrograph of well 7N/34W-27F4 (fig. 2-A) shows fluctuations in the area of recharge.

Chemical analyses of water samples for the determination of chloride concentration as an indication of sea-water intrusion showed no increase in chloride in 1963. The chloride concentration in water from wells near the ocean has not changed significantly during the 22 years of record.

Alluvial Deposits Between San Lucas and Robinson Bridges

Water levels in wells near the Santa Ynez River between San Lucas and Robinson bridges declined an average of 2 feet from the spring of 1962 to the spring of 1963.

Santa Ynez Upland

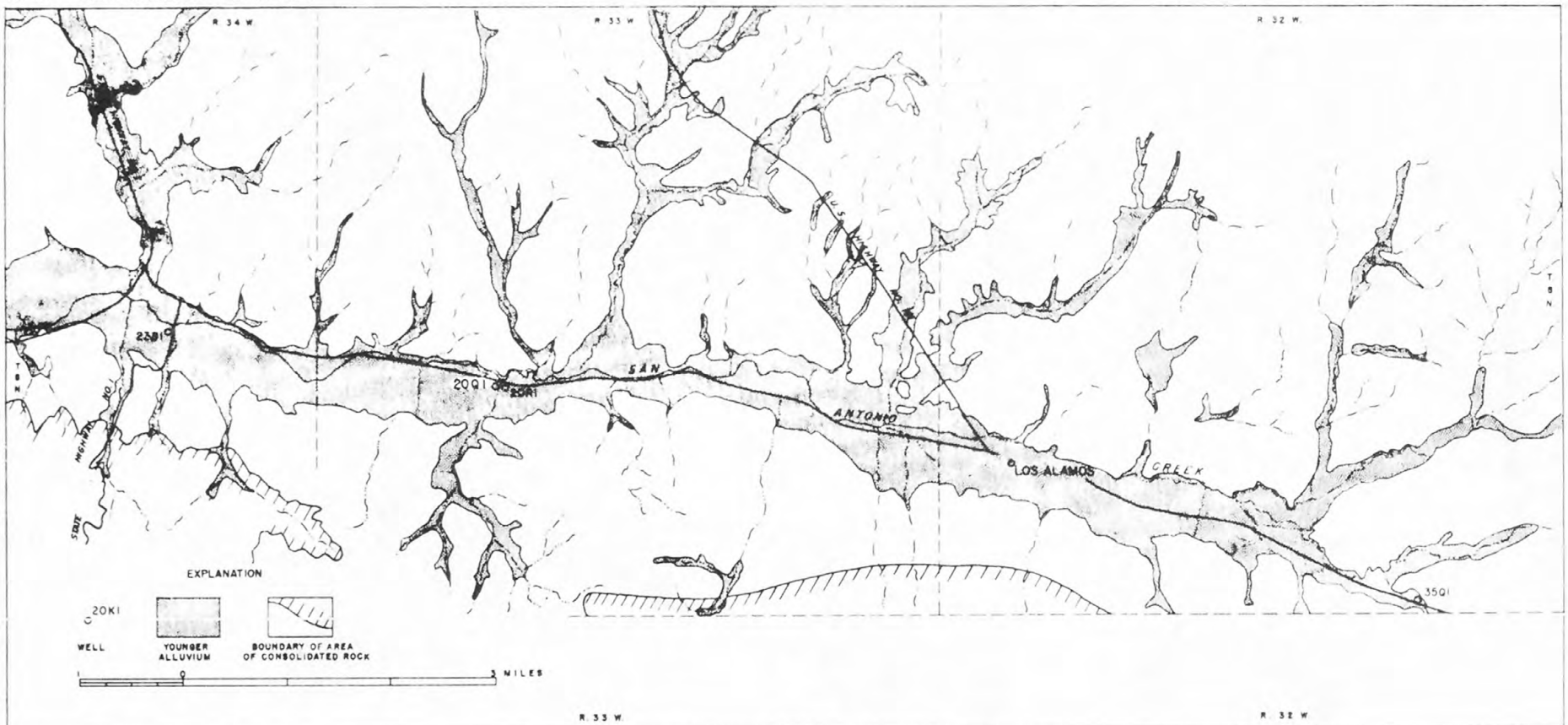
Water levels in the observation wells in the Santa Ynez upland (fig. 8) declined an average of about 1 foot from the spring of 1962 to the spring of 1963. Net changes in water levels ranged from 28 feet above to 15 feet below the levels in the spring of 1962. The hydrograph of well 6N/30W-6A1 (fig. 2-A), representative for the upland, shows a water-level decline of less than 1 foot from the spring of 1962 to the spring of 1963. Water levels in the spring of 1963 averaged about 33 feet lower than levels in the spring of 1942.

San Antonio Creek Valley

In general, water levels in wells in the San Antonio Creek valley (fig. 9) declined from the spring of 1962 to the spring of 1963; the average decline was 1 foot.

U. S. GEOLOGICAL SURVEY

FIGURE 9



MAP OF SAN ANTONIO CREEK VALLEY SHOWING LOCATION OF OBSERVATION WELLS, 1963

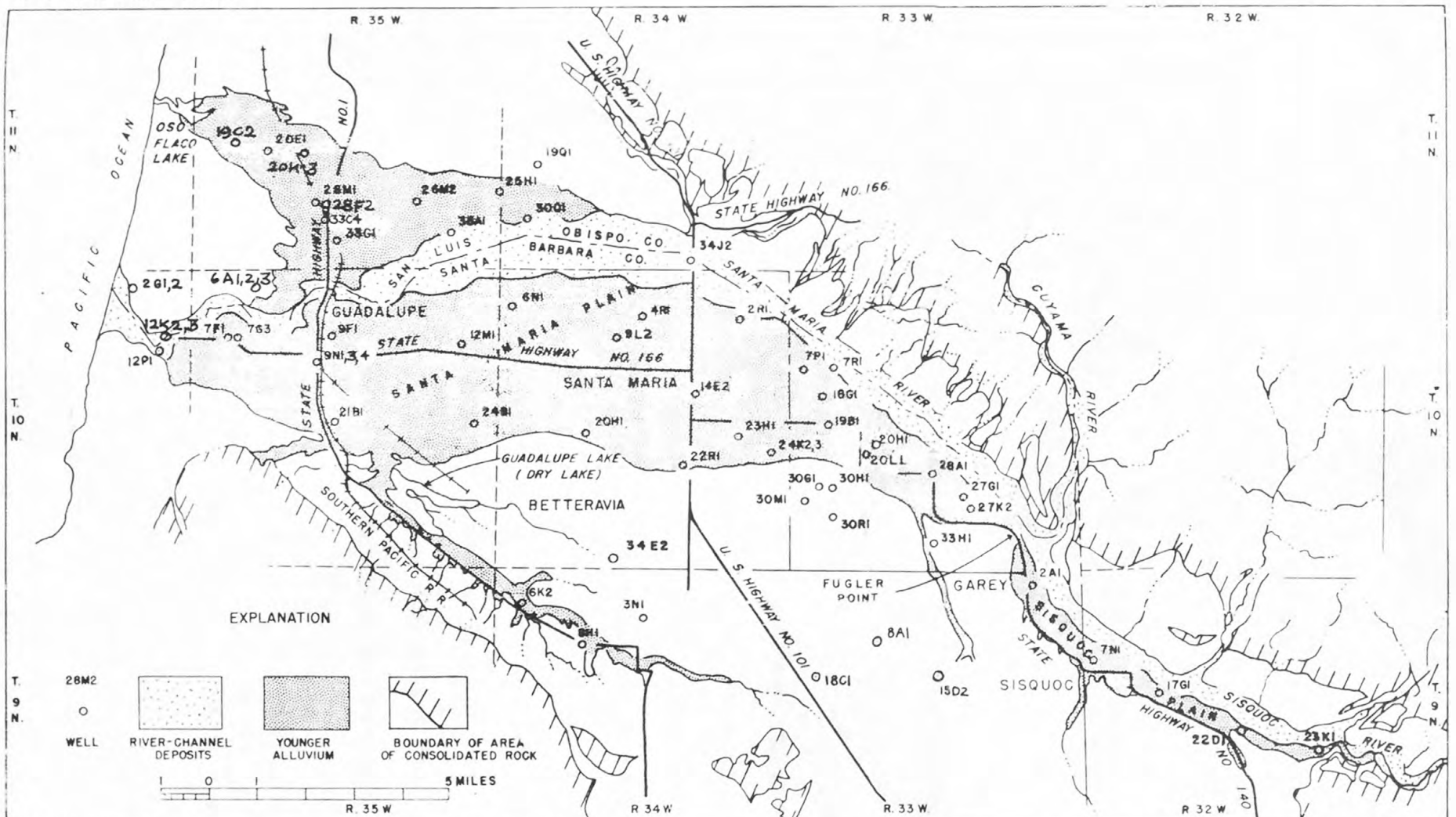
Santa Maria Valley

The Santa Maria Valley area (fig. 10) is the largest agricultural district in Santa Barbara County. It consists of the broad alluvial plain of the Santa Maria River, the elevated terrace areas to the north and south of this plain, and the small alluvial plain of the Sisquoc River.

In the western half of the Santa Maria plain, ground water is confined and water levels showed no change from the spring of 1962 to the spring of 1963. The average water level in this area in the spring of 1963 was about 29 feet lower than the level in the spring of 1942. The hydrograph of well 10N/35W-7F1 (fig. 2-B), which is typical of those of wells at the seaward edge of the area of confined water, shows that water levels have declined about 16 feet since 1942.

In the eastern half, which is the recharge area of the plain, the water levels rose an average of about 1 foot from the spring of 1962 to the spring of 1963. This rise is probably due to the time lag for the movement of water, during the wet year 1961-62, through the alluvial deposits in the basin. Water levels in the recharge area in the spring of 1963 averaged 33 feet lower than in the spring of 1942. The hydrographs of wells 9N/33W-2A1 and 10N/34W-14E2 (fig. 2-B) are typical of wells in the recharge area. Beneath the Sisquoc plain, upstream from Fugler Point, water levels declined an average of about 4 feet for the year.

FIGURE 10



MAP OF SANTA MARIA VALLEY AREA SHOWING LOCATION OF OBSERVATION WELLS, 1963

The chloride content of well water at the western end of the Santa Maria Valley remained virtually the same as in previous years and averaged less than 100 parts per million. Water levels near the coast remained above sea level, and, consequently, there is no immediate threat of sea-water encroachment.

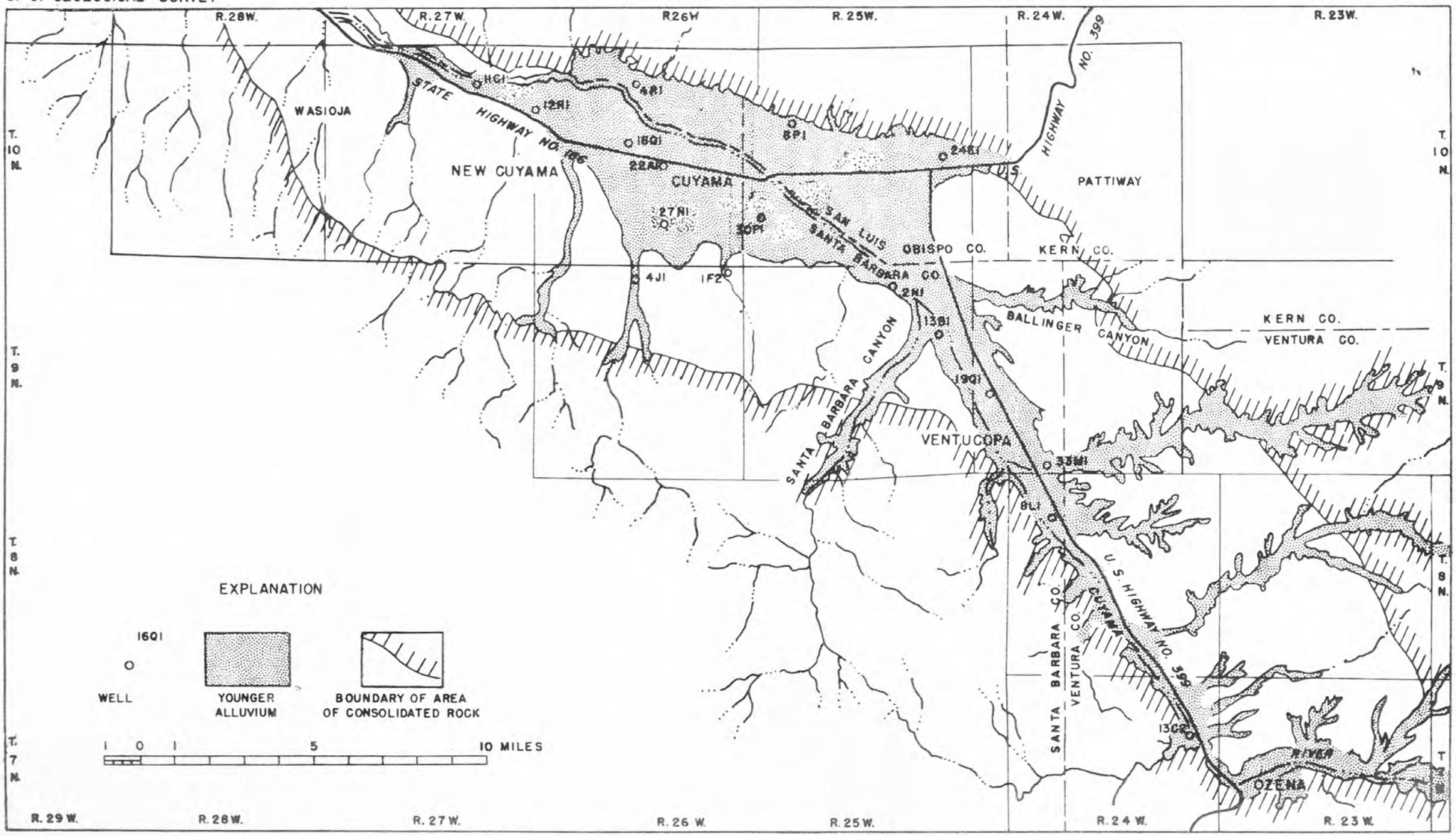
Cuyama Valley

The Cuyama Valley (fig. 11) is a broad semiarid valley in the extreme northeastern part of Santa Barbara County. Prior to 1946 there was no electric power in the valley, and this tended to prevent intensive development of ground water for irrigation. Consequently, water levels in the principal agricultural area near the western end of the valley remained fairly static until large withdrawals began in 1946. The hydrograph for well 10N/25W-30P1 (fig. 2-B) shows a decline in water level because of the increased pumping for irrigation and because of the subnormal precipitation.

Water levels in the Cuyama Valley declined an average of about 3 feet from the spring of 1962 to the spring of 1963. Since 1946, when electric power was brought into the Cuyama Valley, water levels have declined an average of about 38 feet.

U. S. GEOLOGICAL SURVEY

FIGURE 11



MAP OF CUYAMA VALLEY AND VICINITY SHOWING LOCATION OF OBSERVATION WELLS, 1963

SUMMARY

The general downward trend of ground-water levels in most of the valleys of Santa Barbara County in 1962-63 was a result of below-normal precipitation in the winter of 1962-63. However, in the Carpinteria and Goleta Basins this trend is somewhat masked because of the use of surface water impounded in Cachuma reservoir. In the Santa Maria Valley, a rise of water level is the delayed result of recharge of water from the above-average precipitation of 1961-62.

Chemical analyses of water from wells in the coastal basins indicate no significant change in chloride concentration in 1963.

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RECORDS OF WATER LEVELS AND ARTESIAN PRESSURES IN WELLS AND WELL-NUMBERING SYSTEM

Records of water levels and artesian pressures in observation wells in Santa Barbara County are given in table 1 in numerical order and according to their location in the ground-water basins. The well number indicates its location in the rectangular system of subdivision of public land.

For example, in the number 4N/25W-19F4 the part of the number preceding the hyphen indicates the township (T. 4 N.) and range (R. 25 W.), San Bernardino base line and meridian; the digits between the hyphen and the letter indicate the section (sec. 19); and the letter indicates the 40-acre subdivision as shown in the following 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 4N/25W-19F4 is the fourth well to be listed in the SE$\frac{1}{4}$NW$\frac{1}{4}$ sec. 19, T. 4 N., R. 25 W.

Table 1.--WATER LEVELS AND ARTESIAN PRESSURES IN OBSERVATION WELLS

Numbers in parentheses for Area or Basin coincide with the California Department of Water Resources system of classifying hydrologic areas and ground-water basins.

Depths of wells given in whole feet were reported by owners, drillers, or others; depths given in feet and tenths were measured below land-surface datum by the Geological Survey.

Measurements are in feet below or above (+) the described point of reference.

STANDARDIZED FOOTNOTES

a. Well being pumped.

b. Well pumped recently.

c. Nearby well being pumped.

d. Nearby well pumped recently.

e. Estimated.

f. Dry.

g. Measurement by outside agency or person.

h. Automatic water-level recorder charts on file.