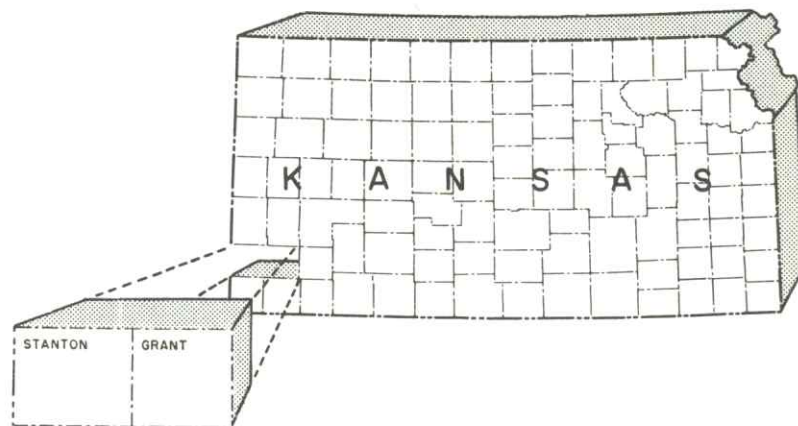


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Water-Level Changes in Grant and Stanton counties, Kansas, 1939-1965

By Carl E. Nuzman
and Walter R. Meyer



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1965

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WATER-LEVEL CHANGES IN GRANT
AND STANTON COUNTIES, KANSAS, 1939-1965

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Walter R. Meyer

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Prepared as part of the cooperative ground-water program in Kansas conducted by the United States Geological Survey, the State Geological Survey of Kansas, the Division of Water Resources of the Kansas State Board of Agriculture, and the Environmental Health Services of the Kansas State Department of Health.

State Geological Survey

The University of Kansas, Lawrence, Kansas

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WATER-LEVEL CHANGES IN GRANT AND STANTON COUNTIES, KANSAS, 1939-1965

by

Carl E. Nuzman* and Walter R. Meyer⁺

INTRODUCTION

This publication is the second in a series of short annual reports designed to present the pertinent data collected during the past year for the information and consideration of all concerned with the ground-water supply in the two-county area. The graphs and illustrations are indicative of the developing water-supply problem in Grant and Stanton counties. These data were collected as part of the cooperative water-resources investigation of Kansas being conducted by the U.S. Geological Survey, the State Geological Survey of Kansas, the Division of Water Resources of the Kansas State Board of Agriculture, and the Environmental Health Services of the Kansas State Department of Health.

Ground-water levels continued to decline through 1964 in most of the 1,260-square-mile area of Grant and Stanton counties. The decline of water level is in response to the use of large quantities of ground water for irrigation. The quantity of water pumped annually continues to be in excess of the natural recharge to the ground-water system (Fader and others, 1964). The difference between the quantity of water discharged and the recharge is derived from ground water in storage in the area and, therefore, the water levels decline.

The amount and distribution of pumping will determine the number of years that irrigation will remain practical in parts of the area. As the use of water from storage continues, the water remaining in storage diminishes.

The nomenclature and classification of the geologic units described in this report are those of the State Geological Survey of Kansas and differ somewhat from the usage adopted by the U.S. Geological Survey.

* Division of Water Resources, Kansas State Board of Agriculture.

⁺ Branch of Ground Water, U.S. Geological Survey.

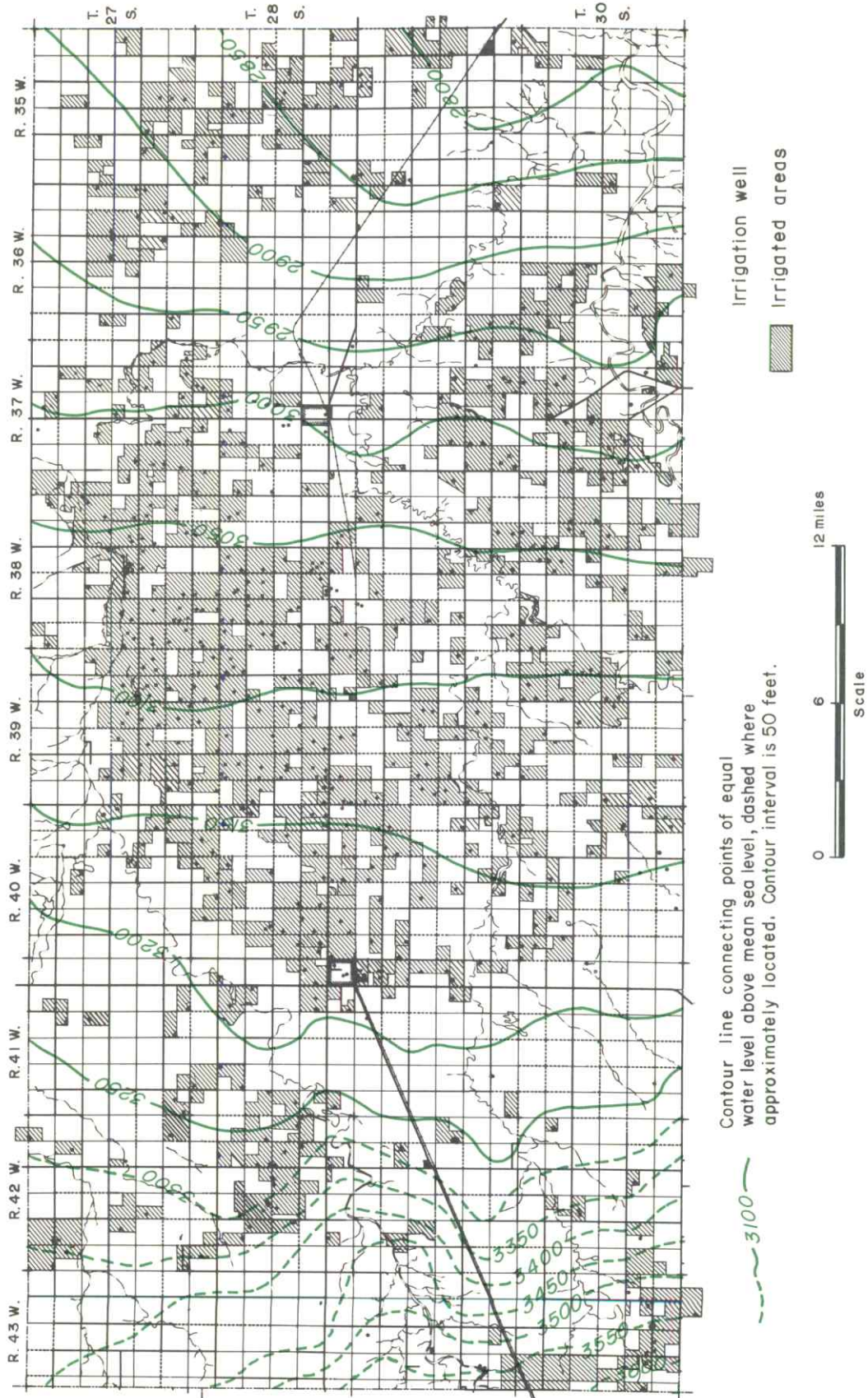


Figure 1.--Map showing irrigated areas as of January 1, 1965, and water-level contours for the base period 1939-42. (Modified after Fader and others, 1964; Latta, 1941; and McLaughlin, 1946.)

INCREASE OF WATER USE

Water-well drilling activity continued in Grant and Stanton counties during 1964. As of January 1965, 90 new wells had been constructed during the preceeding 12 months for an approximate total of 640 irrigation wells in the area. In addition, some new wells were constructed to replace wells with existing water rights. The less-than-average rainfall during 1964 was a significant factor contributing to the increased use of ground water for irrigation in the area.

Most of the wells drilled in the 1950's obtained water from unconsolidated sand and gravel deposits of Neogene age (illustrated on back cover)*. In recent years, a number of wells have been drilled to the Permian rocks, penetrating the Mesozoic sandstones which include the Cheyenne Sandstone and Dockum(?) Group. These deeper wells are constructed so that water is obtained from all significant water-bearing zones below the projected pumping level. On the average an increase in yield of 500 to 700 gallons per minute has been obtained from the aquifers penetrated by the deeper drilling. The deeper wells naturally require larger pumps and power units to take advantage of the additional available yield. The lowering of pumping levels in some localities has required the reconditioning of wells and the changing or adapting of some pumps to maintain original yields.

The locations of wells and irrigated areas in Grant and Stanton counties are shown in Figure 1. This map was adapted from Winslow and others (1964) and modified to include current data on file at the Division of Water Resources of the Kansas State Board of Agriculture. The present authorized annual water use for the two counties is 443,975 acre-feet as of January 1, 1965, an increase of 43,600 acre-feet in 1964. The irrigated area listed on water rights is 208,540 acres, an increase of 17,900 acres during 1964 (Fig. 2).

*For a detailed description of the geology of the area, see Latta (1941), McLaughlin (1946), and Fader and others (1964).

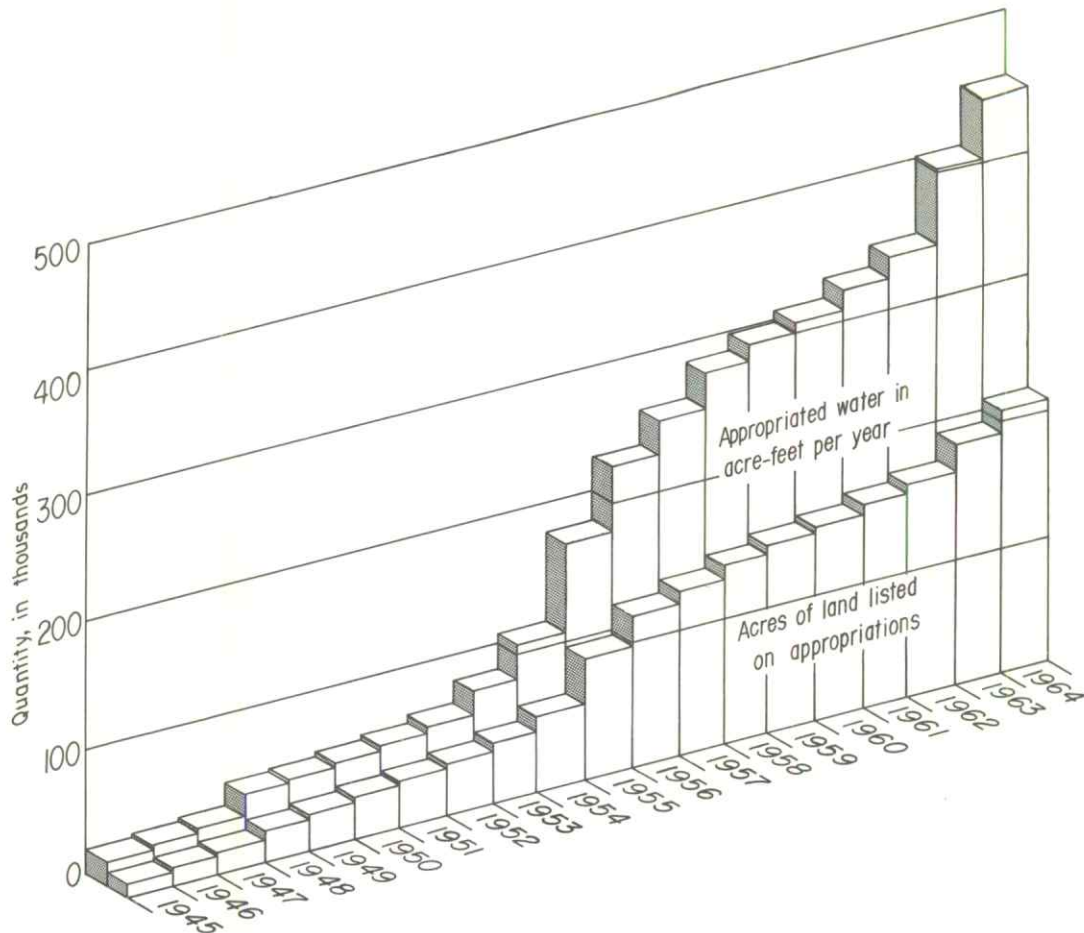


Figure 2.--Increase in irrigation, 1945-64. (Data on file at the Division of Water Resources, Kansas State Board of Agriculture.)

DECLINE OF WATER LEVEL

A compilation of water-level data collected in the period 1939-42 was used to construct the water-level contours shown in Figure 1. The water levels represented on this map are of an equilibrium condition, as there was essentially no pumpage at this time. This water-level map is used as a basis for evaluating changes that have occurred since irrigation commenced.

In 1958, a restudy of Grant and Stanton counties was initiated to evaluate the hydrology of the area (Fader and others, 1964). In 1960 a water-level contour map and a water-level change map were prepared (Broeker and Fishel, 1962, fig. 23).

Water levels generally declined after 1960, as is shown by the hydrographs of wells in Figure 6. In January 1963 an intensive survey of water levels in the two-county area was made and a second water-level change map was prepared (Winslow and others, 1964, fig. 5).

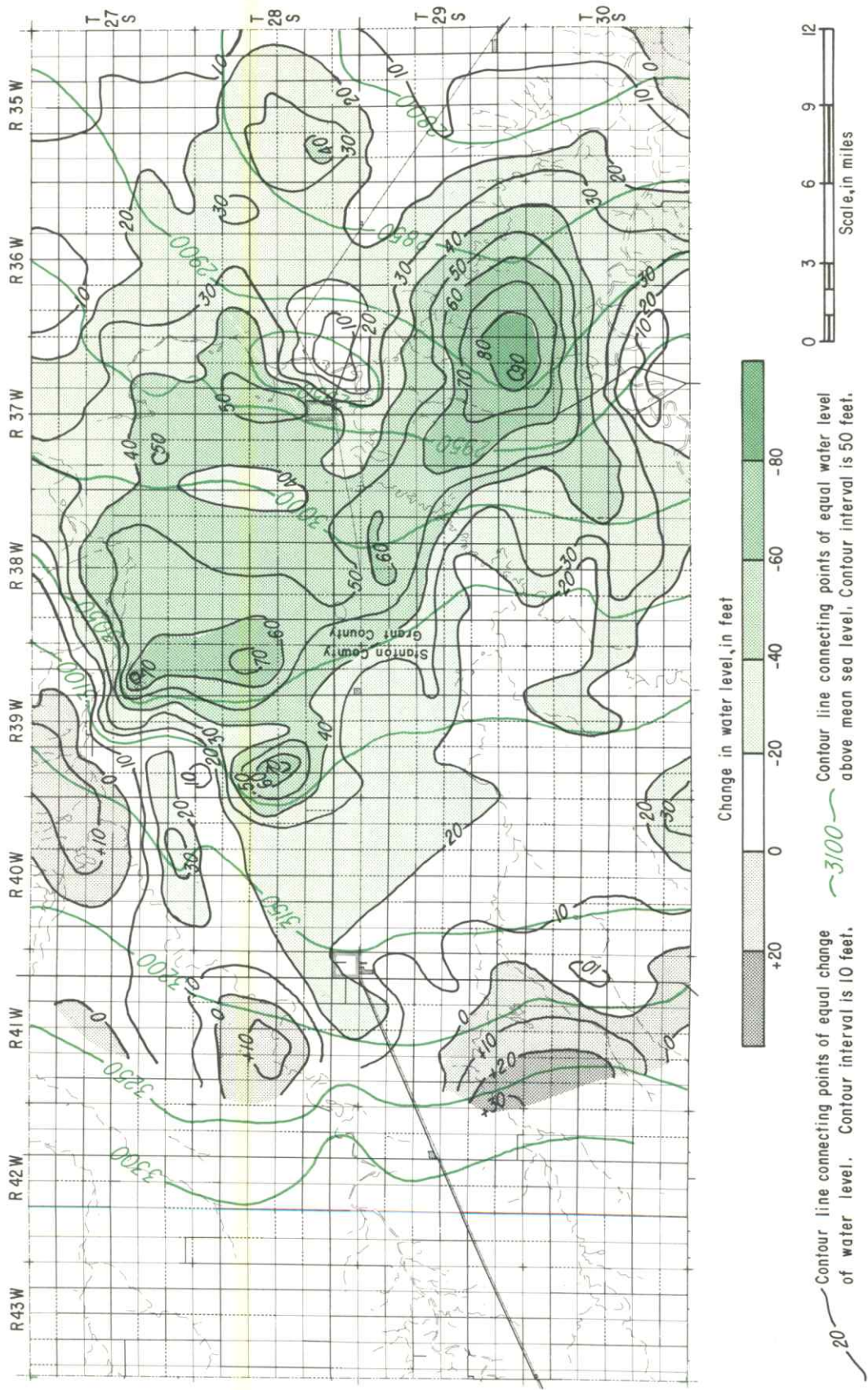


Figure 3. --Map showing lines of equal change in water level between 1939-42 and January 1964, and water-level contours as of January 1964.

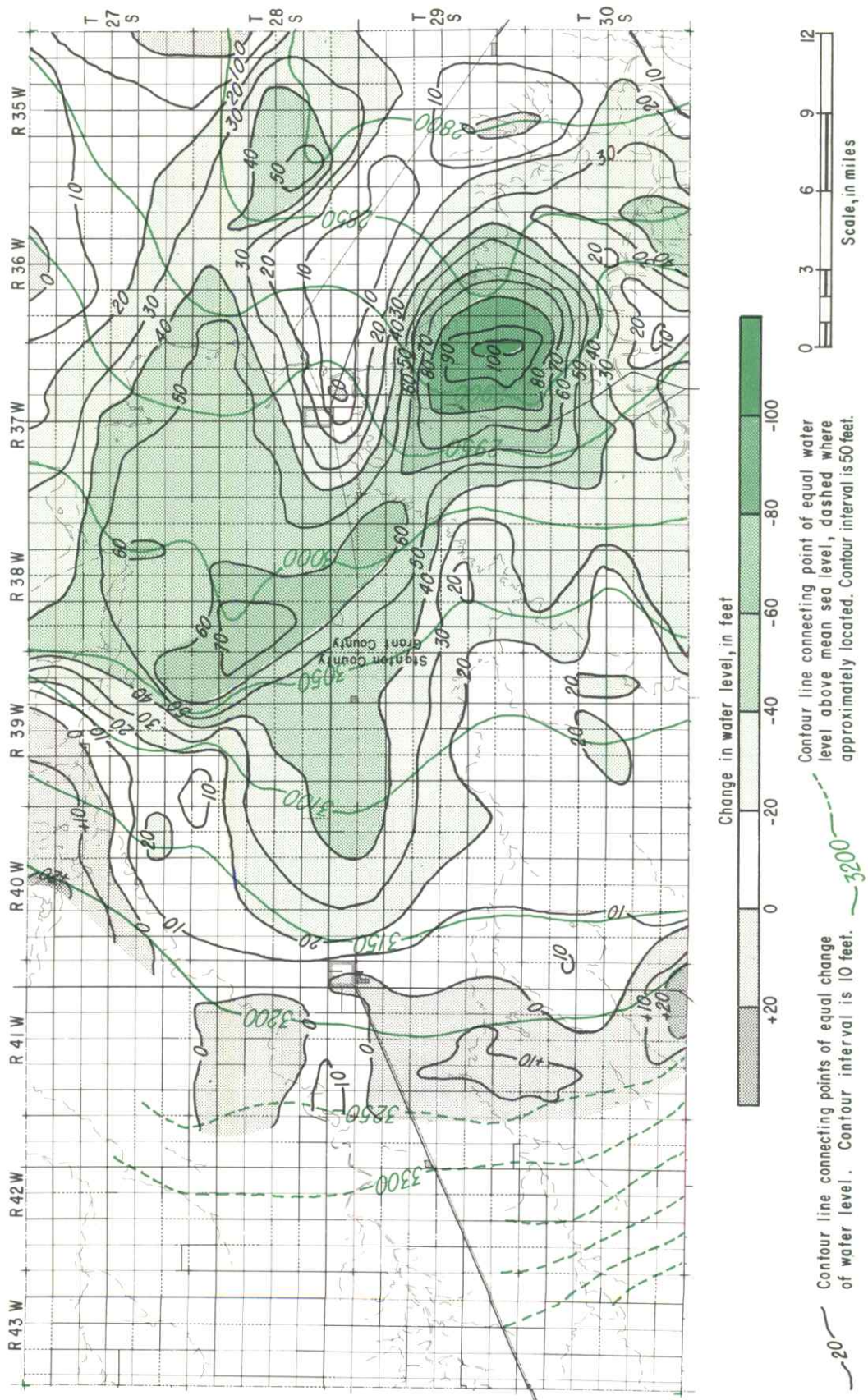


Figure 4. --Map showing lines of equal change in water level between 1939-42 and January 1965, and water-level contours as of January 1965.

The water-levels were measured in approximately 300 wells in the two-county area in January 1964. The resulting water-level contour map with the change in water level from the base period of 1939-42 is shown in Figure 3. In January 1965, 110 selected wells were again measured. The water-level contour map with the change in water level from the base period to January 1965 is shown in Figure 4. The progressive decline of water level below the 1939-42 base period with respect to the area of water-level decline is shown in Figure 5 and Table 1.

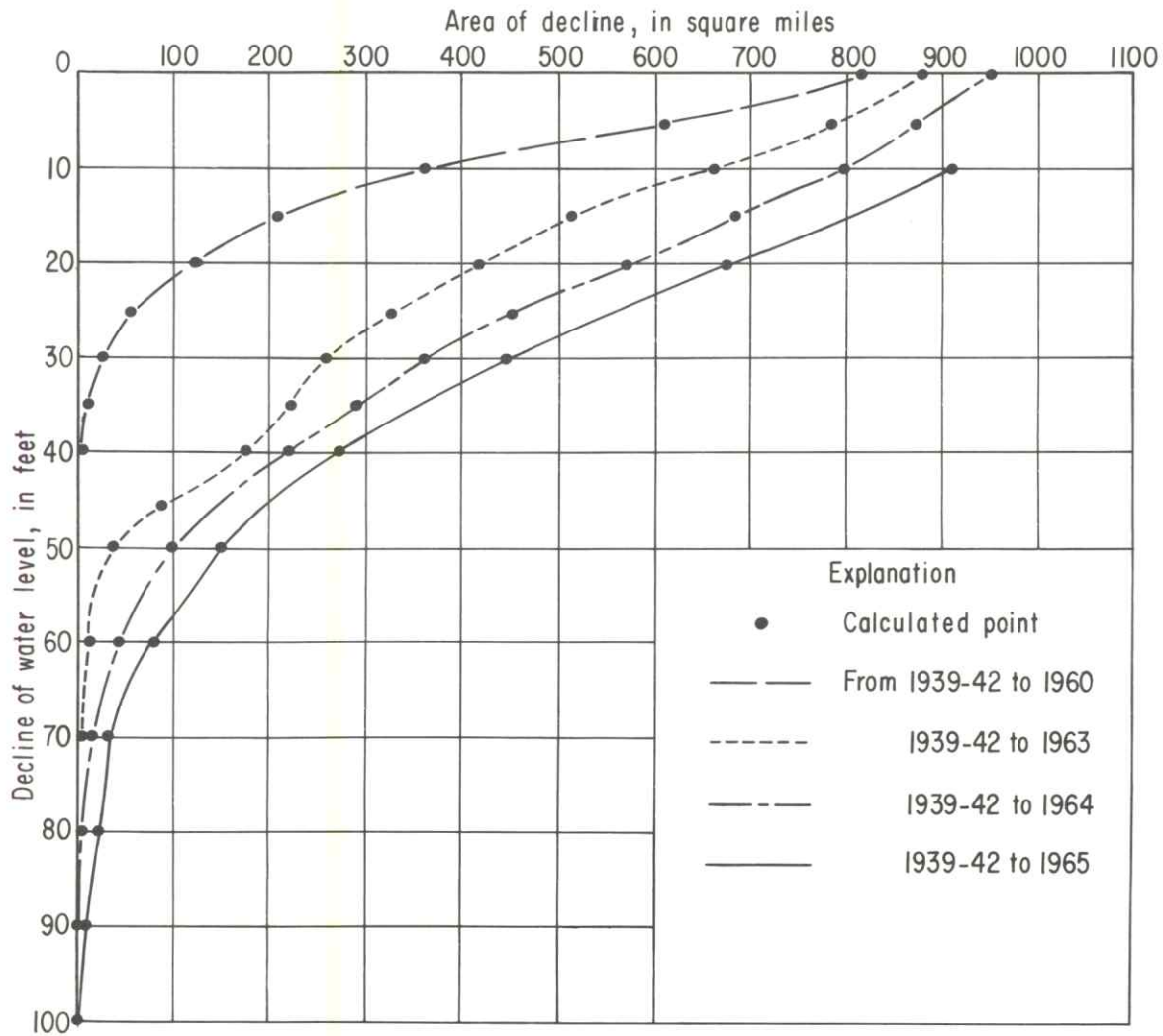


Figure 5.--Areal decline of water levels. (Modified after Fader and others, 1964.)

Table 1.--Area of decline of water level in Grant and Stanton counties, Kansas.

Time interval	Area in which water-level decline exceeded:			
	10 feet,	40 feet,	70 feet,	100 feet.
1939-42 to 1960	350*	3	0	0
1939-42 to 1963	660	170	1	0
1939-42 to 1964	790	220	18	0
1939-42 to 1965	910	270	33	1

*Area, in square miles.

Most of the decline in water level has occurred since 1955, as shown by hydrographs of water levels in specific wells (Broeker and Winslow, 1963). The rate of decline was less in 1958 and 1959 due to near-normal precipitation and to the resulting reduction in pumpage. Since 1960 rainfall has been less than normal in this area, and there has been an increase in use of irrigation water with an expansion of irrigated acres. As a result, the water level had declined an average of $6\frac{1}{2}$ feet from January 1964 to January 1965, and has declined an average of 25 feet since May 1960.

SUMMARY

The trend in water-level decline is illustrated in Figure 6 for the period of record for selected wells in Grant and Stanton counties. The geographical locations of these wells are shown in Figure 7 with the present (January 1, 1965) depth to water below land surface and the change in water level from January 1, 1964 for other wells measured in the counties. The graphs and illustrations in this report indicate that as the use of ground water in Grant and Stanton counties has increased, water levels have declined, and the amount of water remaining in storage has been reduced.

Many new wells and replacement wells have penetrated the Mesozoic sandstones and have obtained 500 to 700 gpm from these consolidated sediments. Some older wells have been reconditioned, and pump design has been changed to maintain original yields. Yields of older wells in the areas of greatest decline have been reduced owing to increase in pumping lift.

Irrigation acreage increased 17,900 acres, and authorized annual use increased 43,600 acre-feet during 1964. The total areal pumpage caused an average decline of $6\frac{1}{2}$ feet in 1964. The average decline between 1960 and 1965 was 25 feet.

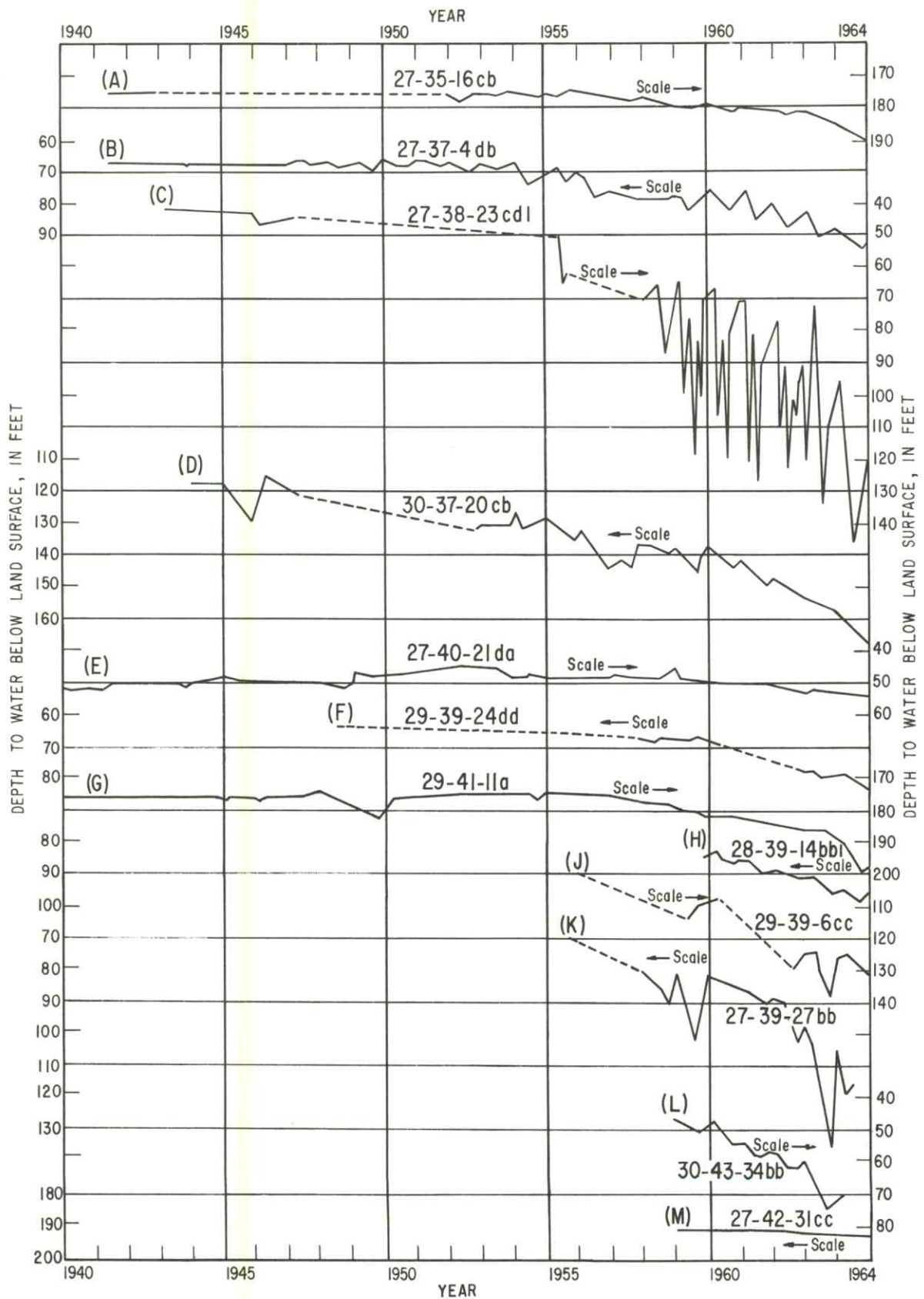


Figure 6.--Hydrographs of water-level fluctuations in selected wells in Grant and Stanton counties, Kansas.

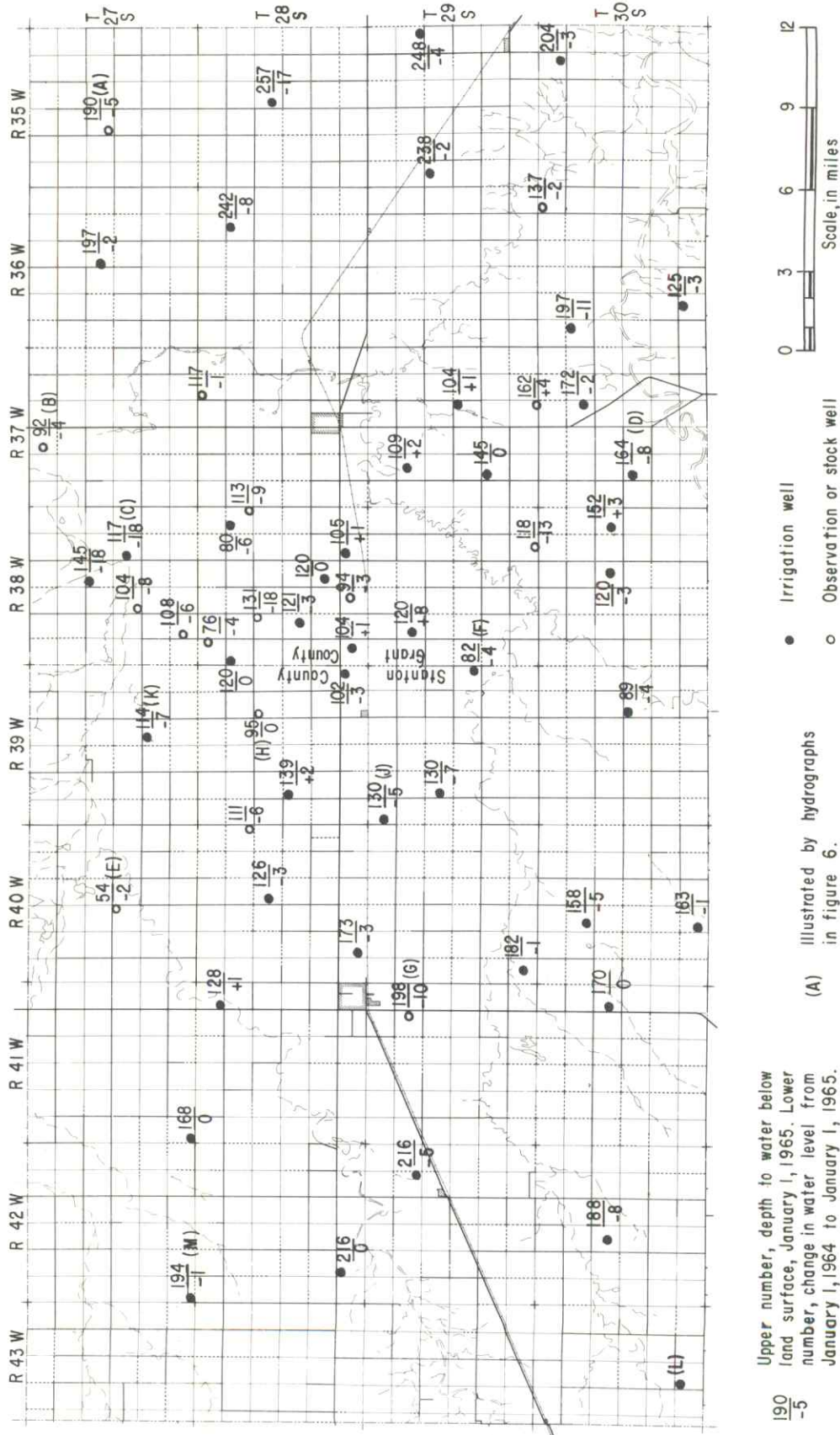
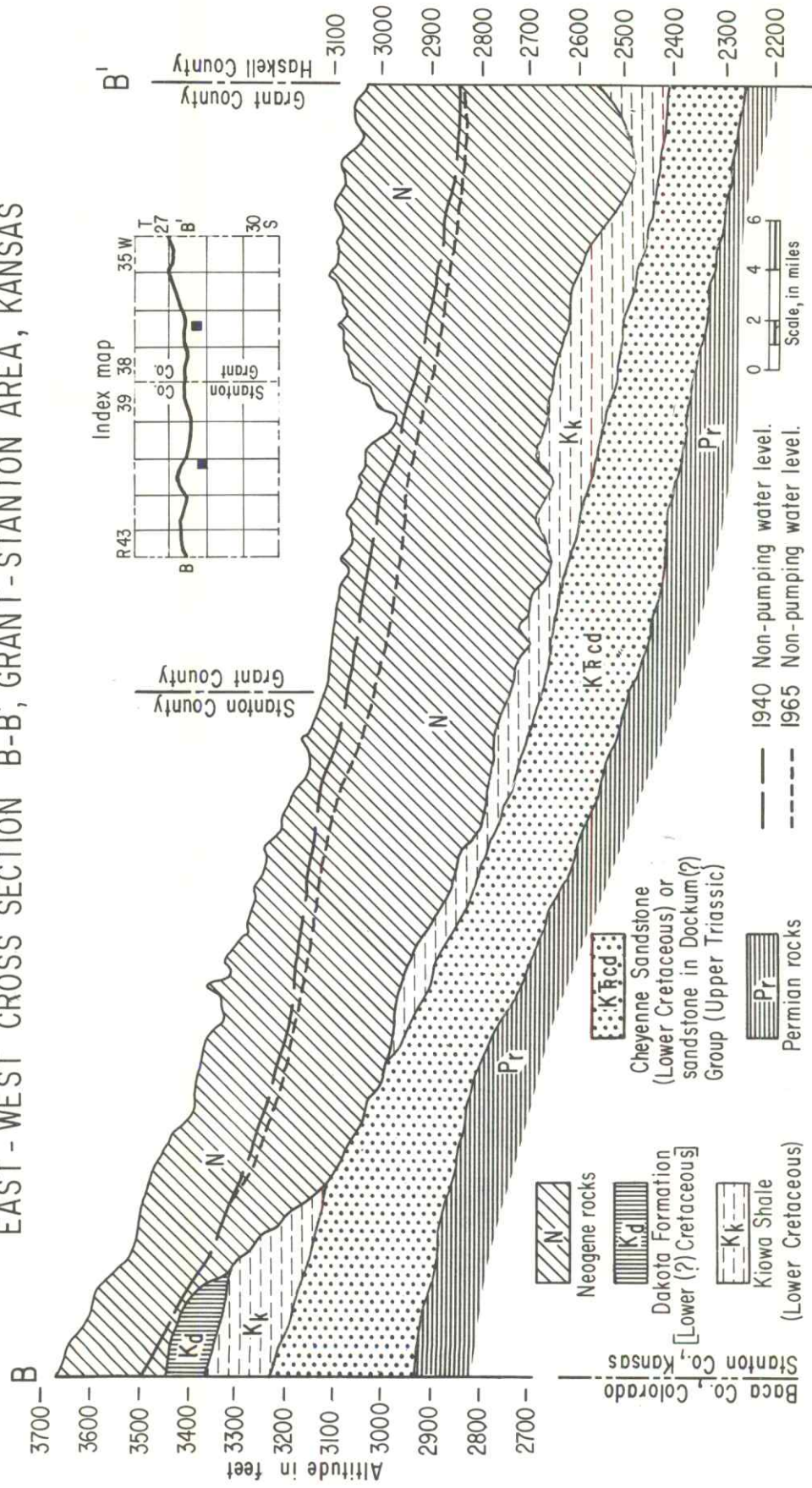


Figure 7.--Map of Grant and Stanton counties, Kansas, showing the location of selected wells and depth to water below land surface.

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EAST - WEST CROSS SECTION B-B', GRANT-STANTON AREA, KANSAS



Geologic cross section B-B', Grant and Stanton counties, Kansas. (Modified after Fader and others, 1964.)