STATE OF ARKANSAS

ARKANSAS GEOLOGICAL COMMISSION

Norman F. Williams, State Geologist

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GROUND-WATER LEVELS IN DEPOSITS OF QUATERNARY AND TERTIARY AGE, SPRING 1965

By

Donald R. Albin, J. W. Stephens, and Joe Edds

U.S. Geological Survey

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Introduction

This report has been prepared to show the configuration of the water table in deposits of Quaternary age and of the piezometric surface in wells screened in the Sparta Sand as of spring 1965. The report results from a Statewide program of water-resources investigations conducted by the U.S. Geological Survey in cooperation with the Arkansas Geological Commission and the University of Arkansas Agricultural Experiment Station. Water levels were measured in 208 wells screened in deposits of Quaternary age and in 75 wells screened in the Sparta Sand of Tertiary age. The map showing Quaternary water levels is compared to a similar map for spring 1961 modified from a report by Plebuch (1962).

The authors wish to thank the many landowners and municipal officials who permit use of their wells for observation of water-level fluctuations. The authors are especially indebted to Professor Kyle Engler, Department of Agricultural Engineering, University of Arkansas, for his participation in the collection of data for this report.

Water levels in deposits of Quaternary age

Deposits of Quaternary age cover most of eastern Arkansas and attain thicknesses as great as 200 feet. The deposits generally contain a basal gravel or coarse sand that is the principal source of water to irrigation wells in the area. Water levels in wells screened in the deposits fluctuate primarily in response to changes in the rate of natural recharge and discharge and in response to irrigation pumpage. As a result, water levels generally are highest in spring when precipitation is greatest and before evapotranspiration by plants and pumpage for irrigation have begun.

Figures 1 and 2 show the configuration of the water table in spring 1961 and 1965. In general, the water table slopes southward from altitudes of about 280 feet above sea level in the northern part of the area to altitudes of about 100 feet in the southern part. The most noteworthy feature is the large cone of depression in Lonoke, Prairie, and Arkansas Counties, that has been caused by pumpage of water for irrigation. The cone of depression has been discussed in reports by Engler and others (1945), Counts and Engler (1954), and Plebuch (1962). Comparison of the figures indicates that the cone is not as deep in 1965 as it was in 1961 when water levels in two small areas declined below the 100-foot contour. However, in 1965, the influence of the cone extended over a greater area as evidenced by the northward shifting on the 160- and 180-foot contours.

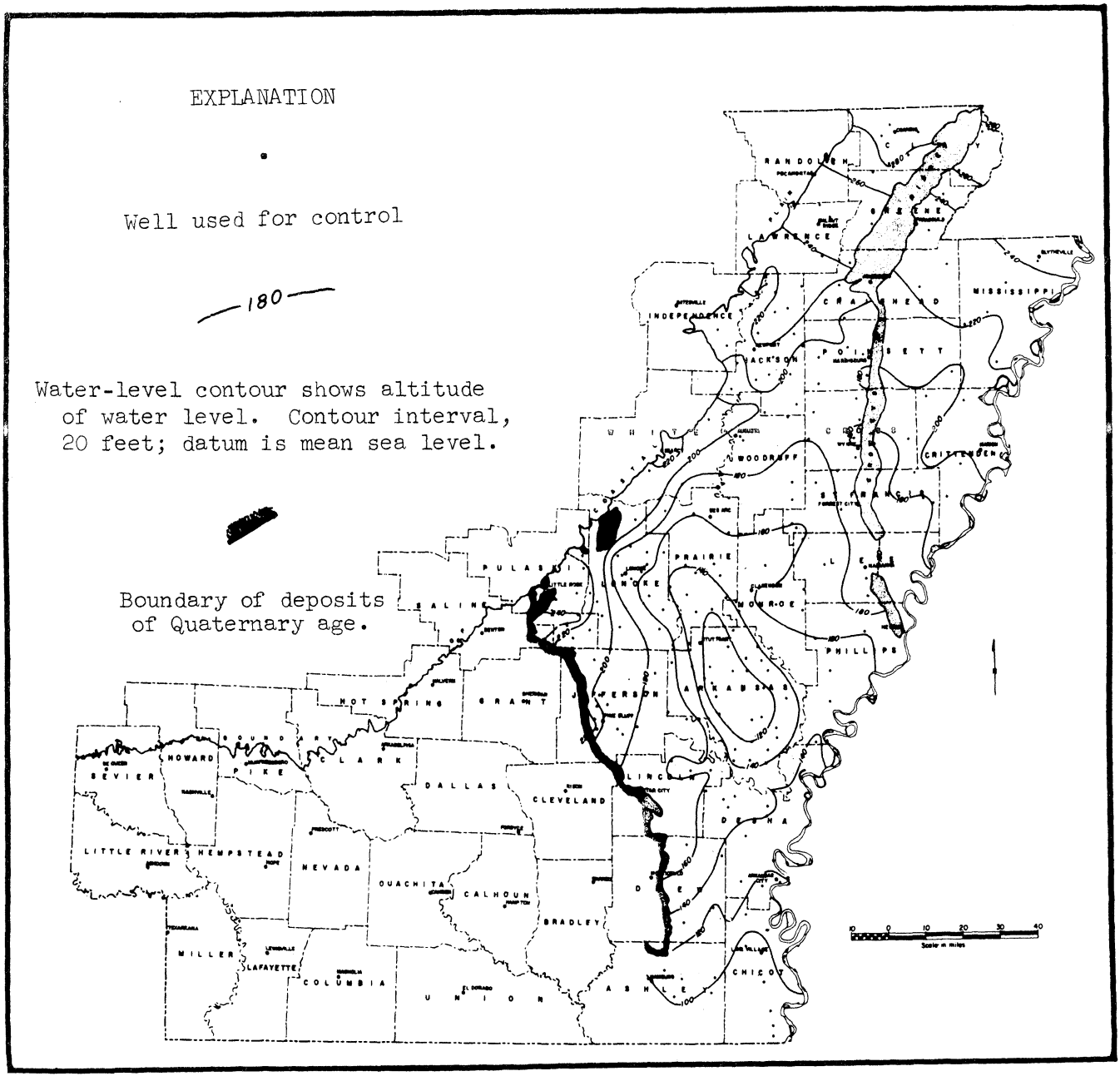

Figure 1.— Water levels in deposits of Quaternary age, spring 1965.

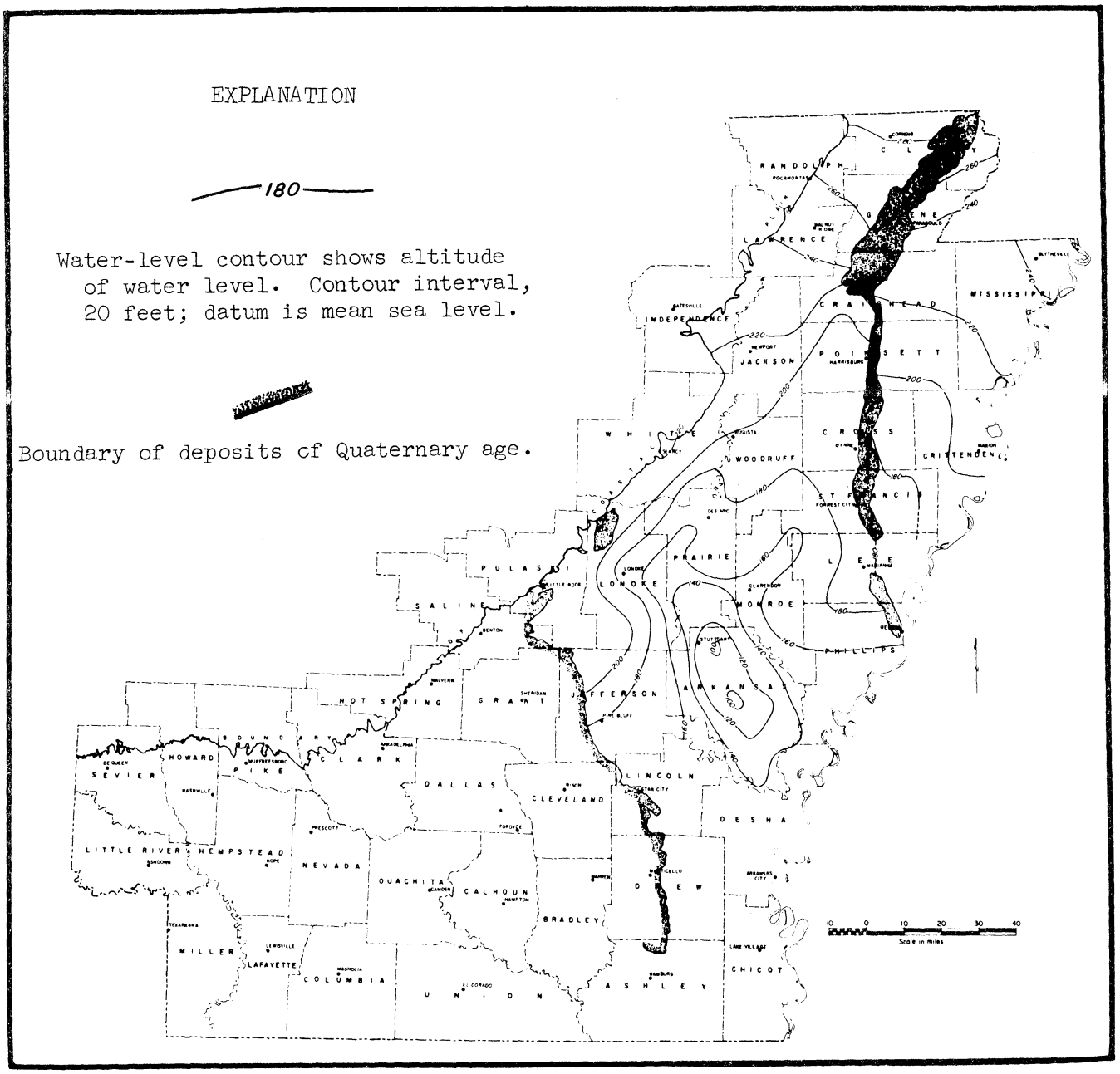

Figure 2.— Water levels in deposits of Quaternary age, spring 1961. (Modified after Plebuch, 1962.)

Other significant features of the maps are (1) the Mississippi River was effluent in spring 1961--the alluvial deposits were contributing water to the stream--whereas it was influent in spring 1965, (2) the change in configuration of the 200- and 220-foot contours in Jackson County from 1961-65 probably reflects increased irrigation pumpage in the western part of the county, and (3) minor cones of depression apparently have formed in Lincoln County and adjacent to the west side of Crowleys Ridge in Cross and Poinsett Counties. Overall, however, there has been little change in water levels in the Quaternary aquifer since 1961, indicating little change in the amount of ground water in storage.

Water levels in the Sparta Sand of Tertiary age

The Sparta Sand of Tertiary age is the principal source of water for municipal- and industrial-supply wells in southeast Arkansas. The formation is as much as 800 feet thick and dips eastward to depths as great as 1,000 feet below land surface. Water levels in wells screened in the Sparta Sand fluctuate primarily in response to changes in the rate of natural recharge and discharge and to pumpage for industrial-supply wells. Figure 3 shows the configuration of the piezometric surface in spring 1965. Water in the formation moves downdip from the outcrop area into cones of depression that have developed near Pine Bluff, El Dorado, and Magnolia.

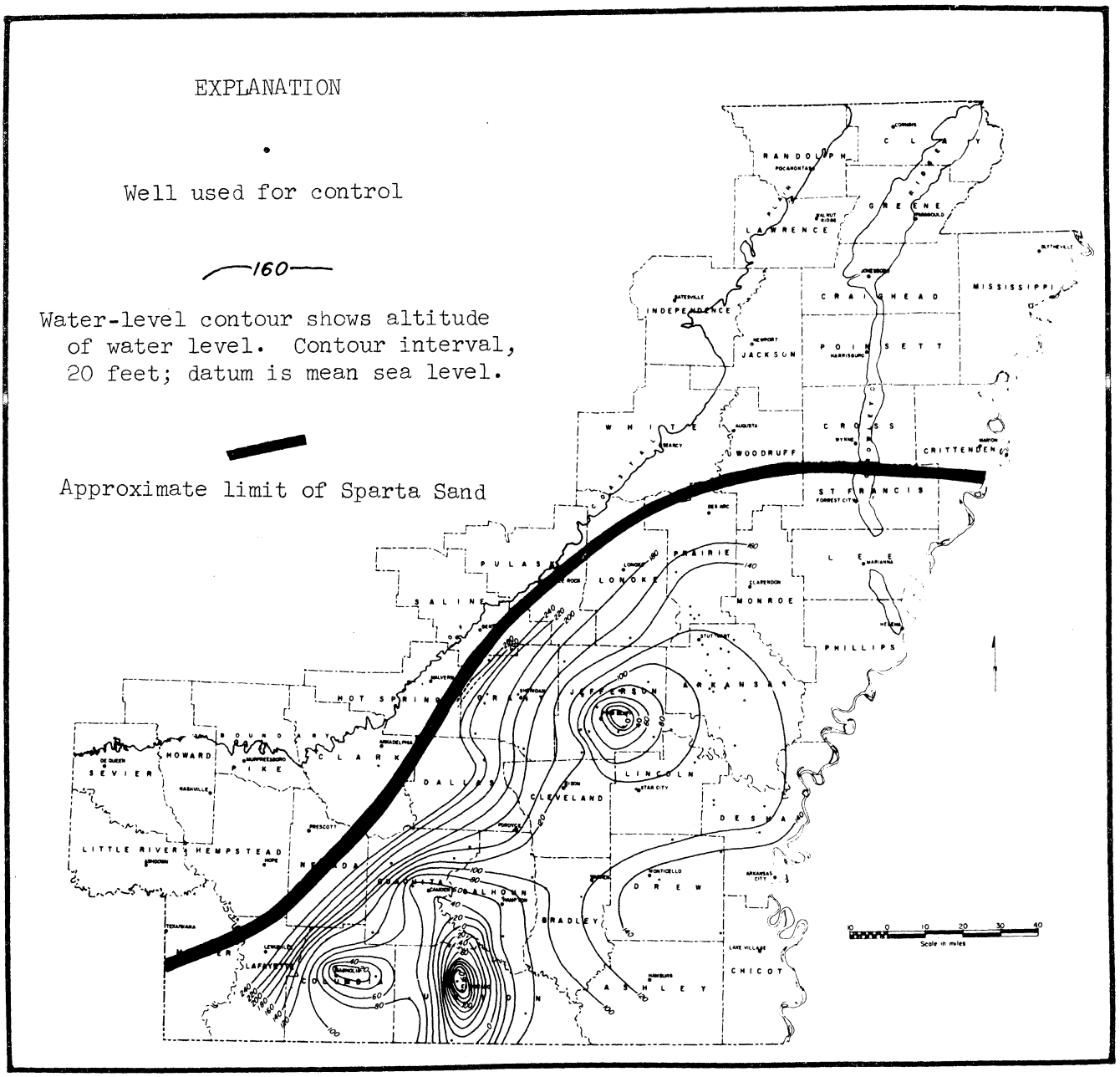

Figure 3.- Water levels in the Sparta Sand, spring 1965.

The principal development of the cone of depression at Pine Bluff has occurred since 1958, when pumpage for industrial use was greatly increased (Bedinger, Stephens, and Edds, 1960, p. 9). The water level in an observation well near the center of the cone has declined about 160 feet since 1958, 23 feet since 1961, and was slightly below sea level in 1965. Although the cone still is deepening and expanding, it is doing so at a progressively slower rate. If total pumpage from the Pine Bluff area remains at about 45 mgd (million gallons per day) the cone should stabilize by 1970.

The drawdown cone near El Dorado also results primarily from pumpage for industrial supply which is estimated to be 30 to 35 mgd. The apex of the cone is 160 feet below sea level, which is considerably lower than the apex of the cone at Pine Bluff. The piezometric surface in wells near the center of the El Dorado cone is at or very near the top of the aquifer. If the cone continues to deepen at the present rate of about 2.5 feet per year, the aquifer soon will be partially dewatered and its ability to yield water to wells will be decreased. Although declining water levels generally result in declining well yields and (or) increased pumping costs, the rate of well-yield decline and pumping-cost rise is increased when the aquifer is dewatered. Therefore, increased pumpage in the El Dorado area should be carefully considered in light of the consequences.

At Magnolia, water levels in the Sparta Sand have declined almost to the top of the aquifer. At the present rate of decline, about 4 feet per year, a significant part of the aquifer will be dewatered by approximately 1970.

References

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