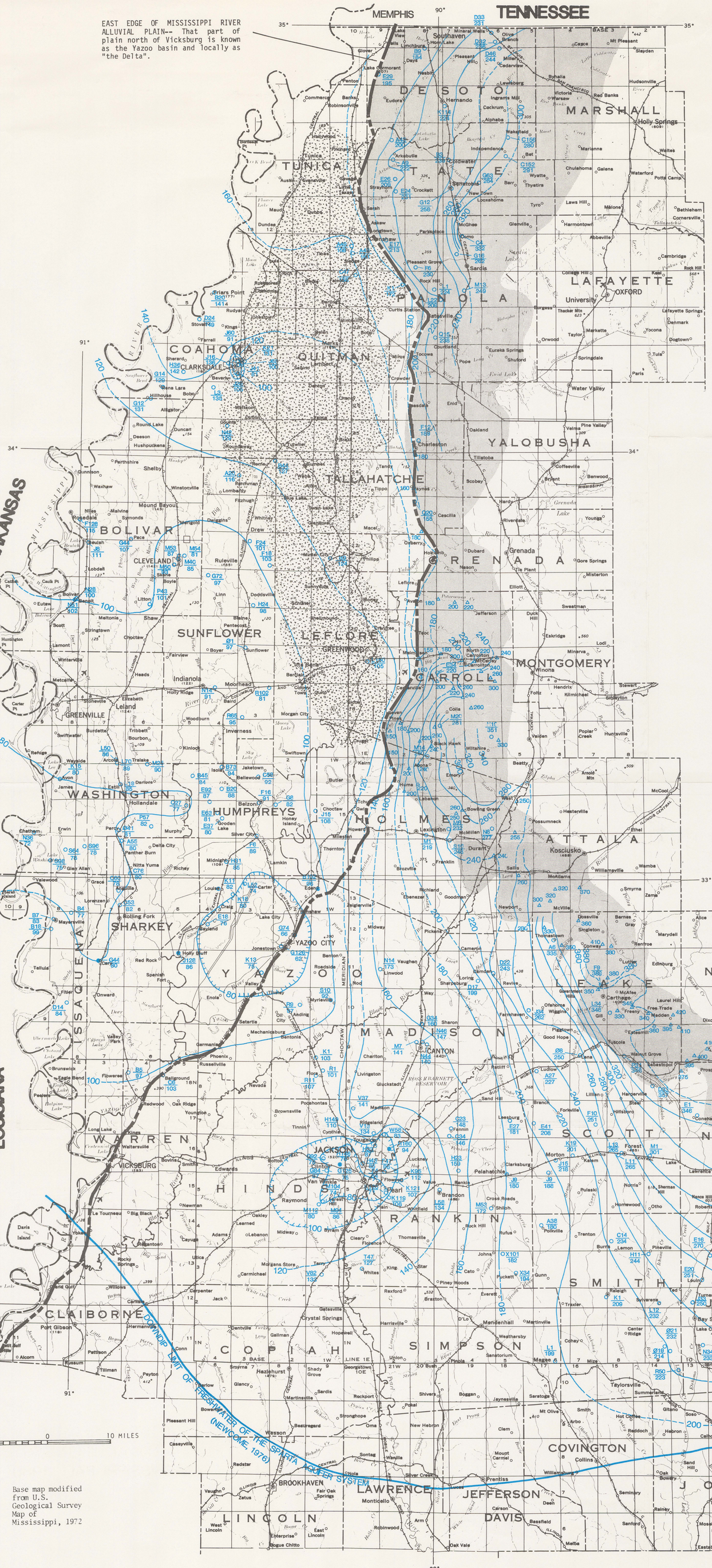
Department of the Interior
United States Geological Survey

Prepared in cooperation with the
Mississippi Department of Natural Resources
Bureau of Land and Water Resources

WATER-RESOURCES INVESTIGATIONS
OPEN-FILE REPORT 81-1051

EAST EDGE OF MISSISSIPPI RIVER ALLUVIAL PLAIN-- That part of plain north of Vicksburg is known as the Yazoo basin and locally as "the Delta".



EXPLANATION

AREA OF OUTCROP OF SPARTA SAND--Modified from Belt and others, 1945. North of Leake County, the Sparta Sand outcrop is mostly covered with a mantle of loess, which may be as much as 75 feet thick in the western edge of the Sparta outcrop and completely missing in areas in the eastern edge of the Sparta outcrop.

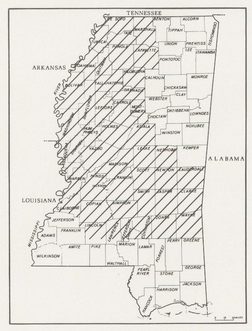
AREA OF SUBCROP OF SPARTA SAND BENEATH THE MISSISSIPPI RIVER VALLEY ALLUVIUM--Generalized after Dalsin (1978b)

160 — POTENTIOMETRIC CONTOUR--Shows altitude at which water level would stand in tightly cased wells. Dashed where approximately located. Contour interval is 20 feet. Datum is National Geodetic Vertical Datum of 1929. Based on measurements of water-level altitudes in wells and on water-surface altitudes of streams in and near outcrop area.

F6 / 88 — OBSERVATION WELL--Upper number is well number, which is alpha-numerical by county. Lower number is altitude of water surface in feet.

B102 / 96 — OBSERVATION WELL FOR WHICH HYDROGRAPH IS SHOWN.

275 — POINT AT WHICH ALTITUDE OF WATER SURFACE IN STREAM DURING THE FALL WAS USED TO DEFINE THE POTENTIOMETRIC SURFACE OF AQUIFER. Number is approximate altitude of water surface in feet.



LOCATION OF STUDY AREA IN MISSISSIPPI

POTENTIOMETRIC MAP OF THE SPARTA AQUIFER SYSTEM IN MISSISSIPPI, FALL, 1980

The potentiometric map of the Sparta aquifer system is the tenth in a series of maps, prepared by the U. S. Geological Survey in cooperation with the Mississippi Department of Natural Resources, Bureau of Land and Water Resources, delineating the potentiometric surfaces of the major aquifers in Mississippi. This map is based on (1) water-level measurements made in 203 wells in Mississippi during the fall of 1980, (2) measurements in 10 observation wells directly across the state line in Arkansas and Tennessee, and (3) water-surface altitudes determined at several points on streams in or near the outcrop area of the aquifer system.

The base of the Sparta Sand of Eocene age dips 20 to 50 feet per mile to the southwest away from the outcrop area. Thickness of the Sparta Sand increases from about 100 feet in Clarke County to about 1,000 feet in Warren County (Newcome, 1976). The Sparta aquifer system consists of sand layers that commonly comprise more than 50 percent of the thickness of the formation. Primary recharge to the aquifer system is from precipitation in the outcrop area. Mineralization of the water increases downdip. The downdip limit of freshwater (less than 1,000 milligrams per liter of dissolved solids) generally is 70 to 100 miles southwest of the outcrop area; however, freshwater extends less than 20 miles from the outcrop area near the Mississippi-Alabama state line.

The Sparta aquifer system commonly consists of thick beds of sand and thinner beds of clay which may be discontinuous. At a site, water levels in these beds of sand generally are within 20 feet of each other unless there is heavy local pumpage from one of the beds of sand.

Thick units of clay that typically overlie and underlie the Sparta aquifer system retard vertical movement of water. The overlying Cook Mountain Formation consists of about 170 feet of clay and limestone in the southern part of the study area, but the formation becomes more sandy and permeable north of Yazoo County. Where the Mississippi River Valley alluvial aquifer overlies beds of sand in the Sparta, as in the area north of Leflore County (see Sparta subcrop on map), the water levels in the two aquifers are at about the same altitude.

The Zilpha Clay, which underlies the Sparta aquifer system, commonly is from 50 to 150 feet thick south of Yazoo County, but northward it thins and disappears. Several of the geologic units in northern Mississippi are sandier than to the south. At Memphis, the Memphis aquifer (Hosman and others, 1968) includes water-bearing zones equivalent to the Sparta aquifer system at the top, the Winona-Tallahatta aquifer in the middle, and the Meridian-upper Wilcox aquifer at the bottom -- all including few or no beds of clay.

Depths of wells completed in the Sparta aquifer system range from less than 100 feet in the outcrop area to about 1,800 feet near the downdip limit of freshwater. Large-diameter wells commonly will yield water at a rate of 500 gallons per minute. The aquifer system is important as a source, or potential source, of water in 38 counties.

In the Sparta outcrop area the potentiometric surface of the Sparta aquifer system is affected by topography, drainage of the aquifer into streams, and recharge from precipitation. The potentiometric surface slopes west to southwest from the outcrop area. This surface is strongly influenced by large ground-water withdrawals in the Jackson, Yazoo City, Cleveland, Clarksdale, and Memphis areas (see potentiometric map).

Water levels in or near the outcrop of the Sparta aquifer system have shown little long-term change. Large withdrawals have caused long-term water-level declines of 1 to 3 feet per year in much of the confined part of the aquifer (see hydrographs). In the Jackson area, the decline has been about 3 feet per year. Some of these hydrographs also show effects of variable pumpage of nearby wells. Previous potentiometric maps of large parts of the Sparta aquifer were made by Brown (1947), Harvey and others (1964), and Spiers and Dalsin (1979).

Other reports containing information on the geohydrology of the Sparta aquifer and nine other potentiometric maps in this series are included in the selected refernces.

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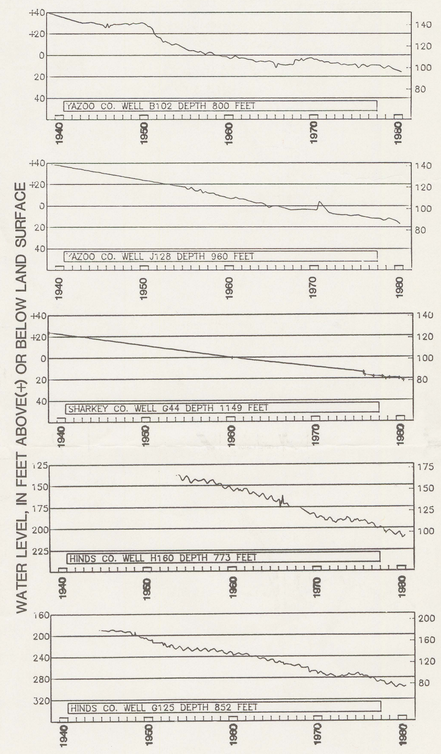

HYDROGRAPHS OF SELECTED WELLS IN THE SPARTA AQUIFER SYSTEM.

(See map for locations. Note that vertical scales vary. Straight lines connect data points. Data points represent periodic water-level measurements, generally made with steel tape.)

POTENTIOMETRIC MAP OF THE SPARTA AQUIFER SYSTEM IN MISSISSIPPI, FALL 1980

B. E. WASSON

1980