POTENTIOMETRIC MAP OF THE RIPLEY AQUIFERS

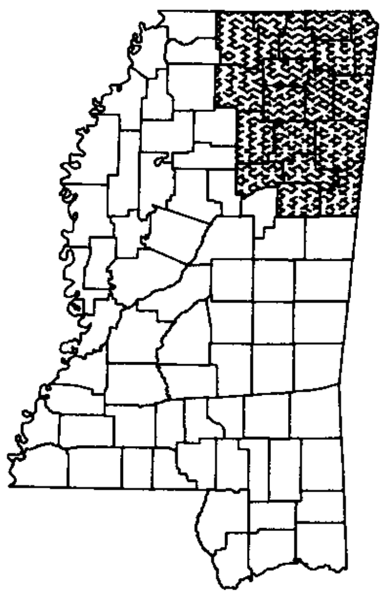
IN NORTHEASTERN MISSISSIPPI

AUGUST, 1992

by

Carol R. Hill and L. Ann Robinson

OLWR HYDROLOGIC MAP 93-1



MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY

OFFICE OF LAND AND WATER RESOURCES

Charles T. Branch

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STATE OF MISSISSIPPI
DEPARTMENT OF ENVIRONMENTAL QUALITY
JAMES I. PALMER, JR.
EXECUTIVE DIRECTOR

LETTER OF TRANSMITTAL

Commission on Environmental Quality
of the State of Mississippi

To the Citizens of the State of Mississippi:

The Department of Environmental Quality, Office of Land and Water Resources, is pleased to transmit to you OLWR Map 93-1, entitled "Potentiometric Map of the Ripley Aquifers in Northeastern Mississippi, August, 1992" by Carol R. Hill and L. Ann Robinson.

The wise use of the ground-water resources of Mississippi is dependent upon the collection of water-level data. This report presents data and interpretations pertinent to that effort.

It is hoped that water-management agencies, municipalities, water associations, and the water development industry can utilize data from this report to the benefit of the citizens of the State of Mississippi.

Respectfully submitted,

R. B. Flowers

R. B. (Dick) Flowers
Chairman

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POTENTIOMETRIC MAP OF THE RIPLEY AQUIFERS IN NORTHEASTERN MISSISSIPPI, AUGUST, 1992

INTRODUCTION

This potentiometric map of the Ripley aquifers is the first in a series of maps prepared by the Mississippi Department of Environmental Quality, Office of Land and Water Resources, delineating the potentiometric surfaces of the major fresh-water aquifers in Mississippi. These maps are produced at five-year intervals for the purpose of documenting changes in water levels. It should be noted that water levels may be highly variable seasonally or even daily, and therefore only long-term and regional trends should be interpreted from the data presented herein. This publication augments and updates water-level information previously published by the U. S. Geological Survey Water Resources Division in cooperation with the Mississippi Office of Land and Water Resources (Darden, 1985; Goldsmith, 1992; Wasson, 1980). The potentiometric map shown on Plate 1 is based on water-level measurements made in 48 wells during August, 1992.

Records of water wells screened in the Ripley aquifer were evaluated to select wells as candidates for water-level measurements. Each of these wells was visited to determine that a water-level measurement could be obtained. If a measurement could be made, the well location was plotted at the site on a U. S. Geological Survey 7.5 Minute Series Topographic map. The altitude of the land surface at the well was determined from the map, the measuring point on the well was described, and the height of the measuring point above land surface was noted. These plotted well locations were used to establish the latitude and longitude of each well. These sites were entered into a GIS database that was used to generate base maps for this study. After collecting the field data, the altitude of the screened interval of each well was checked on electric logs if available or compared with the structural altitude of the top and base of the Ripley aquifer to ensure that each well was screened in the Ripley aquifer. Water levels that were below land surface were measured using a steel tape. Each measurement was recorded and at least one additional measurement was made to verify the validity of the first measurement. Flowing (artesian) wells were measured with a pressure gage.

ACKNOWLEDGEMENTS

In the course of the field investigation, S. C. Cash and P. E. Grantham were of great assistance in the collection of water-level data used in this study. E. H. Boswell and J. H. Hoffmann made many helpful suggestions and reviewed the report. A. J. Warner was most helpful in providing information concerning water use from the Ripley. P. A. Phillips rendered great service in preparation of all of the data for presentation in its final format through the use of a GIS database and software.

HYDROGEOLOGY

The Ripley Formation is a part of the Selma Group. Sediments of the Ripley crop out in Mississippi in an arcuate belt that extends from Tennessee into Alcorn and Tippah Counties and southward to Clay County where it swings to the southeast into the northeastern part of Kemper County and on into Alabama. From the outcrop area, the formation dips into the subsurface to the west in the study area and to the southwest in the area in Mississippi to the south. The Ripley is composed of sediments ranging from chalky sand and clay in the south to thick beds of sand, clay, sandstone, marl, and limestone in the north. The Ripley Formation is about 40 feet thick in Kemper County and increases to more than 400 feet in Tippah County (Boswell 1963, p. 58).

The aquifers in the Ripley Formation are hydraulically isolated from underlying aquifers of Cretaceous age by the Demopolis Chalk of the Selma Group and from the overlying aquifers of the Wilcox Group by the Porters Creek Clay of the Midway Group. South of the latitude of Pontotoc and Union Counties, the Prairie Bluff Chalk overlies the Ripley and to the north it is overlain by the Owl Creek Formation. In northern Mississippi, near the Tennessee boundary, the Ripley Formation comprises, in ascending order, the transitional clay, Coon Creek Tongue, McNairy Sand Member, and the Chiwapa Sandstone Member. The principal aquifers of the Ripley Formation are in sands of the Chiwapa Member, the McNairy Sand Member, and a lower sand aquifer originally described by Parks (1961, p. 78) in Calhoun County.

The McNairy Sand Member is the most productive Ripley aquifer, typically being composed of medium to coarse-grained sand and reaching a maximum thickness in Mississippi of about 200 feet in Tippah County. The McNairy thins rapidly southward and wedges out in central Union County. The McNairy is widely utilized in Tippah County as a source of water and is probably usable in the subsurface of most of Benton County and part of Marshall County (Boswell, 1963, p.61).

The Chiwapa Sandstone Member is only a few feet thick in northern Tippah County and thickens southward until it attains a thickness of about 100 feet in the subsurface in Pontotoc county. To the south, the Chiwapa grades into calcareous sand, clay, and silt in Chickasaw County. Boswell (1963, p. 61) stated that the Chiwapa replaces the McNairy as the principal Ripley aquifer south of northern Union County and that it is extensively used as a source of water in Pontotoc, part of northwestern Chickasaw, northeastern Lafayette, and part of western Union Counties. Permeability is lower than that of the McNairy Sand and decreases westward into the subsurface so that the Chiwapa is not a significant aquifer in Calhoun County.

The sand aquifer in the lower part of the Ripley is used in northeastern Calhoun County as well as parts of Chickasaw, Pontotoc, and Lafayette Counties. South of central Calhoun County and down the dip to the west, this aquifer becomes too fine-grained and calcareous to yield significant supplies of water to wells (Boswell, 1979).

AQUIFER DEVELOPMENT AND GROUND-WATER USE

The Ripley aquifers are sources of freshwater for some public water supplies and industries and for numerous domestic and farm wells in several counties of northern Mississippi.

Stephenson, Logan, and Waring (1928) discussed the development of the Ripley aquifers that had occurred during the years of the late nineteenth and early twentieth century. Springs and shallow wells supplied water for domestic and farm supplies in the outcrop areas of the Ripley Formation in Alcorn, Tippah, Union, Pontotoc, and Chickasaw Counties. Flowing wells were widely developed in the Ripley aquifers during this period in the Wolf River Valley in Benton County, the valley of Tippah Creek in Marshall, Benton, and Tippah Counties, and in the valley of the Tallahatchie River and its tributaries in Marshall, Lafayette, Union, and northern Pontotoc Counties.

The Ripley aquifers were sources of water for many communities in the area during this time. At Potts Camp in Marshall County, a well was drilled to a depth of 718 feet in 1912. The water level in this well was initially 35 feet above land surface. At Hickory Flat in Benton County, a well was drilled to a depth of 600 feet in 1900. Several communities in Tippah County, such as Ripley, Blue Mountain, and Falkner were supplied by Ripley wells in the early twentieth century. At New Albany, a municipal well was drilled in 1905 that produced water from the Ripley from a depth of more than 200 feet. This well flowed when it was first completed but the demand for water eventually caused static water levels to decline below land surface. Two other wells were added in 1914 and pumpage was reported to be 75,000 gallons per day by 1928. In Pontotoc County, Ripley wells were drilled shortly after the turn of the century in the communities of Pontotoc, Algoma, Wallfield, and Ecru. In Chickasaw County, Ripley wells were drilled in the vicinity of Houston and Houlka.

In 1991, slightly more than 1 million gallons of water per day were pumped from the Ripley aquifers for public water supplies. The Ripley aquifers are currently sources of water for the towns of Ashland, Byhalia, Hickory Flat, Houlka, and Myrtle as well as several rural public water systems. Some small industrial supplies and numerous domestic wells also derive their water from the Ripley aquifers. Flowing wells are still in existence in the valleys of the Tallahatchie River and its tributary streams mainly in Marshall, Benton, Tippah, and Union Counties.

WATER LEVELS

Recharge to the Ripley aquifers is primarily by precipitation on the outcrop where permeable sandy units are exposed at the surface. In the outcrop areas, ground water is primarily under water-table conditions. Water levels in these areas are influenced by topography and by relatively localized discharge into streams or springs. Water levels in and near the outcrop areas of the Ripley have shown little or no historical long-term changes (Wasson, 1980).

In the areas to the west of the outcrop, the Ripley aquifers are under artesian conditions and water moves in a general westward or southwestward direction. Water levels in these areas are influenced by pumpage in the vicinity of larger wells and by the loss of hydrostatic pressure caused by flowing wells in the valleys of the Tallahatchie River and Tippah Creek (Plate 1).

A comparison of 1992 water-level measurements with previous measurements in the same wells reveals that there has been a general decline in water levels in the downdip areas of the Ripley aquifers as shown in Table 1 and Figures 1-3. The annual rate of decline is no more than

1 to 2 feet per year in a few wells and is generally less than 1 foot per year. Water levels have been rising in some wells screened in the Ripley. Because the Ripley aquifers are not heavily pumped, water levels have not been declining as rapidly as in some of the other aquifers in the state that are more extensively utilized as sources of water.

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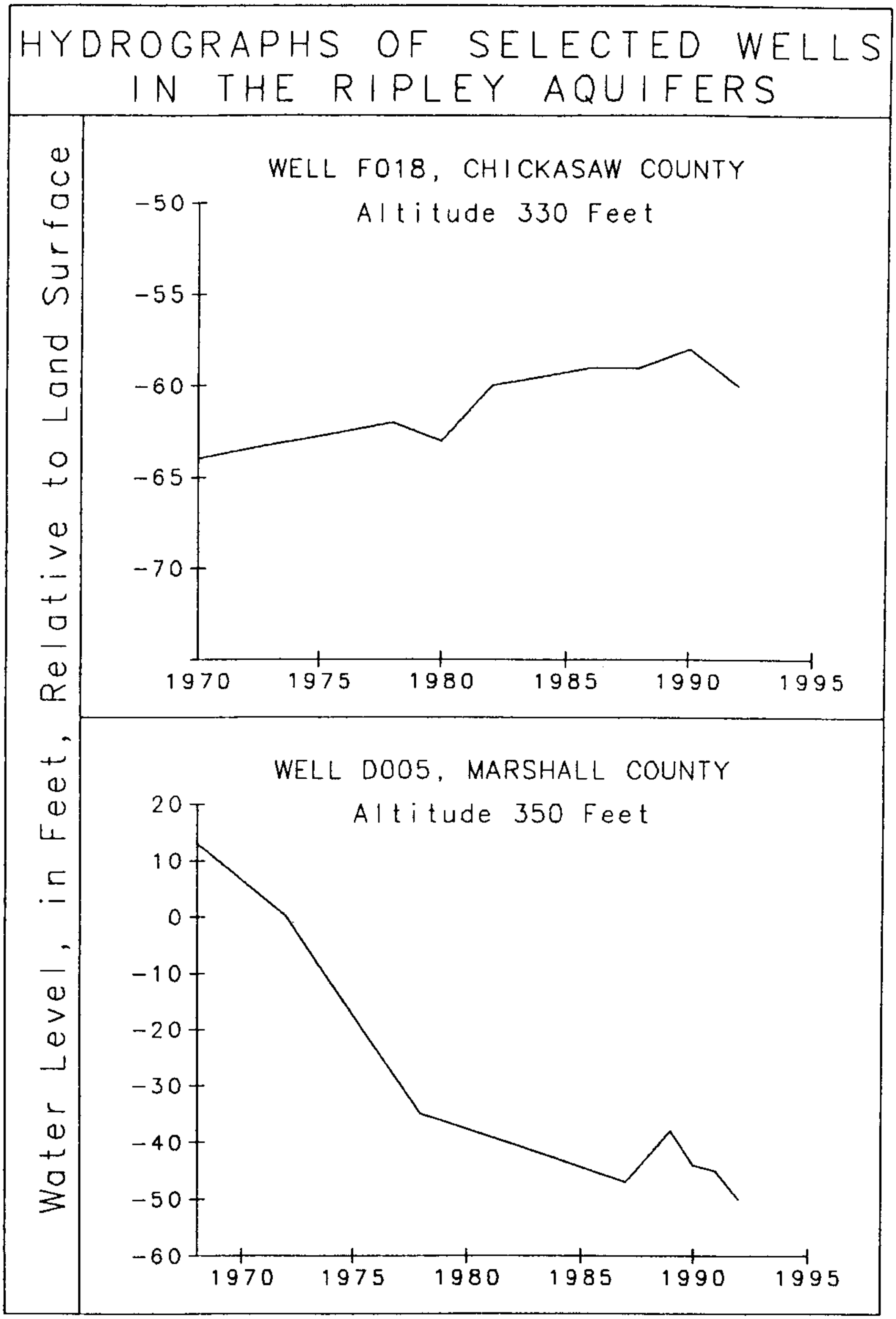

HYDROGRAPHS OF SELECTED WELLS
IN THE RIPLEY AQUIFERS
Water Level, in Feet, Relative to Land Surface
WELL F018, CHICKASAW COUNTY
Altitude 330 Feet
-50
-55
-60
-65
-70
1970
1975
1980
1985
1990
1995
WELL D005, MARSHALL COUNTY
Altitude 350 Feet
20
10
0
-10
-20
-30
-40
-50
-60
1970
1975
1980
1985
1990
1995

FIGURE 1

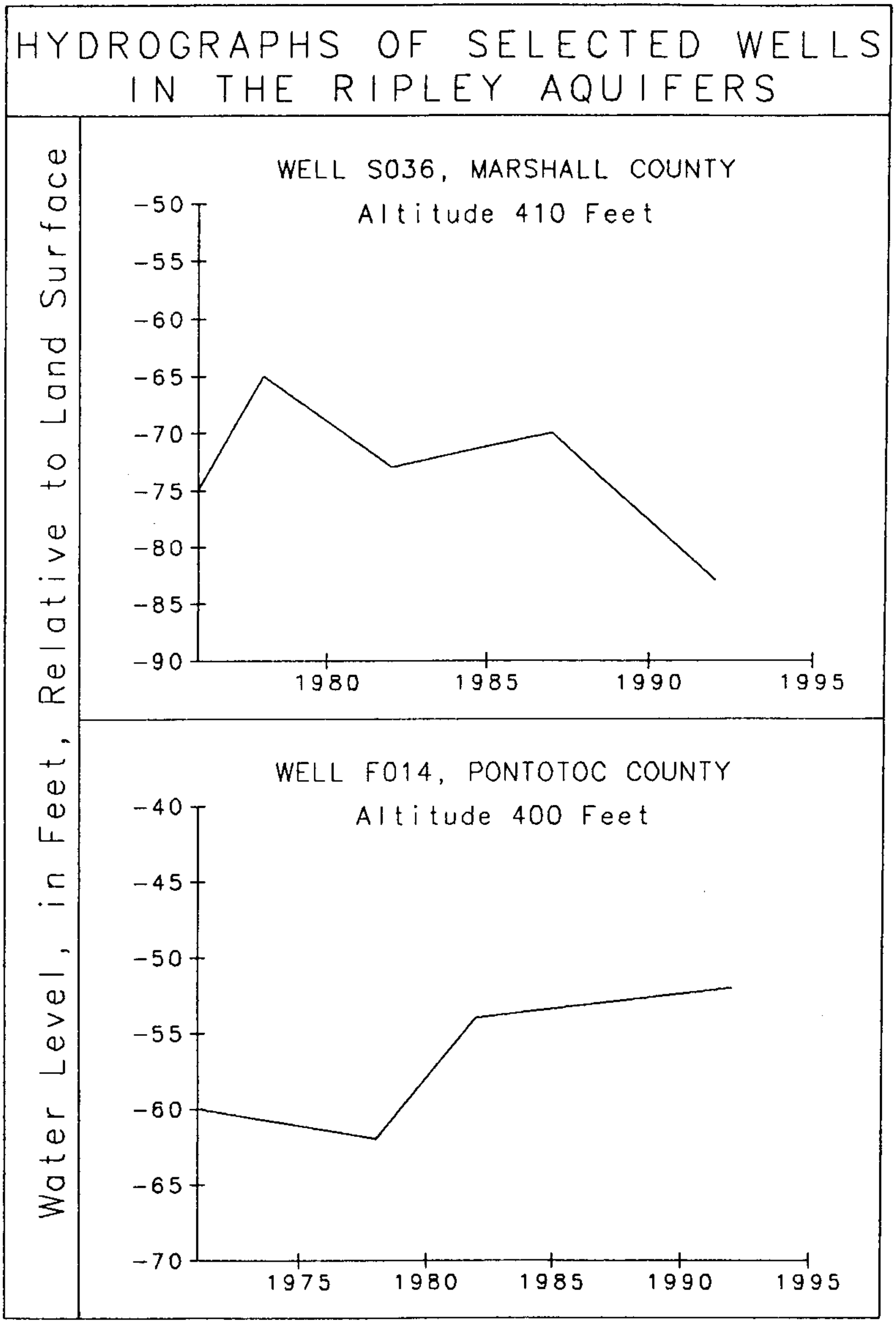

HYDROGRAPHS OF SELECTED WELLS IN THE RIPLEY AQUIFERS
Water Level, in Feet, Relative to Land Surface
WELL S036, MARSHALL COUNTY
Altitude 410 Feet
-50
-55
-60
-65
-70
-75
-80
-85
-90
1980
1985
1990
1995
WELL F014, PONTOTOC COUNTY
Altitude 400 Feet
-40
-45
-50
-55
-60
-65
-70
1975
1980
1985
1990
1995

FIGURE 2

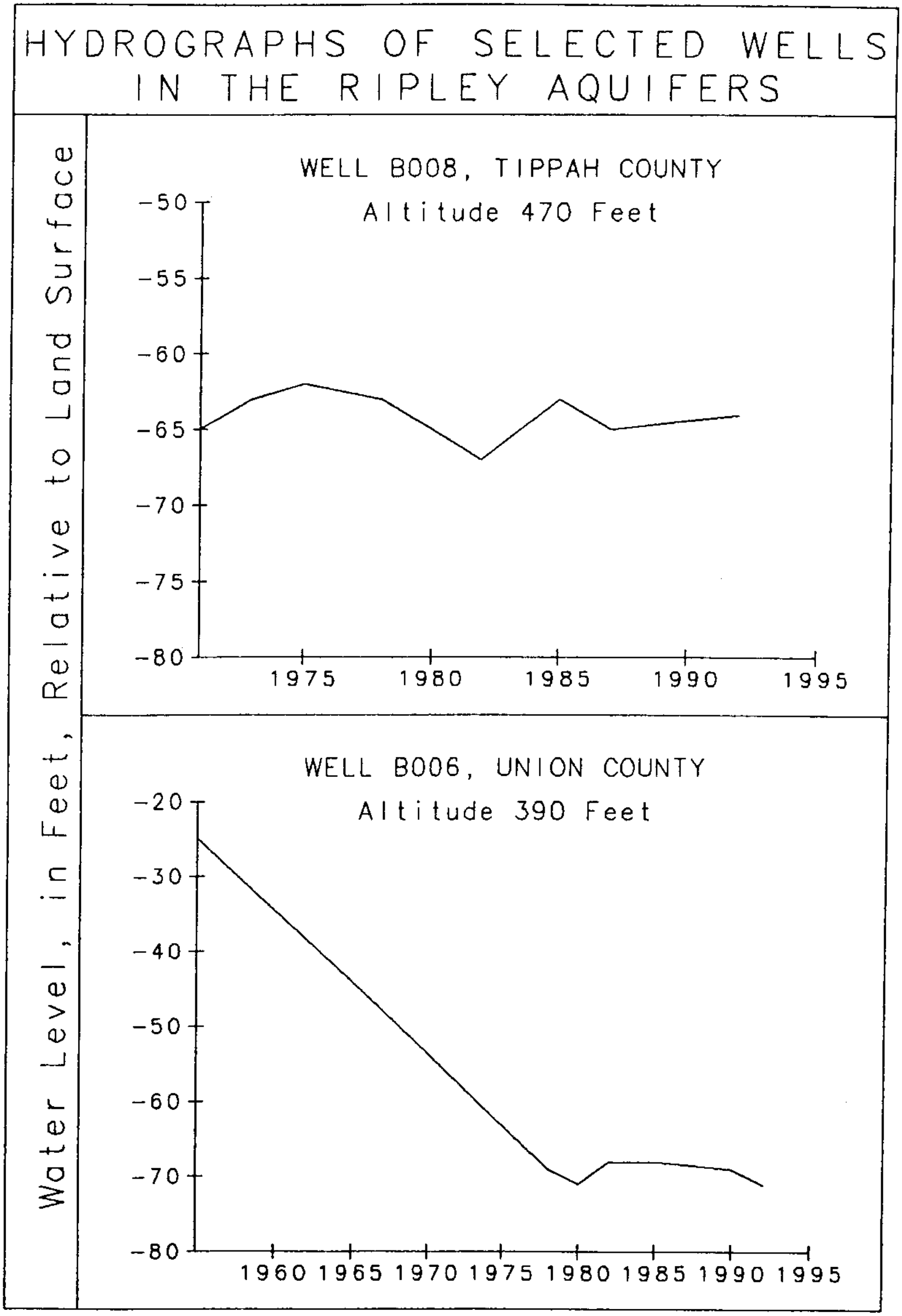

HYDROGRAPHS OF SELECTED WELLS IN THE RIPLEY AQUIFERS
Water Level, in Feet, Relative to Land Surface
WELL B008, TIPPAH COUNTY
Altitude 470 Feet
-50
-55
-60
-65
-70
-75
-80
1975 1980 1985 1990 1995
WELL B006, UNION COUNTY
Altitude 390 Feet
-20
-30
-40
-50
-60
-70
-80
1960 1965 1970 1975 1980 1985 1990 1995

FIGURE 3

TABLE 1: WATER LEVEL RECORDS OF WELLS SCREENED IN THE RIPLEY AQUIFERS

COUNTY	U.S.G.S WELL NUMBER	ALTITUDE IN FEET RELATIVE TO MSL	1992 HEAD VALUES IN FEET RELATIVE TO MSL	1992 WATER LEVELS IN FEET RELATIVE TO LAND SURFACE	PREVIOUS WATER LEVELS IN FEET RELATIVE TO LAND SURFACE	AVERAGE CHANGE IN WATER LEVEL RISE (+) OR DECLINE (-) IN FEET PER YEAR
ALCORN	A005	520	442.3	77.7	85.0 (1956)	+ 0.20
	E008	450	446.8	3.2	59.0 (1956)	+ 1.55
	F032	505	485.9	19.1	80.0 (1959)	+ 1.85
	J008	560	541.1	18.9	26.0 (1956)	+ 0.20
BENTON	0007	410	354.9	55.1	45.3 (1987)	- 1.96
CHICKASAW	A013	325	265.5	59.5	30.0 (1957)	- 0.84
	A022	340	267.1	72.9	71.0 (1978)	- 0.14
	E030	330	267.6	62.4	----.---------	----.----
	F015	350	268.4	81.6	----.---------	----.----
	F018	330	270.0	60.0	62.2 (1978)	+ 0.16
	J027	290	264.6	25.4	32.7 (1982)	+ 0.73
	K015	345	271.0	74.0	78.0 (1978)	+ 0.29
MARSHALL	D005	350	299.5	50.5	35.0 (1978)	- 1.11
	D060	390	293.9	96.1	----.---------	----.----
	P009	495	347.8	147.2	146.2 (1978)	- 0.07
	S036	410	327.3	82.7	65.3 (1978)	- 1.24
	X002	300	313.0	+ 13.0	+ 27.0 (1960)	- 0.44
	Y004	385	320.4	64.6	63.2 (1982)	- 0.14
	Y007	300	310.3	+ 10.3	----.---------	----.----
PONTOTOC	A046	420	304.5	115.5	107.0 (1978)	- 0.61
	A048	470	256.3	213.7	----.---------	----.----
	F014	400	347.6	52.4	62.2 (1978)	+ 0.70
	G014	450	377.9	72.1	74.2 (1982)	+ 0.21
	G045	390	368.8	21.2	22.0 (1978)	+ 0.06
	J001	370	259.1	110.9	103.8 (1982)	- 0.71
	J008	380	254.2	125.8	110.0 (1972)	- 0.79
	K019	357	274.9	82.1	80.4 (1978)	- 0.12
	K020	365	256.4	108.6	----.---------	----.----

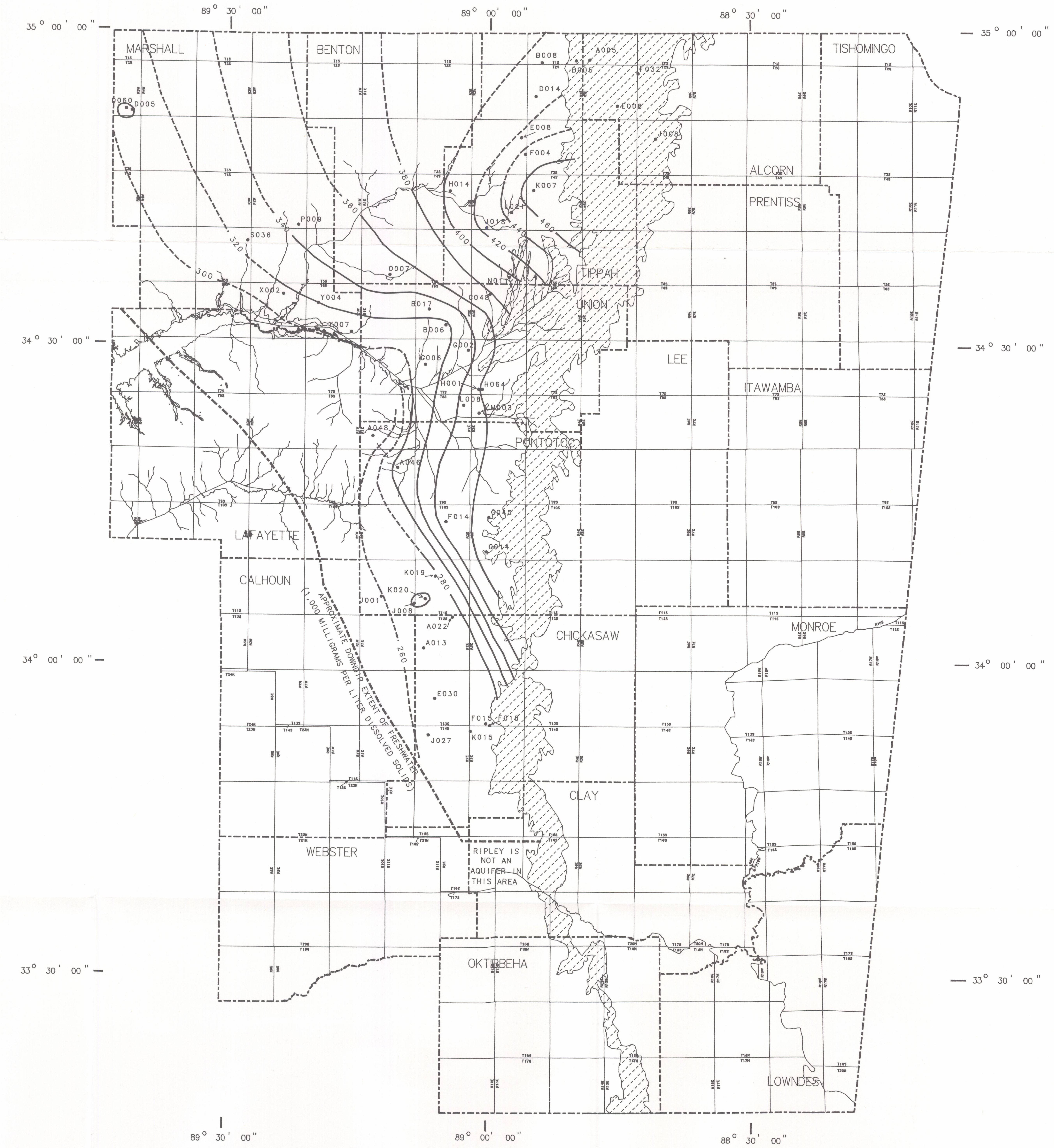
COUNTY	U.S.G.S WELL NUMBER	ALTITUDE IN FEET RELATIVE TO MSL	1992 HEAD VALUES IN FEET RELATIVE TO MSL	1992 WATER LEVELS IN FEET RELATIVE TO LAND SURFACE	PREVIOUS WATER LEVELS IN FEET RELATIVE TO LAND SURFACE	AVERAGE CHANGE IN WATER LEVEL RISE (+) OR DECLINE (-) IN FEET PER YEAR
TIPPAH	B005	490	465.2	24.8	-----.---------	-----.-----
	B008	470	405.6	64.4	64.6 (1978)	+ 0.01
	D014	480	416.2	63.8	62.7 (1982)	- 0.11
	E008	480	431.3	48.7	40.9 (1958)	- 0.23
	F004	530	444.5	85.5	-----.---------	-----.-----
	H014	395	397.5	+ 2.5	+ 5.0 (1978)	- 0.18
	J018	435	419.6	15.4	6.0 (1982)	- 0.94
	J021	465	447.3	17.7	27.1 (1982)	+ 0.94
	K007	530	471.1	58.9	40.0 (1956)	- 0.53
	N011	400	397.0	3.0	+ 2.0 (1959)	- 0.03
UNION	B006	390	319.1	70.9	68.8 (1978)	- 0.15
	B017	470	325.7	144.3	141.0 (1978)	- 0.24
	C048	390	379.1	10.9	12.5 (1978)	+ 0.11
	G002	385	328.8	56.2	57.1 (1982)	+ 0.09
	G006	369	315.0	54.0	54.8 (1978)	+ 0.06
	H001	425	359.5	65.5	-----.---------	-----.-----
	H064	430	366.9	63.1	-----.---------	-----.-----
	L008	370	342.1	27.9	38.9 (1982)	+ 1.10
	M003	365	351.0	14.0	-----.---------	-----.-----

MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF LAND AND WATER RESOURCES

POTENTIOMETRIC MAP OF THE RIPLEY AQUIFERS IN NORTHEASTERN MISSISSIPPI FALL AND WINTER, 1992

by

Carol R. Hill and L. Ann Robinson



EXPLANATION

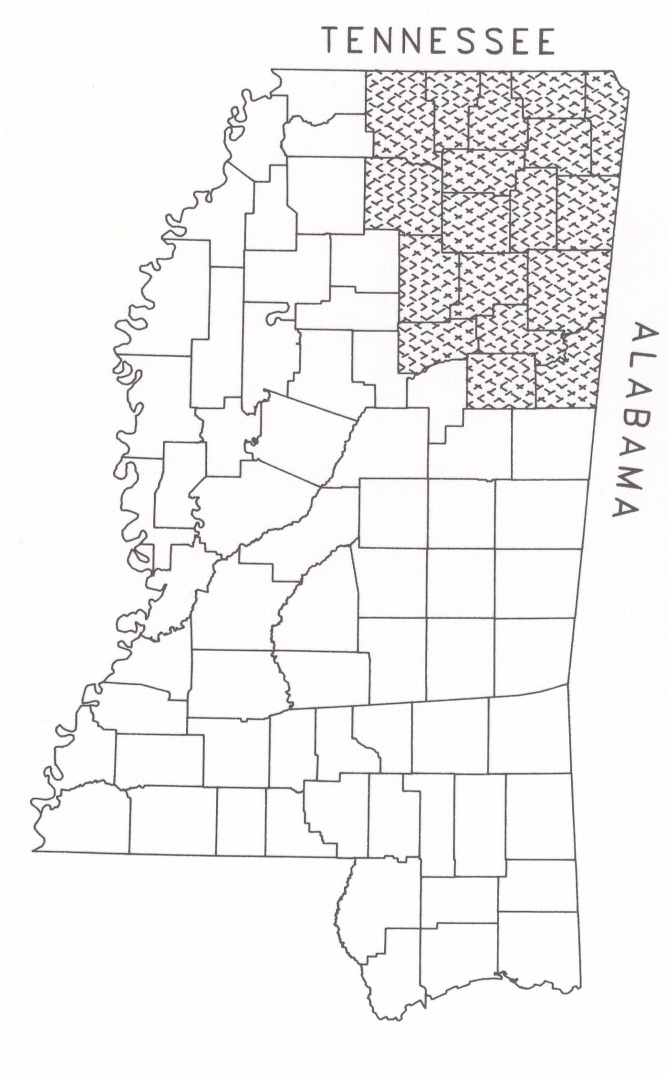
— 260 — POTENTIOMETRIC CONTOUR
Contour interval 20 feet
Datum is sea level.

OUTCROP AREA OF THE RIPLEY FORMATION IN MISSISSIPPI

● A046 OBSERVATION WELL AND NUMBER

SCALE 1:450000

5 0 5 10 15 20
MILES



Location of Study Area