U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared in cooperation with the
MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF LAND AND WATER RESOURCES

WATER-RESOURCES INVESTIGATIONS REPORT 93-4202

INTRODUCTION

As part of a program to document and evaluate the potentiometric surface (water level) of the major aquifers in Mississippi, the U.S. Geological Survey, in cooperation with the Mississippi Department of Environmental Quality, Office of Land and Water Resources, measures water levels at about 5-year intervals in wells completed in the Cockfield aquifer. This report is the third in a series of reports showing the potentiometric surface of the Cockfield aquifer; included in the report are a potentiometric-surface map (fig. 1) based on water-level data collected in 62 wells in 14 counties during October through November 1989, and hydrographs of selected observation wells completed in the aquifer (fig. 2). Previously published potentiometric-surface maps of the aquifer were based on water-level measurements made in 1980 (Wasson, 1981) and 1984 (Darden, 1986).

HYDROGEOLOGY

The Cockfield aquifer consists of sand beds in the Cockfield Formation. The formation is in the upper part of the Claiborne Group of Eocene age; the formation consists of beds of fine to medium sand, sandy carbonaceous clay, and thin beds of lignite. Massive beds of sand in the Cockfield Formation are common. The Cockfield Formation is overlain by the Jackson Group and underlain by the Cook Mountain Formation. Deposits of the Jackson Group and of the Cook Mountain Formation act as confining units for water in the Cockfield aquifer.

In Mississippi, the Cockfield Formation crops out in a belt from Holmes County in the west-central part of the State southeastward to Clarke County at the border between Mississippi and Alabama. The formation also crops out in a small area in Hinds County along the Pearl River at Jackson. The Cockfield Formation subcrops the Mississippi River alluvium in a large area in the northwestern part of the State. Spiers (1977) reported that the Cockfield Formation ranges in thickness from about 50 feet in the eastern part of the outcrop area to about 600 feet in the western part of the State downdip near the limit of freshwater--water having less than 1,000 milligrams per liter dissolved solids. Structural features in the study area have had considerable influence on the thickness, depth, and configuration of the formation. A detailed description of the hydrogeology of the Cockfield aquifer is given by Spiers (1977).

WATER USE

The Cockfield aquifer is a source of water supplies in about 30 percent of Mississippi. The quality of the water meets State standards for use as a source of raw water for drinking and food processing purposes (Mississippi Department of Environmental Quality, 1992). The aquifer is a principal source of water for a number of large water supplies in northwestern and central Mississippi. Total withdrawal from the aquifer in Mississippi in 1985 was estimated to be about 35 million gallons per day (P.M. Johnson, U.S. Geological Survey, oral commun., 1993). The largest withdrawal from the aquifer was about 12 million gallons per day at Greenville in Washington County. Other major withdrawals, totaling about 8 million gallons per day, occurred in the Jackson metropolitan area of Hinds, Madison, and Rankin Counties.

WATER LEVELS

The largest depression in the potentiometric surface shown on the accompanying map (fig. 1) was at Greenville in Washington County, where large withdrawals are made from the Cockfield aquifer for industrial and public supplies. The potentiometric surface of the aquifer fluctuates seasonally in response to natural variation in recharge and discharge and to pumping from nearby wells. Water-table conditions exist in the outcrop area, and artesian conditions exist in the confined part of the aquifer. Groundwater levels in or near the outcrop area generally fluctuate only a few feet seasonally and show no long-term changes. Wells completed in the confined part of the aquifer show long-term declines in water levels as a result of pumping.

The potentiometric surface indicates that over most of the study area the regional ground-water flow in the Cockfield aquifer generally is to the west and southwest, away from the outcrop area in the central and eastern part of the study area. In the Jackson area, over the crest of the Jackson Dome, the regional slope of the potentiometric surface is disrupted. Water levels are higher over the dome than in the surrounding area as a result of recharge to the aquifer where the Cockfield Formation crops out along the Pearl River. In the southeastern part of the study area near the Chickasawhay River, the flow is toward the river.

From 1980 to 1989, water levels in the confined part of the Cockfield aquifer, in areas distant from heavy pumping, generally declined less than 1 foot per year. During that period water-level declines of more than 20 feet per year were measured at Raymond (Hinds County), Heidelberg (Jasper County), and west-central Smith County. The water level recovered 39 feet in well J4 at Bay Springs (Jasper County), where wells completed in the Cockfield aquifer were replaced with wells completed in the Sparta aquifer, a deeper, more productive source of ground water. Changes in the areal distribution of pumpage at Greenville (Washington County) resulted in a recovery in water levels near the center of the city. The water level in well D49 at Greenville was 11 feet higher in 1989 than in 1980. Measured water-level changes from 1980 to 1989 for 50 wells are listed in table 1.

HYDROGRAPHS

Hydrographs of water levels from 1970 to 1989 for four observation wells completed in the Cockfield aquifer are shown on figure 2. Water levels in wells H155 and L5 (Hinds County) and V13 (Madison County) in the confined part of the aquifer had downward trends overall, with seasonal variations as a result of seasonal pumping. During the same period, water levels recovered in well L1 at Forest (Scott County), where the city developed wells in the deeper Meridian-upper Wilcox aquifer. The Meridian-upper Wilcox is a more productive source than the shallow aquifers. Also, water from the Meridian-upper Wilcox requires minimal treatment and has low concentrations of iron.

REFERENCES

Belt, W.E., and others, 1945, Geologic map of Mississippi: Mississippi Geological Society, Jackson, Mississippi.

Darden, Daphne, 1986, Potentiometric map of the Cockfield aquifer in Mississippi, fall 1984: U.S. Geological Survey Water-Resources Investigations Report 86-4042, 1 sheet.

Mississippi Department of Environmental Quality, Bureau of Pollution Control, 1992, Water quality criteria for intrastate, interstate and coastal waters [adopted July 23, 1992]: Mississippi Department of Environmental Quality, 21 p.

Spiers, C.A., 1977, The Cockfield aquifer in Mississippi: U.S. Geological Survey Water-Resources Investigations Report 77-17, 1 sheet.

Wasson, B.E., 1981, Potentiometric map of the Cockfield aquifer in Mississippi, fall 1980: U.S. Geological Survey Water-Resources Investigations Report 81-1053, 1 sheet.

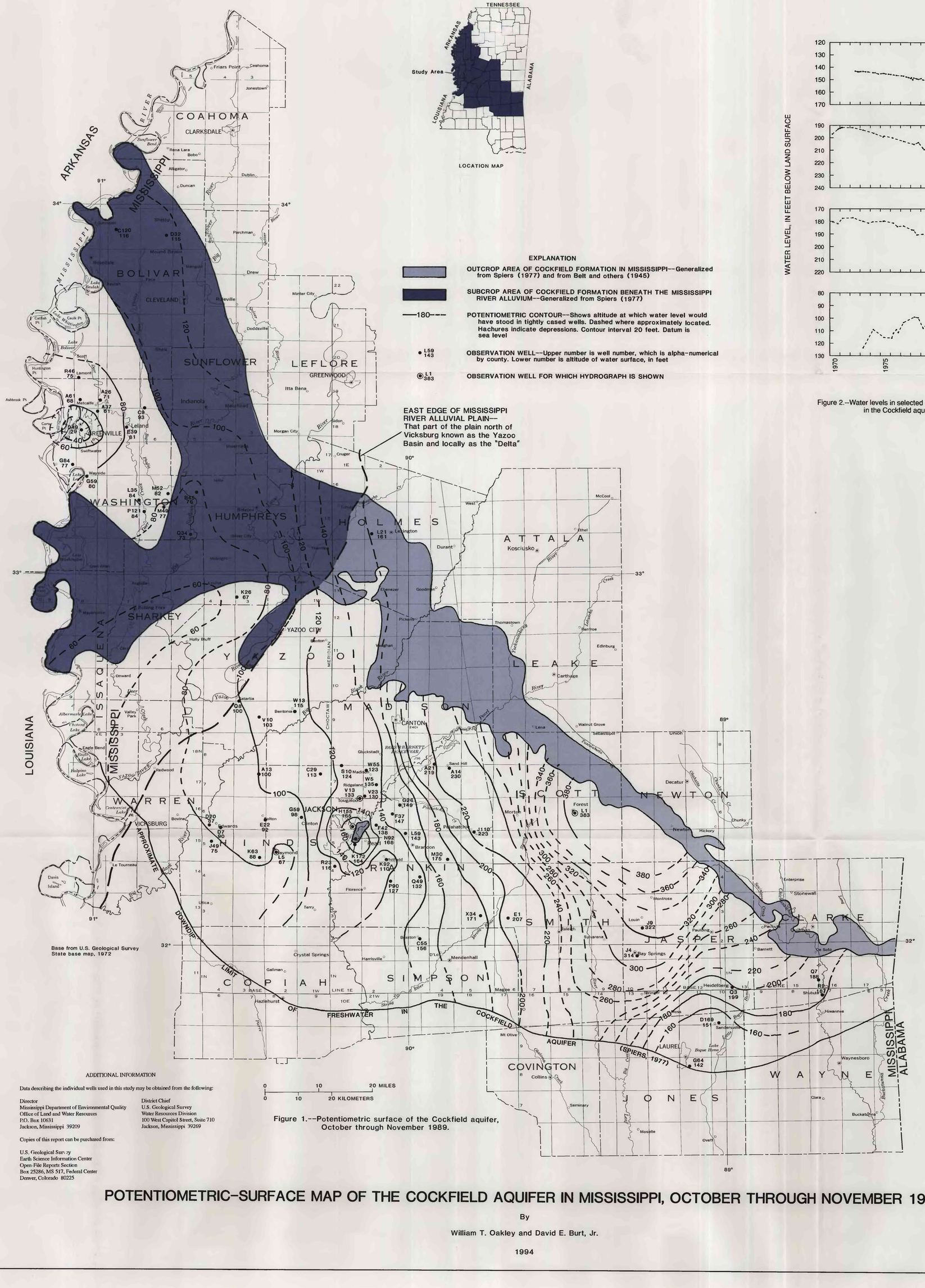

Figure 1.--Potentiometric surface of the Cockfield aquifer, October through November 1989.

Figure 2.--Water levels in selected observation wells completed in the Cockfield aquifer, 1970-89.

Table 1.--Water-level changes for wells completed in the Cockfield aquifer
[--, insufficient data to compute value; negative value indicates a decrease in water level;]

County	Local well number	Measured water-level change from 1980 to 1989 (in feet)
Bolivar	C120	-4
	D32	-7
	R46	-3
Clarke	Q7	6
	R2	0
Hinds	A13	-9
	C29	--
	D1	-2
	D20	--
	E22	-9
	G59	-5
	H155	-12
	J49	-12
	K63	-4
	L5	-29
	N92	--
	R23	3
Holmes	L21	0
Humphreys	B45	--
	K26	-13
Jasper	J4	39
	J9	0
	Q3	-28
Jones	D169	--
	G64	-16
Madison	S10	-18
	V13	--
	V23	--
	W5	-19
	W55	-17
Rankin	A14	1
	A21	9
	F37	-20
	F42	-20
	G26	-18
	J110	-3
	K92	--
	K172	--
	L59	-19
	M30	-17
	P90	-5
	Q49	-19
	X34	--
Scott	L1	5
Simpson	C55	-20
Smith	E1	-26
Washington	A26	6
	A37	-2
	A61	-1
	C9	-3
	D49	11
	E39	1
	G59	-2
	G84	--
	L35	-1
	M49	-4
	M52	-3
	P121	--
	Q34	-3
Yazoo	Q8	-7
	V10	-7
	W13	-19

ADDITIONAL INFORMATION

Data describing the individual wells used in this study may be obtained from the following:

Director
Mississippi Department of Environmental Quality
Office of Land and Water Resources
P.O. Box 10631
Jackson, Mississippi 39209

District Chief
U.S. Geological Survey
Water Resources Division
100 West Capitol Street, Suite 710
Jackson, Mississippi 39269

Copies of this report can be purchased from:

U.S. Geological Survey
Earth Science Information Center
Open-File Reports Section
Box 25286, MS 517, Federal Center
Denver, Colorado 80225

CONVERSION FACTORS AND VERTICAL DATUM

Multiply	By	To obtain
foot	0.3048	meter
mile	1.609	kilometer
million gallons per day	0.04381	cubic meter per second

Sea Level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929--a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

POTENTIOMETRIC-SURFACE MAP OF THE COCKFIELD AQUIFER IN MISSISSIPPI, OCTOBER THROUGH NOVEMBER 1989

By

William T. Oakley and David E. Burt, Jr.

1994