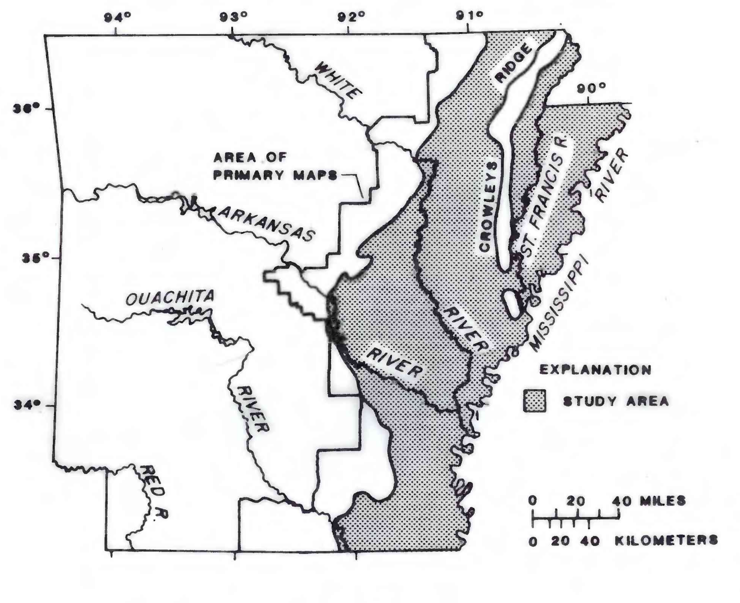

Figure 1.--Location of study area.

Base from U.S. Geological Survey
State base map

Figure 2.--Potentiometric surface of the Mississippi River Valley alluvial aquifer, eastern Arkansas, spring 1972.

EXPLANATION

WESTERN EXTENT OF THE MISSISSIPPI RIVER VALLEY ALLUVIAL AQUIFER--Dashed where approximately located.

—90— POTENTIOMETRIC CONTOUR--Shows altitude at which water level would have stood in tightly cased wells. Dashed where approximately located. Hachures indicate depression. Contour interval 10 feet. Datum is sea level.

• B WELL FOR WHICH MEASUREMENT WAS USED AS CONTROL--Letter next to well refers to hydrograph.

▲ GAGE FOR WHICH STAGE MEASUREMENT WAS USED AS CONTROL.

Figure 3.--Potentiometric surface of the Mississippi River Valley alluvial aquifer, eastern Arkansas, spring 1980.

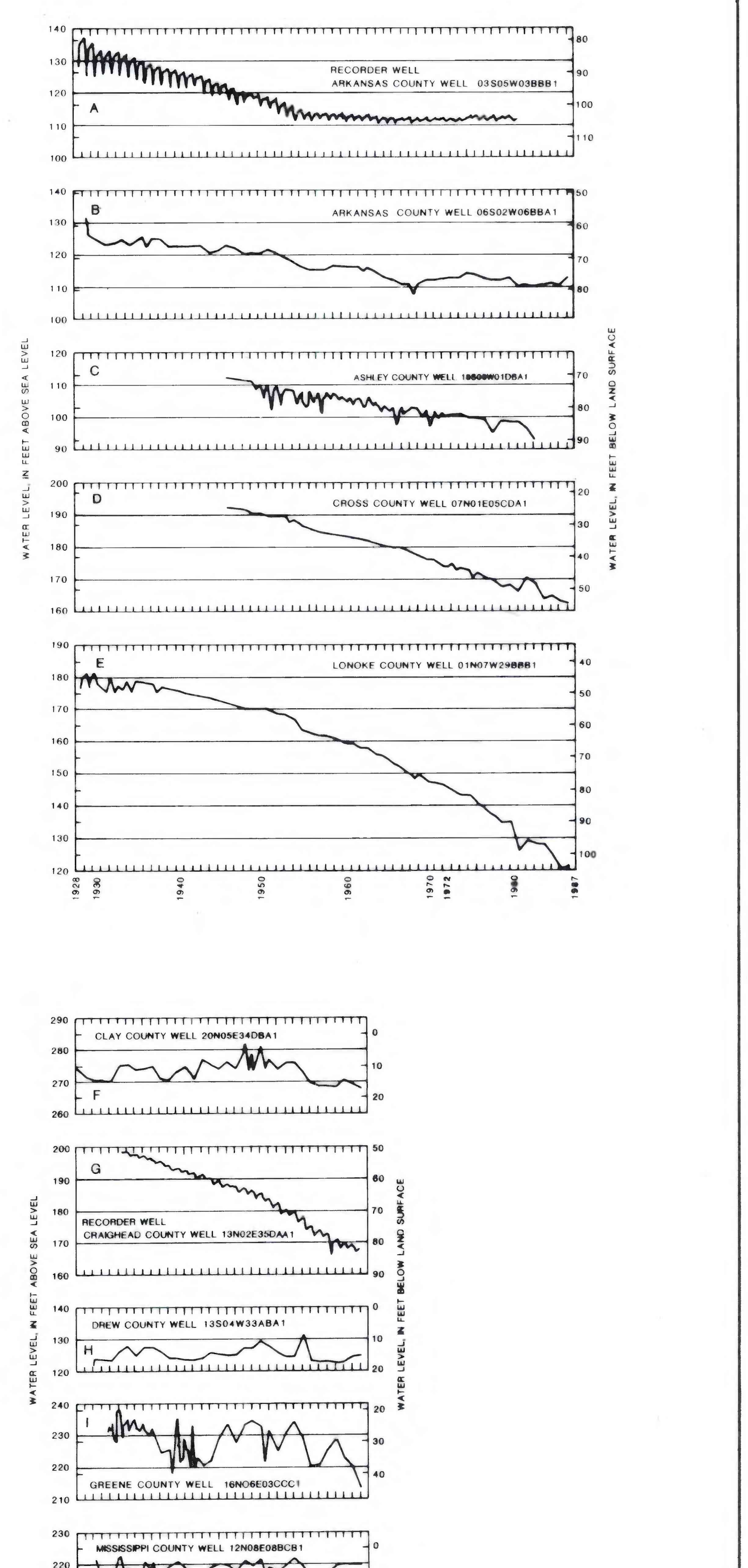

Figure 4.--Hydrographs of selected wells completed in the Mississippi River Valley alluvial aquifer.

INTRODUCTION

The Mississippi River Valley alluvial aquifer in eastern Arkansas is the most extensive and most productive aquifer in the State. It is used extensively as a source of water for irrigation of crops (principally rice) and for aquaculture (fish farming). Withdrawals from the aquifer have increased from about 1,300 Mgal/d in 1970 (Halberg, 1972) to about 3,700 Mgal/d in 1980 (Holland and Ludwig, 1981) and exceeded 3,500 Mgal/d in 1985 (Holland, 1987). These large withdrawals have resulted in water-level declines throughout much of the area and depressions in the potentiometric surface in areas where withdrawals from the aquifer are greatest.

The potentiometric surface maps are based on water-level measurements made in wells in the alluvial aquifer in the spring of 1972 and the spring of 1980. These maps show altitudes of water levels in the aquifer and clearly show depressions in the potentiometric surface in areas where water-level declines have been large. At a few locations the altitude of the water surface in rivers was used to define the potentiometric surface. Water-level data from Arkansas and adjacent States used in the construction of the maps are from the ground-water file of the U.S. Geological Survey's National Water Data Storage and Retrieval System. These maps were prepared as a part of the Gulf Coast Regional Aquifer-System Analysis study (Grubb, 1984) and should be useful to those studying flow systems in or including the Mississippi River Valley alluvial aquifer.

HYDROGEOLOGIC SETTING

The Mississippi River Valley alluvial aquifer consists of the permeable portions of flood-plain and terrace deposits of Quaternary age (Boswell and others, 1968). The alluvial aquifer commonly ranges from 60 to 140 ft in thickness and generally grades from gravel at the bottom to fine sand near the top. Throughout most of the area the aquifer is overlain by 10 to 50 ft of silts, clays, and fine-grained sands that act as a confining unit. Large capacity wells in the aquifer commonly yield more than 1,000 gal/min, and in some places, as much as 3,000 gal/min (Petersen and others, 1985). Because of the large withdrawals from the aquifer, water levels in some areas have been lowered below the bottom of the confining unit (top of the aquifer) and unconfined conditions exist in the aquifer.

The alluvial aquifer is bounded on the west by the outcrops of less permeable Eocene and older rocks. It does not occur on Crowleys Ridge, an erosional remnant of Tertiary strata that trends north to south and bisects the northern half of the aquifer. In some places, especially south of the Arkansas River, the contact of the aquifer with older strata is masked by a thin covering of older and somewhat higher terrace deposits. The aquifer is continuous to the north and to the south across the Missouri and Louisiana State lines. On the east the aquifer is in hydrologic connection with the Mississippi River. Underlying the aquifer are alternating beds of sands and clay that correspond to regional aquifers and confining units in strata of Eocene and older age.

The alluvial aquifer is recharged by infiltration of precipitation, especially where the confining unit is thin or permeable. Substantial recharge to the aquifer also comes from rivers during periods of high stage and continuously from parts of some rivers in areas of long-term decline in the potentiometric surface. Most discharge not intercepted by wells is to rivers.

POTENTIOMETRIC SURFACE

Water levels in the alluival aquifer fluctuate seasonally in response to seasonal irrigation withdrawals and natural variation in recharge and discharge. Long-term declines in water levels in the aquifer are apparent in hydrographs of wells in the areas of heaviest pumping (A, B, D, E, and G). These declines have resulted in depressions in the potentiometric surface. An area of long-term decline, which is still expanding, can be seen on the potentiometric maps as a closed depression in Arkansas, Lonoke, and Prairie Counties. Another area of significant long-term declines in water levels is west of Crowleys Ridge in an area along and either side of a line from Brinkley in Monroe County to Gibson (southwest of Jonesboro) in Craighead County. The depth to water exceeds 100 ft (Plafcan and Fugitt, 1987) in some parts of Arkansas, Lonoke, Poinsett, and Cross Counties, areas of large ground-water withdrawals for irrigation. Water levels in areas without long-term declines (F, H, I, and J) generally are between 5 and 25 ft below land surface. Water levels are shallow and closely related to river stage near large rivers that penetrate the confining unit.

Except near depressions in the potentiometric surface, water in the alluvial aquifer moves in the general direction of the slope of the land surface and toward rivers that penetrate the confining unit. Gradients on the potentiometric surface are 1 to 2 ft/mi in areas without long-term water-level declines and about 2 to 10 ft/mi on the flanks of areas of depression of the potentiometric surface.

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CONVERSION FACTORS

For use of readers who prefer to use metric (International System) units, rather than the inch-pound units used in this report, the following conversion factors may be used:

Multiply inch-pound unit	By	To obtain metric unit
foot (ft)	0.3048	meter (m)
gallon per minute (gal/min)	0.0630	liter per second (L/s)
million gallon per day (Mgal/d)	0.04381	cubic meter per second (m^3/s)
foot per mile (ft/mi)	0.4905	meter per kilometer (m/km)

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

POTENTIOMETRIC SURFACES OF THE MISSISSIPPI RIVER VALLEY ALLUVIAL AQUIFER IN EASTERN ARKANSAS, SPRING 1972 AND 1980

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1989