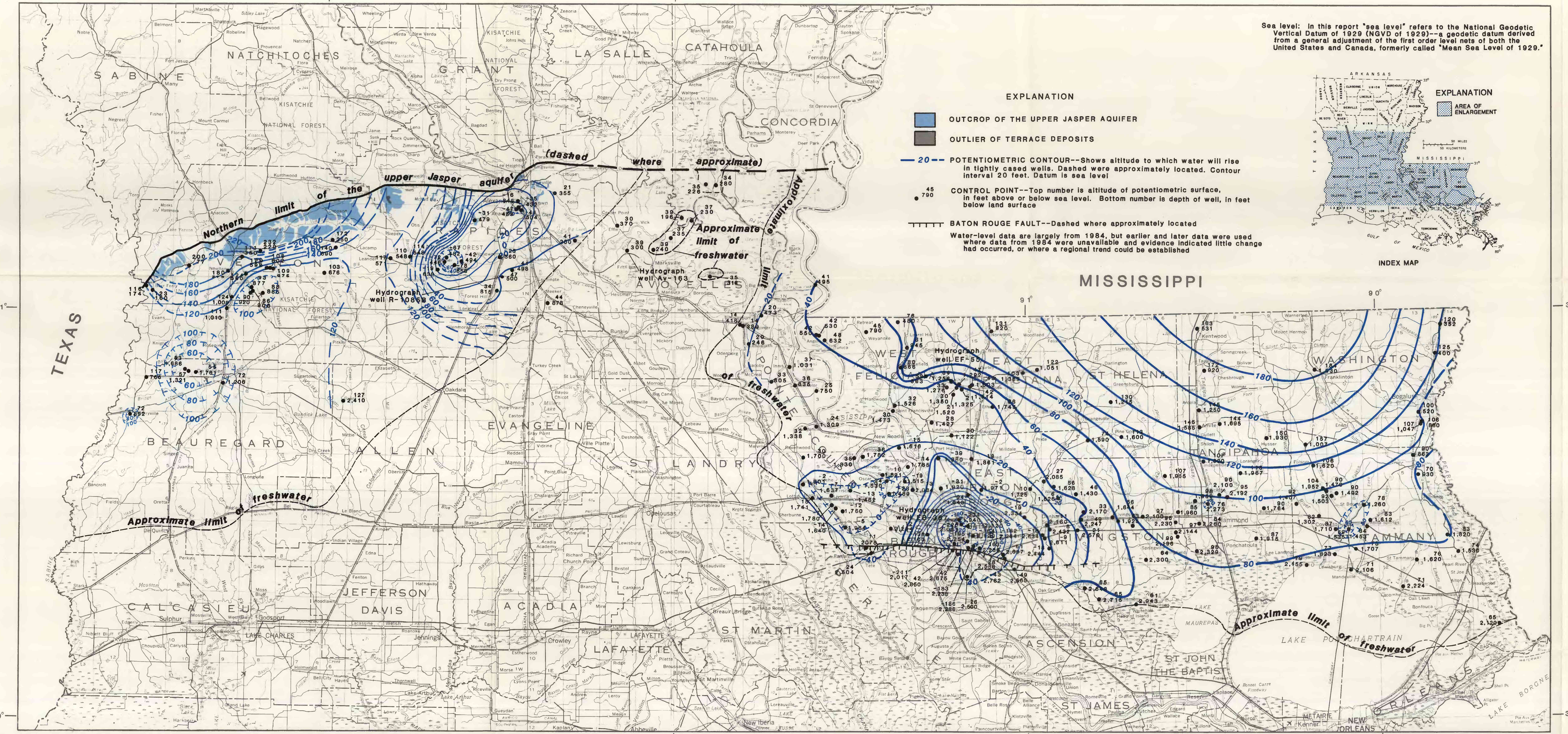

INDEX MAP

Base from U.S. Geological Survey
State base map, 1968

Hydrology modified (Smoot, C.W., U.S. Geological Survey, written commun., 1986) Geology from Geologic Map of Louisiana, 1984, Louisiana Geological Survey

SCALE 1:500,000

10 0 10 20 30 40 MILES

10 0 10 20 30 40 50 KILOMETERS

NATIONAL GEODETIC VERTICAL DATUM OF 1929

GENERALIZED POTENTIOMETRIC SURFACE OF THE UPPER JASPER AND EQUIVALENT AQUIFERS IN LOUISIANA, 1984

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1988

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Map Distribution
Federal Center, Bldg. 810
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Denver, Colorado 80225

INTRODUCTION

Maps of the Jasper and equivalent aquifers are the final maps in a series showing water levels in aquifers of Miocene age and younger in central and southern Louisiana that were prepared as part of the Gulf Coast Regional Aquifer-System Analysis study (Grubb, 1984). These maps show generalized contours of the altitude of water levels in wells completed in the Jasper aquifer in central and southwestern Louisiana and in aquifers in stratigraphically equivalent deposits of southeastern Louisiana for 1984. Separate maps were prepared for the upper and lower units of the Jasper and equivalent aquifers to provide a better representation of water levels. Although these maps provide a regional picture of water levels in the Jasper aquifer, they do not show the local differences in water levels between individual sand beds that occur near pumping centers. Generally, water levels shown at pumping centers are for the most heavily pumped sand beds at those centers.

Most water-level measurements used in compiling these maps were made in 1984. Where measurements from 1984 were unavailable, earlier and later measurements were used in areas where evidence indicated little change had occurred and in areas where definite regional trends of water-level change could be established. In the areas where trends were established, water levels were adjusted to 1984 values by applying corrections based on the trends. Other maps in the series show water levels in aquifers of Pleistocene age (Martin and Whiteman, 1985a), the Evangeline and equivalent aquifers (Martin and Whiteman, 1985b), and the Catahoula aquifer (Martin and Whiteman, 1986).

HYDROGEOLOGY

The Jasper aquifer of southwestern Louisiana and southeastern Texas was defined and named by Turcan and others (1966). The Jasper aquifer consists of sediments of Miocene age equivalent to the Williamson Creek, Dough Hills, and Carnahan Bayou Members (Fisk, 1940) of the Fleming Formation (Kennedy, 1892). The Jasper aquifer is separated from the underlying Catahoula aquifer by the calcareous clays of the Lena Member of the Fleming Formation (Fisk, 1940) and from the overlying Evangeline aquifer by the calcareous clays of the Castor Creek Member of the Fleming Formation (Fisk, 1940). Whitfield (1975), Rogers and Calandro (1965), Newcome and Sloss (1966), and Winner and others (1968) provide detailed descriptions of the hydrogeology of these sediments in central and southwestern Louisiana. Stratigraphically equivalent sediments of southeastern Louisiana have been divided into hydraulic zones by Morgan (1963) and into local aquifers by Meyer and Turcan (1955), Nyman and Fayard (1978), and Case (1979). Table 1 shows the relation between the hydraulic zones and local aquifers of southeastern Louisiana and the Jasper aquifer.

The Jasper and equivalent aquifers were deposited as an off-lapping sequence of continental, deltaic, and marine sediments along the northern flank of the Gulf Coast geosyncline. The Williamson Creek and Carnahan Bayou Members consist predominantly of alternating beds of sand and clay; whereas, the Dough Hills Member consists primarily of calcareous clay. The Jasper aquifer in this report is divided into an upper unit corresponding to the Williamson Creek Member and a lower unit corresponding to the Carnahan Bayou Member by the clays of the Dough Hills Member, which form a widespread confining unit within the aquifer. Calcareous clays equivalent to the Dough Hills Member can be identified in many wells in southeastern Louisiana (C.W. Smoot, U.S. Geological Survey, written commun., 1986). It is convenient to subdivide the aquifers of southeastern Louisiana equivalent to the Jasper aquifer into upper and lower units as shown in table 1.

The Jasper and equivalent aquifers crop out in the upland terrace areas of central Louisiana and southwestern Mississippi. Across much of the outcrop area, the Jasper and equivalent aquifers are covered by a thin veneer of Pleistocene terrace deposits. Across the Mississippi and Red River valleys, the aquifers subcrop beneath Holocene and Pleistocene alluvium. The aquifers generally dip in a southerly direction at about 30 feet per mile or less in the outcrop areas and shallow subsurface. The dip increases southward, reaching 100 feet per mile or more at depths of 2,000 to 3,000 feet.

RECHARGE

The Jasper and equivalent aquifers are recharged by rainfall on the upland terrace areas of central Louisiana and southwestern Mississippi. Recharge occurs primarily through the outcrops of the aquifers and terrace deposits at altitudes of 200 to 300 feet. Most of the water entering the outcrop areas and the terrace deposits is discharged locally to streams. Water that is not discharged locally moves downgradient in the Jasper and equivalent aquifers toward lower altitudes in the coastal plain and along the Mississippi River. As freshwater moves downgradient, it tends to flush connate salty water from the aquifer. The "approximate limit of freshwater" lines on the maps show the downgradient extent of freshwater in the upper and lower Jasper aquifers; the lines were determined using water-quality data and analysis of resistivity curves from geophysical well logs. Freshwater in the Jasper aquifer occurs to a maximum depth of more than 2,500 feet in southern Beauregard Parish in southwestern Louisiana (Whitfield, 1975, pl. 7). Equivalent aquifers of southeastern Louisiana contain freshwater to a maximum depth of more than 3,500 feet in southeastern Tangipahoa Parish (Winner, 1963, pl. 1).

DISCHARGE

Natural discharge from the aquifers is upward through overlying younger sediments. Artesian conditions prevail in the Jasper and equivalent aquifers except in the upland recharge areas, where water-table conditions occur in places.

Under predevelopment conditions, regional ground-water flow in the Jasper and equivalent aquifers was primarily southward and toward the valleys of the Mississippi, Pearl, and Sabine Rivers. Heavy pumpage of ground water for municipal, industrial, and domestic purposes has produced several areally extensive cones of depression that distort, and locally reverse, the natural regional flow pattern. Approximately 87 million gallons per day were pumped from the upper Jasper and equivalent aquifers in 1985 (Lurry, 1987). Heaviest pumpage and the most extensive cones of depression occur in the De Ridder, Alexandria, and Baton Rouge areas. Approximately 78 million gallons per day were pumped from the lower Jasper and equivalent aquifers in 1985. Deep cones of depression occur in the Alexandria area and near Bogalusa. Although a large volume of water is pumped from aquifers equivalent to the lower Jasper aquifer in the area north of Baton Rouge, the pumpage is widely distributed at numerous sites and the resulting cone of depression is widespread but relatively shallow. Regional ground-water gradients are generally 3 to 8 feet per mile in unstressed areas and range up to 20 feet per mile near pumping centers.

GROUND-WATER LEVELS

Ground-water levels in and near the outcrop areas typically fluctuate a few feet per year, and no long-term declines have occurred. This is illustrated by the hydrographs of observation wells AV-163 in the upper Jasper aquifer (fig. 1) and V-412 in the lower Jasper aquifer (fig. 2). Downdip in areas remote from pumping, water levels in both the upper and lower units of the Jasper aquifer and their equivalents have undergone long-term declines as shown by the hydrographs of observation wells R-1085B and EF-55 in the upper Jasper aquifer (fig. 1) and V-426 and SH-9 in the lower Jasper aquifer (fig. 2). The hydrograph of observation well EB-367 (fig. 1) shows water-level changes in the upper Jasper aquifer near the center of the Baton Rouge pumping cone. Steady increases in pumpage from the aquifer caused s sharp decline in water levels until 1974, when a decrease in pumpage permitted water levels to recover somewhat and then hold roughly steady until 1980. Further reduction in pumpage since 1980 has permitted a sharp rise in water levels near the center of the pumping cone, but this rise is not yet reflected in the regional trend of water-level decline.

The Baton Rouge fault, a down-to-the-coast growth fault in the Baton Rouge-Tepetate fault zone, displaces aquifers equivalent to the Jasper aquifer by about 300 feet across southern East Baton Rouge Parish and extends eastward into Livingston Parish and westward into Iberville Parish. Hydrologic effects of the fault are particularly evident in the upper Jasper aquifer and equivalents, where water-level differences of more than 200 feet occur across the fault in a distance of less than a mile. The fault acts as a barrier to the movement of salty water from the south to the pumping centers north of the fault (Rollo, 1969, p. 33). Effects of the fault are much less evident in the lower Jasper aquifer and equivalents because saltwater is present on both sides of the fault. The cone of depression north of the fault is broad and relatively shallow; no water levels are available south of the fault for comparison.

Table 1.--Aquifers equivalent to the Jasper aquifer of central and southwestern Louisiana

This report		Southwestern Louisiana[1,2]	East and West Feliciana and Pointe Coupee Parishes[3]	Baton Rouge area[4]	Southeastern Louisiana[5]
Burkeville confining unit		Castor Creek	Undefined	Undefined	Undefined
Jasper aquifer	Upper	Williamson Creek	Zone 2 (lower) Zone 3 (upper)	"2,000-foot" sand "2,400-foot" sand	Tchefuncta aquifer Hammond aquifer
Jasper aquifer	Unnamed confining unit	Dough Hills	Undefined	Undefined	Undefined
Jasper aquifer	Lower	Carnahan Bayou	Zone 3 (middle)	"2,800-foot" sand Unnamed sands of Miocene age	Amite aquifer Ramsay aquifer
Unnamed confining unit		Lena	Undefined	Undefined	Undefined

[1]Member of the Fleming Formation of Miocene age (Fisk, 1940). [2] Turcan and others, 1966. [3] Winner and others, 1968; Morgan, 1963. [4]Meyer and Turcan, 1955. [5]Nyman and Fayard, 1978.

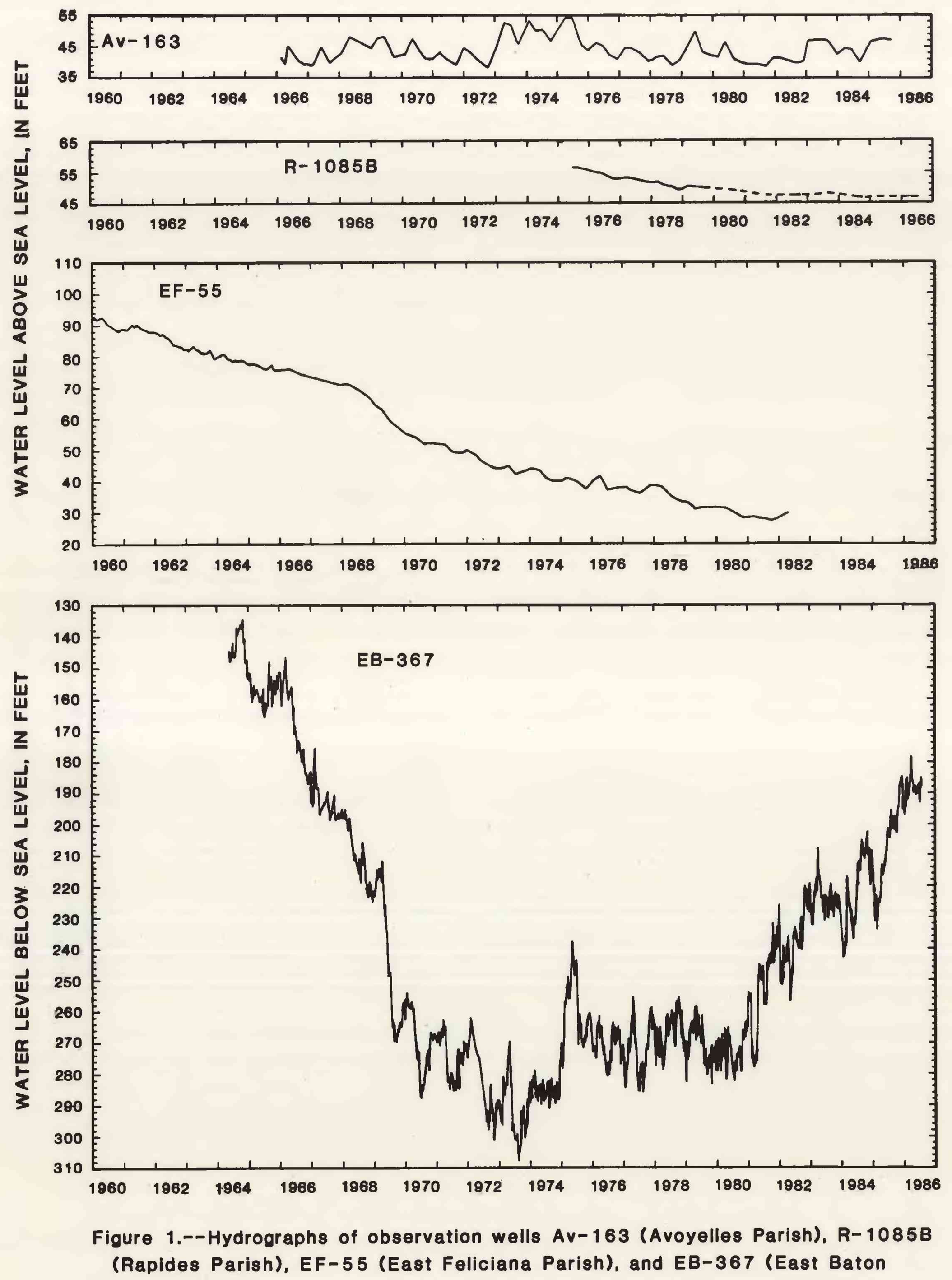

Figure 1.--Hydrographs of observation wells Av-163 (Avoyelles Parish), R-1085B (Rapides Parish), EF-55 (East Feliciana Parish), and EB-367 (East Baton Rouge Parish).