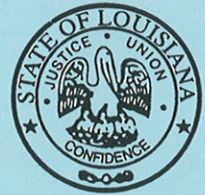




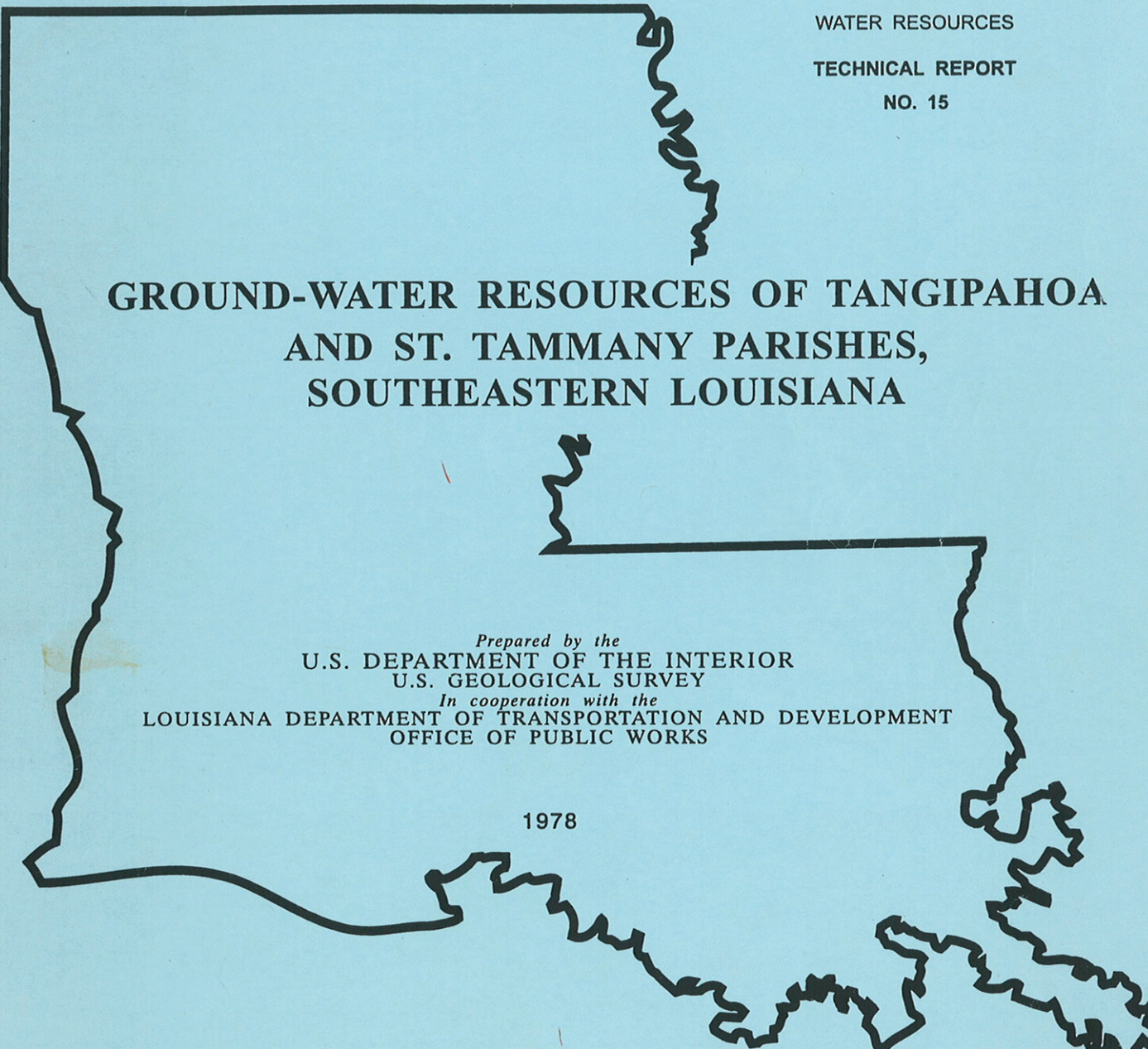
STATE OF LOUISIANA  
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT  
OFFICE OF PUBLIC WORKS



WATER RESOURCES

TECHNICAL REPORT

NO. 15



**GROUND-WATER RESOURCES OF TANGIPAHOA  
AND ST. TAMMANY PARISHES,  
SOUTHEASTERN LOUISIANA**

*Prepared by the*  
U.S. DEPARTMENT OF THE INTERIOR  
U.S. GEOLOGICAL SURVEY  
*In cooperation with the*  
LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT  
OFFICE OF PUBLIC WORKS

1978

STATE OF LOUISIANA  
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT  
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UNITED STATES GEOLOGICAL SURVEY

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SOUTHEASTERN LOUISIANA

By

Dale J. Nyman and Larry D. Fayard  
U.S. Geological Survey

Published by  
LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT  
OFFICE OF PUBLIC WORKS  
Baton Rouge, La.

1978

STATE OF LOUISIANA  
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DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT  
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## GLOSSARY

### Aquifer

A formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.

### Artesian well

A well in which the water level rises above the base of the bed confining the aquifer; an artesian well may be either flowing or nonflowing.

### Base flow

The discharge entering stream channels from ground-water or other delayed sources and excludes direct overland runoff.

### Cone of depression

The depression, roughly conical in shape, produced in a potentiometric surface by pumping (or artesian flow).

### Confining bed

A body of "impermeable" material stratigraphically adjacent to one or more aquifers that serves to confine water in the aquifer that the water level rises above the base of the confining bed.

### Corrected specific capacity

Specific capacity corrected for head loss due to pipe friction (including correction for temperature) and partial penetration.

### Dip

The angle at which a stratum or any planar feature is inclined from the horizontal.

### Ground-water discharge

The water or the quantity of water released from the zone of saturation by any means.

### Hydraulic conductivity

The volume of water at the existing kinematic viscosity that will move through a unit area of an isotropic porous medium in unit time under a unit hydraulic gradient through a unit area measured at right angles to the direction of flow. Replaces the term "field coefficient of permeability." The hydraulic conductivity multiplied by 7.48 is equal to the coefficient of permeability. For conversion of hydraulic conductivity in feet per day to meters per day, multiply by 0.3048.

### Hydraulic gradient

The difference in head per unit distance measured normal to lines connecting points of equal head. The hydraulic gradient, hydraulic conductivity (permeability), and porosity determine the velocity, or rate of ground-water movement.



#### Milligrams per liter (mg/L)

For the purpose of converting to the metric system, the unit "milligrams per liter" replaces the unit "parts per million," formerly used by the U.S. Geological Survey. The two units are equivalent at dissolved-solids concentrations less than about 7,000 mg/L.

#### Potentiometric surface

The surface which represents the static head with reference to a specified datum, such as mean sea level. As related to an aquifer, it is defined by the levels to which water will rise in tightly cased wells. The water table is a particular potentiometric surface.

#### Recharge

The process by which water is absorbed and added to the zone of saturation, either directly into a formation or indirectly by way of another formation.

#### Seepage run

A series of stream-discharge measurements along a river channel to determine changes in flow between measuring points and the contribution of tributary streams.

#### Specific capacity

The rate of discharge of water from the well divided by the drawdown of water level within the well. It varies slowly with duration of discharge, which should be stated when known. Commonly expressed in gallons per minute per foot of drawdown for a specified period of continuous pumping at a constant rate.

#### Storage coefficient

The volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head.

#### Strike

The direction or bearing of a horizontal line in a plane of an inclined stratum; it is perpendicular to the direction of dip.

#### Transmissivity

The rate at which water of the prevailing kinematic viscosity is transmitted through a unit width of the aquifer under a unit hydraulic gradient. It is equal to an integration of the hydraulic conductivities across the saturated part of the aquifer perpendicular to the flow paths. (Formerly termed "transmissibility," defined as the rate of flow of water, at the prevailing water temperature, in gallons per day, through a vertical strip of the aquifer 1 foot wide extending the full saturated height of the aquifer under a unit hydraulic gradient.) The transmissivity multiplied by 7.48 is equal to the coefficient of transmissibility. For conversion of transmissivity in feet squared per day to meters squared per day, multiply by 0.093.

#### Underflow

The downstream flow of water through the permeable deposits that underlie a stream and that are more or less limited by adjacent sediments of lower permeability.

#### Unit yield

The number of cubic feet of water flowing per second for each square mile of area drained, assuming that the runoff (yield) is uniformly distributed with regard to time and area.

#### Unsaturated zone (zone of aeration)

The permeable zone between the land surface and the water table, which contains water only temporarily plus water held by capillarity.

#### Water table

That surface in an unconfined water body at which the pressure is atmospheric (water level below the top of the aquifer). It is defined by the levels at which water stands in wells that penetrate the water body just far enough to hold standing water.

FACTORS FOR CONVERTING ENGLISH UNITS TO INTERNATIONAL SYSTEM (SI) UNITS

<u>Multiply English units</u>	<u>By</u>	<u>To obtain SI units</u>
acres	0.4047	hectares (ha)
cubic feet per second (ft <sup>3</sup> /s)	28.32	liters per second (L/s)
cubic feet per second per square mile [(ft <sup>3</sup> /s)/mi <sup>2</sup> ]	10.93	liters per second per square kilometer [(L/s)/km <sup>2</sup> ]
feet (ft)	.3048	meters (m)
feet per day (ft/d)	.3048	meters per day (m/d)
feet per mile (ft/mi)	.1894	meters per kilometer (m/km)
feet per year (ft/yr)	.3048	meters per year (m/yr)
feet squared per day (ft <sup>2</sup> /d)	.09290	meters squared per day (m <sup>2</sup> /d)
gallons per day (gal/d)	.003785	cubic meters per day (m <sup>3</sup> /d)
gallons per day per foot [(gal/d)/ft]	.01242	meters squared per day (m <sup>2</sup> /d)
gallons per day per square foot [(gal/d)/ft <sup>2</sup> ]	.04068	meters per day (m/d)
gallons per minute (gal/min)	.06308	liters per second (L/s)
gallons per minute per foot [(gal/min)/ft]	.2070	liters per second per meter [(L/s)/m]
inches (in)	2.540	centimeters (cm)
miles (mi)	1.609	kilometers (km)
million gallons per day (Mgal/d)	3.785x10 <sup>6</sup>	liters per day (L/d)
square miles (mi <sup>2</sup> )	2.590	square kilometers (km <sup>2</sup> )

(To convert temperature in °C to °F, multiply by 9/5 and add 32.)

GROUND-WATER RESOURCES OF TANGIPAOHA AND ST. TAMMANY PARISHES.  
SOUTHEASTERN LOUISIANA

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By Dale J. Nyman and Larry D. Fayard

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ABSTRACT

The aquifers in Tangipahoa and St. Tammany Parishes constitute one of the largest sources of fresh ground water in Louisiana. There are 12 major aquifers, ranging from Miocene to Holocene in age, that yield water of good quality at rates of 1,000 gallons per minute to more than 3,000 gallons per minute to large-capacity wells as deep as 3,354 feet. Water levels in the shallow aquifer range from near land surface near permanent streams to as much as 80 feet below land surface in some upland areas. Aquifers below depths of 2,000 feet in the extreme southern part of the area may have water levels nearly 100 feet above land surface.

Water levels in wells in aquifers less than about 1,500 feet deep are relatively stable; maximum rates of decline measured from 1939 to 1976 generally have been less than 1 foot per year. The average water-level decline for aquifers below depths of 1,500 feet during the period 1969-76 has been about 2 feet per year. However, the Amite and Hammond aquifers are extensively developed and have had higher than average decline rates, locally more than 3 feet per year. During 1974 an average of about 42 million gallons per day was discharged from aquifers in the area; of this amount, nearly 20 million gallons per day was discharged from uncontrolled, or partially controlled, flowing wells.

The hardness of water from the aquifers generally is less than 30 milligrams per liter, iron and manganese concentration generally is less than 0.5 milligram per liter, and dissolved solids generally are less than 350 milligrams per liter. Locally, the water may contain 0.5 milligram per liter or more of hydrogen sulfide. Water from most of the shallow aquifer and from many of the deep aquifers in the north half of the area tends to be corrosive.

## INTRODUCTION

The ground-water system underlying Tangipahoa, St. Tammany, and adjacent parishes is one of the largest sources of fresh ground water in Louisiana. The parishes are in southeastern Louisiana, north of Lake Pontchartrain. (See fig. 1.) The ground-water resources of the area have been described in earlier reports, but the ground-water hydrology of the area had not been studied in detail. The area was included in a reconnaissance investigation of the Florida Parishes by Winner (1963), and the extreme southern part of the area was included in a comprehensive report on the water resources of the Lake Pontchartrain area by Cardwell, Forbes, and Gaydos (1967).



Figure 1.--Location of report area.

### Purpose and Scope

Tangipahoa and St. Tammany Parishes are developing rapidly, and ground-water use is increasing. Because of the lack of quantitative information on ground water, a comprehensive study was conducted to map the principal aquifers, to determine the quantity and quality of water available from these aquifers, and to determine the effects of ground-water withdrawals on the aquifers.

The study began in June 1968, and most fieldwork was completed by April 1971; however, water-use data for 1974 and water-level data through 1976 are included. Data from geophysical and drillers' logs were used to define the aquifer systems. The resulting aquifer maps show the locations of wells used for hydrologic and geologic control; descriptive data for these wells are given in table 19 and 21. Records of water wells were obtained and wells were pumped to determine yields and aquifer characteristics for most of the aquifers. Potentiometric maps reflecting 1974 water levels were drawn for some aquifers. Additional data collected include chemical data on ground water and an inventory of water use. A seepage run better defined the hydrology of the shallow aquifer. The surface-water resources of the area are discussed in detail in a separate report by Fayard and Nyman (1976).

### Cooperation and Acknowledgments

This project was part of the continuing cooperative program of water-resources studies by the U.S. Geological Survey and the Louisiana Office of Public Works. Electrical logs of oil wells and test holes were made available by the Louisiana Geological Survey.

The Louisiana Health and Human Resources Administration, Division of Health; the U.S. Environmental Protection Agency; and the U.S. Army Corps of Engineers, New Orleans District, aided the project by furnishing data. The Louisiana Office of Highways provided test-hole sites. County Agents J. M. Bankston, St. Tammany Parish; R. D. Mitchell, Tangipahoa Parish; and M. H. Jones, Washington Parish, supplied data for water-use estimates.

Special appreciation is extended to the well drillers who were serving the area when the fieldwork was conducted--Mr. D. K. Summers, Sr., of Denham Springs; Summers Brothers of Walker; Messrs, C. B. Smith and Frank Morrison of Albany; Mr. Edward Morrison of Livingston; Messrs. H. L. Varnado and Son, Edward Carroll, and Jack Gill, Jr., all of Amite; Mr. Merlin Anthon of Lacombe; Mr. Paul Anthon of Hammond; Mr. John Anthon of Pearl River; and Mr. Frank Cotton of Pine.

The assistance given by managers of public and private water systems and by many individual well owners was invaluable to the project.

### WATER USE

An average of about 42 Mgal/d was discharged from aquifers in St. Tammany and Tangipahoa Parishes during 1974. Essentially none of this water is returned to the aquifers. Water use by category is given in table 1.

The largest category of water use (1974) is discharge from uncontrolled flowing wells, which amounts to nearly 20 Mgal/d. The many wells that are allowed to flow uncontrolled for no useful purpose contribute to water-level declines. Hopefully, the wastage of water will decrease as the public becomes more aware of water problems and the need for water conservation. Even without controls, wastage will gradually diminish as



Table 1.--Ground-water use, 1959-74

Year	Water-use category, in millions of gallons per day							Total
	Uncontrolled flowing wells	Public water supplies	Rural- domestic	Commercial lakes	Industrial	Irrigation	Livestock	
ST. TAMMANY PARISH								
1959	----	1.5	0.93	1.2	1.8	0.18	0.07	-----
1965	27	4.1	1.2	----	1.6	.47	.06	<u>1</u> /34.4
1969	20	5.1	1.9	2.9	.77	.22	.08	31.0
1974	16	6.0	2.4	1.7	.98	.35	.09	27.5
TANGIPAHOA PARISH								
1959	----	3.1	1.1	----	1.1	1.3	0.83	-----
1965	4.2	5.6	1.9	0.72	1.1	.98	.99	15.5
1969	4.7	6.4	2.1	.50	.63	1.8	.93	17.1
1974	2.7	5.5	2.0	.18	1.1	1.6	.87	14.0

1/Incomplete.

artesian pressures decline. Suggestions concerning control of wells from which water is flowing to waste are discussed in the following section.

Pumpage for public water systems is the second largest water-use category. An average of more than 11 Mgal/d was used in 1969 and 1974. This usage will probably increase as municipalities grow and as rural water systems are developed. The amount of water pumped by municipal systems in Tangipahoa and St. Tammany Parishes is about equal.

Rural-domestic pumpage, about 4 Mgal/d in 1974, ranks third and is greater in St. Tammany Parish. According to the Covington Chamber of Commerce (oral commun., 1975), the population in St. Tammany Parish is growing about 10 percent per year, and many of these people reside in rural or suburban areas. The rural-domestic category consists of the small, privately owned, home water systems.

Ground-water pumpage for industrial use averaged slightly more than 2 Mgal/d during 1974 and ranked fourth in water use. Industrial pumpage was lowest in 1969 (for the period 1959-74).

Irrigation pumpage averaged slightly less than 2 Mgal/d and ranked fifth in 1974. According to statistics from the U.S. Department of Commerce, Bureau of the Census (1966a, b; 1971a, b), irrigated acreage declined from 1959 to 1969 but returned to about 1959 levels by 1974. The irrigation pumpage given in table 1 may differ from figures published previously by the U.S. Geological Survey for the years 1959-69 because they are based on census figures that were unavailable when the previous estimates were made.

Commercial lakes ranked sixth in use of ground water during 1974. This category includes recreation lakes and those used for fish farming. About 3.4 Mgal/d was pumped in 1969 in the report area; pumping decreased to about 1.9 Mgal/d in 1974. The largest recreation lakes and the largest acreage of fish ponds were built and filling began during 1968 and 1969. By 1974 the recreation lakes were full, and some of the fish farms had gone out of business.

The water used for watering livestock averaged slightly less than 1 Mgal/d during 1974 and ranked seventh in water use. The use of ground water for milk cows, laying hens, broilers, feedlot operations, and for other domestic animals has remained essentially the same for the period 1959-74.

It is not feasible to completely subdivide ground-water pumpage by aquifer at this time. However, estimates have been made for some aquifers in the following sections.

#### WASTAGE OF GROUND-WATER RESOURCES

Over the years, much ground water has been wasted in southeastern Louisiana because of the belief that if a flowing well were shut down, the life of the well would be shortened or it might not flow again when the valve was reopened. This belief began before modern well screens were developed. The first flowing wells had no screens, or had an improvised "shop screen" that might fail in a short time. Wells completed without screens flow as long as there is a cavity in the sand below the casing. The sudden closing of a valve to stop the flow can create a "water hammer" that will cause this cavity to collapse and fill with sand, thereby reducing or stopping flow. The size of the cavity is analogous to length and size of screen--the greater the area open to the aquifer, the greater the flow. Modern well screens maintain an opening to the aquifer, and the screen is strong enough to withstand normal water-hammer pressures. It is therefore important that flowing wells be properly constructed and equipped with valves so that the flow can be limited to the amount needed. The rules and regulations that implement State Act 606 (1976) require that well owners or lessees install control devices on free-flowing wells that produce more than 25,000 gal/d (Louisiana Department of the State Register, 1977, p. 209-210).

Many of the old wells still exist, although their flow has ceased or been greatly reduced because of declining head. Old wells can also lose flow to aquifers of lower head through holes rusted in casing and couplings. Thus, although surface flow is reduced, the aquifer with higher head is being depleted at a faster rate than is apparent. The potential for contamination of the deeper aquifer increases as its head decreases with time.

Another possible cause of depletion of artesian pressure is flow outside the well casing if the annular space is not effectively sealed. Such flow cannot be easily detected, but it can be prevented by cementing the annular space between the well casing and borehole from top to bottom, as is the practice for most large industrial and municipal wells.

Cementing the annular space protects the outside of the casing from shallow, corrosive water and prevents or retards leakage through cracks and holes. Additional information regarding the advantages of cementing well casings is available in Ahrens (1970, p. 51).

State Act 535 (1972) requires the plugging and sealing of all abandoned wells whether they flow or not. Standards for the abandonment of water wells are outlined in "Water Well Rules, Regulations, and Standards, State of Louisiana" (Louisiana Department of Public Works, 1976).

#### GEOHYDROLOGIC FRAMEWORK

The sediments of Miocene to Holocene age that underlie the project area are an overlapping series of wedge-shaped, unconsolidated deposits that dip and thicken to the south and southwest. The strike (see "Glossary") of the deposits is generally eastward for most of Tangipahoa Parish, curving slightly southward into St. Tammany Parish, and becoming southeastward in the vicinity of Slidell. The rate of dip is less than 30 ft/mi for sediments shallower than 500 ft below the land surface, but the rate increases with depth and to the southeast, becoming about 100 ft/mi below 3,000 ft near Slidell. The changes in dip and strike are related to regional structural features--the subsiding Mississippi embayment and the uplift in southern Mississippi (Howe, 1962).

Changes in attitude, thickness, depth, and grain size reflect differences in the depositional environment of the sediments. There were many changes in sea level from Miocene time to the present (Holocene); also, sea level changed relative to sedimentary beds because of subsidence and uplift.

Some sands (aquifers) were deposited as offshore bars oriented essentially east-west. Clays were deposited in protected lagoons between bars and the shore. Fairly uniform medium to coarse beach sands were also deposited over extensive areas.

Concurrent with shoreline and nearshore deposition, continental deposition was also occurring. Aquifers resulting from continental deposition are primarily river-channel and flood-plain deposits of generally southward-flowing streams. Such aquifers are therefore more continuous in the north-south direction and may be limited laterally by the clays of natural levees or because the channel was incised into an extensive clay deposit. Continental deposits are typically discontinuous and may exhibit abrupt changes in lithology in a short distance (pls. 1-3). The sequence and a brief description of the aquifers is given in table 2. Aquifers from about 1,800 to 3,000 ft below land surface along the north shore of Lake Pontchartrain are reasonably continuous in the study area. Aquifers above a depth of 1,800 ft may be continuous east-west but extend varying distances north-south because updip they intersect terrace and alluvial deposits that blanket Tangipahoa-St. Tammany Parishes.

Table 2.--Geohydrologic summary of aquifers

System	Series	Correlative units [Aquifer in Baton Rouge area (Rollo, 1969) or hydraulic zone (Morgan, 1963)]	Aquifer name in this report	Typical range in thickness (ft)	Description and remarks	Highest reported yield (gal/min)	Water-level range, in feet above or below land surface (1974)	Rate of water-level decline, 1974 (ft/yr)	Water quality			
Quaternary	Pleistocene and Holocene		Shallow	100 to 400	Mostly sand and gravel. Aquifer includes terrace deposits and alluvium and underlies most of report area. Supplies base flow to streams and is thickest in the flood plains of major streams. Good potential for future development. Hydraulic conductivity ranges from 500 to 1,000 (gal/d)/ft <sup>2</sup> , or from 70 to 140 ft/d.	550	+2 to -80	No continuous decline; water levels respond to rainfall trends.	Iron and manganese range from 0.40 to 2.2 mg/L; hardness typically less than 20 mg/L; water is generally corrosive.			
				Ponchatoula	Upper	200 to 300	Mostly sand and gravel. Aquifer underlies southern half of Tangipahoa and St. Tammany Parishes and is subsurface equivalent of Citronelle Formation. Good potential for future development. Hydraulic conductivity is 1,300 (gal/d)/ft <sup>2</sup> , or 180 ft/d, at Ponchatoula.	1,425	+15 to -7	0 to 0.2	Iron and manganese generally less than 0.35 mg/L; hardness less than 20 mg/L; pH generally ranges from 7.5 to 9.0. Water in aquifer saline in Manchac area.	
					Lower	100 to 200	Mostly medium sand. Aquifer underlies southern two-thirds of Tangipahoa Parish and most of St. Tammany Parish. Some potential for future development. Hydraulic conductivity ranges from 250 (gal/d)/ft <sup>2</sup> , or 35 ft/d, at Hammond, to 500 (gal/d)/ft <sup>2</sup> , or 65 ft/d, at Madisonville.	100	+17 to -2			
	Tertiary	Pliocene	"800-foot," "1,000-foot," and "1,200-foot" sands	Zone 1	Big Branch	50 to 150	Mostly medium to coarse sand. Aquifer occurs only in southeastern part of St. Tammany Parish. Some potential for future development. Hydraulic conductivity averages about 500 (gal/d)/ft <sup>2</sup> , or 70 ft/d, near Big Branch.	500	+32 to +5	0.5	Iron and manganese generally less than 0.20 mg/L; hardness generally less than 10 mg/L; pH generally greater than 8.0. Water in aquifer saline in vicinity of Lacombe.	
					Kentwood aquifer system	Kentwood	400 to 500	Mostly sand and gravel. Aquifer occurs in northern Tangipahoa Parish and northwestern Washington Parish. Very good potential for future development. Hydraulic conductivity about 1,000 (gal/d)/ft <sup>2</sup> , or 135 ft/d, at Kentwood.	1,557	+20 to -60	0 to 1	Iron and manganese generally range from 0.01 to 0.20 mg/L; hardness generally less than 35 mg/L; pH about 6.5.
						Abita	50 to 100	Mostly medium to very coarse sand. Aquifer underlies most of report area. Some potential for future development. Hydraulic conductivity about 900 (gal/d)/ft <sup>2</sup> , or 120 ft/d, near Pearl River.	1,515	+90 to -40	0.5 to 2.5	Iron and manganese generally less than 0.40 mg/L; hardness generally less than 10 mg/L; pH 6.5-9.0.
		Covington	100 to 200	Mostly medium to coarse sand. Aquifer underlies most of report area. Good potential for future development. Hydraulic conductivity about 1,700 (gal/d)/ft <sup>2</sup> , or 220 ft/d, near Pearl River.		750	+97 to -30	2.0 to 2.2	Iron and manganese generally less than 0.35 mg/L; hardness generally less than 25 mg/L; pH 6.5-9.5.			
		Slidell	100 to 200	Mostly medium to coarse sand. Aquifer occurs in southeastern St. Tammany Parish. Good potential for future development. Hydraulic conductivity 1,400 (gal/d)/ft <sup>2</sup> , or 190 ft/d, at Slidell.		4,000	+85 to +80	2.5	Iron and manganese generally less than 0.20 mg/L; hardness less than 10 mg/L; pH 8.0-8.5.			
		Miocene	"2,000-foot" sand "2,400-foot" sand "2,800-foot" sand	Zone 3	Tchefuncta	100 to 150	Mostly medium to coarse sand. Aquifer underlies most of report area except northern half of Tangipahoa Parish. Good potential for future development. Hydraulic conductivity ranges from 500 (gal/d)/ft <sup>2</sup> , or 65 ft/d, at Hammond, to 1,000 (gal/d)/ft <sup>2</sup> , or 135 ft/d, near Covington.	1,500	+98 to -15	1.7 to 2.8	Iron and manganese generally less than 0.40 mg/L but may be as much as 4.0 mg/L; hardness less than 20 mg/L; pH 6.6-8.2. Water in aquifer saline south of Slidell.	
					Hammond	100 to 200	Mostly medium to coarse sand. Aquifer underlies most of report area. Heavily developed in Hammond area. Hydraulic conductivity ranges from 650 (gal/d)/ft <sup>2</sup> , or 85 ft/d, at Hammond, to 1,500 (gal/d)/ft <sup>2</sup> , or 200 ft/d, at Covington.	3,400	+90 to -50	3.0 to 5.0	Iron and manganese generally less than 0.50 mg/L but may exceed 1.0 mg/L; hardness less than 15 mg/L; pH generally 7.0-9.0. Water in aquifer saline south of line from Slidell to just north of Manchac.	
					Amite	100 to 150	Mostly medium to coarse sand. Aquifer underlies most of report area. Heavily developed in vicinity of Amite and Independence. Hydraulic conductivity about 1,100 (gal/d)/ft <sup>2</sup> , or 150 ft/d, at Amite.	1,700	+95 to -45	2.4 to 3.4	Iron and manganese generally less than 0.20 mg/L but may exceed 4.0 mg/L; hardness less than 5 mg/L; pH 8.0-9.2. Water in aquifer saline south of a line through Ponchatoula and Pearl River.	
					Ramsay	100 to 250	Mostly medium to coarse sand. Aquifer underlies southern Tangipahoa Parish and St. Tammany and Washington Parishes. Good potential for future development. Hydraulic conductivity about 1,600 (gal/d)/ft <sup>2</sup> , or 210 ft/d, at Ramsay.	2,100	+84 to +61	2.4	Iron and manganese range from 0.05 to 0.60 mg/L; hardness 2-20 mg/L; pH 7.1-8.6. Water in aquifer saline south of a line through Hammond and Abita Springs.	
Franklinton	100 to 250				Mostly medium to coarse sand. Aquifer contains freshwater in northernmost Tangipahoa Parish and most of Washington Parish. Good potential for future development. Hydraulic conductivity about 2,000 (gal/d)/ft <sup>2</sup> , or 290 ft/d, at Franklinton.	1,300	-45 to -100	1.7	Iron and manganese less than 0.10 mg/L; hardness less than 10 mg/L; pH 8.6-9.0. Water in aquifer saline south of a line from Greensburg to Sun.			

Faulting can be another reason for abrupt changes in lithology and differences in water level and water quality at similar depths within short distances. No faults were mapped in this report; however, fault zones in southern Tangipahoa and St. Tammany Parishes have been described by Murray (1961, p. 189).

The depth to a particular aquifer can be estimated from information in this report if the elevation of the drilling site is known and the location of the site can be plotted on the appropriate geohydrologic map. For example, for the Ponchatoula aquifer (pl. 6) the depth to the top and bottom of the lower Ponchatoula aquifer would be greater at Natalbany (between Tickfaw and Hammond) than at well Ta-266 and less than at well Ta-276 because the aquifers dip southward, as indicated by the depth information given for these wells in table 4. Natalbany is nearer well Ta-276; therefore, the depth to the aquifer would be closer to the aquifer depths at well Ta-276. The depth of the aquifer interval below sea level at Natalbany would be more than 360 ft and less than 500 ft to the top, and more than 855 ft and less than 975 ft to the bottom. The actual drilling depth would be between 550 and 1,025 ft below land surface, assuming a 50-ft elevation for the land surface at Natalbany. Planners following this procedure should be aware that the aquifers vary greatly in thickness and grain size; therefore a test hole may be needed to determine actual conditions at a particular site. Also, it may be necessary to complete a well in an aquifer to accurately determine the water quality.

#### AQUIFER CHARACTERISTICS AND WELL YIELDS

The term "aquifer characteristics" refers to variables that quantitatively describe the ability of an aquifer to transmit and store water and to yield water to a well. These variables are hydraulic conductivity, transmissivity, and storage coefficient and are defined in the "Glossary." Values for these variables generally are determined from aquifer tests. Transmissivity is indicative of the amount of water that can flow through the full thickness of the aquifer. Under similar hydrologic conditions the larger the transmissivity, the smaller the drawdown in wells of equal construction and development for a specific pumping rate. The aquifer thickness (tables 4, 6, 8, 10, 12, 15, 17; fig. 7; and pls. 9, 12, 13) multiplied by the average hydraulic conductivity, listed in the section "Aquifer Characteristics and Well Yields" for the aquifer of interest, gives an estimate of the transmissivity at that point.

The specific capacity of a well, or the yield per foot of drawdown for a given period of time, is a factor used to evaluate the performance of a well. The nearer the measured specific capacity approaches the theoretical value, determined from aquifer characteristics, the more efficient the well. Most deep wells in the area have specific capacities of only 1/2 to 1/3 of the theoretical capacity because the total thickness of the aquifer generally is not screened and pipe-friction and entrance losses generally occur.

The relation between theoretical specific capacity and transmissivity has been demonstrated by Meyer (1963, p. 339). However, the theoretical specific capacities must be corrected for partial penetration and for pipe friction in deep wells.

Partial penetration concerns the percentage of the aquifer screened by the well. As more of an aquifer is screened, the drawdown at a specific pumping rate is reduced. A convenient method for correcting the drawdown of a partially penetrating well is described by Turcan (1963, p. E145).

Pipe-friction loss is directly proportional to well depth. A convenient source of friction data is the "Water Well Handbook" (Anderson, 1973, p. 34). Because the formulas for pipe friction were determined at a standard temperature (60°F or 15.5°C), and the temperature of water from deep wells in the report area may exceed 90°F (32.0°C), the temperature correction should be made (Cardwell, in Cardwell and others, 1967, p. 32).

If aquifer characteristics are known or can be estimated, graphs can be drawn from which the size of the cone of depression and the additional drawdown caused by interference between wells can be estimated. The hydraulic characteristics for most of the aquifers discussed in this report are given or can be estimated on the basis of the information given.

The use of information in this report to aid in solving practical ground-water problems is illustrated by the following example. Suppose an industry built a plant north of Natalbany in Tangipahoa Parish near well Ta-266 (pl. 1) and required about 2,000 gal/min. The water quality needed and the aquifer characteristics required to produce the desired quantity of water could be supplied by the lower Ponchatoula aquifer. From plate 6 the aquifer occurs between 360 and 510 ft below sea level. Land surface is 50 ft above sea level; therefore, the aquifer occurs 410 to 560 ft below land surface and is 150 ft thick. The average hydraulic conductivity for the lower Ponchatoula aquifer is about 400 (gal/d)/ft<sup>2</sup> (53.5 ft/d) (see section "Ponchatoula Aquifer," "Aquifer Characteristics and Well Yields"); therefore, the transmissivity would be about 60,000 (gal/d)/ft (8,000 ft<sup>2</sup>/d).<sup>1/</sup> The theoretical specific capacity for a 12-in well, which screened the entire aquifer thickness, would be nearly 25 (gal/min)/ft after pumping 1 day (Meyer, 1963).

If two wells were installed, each yielding 1,000 gal/min, each well would have 40 ft of drawdown after 1 day, assuming no head losses owing to friction and (or) partial penetration or interference between wells. If only half of the aquifer were screened, the drawdown would be increased to about 64 ft, and pipe friction for about 450 ft of 12-in pipe would increase the drawdown to about 65 ft. The observed specific capacity would therefore be about 15 (gal/min)/ft of drawdown. If the two wells were pumping 1,000 gal/min simultaneously and were 500 ft apart, then each well would have nearly 20 ft of additional drawdown after 1 day because of interference (fig. 2). This analysis is described by Lohman (1972, p. 55-56) and by Bruin and Hudson (1955, p. 13-22).

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<sup>1/</sup> Hydraulic conductivity times aquifer thickness.



It should also be noted from figure 2 that much of the drawdown occurs during the first day of pumping. After nearly 3 years of pumping (1,000 days) the additional drawdown is estimated to be 33 ft. The drawdown for a transmissivity of 60,000 (gal/d)/ft (8,000 ft<sup>2</sup>/d) would be approximately twice as great as for a transmissivity of 100,000 (gal/d)/ft (1,300 ft<sup>2</sup>/d). The above estimates of drawdown assume that the pumping rate is constant, that the aquifer has a reasonably consistent thickness and permeability for a radius of several miles around the plantsite, that there is little or no leakage from adjacent aquifers, and that there is no nearby pumping.

#### WATER LEVELS AND THE POTENTIOMETRIC SURFACE

The potentiometric surface is the altitude to which the water will rise in a tightly cased well screened in an aquifer. For nonflowing wells the head, or water level below land surface, of an aquifer at a particular site can be estimated by subtracting the altitude (which may be positive or negative) of the potentiometric surface from the topographic altitude of the well site. For flowing wells the head above land surface is determined by subtracting the topographic altitude from the altitude of the potentiometric surface. The maps in this report (pls. 5, 6, 7, 8, 10, and 11) are based on data of June 1969 or May 1974.

The hydraulic gradient is the slope of the potentiometric surface, generally measured perpendicular to the potentiometric contour lines. Aquifers of low transmissivity require steeper gradients to supply a given amount of water to a pumping center than do aquifers of high transmissivity. In general, the gradient and shape of the potentiometric contours reflect areal changes in transmissivity and effects of recharge and discharge; they also indicate the location and extent of areas affected by pumping.

The rate of water-level decline reflects the rate of pumping, the distance from pumping, the effect and proximity of boundaries, and the hydraulic characteristics of the aquifer. The average water-level decline, 1969-74, was about 2 ft/yr for aquifers deeper than 1,500 ft. Water levels in wells less than 1,500 ft deep generally declined at less than 1 ft/yr during the same period. Water levels in the terrace deposits respond to local recharge from rainfall. The rate of decline caused by pumping from the shallow aquifers in most of the report area is negligible.

Water-level declines exceeding 1 ft/yr in wells tapping deep aquifers in areas remote from pumping centers probably reflect, at least in part, exchange of water between aquifers in response to head differentials produced by pumping.

Water-level declines cannot continue indefinitely without some consequences. The first notable consequence for aquifers having flowing wells will be the cessation of flow. In nonflowing wells there will be increased pumping lifts resulting in increased costs of pumping water. Eventually, if water-level declines are large, subsidence of the land

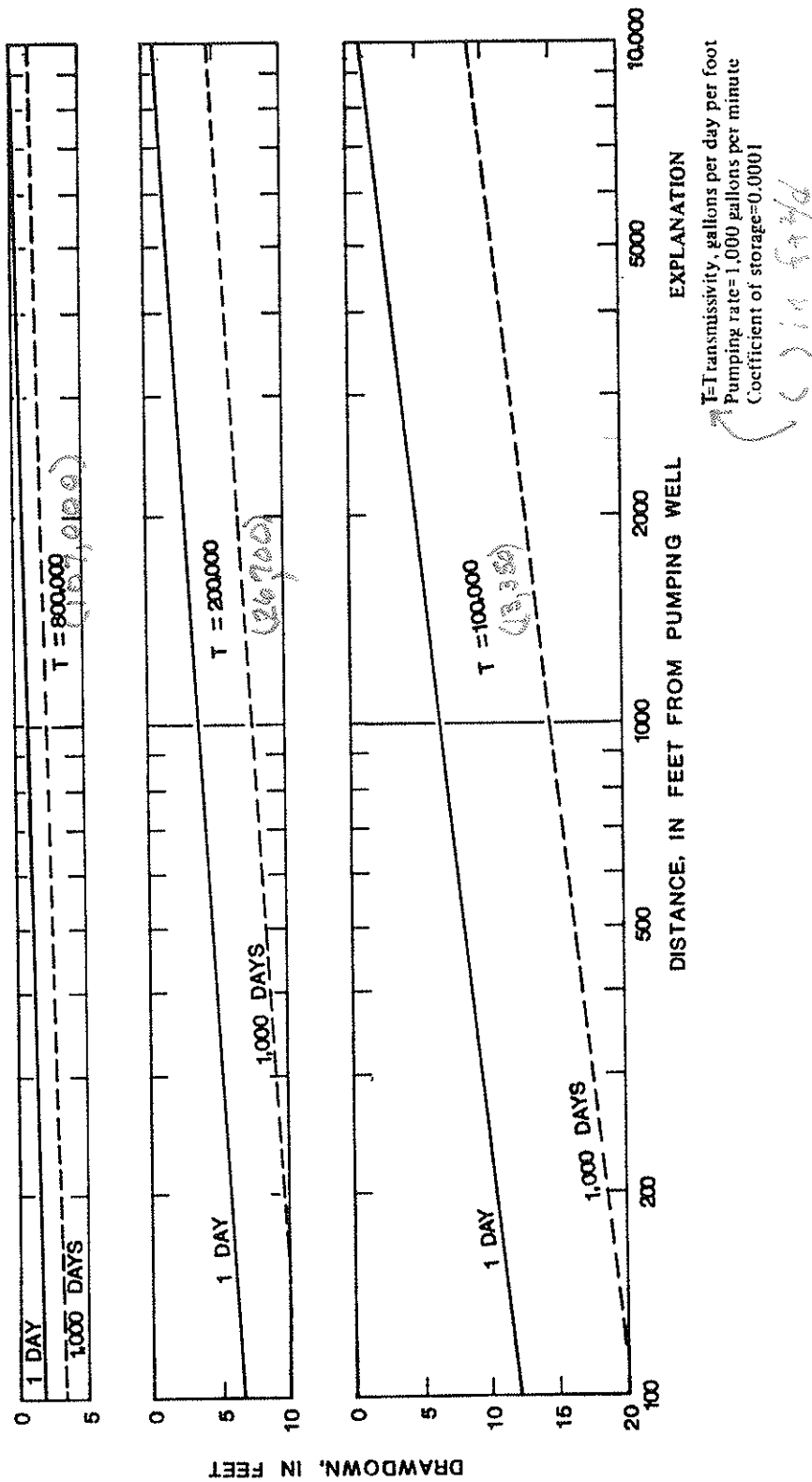


Figure 2.--Theoretical drawdown with distance for indicated time intervals.

surface could become a consequence. Southern Tangipahoa and St. Tammany Parishes likely would be the first areas affected; however, no problems are foreseen for many years.

### WATER QUALITY

Fresh ground water in the area is generally of good quality and is within the limits of drinking water criteria set by the U.S. Environmental Protection Agency (1976, 1977). Analyses of water from selected wells in each aquifer are listed in table 20. The water is a sodium bicarbonate type, and dissolved solids generally range from 120 to 500 mg/L (milligrams per liter). Hardness is normally less than 50 mg/L. Chloride is less than 50 mg/L except in water from some minor aquifers of intermediate depth in the southern part of the area. The pH range is about 5.0 to 8.3 in water from shallow sands, and about 7.0 to 9.4 in deeper sands. Iron and manganese generally occur in concentrations of less than 0.3 to 0.05 mg/L, respectively, although water from some aquifers contains higher concentrations in the northern part of the area. Hydrogen sulfide in solution occurs locally throughout the area, regardless of depth. Fluoride concentrations seldom exceed 0.8 mg/L. Silica content varies from 10 mg/L to as high as 80 mg/L. Color is usually less than 20 units on the platinum-cobalt scale, although there are isolated occurrences of color as high as 50 units.

High iron concentrations occur in water from sands between 1,600 and 1,900 ft below land surface in an area bounded by Independence, Hammond, and Albany. These sands have poor hydraulic connection with the principal aquifers. Iron concentrations range from 1.0 mg/L to as high as 5.0 mg/L, and color is generally in the range of 30 to 50 units on the platinum-cobalt scale.

Ground-water temperatures in the area range from a minimum of about 66°F (19.0°C) in shallow wells to about 100°F (38.0°C) in the deepest wells and increase at the rate of a little more than 1°F per 100 ft of depth.

The following tabulations show the recommended limits of some of the problem constituents in drinking water as suggested by the U.S. Environmental Protection Agency (1976, 1977).

Primary standards (U.S. Environmental Protection Agency, 1976) include:

<u>Constituent</u>	<u>Concentration</u> <u>(mg/L)</u>
Iron-----	<u>a</u> /0.30
Manganese-----	<u>b</u> /.05
Nitrate (as nitrogen)-----	10
<u>a</u> /300 micrograms per liter.	
<u>b</u> /50 micrograms per liter.	

Proposed secondary standards (U.S. Environmental Protection Agency, 1977) include:

<u>Constituent</u>	<u>Concentration</u> <u>(mg/L)</u>
Chloride-----	250
Dissolved solids-----	250
Color-----	(a)
<u>a/Should be no more than 15 units on the platinum-cobalt scale.</u>	

## SHALLOW AQUIFER

### Extent, Thickness, and Lithology

The shallow aquifer consists of sand and gravel deposits underlying the upland terraces and similar, younger flood-plain deposits of major streams. The upland terrace deposits originally blanketed the entire area but locally have been eroded and redistributed by streams.

The upland terrace deposits are typically more than 100 ft thick in northern Tangipahoa Parish and have been included with the Citronelle Formation in southern Mississippi (Newcome and Thomson, 1970, p. 6-7). In central Tangipahoa and northern St. Tammany Parishes the shallow aquifer dips beneath younger Coastal Plain sediments; the subsurface equivalent of the upland terrace deposits is the upper Ponchatoula aquifer in this report. (See pl. 1 and table 2.) In central Tangipahoa Parish the Citronelle Formation is locally overlain by flood-plain deposits of the Tangipahoa River, forming a massive aquifer of about 400 ft of sand and gravel. In northeastern St. Tammany Parish the Citronelle Formation is locally overlain by flood-plain deposits of the Bogue Chitto and Pearl River, forming an aquifer of about 450 ft of sand and gravel. These thick sections of the aquifer are hydraulically connected to the large rivers in the area and have the potential to yield large quantities of water.

The shallow aquifer locally may contain a large percentage of silt and clay, making well yields highly variable.

Another area of large ground-water potential is the flood plain of Chapepeela Creek from the mouth to a few miles north of Loranger. The electrical log of a well at Zemurray Park indicates about 250 ft of clayey sand and gravel between 22 and 265 ft below land surface.

The Tchefuncta River basin has a high rate of ground-water discharge from the headwaters to near the gage at Folsom. The thickness of the contributing sand and gravel underlying the flood plain of the Tchefuncta River is about 150 ft northwest of Folsom and about 200 ft near Folsom.

Ground-water discharge also is high in the Bogue Falaya basin from near Folsom to north of Ramsay. The aquifer has a thickness of about 200 ft in the northern part of the basin, but southward the aquifer thins to 100 ft near Covington and is more confined.

Sand and gravel deposits beneath the low coastal terrace and above the Ponchatoula aquifer constitute a unit of the shallow aquifer in southern Tangipahoa and St. Tammany Parishes. (See pl. 1, well Ta-276.) In this area the unit is typically less than 100 ft thick and grades into clay and sandy clay as it thins south of Hammond and Covington.

#### Aquifer Characteristics and Well Yields

The largest reported well yield from the shallow aquifer is 550 gal/min from an 8-in irrigation well (Wa-104) at the Southeast Louisiana Dairy and Pasture Experiment Station, Franklinton. (See table 19.) A 6-in irrigation well near Amite (Ta-322) yields 300 gal/min; a 4-in well near Roseland (Ta-330) yields 75 gal/min. Most wells in the shallow aquifer are domestic wells, and very few large-capacity wells were found in the project area.

The relations between ground and surface water along the main channel of the Tangipahoa River were analyzed to estimate transmissivity and hydraulic conductivity of the shallow aquifer using a flow net (based on potentiometric contours, pl. 5) and aquifer discharge (based on seepage run, table 3). This assumes that the aquifer is homogeneous and isotropic, that the stream is fully penetrating, and that the gradient is constant. The transmissivities ranged from 70,000 to 350,000 (gal/d)/ft (9,400 to 50,000 ft<sup>2</sup>/d). Hydraulic conductivities ranged from 500 to 1,000 (gal/d)/ft<sup>2</sup> (70 to 140 ft/d). These results are in general agreement with the results from aquifer tests of wells in the shallow aquifer in parishes to the west.

The range in base flow reflects the range in characteristics of the aquifer adjacent to the channel where ground-water discharge sustains streamflow. The yield per square mile is based on the area of surface drainage, but it also reflects the size of the subsurface drainage area. Because the instantaneous rate of ground-water discharge is dependent, among other factors, upon the aquifer's transmissivity, the measured ground-water discharge (pl. 4 and table 3) is an index of the aquifer's yield characteristics. Streams with high ground-water discharge, therefore, can be assumed to be connected with aquifers having a high hydraulic conductivity and transmissivity. Although the relation to unit yield is not direct, one can expect that where similar aquifer-stream relations occur, the hydraulic conductivity or transmissivity will be higher in an area where the unit yield is higher.

The aquifer constants determined for the shallow aquifer in the Tangipahoa River basin indicate that a unit yield of 1.0 (ft<sup>3</sup>/s)/mi<sup>2</sup> corresponds to a transmissivity of about 100,000 (gal/d)/ft (13,000 ft<sup>2</sup>/d). A unit yield of 0.5 (ft<sup>3</sup>/s)/mi<sup>2</sup> corresponds to a transmissivity of about 35,000 (gal/d)/ft (4,800 ft<sup>2</sup>/d), based on the seepage run of June 11, 1969.

### Areas of Highest Yield

Along the flood plains of the major streams there is a decrease in yield downstream (for example, between sites 21 and 28, 36 and 37, and 42 and 43 on pl. 4 and in "Unit yield between sites" column, table 3). It should be pointed out that the unit yields for sites 1, 3, 10, 35, 39, 41, 44, 45, 47, and 48 in the headwater areas do not necessarily indicate areas of low transmissivity. In the headwater areas, tributary streams do not cut deeply into the aquifer and therefore have a lower yield.

The subbasins having the highest unit yields are associated with four streams--the Tangipahoa, Chappapeela, and Tchefuncta Rivers and the Bogue Falaya. Subbasins with yields of about  $0.5 \text{ (ft}^3\text{/s)/mi}^2$  or larger can be considered areas of potentially high ground-water yield or availability. (Well yields of 500 to 1,000 gal/min may be possible.) A high unit yield indicates that ground water in the shallow aquifer is plentiful within a basin or subbasin; however, whether or not a well of a certain size and capacity can be completed at a specific location will be determined by the thickness and permeability of the material found at the well site.

Highest unit yields are along the Tangipahoa River in the northern part of the Tangipahoa basin. Sand and gravel of the Citronelle Formation crop out and increase the yield to streams, as indicated by the high yield of Terrys Creek (pl. 4). Logs of wells along U.S. Highway 51 indicate 100 to 400 ft of sand and gravel adjacent to the river. (See pl. 1). The amount of ground water in storage in such deposits should be very large.

In table 3 the gain in flow (change in discharge between sites) represents the ground-water discharge in the respective reach or subbasin. The flow of a stream would be reduced if wells were installed near the stream in the shallow aquifer. Depending on the use of the water, much of it may be returned to the stream. Although many millions of gallons per day are available from the shallow aquifer near the Tangipahoa River and other streams in the area, significant reduction in the low flow of the streams would be undesirable because of the need to maintain sufficient flow to carry away wastes, support wildlife, and supply riparian water users.

### Potentiometric Surface

The potentiometric surface of the shallow aquifer (pl. 5) in June 1969 ranged from a maximum of about 80 ft below land surface in the highland areas to a few feet above land surface in some lowland areas.

Water-level gradients are as much as 20 ft/mi near Kentwood, about 10 ft/mi near Amite, and about 5 ft/mi near Hammond and Covington. These gradients indicate that the rate of ground-water movement may be as much as 550 ft/yr near major rivers in the north and less than 140 ft/yr to the south. This calculation assumes an average hydraulic conductivity of  $750 \text{ (gal/d)/ft}^2$  (100 ft/d) and an average porosity of 25 percent.



Table 3.--Data for seepage run of June 11, 1969

Map No. (pl. 4)	Station number	Name of site	Drainage area above site (mi <sup>2</sup> )	Drainage area between sites (mi <sup>2</sup> )	Discharge at site (ft <sup>3</sup> /s)	Change in discharge between sites (ft <sup>3</sup> /s)	Unit yield [(ft <sup>3</sup> /s)/mi <sup>2</sup> ]	Unit yield between sites [(ft <sup>3</sup> /s)/mi <sup>2</sup> ]
NATALBANY RIVER BASIN								
1	07376440	Natalbany River 2.2 mi NNW. of Independence	<u>a</u> /55.8	-----	5.13	-----	0.092	-----
2	07376505	Natalbany River 2.0 mi SE. of Albany	<u>a</u> /81.6	25.8	11.4	6.27	.140	0.243
3	07376510	Little Natalbany River 4.9 mi W. of Independence	11.3	-----	.98	-----	.087	-----
4	07376525	Little Natalbany River 1.9 mi SE. of Albany	41.7	30.4	4.30	3.32	.103	.109
5	07376622.8	Yellow Water River Canal 4.1 mi WNW. of Ponchatoula	<u>a</u> /13.9	-----	3.97	-----	.286	-----
6	07376614	Ponchatoula Creek 2 mi NNW. of Ponchatoula	<u>a</u> /33.7	-----	2.37	-----	.070	-----
7	07375720	Selsers Creek 2.9 mi NE. of Ponchatoula	<u>a</u> /8.3	-----	.01	-----	.0012	-----
TANGIPAHOA RIVER BASIN								
8	07375300	Tangipahoa River 1.1 mi E. of Kentwood	237	-----	135	-----	0.570	-----
9	07375310	Terrys Creek 1.2 mi E. of Kentwood	59.6	-----	35.6	-----	.597	-----
10	07375380	Beaver Creek 3.4 mi SW. of Kentwood	<u>a</u> /13.2	-----	1.50	-----	.114	-----
11	07375400	Beaver Creek 0.5 mi N. of Tangipahoa	25.5	12.3	6.29	4.79	.247	0.390
12	07375403	Beaver Creek at mouth, 0.9 mi E. of Tangipahoa	26.0	.5	8.79	2.50	.340	5.0
13	07375404	Tangipahoa River 0.9 mi E. of Tangipahoa	340	17.4	188	8.61	.553	.490
14	07375415	Spring Creek 1.2 mi E. of Tangipahoa	12.5	-----	4.64	-----	.371	-----
15	07375420	Tangipahoa River 0.7 mi E. of Arcola	381	28.5	216	23.4	.567	.826
16	07375424	Big Creek 3.5 mi NE. of Roseland	38.4	-----	18.9	-----	.492	-----
17	07375426	East Fork Big Creek 3.8 mi NE. of Roseland	31.2	-----	10.3	-----	.330	-----
18	07375428	Big Creek 2.1 mi NE. of Amite	81.5	11.9	42.9	13.7	.526	1.15
19	07375430	Tangipahoa River 1.5 mi E. of Amite	474	11.5	290	31.1	.612	2.70
20	07375440	Tangipahoa River 1.4 mi E. of Independence	491	17	308	18	.629	1.06
21	07375450	Tangipahoa River 3.2 mi NE. of Tickfaw	514	23	366	58	.712	2.52
22	07375463	Chappeeela Creek 1.9 mi SE. of Husser	<u>a</u> /31.7	-----	12.9	-----	.407	-----
23	07375475	Chappeeela Creek 3.3 mi SSE. of Loranger	<u>a</u> /46.0	14.1	<u>b</u> /19.3	6.4	.419	.457
24	07375470	Little Chappeeela Creek 2.1 mi NE. of Loranger	27.9	-----	9.17	-----	.329	-----

25	07375476	Chappeeela Creek 4.8 mi S. of Husser	86.6	21.6	35.7	7.33	.412	.335
26	07375478	Bailey Branch 4.8 mi SE. of Loranger	4.72		<u>c/</u> 1.43			
27	07375491	Chappeeela Creek 3.6 mi N. of Robert	98.1	<u>d/</u> 7.58	<u>d/</u> 48.3	11.2	.492	1.65
28	07375500	Tangipahoa River 1 mi E. of Robert	646	36.9	460	47.1	.712	1.28
29	07375605	Washley Creek 1.1 mi SW. of Robert	<u>a/</u> 35.0		.03		.0008	
30	07375650	Tangipahoa River 4.3 mi S. of Robert	703	22	<u>a/</u> 385	-75		
31	07375680	Bedico Creek 7.0 mi NE. of Madisonville	13.7		.35		.026	

TCHFUNCTA RIVER BASIN

32	07374600	Tchefuncta River 4.3 mi E. of Wilmer	19.8		9.68		0.488	
33	07374650	Gorman Creek 6.8 mi SE. of Wilmer	16.4		5.04		.307	
34	07374700	Tchefuncta River 9 mi SW. of Franklinton	53.1	16.9	25.6	10.88	.482	0.644
35	07374720	Catca Creek 8.5 mi SW. of Franklinton	8.4		2.25		.268	
36	07375000	Tchefuncta River 3.6 mi SW. of Folsom	95.5	34.0	44.9	17.05	.470	.501
37	07375035	Tchefuncta River 6 mi WNW. of St. Benedict	125	29.5	48.7	3.8	.390	.129
38	07375050	Tchefuncta River 4.0 mi W. of Covington	145	20.0	52.0	3.3	.359	.165
39	07375075	Bogue Falaya 4 mi N. of Folsom	13.9		2.63		.190	
40	07375085	Bogue Falaya 1 mi E. of Folsom	<u>a/</u> 28.7	14.8	6.38	3.75	.222	.253
41	07375110	Simalusa Creek 4.0 mi NNW. of St. Benedict	20.9		3.35		.160	
42	07375115	Bogue Falaya 3.0 mi NW. of St. Benedict	68.6	19.0	20.8	11.1	.303	.583
43	07375170	Bogue Falaya 1.0 mi NE. of Covington	88.2	19.6	30.5	9.7	.345	.495
44	07375200	Little Bogue Falaya 4.0 mi N. of Covington	17.4		1.84		.106	
45	07375210	East Fork Little Bogue Falaya 4.5 mi NE. of Covington	16.8		.22		.013	
46	07375214	Little Bogue Falaya 1.6 mi NE. of Covington	37.0	2.8	7.85	5.73	.212	2.05
47	07375222	Abita River 0.2 mi N. of Abita Springs	<u>a/</u> 46.2		1.19		.026	

BAYOU LACOMBE BASIN

48	07374584	Bayou Lacombe 6.2 mi N. of Lacombe	<u>a/</u> 35.6		5.13		0.144	
----	----------	------------------------------------	----------------	--	------	--	-------	--

a/ Estimated.

b/ Includes diversions through Chappeeela and Spring Creek Lakes.

c/ Most of discharge is flow from well Ta-269.

d/ Flow and drainage area of Bailey Branch subtracted.

e/ Affected by tide.

The potentiometric contours on the map (pl. 5) can be used to infer the loss, gain, or absence of streamflow. Closely spaced contours usually indicate an increased rate of ground-water flow, assuming no change in the aquifer's thickness and permeability and no pumping. The contours generally become closely spaced near areas of discharge.

Aquifer Development and Water-Level Trends

Water levels in the shallow aquifer in nonpumping areas reflect short- and long-term climatic trends. There has been a general rising trend in water levels from 1968 to 1975 (fig. 3), and at wells Ta-360 and ST-615 (well locations shown on pl. 5) the annual average rise has been about 0.3 ft/yr. The rising trend reflects a period of above-average rainfall. During the winter months, water levels in wells in the north-central part of the study area generally react to local rains within a few hours. In many of these wells, water levels rise 0.1 to 0.5 ft after a rain, returning to nearly the original level within a day or two as the additional water (recharge) dissipates. During the summer, rainfall often has little or no immediate effect on water levels in the aquifer because most of the moisture that infiltrates the soil is returned to the atmosphere by evapotranspiration. Evapotranspiration and the time, frequency, and intensity of precipitation are probably the most important factors controlling water levels in the shallow aquifer.

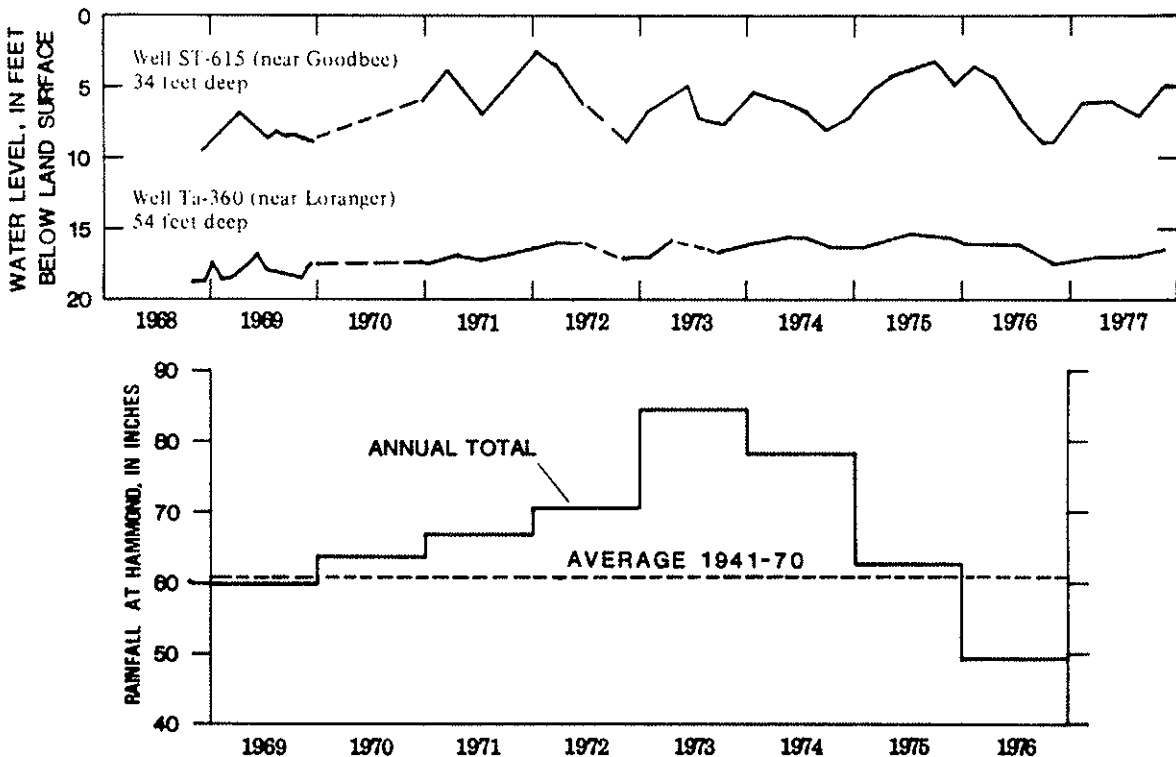


Figure 3.--Hydrographs for wells in the shallow aquifer.

Water levels generally fluctuate from 3 to 6 ft annually near the rivers and 1 ft or less near ground-water divides (the water-table ridge separating two adjacent subbasins). Years of greater or lesser rainfall will cause fluctuations of greater or lesser amplitude. Shallow wells should be deep enough to allow for the maximum annual change in water level for the location in addition to allowing for adequate drawdown for the quantity of water to be pumped.

About 7 Mgal/d is pumped each year from the shallow aquifer in and adjacent to the study area. Of this amount, about 4 Mgal/d is pumped for rural-domestic use, 1.4 Mgal/d for irrigation, and 0.7 Mgal/d for livestock; of the remainder, most is pumped by small industries.

### Water Quality

The shallow aquifer has a mixed-type water of very low mineral content in the northern part of the area. The concentration of dissolved solids ranges from about 30 mg/L near Kentwood to about 50 mg/L near Independence. Iron is present in concentrations ranging from 0.03 to 2.0 mg/L. The pH of the water is generally less than 6.0, and hardness is generally less than 20 mg/L. This water is usually corrosive and may require treatment for some uses. Several wells in the Independence-Amite area yield water with relatively high amounts of nitrate (5.0 and 13.0 mg/L). This may reflect slight contamination from surface sources, possibly from fertilizer applied to crops. However, the recommended limit of 45 mg/L of nitrate (10 mg/L of nitrate as nitrogen) for water to be used for human consumption was not exceeded in any of the samples. (See table 20.)

In the southern part of the area the shallow aquifer contains water that is more mineralized than that in the northern part. Dissolved solids range from about 60 mg/L near Hammond to about 160 mg/L near Slidell. This water is predominantly a sodium bicarbonate type. Hardness is generally less than 20 mg/L, pH is generally in the range of 6.5 to 8.0, and iron is generally present in the range of 0.3 to 2.0 mg/L.

Water from the Bayou Lacombe basin differs greatly from water in the other basins. Drill cuttings from well ST-606, about 8 mi west of Hickory, revealed lignitic, clayey, sand deposits. Water from well ST-606 has a pH of 8.3, hardness of 153 mg/L, and dissolved solids of 256 mg/L. The water has a hydrogen sulfide odor and a very high color, similar to water from a bog or marsh.

## PONCHATOULA AQUIFER

### Extent, Thickness, and Lithology

The Ponchatoula aquifer underlies the south half of Tangipahoa Parish and most of St. Tammany Parish (pl. 6) and extends to the east, west, and south beyond the study area. The aquifer is hydraulically connected to the shallow aquifer along an approximately east-west line through the towns of Independence and Sun (pls. 1 and 6). North of this

line the Ponchatoula aquifer and the shallow aquifer combine to form a single hydrologic unit. The combined unit reaches a maximum thickness of about 400 ft near the flood plain of the Tangipahoa River, and a thickness of about 450 ft beneath the flood plains of the Bogue Chitto and Pearl River. South of the line the aquifer dips at about 25 to 50 ft/mi and is divided by an extensive clay bed into upper and lower units. The clay interval separating the Ponchatoula aquifer from the shallow aquifer thickens southward (pl. 1).

The upper Ponchatoula is typically 200 to 300 ft thick. It is thickest in the vicinity of Tickfaw and Hammond, thins to about 200 ft at Ponchatoula, and continues to thin southward. (See tables 2 and 4; pl. 6.) The aquifer becomes finer grained and discontinuous locally in St. Tammany Parish and is also locally broken into many thin sand beds, making aquifer correlation uncertain.

Table 4.--Altitude of aquifer interval, Ponchatoula aquifer  
[ In feet below mean sea level ]

Well or permit number	Altitude of top of aquifer	Altitude of base of aquifer	Well or permit number	Altitude of top of aquifer	Altitude of base of aquifer	Well or permit number	Altitude of top of aquifer	Altitude of base of aquifer
Upper Ponchatoula aquifer			Upper Ponchatoula aquifer--con.			Lower Ponchatoula aquifer--con.		
Li-145	35	295	Ta-276	170	460	ST-666	475	605+
ST-449	135	180	Ta-284	310	595	ST-669	580	950
ST-563	485	655	Ta-285	210	470	ST-682	430	795
ST-564	345	510	Ta-310	(a)	(a)	ST-684	570	610+
ST-576	420	590	Ta-341	285	430	ST-710	495	650
ST-582	300	505	Ta-421	165	352	ST-712	520	875+
ST-644	170	360	Ta-435	705	940	ST-721	145	535
ST-652	90	215	29307	375	605	Ta-255	575	670+
ST-653	180	445	Lower Ponchatoula aquifer			Ta-257	455	580
ST-663	135	370				Ta-264	505	1,180
ST-666	235	320	Li-145	390	815	Ta-266	365	855
ST-669	150	175	ST-449	540	580+	Ta-267	575	1,155
ST-682	(a)	(a)	ST-525	355	655	Ta-270	640	1,165
ST-684	235	360	ST-563	765	1,130	Ta-271	425	710
ST-710	(a)	(a)	ST-564	675	1,160	Ta-273	820	1,270
ST-712	255	395	ST-567	430	715	Ta-276	505	975
ST-721	(a)	(a)	ST-576	885	1,215	Ta-284	695	890+
Ta-255	210	455	ST-582	595	1,080	Ta-285	535	1,135
Ta-264	270	430	ST-599	(b)	(b)	Ta-310	255	740
Ta-266	25	265	ST-644	575	960	Ta-341	510	1,190
Ta-267	295	470	ST-652	495	625	Ta-421	445	755
Ta-270	285	570	ST-653	600	1,095	Ta-435	1,170	1,940
Ta-271	(a)	(a)	ST-663	570	840	21045	430	1,005
Ta-273	270	715				29307	800	1,390

a/ Upper Ponchatoula missing.

b/ Lower Ponchatoula missing.

The upper Ponchatoula contains extensive deposits of coarse sand and gravel. A sample for the depth interval 540-550 ft from well Ta-268 at Hammond (fig. 4) indicates the coarseness of these deposits. The upper Ponchatoula typically contains some gravel throughout most of the report area; however, in some areas the aquifer is mostly medium sand. (See sample for well ST-712, near Madisonville, depth 389-411 ft in fig. 4.) The lithology of the aquifer and its stratigraphic position indicate that the upper Ponchatoula is the subsurface equivalent of the Citronelle Formation. The grain size in the aquifer becomes finer southward toward Manchac where the aquifer thins and contains salty water (pl. 1).

The lower Ponchatoula is typically more continuous, although individual sand beds are generally thinner and finer grained than in the upper Ponchatoula. In figure 4 the sieve analyses for depth intervals 619-629 ft (well Ta-268) and 834-856 ft (well ST-712) are representative of the grain-size distribution in the lower Ponchatoula aquifer. Sand thicknesses of less than 100 ft are common, although thicknesses of 100 to 200 ft are more typical. The aquifer generally consists of medium

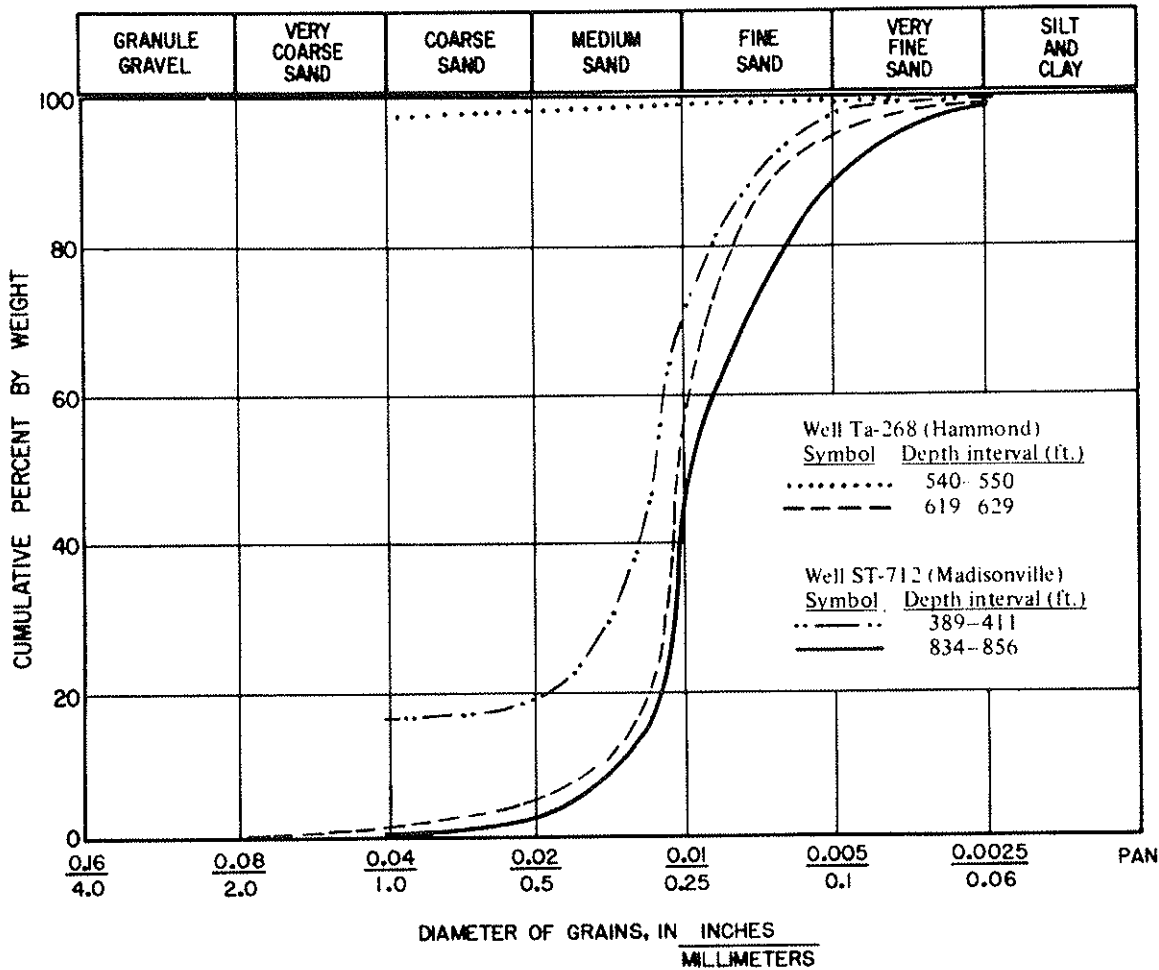


Figure 4.--Sieve analyses of sand samples from the Ponchatoula aquifer.

sand; coarse sand and some gravel occur locally. Southward, this unit divides into three sands and becomes finer grained. It contains salty water in the vicinity of Manchac (pl. 1).

The information given in table 4 for the lower Ponchatoula aquifer (pl. 6) defines the interval occupied by the aquifer rather than the top and bottom of a major sand. The aquifer generally contains several sandy units (pls. 1-3), which commonly thicken or thin rapidly. Thus, wells drilled a short distance away from the wells shown on plate 6 may penetrate substantially different sand strata.

#### Aquifer Characteristics and Well Yields

Reported yields to wells range from less than 10 gal/min to more than 100 gal/min for small-diameter wells. The largest reported yield from the upper Ponchatoula aquifer was 1,425 gal/min from a 12-in municipal well (Ta-284) at Ponchatoula. The well, which is reportedly screened in sand and gravel, has an observed specific capacity of 62 (gal/min)/ft of drawdown and a corrected specific capacity of 80 (gal/min)/ft of drawdown after pumping 1,100 gal/min for 24 hours. (See section "Aquifer Characteristics and Well Yields.")

An aquifer test (Lohman, 1972) was made using well Ta-284 as the pumping well; the transmissivity was about 200,000 (gal/d)/ft (27,000 ft<sup>2</sup>/d), and the storage coefficient was 0.00045. The 145-ft sand interval in which the well is screened has a hydraulic conductivity of about 1,300 (gal/d)/ft<sup>2</sup> (180 ft/d).

The amount of drawdown that will occur at different distances from well Ta-284 can be estimated from figure 5. For example, the graph shows that for a pumping rate of 500 gal/min, the approximate average continuous usage for the town of Ponchatoula, the drawdown 1,000 ft away would be about 3.5 ft after pumping for 1 year. This analysis is based on procedures described by Lohman (1972, p. 55-56) and by Bruin and Hudson (1955, p. 13-22).

No aquifer test was made in the lower Ponchatoula; however, based on the grain-size distribution (fig. 4) for the applicable wells and depths, it is estimated that the hydraulic conductivity probably ranges from 250 to 500 (gal/d)/ft<sup>2</sup> (35 to 65 ft/d). The highest reported yield from the lower Ponchatoula was 100 gal/min from well Ta-255 at Hammond.

#### Potentiometric Surface

The potentiometric surface of the upper Ponchatoula is defined primarily in Tangipahoa Parish, and the lower Ponchatoula in St. Tammany Parish. Data for both aquifers are available at a few points (pl. 6), and these indicate that the water level in the lower Ponchatoula is generally higher by 2 or 3 ft. Water-level gradients are low over most of the area but increase to the north where the potentiometric surfaces of the Ponchatoula and the shallow aquifers merge.

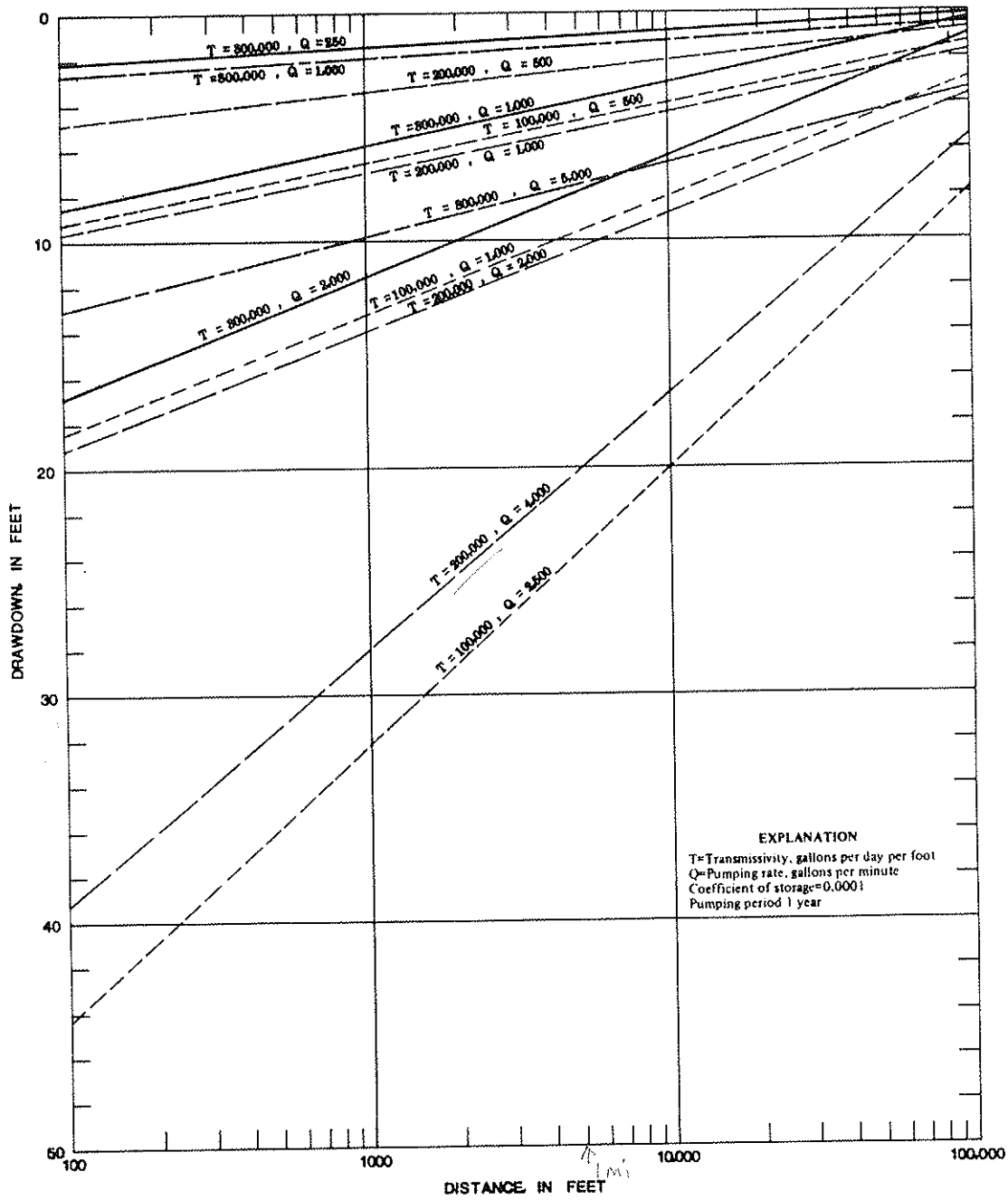


Figure 5.--Theoretical drawdown with distance for indicated pumping rates.



The most concentrated ground-water development is in the upper Ponchatoula at the town of Ponchatoula. Because of the high transmissivity of the aquifer and the small pumpage, there is no appreciable cone of depression at Ponchatoula. The average water-level gradient near the town of Ponchatoula is about 2 ft/mi, and the water is moving downgradient at a rate of about 100 ft/yr. Water levels range from about 15 ft above land surface to 7 ft below land surface.

Less water is withdrawn from the lower Ponchatoula than the upper Ponchatoula. Potentiometric gradients in the lower unit are less than 2 ft/mi near Covington and about 1 ft/mi near Lacombe. Water levels in the lower Ponchatoula aquifer ranged from about 17 ft above land surface to 2 ft below land surface during 1969.

#### Aquifer Development and Water-Level Trends

The Ponchatoula aquifer is one of the least developed aquifers in the area. Only about 1.2 Mgal/d is known to be withdrawn from the aquifer: about 1.0 Mgal/d from the upper Ponchatoula and 0.2 Mgal/d from the lower Ponchatoula. The largest user is the town of Ponchatoula, pumping an estimated average of 0.6 Mgal/d in 1974. Most of the remainder is industrial use; rural-domestic and agricultural uses are small.

The effects of development are shown by water-level changes in two observation wells, Ta-7 and Ta-19, in the upper Ponchatoula (fig. 6). The water level in well Ta-7, at Ponchatoula, has been declining at an average rate of about 0.2 ft/yr for the 37 years of record (fig. 6). There has been no obvious decline during the past 4 years. The water level in well Ta-19, about 4 mi east of Ponchatoula, declined an average of 0.1 ft/yr for the period 1940-65, and 0.2 ft/yr for the period 1965-74.

In St. Tammany Parish the water level in the upper Ponchatoula declined, during the period 1939-76, at an average rate of 0.5 ft/yr at well ST-428, near Hickory. This decline probably indicates a large number of continuously flowing wells in eastern St. Tammany Parish and in the adjacent area in Mississippi. At well ST-449, in the lower Ponchatoula at Abita Springs, the rate of decline was slightly more than 0.2 ft/yr until the late 1960's when the downward trend ceased. The water level has been rising since 1972.

The low rate of water-level decline in the Ponchatoula aquifer at Ponchatoula prior to 1972 was related to the high transmissivity of the aquifer and the relatively low withdrawals. Miscellaneous water-level measurements for the Ponchatoula aquifer are given in table 5.

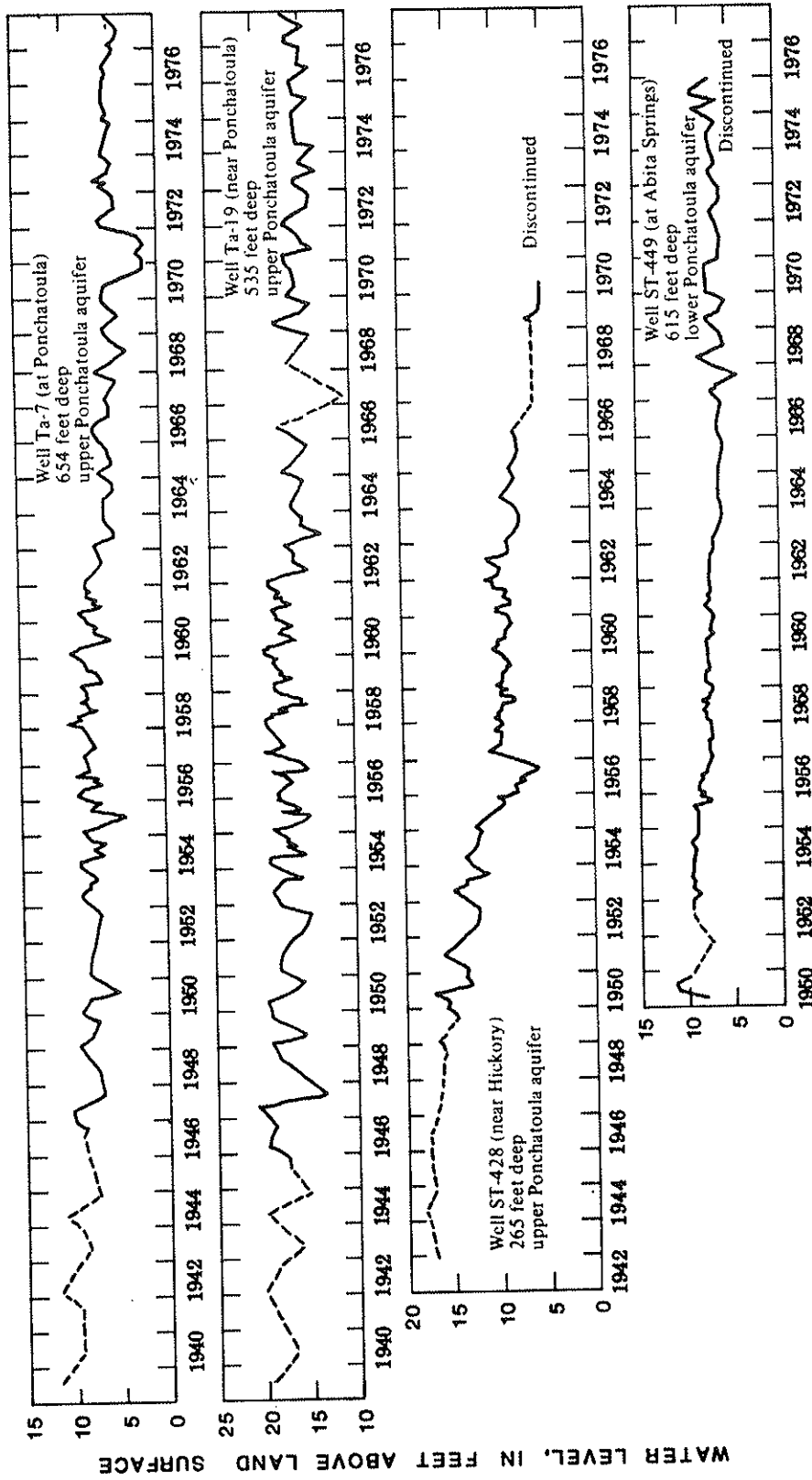


Figure 6.--Hydrographs for the Ponchatoula aquifer.

Table 5. --Water levels for the Ponchatoula aquifer

Well number	Depth (feet)	Water level, in feet above (+) or below land-surface datum		Well number	Depth (feet)	Water level, in feet above (+) or below land-surface datum	
		April-May 1969	April-May 1974			April-May 1969	April-May 1974
UPPER PONCHATOULA				LOWER PONCHATOULA			
ST-428	265	+6.52	-----	ST-449	615	+7.6	+7.1
Ta-7	654	+5.03	+5.20	ST-662	1,026	+13.8	-----
Ta-19	535	+18.0	+15.3	ST-671	1,026	+17.2	+17.4
Ta-328	505	a/2.76	-----	ST-673	925	+15.9	+16.2
Ta-400	540	+2.03	-----	ST-684	630	+14.6	+14.5
Ta-416	420	7.81	b/6.83	Ta-255	708	2.16	-----

a/Measured July 1969.

b/Measured September 1974.

### Water Quality

Water in the Ponchatoula aquifer is generally of excellent quality for most uses, although hydrogen sulfide may be present locally in quantities as high as 0.5 mg/L. Dissolved solids range from about 160 to 350 mg/L, and hardness is generally less than 20 mg/L. Iron and manganese are generally present in concentrations of less than 0.3 and 0.05 mg/L, respectively. One well (ST-684) in the Madisonville area has an iron concentration of 1.4 mg/L. The pH typically ranges from 7.5 to 9.0. In the Manchac area the aquifer contains slightly saline water (chloride concentration about 350 mg/L). The average water temperature is 73°F (23.0°C).

### BIG BRANCH AQUIFER

#### Extent, Thickness, and Lithology

The Big Branch aquifer occurs primarily in southern St. Tammany Parish and is named for the Big Branch community between Lacombe and Mandeville where most pumpage occurs. (See fig. 7.) The aquifer occurs at depths of 1,350 to 1,500 ft below land surface in the vicinity of the Big Branch and Lacombe communities and typically is about 50 to 150 ft thick (fig. 7). South of Covington the aquifer occurs at a depth of about 1,200 ft and is less than 50 ft thick. East of Slidell the aquifer occurs at depths of 1,300 to 1,400 ft and is about 80 ft thick.

Geophysical logs indicate that the aquifer grades into clay southward beneath Lake Pontchartrain and north of Covington and Slidell. The aquifer does not extend far enough north in Louisiana to have connection with the shallow aquifer. The aquifer extends eastward into the State of Mississippi. Below the Big Branch are major aquifers having higher artesian head, the Abita and Covington aquifers. Recharge is probably by leakage through confining clays, particularly permeable zones in the

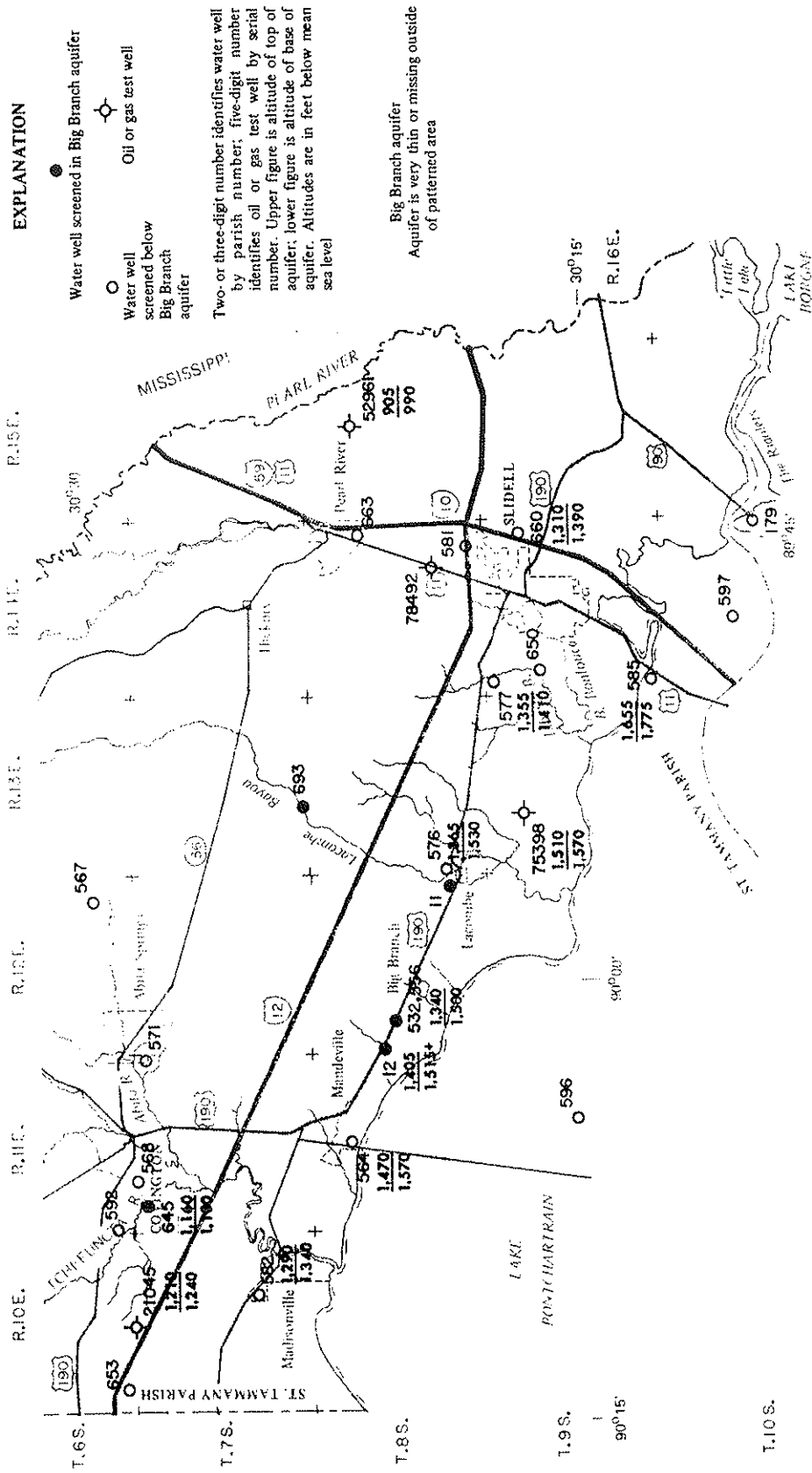


Figure 7.--Geohydrologic map of the Big Branch aquifer.

lower confining clay (for example, near well ST-572, pl. 3). The confining clay separating the Big Branch and lower Ponchatoula aquifers thins north of well ST-577 (3 mi west of Slidell, fig. 7 and pl. 3), and the two aquifers may be interconnected in that area.

The aquifer is mostly medium to coarse sand. Medium sand is typical of the upper part of the aquifer, grading into coarser material near the bottom. (See fig. 8.)

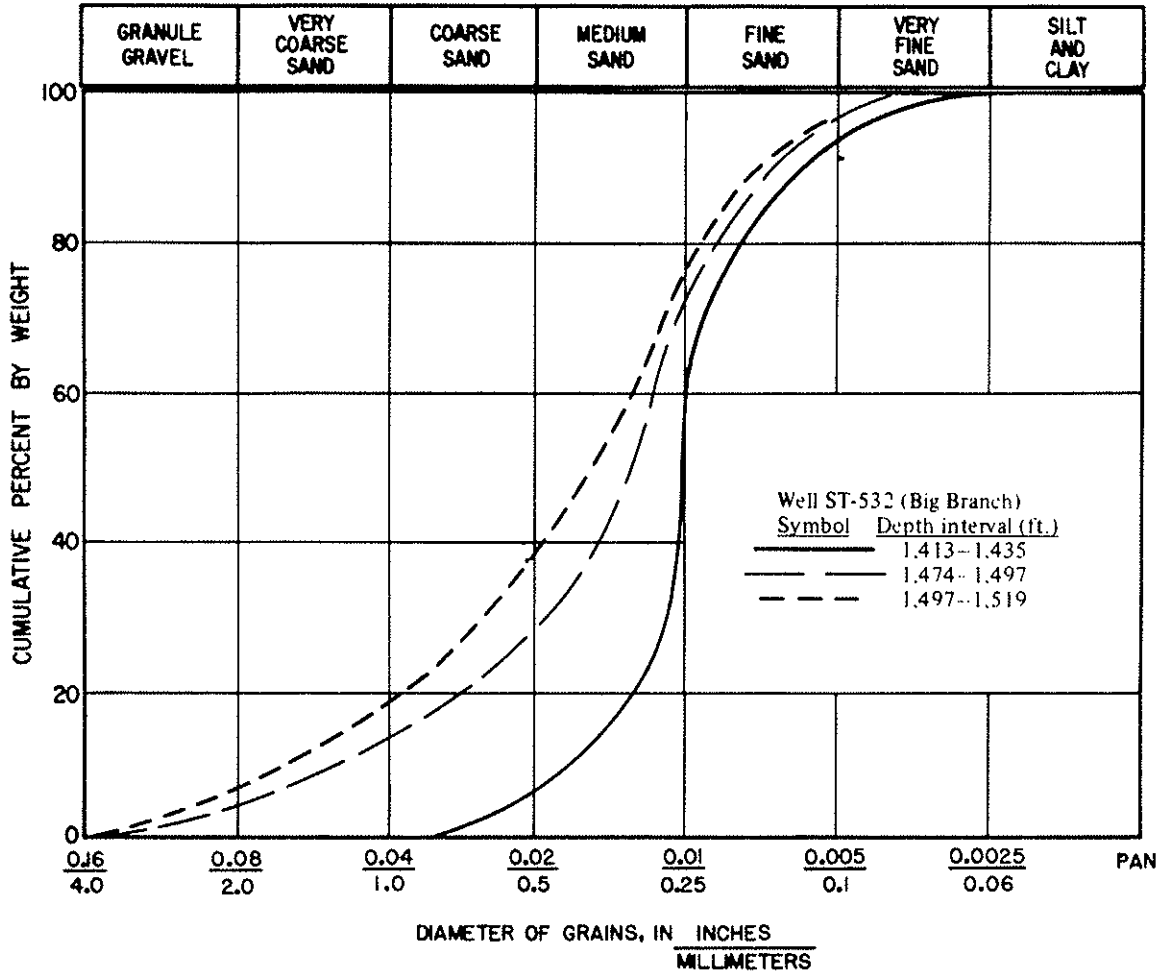


Figure 8.--Sieve analyses of sand samples from the Big Branch aquifer.

#### Aquifer Characteristics and Well Yields

No aquifer tests or specific-capacity data are available for wells in the Big Branch aquifer. However, based on sieve analyses of sand samples from well ST-532 (fig. 8), it is estimated that the hydraulic conductivity ranges from about 300 to 800 (gal/d)/ft<sup>2</sup> (40 to 160 ft/d).

In the past, 6-in wells owned by State facilities in the area have had flowing yields ranging from 300 to 500 gal/min. For example, in 1939, well ST-12, at Fontainebleau State Park, had an artesian head of

50.7 ft above land surface and flowed 500 gal/min open discharge. Because of declining water levels, many of these wells have been equipped with turbine pumps to maintain desired yields.

### Aquifer Development and Water-Level Trends

Pumpage from the Big Branch aquifer apparently began in the 1920's and 1930's. Largest users of the Big Branch aquifer are the Lacombe Fish Hatchery, Southeast Louisiana Hospital, and Fontainebleau State Park. Combined water use by these State facilities was estimated at 0.75 Mgal/d in 1974. Combined discharge from all wells in the aquifer probably is more than 1.2 Mgal/d, nearly 0.3 Mgal/d of which is discharged by uncontrolled flowing wells. During 1969 about 0.4 Mgal/d was discharged from uncontrolled flowing wells.

During the spring of 1974, water levels ranged from 32 ft above land surface near the community of Big Branch to about 5 ft above land surface near Pearl River. Water-level data for the aquifer are given in the following table. The water-level gradient slopes generally southward at the rate of about 1 ft/mi, based on the 1969 water levels corrected to mean sea level. Water levels in wells near the mapped boundary of the aquifer (fig. 7) may be anomalously low because of boundary effects, particularly if there is pumping nearby.

#### Water levels for the Big Branch Aquifer

Well number	Depth (feet)	Water level, in feet above land-surface datum	
		May 1969	May 1974
ST-12	1,530	30.1	32.5
ST-645	1,200	20.9	----
ST-693	1,235	16.8	----

The hydrograph for key observation well ST-12 (fig. 9) indicates an average water-level decline of about 1 ft/yr prior to 1955. The decline during 1955-56 was due to increased use of the Southeastern Louisiana State Hospital. The average rate of decline, 1956-76, has been about 0.5 ft/yr, but there have been short periods of rising and declining water levels.

### Water Quality

Water in the Big Branch aquifer ranges from a soft, sodium bicarbonate type near Madisonville to a sodium chloride type near Lacombe. Wells in the aquifer west of Lacombe produce water of very good quality. The dissolved solids in this area range from 175 to 200 mg/L, iron and manganese concentrations are generally less than 0.2 mg/L, and hardness is generally less than 10 mg/L. The only constituent that detracts from the quality in this area is the local occurrence of hydrogen sulfide, which ranges from 0.1 to 1.0 mg/L.

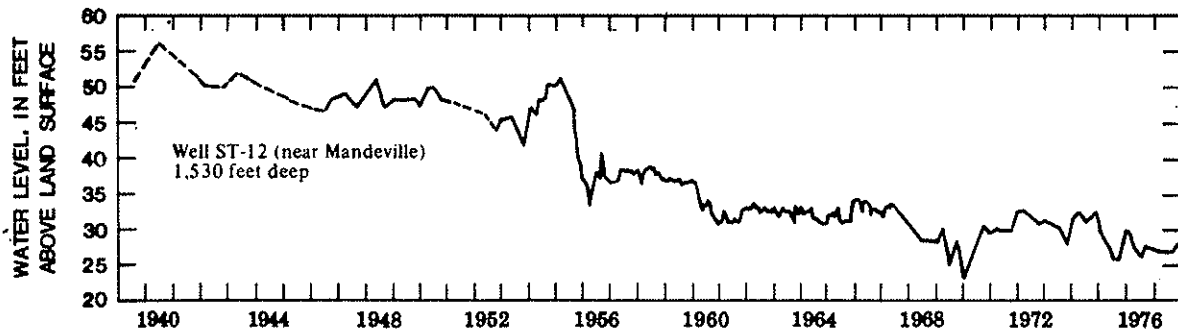


Figure 9.--Hydrograph for the Big Branch aquifer.

Wells in the Lacombe area yield water with a higher chloride concentration than those from the surrounding area. Water from well ST-11, in Lacombe, has a chloride concentration of 1,340 mg/L, hardness of 75 mg/L, and dissolved solids of 2,490 mg/L. The high-chloride water in this section of the aquifer apparently results from incomplete flushing, rather than saltwater encroachment, because the aquifer is discontinuous to the south.

Because of a lack of quality-of-water data for the aquifer east of Lacombe, electrical logs of wells in the area were used to estimate the quality (Turcan, 1966). Dissolved solids in this eastern area probably range from 300 to 400 mg/L, and chloride concentrations probably range from 20 to 40 mg/L.

#### KENTWOOD AQUIFER SYSTEM

The Kentwood aquifer of northern Tangipahoa and western Washington Parishes divides into three aquifers--the Abita, Covington, and Slidell--in the southern part of the area (fig. 10). The Abita corresponds to the upper part of the Kentwood aquifer, and the Covington is connected to the lower part. The Slidell aquifer is stratigraphically equivalent to the basal part of the Kentwood but is not directly connected to the Kentwood aquifer. The Slidell aquifer is, however, connected to the Covington aquifer near the town of Pearl River. The four aquifers are discussed separately in this report.

#### Kentwood Aquifer

##### Extent, Thickness, and Lithology

The Kentwood aquifer in the northern part of Tangipahoa Parish is a sand and gravel deposit, 400 to 500 ft thick (pl. 1 and table 6), that dips to the south at the rate of about 30 ft/mi. South of an approximately east-west line about 2 mi north of Roseland (pls. 7 and 8), the Kentwood aquifer divides into an upper unit (Abita aquifer) and a lower unit (Covington aquifer). North of this east-west line the deposit of sand and gravel continues into the State of Mississippi where the

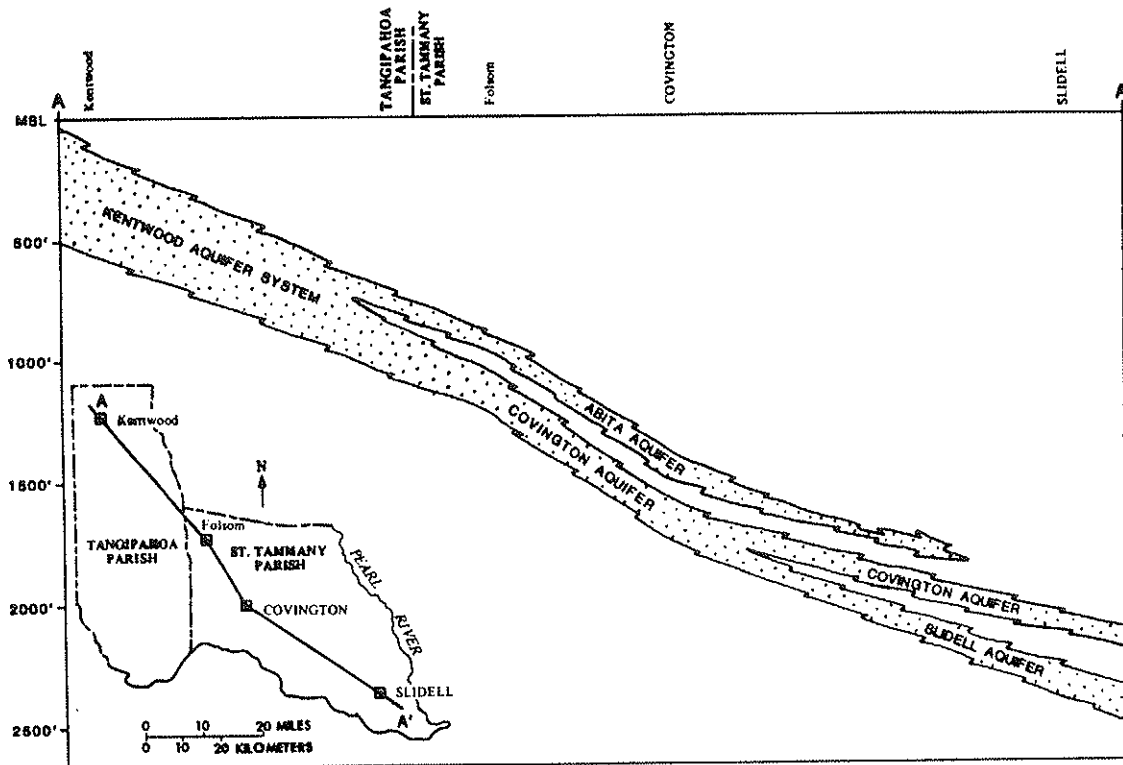


Figure 10.--Idealized section from Kentwood to Slidell showing the relations between units in the Kentwood aquifer system.

deposits are in contact with the Citronelle Formation and the alluvium of major rivers. The amount of gravel in the aquifer decreases to the east, west, and south of the town of Kentwood where it occurs between the depths of about 370 ft to more than 640 ft.

Table 6.--Altitude of aquifer interval, Kentwood aquifer  
[In feet below mean sea level]

Well or permit number	Altitude of top of aquifer	Altitude of base of aquifer	Well or permit number	Altitude of top of aquifer	Altitude of base of aquifer
Ta-283	265	670	Ta-440	200	630+
Ta-286	120	530+	Wa-57	335	575
Ta-290	465	880	Wa-91	210	605
Ta-407	40	320+			



## Aquifer Characteristics and Well Yields

The transmissivity of the aquifer near Kentwood is very large because of the great thickness and high permeability of the sand and gravel deposits. Well Ta-286, at Kentwood, is screened near the middle of the aquifer, which is more than 400 ft thick at the site. The well, which furnishes part of the water supply for the town of Kentwood, had an observed specific capacity of about 30 (gal/min)/ft of drawdown while pumping 1,557 gal/min for 24 hours. The corrected specific capacity is estimated at about 150 (gal/min)/ft of drawdown, which corresponds to a transmissivity of about 400,000 (gal/d)/ft (54,000 ft<sup>2</sup>/d) and an average permeability of about 1,000 (gal/d)ft<sup>2</sup> (140 ft/d) (Meyer, 1963, p. 338-340). A well in this aquifer pumping 250 gal/min, the approximate average usage by Kentwood, would cause only 1.0 ft of drawdown 1,000 ft away after 1 year of pumping. (See fig. 5.)

## Potentiometric Surface

The potentiometric surface of the Kentwood aquifer (pls. 7 and 8) indicates the changes in gradient between areas of recharge (in southern Mississippi) and areas of discharge to the south. In addition to pumping from the Abita and Covington aquifers, natural discharge occurs by upward leakage of water through the confining clays to aquifers of lower hydrostatic head. The southward gradient is about 10 ft/mi between Kentwood and Franklinton, decreasing to about 3 ft/mi north of Roseland.

In May 1974, water levels in the Kentwood aquifer ranged from about 60 ft below land surface in highland areas to about 20 ft above land surface in the flood plains of major rivers near Kentwood and Franklinton.

## Aquifer Development and Water-Level Trends

During the past 5 years (1969-74) water levels have been rising about 1 ft/yr in the vicinity of Kentwood (table 7). The rising water levels reflect above-average rainfall in the recharge areas in southern Mississippi. North of Franklinton there has been a slight rise in water level (1969-74), whereas at the village of Tangipahoa, water levels are declining nearly 1 ft/yr. This north-south transition from a rising to a declining water level is caused by effects of pumping from the contiguous Abita and Covington aquifers to the south.

Water-level fluctuations in the Kentwood aquifer are represented by the hydrograph for well Wa-18 (fig. 11). The water-level changes in this well have not shown a consistent trend. From 1950 to 1958, well Wa-18 was in service supplying the town of Franklinton, and the water level declined. In 1958 the well was replaced by a deeper well, and the water level rose sharply. From 1969 to 1976 there has been little water-level change. Additional water-level data are given in table 7.

Total pumpage from the Kentwood aquifer during 1974 was about 0.8 Mgal/d. The principal areas of development in the Kentwood aquifer include the town of Kentwood, which pumped about 0.33 Mgal/d, and numerous controlled flowing wells in the flood plains of the Tangipahoa River and

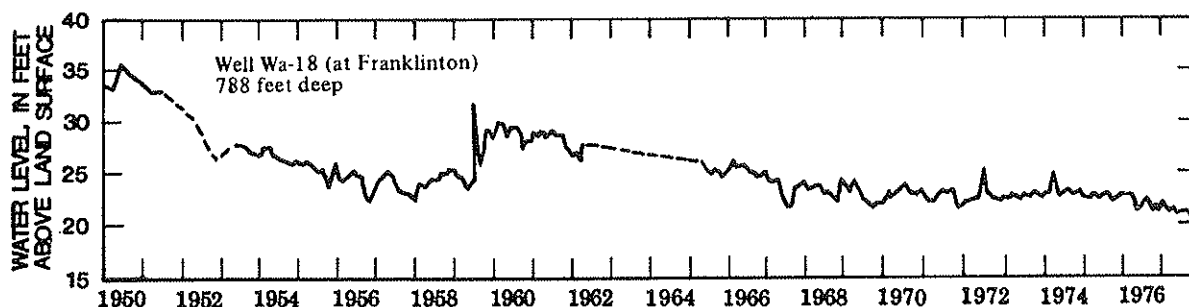


Figure 11.--Hydrograph for the Kentwood aquifer.

Table 7.--Water levels for the Kentwood aquifer

Well number	Depth (feet)	Water level, in feet above(+) or below land-surface datum		Well number	Depth (feet)	Water level, in feet above(+) or below land-surface datum	
		May 1969	May 1974			May 1969	May 1974
Ta-286	640	60.96	57.22	Wa-18	788	+23.5	+23.7
Ta-380	580	+17.52	<sup>a/</sup> +12.15	Wa-79	310	+23.6	+24.5
Ta-440	603	-----	2.01	Wa-91	600	-----	12.98

<sup>a/</sup> Measured February 1975.

Bogue Chitto. An additional 0.3 Mgal/d probably is removed from the aquifer by uncontrolled flowing wells.

#### Water Quality

The Kentwood aquifer contains a very dilute mixed-type water. Dissolved solids range from 50 to 150 mg/L. Hardness (as CaCO<sub>3</sub>) ranges from 10 to 35 mg/L, dissolved iron from 0.01 to 0.12 mg/L, and dissolved manganese from 0 to 0.08 mg/L. The water has a pH of approximately 6.5 and a temperature of 70° to 72°F (21.0° to 22.0°C). There are local occurrences of hydrogen sulfide.

#### Abita Aquifer

##### Extent, Thickness, and Lithology

The Abita aquifer of the Kentwood aquifer system is the shallowest unit that is generally continuous throughout the report area. The depth to the top of the aquifer ranges from 500 ft below land surface south of Franklinton (table 8 and pl. 7) to about 2,300 ft at the Rigolets south of Slidell. South of an east-west line 2 mi north of Roseland (pl. 7) the Abita aquifer is highly variable in thickness, ranging from 0 to more than 200 ft, but is typically between 50 and 100 ft thick. The aquifer dips to the southwest at the rate of 40 ft/mi near Folsom and 70 ft/mi near Slidell. East of the town of Pearl River (oil test 52961, pl. 7) the Abita, Covington, and Slidell aquifers converge into a single

sand unit. The Abita aquifer is absent locally south of Folsom, northwest of Folsom in Tangipahoa Parish, northeast of Abita Springs, at Lacombe and Slidell, and near Hammond (pl. 7).

Table 8. ---Altitude of aquifer interval, Abita aquifer  
[In feet below mean sea level]

Well or permit number	Altitude of top of aquifer	Altitude of base of aquifer	Well or permit number	Altitude of top of aquifer	Altitude of base of aquifer	Well or permit number	Altitude of top of aquifer	Altitude of base of aquifer
Li-149	1,740	1,985+	ST-646	2,115	2,260+	Ta-287	670	960
Or-179	2,320	2,435	ST-648	1,595	1,715	Ta-289	610	830
SH-7	800	990	ST-652	1,185	1,260	Ta-296	1,170	1,325
ST-525	(a)	(a)	ST-653	(a)	(a)	Ta-303	1,025	1,130
ST-555	1,640	1,760+	ST-664	1,310	1,370+	Ta-310	890	1,025
ST-558	(a)	(a)	ST-669	(a)	(a)	Ta-313	865	905
ST-562	1,695	1,765	ST-682	1,045	1,115	Ta-314	745	935
ST-563	(a)	(a)	ST-686	770	835+	Ta-341	(a)	(a)
ST-564	1,795	1,870	ST-708	1,890	1,935	Ta-411	(a)	(a)
ST-565	1,930	1,960+	ST-721A	915	965	Ta-435	2,195	2,560
ST-567	(a)	(a)	Ta-257	900	965	21045	1,450	1,555
ST-571	1,390	1,475+	Ta-260	575	900	29307	1,770	1,920
ST-575	985	1,100	Ta-264	(a)	(a)	30902	(a)	(a)
ST-576	(a)	(a)	Ta-266	1,165	1,205	44836	450	520
ST-577	1,865	1,935	Ta-270	(a)	(a)	46024	485	600
ST-578	1,130	1,220	Ta-272	685	910	52961	1,450	1,940
ST-592	1,410	1,665	Ta-278	1,160	1,260	75398	2,010	2,135
ST-598	1,600	1,765	Ta-282	1,015	1,265	78492	1,690	1,740
ST-644	1,260	1,540	Ta-285	(a)	(a)	85312	1,410	1,490

a/Aquifer missing.

The vertical gradation in texture of aquifer material is shown by sieve analyses of sand samples from wells ST-564 and ST-571 (fig. 12). The analyses represent nearly the full thickness of the aquifer. The particle-size distribution indicates that the aquifer is dominantly a medium to very coarse sand at well ST-564 and in the bottom interval of well ST-571. The upper part of the aquifer at well ST-571 is a medium sand.

#### Aquifer Characteristics and Well Yields

The Abita aquifer has a good yield potential with transmissivities typically ranging from about 80,000 to 100,000 (gal/d)/ft (10,000 to 13,000 ft<sup>2</sup>/d). The transmissivity is much greater where the Covington and Slidell aquifers are interconnected, and smaller where the aquifer is thin.

Well ST-586 (pl. 7) had an uncorrected specific capacity of 14.4 (gal/min)/ft of drawdown, or 33 (gal/min)/ft of drawdown after

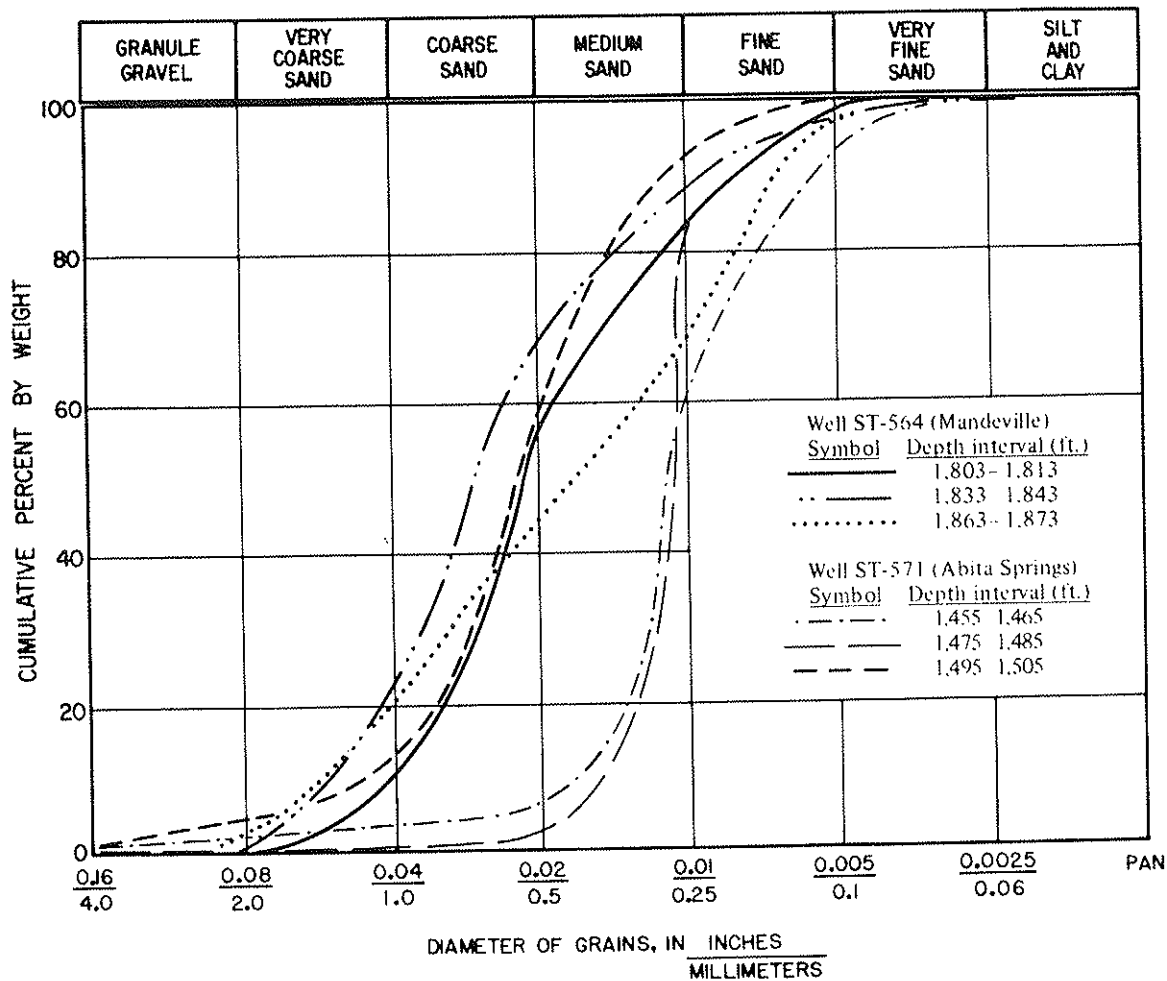


Figure 12.--Sieve analyses of sand samples from the Abita aquifer.

corrections for losses due to pipe friction and partial penetration (Cardwell and others, 1967, p. 84). The well was pumping 1,515 gal/min for an unknown period of time. This specific capacity is equivalent to a transmissivity of about 100,000 (gal/d)/ft (13,000 ft<sup>2</sup>/d). No additional aquifer data are available within the report area; however, applicable information is available for wells at the National Space Technology Laboratories, 7 mi east of the town of Pearl River.

Three wells at the National Space Technology Laboratories are screened in the Abita aquifer. An aquifer test at one of these wells indicated a transmissivity of 81,000 (gal/d)/ft (11,000 ft<sup>2</sup>/d), and a hydraulic conductivity of 930 (gal/d)/ft<sup>2</sup> (120 ft/d) (Newcome, 1967, p. H11). The observed specific capacity was 15 (gal/min)/ft of draw-down after 24 hours of pumping at 1,218 gal/min. No aquifer tests were made at the other wells, but their yields were 2,487 and 1,089 gal/min.

The relation between the drawdown caused by pumping and distance from a pumping well (fig. 5) for an aquifer with a transmissivity of 100,000 (gal/d)/ft (13,000 ft<sup>2</sup>/d) shows that at a pumping rate of

500 gal/min there would be less than 5 ft of drawdown 1 mi from the well after 1 year of continuous pumping.

### Potentiometric Surface

Water levels in the Abita aquifer in May 1974 ranged from nearly 40 ft below land surface near Folsom to about 90 ft above land surface in the Slidell area. The potentiometric surface of the Abita aquifer (pl. 7) indicates the changes in gradient between the Kentwood aquifer to the north and areas of discharge to the south. The southward gradient of about 3 ft/mi near Amite decreases to about 1.5 ft/mi near Covington and becomes very flat near Slidell. This change in the potentiometric surface that occurs in a triangular area between Sun, Covington, and Slidell suggests significant changes in the aquifer in this area. The aquifer is apparently discontinuous between Abita Springs and Slidell, causing the flat gradient. Geologic data are inadequate to define the nature of the discontinuities. A fault mapped by Cardwell (Cardwell and others, 1967, pl. 2) cuts the aquifer south of well Or-179 and may restrict discharge to the south.

The Abita aquifer becomes discontinuous and is locally absent in the Hammond area. In sand units equivalent to the Abita the artesian pressure is lower than would be expected--for example, the water level of well Li-149 (table 9) is 60 ft below the projected potentiometric surface. The low water levels probably reflect the influence of pumping in the Baton Rouge area because there is little pumping near well Li-149. The Abita, Covington, and Slidell aquifers apparently are interconnected near the Pearl River, according to geologic data from oil test 52961. Water-level data indicate that near the area of the interconnection, heads in the three aquifers are within a few feet of each other, with the Slidell aquifer having the highest artesian pressure.

### Aquifer Development and Water-Level Trends

An estimated 1.0 Mgal/d is discharged from the Abita aquifer (exclusive of water discharged by uncontrolled flowing wells), nearly all of which is pumped in St. Tammany Parish. About 0.3 Mgal/d is pumped in the Covington area from public-supply wells, and another 0.3 Mgal/d is pumped in the Slidell area for domestic and industrial uses. The remaining 0.4 Mgal/d is discharged from rural wells in St. Tammany Parish and central Tangipahoa Parish.

The average rate of water-level decline at observation well ST-16 was about 0.5 ft/yr from 1939 to 1976. (See pl. 7 for location.) The long-term trends of the hydrograph of well ST-16 (fig. 13) reflect regional pumping, and the short-term fluctuations reflect variable use of the well and other wells nearby. Although the overall trend is downward, the water level rose sharply in 1974 and remained at a high level during 1975. The trend during 1976 was sharply downward. The water level in observation well Or-179, in the Abita aquifer south of Slidell, declined about 2.5 ft/yr from 1965 to 1976. This rate of decline is

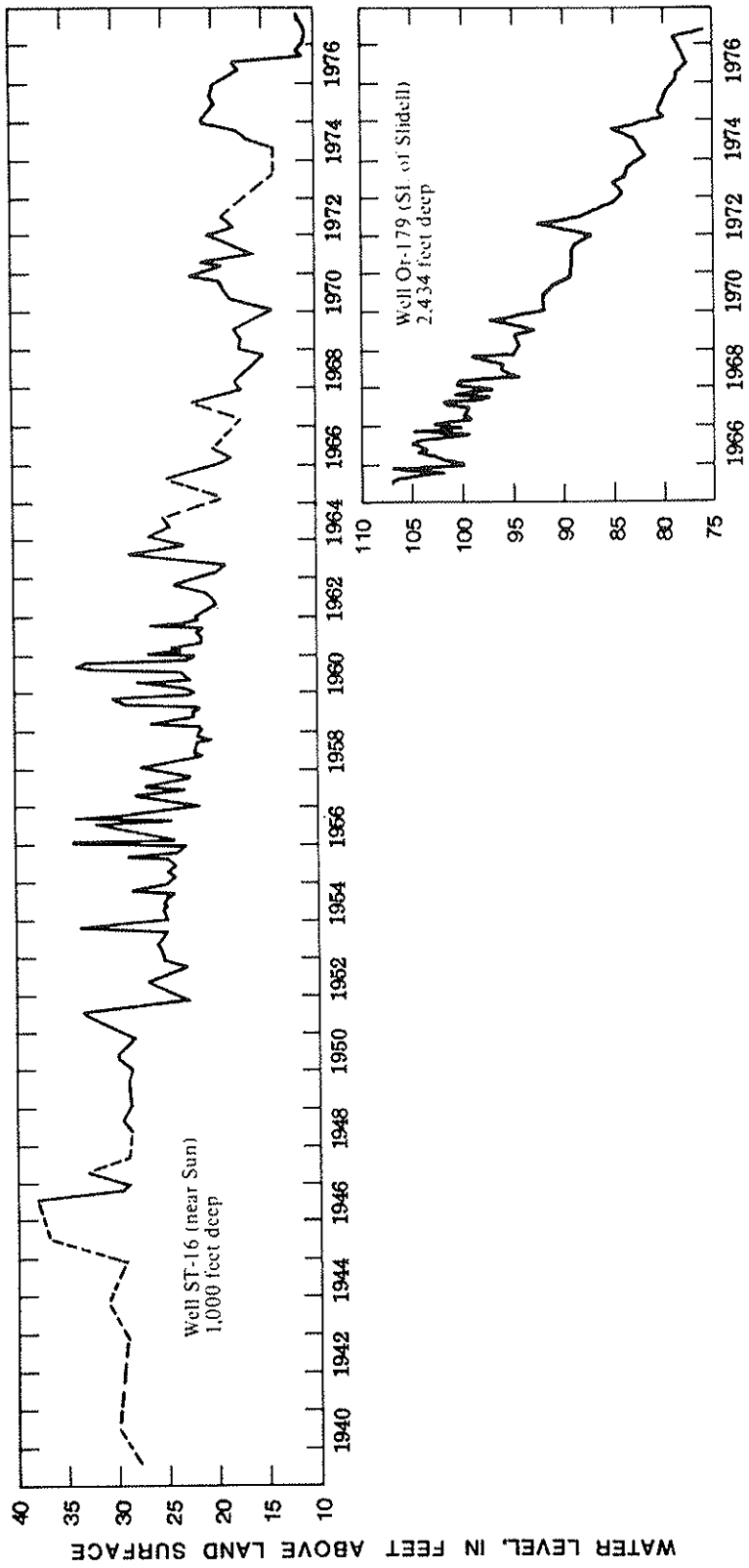


Figure 13.--Hydrographs for the Abita aquifer.

greater than would be expected from the estimated pumpage. Additional water-level data for the Abita aquifer are given in table 9.

Table 9. --Water levels for the Abita aquifer

Well number	Depth (feet)	Water level, in feet above(+)or below land-surface datum		Well number	Depth (feet)	Water level, in feet above(+)or below land-surface datum	
		May 1969	May 1974			May 1969	May 1974
Li-149	1,898	-----	+24.8	ST-649	1,600	+74.9	<u>a/</u> +63.3
Or-179	2,435	+94.9	+82.4	ST-664	1,407	+65.0	+58.2
ST-16	1,000	+18.2	+14.0	ST-676	1,530	+65.2	+54.9
ST-565	1,971	+96.8	+87.4	ST-681	930	+9.4	-----
ST-571	1,505	+71.7	<u>a/</u> +62.9	ST-686	1,100	32.64	37.0
ST-646	2,263	+96.9	-----	ST-692	1,620	+72.4	+62.4
ST-648	1,685	+80.0	<u>a/</u> +69.0	Ta-347	1,380	+77.5	<u>a/</u> +63.3

a/ Measured February 1975.

### Water Quality

Water in the Abita aquifer is a sodium bicarbonate type, having dissolved solids ranging from 50 to 400 mg/L. Iron concentrations are generally less than 0.3 mg/L; however, water from wells west of Abita Springs contains iron in excess of this amount, and some concentrations are as high as 3.0 mg/L. Manganese is present in water from most wells in the aquifer in concentrations of less than 0.1 mg/L. Silica in water from the area west of Abita Springs is generally in the range of 40 to 60 mg/L. The pH ranges from about 6.5 in the northern part of the aquifer to about 9.0 in the southeastern part. Hydrogen sulfide occurs locally and may be as high as 0.5 mg/L. Temperature ranges from 70°F (21.0°C) in the northern part of the aquifer (depths of about 500 ft) to 98°F (36.5°C) in the southern part (well Or-179, 2,435 ft deep).

### Covington Aquifer

#### Extent, Thickness, and Lithology

The Covington aquifer, of the Kentwood aquifer system, is a continuous unit in most of the report area and is one of the most important aquifers. The aquifer ranges in depth below land surface from about 600 ft near Franklinton to about 2,200 ft near Slidell. The aquifer thickness typically ranges from 100 to 200 ft (table 10); however, in the Slidell area the thickness varies greatly and may be less than 100 ft. The aquifer dips to the southwest at a rate ranging from 40 ft/mi in northern Tangipahoa Parish to about 70 ft/mi in southern St. Tammany Parish.

Table 10.--Altitude of aquifer interval, Covington aquifer  
[In feet below mean sea level]

Well or permit number	Altitude of top of aquifer	Altitude of base of aquifer	Well or permit number	Altitude of top of aquifer	Altitude of base of aquifer	Well or permit number	Altitude of top of aquifer	Altitude of base of aquifer
Li-54	(a)	(a)	ST-669	1,430	1,580+	Ta-312	1,240	1,455
SH-5	460	610	ST-708	1,990	2,145+	Ta-314	(a)	(a)
SH-7	1,075	1,255	ST-710	1,410	1,475+	Ta-341	1,550	1,690
SH-8	1,230	1,290	ST-721B	1,045	1,205	Ta-429	(a)	(a)
SJB-158	2,830	3,040	Ta-257	1,165	1,295	Ta-435	2,380	2,560
ST-525	1,265	1,330	Ta-258	1,855	1,940+	21045	1,600	1,745
ST-558	1,165	1,360	Ta-264	1,545	1,710	29307	(a)	(a)
ST-562	1,785	1,915	Ta-265	1,465	1,575	30902	805	965
ST-564	1,960	2,095+	Ta-266	1,380	1,550	34709	2,110	2,190
ST-567	1,425	1,455	Ta-269	1,125	1,205	44836	565	765
ST-573	1,955	2,020	Ta-272	(a)	(a)	46024	815	1,035
ST-576	(a)	(a)	Ta-273	(a)	(a)	47328	575	820
ST-591	2,150	2,180+	Ta-278	1,290	1,380+	52961	1,450	1,940
ST-592	1,410	1,665	Ta-281	1,480	1,685	81235	1,560	1,735
ST-598	1,780	1,895+	Ta-285	(a)	(a)	85312	1,525	1,630
ST-644	1,620	1,710+	Ta-289	955	995	87776	1,450	1,475
ST-652	1,295	1,465	Ta-310	1,270	1,440	137657	1,860	2,055

a/Aquifer missing.

In addition to northern Tangipahoa and western Washington Parishes where the Covington and Abita merge, forming the Kentwood aquifer, the Abita, Covington, and Slidell aquifers also merge to form a massive sand 490 ft thick near the Pearl River at the site of oil test 52961 (pl. 8). The aquifer is essentially absent in the vicinity of Amite (well Ta-272, pl. 1), Lacombe (well ST-576, pl. 3), and near Hammond and Ponchatoula.

Sieve analyses of the aquifer material penetrated by a well at Madisonville indicate that the Covington aquifer is dominantly a medium to coarse sand (fig. 14). Sands in the lower part of the aquifer are typically coarser than in the upper part.

#### Aquifer Characteristics and Well Yields

Two Covington municipal-supply wells (ST-57 and ST-554) are screened in the Covington aquifer. Well ST-57 had a yield of 750 gal/min when drilled in 1942. The yield of well ST-554 was not documented.

No specific capacity or aquifer tests were conducted in the Covington aquifer in the project area; however, a test at the National Space Technology Laboratories indicated a hydraulic conductivity of 1,670 (gal/d)/ft<sup>2</sup> (220 ft/d), a transmissivity of 200,000 (gal/d)/ft, (27,000 ft<sup>2</sup>/d), and an observed specific capacity of 26 (gal/min)/ft of drawdown for industrial well 2 (Newcome, 1967, p. H14). The well was pumped at about 5,000 gal/min for 24 hours.