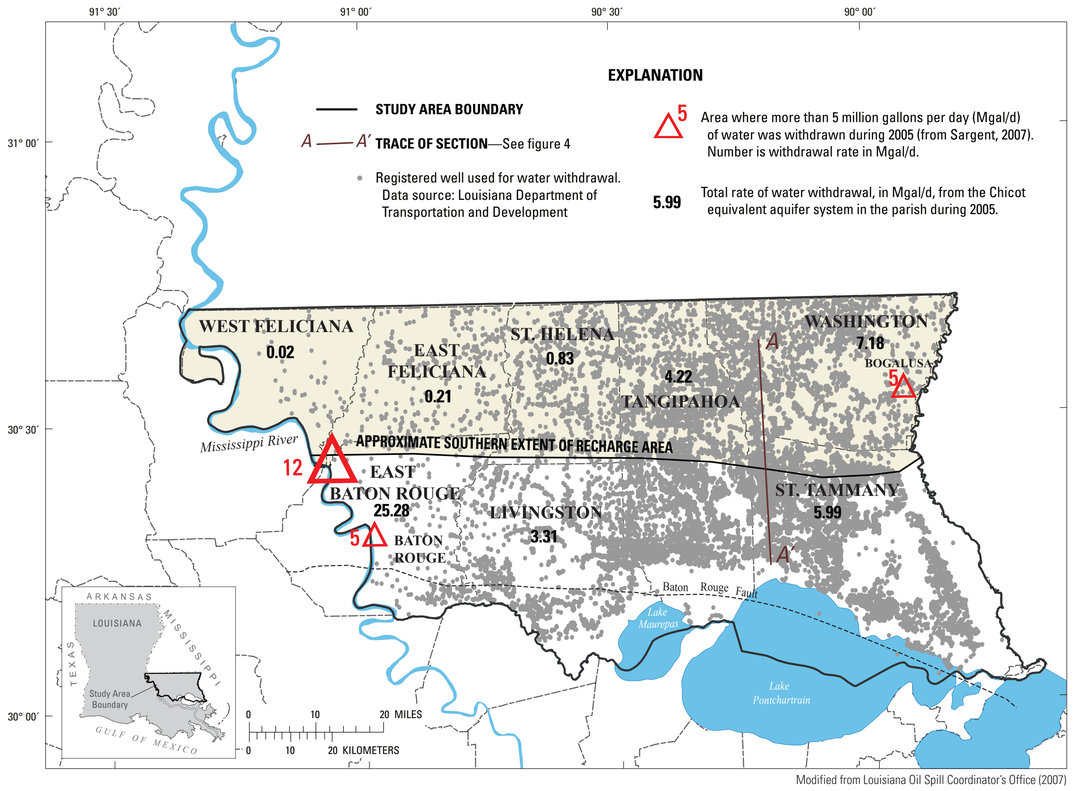
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared in cooperation with the
LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
OFFICE OF PUBLIC WORKS, HURRICANE FLOOD PROTECTION AND INTERMODAL TRANSPORTATION
WATER RESOURCES PROGRAMS

SCIENTIFIC INVESTIGATIONS MAP 3173
Chicot Equivalent aquifer system—SHEET 1 OF 2



Modified from Louisiana Oil Spill Coordinator's Office (2007)

Figure 1. Location of the study area and locations of wells constructed in the Chicot equivalent aquifer system in southeastern Louisiana.

Introduction

The Chicot equivalent aquifer system is an important source of freshwater in southeastern Louisiana. In 2005, about 47 million gallons per day (Mgal/d) were withdrawn from the Chicot equivalent aquifer system in East Baton Rouge, East Feliciana, Livingston, Tangipahoa, St. Helena, St. Tammany, Washington, and West Feliciana Parishes (figs.1 and 2; Sargent, 2007). Concentrated withdrawals exceeded 5 Mgal/d in Bogalusa, the city of Baton Rouge, and in northwestern East Baton Rouge Parish (fig. 1). In the study area, about 30,000 wells screened in the Chicot equivalent aquifer system were registered with the Louisiana Department of Transportation and Development (LaDOTD). These wells were constructed for public-supply, industry, irrigation, and domestic uses (Z. Bolourchi, Louisiana Department of Transportation and Development, written commun., 2009). Most of the wells (about 27,500) were registered as domestic-use wells and are small-diameter (4-inch casing or smaller), low-yielding wells. Total withdrawal from the Chicot equivalent aquifer system for domestic use was estimated to be 12 Mgal/d in 2005 (Sargent, 2007).

This report documents the 2009 water-level surface of the Chicot equivalent aquifer system in southeastern Louisiana. The report also shows differences in water-level measurements for the years 1991 and 2009 at selected sites. Understanding changes and trends in water levels is important for continued use, planning, and management of groundwater resources. The U.S. Geological Survey (USGS), in cooperation with the LaDOTD, conducted this study of the water-level surface of the Chicot equivalent aquifer system in Louisiana as part of an ongoing effort to monitor groundwater levels in aquifers in Louisiana.

The study area (fig. 1) is bounded by the Mississippi-Louisiana State line to the north and east. The southern boundary is the approximate southern extent of East Baton Rouge, Livingston, Tangipahoa, and St. Tammany Parishes. The western boundary is the Mississippi River.

The cooperation of municipal, industrial, and private well owners during data collection is greatly appreciated. Special thanks go to Zahir "Bo" Bolourchi, Director, Water Resources Programs, Louisiana Department of Transportation and Development, for providing water-well registration data and assistance in the publication of this report.

Methods

Water-level data were collected by USGS personnel by using steel or electric tapes and pressure gages. Measurements were made by using equipment that is quality assured. Field procedures included making a second water-level measurement to verify the first and to ensure that the water level was static. A land-surface elevation was estimated for each site by using quadrangle maps with 5- or 10-foot (ft) contours. Although not shown on the map, water-level data reported by drillers and contained in LaDOTD well-registration files were used as ancillary data. Water-level data from LaDOTD were used to refine the conceptualization of the water-level surface with respect to land surface. Digital-elevation model data (Gesch and others, 2002; Gesch, 2007) were evaluated in the recharge area to configure water-level contours with land surface. Water-level data collected during this study are stored in the National Water Information System (accessible at http://nwis.waterdata.usgs.gov/la/nwis/gwlevels).

Hydrographs showing water-level data since 1990 were selected from long-term water-level network wells. The selected hydrographs had the most complete (no large time periods of missing measurements) datasets for the period 1990–2010 and were spatially distributed across the study area. Water levels at these sites were measured by USGS personnel in cooperation with personnel from the LaDOTD and the Capital Area Ground Water Conservation Commission. An average rate of water-level decline for the period 1990–2009 was determined for each hydrograph by using a simple least-squares linear regression (Golden Software, Inc., 2007).

The difference between 1991 and 2009 water levels in the aquifer system was evaluated by using water-level data collected at 29 sites. These sites were measured in 1991 for mapping the water-level surface in the Chicot equivalent aquifer system in St. Helena, Livingston, Tangipahoa, St. Tammany, and Washington Parishes (Walters, 1995) or as part of a USGS observation network in East Baton Rouge Parish.

Hydrogeology

The Chicot equivalent aquifer system (figs. 3 and 4) consists of southerly dipping unconsolidated deposits of silt, sand, and gravel separated by discontinuous units of clay and sandy clay (Walters, 1995). The aquifer system is regionally extensive and extends north and east of the study area into Mississippi. West of the study area, the Chicot equivalent aquifer system is truncated by the Mississippi River alluvial aquifer system (Griffith, 2006). At the approximate southern boundary of the study area, locally named aquifers in the Chicot equivalent aquifer system transition into the New Orleans aquifer system. South of the study area, the aquifers contain large areas of saltwater, although limited quantities of freshwater are available (Tomaszewski, 2003).

In the northern half of the study area (the area north of a line drawn along the northern boundaries of East Baton Rouge, Livingston, and St Tammany Parishes), the system contains large amounts of sand and gravel. Previous reports have referred to aquifers in this area as the upland terrace aquifer or shallow aquifer (Nyman and Fayard, 1978; Tomaszewski, 1988). The northern half of the study area contains higher land-surface altitudes (hilltops) where precipitation infiltrates through permeable sands into the aquifer system—the recharge area. Groundwater in the recharge area has higher water-levels than in the south because of the higher elevation of land surface.

South of the recharge area (fig. 1), the Chicot equivalent aquifer system dips below younger deposits and is confined by clays (fig. 4). In the approximate southern half of the study area, aquifers in the system are generally referred to as the shallow, "400-foot," or "600-foot" sands of the Baton Rouge area, and in Tangipahoa and St. Tammany Parishes, as the shallow and upper Ponchatoula aquifers (fig. 3).

The base of the Chicot equivalent aquifer system is about 100 ft above National Geodetic Vertical Datum of 1929 (NGVD 29) near the Mississippi-Louisiana State line. In northern parts of the study area, sands in the aquifer system are near land surface and coalesce with underlying sands. The aquifer system dips southward; the base of the aquifer system is about 0 ft NGVD 29 in central parts of the study area and 600 ft below NGVD 29 in southern areas. The aquifer system generally contains 100–200 ft of combined sand thickness; however, sands can be locally missing. The aquifer system thickens southward, and thickness reaches 400 ft or more in southern areas (Griffith, 2003).

Previous investigations have shown that the Baton Rouge fault affects water levels in the Baton Rouge area (Whiteman, 1979; Tomaszewski, 1996). The effects of faulting on water levels were not evident during this investigation because water levels in wells south of the fault were not measured in the Baton Rouge area. In Livingston, Tangipahoa, and St. Tammany Parishes, thick beds of sand north and south of the Baton Rouge fault are present (Griffith, 2003, plates 4, 5, and 7) and may allow unrestricted groundwater flow across the fault in the aquifer system.

Wells in the recharge area are shallower than wells in the downdip confined zones. Wells constructed in the recharge area generally have total depths that range from 70 to 190 ft below land surface (10 and 90 percentiles) and have a median depth of 110 ft (Z. Bolourchi, Louisiana Department of Transportation and Development, written commun., 2009). Depths of wells in the southern half of the study area generally range from 100 to 480 ft below land surface (10th and 90th percentiles) and

System	Series	Stratigraphic unit	Hydrogeologic units		
			Aquifer system or confining unit	Aquifer or confining unit	
				East Baton Rouge, East Feliciana, Livingston, St. Helena, and West Feliciana Parishes	St. Tammany, Tangipahoa, and Washington Parishes
					North / South
Quaternary	Holocene	Mississippi River and other alluvial deposits	Near-surface aquifers or surficial confining unit	Mississippi River alluvial aquifer	No regionally extensive hydrogeologic units
	?		?		
	Pleistocene	Unnamed Pleistocene deposits	Southern Hills regional aquifer system: Chicot equivalent aquifer system or surficial confining unit	Shallow sands	Shallow aquifer
				Upland terrace aquifer "400-ft" sand "600-ft" sand	Upland terrace aquifer / Upper Ponchatoula aquifer
				Sequence of aquifers and clay confining units	

Figure 3. Correlation of hydrogeologic units in the Chicot equivalent aquifer system in southeastern Louisiana (modified from Stuart and others, 1994).

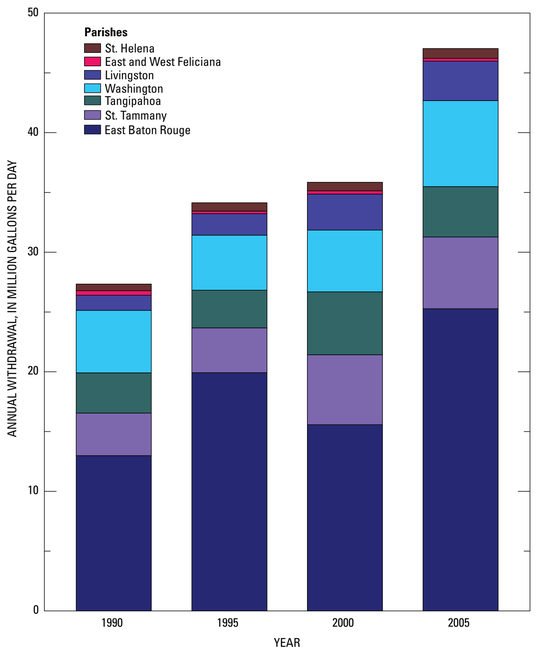


Figure 2. Withdrawals from the Chicot equivalent aquifer system in selected parishes of southeastern Louisiana, 1990–2005 (from Sargent, 2007).

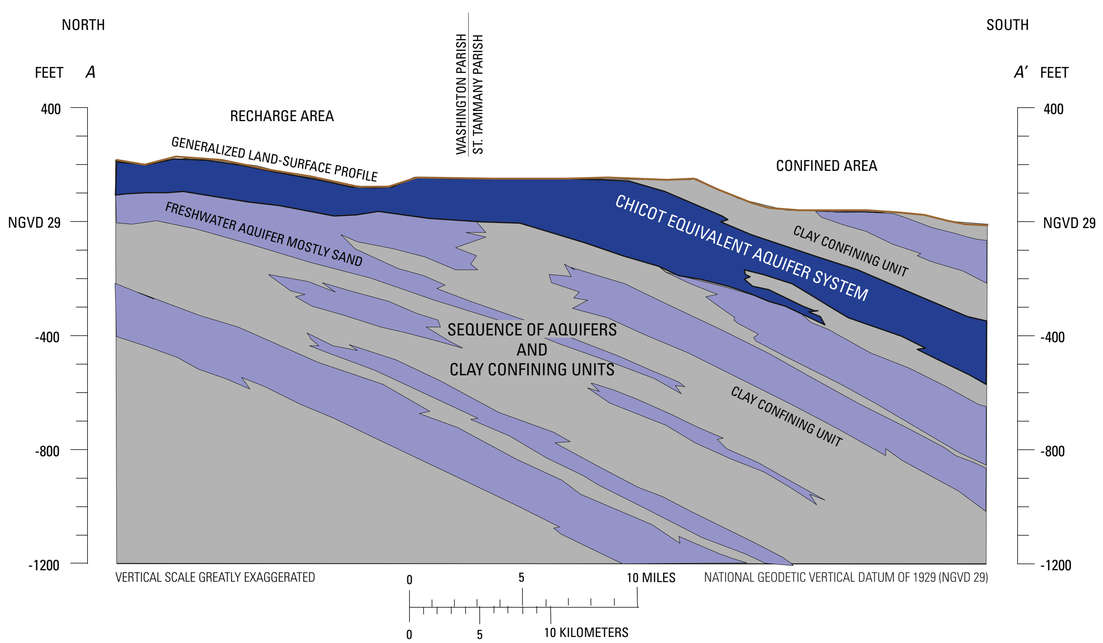


Figure 4. Generalized hydrogeology of the Chico equivalent aquifer system in southeastern Louisiana (modified from Griffith, 2003).

Water-Level Surface in the Chicot Equivalent Aquifer System in Southeastern Louisiana, 2009

By
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