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DOTD LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

Water Resources of the Southern Hills Regional Aquifer System, Southeastern Louisiana

Introduction

Information concerning the availability, use, and quality of groundwater in the 10 parishes overlying the Southern Hills regional aquifer system of Louisiana (fig. 1) is critical for water-supply management. The purpose of this fact sheet is to present information that can be used by water managers, residents, and others for stewardship of this vital resource. Information on the availability, past and current use, use trends, and water quality from groundwater sources in these parishes is presented. Previously published reports (see References Cited section) and data stored in the U.S. Geological Survey's National Water Information System (U.S. Geological Survey, 2017) are the primary sources of the information presented here.

Groundwater Withdrawals

In 2014, about 293 million gallons per day (Mgal/d) (table 1; fig. 2) were withdrawn from groundwater sources in the 10-parish area (West Feliciana, East Baton Rouge, East Feliciana, Livingston, Pointe Coupee, St. Helena, St. Tammany, Tangipahoa, Washington, and West Baton Rouge; figs. 1, 2) that overlies the Southern Hills regional aquifer system (Buono, 1983; U.S. Geological Survey, 2016).[1] Most of the groundwater withdrawals come from the regional aquifer system, but in the western part of the study area, the Mississippi River alluvial aquifer is also a major source. Withdrawals for public supply accounted for about 48 percent (140.34 Mgal/d), and industrial use accounted for about 32 percent (94.34 Mgal/d) of the total withdrawn (table 1). Other categories of use included power generation, rural domestic, livestock, general irrigation, rice irrigation, and aquaculture. Water-use data collected at 5-year intervals from 1960 to 2010 and again in 2014 (fig. 2) indicated that groundwater withdrawals peaked in 2014. These withdrawals were highest in East Baton Rouge Parish (148.26 Mgal/d) and lowest in St. Helena Parish (1.79 Mgal/d) (fig. 1).

[1]Water-withdrawal data are based on estimated or reported site-specific data and aggregated data, which are distributed to sources. For a full description of water-use estimate methodology, see "Data Collection" in Sargent (2011). Tabulation of numbers in text and tables may result in different totals because of rounding; nonrounded numbers are used for calculation of totals.

Table 1. Groundwater withdrawals, 2014, in million gallons per day, by use category in the 10-parish area overlying the Southern Hills regional aquifer system, Louisiana (U.S. Geological Survey, 2016).

Use category	Groundwater
Public supply	140.34
Industrial	94.34
Power generation	9.69
General irrigation	23.18
Rice irrigation	3.47
Rural domestic	12.83
Livestock	0.57
Aquaculture	8.23
Total	**292.65**

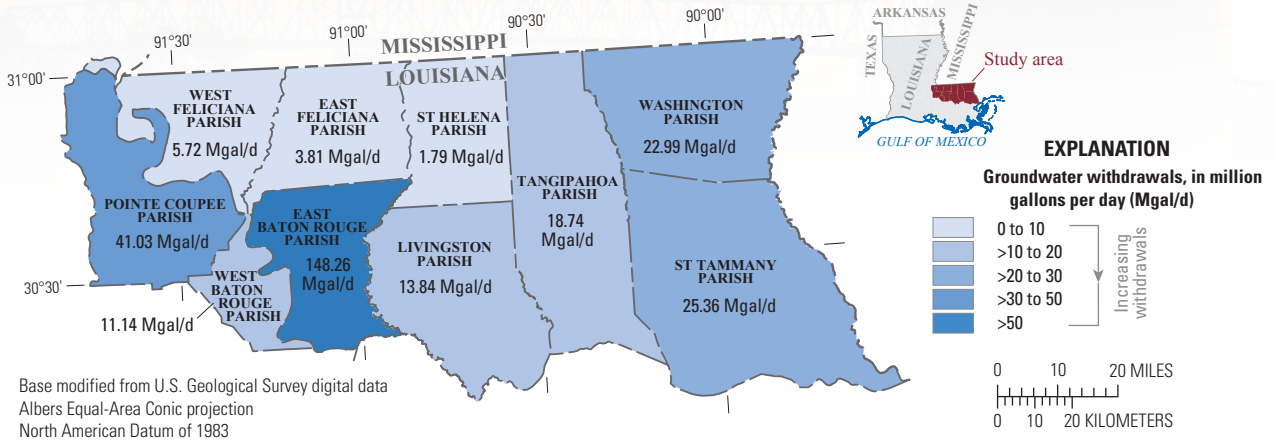

Figure 1. Location of the 10-parish area overlying the Southern Hills regional aquifer system with 2014 groundwater withdrawals, Louisiana. Darker shading indicates greater withdrawal amount (U.S. Geological Survey, 2016).

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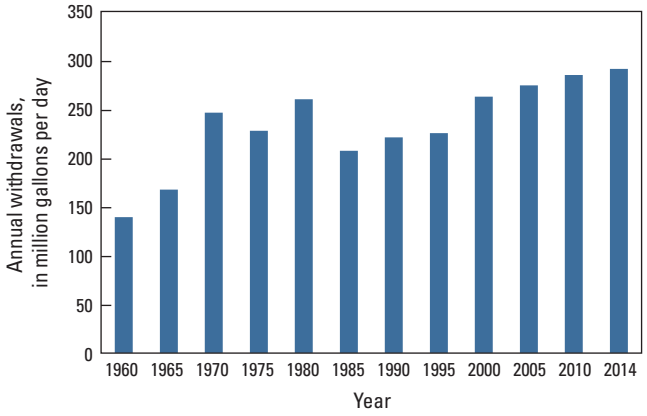

Figure 2. Groundwater withdrawals in the 10 parishes overlying the Southern Hills regional aquifer system in Louisiana, 1960–2014 (U.S. Geological Survey, 2016).

Groundwater Resources

Fresh groundwater (water with a chloride concentration of 250 milligrams per liter [mg/L] or less) in the Southern Hills regional aquifer system in Louisiana is present in three aquifer systems: from shallowest to deepest, (1) the Chicot equivalent, (2) Evangeline equivalent, and (3) Jasper equivalent aquifer systems (figs. 3, 4). The Mississippi River alluvial aquifer is present along much of the western edge of East Baton Rouge and West Feliciana Parishes and within Pointe Coupee and West Baton Rouge Parishes. The Mississippi River alluvial aquifer is hydraulically connected to the Chicot equivalent aquifer system in localized areas but is not considered part of the Southern Hills regional aquifer system.

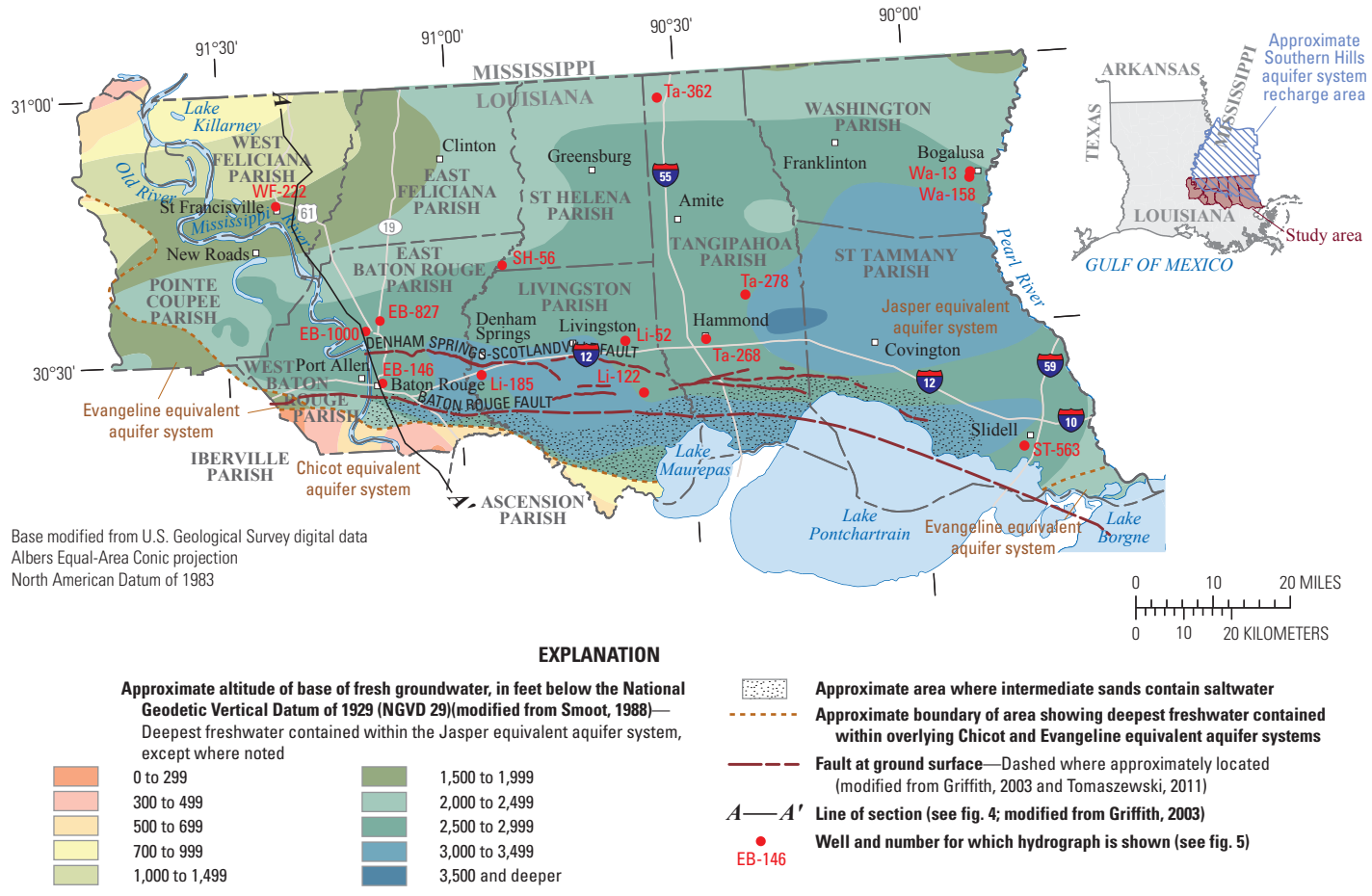

Figure 3. Hydrogeologic features of the Southern Hills regional aquifer system in the study area with section line and well locations (see fig. 4 for cross-section and fig. 5 for well hydrographs).

The Chicot, Evangeline, and Jasper equivalent aquifer systems extend across most of southeastern Louisiana and generally consist of silt, sand, and gravel separated by discontinuous layers of clay and sandy clay. The aquifer systems dip and thicken to the south and contain freshwater to depths of greater than 3,500 feet (ft) below the National Geodetic Vertical Datum of 1929 (NGVD 29) (fig. 3). Recharge to the aquifers is primarily by precipitation in outcrop areas across the northern part of the 10-parish area and in southwestern Mississippi (Griffith, 2003) (figs. 3, 4).

Prior to development of the regional aquifer system, which began in the late 1800s (Harris, 1904), groundwater generally flowed from north to south and towards the Mississippi and Pearl Rivers (Kuniansky, 1989; Martin and Whiteman, 1989; Halford and Lovelace, 1994). Development of the aquifer systems has altered the direction of flow in some areas, particularly near Baton Rouge, where large regional cones of depression have formed in the water-level surfaces

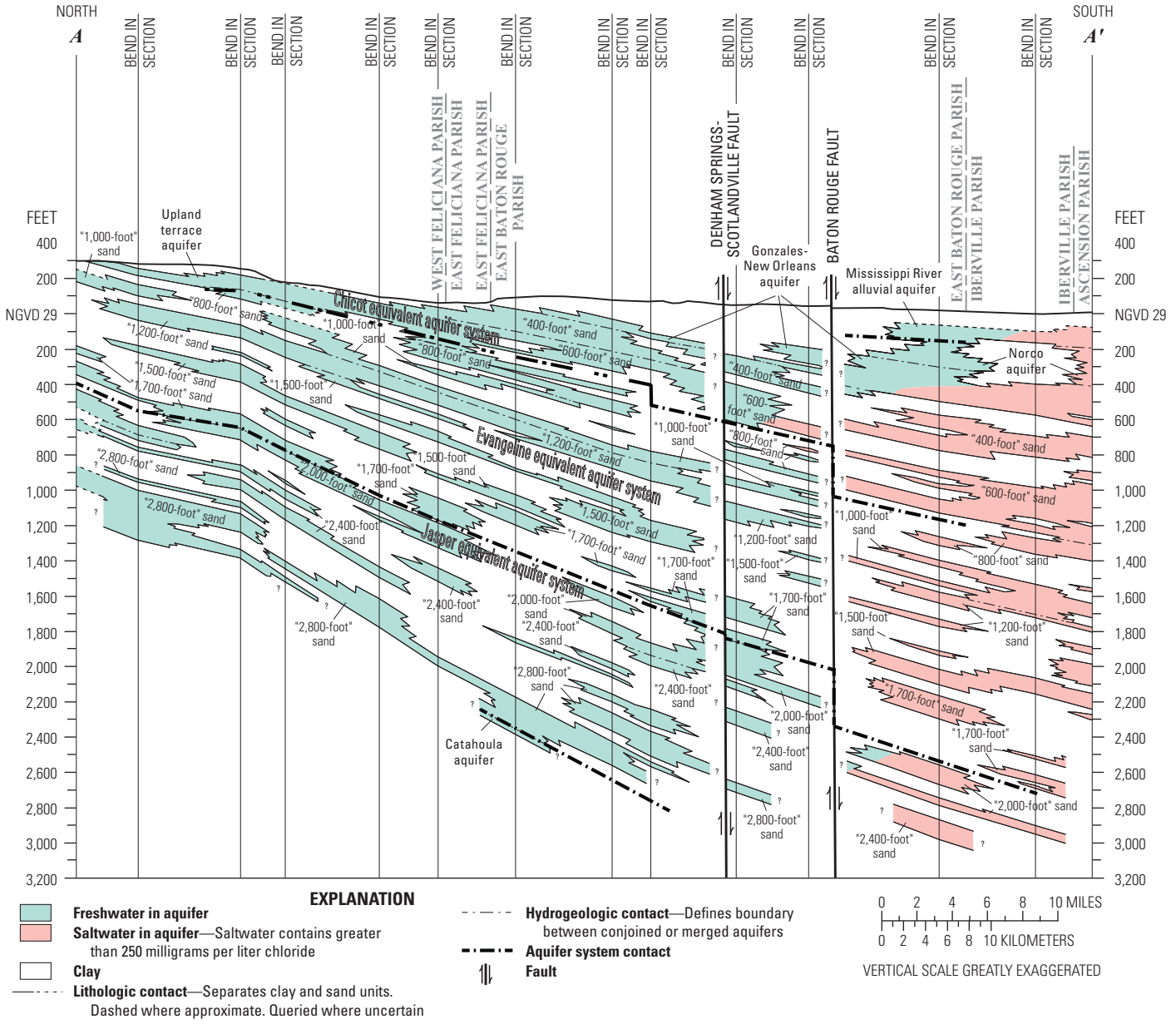

Figure 4. Generalized north-to-south hydrogeologic section through the western part of the Southern Hills regional aquifer system, Louisiana (modified from Griffith, 2003). Trace of section shown on figure 1.

in wells screened in these aquifer systems. A smaller local cone of depression has been observed near Bogalusa in the Jasper equivalent aquifer system. Cones of depression indicate that groundwater is moving radially towards the center of the cone (Prakken, 2004; Fendick, 2007; Tomaszewski, 2011).

Generally, the location of the Baton Rouge Fault (fig. 3) coincides with abrupt changes in availability of freshwater (fig. 4). North of the fault, the base of fresh groundwater is consistently present in the Jasper equivalent aquifer system, in some places to deeper than 3,500 ft below NGVD 29. In general, south of the fault, the depth of the base of fresh groundwater transitions and is restricted to the Chicot equivalent aquifer system; however, freshwater extends south of the fault to a limited distance in the Evangeline and Jasper equivalent aquifer systems in some areas. Salty groundwater movement in East Baton Rouge Parish affects the availability of fresh groundwater. Large groundwater withdrawals in the Baton Rouge area have induced northward encroachment of saltwater across the Baton Rouge Fault into freshwater areas in some locations (Griffith, 2003).

Water levels and withdrawals vary by aquifer system. Water levels remained stable in wells screened in the upper part of the Chicot equivalent aquifer system during 2002–11 (fig. 5*A*), whereas wells screened in the lower part of the Chicot equivalent aquifer system declined in the western parts of the 10-parish area during 1991–2012 (fig. 5*B*). Water levels have generally declined during the last 20–60 years at monitored wells screened in the Evangeline and Jasper equivalent aquifer systems because of withdrawals (figs. 5*C*, *D*). Declines have generally been the greatest near withdrawal centers in and near the Baton Rouge metropolitan area. In 2014, withdrawals increased with aquifer-system depth: Chicot equivalent (40.99 Mgal/d), Evangeline equivalent (100.35 Mgal/d), and Jasper equivalent (118.8 Mgal/d).

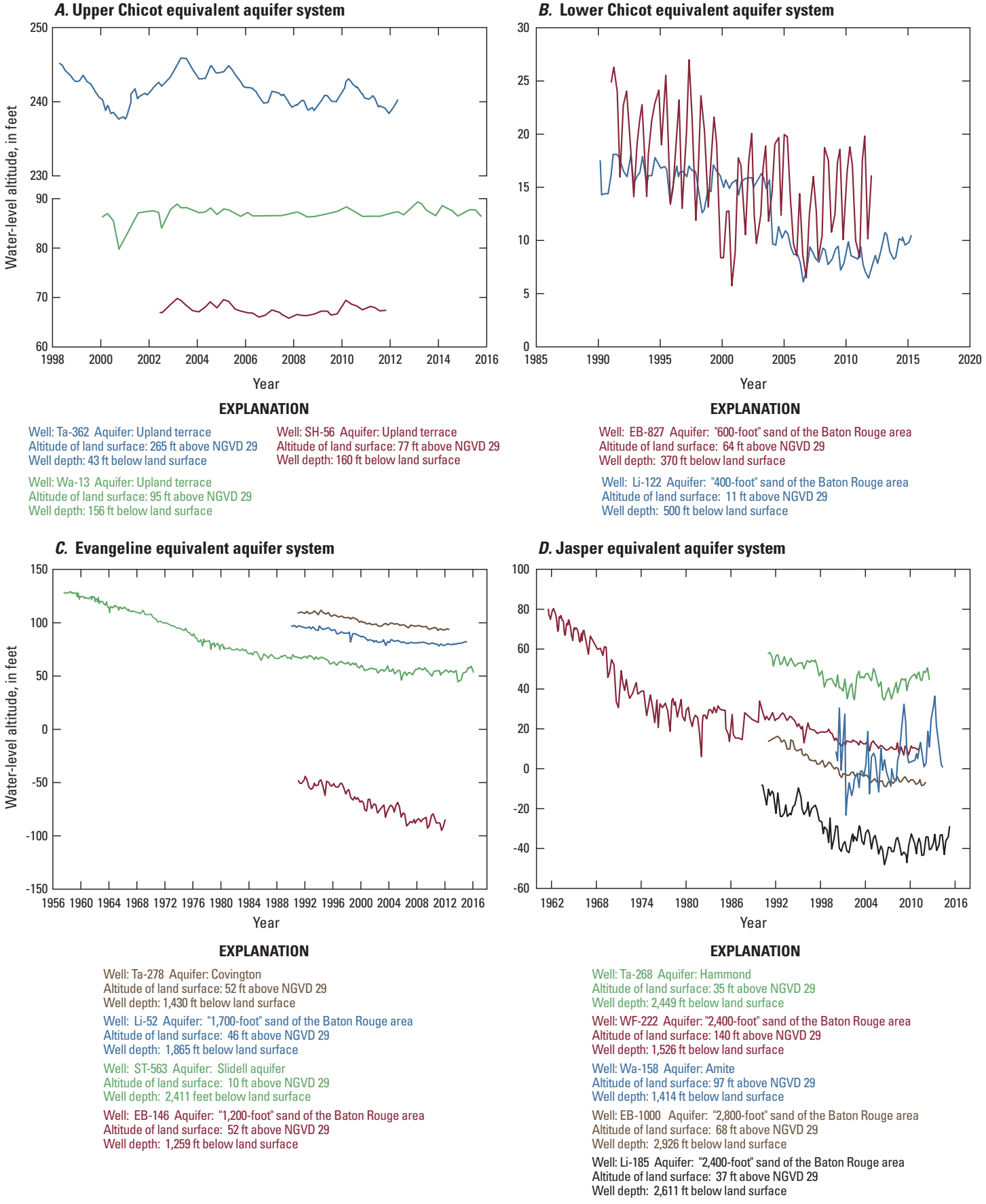

Figure 5. Water levels in wells screened in the *A*, upper part of the Chicot equivalent aquifer system; *B*, lower part of the Chicot equivalent aquifer system; *C*, Evangeline equivalent aquifer system; and *D*, Jasper equivalent aquifer system of the Southern Hills regional aquifer system, Louisiana (see fig. 3 for well locations; U.S. Geological Survey, 2017). Land surface and water-level altitude are in feet (ft) relative to the National Geodetic Vertical Datum of 1929 (NGVD 29).

In addition, 31.99 Mgal/d were withdrawn from the Mississippi River alluvial aquifer in Pointe Coupee (28.05 Mgal/d), West Baton Rouge (3.87 Mgal/d), East Baton Rouge (0.06 Mgal/d), and West Feliciana (0.01 Mgal/d) Parishes (U.S. Geological Survey, 2016).

The Chicot Equivalent Aquifer System

The primary aquifers composing the Chicot equivalent aquifer system in the western part of the 10-parish area, from shallowest to deepest, are the shallow sands, Upland terrace aquifer, and the "400-foot" and "600-foot" sands of the Baton Rouge area (Griffith, 2003; fig. 4). In the eastern part of the 10-parish area, from shallowest to deepest, the primary aquifers are the Upland terrace and upper Ponchatoula aquifers.

In 2016, State well-registration records listed 26,358 active water wells screened in the Chicot equivalent aquifer system in the Southern Hills region, including 23,743 domestic, 1,477 irrigation, 1,006 public supply, and 132 industrial. Well depths ranged from 10 to 980 ft below land surface, and reported yields ranged from 1 to 3,000 gallons per minute (gal/min) (data provided by Louisiana Department of Natural Resources Office of Conservation /Environmental Division, 2016).

The Evangeline Equivalent Aquifer System

The primary aquifers composing the Evangeline equivalent aquifer system, from shallowest to deepest, in the western part of the 10-parish area are the "800-foot," "1,000-foot," "1,200-foot," "1,500-foot," and "1,700-foot" sands of the Baton Rouge area (Griffith, 2003; fig. 4). In the eastern part of the 10-parish area, the primary aquifers are the Lower Ponchatoula, Big Branch, Kentwood, Abita, Covington, and Slidell aquifers.

In 2016, State well-registration records listed 2,552 active water wells screened in the Evangeline equivalent aquifer system in the Southern Hills region, including 428 public supply, 91 industrial, 1,870 domestic, 156 irrigation, and 7 power generation. Well depths ranged from 60 to 2,460 ft below land surface, and reported yields ranged from about 1 to 3,000 gal/min (data provided by Louisiana Department of Natural Resources Office of Conservation/Environmental Division, 2016).

The Jasper Equivalent Aquifer System

The primary aquifers composing the Jasper equivalent aquifer system, from shallowest to deepest, in the western part of the 10-parish area are the "2,000-foot," "2,400-foot," and "2,800-foot" sands of the Baton Rouge area (Griffith, 2003; fig. 4). In the eastern part of the 10-parish area, the primary aquifers are the Tchefuncte, Hammond, Amite, Ramsay, and Franklinton aquifers.

In 2016, State well-registration records listed 564 active water wells screened in the Jasper equivalent aquifer system in the Southern Hills region, including 329 public supply, 69 industrial, 130 domestic, 10 power generation, and 26 irrigation. Well depths ranged from 469 to 3,072 ft below land surface. Reported yields from these wells ranged from about 5 to 3,400 gal/min (data provided by Louisiana Department of Natural Resources Office of Conservation/Environmental Division, 2016).

Water Quality

Freshwater samples collected from 1,522 wells screened in the Chicot, Evangeline, and Jasper equivalent aquifer systems of the Southern Hills regional aquifer system indicate that groundwater from the aquifer systems is soft[2] and does not exceed the U.S. Environmental Protection Agency's Secondary Maximum Contaminant Levels (SMCLs)[3] for dissolved-solids concentrations. Median values for pH and temperature in groundwater increase as aquifer-system depth increases (table 2). Localized concentrations of iron and manganese can greatly exceed the SMCLs.

[2]Hardness ranges, expressed as milligrams per liter of calcium carbonate, are as follows: 0–60, soft; 61–120, moderately hard; 121–180, hard; greater than 180, very hard (Hem, 1985).

[3]The SMCLs are nonenforceable Federal guidelines regarding cosmetic effects (such as tooth or skin discoloration), aesthetic effects (such as taste, odor, or color), or technical effects (such as damage to water equipment or reduced effectiveness of treatment for other contaminants) of drinking water. SMCLs were established as guidelines by the U.S. Environmental Protection Agency (2016).

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Table 2. Summary of selected water-quality characteristics for 1,522 wells screened in the Chicot, Evangeline, and Jasper equivalent aquifer systems in the 10 parishes overlying the Southern Hills regional aquifer system (U.S. Geological Survey, 2017).

[Values are in milligrams per liter, except as noted. °C, degree Celsius; SU, standard unit; $CaCO_3$, calcium carbonate; µg/L, microgram per liter; <, less than; SMCL, Secondary Maximum Contaminant Level established by the U.S. Environmental Protection Agency (2016); NA, not applicable]

	Temperature (°C)	pH, field (SU)	Hardness (as $CaCO_3$)	Chloride, filtered (as Cl)	Iron, filtered, µg/L (as Fe)	Manganese, filtered, µg/L (as Mn)	Dissolved solids, filtered
Chicot equivalent aquifer system (1939–2015; 476 wells)							
Median	22.5	7.1	22	11	100	50	194
10th percentile	20	5.2	6	3.1	<4	<0.8	48
90th percentile	24.5	8.2	98.8	120	1,100	311	418.8
Number of samples	625	402	813	1,516	197	204	230
Percentage of samples that do not exceed SMCLs	NA	65	NA	NA	71	50	95
Evangeline equivalent aquifer system (1936–2015; 544 wells)							
Median	28	7.9	5	4.4	70	20.5	198
10th percentile	22.5	6.5	1	2.3	<10	<10	110
90th percentile	32.1	8.9	25	100	1,200	183	260.4
Number of samples	987	546	1,165	2,005	259	208	397
Percentage of samples that do not exceed SMCLs	NA	63	NA	100	76	64	99
Jasper equivalent aquifer system (1939–2014; 502 wells)							
Median	31.2	8.3	4	4.1	90	20	213
10th percentile	24	7	1	1.6	<10	<5.0	160.8
90th percentile	36	9	20	140	1,300	199	391.6
Number of samples	905	647	1,101	1,893	342	242	459
Percentage of samples that do not exceed SMCLs	NA	57	NA	100	74	67	95
SMCLs							
	NA	6.5–8.5	NA	250	300	50	500

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