USGS
science for a changing world

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

Prepared in cooperation with the Louisiana Department of Transportation and Development

Water Resources of Sabine Parish, Louisiana

Introduction

Information concerning the availability, use, and quality of water in Sabine Parish, Louisiana (fig. 1), is critical for proper water-supply management. The purpose of this fact sheet is to present information that can be used by water managers, parish residents, and others for stewardship of this vital resource. Information on the availability, past and current use, use trends, and water quality from groundwater and surface-water sources in the parish is presented. Previously published reports (see References Cited section) and data stored in the U.S. Geological Survey's (USGS) National Water Information System (http://waterdata.usgs.gov/nwis) are the primary sources of the information presented here.

In 2010, about 3.85 million gallons per day (Mgal/d) of water were withdrawn in Sabine Parish, including about 2.09 Mgal/d from groundwater sources and 1.76 Mgal/d from surface-water sources[1] (table 1). Withdrawal amounts for various categories of use are found in table 2. Water-use data collected at 5-year intervals from 1960 to 2010 (fig. 2) indicated that water withdrawals peaked in 1990.

[1]Tabulation of numbers in text and tables may result in different totals because of rounding; nonrounded numbers are used for calculation of totals.

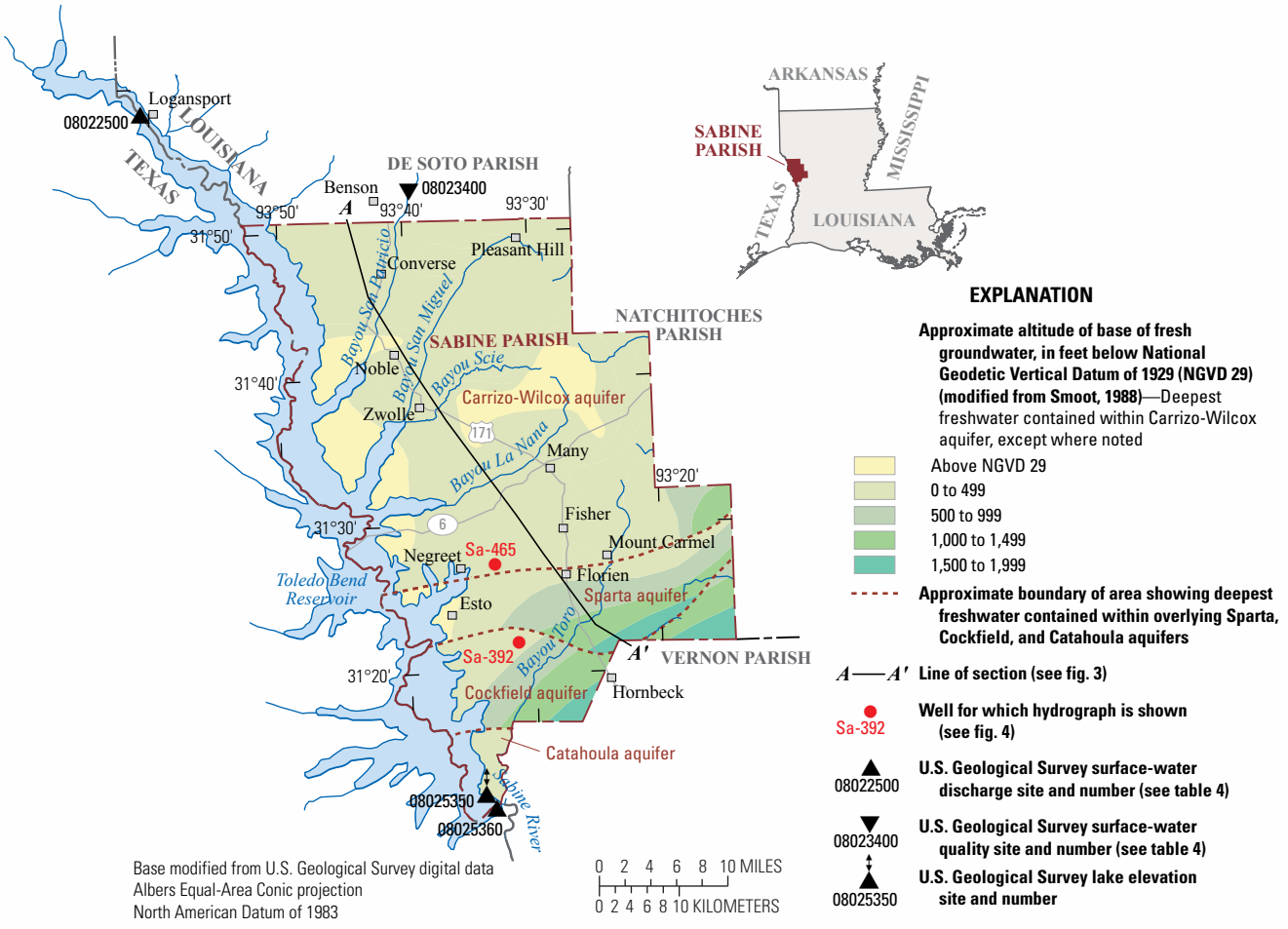

Figure 1. Location of study area, Sabine Parish, Louisiana.

Table 1. Water withdrawals, in million gallons per day, by source in Sabine Parish, Louisiana, 2010 (modified from Sargent, 2011).

Aquifer or surface-water body	Groundwater	Surface water
Upland terrace aquifer	0.03	
Catahoula aquifer	0.05	
Cockfield aquifer	0.07	
Sparta aquifer	0.13	
Carrizo-Wilcox aquifer	1.81	
Toledo Bend Reservoir		1.35
Other water bodies		0.41
Total	2.09	1.76

Table 2. Water withdrawals, in million gallons per day, by use category in Sabine Parish, Louisiana, 2010 (modified from Sargent, 2011).

[<, less than]

Use category	Groundwater	Surface water	Total
Public supply	1.25	1.30	2.55
Industrial	0.14	0.36	0.50
Rural domestic	0.68	0.00	0.68
Livestock	0.01	0.10	0.12
General irrigation	<0.01	<0.01	<0.01
Total	2.09	1.76	3.85

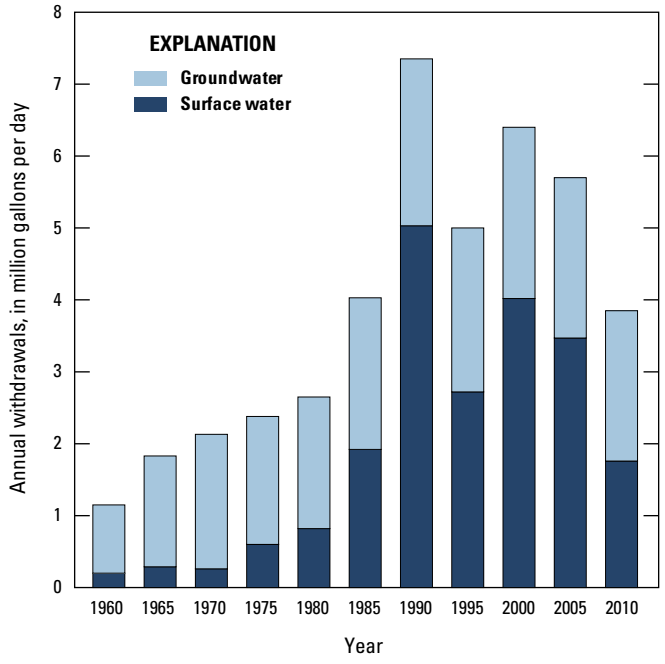

Figure 2. Water withdrawals in Sabine Parish, Louisiana, 1960–2010 (Sargent, 2011).

Groundwater Resources

The primary sources of fresh groundwater (water with a chloride concentration of 250 milligrams per liter [mg/L] or less) in Sabine Parish are the Cockfield, Sparta, and Carrizo-Wilcox aquifers (fig. 3). The Upland terrace aquifer, Catahoula aquifer (table 1), and Jasper aquifer system also are present in Sabine Parish and could be locally important but are not discussed further in this fact sheet because of their limited extents within the parish. Fresh groundwater is available throughout the parish, and the depth to the base of freshwater ranges from greater than 100 feet (ft) above the National Geodetic Vertical Datum of 1929 (NGVD 29) near the Sabine River in the west-central part of the parish to about 1,800 ft below NGVD 29 in the southeastern corner of the parish (fig. 1) (Smoot, 1988).

Recharge to aquifers in the parish is primarily from precipitation in areas where the aquifers outcrop in the parish and to the north. Discharge from the aquifers is primarily by natural seasonal flow into streams, leakage into adjacent aquifers, and withdrawals from wells. State well-registration records listed 1,389 active water wells in Sabine Parish in 2010, including 1,186 domestic, 122 irrigation, 64 public supply, and 17 industrial (Louisiana Department of Natural Resources, 2012). In 2010, categories of use for groundwater withdrawals included public supply, industrial, rural domestic, livestock, and general irrigation (table 2).

Cockfield Aquifer

Sands and clays of the Cockfield aquifer underlie the clayey Vicksburg-Jackson confining unit and overlie the clayey Cook Mountain confining unit (fig. 3). The aquifer outcrops in a southwest-to- northeast trending band that ranges from about 3 to 5 miles (mi) wide and runs through the towns of Florien and Mount Carmel in southern Sabine Parish. The top of the aquifer is about 1,000 ft below NGVD 29 in the southeastern corner of the parish and about 1,500 ft below NGVD 29 in the southwestern corner (Page and others, 1963). In 1993, the direction of groundwater flow in the Cockfield aquifer was generally to the east or southeast in southeastern Sabine Parish but toward the southwest in the southwestern part of the parish (Brantly and Seanor, 1996). Water levels in well Sa-392 (fig. 1), screened 544 ft below land surface in the Cockfield aquifer, generally fluctuate 1 ft or less annually (fig. 4).

State well-registration records listed 129 active water wells screened in the Cockfield aquifer in Sabine Parish in 2010, including 111 domestic, 8 public supply, 6 irrigation, and 4 industrial. Depths of these wells ranged from 15 to 2,112 ft below land surface, with a median depth of 164 ft. Reported yields from wells screened in the Cockfield aquifer in Sabine Parish have ranged from 3 to 300 gallons per minute (gal/min) (Louisiana Department of Natural Resources, 2012). In 2010, withdrawals from the Cockfield aquifer in Sabine Parish totaled about 0.07 Mgal/d and were all for rural-domestic use.

A statistical summary of selected water-quality characteristics for freshwater samples collected from 16 wells screened in the Cockfield aquifer in Sabine Parish is presented in table 3. The median value for hardness fell within the soft[2] range, and median values for pH and concentrations of chloride, manganese, and dissolved solids generally

[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).

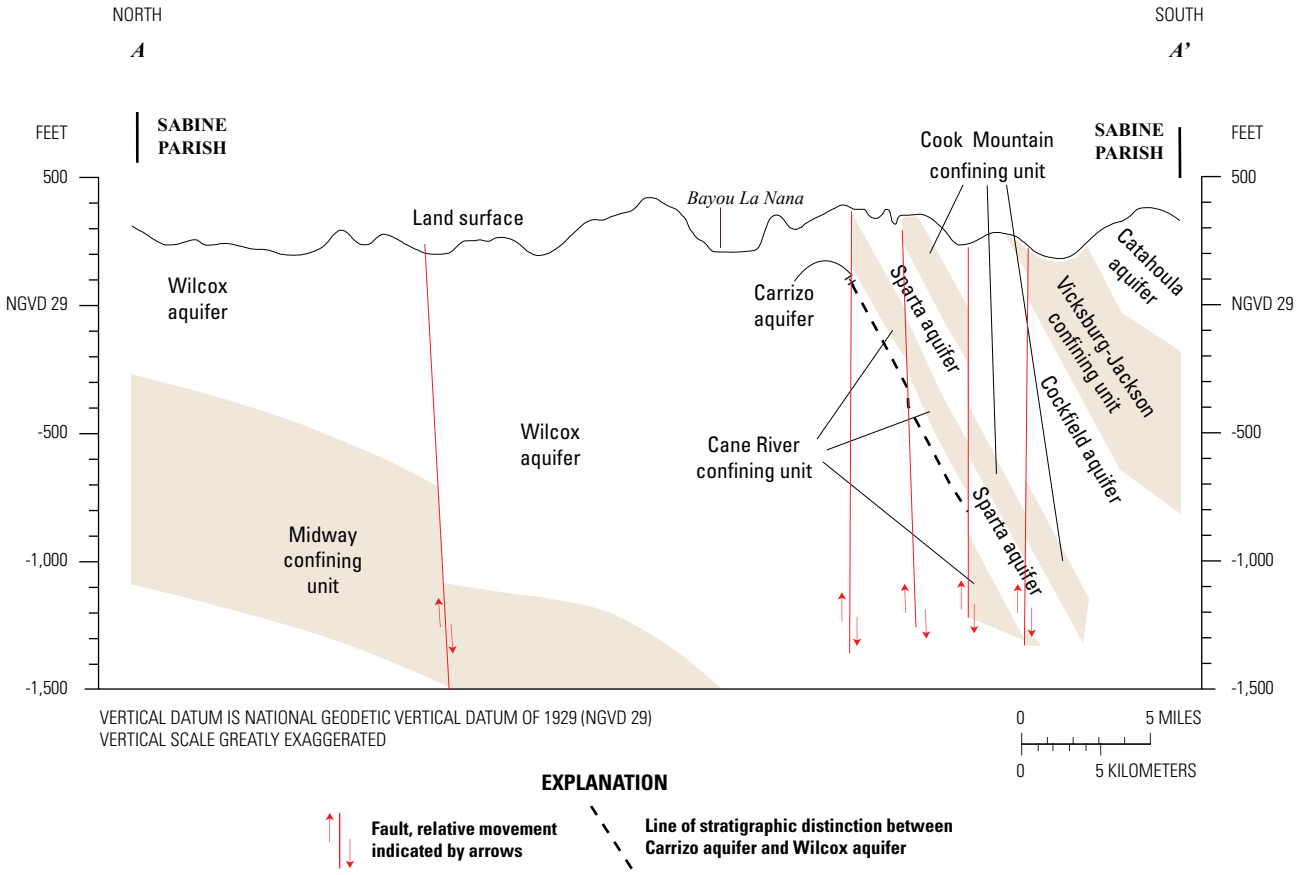

Figure 3. Generalized north-to-south hydrogeologic section showing aquifer and confining unit intervals in Sabine Parish, Louisiana (modified from Page and others, 1963). Individual sand and clay layers not shown. Trace of section shown on figure 1.

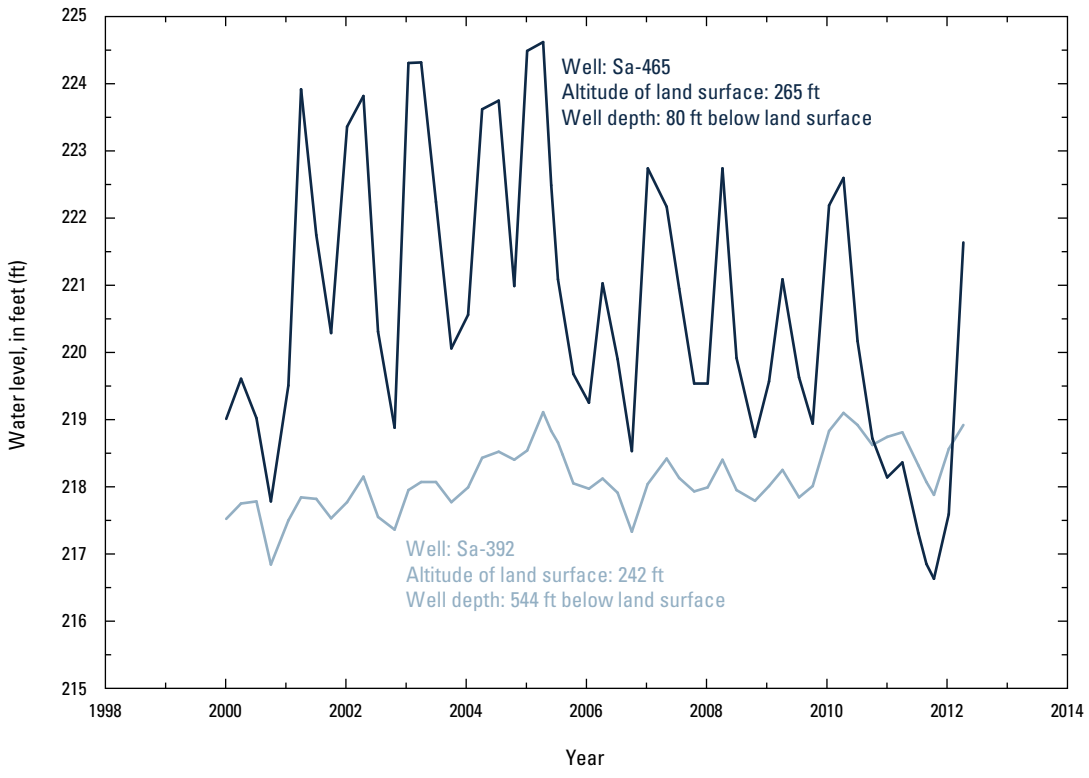

Figure 4. Groundwater levels in well Sa-392 screened in the Cockfield aquifer and well Sa-465 screened in the Carrizo-Wilcox aquifer in Sabine Parish, Louisiana (see fig. 1 for well locations; U.S. Geological Survey, 2011). Altitude of land surface and water level is measured in feet (ft) above the National Geodetic Vertical Datum of 1929.

Table 3. Summary of selected water-quality characteristics of freshwater in the Cockfield, Sparta, and Carrizo-Wilcox aquifers in Sabine Parish, Louisiana (U.S. Geological Survey, 2013a).

[Values are in milligrams per liter, except as noted. °C, degrees Celsius; PCU, platinum cobalt units; µS/cm, microsiemens per centimeter; SU, standard units; $CaCO_3$, calcium carbonate; µg/L, micrograms per liter; SMCL, Secondary Maximum Contaminant Level established by the U.S. Environmental Protection Agency (2012); NA, not applicable; <, less than]

	Temperature (°C)	Color, (PCU)	Specific conductance, field (µS/cm at 25 °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
Cockfield aquifer, 1955–74 (16 wells)									
Median	24.5	25	610	7.2	7	38	1,100	15	368
10th percentile	23.0	6	189	6.6	4	13	70	0	187
90th percentile	26.4	140	1,240	8.2	85	78	3,000	52	799
Number of samples	4	12	12	6	16	16	9	8	12
Percentage of samples that do not exceed SMCLs	NA	42	NA	83	NA	100	44	88	67
Sparta aquifer, 1955–84 (19 wells)									
Median	25.0	20	262	6.6	16	14	410	20	203
10th percentile	20.0	0	59	5.5	6	6.9	160	<10	74
90th percentile	30.2	95	808	8.3	99	34	2,400	40	518
Number of samples	7	14	15	12	19	19	9	8	15
Percentage of samples that do not exceed SMCLs	NA	43	NA	58	NA	100	33	100	87
Carrizo-Wilcox aquifer, 1954–2004 (70 wells)									
Median	21.5	25	905	8.4	10	37	120	20	572
10th percentile	20.3	5	368	6.9	3	15	20	0	241
90th percentile	23.0	110	1,440	8.8	170	94	880	280	920
Number of samples	32	57	57	46	69	69	38	24	55
Percentage of samples that do not exceed SMCLs	NA	37	NA	59	NA	100	74	71	45
SMCLs									
	NA	15	NA	6.5–8.5	NA	250	300	50	500

did not exceed the U.S. Environmental Protection Agency's Secondary Maximum Contaminant Levels (SMCLs).[3]

Sparta Aquifer

About 1 to 2 mi north of the Cockfield aquifer outcrop, the Sparta aquifer outcrops in a southwest-to-northeast trending band that ranges from about 1 to 2 mi wide. The aquifer underlies the clayey Cook Mountain confining unit and overlies the clayey Cane River confining unit (fig. 3). Aquifer thickness ranges from about 200 ft near the outcrop to 440 ft near the southeastern parish boundary. Because of the regional dip (fig. 3), the aquifer reaches depths of about 1,800 ft below NGVD 29 near the southern boundary of the parish and 2,300 ft below NGVD 29 near the southeastern boundary. At distances of more than 3 to 4 mi south of the outcrop area, the Sparta aquifer contains saltwater (Page and others, 1963).

State well-registration records listed 170 active water wells screened in the Sparta aquifer in Sabine Parish in 2010, including 137 domestic, 18 irrigation, 8 public supply, and 7 industrial. Well depths ranged from 22 to 1,605 ft below land surface, with a median depth of 148 ft. Reported yields from wells screened in the Sparta aquifer in Sabine Parish have ranged from 3 to 453 gal/min (Louisiana Department of Natural Resources, 2012). In 2010, withdrawals from the Sparta aquifer in Sabine Parish totaled about 0.13 Mgal/d, including 0.03 Mgal/d for public supply, 0.09 Mgal/d for rural domestic use, and less than 0.01 Mgal/d for general irrigation and industrial use combined.

A statistical summary of selected water-quality characteristics for freshwater samples collected from 19 wells screened in the Sparta aquifer in Sabine Parish is presented in table 3. The median value for hardness fell within the soft range. Median values for pH and concentrations of chloride, manganese, and dissolved solids fell within the SMCLs.

Carrizo-Wilcox Aquifer

The Carrizo-Wilcox aquifer is composed of sands and gravels of the Carrizo aquifer and the Wilcox aquifer. These units are hydraulically connected and considered to be a single aquifer in Sabine Parish. The aquifer outcrops at land surface throughout the northern two-thirds of the parish and overlies the Midway confining unit (fig. 3). In the southern third of the parish, the aquifer dips more steeply southward and is overlain by the Cane River confining unit. Because the Carrizo-Wilcox aquifer is present throughout most of Sabine Parish, it is the principal source of fresh groundwater within the parish (table 1).

[3]The SMCLs are nonenforceable Federal guidelines regarding cosmetic effects (such as tooth or skin discoloration) or aesthetic effects (such as taste, odor, or color) of drinking water. At high concentrations or values, health implications as well as aesthetic degradation might exist. SMCLs were established as guidelines for the States by the U.S. Environmental Protection Agency (1992).

The Carrizo-Wilcox aquifer consists of alternating sand, silt, and clay beds that range in thickness from about 500 ft in the northern part of the parish to 3,500 ft in the southeastern corner of the parish. Within the aquifer, individual sand beds consisting of very fine to medium-grained sand range in thickness from less than 5 ft up to about 250 ft but average about 30 ft. The beds dip southward increasing in depth and are separated by clay layers ranging in thickness from less than 1 ft to greater than 100 ft (Page and others, 1963).

Saltwater is present in the Wilcox aquifer at depths that range from 200 ft above NGVD 29 in some parts of the parish to more than 800 ft below NGVD 29 in other parts of the parish (Page and others, 1963). South of a line extending approximately between the towns of Esto and Fisher, the Wilcox aquifer contains only saltwater (Smoot, 1986).

In 1991, groundwater levels in the Carrizo-Wilcox aquifer in Sabine Parish ranged from about 220 ft above NGVD 29 in north-central Sabine Parish, near the De Soto Parish line, to less than 160 ft above NGVD 29 in southwestern Sabine Parish. In most of the parish, water in the Carrizo-Wilcox aquifer flows in a southerly direction (Seanor and Smoot, 1995). Water levels in the aquifer generally fluctuate in response to precipitation. Groundwater levels in well Sa-465 (fig. 1), screened 80 ft below land surface in the Carrizo-Wilcox aquifer, fluctuated up to about 6 ft annually (fig. 4).

State well-registration records listed 822 active water wells screened in the Carrizo-Wilcox aquifer in Sabine Parish in 2010, including 699 domestic, 75 irrigation, 42 public supply, and 6 industrial. Well depths ranged from 11 to 2,000 ft below land surface, with a median depth of 188 ft. Yields from wells screened in the Carrizo-Wilcox aquifer in Sabine Parish have reportedly ranged from 3 to 360 gal/min (Louisiana Department of Natural Resources, 2012). In 2010, withdrawals from the Carrizo-Wilcox aquifer in Sabine Parish totaled about 1.81 Mgal/d and included about 1.23 Mgal/d for public supply, 0.12 Mgal/d for industrial use, 0.45 Mgal/d for rural domestic use, and 0.01 Mgal/d for livestock.

A statistical summary of selected water-quality characteristics for freshwater samples collected from 70 wells screened in the Carrizo-Wilcox aquifer in Sabine Parish is presented in table 3. The median value for hardness fell within the soft range. Median values for pH and concentrations of chloride, iron, and manganese fell within the SMCLs.

Surface-Water Resources

In 2010, about 1.76 Mgal/d of surface water were withdrawn in Sabine Parish. Public-supply use accounted for about 74 percent (1.30 Mgal/d) of the total water withdrawn. Other withdrawals were for industrial use and livestock (table 2). The Toledo Bend Reservoir on the Sabine River is the primary source of fresh surface water in the parish, providing about 77 percent (1.35 Mgal/d) of all surface-water withdrawals in the parish (table 1). Major streams in the parish include Bayou San Patricio, Bayou San Miguel, Bayou Scie, Bayou La Nana, and Bayou Toro (fig. 1).

Table 4. Summary of selected water-quality characteristics for the Sabine River at Logansport and Bayou San Patricio near Benson, Louisiana (U.S. Geological Survey, 2013a).

[Values are in milligrams per liter, except as noted. µS/cm, microsiemens per centimeter; °C, degrees Celsius; SU, standard units; $CaCO_3$, calcium carbonate; µg/L, micrograms per liter; SMCL, Secondary Maximum Contaminant Level established by the U.S. Environmental Protection Agency (2012); NA, not applicable]

	Specific conductance, field (µS/cm at 25 °C)	Oxygen, dissolved	pH, field (SU)	Hardness (as $CaCO_3$)	Calcium, filtered (as Ca)	Magnesium, filtered (as Mg)	Sodium, filtered (as Na)	Chloride, filtered (as Cl)	Sulfate, filtered (as SO_4)	Iron, filtered (µg/L as Fe)
Sabine River at Logansport, 1971–85[1]										
Median	321.0	8.4	6.9	60.0	16.0	4.4	34.0	53.0	30.0	100
10th percentile	203.6	6.2	6.5	34.0	8.6	3.1	17.6	24.6	18.6	10
90th percentile	498.4	11.1	7.4	75.0	21.4	5.9	66.0	93.6	38.8	290
Number of samples	47.0	44.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	19
Percentage of samples that do not exceed SMCLs	NA	NA	96	NA	NA	NA	NA	100	100	89
Bayou San Patricio near Benson, 1955–88[2]										
Median	152	6.5	6.5	36	8.6	3.2	13	17.5	13.0	505
10th percentile	91.5	3.9	5.9	21	4.4	1.9	7.8	9.5	7.0	232
90th percentile	217	9.8	7.1	47	13	4.4	21	28	24	841
Number of samples	36	35	36	36	36	36	36	36	36	14
Percentage of samples that do not exceed SMCLs	NA	NA	56	NA	NA	NA	NA	100	100	21
SMCLs										
	NA	NA	6.5–8.5	NA	NA	NA	NA	250	250	300

[1]Station number 08022500.

[2]Station number 08023400.

The Toledo Bend Reservoir was constructed primarily for the purposes of water supply, hydroelectric power generation, and recreation. The reservoir was completed in 1969 and normally covers an area of about 185,000 acres at full-pool stage (Louisiana Department of Transportation and Development, 2011). USGS gage records for Toledo Bend Reservoir near Burkeville, Texas (site number 08025350), and Sabine River at Toledo Bend Reservoir near Burkeville, Texas (site number 08025360), indicated that at the conservation stage of 172 ft above NGVD 29, lake storage is 4,472,900 acre-feet (acre-ft), and mean annual runoff during the period from 1972 to 2012 was 4,017,000 acre-ft.[4] The reservoir extends from the dam site up the Sabine River for about 65 mi to just north of Logansport. Prior to the completion of Toledo Bend Reservoir, the average discharge for the Sabine River at Logansport (site number 08022500) was 3,325 cubic feet per second (ft^3/s) for the period 1904–60. In 1961, the drainage area was heavily regulated, and average discharge during the period 1961–67 was 2,252 ft^3/s (U.S. Geological Survey, 2013b).

Water samples analyzed during the period 1971–85 indicated that water in the Sabine River at Logansport generally was soft to moderately hard (table 4) and did not exceed the SMCLs for concentrations of chloride and sulfate. Iron concentrations were below the SMCL for 89 percent of the samples. Dissolved-oxygen concentrations were generally greater than 5 mg/L. This concentration is considered the minimum value for a diversified population of fresh, warmwater biota, including sport fish (Louisiana Department of Environmental Quality, 2008). To the east of Toledo Bend Reservoir, Bayou San Patricio flows into Sabine Parish roughly 4 mi north-northeast of the town of Converse. Water samples analyzed during the period 1955–88 from Bayou San Patricio near Benson (site number 08023400) indicated that water from this stream did not exceed the SMCLs for concentrations of chloride or sulfate but was found to generally exceed the SMCL for iron concentrations (table 4). Dissolved-oxygen concentrations were generally greater than 5 mg/L (U.S. Geological Survey, 2013a).

[4]1 acre-ft is the volume of water covering 1 acre of land to a depth of 1 ft resulting in 43,560 ft^3 or approximately 325,851 gallons.

References Cited

Brantly, J.A., and Seanor, R.C., 1996, Louisiana ground-water map no. 9—Potentiometric surface, 1993, and water-level changes, 1968–93, of the Cockfield aquifer in northern Louisiana: U.S. Geological Survey Water-Resources Investigations Report 95–4241, 2 sheets, accessed January 24, 2012, at http://pubs.er.usgs.gov/publication/wri954241.

Hem, J.D., 1985, Study and interpretation of the chemical characteristics of natural water (3d ed.): U.S. Geological Survey Water-Supply Paper 2254, 264 p., accessed February 20, 2013, at http://pubs.er.usgs.gov/publication/wsp2254.

Louisiana Department of Environmental Quality, 2008, Environmental Regulatory Code, Title 33, Part IX, Subpart 1: Baton Rouge, Louisiana Department of Environmental Quality, accessed June 9, 2009, at http:www.deq.louisiana.gov/portal/tabid/1674/Default.aspx.

Louisiana Department of Natural Resources, 2012, Strategic Online Natural Resources Information System (SONRIS): Louisiana Department of Natural Resources database, accessed June 26, 2012, at http://sonris.com/.

Louisiana Department of Transportation and Development, 2011, DOTD A–Z, Sabine River Authority: accessed November 29, 2011, at http://www8.dotd.la.gov/dotdaz/definition.aspx?termID=45.

Page, L.V., Newcome, Roy, Jr., and Graeff, G.D., Jr., 1963, Water resources of Sabine Parish, Louisiana: Department of Conservation, Louisiana Geological Survey, and Louisiana Department of Public Works Water Resources Bulletin no. 3, 146 p.

Sargent, B.P., 2011, Water use in Louisiana, 2010: Louisiana Department of Transportation and Development Water Resources Special Report no. 17, 133 p.

Seanor, R.C., and Smoot, C.W., 1995, Louisiana ground-water map no. 8—Potentiometric surface, 1991, of the Carrizo-Wilcox aquifer in northwestern Louisiana: U.S. Geological Survey Water-Resources Investigations Report 95–4176, 1 sheet, accessed July 6, 2012, at http://pubs.er.usgs.gov/publication/wri954176.

Smoot, C.W., 1986, Louisiana hydrologic atlas map no. 2—Areal extent of freshwater in major aquifers of Louisiana: U.S. Geological Survey Water-Resources Investigations Report 86-4150, 1 sheet, accessed January 18, 2012, at http://pubs.er.usgs.gov/publication/wri864150.

Smoot, C.W., 1988, Louisiana hydrologic atlas map no. 3—Altitude of the base of freshwater in Louisiana: U.S. Geological Survey Water-Resources Investigations Report 86–4314, 1 sheet, accessed November 2, 2011, at http://pubs.er.usgs.gov/publication/wri864314.

U.S. Environmental Protection Agency, 1992, Secondary Drinking Water Regulations—Guidance for nuisance chemicals: U.S. Environmental Protection Agency publication EPA 810/K-92-001, 4 p., accessed September 28, 2011, at http://water.epa.gov/drink/contaminants/secondarystandards.cfm.

U.S. Environmental Protection Agency, 2012, 2012 Edition of the drinking water standards and health advisories: U.S. Environmental Protection Agency publication EPA 822-S-12-001, Office of Water, 12 p., accessed August 7, 2012, at http://water.epa.gov/action/advisories/drinking/upload/dwstandards2012.pdf.

U.S. Geological Survey, 2011, Groundwater levels for Louisiana: National Water Information System Web Interface, accessed November 2, 2011, at http://nwis.waterdata.usgs.gov/la/nwis/gwlevels.

U.S. Geological Survey, 2013a, Water quality samples for Louisiana: National Water Information System Web Interface, accessed September 24, 2013, at http://nwis.waterdata.usgs.gov/la/nwis/qwdata.

U.S. Geological Survey, 2013b, Annual water-data report: USGS Water Resources of the United States, Publications, Annual Water Data Reports, accessed September 24, 2013, at http://wdr.water.usgs.gov.

This fact sheet was published by the U.S. Geological Survey, in cooperation with the Louisiana Department of Transportation and Development (DOTD). Thanks are given to Zahir "Bo" Bolourchi, Director, Water Resources Programs, Louisiana DOTD, who contributed to the content of the fact sheet.

By Lawrence B. Prakken, Vincent E. White, and John K. Lovelace

For additional information, contact:

Director, USGS Louisiana Water Science Center
3535 S. Sherwood Forest Blvd., Suite 120
Baton Rouge, LA 70816
E-mail: dc_la@usgs.gov
Fax: (225) 298–5490
Telephone: (225) 298–5481
Home Page: http://la.water.usgs.gov

ISSN 2327–6916 (print)
ISSN 2327–6932 (online)
http://dx.doi.org/10.3133/fs20143040