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LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

Prepared in cooperation with the Louisiana Department of Transportation and Development

Water Resources of Tensas Parish, Louisiana

Introduction

Information concerning the availability, use, and quality of water in Tensas 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. In 2014, 38.01 million gallons per day (Mgal/d) of water were withdrawn in Tensas Parish, including about 33.02 Mgal/d from groundwater sources and about 4.99 Mgal/d from surface-water sources[1] (table 1). Withdrawals for agricultural use, composed of general irrigation, rice irrigation, aquaculture, and livestock, accounted for about 97 percent (36.88 Mgal/d) of the total water withdrawn (table 2). Other use categories included public supply and rural domestic. Water-use data collected at 5-year intervals from 1960 to 2010 and again in 2014 indicated that water withdrawals peaked in 2014 (fig. 2). The large increase in 1985 relative to 1980 and 1990 for groundwater usage is likely an outlier that is attributable to a change in methodology for estimating rice irrigation. A transition in available farm-by-farm data from 1980 to 1985 to 1990 resulted in three different methods being used for estimating groundwater withdrawals for rice irrigation (U.S. Geological Survey [USGS], 2016b).

[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.

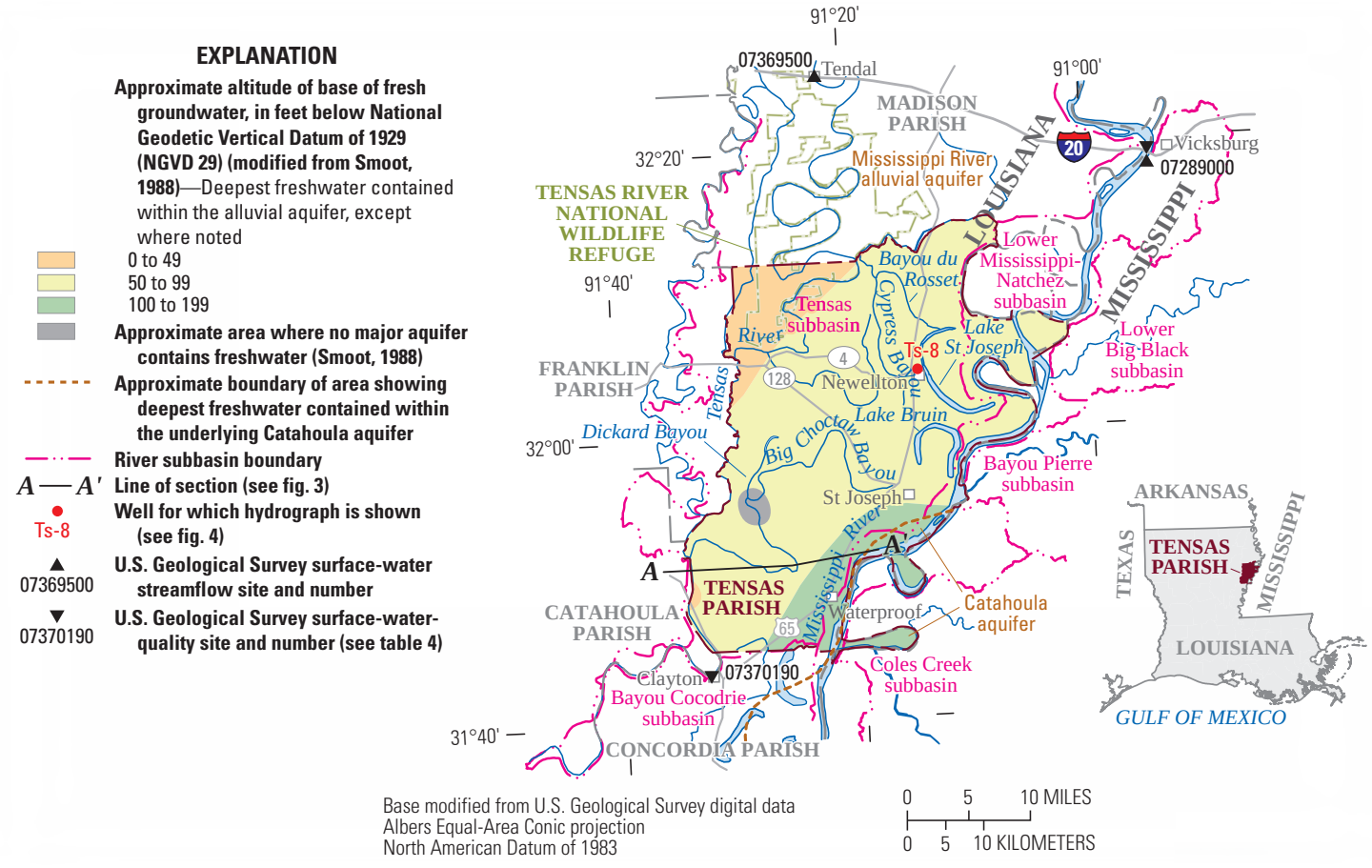

Figure 1. Location of study area, Tensas Parish, Louisiana.

Table 1. Water withdrawals, in million gallons per day, by source in Tensas Parish, Louisiana, 2014 (Collier, 2018).

Aquifer or surface-water body	Groundwater	Surface water
Mississippi River alluvial aquifer	33.02	
Lake Bruin		1.74
Tensas River		1.47
Miscellaneous surface waters		1.78
Total	**33.02**	**4.99**

Table 2. Water withdrawals, in million gallons per day, by use category in Tensas Parish, Louisiana, 2014 (Collier, 2018).

Use category	Groundwater	Surface water	Total
Public supply	0.66	0.45	1.11
Rural domestic	0.02	0.00	0.02
Livestock	0.00	0.01	0.01
Rice irrigation	4.77	1.47	6.25
General irrigation	27.55	3.06	30.61
Aquaculture	0.02	0.00	0.02
Total	**33.02**	**4.99**	**38.01**

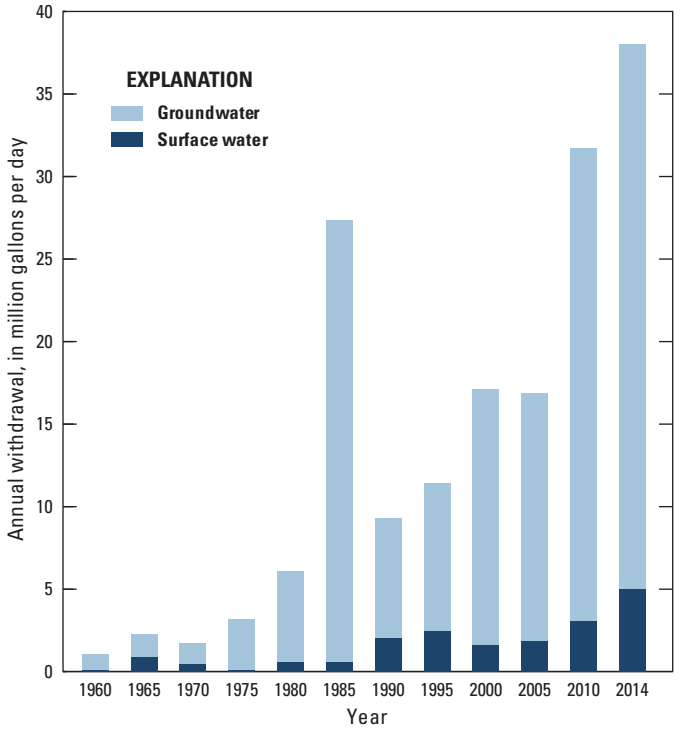

Figure 2. Water withdrawals in Tensas Parish, Louisiana, 1960–2014 (U.S. Geological Survey, 2016b; Collier, 2018).

Groundwater Resources

The primary freshwater-bearing aquifer in Tensas Parish is the Mississippi River alluvial aquifer (also called the Mississippi River Valley alluvial aquifer in some publications). The Catahoula aquifer also contains freshwater in limited areas in the southeastern corner of the parish (fig. 1), but no withdrawals from this aquifer are reported for 2014. The altitude of the base of fresh groundwater (water with a chloride concentration of 250 milligrams per liter [mg/L] or less) is generally present within the Mississippi River alluvial aquifer, where it ranges from less than 50 feet (ft) below the National Geodetic Vertical Datum of 1929 (NGVD 29) in the northwestern corner of the parish to greater than 100 ft below NGVD 29 in the southeastern corner of the parish. In limited areas of the southeastern corner, the base of freshwater is in the Catahoula aquifer at altitudes of less than 200 ft below NGVD 29 (figs. 1 and 3) (Smoot, 1988). Generally, no fresh groundwater is available in a small area of west-central Tensas Parish (fig. 1) (Smoot, 1988).

Mississippi River Alluvial Aquifer

The Mississippi River alluvial aquifer, which extends across all of Tensas Parish, is a large regional aquifer present in various States (Saucier, 1994). The Mississippi River alluvial aquifer is composed of the sand and gravel component of sediments deposited primarily by the Mississippi River. These deposits generally grade from silt and clay at land surface to coarse sand and gravel at the base. The thickness of the Mississippi River alluvial deposit ranges from less than 120 ft in the northwestern part of the parish to greater than 180 ft near the northeastern and southeastern borders of the parish. The altitude of the base of the aquifer ranges from less than 40 ft below NGVD 29 in the northwestern part of the parish to greater than 100 ft below NGVD 29 in the southeastern corner (Whitfield, 1975). The Mississippi River alluvial aquifer lies unconformably over and is in direct hydraulic connection with saltwater-bearing[2] sands of the Catahoula aquifer in the approximate southern two-thirds of the parish (Whitfield, 1975).

The primary source of recharge to the alluvial aquifer is the infiltration of precipitation, with secondary sources of recharge from streams and rivers during high stage. Groundwater discharge is by evapotranspiration, natural flow into streams and rivers, and well withdrawals (Whitfield, 1975). Historically, groundwater in the alluvial aquifer generally flowed towards the west and southwest in Tensas Parish, and also southward and eastward in areas closer to the Mississippi River.

In 1990, altitudes of water levels in wells screened in the Mississippi River alluvial aquifer ranged from greater than 50 ft above NGVD 29 in the southwestern part of the parish to greater than 60 ft above NGVD 29 in the northeastern part of the parish (Seanor and Smoot, 1995). Water levels at well Ts-8 (site number 320431091144801), located near Newellton (fig. 1) and screened in the Mississippi River alluvial aquifer, generally fluctuated from about 4 to 6 ft seasonally and showed little, if any, long-term trend of increase or decrease during 1955–2010 (fig. 4) although groundwater withdrawals increased during this time period (fig. 2).

State well-registration records listed 318 active water wells screened in the Mississippi River alluvial aquifer in Tensas Parish in 2016: 254 irrigation wells, 52 domestic wells, 11 public-supply wells, and 1 industrial well. Depths of these wells ranged from 32 to 160 ft below land surface, and reported yields ranged from 10 to 4,500 gallons per minute (Louisiana Department of Natural Resources, 2016). In 2014, withdrawals from the Mississippi

[2]For the purposes of this report, saltwater is defined as water with a chloride concentration that exceeds 250 milligrams per liter.

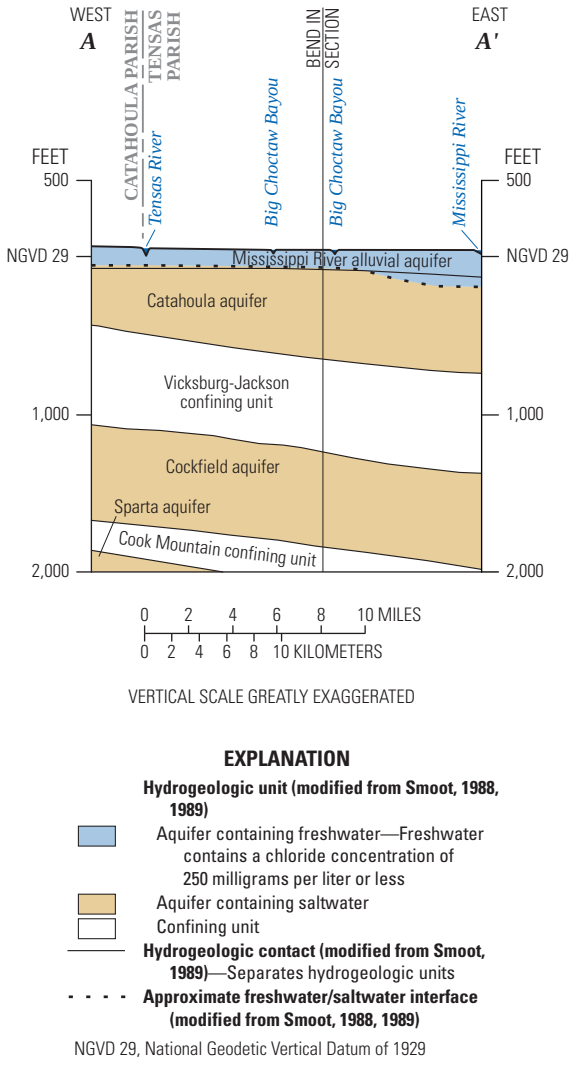

Figure 3. Idealized west-to-east hydrogeologic section through Tensas Parish, Louisiana, showing aquifer and confining unit intervals (individual sand and clay layers not shown). Modified from Smoot (1988, 1989). Trace of section shown on figure 1.

River alluvial aquifer totaled about 33.02 Mgal/d: 0.02 Mgal/d for aquaculture, 0.02 Mgal/d for rural domestic, 27.55 Mgal/d for general irrigation, less than 0.01 Mgal/d for livestock, 4.77 Mgal/d for rice irrigation, and 0.66 for public supply (Collier, 2018).

Groundwater Quality

Groundwater samples were collected during 1945–2011 from 53 wells screened in the Mississippi River alluvial aquifer as part of an ongoing program to monitor the State's groundwater resources. These samples were within the U.S. Environmental Protection Agency's Secondary Maximum Contaminant Levels[3] (SMCLs) for pH and sulfate concentration (table 3). The median hardness value of 415 mg/L was within the very hard[4] range. Iron and manganese concentrations exceeded the SMCLs (300 micrograms per liter [µg/L] and 50 µg/L, respectively) for more than 95 percent of samples. The median value for color was at the limit of 15 platinum cobalt units, whereas the median value for dissolved solids, 542 mg/L, exceeded the SMCL (500 mg/L).

[3]The SMCLs are 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 potential constituents of drinking water. SMCLs were established as guidelines by the U.S. Environmental Protection Agency (2016).

Surface-Water Resources

Numerous surface-water resources in Tensas Parish are primarily present in two drainage subbasins with other subbasins present to small degrees in or near the peripheries of the parish (fig. 1); surface water flows in a general southerly direction through the parish. The Lower Mississippi-Natchez subbasin (Hydrologic Unit Code [HUC] 08060100) drains the narrow strip of land adjacent to the Mississippi River, and the Tensas subbasin (HUC 08050003) drains the majority of the land area of the parish (USGS, 2016a). In 2014, 4.99 Mgal/d of surface water were withdrawn in the parish from Lake Bruin (1.74 Mgal/d), from Tensas River (1.47 Mgal/d), and from other miscellaneous surface waters (1.78 Mgal/d) (table 1). Surface water was used for public supply (0.45 Mgal/d), livestock (less than 0.01 Mgal/d), rice irrigation (1.47 Mgal/d), and general irrigation (3.06 Mgal/d) (table 2) (Collier, 2018).

Lower Mississippi-Natchez Subbasin

The Mississippi River forms much of the eastern boundary of Tensas Parish. The river is sustained by drainage from more than 40 percent of the conterminous United States but drains little land area in Tensas Parish because of levees built along the river for flood protection. The annual average flow of the Mississippi River at Vicksburg, Mississippi (site number 07289000; fig. 1), was about 689,700 cubic feet per second (ft^3/s) for the period 2007–14 from a drainage area of 1,144,500 square miles (mi^2) (USGS, 2016a). The highest and lowest monthly averages were during May (1,199,000 ft^3/s) and September (393,500 ft^3/s), respectively. In 2011, a high of 2,310,000 ft^3/s was recorded at this site, and in 2012, a low of 191,000 ft^3/s was recorded.

Tensas Subbasin

The Tensas River flows into Tensas Parish from Madison Parish and follows much of the western parish border (fig. 1). Numerous tributaries flow directly or indirectly into the Tensas River in Tensas Parish, including Big Choctaw Bayou, Dickard Bayou, Cypress Bayou, and Bayou du Rosset. The annual average streamflow of the Tensas River at Tendal, Louisiana (site number 07369500), upstream of Tensas Parish in Madison Parish, was about 358 ft^3/s during 1935–2015 (USGS, 2016a). During this period, the highest monthly average flow occurred during February (666 ft^3/s), and the lowest occurred during August (83.9 ft^3/s). This streamflow serves as an important source of water and habitat for the Tensas River National Wildlife Refuge, which is present in northwestern Tensas Parish (fig. 1) and surrounding parishes. The refuge covers nearly 80,000 acres and contains a wide diversity of habitats that serve as home to more than 400 different species of amphibians, birds, fish, mammals, and reptiles (U.S. Fish and Wildlife Service, 2016).

[4]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).

Table 3. Summary of selected water-quality characteristics for samples from 53 wells screened in the Mississippi River alluvial aquifer in Tensas Parish, Louisiana, 1945–2011 (U.S. Geological Survey, 2016a).

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

	Temperature (°C)	Color (platinum cobalt units)	Specific conductance, field (µS/cm at 25 °C)	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, in µg/L (as Fe)	Manganese, filtered, in µg/L (as Mn)	Dissolved solids, filtered
Median	19.7	15	800	7	415	100	33.5	21	16.5	1.6	10,300	758	542
10th percentile	18.5	5	540	6.7	270	67	22.6	8.1	3.9	0	2,450	449	360
90th percentile	20.1	45	1,110	7.6	580	130	52.1	130	297	17.3	20,100	1,900	769
Number of samples	29	21	29	29	56	33	34	25	64	24	26	19	23
Percentage of samples that do not exceed SMCLs	NA	62	NA	100	NA	NA	NA	NA	86	100	4	0	39
SMCLs	NA	15	NA	6.5–8.5	NA	NA	NA	NA	250	250	300	50	500

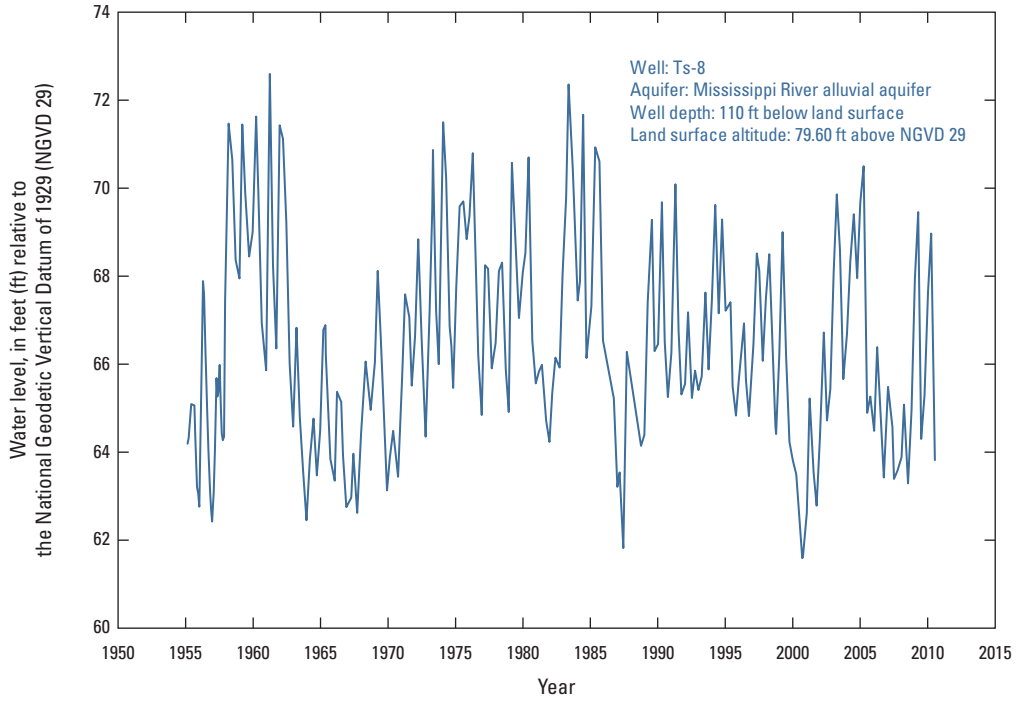

Figure 4. Water levels in well Ts-8 screened in the Mississippi River alluvial aquifer in Tensas Parish, Louisiana (see figure 1 for well location; U.S. Geological Survey, 2016a).

Lakes

Lake Bruin and Lake St. Joseph are located in the east-central part of Tensas Parish. These oxbow lakes are remnants of historic channels of the Mississippi River and were affected by flooding from the Mississippi River prior to the construction of levees along the river. An irrigation ditch hydraulically connects the lakes when water levels in the lakes are high enough. Both lakes have spillways that allow for artificial manipulation of water levels (Louisiana Department of Wildlife and Fisheries, 2016). Lake Bruin covers about 2,842 acres, and more than 50 percent of the lake is deeper than 22 ft. The lake has extensive shoreline development and serves as a source of public water supply, fishing, and recreation. Lake St. Joseph is about 1,200 acres and has sparse shoreline development. The lake has an average depth of 2.5 ft, with a maximum depth of 6 ft. Sedimentation in the lake has created the shallow lake depth and promotes high daytime water temperatures, high turbidity, limited dissolved oxygen, and the potential for fish kills (Louisiana Department of Wildlife and Fisheries, 2016).

Surface-Water Quality

Water samples were collected from the Mississippi River at Vicksburg (site number 07289000) during 1961–99 and from the Tensas River at Clayton (site number 07370190) during 1968–91 as part of an ongoing program to monitor the State's surface-water resources (fig. 1). These samples were generally within SMCLs for pH and chloride, sulfate, iron, and dissolved-solids concentrations (table 4). Manganese concentrations were generally within the SMCL for the Mississippi River and in more than 60 percent of samples from the Tensas River; however, only nine samples from the Tensas River were analyzed for manganese. Median hardness values were within the moderately hard range for the Tensas River and within the hard range for the Mississippi River. Median values for dissolved-oxygen concentrations for both rivers were greater than 7 mg/L. A dissolved-oxygen concentration of 5 mg/L is considered the minimum value for a diverse population of fresh, warmwater biota, including sport fish (Louisiana Department of Environmental Quality, 2008).

Table 4. Summary of selected water-quality characteristics for samples from the Tensas River at Clayton, Louisiana, and the Mississippi River at Vicksburg, Mississippi (U.S. Geological Survey, 2016a).

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

	Temperature (°C)	Color (platinum cobalt units)	Specific conductance, field (µS/cm at 25 °C)	Dissolved oxygen	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, in µg/L (as Fe)	Manganese, filtered, in µg/L (as Mn)	Dissolved solids, filtered
Tensas River at Clayton, La. (1968–91)[1]														
Median	20	30	292	7.9	7.3	110	27.5	8.6	14.5	18	11	25	30	168
10th percentile	8	10	123	5.6	6.5	42	12	2.9	3.9	3.9	5.7	<10	<10	87
90th percentile	31	120	525	10.8	8.2	210	53.6	17.9	33	45.3	16	51	80	313
Number of samples	55	57	58	35	58	58	58	58	58	58	58	10	9	58
Percentage of samples that do not exceed SMCLs	NA	32	NA	NA	90	NA	NA	NA	NA	100	100	100	67	100
Mississippi River at Vicksburg, Ms. (1961–99)[2]														
Median	16.5	15	370	8.2	7.7	147	39	12	18	18	48	20	<10	228
10th percentile	5	7	280	6.5	7.3	120	32	9	11	13	35	<6.3	<2	170
90th percentile	28.5	20	440	11.5	8	170	45	15	25	26	64	90	20	271
Number of samples	156	5	160	146	158	155	155	155	155	156	155	89	72	154
Percentage of samples that do not exceed SMCLs	NA	60	NA	NA	97	NA	NA	NA	NA	100	100	98	93	100
SMCLs	NA	15	NA	NA	6.5–8.5	NA	NA	NA	NA	250	250	300	50	500

[1]U.S. Geological Survey site number 07370190 (see fig. 1).

[2]U.S. Geological Survey site number 07289000 (see fig. 1).

Natural processes and agricultural, municipal, and industrial activities in the Mississippi River watershed upstream of Tensas Parish affect the quality of Mississippi River water available to the parish. Water-quality constituent concentrations, such as agricultural pesticides and nutrients, are generally highest in late spring-early summer, a period commonly referred to as the "spring flush," which results from the runoff of upstream applications of these pesticides and nutrients (Demcheck and others, 2004). Suspended-sediment concentrations are generally highest in late winter and early spring and lowest in late summer and fall (Wells, 1980).

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This fact sheet has been prepared by the U.S. Geological Survey (USGS), in cooperation with the Louisiana Department of Transportation and Development (DOTD), as part of a program to document water use, availability, and quality in the parishes of Louisiana. Information on the availability, past and current water use, use trends, and water quality from groundwater and surface-water sources in the parish is presented here. Previously published reports (see References Cited section) and data stored in the USGS National Water Information System (USGS, 2016a) are the primary sources of the information presented here. Special thanks are given to Doug Taylor, Director, and Zahir "Bo" Bolourchi (retired), DOTD Cooperative Program with the USGS.

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