Water Resources of Richland Parish, Louisiana

Introduction

Information concerning the availability, use, and quality of water in Richland 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 In 2014, about 41.73 million gallons per day (Mgal/d) of water were withdrawn in Richland Parish, including about 28.57 Mgal/d from groundwater sources and 13.17 Mgal/d from surface-water sources (table 1). Withdrawals for agricultural use, composed of general irrigation, rice irrigation, aquaculture, and livestock uses, accounted for about 88 percent (36.88 Mgal/d) of the total water withdrawn (table 2). Other categories of use included public supply, which accounted for about 10 percent (4.38 Mgal/d) of the total water withdrawn and rural domestic which accounted for about 1 percent (0.48 Mgal/d). Water-use data collected at 5-year intervals from 1960 to 2010 and again in 2014 indicate that water withdrawals peaked in 1980 at more than 60 Mgal/d (fig. 2).

1Water 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.

Groundwater Resources

The primary freshwater-bearing aquifer in Richland Parish is the Mississippi River alluvial aquifer. The Cockfield aquifer underlies, and is in direct hydraulic connection with, the Mississippi River alluvial aquifer and contains freshwater beneath much of the parish (figs. 1 and 3) but is not pumped as heavily as the alluvial aquifer (table 1). The Sparta aquifer underlies the Cockfield aquifer and contains freshwater in limited areas of western Richland Parish (figs. 1 and 3). The altitude of the base of fresh groundwater (water having a chloride concentration of 250 milligrams per liter [mg/L] or less) ranges from less than 50 feet (ft) above the National Geodetic Vertical Datum of 1929 (NGVD 29) along the eastern border of the parish in the Mississippi River alluvial aquifer to more than 600 ft below NGVD 29 in the west-central part of the parish in the Sparta aquifer (Smoot, 1988).

Figure 1. Location of study area, Richland Parish, Louisiana.
The Mississippi River alluvial aquifer, which extends across all of Richland Parish, is a large regional aquifer that is present in various States. (In many publications, the aquifer is called the Mississippi River Valley alluvial aquifer.) The Mississippi River alluvial aquifer is composed of the sand and gravel portion of sediments deposited primarily by the Mississippi River. These deposits generally grade from silt and clay at the surface to coarse sand and gravel at the base. The thickness of the Mississippi River alluvial aquifer ranges from less than 80 ft along the western border of the parish to greater than 160 ft northwest of Mangham. The altitude of the base of the aquifer ranges from near NGVD 29 east of Delhi, along the northeastern parish border, to more than 80 ft below NGVD 29 northwest of Mangham. In most of the parish, the altitude of the base is from 20 to 60 ft below NGVD 29 (Whitfield, 1975).

The primary source of recharge for the alluvial aquifer is the infiltration of precipitation, with secondary sources of recharge from streams and rivers during high stage. Groundwater in the alluvial aquifer generally moves southward in the alluvial aquifer but also moves westward towards the Boeuf River and Bayou Lafourche in western parts of the parish and eastward towards Bayou Macon and Big Creek in eastern parts of the parish. Groundwater discharge is by evapotranspiration, natural leakage into rivers and streams, and well withdrawals (Whitfield, 1975).

In 1990, water levels in wells screened in the Mississippi River alluvial aquifer ranged from greater than 70 ft above NGVD 29 in the northern part of the parish to less than 40 ft above NGVD 29 in the southwestern part of the parish (Seanor and Smoot, 1995). Water levels at well Ri-89, screened in the Cockfield aquifer in Richland Parish, generally fluctuated from about 1 to 2 ft annually during 1969–2016 (fig. 4), and little if any, long-term increasing or decreasing trend.

State well-registration records listed 1,396 active water wells screened in the Mississippi River alluvial aquifer in Richland Parish in 2016: 1,012 irrigation wells, 323 domestic wells, 42 public-supply wells, and 19 industrial wells. Depths of these wells ranged from 23 to 145 ft below land surface, and reported yields ranged from 5 to 3,500 gallons per minute (gal/min) (Louisiana Department of Natural Resources, 2016). In 2014, about 26.42 Mgal/d were withdrawn from the Mississippi River alluvial aquifer at wells Ri-92 and Ri-114 (figs. 1 and 4) generally fluctuated from 1 to 2 ft annually from the early 1970s to 2016, but show little, if any, long-term increasing or decreasing trend.

Mississippi River Alluvial Aquifer

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any long-term increasing or decreasing trend was observed (U.S. Geological Survey, 2016). These annual fluctuations are similar to those in the overlying Mississippi River alluvial aquifer because of the direct hydraulic connection between the aquifers.

State well-registration records listed 20 active water wells screened in the Cockfield aquifer in Richland Parish in 2016: 5 domestic wells, 13 public-supply wells, and 2 industrial wells. Well depths ranged from 189 to 490 ft below land surface, and reported yields ranged from 25 to 1,001 gal/min (Louisiana Department of Natural Resources, 2016). In 2014, about 2.15 Mgal/d were withdrawn from the Cockfield aquifer: about 0.99 Mgal/d for public supply and less than 0.01 Mgal/d for rural domestic (Collier, 2018).

Sparta Aquifer

The Sparta aquifer is a large and heavily developed regional aquifer that extends from Louisiana into Arkansas. Although it underlies much of Richland Parish, the aquifer contains freshwater only in a limited area in the western part of the parish (figs. 1 and 3). The base of the aquifer ranges from more than 900 ft below NGVD 29 in the northeastern part of the freshwater area to less than 800 ft below NGVD 29 in the southwestern part. The top of the aquifer ranges from about 300 ft below NGVD 29 in the northeastern part of the freshwater area to less than 150 ft below NGVD 29 in the southwestern part. The Sparta aquifer is confined by massive clay layers above (Cook Mountain confining unit) and below (Cane River confining unit). In general, the aquifer consists of very fine to medium sand in its lower half and silty clay, lignite, and clay in its upper half. Sand beds within the aquifer can vary from being 100 percent sand to up to 50 percent clay (Brantly and others, 2002).

In 2012, altitudes of water levels in wells screened in the Sparta aquifer in Richland Parish were between about zero and 20 ft below NGVD 29, and the direction of groundwater flow was generally to the west-northwest toward pumping centers in neighboring Ouachita Parish (McGee and Brantly, 2015). Water levels at well Ou-404 (fig. 4), located about 1 mile west of Richland Parish in Ouachita Parish, declined more than 25 ft from 1965 to 2006, but rebounded about 10 ft during 2006–16. The rebound was probably caused by decreased withdrawals in Ouachita Parish. Between 2005 and 2014, withdrawals from the Sparta aquifer in Ouachita Parish declined from 22.32 to 18.47 Mgal/d. No withdrawals from the Sparta aquifer in Richland Parish were reported for 2014 (Collier, 2018), and State well-registration records listed only one active well, which was for domestic use and screened at a depth of 400 ft (Louisiana Department of Natural Resources, 2016).

Groundwater Quality

Samples of fresh groundwater were collected during 1941–2015 from 82 wells screened in the Mississippi River alluvial aquifer and during 1945–88 from 29 wells screened in the Cockfield aquifer as part of an ongoing program to monitor the State’s groundwater resources. These samples were generally within the U.S. Environmental Protection Agency’s Secondary Maximum Contaminant Levels (SMCLs) for pH, color, and sulfate concentration (table 3). The median hardness values of 380 mg/L for the Mississippi River alluvial aquifer and 100 mg/L for the Cockfield aquifer were within the very hard range and the moderately hard range, respectively. Manganese concentrations in both aquifers exceeded the SMCL of 50 micrograms per liter (µg/L) for more than 60 percent of samples. Iron concentrations exceeded the SMCL of 300 µg/L in more than 50 percent of samples from the Cockfield aquifer and more than 30 percent of samples from the Mississippi River alluvial aquifer; however, iron concentrations in the Mississippi River alluvial aquifer locally exceeded seven times the SMCL.

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1. 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).

3. 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 4. Water levels in wells Ri-92 and Ri-114 screened in the Mississippi River alluvial aquifer, well Ri-89 screened in the Cockfield aquifer, and well Ou-404 screened in the Sparta aquifer, located in or near Richland Parish, Louisiana (see figure 1 for well location; U.S. Geological Survey, 2016).
Surface-Water Resources

Numerous surface-water resources in Richland Parish are present in two drainage subbasins and flow in a general southerly direction. The Boeuf subbasin (Hydrologic Unit Code [HUC] 08050001) drains the majority of the parish, and the Bayou Macon subbasin (HUC 08050002) drains the land adjacent to the northeastern border of the parish (fig. 1) (U.S. Geological Survey, 2016). In 2014, 3.30 Mgal/d were withdrawn from miscellaneous streams for general irrigation (3.29 Mgal/d) and livestock (0.01 Mgal/d) (table 1) (Collier, 2018).

Boeuf Subbasin

The Boeuf subbasin covers the majority of Richland Parish. Major streams in the subbasin in the parish include Bayou Lafourche, the Boeuf River, Little Creek, and Big Creek. These streams drain in a general southerly direction and partially align with the western and eastern borders of the parish (fig. 1). The annual average discharge during 1938–2015 was 268 cubic feet per second (ft³/s) at the Boeuf River near Girard (site number 07368000; fig. 1). During this same period, the highest monthly average discharge was 504 ft³/s in February, and the lowest was 85 ft³/s during August (U.S. Geological Survey, 2016). During 1938–2016, the average annual discharge for Bayou Lafourche near Crew Lake (site number 07369000), located on the border with Ouachita Parish, was 1,922 ft³/s (U.S. Geological Survey, 2016). In 2014, 6.84 Mgal/d were withdrawn from the Boeuf River and 3.03 Mgal/d were withdrawn from Big Creek for general irrigation use (table 1) (Collier, 2018).

Bayou Macon Subbasin

The primary drainage of the Bayou Macon subbasin in Richland Parish is Bayou Macon, which drains a relatively narrow strip of land adjacent to the parish border near Delhi (fig. 1). The average discharge during 1934 to 1992 was 975 ft³/s at Bayou Macon near Delhi (site number 07370000; fig. 1) (U.S. Geological Survey, 2016).


<table>
<thead>
<tr>
<th></th>
<th>Temperature (°C)</th>
<th>Color (platinum cobalt units)</th>
<th>Specific conductance, field (µS/cm at 25 °C)</th>
<th>Oxygen, dissolved</th>
<th>pH, field (SU)</th>
<th>Hardness (as CaCO₃)</th>
<th>Chloride, filtered (as Cl)</th>
<th>Sulfate, filtered (as SO₄)</th>
<th>Iron, filtered, in µg/L (as Fe)</th>
<th>Dissolved solids, filtered</th>
</tr>
</thead>
<tbody>
<tr>
<td>**Bayou Lafourche near Crew Lake (1964–96)**¹</td>
<td>19</td>
<td>30</td>
<td>325</td>
<td>6.7</td>
<td>7.3</td>
<td>90.5</td>
<td>29.5</td>
<td>16.5</td>
<td>90</td>
<td>198</td>
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<tr>
<td>Median</td>
<td>10th percentile</td>
<td>9</td>
<td>10</td>
<td>153</td>
<td>6.0</td>
<td>6.7</td>
<td>45.6</td>
<td>8.6</td>
<td>8.1</td>
<td>55</td>
</tr>
<tr>
<td>90th percentile</td>
<td>29</td>
<td>96</td>
<td>640</td>
<td>10.3</td>
<td>7.8</td>
<td>227</td>
<td>76</td>
<td>33</td>
<td>125</td>
<td>384</td>
</tr>
<tr>
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<td>53</td>
<td>58</td>
<td>8</td>
<td>58</td>
<td>54</td>
<td>54</td>
<td>54</td>
<td>4</td>
<td>53</td>
</tr>
<tr>
<td>Percentage of samples</td>
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<td>36</td>
<td>NA</td>
<td>NA</td>
<td>95</td>
<td>NA</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>that do not exceed SMCLs</td>
<td>NA</td>
<td>36</td>
<td>NA</td>
<td>NA</td>
<td>95</td>
<td>NA</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

| **Bayou Macon near Delhi (1952–98)**² | 21.6 | 20 | 298 | 8.2 | 7.3 | 120 | 15 | 16 | NA | 174 |
| Median                      | 10th percentile | 9 | 10 | 105 | 5.2 | 6.8 | 42 | 3.5 | 4.1 | NA | 81.1 |
| 90th percentile             | 29 | 60 | 556 | 10.1 | 7.8 | 225 | 36 | 26.5 | NA | 336 |
| Number of samples           | 56 | 51 | 75 | 33 | 73 | 66 | 66 | 66 | 5 | 48 |
| Percentage of samples       | NA | 45 | NA | NA | 97 | NA | 100 | 100 | 100 | 100 |
| that do not exceed SMCLs    | NA | 45 | NA | NA | 97 | NA | 100 | 100 | 100 | 100 |

| **Boeuf River near Girard (1943–96)**³ | 20 | 20 | 249 | 6.7 | 7.2 | 97 | 19.5 | 17 | 80 | 216 |
| Median                      | 10th percentile | 9.6 | 5 | 98 | 4.0 | 6.5 | 35.6 | 3.6 | 5.2 | 68 | 86.7 |
| 90th percentile             | 27.7 | 90 | 594 | 9.4 | 7.9 | 244 | 98.6 | 61.3 | 248 | 510 |
| Number of samples           | 47 | 78 | 49 | 24 | 84 | 47 | 82 | 80 | 5 | 58 |
| Percentage of samples       | NA | 46 | NA | NA | 94 | NA | 100 | 100 | 80 | 88 |
| that do not exceed SMCLs    | NA | 46 | NA | NA | 94 | NA | 100 | 100 | 80 | 88 |

| SMCL | NA | 15 | NA | 6.5–8.5 | NA | 250 | 250 | 300 | 500 |

¹U.S. Geological Survey site number 07369000 (see fig. 1).
²U.S. Geological Survey site number 07370000 (see fig. 1).
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Surface-Water Quality

Water samples were collected from Bayou Lafourche near Crew Lake (site number 07369000) during 1964–96, Bayou Macon near Delhi (site number 07370000) during 1952–98, and Boeuf River near Girard (site number 07368000) during 1943–96 (fig. 1) as part of an ongoing program to monitor the State’s surface-water resources. These samples were generally within SMCLs for pH and concentrations of chloride and sulfate (table 4). Median hardness values were within the moderately hard range. Median values for dissolved-oxygen concentration were greater than 6.5 mg/L; 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). Median values for color were greater than the SMCL (15 platinum cobalt units) for all three sites.

References Cited


