

Prepared in cooperation with the Louisiana Department of Transportation and Development

Water Resources of Caldwell Parish, Louisiana

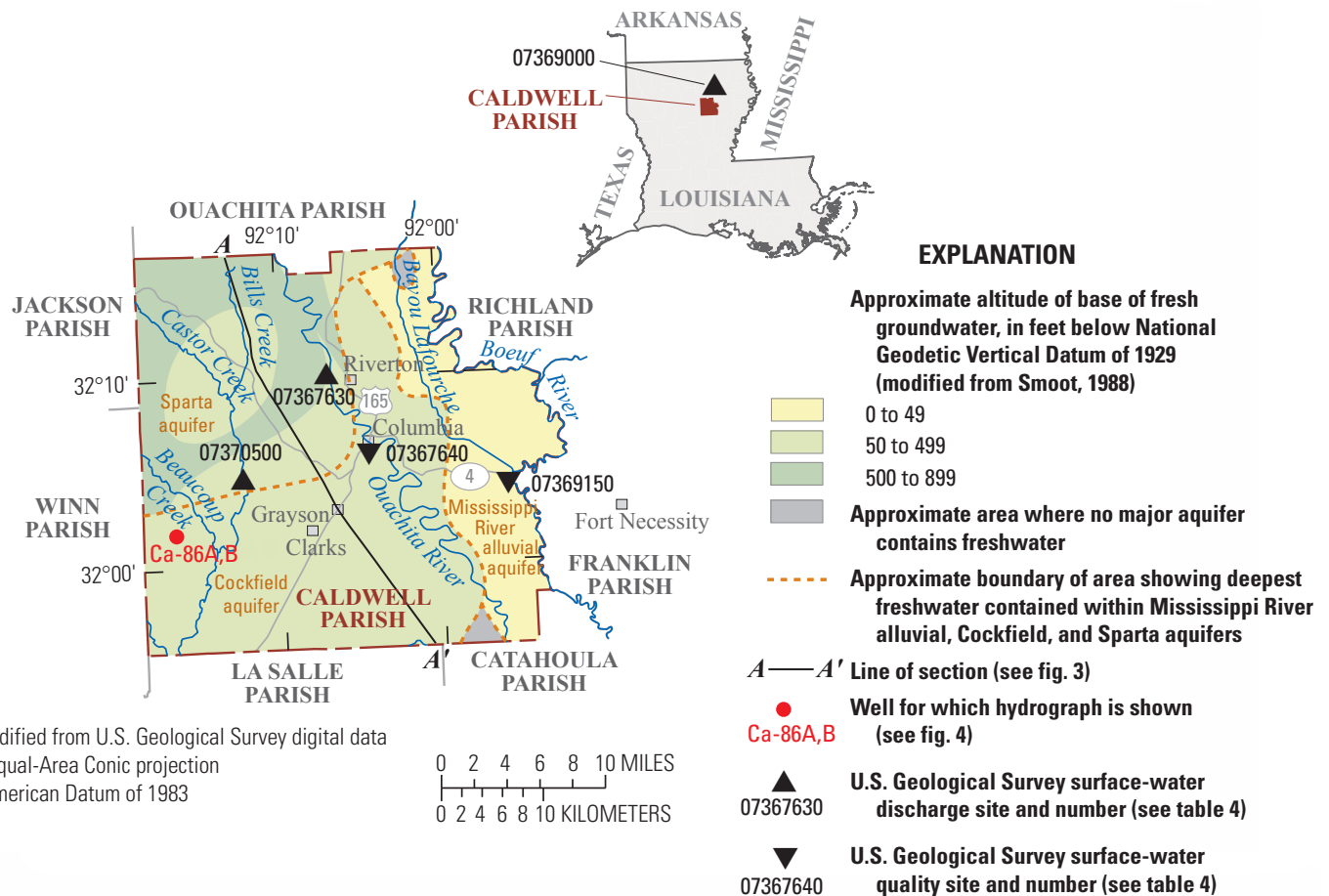
Introduction

Information concerning the availability, use, and quality of water in Caldwell 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 National Water

Information System (<http://waterdata.usgs.gov/nwis>) are the primary sources of the information presented here.

In 2010, about 4.39 million gallons per day (Mgal/d) of water were withdrawn in Caldwell Parish, including about 2.67 Mgal/d from surface-water sources and 1.73 Mgal/d from groundwater sources¹ (table 1). Withdrawals for various use categories are presented in table 2. Water-use data collected at 5-year intervals from 1960 to 2010 (fig. 2) indicated that water withdrawals peaked in 1980.

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



Base modified from U.S. Geological Survey digital data
 Albers Equal-Area Conic projection
 North American Datum of 1983

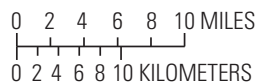


Figure 1. Location of study area, Caldwell Parish, Louisiana.

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

Aquifer or surface-water body	Groundwater	Surface water
Mississippi River alluvial aquifer	0.61	
Cockfield aquifer	1.09	
Sparta aquifer	0.02	
Miscellaneous streams		2.67
Total	1.73	2.67

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

Use category	Groundwater	Surface water	Total
Public supply	1.07	0.00	1.07
Rural domestic	0.07	0.00	0.07
Livestock	0.03	0.03	0.05
Rice irrigation	0.57	1.32	1.88
General irrigation	0.00	1.32	1.32
Total	1.73	2.67	4.39

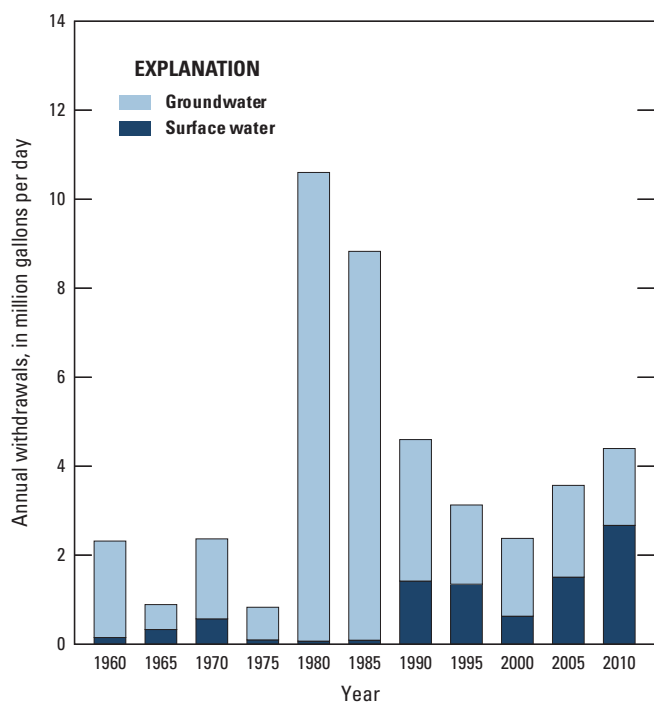


Figure 2. Water withdrawals in Caldwell Parish, Louisiana, 1960–2010 (Sargent, 2011).

Groundwater Resources

Fresh groundwater (water with a chloride concentration of 250 milligrams per liter [mg/L] or less) is available throughout Caldwell Parish except near the extreme southeastern corner of the parish. The base of freshwater is present at depths generally ranging from less than 100 to 800 feet (ft) below the National Geodetic Vertical Datum of 1929 (NGVD 29) (Smoot, 1988). The primary sources

of fresh groundwater in Caldwell Parish are the Mississippi River alluvial aquifer and the Cockfield aquifer. A minor source of fresh groundwater underlying the parish is the Sparta aquifer (fig. 3, table 1). Recharge to aquifers in the parish is from precipitation, leakage from adjacent aquifers, and seasonal input from streams. Discharge from the aquifers is by evapotranspiration, natural seasonal flow into streams, leakage into adjacent aquifers, and withdrawals from wells.

State well-registration records listed 208 active water wells in Caldwell Parish in 2010, including 90 domestic, 78 irrigation, 33 public supply, and 7 industrial (Louisiana Department of Natural Resources, 2011). In 2010, categories of use for groundwater withdrawals included public supply, rural domestic, livestock, and rice irrigation (table 2).

Mississippi River Alluvial Aquifer

In Caldwell Parish, the Mississippi River alluvial aquifer is present from roughly the Ouachita River to the eastern boundary of the parish and ranges in thickness from less than 25 to 75 ft (Ackerman, 1996). The base of the aquifer in the parish is an uneven surface that ranges in altitude from about 0 to 40 ft or more below NGVD 29 (Whitfield, 1975). Freshwater is generally present throughout the alluvial aquifer in Caldwell Parish (fig. 1); however, small lenses of saltwater (water with a chloride concentration greater than 250 mg/L) are locally present within the aquifer (Whitfield, 1975).

Recharge to the Mississippi River alluvial aquifer is primarily from precipitation and, to a lesser degree, by leakage from underlying sediments such as the Cockfield aquifer. Natural discharge occurs by seepage into streams (Whitfield, 1975). The direction of groundwater flow in the alluvial aquifer in Caldwell Parish is generally toward Bayou Lafourche and the Boeuf River (fig. 1). In 1990, water levels in the aquifer were generally 50 ft or more above NGVD 29 along the Ouachita River in the northern part of the parish and less than 40 ft above NGVD 29 along the Boeuf River in the southeastern corner of the parish (Seanor and Smoot, 1995).

State well-registration records listed 109 active wells screened in the Mississippi River alluvial aquifer in Caldwell Parish in 2010, including 2 public supply, 68 irrigation, 38 domestic, and 1 industrial well. Depths of these wells ranged from 27 to 130 ft below land surface, with a median depth of 90 ft. Reported yields from wells screened in the Mississippi River alluvial aquifer in Caldwell Parish have ranged from 5 to 3,000 gallons per minute (gal/min) (Louisiana Department of Natural Resources, 2011). In 2010, groundwater withdrawals from the Mississippi River alluvial aquifer in Caldwell Parish totaled about 0.61 Mgal/d (table 1), and uses included about 0.03 Mgal/d for rural domestic, 0.02 Mgal/d for livestock, and 0.57 Mgal/d for rice irrigation.

A statistical summary of selected water-quality characteristics of freshwater samples from 10 wells screened in the Mississippi River alluvial aquifer in Caldwell Parish is listed in table 3. Freshwater from the aquifer generally is very hard.² The data are limited but indicate that concentrations of iron and manganese greatly exceed the U.S. Environmental Protection Agency's Secondary Maximum Contaminant Levels³ (SMCLs) for drinking water.

²Hardness 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).

³The 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).

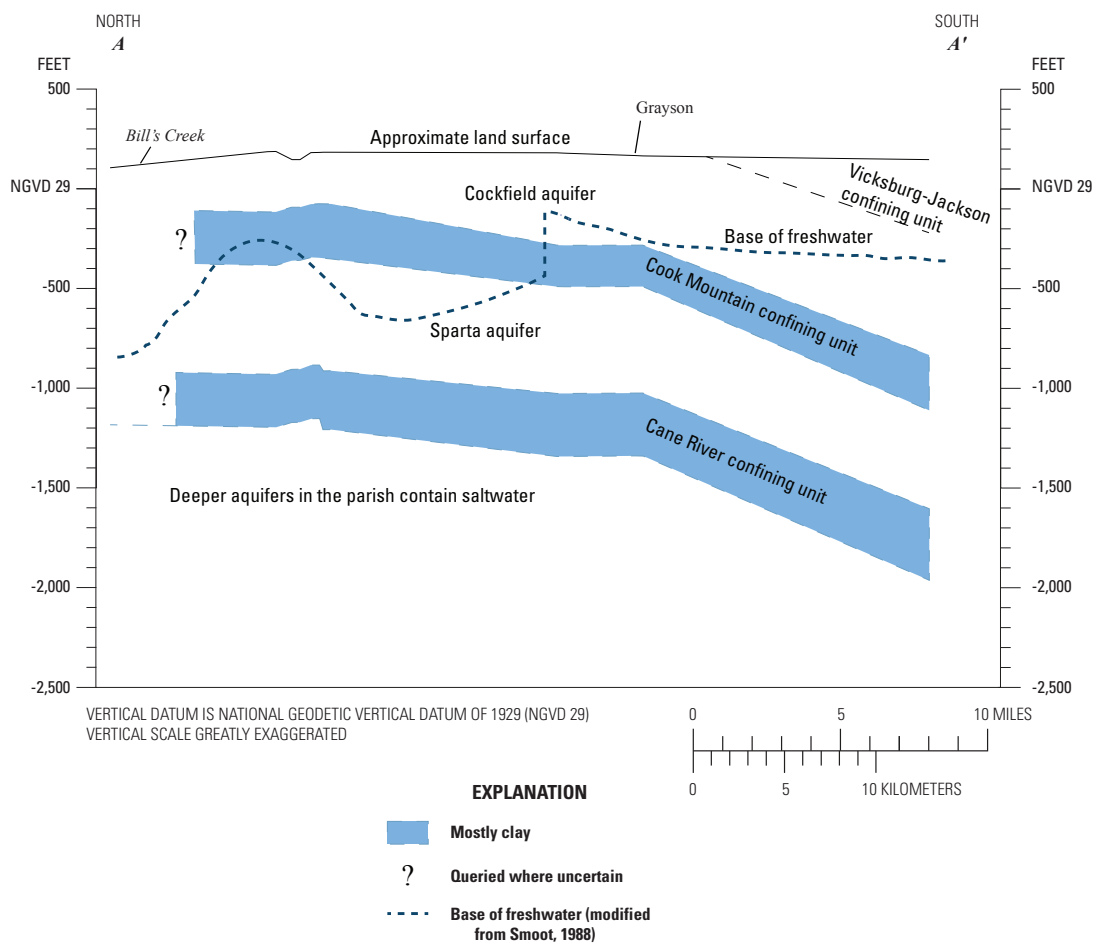


Figure 3. Generalized north-to-south hydrogeologic section through Caldwell Parish, Louisiana, showing aquifer and confining unit intervals (individual sand and clay layers not shown) (modified from Huner, 1939 and Smoot, 1988). Trace of section shown on figure 1.

Cockfield Aquifer

The Cockfield aquifer is present throughout Caldwell Parish except in the northeastern corner of the parish where it is thin or absent (Ryals, 1984). The aquifer outcrops and receives recharge from precipitation west of the Ouachita River, except in the stream valleys of Castor Creek and its tributaries and in the south-central part of the parish where the aquifer is overlain by clay of the Vicksburg-Jackson confining unit (Snead and McCulloh, 1984) (fig. 3). The Cook Mountain confining unit underlies the Cockfield aquifer.

In Caldwell Parish, the Cockfield aquifer dips to the southeast, and the base of the aquifer ranges in altitude from about 0 ft below NGVD 29 in the northwestern corner of the parish to nearly 1,000 ft below NGVD 29 in the southeastern corner. Aquifer thickness ranges from less than 200 ft along the northwestern parish line to 600–800 ft in the southeastern corner of the parish (Ryals, 1984). The Cockfield aquifer generally contains freshwater in Caldwell Parish; however, in the southeastern corner and along the eastern margin of the parish, the aquifer contains saltwater (Brantly and Seanor, 1996; Ryals, 1984). The altitude of the base of freshwater within the Cockfield aquifer in central and southwestern Caldwell Parish is shown in figure 1.

The direction of groundwater flow in the Cockfield aquifer in Caldwell Parish is generally eastward toward the Ouachita River. In 1993, water levels were generally more than 140 ft above NGVD 29 in the northwestern corner of the parish and about 60 ft above NGVD 29 along the Ouachita River Valley (Brantly and Seanor, 1996). The water level in well Ca-86A (fig. 1), which is screened in the Cockfield aquifer, fluctuates from 2 to 6 ft or more annually but has remained at about the same altitude since 2002 (fig. 4).

State well-registration records listed 75 active wells screened in the Cockfield aquifer in Caldwell Parish in 2010, including 39 domestic, 26 public supply, 6 industrial, and 4 irrigation wells. Depths of these wells ranged from 50 to 630 ft below land surface, with a median depth of 335 ft. Reported yields from wells screened in the Cockfield aquifer in Caldwell Parish have ranged from 10 to 400 gal/min (Louisiana Department of Natural Resources, 2011). Water withdrawals from the Cockfield aquifer in Caldwell Parish totaled about 1.09 Mgal/d (table 1) in 2010, and uses included about 1.05 Mgal/d for public supply, 0.03 Mgal/d for rural domestic, and 0.01 Mgal/d for livestock.

A statistical summary of selected water-quality characteristics of freshwater from 54 wells screened in the Cockfield aquifer in Caldwell Parish is presented in table 3. Freshwater from the aquifer generally is soft and generally does not exceed the SMCLs for color, pH, and concentrations of chloride and dissolved solids. Iron concentrations often greatly exceed the SMCL of 300 micrograms per liter ($\mu\text{g/L}$), and manganese concentrations generally exceed the SMCL of 50 $\mu\text{g/L}$.

Sparta Aquifer

The Sparta aquifer is present throughout Caldwell Parish but contains freshwater only in the northwestern quadrant of the parish. The aquifer lies between massive clay beds of the underlying Cane River confining unit and the overlying Cook Mountain confining unit (fig. 3) (Rollo, 1960).

In Caldwell Parish, the Sparta aquifer dips to the southeast and the base of the aquifer ranges in altitude from about 800 ft below NGVD 29 in the extreme northwestern corner of the parish to nearly 2,000 ft below NGVD 29 in the extreme southeastern corner.

Table 3. Summary of selected water-quality characteristics of freshwater in the Mississippi River alluvial, Cockfield, and Sparta aquifers in Caldwell Parish, Louisiana (U.S. Geological Survey, 2012b).

[Values are in milligrams per liter, except as noted. °C, degrees Celsius; PCU, platinum cobalt units; µS/cm, microsiemens per centimeter; SU, standard units; CaCO₃, calcium carbonate; µg/L, micrograms per liter; —, insufficient data; 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
Mississippi River alluvial aquifer, 1970–2011 (10 wells)									
Median	20.1	5	537	7.2	210	20	8,200	980	156
10th percentile	19.5	—	346	—	150	11	4,400	540	—
90th percentile	20.5	—	698	—	300	78	12,000	3,000	—
Number of samples	9	1	7	2	8	10	8	7	1
Percentage of samples that do not exceed SMCLs	NA	100	NA	100	NA	100	0	0	100
Cockfield aquifer, 1939–89 (54 wells)									
Median	20.6	5	414	7.5	40	20	1,200	80	272
10th percentile	19.5	5	263	6.5	2	9.3	70	20	190
90th percentile	21.8	50	715	8.5	110	38	6,000	250	412
Number of samples	14	41	38	40	54	54	34	23	37
Percentage of samples that do not exceed SMCLs	NA	78	NA	88	NA	100	29	35	92
Sparta aquifer, 1947–2012 (13 wells)									
Median	23.0	120	1,540	8.5	8	80	80	<1	757
10th percentile	22.1	55	1,070	8.2	2	18	20	<1	651
90th percentile	24.1	200	1,970	8.8	27	140	1,000	16	1,120
Number of samples	5	8	10	8	12	13	8	5	6
Percentage of samples that do not exceed SMCLs	NA	0	NA	62	NA	100	75	100	0
SMCLs									
	NA	15	NA	6.5–8.5	NA	250	300	50	500

The thickness of the aquifer ranges from 600 to 800 ft throughout the parish except in the southeastern corner, where the thickness is from 800 to 1,000 ft (Ryals, 1984). The altitude of the base of freshwater within the Sparta aquifer in northwestern Caldwell Parish is shown in figure 1.

In 2007, water levels in the Sparta aquifer in Caldwell Parish ranged from about 80 ft above NGVD 29 in the southwestern corner of the parish to about 20 ft below NGVD 29 in the northwestern corner (Schrader, 2008). Regional groundwater withdrawals have greatly affected the direction of groundwater flow in the Sparta aquifer. In Caldwell Parish, the direction of groundwater flow in the Sparta aquifer is northward toward a pumping center in Ouachita Parish (Schrader, 2008). The water level in well Ca-86B (fig. 1), which is screened in the Sparta aquifer in Caldwell Parish, declined about 8 ft between 2002 and 2013 (fig. 4).

State well-registration records listed 14 active wells screened in the Sparta aquifer in Caldwell Parish in 2010, including 9 domestic and 5 public supply. Well depths ranged from 400 to 845 ft below land surface, with a median depth of 525 ft. Reported yields from wells screened in the Sparta aquifer in Caldwell Parish have ranged from 2 to 140 gal/min (Louisiana Department of Natural Resources, 2011). In 2010, groundwater withdrawals from the Sparta aquifer in Caldwell Parish totaled about 0.02 Mgal/d (table 1), primarily for public supply.

A statistical summary of selected water-quality characteristics of freshwater from 13 wells screened in the Sparta aquifer in Caldwell Parish is presented in table 3. Freshwater from the aquifer generally is soft and generally does not exceed the SMCLs for concentrations of iron and manganese. Color and dissolved solids concentrations exceeded the SMCLs in sampled wells. The median value for pH is at the upper SMCL limit of 8.5 standard units, indicating that water in the Sparta aquifer tends to be alkaline.

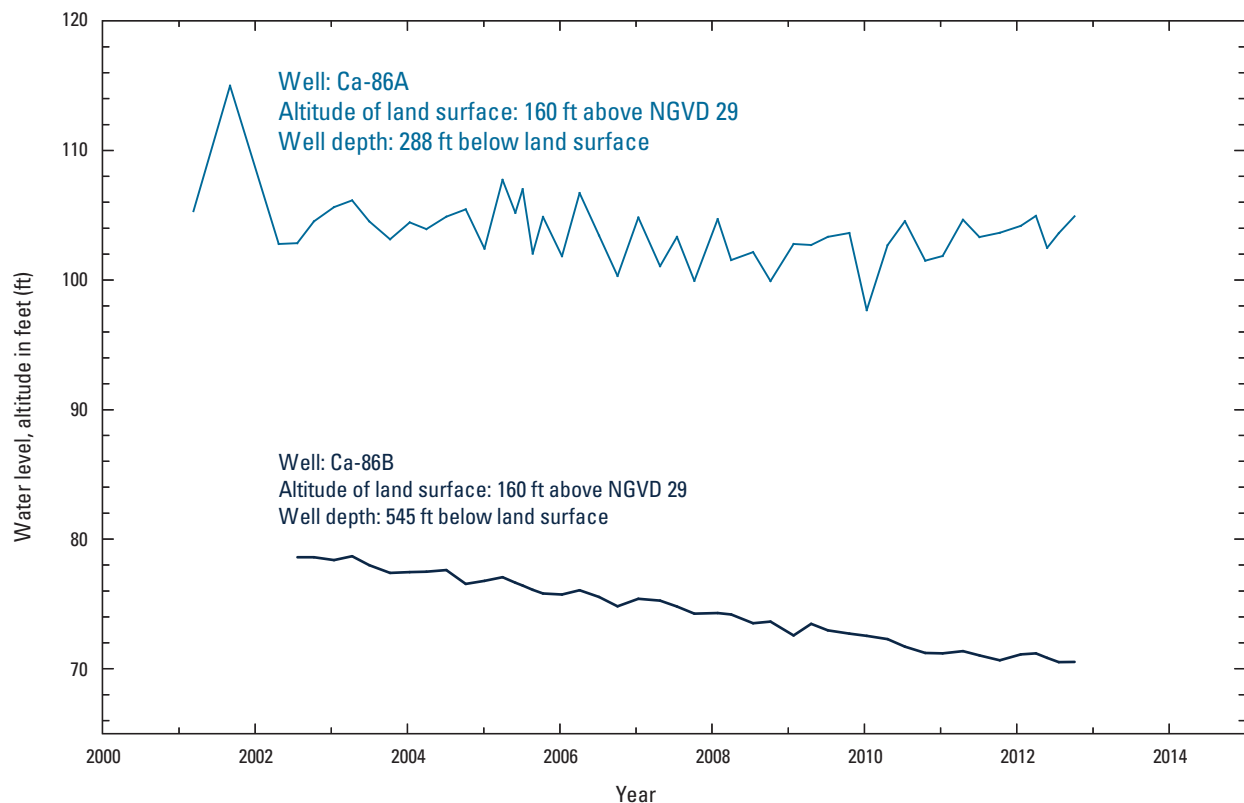


Figure 4. Water levels in well Ca-86A screened in the Cockfield aquifer and well Ca-86B screened in the Sparta aquifer in Caldwell Parish, Louisiana (see fig. 1 for well locations; U.S. Geological Survey, 2012a). Altitude of land surface and water level is measured in feet (ft) above the National Geodetic Vertical Datum of 1929 (NGVD 29).

Surface-Water Resources

In 2010, about 2.67 Mgal/d of surface water were withdrawn in Caldwell Parish, and uses included about 0.03 Mgal/d for livestock, 1.32 Mgal/d for rice irrigation, and 1.32 Mgal/d for general irrigation (tables 1 and 2). Notable surface-water bodies in the parish are the Ouachita River, Bayou Lafourche, Boeuf River, Castor Creek, and Beaucoup Creek (fig. 1). The average daily discharge for the Ouachita River at Columbia L&D (Lock and Dam) near Riverton (site number 07367630; fig. 1) during 1982–87 was about 21,326 cubic feet per second (ft³/s). During 1940–71, the average daily discharge for Castor Creek near Grayson (site number 07370500) was 243 ft³/s. During 1938–2012, the average daily discharge for Bayou Lafourche near Crew Lake (site number 07369000), located roughly 16 mi north-northeast of Caldwell Parish, was 1,818 ft³/s (U.S. Geological Survey, 2013).

Water samples analyzed during 1974–93 (table 4) indicated that water in the Ouachita River at Columbia (site number 07367640) is soft and that samples generally do not exceed the SMCLs for pH and concentrations of chloride and sulfate. Dissolved oxygen is generally greater than 5 mg/L, which is considered the minimum value for a diversified population of fresh, warmwater biota, including sport fish (Louisiana Department of Environmental Quality, 2008). Water samples analyzed during 1975–91 from the Boeuf River near Fort Necessity (site number 07369150; table 4) indicated that the median value for hardness fell within the moderately hard range and that samples generally do not exceed the SMCLs for pH and concentrations of chloride, sulfate, and iron. Dissolved oxygen concentrations are generally greater than 5 mg/L.

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Table 4. Summary of selected water-quality characteristics for the Ouachita and Boeuf Rivers in Caldwell Parish, Louisiana (U.S. Geological Survey, 2012b).

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

	Specific conductance, field ($\mu\text{S}/\text{cm}$ at 25 $^{\circ}\text{C}$)	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 ($\mu\text{g}/\text{L}$ as Fe)
Ouachita River at Columbia, 1974–93¹										
Median	168	7.2	6.7	31	8.4	2.1	19	29	13	280
10th percentile	88	4.7	6.1	19	5.0	1.3	8.3	13	6.8	110
90th percentile	324	10.3	7.2	48	14	3.1	40	61	23	550
Number of samples	154	148	155	154	154	154	153	153	151	73
Percentage of samples that do not exceed SMCLs	NA	NA	66	NA	NA	NA	NA	100	100	62
Boeuf River near Fort Necessity, 1975–91²										
Median	395	7.7	7.2	100	26	8.3	34	53	16	100
10th percentile	87	4.9	6.4	25	6.6	2.0	6.4	7.0	6.0	10
90th percentile	1,040	10.6	7.8	200	50	18	130	210	32	280
Number of samples	95	93	96	96	96	96	96	96	96	40
Percentage of samples that do not exceed SMCLs	NA	NA	88	NA	NA	NA	NA	96	100	90
SMCLs										
	NA	NA	6.5–8.5	NA	NA	NA	NA	250	250	300

¹Site number 07367640.

²Site number 07369150.

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