U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared in cooperation with the
LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
Office of Public Works and Intermodal
Public Works and Water Resources Division

SCIENTIFIC INVESTIGATIONS MAP 2861
Williamson Creek Aquifer--Sheet 1 of 2
Brantly, J.A., and Seanor, R.C., 2005, Louisiana Ground-Water Map No. 18:
Potentiometric Surface, 2003, Jasper Aquifer System in West-Central Louisiana

INTRODUCTION

The Jasper aquifer system, consisting of the Williamson Creek and Carnahan Bayou aquifers, is a major source of freshwater withdrawals in Beauregard, Rapides, and Vernon Parishes (Sargent, 2002, p. 96) in west-central Louisiana (fig. 1). In 2000, water withdrawals from the Jasper aquifer system were about 42 Mgal/d (Sargent, 2002), a decrease from the 46 Mgal/d withdrawn in 1995 (Lovelace and Johnson, 1996). About 22 Mgal/d was from the Williamson Creek aquifer, and 20 Mgal/d was withdrawn from the Carnahan Bayou aquifer. Most withdrawal from the aquifers was in Rapides (about 19 Mgal/d), Beauregard (about 14 Mgal/d), and Vernon (about 7 Mgal/d) Parishes. About 26 Mgal/d of water was used for public supply, and about 14 Mgal/d was used for industrial purposes (Sargent, 2002, p. 96).

Municipal withdrawals from the Jasper aquifer system in the Alexandria-Pineville area have created a large cone of depression in the Carnahan Bayou aquifer that was more than 230 ft below NGVD 29 in 1989 and areally extensive across Rapides Parish. Smaller cones of depression are present in the Williamson Creek aquifer in the Leesville-Fort Polk and DeRidder areas (Smoot and Seanor, 1992).

Withdrawals from the Jasper aquifer system have prompted concern about the capability of the aquifer to meet future demands for freshwater. Additional knowledge of the effects of water withdrawals on the Jasper aquifer system is essential in assessing the aquifer system's potential as a sustained source of water for present and future needs and for protection of the resource.

In 2003, the U.S. Geological Survey, in cooperation with the Louisiana Department of Transportation and Development, began a study of the Jasper aquifer system in west-central Louisiana to describe the potentiometric surface of the Williamson Creek and Carnahan Bayou aquifers. This report presents maps and data that describe the potentiometric surface, water-level changes, and ground-water-flow direction in the Williamson Creek and Carnahan Bayou aquifers in all or parts of Allen, Avoyelles, Beauregard, Evangeline, Grant, LaSalle, Natchitoches, Rapides, Sabine, and Vernon Parishes (fig. 1). Reports with emphasis on the Jasper aquifer system are included in the "Selected References" section.

Table 1. Water-level data used to construct the potentiometric-surface map of the Williamson Creek aquifer, west-central Louisiana, March-April 2003.

[NGVD 29, National Geodetic Vertical Datum of 1929]

Well number	Well depth, in feet below land surface	Water level, in feet above or below (-) land surface	Water level, in feet above or below (-) NGVD 29	Date measured
Avoyelles Parish				
Av-271	370	-63.23	31.77	4-15
Beauregard Parish				
Be-407	1,657	-157.42	50.58	4-11
Be-408	1,686	-139.19	62.81	4-11
Be-415	1,761	-133.16	71.84	4-11
Be-501	755	-1.62	103.38	4-02
Be-521	1,640	-104.76	70.24	4-22
Rapides Parish				
R-18	406	-119.12	-40.59	4-09
R-439	460	-37.58	37.42	3-20
R-875	504	-116.42	-34.42	4-09
R-1071	638	-246.11	-46.11	4-22
R-1085B	500	-69.62	30.38	4-08
R-1098	355	-137.23	19.77	4-03
R-1193	571	-175.04	31.96	4-10
R-1464	610	-152.06	37.94	4-17
Vernon Parish				
V-196	503	-136.51	106.49	4-02
V-305	350	-105.25	179.75	3-19
V-467	560	-217.84	102.16	3-11
V-478	1,010	-227.67	92.33	4-01
V-497	885	-247.48	77.52	4-02
V-518	885	-251.83	83.17	4-02
V-521	350	-112.56	157.44	4-03
V-525	840	0.90	90.90	4-03
V-644	612	-240.03	84.97	4-01
V-651	938	-250.29	99.71	4-02
V-658	635	-212.73	96.27	4-01
V-659	912	-242.93	67.07	4-01
V-669	904	-236.35	78.65	4-01
V-682	1,282	-148.85	71.15	4-03
V-8586Z	475	-249.16	130.84	4-17

HYDROGEOLOGY

The Jasper aquifer system consists of a series of alternating aquifers and confining units within the Mississippi Embayment. The aquifer system consists of three hydrogeologic units: the Williamson Creek aquifer, the Dough Hills confining unit, and the Carnahan Bayou aquifer (fig. 2; Smoot and Seanor, 1992). The Williamson Creek and Carnahan Bayou aquifers consist of alternating layers of sand and clay, and the Dough Hills confining unit is primarily silt and clay (Rogers and Calandro, 1965, p. 8, 21, 25, 26). The sands and clays composing the Jasper aquifer system were deposited as a result of marine and fluvial-deltaic deposition during the Miocene epoch (Martin and others, 1988, sheet 1). During this time, changes in depositional environment and materials available for deposition resulted in a complex sequence of sediments. In this sequence, sands often grade vertically or horizontally into silts and clays making correlations difficult (Rogers and Calandro, 1965, p. 8). The aquifer system contains freshwater to depths as great as 2,000 to 3,000 ft in Beauregard, Rapides, and Vernon Parishes, and part of Allen Parish (Smoot, 1988). The natural flow of ground water in the system is generally toward the southeast from the outcrop area, except in the western extent of the study area where ground-water flow is toward the southwest (Smoot and Seanor, 1992, sheet 1).

The Williamson Creek aquifer outcrops in Vernon and Rapides Parishes (fig. 1). The aquifer ranges in thickness from approximately 400 ft in the outcrop area in north-central Vernon Parish to approximately 900 ft in southern Vernon Parish (Rogers and Calandro, 1965, p. 26). The aquifer is approximately 300 ft thick in the Alexandria area in central Rapides Parish and increases in thickness to more than 800 ft in southern Rapides Parish (Smoot and Fendick, 1998, p. 14). In Vernon Parish, electric log data indicate that individual sands can range from 50 ft to more than 100 ft in thickness (Rogers and Calandro, 1965, p. 26). Individual sand units within the aquifer average 53 ft in thickness in Rapides Parish (Newcome and Sloss, 1966, p. 11).

The Carnahan Bayou aquifer outcrops in southern Grant, Natchitoches, and Sabine Parishes as well as northern Vernon and Rapides Parishes (fig. 4; Smoot and Fendick, 1998, p. 17; Snead and McCulloh, 1984, sheet 1). The aquifer ranges in thickness from about 540 ft in northwestern Vernon Parish to about 1,100 ft in southeastern Vernon Parish (Rogers and Calandro, 1965, p. 21). Individual sand units within the aquifer vary in average thickness from 38 ft in Rapides Parish (Newcome and Sloss, 1966, p. 11) to 70 ft or more in Vernon Parish (Rogers and Calandro, 1965, p. 21).

POTENTIOMETRIC SURFACE

Williamson Creek Aquifer

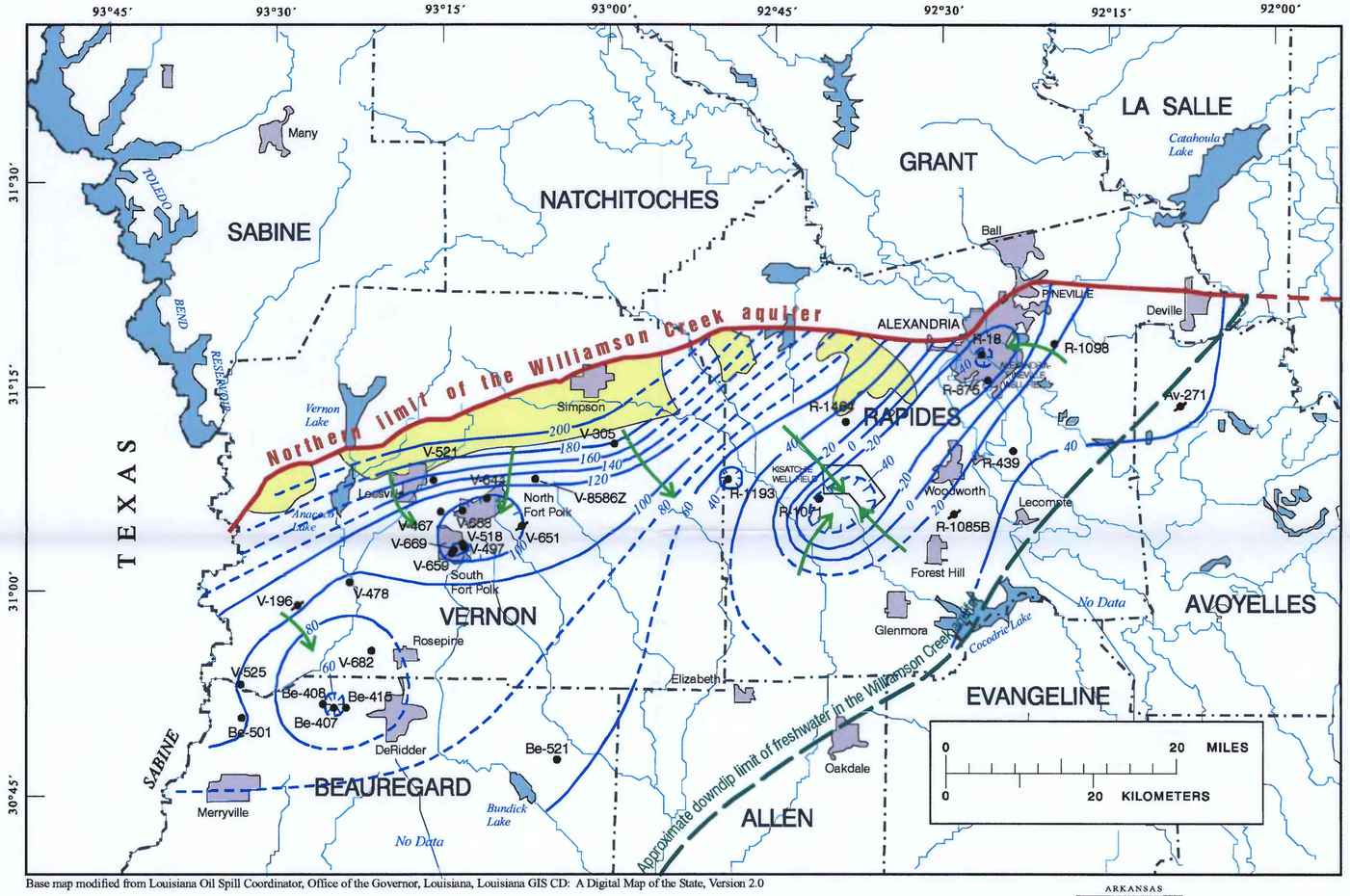
The generalized potentiometric surface of the Williamson Creek aquifer was constructed using water levels from 29 wells (table 1). Measured water levels ranged from 179.75 ft above NGVD 29 in well V-305 near the outcrop area in northeastern Vernon Parish to 46.11 ft below NGVD 29 in well R-1071 in the Kisatchie well-field area in southwestern Rapides Parish. Water levels are lowest in the areas affected by major pumping centers, including the Alexandria-Pineville area and the Kisatchie well-field area in Rapides Parish, the Leesville-Fort Polk area in Vernon Parish, and the DeRidder area in Beauregard Parish. Flow lines indicate movement of ground water is generally toward the major pumping centers (fig. 1). In general, water-level gradients are steeper in and near the outcrop areas and the major pumping centers of the aquifer. Water-level gradients are less steep in the areas downdip of the outcrop areas and in areas minimally affected by pumpage. Water-level gradients (2003) vary from approximately 6 ft/mi in southern Vernon Parish to approximately 16 ft/mi in the outcrop area of northern Rapides Parish (fig. 1).

Cones of depression have formed in the Williamson Creek aquifer around major pumping centers: the Alexandria-Pineville well-field, the Kisatchie well-field, Leesville-Fort Polk, and DeRidder areas (fig. 1). Pumpage, mainly for public supply and industrial purposes (B.P. Sargent, U.S. Geological Survey, written commun., 2003) has created cones of depression.

Figure 3 shows hydrographs for four wells. The hydrograph for well Av 271, in northwestern Avoyelles Parish, shows fluctuations of 5 ft or more annually. The hydrograph for well V-651, in central Vernon Parish, shows annual water-level fluctuations of 10 ft or more since 1996, and no long term water-level decline during the period shown. Analysis of water-level data for well V-196, in southwestern Vernon Parish, shows water-levels were stable (no long-term declining or rising trend) during the period from 1989 to 1994. Water levels declined approximately 0.7 ft/yr from 1994 to 2003. The hydrograph for well R-1085B, in central Rapides Parish, shows water levels declined prior to about 1980, and were stable during the period from 1980 to 1996. Since 1996, water levels at well R-1085B fluctuated 10 ft or more annually; however, no long-term water-level decline is apparent.

System	Series	Stratigraphic unit		Hydrogeologic unit	
Tertiary	Pliocene ?— Miocene	Fleming Formation	Blounts Creek Member	Evangeline aquifer	
			Castor Creek Member	Castor Creek confining unit	
			Williamson Creek Member	Jasper aquifer system	Williamson Creek aquifer
			Dough Hills Member		Dough Hills confining unit
			Carnahan Bayou Member		Carnahan Bayou aquifer
			Lena Member	Lena confining unit	
		Catahoula Formation		Catahoula aquifer	

Figure 2. Partial column of stratigraphic and hydrogeologic units in west-central Louisiana (from Smoot and Seanor, 1992).



Base map modified from Louisiana Oil Spill Coordinator, Office of the Governor, Louisiana, Louisiana GIS CD: A Digital Map of the State, Version 2.0

EXPLANATION

- GENERALIZED OUTCROP AREA AND PRINCIPAL AREA OF RECHARGE FOR THE WILLIAMSON CREEK AQUIFER (Modified from; Martin and others, 1988)
- 80 — POTENTIOMETRIC CONTOUR--Shows altitude at which water level would have stood in tightly cased wells. Dashed where approximately located. Contour interval is 20 feet. Datum is NGVD 29
- FLOW LINE INDICATING GENERAL DIRECTION OF GROUND-WATER FLOW
- Be-521 — CONTROL POINT AND WELL NUMBER
- V-196 — OBSERVATION WELL FOR WHICH HYDROGRAPH IS SHOWN

Figure 1. Location of study area and potentiometric surface of the Williamson Creek aquifer in west-central Louisiana, March-April 2003.

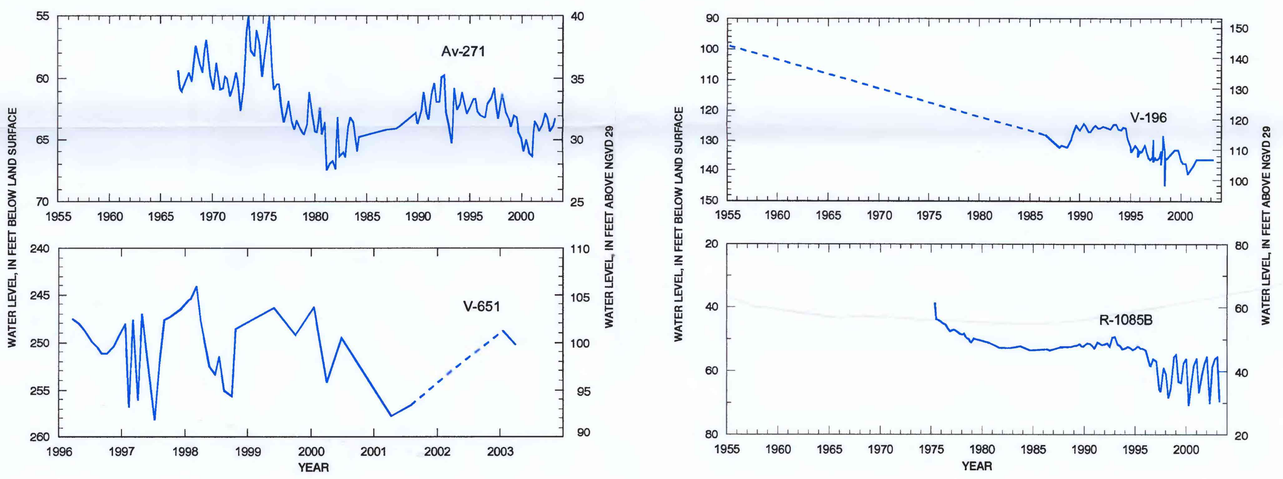


Figure 3. Water levels in wells Av-271, V-651, V-196, and R-1085B in the Williamson Creek aquifer, Jasper aquifer system in west-central Louisiana..

Louisiana Department of Transportation and Development - U.S. Geological Survey Water Resources Cooperative Program

Louisiana Ground-Water Map No. 18:

Potentiometric Surface, 2003, Jasper Aquifer System in West-Central Louisiana

By

Jeffrey A. Brantly and Ronald C. Seanor

2005

For additional information, contact:

Director, USGS Louisiana Water Science Center
U.S. Geological Survey
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: la.water.usgs.gov

Copies of this report can be purchased from:

U.S. Geological Survey
Information Services
Box 25286
Denver, CO 80225
E-mail: infoservices@usgs.gov
Fax: (303) 202-4693
Telephone (toll free): 1-888-ASK-USGS