STATE OF LOUISIANA

DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

OFFICE OF PUBLIC WORKS, HURRICANE FLOOD PROTECTION

AND INTERMODAL TRANSPORTATION

WATER RESOURCES PROGRAMS

WATER RESOURCES

TECHNICAL REPORT

NO. 81

QUALITY OF WATER IN DOMESTIC WELLS IN THE WILCOX AQUIFER IN NORTHWESTERN LOUISIANA AND EAST-CENTRAL TEXAS, DECEMBER 2003–SEPTEMBER 2004

Prepared by the

U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

In cooperation with the

LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

2011

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By

Roland W. Tollett and Ronald C. Seanor

U.S. GEOLOGICAL SURVEY

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Conversion Factors, Datum, Abbreviated Water-Quality Units, Acronyms, and Symbols

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	2.590	square kilometer (km^2)
	Flow rate	
million gallons per day (Mgal/d)	3,785	cubic meter per day (m^3/d)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

°F=(1.8×°C)+32

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

°C=(°F-32)/1.8

Vertical coordinate information in this report is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29)

Horizontal coordinate information in this report is referenced to the North American Datum of 1983 (NAD 83)

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25 °C).

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L).

Abbreviated water-quality units:

milligrams per liter (mg/L)

micrograms per liter (μg/L)

picocuries per liter (pCi/L)

milliliter (mL)

microsiemens per centimeter at 25 degrees Celsius (μS/cm)

grams per kilogram (g/kg)

colonies per 100 milliliters (cols/100 mL)

Abbreviations:

dissolved organic carbon (DOC)

dissolved oxygen (DO)

Louisiana Department of Transportation and Development (DOTD)

Health Advisory (HA)

Maximum Contaminant Level (MCL)

Maximum Contaminant Level Goal (MCLG)

Method Detection Limit (MDL)

National Water Quality Assessment (NAWQA)

Secondary Maximum Contaminant Level (SMCL)

nephelometric turbidity ratio units (NTRU)

platinum cobalt units (PCU)

total dissolved solids (TDS)

total organic carbon (TOC)

U.S. Environmental Protection Agency (USEPA)

U.S. Geological Survey (USGS)

volatile organic compound (VOC)

Symbols:

greater than (>)

less than (<)

greater than or equal to (≥)

less than or equal to (≤)

Quality of Water in Domestic Wells in the Wilcox Aquifer in Northwestern Louisiana and East-Central Texas, December 2003–September 2004

By Roland W. Tollett and Ronald C. Seanor

Abstract

During December 2003–September 2004, water-quality data were collected from 92 randomly selected domestic wells screened in the Wilcox aquifer in northwestern Louisiana and east-central Texas. The data were collected to describe the groundwater quality and to gain an understanding of the natural and human-related factors that affect groundwater quality. The Wilcox aquifer is an unconsolidated sand aquifer that crops out in northwestern Louisiana and east-central Texas, and is the principal source of fresh groundwater in the area. Well depths ranged from 55 to 425 feet below land surface with a median depth of 211 feet. The median values were 715 microsiemens per centimeter at 25 degrees Celsius for specific conductance, 7.9 standard units for pH, and 244 mg/L (milligrams per liter) for alkalinity. Dissolved-solids had a median of 433 mg/L; concentrations for 35 wells exceeded the U.S. Environmental Protection Agency (USEPA) Secondary Maximum Contaminant Level (SMCL) of 500 mg/L. Five chloride concentrations and one sulfate concentration exceeded 250 mg/L, the SMCL for both constituents. The highest percentage cations were sodium in water from 87 wells and calcium for 5 wells.

Trace elements were analyzed for 30 wells, except iron and manganese, which were analyzed for all 92 wells. Trace-element concentrations were less than 1,000 μg/L (micrograms per liter) except eight concentrations for iron and five concentrations for both boron and strontium. Concentrations exceeded a USEPA drinking-water standard for iron and lead in 21 wells, arsenic in 11 wells, manganese in 16 wells, boron in 8 wells, and uranium in 7 wells. Lead concentrations (17.7 μg/L and 41.2 μg/L) in two wells exceeded the USEPA Maximum Contaminant Level (MCL) of 15 μg/L.

Six radionuclides (radon-222; radium-224, -226, and -228; gross-alpha and -beta radioactivity) were sampled from 30 wells; and a seventh radionuclide, tritium, was sampled from 5 wells. Radon concentrations ranged from 50 to 1,050 pCi/L (picocuries per liter) with a median of 340 pCi/L, and 19 concentrations were greater than or equal to the MCL of 300 pCi/L. Concentrations of radium-224, -226, and -228, and tritium and counts of gross-alpha and gross-beta radioactivity were less than the applicable MCLs.

Selected nutrients were sampled from 30 wells, except nitrite (91 wells) and nitrite plus nitrate (all 92 wells). One concentration, a value of 3.4 mg/L, for nitrate plus nitrite was greater than 2 mg/L, a level for nitrate that might indicate contamination from human activities, but less than the MCL of 10 mg/L. Total organic carbon (TOC) concentrations from 70 wells sampled had a median of 1.3 mg/L. Dissolved organic carbon (DOC) concentrations from 30 wells sampled had a median of 1.4 mg/L. DOC concentrations of about 0.5 mg/L typically occur naturally in groundwater. The relatively high TOC and DOC might be because of the presence of lignite (a low-grade coal) deposits throughout the Wilcox aquifer.

No concentrations of 46 pesticides or 7 pesticide-degradation products were detected in the 30 wells sampled. Seven of 85 volatile organic compounds (VOCs) were detected in 30 wells sampled. The most frequently detected VOC was 1,2,4-trimethylbenzene in samples from 10 wells. The maximum concentration for a VOC detected was 10 μg/L for tetrahydrofuran, and all concentrations were less than drinking-water standards.

Four fecal indicators, two bacterial and two viral, were analyzed in water from 30 wells. Total coliform, a bacterial fecal indicator, was detected in eight of the wells. The two highest counts were estimated as 93 and 75 colonies per 100 milliliters. Sterilizing techniques may not have been adequate to completely remove all bacteria from the spigot at these two wells. *Escherichia coli* (*E. coli*), a bacterial fecal indicator, was detected in three wells. *E. coli* F-specific and *E. coli* somatic coliphage, both viral fecal indicators, were not detected in water from the 30 wells sampled.

Introduction

Groundwater is one of the Nation's most important resources and is the source of drinking water for about 50 percent of the population in the United States (U.S. Geological Survey, 1999b). In 1991, the U.S. Geological Survey (USGS) began full implementation of its National Water Quality Assessment (NAWQA) Program to describe the status and trends in the quality of the Nation's surface-water and groundwater resources and to determine the natural and human-related factors that affect water quality (Hirsch and others, 1988; Gilliom and others, 1995). More than 50 major river basins or aquifer systems have been identified for investigation as part of the NAWQA Program. Together, these basins and aquifer systems include water resources available to more than 60 percent of the population and encompass about one-half of the land area in the conterminous United States. Knowledge of the quality of the Nation's surface-water and groundwater resources is important for the protection of human and aquatic health and for the management of land and water resources and the conservation and regulation of those resources.

The USGS NAWQA Program is currently (2003–04) compiling information concerning the quality of water in the Mississippi Embayment and Texas Coastal Uplands Principal Aquifer System, which includes the Wilcox aquifer. The Wilcox aquifer is the principal source of fresh groundwater in northwestern Louisiana and east-central Texas (Sargent, 2002; Boghici, 2009). In Louisiana alone, about 7,000 domestic wells (Z. Bolourchi, Louisiana Department of Transportation and Development, written commun., 2002) are screened in the Wilcox aquifer, with an estimated 41,000 people using water from this aquifer in Bossier, Caddo, and DeSoto Parishes (Sargent, 2002). Current (2003–04) data are needed to assess the quality of water in domestic wells screened in the Wilcox aquifer in northwestern Louisiana and east-central Texas. In 2003, the USGS NAWQA Program, as part of a joint effort with the Louisiana Department of Transportation and Development (DOTD), began a study to describe the quality of water in the Wilcox aquifer to gain an understanding of the natural and human-related factors that affect the water quality.

Background

The Wilcox aquifer crops out in northwestern Louisiana and east-central Texas (fig. 1). Water in shallow sands (generally less than 500 ft below land surface) in the Wilcox aquifer is vulnerable to effects from land-use activities because these sands are exposed or are present near land surface. Shallow depths to groundwater and lack of a continuous surficial confining unit to slow downward migration of contaminants increase the potential for degradation of water quality in this aquifer. Vertical leakage through discontinuous surficial confining units and overlying terrace and alluvial deposits, combined with groundwater withdrawals for public supply, might increase the potential for downward migration of contaminants during periods of rainwater or surface-water recharge.

Water from wells screened in the Wilcox aquifer generally is clear, odorless, and soft to moderately hard with a high percentage of sodium and bicarbonate (Page and May, 1964; Page and Preé, 1964). Well drillers and previous studies have reported areas of poor water quality in the aquifer (Page and May, 1964). Some water contains excessive amounts of iron, total dissolved solids (TDS), fluoride, or chloride but is used because water of better quality is unavailable (Page and May, 1964). Water quality in the Wilcox aquifer varies laterally and vertically and is affected by hydrogeologic factors. In Caddo Parish, hydrogeologic factors such as faults and disconnected sands prevent areas of the Wilcox aquifer from being completely flushed by recharging freshwater (Rapp, 1996). These and other factors, such as well depth, location within the regional flow system, and aquifer lithology might affect the quality of water produced by wells in the Wilcox aquifer (Rapp, 1996; Boghici, 2009).

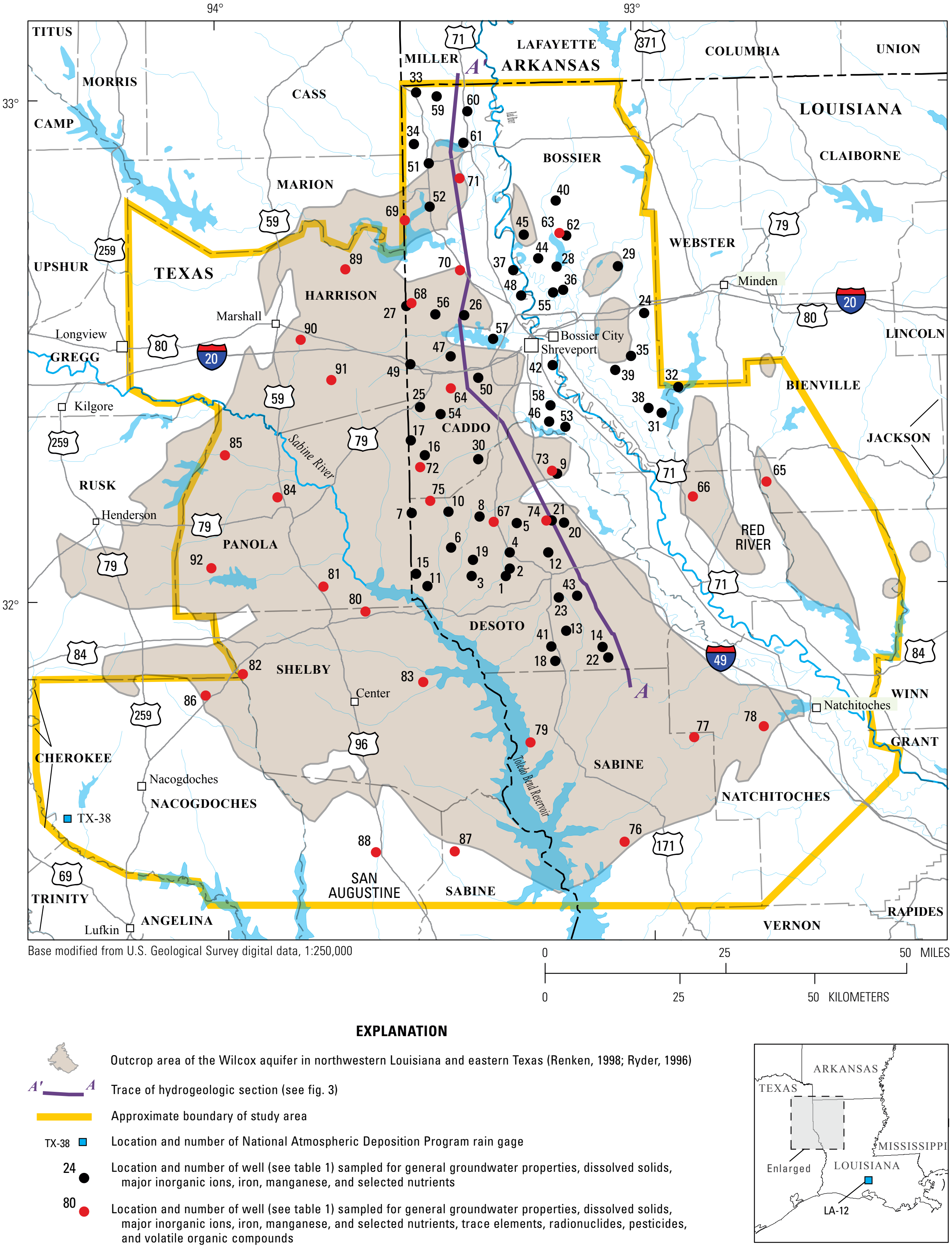

Figure 1. Map showing study area and locations of selected domestic wells in northwestern Louisiana and east-central Texas, 2003–04.

Purpose and Scope

This report describes the quality of water from 92 randomly selected domestic wells screened in the Wilcox aquifer in northwestern Louisiana and east-central Texas and relates that quality of water to natural factors, such as depth to groundwater, and to human activities, such as pesticide and fertilizer use. Water samples collected from the 92 wells during 2003–04 were analyzed for seven general groundwater properties—TDS, major inorganic ions, iron, manganese, nitrate, nitrite, and total organic carbon (TOC). In addition, selected wells (30 for most analytes) among the 92 were sampled for 23 trace elements, radon, radium-224, -226, and -228, gross-alpha and -beta radioactivity, tritium, dissolved organic carbon (DOC), 46 pesticides and 7 pesticide degradation products, 85 volatile organic compounds (VOCs), and biological indicators, including total coliform, *Escherichia coli* (*E. coli*), and *E. coli* F-specific and somatic coliphage.

Though water quality in domestic wells is not regulated, concentrations of constituents were compared to applicable U.S. Environmental Protection Agency (USEPA) drinking-water guidelines and standards for a frame of reference. Diagrams, maps, and tables describe the quality of water in the sampled wells. Statistical techniques were used to determine if hydrogeologic factors might be affecting the quality of water. Correlations between selected general groundwater properties and chemical constituents from 92 randomly selected domestic wells screened in the Wilcox aquifer, and a comparison between the quality of water in these wells with that of other wells in the Wilcox aquifer are presented. This report provides water-quality information on the Wilcox aquifer that will be useful to domestic well owners and water managers and planners. Data from this study can be compared to data from similar studies throughout the United States to assess the quality of the Nation's water resources, to determine any long-term changes in water quality, and to identify the natural and human-related factors that might affect water quality (Gilliom and others, 1998).

Acknowledgments

The authors express appreciation to the well owners in the study area for allowing the USGS to sample and collect information concerning their wells. Also, the authors express appreciation to Zahir "Bo" Bolourchi, Chief, Water Resources Programs, Louisiana Department of Transportation and Development, for providing construction information for the domestic wells located in Louisiana, and to the Texas Water Development Board and Texas Commission on Environmental Quality for providing construction information for the domestic wells located in Texas.

Description of the Study Area

The study area includes all or parts of seven parishes (Bienville, Bossier, Caddo, DeSoto, Natchitoches, Red River, and Sabine) in northwestern Louisiana and six counties (Harrison, Nacogdoches, Panola, Sabine, San Augustine, and Shelby) in east-central Texas. The approximately 11,000 square miles (mi^2) study area extends north to the Louisiana-Arkansas State line; about 40 miles (mi) east of the Red River; about 90 mi south of Shreveport, La.; and 70 mi into Texas, west of the Louisiana-Texas State line and Sabine River (fig. 1). Land-surface elevations range from less than 60 ft above the National Geodetic Vertical Datum of 1929 (NGVD 29) in the southeastern part of the study area to more than 535 ft above NGVD 29 in east-central Texas.

Climate

The climate in northwestern Louisiana and east-central Texas is humid and subtropical. Warm temperatures prevail from May through September with generally mild temperatures during the remainder of the year. The average annual rainfall and temperature for 2004 and the 30-year normal (1971–2000) rainfall and temperature were obtained for two selected stations: Shreveport Regional Airport, La., and Center, Tex. (National Oceanic and Atmospheric Administration, 2006). At the Shreveport station, the annual rainfall was 62.94 inches (in.), 11.64 in. above the 30-year normal, and the average annual temperature was 66.5 °F, 0.8 °F below the 30-year normal. At the Center station, the annual rainfall was 70.15 in., 17.14 in. above the 30-year normal, and the average annual temperature was 65.6 °F, 0.6 °F above the 30-year normal.

Hydrogeologic Setting

The Wilcox Group of Paleocene age (fig. 2) consists of an undifferentiated series of interbedded sands and clays mixed with sandy lignite areas (Seanor and Smoot, 1995). At the base of the Wilcox Group is the Naborton and Dolet Hills Formations (fig. 3), which are separated by the Chemard Lake lignite lentil, a major lignite layer that is mined at the surface in southeastern DeSoto Parish (Snider, 1982). The Wilcox Group is underlain by the older Midway Group and overlain by the younger Claiborne Group. At the base of the Claiborne Group is the Carrizo Sand, a discontinuous massive sand that lies unconformably over the eroded surface of the undifferentiated deposits of the Wilcox Formation. Unconsolidated sedimentary deposits of the Wilcox Formation crop out across much of the study area as a result of the Sabine uplift (fig. 3) (Renken, 1998; Ryder, 1996). Sand and clay beds within the formation mostly are horizontal in the outcrop area and begin to dip in a radial pattern away from the extent of the outcrop (Rapp, 1996; Boghici, 2009).

Within the Wilcox Formation, water-bearing sands comprise the Wilcox aquifer, and these sands generally are less than 500 ft thick (Ryder, 1996; Renken, 1998; Page and May, 1964). The Wilcox aquifer is referred to as the undifferentiated Wilcox aquifer in the Louisiana part of the study area (Renken, 1998) and the Middle Wilcox aquifer in the Texas part of the study area (Ryder, 1996). In Louisiana, the Dolet Hills and Naborton aquifers are delineated near the base of the Wilcox aquifer in southeastern DeSoto Parish (fig. 3). The Wilcox aquifer is exposed to land surface throughout most of the study area (Ryder, 1996; Renken, 1998). Towards the edge of the Sabine uplift, the Wilcox aquifer is overlain by and hydraulically connected to the lower Claiborne-upper Wilcox aquifer, which in some reports is referred to as the Carrizo-Wilcox aquifer.

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

System	Series	Group	Northwestern Louisiana		East-Central Texas	
			Stratigraphic unit	Hydrogeologic unit	Stratigraphic unit	Hydrogeologic unit
Quaternary	Holocene and Pleistocene	Unnamed	Terrace and alluvial deposits	Terrace deposits, Red River alluvial aquifer, and unnamed Pleistocene deposits	Terrace and alluvial deposits	Terrace, alluvial, and unnamed Pleistocene deposits
Tertiary	Eocene	Claiborne	Cockfield Formation	Upper Claiborne aquifer	Yegua Formation	Upper Claiborne aquifer
			Cook Mountain Formation	Middle Claiborne confining unit	Cook Mountain confining unit	Middle Claiborne confining unit
			Sparta Sand	Middle Claiborne aquifer	Sparta Sand Weches Formation Queen City Sand	Middle Claiborne aquifer
			Cane River Formation	Lower Claiborne confining unit	Reklaw Formation	Lower Claiborne confining unit
			Carrizo Sand	Lower Claiborne-upper Wilcox aquifer	Carrizo Sand	Lower Claiborne-upper Wilcox aquifer
			?	?	?	?
	Paleocene	Wilcox	Undifferentiated deposits of the Wilcox Formation	Undifferentiated Wilcox aquifer	Undifferentiated deposits of the Wilcox Formation	Middle Wilcox aquifer
			Dolet Hills Fm. Naborton Fm.	Dolet Hills aquifer Naborton aquifer		
		Midway	Undifferentiated Midway	Midway confining unit	Midway Group	Midway confining unit

Figure 2. Partial column of hydrogeologic units in northwestern Louisiana and east-central Texas. Figure modified from Lovelace and Lovelace, 1995; Ryder, 1996; Renken, 1998; Boghici, 2009.

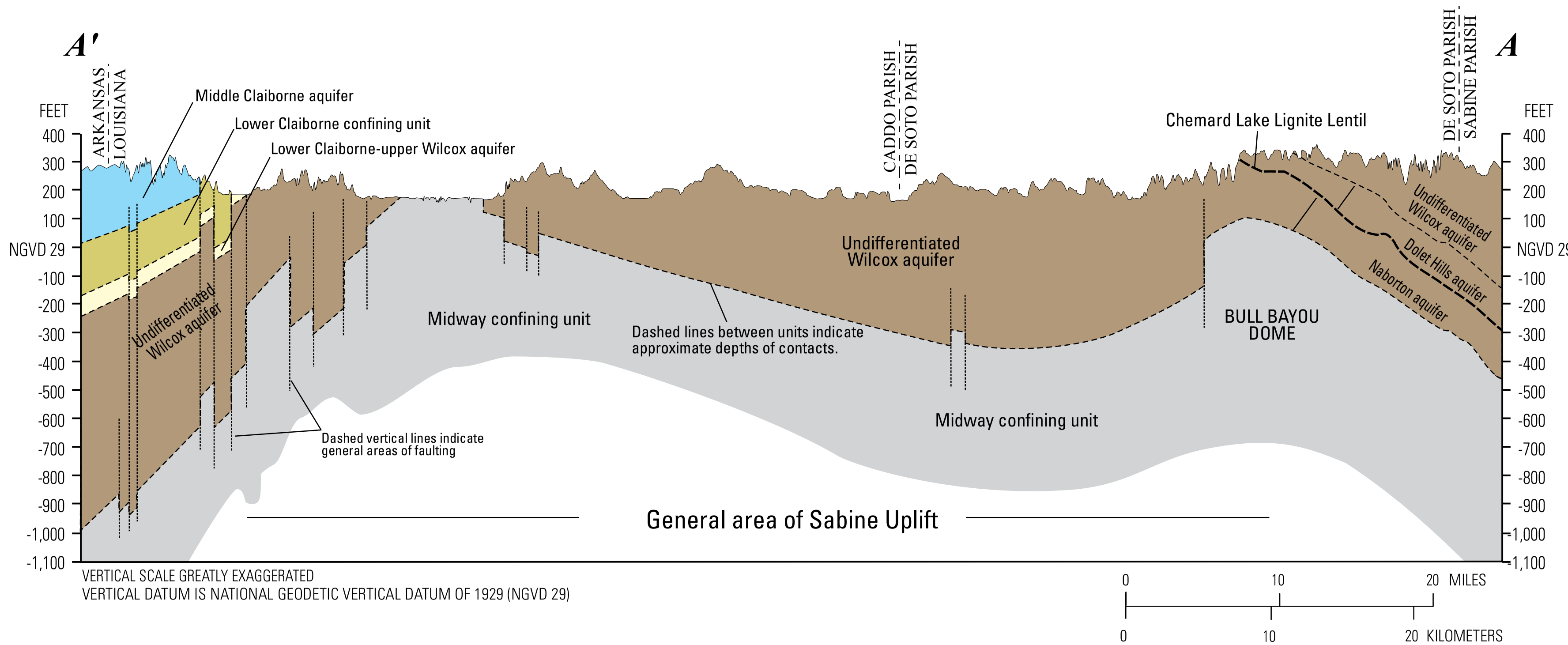

Figure 3. Idealized north-south hydrogeologic section of Caddo Parish and part of De Soto Parish, Louisiana. Figure modified from Rapp, 1996; Snider, 1982; Payne, 1975; and Page and May, 1964.

Land Use, Population, and Water Use

The land uses in the study area are forest (66 percent), agriculture (20 percent), wetlands (7 percent), lakes and rivers (3 percent), urban (2 percent), and barren (2 percent) (fig. 4) (Kerie Hitt, U.S. Geological Survey, written commun., 2006). In 2000, the total population in the study area was 652,586 (U.S. Census Bureau, 2006). The largest populations by parish or county were in Caddo Parish, La. (252,161); Bossier Parish, La. (98,310); and Nacogdoches County, Tex. (59,203). The largest populations by city were in Shreveport, La. (200,145); Bossier City, La. (56,461); and Nacogdoches, Tex. (29,914).

Groundwater is the primary source of potable water in northwestern Louisiana and east-central Texas. In 2005, groundwater withdrawals in the seven Louisiana parishes in the study area provided about 37.2 million gallons per day (Mgal/d): about 11.4 Mgal/d for industrial, 9.6 Mgal/d for public supply, 5.6 Mgal/d for domestic supply, 5.3 Mgal/d for irrigation, and 5.2 Mgal/d for other uses (U.S. Geological Survey, 2010). In 2005, groundwater withdrawals in the six Texas counties in the study area provided about 40.9 Mgal/d: about 22.6 Mgal/d for public supply, 8.6 Mgal/d for domestic supply, 2.1 Mgal/d for industrial, 0.4 Mgal/d for irrigation, and 7.2 Mgal/d for other uses (U.S. Geological Survey, 2010; Texas Water Development Board, 2010). Water-withdrawal data by aquifer were available for Louisiana and during 2004–05, the Carrizo-Wilcox aquifer provided about 17.6 Mgal/d of water in northwestern Louisiana, including 7.5 Mgal/d for public supply, 4.6 Mgal/d for domestic supply, 2.9 Mgal/d for irrigation, 2.3 Mgal/d for industrial uses, and 0.3 Mgal/d for livestock (Sargent, 2007). Most (about 70 percent) of the groundwater used for public supply and domestic use in the study area in Lousianan was withdrawn from the Wilcox aquifer.

Methods

During December 2003 - September 2004, water-quality data were collected from 92 randomly selected domestic wells in the Wilcox aquifer in northwestern Louisiana (79 wells) and east-central Texas (13 wells) for this study. Water-quality samples were collected using USGS parts-per-billion national protocols (Wilde and Radtke, 1999). Standardization of data-collection protocols was intended to produce reliable data for statistical interpretations; however, because of local conditions, modification of the national protocols sometimes was necessary. The following sections describe how the protocols were applied and, when necessary, how they were modified.

Well-Site Selection

Wells sampled for this study were selected following criteria published in Lapham and others (1997) and Koterba (1998). For a random distribution of wells, a computer program (Scott, 1990) was used to divide the study area into a grid of 100 equal-area cells. A well was successfully located and sampled in 92 of the 100 cells. Well-registration records were obtained for the selected wells to review hydrogeologic code assignment. The 79 wells sampled in Louisiana during this study were selected from the DOTD State well-registration data base. The 13 wells sampled in Texas were identified through field reconnaissance for each cell.

Well-Construction Data and Water Levels

Site and well-construction data were obtained from well-registration forms and well owners. Well-construction data for the sampled wells are listed in table 1. Ninety wells were constructed of polyvinyl chloride (PVC), and two wells were constructed of steel. Land-surface elevations for the wells ranged from 154 to 399 ft above NGVD 29. The wells ranged in depth from 55 to 425 ft below land surface, with a median of 211 ft. Well casing diameters were 3 or 4 in., and screen diameters ranged from 1.25 to 4 in. Screened intervals ranged from 9 to 105 ft in length, with a median of 20 ft for those wells with known screened intervals. Water levels were measured in 30 wells and ranged from 6.48 to 130.67 ft below land surface.

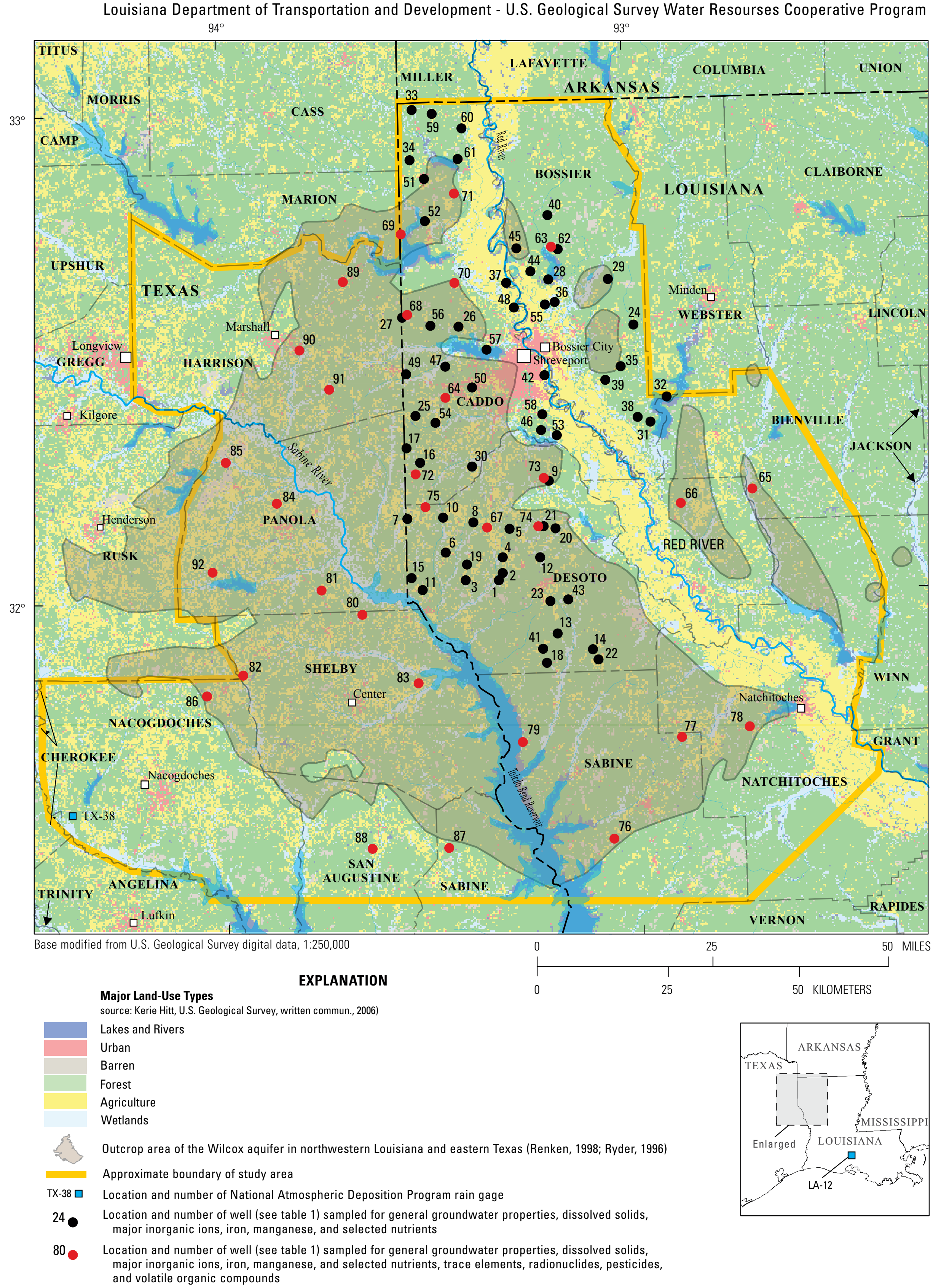

Figure 4. Map showing major land-use types and location of selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.

Table 1. Description of selected domestic wells screened in the Wilcox aquifer in northwestern Louisiana and east-central Texas.

[State well numbers are assigned by the Louisiana Department of Transportation and the Development or the Texas Water Development Board. NGVD 29, National Geodetic Vertical Datum of 1929; casing material: P, polyvinyl chloride or S, steel; 124WLCX, Wilcox aquifer; U, unknown; --, no data]

Well number (fig. 1)	State well number	Date well constructed	Casing material	Land surface elevation above NGVD 29 (feet)	Well depth (feet below land surface)	Diameter of well (inches)	Diameter of screen (inches)	Screened interval(s) (feet below land surface)	Screen length (feet)	Water-level measurement date	Water level (feet below land surface)
Wells sampled in northwestern Louisiana											
1	Ds-UR001	1975	P	275	180	4	4	U	U	--	--
2	Ds-UR002	1970	P	295	180	4	4	U	U	--	--
3	Ds-UR003	U	P	250	225	4	4	U	U	--	--
4	Ds-UR004	1945	S	295	165	4	4	U	U	--	--
5	Ds-UR005	2002	P	315	350	4	4	U	U	--	--
6	Ds-5472Z	5/7/1988	P	318	290	4	1.5	240-290	50	--	--
7	Ds-91	1953	S	280	160	4	4	U	U	--	--
8	Ds-5222Z	8/13/1985	P	325	280	4	4	260-280	20	--	--
9	Ds-5481Z	9/12/1987	P	171	268	4	4	248-268	20	--	--
10	Ds-7041Z	11/12/2001	P	271	220	4	4	200-220	20	--	--
11	Ds-6211Z	5/17/1996	P	216	80	4	4	60-80	20	--	--
12	Ds-6832Z	10/6/2000	P	220	280	4	1.5	180-280	100	--	--
13	Ds-6045Z	5/1/1995	P	304	120	4	4	100-120	20	--	--
14	Ds-6622Z	6/19/1999	P	310	160	4	4	140-160	20	--	--
15	Ds-6425Z	9/17/1997	P	225	400	4	4	360-400	40	--	--
16	Cd-6028Z	12/1/1987	P	354	97	4	4	88-97	9	--	--
17	Cd-9320Z	5/28/2001	P	374	160	4	4	140-160	20	--	--
18	Ds-5297Z	12/20/1985	P	270	170	4	4	160-170	10	--	--
19	Ds-6576Z	4/15/1999	P	320	212	4	4	197-212	15	--	--
20	Ds-6771Z	6/29/2000	P	210	340	4	4	280-340	60	--	--
21	Ds-5223Z	2/26/1985	P	247	230	4	1.25	200-225	25	--	--
22	Ds-5378Z	11/4/1986	P	361	394	4	4	379-394	15	--	--
23	Ds-5550Z	10/7/1988	P	329	197	4	4	167-197	30	--	--
24	Bo-8740Z	9/7/2001	P	180	240	4	4	220-240	20	--	--
25	Cd-8080Z	7/27/1995	P	340	220	4	1.5	180-220	40	--	--
26	Cd-6189Z	7/1/1988	P	260	180	4	4	110-130; 140-160	20; 20	--	--
27	Cd-6410Z	3/27/1989	P	309	107	4	2	87-107	30	--	--
28	Bo-UR001	1985	P	190	265	4	4	U	U	--	--
29	Bo-7250Z	3/8/1995	P	241	100	4	4	80-100	20	--	--
30	Cd-8822Z	7/2/1998	P	246	300	4	4	260-300	40	--	--
31	Bo-8136Z	4/8/1999	P	190	240	4	1.5	200-240	40	--	--
32	Bo-7323Z	8/22/1985	P	154	163	4	4	153-163	10	--	--
33	Cd-5373Z	3/20/1994	P	223	320	4	2	260-320	60	--	--
34	Cd-9892Z	10/4/2003	P	196	235	4	4	215-235	20	--	--
35	Bo-5294Z	4/7/1984	P	210	70	4	4	60-70	10	--	--

Table 1. Description of selected domestic wells screened in the Wilcox aquifer in northwestern Louisiana and east-central Texas.—Continued

[State well numbers are assigned by the Louisiana Department of Transportation and the Development or the Texas Water Development Board. NGVD 29, National Geodetic Vertical Datum of 1929; casing material: P, polyvinyl chloride or S, steel; 124WLCX, Wilcox aquifer; U, unknown; --, no data]

Well number (fig. 1)	State well number	Date well constructed	Casing material	Land surface elevation above NGVD 29 (feet)	Well depth (feet below land surface)	Diameter of well (inches)	Diameter of screen (inches)	Screened interval(s) (feet below land surface)	Screen length (feet)	Water-level measure-ment date	Water level (feet below land surface)
Wells sampled in northwestern Louisiana -- Continued											
36	Bo-5455Z	10/20/1985	P	170	160	4	4	140-160	20	--	--
37	Cd-8687Z	5/13/1998	P	180	140	4	4	120-130	10	--	--
38	Bo-7655Z	9/30/1996	P	203	265	4	1.5	160-265	105	--	--
39	Bo-7965Z	8/18/1998	P	203	80	4	4	60-80	20	--	--
40	Bo-7952Z	6/11/1998	P	240	300	4	1.5	240-300	60	--	--
41	Ds-6541Z	10/4/1998	P	323	239	4	4	229-239	10	--	--
42	Cd-8906Z	6/1/1999	P	165	192	3	2	172-192	20	--	--
43	Ds-5163Z	9/25/1984	P	325	260	4	4	220-260	40	--	--
44	Bo-8981Z	11/6/2002	P	198	180	4	4	160-180	20	--	--
45	Bo-6697Z	6/19/1991	P	209	280	4	1.5	250-280	30	--	--
46	Cd-9784Z	5/14/2003	P	186	220	4	4	200-220	20	--	--
47	Cd-8023Z	5/25/1995	P	233	140	4	4	120-140	20	--	--
48	Cd-6112Z	5/25/1988	P	175	180	4	4	170-180	10	--	--
49	Cd-9866Z	8/10/2003	P	252	200	4	4	165-200	35	--	--
50	Cd-8118Z	10/5/1995	P	252	220	4	4	200-220	20	--	--
51	Cd-8782Z	11/6/1998	P	260	180	4	4	160-180	20	--	--
52	Cd-6742Z	7/18/1990	P	182	150	4	4	120-150	30	--	--
53	Cd-5221Z	8/14/1984	P	160	250	4	4	220-250	30	--	--
54	Cd-7826Z	3/30/1994	P	230	200	4	4	180-200	20	--	--
55	Bo-8405Z	6/27/2000	P	170	180	4	4	160-180	20	--	--
56	Cd-9160Z	5/23/2000	P	260	55	4	4	40-55	15	--	--
57	Cd-5556Z	3/24/1986	P	180	170	4	4	128-143	15	--	--
58	Cd-8861Z	3/11/1999	P	200	283	4	4	223-283	60	--	--
59	Cd-5631Z	3/8/1986	P	340	425	4	2	355-425	70	--	--
60	Cd-5697Z	10/16/1986	P	225	250	4	2	170-250	80	--	--
61	Cd-6594Z	2/12/1990	P	240	215	4	4	195-215	20	--	--
62	Bo-7530Z	4/16/1996	P	189	225	4	4	205-225	20	--	--
63	Bo-8991Z	9/9/2002	P	261	280	4	1.5	200-280	80	8/2/2004	81.59
64	Cd-8122Z	9/5/1995	P	278	180	4	4	160-180	20	8/3/2004	60.42
65	Bi-6092Z	2/15/2001	P	160	200	4	4	180-200	20	8/3/2004	10.73
66	Rr-5548Z	6/25/1998	P	250	130	4	4	110-130	20	8/3/2004	55.66
67	Ds-5442Z	2/3/1992	P	345	260	4	4	240-260	20	8/3/2004	57.09
68	Cd-9080Z	3/7/2000	P	300	65	4	4	45-65	20	8/2/2004	6.48
69	Cd-8586Z	11/20/1997	P	191	140	4	4	130-140	10	8/6/2004	20.86
70	Cd-6002Z	10/21/1987	P	269	160	4	4	120-160	40	8/6/2004	86.76
71	Cd-8434Z	11/3/1996	P	250	195	4	4	175-195	20	8/6/2004	82.33

Table 1. Description of selected domestic wells screened in the Wilcox aquifer in northwestern Louisiana and east-central Texas.—Continued

[State well numbers are assigned by the Louisiana Department of Transportation and the Development or the Texas Water Development Board. NGVD 29, National Geodetic Vertical Datum of 1929; casing material: P, polyvinyl chloride or S, steel; 124WLCX, Wilcox aquifer; U, unknown; --, no data]

Well number (fig. 1)	State well number	Date well constructed	Casing material	Land surface elevation above NGVD 29 (feet)	Well depth (feet below land surface)	Diameter of well (inches)	Diameter of screen (inches)	Screened interval(s) (feet below land surface)	Screen length (feet)	Water-level measure-ment date	Water level (feet below land surface)
Wells sampled in northwestern Louisiana -- Continued											
72	Cd-8956Z	7/2/1999	P	380	80	4	4	60-80	20	8/13/2004	40.62
73	Ds-6687Z	1/18/2000	P	180	300	4	4	280-300	20	8/13/2004	22.93
74	Ds-6028Z	2/14/1995	P	250	240	4	4	220-240	20	8/13/2004	65.01
75	Ds-6458Z	1/28/1998	P	310	240	4	4	220-240	20	8/18/2004	33.52
76	Sa-5510Z	7/29/1992	P	240	210	4	4	190-210	20	8/23/2004	28.83
77	Sa-5676Z	5/17/1995	P	200	228	4	4	208-228	20	8/20/2004	42.6
78	Na-5037Z	8/28/1984	P	191	319	4	4	306-316	10	8/18/2004	60.67
79	Sa-5561Z	6/17/1993	P	200	120	4	4	100-120	20	9/2/2004	44.23
Wells sampled in east-central Texas											
80	XB-37-07-3	2/4/2001	P	308	191	4	4	167-187	20	8/24/2004	15.98
81	UL-35-62-9	4/24/2002	P	339	79	4	4	64-77	13	8/24/2004	44.81
82	XB-37-16-3	10/23/1995	P	337	270	4	4	250-270	20	8/24/2004	64
83	XB-37-16-6	6/27/2003	P	300	245	4	4	230-245	15	8/24/2004	130.67
84	UL-35-54-401	1981	P	312	210	4	4	190-210	20	9/7/2004	51.63
85	UL-35-45-705	1984	P	270	100	4	4	50-90	40	9/7/2004	42.89
86	TX-37-12-6	3/8/2003	P	399	250	4	4	230-250	20	9/7/2004	72.62
87	WT-36-33-2	6/14/2003	P	326	80	4	4	70-80	10	9/11/2004	28.82
88	WT-37-39-3	6/7/2003	P	332	245	4	4	235-245	10	9/11/2004	19.2
89	LK-35-23-8	7/12/2002	P	290	220	4	4	160-200	40	9/16/2004	82.49
90	LK-35-30-8	3/29/2004	P	313	95	4	4	50-80	30	9/16/2004	13.98
91	LK-35-39-4	2/7/2003	P	356	215	4	4	180-190; 200-210	20	9/16/2004	75.77
92	UL-35-60-6	10/7/2003	P	379	330	4	4	285-325	40	9/21/2004	126.37

Groundwater Sample Collection and Processing

Water samples were collected from a Teflon discharge line connected to a spigot near the wellhead and before the pressure tank if possible. In many wells the pressure gage was removed and a spigot assembly was added. Wells were sampled at the nearest spigot available if no access points were available before the pressure tank. Wells were purged of three casing volumes to remove possible stagnant water and to quality-assure representative aquifer water (Gibs and Wilde, 1999). General groundwater properties, specific conductance, pH, temperature, and dissolved oxygen (DO), were measured about every 5 minutes in a closed-cell, flow-through chamber until stable readings were obtained (Wilde, variously dated). Water was redirected to the clean sampling chamber and immediately collected in the appropriate containers for analysis. Water samples were collected in the appropriate bottles using required filtering apparatus and preservative when necessary. Turbidity was measured on-site using a portable turbidimeter.

Samples for chemical analyses were collected and processed according to parts-per-billion-level protocols described in Koterba and others (1995) and the USGS National Field Manual (U.S. Geological Survey, 1997 to present). To minimize the risk of contamination, all sample collection and preservation took place in environmental chambers consisting of clear polyethylene bags supported by a PVC frame. The polyethylene bags that formed the sample-collection and sample-preservation chambers were replaced after each group of constituents was collected. After all samples were collected at a well, sampling equipment was cleaned thoroughly using a progression of nonphosphate detergent wash, tap-water rinse, and a final deionized-water rinse. All sampling equipment was stored in clean plastic bags or containers for transport between sample-collection sites.

Samples for analysis of four biological indicators, total coliform, *E. coli*, and *E. coli* F-specific and *E. coli* somatic coliphage, were collected at the wellhead. The spigot was sterilized with isopropyl alcohol, air dried, and rinsed with deionized water. Tap water was run for about 10 seconds prior to collection of the sample to remove any residual isopropyl alcohol or deionized water. Samples for total coliform and *E. coli* (Myers, 2003a) and coliphage (Myers, 2003b) were processed according to USGS field methods (U.S. Geological Survey, 1997 to present).

Laboratory methods used to analyze the water samples are listed in table 2. Samples were chilled and shipped to the USGS National Water Quality Laboratory (NWQL) in Lakewood, Colo., for analysis of color, TDS, major inorganic ions, trace elements, radon, selected nutrients, TOC, pesticides and degradation products, and VOCs. Water from selected wells was sent to the (1) USGS laboratory in Boulder, Colo., for analysis of DOC and DOC fractionation; (2) USGS laboratory in Reston, Va., for analysis of radium-224; (3) Eberline Services in Richmond, Calif., for analysis of radium-226 and -228 and gross-alpha and gross-beta radioactivity; (4) USGS Tritium Laboratory, Menlo Park, Calif., for analysis of tritium; and (5) USGS laboratory in Columbus, Ohio, for analysis of total coliform, *E. coli*, and coliphage. Water-quality data are tabulated in appendixes (1 through 10) at the back of this report.

Quality-Control Data and Analysis

Quality-control (QC) data were collected to ensure that sample-collection, sample-processing, and laboratory-analytical procedures did not introduce bias into results and to determine the accuracy and precision associated with collection and analysis of samples. The QC samples collected included blank, replicate environmental, and spike samples (Mueller and others, 1997). Blank samples were collected to verify that decontamination procedures were sufficient and that collection and analytical procedures did not contaminate the samples. Replicate environmental samples were collected to assess the effects of sample collection and laboratory analysis on measurement accuracy and precision. The pesticide and VOC spiked samples were environmental samples to which known concentrations of analytes were added to determine the accuracy and precision of organic analyses, the stability of analytes during typical holding times, and whether characteristics of the environmental sample might interfere with the analysis (matrix effects).

Three types of blank samples included equipment, field, and source-solution. The equipment blank was collected at the USGS laboratory in Baton Rouge prior to all sampling. Equipment- and field-blank samples consisted of universal (inorganic-free and organic-free) blank water which was passed through all sampling equipment, collected in the appropriate bottles, and, when required, treated with the proper preservative. The source-solution blank consisted of universal blank water poured directly into the appropriate bottle at a well, for

Table 2. Laboratory methods used to analyze water samples collected from selected domestic wells screened in the Wilcox aquifer in northwestern Louisiana and east-central Texas.

[IC, ion chromatography; ICP, inductively coupled plasma; ISE, ion selective electrode; MS, mass spectrometry; UV, ultraviolet; USEPA, U.S. Environmental Protection Agency]

Property or constituent	Analytical method	Reference
Dissolved solids, major inorganic ions, and color	Colorimetry, gravimetric, IC, ICP, or ISE	Fishman and Friedman (1989), Fishman (1993)
Trace elements	ICP-MS	Faires (1993), McLain (1993), Garbarino (1999)
Nutrients	Colorimetry	Fishman (1993), U.S. Environmental Protection Agency (1993), Patton and Kryskalla (2003)
Total organic carbon and dissolved organic carbon	UV-persulfate oxidation and infrared spectrometry (USEPA method 415.1)	Brenton and Arnett (1993); American Public Health Association (1992, 1995, 1998)
Radon-222 (radon)	Liquid scintillation	American Society for Testing and Materials (1996)
Radium-224	Alpha spectrographic measurement	U.S. Environmental Protection Agency (2006a)
Radium-226	Radon emanation technique (USEPA method 903.1)	U.S. Environmental Protection Agency (2006a)
Radium-228	Radiochemical methodology (USEPA method 904.0)	U.S. Environmental Protection Agency (2006a)
Gross-alpha and gross-beta radioactivity	Evaporation (USEPA method 900.0)	U.S. Environmental Protection Agency (2006a)
Tritium	Liquid scintillation (USEPA method 906.0)	U.S. Environmental Protection Agency (2006a)
Pesticides and pesticide degradation products	Solid-phase extraction using a carbon-18 cartridge and gas chromatography/mass spectrometry	Zaugg and others (1995)
	Determination of low concentrations of acetochlor in water by automated solid-phase extraction and gas chromatography with mass selective detection	Lindley and others (1996)
	Fipronil and degradates in water by gas chromatography/mass spectrometry	Madsen and others (2003)
Volatile organic compounds	Gas chromatography/mass spectrometry	Connor and others (1997)
Total coliform and Escherichia coli	Membrane filtration using a simultaneous detection technique (USEPA method 1604)	U.S. Environmental Protection Agency (2002d)
Coliphage	Escherichia coli F-specific and Escherichia coli somatic coliphage in water by two-step enrichment procedure (USEPA method 1601)	U.S. Environmental Protection Agency (2001)

example well 63. The equipment and source-solution blanks were analyzed for specific conductance, nutrients, VOCs, and trace elements. Field-blank samples were collected and analyzed for TOC (well 2); radionuclides (well 84); biological indicators (wells 80 and 90); pesticides (wells 63 and 84); TDS, major inorganic ions, and selected nutrients (wells 2, 63, and 84); DOC and VOCs at three wells (63, 84, and 86); and general groundwater properties and selected trace elements (wells 2, 63, 84, and 86).

Five compounds were detected at low levels in the equipment-blank sample: estimated[1] (E) concentrations for boron, selenium, uranium, and orthophosphate, and a detected concentration of 0.09 µg/L, for nickel. Three

[1] The estimated value (E) of a concentration is reported when an analyte is detected and all criteria for a positive result are met. If the concentration is less than the method detection limit (MDL), an "E" code will be reported with the value. If the analyte is qualitatively identified as present, but the quantitative determination is substantially more uncertain, the USGS National Water Quality Laboratory will identify the result with an "E" code although the measured value is greater than the MDL. A value reported with an "E" code should be used with caution (Childress and others, 1999). When no analyte is detected in a sample, the analytical reporting level is the Laboratory Reporting Limit (LRL) preceded by a less than sign (<). The LRL is set at twice the LT-MDL. The LRL is set to limit the false negative rate to less than or equal to 1 percent.

concentrations for calcium, one for sodium, and two for silica were detected in the three major-inorganic-ion field-blank samples, all of which were low (less than or equal to 0.08 mg/L) compared to the respective environmental samples. One concentration for TDS, 19 mg/L, was detected in the field-blank sample collected at well 63, more than 50 times less than the concentration of 1,010 mg/L for the environmental sample. Trace elements cobalt (0.031 µg/L), copper (E0.40 µg/L), lead (0.21 µg/L), manganese (0.30 µg/L), molybdenum (E0.40 µg/L), nickel (1.43 µg/L), and zinc (0.70 µg/L) were detected in the field-blank sample from well 63; no trace elements were detected in the other two field-blank samples. No concentrations of TOC were detected in the field-blank sample collected at well 2. A DOC concentration of 0.3 mg/L was detected in the field-blank sample collected at well 63. No nutrients were detected in the field-blank samples. Low concentrations of radionuclides (radium-226, 0.05 pCi/L; radium-228, M[2]; gross-alpha radioactivity, both 72-hour and 30-day counts, M; gross-beta radioactivity, 72-hour count, 1 pCi/L; and beta radioactivity, 30-day count, M) were detected in the field-blank sample collected at well 84. No concentrations of pesticides, pesticide degradation products, or VOCs were detected in the field-blank samples collected at wells 63 and 80. No total coliform, *E. coli*, or *E. coli* F-specific and *E. coli* somatic coliphage was detected in the two biological field-blank samples collected at wells 80 and 90. The results of the field-blank sample analyses indicated that field conditions and decontamination procedures were adequate to prevent contamination of samples. No nutrients, VOCs, or trace elements were detected in the source-solution blank.

Replicate environmental samples were collected and analyzed for the following constituents or properties at the wells indicated: tritium, radium-224, -226, -228 and gross-alpha and -beta radioactivity (well 63); radon, nutrients, pesticides and pesticide degradation products, and VOCs (wells 63 and 80); TOC (wells 6, 23, and 43); trace elements and DOC (wells 63, 79, and 80); TDS, major inorganic ions, iron, nitrite, and nitrite plus nitrate (wells 6, 23, 43, 63, and 80); general groundwater properties and manganese (wells 6, 23, 43, 63, 79, and 80); and total coliform, *E. coli*, and coliphage (wells 63—92). The relative percent difference (RPD) between the environmental sample and the corresponding replicate sample was calculated by multiplying 100 by the absolute value of the difference in the replicate concentration and the environmental concentration divided by the average of the replicate and environmental concentrations. Estimated values and non-detections were considered low and were not included in the comparisons. The RPDs were greater than 10 percent in 18 of 617 sample pairs (approximately 3 percent of the sample pairs). Ten trace element RPDs exceeded 10 percent: two values for nickel (25 and 77 percent) and vanadium (12 and 133 percent); and one value for boron (29 percent), cobalt (24 percent), copper (54 percent), molybdenum (28 percent), iron (13 percent), and zinc (13 percent). Concentrations of metals with these RPDs were low (less than 5 µg/L) in all sample pairs except for boron (843 µg/L for the paired environmental and1, 130 µg/L for its replicate). Other RPDs that exceeded 10 percent were two values for radon-222 (16 and 17 percent), and one value for sulfate (24 percent), radon-226 (22 percent), organic carbon (22 percent), beta radioactivity (28 percent), total coliform (18 percent), and *E. coli*. (40 percent). Results of the replicate environmental sample analyses indicated an acceptable degree of laboratory precision and reproducibility.

Spiked solutions that contained known concentrations of targeted organic compounds were added in the field (field-spiked samples) to two environmental samples (wells 84 and 92) analyzed for pesticides and pesticide degradation products and at the NWQL (laboratory-spiked sample) to one environmental sample (well 79) analyzed for VOCs. Of the 51 pesticides and pesticide degradation products analyzed in the field-spiked samples, only two values, both from well 92, were outside expected laboratory recovery limits. One for phorate (22 percent) was slightly less the NWQL range of 26 to 131 percent, and one for terbufos (44 percent) was slightly less the NWQL range of 45 to 119 percent. VOC recovery from the laboratory-spiked sample was not reported by the laboratory and was assumed to be within the NWQL control limits. Results of the spiked-sample analyses indicated that sampling and analytical procedures adequately detected the pesticides, pesticide degradation products, and VOCs and that no major matrix effects existed.

[2] M is reported for extremely low concentrations, usually a result less than the reporting level, where a presence of material was verified but not quantified.

Statistical Techniques

The Spearman's rank correlation test (SAS Institute Inc., 1990) was used to determine if a relation existed among selected parameters, such as depth of well, specific conductance, pH, color, DO, TDS, calcium, magnesium, sodium, chloride, bicarbonate, arsenic, iron, lead, manganese, zinc, radon, radium-226, nitrite plus nitrate, and organic carbon. Correlation analysis assesses the relation between two variables and the strength of the relation (Helsel and Hirsch, 1993). The Spearman's rank correlation test was selected because water-quality data usually were nonparametric, and the number of samples was greater than 20 (Helsel and Hirsch, 1993).

Spearman's rank correlation test calculates a probability statistic (p-value) and a correlation coefficient (rho). The probability statistic relates to a confidence level, and the correlation coefficient indicates the strength of this correlation (general properties and chemical constituents). A positive correlation coefficient means that as the value of one variable increases, the value of the other variable also increases. A negative or inverse correlation coefficient means that as the value of one variable increases, the value of the other variable decreases (Helsel and Hirsch, 1993). The 90-percent confidence level used in this report indicated a 90-percent probability ($p \leq 0.1$) that a correlation was statistically significant. Variables with correlation coefficients of ≥ 0.6 were considered strongly correlated; variables with correlation coefficients of ≥ 0.4 but < 0.6 were considered moderately correlated; variables with correlation coefficients ≥ 0.2 and but < 0.4 were considered weakly correlated; and variables with correlation coefficients < 0.2 were considered not to be correlated. Concentrations less than the analytical reporting level were assigned a value of one-fourth the reporting level so they would not rank equal to that of a measured value.

The Mann-Whitney rank-sum test with an alpha value of 0.05 was used to compare selected parameters, namely well depth, specific conductance, pH, color, TDS, calcium, hardness, sodium, chloride, sulfate, and iron for the 92 domestic wells (W92) in this study to historical data for over 700 domestic wells completed in the Wilcox aquifer (WX) in Louisiana (U.S. Geological Survey, 2001). This nonparametric testing procedure was used to compare medians of rank-transformed data for these paired groups of wells. For historical data, only one value for each well for the selected parameter was used for comparision; the most recent value was used for wells having more than one value for a selected parameter.

Quality of Water in Domestic Wells

Comparisons were made between observed values for selected properties and constituents and their water-quality standards established by the USEPA for public-supply drinking water (U.S. Environmental Protection Agency, 2002a, 2006b). Although the 92 domestic wells sampled for this study are not used for a public-supply source of drinking water, comparisons of selected properties and constituents to the Maximum Contaminant Levels Goal (MCLGs)[3], Maximum Contaminant Levels (MCLs)[4], Secondary Maximum Contaminant Levels (SMCLs)[5], and two Health Advisories (HAs)[6] provide a frame of reference. The Lifetime HA is based on exposure of a 70-kilograms adult consuming 2 liters of water per day and includes an adjustment for possible carcinogenicity. The Drinking Water Equivalent Level HA is a lifetime exposure concentration protective of adverse, non-cancer health effects, that assumes all of the exposure to a contaminant is from drinking water.

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[3] The USEPA MCLG is the level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals.

[4] The USEPA MCL is the maximum permissible level of a contaminant that is allowed in drinking water and is an enforceable standard for public drinking-water supplies.

[5] The USEPA SMCL is a nonenforceable guideline regarding aesthetic effects (such as taste, odor, or color) or cosmetic effects (such as tooth or skin discoloration) caused by drinking water.

[6] The USEPA HA is a nonenforceable guideline that serves as an estimate of acceptable concentrations of a chemical constituent based on health effects information and serves as technical guidance to assist Federal, State, and local officials

General Groundwater Properties

A statistical summary for seven general groundwater properties and applicable water-quality standards are listed in table 3, and data for individual wells are listed in appendix 1. The median specific conductance (field) was 715 microsiemens per centimeter at 25 degrees Celsius (µS/cm), and concentrations ranged from 40 to 2,650 µS/cm. The field pH ranged from 4.4 to 8.7, and the median was pH 7.9. The SMCL range for pH is 6.5 to 8.5 (U.S. Environmental Protection Agency, 2006b); two values were less than pH 6.5 and 14 were greater than pH 8.5. The DO concentrations were < 1.0 mg/L in water from 71 of the 92 wells sampled (appendix 1), and the maximum was 6.0 mg/L (table 3). The median alkalinity (field), as calcium carbonate (CaCO3) was 244 mg/L, and concentrations ranged from 2 to 740 mg/L. The median turbidity was 0.6 NTRU, and water from eight wells exceeded the MCL of 5 NTRU. The median color was 5 PCU, and color values for water in 16 of the 80 wells exceeding the SMCL of 15 PCU. Specific conductance and pH were typical for the Wilcox aquifer (Page and May, 1964; Page and Preé, 1964).

Total Dissolved Solids and Major Inorganic Ions

A statistical summary and applicable water-quality standards for TDS and major inorganic ions are listed in table 3, and data for individual wells are listed in appendix 2. The TDS are an important indicator of water quality and, in uncontaminated groundwater, are the result of dissolution of rocks and sediments. The TDS concentrations in water from the 92 wells ranged from 33 to 1,460 mg/L with a median of 433 mg/L. The TDS concentrations for 35 wells were greater than the SMCL of 500 mg/L (U.S. Environmental Protection Agency, 2006b). Although water containing more than 500 mg/L of TDS is undesirable for drinking water and irrigation, it is used in many areas where less-mineralized water is not available. Sulfate, chloride, and fluoride were the only major inorganic ions with USEPA established water-quality standards (table 3). One concentration for sulfate and five for chloride were above this SMCL of 250 mg/L. Two concentrations of fluoride exceeded the SMCL of 2.0 mg/L, and one (6.5 mg/L in well 41) exceeded the MCL of 4.0 mg/L.

Water types were classified by the percentages of major inorganic ions in the water. Because the potassium concentrations were low, those concentrations were added to the sodium concentrations before the water types were classified. Individual cations or anions are listed as the dominant water type if the concentration is greater than 70 percent of the total cation or anion concentration in milliequivalents per liter. Mixed cation types had percentages of each cation between 10 percent and 70 percent of the total cations. Mixed anion types had percentages of each anion between 10 percent and 70 percent of the total anions. Water types were classified as sodium bicarbonate (41 wells), sodium bicarbonate chloride (24 wells), mixed cation mixed anion (13 wells), mixed cation bicarbonate (11 wells), sodium mixed anion (6 wells), mixed cation bicarbonate chloride (3 wells), sodium bicarbonate sulfate (2 wells), mixed cation sulfate chloride (1 well), and sodium magnesium mixed anion (1 well). The highest percentage cations were sodium in 87 wells and calcium in 5 wells. The highest percentage anions were bicarbonate in 84 wells, chloride in 7 wells, and sulfate in one well.

A Piper (trilinear) diagram summarizing concentrations of major inorganic ions in percentage of milliequivalents per liter in groundwater samples showed a linear relation in the cation part of the diagram (fig. 5). Two groups of wells were identified using percentage of cations: group A consisted of 19 wells with mixed cation percentages; and group B consisted of 73 wells with greater than 70 percent sodium. Well depths for group A ranged from 65 to 240 ft below land surface, and well depths for group B ranged from 55 to 425 ft below land surface. The median well depth for group A (130 ft below land surface) was less than for group B (220 ft below land surface). Shallow groundwater represented by group A in figure 5 is high in calcium and magnesium relative to sodium, possibly a result of mixing of rainfall (National Atmospheric Deposition Program/National Trends Network, 1998) and freshwater recharge (Appello and Postma, 1993) and subsequent chemical reactions within aquifer sediments, such as cation exchange and rock or mineral weathering (Hem, 1985, p. 6). The chemical composition of water in group B could be derived from cation exchange or the mixing of shallow groundwater with deeper groundwater, where the deeper groundwater generally is higher in sodium relative to calcium and magnesium in this aquifer (Rapp, 1996, p. 11).

Table 3. Summary statistics and Federal guidelines and standards for selected water-quality data from domestic wells screened in the Wilcox aquifer in northwestern Louisiana and east-central Texas, 2003-04.

[All chemical constituents are dissolved unless otherwise noted. USEPA, U.S. Environmental Protection Agency; MCLG, Maximum Contaminant Level Goal; MCL, Maximum Contaminant Level; SMCL, Secondary Maximum Contaminant; DWEL, Drinking Water Equivalent Level; µS/cm, microsiemens per centimeter at 25 degrees Celsius; --, no value available; °C, degrees Celsius; mg/L, milligrams per liter; NTRU, nephelometric turbidity ratio units; PCU, platinum-cobalt units; ROE, residue on evaporation; µg/L, micrograms per liter; E, estimated value; <, less than; ND, not detected; pCi/L, picocuries per liter; M, presence of material verified but not quantified; N/A, not applicable]

						USEPA drinking water standards			USEPA Health Advisories		
Property or constituent	**Number of detections/ number of samples**	**Analytical reporting level**	**Median of all samples**	**Minimum detection**	**Maximum detection**	**MCLG**	**MCL**	**SMCL**	**DWEL**	**Lifetime**	**Number of wells exceeding a MCLG, MCL, or SMCL**
General gound-water properties											
Specific conductance, field, in µS/cm at 25°C	92/92	1	715	40	2,650	--	--	--	--	--	--
pH, field, in standard units	92/92	0.1	7.9	4.4	8.7	--	--	6.5-8.5	--	--	16
Water temperature, in °C	92/92	0.1	20.7	17.3	23.5	--	--	--	--	--	--
Dissolved oxygen, in mg/L	92/92	0.1	0.3	0.1	6	--	--	--	--	--	--
Alkalinity, as $CaCO_3$, field, in mg/L	92/92	1	244	2	740	--	--	--	--	--	--
Turbidity, in NTRU	88/88	0.1	0.6	0.1	32	--	5	--	--	--	8
Color, in PCU	64/80	1	5	2	150	--	--	15	--	--	16
Dissolved solids and major inorganic ions, in mg/L											
Dissolved solids, ROE, at 180 °C	92/92	10	433	33	1,460	--	--	500	--	--	35
Hardness, mg/L as $CaCO_3$	92/92	1	26	1	470	--	--	--	--	--	--
Calcium, as Ca	92/92	0.02	6.68	0.28	80.8	--	--	--	--	--	--
Magnesium, as Mg	92/92	0.008	2.1	0.09	65.8	--	--	--	--	--	--
Sodium, as Na	92/92	0.2	135	2.51	573	--	--	--	--	--	--
Potassium, as K	92/92	0.16	1.88	0.4	7.87	--	--	--	--	--	--
Bicarbonate, as HCO_3 (calculated)	92/92	1	294	3	846	--	--	--	--	--	--
Carbonate, as CO_3	56/92	1	5	1	38	--	--	--	--	--	--
Sulfate, as SO4	73/92	0.2	3.35	E.00	280	--	--	250	--	--	1
Chloride, as Cl	92/92	0.02	44.6	1.37	608	--	--	250	--	--	5
Fluoride, as F	92/92	0.1	0.2	0.1	6.5	4	4	2	--	--	2
Bromide, as Br	30/30	0.02	0.13	0.02	2.14	--	--	--	--	--	--
Silica, as S	92/92	0.04	13.1	7.6	198	--	--	--	--	--	--

Table 3. Summary statistics and Federal guidelines and standards for selected water-quality data from domestic wells screened in the Wilcox aquifer in northwestern Louisiana and east-central Texas, 2003-04.—Continued

[All chemical constituents are dissolved unless otherwise noted. USEPA, U.S. Environmental Protection Agency; MCLG, Maximum Contaminant Level Goal; MCL, Maximum Contaminant Level; SMCL, Secondary Maximum Contaminant; DWEL, Drinking Water Equivalent Level; µS/cm, microsiemens per centimeter at 25 degrees Celsius; --, no value available; °C, degrees Celsius; mg/L, milligrams per liter; NTRU, nephelometric turbidity ratio units; PCU, platinum-cobalt units; ROE, residue on evaporation; µg/L, micrograms per liter; E, estimated value; <, less than; ND, not detected; pCi/L, picocuries per liter; M, presence of material verified but not quantified; N/A, not applicable]

						USEPA drinking water standards			USEPA Health Advisories		
Property or constituent	Number of detections/ number of samples	Analytical reporting level	Median of all samples	Minimum detection	Maximum detection	MCLG	MCL	SMCL	DWEL	Lifetime	Number of wells exceeding a MCLG, MCL, or SMCL
					Trace elements, in µg/L						
Aluminum, as Al	22/30	1.6	E1.5	E1	37	--	--	50-200	--	--	0
Antimony, as Sb	0/30	0.2	<.2	ND	ND	6	6	--	10	6	0
Arsenic, as As	11/30	0.12	<.2	E.1	2.2	0	10	--	10	--	11
Barium, as Ba	30/30	0.2	70	6	271	2,000	2,000	--	2,000	2,000	0
Beryllium, as Be	5/30	0.06	<.06	E.05	0.16	4	4	--	70	--	0
Boron, as B	30/30	8	199	E8	2,930	--	--	--	3,000[a]	600[a]	--
Cadmium, as Cd	3/30	0.04	<.04	0.11	1.52	5	5	--	20	5	0
Chromium, as Cr	4/30	0.04	<.8	E.7	2.4	100[b]	100[b]	--	100[b]	--	0
Cobalt, as Co	30/30	0.04	0.072	E.010	1.66	--	--	--	--	--	--
Copper, as Cu	24/30	0.4	0.4	E.2	38.6	1,300[c]	1,300[c]	1,000[c]	--	--	0
Iron, as Fe	91/92	6	29	E3	11,100	--	--	300	--	--	21
Lead, as Pb[c]	21/30	0.08	0.14	E.06	41.2	0	15[d]	--	--	--	21
Lithium, as Li	30/30	0.6	18.15	2.2	68.7	--	--	--	--	--	--
Manganese, as Mn	91/92	0.2	11.6	0.6	264	--	--	50	1,600	300	16
Molybdenum, as Mo	13/30	0.4	<.4	E.2	1.6	--	--		200	40	0
Nickel, as Ni	30/30	0.06	0.27	E.04	48.7	--	--		700	100	0
Selenium, as Se	12/30	0.08	<.4	E.2	5.2	50	50	--	200	50	0
Silver, as Ag	0/30	0.2	<.2	ND	ND	--	--	100	200	100	0
Strontium, as Sr	30/30	0.4	386	5.23	1,950	--	--	--	20,000	4,000	0
Thallium, as Tl	1/30	0.04	<.04	E.02	E.02	0.5	2	--	2	0.5	0
Uranium, as U	7/30	0.04	<.04	E.02	0.14	0	30	--	100	--	7
Vanadium, as V	29/30	0.1	0.7	E.1	3.5	--	--	--	--	--	--
Zinc, as Zn	26/30	0.6	3.4	E.5	659	--	--	5,000	10,000	2,000	0
					Radionuclides, in pCi/L						
Radon-222	30/30	1	340	50	1,050	0	300[e]	--	--	--	19
Radium-224	25/25	0.1	0.2	E.07	2.41	--	--	--	--	--	--
Radium-226	30/30	0.1	0.17	E.03	0.66	--	--	--	--	--	--
Radium-228	30/30	1	M	M	2	--	--	--	--	--	--
Radium-226/-228	30/30	N/A	0.17	E0.03	2.66	0[f]	5[f]	--	--	--	30
Gross-alpha radioactivity, 72-hour count, Th-230 curve	30/30	3	E1	M	8	0	15	--	--	--	30

Table 3. Summary statistics and Federal guidelines and standards for selected water-quality data from domestic wells screened in the Wilcox aquifer in northwestern Louisiana and east-central Texas, 2003-04.—Continued

[All chemical constituents are dissolved unless otherwise noted. USEPA, U.S. Environmental Protection Agency; MCLG, Maximum Contaminant Level Goal; MCL, Maximum Contaminant Level; SMCL, Secondary Maximum Contaminant; DWEL, Drinking Water Equivalent Level; µS/cm, microsiemens per centimeter at 25 degrees Celsius; --, no value available; °C, degrees Celsius; mg/L, milligrams per liter; NTRU, nephelometric turbidity ratio units; PCU, platinum-cobalt units; ROE, residue on evaporation; µg/L, micrograms per liter; E, estimated value; <, less than; ND, not detected; pCi/L, picocuries per liter; M, presence of material verified but not quantified; N/A, not applicable]

						USEPA drinking water standards			USEPA Health Advisories		
Property or constituent	Number of detections/ number of samples	Analytical reporting level	Median of all samples	Minimum detection	Maximum detection	MCLG	MCL	SMCL	DWEL	Lifetime	Number of wells exceeding a MCLG, MCL, or SMCL
Radionuclides, in pCi/L—Continued											
Gross-alpha radioactivity, 30-day count, Th-230 curve	30/30	3	M	M	3	--	15	--	--	--	30
Gross-beta radioactivity, 72-hour count, Cs-137 curve	30/30	4	E2	M	12	--	--	--	--	--	--
Gross-beta radioactivity, 30-day count, Cs-137 curve	30/30	4	E2	M	11	--	--	--	--	--	--
Tritium	5/5	1	E.6	E0.3	8	--	20,000	--	--	--	0
Nutrients and total and dissolved organic carbon, in mg/L											
Ammonia (NH_3), as N	25/30	0.04	0.6	E.02	1.39	--	--	--	--	30	--
Total nitrogen (NH_3+NO_2+NO_3 +organic N)	29/30	0.03	0.86	0.04	1.52	--	--	--	--	--	--
Nitrite plus nitrate, as N	31/92	0.06	<.06	0.02	3.4	10	10	--	--	--	0
Nitrate (NO_3), as N	30/91	0.04	<0.04	0.01	3.4	10	10	--	--	--	0
Nitrite (NO_2), as N	17/91	0.01	<.01	E.006	0.17	1	1	--	--	--	0
Orthophosphate, as P	29/30	0.006	0.138	0.008	1.45	--	--	--	--	--	--
Total organic carbon (TOC), as C	67/70	0.1	1.3	0.1	38	--	--	--	--	--	--
Dissolved organic carbon (DOC), as C	30/30	0.1	1.4	0.4	12.1	--	--	--	--	--	--

[a] USEPA Drinking Water Standards and Health Advisories are under review.

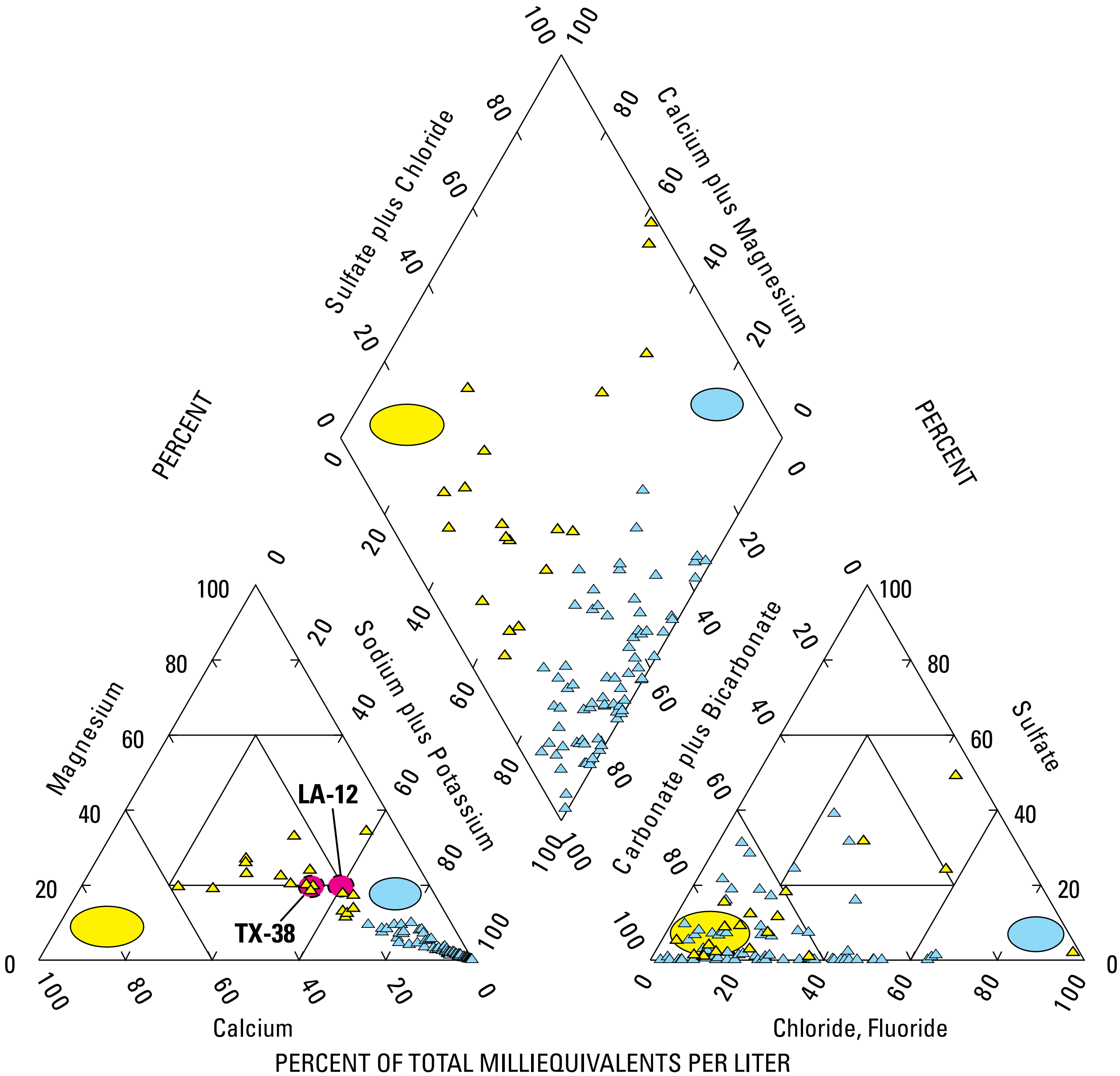
[b] USEPA Drinking Water Standards and Health Advisories are for total concentration (whole water).

[c] USEPA Drinking Water Standards and Health Advisories are for sample taken at tap.

[d] Treatment Technique (TT) - A USEPA action level; a process required for public water systems

[e] USEPA proposed MCL for radon.

[f] USEPA Drinking Water Standards and Health Advisories are for combined Radium 226 and 228.



EXPLANATION

Group A - 19 domestic wells with mixed cation percentages, those having two or more cations for which the percent of each was greater than 20 percent of the total cation concentration

Group B - 73 domestic wells with cation percentage greater than 70 percent sodium

TX-38 Circle represents NADP/NTN major inorganic cation rainfall data, 1986 to 1997

(National Atmospheric Deposition Program (NRSP-3)/National Trends Network, 1998) TX-38 is located at Forest Seed Center, Nacogdoches County, Texas about 15 miles southwest of the study area (see fig. 1) LA-12 is located at Iberia Research Station, Iberia Parish, Louisiana, about 150 miles southeast of the study area (see fig. 1)

Average world's freshwater composition (adapted from Appelo and Postma, 1993)

Average world's seawater composition (adapted from Appelo and Postma, 1993)

Figure 5. Piper diagram comparing major inorganic ions in water from selected domestic wells screened in the Wilcox aquifer, rainfall data from south Louisiana and east-central Texas, and average world's seawater and freshwater composition. Figure modified from Appello and Postma, 1993.

Trace Elements

A statistical summary and applicable water-quality standards for 23 trace elements are listed in table 3, and data for individual wells are listed in appendix 3. The 23 trace elements were analyzed in water from 30 wells, and iron and manganese were analyzed in water from 91 wells. The USEPA has established at least one drinking-water standard for 20 of the 23 trace elements (table 3). Concentrations in water from wells exceeded a USEPA drinking-water standard for five of these trace elements: iron (21 wells); manganese (16 wells); arsenic (11 wells); boron (8 wells); and uranium (7 wells). Concentrations of lead exceeded the USEPA MCLG of 0 µg/L in 21 samples and exceeded the MCL of 15 µg/L in 2 samples, including wells 81 (17.7 µg/L) and 87 (41.2 µg/L). Additionally, trace elements generally are present in groundwater at concentrations less than 1,000 µg/L (Drever, 1988, p. 326), and most trace elements detected in groundwater are metals or semimetallic elements produced from the weathering of minerals. Except for iron in water from 8 of the 92 wells and boron and strontium in 5 of the 30 wells, concentrations were less than 1,000 µg/L for all other trace elements (appendix 3).

Radionuclides

A statistical summary and applicable water-quality standards for selected radionuclides are listed in table 3, and data for individual wells are listed in appendix 4. Radionuclides are known human carcinogens when they radioactively decay. Long-term exposure to radionuclides in drinking water may cause cancer or toxic effects to the kidneys (U.S. Environmental Protection Agency, 2005).

Radon is a gas produced by the natural decay of uranium that is present in small quantities in certain rock and sediment types. Radon gas is soluble in water and is transported in groundwater. The USEPA recommends treating groundwater that has radon concentrations greater than 300 pCi/L (U.S. Environmental Protection Agency, 2002b). When radon gas is exposed to air, such as when groundwater is pumped from an aquifer for indoor use, the radon diffuses into the air where it can be inhaled. About 1 to 2 percent of radon in indoor air comes from drinking water (U.S. Environmental Protection Agency, 2002c). The entire State of Louisiana is classified in the lowest national risk zone, Zone 3, for indoor air concentrations of radon. However, high indoor-air radon values have been found in local areas of the state. A 1990 survey of homes in Louisiana showed elevated concentrations of radon in the indoor air (greater than the 4 pCi/L USEPA MCL) in only 10 of the 1,314 homes sampled, with 2 of these homes located in the study area (Louisiana Department of Environmental Quality, 1998).

Radon was analyzed in water from 30 wells and was detected in all 30 samples (table 3). Radon concentrations ranged from 50 to 1,050 pCi/L, with a median of 340 pCi/L. Radon concentrations in water from 19 wells were greater than or equal to 300 pCi/L, the proposed USEPA MCL.

Radium isotopes (radium-224, -226, -228) are decay products of uranium and thorium and are common in virtually all rock, soil, and water (U.S. Environmental Protection Agency, 2002b). Radium-226, radium-228, and uranium have been linked to increased rates of cancer, and uranium also has been linked to increased kidney toxicity (Bunnell and others, 2003).

Radium-224 was analyzed in water from 25 wells. Radium-226 and -228 were analyzed in water from 30 wells and were detected in all samples. Radium-224 concentrations ranged from an estimated value of 0.07 to 2.41 pCi/L; radium-226 concentrations ranged from an estimated value of 0.03 to 0.66 pCi/L; and radium-228 concentrations ranged from M (a level at which its presence was verified but not qualified) to 2 pCi/L. The USEPA has established a MCL of 5 pCi/L (table 3) for the combined concentrations of radium-226 and -228. The combined concentrations of radium-226 and -228 in the 30 wells sampled ranged from estimated value of 0.03 to 2.66 pCi/L, with no wells exceeding the MCL (table 3).

Alpha emitters occur naturally in the environment. Alpha particles are given off by uranium-238, radium-226, and other members of the uranium decay series, such as radon (U.S. Environmental Protection Agency, 2005). Alpha particles are present in varying amounts in most all rocks, soils, and water. The greatest exposure risk of alpha radiation comes from the inhalation of radon and its decay products. Beta emitters are both naturally occurring and man-made. Some radon decay products emit beta particles, but alpha emitting decay products of radon pose a much greater health risk. Fallout from nuclear testing from the early 1950's to 1970's spread strontium-90, a man-made beta emitter, into the environment worldwide; however, most of these particles have decayed away.

Gross-alpha and -beta radioactivity for 72-hour and 30-day counts were analyzed in water from 30 wells. Both the 72-hour and 30-day counts of gross-alpha radioactivity have an MCL of 15 pCi/L and an analytical reporting level of 3 pCi/L (table 3). The 72-hour count of gross-alpha radioactivity was detected in all 30 wells, with a median of an estimated value of 1 pCi/L, less than the analytical reporting level, and had a maximum concentration of 8 pCi/L, less than the USEPA MCL. The 30-day count of gross-alpha radioactivity was detected in all 30 wells, with a median of M (a level at which its presence was verified but not qualified), less than the analytical reporting level, and had a maximum concentration of 3 pCi/L, less than the USEPA MCL. Both the 72-hour count and 30-day count of gross-beta radioactivity had analytical reporting levels of 4 pCi/L. The EPA has not established a MCL for gross-beta radioactivity. The 72-hour count of gross-beta radioactivity was detected in all 30 wells, with a median of an estimated value of 2 pCi/L and a maximum concentration of 12 pCi/L. The 30-day count of gross-beta radioactivity was detected in all 30 wells, with a median of an estimated value of 2 pCi/L and a maximum concentration of 11 pCi/L.

Tritium, ^{3}H, is a naturally occurring and man-made radioactive isotope of hydrogen and has a half-life of 12.4 years (Plummer and Friedman, 1999). Atmospheric levels of tritium increased by three orders of magnitude during hydrogen bomb testing in the early 1950's. Measurable concentrations of tritium above 1 pCi/L in a water sample might indicate a sample contains some post-1950 water. Tritium was sampled in water from 5 wells and was detected in all 5 samples (appendix 4). Concentrations ranged from an estimated value of 0.3 to 8 pCi/L, with a median of an estimated value of 0.6 pCi/L. All concentrations were well below the USEPA MCL of 20,000 pCi/L (table 3). The tritium concentration of 8 pCi/L in well 68 indicated that this well may have received recharge since 1950 by water that originated at land surface.

Nutrients

Nutrients are nitrogen- or phosphorus-containing compounds that are necessary for plant growth and important for animal nutrition (Mueller and others, 1995). Although these compounds occur naturally, concentrations in groundwater or surface water can be increased through human activities such as fertilizer applications, discharge of sewerage and septic effluent, and atmospheric deposition from industrial emissions. Nitrate, one of the most widespread contaminants of groundwater, is highly soluble and very mobile and is susceptible to leaching through the soil with infiltrating water (Hallberg and Keeney, 1993). Nitrate is formed through a process called nitrification, where bacteria convert ammonia to nitrite, and then nitrite is converted to the more stable, much less toxic nitrate. Nitrification occurs only under aerobic conditions, generally at dissolved oxygen levels of 1.0 mg/L or more. Excessive nitrate concentrations (greater than 10 mg/L) may cause adverse human-health effects, such as methemoglobinemia (blue baby syndrome) (Hem, 1985, p. 125), and excessive nitrogen and phosphorus concentrations may cause adverse environmental effects, such as eutrophication of surface-water bodies (Hem, 1985). Nitrate concentrations in uncontaminated water usually are relatively small (generally less than 2 mg/L), and larger concentrations may indicate possible contamination from human activities (Mueller and Helsel, 1996).

A statistical summary and applicable water-quality standards for six nutrients are listed in table 3, and data for individual wells are listed in appendix 5. Nutrient concentrations for wells sampled were low, and none exceeded a drinking-water standard (table 3). Ammonia was analyzed in water from 30 wells, and had a median concentration of 0.60 mg/L and a maximum concentration of 1.39 mg/L. Total nitrogen (ammonia plus nitrite plus nitrate plus organic nitrogen) was analyzed in water from 30 wells, and had a median of 0.86 mg/L and a maximum concentration of 1.52 mg/L. Nitrite plus nitrate was detected in water from 31 of 92 wells sampled, and only one concentration, 3.4 mg/L in well 49, was greater than 2 mg/L. Nitrite concentrations can be determined within 48 hours of collection. Nitrite was detected in 17 of 91 wells sampled, and the maximum concentration was 0.17 mg/L. Nitrate is calculated by subtracting the nitrite concentration from the nitrite plus nitrate concentration. Nitrate concentrations were calculated for 30 of 91 wells sampled, and the maximum concentration was 3.4 mg/L, which indicated that most of the nitrite plus nitrate concentrations were in the more stable and less toxic form of nitrate. Orthophosphate was analyzed in water from 30 wells, and had a median of 0.138 mg/L and a maximum concentration of 1.45 mg/L.

Total and Dissolved Organic Carbon

The amount of organic carbon present in groundwater may affect microbial communities in an aquifer and, in turn, affect the concentration of redox-sensitive constituents such as DO, trace elements, and nutrients (Hem, 1985). The DOC concentrations (about 0.5 mg/L) typically occur naturally in groundwater, and higher concentrations can occur in areas with increased human activity (Drever, 1997) or increased organic material in aquifer sediments (Hem, 1985, p. 152). A statistical summary and applicable water-quality standards for TOC and DOC are listed in table 3, and data for individual wells are listed in appendix 5. The TOC was detected in water from 67 of 70 wells sampled; the median concentration was 1.3 mg/L, and the maximum concentration was 38 mg/L (table 3). Fifty-five TOC concentrations were greater than 0.5 mg/L, six of which were greater than 5 mg/L. The DOC was analyzed in water from 30 wells, and had a median concentration of 1.4 mg/L and a maximum concentration of 12.1 mg/L (table 3). Twenty-seven DOC concentrations were greater than 0.5 mg/L, three of which were greater than 5 mg/L. The relatively high TOC and DOC concentrations might be due to the presence of lignite (a low-grade coal) deposits throughout the Wilcox aquifer.

Pesticides and Pesticide Degradation Products

Pesticides are chemicals used to control unwanted vegetation, insects, and fungi. They are applied primarily to cropland in rural areas but also are used on lawns, gardens, and rights-of-way. The widespread use of pesticides creates the potential for the movement of these chemicals or their degradation products into shallow groundwater. The presence of pesticides or their degradation products in groundwater indicates an effect from human activities on groundwater quality and can be human-health concern for those using groundwater as a drinking-water supply (U.S. Environmental Protection Agency, 2011).

Data are listed for pesticides in appendix 6, pesticide degradation products in appendix 7, and pesticide surrogate recoveries in appendix 8. Forty-six pesticides and seven pesticide degradation products were analyzed in water from30 wells. No pesticides or pesticide degradation products were detected. Pesticide surrogates diazinon-d10 and alpha-HCH-d6 were analyzed with each sample. Recoveries, which ranged between 78.3 to 116 percent, were within the acceptable range for these surrogates, and, along with QC spike recoveries, verified the sampling results.

Volatile Organic Compounds

A statistical summary for VOCs detected and applicable water-quality standards are listed in table 4, and data for individual wells are listed in appendix 9; VOC surrogate recoveries are listed in appendix 8. The VOCs were analyzed in water from 30 wells and at least one VOC was detected in 20 of the wells (fig. 6). Of the 85 VOCs analyzed, 7 compounds were detected, 4 of which were detected in more than one sample (table 4). There were a total of 28 VOC detections. Of these detections, 10 were greater than estimated values, and all were less than the applicable drinking-water standard (U.S. Environmental Protection Agency, 2006b). The VOCs were detected throughout the study area with no particular area having a larger concentration of detections (fig. 6).

Table 4. Summary statistics for volatile organic compounds in water from 30 selected domestic wells screened in the Wilcox aquifer in northwestern Louisiana and east-central Texas, 2003-04.

[All concentrations are in micrograms per liter. MCL, Maximum Contaminant Level; E, estimated value; ---, no value available; M, presence of material verified but not quantified]

Volatile organic compound	Number of detections/ number of samples	Analytical reporting limit	Minimum detection	Maximum detection	Drinking-water standard	Type of standard[2]	Number of concentrations exceeding drinking-water standard
Benzene	1/30	0.02	0.36	0.36	5	MCL	0
Bromodichloromethane	1/30	0.03	0.17	0.17	80	MCL	0
Carbon disulfide	3/30	0.04	E.04[1]	0.18	---	---	---
Chloroform (trichloromethane)	8/30	0.02	E .02	0.91	80	MCL	0
Tetrahydrofuran	4/30	2	M	10	---	---	---
1,2,4-Trimethylbenzene	10/30	0.06	E .02	0.15	---	---	---
Toluene	1/30	0.05	E .01	E.01	1,000	MCL	0

[1] The estimated value (E) of a concentration is reported when an analyte is detected and all criteria for a positive result are met. If the concentration is less than the method detection limit (MDL), an "E" code will be reported with the value. If the analyte is qualitatively identified as present, but the quantitative determination is substantially more uncertain, the USGS National Water Quality Laboratory will identify the result with an "E" code although the measured value is greater than the MDL. A value reported with an "E" code should be used with caution (Childress and others, 1999). When no analyte is detected in a sample, the analytical reporting level is the Laboratory Reporting Limit (LRL) preceded by a less-than sign (<). The LRL is set at twice the LT-MDL. The LRL is set to limit the false negative rate to less than or equal to one percent.

[2] U.S. Environmental Protection Agency, 2002a

The VOCs detected in water were 1,2,4-trimethylbenzene (10 wells), chloroform (trichloromethane) (8 wells), tetrahydrofuran (4 wells), carbon disulfide (3 wells), and benzene, bromodichloromethane, and toluene (one well each). Only well 85 had water in which three VOCs were detected (bromodichloromethane, chloroform, and 1,2,4-trimethylbenzene). Six wells had water in which two VOCs were detected: carbon disulfide and 1,2,4-trimethylbenzene (wells 78, 82, and 86), tetrahydrofuran and 1,2,4-trimethylbenzene (well 65), benzene and 1,2,4-trimethylbenzene (well 69), and tetrahydrofuran and toluene (well 90). In water from 13 wells, only one VOC was detected: 1,2,4-trimethylbenzene (wells 63, 76, 77, and 79), chloroform (wells 68, 70, 72, 81, 83, 88, and 92), and tetrahydrofuran (wells 64 and 74) (appendix 9). The most frequently detected VOC was 1,2,4-trimethylbenzene in 10 wells, and this compound had a maximum concentration of 0.15 µg/L. Chloroform was the second most frequently detected compound (eight wells) and had a maximum concentration of 0.91 µg/L. The maximum concentration for a VOC detected was 10 µg/L of tetrahydrofuran (well 74), and all other detected concentrations were less than 1 µg/L. VOC surrogates 1,2-dichloroethane-d4, toluene-d8, 1-bromo-4-fluorobenzene were analyzed with each sample. Recoveries, which ranged from 71.6 to 133 percent (appendix 8), were within the acceptable range for these surrogates, and, along with laboratory QC spike recoveries, verified the sampling results.

Biological Fecal Indicators

Four biological fecal indicators, including two bacterial, total coliform and *E. coli*, and two viral, *E. coli* F-specific and *E. coli* somatic coliphage, were analyzed in water from 30 wells. Total coliform bacteria in water is used to indicate the presence of potentially harmful bacteria related to human activities and other sources. The presence of *E. coli* and coliphage indicates the water may be contaminated by human or animal waste.

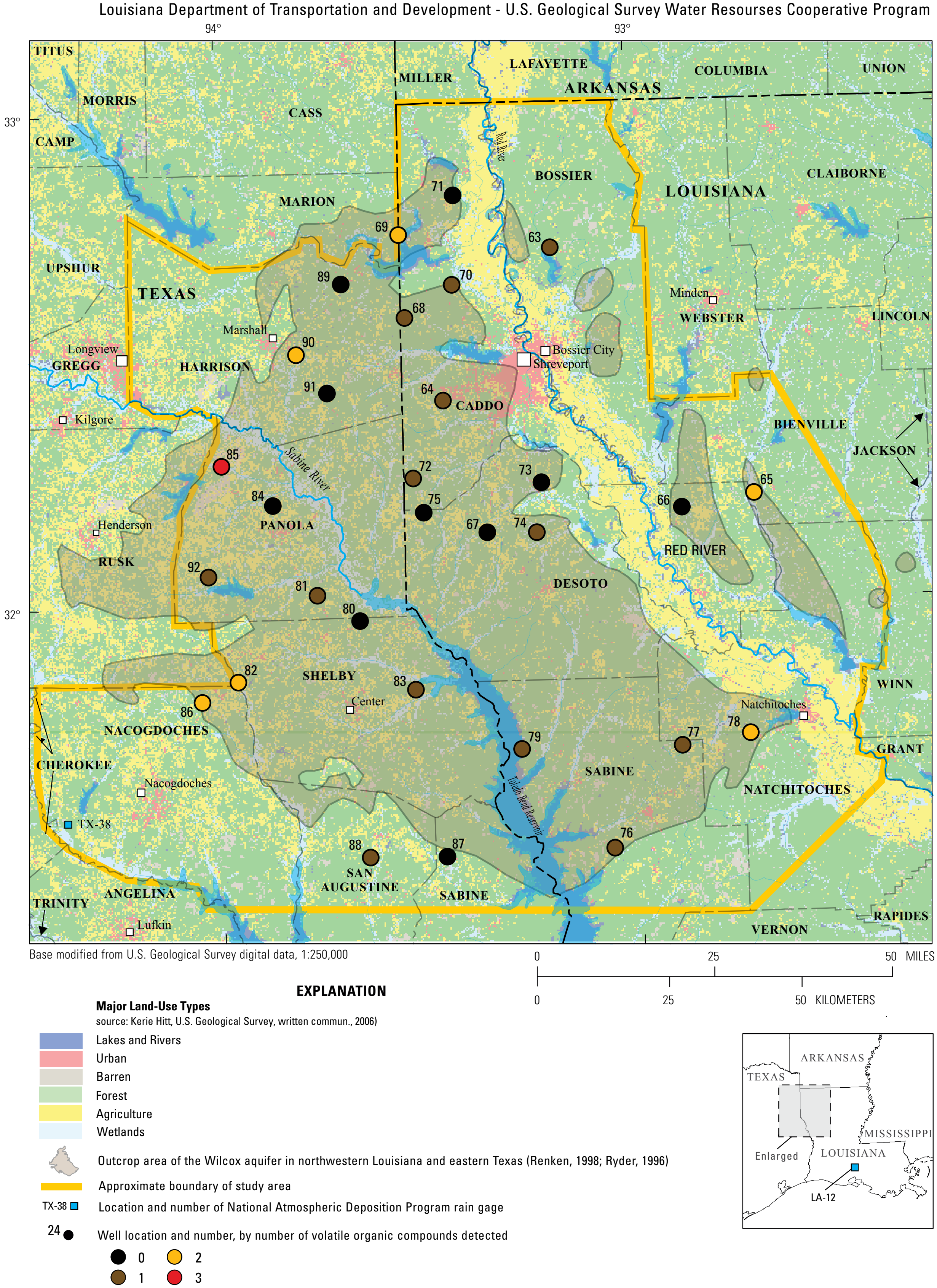


Figure 6. Map showing number of volatile organic compounds detected in water from 30 domestic wells screened in the Wilcox aquifer in northwestern Louisiana and east-central Texas, 2003–04.

Data for biological indicators are listed in appendix 10. Total coliform colonies were detected in eight wells (wells 64, 67, 72, 73, 79, 86, 87, and 92), four of which (wells 67, 72, 73, and 79) were within the ideal count[7] range of 20 to 80 cols/100 mL. The highest two counts for total coliform were an estimated 93 cols/100 mL (well 86) and 75 cols/100 mL (well 72). The spigots at these wells were heavily covered by insulation and debris. Sterilizing techniques may not have been adequate to remove all of the organic matter from the small crevices around the spigots. Total coliform counts in the other six wells were less than or equal to 30 cols/100 mL. *E. coli* was detected in samples from three wells (wells 64, 72, and 86), all of which were less than 20 cols/100 mL. Both *E. coli*. F-specific and E. Coli. somatic coliphage are reported as either present or absent in a sample, and none was present in the samples collected.

Statistical Analyses of Water-Quality Data

Correlations Of Selected General Groundwater Properties and Chemical Constituents Using Spearman's Rank Correlation Test

Correlations of selected general groundwater properties and chemical constituents are given in table 5. Depth of well correlated positively to specific conductance (weak), pH (moderate), TDS (weak), and bicarbonate (weak), indicating that the ionic strength of water generally increased with depth. Depth of well also correlated positively with sodium (weak) and TOC (weak). Specific conductance correlated positively with TDS (strong), sodium (strong), bicarbonate (strong), chloride (strong), and TOC (moderate), which is typical for most groundwater (Hem, 1985, p. 66-69). Depth of well correlated inversely (negatively) to DO (weak), indicating that as well depth (or distance along a flow path) increased, DO decreased, which is typical for most groundwater systems (Chapelle, 1993, p. 149). In addition, DO correlated inversely to TDS (moderate). Depth of well also correlated inversely to calcium (weak), magnesium (weak), hardness (weak), manganese (weak), iron (weak), arsenic (moderate), nitrite plus nitrate (weak), radon (weak), and radium-226 (weak). The pH correlated inversely to arsenic (moderate), iron (moderate), lead (weak), manganese (moderate), and zinc (strong).

Comparison of Selected Water-Quality Data from Wells in this Study with Historical Data from other Wells in the Wilcox Aquifer Using Mann-Whitney Rank-Sum Test

The Mann-Whitney Rank-Sum Test was used to compare selected water-quality data from a group of domestic wells in this study (W92) to historical data from a group of over 700 domestic wells (WX) with similar depths (25 to 450 ft below land surface) completed in the Wilcox aquifer in Louisiana (table 6). The historical well data represented wells sampled (various dates) from the late 1950's to present day, and the data are available on the worldwide web (U.S. Geological Survey, 2001). Water-quality data in group W92 were statistically similar to water-quality data in group WX for most variables. The medians of the rank-transformed data for well depth, specific conductance, color, TDS, calcium, sodium, chloride, and sulfate were similar (p-value greater than or equal to 0.05) between W92 and WX, indicating group W92 is representative of the water quality in the Wilcox aquifer for these parameters. The medians of the rank-transformed data for pH, hardness, and iron were statistically different (p-value less than 0.05) between groups W92 and WX, indicating the sample population in this study is not representative of the overall water quality in the Wilcox aquifer for these parameters.

[7] The ideal count range brackets the values between which there is a high degree of confidence that the number of colonies observed are reproducible and reflect environmental conditions. Values observed above the range may be inaccurate due to crowding and competition, and statistical validity becomes questionable for values observed below the range (U.S. Geological Survey, 1997 to present). The reported value is tagged as estimated (E) if the number of observed colonies are outside the ideal range.

Table 5. Results of Spearman's rank correlation test for selected general ground-water properties and chemical constituents in water from domestic wells screened in the Wilcox aquifer in northwestern Louisiana and east-central Texas, 2003-04.

[<, less than; >, greater than; -, inversely related]

Variable	Number of sample pairs	Probability statistic (p-value)	Correlation coefficient (rho)	Correlation Strength
Positive correlations				
Depth of well and specific conductance	92	0.04	0.21	Weak
Depth of well and pH	92	<.001	0.57	Moderate
Depth of well and color	80	0.66	0.05	None
Depth of well and total dissolved solids	92	0.06	0.2	Weak
Depth of well and sodium	92	0.002	0.32	Weak
Depth of well and bicarbonate	92	<.001	0.34	Weak
Depth of well and chloride	92	0.28	0.11	None
Depth of well and total organic carbon	70	0.02	0.28	Weak
Specific conductance and total dissolved solids, sodium, bicarbonate, and chloride	92	<.001	>.80	Strong
Specific conductance and total organic carbon	70	<.001	0.51	Moderate
Inverse (negative) correlations				
Depth of well and dissolved oxygen	92	0.02	-0.25	Weak
Depth of well and calcium, magnesium, hardness, and manganese	92	<.006	-.29 to -0.38	Weak
Depth of well and sulfate	92	0.12	-0.16	None
Depth of well and iron	92	0.03	-0.22	Weak
Depth of well and arsenic	30	0.003	-0.52	Moderate
Depth of well and lead	30	0.44	-0.15	None
Depth of well and nitrite plus nitrate	92	0.04	-0.21	Weak
Depth of well and radon	30	0.07	-0.34	Weak
Depth of well and radium-226	30	0.15	-0.27	None
pH and arsenic	30	<.009	-0.47	Moderate
pH and iron	92	<.001	-0.45	Moderate
pH and lead	30	0.07	-0.34	Weak
pH and manganese	92	<.001	-0.49	Moderate
pH and zinc	30	<.001	-0.71	Strong
Dissolved oxygen and specific conductance, pH, and total dissolved solids	92	<.001	-.40 to -0.43	Moderate

Table 6. Results of comparison between wells in this study and historical data from more than 700 other wells screened in the Wilcox aquifer using a two-tailed Mann-Whitney Rank-Sum test at a level of significance (α) of 0.05.

[$\overline{X}$, median of sample population; W92, 92 wells sampled in this study; WX, historical data from more than 700 wells screened in the Wilcox aquifer; <, less than; <>, not equal to; -, inversely related]

Variable	Null Hypothesis (H_o)	Alternate Hypothesis (H_a)	Number of samples from this study	Number of historical samples	Z-value	Probability statistic (p-value)	Decision (5 percent)	Summary
Depth of well	$\overline{X}_{W92} = \overline{X}_{WX}$	$\overline{X}_{W92} <> \overline{X}_{WX}$	92	693	1.31	0.19	Accept H_o	Median values are not significantly different
Specific conductance	$\overline{X}_{W92} = \overline{X}_{WX}$	$\overline{X}_{W92} <> \overline{X}_{WX}$	92	382	0.03	0.97	Accept H_o	Median values are not significantly different
pH	$\overline{X}_{W92} = \overline{X}_{WX}$	$\overline{X}_{W92} <> \overline{X}_{WX}$	92	370	1.98	0.05	Reject H_o	Median values are significantly different
pH	$\overline{X}_{W92} = \overline{X}_{WX}$	$\overline{X}_{W92} <> \overline{X}_{WX}$	92	370	-1.98	0.02	Reject H_o	Median of W92 is less than WX
Color	$\overline{X}_{W92} = \overline{X}_{WX}$	$\overline{X}_{W92} <> \overline{X}_{WX}$	80	380	1.69	0.09	Accept H_o	Median values are not significantly different
Total dissolved solids	$\overline{X}_{W92} = \overline{X}_{WX}$	$\overline{X}_{W92} <> \overline{X}_{WX}$	92	378	0.39	0.7	Accept H_o	Median values are not significantly different
Calcium	$\overline{X}_{W92} = \overline{X}_{WX}$	$\overline{X}_{W92} <> \overline{X}_{WX}$	92	404	0.12	0.9	Accept H_o	Median values are not significantly different
Hardness	$\overline{X}_{W92} = \overline{X}_{WX}$	$\overline{X}_{W92} <> \overline{X}_{WX}$	92	663	2.63	0.008	Reject H_o	Median values are significantly different
Hardness	$\overline{X}_{W92} = \overline{X}_{WX}$	$\overline{X}_{W92} <> \overline{X}_{WX}$	92	663	2.63	0.004	Reject H_o	Median of W92 is less than WX
Sodium	$\overline{X}_{W92} = \overline{X}_{WX}$	$\overline{X}_{W92} <> \overline{X}_{WX}$	92	391	0.24	0.81	Accept H_o	Median values are not significantly different
Chloride	$\overline{X}_{W92} = \overline{X}_{WX}$	$\overline{X}_{W92} <> \overline{X}_{WX}$	92	693	1.02	0.31	Accept H_o	Median values are not significantly different
Sulfate	$\overline{X}_{W92} = \overline{X}_{WX}$	$\overline{X}_{W92} <> \overline{X}_{WX}$	92	472	0.88	0.38	Accept H_o	Median values are not significantly different
Iron	$\overline{X}_{W92} = \overline{X}_{WX}$	$\overline{X}_{W92} <> \overline{X}_{WX}$	92	293	6.49	<0.001	Reject H_o	Median values are not significantly different
Iron	$\overline{X}_{W92} = \overline{X}_{WX}$	$\overline{X}_{W92} <> \overline{X}_{WX}$	92	293	-6.49	<0.001	Reject H_o	Median of W92 is less than WX

Summary and Conclusions

During 2003–04, water-quality data were collected from 92 randomly selected domestic wells in the Wilcox aquifer in northwestern Louisiana and east-central Texas as part of a joint effort between the U.S. Geological Survey National Water-Quality Assessment (NAWQA) Program and the Louisiana Department of Transportation and Development. The data were collected to describe the groundwater quality and to gain an understanding of the natural and human-related factors that affect groundwater quality. The Wilcox aquifer is an unconsolidated sand aquifer that crops out in northwestern Louisiana and east-central Texas, and is the principal source of fresh groundwater in the area.

Well depths ranged from 55 to 425 feet below land surface with a median of 211 feet, and water levels measured in 30 wells ranged from 6.48 to 130.67 feet below land surface. Water samples collected from the 92 wells were analyzed for seven general groundwater properties, TDS, major inorganic ions, iron, manganese, nitrate, nitrite, and total organic carbon (TOC). In addition, selected wells (30 for most analytes) among the 92 were sampled for 23 trace elements, radon, radium-224, -226, and -228, gross-alpha and –beta radioactivity, tritium, dissolved organic carbon (DOC), 46 pesticides and 7 pesticide degradation products, 85 volatile organic compounds (VOCs), and biological indicators, including total coliform, *Escherichia coli* (*E. coli*), and *E. coli* F-specific and somatic coliphage.

The median values were 715 microsiemens per centimeter at 25 degrees Celsius for specific conductance, pH 7.9, and 244 milligrams per liter (mg/L) for alkalinity. The median total dissolved solids concentration was 433 mg/L, and concentrations in 35 wells exceeded the U.S. Environmental Protection Agency (USEPA) Secondary Maximum Contaminant Level (SMCL) of 500 mg/L. Five concentrations of chloride and one of sulfate were above the SMCL of 250 mg/L for both. Two concentrations of fluoride exceeded the SMCL of 2 mg/L, and one exceeded the USEPA maximum contaminant level (MCL) of 4.0 mg/L. The highest percentage of cations were sodium in 87 wells and calcium in 5 wells. Two groups of wells were identified based on percentages of cations. Group A represented shallow groundwater with mixed cation composition, possibly a result of mixing of rainfall and freshwater recharge and subsequent chemical reactions within aquifer sediments. Group B had high sodium relative to calcium and magnesium, possibly from cation exchange or the mixing of shallow groundwater with deeper, sodium-dominated groundwater within the Wilcox aquifer.

Iron and manganese were analyzed for all 92 wells, and 21 additional trace elements were analyzed in 30 of the wells. Trace-element concentrations were less than 1,000 µg/L (micrograms per liter) except iron in eight wells and boron and strontium in five wells. Concentrations of trace elements exceeded a drinking-water standard for iron in 21 wells; lead in 21 wells, two of which (17.7 µg/L in well 81 and 41.2 µg/L in well 87) exceeded the MCL of 15 µg/L; arsenic in 11 wells; manganese in 16 wells; arsenic in 11 wells; boron in 8 wells; and uranium in 7 wells.

Seven radionuclides were sampled in water from 30 wells except for tritium, which was sampled from five wells. Radon concentrations in water from 19 wells sampled were greater than or equal to the USEPA MCL of 300 picocuries per liter (pCi/L). Radon concentrations ranged from 50 to 1,050 pCi/L and had a median of 340 pCi/L. Concentrations of radium-224, -226, and -228, and counts of gross-alpha and gross-beta radioactivity were low and no concentrations exceeded an applicable MCL. Tritium was sampled only in water from five wells and no concentration exceeded the MCL. The tritium concentration of 8 pCi/L in well 68 indicated that this well may have received recharge since 1950 by water that originated at the land surface.

Nutrients were sampled in water from 30 wells except for nitrite (91 wells) and nitrite plus nitrate (92 wells). Nutrient concentrations were low and only one concentration value, 3.4 mg/L for nitrite plus nitrate, was greater than 2 mg/L, a level that might indicate contamination from human activities, but this concentration was less than the MCL of 10 mg/L. Total organic carbon (TOC) was detected in water from 67 of 70 wells sampled and had a median of 1.3 mg/L. Dissolved organic carbon (DOC) was detected in water from all 30 wells sampled for this constituent and had a median of 1.4 mg/L. DOC concentrations of about 0.5 mg/L typically occur naturally in groundwater. The relatively high TOC and DOC might be due to the presence of lignite (a low-grade coal) deposits throughout the Wilcox aquifer.

No concentrations of 46 pesticides or 7 pesticide degradation products were detected in water from the 30 wells sampled. The same 30 wells were sampled for 85 VOCs, seven of which were detected in the groundwater samples. Of those seven, four were detected more than once. Ten concentrations of a detected VOC were greater than estimated values. The most frequently detected VOC was 1,2,4-trimethylbenzene in 10 wells, and this compound had a maximum concentration of 0.15 µg/L. Chloroform was the second most frequently detected compound (8 wells) and had a maximum concentration of 0.91 µg/L. The maximum concentration for a VOC detected was 10 µg/L for tetrahydrofuran, and all other detected concentrations were less than the applicable drinking-water standards.

Four fecal indicators, two bacterial and two viral, were sampled in water from 30 wells. Total coliform, a bacterial fecal indicator, was detected in water from eight wells located in Louisiana, six of which counts were less than 30 colonies per 100 milliliters (cols/100 mL). The highest two values counts for total coliform were an estimated 93 cols/100 mL in well 86 and 75 cols/100 mL in well 72. Sterilizing techniques may not have been adequate to completely remove all bacteria from the spigot at these wells. All other total coliform counts were less than 30 cols/100 mL. *E. coli*., a bacterial fecal indicator, was detected in three wells, all of which were less than 20 cols/100 mL. *E. coli* F-specific and *E. coli* F somatic coliphage, both viral fecal indicators, were not present in water from the 30 wells sampled.

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Appendix 1. General ground-water properties of water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. USGS, U.S. Geological Survey; µS/cm, microsiemens per centimeter at 25 degrees Celsius; SU, standard units; ºC, degrees Celsius; mg/L, milligrams per liter; NTRU, nephelometric turbidity ratio units; PCU, platinum-cobalt units; <, less than; —, no data; E, estimated]

Well number (fig. 1)	USGS site identification number	State well number	Sample date	Sample time	Specific conductance, field (µS/cm at 25ºC)	Specific conductance, laboratory (µS/cm at 25ºC)	pH, field (SU)	pH, laboratory (SU)	Water temperature (ºC)	Dissolved oxygen (mg/L)	Alkalinity, incremental titration, field (mg/L as CaCO3)	Alkalinity, fixed end-point titration (pH 4.5), laboratory (mg/L as CaCO3)	Turbidity (NTRU)	Color (PCU)
Wells sampled in northwestern Louisiana														
1	320216093492101	DS-UR001	12/2/2003	1300	459	451	7.6	8.1	19.3	0.3	209	216	2.2	5
2	320309093484601	DS-UR002	12/2/2003	1400	505	495	7.1	8.1	20.4	0.2	171	175	0.4	10
3	320222093541001	DS-UR003	12/4/2003	1300	853	825	8.1	8.5	20.4	0.9	305	316	3.6	<5
4	320504093484201	DS-UR004	12/8/2003	1300	594	587	8.1	8.6	20.1	0.2	231	231	1.9	<5
5	320833093473701	DS-UR005	12/8/2003	1500	531	519	8.1	8.6	20.6	0.2	241	242	0.6	<5
6	320547093570101	DS-5472Z	12/10/2003	1200	592	593	8	8.6	19.1	0.3	294	294	0.2	<5
7	321002094023001	DS-91	1/12/2004	1200	384	377	7.2	7.9	19.5	0.3	167	169	0.5	40
8	320929093525201	DS-5222Z	1/13/2004	1200	586	567	7.8	8.4	21.6	0.2	240	245	0.2	<5
9	321429093415701	DS-5481Z	1/14/2004	1515	913	898	8.3	8.7	19.4	0.6	291	293	0.3	5
10	321006093571501	DS-7041Z	1/20/2004	1300	469	471	7.9	8.6	19.7	1.7	249	249	0.6	5
11	320115094003001	DS-6211Z	1/21/2004	1245	652	630	6.5	7.5	18.4	0.3	207	210	2.6	15
12	320500093431201	DS-6832Z	1/27/2004	1230	1,060	1,050	8.3	8.7	20.1	0.2	401	411	0.6	30
13	315532093405701	DS-6045Z	1/27/2004	1430	1,430	1,430	7.2	7.7	19.1	0.3	252	257	1.1	15
14	315330093355001	DS-6622Z	2/2/2004	1200	697	688	7.8	8.2	19.6	0.3	227	233	0.3	<5
15	320246094020401	DS-6425Z	2/2/2004	1500	1,970	1,960	8.5	8.8	19.4	0.2	604	618	0.4	20
16	321656094002801	Cd-6028Z	2/3/2004	1130	93	94	5.4	8.7	18.8	3.1	27	30	0.2	5
17	321845094022401	Cd-9320Z	2/3/2004	1400	331	325	6.7	7.7	20.7	3	150	152	1.2	20
18	315157093423401	DS-5297Z	2/3/2004	1600	1,560	1,560	8.4	8.7	19.6	1.1	303	309	2.4	10
19	320418093535801	DS-6576Z	2/16/2004	1230	584	569	7.9	8.4	20.2	0.1	196	206	0.4	<5
20	320828093405201	DS-6771Z	2/17/2004	1100	1,150	1,060	8.5	8.9	20.7	2.6	442	452	0.5	15
21	320846093424401	DS-5223Z	2/17/2004	1300	1,140	768	8.3	8.2	19.7	0.5	235	227	1	10
22	315213093350501	DS-5378Z	2/18/2004	1230	345	311	6.1	6.9	21.5	1.6	89	85	4.3	60

Appendix 1. General ground-water properties of water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.—Continued

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. USGS, U.S. Geological Survey; µS/cm, microsiemens per centimeter at 25 degrees Celsius; SU, standard units; ºC, degrees Celsius; mg/L, milligrams per liter; NTRU, nephelometric turbidity ratio units; PCU, platinum-cobalt units; <, less than; —, no data; E, estimated]

Well number (fig. 1)	USGS site identification number	State well number	Sample date	Sample time	Specific conductance, field (µS/cm at 25ºC)	Specific conductance, laboratory (µS/cm at 25ºC)	pH, field (SU)	pH, laboratory (SU)	Water temperature (ºC)	Dissolved oxygen (mg/L)	Alkalinity, incremental titration, field (mg/L as CaCO3)	Alkalinity, fixed end-point titration (pH 4.5), laboratory (mg/L as CaCO3)	Turbidity (NTRU)	Color (PCU)
Wells sampled in northwestern Louisiana—Continued														
23	315933093415301	DS-5550Z	2/18/2004	1700	770	741	8.2	8.6	20.3	0.3	319	321	2.5	5
24	323322093284201	Bo-8740Z	2/23/2004	1100	494	462	7.5	8.1	18	0.6	155	157	0.5	5
25	322242094010201	Cd-8080Z	2/24/2004	1130	315	288	6.7	7.4	19.5	0.4	136	144	0.2	5
26	323335093542401	Cd-6189Z	2/24/2004	1400	631	600	6.9	7.8	19.7	2.9	243	252	0.2	<5
27	323451094023401	Cd-6410Z	2/26/2004	1130	148	118	5.7	6.6	20.6	4.1	54	43	32	10
28	323908093410301	Bo-UR001	2/26/2004	1400	1,170	1,040	8.4	8.7	17.3	0.2	52	531	0.1	10
29	323901093321701	Bo-7250Z	3/3/2004	1100	175	146	5.9	6.8	18.8	0.7	68	55	0.4	20
30	321620093525201	Cd-8822Z	3/3/2004	1330	693	677	8.5	8.9	21	0.7	301	309	—	10
31	322120093263401	Bo-8136Z	4/5/2004	1130	1,820	1,840	8	8.5	20.8	0.3	311	329	0.2	5
32	322423093240701	Bo-7323Z	4/5/2004	1300	1,680	1,680	7.2	7.9	21.3	0.2	373	386	5.2	30
33	330022094003701	Cd-5373Z	4/7/2004	1300	297	297	8.1	8.5	21.1	1	142	148	1	10
34	325413094010501	Cd-9892Z	4/7/2004	1430	1,220	1,210	8.1	8.3	20.2	1.4	391	403	0.8	8
35	322816093304301	Bo-5294Z	4/8/2004	1100	163	164	6.1	7.3	19.6	2.1	52	54	1.4	5
36	323622093401001	Bo-5455Z	4/8/2004	1400	1,260	1,270	8.1	8.6	20.3	0.1	362	378	0.5	5
37	323853093471701	Cd-8687Z	4/12/2004	1200	951	950	7.2	7.9	19.1	0.4	309	317	1.2	30
38	322157093282601	Bo-7655Z	4/13/2004	1100	1,070	1,060	8	8.6	20.2	0.1	338	344	0.2	5
39	322638093330301	Bo-7965Z	4/13/2004	1300	74	74	5.7	E7.1	19.2	4.8	24	26	1.3	5
40	324703093405701	Bo-7952Z	4/13/2004	1730	1,140	1,140	8	8.3	19.6	0.5	452	450	0.7	10
41	315343093430801	DS-6541Z	4/14/2004	1245	1,560	1,540	8.3	8.6	21.8	0.1	690	697	6.5	40
42	322724093415801	Cd-8906Z	4/14/2004	1630	1,440	1,430	8.3	8.6	21.7	0.5	341	352	3.2	15
43	315941093391801	DS-5163Z	4/19/2004	1130	900	894	8.1	8.4	21.2	1	319	327	0.3	15
44	324013093434001	Bo-8981Z	5/24/2004	1130	731	717	7.4	8.1	21.2	0.1	360	368	0.4	<5
45	324303093454001	Bo-6697Z	5/24/2004	1300	1,580	1,560	8.3	8.6	20.8	0.1	408	418	0.2	<5
46	322039093423801	Cd-9784Z	5/25/2004	1030	975	965	8.3	8.6	21.1	1	348	361	0.3	6
47	322842093563001	Cd-8023Z	5/25/2004	1300	316	314	6.7	7.3	21.1	0.6	135	139	1.7	8

Appendix 1. General ground-water properties of water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.—Continued

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. USGS, U.S. Geological Survey; µS/cm, microsiemens per centimeter at 25 degrees Celsius; SU, standard units; ºC, degrees Celsius; mg/L, milligrams per liter; NTRU, nephelometric turbidity ratio units; PCU, platinum-cobalt units; <, less than; —, no data; E, estimated]

Well number (fig. 1)	USGS site identification number	State well number	Sample date	Sample time	Specific conductance, field (µS/cm at 25ºC)	Specific conductance, laboratory (µS/cm at 25ºC)	pH, field (SU)	pH, laboratory (SU)	Water temperature (ºC)	Dissolved oxygen (mg/L)	Alkalinity, incremental titration, field (mg/L as CaCO3)	Alkalinity, fixed end-point titration (pH 4.5), laboratory (mg/L as CaCO3)	Turbidity (NTRU)	Color (PCU)
Wells sampled in northwestern Louisiana—Continued														
48	323548093461201	Cd-6112Z	6/2/2004	1200	1,280	1,270	8.4	8.7	20.6	0.1	300	307	1.4	5
49	322753094021401	Cd-9866Z	6/14/2004	1330	758	763	6.7	7.1	20.3	1.6	160	160	1.4	<5
50	322606093523601	Cd-8118Z	6/14/2004	1500	847	841	8.4	8.6	21.8	0.1	318	323	0.2	<5
51	325151093590101	Cd-8782Z	6/21/2004	1100	880	873	7.7	8	21.6	0.6	223	232	0.6	<5
52	324642093590001	Cd-6742Z	6/21/2004	1315	776	765	7.2	7.5	21.6	0.2	202	204	2.3	<5
53	321958093402001	Cd-5221Z	6/22/2004	915	606	577	8.2	8.4	21.5	0.3	243	253	0.3	<5
54	322148093580601	Cd-7826Z	6/22/2004	1100	517	503	8.4	8.6	23.3	0.2	173	179	0.6	<5
55	323604093413701	Bo-8405Z	6/23/2004	1100	1,000	985	7.6	8.1	21.2	0.2	529	537	0.3	5
56	323347093583201	Cd-9160Z	6/24/2004	1130	49	48	5.3	6.4	19.1	6	16	19	0.3	5
57	323042093502001	Cd-5556Z	6/28/2004	1100	812	798	7.9	8.3	21.8	0.9	320	333	0.2	5
58	322233093422601	Cd-8861Z	6/28/2004	1200	535	559	8.2	8.5	21.4	0.2	260	269	4.6	10
59	325951093574101	Cd-5631Z	6/29/2004	1200	344	334	7.8	8.3	20.6	0.3	169	171	0.6	5
60	325759093532101	Cd-5697Z	6/29/2004	1430	272	269	8	8.4	19.9	1.1	116	121	0.2	5
61	325413093535801	Cd-6594Z	6/30/2004	1430	1,350	1,330	8.1	8.4	21.7	0.1	374	373	0.4	5
62	324250093393201	Bo-7530Z	6/30/2004	1600	2,650	2,670	7.9	8.2	20.3	0.2	474	468	2	5
63	324310093402801	Bo-8991Z	8/9/2004	1100	1,700	1,680	7.9	8.3	22.6	0.3	563	558	3.1	25
64	322452093563001	Cd-8122Z	8/9/2004	1700	606	553	7.1	7.4	21.1	0.1	245	256	15	25
65	321246093115501	Bi-6092Z	8/10/2004	1100	764	693	8.6	8.8	20.9	0.2	407	411	6.7	40
66	321113093222401	RR-5548Z	8/10/2004	1500	179	162	6.1	6.4	20.6	0.3	106	60	2.1	150
67	320849093505001	DS-5442Z	8/11/2004	1100	699	654	8.2	8.4	21.6	0.2	326	328	0.6	8
68	323508094020101	Cd-9080Z	8/11/2004	1600	452	414	5.2	E6.1	19.7	5.2	9	10	0.3	2
69	324506094023301	Cd-8586Z	8/16/2004	1200	1,040	1,000	8	8.2	20.9	0.4	278	295	—	5
70	323901093545201	Cd-6002Z	8/16/2004	1600	1,130	1,100	7.9	8.2	20.8	0.9	360	370	0.2	5
71	324959093543701	Cd-8434Z	8/17/2004	1000	965	896	7.8	8.1	20.4	0.4	276	287	0.4	8
72	321532094010901	Cd-8956Z	8/17/2004	1500	48	42	5.4	E6.3	21.5	5.8	15	22	0.5	5

Appendix 1. General ground-water properties of water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.—Continued

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. USGS, U.S. Geological Survey; µS/cm, microsiemens per centimeter at 25 degrees Celsius; SU, standard units; ºC, degrees Celsius; mg/L, milligrams per liter; NTRU, nephelometric turbidity ratio units; PCU, platinum-cobalt units; <, less than; —, no data; E, estimated]

Well number (fig. 1)	USGS site identification number	State well number	Sample date	Sample time	Specific conductance, field (µS/cm at 25ºC)	Specific conductance, laboratory (µS/cm at 25ºC)	pH, field (SU)	pH, laboratory (SU)	Water temperature (ºC)	Dissolved oxygen (mg/L)	Alkalinity, incremental titration, field (mg/L as CaCO3)	Alkalinity, fixed end-point titration (pH 4.5), laboratory (mg/L as CaCO3)	Turbidity (NTRU)	Color (PCU)
Wells sampled in northwestern Louisiana—Continued														
73	321442093421101	DS-6687Z	8/18/2004	1200	871	800	8.4	8.6	22	0.7	276	291	2.1	15
74	320848093431201	DS-6028Z	8/18/2004	1600	561	503	7	7.3	22.9	0.2	175	190	5.3	2
75	321130093594601	DS-6458Z	8/24/2004	1300	458	414	6.9	7	23.5	0.2	194	195	5.1	2
76	313006093332501	Sa-5510Z	8/30/2004	1300	1,600	1,550	8.7	8.9	22.9	0.1	740	786	0.5	125
77	314223093231001	Sa-5676Z	9/1/2004	1100	1,330	1,280	8.5	8.8	21.6	0.3	513	530	1	75
78	314328093131901	Na-5037Z	9/1/2004	1500	1,460	1,410	8.5	8.8	22.2	0.2	554	586	1.6	40
79	314217093461901	Sa-5561Z	9/8/2004	1400	1,130	1,100	7.6	7.9	20.3	0.2	436	461	—	10
Wells sampled in east-central Texas														
80	315823094092001	XB-37-07-3	8/31/2004	1100	678	619	6.8	7.2	21.8	0.4	196	209	1.8	2
81	320128094151201	UL-35-62-9	9/7/2004	1300	1,730	1,690	5.5	E5.9	20.5	0.9	12	19	—	—
82	315107094265101	XB-37-16-3	9/7/2004	1600	397	366	8	8.1	23.1	0.2	174	180	0.2	—
83	314948094011901	XB-37-16-6	9/8/2004	1000	1,500	1,470	8.2	8.4	21	0.1	715	737	9.5	—
84	321214094213001	UL-35-54-401	9/13/2004	1200	913	863	7.3	7.6	20.8	0.2	164	176	0.3	—
85	321722094285201	UL-35-45-705	9/13/2004	1500	1,230	1,180	8.5	8.7	21.1	0.1	518	554	0.5	—
86	314837094320701	TX-37-12-6	9/14/2004	900	490	462	8.3	8.4	21.4	0.2	216	228	0.8	—
87	312923093572101	WT-36-33-2	9/14/2004	1300	40	40	4.4	E4.9	19.1	3.8	2	2	4.3	—
88	312930094082801	WT-37-39-3	9/15/2004	1500	219	204	6.1	E7.0	21.6	0.2	67	66	0.8	—
89	323925094111301	LK-35-23-8	9/20/2004	1200	511	480	8.3	8.4	20.8	0.1	201	214	0.3	—
90	323103094175001	LK-35-30-8	9/20/2004	1500	59	64	5.4	6.4	19.5	1.2	20	21	1.9	—
91	322611094133401	LK-35-39-4	9/21/2004	1000	571	536	7.5	7.9	21	0.3	272	268	1.7	—
92	320354094310301	UL-35-60-6	9/21/2004	1200	404	373	7.7	7.9	21.2	0.9	176	178	4.5	—

Appendix 2. Total dissolved-solids and major inorganic ion concentrations in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers1. USGS, U.S. Geological Survey; °C, degrees Celsius; mg/L, milligrams per liter; Na, sodium; HCO3, bicarbonate; Cl, chloride; SO4, sulfate —, no data; <, less than; E, estimated]

Well number (fig. 1)	USGS site identification number	State well number	Sample start date	Sample time	Water type	Total dis-solved solids, resi-due, at 180 °C (mg/L)	Total dis-solved solids, residue, sum of con-stituents (mg/L)	Calcium (mg/L) 7440-70-2	Mag-nesium (mg/L) 7439-95-4	Hard-ness (mg/L as CaCO3)	Noncar-bonate hard-ness, field (mg/L as CaCO3)
Wells sampled in northwestern Louisiana											
1	320216093492101	DS-UR001	12/2/2003	1300	Na HCO3	298	271	8.8	1.9	30	—
2	320309093484601	DS-UR002	12/2/2003	1400	Na HCO3-Cl	308	290	16	4.8	60	—
3	320222093541001	DS-UR003	12/4/2003	1300	Na HCO3	471	482	8	3.8	36	—
4	320504093484201	DS-UR004	12/8/2003	1300	Na HCO3	350	354	6	1.2	20	—
5	320833093473701	DS-UR005	12/8/2003	1500	Na HCO3	303	312	5.2	0.8	16	—
6	320547093570101	DS-5472Z	12/10/2003	1200	Na HCO3	346	—	8.2	2.1	29	—
7	321002094023001	DS-91	1/12/2004	1200	mixed cation HCO3	230	227	18	5.3	67	—
8	320929093525201	DS-5222Z	1/13/2004	1200	Na HCO3	335	333	12	3.1	43	—
9	321429093415701	DS-5481Z	1/14/2004	1515	Na HCO3-Cl	516	—	0.3	0.1	1	—
10	321006093571501	DS-7041Z	1/20/2004	1300	Na HCO3	283	283	1.7	0.4	6	—
11	320115094003001	DS-6211Z	1/21/2004	1245	Na mixed anion	389	386	16	6	65	—
12	320500093431201	DS-6832Z	1/27/2004	1230	Na HCO3	600	—	2.5	0.6	9	—
13	315532093405701	DS-6045Z	1/27/2004	1430	mixed cation and anion	870	846	76	34	330	77
14	315330093355001	DS-6622Z	2/2/2004	1200	Na mixed anion	396	397	18	5.8	69	—
15	320246094020401	DS-6425Z	2/2/2004	1500	Na HCO3-Cl	1,060	—	0.9	0.3	4	—
16	321656094002801	Cd-6028Z	2/3/2004	1130	mixed cation HCO3-Cl	94	108	3.7	1.9	17	—
17	321845094022401	Cd-9320Z	2/3/2004	1400	mixed cation HCO3	224	228	27	9.3	110	—
18	315157093423401	DS-5297Z	2/3/2004	1600	Na mixed anion	944	937	2.6	0.9	10	—
19	320418093535801	DS-6576Z	2/16/2004	1230	Na HCO3-Cl	332	324	5.1	1.3	18	—
20	320828093405201	DS-6771Z	2/17/2004	1100	Na HCO3	668		1	0.24	3	—
21	320846093424401	DS-5223Z	2/17/2004	1300	Na HCO3-Cl	454	441	7.7	2.3	29	—
22	315213093350501	DS-5378Z	2/18/2004	1230	Na mixed anion	208	218	4.2	2.1	19	—
23	315933093415301	DS-5550Z	2/18/2004	1700	Na HCO3	441	441	2.9	0.5	9	—
24	323322093284201	Bo-8740Z	2/23/2004	1100	Na HCO3-SO4	305	299	19	5.6	71	—

Noncar-bonate hard-ness, labora-tory (mg/L as CaCO3)	Sodium (mg/L)	Sodium adsorp-tion ratio	Sodium (per-cent in equiva-lents of major cations)	Potas-sium (mg/L) 7440-09-7	Carbon-ate (mg/L) 3812-32-6	Bicar-bonate (mg/L) 71-52-3	Sulfate (mg/L) 14808-79-8	Chloride mg/L 16887-00-6	Fluoride (mg/L) 16984-48-8	Bromide (mg/L) 24959-67-9	Silica (mg/L as SiO2) 7631-86-9
Wells sampled in northwestern Louisiana											
—	93	7	87	1.4	—	254	12	10	0.2	—	18
—	81	5	74	2	—	208	15	43	0.3	—	25
—	180	13	91	1.6	3	366	27	66	0.2	—	12
—	130	13	93	1.3	3	275	46	20	0.2	—	11
—	120	13	94	1.2	5	285	6.9	22	0.2	—	11
—	130	10	90	1.5	4	351	<.2	22	0.2	—	11
—	56	3	64	1.7	—	203	7.7	16	0.1	—	21
—	110	7	84	2.2	2	288	21	27	0.1	—	14
—	200	84	100	0.7	10	334	<.6	110	0.5	—	11
—	110	20	97	1.4	6	292	1.9	6.1	0.2	—	12
—	120	6	80	1.5	—	252	53	44	0.2	—	20
—	240	36	98	1.5	14	461	<.6	95	1.1	—	10
73	170	4	52	6	—	307	220	170	0.1	—	18
—	120	6	78	5	3	271	61	38	0.1	—	13
—	450	100	99	1.2	38	660	<.2	280	1.4	—	11
—	11	1	54	2.3	—	33	0.4	11	<.1	—	60
—	26	1	34	3	—	182	1.8	14	0.1	—	56
—	340	47	98	1.8	10	348	280	120	0.8	—	9.7
—	120	12	93	1.8	3	234	19	46	0.1	—	13
—	260	61	99	1.5	—	499	<.2	100	0.7	—	11
—	160	13	91	3	2	284	27	89	0.9	—	10
—	61	6	86	2.1	—	108	38	24	0.1	—	29
—	180	26	97	1.7	5	378	24	33	0.4	—	7.6
—	78	4	69	3.8	—	188	73	9.4	<.1	—	17

Appendix 2. Total dissolved-solids and major inorganic ion concentrations in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.—Continued

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers1. USGS, U.S. Geological Survey; ºC, degrees Celsius; mg/L, milligrams per liter; Na, sodium; HCO3, bicarbonate; Cl, chloride; SO4, sulfate —, no data; <, less than; E, estimated]

Well number (fig. 1)	USGS site identification number	State well number	Sample start date	Sample time	Water type	Total dis-solved solids, resi-due, at 180 ºC (mg/L)	Total dis-solved solids, residue, sum of con-stituents (mg/L)	Calcium (mg/L) 7440-70-2	Mag-nesium (mg/L) 7439-95-4	Hard-ness (mg/L as CaCO3)	Noncar-bonate hard-ness, field (mg/L as CaCO3)
Wells sampled in northwestern Louisiana—Continued											
25	322242094010201	Cd-8080Z	2/24/2004	1130	mixed cation HCO3	201	202	15	5.1	58	—
26	323335093542401	Cd-6189Z	2/24/2004	1400	mixed cation HCO3	383	380	37	16	160	—
27	323451094023401	Cd-6410Z	2/26/2004	1130	mixed cation HCO3	124	145	5.8	3.3	28	—
28	323908093410301	Bo-UR001	2/26/2004	1400	Na HCO3-Cl	699	396	2	0.8	8	—
29	323901093321701	Bo-7250Z	3/3/2004	1100	Na HCO3	137	159	2.6	1.7	13	—
30	321620093525201	Cd-8822Z	3/3/2004	1330	Na HCO3	403	—	1.1	0.16	3	—
31	322120093263401	Bo-8136Z	4/5/2004	1130	Na HCO3-Cl	982	—	7.7	2.6	30	—
32	322423093240701	Bo-7323Z	4/5/2004	1300	Na HCO3-Cl	931	—	24	6.2	85	—
33	330022094003701	Cd-5373Z	4/7/2004	1300	Na HCO3	173	—	4.4	1	15	—
34	325413094010501	Cd-9892Z	4/7/2004	1430	Na HCO3-Cl	681	—	5.8	2.1	23	—
35	322816093304301	Bo-5294Z	4/8/2004	1100	mixed cation HCO3-Cl	130	128	12	5.1	51	—
36	323622093401001	Bo-5455Z	4/8/2004	1400	Na HCO3-Cl	715	689	11	4.2	45	—
37	323853093471701	Cd-8687Z	4/12/2004	1200	Na HCO3-Cl	536	—	26	11	110	—
38	322157093282601	Bo-7655Z	4/13/2004	1100	Na HCO3-Cl	607	—	6.4	1.9	24	—
39	322638093330301	Bo-7965Z	4/13/2004	1300	mixed cation HCO3	90	90	4.4	1.7	18	—
40	324703093405701	Bo-7952Z	4/13/2004	1730	Na HCO3	668	—	8	2.9	32	—
41	315343093430801	DS-6541Z	4/14/2004	1245	Na HCO3	923	—	1.1	0.3	4	—
42	322724093415801	Cd-8906Z	4/14/2004	1630	Na HCO3-Cl	755	—	2.1	0.5	7	—
43	315941093391801	DS-5163Z	4/19/2004	1130	Na HCO3	529	509	1.5	0.57	6	—
44	324013093434001	Bo-8981Z	5/24/2004	1130	Na HCO3	440	434	12	5.3	52	—
45	324303093454001	Bo-6697Z	5/24/2004	1300	Na HCO3-Cl	870	—	2.9	1	11	—
46	322039093423801	Cd-9784Z	5/25/2004	1030	Na HCO3	561	538	2.4	0.6	8	—
47	322842093563001	Cd-8023Z	5/25/2004	1300	Na HCO3	213	217	10	3.2	38	—

Noncarbonate hardness, laboratory (mg/L as CaCO3)	Sodium (mg/L)	Sodium adsorption ratio	Sodium (percent in equivalents of major cations)	Potassium (mg/L) 7440-09-7	Carbonate (mg/L) 3812-32-6	Bicarbonate (mg/L) 71-52-3	Sulfate (mg/L) 14808-79-8	Chloride mg/L 16887-00-6	Fluoride (mg/L) 16984-48-8	Bromide (mg/L) 24959-67-9	Silica (mg/L as SiO2) 7631-86-9
Wells sampled in northwestern Louisiana—Continued											
—	46	3	62	1.4	—	166	1.6	13	0.1	—	38
—	76	3	50	3.1	—	296	48	21	0.2	—	32
—	12	1	46	2	—	67	2.1	11	<.1	—	69
—	280	43	98	2.1	1	60	1.8	65	1.5	—	12
—	25	3	77	2.1	—	84	1.1	12	0.1	—	65
—	160	38	99	0.8	15	336	<.2	34	0.4	—	12
—	380	30	96	2.1	4	371	<.2	380	1.4	—	11
—	330	16	89	2.4	—	453	<0.2	300	0.7	—	24
—	63	7	89	1.4	2	168	<.2	7.3	0.2	—	9.9
—	260	24	95	4.6	4	468	<.2	140	1.4	—	9.3
—	12	0.7	34	0.4	—	63	5.3	12	0.2	—	48
—	260	17	92	2.1	5	431	1.5	180	0.9	—	12
—	170	7	76	3.3	—	376	<.2	130	0.2	—	18
—	230	21	95	1.8	5	401	<.2	140	1.1	—	11
—	7.2	0.7	45	0.7	—	29	2.8	3.6	<.1	—	52
—	260	20	94	4.2	6	539	<.2	100	1.9	—	14
—	370	80	99	1.7	26	789	<.2	87	6.5	—	9.7
—	310	50	98	2.4	11	394	<.2	240	0.9	—	9.6
—	200	35	98	1.6	6	377	38	65	0.4	—	10
—	160	10	86	2.4	1	437	0.5	18	0.9	—	19
—	340	44	98	2.7	9	478	<.2	250	1.7	—	10
—	220	33	98	1.5	7	410	5.2	88	0.5	—	10
—	55	4	75	1.2	—	164	0.8	17	0.2	—	48

Appendix 2. Total dissolved-solids and major inorganic ion concentrations in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.—Continued

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers1. USGS, U.S. Geological Survey; ºC, degrees Celsius; mg/L, milligrams per liter; Na, sodium; HCO3, bicarbonate; Cl, chloride; SO4, sulfate —, no data; <, less than; E, estimated]

Well number (fig. 1)	USGS site identification number	State well number	Sample start date	Sample time	Water type	Total dis-solved solids, resi-due, at 180 ºC (mg/L)	Total dis-solved solids, residue, sum of con-stituents (mg/L)	Calcium (mg/L) 7440-70-2	Mag-nesium (mg/L) 7439-95-4	Hard-ness (mg/L as CaCO3)	Noncar-bonate hard-ness, field (mg/L as CaCO3)
Wells sampled in northwestern Louisiana—Continued											
48	323548093461201	Cd-6112Z	6/2/2004	1200	Na HCO3-Cl	686	688	2.7	0.9	10	—
49	322753094021401	Cd-9866Z	6/14/2004	1330	Na mixed anion	476	491	17	8.2	76	—
50	322606093523601	Cd-8118Z	6/14/2004	1500	Na HCO3	482	480	4.2	0.96	14	—
51	325151093590101	Cd-8782Z	6/21/2004	1100	Na HCO3-Cl	482	473	24	5.9	84	—
52	324642093590001	Cd-6742Z	6/21/2004	1315	Na HCO3-Cl	428	—	18	6	70	—
53	321958093402001	Cd-5221Z	6/22/2004	915	Na HCO3	342	—	7.8	2.4	29	—
54	322148093580601	Cd-7826Z	6/22/2004	1100	Na HCO3	287	—	2.8	0.6	10	—
55	323604093413701	Bo-8405Z	6/23/2004	1100	Na HCO3	603	600	18.6	6.9	75	—
56	323347093583201	Cd-9160Z	6/24/2004	1130	Na HCO3	91	95	0.7	0.4	4	—
57	323042093502001	Cd-5556Z	6/28/2004	1100	Na HCO3	468	458	8.7	3.2	35	—
58	322233093422601	Cd-8861Z	6/28/2004	1200	Na HCO3	348	339	4.3	1.6	17	—
59	325951093574101	Cd-5631Z	6/29/2004	1200	Na HCO3	200	202	3.3	0.9	12	—
60	325759093532101	Cd-5697Z	6/29/2004	1430	Na HCO3	158	162	1.7	0.5	7	—
61	325413093535801	Cd-6594Z	6/30/2004	1430	Na HCO3-Cl	739	734	9.1	2.9	35	—
62	324250093393201	Bo-7530Z	6/30/2004	1600	Na HCO3-Cl	1,460	1,510	11.2	4.8	48	—
63	324310093402801	Bo-8991Z	8/9/2004	1100	Na HCO3-Cl	1,010	972	5.3	1.9	21	—
64	322452093563001	Cd-8122Z	8/9/2004	1700	mixed cation HCO3	332	353	51	20	210	—
65	321246093115501	Bi-6092Z	8/10/2004	1100	Na HCO3	466	450	0.8	0.2	3	—
66	321113093222401	RR-5548Z	8/10/2004	1500	mixed cation HCO3	152	312	7.7	3.1	32	—
67	320849093505001	DS-5442Z	8/11/2004	1100	Na HCO3	438	415	7	1.5	24	—
68	323508094020101	Cd-9080Z	8/11/2004	1600	mixed cation SO4-Cl	300	294	24	10	100	95
69	324506094023301	Cd-8586Z	8/16/2004	1200	Na HCO3-Cl	567	560	13	3.3	46	—
70	323901093545201	Cd-6002Z	8/16/2004	1600	Na HCO3-Cl	670	648	11	2.9	41	—
71	324959093543701	Cd-8434Z	8/17/2004	1000	Na HCO3-Cl	544	—	7.8	2.3	30	—
72	321532094010901	Cd-8956Z	8/17/2004	1500	Na HCO3	103	104	0.7	0.4	3	—

Noncarbonate hardness, laboratory (mg/L as CaCO3)	Sodium (mg/L)	Sodium adsorption ratio	Sodium (percent in equivalents of major cations)	Potassium (mg/L) 7440-09-7	Carbonate (mg/L) 3812-32-6	Bicarbonate (mg/L) 71-52-3	Sulfate (mg/L) 14808-79-8	Chloride mg/L 16887-00-6	Fluoride (mg/L) 16984-48-8	Bromide (mg/L) 24959-67-9	Silica (mg/L as SiO2) 7631-86-9
Wells sampled in northwestern Louisiana—Continued											
—	276	37	98	2.2	8	350	E.1	216	0.4	—	10
—	130	6	79	1	—	194	54	98	0.5	—	71
—	190	22	96	1.6	7	373	3.4	77	0.2	—	12
—	150	7	79	3.7	—	270	9	130	0.5	—	16
—	130	7	79	2.6	—	245	<.2	120	0.3	—	28
—	130	10	90	1.3	3	290	<.2	40	0.4	—	12
—	110	16	96	0.9	5	201	<.2	51	0.3	—	12
—	220	11	86	3.4	2	640	E.2	16	0.6	—	16
—	8.3	2	79	1	—	20	0.4	2.2	0.1	—	70
—	173	13	91	2.7	2	385	6.2	59	0.3	—	13
—	131	14	94	1.2	5	307	2.8	29	0.4	—	13
—	75.6	9	92	1.8	1	204	E.0	7.9	0.2	—	11
—	60	10	94	1.5	1	139	10.2	6.8	0.1	—	12
—	281	21	94	3.4	4	447	E.1	202	1	—	10
—	573	36	96	5.6	4	568	10.4	608	1.6	—	10
—	378	36	97	3.9	9	668	2.9	222	3.8	1.3	12
—	50.4	2	34	2	—	298	26.5	27.8	0.3	0.2	25
—	183	47	99	0.9	20	456	0.3	5.7	0.4	0.04	12
—	15.7	1	50	2.1	—	129	1.6	7.8	<.2	0.54	200
—	152	14	93	2.1	5	387	23.5	17.7	0.2	0.11	13
93	36.8	2	43	2.1	—	11	86.8	59.8	<.2	0.33	63
—	201	13	90	2.7	3	333	0.3	157	0.3	0.86	13
—	236	16	92	2.7	4	430	42.1	121	0.2	0.57	12
—	198	16	93	3.2	3	330	E.1	140	0.5	0.9	11
—	8.2	2	78	1.2	—	18	0.4	1.4	<.2	0.03	82

Appendix 2. Total dissolved-solids and major inorganic ion concentrations in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.—Continued

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers1. USGS, U.S. Geological Survey; ºC, degrees Celsius; mg/L, milligrams per liter; Na, sodium; HCO3, bicarbonate; Cl, chloride; SO4, sulfate —, no data; <, less than; E, estimated]

Well number (fig. 1)	USGS site identification number	State well number	Sample start date	Sample time	Water type	Total dissolved solids, residue, at 180 ºC (mg/L)	Total dissolved solids, residue, sum of constituents (mg/L)	Calcium (mg/L) 7440-70-2	Magnesium (mg/L) 7439-95-4	Hardness (mg/L as CaCO3)	Noncarbonate hardness, field (mg/L as CaCO3)
Wells sampled in northwestern Louisiana—Continued											
73	321442093421101	DS-6687Z	8/18/2004	1200	Na HCO3-Cl	492	479	0.4	0.1	1	—
74	320848093431201	DS-6028Z	8/18/2004	1600	mixed cation and anion	344	332	63	13	210	38
75	321130093594601	DS-6458Z	8/24/2004	1300	mixed cation HCO3	271	284	46	11	160	—
76	313006093332501	Sa-5510Z	8/30/2004	1300	Na HCO3	995	938	2	0.5	7	—
77	314223093231001	Sa-5676Z	9/1/2004	1100	Na HCO3	833	800	0.7	0.2	3	—
78	314328093131901	Na-5037Z	9/1/2004	1500	Na HCO3	906	862	1.1	0.3	4	—
79	314217093461901	Sa-5561Z	9/8/2004	1400	Na HCO3	657	646	7.7	2.3	29	—
Wells sampled in east-central Texas											
80	315823094092001	XB-37-07-3	8/31/2004	1100	mixed cation and anion	409	413	31	10	120	—
81	320128094151201	UL-35-62-9	9/7/2004	1300	mixed cation HCO3-Cl	1,040	915	81	66	470	460
82	315107094265101	XB-37-16-3	9/7/2004	1600	Na HCO3	246	242	12	2.2	39	—
83	314948094011901	XB-37-16-6	9/8/2004	1000	Na HCO3	923	905	3	1.8	15	—
84	321214094213001	UL-35-54-401	9/13/2004	1200	Na mixed anion	537	524	28	7.3	100	—
85	321722094285201	UL-35-45-705	9/13/2004	1500	Na HCO3	748	692	1.2	0.3	4	—
86	314837094320701	TX-37-12-6	9/14/2004	900	Na HCO3	291	279	1.4	0.3	5	—
87	312923093572101	WT-36-33-2	9/14/2004	1300	Na-Mg mixed anion	33	30	0.31	0.9	4	2
88	312930094082801	WT-37-39-3	9/15/2004	1500	Na HCO3-SO4	139	138	3.4	1.9	17	—
89	323925094111301	LK-35-23-8	9/20/2004	1200	Na HCO3	303	300	6.1	1.6	22	—
90	323103094175001	LK-35-30-8	9/20/2004	1500	mixed cation HCO3	78	71	2.2	1.2	11	—
91	322611094133401	LK-35-39-4	9/21/2004	1000	mixed cation HCO3	342	345	25.9	10.5	110	—
92	320354094310301	UL-35-60-6	9/21/2004	1200	Na HCO3	241	246	11.3	2.2	38	—

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Noncarbonate hardness, laboratory (mg/L as CaCO3)	Sodium (mg/L)	Sodium adsorption ratio	Sodium (percent in equivalents of major cations)	Potassium (mg/L) 7440-09-7	Carbonate (mg/L) 3812-32-6	Bicarbonate (mg/L) 71-52-3	Sulfate (mg/L) 14808-79-8	Chloride mg/L 16887-00-6	Fluoride (mg/L) 16984-48-8	Bromide (mg/L) 24959-67-9	Silica (mg/L as SiO2) 7631-86-9
Wells sampled in northwestern Louisiana—Continued											
—	191	74	99	0.8	8	318	0.5	106	0.5	0.41	11
23	27.1	0.8	22	1.7	—	214	30.1	45.3	<.2	0.25	42
—	31.2	1	30	1.8	—	236	4.9	22.8	0.2	0.12	47
—	387	63	99	2	37	828	22.8	57.4	1.3	0.12	12
—	309	82	99	1.3	20	585	137	26.4	0.7	0.09	11
—	338	72	99	1.5	30	613	126	45.1	0.6	0.08	13
—	241	20	94	4.3	2	527	5.2	93.5	1.7	0.24	23
Wells sampled in east-central Texas											
—	99.2	4	63	4	—	238	57.1	51.4	<.2	0.2	37
460	155	3	41	7.9	—	14	14.2	508	<.2	2.14	70
—	73.7	5	80	1.5	3	207	14	15.7	<.2	0.07	17
—	374	42	98	1.5	13	846	3.5	67.7	2	0.23	17
—	139	6	74	3.4	—	200	129	90.8	<.2	0.44	24
—	281	61	99	1.6	21	589	11.8	68.7	1.1	0.14	11
—	105	20	97	0.9	5	252	21.7	5.2	<.2	0.03	13
2	2.5	0.5	51	0.6	—	3	2.9	4.9	<.2	0.02	16
—	36.9	4	80	3	—	82	29.1	6.6	<.2	0.04	15
—	111	10	91	2.2	4	236	17	24	0.2	0.11	15
—	8.1	1	60	0.8	—	24	3.3	3.2	<.2	0.04	39
—	92	4	64	4.7	1	330	14.9	7.3	<.2	0.06	22
—	84.5	6	82	1.9	—	214	2.2	17.1	<.2	0.1	18

Appendix 3. Trace-element concentrations in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers1. USGS. U.S. Geological Survey; µg/L, micrograms per liter; —, no data; <, less than; E, estimated; M, presence of material verified but not quantified]

Well number (fig. 1)	USGS site identification number	State well number	Sample start date	Sample time	Aluminum (µg/L) 7429-90-5	Antimony (µg/L) 7440-36-0	Arsenic (µg/L) 7440-38-2	Barium (µg/L) 7440-39-3	Beryllium (µg/L) 7440-41-7	Boron (µg/L) 7440-42-8	Cadmium (µg/L) 7440-43-9	Chromium (µg/L) 7440-47-3
Wells sampled in northwestern Louisiana												
1	320216093492101	DS-UR001	12/2/2003	1300	—	—	—	—	—	—	—	—
2	320309093484601	DS-UR002	12/2/2003	1400	—	—	—	—	—	—	—	—
3	320222093541001	DS-UR003	12/4/2003	1300	—	—	—	—	—	—	—	—
4	320504093484201	DS-UR004	12/8/2003	1300	—	—	—	—	—	—	—	—
5	320833093473701	DS-UR005	12/8/2003	1500	—	—	—	—	—	—	—	—
6	320547093570101	DS-5472Z	12/10/2003	1200	—	—	—	—	—	—	—	—
7	321002094023001	DS-91	1/12/2004	1200	—	—	—	—	—	—	—	—
8	320929093525201	DS-5222Z	1/13/2004	1200	—	—	—	—	—	—	—	—
9	321429093415701	DS-5481Z	1/14/2004	1515	—	—	—	—	—	—	—	—
10	321006093571501	DS-7041Z	1/20/2004	1300	—	—	—	—	—	—	—	—
11	320115094003001	DS-6211Z	1/21/2004	1245	—	—	—	—	—	—	—	—
12	320500093431201	DS-6832Z	1/27/2004	1230	—	—	—	—	—	—	—	—
13	315532093405701	DS-6045Z	1/27/2004	1430	—	—	—	—	—	—	—	—
14	315330093355001	DS-6622Z	2/2/2004	1200	—	—	—	—	—	—	—	—
15	320246094020401	DS-6425Z	2/2/2004	1500	—	—	—	—	—	—	—	—
16	321656094002801	Cd-6028Z	2/3/2004	1130	—	—	—	—	—	—	—	—
17	321845094022401	Cd-9320Z	2/3/2004	1400	—	—	—	—	—	—	—	—
18	315157093423401	DS-5297Z	2/3/2004	1600	—	—	—	—	—	—	—	—
19	320418093535801	DS-6576Z	2/16/2004	1230	—	—	—	—	—	—	—	—
20	320828093405201	DS-6771Z	2/17/2004	1100	—	—	—	—	—	—	—	—
21	320846093424401	DS-5223Z	2/17/2004	1300	—	—	—	—	—	—	—	—
22	315213093350501	DS-5378Z	2/18/2004	1230	—	—	—	—	—	—	—	—
23	315933093415301	DS-5550Z	2/18/2004	1700	—	—	—	—	—	—	—	—
24	323322093284201	Bo-8740Z	2/23/2004	1100	—	—	—	—	—	—	—	—
25	322242094010201	Cd-8080Z	2/24/2004	1130	—	—	—	—	—	—	—	—
26	323335093542401	Cd-6189Z	2/24/2004	1400	—	—	—	—	—	—	—	—
27	323451094023401	Cd-6410Z	2/26/2004	1130	—	—	—	—	—	—	—	—
28	323908093410301	Bo-UR001	2/26/2004	1400	—	—	—	—	—	—	—	—
29	323901093321701	Bo-7250Z	3/3/2004	1100	—	—	—	—	—	—	—	—
30	321620093525201	Cd-8822Z	3/3/2004	1330	—	—	—	—	—	—	—	—
31	322120093263401	Bo-8136Z	4/5/2004	1130	—	—	—	—	—	—	—	—
32	322423093240701	Bo-7323Z	4/5/2004	1300	—	—	—	—	—	—	—	—
33	330022094003701	Cd-5373Z	4/7/2004	1300	—	—	—	—	—	—	—	—
34	325413094010501	Cd-9892Z	4/7/2004	1430	—	—	—	—	—	—	—	—
35	322816093304301	Bo-5294Z	4/8/2004	1100	—	—	—	—	—	—	—	—
36	323622093401001	Bo-5455Z	4/8/2004	1400	—	—	—	—	—	—	—	—
37	323853093471701	Cd-8687Z	4/12/2004	1200	—	—	—	—	—	—	—	—
38	322157093282601	Bo-7655Z	4/13/2004	1100	—	—	—	—	—	—	—	—

Cobalt (µg/L) 7440-48-4	Copper (µg/L) 7440-50-8	Iron (µg/L) 7439-89-6	Lead (µg/L) 7439-92-1	Lithium (µg/L) 7439-93-2	Manganese (µg/L) 7439-96-5	Molybdenum (µg/L) 7439-98-7	Nickel (µg/L) 7440-02-0	Selenium (µg/L) 7782-49-2	Silver (µg/L) 7440-22-4	Strontium (µg/L) 7440-24-6	Thallium (µg/L) 7440-28-0	Uranium (natural) (µg/L) 7440-61-1	Vanadium (µg/L) 7440-62-2	Zinc (µg/L) 7440-66-6
Wells sampled in northwestern Louisiana														
—	—	142	—	—	53	—	—	—	—	—	—	—	—	—
—	—	573	—	—	42	—	—	—	—	—	—	—	—	—
—	—	28	—	—	13	—	—	—	—	—	—	—	—	—
—	—	12	—	—	10	—	—	—	—	—	—	—	—	—
—	—	3	—	—	10	—	—	—	—	—	—	—	—	—
—	—	12	—	—	6	—	—	—	—	—	—	—	—	—
—	—	1,170	—	—	61	—	—	—	—	—	—	—	—	—
—	—	52	—	—	19	—	—	—	—	—	—	—	—	—
—	—	9	—	—	3	—	—	—	—	—	—	—	—	—
—	—	6	—	—	9	—	—	—	—	—	—	—	—	—
—	—	1,240	—	—	193	—	—	—	—	—	—	—	—	—
—	—	17	—	—	10	—	—	—	—	—	—	—	—	—
—	—	617	—	—	67	—	—	—	—	—	—	—	—	—
—	—	37	—	—	23	—	—	—	—	—	—	—	—	—
—	—	14	—	—	3	—	—	—	—	—	—	—	—	—
—	—	12	—	—	<1	—	—	—	—	—	—	—	—	—
—	—	1,280	—	—	156	—	—	—	—	—	—	—	—	—
—	—	29	—	—	5	—	—	—	—	—	—	—	—	—
—	—	68	—	—	14	—	—	—	—	—	—	—	—	—
—	—	6	—	—	4	—	—	—	—	—	—	—	—	—
—	—	43	—	—	14	—	—	—	—	—	—	—	—	—
—	—	4,470	—	—	97	—	—	—	—	—	—	—	—	—
—	—	12	—	—	17	—	—	—	—	—	—	—	—	—
—	—	42	—	—	48	—	—	—	—	—	—	—	—	—
—	—	319	—	—	71	—	—	—	—	—	—	—	—	—
—	—	8	—	—	18	—	—	—	—	—	—	—	—	—
—	—	7,150	—	—	197	—	—	—	—	—	—	—	—	—
—	—	16	—	—	3	—	—	—	—	—	—	—	—	—
—	—	8,370	—	—	264	—	—	—	—	—	—	—	—	—
—	—	7	—	—	6	—	—	—	—	—	—	—	—	—
—	—	36	—	—	7	—	—	—	—	—	—	—	—	—
—	—	928	—	—	76	—	—	—	—	—	—	—	—	—
—	—	38	—	—	2	—	—	—	—	—	—	—	—	—
—	—	17	—	—	4	—	—	—	—	—	—	—	—	—
—	—	104	—	—	19	—	—	—	—	—	—	—	—	—
—	—	17	—	—	13	—	—	—	—	—	—	—	—	—
—	—	478	—	—	48	—	—	—	—	—	—	—	—	—
—	—	29	—	—	8	—	—	—	—	—	—	—	—	—

Appendix 3. Trace-element concentrations in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04. —Continued

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers[1]. USGS. U.S. Geological Survey; µg/L, micrograms per liter; —, no data; <, less than; E, estimated; M, presence of material verified but not quantified]

Well number (fig. 1)	USGS site identification number	State well number	Sample start date	Sample time	Aluminum (µg/L) 7429-90-5	Antimony (µg/L) 7440-36-0	Arsenic (µg/L) 7440-38-2	Barium (µg/L) 7440-39-3	Beryllium (µg/L) 7440-41-7	Boron (µg/L) 7440-42-8	Cadmium (µg/L) 7440-43-9	Chromium (µg/L) 7440-47-3
			Wells sampled in northwestern Louisiana—Continued									
39	322638093330301	Bo-7965Z	4/13/2004	1300	—	—	—	—	—	—	—	—
40	324703093405701	Bo-7952Z	4/13/2004	1730	—	—	—	—	—	—	—	—
41	315343093430801	DS-6541Z	4/14/2004	1245	—	—	—	—	—	—	—	—
42	322724093415801	Cd-8906Z	4/14/2004	1630	—	—	—	—	—	—	—	—
43	315941093391801	DS-5163Z	4/19/2004	1130	—	—	—	—	—	—	—	—
44	324013093434001	Bo-8981Z	5/24/2004	1130	—	—	—	—	—	—	—	—
45	324303093454001	Bo-6697Z	5/24/2004	1300	—	—	—	—	—	—	—	—
46	322039093423801	Cd-9784Z	5/25/2004	1030	—	—	—	—	—	—	—	—
47	322842093563001	Cd-8023Z	5/25/2004	1300	—	—	—	—	—	—	—	—
48	323548093461201	Cd-6112Z	6/2/2004	1200	—	—	—	—	—	—	—	—
49	322753094021401	Cd-9866Z	6/14/2004	1330	—	—	—	—	—	—	—	—
50	322606093523601	Cd-8118Z	6/14/2004	1500	—	—	—	—	—	—	—	—
51	325151093590101	Cd-8782Z	6/21/2004	1100	—	—	—	—	—	—	—	—
52	324642093590001	Cd-6742Z	6/21/2004	1315	—	—	—	—	—	—	—	—
53	321958093402001	Cd-5221Z	6/22/2004	915	—	—	—	—	—	—	—	—
54	322148093580601	Cd-7826Z	6/22/2004	1100	—	—	—	—	—	—	—	—
55	323604093413701	Bo-8405Z	6/23/2004	1100	—	—	—	—	—	—	—	—
56	323347093583201	Cd-9160Z	6/24/2004	1130	—	—	—	—	—	—	—	—
57	323042093502001	Cd-5556Z	6/28/2004	1100	—	—	—	—	—	—	—	—
58	322233093422601	Cd-8861Z	6/28/2004	1200	—	—	—	—	—	—	—	—
59	325951093574101	Cd-5631Z	6/29/2004	1200	—	—	—	—	—	—	—	—
60	325759093532101	Cd-5697Z	6/29/2004	1430	—	—	—	—	—	—	—	—
61	325413093535801	Cd-6594Z	6/30/2004	1430	—	—	—	—	—	—	—	—
62	324250093393201	Bo-7530Z	6/30/2004	1600	—	—	—	—	—	—	—	—
63	324310093402801	Bo-8991Z	8/9/2004	1100	3	<0.20	<0.2	95	<0.06	1,650	<0.04	<0.8
64	322452093563001	Cd-8122Z	8/9/2004	1700	<2	<.20	<.2	146	<.06	64	<.04	<.8
65	321246093115501	Bi-6092Z	8/10/2004	1100	4	<0.20	E0.1	11	<0.06	527	<0.04	<0.8
66	321113093222401	RR-5548Z	8/10/2004	1500	<2	<.20	2.2	50	<.06	13	<.04	<.8
67	320849093505001	DS-5442Z	8/11/2004	1100	E2	<.20	<.2	64	<.06	391	<.04	<.8
68	323508094020101	Cd-9080Z	8/11/2004	1600	3	<.20	E.2	76	0.16	12	0.27	1
69	324506094023301	Cd-8586Z	8/16/2004	1200	E2	<.20	E.2	152	<.06	503	<.04	<.8
70	323901093545201	Cd-6002Z	8/16/2004	1600	E1	<.20	E.2	111	<.06	410	<.04	<.8
71	324959093543701	Cd-8434Z	8/17/2004	1000	E2	<.20	E.1	95	<.06	816	<.04	E.7
72	321532094010901	Cd-8956Z	8/17/2004	1500	<2	<.20	E.2	62	0.07	E8	<.04	1.7
73	321442093421101	DS-6687Z	8/18/2004	1200	3	<.20	<.2	6	<.06	470	<.04	<.8
74	320848093431201	DS-6028Z	8/18/2004	1600	<2	<.20	E.2	141	<.06	35	<.04	<.8
75	321130093594601	DS-6458Z	8/24/2004	1300	<2	<.20	0.3	220	<.06	35	<.04	<.8
76	313006093332501	Sa-5510Z	8/30/2004	1300	2	<.20	<.2	98	<.06	2,930	<.04	<.8

Cobalt (µg/L) 7440-48-4	Copper (µg/L) 7440-50-8	Iron (µg/L) 7439-89-6	Lead (µg/L) 7439-92-1	Lithium (µg/L) 7439-93-2	Manganese (µg/L) 7439-96-5	Molybdenum (µg/L) 7439-98-7	Nickel (µg/L) 7440-02-0	Selenium (µg/L) 7782-49-2	Silver (µg/L) 7440-22-4	Strontium (µg/L) 7440-24-6	Thallium (µg/L) 7440-28-0	Uranium (natural) (µg/L) 7440-61-1	Vanadium (µg/L) 7440-62-2	Zinc (µg/L) 7440-66-6
Wells sampled in northwestern Louisiana—Continued														
—	—	8	—	—	4	—	—	—	—	—	—	—	—	—
—	—	16	—	—	1	—	—	—	—	—	—	—	—	—
—	—	85	—	—	6	—	—	—	—	—	—	—	—	—
—	—	23	—	—	6	—	—	—	—	—	—	—	—	—
—	—	8	—	—	1	—	—	—	—	—	—	—	—	—
—	—	101	—	—	12	—	—	—	—	—	—	—	—	—
—	—	12	—	—	2	—	—	—	—	—	—	—	—	—
—	—	5	—	—	5	—	—	—	—	—	—	—	—	—
—	—	298	—	—	42	—	—	—	—	—	—	—	—	—
—	—	41	—	—	7	—	—	—	—	—	—	—	—	—
—	—	2	—	—	40	—	—	—	—	—	—	—	—	—
—	—	13	—	—	7	—	—	—	—	—	—	—	—	—
—	—	29	—	—	49	—	—	—	—	—	—	—	—	—
—	—	503	—	—	23	—	—	—	—	—	—	—	—	—
—	—	23	—	—	8	—	—	—	—	—	—	—	—	—
—	—	5	—	—	12	—	—	—	—	—	—	—	—	—
—	—	217	—	—	32	—	—	—	—	—	—	—	—	—
—	—	1	—	—	M	—	—	—	—	—	—	—	—	—
—	—	3	—	—	19	—	—	—	—	—	—	—	—	—
—	—	23	—	—	8	—	—	—	—	—	—	—	—	—
—	—	76	—	—	3	—	—	—	—	—	—	—	—	—
—	—	11	—	—	3	—	—	—	—	—	—	—	—	—
—	—	33	—	—	3	—	—	—	—	—	—	—	—	—
—	—	65	—	—	3	—	—	—	—	—	—	—	—	—
0.107	E0.3	29	0.11	22.5	2.2	1.6	0.7	E0.2	<0.2	396	<0.04	<0.04	2.3	3.3
0.153	E.3	529	<.08	34.3	133	E.3	0.92	<.4	<.2	917	<.04	<.04	1.2	0.6
0.064	<.4	E6	<.08	11.7	7.7	E.2	E.06	<.4	<.2	40.3	<.04	<.04	1.2	E.6
0.155	E.2	11,100	<.08	11	242	<.4	1.27	<.4	<.2	142	<.04	<.04	0.4	6.6
0.036	E.3	18	<.08	17	22.8	0.4	0.18	<.4	<.2	376	<.04	0.05	0.9	<.6
0.579	5.3	E4	0.57	29.5	15.3	<.4	12.7	1.3	<.2	409	<.04	<.04	0.7	32
0.083	E.2	30	0.14	25.7	25.5	<.4	0.41	0.7	<.2	807	<.04	<.04	0.7	1.6
0.05	1.7	E3	0.25	33.4	6.8	<.4	0.34	0.5	<.2	443	<.04	<.04	1	3
0.055	E.3	19	0.21	21.1	11.1	<.4	0.24	E.4	<.2	497	<.04	<.04	0.7	13.7
0.081	13.2	<6	1.01	2.2	0.6	<.4	1.04	<.4	<.2	32.2	<.04	<.04	0.9	10.9
0.017	<.4	E6	0.3	12.7	3.4	E.3	E.05	<.4	<.2	23.1	<.04	<.04	0.5	3.6
0.393	.4	1,170	<.08	58.8	116	<.4	1.63	<.4	<.2	1,120	<.04	E.03	0.2	145
0.122	E.2	854	E.06	36.2	87	E.2	1.33	<.4	<.2	935	<.04	<.04	0.3	0.9
0.033	.4	38	<.08	7.1	6.6	E.3	E.06	<.4	<.2	187	<.04	E.02	1.7	<.6

Appendix 3. Trace-element concentrations in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04. —Continued

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers1. USGS. U.S. Geological Survey; µg/L, micrograms per liter; —, no data; <, less than; E, estimated; M, presence of material verified but not quantified]

Well number (fig. 1)	USGS site identification number	State well number	Sample start date	Sample time	Aluminum (µg/L) 7429-90-5	Antimony (µg/L) 7440-36-0	Arsenic (µg/L) 7440-38-2	Barium (µg/L) 7440-39-3	Beryllium (µg/L) 7440-41-7	Boron (µg/L) 7440-42-8	Cadmium (µg/L) 7440-43-9	Chromium (µg/L) 7440-47-3
Wells sampled in northwestern Louisiana—Continued												
77	314223093231001	Sa-5676Z	9/1/2004	1100	4	<.20	<.2	37	<.06	1,540	<.04	<.8
78	314328093131901	Na-5037Z	9/1/2004	1500	5	<.20	<.2	53	<.06	1,010	<.04	<.8
79	314217093461901	Sa-5561Z	9/8/2004	1400	E1	<.20	<.2	148	<.06	843	<.04	<.8
Wells sampled in east-central Texas												
80	315823094092001	XB-37-07-3	8/31/2004	1100	<2	<.20	<.2	271	<.06	170	<.04	<.8
81	320128094151201	UL-35-62-9	9/7/2004	1300	M	<.20	0.9	27	E.06	12	1.52	2.4
82	315107094265101	XB-37-16-3	9/7/2004	1600	M	<.20	<.2	133	<.06	75	<.04	<.8
83	314948094011901	XB-37-16-6	9/8/2004	1000	2	<.20	<.2	43	<.06	1,280	<.04	<.8
84	321214094213001	UL-35-54-401	9/13/2004	1200	<2	<.20	<.2	122	<.06	141	<.04	<.8
85	321722094285201	UL-35-45-705	9/13/2004	1500	3	<.20	<.2	25	<.06	699	<.04	<.8
86	314837094320701	TX-37-12-6	9/14/2004	900	3	<.20	<.2	24	<.06	193	<.04	<.8
87	312923093572101	WT-36-33-2	9/14/2004	1300	37	<.20	<.2	24	0.1	10	0.11	<.8
88	312930094082801	WT-37-39-3	9/15/2004	1500	<2	<.20	<.2	47	<.06	54	<.04	<.8
89	323925094111301	LK-35-23-8	9/20/2004	1200	3	<.20	<.2	31	<.06	236	<.04	<.8
90	323103094175001	LK-35-30-8	9/20/2004	1500	M	<.20	0.3	41	E.05	10	<.04	<.8
91	322611094133401	LK-35-39-4	9/21/2004	1000	E1	<.20	<.2	153	<.06	205	<.04	<.8
92	320354094310301	UL-35-60-6	9/21/2004	1200	M	<.20	<.2	145	<.06	150	<.04	<.8

[1]CAS Registry Number® is a Registered Trademark of the American Chemical Society. CAS recommends the verification of the CASRNs through CAS Client ServicesSM.

Cobalt (µg/L) 7440-48-4	Copper (µg/L) 7440-50-8	Iron (µg/L) 7439-89-6	Lead (µg/L) 7439-92-1	Lithium (µg/L) 7439-93-2	Manganese (µg/L) 7439-96-5	Molybdenum (µg/L) 7439-98-7	Nickel (µg/L) 7440-02-0	Selenium (µg/L) 7782-49-2	Silver (µg/L) 7440-22-4	Strontium (µg/L) 7440-24-6	Thallium (µg/L) 7440-28-0	Uranium (natural) (µg/L) 7440-61-1	Vanadium (µg/L) 7440-62-2	Zinc (µg/L) 7440-66-6
Wells sampled in northwestern Louisiana—Continued														
0.038	.8	23	E.07	6.5	3.5	E.3	0.13	E.3	<.2	58.8	<.04	0.14	3.5	0.7
E.013	.7	7	0.33	6.8	4.9	0.5	E.04	E.3	<.2	86.5	<.04	0.14	2.3	<.6
0.033	<.4	159	<.08	48.7	9.2	E.3	0.09	E.3	<.2	505	<.04	<.04	1	3.8
Wells sampled in east-central Texas														
0.064	.7	533	0.52	54.7	38.6	<.4	0.36	E.3	<.2	1,950	<.04	<.04	E.1	0.8
0.421	8.1	31	17.7	68.7	15.9	<.4	48.7	5.2	<.2	1,180	<.04	E.03	0.4	37.8
0.023	<.4	23	0.57	7.2	21	<.4	0.21	<.4	<.2	525	<.04	<.04	0.1	4.3
0.262	<.4	596	E.07	26	82.8	0.5	0.22	<.4	<.2	146	<.04	<.04	1.6	<.6
0.084	1.2	787	0.16	44.5	38.2	<.4	0.2	<.4	<.2	1,390	<.04	<.04	<.1	3.5
0.02	.8	11	0.57	17.5	1.4	E.2	0.1	<.4	<.2	79.7	<.04	<.04	0.4	2
E.010	1	9	0.14	4.7	8.3	<.4	0.08	E.3	<.2	57.9	<.04	<.04	1.2	1.3
1.09	38.6	65	41.2	2.2	3.5	<.4	1.84	0.5	<.2	5.23	E.02	<.04	0.7	37.2
0.047	4.2	740	1.06	11.4	17.2	<.4	0.3	<.4	<.2	106	<.04	<.04	0.5	659
0.031	E.3	18	<.08	18.8	12.8	<.4	E.05	<.4	<.2	315	<.04	<.04	0.4	E.5
1.66	<.4	848	0.11	6.5	68	<.4	2.23	<.4	<.2	64.9	<.04	<.04	0.2	11.6
0.185	E.4	111	<.08	36.1	8.2	E.4	0.3	<.4	<.2	1,920	<.04	E.03	0.3	24
0.094	.8	11	0.72	14	14.5	<.4	0.15	<.4	<.2	608	<.04	<.04	0.2	5.8

Appendix 4. Radionuclide concentrations in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers[1]. All concentrations are in picocuries per liter. USGS, U.S. Geological Survey; E, estimated; M, presence of material verified but not quantified; --, no data]

Well number (fig. 1)	USGS site identification number	State well number	Sample date	Sample time	Radon-222 14859-67-7	Radon-222, 2-sigma combined uncertainty 14859-67-7	Radium-224 13233-32-4	Radium-226 13982-63-3
Wells sampled in northwestern Louisiana								
63	324310093402801	Bo-8991Z	8/9/2004	1100	260	22	0.26	0.16
64	322452093563001	Cd-8122Z	8/9/2004	1700	220	21	1.04	0.2
65	321246093115501	Bi-6092Z	8/10/2004	1100	490	27	0.1	E.09
66	321113093222401	RR-5548Z	8/10/2004	1500	340	25	0.11	0.26
67	320849093505001	DS-5442Z	8/11/2004	1100	390	25	0.14	0.17
68	323508094020101	Cd-9080Z	8/11/2004	1600	610	28	0.31	0.14
69	324506094023301	Cd-8586Z	8/16/2004	1200	340	24	--	0.23
70	323901093545201	Cd-6002Z	8/16/2004	1600	380	25	--	0.26
71	324959093543701	Cd-8434Z	8/17/2004	1000	220	21	--	0.18
72	321532094010901	Cd-8956Z	8/17/2004	1500	1,050	34	--	E.08
73	321442093421101	DS-6687Z	8/18/2004	1200	50	18	--	E.03
74	320848093431201	DS-6028Z	8/18/2004	1600	280	23	0.36	0.23
75	321130093594601	DS-6458Z	8/24/2004	1300	320	24	0.51	0.32
76	313006093332501	Sa-5510Z	8/30/2004	1300	440	26	E.08	0.11
77	314223093231001	Sa-5676Z	9/1/2004	1100	300	23	0.2	0.14
78	314328093131901	Na-5037Z	9/1/2004	1500	380	24	E.07	0.13
79	314217093461901	Sa-5561Z	9/8/2004	1400	270	22	0.42	0.24
Wells sampled in east-central Texas								
80	315823094092001	XB-37-07-3	8/31/2004	1100	190	20	0.68	0.5
81	320128094151201	UL-35-62-9	9/7/2004	1300	480	25	2.41	0.66
82	315107094265101	XB-37-16-3	9/7/2004	1600	360	23	0.36	0.14
83	314948094011901	XB-37-16-6	9/8/2004	1000	360	24	0.12	E.07
84	321214094213001	UL-35-54-401	9/13/2004	1200	230	22	0.8	0.47
85	321722094285201	UL-35-45-705	9/13/2004	1500	460	26	0.12	E.08
86	314837094320701	TX-37-12-6	9/14/2004	900	340	23	0.14	E.09
87	312923093572101	WT-36-33-2	9/14/2004	1300	100	26	0.31	0.24
88	312930094082801	WT-37-39-3	9/15/2004	1500	180	20	0.2	0.18
89	323925094111301	LK-35-23-8	9/20/2004	1200	520	27	0.12	E.08
90	323103094175001	LK-35-30-8	9/20/2004	1500	370	24	0.11	E.09
91	322611094133401	LK-35-39-4	9/21/2004	1000	400	25	0.28	0.18
92	320354094310301	UL-35-60-6	9/21/2004	1200	70	18	0.1	0.17

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Radium-228 15262-20-1	Gross-alpha radioactivity, 72-hour count 12587-46-1	Gross-alpha radioactivity, 30-day count 12587-46-1	Gross-beta radioactivity, 72-hour count 12587-46-2	Gross-beta radio-activity, 30-day count 12587-46-2	Tritium 10028-17-8	Tritium, 2-sigma combined uncertainty 10028-17-8
Wells sampled in northwestern Louisiana						
M	E1	M	E3	4	E0.3	0.6
M	8	M	E3	E3	E.6	0.6
M	M	M	E1	M	E.6	0.6
M	M	E2	E3	E1	E.3	0.6
M	E2	M	E2	E2	--	--
M	E2	E1	E2	E1	8	1
M	E1	M	4	E3	--	--
M	E2	M	E2	E3	--	--
M	M	M	4	E2	--	--
M	M	M	E1	M	--	--
M	E-1	M	E2	M	--	--
M	3	M	E2	E3	--	--
M	E2	E2	E3	E2	--	--
M	E-2	M	7	E3	--	--
M	3	E1	M	M	--	--
M	6	M	E2	E2	--	--
M	M	M	E2	E3	--	--
Wells sampled in east-central Texas						
M	E1	3	6	5	--	--
2	8	3	12	11	--	--
M	E1	M	E2	M	--	--
M	M	M	5	E2	--	--
1	5	E2	5	4	--	--
M	E-1	M	M	M	--	--
M	M	M	E1	E1	--	--
M	M	E1	E2	M	--	--
M	E2	M	4	E3	--	--
M	M	M	E2	E2	--	--
M	M	M	E2	E1	--	--
M	E1	E2	6	4	--	--
M	M	M	7	E2	--	--

Appendix 5. Nutrients, total organic carbon, and dissolved organic carbon in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers[1]. USGS, U.S. Geological Survey; mg/L, milligrams per liter; --, no data; E, estimated; <, less than; NC, not caculated; A, average value]

Well number (fig. 1)	USGS site identification number	State well number	Sample date	Sample time	Ammonia (mg/L as N) no CAS number	Total nitrogen (NO2 + NO3 + ammonia + organic-N) (mg/L as N) no CAS number	Nitrite plus nitrate (mg/L as N) no CAS number	Nitrate (mg/L as N) 14797-55-8	Nitrite (mg/L as N) 14797-65-0	Orthophosphate (mg/L as P) 14265-44-2	Total organic carbon, unfiltered (mg/L) no CAS number	Dissolved organic carbon, filtered (mg/L) no CAS number
Wells sampled in northwestern Louisiana												
1	320216093492101	DS-UR001	12/2/2003	1300	--	--	<0.02	NC	<0.010	--	0.6	--
2	320309093484601	DS-UR002	12/2/2003	1400	--	--	<.02	NC	<.010	--	0.3	--
3	320222093541001	DS-UR003	12/4/2003	1300	--	--	<.02	NC	<.010	--	0.8	--
4	320504093484201	DS-UR004	12/8/2003	1300	--	--	<.02	NC	<.010	--	0.7	--
5	320833093473701	DS-UR005	12/8/2003	1500	--	--	<.02	NC	<.010	--	0.5	--
6	320547093570101	DS-5472Z	12/10/2003	1200	--	--	<.02	NC	<.010	--	0.7	--
7	321002094023001	DS-91	1/12/2004	1200	--	--	<.02	NC	<.010	--	0.2	--
8	320929093525201	DS-5222Z	1/13/2004	1200	--	--	<.02	NC	<.010	--	0.4	--
9	321429093415701	DS-5481Z	1/14/2004	1515	--	--	<.02	NC	<.010	--	0.8	--
10	321006093571501	DS-7041Z	1/20/2004	1300	--	--	.07	0.06	0.01	--	0.6	--
11	320115094003001	DS-6211Z	1/21/2004	1245	--	--	<.02	NC	<.010	--	0.9	--
12	320500093431201	DS-6832Z	1/27/2004	1230	--	--	<.02	NC	<.010	--	<.1	--
13	315532093405701	DS-6045Z	1/27/2004	1430	--	--	<.02	NC	<.010	--	<.1	--
14	315330093355001	DS-6622Z	2/2/2004	1200	--	--	<.02	NC	<.010	--	1.2	--
15	320246094020401	DS-6425Z	2/2/2004	1500	--	--	<.02	NC	<.010	--	38	--
16	321656094002801	Cd-6028Z	2/3/2004	1130	--	--	.40	.40	<.010	--	0.3	--
17	321845094022401	Cd-9320Z	2/3/2004	1400	--	--	<.02	NC	<.010	--	0.6	--
18	315157093423401	DS-5297Z	2/3/2004	1600	--	--	<.02	NC	<.010	--	1.9	--
19	320418093535801	DS-6576Z	2/16/2004	1230	--	--	<.02	NC	<.010	--	2.1	--
20	320828093405201	DS-6771Z	2/17/2004	1100	--	--	<.02	NC	<.010	--	2.2	--
21	320846093424401	DS-5223Z	2/17/2004	1300	--	--	.14	.14	<0.010	--	3.2	--
22	315213093350501	DS-5378Z	2/18/2004	1230	--	--	<.02	NC	<.010	--	0.4	--
23	315933093415301	DS-5550Z	2/18/2004	1700	--	--	.03	.03	<.010	--	1.4	--
24	323322093284201	Bo-8740Z	2/23/2004	1100	--	--	.14	.14	<.010	--	0.6	--
25	322242094010201	Cd-8080Z	2/24/2004	1130	--	--	<.02	NC	<.010	--	0.1	--

26	323335093542401	Cd-6189Z	2/24/2004	1400	--	--	.13	0.11	0.02	--	0.3	--
27	323451094023401	Cd-6410Z	2/26/2004	1130	--	--	<.02	NC	<.010	--	0.1	--
28	323908093410301	Bo-UR001	2/26/2004	1400	--	--	<.02	NC	<.010	--	2.1	--
29	323901093321701	Bo-7250Z	3/3/2004	1100	--	--	<.02	NC	0.02	--	0.2	--
30	321620093525201	Cd-8822Z	3/3/2004	1330	--	--	.08	.08	<.010	--	0.9	--
31	322120093263401	Bo-8136Z	4/5/2004	1130	--	--	<.02	NC	<.010	--	1.2	--
32	322423093240701	Bo-7323Z	4/5/2004	1300	--	--	<0.02	NC	<0.010	--	0.9	--
33	330022094003701	Cd-5373Z	4/7/2004	1300	--	--	<.02	NC	<.010	--	0.6	--
34	325413094010501	Cd-9892Z	4/7/2004	1430	--	--	<.02	NC	A.030	--	1.4	--
35	322816093304301	Bo-5294Z	4/8/2004	1100	--	--	.45	.45	<.010	--	0.2	--
36	323622093401001	Bo-5455Z	4/8/2004	1400	--	--	<.02	NC	<.010	--	0.9	--
37	323853093471701	Cd-8687Z	4/12/2004	1200	--	--	<.02	NC	<.010	--	0.7	--
38	322157093282601	Bo-7655Z	4/13/2004	1100	--	--	<.02	NC	<.010	--	1	--
39	322638093330301	Bo-7965Z	4/13/2004	1300	--	--	.77	.77	<.010	--	0.2	--
40	324703093405701	Bo-7952Z	4/13/2004	1730	--	--	<.02	NC	<.010	--	2	--
41	315343093430801	DS-6541Z	4/14/2004	1245	--	--	<.02	NC	<.010	--	4.9	--
42	322724093415801	Cd-8906Z	4/14/2004	1630	--	--	<.02	NC	<.010	--	1.4	--
43	315941093391801	DS-5163Z	4/19/2004	1130	--	--	.12	.12	<.010	--	2	--
44	324013093434001	Bo-8981Z	5/24/2004	1130	--	--	<.02	NC	<.010	--	3.1	--
45	324303093454001	Bo-6697Z	5/24/2004	1300	--	--	<.02	NC	<.010	--	3.7	--
46	322039093423801	Cd-9784Z	5/25/2004	1030	--	--	.36	0.19	0.17	--	1.5	--
47	322842093563001	Cd-8023Z	5/25/2004	1300	--	--	.03	.03	<.010	--	<.1	--
48	323548093461201	Cd-6112Z	6/2/2004	1200	--	--	.02	0.01	0.01	--	1.3	--
49	322753094021401	Cd-9866Z	6/14/2004	1330	--	--	3.4	3.4	<.010	--	1.3	--
50	322606093523601	Cd-8118Z	6/14/2004	1500	--	--	<.02	NC	<.010	--	1	--
51	325151093590101	Cd-8782Z	6/21/2004	1100	--	--	.06	.06	<.010	--	1.8	--
52	324642093590001	Cd-6742Z	6/21/2004	1315	--	--	<.02	NC	<.010	--	1.7	--
53	321958093402001	Cd-5221Z	6/22/2004	915	--	--	<.02	NC	<.010	--	1.8	--
54	322148093580601	Cd-7826Z	6/22/2004	1100	--	--	<.02	NC	<.010	--	1.6	--
55	323604093413701	Bo-8405Z	6/23/2004	1100	--	--	.09	0.08	0.01	--	2.1	--
56	323347093583201	Cd-9160Z	6/24/2004	1130	--	--	.66	0.65	0.01	--	2.2	--
57	323042093502001	Cd-5556Z	6/28/2004	1100	--	--	.02	0.01	0.01	--	3.9	--
58	322233093422601	Cd-8861Z	6/28/2004	1200	--	--	.02	0.01	0.01	--	4.2	--
59	325951093574101	Cd-5631Z	6/29/2004	1200	--	--	.02	0.01	0.01	--	3	--
60	325759093532101	Cd-5697Z	6/29/2004	1430	--	--	.04	--	--	--	3.1	--
61	325413093535801	Cd-6594Z	6/30/2004	1430	--	--	.02	0.01	0.01	--	4.2	--

Appendix 5. Nutrients, total organic carbon, and dissolved organic carbon in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers[1]. USGS, U.S. Geological Survey; mg/L, milligrams per liter; --, no data; E, estimated; <, less than; NC, not caculated; A, average value]

Well number (fig. 1)	USGS site identification number	State well number	Sample date	Sample time	Ammonia (mg/L as N) no CAS number	Total nitrogen (NO2 + NO3 + ammonia + organic-N) (mg/L as N) no CAS number	Nitrite plus nitrate (mg/L as N) no CAS number	Nitrate (mg/L as N) 14797-55-8	Nitrite (mg/L as N) 14797-65-0	Orthophosphate (mg/L as P) 14265-44-2	Total organic carbon, unfiltered (mg/L) no CAS number	Dissolved organic carbon, filtered (mg/L) no CAS number
Wells sampled in northwestern Louisiana—Continued												
62	324250093393201	Bo-7530Z	6/30/2004	1600	--	--	.02	0.01	0.01	--	5.4	--
63	324310093402801	Bo-8991Z	8/9/2004	1100	1.27	1.43	<0.06	NC	<0.008	0.169	--	5.7
64	322452093563001	Cd-8122Z	8/9/2004	1700	0.22	0.22	<.06	NC	<.008	0.035	--	1.7
65	321246093115501	Bi-6092Z	8/10/2004	1100	0.52	0.61	<.06	NC	<.008	0.576	--	2.7
66	321113093222401	RR-5548Z	8/10/2004	1500	E.02	0.04	<.06	NC	E.007	0.251	--	0.6
67	320849093505001	DS-5442Z	8/11/2004	1100	0.86	0.95	<.06	NC	<.008	0.183	0.8	1.4
68	323508094020101	Cd-9080Z	8/11/2004	1600	<.04	1.14	1.14	1.14	<.008	0.022	1.4	0.8
69	324506094023301	Cd-8586Z	8/16/2004	1200	0.85	0.91	<.06	NC	E.006	0.117	--	1.5
70	323901093545201	Cd-6002Z	8/16/2004	1600	0.5	0.88	0.29	0.26	0.029	0.136	--	1.7
71	324959093543701	Cd-8434Z	8/17/2004	1000	0.99	1.11	<.06	NC	<.008	0.118	--	1.4
72	321532094010901	Cd-8956Z	8/17/2004	1500	<.04	0.17	0.15	0.15	<.008	0.03	--	0.5
73	321442093421101	DS-6687Z	8/18/2004	1200	0.44	0.56	E.06	E.06	<.008	0.537	--	1.6
74	320848093431201	DS-6028Z	8/18/2004	1600	0.14	0.16	<.06	NC	<.008	0.141	--	0.7
75	321130093594601	DS-6458Z	8/24/2004	1300	0.1	0.08	<.06	NC	<.008	0.15	4.2	0.5
76	313006093332501	Sa-5510Z	8/30/2004	1300	1.07	1.45	<.06	NC	<.008	1.45	8.2	12.1
77	314223093231001	Sa-5676Z	9/1/2004	1100	0.89	1.07	<.06	NC	<.008	0.96	10.8	5.2
78	314328093131901	Na-5037Z	9/1/2004	1500	1.09	1.27	<.06	NC	<.008	0.895	15.9	3.5
79	314217093461901	Sa-5561Z	9/8/2004	1400	1.39	1.52	<.06	NC	<.008	0.824	10.6	2.9
Wells sampled in east-central Texas												
80	315823094092001	XB-37-07-3	8/31/2004	1100	0.98	1.13	0.08	0.08	<.008	0.129	2.6	0.6
81	320128094151201	UL-35-62-9	9/7/2004	1300	<.04	0.74	.71	.71	<.008	0.049	--	1.7
82	315107094265101	XB-37-16-3	9/7/2004	1600	0.6	0.6	<.06	NC	<.008	0.173	--	--
83	314948094011901	XB-37-16-6	9/8/2004	1000	0.87	1.02	<.06	NC	<.008	0.866	--	4.5
84	321214094213001	UL-35-54-401	9/13/2004	1200	1.03	1.08	<.06	NC	<.008	0.102	--	1.9
85	321722094285201	UL-35-45-705	9/13/2004	1500	0.84	1.04	<.06	NC	<.008	0.874	--	4

86	314837094320701	TX-37-12-6	9/14/2004	900	0.59	0.58	<.06	NC	<.008	0.249	--	1.1
87	312923093572101	WT-36-33-2	9/14/2004	1300	<.04	0.11	.10	.10	<.008	<.006	--	0.7
88	312930094082801	WT-37-39-3	9/15/2004	1500	0.25	0.25	<.06	NC	<.008	0.046	--	0.9
89	323925094111301	LK-35-23-8	9/20/2004	1200	0.78	0.85	<.06	NC	<.008	0.135	--	0.7
90	323103094175001	LK-35-30-8	9/20/2004	1500	<.04	<.03	<.06	NC	<.008	0.034	--	0.4
91	322611094133401	LK-35-39-4	9/21/2004	1000	0.97	1.06	<.06	NC	<.008	0.008	--	1
92	320354094310301	UL-35-60-6	9/21/2004	1200	0.32	0.55	.20	.20	E.007	0.116	--	0.8

[1] CAS Registry Number® is a Registered Trademark of the American Chemical Society. CAS recommends the verification of the CASRNs through CAS Client ServicesSM.

Appendix 6. Pesticide concentrations in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers[1]. All concentrations are in micrograms per liter. USGS, U.S. Geological Survey; H, herbicide; I, insecticide; <, less than]

Well number (fig. 1)	USGS site identification number	State well number	Sample date	Sample time	Acetochlor H 34256-82-1	Alachlor H 15972-60-8	Atrazine H 1912-24-9	Azinphos-methyl I 86-50-0
			Wells sampled in northwestern Louisiana					
63	324310093402801	Bo-8991Z	8/9/2004	1100	<0.006	<0.005	<0.007	<0.050
64	322452093563001	Cd-8122Z	8/9/2004	1700	<.006	<.005	<.007	<.050
65	321246093115501	Bi-6092Z	8/10/2004	1100	<.006	<.005	<.007	<.050
66	321113093222401	RR-5548Z	8/10/2004	1500	<.006	<.005	<.007	<.050
67	320849093505001	DS-5442Z	8/11/2004	1100	<.006	<.005	<.007	<.050
68	323508094020101	Cd-9080Z	8/11/2004	1600	<.006	<.005	<.007	<.050
69	324506094023301	Cd-8586Z	8/16/2004	1200	<.006	<.005	<.007	<.050
70	323901093545201	Cd-6002Z	8/16/2004	1600	<.006	<.005	<.007	<.050
71	324959093543701	Cd-8434Z	8/17/2004	1000	<.006	<.005	<.007	<.050
72	321532094010901	Cd-8956Z	8/17/2004	1500	<.006	<.005	<.007	<.050
73	321442093421101	DS-6687Z	8/18/2004	1200	<.006	<.005	<.007	<.050
74	320848093431201	DS-6028Z	8/18/2004	1600	<.006	<.005	<.007	<.050
75	321130093594601	DS-6458Z	8/24/2004	1300	<.006	<.005	<.007	<.050
76	313006093332501	Sa-5510Z	8/30/2004	1300	<.006	<.005	<.007	<.050
77	314223093231001	Sa-5676Z	9/1/2004	1100	<.006	<.005	<.007	<.050
78	314328093131901	Na-5037Z	9/1/2004	1500	<.006	<.005	<.007	<.050
79	314217093461901	Sa-5561Z	9/8/2004	1400	<.006	<.005	<.007	<.050
			Wells sampled in east-central Texas					
80	315823094092001	XB-37-07-3	8/31/2004	1100	<.006	<.005	<.007	<.050
81	320128094151201	UL-35-62-9	9/7/2004	1300	<.030	<.025	<.035	<.250
82	315107094265101	XB-37-16-3	9/7/2004	1600	<.006	<.005	<.007	<.050
83	314948094011901	XB-37-16-6	9/8/2004	1000	<.006	<.005	<.007	<.050
84	321214094213001	UL-35-54-401	9/13/2004	1200	<.006	<.005	<.007	<.050
85	321722094285201	UL-35-45-705	9/13/2004	1500	<.006	<.005	<.007	<.050
86	314837094320701	TX-37-12-6	9/14/2004	900	<.006	<.005	<.007	<.050
87	312923093572101	WT-36-33-2	9/14/2004	1300	<.006	<.005	<.007	<.050
88	312930094082801	WT-37-39-3	9/15/2004	1500	<.006	<.005	<.007	<.050
89	323925094111301	LK-35-23-8	9/20/2004	1200	<.006	<.005	<.007	<.050
90	323103094175001	LK-35-30-8	9/20/2004	1500	<.006	<.005	<.007	<.050
91	322611094133401	LK-35-39-4	9/21/2004	1000	<.006	<.005	<.007	<.050
92	320354094310301	UL-35-60-6	9/21/2004	1200	<.006	<.005	<.007	<.050

Benfluralin H 1861-40-1	Butylate H 2008-41-5	Carbaryl I 63-25-2	Carbofuran I 1563-66-2	Chlorpyrifos I 2921-88-2	Cyanazine H 21725-46-2	DCPA H 1861-32-1	Diazinon I 333-41-5	Dieldrin I 60-57-1	Disulfoton I 298-04-4
Wells sampled in northwestern Louisiana									
<0.010	<0.004	<0.041	<0.020	<0.005	<0.018	<0.003	<0.005	<0.009	<0.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
Wells sampled in east-central Texas									
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.050	<.020	<.205	<.100	<.025	<.090	<.015	<.025	<.045	<.10
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02
<.010	<.004	<.041	<.020	<.005	<.018	<.003	<.005	<.009	<.02

Appendix 6. Pesticide concentrations in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.—Continued

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers[1]. All concentrations are in micrograms per liter. USGS, U.S. Geological Survey; H, herbicide; I, insecticide; <, less than]

Well number (fig. 1)	USGS site identification number	State well number	Sample date	Sample time	EPTC H 759-94-4	Ethalfluralin H 55283-68-6	Ethoprop I 13194-48-4	Fipronil I 120068-37-3
Wells sampled in northwestern Louisiana								
63	324310093402801	Bo-8991Z	8/9/2004	1100	<0.004	<0.009	<0.005	<0.016
64	322452093563001	Cd-8122Z	8/9/2004	1700	<.004	<.009	<.005	<.016
65	321246093115501	Bi-6092Z	8/10/2004	1100	<.004	<.009	<.005	<.016
66	321113093222401	RR-5548Z	8/10/2004	1500	<.004	<.009	<.005	<.016
67	320849093505001	DS-5442Z	8/11/2004	1100	<.004	<.009	<.005	<.016
68	323508094020101	Cd-9080Z	8/11/2004	1600	<.004	<.009	<.005	<.016
69	324506094023301	Cd-8586Z	8/16/2004	1200	<.004	<.009	<.005	<.016
70	323901093545201	Cd-6002Z	8/16/2004	1600	<.004	<.009	<.005	<.016
71	324959093543701	Cd-8434Z	8/17/2004	1000	<.004	<.009	<.005	<.016
72	321532094010901	Cd-8956Z	8/17/2004	1500	<.004	<.009	<.005	<.016
73	321442093421101	DS-6687Z	8/18/2004	1200	<.004	<.009	<.005	<.016
74	320848093431201	DS-6028Z	8/18/2004	1600	<.004	<.009	<.005	<.016
75	321130093594601	DS-6458Z	8/24/2004	1300	<.004	<.009	<.005	<.016
76	313006093332501	Sa-5510Z	8/30/2004	1300	<.004	<.009	<.005	<.016
77	314223093231001	Sa-5676Z	9/1/2004	1100	<.004	<.009	<.005	<.016
78	314328093131901	Na-5037Z	9/1/2004	1500	<.004	<.009	<.005	<.016
79	314217093461901	Sa-5561Z	9/8/2004	1400	<.004	<.009	<.005	<.016
Wells sampled in east-central Texas								
80	315823094092001	XB-37-07-3	8/31/2004	1100	<.004	<.009	<.005	<.016
81	320128094151201	UL-35-62-9	9/7/2004	1300	<.020	<.045	<.025	<.080
82	315107094265101	XB-37-16-3	9/7/2004	1600	<.004	<.009	<.005	<.016
83	314948094011901	XB-37-16-6	9/8/2004	1000	<.004	<.009	<.005	<.016
84	321214094213001	UL-35-54-401	9/13/2004	1200	<.004	<.009	<.005	<.016
85	321722094285201	UL-35-45-705	9/13/2004	1500	<.004	<.009	<.005	<.016
86	314837094320701	TX-37-12-6	9/14/2004	900	<.004	<.009	<.005	<.016
87	312923093572101	WT-36-33-2	9/14/2004	1300	<.004	<.009	<.005	<.016
88	312930094082801	WT-37-39-3	9/15/2004	1500	<.004	<.009	<.005	<.016
89	323925094111301	LK-35-23-8	9/20/2004	1200	<.004	<.009	<.005	<.016
90	323103094175001	LK-35-30-8	9/20/2004	1500	<.004	<.009	<.005	<.016
91	322611094133401	LK-35-39-4	9/21/2004	1000	<.004	<.009	<.005	<.016
92	320354094310301	UL-35-60-6	9/21/2004	1200	<.004	<.009	<.005	<.016

Fonofos I 944-22-9	alpha-HCH I 319-84-6	Lindanel 58-89-9	Linuron H 330-55-2	Malathion I 121-75-5	Methyl parathion I 298-00-0	Metolachlor H 51218-45-2	Metribuzin H 21087-64-9	Molinate H 2212-67-1	Napropamide H 15299-99-7
Wells sampled in northwestern Louisiana									
<0.003	<0.005	<0.004	<0.035	<0.027	<0.015	<0.013	<0.006	<0.003	<0.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
Wells sampled in east-central Texas									
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.015	<.025	<.020	<.175	<.135	<.075	<.065	<.030	<.015	<.035
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007
<.003	<.005	<.004	<.035	<.027	<.015	<.013	<.006	<.003	<.007

Appendix 6. Pesticide concentrations in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.—Continued

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers[1]. All concentrations are in micrograms per liter. USGS, U.S. Geological Survey; H, herbicide; I, insecticide; <, less than]

Well number (fig. 1)	USGS site identification number	State well number	Sample date	Sample time	Parathion I 56-38-2	Pebulate H 1114-71-2	Pendimethalin H 40487-42-1	cis-Permethrin I 54774-45-7
				Wells sampled in northwestern Louisiana				
63	324310093402801	Bo-8991Z	8/9/2004	1100	<0.010	<0.004	<0.022	<0.006
64	322452093563001	Cd-8122Z	8/9/2004	1700	<.010	<.004	<.022	<.006
65	321246093115501	Bi-6092Z	8/10/2004	1100	<.010	<.004	<.022	<.006
66	321113093222401	RR-5548Z	8/10/2004	1500	<.010	<.004	<.022	<.006
67	320849093505001	DS-5442Z	8/11/2004	1100	<.010	<.004	<.022	<.006
68	323508094020101	Cd-9080Z	8/11/2004	1600	<.010	<.004	<.022	<.006
69	324506094023301	Cd-8586Z	8/16/2004	1200	<.010	<.004	<.022	<.006
70	323901093545201	Cd-6002Z	8/16/2004	1600	<.010	<.004	<.022	<.006
71	324959093543701	Cd-8434Z	8/17/2004	1000	<.010	<.004	<.022	<.006
72	321532094010901	Cd-8956Z	8/17/2004	1500	<.010	<.004	<.022	<.006
73	321442093421101	DS-6687Z	8/18/2004	1200	<.010	<.004	<.022	<.006
74	320848093431201	DS-6028Z	8/18/2004	1600	<.010	<.004	<.022	<.006
75	321130093594601	DS-6458Z	8/24/2004	1300	<.010	<.004	<.022	<.006
76	313006093332501	Sa-5510Z	8/30/2004	1300	<.010	<.004	<.022	<.006
77	314223093231001	Sa-5676Z	9/1/2004	1100	<.010	<.004	<.022	<.006
78	314328093131901	Na-5037Z	9/1/2004	1500	<.010	<.004	<.022	<.006
79	314217093461901	Sa-5561Z	9/8/2004	1400	<.010	<.004	<.022	<.006
				Wells sampled in east-central Texas				
80	315823094092001	XB-37-07-3	8/31/2004	1100	<.010	<.004	<.022	<.006
81	320128094151201	UL-35-62-9	9/7/2004	1300	<.050	<.020	<.110	<.030
82	315107094265101	XB-37-16-3	9/7/2004	1600	<.010	<.004	<.022	<.006
83	314948094011901	XB-37-16-6	9/8/2004	1000	<.010	<.004	<.022	<.006
84	321214094213001	UL-35-54-401	9/13/2004	1200	<.010	<.004	<.022	<.006
85	321722094285201	UL-35-45-705	9/13/2004	1500	<.010	<.004	<.022	<.006
86	314837094320701	TX-37-12-6	9/14/2004	900	<.010	<.004	<.022	<.006
87	312923093572101	WT-36-33-2	9/14/2004	1300	<.010	<.004	<.022	<.006
88	312930094082801	WT-37-39-3	9/15/2004	1500	<.010	<.004	<.022	<.006
89	323925094111301	LK-35-23-8	9/20/2004	1200	<.010	<.004	<.022	<.006
90	323103094175001	LK-35-30-8	9/20/2004	1500	<.010	<.004	<.022	<.006
91	322611094133401	LK-35-39-4	9/21/2004	1000	<.010	<.004	<.022	<.006
92	320354094310301	UL-35-60-6	9/21/2004	1200	<.010	<.004	<.022	<.006

[1] CAS Registry Number® is a Registered Trademark of the American Chemical Society. CAS recommends the verification of the CASRNs through CAS Client ServicesSM.

Phorate I 298-02-2	Prometon H 1610-18-0	Napropamide H 15299-99-7	Pronamide H 23950-58-5	Propachlor H 1918-16-7	Propanil H 709-98-8	Propargite I 2312-35-8	Simazine H 122-34-9	Tebuthiuron H 34014-18-1
Wells sampled in northwestern Louisiana								
<0.011	<0.01	<0.007	<0.004	<0.025	<0.011	<0.02	<0.005	<0.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
Wells sampled in east-central Texas								
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.055	<.03	<.035	<.020	<.125	<.055	<.12	<.025	<.08
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02
<.011	<.01	<.007	<.004	<.025	<.011	<.02	<.005	<.02

Appendix 7. Concentrations of pesticide degradation products in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers[1]. All concentrations are in micrograms per liter. USGS, U.S. Geological Survey; <, less than]

Well number (fig. 1)	USGS site identification number	State well number	Sample date	Sample time	p,p′-DDE 72-55-9	CIAT 6190-65-4	2,6-Diethylaniline 579-66-8	Desulfinyl fipronil no CAS number	Fipronil degradate RPA105048 no CAS number	Fipronil sulfide 120067-83-6	Fipronil sulfone 120068-36-2
Wells sampled in northwestern Louisiana											
63	324310093402801	Bo-8991Z	8/9/2004	1100	<0.003	<0.006	<0.006	<0.012	<0.029	<0.013	<0.024
64	322452093563001	Cd-8122Z	8/9/2004	1700	<.003	<.006	<.006	<.012	<.029	<.013	<.024
65	321246093115501	Bi-6092Z	8/10/2004	1100	<.003	<.006	<.006	<.012	<.029	<.013	<.024
66	321113093222401	RR-5548Z	8/10/2004	1500	<.003	<.006	<.006	<.012	<.029	<.013	<.024
67	320849093505001	DS-5442Z	8/11/2004	1100	<.003	<.006	<.006	<.012	<.029	<.013	<.024
68	323508094020101	Cd-9080Z	8/11/2004	1600	<.003	<.006	<.006	<.012	<.029	<.013	<.024
69	324506094023301	Cd-8586Z	8/16/2004	1200	<.003	<.006	<.006	<.012	<.029	<.013	<.024
70	323901093545201	Cd-6002Z	8/16/2004	1600	<.003	<.006	<.006	<.012	<.029	<.013	<.024
71	324959093543701	Cd-8434Z	8/17/2004	1000	<.003	<.006	<.006	<.012	<.029	<.013	<.024
72	321532094010901	Cd-8956Z	8/17/2004	1500	<.003	<.006	<.006	<.012	<.029	<.013	<.024
73	321442093421101	DS-6687Z	8/18/2004	1200	<.003	<.006	<.006	<.012	<.029	<.013	<.024
74	320848093431201	DS-6028Z	8/18/2004	1600	<.003	<.006	<.006	<.012	<.029	<.013	<.024
75	321130093594601	DS-6458Z	8/24/2004	1300	<.003	<.006	<.006	<.012	<.029	<.013	<.024
76	313006093332501	Sa-5510Z	8/30/2004	1300	<.003	<.006	<.006	<.012	<.029	<.013	<.024
77	314223093231001	Sa-5676Z	9/1/2004	1100	<.003	<.006	<.006	<.012	<.029	<.013	<.024
78	314328093131901	Na-5037Z	9/1/2004	1500	<.003	<.006	<.006	<.012	<.029	<.013	<.024
79	314217093461901	Sa-5561Z	9/8/2004	1400	<.003	<.006	<.006	<.012	<.029	<.013	<.024
Wells sampled in east-central Texas											
80	315823094092001	XB-37-07-3	8/31/2004	1100	<.003	<.006	<.006	<.012	<.029	<.013	<.024
81	320128094151201	UL-35-62-9	9/7/2004	1300	<.015	<.030	<.030	<.060	<.145	<.065	<.120
82	315107094265101	XB-37-16-3	9/7/2004	1600	<.003	<.006	<.006	<.012	<.029	<.013	<.024
83	314948094011901	XB-37-16-6	9/8/2004	1000	<.003	<.006	<.006	<.012	<.029	<.013	<.024
84	321214094213001	UL-35-54-401	9/13/2004	1200	<.003	<.006	<.006	<.012	<.029	<.013	<.024
85	321722094285201	UL-35-45-705	9/13/2004	1500	<.003	<.006	<.006	<.012	<.029	<.013	<.024
86	314837094320701	TX-37-12-6	9/14/2004	900	<.003	<.006	<.006	<.012	<.029	<.013	<.024
87	312923093572101	WT-36-33-2	9/14/2004	1300	<.003	<.006	<.006	<.012	<.029	<.013	<.024
88	312930094082801	WT-37-39-3	9/15/2004	1500	<.003	<.006	<.006	<.012	<.029	<.013	<.024
89	323925094111301	LK-35-23-8	9/20/2004	1200	<.003	<.006	<.006	<.012	<.029	<.013	<.024
90	323103094175001	LK-35-30-8	9/20/2004	1500	<.003	<.006	<.006	<.012	<.029	<.013	<.024
91	322611094133401	LK-35-39-4	9/21/2004	1000	<.003	<.006	<.006	<.012	<.029	<.013	<.024
92	320354094310301	UL-35-60-6	9/21/2004	1200	<.003	<.006	<.006	<.012	<.029	<.013	<.024

[1] CAS Registry Number® is a Registered Trademark of the American Chemical Society. CAS recommends the verification of the CASRNs through CAS Client ServicesSM.

Appendix 8. Pesticide and VOC surrogate recoveries in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers[1]. All concentrations are in percent recovery. USGS, U.S. Geological Survey; VOC, volatile organic compound]

Well number (fig. 1)	USGS site identification number	State well number	Sample date	Sample time	1,2-Dichloroethane-d4 17060-07-0 (VOC)	Toluene-d8 2037-26-5 (VOC)	Diazinon-d10 100155-47-3 (Pesticide)	alpha-HCH-d6 86194-41-4 (Pesticide)	1-Bromo-4-fluorobenzene 460-00-4 (VOC)
Wells sampled in northwestern Louisiana									
63	324310093402801	Bo-8991Z	8/9/2004	1100	102	104	115	93.4	98.8
64	322452093563001	Cd-8122Z	8/9/2004	1700	133	103	108	86.5	103
65	321246093115501	Bi-6092Z	8/10/2004	1100	104	103	107	87.3	95
66	321113093222401	RR-5548Z	8/10/2004	1500	101	103	102	78.5	93.3
67	320849093505001	DS-5442Z	8/11/2004	1100	104	106	104	82.6	93
68	323508094020101	Cd-9080Z	8/11/2004	1600	110	114	102	86.2	109
69	324506094023301	Cd-8586Z	8/16/2004	1200	115	105	106	82.2	100
70	323901093545201	Cd-6002Z	8/16/2004	1600	107	97.6	95.7	78.3	97.1
71	324959093543701	Cd-8434Z	8/17/2004	1000	108	98.7	99.2	79.6	95.3
72	321532094010901	Cd-8956Z	8/17/2004	1500	109	100	108	87.6	94.1
73	321442093421101	DS-6687Z	8/18/2004	1200	113	97.9	110	88.2	97.5
74	320848093431201	DS-6028Z	8/18/2004	1600	112	100	114	90.8	97.7
75	321130093594601	DS-6458Z	8/24/2004	1300	114	101	103	95.5	101
76	313006093332501	Sa-5510Z	8/30/2004	1300	120	100	103	104	102
77	314223093231001	Sa-5676Z	9/1/2004	1100	111	102	106	103	85.6
78	314328093131901	Na-5037Z	9/1/2004	1500	108	101	98.7	94.8	85.7
79	314217093461901	Sa-5561Z	9/8/2004	1400	113	103	93.7	90.4	83.3

Appendix 8. Pesticide and VOC surrogate recoveries in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.—Continued

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers[1]. All concentrations are in percent recovery. USGS, U.S. Geological Survey; VOC, volatile organic compound]

Wells sampled in east-central Texas									
80	315823094092001	XB-37-07-3	8/31/2004	1100	117	101	97.7	85.3	101
81	320128094151201	UL-35-62-9	9/7/2004	1300	110	102	116	94.1	103
82	315107094265101	XB-37-16-3	9/7/2004	1600	115	103	84.4	87.3	106
83	314948094011901	XB-37-16-6	9/8/2004	1000	113	103	102	94.9	85.4
84	321214094213001	UL-35-54-401	9/13/2004	1200	114	97.1	87	84.1	92
85	321722094285201	UL-35-45-705	9/13/2004	1500	112	99.8	90.7	90.3	94.7
86	314837094320701	TX-37-12-6	9/14/2004	900	114	97.6	84.8	80.4	72.4
87	312923093572101	WT-36-33-2	9/14/2004	1300	112	97.1	109	100	71.6
88	312930094082801	WT-37-39-3	9/15/2004	1500	110	97.2	96.5	87.6	92.4
89	323925094111301	LK-35-23-8	9/20/2004	1200	101	97.5	90.7	84	86.2
90	323103094175001	LK-35-30-8	9/20/2004	1500	103	98.5	87	81.4	85.3
91	322611094133401	LK-35-39-4	9/21/2004	1000	104	98.9	95.8	86.6	85.5
92	320354094310301	UL-35-60-6	9/21/2004	1200	106	98.7	90.6	80.4	86.5

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Appendix 9. Volatile organic compounds in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers[1]. All concentrations are in micrograms per liter. USGS, U.S. Geological Survey; <, less than; E, estimated; M, presence of material verified but not quantified; Detected concentrations are highlighted in bold]

Well number (fig. 1)	USGS site identification number	State well number	Sample date	Sample time	Acetone 67-64-1	Acrylonitrile 107-13-1	Benzene 71-43-2	Bromo-benzene 108-86-1
			Wells sampled in northwestern Louisiana					
63	324310093402801	Bo-8991Z	8/9/2004	1100	<6	<1	<0.02	<0.03
64	322452093563001	Cd-8122Z	8/9/2004	1700	<6	<1	<.02	<.03
65	321246093115501	Bi-6092Z	8/10/2004	1100	<6	<1	<.02	<.03
66	321113093222401	RR-5548Z	8/10/2004	1500	<6	<1	<.02	<.03
67	320849093505001	DS-5442Z	8/11/2004	1100	<6	<1	<.02	<.03
68	323508094020101	Cd-9080Z	8/11/2004	1600	<6	<1	<.02	<.03
69	324506094023301	Cd-8586Z	8/16/2004	1200	<6	<1	0.36	<.03
70	323901093545201	Cd-6002Z	8/16/2004	1600	<6	<1	<.02	<.03
71	324959093543701	Cd-8434Z	8/17/2004	1000	<6	<1	<.02	<.03
72	321532094010901	Cd-8956Z	8/17/2004	1500	<6	<1	<.02	<.03
73	321442093421101	DS-6687Z	8/18/2004	1200	<6	<1	<.02	<.03
74	320848093431201	DS-6028Z	8/18/2004	1600	<6	<1	<.02	<.03
75	321130093594601	DS-6458Z	8/24/2004	1300	<6	<1	<.02	<.03
76	313006093332501	Sa-5510Z	8/30/2004	1300	<6	<1	<.02	<.03
77	314223093231001	Sa-5676Z	9/1/2004	1100	<6	<1	<.02	<.03
78	314328093131901	Na-5037Z	9/1/2004	1500	<6	<1	<.02	<.03
79	314217093461901	Sa-5561Z	9/8/2004	1400	<6	<1	<.02	<.03
			Wells sampled in east-central Texas					
80	315823094092001	XB-37-07-3	8/31/2004	1100	<6	<1	<.02	<.03
81	320128094151201	UL-35-62-9	9/7/2004	1300	<6	<1	<.02	<.03
82	315107094265101	XB-37-16-3	9/7/2004	1600	<6	<1	<.02	<.03
83	314948094011901	XB-37-16-6	9/8/2004	1000	<6	<1	<.02	<.03
84	321214094213001	UL-35-54-401	9/13/2004	1200	<6	<1	<.02	<.03
85	321722094285201	UL-35-45-705	9/13/2004	1500	<6	<1	<.02	<.03
86	314837094320701	TX-37-12-6	9/14/2004	900	<6	<1	<.02	<.03
87	312923093572101	WT-36-33-2	9/14/2004	1300	<6	<1	<.02	<.03
88	312930094082801	WT-37-39-3	9/15/2004	1500	<6	<1	<.02	<.03
89	323925094111301	LK-35-23-8	9/20/2004	1200	<6	<1	<.02	<.03
90	323103094175001	LK-35-30-8	9/20/2004	1500	<6	<1	<.02	<.03
91	322611094133401	LK-35-39-4	9/21/2004	1000	<6	<1	<.02	<.03
92	320354094310301	UL-35-60-6	9/21/2004	1200	<6	<1	<.02	<.03

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Bromochlo-romethane 74-97-5	Bromodi-chloro-methane 75-27-4	Bromo-ethene 593-60-2	Tribromo-methane 75-25-2	Bromo-methane 74-83-9	n-Butyl-benzene 104-51-8	sec-Butyl-benzene 135-98-8	tert-Butyl-benzene 98-06-6	Carbon disulfide 75-15-0	Chloro-benzene 108-90-7
Wells sampled in northwestern Louisiana									
<0.12	<0.03	<0.1	<0.10	<0.3	<0.1	<0.06	<0.06	<0.04	<0.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	0.18	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
Wells sampled in east-central Texas									
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	E.07	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	0.17	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	E.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03
<.12	<.03	<.1	<.10	<.3	<.1	<.06	<.06	<.04	<.03

Appendix 9. Volatile organic compounds in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.—Continued

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers[1]. All concentrations are in micrograms per liter. USGS, U.S. Geological Survey; <, less than; E, estimated; M, presence of material verified but not quantified; Detected concentrations are highlighted in bold]

Well number (fig. 1)	USGS site identification number	State well number	Sample date	Sample time	Chloroethane 75-00-3	Chloroform (Trichloromethane) 67-66-3	Chloromethane 74-87-3	3-Chloropropene 107-05-1
			Wells sampled in northwestern Louisiana					
63	324310093402801	Bo-8991Z	8/9/2004	1100	<0.1	<0.02	<0.2	<0.50
64	322452093563001	Cd-8122Z	8/9/2004	1700	<.1	<.02	<.2	<.50
65	321246093115501	Bi-6092Z	8/10/2004	1100	<.1	<.02	<.2	<.50
66	321113093222401	RR-5548Z	8/10/2004	1500	<.1	<.02	<.2	<.50
67	320849093505001	DS-5442Z	8/11/2004	1100	<.1	<.02	<.2	<.50
68	323508094020101	Cd-9080Z	8/11/2004	1600	<.1	E.02	<.2	<.50
69	324506094023301	Cd-8586Z	8/16/2004	1200	<.1	<.02	<.2	<.50
70	323901093545201	Cd-6002Z	8/16/2004	1600	<.1	E.02	<.2	<.50
71	324959093543701	Cd-8434Z	8/17/2004	1000	<.1	<.02	<.2	<.50
72	321532094010901	Cd-8956Z	8/17/2004	1500	<.1	E.05	<.2	<.50
73	321442093421101	DS-6687Z	8/18/2004	1200	<.1	<.02	<.2	<.50
74	320848093431201	DS-6028Z	8/18/2004	1600	<.1	<.02	<.2	<.50
75	321130093594601	DS-6458Z	8/24/2004	1300	<.1	<.02	<.2	<.50
76	313006093332501	Sa-5510Z	8/30/2004	1300	<.1	<.02	<.2	<.50
77	314223093231001	Sa-5676Z	9/1/2004	1100	<.1	<.02	<.2	<.50
78	314328093131901	Na-5037Z	9/1/2004	1500	<.1	<.02	<.2	<.50
79	314217093461901	Sa-5561Z	9/8/2004	1400	<.1	<.02	<.2	<.50
			Wells sampled in east-central Texas					
80	315823094092001	XB-37-07-3	8/31/2004	1100	<.1	<.02	<.2	<.50
81	320128094151201	UL-35-62-9	9/7/2004	1300	<.1	0.39	<.2	<.50
82	315107094265101	XB-37-16-3	9/7/2004	1600	<.1	<.02	<.2	<.50
83	314948094011901	XB-37-16-6	9/8/2004	1000	<.1	E.03	<.2	<.50
84	321214094213001	UL-35-54-401	9/13/2004	1200	<.1	<.02	<.2	<.50
85	321722094285201	UL-35-45-705	9/13/2004	1500	<.1	0.91	<.2	<.50
86	314837094320701	TX-37-12-6	9/14/2004	900	<.1	<.02	<.2	<.50
87	312923093572101	WT-36-33-2	9/14/2004	1300	<.1	<.02	<.2	<.50
88	312930094082801	WT-37-39-3	9/15/2004	1500	<.1	E.02	<.2	<.50
89	323925094111301	LK-35-23-8	9/20/2004	1200	<.1	<.02	<.2	<.50
90	323103094175001	LK-35-30-8	9/20/2004	1500	<.1	<.02	<.2	<.50
91	322611094133401	LK-35-39-4	9/21/2004	1000	<.1	<.02	<.2	<.50
92	320354094310301	UL-35-60-6	9/21/2004	1200	<.1	0.72	<.2	<.50

[1] CAS Registry Number® is a Registered Trademark of the American Chemical Society. CAS recommends the verification of the CASRNs through CAS Client ServicesSM.

2-Chloro-toluene 95-49-8	4-Chloro-toluene 106-43-4	Dibromoch-loromethane 124-48-1	1,2-Dibro-mo-3-chloropro-pane 96-12-8	1,2-Dibro-moethane 106-93-4	Dibromo-methane 74-95-3	1,2-Dichlo-robenzene 95-50-1	1,3-Dichlo-robenzene 541-73-1	1,4-Dichlo-robenzene 106-46-7	trans-1,4-Dichloro-2-butene 110-57-6
Wells sampled in northwestern Louisiana									
<0.04	<0.05	<0.1	<0.5	<0.04	<0.05	<0.05	<0.03	<0.03	<0.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
Wells sampled in east-central Texas									
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7
<.04	<.05	<.1	<.5	<.04	<.05	<.05	<.03	<.03	<.7

Appendix 9. Volatile organic compounds in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.—Continued

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers[1]. All concentrations are in micrograms per liter. USGS, U.S. Geological Survey; <, less than; E, estimated; M, presence of material verified but not quantified; Detected concentrations are highlighted in bold]

Well number (fig. 1)	USGS site identification number	State well number	Sample date	Sample time	Dichlorodi-fluorometh-ane 75-71-8	1,1-Dichlo-roethane 75-34-3	1,2-Dichlo-roethane 107-06-2	1,1-Dichlo-roethene 75-35-4
Wells sampled in northwestern Louisiana								
63	324310093402801	Bo-8991Z	8/9/2004	1100	<0.18	<0.04	<0.1	<0.02
64	322452093563001	Cd-8122Z	8/9/2004	1700	<.18	<.04	<.1	<.02
65	321246093115501	Bi-6092Z	8/10/2004	1100	<.18	<.04	<.1	<.02
66	321113093222401	RR-5548Z	8/10/2004	1500	<.18	<.04	<.1	<.02
67	320849093505001	DS-5442Z	8/11/2004	1100	<.18	<.04	<.1	<.02
68	323508094020101	Cd-9080Z	8/11/2004	1600	<.18	<.04	<.1	<.02
69	324506094023301	Cd-8586Z	8/16/2004	1200	<.18	<.04	<.1	<.02
70	323901093545201	Cd-6002Z	8/16/2004	1600	<.18	<.04	<.1	<.02
71	324959093543701	Cd-8434Z	8/17/2004	1000	<.18	<.04	<.1	<.02
72	321532094010901	Cd-8956Z	8/17/2004	1500	<.18	<.04	<.1	<.02
73	321442093421101	DS-6687Z	8/18/2004	1200	<.18	<.04	<.1	<.02
74	320848093431201	DS-6028Z	8/18/2004	1600	<.18	<.04	<.1	<.02
75	321130093594601	DS-6458Z	8/24/2004	1300	<.18	<.04	<.1	<.02
76	313006093332501	Sa-5510Z	8/30/2004	1300	<.18	<.04	<.1	<.02
77	314223093231001	Sa-5676Z	9/1/2004	1100	<.18	<.04	<.1	<.02
78	314328093131901	Na-5037Z	9/1/2004	1500	<.18	<.04	<.1	<.02
79	314217093461901	Sa-5561Z	9/8/2004	1400	<.18	<.04	<.1	<.02
Wells sampled in east-central Texas								
80	315823094092001	XB-37-07-3	8/31/2004	1100	<.18	<.04	<.1	<.02
81	320128094151201	UL-35-62-9	9/7/2004	1300	<.18	<.04	<.1	<.02
82	315107094265101	XB-37-16-3	9/7/2004	1600	<.18	<.04	<.1	<.02
83	314948094011901	XB-37-16-6	9/8/2004	1000	<.18	<.04	<.1	<.02
84	321214094213001	UL-35-54-401	9/13/2004	1200	<.18	<.04	<.1	<.02
85	321722094285201	UL-35-45-705	9/13/2004	1500	<.18	<.04	<.1	<.02
86	314837094320701	TX-37-12-6	9/14/2004	900	<.18	<.04	<.1	<.02
87	312923093572101	WT-36-33-2	9/14/2004	1300	<.18	<.04	<.1	<.02
88	312930094082801	WT-37-39-3	9/15/2004	1500	<.18	<.04	<.1	<.02
89	323925094111301	LK-35-23-8	9/20/2004	1200	<.18	<.04	<.1	<.02
90	323103094175001	LK-35-30-8	9/20/2004	1500	<.18	<.04	<.1	<.02
91	322611094133401	LK-35-39-4	9/21/2004	1000	<.18	<.04	<.1	<.02
92	320354094310301	UL-35-60-6	9/21/2004	1200	<.18	<.04	<.1	<.02

[1] CAS Registry Number® is a Registered Trademark of the American Chemical Society. CAS recommends the verification of the CASRNs through CAS Client ServicesSM.

cis-1,2-Dichloroeth-ene 156-59-2	trans-1,2-Dichloroeth-ene 156-60-5	Dichloro-methane 75-09-2	1,2-Dichlo-ropropane 78-87-5	1,3-Dichlo-ropropane 142-28-9	2,2-Dichlo-ropropane 594-20-7	1,1-Dichlo-ropropene 563-58-6	cis-1,3-Dichloro-propene 10061-01-5	trans-1,3-Di-chloropropene 10061-02-6	Diethyl ether 60-29-7
Wells sampled in northwestern Louisiana									
<0.02	<0.03	<0.1	<0.03	<0.1	<0.05	<0.03	<0.05	<0.09	<0.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
Wells sampled in east-central Texas									
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1
<.02	<.03	<.1	<.03	<.1	<.05	<.03	<.05	<.09	<.1

Appendix 9. Volatile organic compounds in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.—Continued

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers[1]. All concentrations are in micrograms per liter. USGS, U.S. Geological Survey; <, less than; E, estimated; M, presence of material verified but not quantified; Detected concentrations are highlighted in bold]

Well number (fig. 1)	USGS site identification number	State well number	Sample date	Sample time	Diisopropyl ether 108-20-3	Ethylbenzene 100-41-4	tert-Butyl ethyl ether 637-92-3	Ethyl methacrylate 97-63-2
Wells sampled in northwestern Louisiana								
63	324310093402801	Bo-8991Z	8/9/2004	1100	<0.10	<0.03	<0.05	<0.2
64	322452093563001	Cd-8122Z	8/9/2004	1700	<.10	<.03	<.05	<.2
65	321246093115501	Bi-6092Z	8/10/2004	1100	<.10	<.03	<.05	<.2
66	321113093222401	RR-5548Z	8/10/2004	1500	<.10	<.03	<.05	<.2
67	320849093505001	DS-5442Z	8/11/2004	1100	<.10	<.03	<.05	<.2
68	323508094020101	Cd-9080Z	8/11/2004	1600	<.10	<.03	<.05	<.2
69	324506094023301	Cd-8586Z	8/16/2004	1200	<.10	<.03	<.05	<.2
70	323901093545201	Cd-6002Z	8/16/2004	1600	<.10	<.03	<.05	<.2
71	324959093543701	Cd-8434Z	8/17/2004	1000	<.10	<.03	<.05	<.2
72	321532094010901	Cd-8956Z	8/17/2004	1500	<.10	<.03	<.05	<.2
73	321442093421101	DS-6687Z	8/18/2004	1200	<.10	<.03	<.05	<.2
74	320848093431201	DS-6028Z	8/18/2004	1600	<.10	<.03	<.05	<.2
75	321130093594601	DS-6458Z	8/24/2004	1300	<.10	<.03	<.05	<.2
76	313006093332501	Sa-5510Z	8/30/2004	1300	<.10	<.03	<.05	<.2
77	314223093231001	Sa-5676Z	9/1/2004	1100	<.10	<.03	<.05	<.2
78	314328093131901	Na-5037Z	9/1/2004	1500	<.10	<.03	<.05	<.2
79	314217093461901	Sa-5561Z	9/8/2004	1400	<.10	<.03	<.05	<.2
Wells sampled in east-central Texas								
80	315823094092001	XB-37-07-3	8/31/2004	1100	<.10	<.03	<.05	<.2
81	320128094151201	UL-35-62-9	9/7/2004	1300	<.10	<.03	<.05	<.2
82	315107094265101	XB-37-16-3	9/7/2004	1600	<.10	<.03	<.05	<.2
83	314948094011901	XB-37-16-6	9/8/2004	1000	<.10	<.03	<.05	<.2
84	321214094213001	UL-35-54-401	9/13/2004	1200	<.10	<.03	<.05	<.2
85	321722094285201	UL-35-45-705	9/13/2004	1500	<.10	<.03	<.05	<.2
86	314837094320701	TX-37-12-6	9/14/2004	900	<.10	<.03	<.05	<.2
87	312923093572101	WT-36-33-2	9/14/2004	1300	<.10	<.03	<.05	<.2
88	312930094082801	WT-37-39-3	9/15/2004	1500	<.10	<.03	<.05	<.2
89	323925094111301	LK-35-23-8	9/20/2004	1200	<.10	<.03	<.05	<.2
90	323103094175001	LK-35-30-8	9/20/2004	1500	<.10	<.03	<.05	<.2
91	322611094133401	LK-35-39-4	9/21/2004	1000	<.10	<.03	<.05	<.2
92	320354094310301	UL-35-60-6	9/21/2004	1200	<.10	<.03	<.05	<.2

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2-Ethyl-toluene 611-14-3	Hexachlo-robutadiene 87-68-3	Hexachlo-roethane 67-72-1	n-Butyl methyl ketone 591-78-6	Isopropyl-benzene 98-82-8	4-Isopro-pyltoluene 99-87-6	Methyl acrylate 96-33-3	Methac-rylonitrile 126-98-7	tert-Butyl methyl ether 1634-04-4	Ethyl methyl ketone 78-93-3
Wells sampled in northwestern Louisiana									
<0.06	<0.1	<0.1	<0.7	<0.04	<0.08	<2.0	<0.8	<0.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
Wells sampled in east-central Texas									
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0
<.06	<.1	<.1	<.7	<.04	<.08	<2.0	<.8	<.2	<4.0

Appendix 9. Volatile organic compounds in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.—Continued

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers[1]. All concentrations are in micrograms per liter. USGS, U.S. Geological Survey; <, less than; E, estimated; M, presence of material verified but not quantified; Detected concentrations are highlighted in bold]

Well number (fig. 1)	USGS site identification number	State well number	Sample date	Sample time	Iodomethane 74-88-4	Methyl methacrylate 80-62-6	Isobutyl methyl ketone 108-10-1	Naphthalene 91-20-3
Wells sampled in northwestern Louisiana								
63	324310093402801	Bo-8991Z	8/9/2004	1100	<0.35	<0.3	<0.4	<0.5
64	322452093563001	Cd-8122Z	8/9/2004	1700	<.35	<.3	<.4	<.5
65	321246093115501	Bi-6092Z	8/10/2004	1100	<.35	<.3	<.4	<.5
66	321113093222401	RR-5548Z	8/10/2004	1500	<.35	<.3	<.4	<.5
67	320849093505001	DS-5442Z	8/11/2004	1100	<.35	<.3	<.4	<.5
68	323508094020101	Cd-9080Z	8/11/2004	1600	<.35	<.3	<.4	<.5
69	324506094023301	Cd-8586Z	8/16/2004	1200	<.35	<.3	<.4	<.5
70	323901093545201	Cd-6002Z	8/16/2004	1600	<.35	<.3	<.4	<.5
71	324959093543701	Cd-8434Z	8/17/2004	1000	<.35	<.3	<.4	<.5
72	321532094010901	Cd-8956Z	8/17/2004	1500	<.35	<.3	<.4	<.5
73	321442093421101	DS-6687Z	8/18/2004	1200	<.35	<.3	<.4	<.5
74	320848093431201	DS-6028Z	8/18/2004	1600	<.35	<.3	<.4	<.5
75	321130093594601	DS-6458Z	8/24/2004	1300	<.35	<.3	<.4	<.5
76	313006093332501	Sa-5510Z	8/30/2004	1300	<.35	<.3	<.4	<.5
77	314223093231001	Sa-5676Z	9/1/2004	1100	<.35	<.3	<.4	<.5
78	314328093131901	Na-5037Z	9/1/2004	1500	<.35	<.3	<.4	<.5
79	314217093461901	Sa-5561Z	9/8/2004	1400	<.35	<.3	<.4	<.5
Wells sampled in east-central Texas								
80	315823094092001	XB-37-07-3	8/31/2004	1100	<.35	<.3	<.4	<.5
81	320128094151201	UL-35-62-9	9/7/2004	1300	<.35	<.3	<.4	<.5
82	315107094265101	XB-37-16-3	9/7/2004	1600	<.35	<.3	<.4	<.5
83	314948094011901	XB-37-16-6	9/8/2004	1000	<.35	<.3	<.4	<.5
84	321214094213001	UL-35-54-401	9/13/2004	1200	<.35	<.3	<.4	<.5
85	321722094285201	UL-35-45-705	9/13/2004	1500	<.35	<.3	<.4	<.5
86	314837094320701	TX-37-12-6	9/14/2004	900	<.35	<.3	<.4	<.5
87	312923093572101	WT-36-33-2	9/14/2004	1300	<.35	<.3	<.4	<.5
88	312930094082801	WT-37-39-3	9/15/2004	1500	<.35	<.3	<.4	<.5
89	323925094111301	LK-35-23-8	9/20/2004	1200	<.35	<.3	<.4	<.5
90	323103094175001	LK-35-30-8	9/20/2004	1500	<.35	<.3	<.4	<.5
91	322611094133401	LK-35-39-4	9/21/2004	1000	<.35	<.3	<.4	<.5
92	320354094310301	UL-35-60-6	9/21/2004	1200	<.35	<.3	<.4	<.5

[1] CAS Registry Number® is a Registered Trademark of the American Chemical Society. CAS recommends the verification of the CASRNs through CAS Client ServicesSM.

Methyl tert-pentyl ether 994-05-8	n-Propyl-benzene 103-65-1	Styrene 100-42-5	1,1,1,2-Tet-rachloroeth-ane 630-20-6	1,1,2,2-Tet-rachloroeth-ane 79-34-5	Tetrachlo-roethene 127-18-4	Tetrachlo-romethane 56-23-5	Tetrahy-drofuran 109-99-9	1,2,3,4-Tet-ramethyl-benzene 488-23-3	1,2,3,5-Tet-ramethyl-benzene 527-53-7
Wells sampled in northwestern Louisiana									
<0.08	<0.04	<0.04	<0.03	<0.16	<0.06	<0.06	<2	<0.1	<0.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	E1	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	M	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	10	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
Wells sampled in east-central Texas									
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	E1	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1
<.08	<.04	<.04	<.03	<.16	<.06	<.06	<2	<.1	<.1

Appendix 9. Volatile organic compounds in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.—Continued

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers[1]. All concentrations are in micrograms per liter. USGS, U.S. Geological Survey; <, less than; E, estimated; M, presence of material verified but not quantified; Detected concentrations are highlighted in bold]

Well number (fig. 1)	USGS site identification number	State well number	Sample date	Sample time	1,2,3-Trichlorobenzene 87-61-6	1,2,4-Trichlorobenzene 120-82-1	1,1,1-Trichloroethane 71-55-6	1,1,2-Trichloroethane 79-00-5
Wells sampled in northwestern Louisiana								
63	324310093402801	Bo-8991Z	8/9/2004	1100	<0.3	<0.1	<0.03	<0.06
64	322452093563001	Cd-8122Z	8/9/2004	1700	<.3	<.1	<.03	<.06
65	321246093115501	Bi-6092Z	8/10/2004	1100	<.3	<.1	<.03	<.06
66	321113093222401	RR-5548Z	8/10/2004	1500	<.3	<.1	<.03	<.06
67	320849093505001	DS-5442Z	8/11/2004	1100	<.3	<.1	<.03	<.06
68	323508094020101	Cd-9080Z	8/11/2004	1600	<.3	<.1	<.03	<.06
69	324506094023301	Cd-8586Z	8/16/2004	1200	<.3	<.1	<.03	<.06
70	323901093545201	Cd-6002Z	8/16/2004	1600	<.3	<.1	<.03	<.06
71	324959093543701	Cd-8434Z	8/17/2004	1000	<.3	<.1	<.03	<.06
72	321532094010901	Cd-8956Z	8/17/2004	1500	<.3	<.1	<.03	<.06
73	321442093421101	DS-6687Z	8/18/2004	1200	<.3	<.1	<.03	<.06
74	320848093431201	DS-6028Z	8/18/2004	1600	<.3	<.1	<.03	<.06
75	321130093594601	DS-6458Z	8/24/2004	1300	<.3	<.1	<.03	<.06
76	313006093332501	Sa-5510Z	8/30/2004	1300	<.3	<.1	<.03	<.06
77	314223093231001	Sa-5676Z	9/1/2004	1100	<.3	<.1	<.03	<.06
78	314328093131901	Na-5037Z	9/1/2004	1500	<.3	<.1	<.03	<.06
79	314217093461901	Sa-5561Z	9/8/2004	1400	<.3	<.1	<.03	<.06
Wells sampled in east-central Texas								
80	315823094092001	XB-37-07-3	8/31/2004	1100	<.3	<.1	<.03	<.06
81	320128094151201	UL-35-62-9	9/7/2004	1300	<.3	<.1	<.03	<.06
82	315107094265101	XB-37-16-3	9/7/2004	1600	<.3	<.1	<.03	<.06
83	314948094011901	XB-37-16-6	9/8/2004	1000	<.3	<.1	<.03	<.06
84	321214094213001	UL-35-54-401	9/13/2004	1200	<.3	<.1	<.03	<.06
85	321722094285201	UL-35-45-705	9/13/2004	1500	<.3	<.1	<.03	<.06
86	314837094320701	TX-37-12-6	9/14/2004	900	<.3	<.1	<.03	<.06
87	312923093572101	WT-36-33-2	9/14/2004	1300	<.3	<.1	<.03	<.06
88	312930094082801	WT-37-39-3	9/15/2004	1500	<.3	<.1	<.03	<.06
89	323925094111301	LK-35-23-8	9/20/2004	1200	<.3	<.1	<.03	<.06
90	323103094175001	LK-35-30-8	9/20/2004	1500	<.3	<.1	<.03	<.06
91	322611094133401	LK-35-39-4	9/21/2004	1000	<.3	<.1	<.03	<.06
92	320354094310301	UL-35-60-6	9/21/2004	1200	<.3	<.1	<.03	<.06

[1] CAS Registry Number® is a Registered Trademark of the American Chemical Society. CAS recommends the verification of the CASRNs through CAS Client ServicesSM.

Trichloroethene 79-01-6	Trichlorofluoromethane 75-69-4	1,2,3-Trichloropropane 96-18-4	1,1,2-Trichloro-1,2,2-trifluoroethane 76-13-1	1,2,3-Trimethylbenzene 526-73-8	1,2,4-Trimethylbenzene 95-63-6	1,3,5-Trimethylbenzene 108-67-8	Toluene 108-88-3	Vinyl chloride 75-01-4	m-Xylene plus p-xylene no CAS number	o-Xylene 95-47-6
Wells sampled in northwestern Louisiana										
<0.04	<0.16	<0.18	<0.04	<0.1	E0.04	<0.04	<0.05	<0.1	<0.06	<0.04
<.04	<.16	<.18	<.04	<.1	<.06	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	E.02	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	<.06	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	<.06	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	<.06	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	0.11	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	<.06	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	<.06	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	<.06	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	<.06	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	<.06	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	<.06	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	E.04	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	E.07	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	0.15	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	E.03	<.04	<.05	<.1	<.06	<.04
Wells sampled in east-central Texas										
<.04	<.16	<.18	<.04	<.1	<.06	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	<.06	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	0.12	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	<.06	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	<.06	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	E.03	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	E.05	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	<.06	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	<.06	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	<.06	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	<.06	<.04	E.01	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	<.06	<.04	<.05	<.1	<.06	<.04
<.04	<.16	<.18	<.04	<.1	<.06	<.04	<.05	<.1	<.06	<.04

Appendix 10. Microbial indicators in water from selected domestic wells in northwestern Louisiana and east-central Texas, 2003-04.

[State well numbers were assigned by the Louisiana Department of Transportation and Development or the Texas Water Development Board. USGS, U.S. Geological Survey; <, less than; E, estimated]

Well number (fig. 1)	USGS site identification number	State well number	Sample date	Sample time	Total coliform (colonies per 100 milliliters)	Escherichia coli (colonies per 100 milliliters)	Coliphage, somatic (presence [1] or absence [2] per liter)	Coliphage, F-specific (presence [1] or absence [2] per liter)
Wells sampled in northwestern Louisiana								
63	324310093402801	Bo-8991Z	8/9/2004	1100	<1	<1	2	2
64	322452093563001	Cd-8122Z	8/9/2004	1700	E1	E1	2	2
65	321246093115501	Bi-6092Z	8/10/2004	1100	<1	<1	2	2
66	321113093222401	RR-5548Z	8/10/2004	1500	<1	<1	2	2
67	320849093505001	DS-5442Z	8/11/2004	1100	24	<1	2	2
68	323508094020101	Cd-9080Z	8/11/2004	1600	<1	<1	2	2
69	324506094023301	Cd-8586Z	8/16/2004	1200	<1	<1	2	2
70	323901093545201	Cd-6002Z	8/16/2004	1600	<1	<1	2	2
71	324959093543701	Cd-8434Z	8/17/2004	1000	<1	<1	2	2
72	321532094010901	Cd-8956Z	8/17/2004	1500	75	E15	2	2
73	321442093421101	DS-6687Z	8/18/2004	1200	30	<1	2	2
74	320848093431201	DS-6028Z	8/18/2004	1600	<1	<1	2	2
75	321130093594601	DS-6458Z	8/24/2004	1300	<1	<1	2	2
76	313006093332501	Sa-5510Z	8/30/2004	1300	<1	<1	2	2
77	314223093231001	Sa-5676Z	9/1/2004	1100	<1	<1	2	2
78	314328093131901	Na-5037Z	9/1/2004	1500	<1	<1	2	2
79	314217093461901	Sa-5561Z	9/8/2004	1400	27	<1	2	2
Wells sampled in east-central Texas								
80	315823094092001	XB-37-07-3	8/31/2004	1100	<1	<1	2	2
81	320128094151201	UL-35-62-9	9/7/2004	1300	<1	<1	2	2
82	315107094265101	XB-37-16-3	9/7/2004	1600	<1	<1	2	2
83	314948094011901	XB-37-16-6	9/8/2004	1000	<1	<1	2	2
84	321214094213001	UL-35-54-401	9/13/2004	1200	<1	<1	2	2
85	321722094285201	UL-35-45-705	9/13/2004	1500	<1	<1	2	2
86	314837094320701	TX-37-12-6	9/14/2004	900	E93	E5	2	2
87	312923093572101	WT-36-33-2	9/14/2004	1300	E4	<1	2	2
88	312930094082801	WT-37-39-3	9/15/2004	1500	<1	<1	2	2
89	323925094111301	LK-35-23-8	9/20/2004	1200	<1	<1	2	2
90	323103094175001	LK-35-30-8	9/20/2004	1500	<1	<1	2	2
91	322611094133401	LK-35-39-4	9/21/2004	1000	<1	<1	2	2
92	320354094310301	UL-35-60-6	9/21/2004	1200	E14	<1	2	2