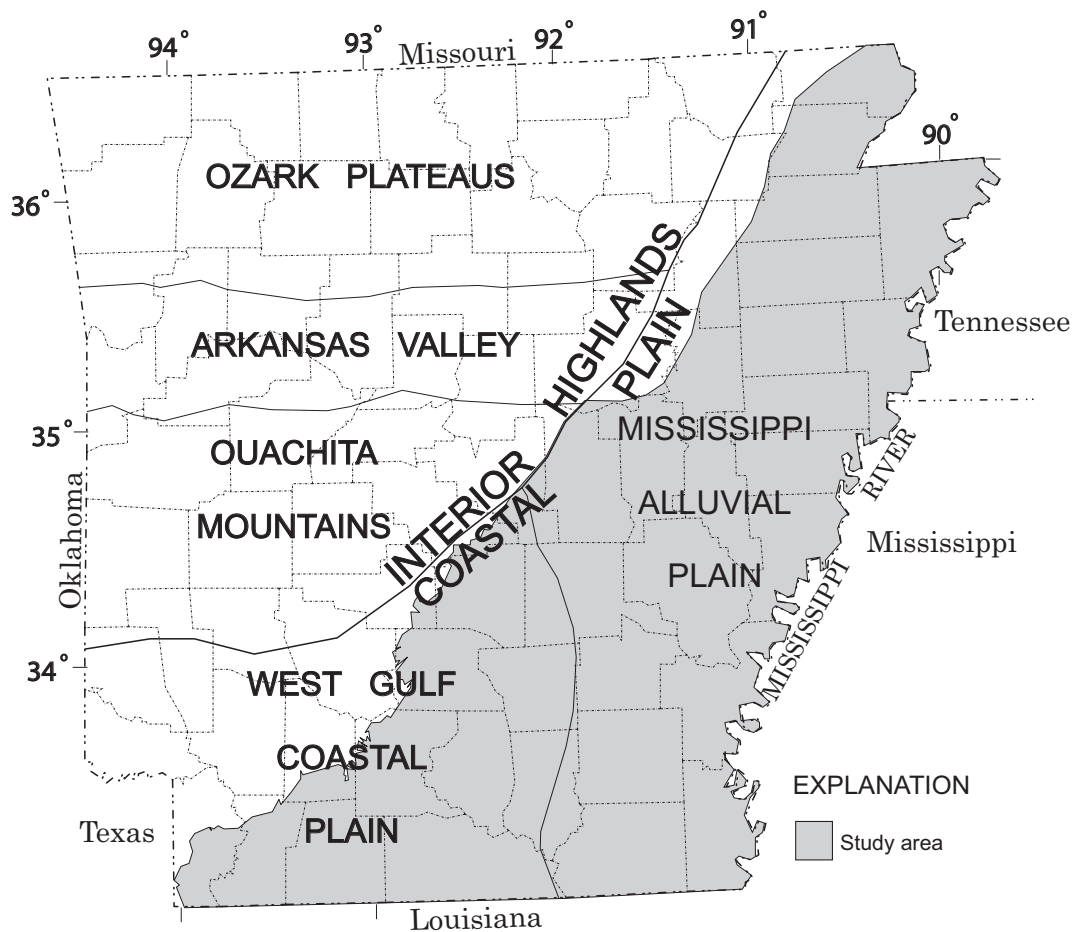


# Status of Water Levels and Selected Water-Quality Conditions in the Sparta-Memphis Aquifer in Arkansas, Spring-Summer 2003



Prepared in cooperation with  
Arkansas Natural Resources Commission and the  
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Scientific Investigations Report 2006-5021

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**U.S. Department of the Interior**  
**U.S. Geological Survey**

**U.S. Department of the Interior**  
Gale A. Norton, Secretary

**U.S. Geological Survey**  
P. Patrick Leahy, Acting Director

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# Status of Water Levels and Selected Water-Quality Conditions in the Sparta-Memphis Aquifer in Arkansas, Spring-Summer 2003

by T.P. Schrader

## Abstract

During the spring of 2003, water levels were measured in 341 wells in the Sparta-Memphis aquifer in Arkansas. Water-quality samples were collected for temperature and specific-conductance measurements during the spring-summer of 2003 from 70 wells in Arkansas in the Sparta-Memphis aquifer. Maps of areal distribution of potentiometric surface, change in water-level measurements from 1999 to 2003, and specific-conductance data reveal spatial trends across the study area. The highest water-level altitude measured in Arkansas was 328 feet above National Geodetic Vertical Datum of 1929 (NGVD of 1929) in Craighead County; the lowest water-level altitude was 199 feet below NGVD of 1929 in Union County.

Three large cones of depression are shown in the 2003 potentiometric surface map, centered in Columbia, Jefferson, and Union Counties in Arkansas as a result of large withdrawals for industrial and public supplies. A broad depression exists in western Poinsett County in Arkansas.

The potentiometric surface indicates that large withdrawals have altered or reversed the natural direction of flow in most areas. In the northern third of the study area the flow is from the east, west, and north towards the broad depression in Poinsett County. In the central third of the study area the flow is dominated by the cone of depression centered in Jefferson County. In the southern third of the study area the flow is dominated by the two cones of depression in Union and Columbia Counties.

A map of water-level changes from 1999 to 2003 was constructed using water-level measurements from 281 wells. The largest rise in water level measured was about 57.8 feet in Columbia County. The largest decline in water level measured was about -71.6 feet in Columbia County. Areas with a general rise are shown in Arkansas, Bradley, Calhoun, Cleveland, Columbia, Ouachita, and Union Counties. Areas with a general decline are shown in Craighead, Crittenden, Cross, Desha, Drew, Jefferson, Lonoke, Phillips, Poinsett, Prairie, and Woodruff Counties.

Hydrographs were constructed for wells with a minimum of 25 years of water-level measurements. A trend line using a linear regression was calculated for the period of record from spring of 1978 to spring of 2003 to determine the annual decline or rise in feet per year for water levels in each well. The hydro-

graphs were grouped by county. The mean values for county annual water-level decline or rise ranged from -1.42 to 0.27 foot per year.

Specific conductance ranged from 82 microsiemens per centimeter at 25 degrees Celsius in Jefferson County to about 1,210 microsiemens per centimeter at 25 degrees Celsius in Lee County. The mean specific conductance was 400 microsiemens per centimeter at 25 degrees Celsius.

## Introduction

The study area (fig. 1, plate 1) includes most of the Coastal Plain physiographic province in Arkansas. The area is bounded on the north by the Missouri State line, and on the east by the Tennessee and Mississippi State lines. The western boundary is defined as the western extent of the outcrop and subcrop (Hosman, 1982) of the Sparta Sand and the Memphis Sand of Claiborne Group (herein referred to as the Sparta Sand and Memphis Sand, respectively, which compose the Sparta-Memphis aquifer).

The U.S. Geological Survey in cooperation with the Arkansas Natural Resources Commission and the Arkansas Geological Commission has monitored water levels in the Sparta-Memphis aquifer since the 1920's. During the spring of 2003, 341 water levels were measured in wells completed in the Sparta-Memphis aquifer. The purpose of these measurements was to provide information describing the potentiometric surface of the Sparta-Memphis aquifer. During the summer of 2003, 70 water-quality samples were measured for temperature and specific conductance from wells completed in the Sparta-Memphis aquifer in Arkansas. This report presents results as a potentiometric-surface map, a water-level change map comparing water levels from 1999 to 2003, water-level hydrographs, and water-level and water-quality data tables.

The well-numbering system used in this report is based upon the location of the wells according to the Federal land survey used in Arkansas. The component parts of a well number are the township designation; the range designation; the section number; three letter designation which indicates, respectively, the quarter section, the quarter-quarter section, and the quarter-quarter-quarter section in which the well is located; and the



Figure 1. Location of study area.

sequence number of the well in the quarter-quarter-quarter section. The letters are assigned counterclockwise, beginning with "A" in the northeast quarter or quarter-quarter or quarter-quarter-quarter section in which the well is located. For example, well 01S03W04BBD16 (fig. 2) is located in Township 1 South, Range 3 West, and in the southeast quarter of the northwest quarter of the northwest quarter of section 4. This well is the 16th well in this quarter-quarter-quarter section of section 4 from which data were collected.

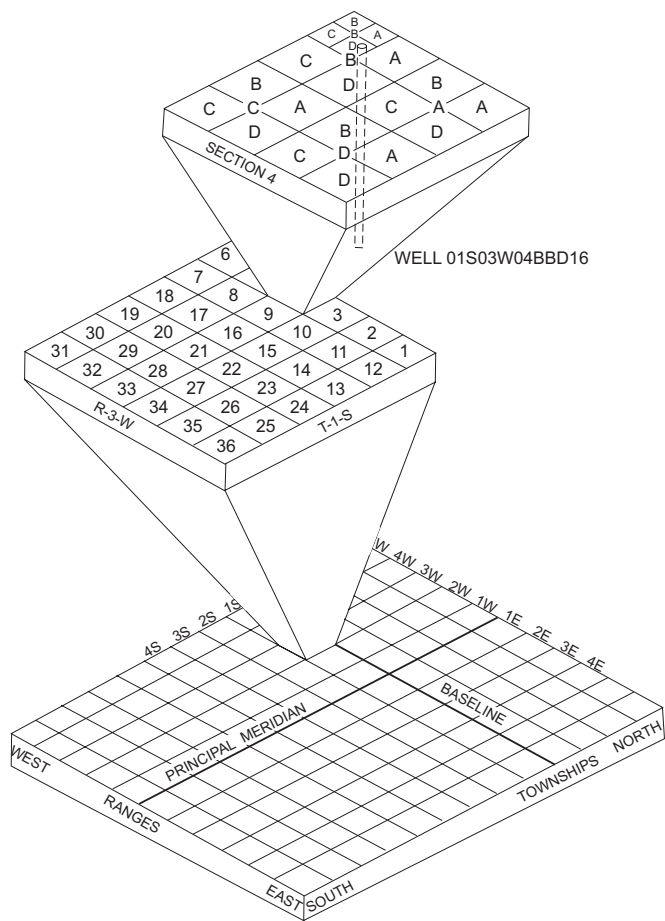


Figure 2. Well numbering system.

## Methods

Personnel from the USGS measured water levels from March 2003 to May 2003 from wells completed in the Sparta-Memphis aquifer. Measurements were made using steel or electric tapes graduated in hundredths of a foot. The steel and electric tapes used by USGS personnel were calibrated during January 2003 prior to collecting measurement from wells. Calibration of steel and electric tapes was performed by com-

paring the field steel or electric tape to a standardized steel tape used only for calibration of field tapes.

Well locations were measured using Global Positioning System receivers to acquire the horizontal coordinate information, latitude and longitude, based on the North American Datum of 1983. The latitude and longitude of the wells in Arkansas were recorded from a Global Positioning System accurate to one-tenth of a second of latitude and longitude (approximately 10-20 feet (ft)). The latitude and longitude of the well location were transferred to the topographic map and the altitude of the well (National Geodetic Vertical Datum of 1929) was determined from the topographic contours at the location on the map. Altitude is accurate to one-half of the contour interval.

Water-quality samples were collected for dissolved chloride analysis using the procedures described in the "National Field Manual for the Collection of Water-Quality Data" (U.S. Geological Survey, variously dated). Wells were purged for a minimum of three casing volumes. During the well purge, specific conductance and temperature were monitored until measurements became stable. If the specific conductance and temperature were unstable, the well purge continued past the minimum three casing volumes until specific conductance and temperature values stabilized. Sample bottles were rinsed with sample water, filled, and chilled with ice for shipping. Preservation is not required for a dissolved chloride analysis.

Specific conductance data were measured from selected wells using specific conductivity meters with temperature compensation. Specific conductance meters were calibrated twice daily by comparing the measurement of the specific conductance meter of two specific conductance calibration solutions. Specific conductance is a measure of the electrical conductance of a substance. As the dissolved solid concentration in ground water increases, specific conductance increases.

## Description of Aquifer

The Sparta Sand and Memphis Sand are of Eocene age mainly consist of fine to medium sand. Some silt, clay, and lignite occur in the upper portion of the Sparta Sand and Memphis Sand. Sands in the Sparta Sand were deposited by shifting streams on a deltaic-fluvial flood plain (Payne, 1968). These sands are mostly interconnected, but separately identifiable sands can be traced for short distances (Snider and others, 1972). The Cook Mountain Formation of Claiborne Group overlies the Sparta Sand and serves as an upper confining unit. The permeable units of the Sparta Sand and the Memphis Sand compose the respective aquifers. Water levels in the Sparta aquifer generally correlate with those in the Memphis aquifer; therefore, the water-bearing formations are considered to be one hydrologic unit (Stanton, 1997).

The Sparta Sand is composed of a sequence of alternating sand and clay beds between the massive clays of the overlying Cook Mountain Formation of Claiborne Group and the

#### 4 Status of Water Levels and Selected Water-Quality Conditions in the Sparta-Memphis Aquifer in Arkansas, Spring-Summer 2003

underlying Cane River Formation of Claiborne Group confining units (Hosman and others, 1968) shown in table 1. The Sparta Sand is in the southern part of the study area (south of about 35 degrees latitude, plate 1) where the Cane River Formation of Claiborne Group is composed predominantly of clay. The Memphis Sand is in the northern part of the study area (north of about 35 degrees latitude), and the Cane River Formation of Claiborne Group or equivalent facies is composed predominantly of sand. In the southern area, the Claiborne Group is subdivided into the Carrizo Sand, Cane River Formation, Sparta Sand, Cook Mountain Formation, and the Cockfield Formation, but the equivalent section in the northern area is a single formation known as the Memphis Sand. The Memphis Sand is underlain by a thick layer of clay in the upper part of the Wilcox Group.

**Table 1.** Stratigraphic correlation of the north and south parts of the study area.

Series	Group	Formation in the south part of the study area	Formation in the north part of the study area
Eocene	Jackson	Undifferentiated	Undifferentiated
	Claiborne	Cockfield Formation	Memphis Sand
		Cook Mountain Formation	
		Sparta Sand	
		Cane River Formation	
		Carrizo Sand	
	Wilcox	Undifferentiated	Undifferentiated

The Sparta Sand generally thickens and ground water increases in salinity as depth of occurrence increases to the southeast. The Sparta Sand is 50 to 200 ft thick within the outcrop area (along the western limit) and thickens easterly to nearly 900 ft. The Sparta Sand contains freshwater throughout most of its extent in Arkansas. However, saltwater is present in the extreme southeastern part of the State in parts of Ashley, Chicot, and Union Counties.

### Potentiometric-Surface Map

A potentiometric-surface map is constructed using water-level measurements from wells that are represented by control points on the map. Hydrologic principles, water-use data, and historical information are interpreted with the control-point data to delineate the potentiometric-surface contours. The number and location of control points will vary for potentiometric-sur-

face maps from different years. The combined information will result in both variations and similarities in potentiometric contours that define the surface depicted on the maps produced in different years.

The potentiometric-surface map shows the altitude to which water would have stood in tightly cased wells completed in the aquifers (plate 1). The map is based upon water-level data collected in 341 wells (table 2), in the Sparta-Memphis aquifer in the spring of 2003. The surface is mapped by determining the altitude of the water levels measured in the wells and is represented on the map by contours that connect points of equal water-level altitude. The general direction of ground-water flow in the Sparta-Memphis aquifer is perpendicular to the contours in the direction of decreasing hydraulic gradient.

Cones of depression or potentiometric depressions are usually caused by withdrawal rates that exceed the flow rates within the aquifer over an extended period of time. When a well is pumped the water level in and around the well declines, creating a slope or gradient in the potentiometric surface. The gradient increases the flow of water in the aquifer towards the lower water level. When pumping is stopped the water level recovers. In an area where withdrawal rates exceed the flow rates in the aquifer, the area of the declining water level expands to form a cone of depression or potentiometric depression. The cone of depression can reach equilibrium when the flow rate increases with the expanding cone of depression or the withdrawal rate declines with the lowering of the water level.

The natural direction of flow, which historically was eastward from the western limit and then southward, in the Sparta-Memphis aquifer is now altered in areas by large ground-water withdrawals. The regional direction of ground-water flow in the Sparta-Memphis aquifer was generally to the south-southeast in the northern half of Arkansas and to the east and south in the southern half of Arkansas, away from the outcrop area except where affected by large ground-water withdrawals (Joseph, 1997; 2000). The highest water-level altitude measured was 328 ft above NGVD of 1929, located in Craighead County at the northern boundary of the county on Crowleys Ridge; the lowest water-level altitude was 199 ft below NGVD of 1929 in Union County (table 2). The lowest level in Union County represents a 2-ft decline in water level since the spring of 2001 (Schrader, 2004), in the cone of depression centered at El Dorado, Arkansas.

Three large cones of depression are shown in the 2003 potentiometric-surface map, centered in Columbia, Jefferson, and Union Counties, as a result of large withdrawals for industrial and public supplies (Holland, 2004; 1999; 1993). A broad depression exists in western Poinsett County in Arkansas. The cone of depression centered in Jefferson County deepened and expanded in recent years into Prairie County where withdrawals for agricultural, irrigation, and public supplies have increased from 22.6 million gallons per day (Mgal/d) in 1990 to 24.7 Mgal/d in 1995 to 27.7 Mgal/d in 2000 (Holland, 2004; 1999; 1993). The cones of depression in Columbia and Union Counties are elongated east to west because of large industrial withdrawals and coalesce at or near the Columbia and Union County



**Table 2.** Water-level data collected during spring 2003 from wells completed in the Sparta-Memphis aquifer in Arkansas.

[NGVD of 1929, National Geodetic Vertical Datum of 1929—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929; Horizontal datum is NAD of 1983]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	Water-level altitude (feet above NGVD of 1929)	Depth to water (feet below land surface)	Land-surface datum (feet above NGVD of 1929)	Date of measurement	Aquifer
<b>Arkansas County</b>							
343312	912849	02S04W06CDB1	51	160.87	212	4/09/2003	Sparta
343044	912355	02S04W23DAA1	58	149.72	208	4/08/2003	Sparta
342922	912703	02S04W33BBB1	34	171.01	205	4/09/2003	Sparta
343144	913319	02S05W16CBB1	34	178.88	213	4/09/2003	Sparta
343028	913230	02S05W27BBB1	36	180.27	216	4/09/2003	Sparta
342925	913148	02S05W34BDA1	36	179.80	216	4/09/2003	Sparta
342930	913035	02S05W35AAB1	41	174.85	216	4/09/2003	Sparta
342748	912458	03S04W02CCB1	40	162.24	202	4/08/2003	Sparta
342421	912438	03S04W26CDA1	66	137.30	203	4/08/2003	Sparta
342407	912639	03S04W33BAA1	41	159.94	201	4/07/2003	Sparta
342842	913034	03S05W02AAB1	37	173.43	210	4/09/2003	Sparta
342631	913005	03S05W13BDC1	31	178.86	210	4/09/2003	Sparta
342633	913229	03S05W15CBB1	34	171.95	206	4/09/2003	Sparta
342629	913525	03S05W18CAB1	27	169.14	196	4/07/2003	Sparta
342447	913240	03S05W28DAB1	31	172.62	204	4/09/2003	Sparta
342516	914216	03S06W30BBD1	30	160.74	191	4/07/2003	Sparta
342225	910808	04S01W04CBD1	83	113.14	196	4/08/2003	Sparta
341927	910748	04S01W28BAA1	84	106.16	190	4/08/2003	Sparta
342157	912502	04S04W11BCC1	43	155.50	198	4/07/2003	Sparta
342004	912929	04S04W19CBB1	32	162.72	195	4/07/2003	Sparta
342007	912515	04S04W22DAA1	35	159.99	195	4/07/2003	Sparta
342303	913413	04S05W05ACC1	29	157.42	186	4/07/2003	Sparta
342132	913133	04S05W15AAA1	34	166.70	201	4/07/2003	Sparta
341752	913004	04S05W36DCC1	33	163.18	196	4/07/2003	Sparta
341551	910745	05S01W17BAA1	83	93.49	176	4/08/2003	Sparta
341734	912006	05S03W04ADB1	26	160.84	187	4/08/2003	Sparta
341358	912434	05S04W26ACA1	59	128.98	188	4/07/2003	Sparta
341228	911620	06S02W06ABB1	66	114.76	181	4/08/2003	Sparta
341023	911453	06S02W17ADA1	73	114.77	188	4/08/2003	Sparta
340904	911331	06S02W22CDB1	80	105.86	186	4/08/2003	Sparta
340859	912009	06S03W27BAA1	61	119.62	181	4/08/2003	Sparta
340340	911411	07S02W28ABA1	75	105.64	181	4/08/2003	Sparta

## 6 Status of Water Levels and Selected Water-Quality Conditions in the Sparta-Memphis Aquifer in Arkansas, Spring-Summer 2003

**Table 2.** Water-level data collected during spring 2003 from wells completed in the Sparta-Memphis aquifer in Arkansas.—Continued

[NGVD of 1929, National Geodetic Vertical Datum of 1929—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929; Horizontal datum is NAD of 1983]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	Water-level altitude (feet above NGVD of 1929)	Depth to water (feet below land surface)	Land-surface datum (feet above NGVD of 1929)	Date of measurement	Aquifer
340702	912248	07S03W06ABC1	54	131.33	185	4/08/2003	Sparta
340031	911448	08S02W09BCC1	74	100.22	174	4/08/2003	Sparta
<b>Ashley County</b>							
332118	915101	15S07W32CDD1	52	137.84	190	3/20/2003	Sparta
<b>Bradley County</b>							
333709	920445	12S09W31CCB1	47	183.54	231	4/08/2003	Sparta
333648	920437	13S09W06ACA1	51	183.67	235	3/19/2003	Sparta
333647	920417	13S09W06ACB2	50	157.75	208	3/19/2003	Sparta
333454	921607	13S11W17BCD1	57	193.43	250	3/19/2003	Sparta
331839	922052	16S12W21CAA1	25	75.29	100	3/19/2003	Sparta
<b>Calhoun County</b>							
334630	922928	11S14W12CAC3	167	146.00	313	3/14/2003	Sparta
333227	922742	13S13W32CDA1	39	168.68	208	4/08/2003	Sparta
333227	923532	13S15W36CBD1	77	80.51	158	3/12/2003	Sparta
333207	922802	14S13W05BBD1	35	154.13	189	3/13/2003	Sparta
333040	922404	14S13W12CCB1	37	168.45	205	3/13/2003	Sparta
333055	923912	14S15W16BAA1	49	97.07	146	3/13/2003	Sparta
332411	922807	15S13W20BDC1	75	34.11	109	3/14/2003	Sparta
<b>Chicot County</b>							
333312	912308	13S03W22DAD1	68	67.03	135	3/21/2003	Sparta
<b>Cleveland County</b>							
340133	920802	08S12W13CAA1	115	145.57	261	3/27/2003	Sparta
335729	921134	09S11W01DCA1	24	206.18	230	5/06/2003	Sparta
335729	921120	09S11W01DDA2	57	207.90	265	4/03/2003	Sparta
334918	920021	10S09W23CDC1	58	161.88	220	5/06/2003	Sparta
334758	915957	10S09W35ACD1	65	154.20	219	3/26/2003	Sparta
335133	921743	10S12W12BDD1	103	117.29	220	3/27/2003	Sparta
334543	921423	11S11W16AAB1	97	205.99	303	3/27/2003	Sparta
<b>Columbia County</b>							
332453	931215	15S20W20CCB1	155	217.04	372	4/16/2003	Sparta
332008	930521	16S19W20ABD1	120	168.50	288	3/13/2003	Sparta
332114	931141	16S20W08DCC1	87	315.10	402	5/13/2003	Sparta
332053	931237	16S20W18ACD1	74	263.20	337	3/11/2003	Sparta

**Table 2.** Water-level data collected during spring 2003 from wells completed in the Sparta-Memphis aquifer in Arkansas.—Continued

[NGVD of 1929, National Geodetic Vertical Datum of 1929—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929; Horizontal datum is NAD of 1983]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	Water-level altitude (feet above NGVD of 1929)	Depth to water (feet below land surface)	Land-surface datum (feet above NGVD of 1929)	Date of measurement	Aquifer
332049	931517	16S21W14CBB1	80	200.60	281	3/11/2003	Sparta
331955	931736	16S21W20DAD1	99	250.70	350	3/11/2003	Sparta
331948	932225	16S22W22CCD1	207	132.68	340	3/05/2003	Sparta
331546	930318	17S19W15AAB1	46	272.37	318	5/13/2003	Sparta
331538	930536	17S19W17ACA1	23	279.95	303	3/11/2003	Sparta
331517	930656	17S19W18CBD1	26	279.49	305	3/11/2003	Sparta
331433	930705	17S19W19BCA1	26	274.59	301	3/12/2003	Sparta
331406	930650	17S19W30ABB1	26	221.90	248	3/12/2003	Sparta
331532	930807	17S20W13BCD1	24	318.10	340	3/11/2003	Sparta
331520	931201	17S20W17CDA1	22	303.03	325.1	3/11/2003	Sparta
331307	930755	17S20W36ABC1	38	297.00	335	3/12/2003	Sparta
331743	931424	17S21W01BBC1	35	270.40	305	3/12/2003	Sparta
331613	931758	17S21W08DCA1	86	211.61	298	3/12/2003	Sparta
331609	931449	17S21W11DCC2	17	283.08	300	3/11/2003	Sparta
331609	931449	17S21W11DCC3	17	280.97	298	3/11/2003	Sparta
331608	931820	17S21W17BAB1	84	203.32	287	3/12/2003	Sparta
331517	932304	17S22W21ABD1	214	81.35	295	3/12/2003	Sparta
331522	932210	17S22W22ABB1	185	136.48	321	3/12/2003	Sparta
331115	931227	18S20W08CBC1	-7	270.16	263	3/06/2003	Sparta
331054	931016	18S20W10CAA1	15	274.98	290	3/13/2003	Sparta
331223	931339	18S21W01ACC1	-3	297.73	295	3/06/2003	Sparta
331034	931759	18S21W17ACD1	79	236.40	315	3/07/2003	Sparta
330835	932159	18S22W27DDD1	189	122.98	312	3/06/2003	Sparta
330555	931149	19S20W08DAD1	66	254.29	320	3/06/2003	Sparta
330555	931129	19S20W09CBD1	66	266.01	332	3/12/2003	Sparta
330239	931031	19S20W34BDD1	78	212.12	290	3/06/2003	Sparta
330517	931724	19S21W16DBB1	110	174.42	284	3/05/2003	Sparta
330644	932833	19S23W10ABD1	197	45.22	242	3/05/2003	Sparta
330609	932744	19S23W11CDA2	195	52.65	248	3/05/2003	Sparta
330605	932722	19S23W11DDB1	192	53.76	246	3/05/2003	Sparta
330555	932752	19S23W14BAB2	194	49.99	244	3/05/2003	Sparta
330109	932133	20S22W11ACD1	164	107.17	271	3/05/2003	Sparta

## 8 Status of Water Levels and Selected Water-Quality Conditions in the Sparta-Memphis Aquifer in Arkansas, Spring-Summer 2003

**Table 2.** Water-level data collected during spring 2003 from wells completed in the Sparta-Memphis aquifer in Arkansas.—Continued

[NGVD of 1929, National Geodetic Vertical Datum of 1929—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929; Horizontal datum is NAD of 1983]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	Water-level altitude (feet above NGVD of 1929)	Depth to water (feet below land surface)	Land-surface datum (feet above NGVD of 1929)	Date of measurement	Aquifer
<b>Craighead County</b>							
354404	904433	13N03E23CDD1	161	86.89	248	4/16/2003	Memphis
354642	904115	13N04E05DCC1	198	142.30	340	4/16/2003	Memphis
354929	903921	14N04E22CBD1	200	55.70	256	4/17/2003	Memphis
354837	903953	14N04E28DBD1	193	61.17	254	4/17/2003	Memphis
354917	903414	14N05E28BBB1	212	17.56	230	4/16/2003	Memphis
354748	903414	14N05E34ADD1	212	17.73	230	4/16/2003	Memphis
354751	903100	14N05E36CBC1	208	12.10	220	4/16/2003	Memphis
355615	904306	15N03E13ABA1	328	0.69	329	4/16/2003	Memphis
355314	904807	15N03E31ADA1	215	54.88	270	4/16/2003	Memphis
355506	904043	15N04E20ADB1	317	120.61	438	4/16/2003	Memphis
355360	903433	15N05E29DBB1	235	23.47	258	4/16/2003	Memphis
355544	902858	15N06E18ACA1	212	18.36	230	4/16/2003	Memphis
<b>Crittenden County</b>							
350345	901300	05N08E11CCA2	185	25.97	211	4/14/2003	Memphis
350958	901738	06N07E01DAD2	185	24.16	209	4/14/2003	Memphis
350850	900922	06N09E08DCC1	205	10.04	215	4/14/2003	Memphis
350745	900553	06N09E23AAB1	158	64.36	222	4/14/2003	Memphis
351349	900628	07N09E14BAC1	180	37.33	217	4/15/2003	Memphis
<b>Cross County</b>							
351004	904238	06N04E06ACA1	156	201.88	358	4/08/2003	Memphis
351538	903330	07N05E04ADD1	174	35.26	209	4/08/2003	Memphis
351908	905538	08N02E18BDB1	144	83.79	228	5/05/2003	Memphis
352405	905951	09N01E16CAC1	154	79.65	234	4/08/2003	Memphis
352244	905554	09N01E25AAD1	143	84.32	227	5/05/2003	Memphis
352404	904518	09N03E22AAB1	154	122.52	277	4/08/2003	Memphis
352403	904512	09N03E22AAD1	144	134.50	278	4/08/2003	Memphis
352404	904518	09N03E22ABD1	154	122.52	277	4/08/2003	Memphis
352232	904218	09N04E30DCA1	166	263.74	429.32	4/08/2003	Memphis
<b>Dallas County</b>							
340431	923360	07S14W30DCC1	215	119.75	335	3/26/2003	Sparta
340425	923334	07S14W31AAA1	221	109.46	330	5/20/2003	Sparta
340555	924545	07S16W20CAB1	298	24.37	322	3/26/2003	Sparta

**Table 2.** Water-level data collected during spring 2003 from wells completed in the Sparta-Memphis aquifer in Arkansas.—Continued

[NGVD of 1929, National Geodetic Vertical Datum of 1929—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929; Horizontal datum is NAD of 1983]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	Water-level altitude (feet above NGVD of 1929)	Depth to water (feet below land surface)	Land-surface datum (feet above NGVD of 1929)	Date of measurement	Aquifer
335859	923730	08S15W34BDC1	214	25.74	240	3/25/2003	Sparta
340152	924639	08S16W18ACC1	236	15.78	252	3/26/2003	Sparta
335937	924307	08S16W27DDD1	242	32.93	275	3/25/2003	Sparta
335309	922413	09S13W35CCD1	128	71.61	200	3/25/2003	Sparta
335754	922919	09S14W01BDC1	186	78.80	265	3/26/2003	Sparta
335605	924701	09S16W19CAA1	253	6.51	260	3/25/2003	Sparta
334829	922458	10S13W34ACA2	121	150.74	272	3/25/2003	Sparta
334908	923138	10S14W27CDB1	235	35.03	270	3/25/2003	Sparta
335120	924120	10S15W18BCC1	253	75.39	328	3/25/2003	Sparta
<b>Desha County</b>							
335346	911521	09S02W26AAC1	83	69.98	153	3/25/2003	Sparta
335310	913007	09S04W28DDD1	53	112.42	165	3/25/2003	Sparta
334750	911624	10S02W26CCC2	76	72.14	148	3/25/2003	Sparta
335034	912905	10S04W11CBC1	59	102.45	161	3/25/2003	Sparta
334616	911711	11S02W03CCA1	69	70.32	139	3/25/2003	Sparta
333749	912259	12S03W26CBB1	42	96.12	138	3/25/2003	Sparta
333643	912305	12S03W34DAD1	69	78.45	147	3/25/2003	Sparta
<b>Drew County</b>							
334632	912827	11S04W02ACA2	61	92.38	153	3/26/2003	Sparta
334249	912707	11S04W25CB2	64	84.28	148	3/26/2003	Sparta
334607	914122	11S06W11DBC1	53	149.95	203	3/26/2003	Sparta
333807	914543	12S06W30BBD1	79	222.63	302	3/26/2003	Sparta
333649	914402	12S06W32DAD1	59	168.02	227	3/26/2003	Sparta
333151	913408	13S05W36ACB1	80	89.13	169	3/26/2003	Sparta
332429	912724	15S04W12DDA1	63	62.02	125	3/26/2003	Sparta
<b>Grant County</b>							
342846	922106	03S13W12AAA1	230	131.45	361	4/01/2003	Sparta
342601	923447	03S15W26DAA1	327	10.45	337	4/02/2003	Sparta
342201	922932	04S14W14CCC1	220	83.05	303	4/02/2003	Sparta
341838	922402	05S13W03CDA4	169	111.90	281	4/02/2003	Sparta
341844	922400	05S13W03CAA1	175	84.77	260	4/02/2003	Sparta
341810	922650	05S13W07ADB1	210	60.22	270	4/02/2003	Sparta
341550	922650	05S13W30AAA1	209	120.65	330	4/02/2003	Sparta

**10 Status of Water Levels and Selected Water-Quality Conditions in the Sparta-Memphis Aquifer in Arkansas, Spring-Summer 2003**

**Table 2.** Water-level data collected during spring 2003 from wells completed in the Sparta-Memphis aquifer in Arkansas.—Continued

[NGVD of 1929, National Geodetic Vertical Datum of 1929—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929; Horizontal datum is NAD of 1983]

<b>Latitude (degrees, minutes, seconds)</b>	<b>Longitude (degrees, minutes, seconds)</b>	<b>Station name</b>	<b>Water-level altitude (feet above NGVD of 1929)</b>	<b>Depth to water (feet below land surface)</b>	<b>Land-surface datum (feet above NGVD of 1929)</b>	<b>Date of measurement</b>	<b>Aquifer</b>
341843	923327	05S14W06DCC1	205	87.62	293	4/02/2003	Sparta
341924	923827	05S15W05ABD1	217	19.03	236	4/02/2003	Sparta
341341	921413	06S11W05ACD1	59	210.47	269	4/03/2003	Sparta
341022	923538	06S15W26ACA1	214	66.34	280	4/02/2003	Sparta
340558	921953	07S12W21BDB1	221	2.17	223	4/01/2003	Sparta
<b>Hot Spring County</b>							
341460	924151	05S16W35ACA1	306	35.67	342	3/24/2003	Sparta
<b>Jefferson County</b>							
342624	915444	03S08W19BAD1	47	169.65	217	4/22/2003	Sparta
342628	915505	03S08W19BBD1	47	167.52	215	4/23/2003	Sparta
342619	915455	03S08W19BDB1	47	167.55	215	4/23/2003	Sparta
342626	915713	03S09W23BCA1	44	178.27	222	4/22/2003	Sparta
342659	920330	03S10W14CAD1	104	116.83	221	4/23/2003	Sparta
342502	920434	03S10W27AAD1	96	125.96	222	4/22/2003	Sparta
342651	921058	03S11W22ABC1	135	175.34	310	3/17/2003	Sparta
342140	914742	04S07W17BCC1	29	171.33	200	4/04/2003	Sparta
341909	915056	04S08W35BBD1	-12	211.75	200	4/04/2003	Sparta
342309	915702	04S09W11BAA1	76	134.17	210	4/04/2003	Sparta
341925	920017	04S09W32BDA1	84	124.66	209	4/22/2003	Sparta
342212	920646	04S10W17BDA1	73	191.57	265	4/22/2003	Sparta
342109	920442	04S10W22BDD1	41	203.68	244.24	4/22/2003	Sparta
342025	920625	04S10W29ADB1	49	218.07	267.55	4/22/2003	Sparta
342220	921000	04S11W14BAD1	91	308.55	400	3/24/2003	Sparta
341452	915440	05S08W30ADB1	-74	295.19	221	4/23/2003	Sparta
341446	915527	05S08W30CBA1	-81	288.87	207.46	4/23/2003	Sparta
341609	920131	05S09W19BAA3	-30	255.57	226	5/06/2003	Sparta
341530	915556	05S09W24DBD1	-64	272.52	208.17	4/23/2003	Sparta
341337	920109	05S09W31DDC1	-59	286.14	227	4/23/2003	Sparta
341420	915653	05S09W35AAB1	-68	273.45	205	4/23/2003	Sparta
341741	920322	05S10W11ACA1	39	195.96	235	4/22/2003	Sparta
341700	920549	05S10W16BAD1	32	244.92	277	3/17/2003	Sparta
341635	920543	05S10W16DBB1	23	292.40	315	3/17/2003	Sparta
341635	920534	05S10W16DBD1	22	279.75	302	3/24/2003	Sparta

**Table 2.** Water-level data collected during spring 2003 from wells completed in the Sparta-Memphis aquifer in Arkansas.—Continued

[NGVD of 1929, National Geodetic Vertical Datum of 1929—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929; Horizontal datum is NAD of 1983]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	Water-level altitude (feet above NGVD of 1929)	Depth to water (feet below land surface)	Land-surface datum (feet above NGVD of 1929)	Date of measurement	Aquifer
341143	915517	06S08W16CCC1	-54	256.40	202.42	3/05/2003	Sparta
341025	915116	06S08W25ADC1	-14	217.39	203.48	4/23/2003	Sparta
341159	920207	06S09W17CAD1	-47	280.07	233	4/23/2003	Sparta
341152	920221	06S09W17CCA1	-35	269.28	234.34	3/17/2003	Sparta
341123	920504	06S10W23ACA2	7	227.68	235	4/23/2003	Sparta
341116	920508	06S10W23ACD1	6	226.16	232	4/23/2003	Sparta
341105	920506	06S10W23DBA1	-10	239.96	230	4/23/2003	Sparta
340633	914523	07S07W24BAB1	26	161.69	188	4/23/2003	Sparta
340549	920421	07S10W24CAC1	9	302.05	311	4/23/2003	Sparta
<b>Lafayette County</b>							
332143	932609	16S23W12CAD1	249	73.11	322	5/20/2003	Sparta
331950	933303	16S24W26AAC1	213	53.85	267	3/05/2003	Sparta
331520	933128	17S23W19ACC1	240	51.12	291	3/05/2003	Sparta
331526	933403	17S24W23BBD1	229	31.59	261	3/05/2003	Sparta
330911	933039	18S23W29ACC1	242	12.57	255	3/04/2003	Sparta
330352	933103	19S23W29BDB1	209	40.90	250	3/04/2003	Sparta
330555	933922	19S25W13CAB1	218	37.10	255	5/20/2003	Sparta
330223	933026	20S23W05ADA1	209	33.18	242	3/04/2003	Sparta
330223	933036	20S23W05ADB1	203	38.69	242	3/04/2003	Sparta
<b>Lee County</b>							
344210	904119	01N04E09CDD1	149	59.28	208	4/09/2003	Sparta
344743	905925	02N01E10CAD1	150	51.10	201	4/09/2003	Sparta
345006	904749	03N03E28CDB1	146	61.11	207	4/09/2003	Sparta
<b>Lincoln County</b>							
340444	915043	07S07W30CDC1	29	179.23	208	3/27/2003	Sparta
340105	912753	08S04W22AAA1	49	117.93	167	3/27/2003	Sparta
340310	913454	08S05W03BAA2	35	145.14	180	3/27/2003	Sparta
335907	913333	08S05W35ACC1	28	136.92	165	3/27/2003	Sparta
335850	914358	08S06W31DCC1	50	131.32	181	3/27/2003	Sparta
335858	915222	08S08W35DBB1	48	201.56	250	5/01/2003	Sparta
335851	915217	08S08W35DCB1	60	210.41	270	3/27/2003	Sparta
335634	915128	09S07W07DAD1	28	268.20	296	3/27/2003	Sparta

12 Status of Water Levels and Selected Water-Quality Conditions in the Sparta-Memphis Aquifer in Arkansas, Spring-Summer 2003

Table 2. Water-level data collected during spring 2003 from wells completed in the Sparta-Memphis aquifer in Arkansas.—Continued

[NGVD of 1929, National Geodetic Vertical Datum of 1929—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929; Horizontal datum is NAD of 1983]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	Water-level altitude (feet above NGVD of 1929)	Depth to water (feet below land surface)	Land-surface datum (feet above NGVD of 1929)	Date of measurement	Aquifer
<b>Lonoke County</b>							
344425	914503	01N07W03BCC1	95	127.59	223	3/03/2003	Sparta
343855	914960	01S08W02DBD1	113	96.65	210	4/10/2003	Sparta
344939	914737	02N07W06ACD1	119	122.12	241	4/10/2003	Sparta
344906	914500	02N07W09AAA1	133	98.64	232	4/10/2003	Sparta
344651	914426	02N07W22DBA1	101	126.17	227	3/03/2003	Sparta
344720	914328	02N07W23BAA1	97	139.16	236	4/10/2003	Sparta
344650	914209	02N07W24DAC1	87	143.96	231	3/03/2003	Sparta
344453	914619	02N07W32DDD1	99	127.33	226	3/03/2003	Sparta
343228	915232	02S08W16BDA1	95	121.07	216	4/11/2003	Sparta
343247	915825	02S09W15BBB2	153	72.99	226	4/11/2003	Sparta
345445	914426	03N07W03CAA1	156	79.11	235	4/10/2003	Memphis
345144	914350	03N07W23CCC1	142	86.21	228	4/10/2003	Sparta
345403	914935	03N08W11ACD1	159	88.65	248	4/01/2003	Memphis
345205	915024	03N08W22DAD1	146	86.56	233	4/01/2003	Memphis
345205	915024	03N08W22DAD2	140	93.37	233	4/01/2003	Memphis
345152	915025	03N08W22DDD2	140	95.00	235	3/31/2003	Memphis
<b>Mississippi County</b>							
353302	900523	11N09E26AAD3	218	21.75	240	5/15/2003	Memphis
353312	901203	11N09E26ABA2	218	17.73	236	5/15/2003	Memphis
<b>Monroe County</b>							
344144	911801	01N03W14CCB1	101	71.29	172	4/07/2003	Sparta
345446	910635	03N01W33CDD1	142	67.51	210	4/07/2003	Sparta
345042	911026	03N02W26DAB1	145	46.87	192	4/07/2003	Sparta
345535	911221	04N02W28DDD4	162	30.06	192	4/07/2003	Memphis
345617	911504	04N02W30BAC1	165	15.16	180	4/07/2003	Memphis
345617	911515	04N02W30BAD1	173	9.09	182	4/07/2003	Memphis
<b>Nevada County</b>							
333251	931708	14S21W04CCB1	304	56.45	360	3/11/2003	Sparta
<b>Ouachita County</b>							
334441	923726	11S15W27ABD1	133	67.03	200	3/13/2003	Sparta
334631	924927	11S17W14CAC1	126	19.59	146	3/14/2003	Sparta
334341	924834	11S17W36CCA1	126	7.43	133	3/14/2003	Sparta



**Table 2.** Water-level data collected during spring 2003 from wells completed in the Sparta-Memphis aquifer in Arkansas.—Continued

[NGVD of 1929, National Geodetic Vertical Datum of 1929—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929; Horizontal datum is NAD of 1983]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	Water-level altitude (feet above NGVD of 1929)	Depth to water (feet below land surface)	Land-surface datum (feet above NGVD of 1929)	Date of measurement	Aquifer
334614	925759	11S18W20AAA1	257	43.80	301	3/13/2003	Sparta
334223	923922	12S15W09BBA1	144	68.75	213	3/13/2003	Sparta
333942	924253	12S16W25BDA1	104	33.10	137	5/12/2003	Sparta
333946	924304	12S16W26ABD1	92	42.32	134	5/12/2003	Sparta
333937	925442	12S18W25CAB1	110	77.29	187	3/13/2003	Sparta
334251	930352	12S19W09BAB1	280	10.42	290	3/13/2003	Sparta
334143	930105	12S19W14AAA1	233	4.36	237	3/13/2003	Sparta
333901	930146	12S19W35BDD1	195	154.95	350	3/13/2003	Sparta
333416	924451	13S16W28ADD1	82	24.35	106	3/13/2003	Sparta
333434	930418	13S19W28BCD1	197	33.19	230	3/12/2003	Sparta
333238	925255	14S17W05CAD1	121	36.25	157	3/12/2003	Sparta
332803	925251	14S17W32CAD1	138	82.30	220	3/12/2003	Sparta
332941	930513	14S19W29ABB1	194	85.73	280	3/12/2003	Sparta
332234	924027	15S15W32DBB2	-56	174.58	119	3/12/2003	Sparta
332311	925436	15S18W36ADD1	65	95.10	160	3/11/2003	Sparta
332618	930318	15S19W10DCC1	139	70.85	210	3/13/2003	Sparta
332438	930432	15S19W21CDD2	85	194.69	280	3/13/2003	Sparta
<b>Phillips County</b>							
343324	905455	01S02E32DDC1	130	80.73	211	5/10/2003	Sparta
343323	905056	02S02E01ADC1	138	37.88	176	5/05/2003	Sparta
343243	903907	02S04E02DBA1	137	113.30	250	4/10/2003	Sparta
343108	903526	02S05E16BCB1	158	32.02	190	4/10/2003	Sparta
342851	903635	02S05E29CCC1	145	33.81	179	4/10/2003	Sparta
342403	904915	03S03E30DAA1	127	44.69	172	4/10/2003	Sparta
342755	903621	03S05E05BAB1	124	56.35	180	4/10/2003	Sparta
341824	905121	04S02E25CCC1	130	36.37	166	5/05/2003	Sparta
<b>Poinsett County</b>							
353026	905630	10N01E12BDC1	139	94.51	234	4/18/2003	Memphis
352931	905825	10N01E15DBB1	138	93.82	232	4/21/2003	Memphis
352725	905924	10N01E33ABA1	146	74.66	221	4/18/2003	Memphis
353139	904447	10N03E02BCD1	141	109.75	251	4/18/2003	Memphis
352850	904432	10N03E23CAC1	147	111.13	258	4/18/2003	Memphis
353448	905321	11N02E16CCC1	139	104.24	243	4/18/2003	Memphis

**Table 2.** Water-level data collected during spring 2003 from wells completed in the Sparta-Memphis aquifer in Arkansas.—Continued

[NGVD of 1929, National Geodetic Vertical Datum of 1929—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929; Horizontal datum is NAD of 1983]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	Water-level altitude (feet above NGVD of 1929)	Depth to water (feet below land surface)	Land-surface datum (feet above NGVD of 1929)	Date of measurement	Aquifer
353325	904323	11N03E25BDD1	149	119.68	269	4/18/2003	Memphis
354104	904928	12N02E12DDC1	138	109.57	248	4/18/2003	Memphis
354137	904340	12N03E12BBB1	152	93.76	246	4/18/2003	Memphis
353745	904456	12N03E35BCC1	145	98.58	244	4/18/2003	Memphis
353727	904353	12N03E35DDA1	139	108.50	247	4/18/2003	Memphis
<b>Prairie County</b>							
344113	913505	01N05W19CDC1	71	141.00	212	4/09/2003	Sparta
344441	913659	01N06W02ABB1	103	117.54	221	4/10/2003	Sparta
343943	913846	01N06W34CBB1	69	157.19	226	4/09/2003	Sparta
343904	913532	01S05W06BCB1	66	153.77	220	4/09/2003	Sparta
343640	913352	01S05W20ABB1	64	155.61	220	4/09/2003	Sparta
343859	913613	01S06W01BDD2	57	168.59	226	4/10/2003	Sparta
343749	913654	01S06W11DBD1	57	169.40	226	4/09/2003	Sparta
344649	912802	02N04W19ACB1	121	89.77	211	4/10/2003	Sparta
344700	912933	02N05W24BCA2	124	101.24	225	4/03/2003	Sparta
344718	914050	02N06W19AAB1	93	142.97	236	4/10/2003	Sparta
344707	914033	02N06W20BCB1	96	139.81	236	4/10/2003	Sparta
344644	913829	02N06W21DAD1	111	121.02	232	4/10/2003	Sparta
344654	913801	02N06W22BDD1	105	127.91	233	4/10/2003	Sparta
345452	913043	03N05W03ADA2	146	59.14	205	4/10/2003	Memphis
345145	913356	03N05W20CCC1	143	70.10	213	4/10/2003	Memphis
345140	914004	03N06W20CDD1	141	84.20	225	4/10/2003	Memphis
<b>Pulaski County</b>							
343115	921225	02S11W29AAA1	205	40.23	245	5/08/2003	Sparta
<b>St. Francis County</b>							
345743	904319	04N04E18BAB1	156	64.25	220	4/09/2003	Memphis
<b>Union County</b>							
331944	923218	16S14W15CAB1	-59	153.21	94	3/12/2003	Sparta
331860	923958	16S15W20DAA1	-86	275.89	190	3/04/2003	Sparta
331717	924129	16S15W31ACC1	-134	301.68	168	3/04/2003	Sparta
332206	924329	16S16W02ABC1	-55	170.90	116	3/04/2003	Sparta
331806	925709	16S18W34ABC2	45	206.35	251	3/06/2003	Sparta
331206	922225	17S12W31AAA1	-15	236.90	222	3/05/2003	Sparta

**Table 2.** Water-level data collected during spring 2003 from wells completed in the Sparta-Memphis aquifer in Arkansas.—Continued

[NGVD of 1929, National Geodetic Vertical Datum of 1929—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929; Horizontal datum is NAD of 1983]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	Water-level altitude (feet above NGVD of 1929)	Depth to water (feet below land surface)	Land-surface datum (feet above NGVD of 1929)	Date of measurement	Aquifer
331203	922219	17S12W32BBC1	-19	249.08	230	3/05/2003	Sparta
331200	922916	17S13W31BAC1	-84	299.97	216	3/05/2003	Sparta
331505	924028	17S15W08DCC1	-159	333.65	174.92	3/06/2003	Sparta
331439	924129	17S15W18DBB1	-164	346.83	182.93	3/04/2003	Sparta
331246	923910	17S15W28DBA1	-167	396.69	230	3/10/2003	Sparta
331233	923924	17S15W28DCC1	-160	445.20	285	3/19/2003	Sparta
331229	924039	17S15W29CDC1	-160	380.40	220	3/19/2003	Sparta
331145	924117	17S15W31DCA1	-165	436.69	272	3/05/2003	Sparta
331144	924105	17S15W31DDA1	-165	426.27	261	3/05/2003	Sparta
331649	924254	17S16W01ABB1	-124	313.10	188.84	3/06/2003	Sparta
331559	924404	17S16W02CCC1	-162	339.93	178	3/07/2003	Sparta
331602	924327	17S16W02DCD1	-174	391.78	218	3/07/2003	Sparta
331506	924233	17S16W12DCC1	-177	399.07	221.58	3/07/2003	Sparta
331357	924248	17S16W24BDB1	-199	403.82	205	3/19/2003	Sparta
331257	925356	17S17W30DCD1	-39	319.40	280	3/06/2003	Sparta
331012	921443	18S11W09ABC1	39	96.15	135	3/06/2003	Sparta
330651	922120	18S12W33BBB1	-25	137.32	112	3/05/2003	Sparta
331039	923531	18S14W06CCD1	-154	386.17	232	3/05/2003	Sparta
330659	923858	18S15W33ADA1	-120	372.64	253	3/05/2003	Sparta
330636	923707	18S15W35DAC1	-105	306.48	201	3/05/2003	Sparta
331000	924445	18S16W10CDD1	-144	325.82	182	3/06/2003	Sparta
331041	924314	18S16W11AAB1	-154	379.23	225	4/03/2003	Sparta
331011	924316	18S16W11DAC1	-145	416.88	272	3/06/2003	Sparta
331029	924232	18S16W12ACB1	-152	453.75	302	3/06/2003	Sparta
330809	924611	18S16W28BBB1	-105	329.96	225	3/06/2003	Sparta
330856	925056	18S17W22BDD1	-75	359.82	285	4/03/2003	Sparta
331057	925600	18S18W11ACA1	-36	280.70	245	3/25/2003	Sparta
330329	920904	19S10W16CBC1	-2	84.28	82	3/06/2003	Sparta
330255	921229	19S11W23ACA1	-9	151.16	142	3/06/2003	Sparta
330218	921113	19S11W25AAA1	-13	148.02	135	3/06/2003	Sparta
330411	921717	19S12W13AAA1	37	154.04	191	3/06/2003	Sparta
330109	924326	19S16W35DDC1	-64	239.08	175	3/05/2003	Sparta
330452	925608	19S18W14ADA1	55	187.60	243	3/05/2003	Sparta

**Table 2.** Water-level data collected during spring 2003 from wells completed in the Sparta-Memphis aquifer in Arkansas.—Continued

[NGVD of 1929, National Geodetic Vertical Datum of 1929—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929; Horizontal datum is NAD of 1983]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	Water-level altitude (feet above NGVD of 1929)	Depth to water (feet below land surface)	Land-surface datum (feet above NGVD of 1929)	Date of measurement	Aquifer
330003	924500	CL-149	-65	294.82	230	4/03/2003	Sparta
<b>Woodruff County</b>							
350426	910407	05N01W11ABA1	155	56.02	211	4/07/2003	Memphis
350311	910727	05N01W17DBB1	164	45.67	210	4/07/2003	Memphis
350027	911456	05N02W31DCB3	182	11.30	193	4/07/2003	Memphis
350852	910254	06N01W13ABA1	147	65.36	212	5/05/2003	Memphis
350827	910247	06N01W13ADC1	144	67.99	212	5/05/2003	Memphis
351442	910326	07N01W12BCB1	159	63.21	222	4/07/2003	Memphis
351934	910311	08N01W12CDA1	147	78.37	225	5/05/2003	Memphis
351726	911004	08N02W26ADC1	177	34.84	212	5/05/2003	Memphis

line. The deepest measurement during 2003 in the center of the cone of depression in Union County has deepened by 2 ft. The area enclosed by the deepest contour, 180 ft below NGVD of 1929, is about one-third the area enclosed in the same contour in the 2001 potentiometric-surface map (Schrader, 2004). The cone of depression in Union County has expanded southeast into Union Parish, Louisiana. The deepest water level measurement in the cone of depression in Columbia County has risen by about 6 ft, rising from 13 ft below NGVD of 1929 in 2001 to 7 ft below NGVD of 1929 in 2003.

Seven smaller depressions are evident in the 2003 Sparta-Memphis potentiometric-surface map. Two depressions in western Lincoln County and southeastern Calhoun County were evident in the 2001 potentiometric-surface map (Schrader, 2004). Five depressions, located in central Cleveland, western Columbia, western Dallas, southern Desha, and northern Lafayette Counties, were not evident in the 2001 potentiometric-surface map. The cone in southern Desha County was connected to the cone of depression centered in Jefferson County in 2001. Rising water levels in eastern Drew County separated the cone in Desha County from the larger cone centered in Jefferson County. Short-term variations in climate and withdrawals may account for these smaller depressions. Local increases in water withdrawals may result in the formation of long-term cones of depression. Continued monitoring of the Sparta-Memphis aquifer potentiometric surface could determine if these are related to climate variations or withdrawals.

The potentiometric surface indicates that large withdrawals have altered or reversed the natural direction of flow in most areas. Flow in the areas surrounding the cones of depression, shaded in grey on plate 1, is toward the cone of depression at the center of pumping. In the northern third of the study area the

flow is from the east, west, and north towards the cone of depression in Poinsett County. In the central third of the study area the flow is dominated by the cone of depression centered in Jefferson County. Flow from all directions is towards the cone of depression in Jefferson County, with the exception of Cleveland County. In Cleveland County the flow is towards the southeast to the small cone of depression centered at the City of Rison. In the southern third of the study area the flow is dominated by the two cones of depression in Union and Columbia Counties. Flow is radially in towards the center of the cones of depression. In most of eastern Columbia County the flow is west towards the cone of depression near Magnolia. Near the Columbia-Union County line the flow reverses direction, east towards the cone of depression in Union County. In Ashley and Chicot Counties the flow is south-southwest.

## Status of Water Levels

### Water-Level Change Map from 1999 to 2003

A map of changes in water-level measurements between 1999 and 2003 (plate 2) was constructed using the difference between water-level measurements from 281 wells (table 3). The change in water level was calculated by subtracting the 2003 depth to water from the 1999 depth to water. Positive values indicate a rise and negative values indicate a decline in water level. Rises in the water level are indicated on plate 2 with blue triangles pointing upward; declines in the water level are indicated with red triangles pointing downward. Triangles are scaled to the relative value of the rise or decline.

**Table 3.** Change in water level from 1999 to 2003 in the Sparta-Memphis aquifer in Arkansas.

[Horizontal datum is NAD of 1983; Negative values denote a decline; 1999 depth to water level from Joseph, 2000]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	1999 depth to water (feet below land-surface datum)	2003 depth to water (feet below land-surface datum)	Change in water level from 1999 to 2003 (feet)	Aquifer
<b>Arkansas County</b>						
343312	912849	02S04W06CDB1	169.47	160.87	8.6	Sparta
343044	912355	02S04W23DAA1	151.75	149.72	2.0	Sparta
342922	912703	02S04W33BBB1	165.38	171.01	-5.6	Sparta
343144	913319	02S05W16CBB1	183.39	178.88	4.5	Sparta
343028	913230	02S05W27BBB1	186.27	180.27	6.0	Sparta
342925	913148	02S05W34BDA1	203.24	179.8	23.4	Sparta
342930	913035	02S05W35AAB1	197.09	174.85	22.2	Sparta
342748	912458	03S04W02CCB1	165.92	162.24	3.7	Sparta
342421	912438	03S04W26CDA1	143.11	137.3	5.8	Sparta
342407	912639	03S04W33BAA1	156.34	159.94	-3.6	Sparta
342842	913034	03S05W02AAB1	173.04	173.43	-0.4	Sparta
342631	913005	03S05W13BDC1	185.58	178.86	6.7	Sparta
342633	913229	03S05W15CBB1	185.35	171.95	13.4	Sparta
342629	913525	03S05W18CAB1	165.88	169.14	-3.3	Sparta
342447	913240	03S05W28DAB1	178.23	172.62	5.6	Sparta
342516	914216	03S06W30BBD1	164.28	160.74	3.5	Sparta
342225	910808	04S01W04CBD1	108.29	113.14	-4.8	Sparta
341927	910748	04S01W28BAA1	101.48	106.16	-4.7	Sparta
342157	912502	04S04W11BCC1	158.88	155.5	3.4	Sparta
342004	912929	04S04W19CBB1	158.54	162.72	-4.2	Sparta
342007	912515	04S04W22DAA1	161.68	159.99	1.7	Sparta
342303	913413	04S05W05ACC1	156.02	157.42	-1.4	Sparta
342132	913133	04S05W15AAA1	169.24	166.7	2.5	Sparta
341752	913004	04S05W36DCC1	157.12	163.18	-6.1	Sparta
341551	910745	05S01W17BAA1	96.02	93.49	2.5	Sparta
341734	912006	05S03W04ADB1	146.28	160.84	-14.6	Sparta
341358	912434	05S04W26ACA1	127.55	128.98	-1.4	Sparta
341228	911620	06S02W06ABB1	113.67	114.76	-1.1	Sparta
341023	911453	06S02W17ADA1	108.59	114.77	-6.2	Sparta
340904	911331	06S02W22CDB1	109.06	105.86	3.2	Sparta
340859	912009	06S03W27BAA1	114.14	119.62	-5.5	Sparta

**Table 3.** Change in water level from 1999 to 2003 in the Sparta-Memphis aquifer in Arkansas.—Continued  
[Horizontal datum is NAD of 1983; Negative values denote a decline; 1999 depth to water level from Joseph, 2000]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	1999 depth to water (feet below land-surface datum)	2003 depth to water (feet below land-surface datum)	Change in water level from 1999 to 2003 (feet)	Aquifer
340340	911411	07S02W28ABA1	99.94	105.64	-5.7	Sparta
340702	912248	07S03W06ABC1	119.49	131.33	-11.8	Sparta
340031	911448	08S02W09BCC1	94.92	100.22	-5.3	Sparta
<b>Ashley County</b>						
332118	915101	15S07W32CDD1	156.71	137.84	18.9	Sparta
<b>Bradley County</b>						
333648	920437	13S09W06ACA1	197.29	183.67	13.6	Sparta
333647	920417	13S09W06ACB2	170.8	157.75	13.1	Sparta
333454	921607	13S11W17BCD1	196.67	193.43	3.2	Sparta
331839	922052	16S12W21CAA1	70.98	75.29	-4.3	Sparta
<b>Calhoun County</b>						
334630	922928	11S14W12CAC3	149.09	146	3.1	Sparta
333227	922742	13S13W32CDA1	175.92	168.68	7.2	Sparta
333227	923532	13S15W36CBD1	81.79	80.51	1.3	Sparta
333040	922404	14S13W12CCB1	191.04	168.45	22.6	Sparta
333055	923912	14S15W16BAA1	97.58	97.07	0.5	Sparta
332411	922807	15S13W20BDC1	82.43	34.11	48.3	Sparta
<b>Chicot County</b>						
333312	912308	13S03W22DAD1	81.23	67.03	14.2	Sparta
<b>Cleveland County</b>						
335729	921134	09S11W01DCA1	197.86	206.18	-8.3	Sparta
334918	920021	10S09W23CDC1	163.01	161.88	1.1	Sparta
335133	921743	10S12W12BDD1	119.18	117.29	1.9	Sparta
334543	921423	11S11W16AAB1	219.87	205.99	13.9	Sparta
<b>Columbia County</b>						
332453	931215	15S20W20CCB1	220.06	217.04	3.0	Sparta
332049	931517	16S21W14CBB1	198.99	200.6	-1.6	Sparta
331948	932225	16S22W22CCD1	152.39	132.68	19.7	Sparta
331546	930318	17S19W15AAB1	294.38	272.37	22.0	Sparta
331517	930656	17S19W18CBD1	316.96	279.49	37.5	Sparta
331406	930650	17S19W30ABB1	229.48	221.9	7.6	Sparta
331532	930807	17S20W13BCD1	324.21	318.1	6.1	Sparta
331520	931201	17S20W17CDA1	299.22	303.03	-3.8	Sparta
331307	930755	17S20W36ABC1	297.59	297	0.6	Sparta

**Table 3.** Change in water level from 1999 to 2003 in the Sparta-Memphis aquifer in Arkansas.—Continued  
 [Horizontal datum is NAD of 1983; Negative values denote a decline; 1999 depth to water level from Joseph, 2000]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	1999 depth to water (feet below land-surface datum)	2003 depth to water (feet below land-surface datum)	Change in water level from 1999 to 2003 (feet)	Aquifer
331743	931424	17S21W01BBC1	328.24	270.4	57.8	Sparta
331613	931758	17S21W08DCA1	140.05	211.61	-71.6	Sparta
331609	931449	17S21W11DCC2	293.35	283.08	10.3	Sparta
331608	931820	17S21W17BAB1	159.32	203.32	-44.0	Sparta
331223	931339	18S21W01ACC1	291.09	297.73	-6.6	Sparta
330835	932159	18S22W27DDD1	125.63	122.98	2.6	Sparta
330555	931149	19S20W08DAD1	244.68	254.29	-9.6	Sparta
330555	931129	19S20W09CBD1	267.9	266.01	1.9	Sparta
330239	931031	19S20W34BDD1	217.12	212.12	5.0	Sparta
330517	931724	19S21W16DBB1	175.04	174.42	0.6	Sparta
330644	932833	19S23W10ABD1	44.83	45.22	-0.4	Sparta
330609	932744	19S23W11CDA2	55.88	52.65	3.2	Sparta
330605	932722	19S23W11DDB1	53.54	53.76	-0.2	Sparta
330555	932752	19S23W14BAB2	51.09	49.99	1.1	Sparta
330109	932133	20S22W11ACD1	108.24	107.17	1.1	Sparta
<b>Craighead County</b>						
354404	904433	13N03E23CDD1	81.74	86.89	-5.2	Memphis
354642	904115	13N04E05DCC1	134.86	142.3	-7.4	Memphis
354929	903921	14N04E22CBD1	50.72	55.7	-5.0	Memphis
354837	903953	14N04E28DBD1	51.89	61.17	-9.3	Memphis
354751	903100	14N05E36CBC1	12.03	12.1	-0.1	Memphis
355360	903433	15N05E29DBB1	23.39	23.47	-0.1	Memphis
355544	902858	15N06E18ACA1	15.68	18.36	-2.7	Memphis
<b>Crittenden County</b>						
350345	901300	05N08E11CCA2	24.49	25.97	-1.5	Memphis
350958	901738	06N07E01DAD2	21.58	24.16	-2.6	Memphis
350850	900922	06N09E08DCC1	9.22	10.04	-0.8	Memphis
350745	900553	06N09E23AAB1	30.62	64.36	-33.7	Memphis
<b>Cross County</b>						
351004	904238	06N04E06ACA1	202.51	201.88	0.6	Memphis
351538	903330	07N05E04ADD1	29.78	35.26	-5.5	Memphis
351908	905538	08N02E18BDB1	79.99	83.79	-3.8	Memphis
352405	905951	09N01E16CAC1	83.15	79.65	3.5	Memphis
352244	905554	09N01E25AAD1	80.05	84.32	-4.3	Memphis

**Table 3.** Change in water level from 1999 to 2003 in the Sparta-Memphis aquifer in Arkansas.—Continued  
 [Horizontal datum is NAD of 1983; Negative values denote a decline; 1999 depth to water level from Joseph, 2000]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	1999 depth to water (feet below land-surface datum)	2003 depth to water (feet below land-surface datum)	Change in water level from 1999 to 2003 (feet)	Aquifer
352404	904518	09N03E22ABD1	120.56	122.52	-2.0	Memphis
352232	904218	09N04E30DCA1	258.21	263.74	-5.5	Memphis
<b>Dallas County</b>						
340431	923360	07S14W30DCC1	118.08	119.75	-1.7	Sparta
340425	923334	07S14W31AAA1	109.73	109.46	0.3	Sparta
340555	924545	07S16W20CAB1	26.17	24.37	1.8	Sparta
335859	923730	08S15W34BDC1	24.13	25.74	-1.6	Sparta
340152	924639	08S16W18ACC1	9.17	15.78	-6.6	Sparta
335937	924307	08S16W27DDD1	32.63	32.93	-0.3	Sparta
335309	922413	09S13W35CCD1	68.87	71.61	-2.7	Sparta
335754	922919	09S14W01BDC1	77.1	78.8	-1.7	Sparta
335605	924701	09S16W19CAA1	5.27	6.51	-1.2	Sparta
334829	922458	10S13W34ACA2	148.45	150.74	-2.3	Sparta
<b>Desha County</b>						
335346	911521	09S02W26AAC1	69.82	69.98	-0.2	Sparta
335310	913007	09S04W28DDD1	114.87	112.42	2.5	Sparta
334750	911624	10S02W26CCC2	70.88	72.14	-1.3	Sparta
335034	912905	10S04W11CBC1	97.09	102.45	-5.4	Sparta
334616	911711	11S02W03CCA1	66.77	70.32	-3.6	Sparta
333749	912259	12S03W26CBB1	81.63	96.12	-14.5	Sparta
333643	912305	12S03W34DAD1	96.97	78.45	18.5	Sparta
<b>Drew County</b>						
334632	912827	11S04W02ACA2	88.62	92.38	-3.8	Sparta
334249	912707	11S04W25CB2	91.65	84.28	7.4	Sparta
334607	914122	11S06W11DBC1	142.77	149.95	-7.2	Sparta
333807	914543	12S06W30BBD1	221.84	222.63	-0.8	Sparta
333649	914402	12S06W32DAD1	155.38	168.02	-12.6	Sparta
333151	913408	13S05W36ACB1	85.35	89.13	-3.8	Sparta
332429	912724	15S04W12DDA1	58.21	62.02	-3.8	Sparta
<b>Grant County</b>						
342846	922106	03S13W12AAA1	129.25	131.45	-2.2	Sparta
342601	923447	03S15W26DAA1	4.59	10.45	-5.9	Sparta
342201	922932	04S14W14CCC1	77.17	83.05	-5.9	Sparta
341844	922400	05S13W03CAA1	88.17	84.77	3.4	Sparta



**Table 3.** Change in water level from 1999 to 2003 in the Sparta-Memphis aquifer in Arkansas.—Continued  
 [Horizontal datum is NAD of 1983; Negative values denote a decline; 1999 depth to water level from Joseph, 2000]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	1999 depth to water (feet below land-surface datum)	2003 depth to water (feet below land-surface datum)	Change in water level from 1999 to 2003 (feet)	Aquifer
341838	922402	05S13W03CDA4	114.13	111.9	2.2	Sparta
341810	922650	05S13W07ADB1	70.32	60.22	10.1	Sparta
341550	922650	05S13W30AAA1	131.36	120.65	10.7	Sparta
341843	923327	05S14W06DCC1	90.06	87.62	2.4	Sparta
341924	923827	05S15W05ABD1	17.14	19.03	-1.9	Sparta
341341	921413	06S11W05ACD1	206.86	210.47	-3.6	Sparta
341022	923538	06S15W26ACA1	67.36	66.34	1.0	Sparta
<b>Hot Spring County</b>						
341460	924151	05S16W35ACA1	37.32	35.67	1.7	Sparta
<b>Jefferson County</b>						
342624	915444	03S08W19BAD1	168.84	169.65	-0.8	Sparta
342628	915505	03S08W19BBD1	159.45	167.52	-8.1	Sparta
342619	915455	03S08W19BDB1	162.24	167.55	-5.3	Sparta
342659	920330	03S10W14CAD1	115.74	116.83	-1.1	Sparta
342502	920434	03S10W27AAD1	122.9	125.96	-3.1	Sparta
342651	921058	03S11W22ABC1	165.95	175.34	-9.4	Sparta
342140	914742	04S07W17BCC1	171.22	171.33	-0.1	Sparta
341909	915056	04S08W35BBD1	201.65	211.75	-10.1	Sparta
342309	915702	04S09W11BAA1	126.59	134.17	-7.6	Sparta
341925	920017	04S09W32BDA1	115.77	124.66	-8.9	Sparta
342212	920646	04S10W17BDA1	187.25	191.57	-4.3	Sparta
342109	920442	04S10W22BDD1	187.7	203.68	-16.0	Sparta
342025	920625	04S10W29ADB1	217.03	218.07	-1.0	Sparta
342220	921000	04S11W14BAD1	303.94	308.55	-4.6	Sparta
341452	915440	05S08W30ADB1	264.65	295.19	-30.5	Sparta
341446	915527	05S08W30CBA1	277.23	288.87	-11.6	Sparta
341609	920131	05S09W19BAA3	252.98	255.57	-2.6	Sparta
341530	915556	05S09W24DBD1	267.26	272.52	-5.3	Sparta
341420	915653	05S09W35AAB1	274.5	273.45	1.1	Sparta
341741	920322	05S10W11ACA1	166.29	195.96	-29.7	Sparta
341700	920549	05S10W16BAD1	238.51	244.92	-6.4	Sparta
341635	920543	05S10W16DBB1	284.3	292.4	-8.1	Sparta
341635	920534	05S10W16DBD1	269.45	279.75	-10.3	Sparta
341143	915517	06S08W16CCC1	245.85	256.4	-10.6	Sparta

**Table 3.** Change in water level from 1999 to 2003 in the Sparta-Memphis aquifer in Arkansas.—Continued  
 [Horizontal datum is NAD of 1983; Negative values denote a decline; 1999 depth to water level from Joseph, 2000]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	1999 depth to water (feet below land-surface datum)	2003 depth to water (feet below land-surface datum)	Change in water level from 1999 to 2003 (feet)	Aquifer
341025	915116	06S08W25ADC1	217.3	217.39	-0.1	Sparta
341152	920221	06S09W17CCA1	263.92	269.28	-5.4	Sparta
341116	920508	06S10W23ACD1	240.82	226.16	14.7	Sparta
341105	920506	06S10W23DBA1	242.8	239.96	2.8	Sparta
340633	914523	07S07W24BAB1	154.18	161.69	-7.5	Sparta
340549	920421	07S10W24CAC1	292.72	302.05	-9.3	Sparta
<b>Lafayette County</b>						
332143	932609	16S23W12CAD1	64.74	73.11	-8.4	Sparta
331950	933303	16S24W26AAC1	52.27	53.85	-1.6	Sparta
331520	933128	17S23W19ACC1	52.14	51.12	1.0	Sparta
331526	933403	17S24W23BBD1	32.99	31.59	1.4	Sparta
330911	933039	18S23W29ACC1	12.92	12.57	0.4	Sparta
330352	933103	19S23W29BDB1	39.55	40.9	-1.4	Sparta
330555	933922	19S25W13CAB1	35.53	37.1	-1.6	Sparta
330223	933036	20S23W05ADB1	39.06	38.69	0.4	Sparta
<b>Lee County</b>						
344210	904119	01N04E09CDD1	49.48	59.28	-9.8	Sparta
344743	905925	02N01E10CAD1	49.59	51.1	-1.5	Sparta
345006	904749	03N03E28CDB1	50.69	61.11	-10.4	Sparta
<b>Lincoln County</b>						
340444	915043	07S07W30CDC1	180.84	179.23	1.6	Sparta
340310	913454	08S05W03BAA2	136.27	145.14	-8.9	Sparta
335907	913333	08S05W35ACC1	124.66	136.92	-12.3	Sparta
335850	914358	08S06W31DCC1	129.17	131.32	-2.2	Sparta
335858	915222	08S08W35DBB1	198.28	201.56	-3.3	Sparta
335851	915217	08S08W35DCB1	212.88	210.41	2.5	Sparta
335634	915128	09S07W07DAD1	273.47	268.2	5.3	Sparta
<b>Lonoke County</b>						
344425	914503	01N07W03BCC1	120.96	127.59	-6.6	Sparta
343855	914960	01S08W02DBD1	102.46	96.65	5.8	Sparta
344906	914500	02N07W09AAA1	94.92	98.64	-3.7	Sparta
344651	914426	02N07W22DBA1	120.02	126.17	-6.2	Sparta
344650	914209	02N07W24DAC1	133.63	143.96	-10.3	Sparta
344453	914619	02N07W32DDD1	121.22	127.33	-6.1	Sparta

**Table 3.** Change in water level from 1999 to 2003 in the Sparta-Memphis aquifer in Arkansas.—Continued  
 [Horizontal datum is NAD of 1983; Negative values denote a decline; 1999 depth to water level from Joseph, 2000]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	1999 depth to water (feet below land-surface datum)	2003 depth to water (feet below land-surface datum)	Change in water level from 1999 to 2003 (feet)	Aquifer
343228	915232	02S08W16BDA1	126.29	121.07	5.2	Sparta
345445	914426	03N07W03CAA1	73.84	79.11	-5.3	Memphis
345144	914350	03N07W23CCC1	84.27	86.21	-1.9	Memphis
345403	914935	03N08W11ACD1	81.64	88.65	-7.0	Memphis
345152	915025	03N08W22DDD2	91.24	95	-3.8	Memphis
<b>Monroe County</b>						
344144	911801	01N03W14CCB1	69.48	71.29	-1.8	Sparta
345446	910635	03N01W33CDD1	62.36	67.51	-5.2	Sparta
345042	911026	03N02W26DAB1	44.39	46.87	-2.5	Sparta
345535	911221	04N02W28DDD4	28.22	30.06	-1.8	Memphis
345617	911504	04N02W30BAC1	19.84	15.16	4.7	Memphis
345617	911515	04N02W30BAD1	22.99	9.09	13.9	Memphis
<b>Nevada County</b>						
333251	931708	14S21W04CCB1	58.89	56.45	2.4	Sparta
<b>Ouachita County</b>						
334441	923726	11S15W27ABD1	72.96	67.03	5.9	Sparta
334631	924927	11S17W14CAC1	18.95	19.59	-0.6	Sparta
334341	924834	11S17W36CCA1	7.33	7.43	-0.1	Sparta
334614	925759	11S18W20AAA1	43.21	43.8	-0.6	Sparta
334223	923922	12S15W09BBA1	70.38	68.75	1.6	Sparta
333946	924304	12S16W26ABD1	49.83	42.32	7.5	Sparta
334251	930352	12S19W09BAB1	16.87	10.42	6.5	Sparta
333901	930146	12S19W35BDD1	158.39	154.95	3.4	Sparta
333416	924451	13S16W28ADD1	34.31	24.35	10.0	Sparta
333434	930418	13S19W28BCD1	36.4	33.19	3.2	Sparta
333238	925255	14S17W05CAD1	37.24	36.25	1.0	Sparta
332803	925251	14S17W32CAD1	85.48	82.3	3.2	Sparta
332941	930513	14S19W29ABB1	85.96	85.73	0.2	Sparta
332234	924027	15S15W32DBB2	175.32	174.58	0.7	Sparta
332311	925436	15S18W36ADD1	95.15	95.1	0.1	Sparta
332618	930318	15S19W10DCC1	66.88	70.85	-4.0	Sparta
332438	930432	15S19W21CDD2	189.04	194.69	-5.7	Sparta
<b>Phillips County</b>						
343324	905455	01S02E32DDC1	80.03	80.73	-0.7	Sparta

**Table 3.** Change in water level from 1999 to 2003 in the Sparta-Memphis aquifer in Arkansas.—Continued  
[Horizontal datum is NAD of 1983; Negative values denote a decline; 1999 depth to water level from Joseph, 2000]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	1999 depth to water (feet below land-surface datum)	2003 depth to water (feet below land-surface datum)	Change in water level from 1999 to 2003 (feet)	Aquifer
343323	905056	02S02E01ADC1	38.43	37.88	0.5	Sparta
343243	903907	02S04E02DBA1	100.2	113.3	-13.1	Sparta
343108	903526	02S05E16BCB1	42.73	32.02	10.7	Sparta
342851	903635	02S05E29CCC1	21.08	33.81	-12.7	Sparta
342403	904915	03S03E30DAA1	43.25	44.69	-1.4	Sparta
342755	903621	03S05E05BAB1	37.41	56.35	-18.9	Sparta
341824	905121	04S02E25CCC1	35.02	36.37	-1.3	Sparta
<b>Poinsett County</b>						
353026	905630	10N01E12BDC1	101.44	94.51	6.9	Memphis
352931	905825	10N01E15DBB1	82.57	93.82	-11.3	Memphis
352725	905924	10N01E33ABA1	68.55	74.66	-6.1	Memphis
353139	904447	10N03E02BCD1	104.48	109.75	-5.3	Memphis
352850	904432	10N03E23CAC1	106.29	111.13	-4.8	Memphis
353448	905321	11N02E16CCC1	98.04	104.24	-6.2	Memphis
353325	904323	11N03E25BDD1	126.81	119.68	7.1	Memphis
354104	904928	12N02E12DDC1	98.97	109.57	-10.6	Memphis
354137	904340	12N03E12BBB1	87.99	93.76	-5.8	Memphis
353745	904456	12N03E35BCC1	91.02	98.58	-7.6	Memphis
353727	904353	12N03E35DDA1	95.88	108.5	-12.6	Memphis
<b>Prairie County</b>						
344113	913505	01N05W19CDC1	145.63	141	4.6	Sparta
343904	913532	01S05W06BCB1	152.47	153.77	-1.3	Sparta
343640	913352	01S05W20ABB1	156.15	155.61	0.5	Sparta
343749	913654	01S06W11DBD1	162.16	169.4	-7.2	Sparta
344649	912802	02N04W19ACB1	91.36	89.77	1.6	Sparta
344707	914033	02N06W20BCB1	129.76	139.81	-10.1	Sparta
344644	913829	02N06W21DAD1	116.86	121.02	-4.2	Sparta
<b>Pulaski County</b>						
343115	921225	02S11W29AAA1	33.13	40.23	-7.1	Sparta
<b>St. Francis County</b>						
345743	904319	04N04E18BAB1	64.53	64.25	0.3	Memphis
<b>Union County</b>						
331944	923218	16S14W15CAB1	163.83	153.21	10.6	Sparta
331860	923958	16S15W20DAA1	279.92	275.89	4.0	Sparta

**Table 3.** Change in water level from 1999 to 2003 in the Sparta-Memphis aquifer in Arkansas.—Continued  
 [Horizontal datum is NAD of 1983; Negative values denote a decline; 1999 depth to water level from Joseph, 2000]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	1999 depth to water (feet below land-surface datum)	2003 depth to water (feet below land-surface datum)	Change in water level from 1999 to 2003 (feet)	Aquifer
331717	924129	16S15W31ACC1	317.57	301.68	15.9	Sparta
332206	924329	16S16W02ABC1	180.92	170.9	10.0	Sparta
331806	925709	16S18W34ABC2	202.64	206.35	-3.7	Sparta
331206	922225	17S12W31AAA1	233.06	236.9	-3.8	Sparta
331203	922219	17S12W32BBC1	247.75	249.08	-1.3	Sparta
331200	922916	17S13W31BAC1	294.06	299.97	-5.9	Sparta
331505	924028	17S15W08DCC1	354.9	333.65	21.3	Sparta
331439	924129	17S15W18DBB1	365.24	346.83	18.4	Sparta
331246	923910	17S15W28DBA1	427.22	396.69	30.5	Sparta
331229	924039	17S15W29CDC1	426.78	380.4	46.4	Sparta
331145	924117	17S15W31DCA1	476.53	436.69	39.8	Sparta
331144	924105	17S15W31DDA1	467.12	426.27	40.9	Sparta
331649	924254	17S16W01ABB1	333.71	313.1	20.6	Sparta
331559	924404	17S16W02CCC1	346.5	339.93	6.6	Sparta
331602	924327	17S16W02DCD1	394.55	391.78	2.8	Sparta
331506	924233	17S16W12DCC1	419.05	399.07	20.0	Sparta
331357	924248	17S16W24BDB1	419.26	403.82	15.4	Sparta
331257	925356	17S17W30DCD1	310.85	319.4	-8.5	Sparta
330651	922120	18S12W33BBB1	136.04	137.32	-1.3	Sparta
331039	923531	18S14W06CCD1	371.62	386.17	-14.6	Sparta
330659	923858	18S15W33ADA1	389.27	372.64	16.6	Sparta
330636	923707	18S15W35DAC1	311.31	306.48	4.8	Sparta
331000	924445	18S16W10CDD1	338.67	325.82	12.9	Sparta
331011	924316	18S16W11DAC1	442.23	416.88	25.4	Sparta
331029	924232	18S16W12ACB1	483.58	453.75	29.8	Sparta
330809	924611	18S16W28BBB1	351.13	329.96	21.2	Sparta
330856	925056	18S17W22BDD1	397.38	359.82	37.6	Sparta
330329	920904	19S10W16CBC1	84.22	84.28	-0.1	Sparta
330255	921229	19S11W23ACA1	145.62	151.16	-5.5	Sparta
330218	921113	19S11W25AAA1	152.6	148.02	4.6	Sparta
330109	924326	19S16W35DDC1	238.31	239.08	-0.8	Sparta
330003	924500	CL-149 Junction City	296.4	294.82	1.6	Sparta
<b>Woodruff County</b>						
350426	910407	05N01W11ABA1	53.22	56.02	-2.8	Memphis

**Table 3.** Change in water level from 1999 to 2003 in the Sparta-Memphis aquifer in Arkansas.—Continued  
 [Horizontal datum is NAD of 1983; Negative values denote a decline; 1999 depth to water level from Joseph, 2000]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	1999 depth to water (feet below land-surface datum)	2003 depth to water (feet below land-surface datum)	Change in water level from 1999 to 2003 (feet)	Aquifer
350311	910727	05N01W17DBB1	42.27	45.67	-3.4	Memphis
350027	911456	05N02W31DCB3	23.52	11.3	12.2	Memphis
350852	910254	06N01W13ABA1	62.12	65.36	-3.2	Memphis
350827	910247	06N01W13ADC1	64.16	67.99	-3.8	Memphis
351442	910326	07N01W12BCB1	57.74	63.21	-5.5	Memphis
351934	910311	08N01W12CDA1	71.66	78.37	-6.7	Memphis
351726	911004	08N02W26ADC1	31.98	34.84	-2.9	Memphis

The change in water level between 1999 and 2003 ranged from -71.6 to 57.8 ft. The largest rise of 57.8 ft and the largest decline of -71.6 ft in water level measured were both in Columbia County. Locations of the largest rise and largest decline in the study area are less than 5 miles apart. Between 1999 and 2003 a large public supply converted from a primary source of ground water to a primary source of surface water. Withdrawals from the Sparta-Memphis aquifer in Columbia County were about 29.1 Mgal/d in 1996, 2.6 Mgal/d in 2000, and 1.2 Mgal/d in 2003. The wells around the largest rise withdrew about 1.02 Mgal/d in 1996, 0.03 Mgal/d in 2000, and 0.04 Mgal/d in 2003. The decrease in withdrawals from the ground water resulted in the largest rise. When public supply changed to surface water as the primary source, an industrial user decreased the amount of public-supplied water and increased self-supplied ground water. The well near the largest decline withdrew about 0.00 Mgal/d in 1996, 0.11 Mgal/d in 2000, and 0.10 Mgal/d in 2003 (Terrance W. Holland, U.S. Geological Survey, written commun., 2005). The increase in self-supplied ground water likely caused the largest decline in water level.

Areas with a general rise in water levels are shown in Arkansas, Bradley, Calhoun, Cleveland, Columbia, Ouachita, and Union Counties. A broad area extending from eastern Columbia and western Union Counties northward throughout much of Ouachita, Calhoun, Bradley, Cleveland, and Grant Counties show water-level rises as much as 48.3 ft in Calhoun County. The inset area on plate 2 shows an expanded view of Union County. The area around El Dorado has rises as much as 46.4 ft, with 11 wells showing a rise of 20 ft or greater, which is an annual rise of 5 ft or greater. The rise in water level around El Dorado coincides with water conservation methods initiated in 1999 (Robert Reynolds, Union County Water Conservation Board, written commun., 2003). An area in northern Arkansas County shows mostly rises in water level, the largest rise is 23.4 ft.

Areas with a general decline in water level are shown in Craighead, Crittenden, Cross, Desha, Drew, Jefferson, Lonoke,

Phillips, Poinsett, Prairie, and Woodruff Counties. Jefferson County is dominated by declines in water level with declines as much as 30.5 ft in the Pine Bluff area. Northeastern Lonoke and western Prairie Counties are areas of decline as much as 10.3 ft. A large part of northeastern and eastern Arkansas have water-level declines in Craighead County south to Desha and Drew Counties. Declines of more than 10 ft have occurred in many of the counties in northeastern and eastern Arkansas with the largest decline of 33.7 ft occurring near West Memphis in Crittenden County.

### Long-Term Hydrographs

Hydrographs were constructed for wells with a minimum of 25 years of water-level measurements. Selected hydrographs are shown in figure 3. The minimum 25-year period is used to evaluate long-term trends not dominated by variations in climate and localized pumping rates on water levels in a single well. A trend line using linear regression was calculated for the period from 1979 to 2003 to determine the slope in feet per year (ft/yr) for water levels in each well. The slope of the trend line represents the typical annual decline or rise in water level during the 25-year period. Table 4 shows the number of wells, the range of the annual rise or decline in water level for the county, the mean, and the median value for each county. Negative values denote a decline in water level.

During the period 1979-2003, the mean annual water-level rose only in Lafayette and Ouachita Counties. Mean annual declines were between -0.5 ft/yr and 0.0 ft/yr in Columbia, Dallas, Grant, Lee, Phillips, and Woodruff Counties. Mean annual declines were between -1.0 ft/yr and -0.5 ft/yr in Bradley, Calhoun, Cleveland, Craighead, Desha, Drew, Jefferson, and Union Counties. Mean annual declines were between -1.5 ft/yr and -1.0 ft/yr in Arkansas, Cross, Lincoln, Lonoke, Poinsett, and Prairie Counties.

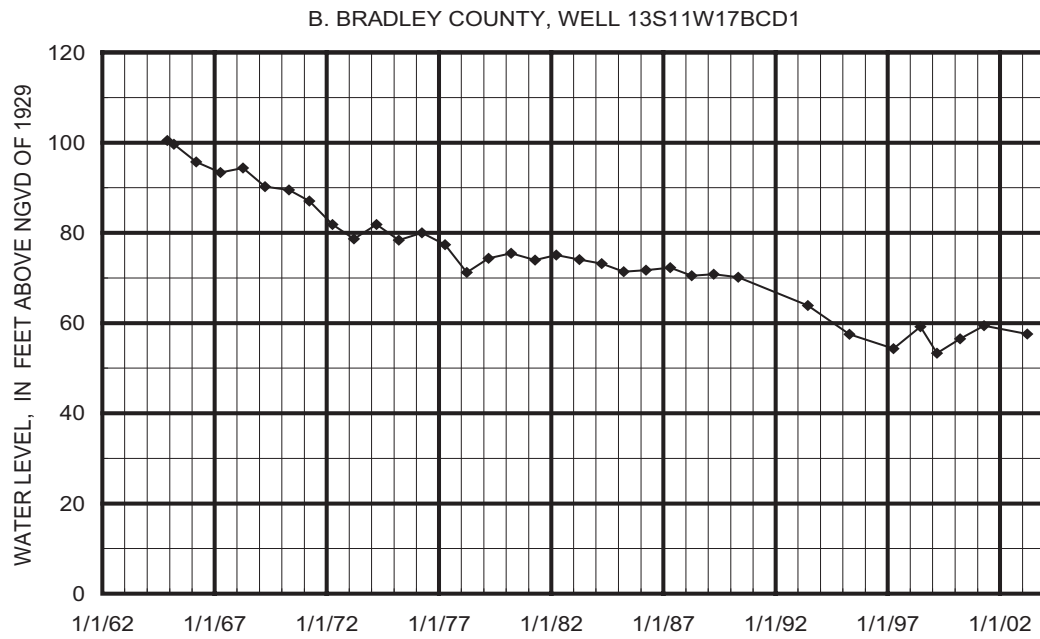
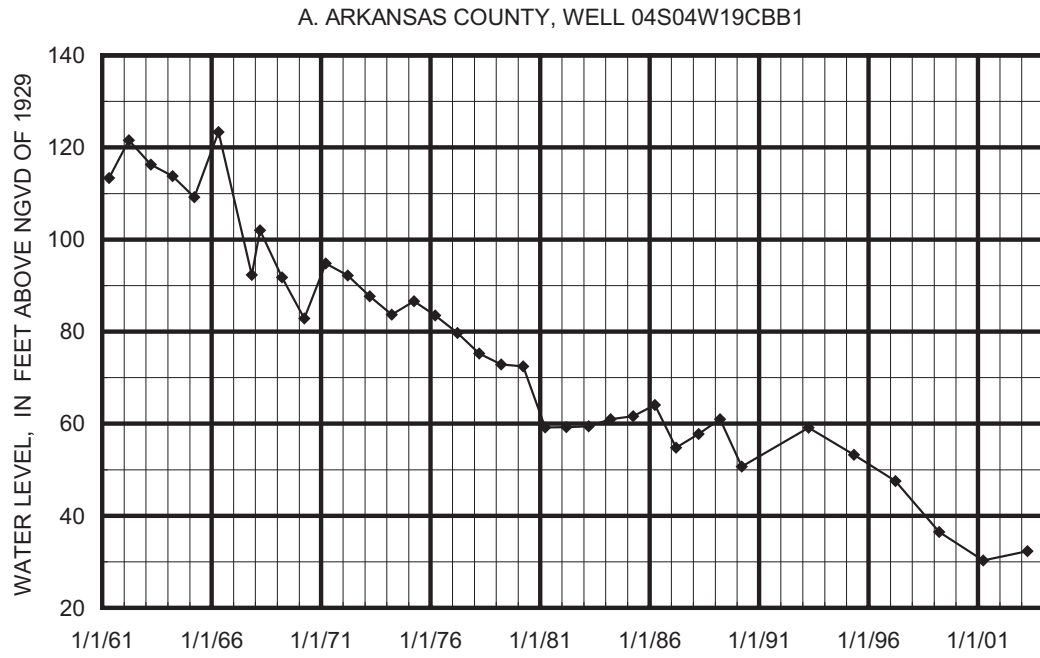


Figure 3. Water-level hydrographs for selected wells completed in the Sparta-Memphis aquifer.

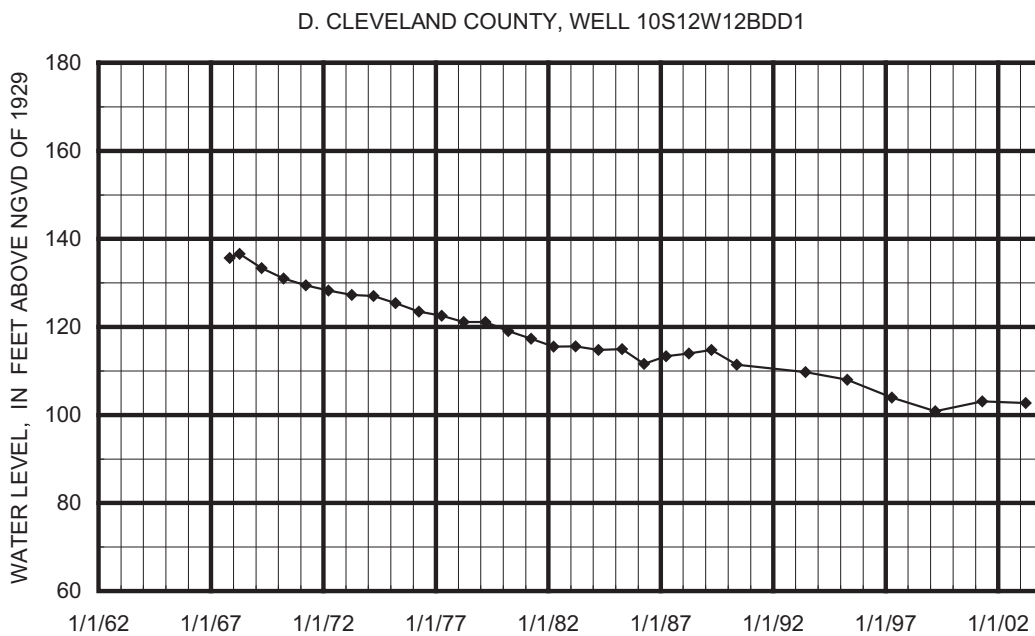
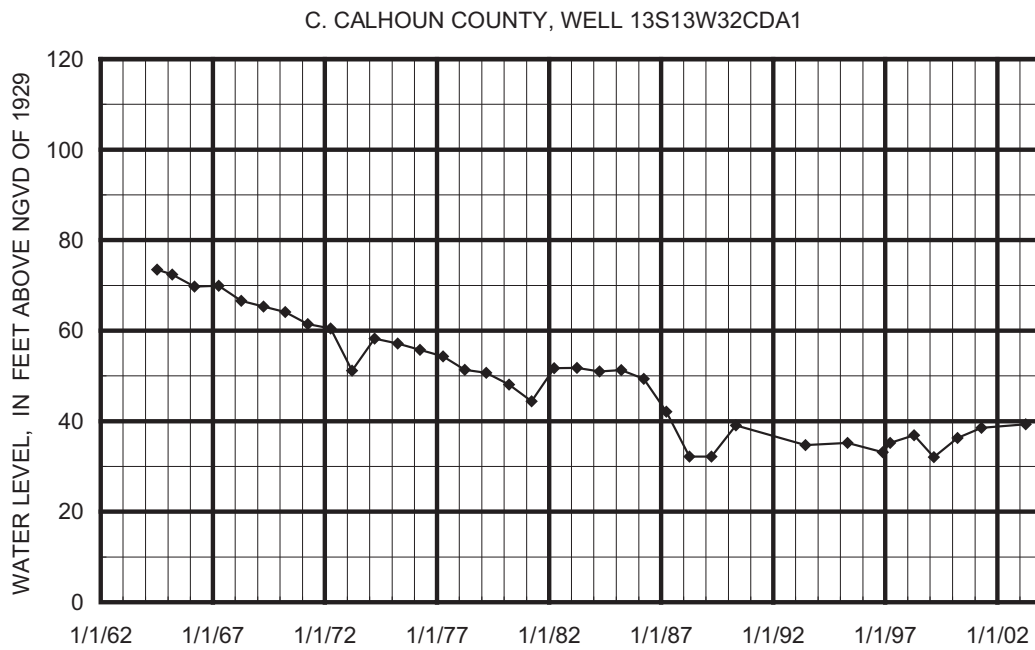


Figure 3. Water-level hydrographs for selected wells completed in the Sparta-Memphis aquifer.—Continued



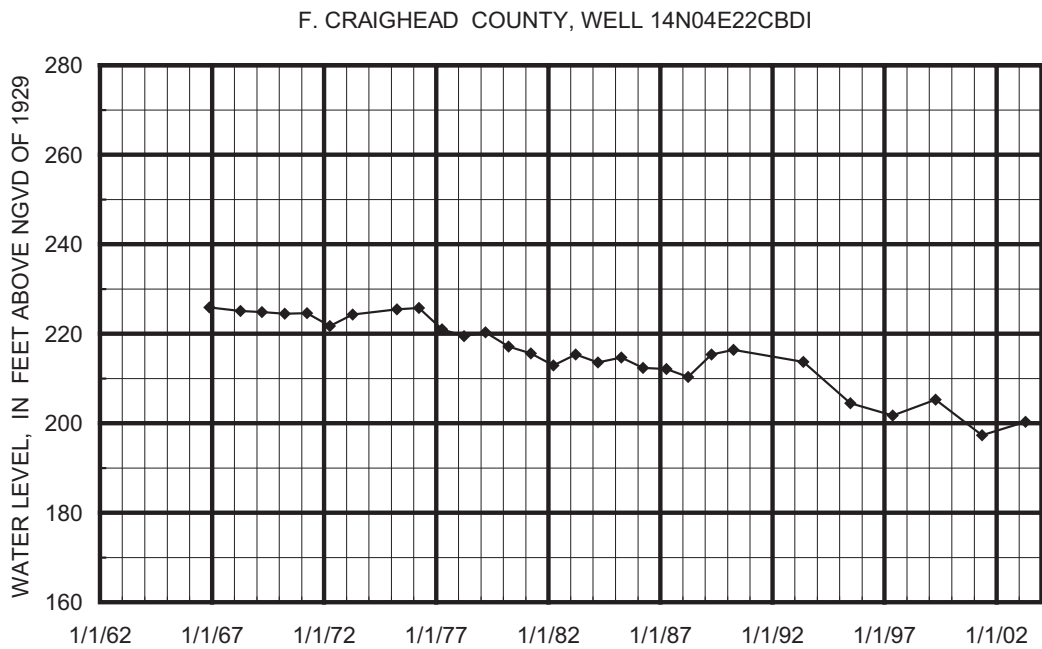
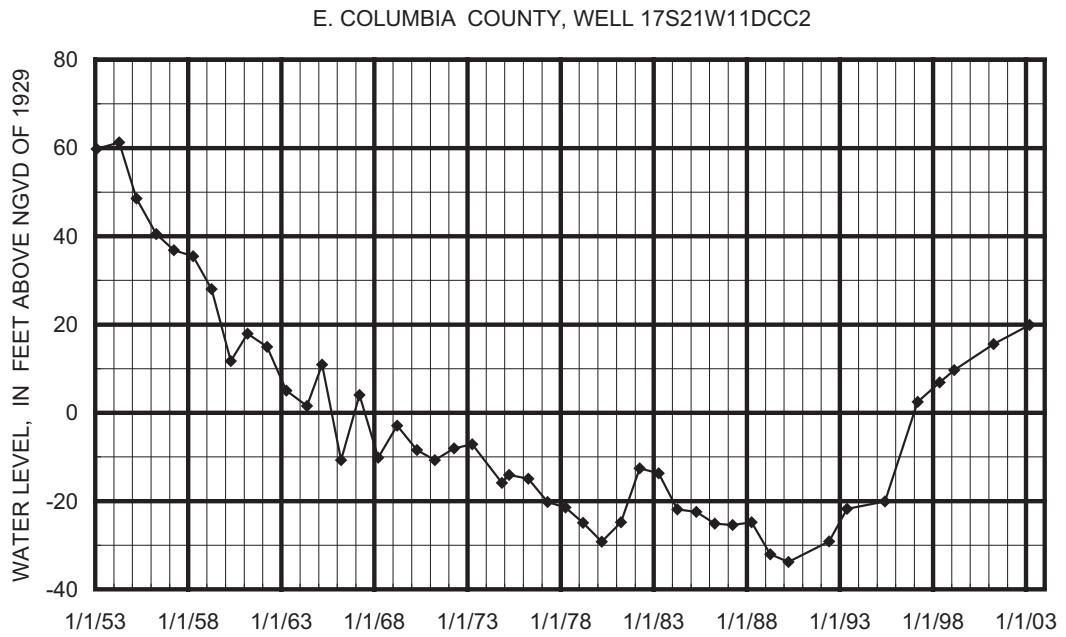


Figure 3. Water-level hydrographs for selected wells completed in the Sparta-Memphis aquifer.—Continued

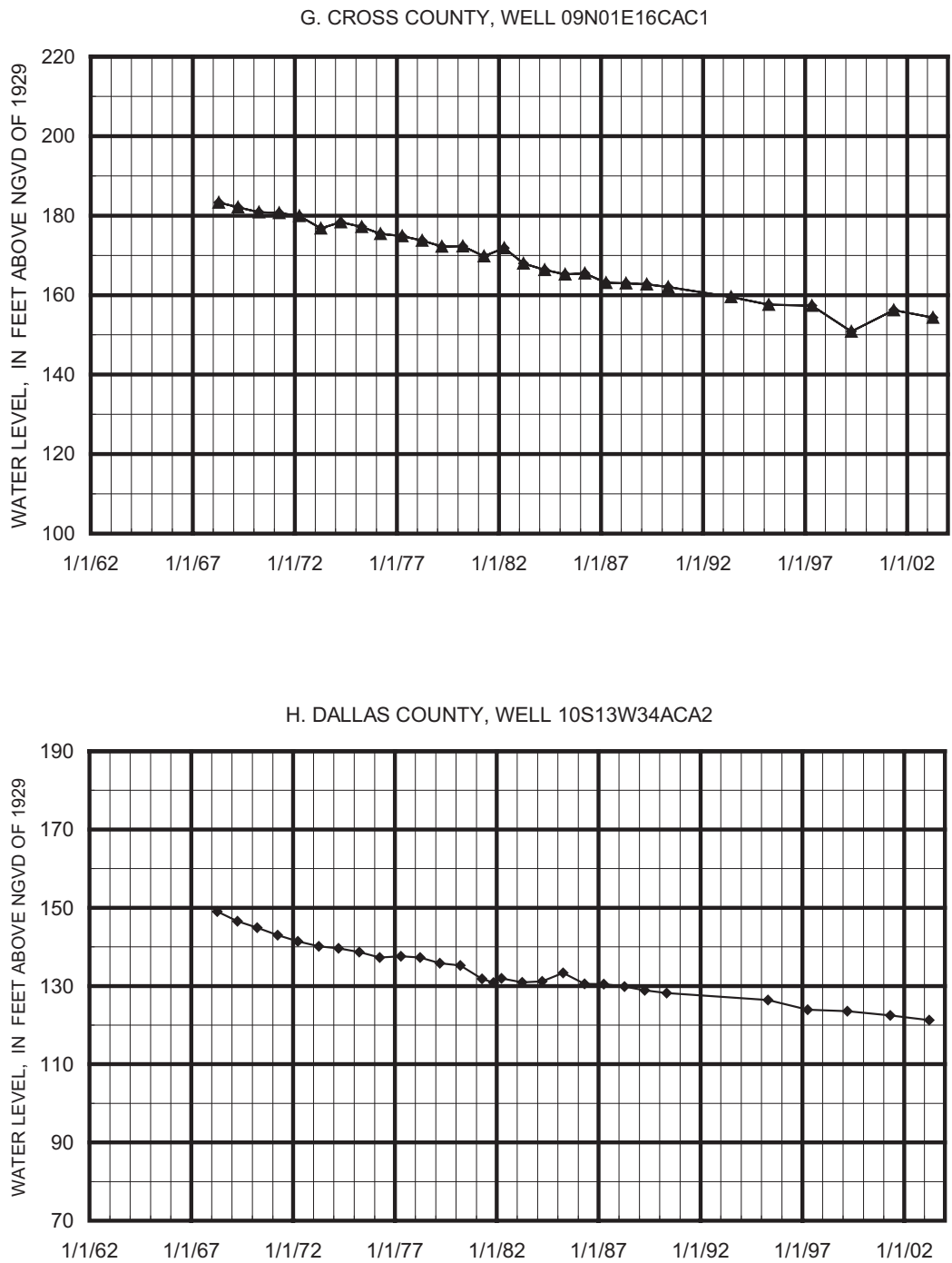


Figure 3. Water-level hydrographs for selected wells completed in the Sparta-Memphis aquifer.—Continued

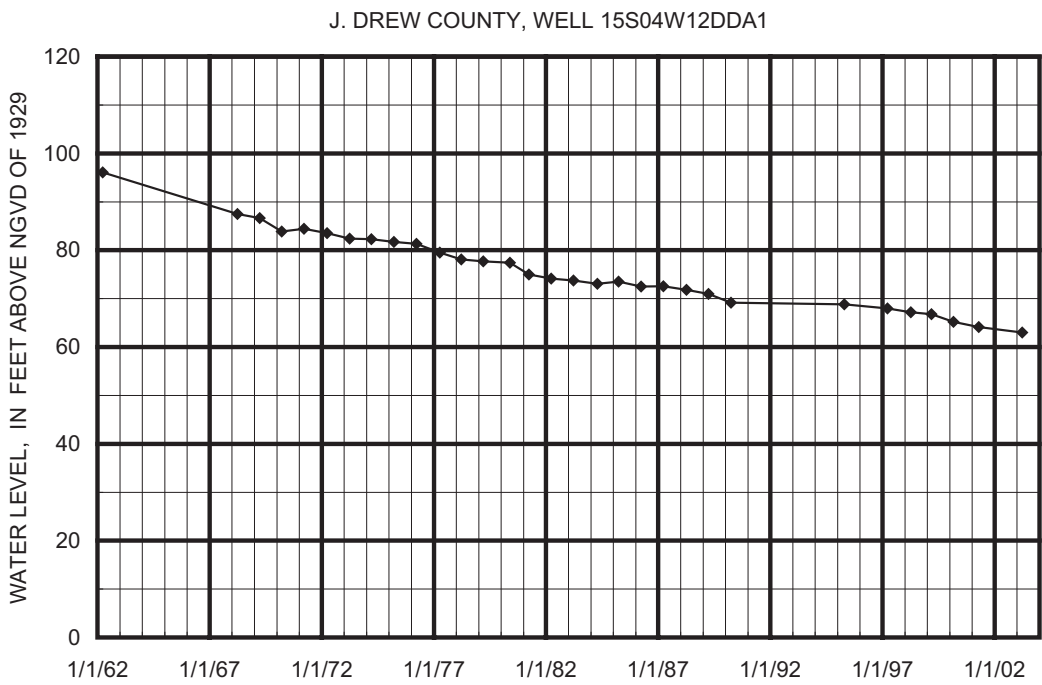
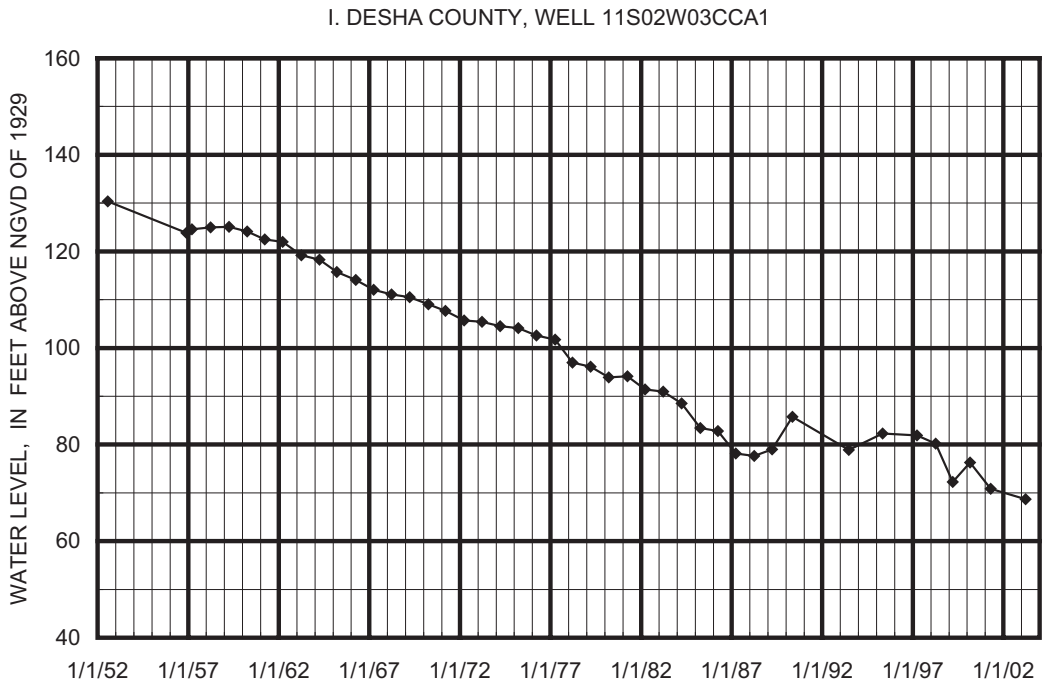


Figure 3. Water-level hydrographs for selected wells completed in the Sparta-Memphis aquifer.—Continued

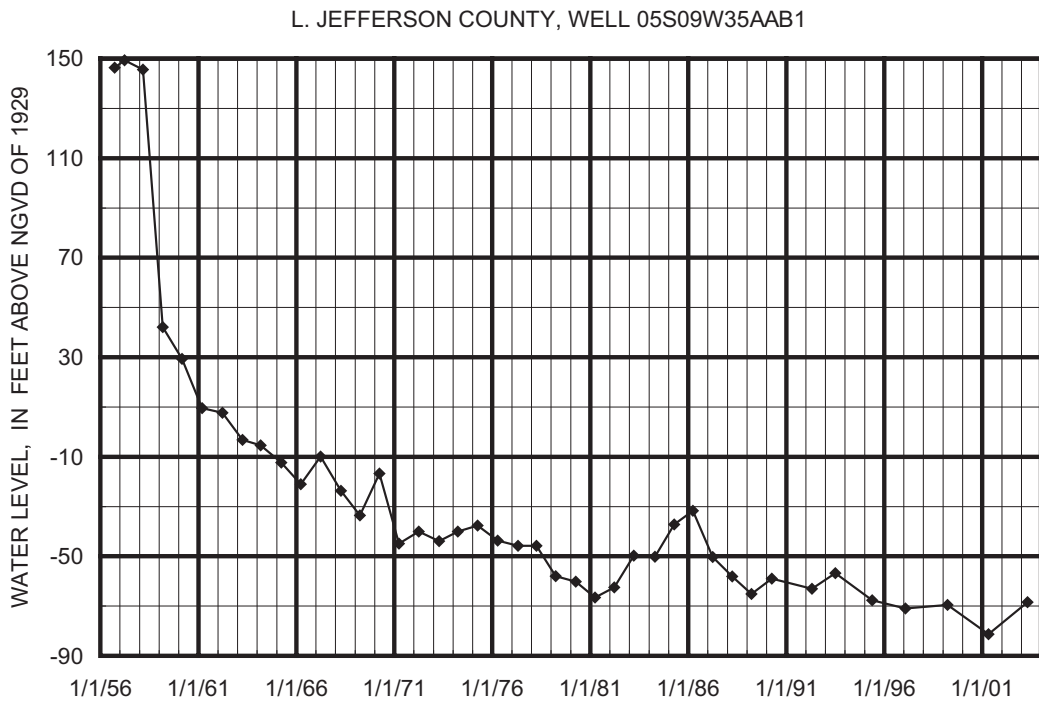
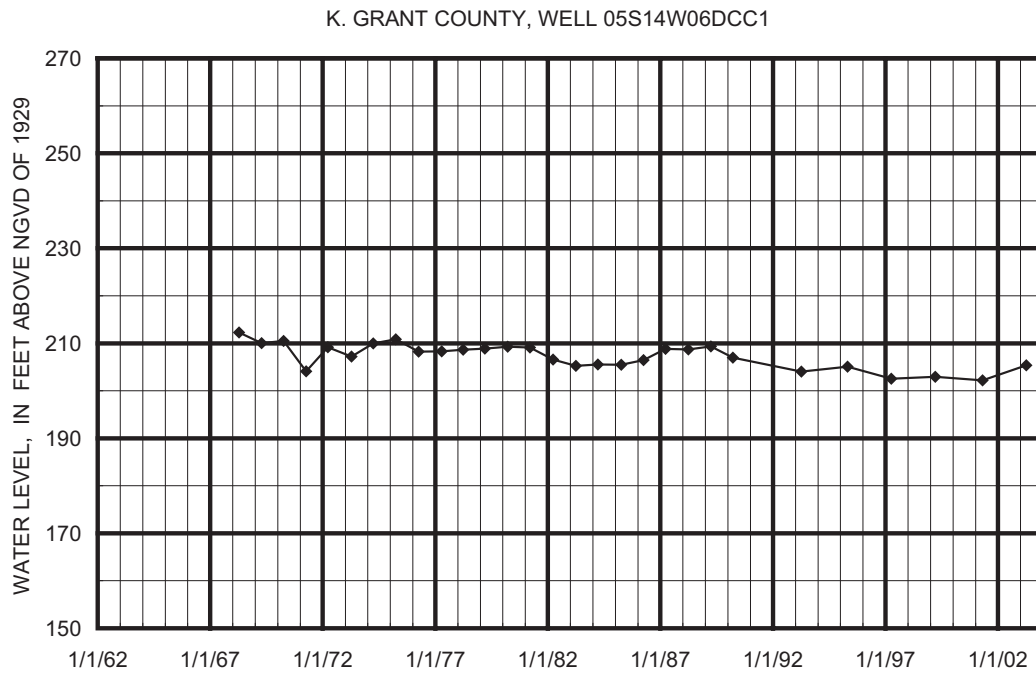


Figure 3. Water-level hydrographs for selected wells completed in the Sparta-Memphis aquifer.—Continued

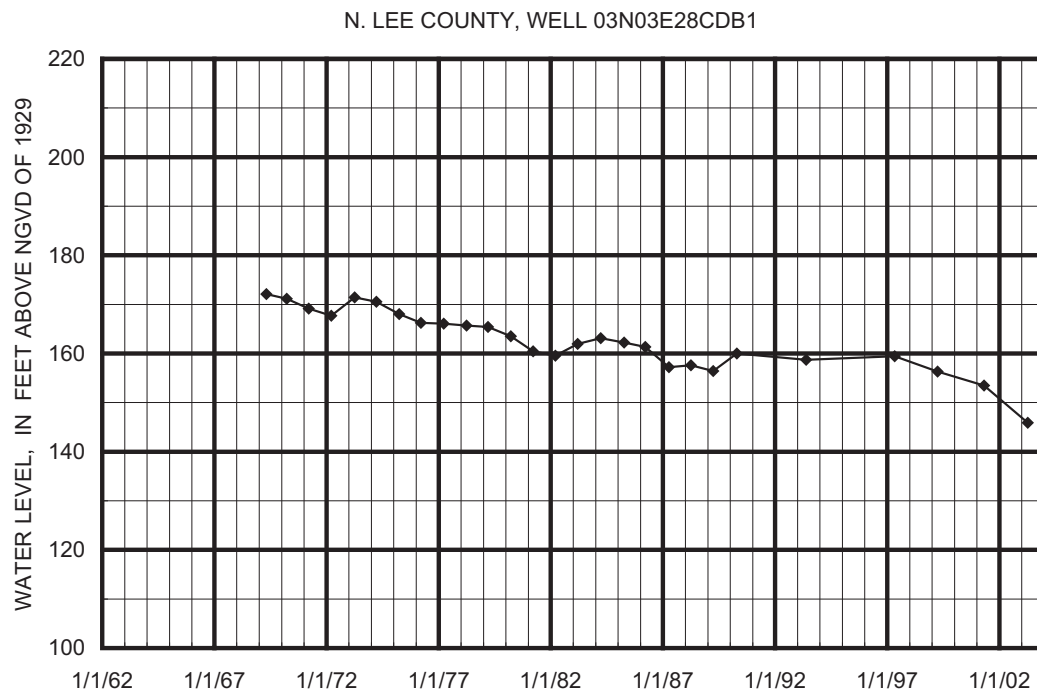
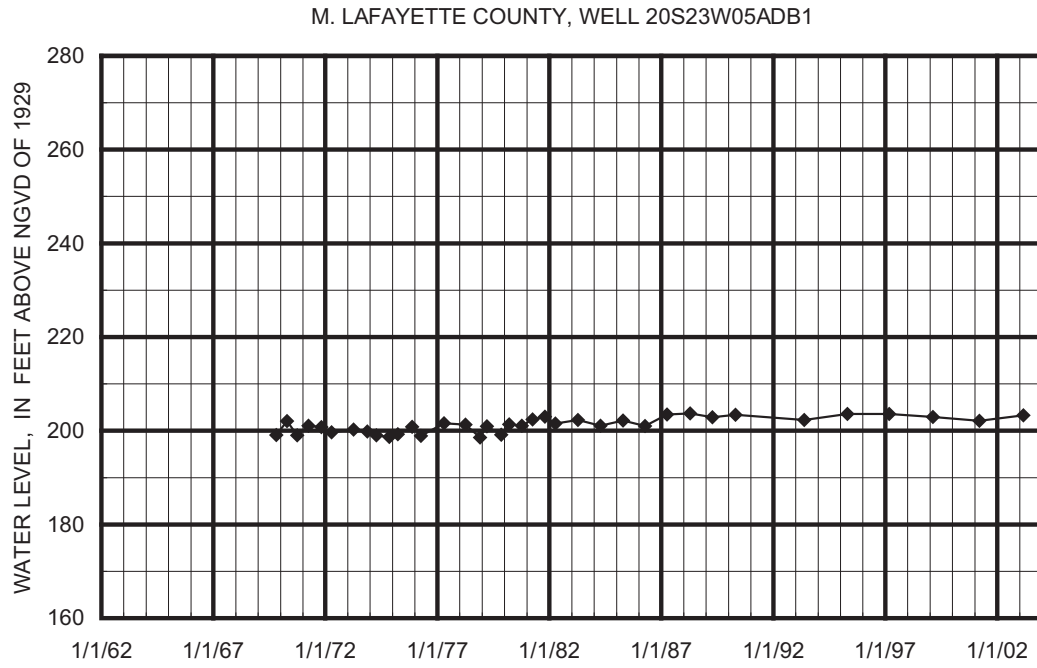


Figure 3. Water-level hydrographs for selected wells completed in the Sparta-Memphis aquifer.—Continued

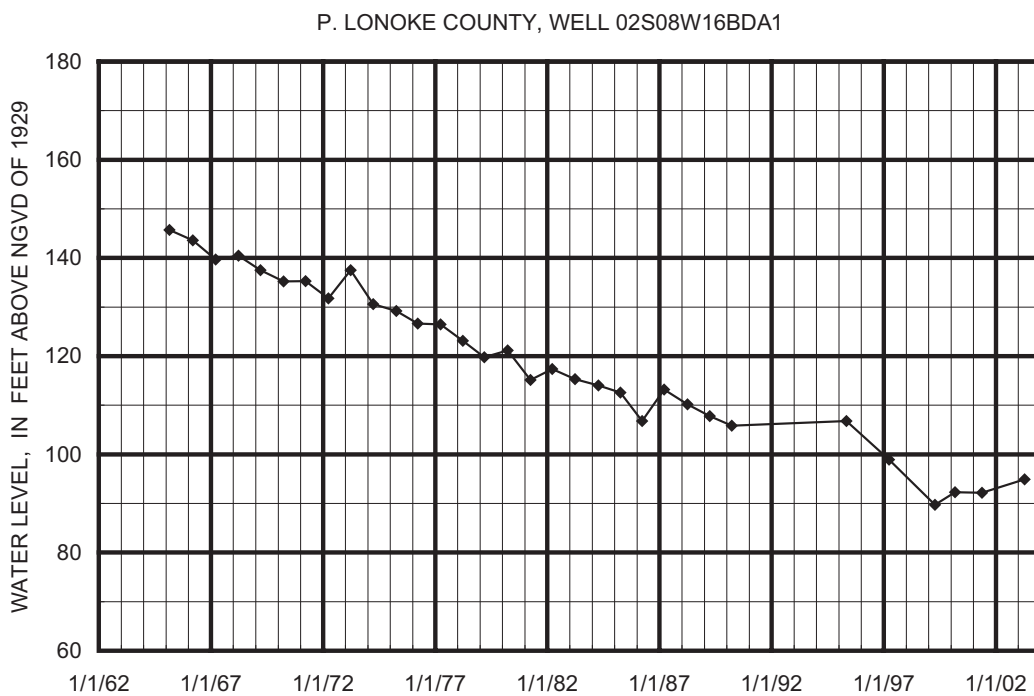
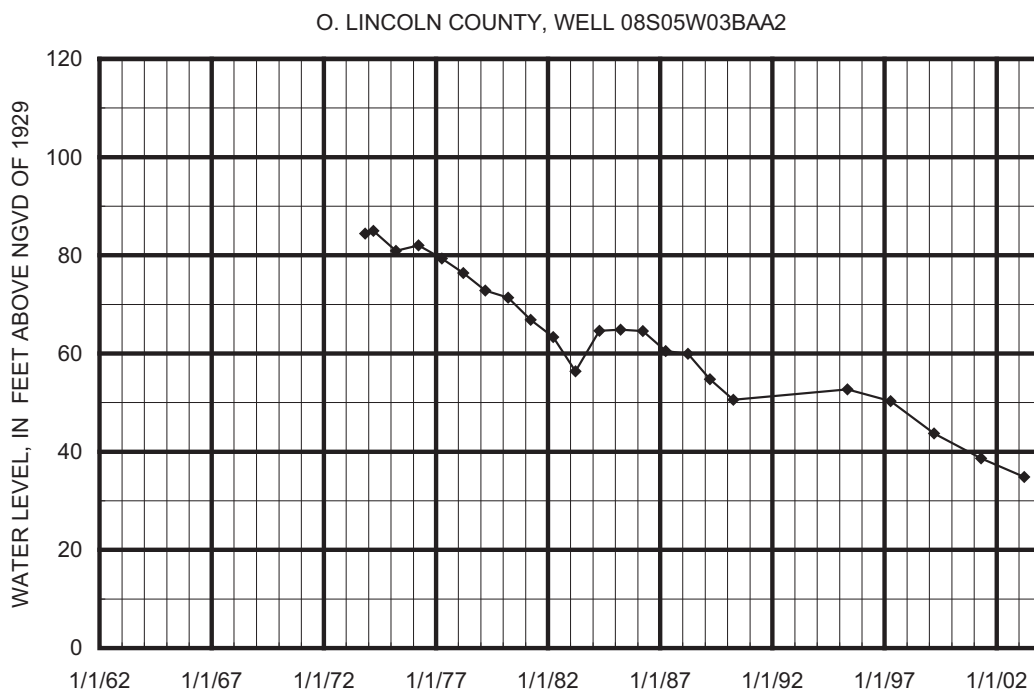


Figure 3. Water-level hydrographs for selected wells completed in the Sparta-Memphis aquifer.—Continued

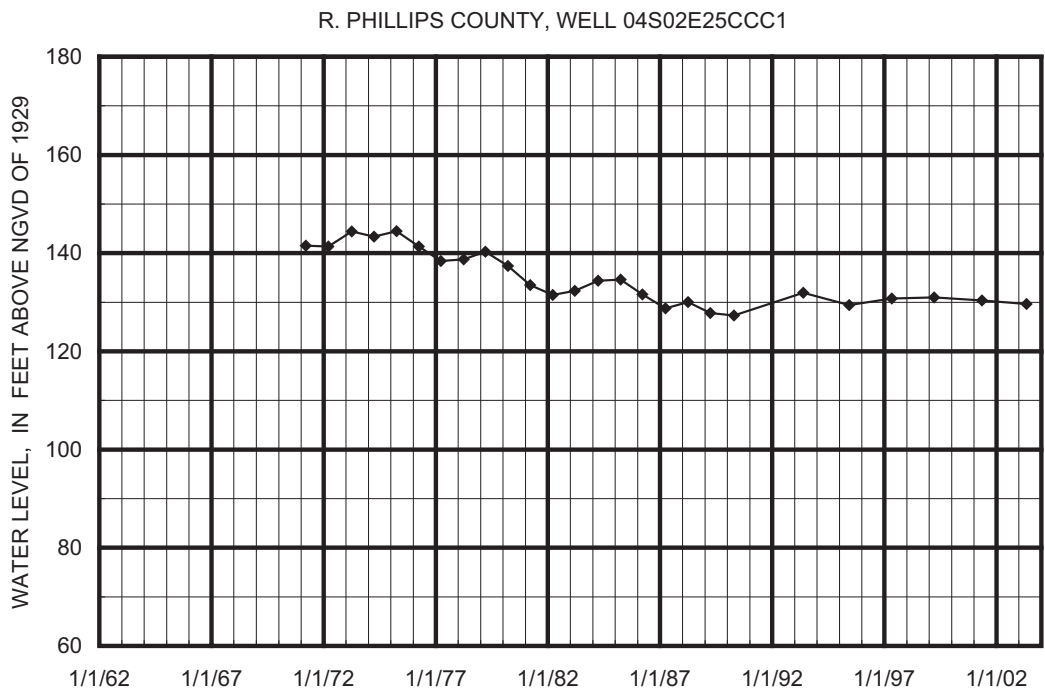
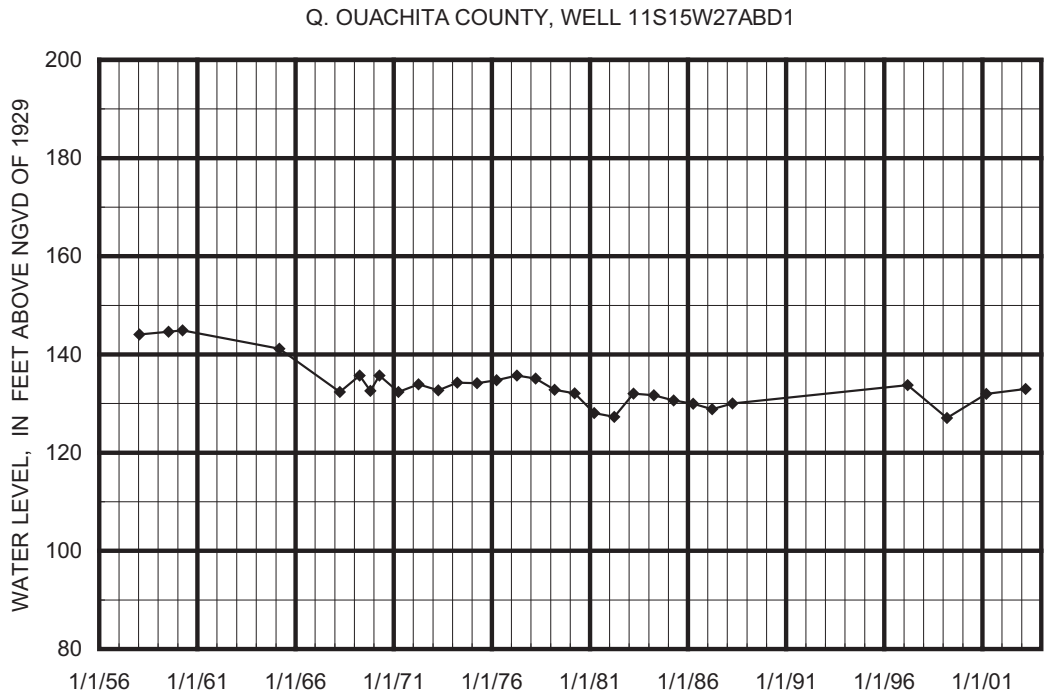


Figure 3. Water-level hydrographs for selected wells completed in the Sparta-Memphis aquifer.—Continued

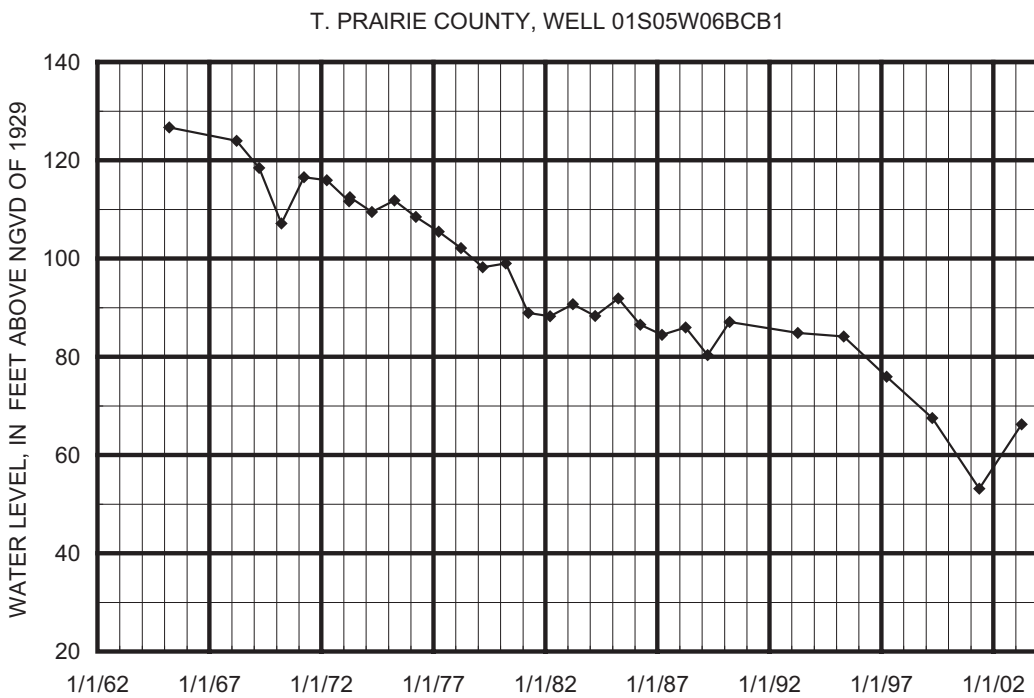
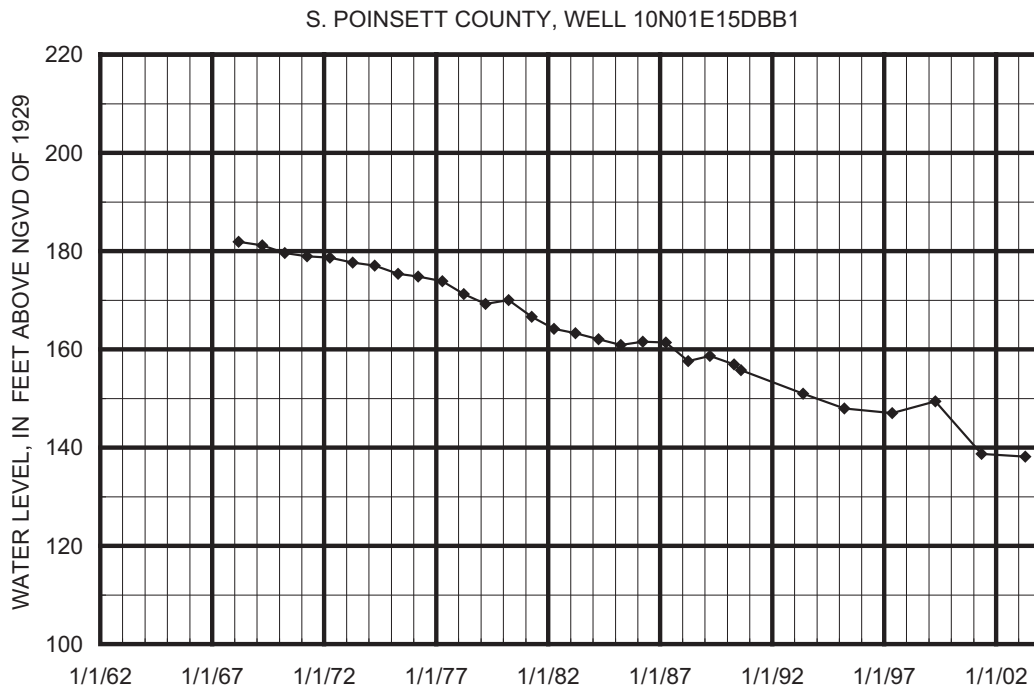


Figure 3. Water-level hydrographs for selected wells completed in the Sparta-Memphis aquifer.—Continued



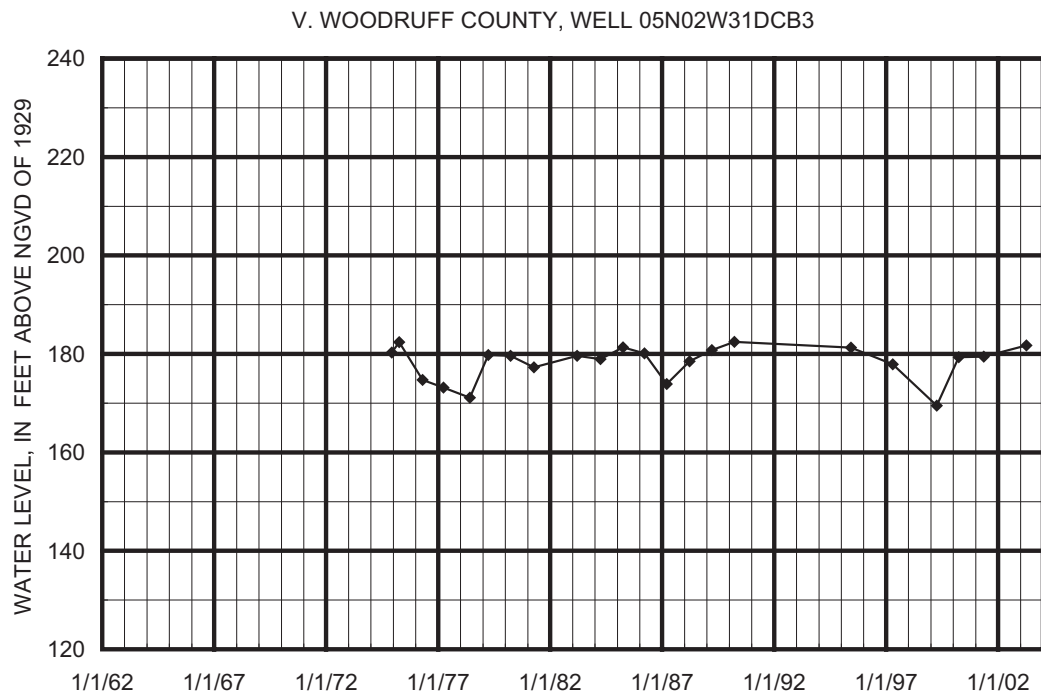
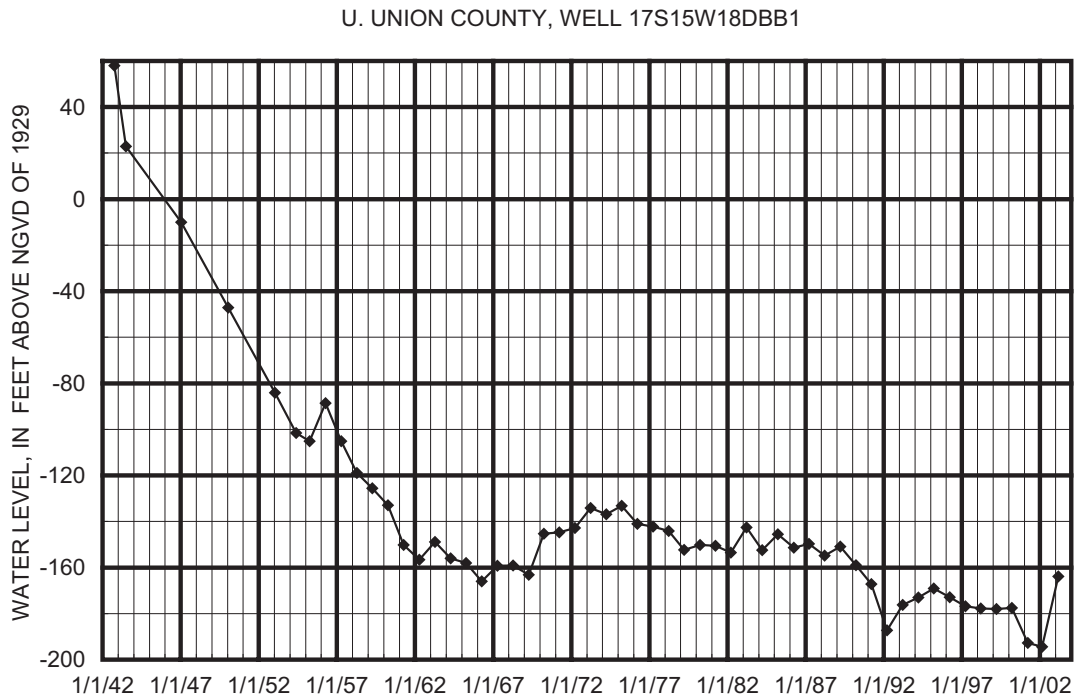


Figure 3. Water-level hydrographs for selected wells completed in the Sparta-Memphis aquifer.—Continued

**Table 4.** Annual rise and decline for water levels in wells in the Sparta-Memphis aquifer for the period 1979 to 2003.

[Slopes are slopes of linear regression trend lines for period 1979 to 2003. Negative values denote a decline]

<b>County</b>	<b>Number of wells</b>	<b>Range of annual rise/decline in water level per well (feet/year)</b>	<b>Mean annual rise/decline in water level for all wells (feet/year)</b>	<b>Median annual rise/decline in water-level for all wells (feet/year)</b>
Arkansas	20	-1.83 to -0.80	-1.34	-1.42
Bradley	3	-1.50 to -0.77	-1.07	-0.95
Calhoun	2	-0.99 to -0.73	-0.86	-0.86
Cleveland	3	-1.75 to -0.77	-1.14	-0.91
Columbia	10	-1.13 to 1.68	-0.07	-0.21
Craighead	3	-0.95 to -0.73	-0.82	-0.77
Cross	3	-1.28 to -0.80	-1.06	-1.10
Dallas	2	-0.55 to -0.15	-0.35	-0.35
Desha	5	-1.57 to -0.73	-1.01	-0.91
Drew	5	-0.99 to -0.11	-0.64	-0.55
Grant	6	-1.39 to -0.07	-0.43	-0.22
Jefferson	15	-1.64 to -0.37	-0.98	-0.95
Lafayette	2	0.11 to 0.44	0.27	0.27
Lee	1	-0.47	-0.47	-0.47
Lincoln	5	-1.83 to -0.95	-1.35	-1.35
Lonoke	1	-1.21	-1.21	-1.21
Ouachita	3	0.01 to 0.11	0.05	0.04
Phillips	6	-0.80 to 0.58	-0.35	-0.44
Poinsett	2	-1.24 to -1.13	-1.19	-1.19
Prairie	8	-1.64 to -0.62	-1.22	-1.30
Union	23	-2.48 to -0.11	-1.07	-0.95
Woodruff	1	-0.04	-0.04	-0.04

## Water-Quality Conditions

Water samples were collected from 70 wells in the summer of 2003 and measured onsite for specific conductance and temperature in Arkansas (table 5). Wells were purged until the

water temperature and specific conductance stabilized before samples were collected to ensure a representative sample. Temperature is necessary to normalize reporting of specific conductance values at 25 degrees Celsius.

**Table 5.** Specific conductance and temperature data collected from wells completed in the Sparta-Memphis aquifer in Arkansas, 2003.

[ $\mu\text{S/cm}$ , microsiemens per centimeter at 25 degrees Celsius; Horizontal data is NAD of 1983]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	Well depth (feet)	Aquifer	Date sampled	Specific conductance ( $\mu\text{S/cm}$ )	Temperature (degrees Celsius)
<b>Arkansas County</b>							
343044	912355	02S04W23DAA1	790	Sparta	6/10/2003	479	22.3
343028	913230	02S05W27BBB1	818	Sparta	6/09/2003	484	23.5
342925	913147	02S05W34ABC1	758	Sparta	6/26/2003	459	23.2
342633	913229	03S05W15CBB1	760	Sparta	6/10/2003	352	23.5
342516	914216	03S06W30BBD1	870	Sparta	6/10/2003	361	23.3
342157	912502	04S04W11BCC1	836	Sparta	6/10/2003	427	23.2
341734	912006	05S03W04ADB1	768	Sparta	6/09/2003	408	23.4
340859	912009	06S03W27BAA1	665	Sparta	6/09/2003	224	19.2
340702	912248	07S03W06ABC1	720	Sparta	6/09/2003	198	23.6
340031	911448	08S02W09BCC1	566	Sparta	6/09/2003	231	23.7
<b>Ashley County</b>							
332118	915101	15S07W32CDD1	1,000	Sparta	6/12/2003	875	25.7
331334	920116	17S09W15ACC1	600	Sparta	6/12/2003	710	18.8
<b>Bradley County</b>							
333649	920406	13S09W06BDC1	1,040	Sparta	6/12/2003	421	24.6
<b>Calhoun County</b>							
334630	922928	11S14W12CAC3	460	Sparta	6/12/2003	202	22.5
333948	924304	12S16W26AAD1	221	Sparta	7/23/2003	218	21.0
333227	922742	13S13W32CDA1	450	Sparta	6/12/2003	428	22.6
333040	922404	14S13W12CCB1	613	Sparta	6/12/2003	444	22.4
<b>Cleveland County</b>							
335820	920237	09S09W04BBD1	725	Sparta	6/11/2003	176	26.0
335729	921134	09S11W01DCA1	558	Sparta	6/11/2003	280	22.1
<b>Columbia County</b>							
332453	931215	15S20W20CCB1	320	Sparta	6/12/2003	310	19.7
331520	931201	17S20W17CDA1	495	Sparta	7/23/2003	392	22.0
331034	931759	18S21W17ACD1	454	Sparta	6/12/2003	244	22.0
330555	931129	19S20W09CBD1	623	Sparta	6/12/2003	220	21.6

**Table 5.** Specific conductance and temperature data collected from wells completed in the Sparta-Memphis aquifer in Arkansas, 2003.—Continued[ $\mu\text{S}/\text{cm}$ , microsiemens per centimeter at 25 degrees Celsius; Horizontal data is NAD of 1983]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	Well depth (feet)	Aquifer	Date sampled	Specific conductance ( $\mu\text{S}/\text{cm}$ )	Temperature (degrees Celsius)
<b>Craighead County</b>							
354837	903953	14N04E28DBD1	210	Memphis	6/10/2003	175	18.0
<b>Crittenden County</b>							
350745	900553	06N09E23AAB1	338	Memphis	6/10/2003	288	19.3
<b>Cross County</b>							
352405	905951	09N01E16CAC1	355	Memphis	6/10/2003	525	19.5
352403	904512	09N03E22AAD1	350	Memphis	6/10/2003	363	19.0
352404	904518	09N03E22ABD1	350	Memphis	6/10/2003	364	18.2
<b>Dallas County</b>							
340425	923334	07S14W31AAA1	545	Sparta	6/11/2003	146	21.8
340152	924639	08S16W18ACC1	23	Sparta	6/11/2003	94	18.1
<b>Desha County</b>							
335034	912905	10S04W11CBC1	830	Sparta	6/13/2003	254	24.7
333643	912305	12S03W34DAD1	796	Sparta	6/13/2003	375	23.7
<b>Drew County</b>							
334450	914905	11S07W22BBC1	850	Sparta	6/12/2003	205	26.1
333151	913408	13S05W36ACB1	692	Sparta	6/12/2003	341	25.0
<b>Grant County</b>							
341844	922400	05S13W03CAA1	569	Sparta	6/17/2003	86	23.3
341843	923327	05S14W06DCC1	370	Sparta	6/17/2003	97	22.9
<b>Jefferson County</b>							
342651	921058	03S11W22ABC1	707	Sparta	6/17/2003	82	22.1
341909	915056	04S08W35BBD1	1,011	Sparta	6/17/2003	163	23.8
341337	920109	05S09W31DDC1	--	Sparta	6/17/2003	178	24.6
341635	920534	05S10W16DBD1	865	Sparta	6/17/2003	104	23.6
341116	920508	06S10W23ACD1	766	Sparta	6/17/2003	177	24.7
<b>Lafayette County</b>							
330223	933036	20S23W05ADB1	231	Sparta	6/11/2003	253	18.8
<b>Lee County</b>							
345006	904749	03N03E28CDB1	591.5	Sparta	6/11/2003	1,210	20.3
<b>Lincoln County</b>							
340445	914140	07S06W33BAA1	816	Sparta	6/11/2003	202	22.4
340310	913454	08S05W03BAA2	760	Sparta	6/11/2003	269	24.0
335907	913333	08S05W35ACC1	836	Sparta	6/11/2003	240	23.1

**Table 5.** Specific conductance and temperature data collected from wells completed in the Sparta-Memphis aquifer in Arkansas, 2003.—Continued[ $\mu\text{S/cm}$ , microsiemens per centimeter at 25 degrees Celsius; Horizontal data is NAD of 1983]

Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Station name	Well depth (feet)	Aquifer	Date sampled	Specific conductance ( $\mu\text{S/cm}$ )	Temperature (degrees Celsius)
<b>Lonoke County</b>							
344906	914500	02N07W09AAA1	568	Sparta	6/09/2003	388	20.4
344453	914619	02N07W32DDD1	276.5	Sparta	6/09/2003	499	20.1
<b>Monroe County</b>							
344144	911801	01N03W14CCB1	595	Sparta	6/10/2003	929	19.5
345617	911504	04N02W30BAC1	345	Memphis	6/10/2003	743	17.4
<b>Nevada County</b>							
333050	931723	14S21W20AAB1	190	Sparta	6/11/2003	200	18.9
<b>Ouachita County</b>							
332618	930318	15S19W10DCC1	375	Sparta	6/12/2003	212	19.7
<b>Phillips County</b>							
343323	905056	02S02E01ADC1	686	Sparta	6/11/2003	765	22.0
341824	905121	04S02E25CCC1	930	Sparta	6/11/2003	1,010	22.4
<b>Poinsett County</b>							
352931	905825	10N01E15DBB1	302	Memphis	6/23/2003	529	18.4
353325	904323	11N03E25BDD1	250	Memphis	6/10/2003	481	18.5
<b>Prairie County</b>							
344649	912802	02N04W19ACB1	482	Sparta	6/09/2003	409	19.5
344707	914033	02N06W20BCB1	330	Sparta	6/09/2003	350	20.5
<b>Union County</b>							
331860	923958	16S15W20DAA1	603	Sparta	7/16/2003	492	23.7
332114	924211	16S16W01DDD1	470	Sparta	7/23/2003	455	21.5
331806	925709	16S18W34ABC2	465	Sparta	7/16/2003	335	22.3
331204	922907	17S13W31BAD1	771	Sparta	7/24/2003	726	25.4
331357	924248	17S16W24BDB1	615	Sparta	7/24/2003	433	21.9
331257	925356	17S17W30DCD1	690	Sparta	7/23/2003	332	25.3
331039	923531	18S14W06CCD1	783	Sparta	7/16/2003	730	25.3
330659	923858	18S15W33ADA1	752	Sparta	7/16/2003	665	24.8
331011	924316	18S16W11DAC1	767	Sparta	7/16/2003	588	22.8
330218	921113	19S11W25AAA1	529	Sparta	7/24/2003	1,170	22.6
330109	924326	19S16W35DDC1	601	Sparta	7/24/2003	578	24.0
<b>Woodruff County</b>							
350027	911456	05N02W31DCB3	259	Memphis	6/10/2003	228	19.5

Specific conductance data indicate regionally diverse zones of mineralized water within the aquifers across the study area. Specific conductance ranged from 82  $\mu\text{S}/\text{cm}$  in Jefferson County to about 1,210  $\mu\text{S}/\text{cm}$  in Lee County (table 5). The median specific conductance was 340  $\mu\text{S}/\text{cm}$  and the mean specific conductance was 400  $\mu\text{S}/\text{cm}$ . Along the western border of the Sparta-Memphis aquifer in Arkansas near the outcrop area, ground water has low specific conductance—generally less than 200  $\mu\text{S}/\text{cm}$ . Specific conductance increases to the east and south. This gradual increase of specific conductance to the south continues to the Louisiana State line.

Although there is a regional increase in specific conductance to the east and south, anomalous increases occur in some parts of the study area. Relatively high specific conductance values (greater than 700  $\mu\text{S}/\text{cm}$ ) occur near the cones of depression in Union and Columbia Counties. This increase in specific conductance may be because of leakage of water with greater conductance from an underlying aquifer. A previous study documented several specific conductance values greater than 2,000  $\mu\text{S}/\text{cm}$  for ground water from the Sparta aquifer in Union County in 1984 (Broom and others, 1984). Relatively high specific conductance values also occur in Lee, Monroe, and Phillips Counties. Morris and Bush (1986) and Broom and others (1984) cited upward leakage of saltwater from the Nacatoch aquifer into the Sparta aquifer through a fault or abandoned oil and gas wells as possible explanations for these anomalies.

## Summary

During the spring of 2003, water levels were measured in 341 wells in the Sparta-Memphis aquifer in Arkansas. Water-quality samples were collected for temperature and specific conductance measurements during the spring and summer of 2003 from 70 wells in Arkansas in the Sparta-Memphis aquifer. Maps of areal distribution of potentiometric surface and change in water-level measurements from 1999 to 2003 and a table of specific conductance data reveal spatial trends across the study area. The highest water-level altitude measured in Arkansas was 328 ft above NGVD of 1929 in Craighead County; the lowest water-level altitude was 199 ft below NGVD of 1929 in Union County. The deepest measurement in Union County represents a 2-foot decline in water level since the spring of 2001.

The 2003 potentiometric surface indicates that large ground-water withdrawals have altered or reversed the natural direction of flow in some areas. Flow in these areas is toward the cone of depression at the center of pumping. Three cones of depression are shown in the 2003 potentiometric-surface map, centered in Columbia, Jefferson, and Union Counties as a result of large withdrawals for industrial and public supplies. The cones of depression in Columbia and Union Counties are elongated to the east and west because of large industrial withdrawals and coalesce at or near the Columbia and Union County line. A broad depression exists in western Poinsett County. Seven smaller depressions are evident in the 2003 Sparta-Memphis

potentiometric-surface map. Two of the smaller depressions were evident in the 2001 potentiometric-surface map in western Lincoln County and southeastern Calhoun County. Five depressions, located in central Cleveland, western Columbia, western Dallas, southern Desha, and northern Lafayette Counties, were not evident in the 2001 potentiometric-surface map.

The potentiometric surface indicates that large withdrawals have altered or reversed the natural direction of flow in most areas. Flow in the areas surrounding the cones of depression is toward the cone of depression at the center of pumping. In the northern third of the study area the flow is from the east, west, and north towards the cone of depression in Poinsett County. In the central third of the study area the flow is dominated by the cone of depression centered in Jefferson County. In the southern third of the study area the flow is dominated by the two cones of depression in Union and Columbia Counties.

The map for water-level changes from 1999 to 2003 was constructed using water-level measurements from 281 wells. The change in water level between 1999 and 2003 ranged from -71.6 to 57.8 ft. The largest rise of 57.8 ft and the largest decline of -71.6 ft in water level were measured in Columbia County. Areas with a general rise are shown in Arkansas, Bradley, Calhoun, Cleveland, Columbia, Ouachita, and Union Counties. Areas with a general decline are shown in Craighead, Crittenden, Cross, Desha, Drew, Jefferson, Lonoke, Phillips, Poinsett, Prairie, and Woodruff Counties.

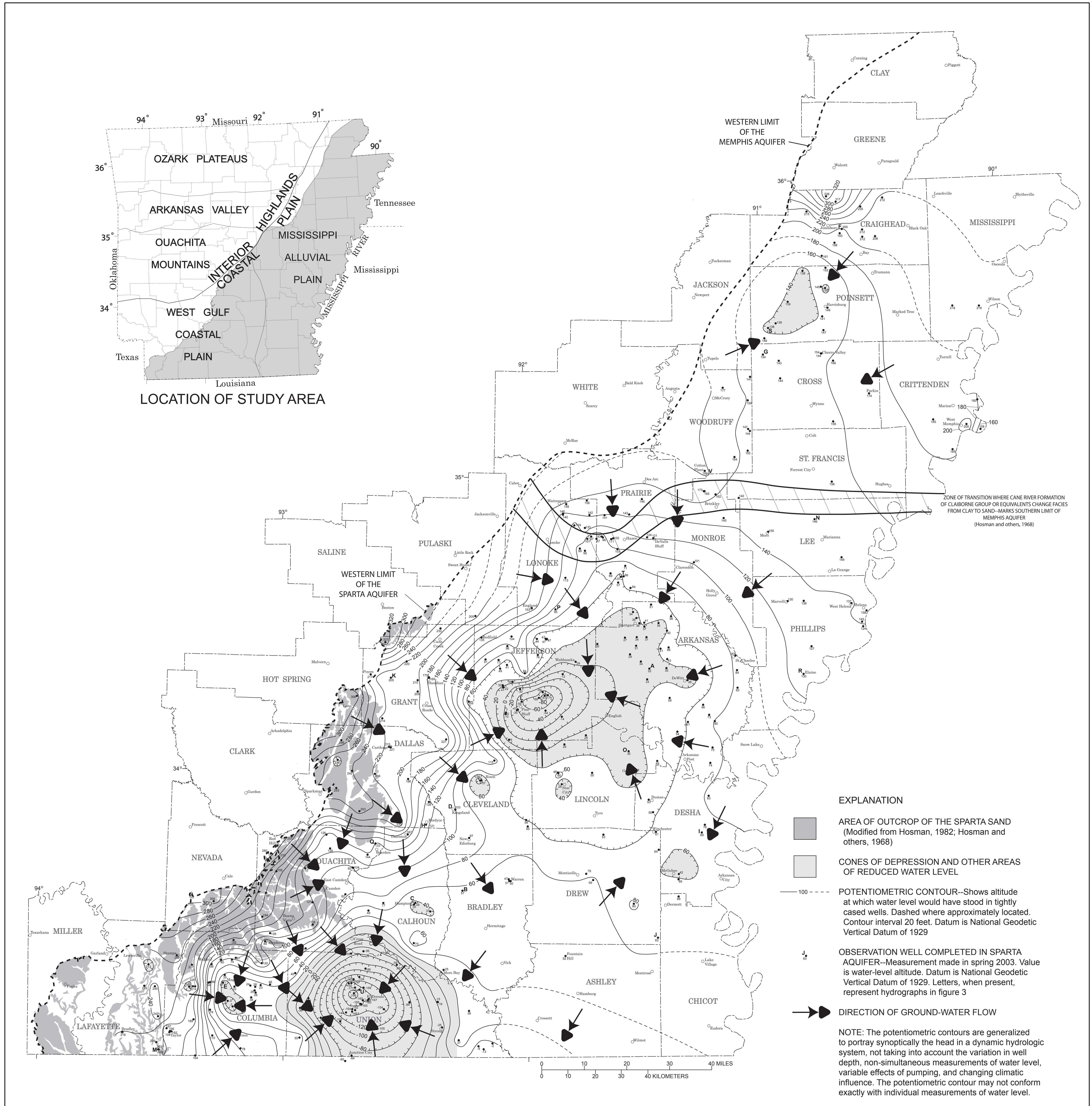
Hydrographs were constructed for wells with a minimum of 25 years of water-level measurements. A trend line using a linear regression was calculated for the period of record from spring 1978 to spring 2003 to determine the annual decline or rise in feet per year for water levels in each well. The mean annual water-level rose only occurred in Lafayette and Ouachita Counties. Mean declines were between -0.5 ft/yr and 0.0 ft/yr in Columbia, Dallas, Grant, Lee, Phillips, and Woodruff Counties. Mean annual declines were between -1.0 ft/yr and -0.5 ft/yr in Bradley, Calhoun, Cleveland, Craighead, Desha, Drew, Jefferson, and Union Counties. Mean declines were between -1.5 ft/yr and -1.0 ft/yr in Arkansas, Cross, Lincoln, Lonoke, Poinsett, and Prairie Counties.

Specific conductance ranged from 82  $\mu\text{S}/\text{cm}$  in Jefferson County to about 1,210  $\mu\text{S}/\text{cm}$  in Lee County. The mean specific conductance was 400  $\mu\text{S}/\text{cm}$ . Elevated specific conductance values generally were associated with wells located in areas where previous studies have documented elevated specific conductance values.

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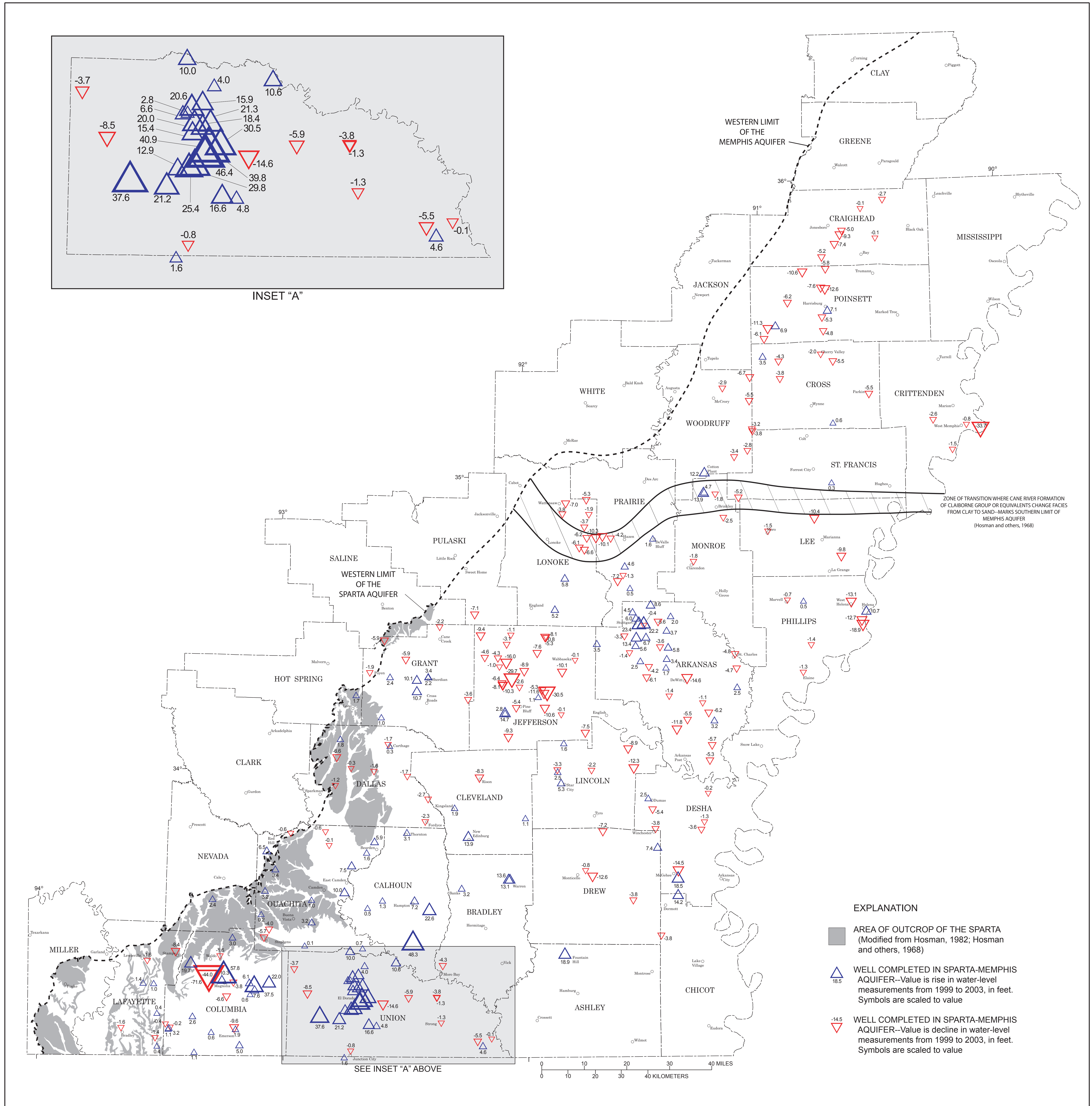
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POTENTIOMETRIC SURFACE FOR THE SPARTA-MEMPHIS AQUIFER  
 IN ARKANSAS, 2003  
 T.P. SCHRADER  
 2006





WATER-LEVEL CHANGE FOR THE SPARTA-MEMPHIS AQUIFER IN ARKANSAS  
FROM 1999 TO 2003  
T.P. SCHRADER  
2006

Schrader, T.P.—STATUS OF WATER LEVELS AND SELECTED WATER-QUALITY CONDITIONS IN THE SPARTA-MEMPHIS AQUIFER IN ARKANSAS, SPRING-SUMMER 2003—U.S. Geological Survey Scientific Investigations Report 2006-5021