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ARKANSAS SOIL AND WATER CONSERVATION COMMISSION
and the **ARKANSAS GEOLOGICAL COMMISSION**

STATUS OF WATER LEVELS AND SELECTED WATER-QUALITY CONDITIONS IN THE SPARTA AND MEMPHIS AQUIFERS IN EASTERN AND SOUTH-CENTRAL ARKANSAS, 1999

Water-Resources Investigations Report 00-4009

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

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Little Rock, Arkansas
2000

U.S. DEPARTMENT OF THE INTERIOR
BRUCE BABBITT, *Secretary*

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Status of Water Levels and Selected Water-Quality Conditions in the Sparta and Memphis Aquifers in Eastern and South-Central Arkansas, 1999

By Robert L. Joseph

ABSTRACT

During the spring of 1999, water levels were measured in the Sparta and Memphis aquifers in 321 wells in eastern and south-central Arkansas. Water samples were collected during the spring and summer of 1999 from wells completed in these aquifers. The specific conductance of the ground water was measured from 147 samples and dissolved chloride was measured from 98 samples. Maps of areal distribution of potentiometric surface and specific conductance generated from these data reveal spatial trends across the study area. The altitude of the potentiometric surface ranged from 214 feet below sea level in Union County to 332 feet above sea level in Grant County.

The regional direction of ground-water flow in Arkansas is from the north and west to the south and east, away from the recharge zone in the outcrop and subcrop area, except near areas affected by intense ground-water withdrawals; such areas are characterized by large cones of depression centered in Columbia, Jefferson, and Union Counties. Heavy pumpage locally has altered or reversed the natural direction of flow in some areas. Flow in these areas is toward the cones of depression at the center of pumping. Comparison of potentiometric surface maps through time shows that the cones of depression in Columbia and Union Counties are coalescing at or near the Columbia and Union County line.

Long-term hydrographs of 20 wells indicate trends of water-level decline over a 31-year period. During the period 1969-1999, average water-level declines generally were less than 0.7 foot per year in Craighead, Drew, Lee, Ouachita, and Phillips Counties, and between 0.7 and 1.1 feet per year in Bradley, Cleveland, Cross, Dallas, Poinsett, and Prairie Counties. Analysis of water-level data from Calhoun, Desha, Jefferson, Lonoke, Lincoln, and Union Counties indicates water levels declined between 1.1 and 2.0 feet per year since 1969. Water levels in Arkansas and Columbia Counties have declined more than 2.0 feet per year for the past 31 years.

Water-level data from counties with cones of depressions indicate that water levels continued to decline in three cones of depression from 1995 to 1999; however, water levels increased in one cone of depression. Water levels declined an average of 2.5 feet per year in Union County, 1.4 feet per year in Jefferson County, and 1.7 feet per year in Cross County since 1995. One relatively new cone of depression has formed in Arkansas County. Water levels declined 4.0 feet per year in Arkansas County since 1995. However, water levels appear to be increasing in Columbia County where the same 11 wells were monitored in 1995 and 1999, and the water levels increased at a rate of 0.6 foot per year.

Specific conductance measurements made on water samples collected during the study ranged from 44 microsiemens per centimeter at 25 degrees Celsius at a well in Ouachita County to 1,510 microsiemens per centimeter at 25 degrees Celsius at a well in Lee County. Dissolved chloride concentrations ranged from 1.1 milligram per liter at a well in Lincoln County to 220 milligrams per liter at a well in Union County.

INTRODUCTION

The Sparta and Memphis aquifers are major sources of water for eastern and south-central Arkansas. Major withdrawals are made from the aquifers for industrial and public supply, with lesser but locally significant withdrawals for agricultural uses. An estimated 284 million gallons per day (Mgal/d) of water was withdrawn from the Sparta and Memphis aquifers in 1995, an increase of about 61 Mgal/d from 1990 (Joseph, 1997). Combined, the two aquifers are the second most productive source of ground water in Arkansas (Holland, 1999).

The study area defined by the extent of the Sparta and Memphis Sands (fig. 1, plate 1) includes most of the Mississippi Alluvial Plain and West Gulf Coastal Plain in Arkansas; the area is bounded on the north by the Missouri State line, on the east by the Mississippi River, and on the south by the Louisiana State line. The western boundary is the western extent of the outcrop and subcrop (Hosman, 1982) of the Sparta Sand and the Memphis Sand.

The U.S. Geological Survey (USGS) in cooperation with the Arkansas Soil and Water Conservation Commission and the Arkansas Geological Commission has monitored water levels in the Sparta and Memphis aquifers since the 1920's. During the spring and summer of 1999, 321 water-level measurements, 147 specific conductance measurements, and 98 dissolved chloride measurements were made by USGS personnel in wells completed in these aquifers. The purpose of these measurements was to provide information describing the potentiometric surface, specific conductance, and dissolved chloride concentrations of the Sparta and Memphis aquifers. This report presents potentiometric-surface and specific conductance maps, water-level hydrographs, and data tables that include well information and water-quality data.

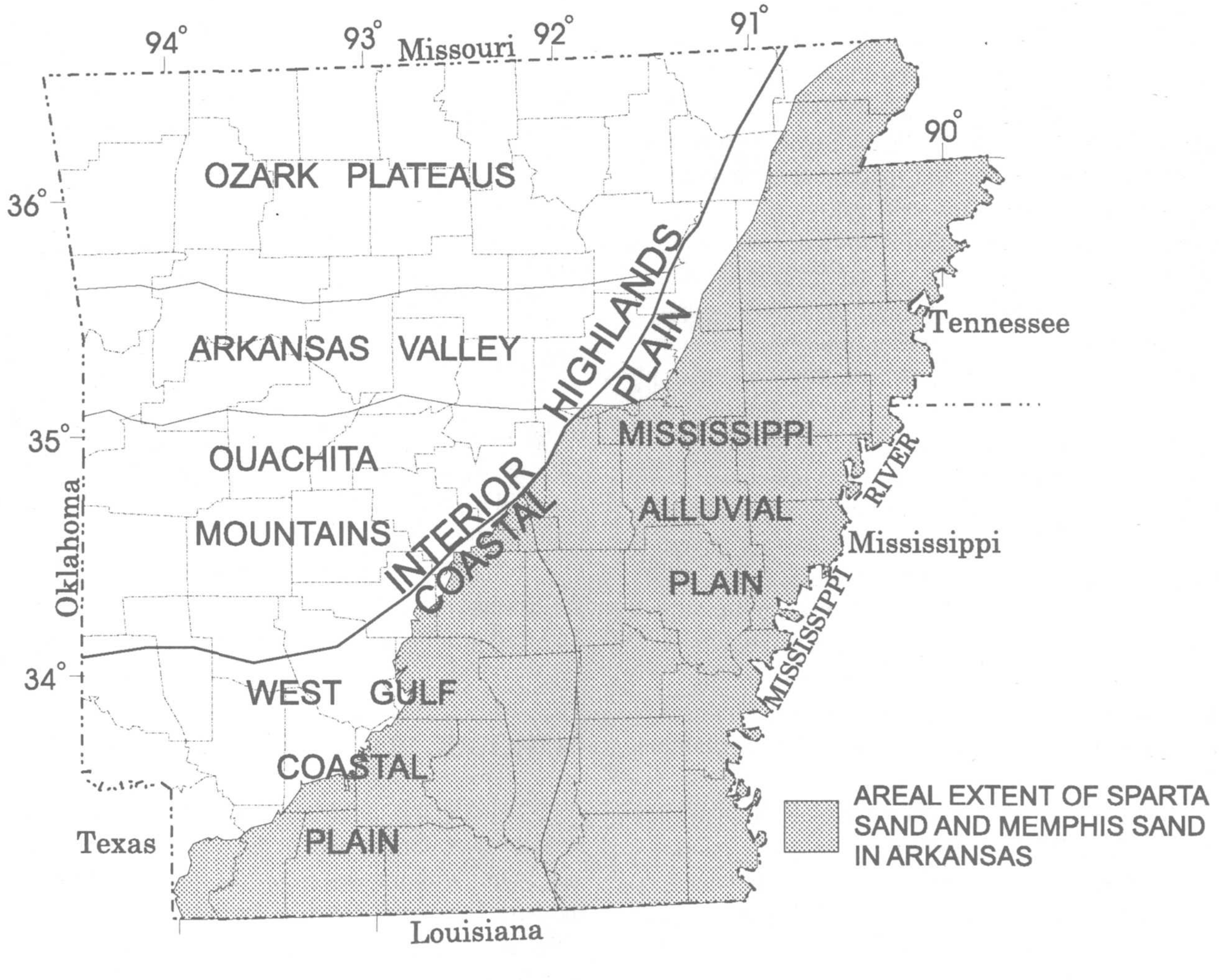


Figure 1. Location of study area.

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 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. The latitude and longitude of wells were recorded from a global positioning system capable of accuracy of one-tenth of a second of latitude and longitude (approximately 10-20 feet (ft)).

DESCRIPTION OF AQUIFERS

The Sparta Sand and Memphis Sand of Eocene age are part of the Claiborne Group and mainly consist of fine- to medium-grain sand beds interbedded with silt and clay beds. In the northern part of the study area (north of about 35 degrees latitude), the Cane River Formation is predominantly composed of sand (Hosman and others, 1968), and the Memphis Sand is thicker and more homogeneous. In this northern area, the Claiborne Group is not subdivided into the Sparta Sand, Cane River Formation, and Carrizo Sand, but the equivalent section is a single formation known as the Memphis Sand. The Memphis Sand is underlain by a thick layer of clay that is part of the Wilcox Group.

Some silt, clay, and lignite occur in the upper portion of the Sparta and Memphis Sands. The Sparta Sand is composed of a sequence of alternating sand and clay beds between the massive clays of the overlying Cook Mountain and the underlying Cane River confining units. 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 overlies the Sparta Sand and Memphis 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).

Water in the Sparta and Memphis aquifers generally is confined except in the recharge area (plate 1). Recharge to the aquifers chiefly occurs from infiltration of precipitation on the outcrop areas and from downward movement of water from the overlying alluvium in subcrop areas (Petersen and others, 1985). Minor amounts of recharge probably occur from leakage of water through the upper and lower confining beds where a positive gradient exists between overlying or underlying aquifers and the Sparta or Memphis aquifer (Edds and Fitzpatrick, 1989). Some lateral flow occurs from the Memphis Sand south to the Sparta Sand at the zone of lithofacies transition (plate 1) near 35° latitude (Petersen and others, 1985). Discharge from the Sparta and Memphis aquifers occurs by withdrawal from wells, discharge to confining beds above or below, subsurface flow to the south, and some discharge to rivers. A more detailed description of the Sparta and Memphis aquifers is given in Hosman and others (1968) and Petersen and others (1985).

The Sparta Sand generally thickens and begins to contain saltwater as depth of occurrence increases to the southeast. The Sparta Sand and Memphis Sand are 50 to 200 ft thick within the recharge zone (along the western limit) and both thicken 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

The potentiometric-surface map shows the altitude to which water would have risen in tightly cased wells screened in the aquifers (plate 1). The map is based upon water-level data collected in 321 wells in the Sparta and Memphis aquifers in the spring of 1999. 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

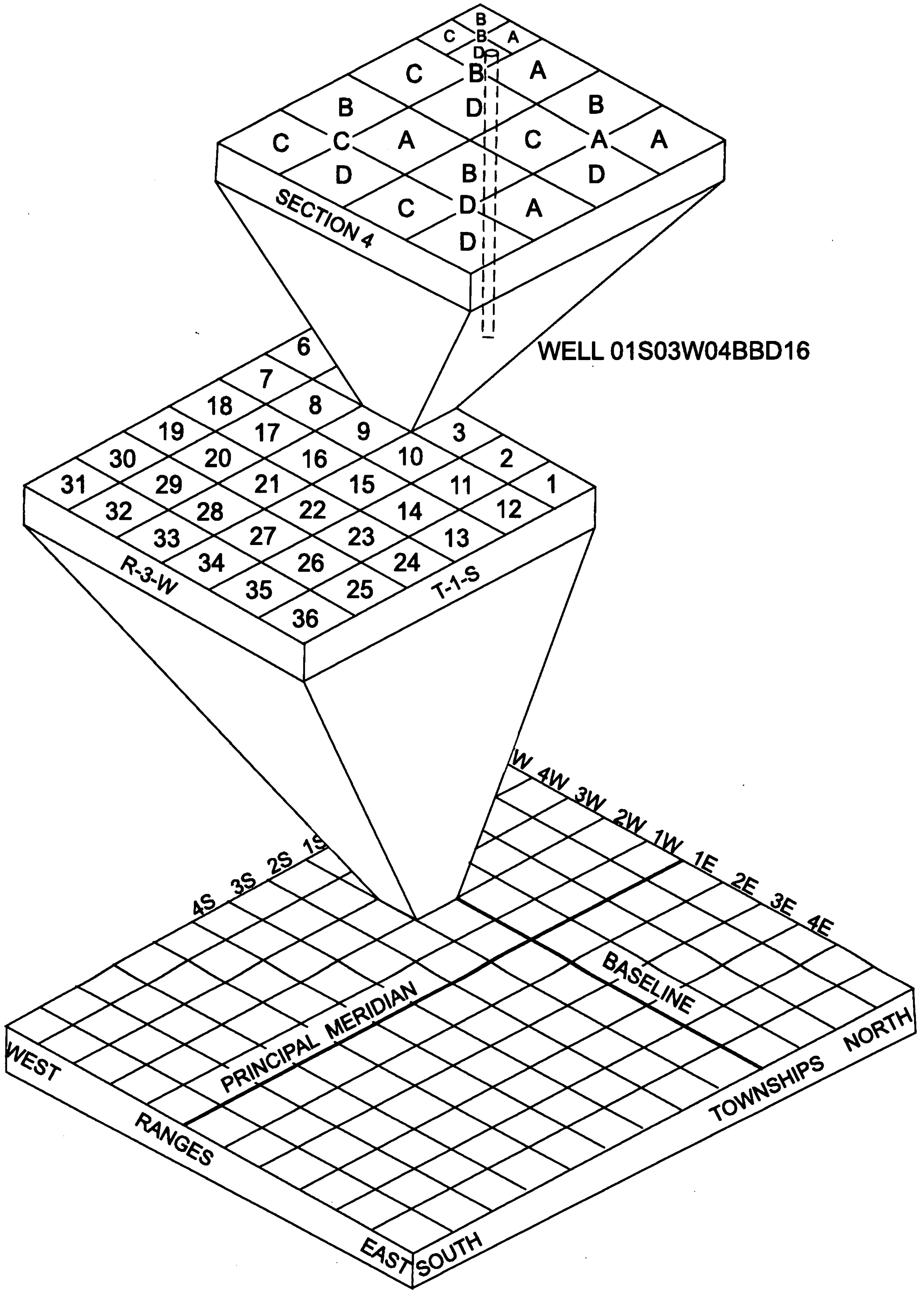


Figure 2. Well-numbering system.

equal value. The general direction of ground-water flow in the Sparta and Memphis aquifers is perpendicular to the contours in the direction of hydraulic gradient.

The natural direction of flow, which historically was eastward from the recharge zone and then southward, has been altered in areas of heavy pumpage. The regional direction of ground-water flow is generally to the south to southeast in the northern half of the study area and to the east and south in the southern half of Arkansas, away from the recharge zone of the outcrop and subcrop area. The highest water-level altitude measured was 332 ft above sea level[1], located in Grant County near the recharge zone of the outcrop and subcrop; the lowest water level was 214 ft below sea level in Union County (table 1). The potentiometric surface indicates that heavy pumpage has altered or reversed the natural direction of flow in some areas. Flow in these areas is toward the cones of depression at the center of pumping.

[1]In this report, sea level refers to 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.

For many years, three large cones of depression have been observed, centered in Columbia, Jefferson, and Union Counties as a result of large withdrawals of water for industrial and public supplies. Comparison of potentiometric-surface maps from 1984 to 1999 indicate that the cones of depression in Columbia and Union Counties are coalescing at or near the Columbia and Union County line. In 1995, a small cone of depression was documented in southwestern Poinsett County. That cone of depression has expanded into northwestern St. Francis County. One additional cone of depression has been documented in Arkansas County as a result of withdrawals for agricultural purposes. There are several smaller discernible cones of depression throughout the study area, which represent localized pumpage of one or two wells that do not influence water levels on a regional scale.The potentiometric surface of the Sparta and Memphis aquifers exhibits cones of depression descending below sea level in the central and southwestern parts of the State. The cone of depression centered in Jefferson County has an elliptical shape because of withdrawals for agricultural purpose in the adjoining Arkansas and Prairie Counties.

Table 1. Information pertaining to measured wells completed in the Sparta and Memphis aquifers in Arkansas, 1999

[124SPRT, Sparta aquifer; 12405MP, Memphis aquifer]

Latitude (degrees)	Longitude (degrees)	Local well number	Water level altitude (feet above sea level)	Depth to water (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measurement	Aquifer
			Arkansas County				
340031.1	911447.9	08S02W09BCC1	79	94.92	174	03/24/99	124SPRT
340339.5	911411.2	07S02W28ABA1	81	99.94	181	03/24/99	124SPRT
340701.6	912247.6	07S03W06ABC1	66	119.49	185	03/24/99	124SPRT
340858.9	912009.1	06S03W27BAA1	67	114.14	181	03/24/99	124SPRT
340904	911331	06S02W22CDB1	77	109.06	186	03/24/99	124SPRT
341022.7	911453.1	06S02W17ADA1	79	108.59	188	03/24/99	124SPRT
341227.9	911620.0	06S02W06ABB1	67	113.67	181	03/24/99	124SPRT
341245.1	912946.7	05S05W36DAA1	41	138.69	180	03/24/99	124SPRT
341358	912435	05S04W26ACA1	60	127.55	188	03/24/99	124SPRT
341550.7	910745.3	05S01W17BAA1	80	96.02	176	03/23/99	124SPRT
341752	913003.6	04S05W36DCC1	39	157.12	196	03/24/99	124SPRT
341819.7	913141.7	04S05W34DAA1	38	154.07	192	03/24/99	124SPRT
341927	910748.0	04S01W28BAA1	89	101.48	190	03/23/99	124SPRT
342003.7	912928.9	04S04W19CBB1	36	158.54	195	03/24/99	124SPRT
342006.9	912515.2	04S04W22DAA1	33	161.68	195	03/30/99	124SPRT

Table 1. Information pertaining to measured wells completed in the Sparta and Memphis aquifers in Arkansas, 1999--Continued

[124SPRT, Sparta aquifer; 12405MP, Memphis aquifer]

Latitude (degrees)	Longitude (degrees)	Local well number	Water level altitude (feet above sea level)	Depth to water (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measure-ment	Aquifer
341734	912006	05S03W04ADB1	41	146.28	187	03/24/99	124SPRT
342132.2	913133.3	04S05W15AAA1	32	169.24	201	03/24/99	124SPRT
342157	912501.5	04S04W11BCC1	39	158.88	198	03/25/99	124SPRT
342225.4	910808.4	04S01W04CBD1	88	108.29	196	03/23/99	124SPRT
342302.7	913412.8	04S05W05ACC1	30	156.02	186	03/30/99	124SPRT
342322.2	912956.4	04S05W01BAA1	4	191.56	196	03/30/99	124SPRT
342406.9	912637.8	03S04W33BAA1	45	156.34	201	03/25/99	124SPRT
342421.1	912438	03S04W26CDA1	60	143.11	203	03/25/99	124SPRT
342447.2	913240.3	03S05W28DAB1	26	178.23	204	03/24/99	124SPRT
342515.5	914216.2	03S06W30BBD1	27	164.28	191	03/30/99	124SPRT
342554.1	913927.2	03S06W21ACC1	58	137.19	195	03/30/99	124SPRT
342629.4	913524.7	03S05W18CAB1	30	165.88	196	03/25/99	124SPRT
342631.2	913004.6	03S05W13BDC1	24	185.58	210	03/25/99	124SPRT
342633.2	913229.3	03S05W15CBB1	21	185.35	206	03/25/99	124SPRT
342747.6	912458.0	03S04W02CCB1	36	165.92	202	03/25/99	124SPRT
342842.2	913033.7	03S05W02AAB1	37	173.04	210	03/30/99	124SPRT
342922.1	912702.7	02S04W33BBB1	40	165.38	205	03/25/99	124SPRT
342924.6	913148.0	02S05W34BDA1	13	203.24	216	03/30/99	124SPRT
342930	913035.3	02S05W35AAB1	19	197.09	216	03/30/99	124SPRT
343028.5	913230.5	02S05W27BBB1	30	186.27	216	03/30/99	124SPRT
343044.2	912354.5	02S04W23DAA1	56	151.75	208	03/25/99	124SPRT
343143	913318	02S05W16CBC1	30	183.39	213	03/30/99	124SPRT
343311.5	912849.3	02S04W06CDB1	43	169.47	212	03/30/99	124SPRT
			Ashley County				
332117.8	915101.1	15S07W32CDD1	33	156.71	190	03/09/99	124SPRT
			Bradley County				
331839.3	922052.4	16S12W21CAA1	29	70.98	100	03/04/99	124SPRT
333453	921607	13S11W17BCD1	53	196.67	250	03/10/99	124SPRT
333647	920437	13S09W06ACA1	4	197.29	201	03/05/99	124SPRT
333647.1	920416.9	13S09W06ACB2	37	170.80	208	03/05/99	124SPRT
333649	920406	13S09W06BDC1	43	169.00	212	03/05/99	124SPRT
334107.6	920807.5	12S10W10BCA1	44	118.94	163	03/05/99	124SPRT
			Calhoun County				
332408.4	922806.7	15S13W20BDC1	26	82.43	108	03/04/99	124SPRT
332626.8	922741.7	13S13W32CDA1	32	175.92	208	03/04/99	124SPRT
333040.1	922403.5	14S13W12CCB1	14	191.04	205	03/05/99	124SPRT
333055	923910	14S15W16BAA1	48	97.58	146	03/05/99	124SPRT
333227.3	923532.4	13S15W36CBD1	76	81.79	158	03/05/99	124SPRT
334630	922927	11S14W12CAC3	164	149.09	313	03/05/99	124SPRT
			Chicot County				
332100	911854.3	15S02W33CBA1	85	38.59	124	03/08/99	124SPRT
333312.4	912307.6	13S03W22DAD1	54	81.23	135	03/08/99	124SPRT
			Cleveland County				
334543.0	921423.5	11S11W16AAB1	83	219.87	303	03/17/99	124SPRT

Table 1. Information pertaining to measured wells completed in the Sparta and Memphis aquifers in Arkansas, 1999--Continued

[124SPRT, Sparta aquifer; 12405MP, Memphis aquifer]

Latitude (degrees)	Longitude (degrees)	Local well number	Water level altitude (feet above sea level)	Depth to water (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measure-ment	Aquifer
334917.9	920020.5	10S09W23CDC1	57	163.01	220	03/17/99	124SPRT
335133	921743.4	10S12W12BDD1	101	119.18	220	03/17/99	124SPRT
335622.7	921250.5	09S11W11CDB1	94	139.20	233	03/17/99	124SPRT
335728	921133	09S11W01DCA1	32	197.86	230	03/17/99	124SPRT
335820.1	920237	09S09W04BBD1	61	220.22	281	03/17/99	124SPRT
340131.5	921639.2	08S12W13CAA2	114	147.32	261	03/17/99	124SPRT
			Columbia County				
330109	932133	20S22W11ACD1	163	108.24	271	02/22/99	124SPRT
330139	932236	20S22W03DCC1	161	53.32	214	02/22/99	124SPRT
330239.6	931030.9	19S20W34BDD1	73	217.12	290	02/23/99	124SPRT
330517	931725	19S21W16DBB1	109	175.04	284	02/25/99	124SPRT
330555	931128	19S20W09CAC1	64	267.90	332	02/26/99	124SPRT
330555	932752	19S23W14BAB2	193	51.09	244	02/23/99	124SPRT
330555.2	931148.6	19S20W08DAD1	75	244.68	320	02/26/99	124SPRT
330604	932722	19S23W11DDB1	192	53.54	246	02/23/99	124SPRT
330609	932743	19S23W11CDA2	192	55.88	248	02/23/99	124SPRT
330643	932831	19S23W10ABD1	197	44.83	242	02/23/99	124SPRT
330834	932158	18S22W27DDD1	186	125.63	312	02/26/99	124SPRT
331142	931248	18S20W06DDC1	-15	315.12	300	02/25/99	124SPRT
331223	931339	18S21W01ACC1	4	291.09	295	02/25/99	124SPRT
331307	930754.9	17S20W36ABC1	37	297.59	335	02/23/99	124SPRT
331408.4	930651.9	17S19W30ABB1	19	229.48	248	02/19/99	124SPRT
331517.2	930655.5	17S19W18CBD1	-12	316.96	305	02/19/99	124SPRT
331520	931200.8	17S20W17CDA1	26	299.22	325.1	02/19/99	124SPRT
331533	930807	17S20W13CB1	-12	324.21	312	02/19/99	124SPRT
331545	930318	17S19W15AAB1	24	294.38	318	02/25/99	124SPRT
331607	931818	17S21W17BAA1	152	159.32	311	02/18/99	124SPRT
331609	931449	17S21W11DCC2	10	293.35	303	02/19/99	124SPRT
331614.3	931800.2	17S21W08DCA1	158	140.05	298	02/18/99	124SPRT
331743.2	931423.8	17S21W01BBC1	-23	328.24	305	02/19/99	124SPRT
331947.6	932225.1	16S22W22CCD1	188	152.39	340	02/17/99	124SPRT
332043.0	931620.8	16S21W15CBC1	88	200.00	288	02/17/99	124SPRT
332049	931516	16S21W14CBB1	82	198.99	281	02/18/99	124SPRT
332453	931215	15S20W20CCB1	152	220.06	372	02/18/99	124SPRT
			Craighead County				
354406	904433	13N03E23CDD1	166	81.74	248	04/13/99	12405MP
354641	904114	13N04E05DCC1	205	134.86	340	04/14/99	12405MP
354747.9	903413.9	14N05E34ADD1	212	17.51	230	06/16/99	12405MP
354750.8	903100.2	14N05E36CBC1	208	12.03	220	04/14/99	12405MP
354836.9	903953.3	14N04E28DBD1	202	51.89	254	04/14/99	12405MP
354917.1	903413.6	14N05E28BBB1	213	17.36	230	06/16/99	12405MP
354929	903922	14N04E22CBD1	205	50.72	256	04/14/99	12405MP
355359.8	903432.7	15N05E29DBB1	235	23.39	258	04/14/99	12405MP
355554	902859	15N06E18ACA1	214	15.68	230	04/14/99	12405MP

Table 1. Information pertaining to measured wells completed in the Sparta and Memphis aquifers in Arkansas, 1999--Continued
[124SPRT, Sparta aquifer; 12405MP, Memphis aquifer]

Latitude (degrees)	Longitude (degrees)	Local well number	Water level altitude (feet above sea level)	Depth to water (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measure-ment	Aquifer
			Crittenden County				
350344.7	901300.2	05N08E11CCA2	187	24.49	211	04/06/99	12405MP
350744.8	900553.1	06N09E23AAB1	191	30.62	222	04/09/99	12405MP
350849.7	900921.8	06N09E08DCC1	206	9.22	215	04/08/99	12405MP
350958.0	901738.4	06N07E01DAD2	187	21.58	209	04/06/99	12405MP
			Cross County				
351004.3	904237.7	06N04E06ACA1	155	202.51	358	04/07/99	12405MP
351538.1	903329.9	07N05E04ADD1	179	29.78	209	04/07/99	12405MP
351908.2	905538.5	08N02E18BDB1	148	79.99	228	04/07/99	12405MP
352231.9	904218.5	09N04E30DCA1	171	258.21	429.32	04/07/99	12405MP
352244.3	905554	09N01E25AAD1	147	80.05	227	04/07/99	12405MP
352403.8	904518.4	09N03E22ABD1	156	120.56	277	04/07/99	12405MP
352405	905950.8	09N01E16CAC1	151	83.15	234	04/07/99	12405MP
			Dallas County				
334829.5	922457.6	10S13W34ACA2	124	148.45	272	03/18/99	124SPRT
335309.3	922413.4	09S13W35CCD1	131	68.87	200	03/18/99	124SPRT
335605.5	924701.2	09S16W19CAA1	255	5.27	260	03/18/99	124SPRT
335753.6	922918.8	09S14W01BDC1	188	77.10	265	03/17/99	124SPRT
335858.8	923730.1	08S15W34BDC1	216	24.13	240	03/17/99	124SPRT
335935	924307	08S16W27DDD1	239	32.63	272	03/17/99	124SPRT
340152.5	924639.4	08S16W18ACC1	243	9.17	252	03/17/99	124SPRT
340425.3	923334.4	07S14W31AAA1	220	109.73	330	03/17/99	124SPRT
340430.9	923359.9	07S14W30DCC1	217	118.08	335	03/17/99	124SPRT
340555.2	924545.1	07S16W20CAB1	296	26.17	322	03/17/99	124SPRT
			Desha County				
333643.4	912305.0	12S03W34DAD1	50	96.97	147	03/18/99	124SPRT
333748.6	912259.2	12S03W26CBB1	56	81.63	138	03/18/99	124SPRT
334225	911415.2	11S01W31BBB1	25	116.17	141	03/18/99	124SPRT
334615.8	911711.0	11S02W03CCA1	72	66.77	139	03/18/99	124SPRT
334750.2	911624	10S02W26CCC2	77	70.88	148	03/18/99	124SPRT
335034.4	912905.1	10S04W11CBC1	64	97.09	161	03/18/99	124SPRT
335309.6	913006.7	09S04W28DDD1	50	114.87	165	03/18/99	124SPRT
335346	911520.8	09S02W26AAC1	83	69.82	153	03/19/99	124SPRT
			Drew County				
332429.4	912723.7	15S04W12DDA1	67	58.21	125	03/09/99	124SPRT
333150.9	913407.6	13S05W36ACB1	84	85.35	169	03/09/99	124SPRT
333649.1	914402	12S06W32DAD1	57	155.38	212	03/10/99	124SPRT
333807.2	914543.1	12S06W30BBD1	35	221.84	257	03/10/99	124SPRT
334249.5	912707	11S04W25DAA1	56	91.65	148	03/09/99	124SPRT
334606.6	914122.34	11S06W11DBC1	60	142.77	203	03/09/99	124SPRT
334632.0	912826.5	11S04W02ACA2	64	88.62	153	03/09/99	124SPRT
			Grant County				
340446.8	921835.9	07S12W27DBC1	135	99.63	235	03/22/99	124SPRT
341022	923537.6	06S15W26ACA1	213	67.36	280	03/19/99	124SPRT

Table 1. Information pertaining to measured wells completed in the Sparta and Memphis aquifers in Arkansas, 1999--Continued

[124SPRT, Sparta aquifer; 12405MP, Memphis aquifer]

Latitude (degrees)	Longitude (degrees)	Local well number	Water level altitude (feet above sea level)	Depth to water (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measurement	Aquifer
341341	921414	06S11W05ACA1	73	206.86	280	03/22/99	124SPRT
341550.1	922649.9	05S13W30AAA1	199	131.36	330	03/22/99	124SPRT
341812	922653	05S13W07ADB1	188	70.32	258	03/22/99	124SPRT
341839	922402	05S13W03CDA4	167	114.13	281	03/19/99	124SPRT
341842.5	923326.7	05S14W06DCC1	203	90.06	293	03/19/99	124SPRT
341845	922359	05S13W03DBC1	172	88.17	260	03/19/99	124SPRT
341923.8	923826.9	05S15W05ABD1	215	17.14	232	03/19/99	124SPRT
342201	922931	04S14W14DCD1	180	77.17	257	03/19/99	124SPRT
342600.5	923447.0	03S15W26DAA1	332	4.59	337	03/19/99	124SPRT
342846	922106	03S13W12AAA1	232	129.25	361	03/22/99	124SPRT
			Hot Spring County				
341459.5	924151.1	05S16W35ACA1	305	37.32	342	03/19/99	124SPRT
			Jefferson County				
340401	915917	07S09W35CCB1	33	236.85	270	03/23/99	124SPRT
340547	920420	07S10W24CAC1	18	292.72	311	03/24/99	124SPRT
340632.7	914523	07S07W24BAB1	34	154.18	188	03/30/99	124SPRT
341026	915116	06S08W25ADC1	-14	217.30	203.48	03/23/99	124SPRT
341052.6	914133.8	06S06W18DAB1	32	155.70	188	03/31/99	124SPRT
341104.6	920506.2	06S10W23DBA1	-13	242.80	230	03/24/99	124SPRT
341115.5	920507.5	06S10W23ACD1	-9	240.82	232	03/24/99	124SPRT
341143.1	915517.1	06S08W16CCC1	-43	245.85	202.42	03/23/99	124SPRT
341151	920221	06S09W17CCA1	-30	263.92	234.34	03/23/99	124SPRT
341158.7	920206.9	06S09W17CAD1	-39	272.00	233	05/24/99	124SPRT
341336.7	920109.4	05S09W31DDC1	-37	263.60	227	05/24/99	124SPRT
341420	915653.1	05S09W35AAB1	-70	274.50	205	03/23/99	124SPRT
341446	915526	05S08W30CBA1	-70	277.23	207.46	03/23/99	124SPRT
341453	915441	05S08W30ADB1	-66	286.74	221	05/24/99	124SPRT
341530	915554	05S09W24DBD1	-59	267.26	208.17	03/23/99	124SPRT
341609.5	920130.7	05S09W19BAA3	-27	252.98	226	03/25/99	124SPRT
341634	920534	05S10W16DBD1	31	269.45	300	03/26/99	124SPRT
341634.6	920542.8	05S10W16DBB1	31	284.30	315	03/26/99	124SPRT
341700.5	920548.6	05S10W16BAD1	38	238.51	277	03/26/99	124SPRT
341741.2	920321.6	05S10W11ACA1	69	166.29	235	03/26/99	124SPRT
341909.1	915056.1	04S08W35BBD1	-2	201.65	200	03/25/99	124SPRT
341924.8	920017.5	04S09W32BDA1	93	115.77	209	04/01/99	124SPRT
342025	920623	04S10W29ADB1	51	217.03	267.55	03/26/99	124SPRT
342109.4	920441.9	04S10W22BDD1	57	187.70	244.24	03/26/99	124SPRT
342140	914741	04S07W17BCC1	29	171.22	200	03/25/99	124SPRT
342212.1	920645.6	04S10W17BDA1	78	187.25	265	03/26/99	124SPRT
342218	920957	04S11W14BAD1	96	303.94	400	03/30/99	124SPRT
342309.3	915702.2	04S09W11BAA1	83	126.59	210	04/01/99	124SPRT
342502	920432.6	03S10W27AAD1	99	122.90	222	04/01/99	124SPRT
342536.6	920831.3	03S11W25ADC4	94	219.20	313	05/25/99	124SPRT
342618	915455	03S08W19BDB1	53	162.24	215	03/25/99	124SPRT

Table 1. Information pertaining to measured wells completed in the Sparta and Memphis aquifers in Arkansas, 1999--Continued
[124SPRT, Sparta aquifer; 12405MP, Memphis aquifer]

Latitude (degrees)	Longitude (degrees)	Local well number	Water level altitude (feet above sea level)	Depth to water (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measurement	Aquifer
342623.8	915443.7	03S08W19BAD1	48	168.84	217	03/25/99	124SPRT
342626	915713	03S09W23BCA1	60	162.31	222	05/24/99	124SPRT
342628.4	915504.5	03S08W19BBD1	56	159.45	215	03/25/99	124SPRT
342650.8	921058.3	03S11W22ABC1	139	165.95	305	03/30/99	124SPRT
342659.2	920330.3	03S10W14CAD1	105	115.74	221	04/01/99	124SPRT
Lafayette County							
330223.4	933036.1	20S23W05ADB1	203	39.06	242	02/17/99	124SPRT
330351	933103	19S23W29BDB1	210	39.55	250	02/17/99	124SPRT
330555.4	933922.0	19S25W13CAB1	219	35.53	255	02/16/99	124SPRT
330911	933038	18S23W29ACC1	242	12.92	255	02/17/99	124SPRT
331519.6	933127.6	17S23W19ACC1	239	52.14	291	02/17/99	124SPRT
331526	933402	17S24W23BBD1	228	32.99	261	02/17/99	124SPRT
331950.2	933303	16S24W26AAC1	215	52.27	267	02/17/99	124SPRT
332142.6	932608.6	16S23W12CAD1	257	64.74	322	02/17/99	124SPRT
Lee County							
344208	904120	01N04E09DCC4	155	49.48	204	03/31/99	124SPRT
344403	903847	02N04E35DBC1	141	43.53	185	03/31/99	124SPRT
344743.4	905924.7	02N01E10CAD1	151	49.59	201	03/31/99	124SPRT
345005.9	904748.8	03N03E28CDB1	156	50.69	207	03/31/99	124SPRT
Lincoln County							
335633.9	915128.3	09S07W07DAD1	27	273.47	300	03/11/99	124SPRT
335849.7	914357.8	08S06W31DCC1	52	129.17	181	03/11/99	124SPRT
335850.6	915217.4	08S08W35DCB1	52	212.88	265	03/11/99	124SPRT
335858.4	915222.4	08S08W35DBB1	42	198.28	240	03/11/99	124SPRT
335907	913333	08S05W35ACC1	40	124.66	165	03/19/99	124SPRT
340309.5	913453.6	08S05W03BAA2	44	136.27	180	03/16/99	124SPRT
340443.9	915042.9	07S07W30CDC1	27	180.84	208	03/11/99	124SPRT
Lonoke County							
342727.8	915233.3	02S08W16BDA1	90	126.29	216	04/13/99	124SPRT
343235.5	914700.3	02S07W08DCC1	71	131.09	202	04/13/99	124SPRT
343854.7	914959.7	01S08W02DBD1	108	102.46	210	04/13/99	124SPRT
344425	914503	01N07W03BCC1	102	120.96	223	04/13/99	124SPRT
344453.3	914619	02N07W32DDD1	105	121.22	226	04/13/99	124SPRT
344650.2	914209.4	02N07W24DAC1	97	133.63	231	04/13/99	124SPRT
344651.5	914425.7	02N07W22DBA1	107	120.02	227	04/13/99	124SPRT
344906.4	914500.3	02N07W09AAA1	137	94.92	232	04/13/99	12405MP
345144.2	914349.7	03N07W23CCC1	144	84.27	228	04/13/99	12405MP
345152	915025	03N08W23DDD1	143	91.24	234	04/13/99	12405MP
345402.5	914934.7	03N08W11ACD1	166	81.64	248	04/16/99	12405MP
345444	914426	03N07W03CAA1	161	73.84	235	04/13/99	12405MP
Monroe County							
344143.9	911801.1	01N03W14CCB1	103	69.48	172	03/31/99	124SPRT
345043	911026	03N02W26DAB1	148	44.39	192	04/01/99	124SPRT
345313.5	911148.6	03N02W10DBC3	152	53.31	205	04/01/99	12405MP

Table 1. Information pertaining to measured wells completed in the Sparta and Memphis aquifers in Arkansas, 1999--Continued

[124SPRT, Sparta aquifer; 12405MP, Memphis aquifer]

Latitude (degrees)	Longitude (degrees)	Local well number	Water level altitude (feet above sea level)	Depth to water (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measurement	Aquifer
345446.3	910635.1	03N01W33CDD1	148	62.36	210	04/08/99	124SPRT
345535	911221	04N02W28DDD4	164	28.22	192	04/01/99	12405MP
345617.0	911504	04N02W30BAC1	160	19.84	180	04/01/99	12405MP
345617.2	911514.6	04N02W30BAD1	159	22.99	182	04/01/99	12405MP
			Nevada County				
333050.0	931722.9	14S21W20AAB1	275	101.83	377	03/09/99	124SPRT
333251.2	931708.3	14S21W04CCB1	301	58.89	360	03/09/99	124SPRT
			Ouachita County				
332233.7	924027.1	15S15W32DBB2	-56	175.32	119	03/11/99	124SPRT
332310.8	925436.1	15S18W36ADD1	65	95.15	160	03/11/99	124SPRT
332415	924313	15S16W23DAC1	45	124.74	170	03/11/99	124SPRT
332437	930431	15S19W21CDD2	91	189.04	280	03/10/99	124SPRT
332618	930318	15S19W10DCC1	143	66.88	210	03/10/99	124SPRT
332804	925251	14S17W32CAD1	135	85.48	220	03/11/99	124SPRT
332942	930513	14S19W29ABB1	194	85.96	280	03/10/99	124SPRT
333238.0	925254.6	14S17W05CAD1	120	37.24	157	03/11/99	124SPRT
333252	924926	14S17W02ABB1	42	78.13	120	03/12/99	124SPRT
333343.3	925956.4	13S18W31BDD1	173	69.43	242	03/11/99	124SPRT
333416.2	924450.6	13S16W28ADD1	72	34.31	106	03/12/99	124SPRT
333435	930417	13S19W28BCD1	194	36.40	230	03/10/99	124SPRT
333901.1	930146	12S19W35BDD1	192	158.49	350	03/10/99	124SPRT
333937.2	925441.9	12S18W25CAB1	179	7.64	187	03/10/99	124SPRT
333945.6	924304.1	12S16W26ABD1	84	49.83	134	03/12/99	124SPRT
334014	925951.3	12S18W19CDC1	195	39.67	235	03/10/99	124SPRT
334218	923914	12S15W09BBA1	143	70.38	213	03/12/99	124SPRT
334251	930351	12S19W09BAB1	273	16.87	290	03/10/99	124SPRT
334342	924835	11S17W36CCA1	126	7.33	133	03/11/99	124SPRT
334440.9	923725.6	11S15W27ABD1	127	72.96	200	03/12/99	124SPRT
334614	925759	11S18W20AAA1	258	43.21	301	03/10/99	124SPRT
334631.4	924927.5	11S17W14CAC1	127	18.95	146	03/11/99	124SPRT
			Phillips County				
341824.2	905121.5	04S02E25CCC1	131	35.02	166	03/23/99	124SPRT
342403	904914	03S03E30DAA1	129	43.25	172	03/23/99	124SPRT
342754	903621	03S05E05BAB1	143	37.41	180	03/22/99	124SPRT
342850.8	903635.4	02S05E29CCC1	158	21.08	179	03/22/99	124SPRT
343106.9	903529.1	02S05E16BCB1	147	42.73	190	03/22/99	124SPRT
343242.9	903907	02S04E02DBA1	150	100.20	250	03/22/99	124SPRT
343323.5	905056.3	02S02E01ADC1	138	38.43	176	03/22/99	124SPRT
343324.3	905455.4	01S02E32DDC1	131	80.03	211	03/22/99	124SPRT
			Poinsett County				
352724	905846	10N01E27CC1	150	81.21	231	04/12/99	12405MP
352724.9	905924.1	10N01E33ABA1	152	68.55	221	04/12/99	12405MP
352849.6	904432.3	10N03E23CAC1	152	106.29	258	04/13/99	12405MP
352930	905825	10N01E15DBB1	149	82.57	232	04/13/99	12405MP

Table 1. Information pertaining to measured wells completed in the Sparta and Memphis aquifers in Arkansas, 1999--Continued

[124SPRT, Sparta aquifer; 12405MP, Memphis aquifer]

Latitude (degrees)	Longitude (degrees)	Local well number	Water level altitude (feet above sea level)	Depth to water (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measure-ment	Aquifer
353026.4	905629.6	10N01E12BDC1	133	101.44	234	04/12/99	12405MP
353144	904454	10N03E02BCD1	147	104.48	251	04/13/99	12405MP
353324.5	904323.4	11N03E25BDD1	142	126.81	269	04/13/99	12405MP
353448.2	905321.2	11N02E16CCC1	145	98.04	243	04/12/99	12405MP
353727.4	904353.1	12N03E35DDA1	151	95.88	247	04/13/99	12405MP
353744.8	904455.7	12N03E35BCC1	153	91.02	244	04/13/99	12405MP
354104.2	904928.2	12N02E12DDC1	149	98.97	248	04/12/99	12405MP
354137.4	904340.1	12N03E12BBB1	158	87.99	246	04/13/99	12405MP
			Prairie County				
343639	913352	01S05W20ABB1	64	156.15	220	04/09/99	124SPRT
343748	913654	01S06W11DBD1	64	162.16	226	04/09/99	124SPRT
343904	913531.6	01S05W06BCB1	68	152.47	220	04/09/99	124SPRT
343943	913845	01N06W34CBB1	73	153.07	226	05/11/99	124SPRT
344113	913504	01N05W19CDC1	66	145.63	212	04/09/99	124SPRT
344440	913658	01N06W02ABB1	111	111.82	223	05/10/99	124SPRT
344644	913828	02N06W21DAD1	115	116.86	232	04/09/99	124SPRT
344649	912801	02N04W19ACB1	120	91.36	211	04/09/99	124SPRT
344706.6	914033	02N06W20BCB1	106	129.76	236	04/09/99	124SPRT
344928	913852	02N06W04DBB1	133	102.39	235	05/10/99	12405MP
345140	914004	03N06W20CDD1	141	83.68	225	05/10/99	12405MP
345144	913356	03N05W20CCC1	146	67.10	213	05/10/99	12405MP
345451	913042	03N05W03ADA2	151	54.32	205	05/10/99	12405MP
			Pulaski County				
343115.1	921225.1	02S11W29AAA1	212	33.13	245	04/06/99	124SPRT
			St. Francis County				
345743.4	904319	04N04E18BAB1	155	64.53	220	04/06/99	12405MP
345711.7	902829.8	04N06E16CCB1	151	47.37	198	04/06/99	12405MP
			Union County				
330109.6	924325.5	19S16W35DDC1	-63	238.31	175	03/02/99	124SPRT
330219	921112	19S11W25AAA1	-18	152.60	135	03/02/99	124SPRT
330255.4	921228.8	19S11W23ACA1	-4	145.62	142	03/03/99	124SPRT
330329.0	920904	19S10W16CBC1	-2	84.22	82	03/02/99	124SPRT
330635.9	923707.3	18S15W35DAC1	-110	311.31	201	03/02/99	124SPRT
330652	922119	18S12W33BBB1	-24	136.04	112	03/03/99	124SPRT
330659.3	923858.5	18S15W33ADA1	-136	389.27	253	03/02/99	124SPRT
330809.2	924611.1	18S16W28BBB1	-126	351.13	225	03/02/99	124SPRT
330855.9	925056.5	18S17W22BDD1	-112	397.38	285	03/02/99	124SPRT
330959	924445	18S16W10CDD1	-157	338.67	182	03/04/99	124SPRT
331011	924317	18S16W11DAB1	-172	442.23	270	03/02/99	124SPRT
331028.8	924231.9	18S16W12ACB1	-181	483.58	303	03/02/99	124SPRT
331040	923531	18S14W06CCA1	-147	371.62	225	04/28/99	124SPRT
331050.2	925615.2	18S17W18BBD1	-35	305.43	270	03/01/99	124SPRT
331143.9	924104.9	17S15W31DDA1	-206	467.12	261	03/03/99	124SPRT
331145	924116.8	17S15W31DCA1	-205	476.53	272	03/02/99	124SPRT

Table 1. Information pertaining to measured wells completed in the Sparta and Memphis aquifers in Arkansas, 1999--Continued

[124SPRT, Sparta aquifer; 12405MP, Memphis aquifer]

Latitude (degrees)	Longitude (degrees)	Local well number	Water level altitude (feet above sea level)	Depth to water (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measure-ment	Aquifer
331200.2	922915.7	17S13W31BAC1	-78	294.06	216	03/03/99	124SPRT
331203	922218	17S12W32BBC1	-18	247.75	230	04/28/99	124SPRT
331206	922225	17S12W31AAA1	-11	233.06	222	04/28/99	124SPRT
331228	924038	17S15W29CDC1	-207	426.78	220	03/03/99	124SPRT
331246.1	923909.8	17S15W28DBA1	-192	427.22	235	03/03/99	124SPRT
331300	925356	17S17W30DCD1	-31	310.85	280	03/01/99	124SPRT
331358	924248	17S16W24BDB1	-214	419.26	205	03/03/99	124SPRT
331439	924129.2	17S15W18DBB1	-182	365.24	182.93	03/03/99	124SPRT
331505	924027	17S15W08DCC1	-180	354.90	174.92	02/23/99	124SPRT
331506	924232	17S16W12DCC1	-197	419.05	221.58	04/08/99	124SPRT
331559	924403	17S16W02CCC1	-168	346.50	178.36	04/07/99	124SPRT
331602	924326	17S16W02DCD1	-177	394.55	218	04/07/99	124SPRT
331649	924253	17S16W01ABB1	-145	333.71	188.84	04/19/99	124SPRT
331718	924128.9	16S15W31ACC1	-150	317.57	168	04/20/99	124SPRT
331805	925709	16S18W34ABC2	45	202.64	248	03/01/99	124SPRT
331859.9	923958	16S15W20DAA1	-90	279.92	190	03/03/99	124SPRT
331944	923217	16S14W15CAB1	-70	163.83	94	03/03/99	124SPRT
332205	924330	16S16W02ABC1	-65	180.92	116	03/03/99	124SPRT
			Woodruff County				
350026.9	911455.9	05N02W31DCB3	169	23.52	193	04/05/99	12405MP
350310	910727	05N01W17DBB1	168	42.27	210	04/05/99	12405MP
350425.8	910407.2	05N01W11ABA1	158	53.22	211	04/05/99	12405MP
350827.4	910246.7	06N01W13ADC1	148	64.16	212	04/08/99	12405MP
350851.8	910253.7	06N01W13ABA1	150	62.12	212	04/08/99	12405MP
351441.6	910326.2	07N01W12BCB1	164	57.74	222	04/05/99	12405MP
351725.8	911004.1	08N02W26ADC1	180	31.98	212	04/08/99	12405MP
351934	910310.8	08N01W12CDA1	153	71.66	225	04/05/99	12405MP

LONG-TERM WATER-LEVEL CHANGES

Thirty-one years of water-level data from each of 20 selected wells completed in the Sparta and Memphis aquifers illustrate the history of water levels in several counties in Arkansas (fig. 3). During the period 1969-1999, average water-level declines generally were less than 0.7 foot per year (ft/yr) in Craighead, Drew, Lee, Ouachita, and Phillips Counties. Declines were between 0.7 and 1.1 ft/yr in Bradley, Cleveland, Cross, Dallas, Poinsett, and Prairie Counties. Data from Calhoun, Desha, Jefferson, Lonoke, Lincoln, and Union Counties indicate water levels declined between 1.1 and 2.0 ft/yr since 1969. Water levels in Arkansas and Columbia Counties have declined more than 2.0 ft/yr for the past 31 years.

COMPARISON OF WATER-LEVEL CHANGES IN CONES OF DEPRESSION FROM 1995 TO 1999

Analysis of 1995 and 1999 water-level data from counties with cones of depression reveals that water levels continued to decline in three cones of depression, one new cone of depression has been documented, and water levels increased in one cone of depression. Large cones of depression are located in Union, Jefferson, Poinsett, Cross, Arkansas, and Columbia Counties.

In 1995, the lowest water-level altitude measured in Union County was 206 ft below sea level. In 1999, the lowest water-level altitude measured in Union County was 214 ft below sea level. The area enclosed by the -175-ft contour in 1995 has expanded northward and eastward in 1999 (fig. 4). In Union County, water levels in 15 wells were measured in both 1995 and 1999. Water levels declined in 14 of those 15 wells from 1995 to 1999. The average decline in those 15 wells was 2.5 ft/yr for the 5-year period.

In Jefferson County in 1995, the -25-ft contour centered around pumpage near Pine Bluff. The area enclosed by the -25-ft contour has expanded, mostly southward in 1999 (fig. 5). In Jefferson County, water levels in 12 wells were measured in both 1995 and 1999. Water levels declined in 10 of those 12 wells; there was no change in the water level in the remaining 2 wells. The average decline in those 12 wells was 1.4 ft/yr for the 5-year period.

In southwestern Poinsett County in 1995, a small cone of depression enclosed by a 150-ft contour was present. The area enclosed by the 150-ft contour has expanded rather rapidly and now encompasses a large portion of western Poinsett County and extends southward through western Cross County into northwestern St. Francis County (fig. 6). In western Cross County, water levels in four wells were measured in both 1995 and 1999. Water levels declined in all four wells in that 5-year period, and the average rate of decline was 1.7 ft/yr from 1995 to 1999.

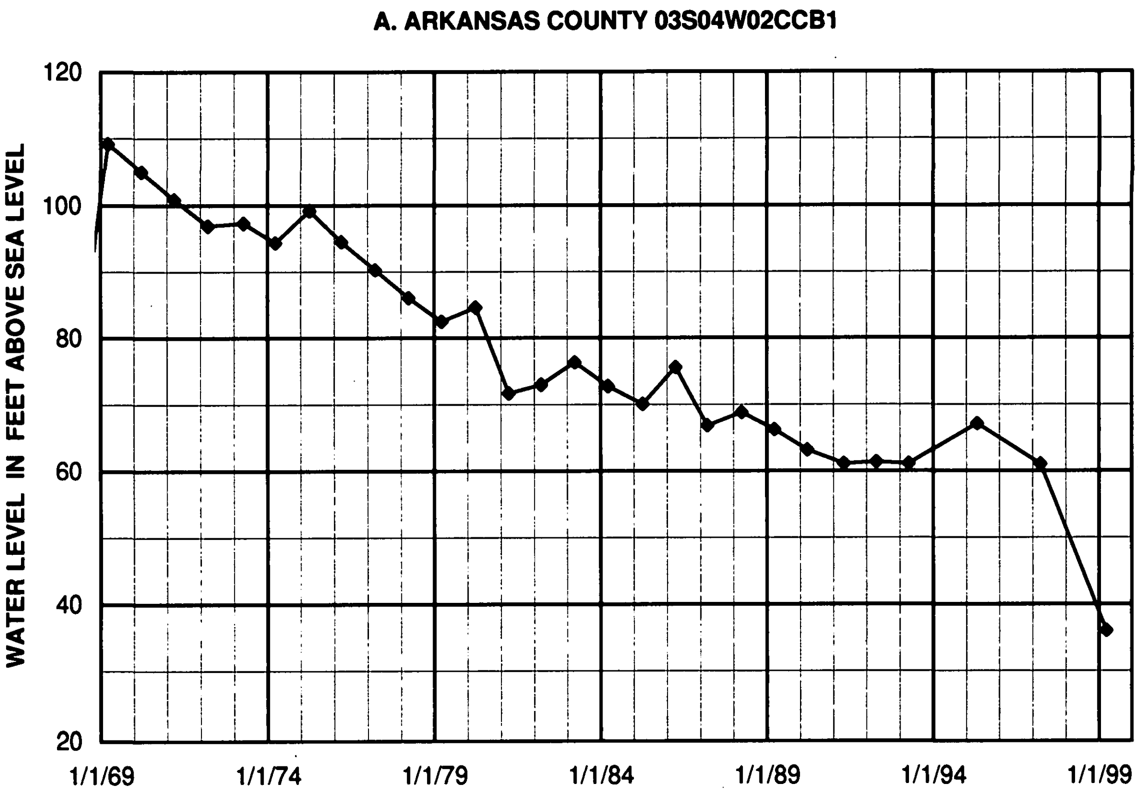
In Arkansas County in 1995, the lowest water-level altitude measured was 45 ft above sea level; in 1999, the lowest water-level measured was 4 ft above sea level. This change in water levels has resulted in the placement of a 25-ft contour in northwestern Arkansas County that was not present in 1995. Twenty wells were monitored in both 1995 and 1999 in Arkansas County, and water levels declined in all of these wells. The average rate of decline in those 20 wells was 4.0 ft/yr from 1995 to 1999.

Water levels in the northwestern portion of Columbia County have risen since 1995. Water levels in numerous other wells in the county declined very little from 1995 to 1999. Analysis of 1995 and 1999 water-level data collected in Columbia County shows that water levels increased in 5 of 11 monitored wells. In Columbia County, water-level increases outpaced declines resulting in an average increase in water levels of 0.6 ft/yr for those 11 wells monitored in 1995 and 1999.

LONG-TERM WATER-LEVEL CHANGES IN CONES OF DEPRESSION

Hydrographs provide valuable information regarding the long-term and short-term trends of water levels in cones of depression and surrounding areas. Water-level changes in the cone of depression in Union County (hydrograph T, fig. 4, plate 1) show that water levels declined an average of 1.6 ft/yr at well T in Union County since 1969. The rate of decline in well T has increased to 2.3 and 3.6 ft/yr over the past 21 years and 11 years, respectively. The cone of depression in Union County is becoming deeper and widening into Bradley (hydrograph B) and Calhoun (hydrograph C) Counties where water levels have declined about 1.0 and 1.1 ft/yr, respectively, over the past 31 years.

Water levels in a well in Jefferson County (hydrograph L, fig. 5, plate 1) have declined at a rate of 1.2 ft/yr since 1969. The decline in well L has slowed to a rate of 0.7 ft/yr the past 11 years. Thus, this cone of



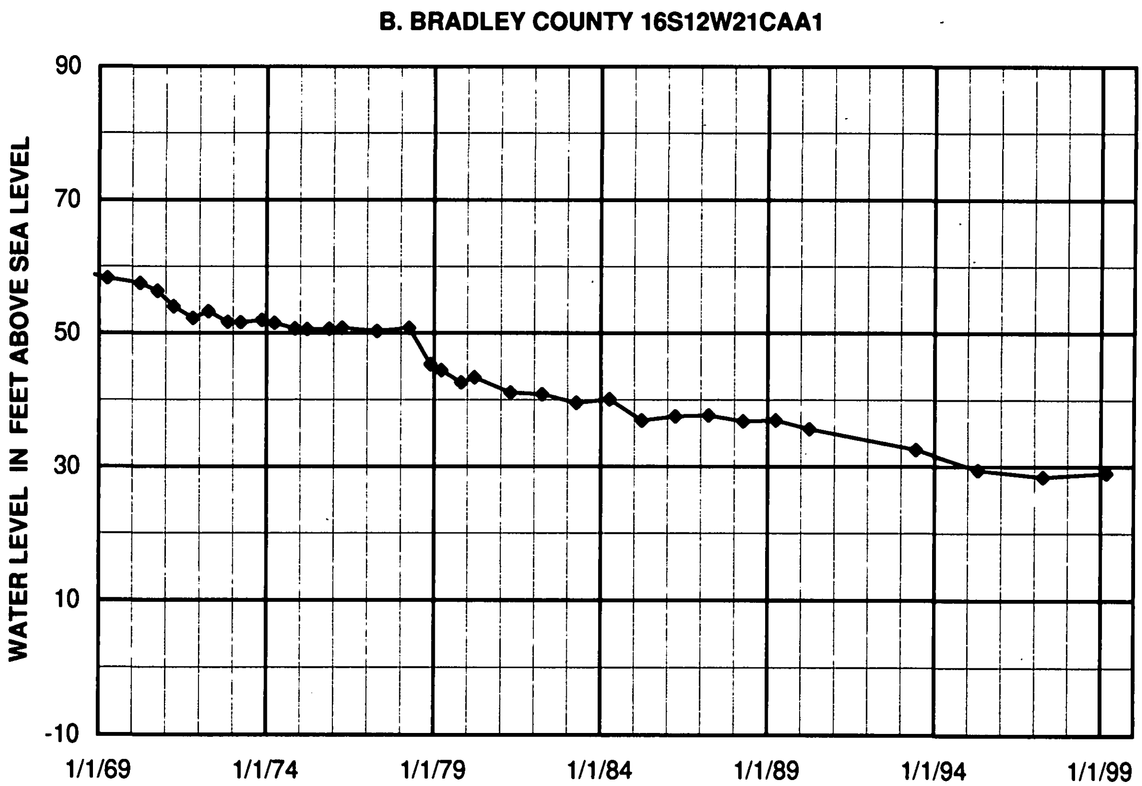
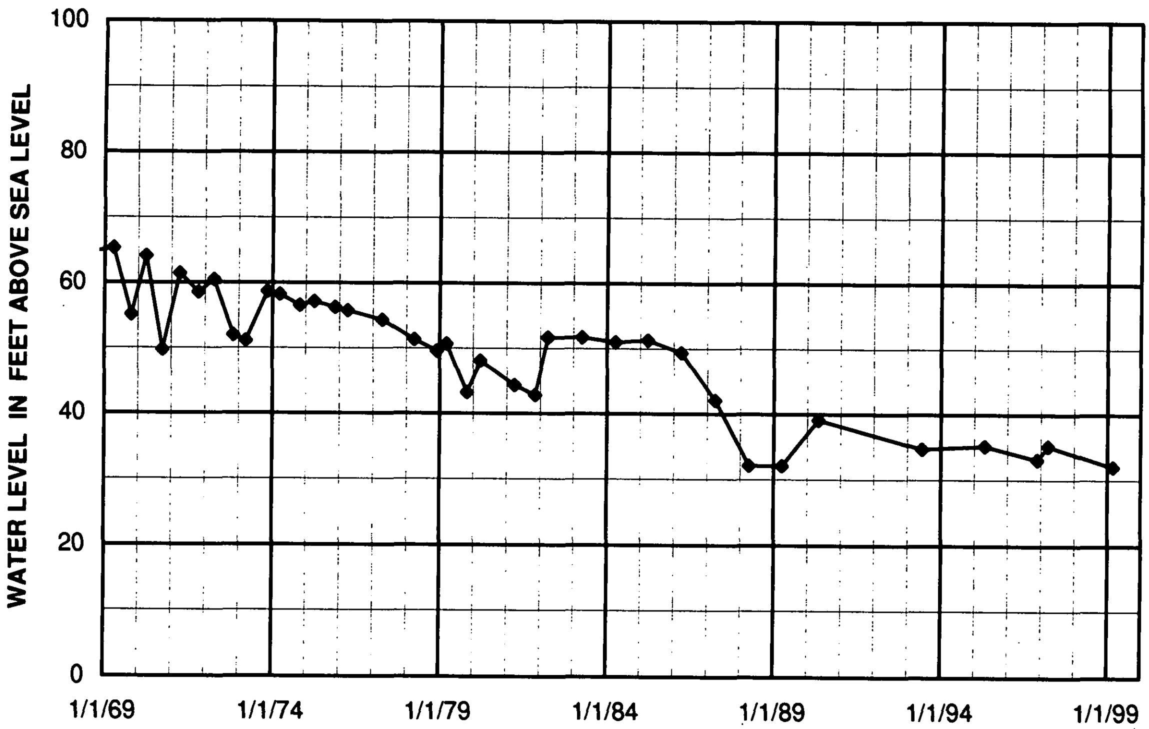


Figure 3. Water-level hydrographs for selected wells completed in the Sparta and Memphis aquifers (page 1 of 10).

C. CALHOUN COUNTY 13S13W32CDA1



D. CLEVELAND COUNTY 10S12W12BDD1

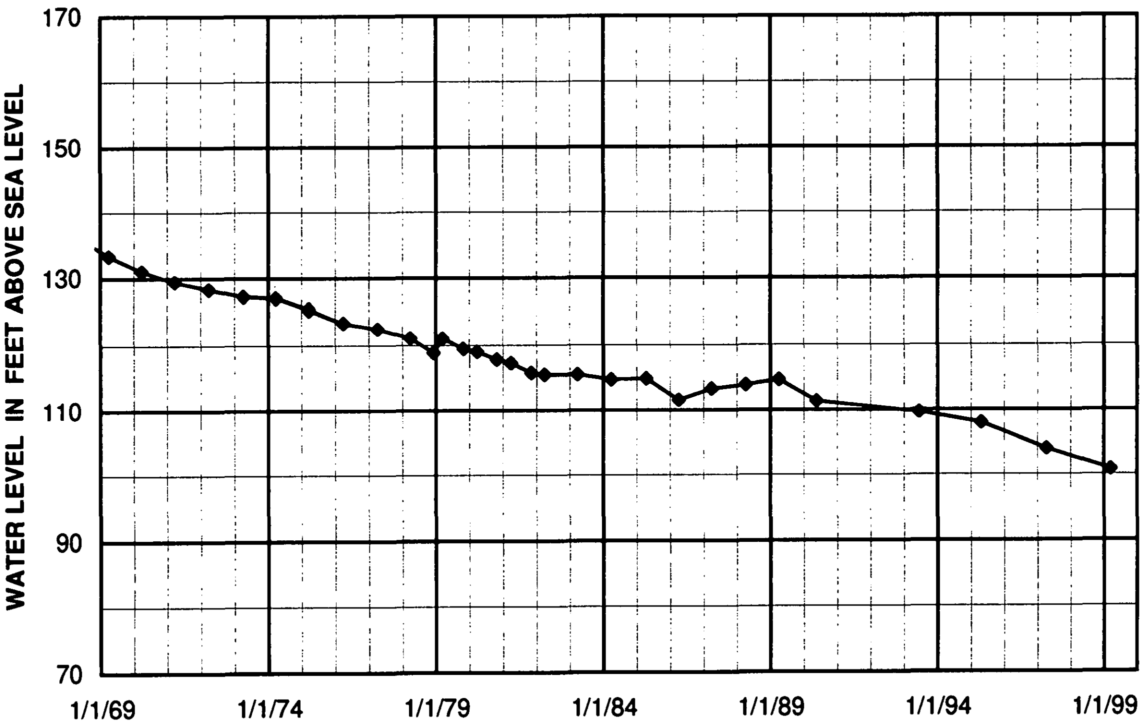
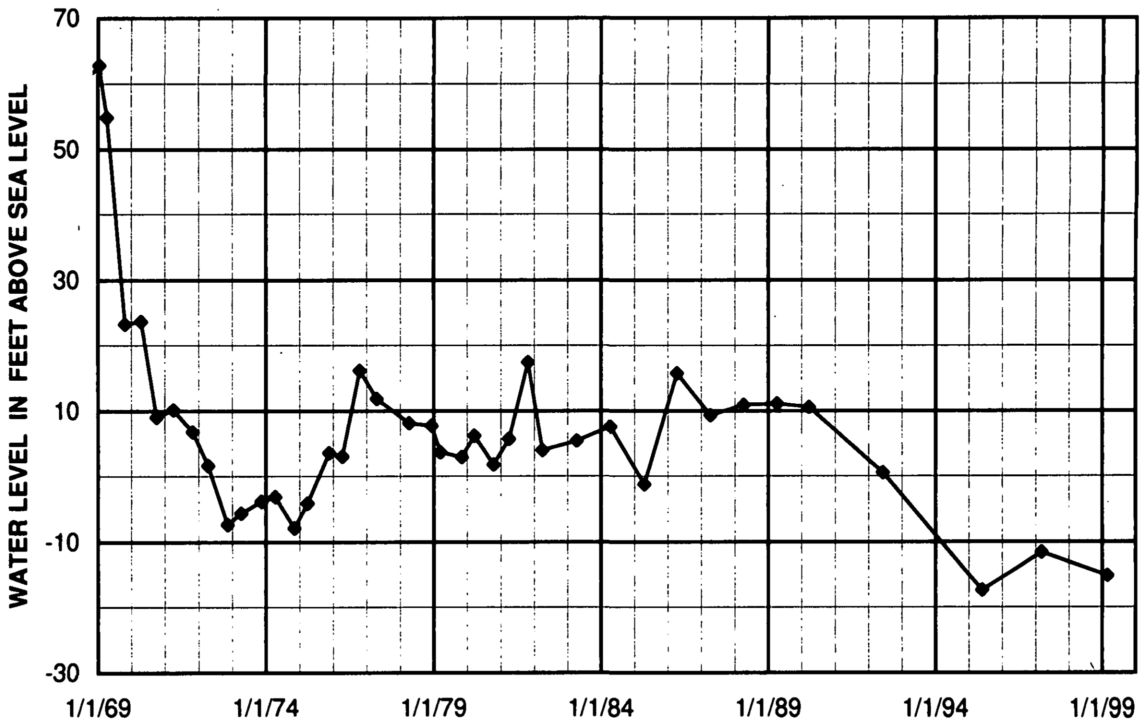


Figure 3. Water-level hydrographs for selected wells completed in the Sparta and Memphis aquifers (page 2 of 10).

E. COLUMBIA COUNTY 18S20W06DDC1



F. CRAIGHEAD COUNTY 14N04E22CBD1

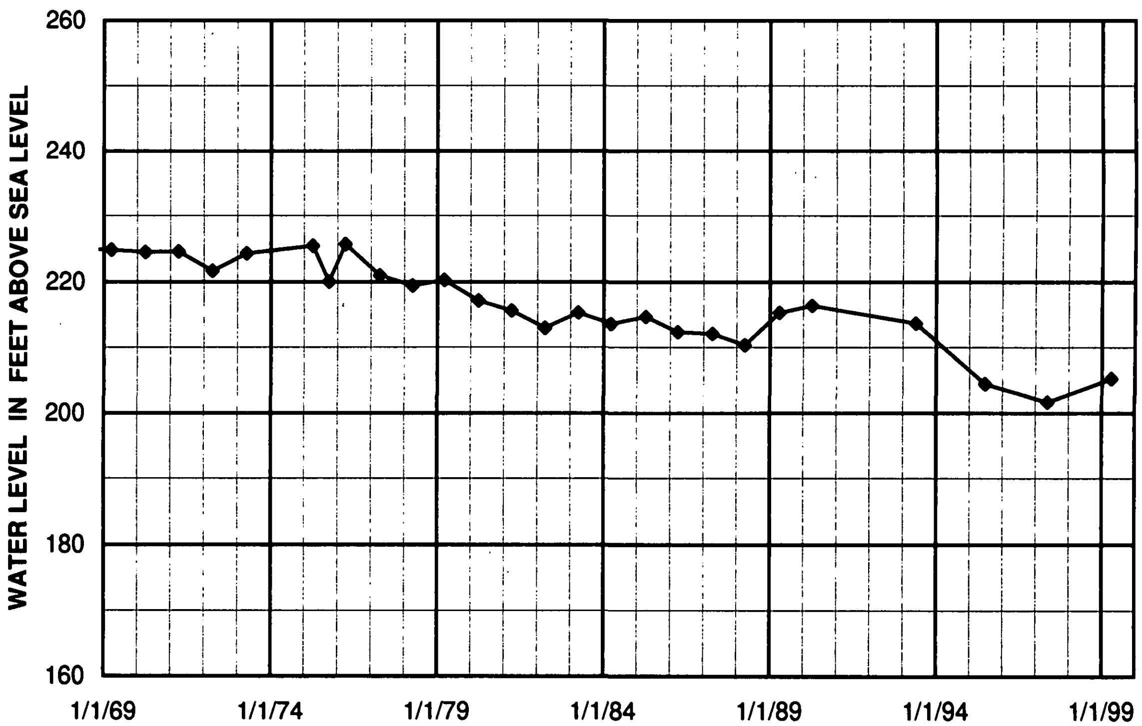
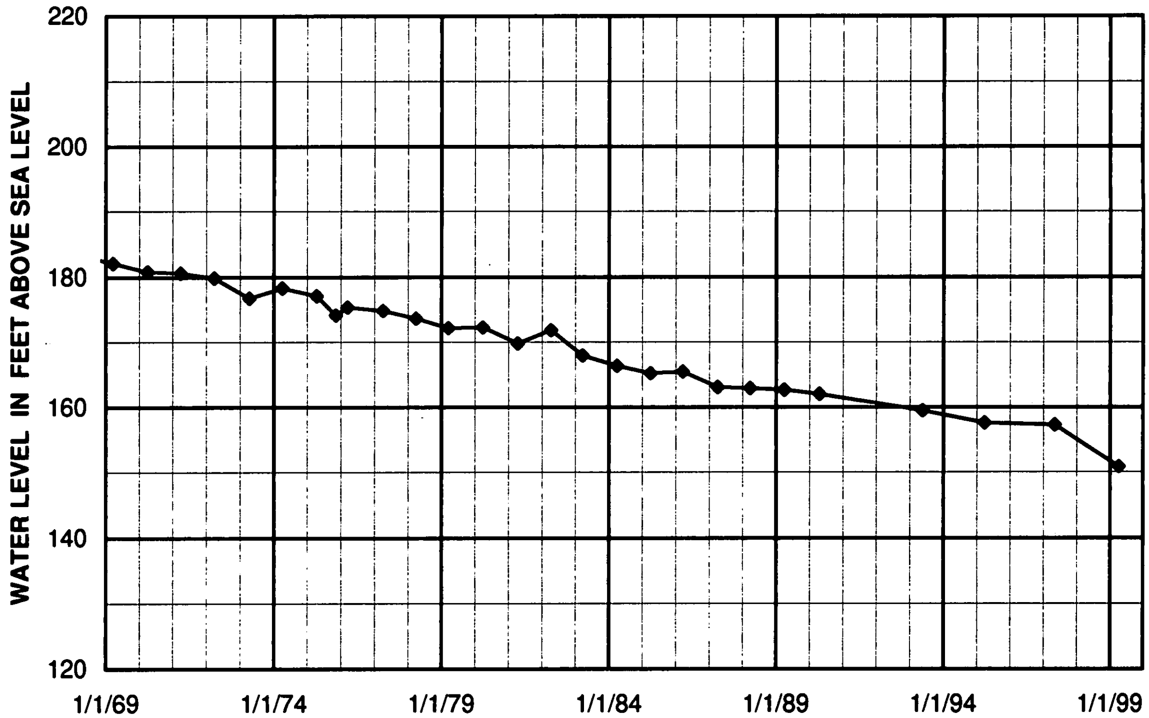


Figure 3. Water-level hydrographs for selected wells completed in the Sparta and Memphis aquifers (page 3 of 10).

G. CROSS COUNTY 09N01E16CAC1



H. DALLAS COUNTY 10S13W34ACA2

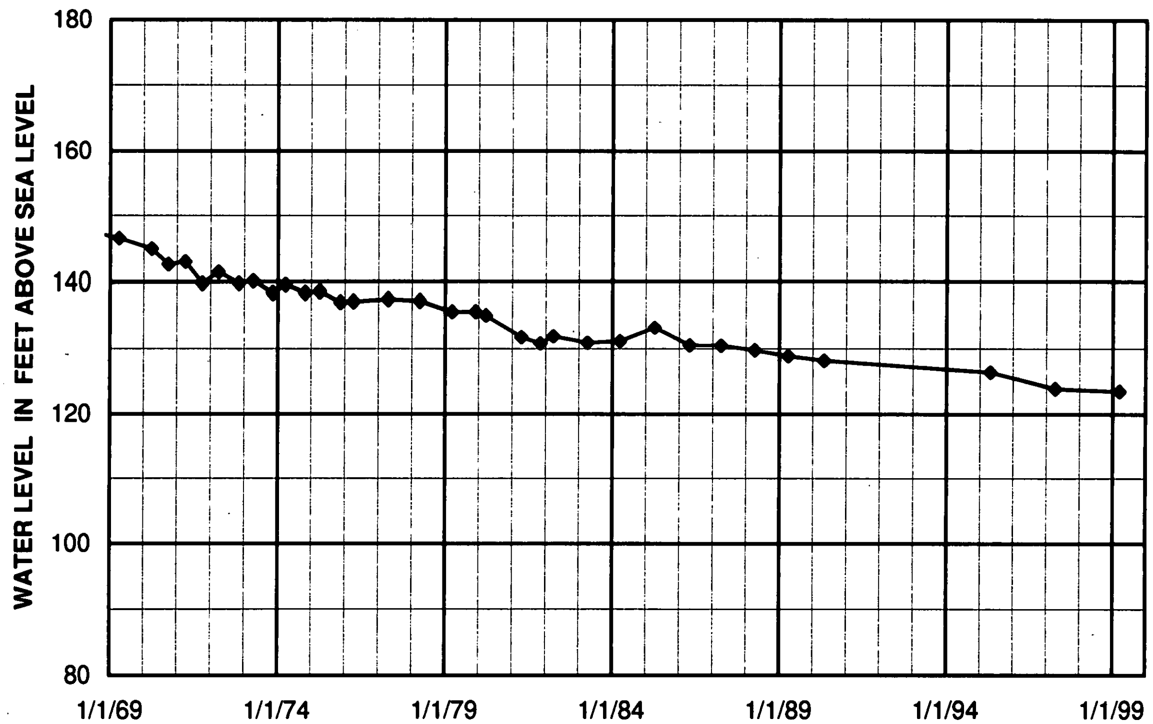
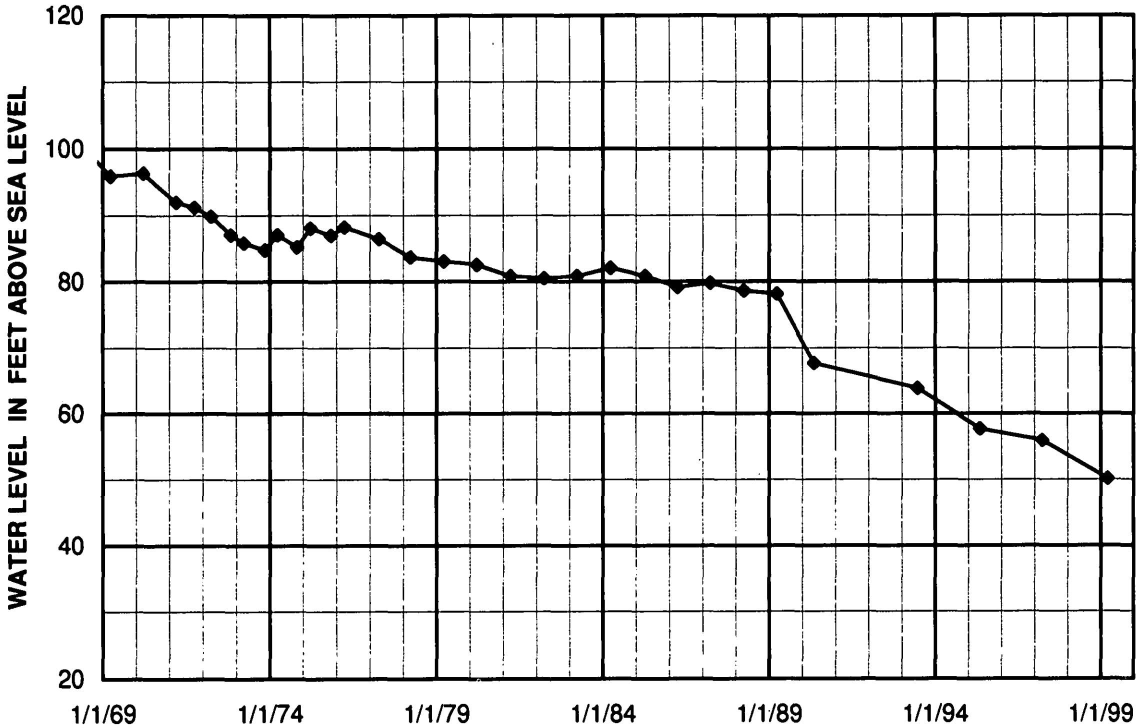


Figure 3. Water-level hydrographs for selected wells completed in the Sparta and Memphis aquifers (page 4 of 10).

I. DESHA COUNTY 09S04W28DDD1



J. DREW COUNTY 15S04W12DDA1

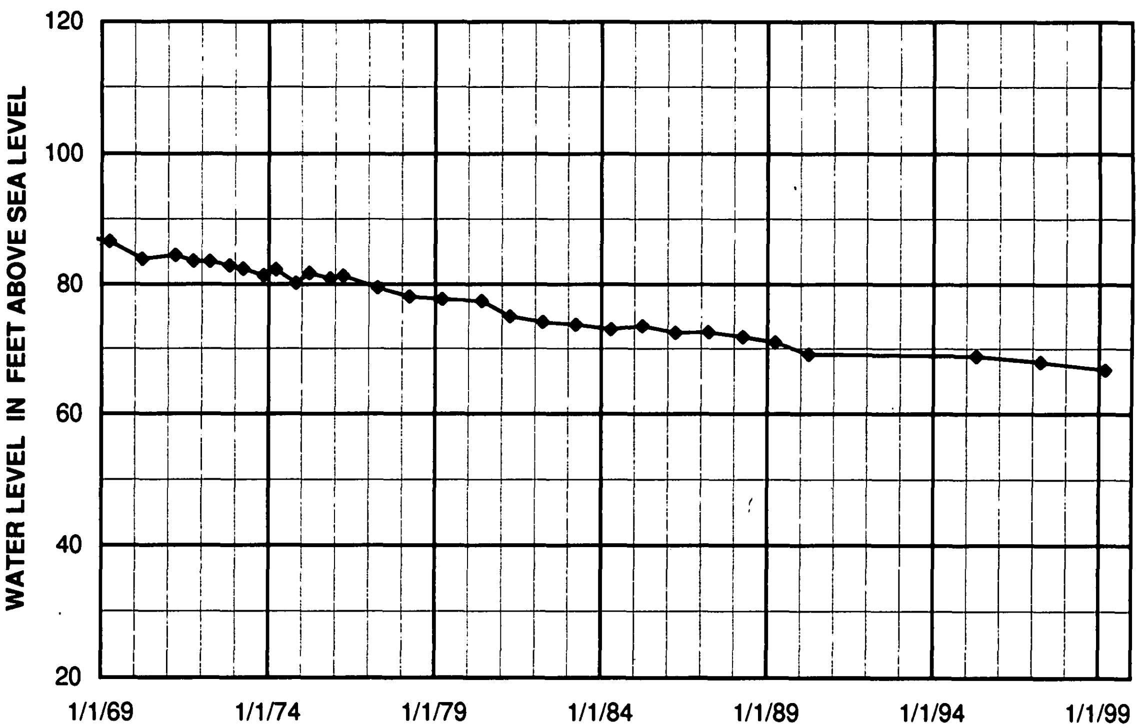
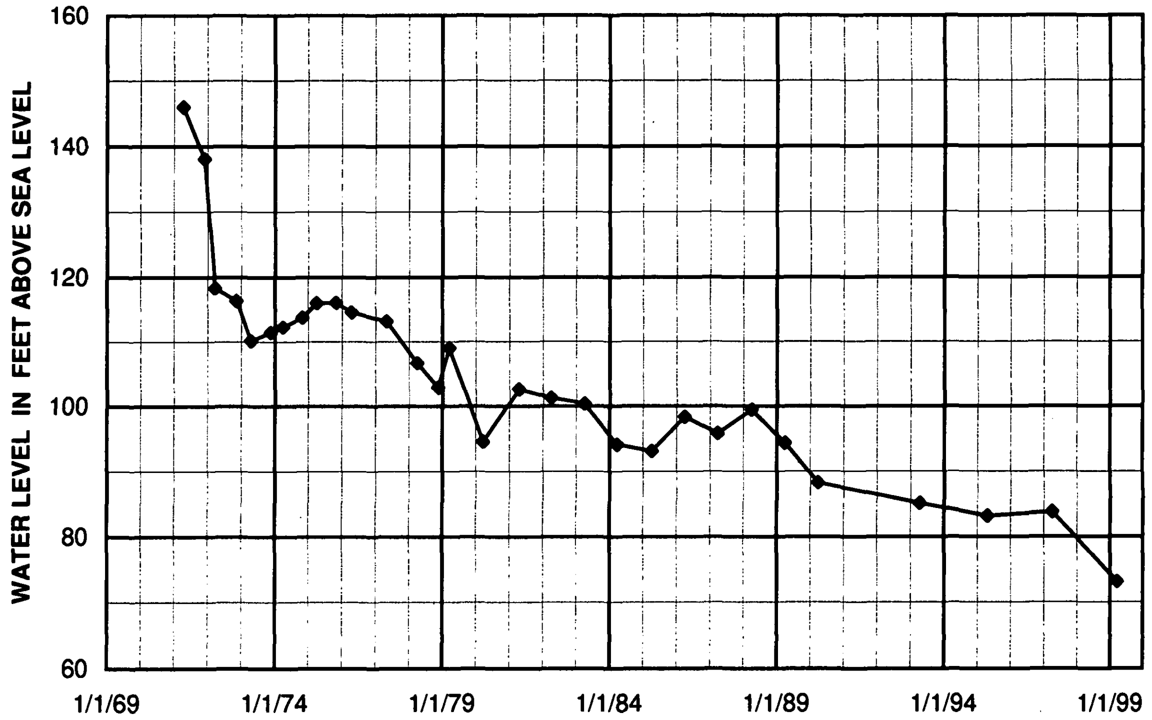


Figure 3. Water-level hydrographs for selected wells completed in the Sparta and Memphis aquifers (page 5 of 10).

K. GRANT COUNTY 06S11W05ACA1



L. JEFFERSON COUNTY 06S08W16CCC1

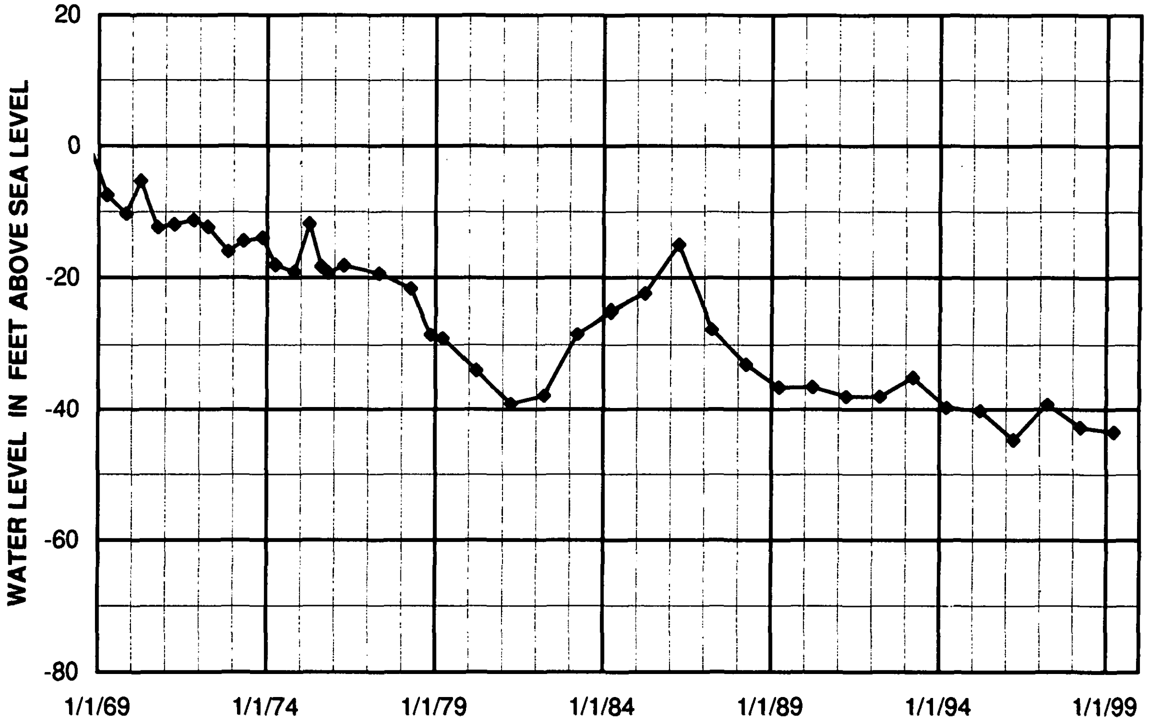
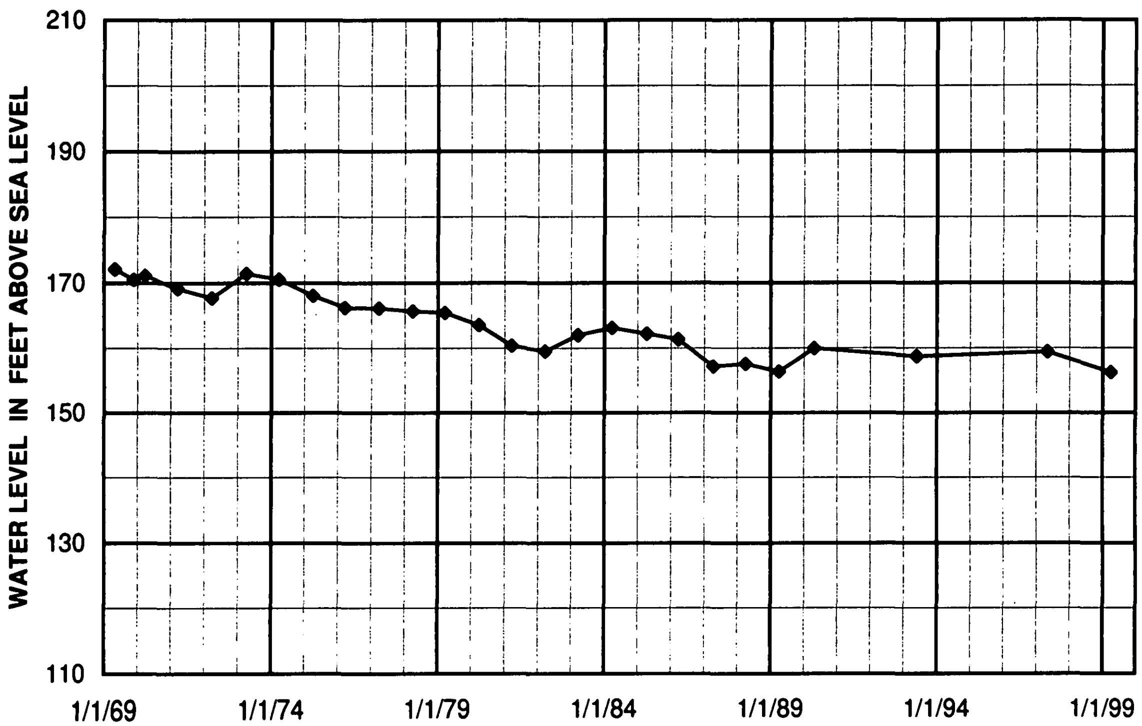


Figure 3. Water-level hydrographs for selected wells completed in the Sparta and Memphis aquifers (page 6 of 10).

M. LEE COUNTY 03N03E28CDB1



N. LINCOLN COUNTY 07S07W30CDC1

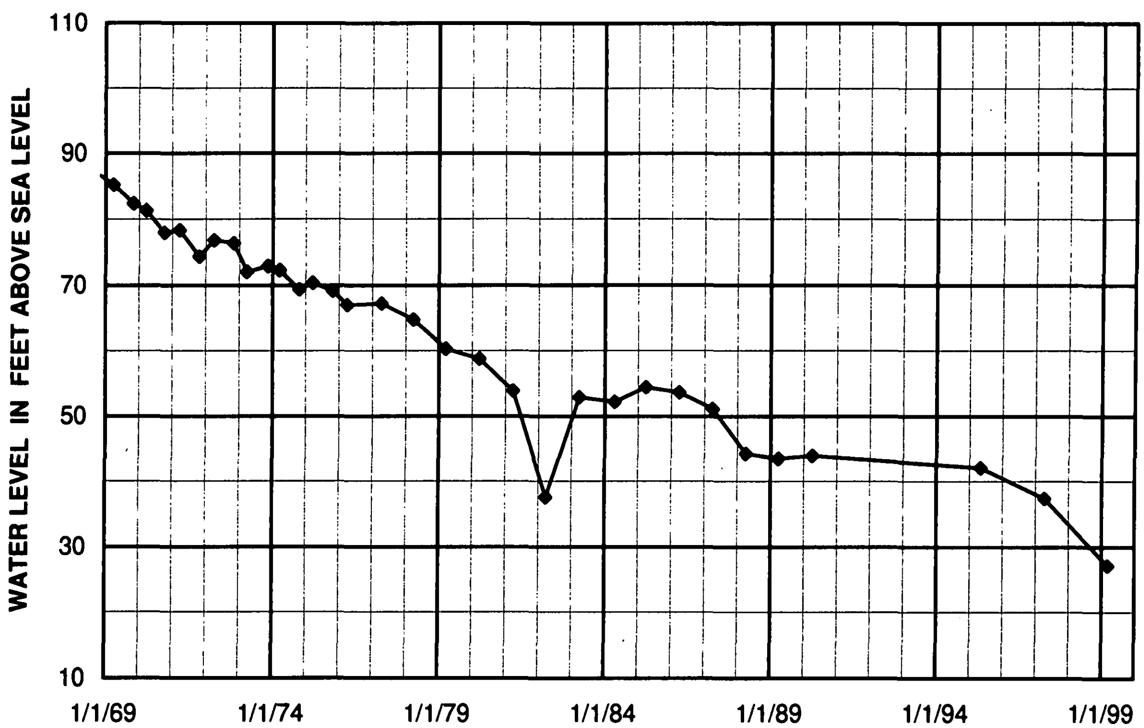
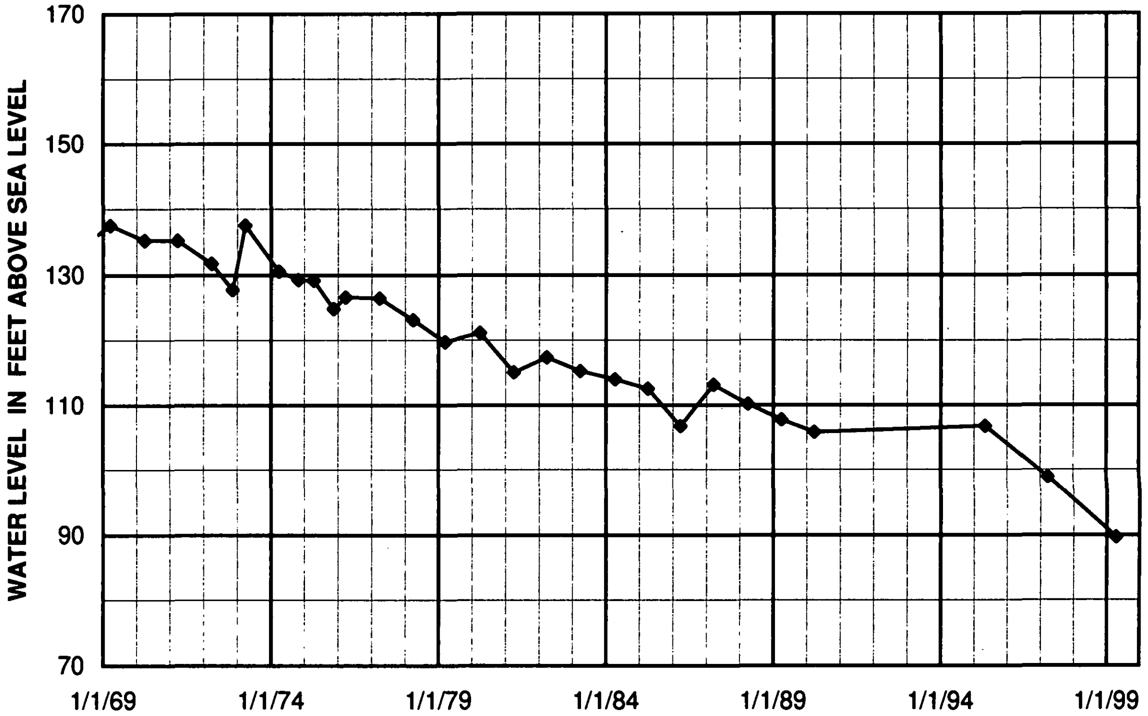


Figure 3. Water-level hydrographs for selected wells completed in the Sparta and Memphis aquifers (page 7 of 10).

O. LONOKE COUNTY 02S08W16BDA1



P. OUACHITA COUNTY 14S17W05CAD1

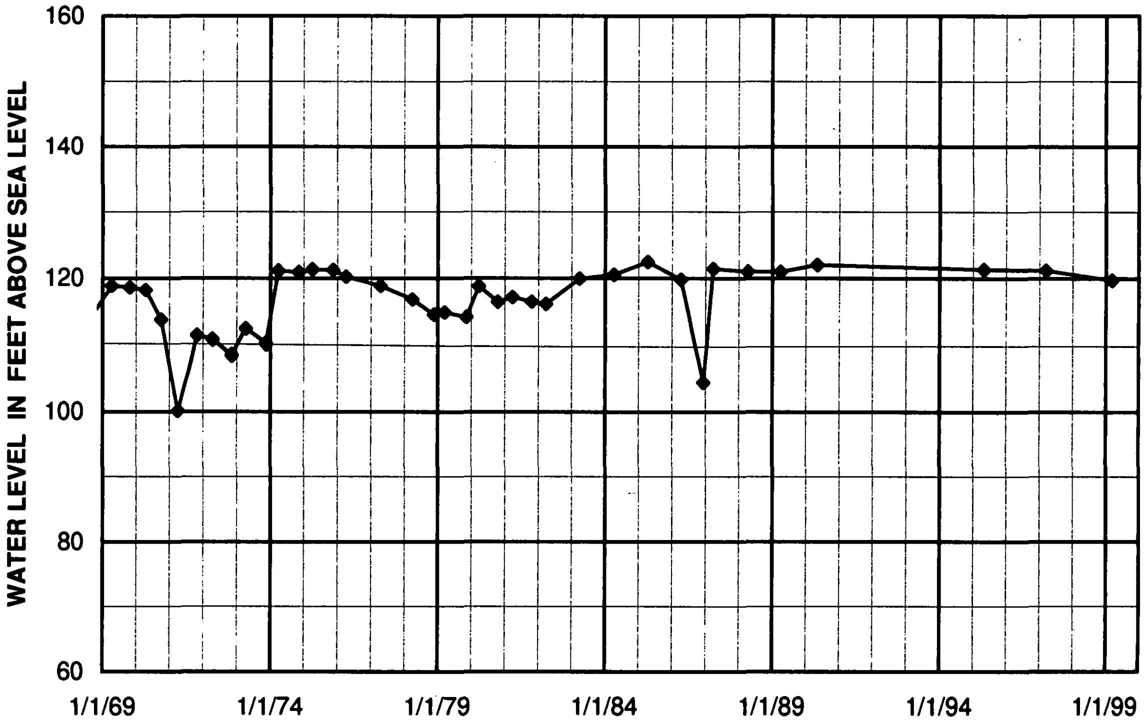
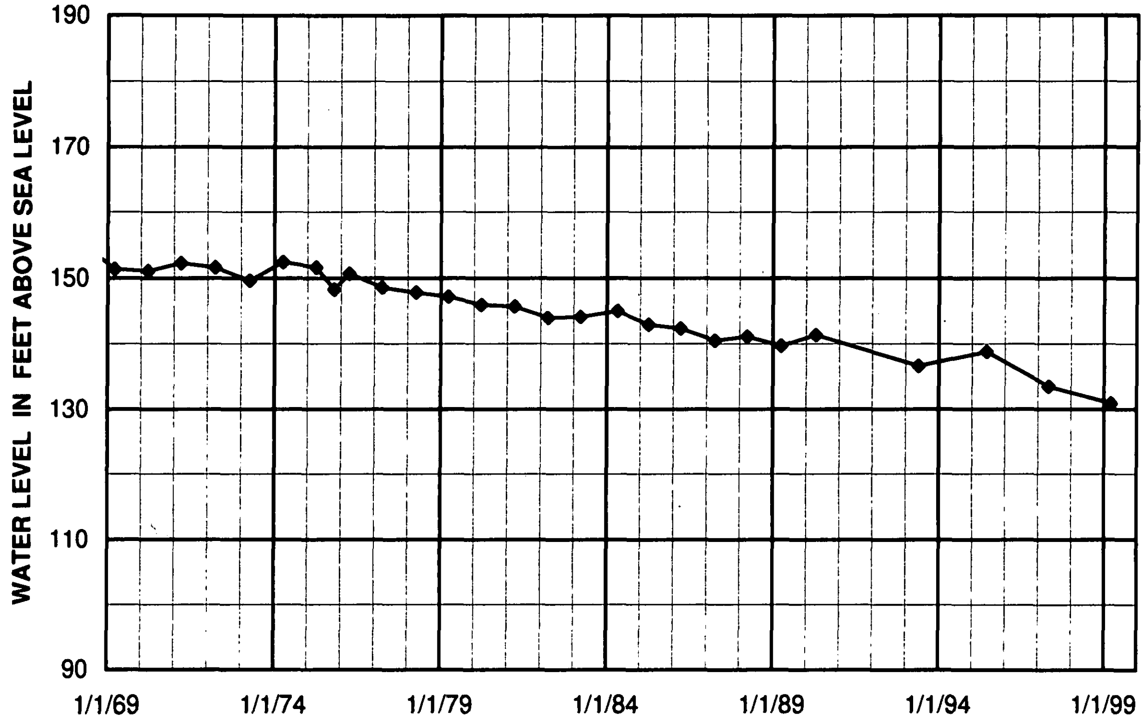


Figure 3. Water-level hydrographs for selected wells completed in the Sparta and Memphis aquifers (page 8 of 10).

Q. PHILLIPS COUNTY 01S02E32DDC1



R. POINSETT COUNTY 10N01E15DBB1

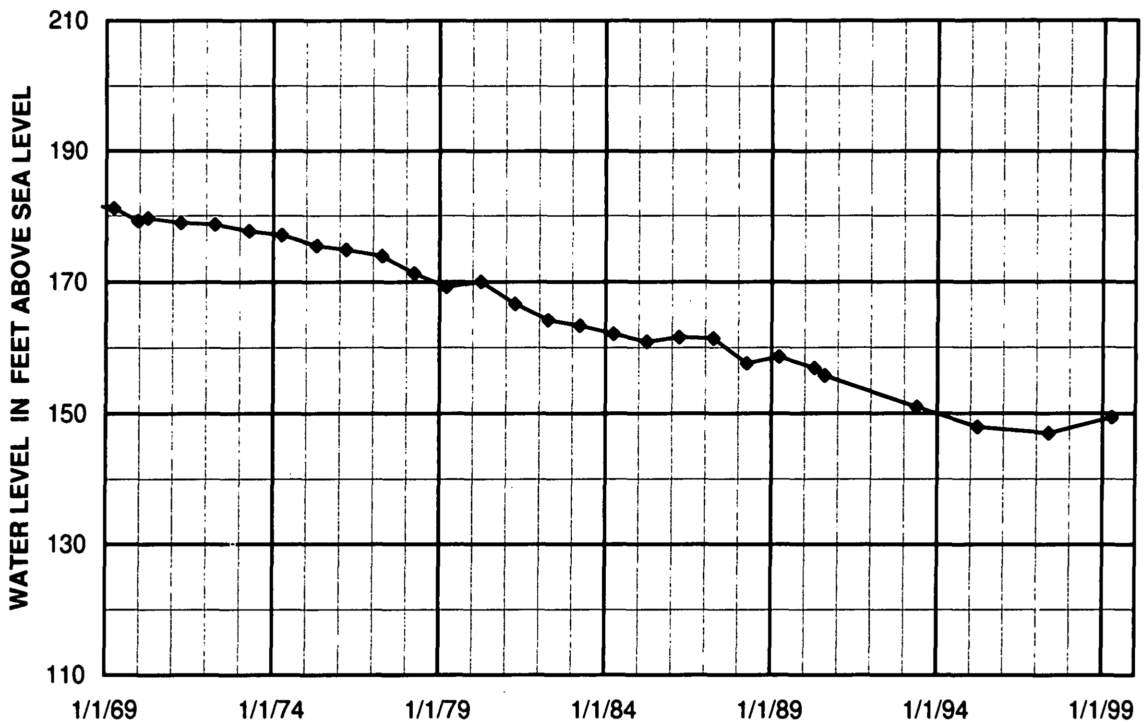
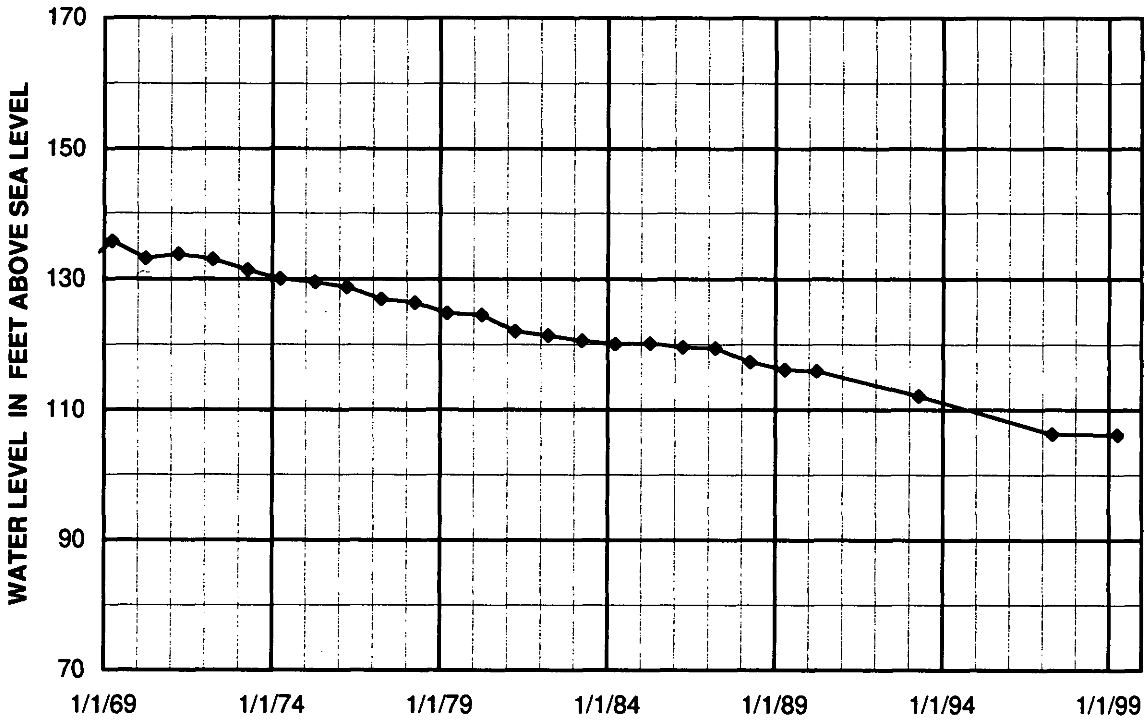


Figure 3. Water-level hydrographs for selected wells completed in the Sparta and Memphis aquifers (page 9 of 10).

S. PRAIRIE COUNTY 02N06W20BCB1



T. UNION COUNTY 17S15W31DCA1

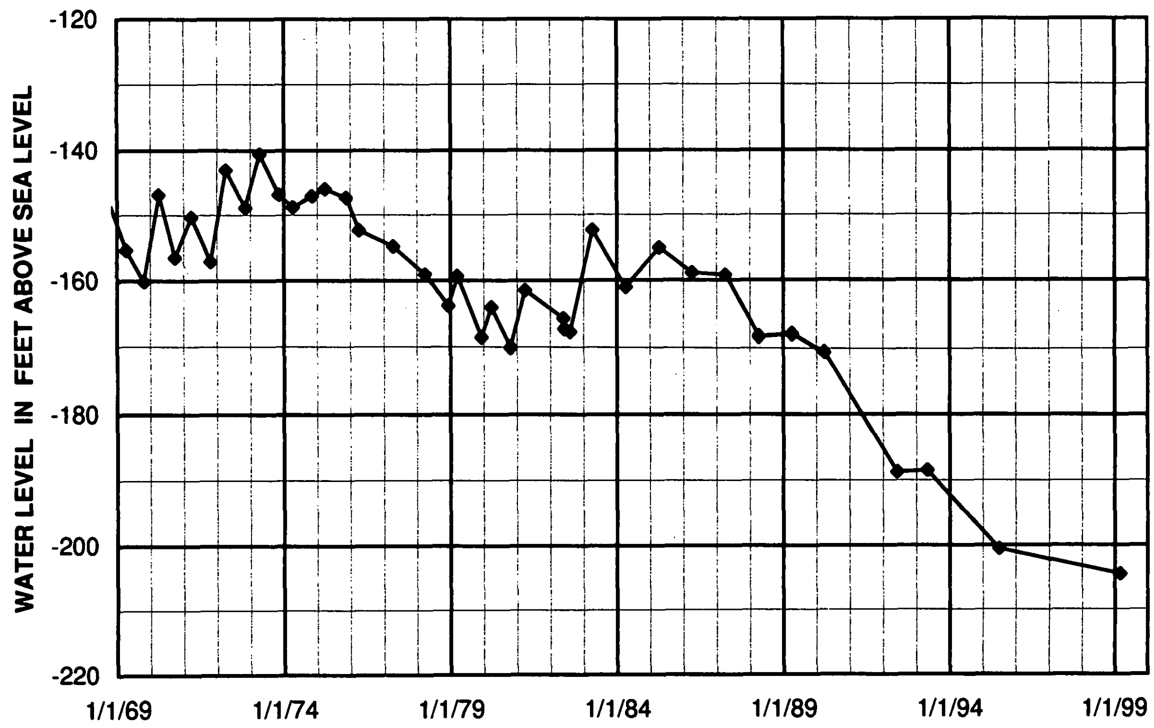


Figure 3. Water-level hydrographs for selected wells completed in the Sparta and Memphis aquifers (page 10 of 10).

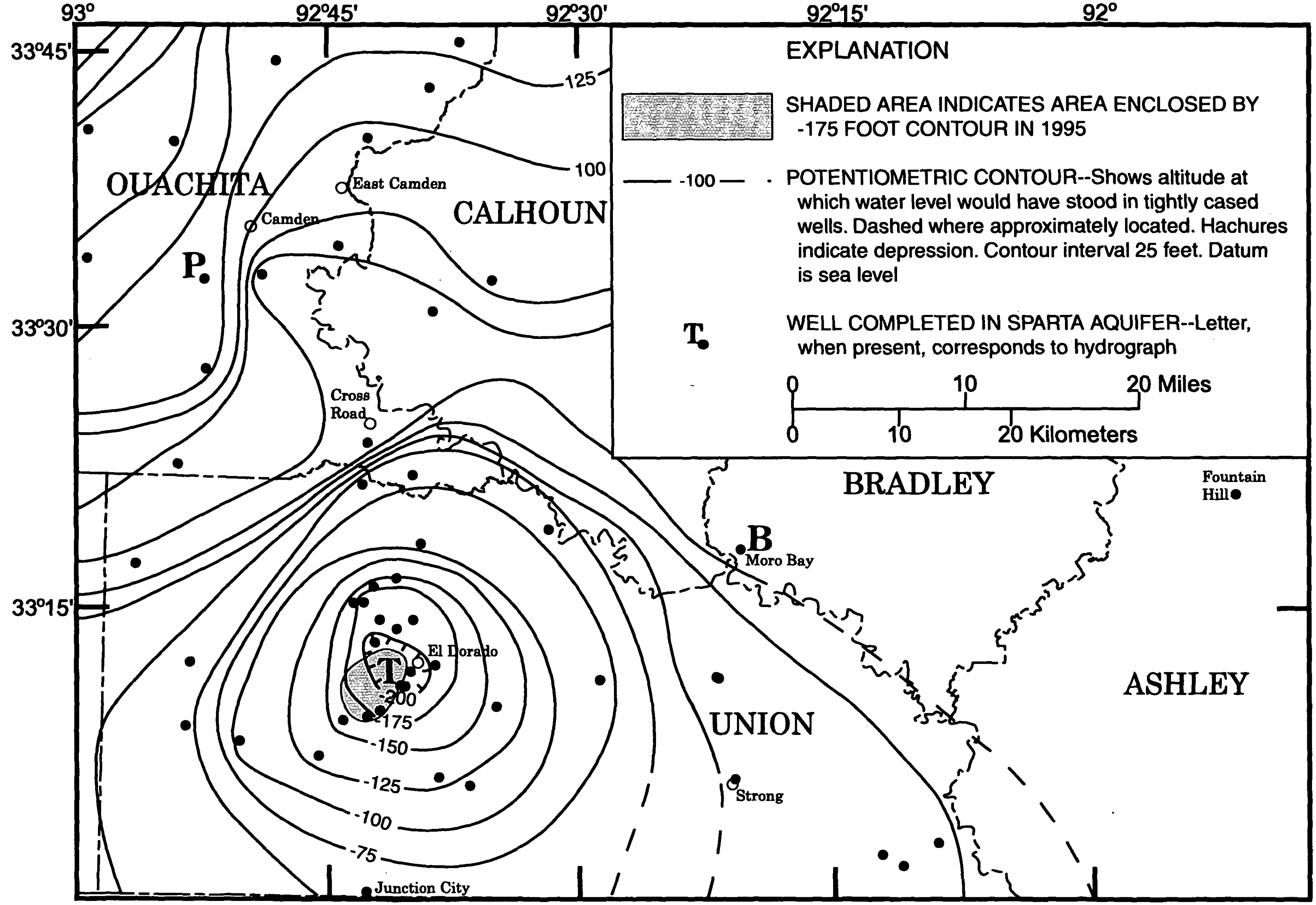


Figure 4. Comparison of Union County cone of depression, 1995 to 1999.

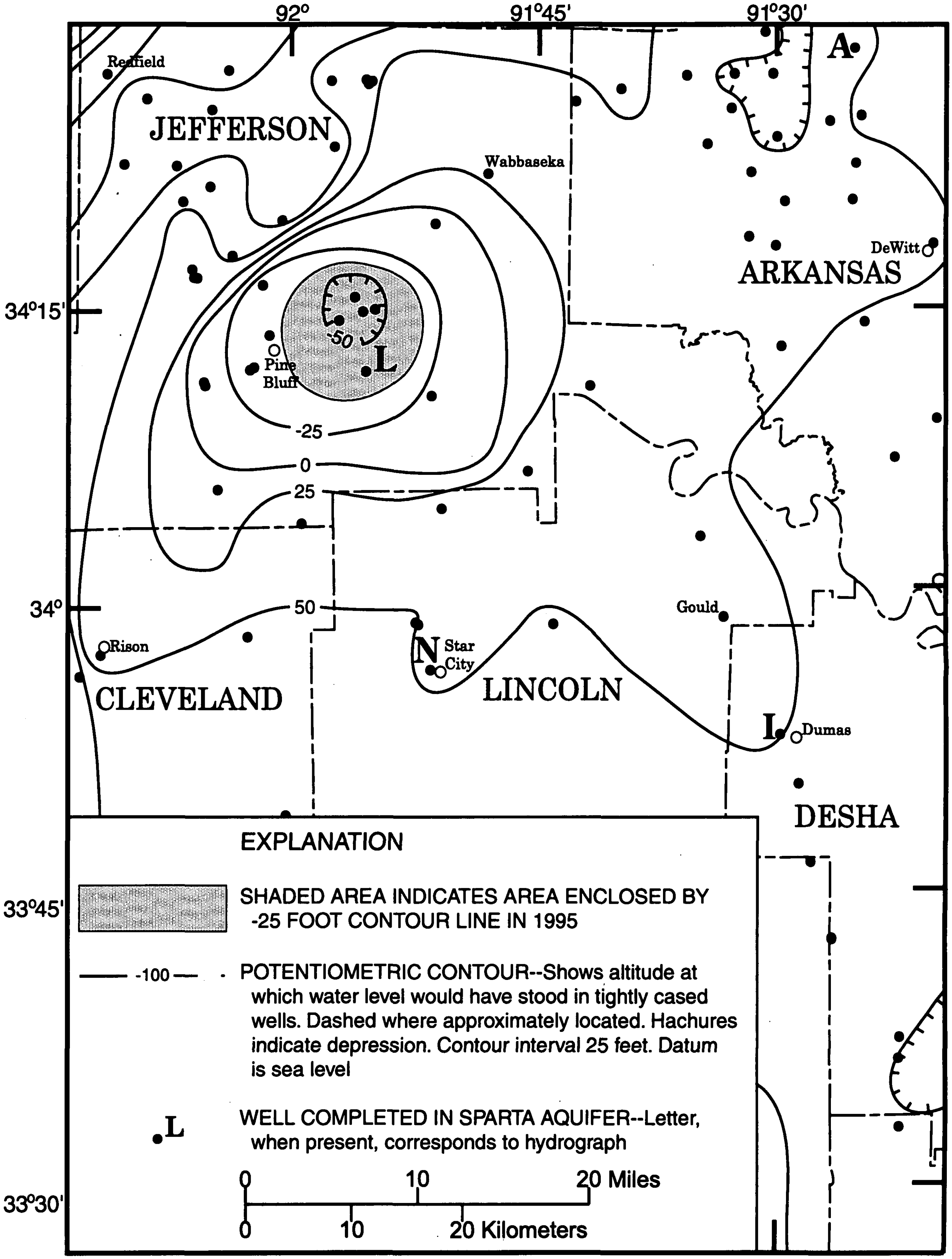


Figure 5. Comparison of Jefferson County cone of depression, 1995 to 1999.

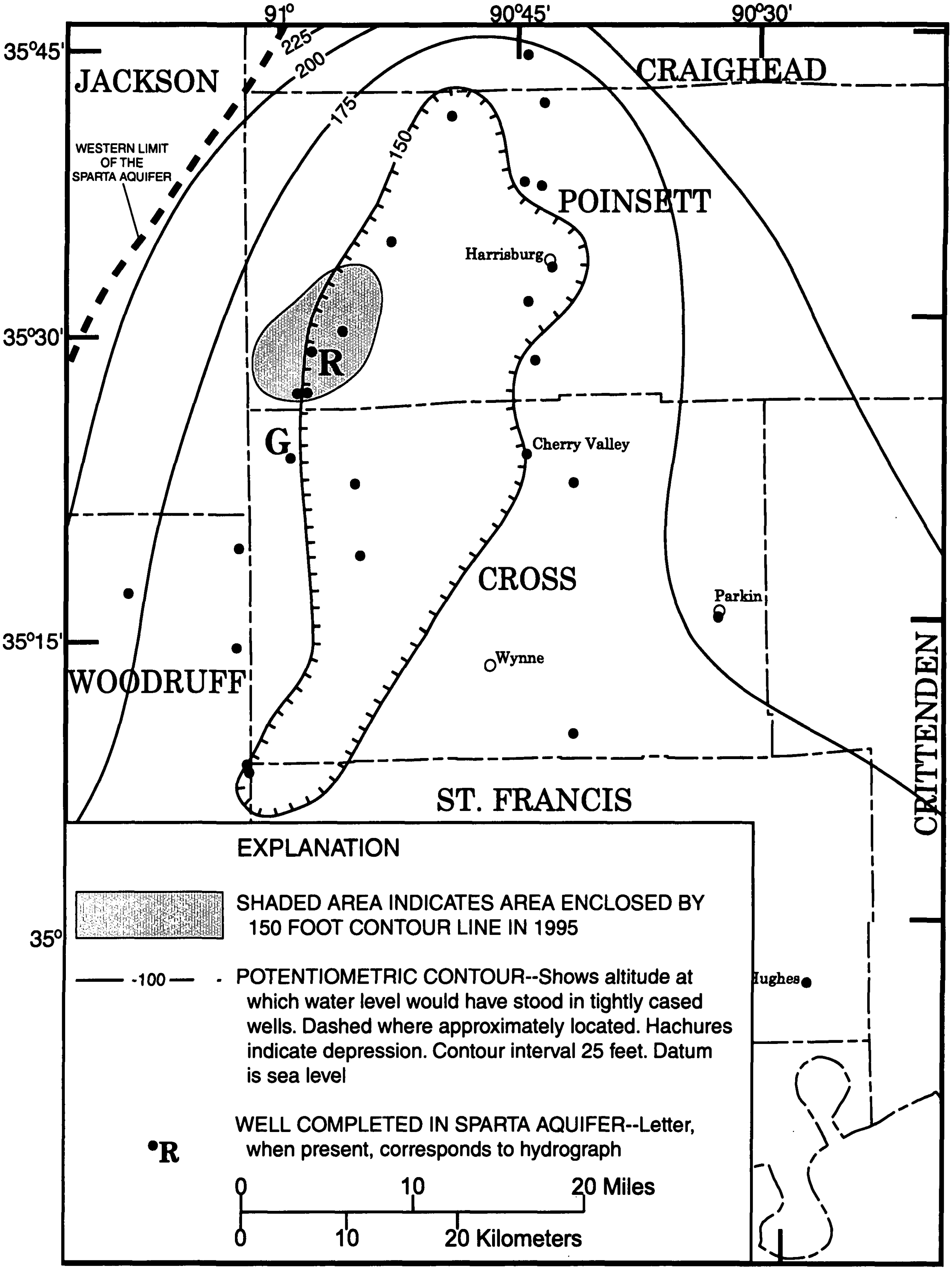


Figure 6. Comparison of Poinsett County cone of depression, 1995 to 1999.

depression appears to be expanding in area rather than deepening. Water-level decline rates in wells in adjacent counties are more than 1 ft/yr. Water-level declines have generally averaged 1.4 to 2.8 ft/yr since 1989 in wells in Cleveland, Desha, Grant, and, Lincoln Counties.

Long-term water-level changes in the cone of depression at well R (hydrograph R, fig. 6, plate 1) in Poinsett County show that water levels declined an average rate of 1.1 ft/yr since 1969. This cone of depression has expanded southward into St. Francis County and northward into Craighead County where water levels in well F (hydrograph F, fig 6., plate 1) have declined at a rate of 0.7 ft/yr during the period 1969 to 1999. The rate of decline in well F has increased to 1.0 ft/yr since 1989.

The rate of decline of the water level in well A (hydrograph A, plate 1) in Arkansas County is 2.4 ft/yr since 1969. The rate of decline for the past 11 years is 3.0 ft/yr. The rate of decline is increasing in the Arkansas County well, and the rate of decline is increasing in neighboring Lonoke County. The rate of decline in Lonoke County well O (hydrograph O, plate 1) for the past 11 years is 1.8 ft/yr. These decline rates also are illustrated by water levels decreasing to 25 ft above sea level (plate 1) and less in Arkansas County. The 25-ft contour line was not present in Arkansas County during a 1997 study of water levels in the Sparta and Memphis aquifers (Joseph, 1997).

Long-term water-level changes at well E (hydrograph E, plate 1) in Columbia County show that water levels declined an average rate of 3.0 ft/yr from 1969 to 1995. However, since 1995 water levels have recovered slightly (less than 10 ft). This increase in water levels may be a result of decreased pumpage and the use of alternative sources of water within the county.

SPECIFIC CONDUCTANCE AND DISSOLVED CHLORIDE

Water samples were collected by USGS personnel from 147 wells and measured on-site for specific conductance. Additional samples were collected at 98 wells and were analyzed for dissolved chloride at the USGS Water-Quality Laboratory in Ocala, Florida. Wells were pumped until temperature stabilized before specific conductance and dissolved chloride samples were collected.

The specific conductance of water is proportional to the concentration of dissolved solids in solution. In ground-water samples collected from wells in Union County (Broom and others, 1984), dissolved solids concentrations (in milligrams per liter) averaged about 60 percent of the specific conductance value (in microsiemens per centimeter). The specific conductance map (plate 2) shows lines of equal specific conductance of ground water in the Sparta and Memphis aquifers, in microsiemens per centimeter at 25 degrees Celsius (µS/cm). The map is based on 147 specific conductance measurements made during the period February through August 1999 from wells that are open to only the Sparta or Memphis aquifers (table 2).

Specific conductance data indicate regionally diverse zones of mineralization within the aquifers across the study area. Specific conductance ranged from 44 µS/cm in Ouachita County to 1,510 µS/cm in Lee County. The median specific conductance value collected during the study was 337 µS/cm. Along the western border of the southern two-thirds of the study area (near the recharge area), ground water in the Sparta aquifer has low specific conductance indicating low dissolved solids. These data are consistent with the potentiometric map, which shows water-level highs near the western edge of the study area. An area where the ground water has low specific conductance extends from the central portion of the western edge of the study area across Jefferson County. This feature may result from the large ground-water withdrawals and resulting cone of depression centered in Jefferson County, producing movement of less mineralized water from the recharge area toward the east-southeast. Specific conductance increases to the northeast and gradually to the south of Jefferson County. This gradual increase of specific conductance to the south continues to the Louisiana State line with a greater increase apparently corresponding to the cones of depression in Union and Columbia Counties. A possible explanation for this increase in specific conductance is leakage of water with greater conductance from an underlying aquifer. A previous study (Broom and others, 1984) documented several specific conductance values greater than 2,000 µS/cm for ground water from the Sparta aquifer in Union County in 1984.

Table 2. Water-quality data from wells completed in the Sparta and Memphis aquifers and sampled during the spring and summer of 1999

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; Cl, chloride; --, no data]

Local well number	Station number	Date	Time	Specific conductance (µS/cm)	Temperature (degrees Celsius)	Chloride, dissolved (mg/L as Cl)	Depth of well, total (feet)
		Arkansas County					
08S02W09BCC1	340030091144701	07/28/99	1530	237	24.5	--	566
08S03W04DBC1	340124091203901	07/28/99	1200	196	22.6	--	681
07S02W28ABA1	340340091141001	07/28/99	1230	290	26.1	--	690
07S03W06ABC1	340711091224801	03/24/99	1310	197	22.5	3.3	720
06S03W27BAA1	340858091200801	07/28/99	1245	220	29.1	--	665
06S02W22CDB1	340904091133101	07/28/99	1600	414	26.1	--	670
06S02W06ABB1	341228091162201	07/28/99	1649	245	29.1	--	760
05S03W04ADB1	341734091200601	03/24/99	0750	397	21.5	9.9	802
04S05W36DCC1	341752091300401	07/29/99	1620	206	26.3	3.5	880
04S01W28BAA1	341929091073901	07/29/99	1505	1,020	26.1	--	688
04S04W19CBB1	342005091292601	07/28/99	1753	301	25.7	--	1,048
04S01W04CBD1	342226091075801	03/23/99	1340	893	16.1	130	713
03S04W26CDA1	342416091243701	03/25/99	0825	443	22.6	7.6	666
03S06W30BBD1	342515091421001	03/30/99	1220	353	22.8	12	870
03S05W15CBB1	342632091322701	07/29/99	1640	344	25.8	8.9	760
03S05W18CAB1	342633091352301	07/29/99	1716	349	25.3	--	819
03S04W02CCB1	342747091245701	07/29/99	1109	485	24.5	--	721
03S04W04ABB1	342829091263201	07/30/99	0946	436	24.9	--	746
03S05W02AAB1	342839091303201	07/29/99	0755	429	24.5	--	801
02S04W31CAB1	342900091285201	07/30/99	0929	410	24.7	--	762
02S05W35AAB1	342930091303401	07/29/99	0807	430	24.5	--	761
02S05W25CCC1	342933091301601	07/29/99	0823	414	24.5	11	765
02S05W27BBB1	343028091323001	07/29/99	0730	498	24.2	--	818
02S04W23DAA1	343044091234901	07/29/99	0900	492	23.5	--	790
02S04W06CDB1	343312091284901	07/29/99	1032	464	24.3	23	840
		Ashley County					
17S09W15ACC1	331357092010901	03/09/99	0800	710	19.7	110	600
15S07W32CDD1	332117091510301	03/09/99	0850	886	21.9	36	1,000
		Bradley County					
14S09W16AAC1	332931092021801	03/05/99	0915	624	19.8	22	750
13S11W17BCD1	333453092160701	03/10/99	1440	449	23.4	16	680
13S09W06BDC1	333649092040601	03/05/99	1200	346	19.6	9.1	1,040
		Calhoun County					
14S13W12CCB1	333040092240301	03/05/99	1015	450	23	14	613
14S15W16BAA1	333055092391001	03/05/99	0830	704	18.6	81	300
13S15W36CBD1	333252092361601	03/05/99	0930	285	19.6	8.8	400
11S14W13BAA1	334616092292201	03/05/99	1510	186	18.9	21	--
11S14W12CAC3	334630092292701	03/05/99	1440	189	22.2	13	460
		Cleveland County					
11S11W16AAB1	334543092142201	03/17/99	1145	371	25.8	5.8	815
10S09W23CDC1	334917092001901	03/17/99	1430	192	24.4	1.8	638
09S11W01DCA1	335728092113301	03/17/99	0800	286	18.7	3.9	558

Table 2. Water-quality data from wells completed in the Sparta and Memphis aquifers and sampled during the spring and summer of 1999--Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; Cl, chloride; --, no data]

Local well number	Station number	Date	Time	Specific conductance (µS/cm)	Temperature (degrees Celsius)	Chloride, dissolved (mg/L as Cl)	Depth of well, total (feet)
09S09W04BBD1	335816092023701	03/17/99	1400	176	25	2.0	725
Columbia County							
19S20W09CAC1	330555093112801	02/26/99	0930	231	21.5	3.1	623
19S23W11CDA2	330609093274302	02/23/99	1405	214	20.5	3.9	385
18S22W27DDD1	330834093215801	02/26/99	0815	139	20.2	2.8	516
18S20W18ABD1	331039093125501	02/25/99	0935	264	21.5	2.9	578
18S20W06DDC1	331142093124801	05/18/99	0830	305	21.3	4.0	502
17S19W09CBA1	331432093070401	02/19/99	1150	366	11.8	5.1	--
17S19W18CBD1	331512093065801	04/27/99	1445	453	21.5	9.7	450
17S20W17CDA1	331519093115901	02/19/99	0855	341	19.6	8.9	495
17S20W13CB1	331533093080701	02/19/99	0930	468	16.7	16	--
17S19W15AAB1	331545093031801	02/25/99	1520	444	22.6	9.6	580
15S20W20CCB1	332453093121501	02/18/99	0930	300	13.2	8.2	320
Craighead County							
14N04E28DBD1	354839090403301	04/14/99	0858	172	16.4	10	210
14N04E22CBD1	354929090392201	04/14/99	0935	146	16	9.9	240
Crittenden County							
06N09E23AAB1	350744090055601	04/06/99	1215	352	17.4	32	338
Cross County							
07N05E04ADD1	351544090334101	04/07/99	1510	216	21	2.5	462
09N04E30DCA1	352231090421501	04/07/99	1000	597	22	2.8	1,148
09N03E22AAD1	352359090451401	04/07/99	1050	365	19.1	3.5	367
09N03E22ABD1	352403090451801	04/07/99	1115	364	18	3.2	--
09N01E16CAC1	352403090594901	04/07/99	1230	530	18.9	9.5	400
Dallas County							
10S13W34ACA4	334832092245504	03/18/99	1010	271	17.9	5.5	667
09S16W19CAA1	335605092470101	08/04/99	0925	104	21.6	--	28.2
09S14W01BDC1	335753092291801	08/04/99	1310	310	19.2	--	190
08S16W18ACC1	340152092463901	08/04/99	1145	96	23.7	--	23
07S16W20CAB1	340559092454101	08/04/99	1200	102	21	--	37.6
Desha County							
12S01W32CDB1	333629091124401	06/23/99	1030	364	23.4	14	495
12S03W34DAD1	333636091230401	03/18/99	1030	371	25.3	9.8	796
11S01W31BBB1	334223091142101	03/18/99	1210	292	23.5	6.7	753
09S02W26AAC1	335341091152201	03/19/99	0830	251	20.9	9.8	626
Drew County							
13S05W36ACB1	333154091340401	03/09/99	1145	338	23.8	7.9	692
13S07W10BCA1	333534091485201	03/10/99	0930	321	21.3	11	830
12S06W30BBD1	333803091454201	03/10/99	0945	263	21.4	3.7	779
11S05W21CDC1	334352091372401	03/09/99	1305	299	17.2	3.7	770
11S07W22BBC1	334444091491501	03/10/99	1235	207	21.3	1.9	850
Grant County							
06S15W26ACA1	341024092354501	08/04/99	1350	62	18.8	--	172
06S11W05ACA1	341341092141401	08/04/99	1650	129	26.9	--	1,081

Table 2. Water-quality data from wells completed in the Sparta and Memphis aquifers and sampled during the spring and summer of 1999--Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; Cl, chloride; --, no data]

Local well number	Station number	Date	Time	Specific conductance (µS/cm)	Temperature (degrees Celsius)	Chloride, dissolved (mg/L as Cl)	Depth of well, total (feet)
05S13W07ADB1	341812092265301	08/04/99	1450	149	24.8	--	452
05S14W06DCC1	341841092332001	03/19/99	1123	100	19.2	5.1	370
05S13W03DBC1	341845092235901	03/19/99	1525	79	21.3	4.4	569
05S15W05ABD1	341923092382501	08/04/99	1415	187	22.8	--	190
04S14W14DCD1	342201092293101	08/04/99	1520	105	25.6	--	310
03S14W35DCA1	342445092284501	08/04/99	1555	68	24.2	--	190
		Jefferson County					
07S10W24CAC1	340547092042001	03/24/99	1150	197	24.3	1.4	836
06S10W23DBA1	341105092050201	08/05/99	1030	175	26.4	--	--
06S10W23ACD1	341117092050401	08/05/99	1015	182	24.7	--	766
06S10W23ACA2	341118092050101	08/05/99	1010	170	26.5	--	849
06S09W17CCB1	341147092022301	07/22/99	1005	151	26.2	--	863
05S09W31DDC1	341336092010901	08/05/99	1110	129	26.6	--	--
05S10W16DBD1	341634092053401	03/26/99	1045	106	17.5	2.8	865
05S10W16DBB1	341639092053901	08/05/99	1205	93	25.2	--	904
04S08W35BBD1	341918091504901	08/05/99	0815	148	24.8	--	1,011
04S07W17BCC1	342140091474101	08/05/99	0830	142	23.5	--	756
04S11W14BAD1	342218092095701	03/30/99	1512	87	22.4	3.1	854
03S11W22ABC1	342644092105501	08/05/99	1230	76	23.3	--	707
		Lafayette County					
20S23W05ADB1	330223093303301	02/17/99	0815	279	19	6.3	231
19S23W29BDB1	330351093310301	02/17/99	0750	240	19	4.1	250
		Lee County					
03N03E28CDB1	345011090474901	07/01/99	1517	1,510	26.3	--	592
		Lincoln County					
09S07W07DAD1	335631091512101	03/11/99	0810	206	21.2	1.4	1,052
08S08W35DCB1	335858091522201	03/11/99	1000	200	26	1.3	1,062
08S05W35ACC1	335907091333301	03/19/99	0945	235	24.5	6.4	836
08S08W35DBB1	335955091530101	03/11/99	0930	200	25.6	1.3	974
08S04W22AAA1	340200091280001	03/16/99	1700	238	14.2	4.0	812
08S05W03BAA2	340345091344602	03/16/99	1630	205	25.1	9.8	760
07S07W30CDC1	340444091504201	03/11/99	1520	208	21	1.1	1,350
07S06W33BAA1	340445091414001	03/19/99	1100	199	23.6	1.4	816
		Lonoke County					
02S07W08DCC1	343235091470001	04/13/99	1215	400	21	4.3	552
02N08W20BCD1	344708091533501	06/23/99	0942	376	--	--	--
02N08W20BCA1	344710091533001	06/23/99	0948	367	--	--	--
02N07W09AAA1	344906091450001	07/09/99	0945	415	20.1	--	568
03N08W23DDD1	345152091502501	04/13/99	1630	273	18.8	12	320
		Monroe County					
01S02W22DBB1	343548091121201	04/01/99	0840	852	16.8	84	625
01N03W14CCB1	344145091175601	03/31/99	1630	1,000	20.5	160	595
04N02W30BAD1	345616091150201	04/01/99	1230	195	17.8	5.4	285

Table 2. Water-quality data from wells completed in the Sparta and Memphis aquifers and sampled during the spring and summer of 1999--Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; Cl, chloride; --, no data]

Local well number	Station number	Date	Time	Specific conductance (µS/cm)	Temperature (degrees Celsius)	Chloride, dissolved (mg/L as Cl)	Depth of well, total (feet)
		Nevada County					
14S21W20AAB1	333050093172301	03/09/99	1450	206	18	4.3	190
		Ouachita County					
15S18W36ADD1	332305092543401	08/03/99	1350	381	19.5	--	220
15S19W10DCC1	332618093031801	08/03/99	1320	188	21.9	--	375
14S17W02ABB1	333252092492601	03/12/99	0720	707	18.7	110	278
13S16W28ADD1	333416092445101	08/04/99	0745	618	21.8	--	190
13S19W28BCD1	333435093041701	08/03/99	1105	63	19	--	52
12S19W13BBC1	334137093013401	08/03/99	1000	44	18.8	--	42
		Phillips County					
04S02E25CCC1	341822090512401	03/23/99	0915	1,230	21.6	170	930
03S05E05BAB1	342754090362101	03/02/99	1640	821	19.3	37	514
02S02E01ADC1	343322090505601	03/22/99	1300	993	20.6	73	686
01S03E34DDC1	343323090462101	03/22/99	1245	977	20.6	72	626
		Poinsett County					
10N01E15DBB1	352930090582501	04/13/99	0825	537	17.1	21	302
11N03E25BDD2	353220090431901	04/13/99	1210	503	17.9	4.3	277
		Prairie County					
01S06W11DBD1	343748091365401	06/17/99	1300	674	21.4	--	618
02N06W21DAD1	344644091382801	06/17/99	0925	500	19.9	--	314
02N06W22BDD1	344653091380001	06/17/99	0905	576	20.6	--	451
02N06W20BCB1	344704091403301	06/17/99	1000	355	21.1	--	330
02N05W17CCA1	344730091335001	06/23/99	1325	770	--	--	--
		Union County					
19S11W25AAA1	330219092111201	04/28/99	0833	1,180	22	220	529
18S15W35DAC1	330631092370801	04/28/99	1421	742	23.9	110	685
18S15W33ADA1	330657092385901	04/28/99	1403	668	25.5	96	752
18S16W28BBB1	330809092461101	03/02/99	1000	548	23.3	27	636
18S16W11DAB1	331011092431701	03/02/99	0915	532	23.5	36	767
18S16W12ACB1	331024092422901	03/02/99	0815	575	22.1	33	797
18S14W06CCA1	331040092353101	03/04/99	0900	726	--	78	783
18S18W11ACA1	331057092555901	03/01/99	1615	352	24.5	13	634
17S13W31BAC1	331205092291601	04/28/99	1045	740	25.1	95	772
17S12W31AAA1	331206092222501	04/28/99	0930	734	24.9	110	--
17S17W30DCD1	331351092572701	03/01/99	1540	328	25	10	690
17S16W24BDB1	331358092424301	03/04/99	1030	436	21.7	23	615
16S18W34ABC1	331805092570901	03/01/99	1400	319	22.8	5.8	430
16S18W35BBB1	331808092563801	03/01/99	1430	337	22.5	7.2	480
16S15W20DAA1	331900092395602	03/03/99	1515	504	--	33	603
16S14W15CAB1	331944092321701	04/28/99	1202	593	21.9	61	466
		Woodruff County					
05N02W31DCB3	350026091145401	04/05/99	1015	225	18.7	1.3	259
05N01W08CBC1	350356091073701	04/05/99	1140	505	19.4	3.8	--

Elevated levels of specific conductance occur in Arkansas, Lee, Monroe, Phillips, and Union Counties where values exceeded 1,000 µS/cm. "Historic" data recorded anomalous highs in specific conductance ranging from 1,500 to 4,000 µS/cm near Brinkley, Arkansas, in Monroe County (Morris and Bush, 1986). Morris and Bush (1986) cited upward leakage of saltwater from the Nacatoch aquifer into the Sparta aquifer via a fault or abandoned oil and gas wells as possible explanations for these anomalies.

Dissolved chloride concentrations ranged from 1.1 mg/L at a well in Lincoln County to 220 mg/L at a well in Union County. Dissolved chloride concentrations greater than 30 mg/L generally coincided with water samples that had specific conductance measurements greater than 700 µS/cm. The median dissolved chloride concentration of the 98 samples collected was 8.9 mg/L. Elevated dissolved chloride and specific conductance values were generally associated with wells located in areas where previous studies have documented elevated specific conductance values.

SUMMARY

The Sparta and Memphis aquifers are the second most productive source of ground water in Arkansas. Major withdrawals are made from the aquifers for industrial and public supply, with lesser but locally significant withdrawals for agricultural uses. An estimated 284 Mgal/d was withdrawn from the Sparta and Memphis aquifers in 1995, an increase of about 61 Mgal/d from 1990.

During the spring of 1999, the water level in the Sparta and Memphis aquifers was measured in 321 wells in eastern and south-central Arkansas. The altitude of water levels ranged from 214 ft below sea level to 332 ft above sea level. Specific conductance was measured in water samples collected during the spring and summer from 147 wells and dissolved chloride samples were collected from 98 wells. Specific conductance from water samples collected ranged from 44 µS/cm to 1,510 µS/cm. Dissolved chloride concentrations ranged from 1.1 mg/L to 220 mg/L.

The regional direction of ground-water flow in Arkansas is from the north and west to the south and east, away from the recharge zone of the outcrop and subcrop area, except near areas affected by intense ground-water withdrawals; such areas are characterized by large cones of depression centered in Columbia, Jefferson, and Union Counties. Heavy pumpage locally has altered or reversed the natural direction of flow in some areas. Flow in these areas is toward the cones of depression at the center of pumping. Comparison of potentiometric-surface maps through time shows that the cones of depression in Columbia and Union Counties are coalescing at or near the Columbia and Union County line.

Long-term hydrographs of 20 wells indicate trends of water-level decline over a 31-year history. During the period 1969-1999, average water-level declines generally were less than 0.7 ft/yr in Ouachita, Lee, Craighead, Drew, and Phillips Counties, between 0.7 and 1.1 ft/yr in Dallas, Bradley, Prairie, Cross, Poinsett, and Cleveland Counties, and more than 2.0 ft/yr in Arkansas and Columbia Counties.

Analysis of 1995 and 1999 water-level data from counties with cones of depressions reveals that water levels continued to decline in three cones of depression, one new cone of depression has been documented, and water levels increased in one cone of depression. Water levels declined an average of 2.5 ft/yr in Union County, 1.4 ft/yr in Jefferson County, and 1.7 ft/yr in Cross County since 1995. One new cone of depression has formed in Arkansas County since 1995. Water levels declined 4.0 ft/yr in Arkansas County since 1995. However, water levels appear to be increasing in Columbia County where the same 11 wells were monitored in both 1995 and 1999, and water levels have recovered slightly.

Specific conductance measurements from water samples collected during the study ranged from 44 µS/cm at a well in Ouachita County to 1,510 µS/cm at a well in Lee County. Dissolved chloride concentrations ranged from 1.1 mg/L at a well in Lincoln County to 220 mg/L at a well in Union County. The high chloride concentrations generally coincide with wells that had a specific conductance greater than 700 µS/cm.

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