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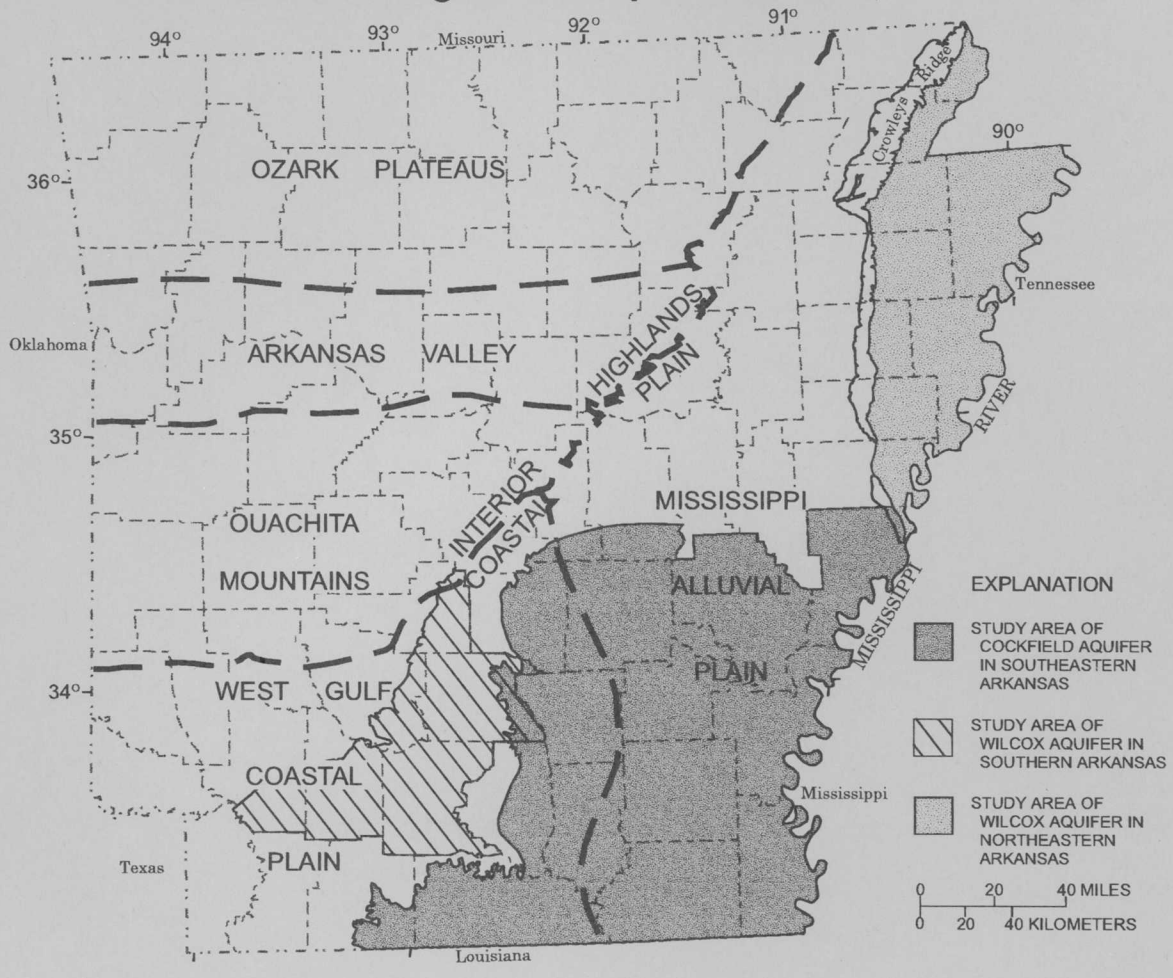
POTENTIOMETRIC SURFACE OF THE COCKFIELD AQUIFER IN SOUTHEASTERN ARKANSAS AND THE WILCOX AQUIFERS IN SOUTHERN AND NORTHEASTERN ARKANSAS, OCTOBER 1996-JULY 1997

Water-Resources Investigations Report 98-4084



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

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Little Rock, Arkansas
1998

U.S. DEPARTMENT OF THE INTERIOR
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CONTENTS

PLATES

ILLUSTRATIONS

TABLES

POTENTIOMETRIC SURFACE OF THE COCKFIELD AQUIFER IN SOUTHEASTERN ARKANSAS AND THE WILCOX AQUIFERS IN SOUTHERN AND NORTHEASTERN ARKANSAS, OCTOBER 1996-JULY 1997

by Robert L. Joseph

ABSTRACT

The Cockfield and Wilcox aquifers are secondary sources of water for local use in southern and northeastern Arkansas, where in 1995 more than 51 million gallons per day of water was withdrawn. During October 1996 to July 1997, water levels in the Cockfield and Wilcox aquifers were measured in 104 wells in Arkansas. The potentiometric surface data reveal spatial trends in both aquifers across the study areas.

The regional direction of ground-water flow of the Cockfield aquifer is generally southeastward, away from the outcrop area, except where affected by intense ground-water withdrawals. 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 centers of pumping within cones of depression. A cone of depression caused by the pumpage near Greenville, Mississippi, extends into Chicot, Desha, and Drew Counties. This cone of depression has altered flow patterns in southeastern Arkansas. Long-term hydrographs of six wells, during the period 1971-1996, showed water levels declined at an average rate between 0.5 and 1.0 foot per year at these locations.

The regional direction of ground-water flow in the Wilcox aquifers is generally toward the east and south, away from the outcrop except where water levels are affected by intense ground-water withdrawals. The potentiometric surface indicates that heavy pumpage has altered or reversed the natural direction of ground-water flow in some areas. Flow in these areas is toward centers of pumping within cones of depression. Two cones of depression are centered in the vicinity of Paragould and West Memphis, Arkansas, where ground-water withdrawals have altered the natural direction of flow. Long-term hydrographs of seven wells, during the period 1971-1996, show water-level declines in the Wilcox aquifer in northeastern Arkansas generally were between 0.5 and 1.0 foot per year but were more than 1.0 foot per year in two wells.

The U.S. Geological Survey in cooperation with the Arkansas Soil and Water Conservation Commission and the Arkansas Geological Commission has monitored water levels in the Cockfield and Wilcox aquifers since the 1960's. During October 1996 to July 1997, 53 water-level measurements were made in wells completed in the Cockfield aquifer, 13 water-level measurements were made in wells completed in the Wilcox aquifer in southern Arkansas, and 38 water-level measurements were made in wells completed in the Wilcox aquifer in northeastern Arkansas. The purpose of these measurements was to provide information to describe the recent potentiometric surfaces and long-term water-level trends in the Cockfield and Wilcox aquifers. This report presents the results as potentiometric surface maps and as long-term water-level hydrographs.

INTRODUCTION

The Cockfield and Wilcox aquifers are secondary sources of water for local use in southern and northeastern Arkansas, where in 1995 more than 51 million gallons per day (Mgal/d) of water was withdrawn from these aquifers (T.W. Holland, U.S. Geological Survey, written commun., 1997). Major withdrawals are made from the aquifers for industrial and public supplies, with lesser but locally significant withdrawals for domestic and livestock uses.

The areas of water-level measurements (study areas) as shown in figure 1 and plates 1-3 include much of the West Gulf Coastal Plain and the Mississippi Alluvial Plain physiographic sections in Arkansas. The study area of the Cockfield aquifer in southeastern Arkansas is bounded on the east by the Mississippi State line and on the south by the Louisiana State line. The western and northern boundaries are defined by the western and northern extent of the outcrop and subcrop (Hosman, 1982) of the Cockfield Formation. The study area of the Wilcox aquifer in southern Arkansas is defined by the outcrop of the Wilcox Formation and the existence of monitoring wells in Clark, Dallas, Hempstead, Hot Spring, Nevada, and Ouachita Counties. The study area of the Wilcox aquifer in northeastern Arkansas is bounded on the north by the Missouri State line and on the east by the Tennessee State line. The western boundary of the study area is defined by the existence of monitoring wells that fully penetrate the Wilcox aquifer.

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 number; the range number; the section number; three letters which indicate, respectively, the quarter section, the quarter-quarter section, and the quarter-quarter-quarter section in which the well is located; and a 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.

COCKFIELD AQUIFER

The Cockfield aquifer comprises the Cockfield Formation of Eocene age, which generally consists of discontinuous fine- to medium-grained sand interbedded with silt, clay, and lignite, all of nonmarine origin. Most of the sand beds, which constitute the aquifer media, are found near the base of the Cockfield Formation. The Cockfield Formation generally ranges from 100 to 400 feet (ft) in thickness near the outcrop area but thickens downdip of the outcrop area and reaches 625 ft in thickness in northeastern Chicot County (Onellion and Criner, 1955). Total sand thickness in the Cockfield Formation generally ranges from 20 to 150 ft. The nonmarine sediments of the Cockfield Formation are underlain and, for much of the area, overlain by fine-grained sediments of marine origin. The Cockfield Formation is underlain throughout the area by calcareous and sandy marl, limestone, or carbonaceous clay of the Cook Mountain Formation. Throughout much of southeastern Arkansas, the Cockfield Formation is overlain by the silty clays of the Jackson Group. Sand beds at the base of the overlying Jackson Group in parts of southeastern Arkansas may be in hydraulic connection with the Cockfield aquifer.

The Cockfield Formation crops out over much of southeastern Arkansas and yields relatively minor quantities of water in this area. In the subcrop area, the Cockfield Formation is overlain by terrace deposits and alluvium of Quaternary age. The terrace deposits may attain a thickness of 40 ft, and as much as 60 ft of alluvium overlies the Cockfield Formation in some of the larger river valleys. The Cockfield Formation dips southeastward from the outcrop area and is confined by the Jackson Group in much of the area. In the outcrop of the Cockfield Formation, water table conditions commonly occur at shallow depth. In the confined part of the aquifer, water levels can be near, or above, land surface. Yields of most wells in the outcrop areas are small, less than 30 gallons per minute (gal/min), but in other areas, properly constructed wells screened the full thickness of the aquifer often yield 100 to 500 gal/min (Westerfield, 1994).

The Cockfield aquifer is recharged in the outcrop area and may discharge water to other units as water moves downdip. Most recharge to the Cockfield aquifer occurs by infiltration of rainfall on the upland outcrop areas and by inflow from the overlying alluvium (Ackerman, 1987). The direction of regional water movement generally is southeastward. Most discharge is to rivers in outcrop areas, to vertically adjacent units

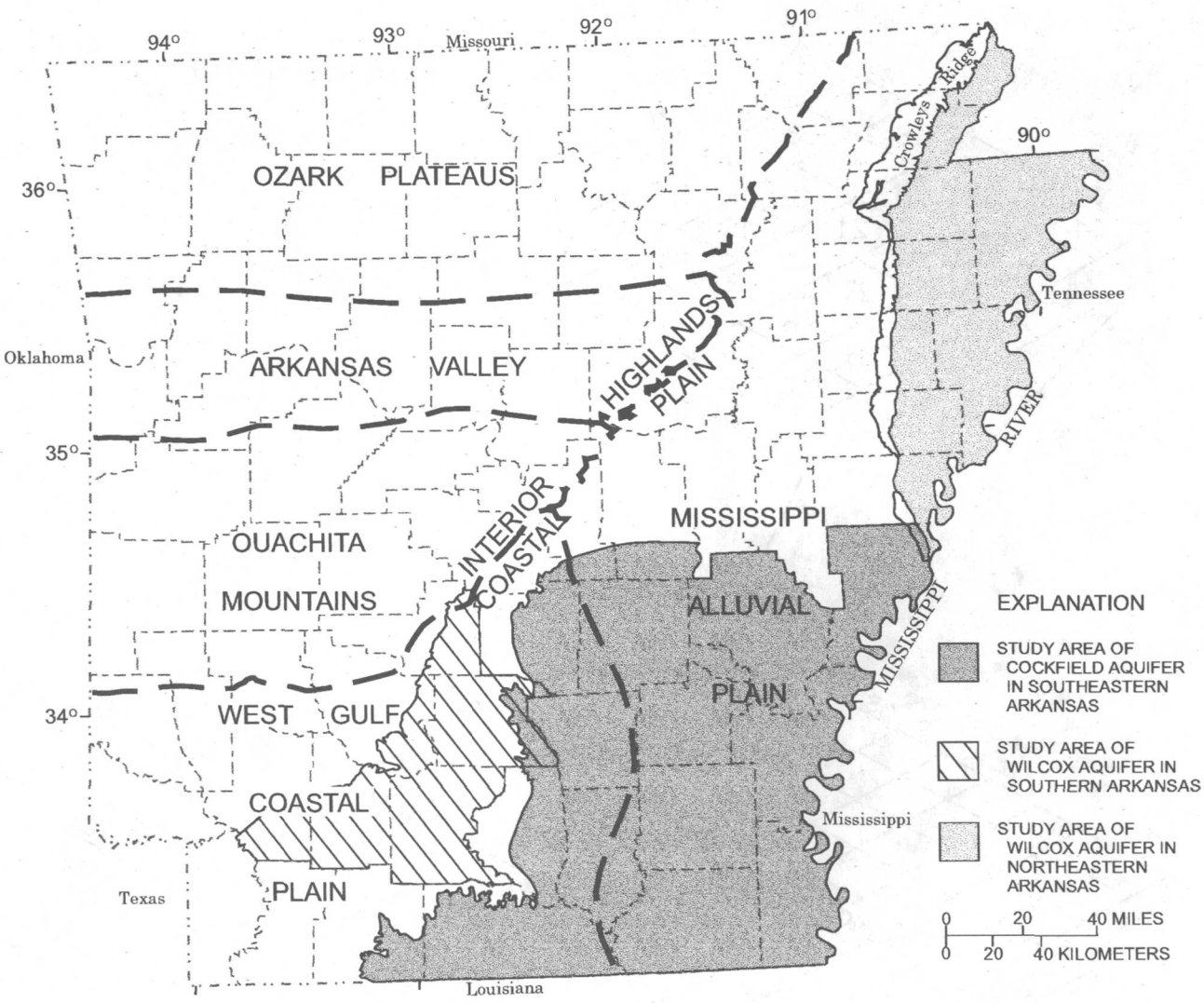


Figure 1. Location of study areas.

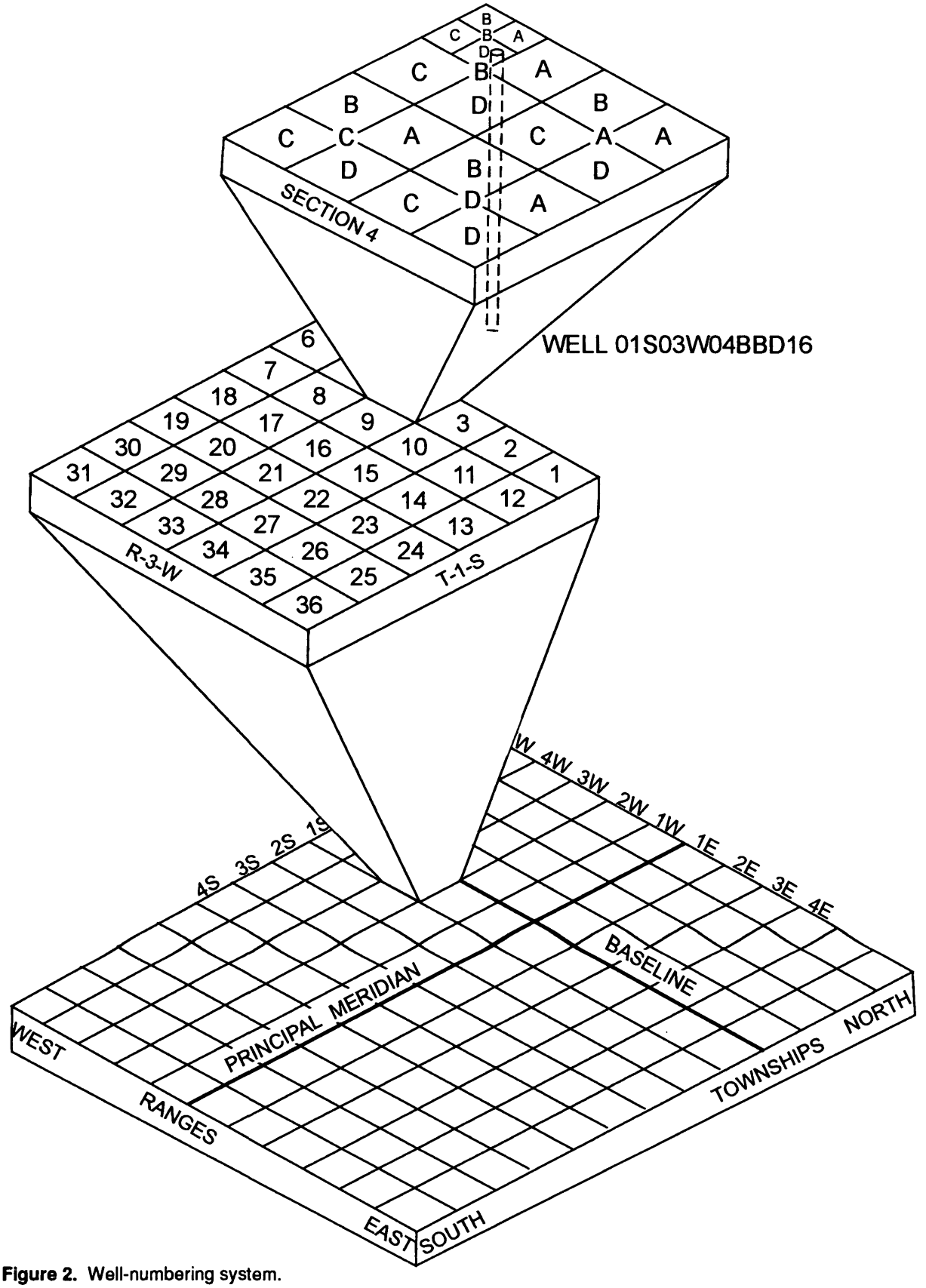


Figure 2. Well-numbering system.

where the Cockfield aquifer is confined, and to wells (Ackerman, 1987).

Withdrawals from the Cockfield aquifer in Arkansas increased 21 percent between 1990 and 1995. Withdrawals from the Cockfield aquifer in Arkansas totaled 9.8 Mgal/d in 1995 (T.W. Holland, U.S. Geological Survey, written commun., 1997), an increase of 1.7 Mgal/d from 1990 (Holland, 1993). An estimated 18 Mgal/d was pumped from the Cockfield aquifer in Mississippi in 1995. In the vicinity of Greenville, Mississippi, immediately across the State line, pumpage from the Cockfield aquifer totaled about 8.2 Mgal/d in 1995 (D.E. Burt, U.S. Geological Survey, written commun., 1997). Most wells completed in the Cockfield aquifer in the study area provide small volumes of water for domestic and livestock use. In some locations, the Cockfield aquifer yields volumes large enough to supply industrial, municipal, and public supply systems.

Potentiometric Surface

The potentiometric-surface map shows the altitude to which water will rise in tightly cased wells screened in the Cockfield aquifer (plate 1). The map is based upon water-level data collected at 53 wells in the Cockfield aquifer during October 1996 to July 1997 in southeastern Arkansas (table 1). The potentiometric surface is mapped by determining the altitude of the water levels measured in wells and is represented on the map by contours that connect points of equal value. The direction of ground-water flow in the Cockfield aquifer is perpendicular to the contours in the direction of downward gradient. The potentiometric surface data reveal spatial trends across the study area.

The regional direction of ground-water flow is generally toward the east and south, away from the outcrop, except where affected by intense ground-water withdrawals. The lowest water-level altitudes measured were 72 ft above sea level in Chicot and Desha Counties; the highest water-level altitude measured was 353 ft above sea level in Columbia County in the outcrop area. The potentiometric surface indicates that heavy pumpage has altered or reversed the natural direction of ground-water flow in some areas. Flow in these areas is toward centers of pumping within cones of depression. A cone of depression caused by the pumpage near Greenville, Mississippi (Wasson, 1981), extends into Chicot, Desha, and Drew Counties in southeastern Arkansas. This cone of depression has altered flow patterns in southeastern Arkansas.

Table 1. Information pertaining to measured wells completed in the Cockfield aquifer in southeastern Arkansas

[In this report, sea level refers to the 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]

Local well number	Latitude	Longitude	Water level altitude (feet above sea level)	Depth to water level (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measurement
			Arkansas			
08S02W04ACA1	340138	0911405	82	83.07	165	01-02-97
			Ashley			
19S05W12CAC1	330335	0913426	84	30.90	115	11-22-96
18S04W19DAA2	330720	0913246	88	28.45	116	11-22-96
18S08W04BBC1	331037	0915626	83	66.39	149	11-22-96
17S04W10BCD2	331416	0913028	96	28.94	125	11-22-96
17S06W07ADA1	331442	0914510	105	69.27	174	11-22-96
15S04W26CBC1	332154	0912928	93	35.18	128	11-22-96
			Bradley			
16S10W11DCB1	331949	0920617	109	43.39	152	11-08-96

Table 1. Information pertaining to measured wells completed in the Cockfield aquifer in southeastern Arkansas--Continued

[In this report, sea level refers to the 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]

Local well number	Latitude	Longitude	Water level altitude (feet above sea level)	Depth to water level (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measure-ment
16S11W11ACA1	332026	0921223	108	32.77	141	11-08-96
15S12W11CAB1	332536	0921857	131	24.18	155	11-08-96
14S10W31DBA1	332658	0921026	99	94.16	193	11-08-96
			Calhoun			
14S13W29ADA1	332828	0922721	133	27.08	160	11-06-96
14S14W21ACB1	332932	0923250	118	13.65	132	01-03-97
13S14W13ACC1	333525	0922934	182	32.82	215	03-19-97
11S13W15BBC1	334558	0922533	256	54.21	310	11-06-96
			Chicot			
18S02W25ABB3	330640	0911541	90	44.60	135	11-25-96
18S02W24CDB1	330645	0911549	83	46.48	129	03-20-97
18S03W14CCC1	330731	0912318	85	12.69	98	01-02-97
16S02W04BAC1	332030	0911854	88	37.18	125	11-25-96
15S03W21ABA1	332317	0912436	87	34.61	122	11-26-96
14S03W05BBA1	333104	0912600	72	66.70	139	11-26-96
13S03W26BBB1	333244	0912259	79	60.08	139	03-24-97
			Cleveland			
11S11W23BBD1	334449	0921256	233	42.18	275	11-21-96
11S09W02ABD1	334725	0915954	104	116.44	220	11-21-96
08S13W34BDA1	335854	0922444	159	89.21	248	11-06-96
08S11W02BCB1	340334	0921152	99	145.89	245	11-21-96
			Columbia			
19S20W34ADC1	330233	0930958	292	21.05	313	11-05-96
19S21W35ADC1	330245	0931510	255	1.07	256	11-05-96
19S22W36DBB1	330246	0932033	310	40.51	351	11-05-96
19S21W17CBB1	330520	0931856	260	46.48	306	11-05-96
17S20W35BBD1	331312	0930914	353	8.11	361	11-05-96
			Desha			
13S02W08CAA1	333502	0911932	127	19.68	147	11-26-96
12S01W32DCA1	333624	0911242	72	63.51	136	03-24-97
12S03W30ADC1	333830	0912630	134	18.68	153	11-26-96

Table 1. Information pertaining to measured wells completed in the Cockfield aquifer in southeastern Arkansas--Continued

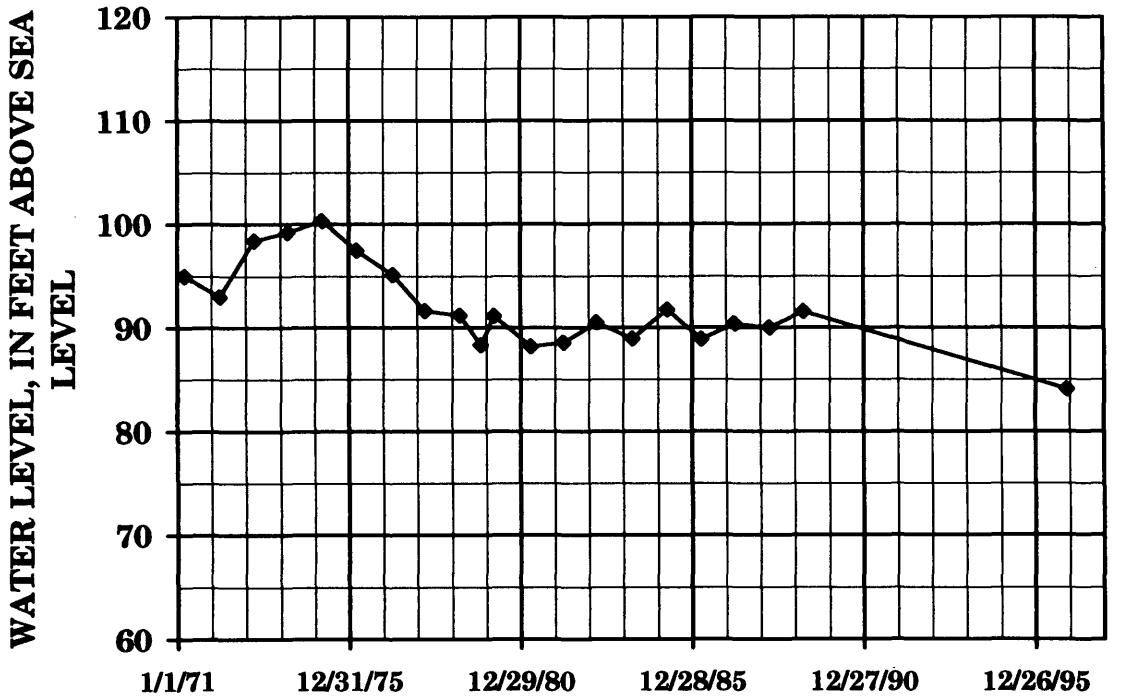
[In this report, sea level refers to the National Geodetic Vertical Datum of 1929—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929]

Local well number	Latitude	Longitude	Water level altitude (feet above sea level)	Depth to water level (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measure-ment
11S02W03ABC1	334630	0911600	142	8.13	150	11-27-96
09S04W21ADD1	335410	0913033	129	31.88	161	11-27-96
			Drew			
14S07W26BAB1	332759	0914749	111	118.73	230	11-26-96
12S08W33AAB1	333749	0915542	80	93.49	173	03-20-97
11S05W35DDB1	334201	0913449	123	57.20	180	11-26-96
			Lincoln			
09S05W24BAA1	335451	0913340	144	26.40	170	11-11-96
08S04W05CCC1	340257	0913057	100	69.64	170	11-04-96
07S06W13BBC1	340715	0913922	164	18.12	182	11-04-96
			Lonoke			
02S09W15BBB2	343246	0915823	167	59.06	226	01-24-97
			Union			
19S12W28CBA1	330201	0922111	191	8.99	200	11-14-96
19S18W25ABD1	330315	0925525	168	58.72	227	11-14-96
18S15W21DAC1	330825	0923908	183	17.31	200	11-14-96
17S15W31DCA2	331144	0924119	217	52.21	269	11-14-96
17S12W27DCA1	331218	0921929	163	6.70	170	11-14-96
17S16W33BBA2	331229	0924600	231	23.80	255	11-06-96
17S13W17DDC1	331401	0922748	153	40.00	193	11-06-96
17S14W14DDD1	331404	0923040	131	3.71	135	11-15-96
17S18W15CDA1	331453	0925722	260	29.59	290	11-06-96
16S17W23BCC1	331914	0925017	210	9.98	220	11-06-96

Long-Term Hydrographs

Twenty-five years of water-level data from each of six selected wells completed in the Cockfield aquifer were plotted to illustrate historical water levels in selected areas of southeastern Arkansas (fig. 3). During the period 1971-96, the water level at a location in Ashley County (hydrograph A) showed an average decline rate of less than 0.5 feet per year (ft/yr) and water levels at some locations in Bradley, Chicot, Cleveland, and Drew Counties (hydrographs B, C, D, and E) showed an average decline rate between 0.5 and 1.0 ft/yr. The hydrograph from a well located in Union County (hydrograph F) illustrates that the water level in that area has remained relatively constant during most of the period since 1971.

A. ASHLEY COUNTY 19S05W12CAC1



B. BRADLEY COUNTY 14S10W31DBA1

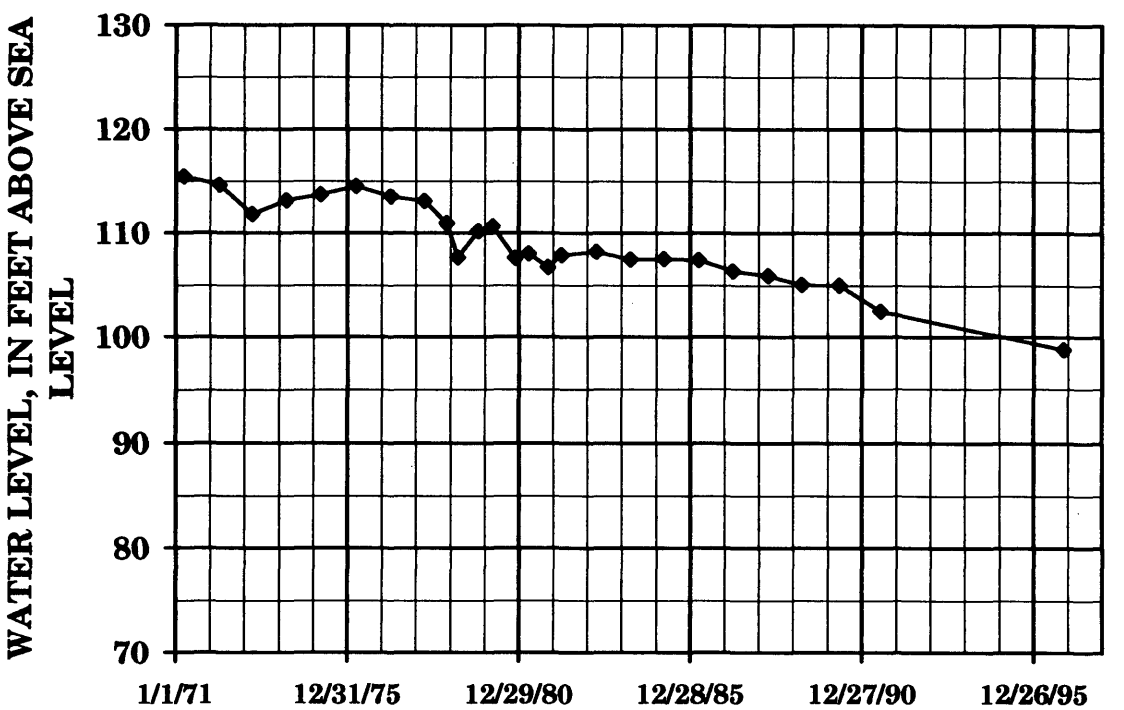
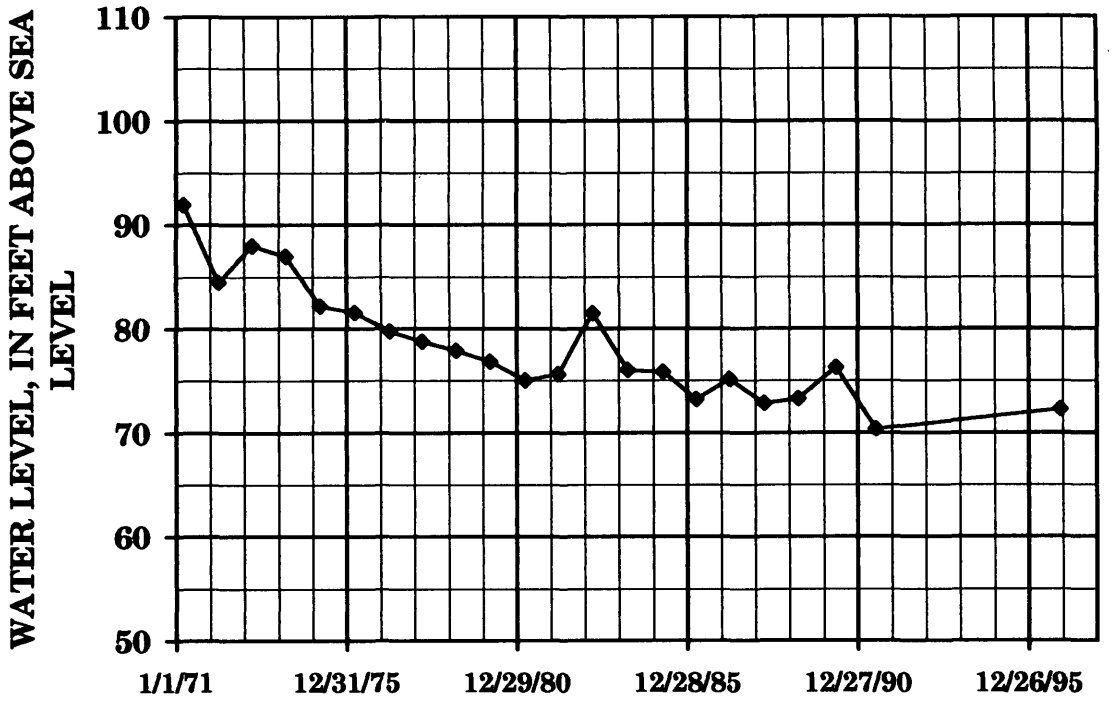


Figure 3. Water-level hydrographs for selected wells completed in the Cockfield aquifer in southeastern Arkansas (page 1 of 3).

C. CHICOT COUNTY 14S03W05BBA1



D. CLEVELAND COUNTY 08S11W02BCB1

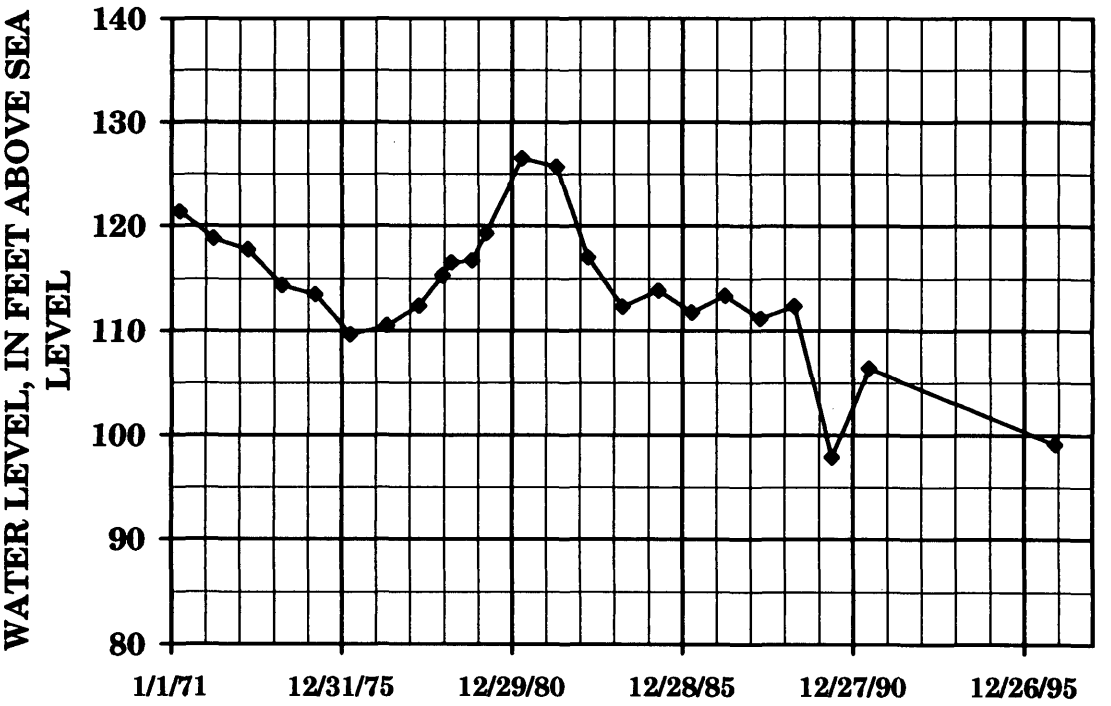
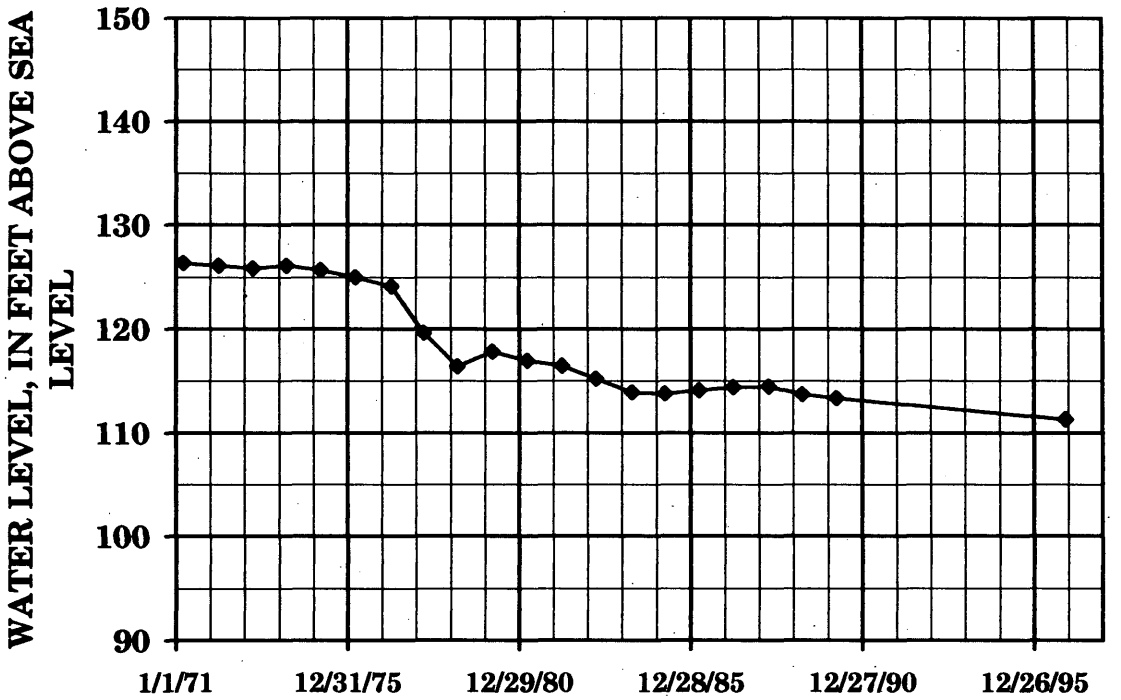


Figure 3. Water-level hydrographs for selected wells completed in the Cockfield aquifer in southeastern Arkansas (page 2 of 3).

E. DREW COUNTY 14S07W26BAB1



F. UNION COUNTY 17S13W17DDC1

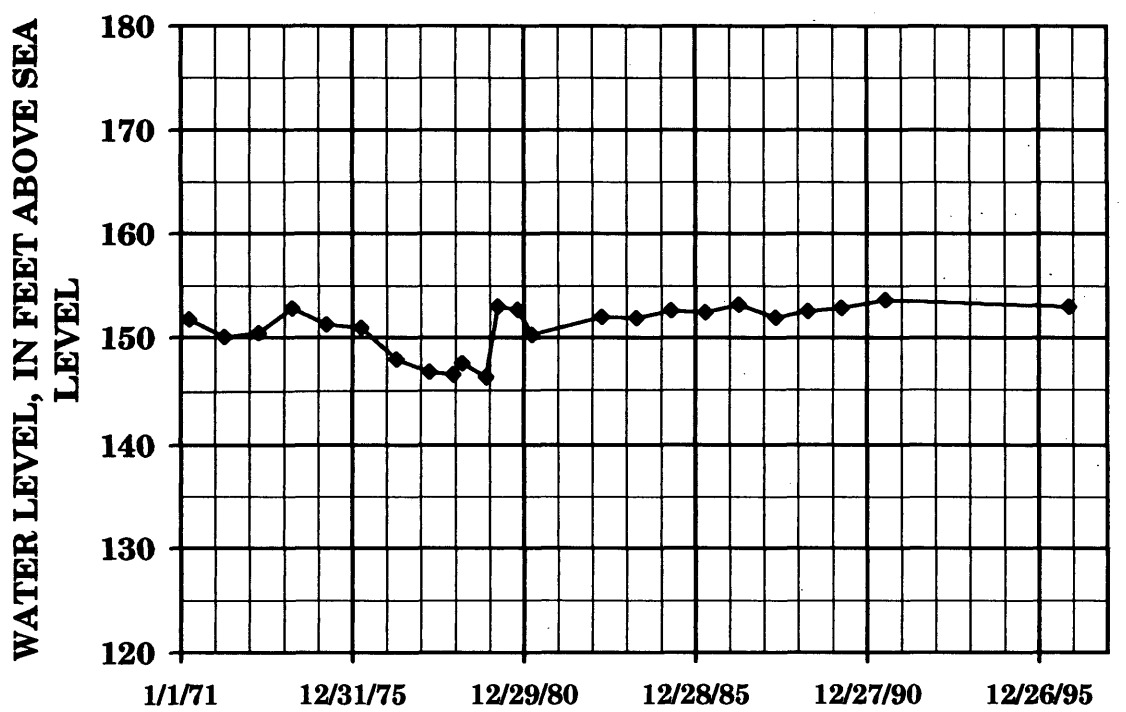


Figure 3. Water-level hydrographs for selected wells completed in the Cockfield aquifer in southeastern Arkansas (page 3 of 3).

WILCOX AQUIFERS

The Wilcox Group of Eocene age extends throughout most of eastern and southern Arkansas. However, the potential yield of water to wells penetrating the Wilcox aquifer varies between the two areas where water-level measurements were collected.

The Wilcox Group contains discontinuous aquifers in the outcrop area of southern Arkansas. The Wilcox Group, in most of the area where present in southern Arkansas, overlies the Midway Group, crops out in a discontinuous band 1 to 3 miles wide in many places, and is overlain by terrace deposits and alluvium of Quaternary age. The Wilcox Group becomes progressively thicker downdip (southeast) from the outcrop, ranging in thickness from a few feet in the outcrop to about 750 ft in northeastern Bradley County (Albin, 1964). The Wilcox Group in southern Arkansas consists of complexly interbedded layers of clay, sandy clay, sand, and lignite. Sand beds generally are thin and are not continuous over large areas. The Wilcox aquifer is typically used on or near the outcrop areas because of small yields to wells. The Wilcox Group does not extend northwest of its outcrop and subcrop area in southern Arkansas.

In northeastern Arkansas, sand beds of the middle to lower part of the Wilcox Group have been referred to as the "1,400-foot sand" (Ryling, 1960; Plebuch, 1961) and the "lower Wilcox aquifer" (Hosman and others, 1968). The Wilcox Group throughout most of northeastern Arkansas is composed of thin interbedded layers of lignitic sand and clays. The lower Wilcox aquifer is confined by an overlying clay bed of the Wilcox Group and an underlying clay bed of the Wilcox Group or the Midway Group. The Wilcox Group outcrops at or near Crowleys Ridge in Clay, Greene, and Craighead Counties (Broom and Lyford, 1981). East of Crowleys Ridge in northeastern Arkansas, the Wilcox Group contains a sand bed 200 ft or more in thickness (Petersen and others, 1985). In this area, the Wilcox aquifer yields sufficient water for industrial and public supplies in wells with depths greater than 1,000 ft. Wells in the vicinity of Blytheville, Arkansas, yield quantities of water that range from 200 to 1,800 gal/min (Halberg and Reed, 1964).

The Wilcox aquifers are recharged in the outcrop and subcrop areas as water moves southeastward (downdip). In the confined part of the Wilcox aquifer in northeastern Arkansas, water levels can be close to, or above, land surface. Discharge from the aquifers mainly is to wells (Westerfield, 1994).

Withdrawals from the Wilcox aquifers have increased nearly 33 percent since 1990. Withdrawals totaled 41 Mgal/d in 1995 (T.W. Holland, U.S. Geological Survey, written commun., 1997), an increase of more than 10 Mgal/d from 1990 (Holland, 1993). In southern Arkansas, the primary use of water from the aquifer is mostly for domestic supplies, usually on or near the outcrop areas. In northeastern Arkansas, the primary use of water from the aquifer is for public supplies, but the aquifer is also a source of water for some commercial, domestic, and industrial users.

Potentiometric Surface

The potentiometric-surface maps show the altitude to which water will rise in tightly cased wells screened in the Wilcox aquifers (plates 2 and 3). The maps are based upon water-level data collected during October 1996 to July 1997 at 13 wells in the Wilcox aquifer in southern Arkansas and at 38 wells in the lower Wilcox aquifer in northeastern Arkansas (tables 2 and 3). The potentiometric surface is mapped by determining the altitude of the water levels measured in wells and is represented on the map by contours that connect points of equal value. The direction of groundwater flow in the Wilcox aquifer is perpendicular to the contours in the direction of downward gradient. The potentiometric surface data reveal spatial trends across the study areas.

The regional direction of ground-water flow is generally southeastward, away from the outcrop, except where affected by intense ground-water withdrawals. The lowest water-level altitude measured in southern Arkansas was 152 ft above sea level in Clark County; the highest water-level altitude measured was 395 ft above sea level in Hempstead County in the outcrop area. The lowest water-level altitude measured in northeastern Arkansas was 140 ft above sea level in Crittenden County; the highest water-level altitude measured was 368 ft above sea level in Clay County. Water levels collected from wells located on Crowleys Ridge may exhibit higher water levels because of irregular topography on the ridge (Hines and others, 1972). 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 centers of pumping within cones of depression. In northeastern Arkansas, two cones of depression are centered in the vicinity of Paragould and West Memphis, Arkansas, where ground-water withdrawals have altered the natural direction of flow.

Table 2. Information pertaining to measured wells completed in the Wilcox aquifer in southern Arkansas

[In this report, sea level refers to the 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]

Local well number	Latitude	Longitude	Water level altitude (feet above sea level)	Depth to water level (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measure-ment
			Clark			
10S18W10DDB1	335214	0925612	152	43.06	195	11-13-96
10S20W01BAC1	335401	0930612	260	35.07	295	11-07-96
09S18W20CBB1	335611	0925906	218	12.23	230	11-13-96
07S18W20ABB2	340653	0925753	229	12.97	242	11-13-96
07S18W03BBD1	340917	0925606	259	10.69	270	11-13-96
			Hempstead			
13S24W29ACC1	333522	0933635	346	24.68	371	11-05-96
13S24W02DCA2	333828	0933309	395	51.07	446	11-05-96
13S23W04BDD1	333843	0932911	347	2.98	350	11-13-96
			Hot Spring			
05S17W10AAC1	341838	0924853	391	19.5	410	11-12-96
04S16W20CBB1	342146	0924531	341	4.38	345	11-12-96
			Nevada			
13S21W02DCC1	333754	0931424	254	61.26	315	11-05-96
12S22W24CDA1	334046	0931939	312	31.79	344	11-13-96
			Ouachita			
12S19W11DCD1	333918	0930126	282	6.23	288	11-07-96

Table 3. Information pertaining to measured wells completed in the Wilcox aquifer in northeastern Arkansas

[In this report, sea level refers to the 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]

Local well number	Latitude	Longitude	Water level altitude (feet above sea level)	Depth to water level (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measurement
			Clay			
20N07E01CBB1	362345	0901649	368	91.79	460	12-11-96
21N08E14CBB1	362712	0901126	290	90.22	380	12-11-96
			Craighead			
13N07E14BBA2	354525	0901910	201	20.29	221	12-12-96
14N06E27ACB2	354857	0902612	202	25.12	227	12-12-96
14N07E17DCB1	355008	0902202	208	24.44	232	12-12-96
15N07E33BAD1	355314	0902108	213	18.94	232	12-12-96
			Crittenden			
04N07E36ADB1	345448	0901827	165	36.44	201	12-03-96
05N07E29ACC1	350129	0902225	166	34.43	200	12-04-96
05N07E01ABB1	350519	0901810	163	44.06	207	12-04-96
06N09E07CAC1	350906	0901042	140	70.39	210	12-04-96
07N07E14CCC1	351318	0901929	165	57.77	223	12-04-96
08N06E33CBD1	351614	0902754	171	44.14	215	12-04-96
09N08E29ADD1	352225	0901515	179	46.38	225	12-04-96
07N08E24CAB1	351238	0901147	162	59.13	221	12-04-96
			Greene			
16N05E13BAB1	360125	0903025	185	105.22	290	12-11-96
17N06E31DCB1	360322	0902904	177	107.90	285	12-11-96
17N04E36BCA1	360350	0903658	340	164.99	505	12-11-96
18N06E10DCD1	361208	0902520	297	22.73	320	12-11-96
			Lee			
01N04E09DCC1	344203	0904116	159	45.22	204	12-12-96
03N05E01BAB1	345416	0903138	164	31.60	196	12-12-96
			Mississippi			
10N08E17ADD1	352923	0901503	188	37.21	225	12-04-96
11N09E33AAB1	353216	0900740	188	48.91	237	12-04-96
11N10E20ADA1	353344	0900210	193	42.38	235	12-04-96

Table 3. Information pertaining to measured wells completed in the Wilcox aquifer in northeastern Arkansas--Continued

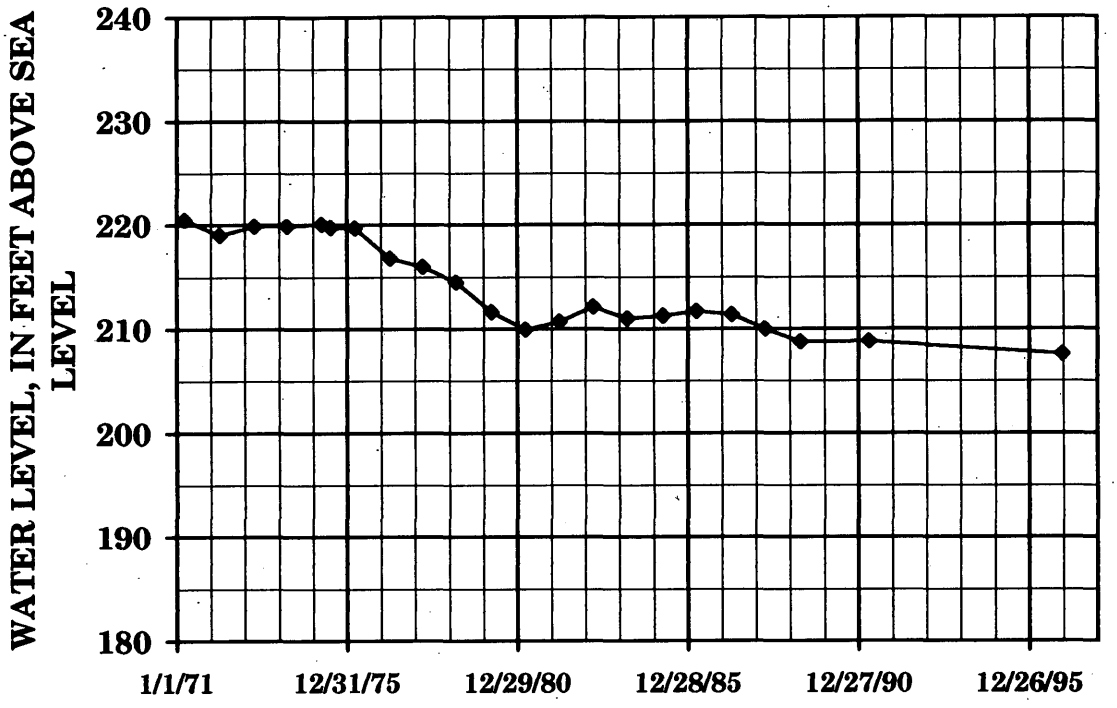
[In this report, sea level refers to the National Geodetic Vertical Datum of 1929—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929]

Local well number	Latitude	Longitude	Water level altitude (feet above sea level)	Depth to water level (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measure-ment
11N08E10AAC1	353537	0901258	191	28.85	220	12-05-96
12N11E17CDD1	353917	0895615	198	46.74	245	12-05-96
12N09E11DBB1	354033	0900552	200	30.18	230	12-05-96
13N11E08DDA1	354528	0895547	207	37.78	245	12-05-96
14N11E20CCA1	354859	0895626	208	31.59	240	12-05-96
15N09E31ACD1	355252	0900957	208	32.28	240	12-05-96
15N12E23DBC1	355415	0894630	217	40.35	258	05-02-97
15N08E08DBC3	355606	0901526	223	13.46	236	12-05-96
15N10E01ADD1	355712	0895802	228	20.22	248	12-05-96
			Poinsett			
10N07E16CBB2	352924	0902130	177	41.24	218	12-10-96
11N06E35CDA3	353152	0902516	178	36.90	215	12-10-96
11N07E03BDD1	353629	0901955	200	15.52	216	12-10-96
12N05E13BBB1	354038	0903059	188	33.61	222	12-10-96
			St. Francis			
04N06E21BAD2	345650	0902808	167	34.22	201	12-12-96
04N06E16CCB1	345705	0902842	163	43.77	207	04-25-97

Long-Term Hydrographs

Twenty-five years of water-level data from each of seven selected wells completed in the Wilcox aquifer were plotted to illustrate historical water levels in selected areas of northeastern Arkansas (fig. 4). During the period 1971-96, water-levels showed an average decline rate between 0.5 and 1.0 ft/yr at some locations in Craighead, Crittenden, Mississippi, Poinsett, and St. Francis Counties (hydrographs G, H, K, L, and M), and more than 1.0 ft/yr at some locations in Greene and Lee Counties (hydrographs I and J).

G. CRAIGHEAD COUNTY 14N07E17CDB1



H. CRITTENDEN COUNTY 08N06E33CBD1

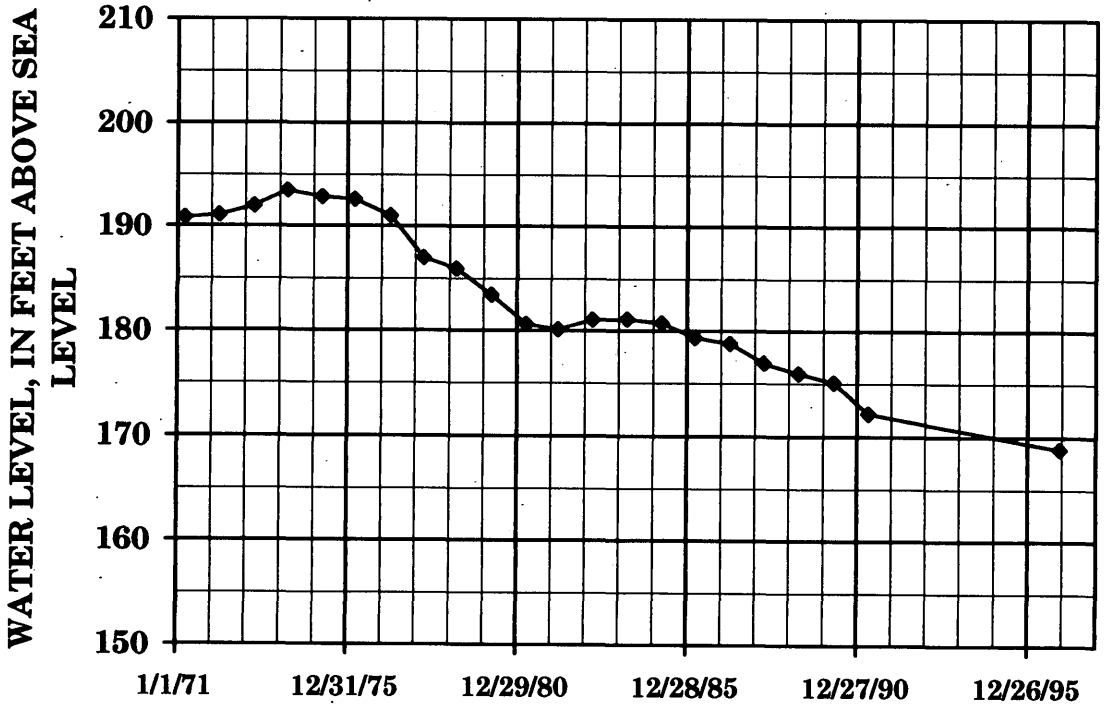
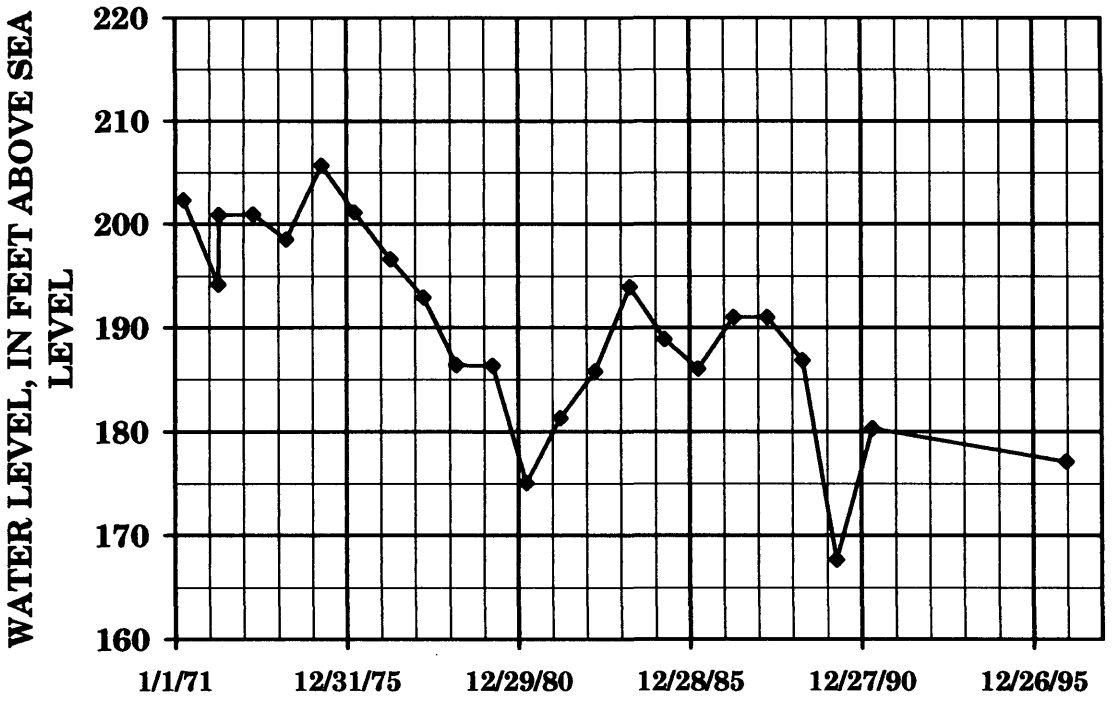


Figure 4. Water-level hydrographs for selected wells completed in the Wilcox aquifer in northeastern Arkansas (page 1 of 4).

I. GREENE COUNTY 17N06E31DCB1



J. LEE COUNTY 01N04E09DCC1

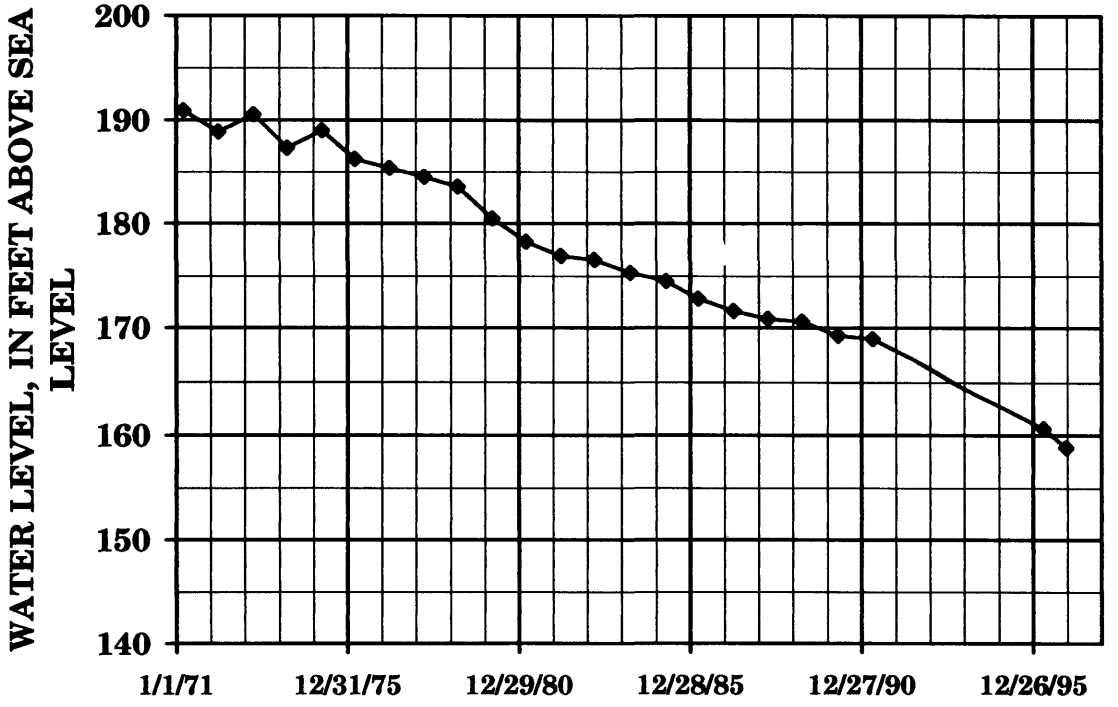
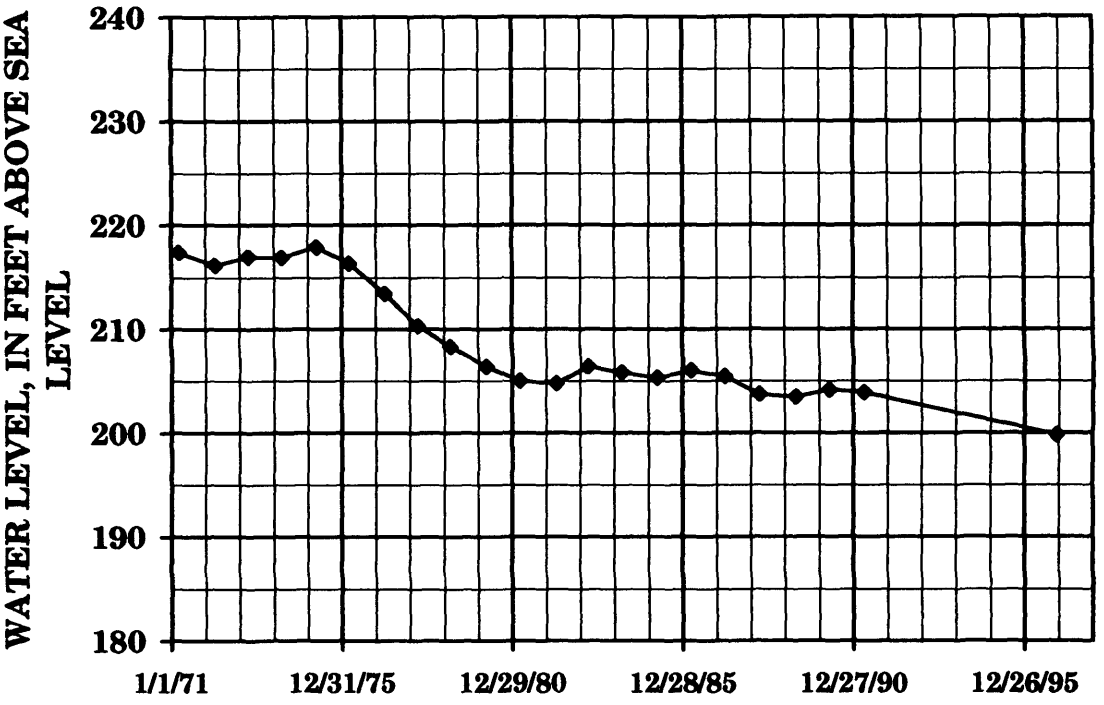


Figure 4. Water-level hydrographs for selected wells completed in the Wilcox aquifer in northeastern Arkansas (page 2 of 4).

K. MISSISSIPPI COUNTY 12N09E11DBB1



L. POINSETT COUNTY 12N05E13BBB1

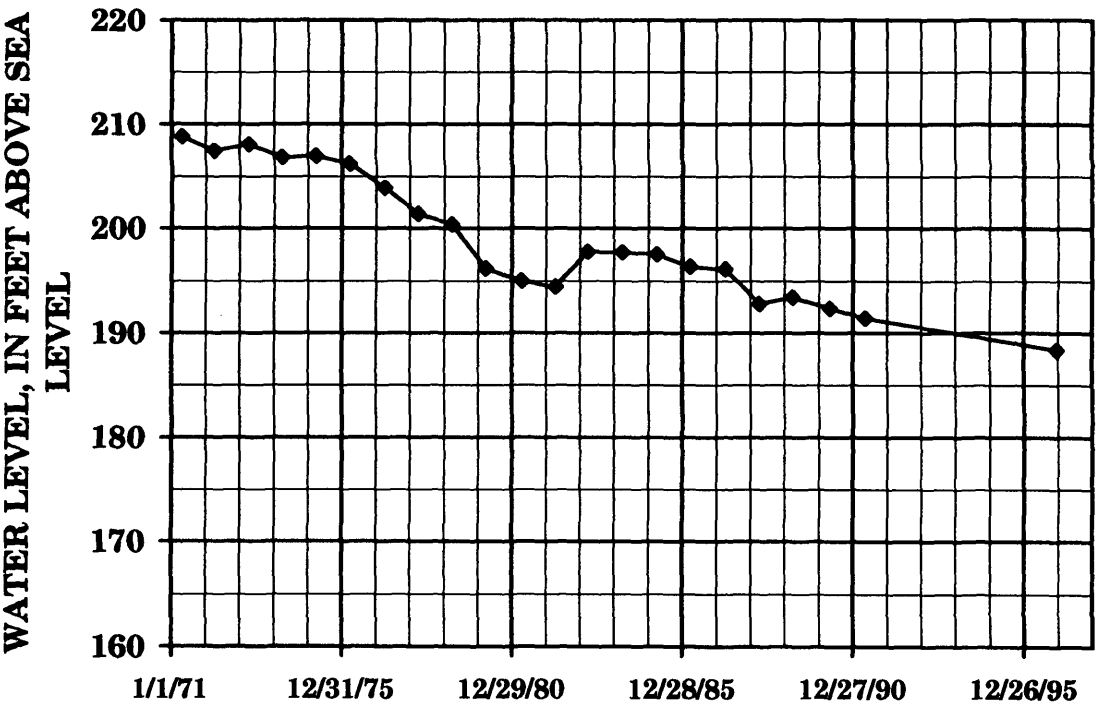


Figure 4. Water-level hydrographs for selected wells completed in the Wilcox aquifer in northeastern Arkansas (page 3 of 4).

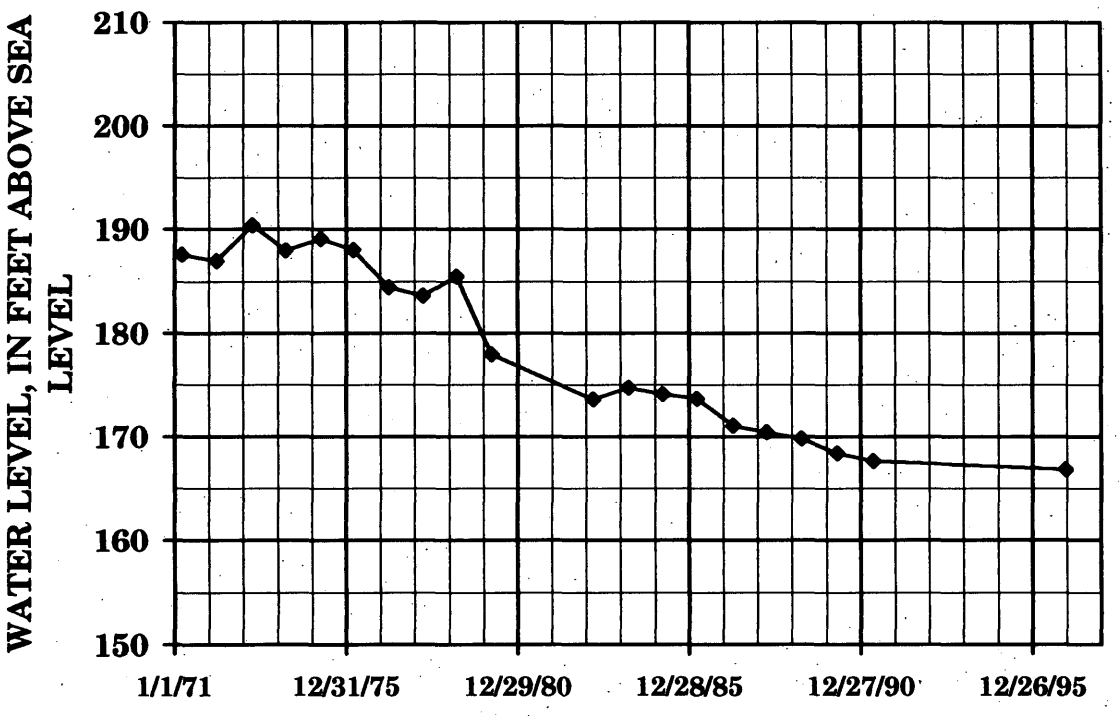


Figure 4. Water-level hydrographs for selected wells completed in the Wilcox aquifer in northeastern Arkansas (page 4 of 4).

SUMMARY

During October 1996 to July 1997, water levels in the Cockfield and Wilcox aquifers were measured in 104 wells in southern and northeastern Arkansas. The Cockfield and Wilcox aquifers are secondary sources of water for local use. Major withdrawals are made from the aquifers for industrial and public supply, with lesser but locally significant withdrawals for domestic and livestock uses. Approximately 51 Mgal/d was withdrawn from these aquifers in 1995, an increase of about 12 Mgal/d from 1990. The potentiometric surface data reveal spatial trends in both aquifers across the study areas.

Water-level measurements at wells completed in the Cockfield aquifer ranged in altitude from 72 to 353 feet above sea level. The regional direction of ground-water flow in the Cockfield aquifer is generally southeastward, away from the outcrop area, except where affected by intense ground-water withdrawals. 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 centers of pumping within cones of depression, such as the cone of depression caused by the pumpage near Greenville, Mississippi. Long-term hydrographs from six wells, during the period 1971-1996, showed an average decline rate of less than 0.5 ft/yr in Ashley County and between 0.5 and 1.0 ft/yr at some locations in Bradley, Chicot, Cleveland, and Drew Counties. The hydrograph from a well located in Union County illustrates that the water level in that location has remained relatively constant during most of the period since 1971.

Water-level measurements at wells completed in the Wilcox aquifer in southern Arkansas ranged from 152 to 395 feet above sea level. Water-level measurements at wells completed in the lower Wilcox aquifer in northeastern Arkansas ranged from 140 to 368 feet above sea level. The regional direction of ground-water flow in the Wilcox aquifers is generally toward the east and south, away from the outcrop area, except where affected by intense ground-water withdrawals. The potentiometric surface indicates that heavy pumpage has altered or reversed the natural direction of ground-water flow in some areas. Flow in these areas is toward centers of pumping within cones of depression. Two cones of depression are centered in the vicinity of Paragould and West Memphis, Arkansas, where ground-

water withdrawals have altered the natural direction of flow. Long-term hydrographs of seven wells, during the period 1971-1996, showed an average decline rate in the Wilcox aquifer in northeastern Arkansas between 0.5 and 1.0 ft/yr at some locations in Craighead, Crittenden, Mississippi, Poinsett, and St. Francis Counties, and more than 1.0 ft/yr at some locations in Greene and Lee Counties.

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