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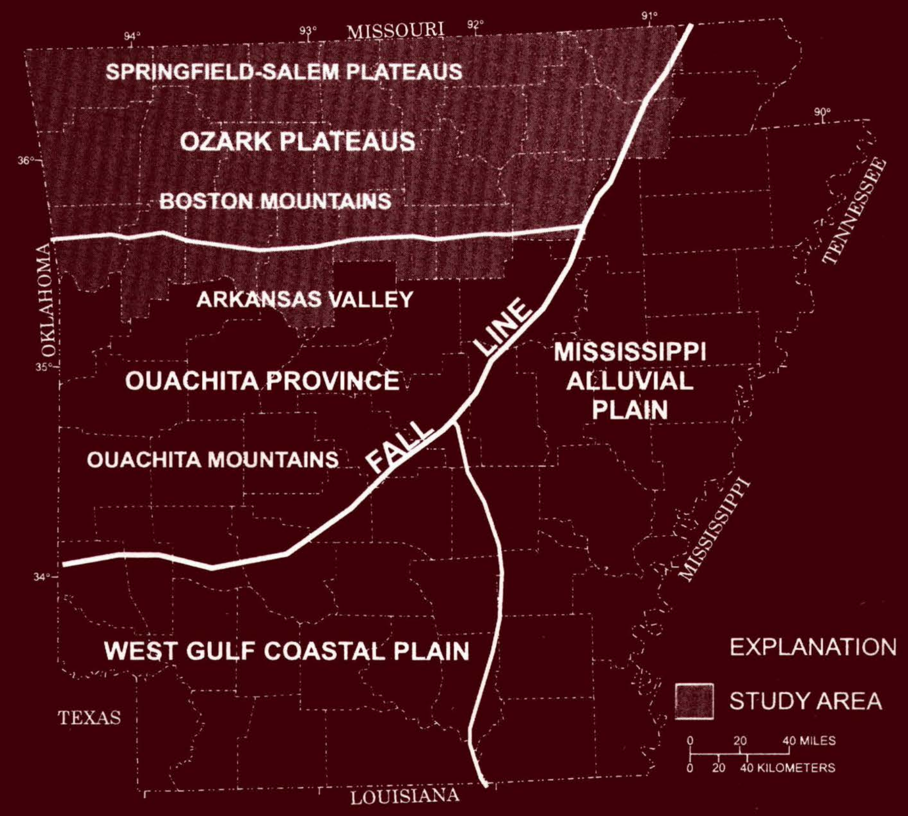
POTENTIOMETRIC SURFACE OF THE OZARK AQUIFER IN NORTHERN ARKANSAS, 2001

Water-Resources Investigations Report 01-4233



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

POTENTIOMETRIC SURFACE OF THE OZARK AQUIFER IN NORTHERN ARKANSAS, 2001

by T.P. Schrader

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Little Rock, Arkansas
2001

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CONTENTS

PLATES

ILLUSTRATIONS

TABLES

POTENTIOMETRIC SURFACE OF THE OZARK AQUIFER IN NORTHERN ARKANSAS, 2001

By T.P. Schrader

ABSTRACT

The Ozark aquifer in northern Arkansas comprises dolomites, limestones, sandstones, and shales of Late Cambrian to Middle Devonian age, and ranges in thickness from approximately 1,100 feet to more than 4,000 feet. Hydrologically, the aquifer is complex, characterized by disconnected and extensive flow components with large variations in permeability.

The potentiometric-surface map, based on 84 well and 6 spring water-level measurements collected in 2001 in Arkansas, indicates maximum water-level altitudes of about 1,359 feet in Carroll County and minimum water-level altitudes of about 241 feet in Randolph County. Regionally, the flow within the aquifer is to the south and southeast in the eastern and central part of the study area and to the northwest and north in the western part of the study area. Comparing the 2001 potentiometric-surface map with a predevelopment potentiometric-surface map indicates general agreement between the two surfaces. Potentiometric-surface differences could be attributed to differences in pumping related to changing population from 1990 to 2000.

INTRODUCTION

The Ozark aquifer is the largest aquifer, both in area of outcrop and thickness, and the most important source of freshwater in the Ozark Plateaus physiographic province, supplying water to large areas of northern Arkansas, southern Missouri, northeastern Oklahoma, and southeastern Kansas. A good understanding of changes in water levels and trends is important for continued use, planning, and management of this resource.

Water use from the Ozark aquifer in Arkansas was estimated to be 35.8 million gallons per day (Mgal/d) in 1995 (Holland, 1999). Water use was 32.3 Mgal/d in 1985 and 33.3 Mgal/d in 1990 (Holland, 1987, Holland, 1993). Water use increased about 11 percent from 1985 to 1995.

A potentiometric-surface map of the Ozark aquifer within the Ozark Plateaus of northern Arkansas (figs. 1 and 2), representing conditions during 2001, was constructed by the U.S. Geological Survey (USGS) in cooperation with the Arkansas Soil and Water Conservation Commission and the Arkansas Geological Commission. The study is part of an ongoing effort by the three agencies to monitor groundwater levels in Arkansas' major aquifers. This report presents the potentiometric-surface map.

The study area includes Arkansas counties lying completely or partially within the Ozark Plateaus of the Interior Highlands major physiographic division (Fenneman, 1938). The study area is bounded on the north by Missouri, on the west by Oklahoma, on the east by the Mississippi Alluvial Plain, and on the south by the Ouachita Province (fig. 1).

The potentiometric-surface map presented in this report was prepared from ground-water level data collected by the USGS from January - June 2001. Additionally, streambed altitudes in areas where the aquifer is unconfined and hydraulically connected to the surface were used as bounding (maximum ground-water level) values.

AQUIFER DESCRIPTION

The Ozark Plateaus aquifer system (fig. 2) is in and adjacent to the Ozark Plateaus and may be divided into five hydrogeologic units based on relative rock permeability and well yields. These units outcrop in a

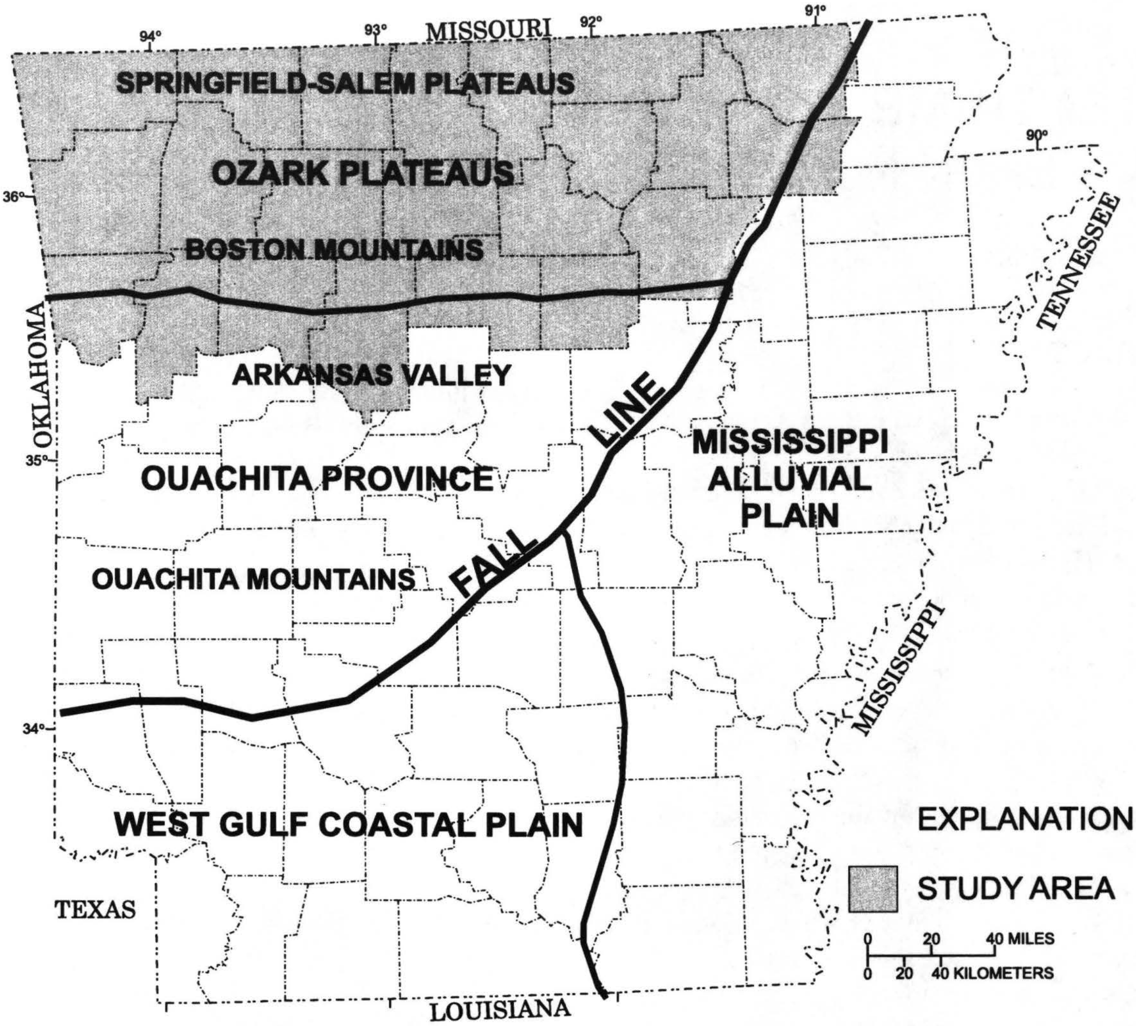

Figure 1. Location of study area.

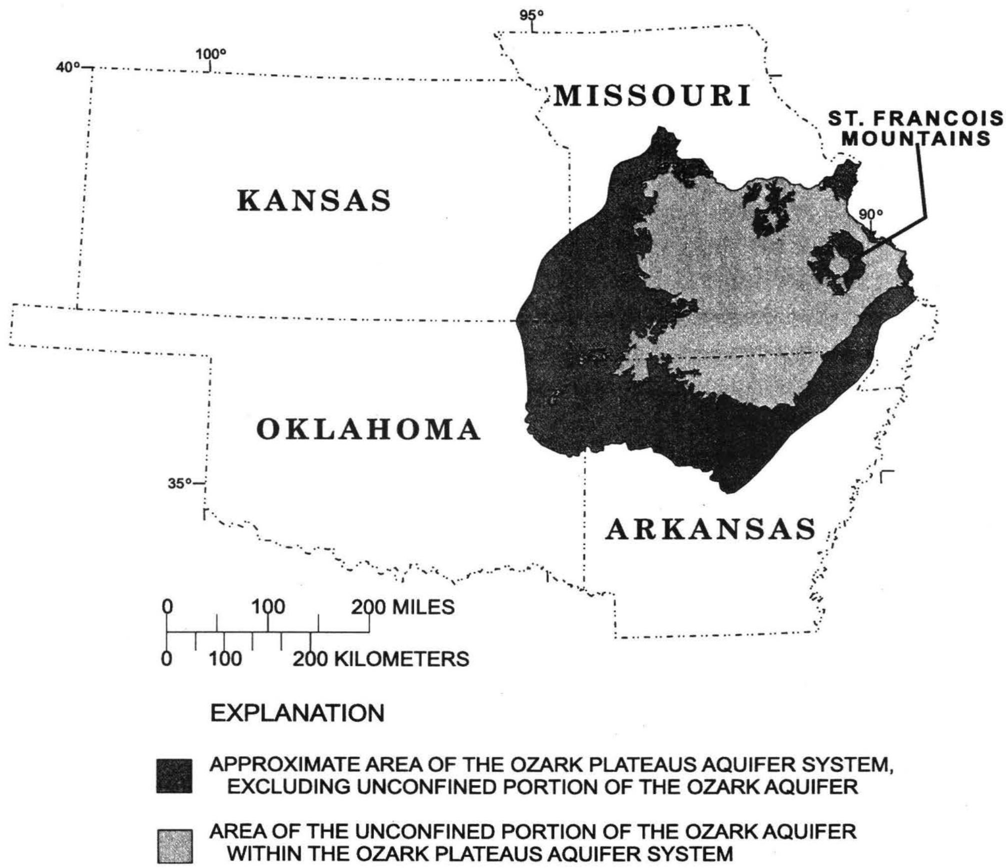

Figure 2. Location of Ozark Plateaus aquifer system.

concentric pattern centered on and dipping away from the St. Francois Mountains of Missouri. The boundaries between these hydrologic units do not always conform to geologic time divisions or formation boundaries, but were chosen to delineate groups of rocks having similar hydrologic properties. These geohydrologic units consist of rocks that range in age from Cambrian to Mississippian and are the St. Francois aquifer, St. Francois confining unit, Ozark aquifer, Ozark confining unit, and Springfield aquifer (Imes and Emmett, 1994). The St. Francois aquifer and St. Francois confining unit underlie the Ozark aquifer. The Ozark confining unit overlies the Ozark aquifer. The Springfield aquifer overlies the Ozark confining unit.

The Ozark aquifer in Arkansas is composed of dolomites, limestones, sandstones, and shales of Late Cambrian to Middle Devonian age (table 1) and ranges in thickness from approximately 1,100 feet (ft) in the northwestern corner of the State to more than 4,000 ft in the west-central portion of the State (Imes, 1990). Most wells completed in the aquifer yield between 50 and 100 gallons per minute (gal/min) although some wells may yield as much as 600 gal/min (Imes and Emmett, 1994; Adamski and others, 1995).

The geohydrology of the Ozark aquifer is complex, consisting of a combination of discrete and discontinuous flow components resulting from spatial variations in regolith thickness, faults, the presence of chert nodules, lithology, and cementation. Primary porosity and permeability are low for most rock units of the aquifer, although secondary permeability resulting from fracturing and dissolution of the carbonate rocks is spatially variable and ranges from moderate to large (Adamski, 1996). Hydraulic conductivity ranges from 1×10^{-8} feet per second (ft/s) to more than 1×10^{-3} ft/s (Imes and Emmett, 1994). The principal recharge area for the aquifer is in central and south-central Missouri and north-central Arkansas, where the aquifer is hydraulically connected to the surface and the potentiometric surface mimics the land-surface topography.

The Ozark aquifer is underlain by the St. Francois confining unit (the top geologic unit of which is the Doe Run Dolomite; table 1). The Ozark aquifer is exposed in much of southern and central Missouri and north-central Arkansas (fig. 2) where uplift of the Ozark dome and erosion of younger rocks has formed a deeply dissected, rugged topography that is the primary recharge area of the aquifer. The aquifer is overlain by the Ozark confining unit mainly in the southern and western portion of the study area (table 1). Within the Mississippi Alluvial Plain, east and southeast of the outcrop area (figs. 1 and 2), thick deposits of Cretaceous-, Tertiary-, and Quaternary-age sediments unconformably overlay the Ordovician-age rocks of the Ozark aquifer. Within this portion of the Mississippi Alluvial Plain, major rivers receive substantial discharge from the adjacent Ozark aquifer (Mesko and Imes, 1995).

Beneath the Mississippi Alluvial Plain (fig. 1), the rocks comprising the Ozark aquifer dip at about 45 feet per mile (ft/mi) to the southeast. In the northern portion of the study area, the regional dip is about 26 ft/mi southward, increasing to 175 ft/mi or more at the southern boundary of the Ozark Plateaus (Imes, 1990). The depth of the Ozark aquifer increases to more than 2,000 ft in the southern part of the study area. In this area, water quality is affected by increasing amounts of dissolved solids, fluoride, sulfide, and radium as water moves downdip, away from recharge areas (Imes and Emmett, 1994). The combination of greater depth and poorer water quality limits the viability of the Ozark aquifer as an economic source of water in the southernmost portion of the study area.

POTENTIOMETRIC SURFACE

The potentiometric-surface map (plate 1) indicates the altitude to which water levels would rise in tightly cased wells completed in the Ozark aquifer. Water levels were measured from January through June 2001 to the nearest 0.01 ft from a measuring point of known altitude using a graduated steel tape or electric water-level indicator. The altitude of the land surface was determined by first locating the wells and springs using a global positioning system instrument to read the latitude and longitude. The location then was plotted using a computer plotting program along with the altitude of land surface from digital 7.5-minute topographic quadrangle maps. The potentiometric surface was contoured using the measured water-level data (table 2) from 84 wells and 6 springs. Additional bounding values were used where the Ozark aquifer is exposed at the surface. Land-surface contours and stream altitudes from a 1:500,000 scale topographic map of Arkansas (U.S. Geological Survey, 1990) were considered in the construction of the potentiometric-surface map (plate 1) to prevent contours from crossing streams at inappropriate locations, and to reflect the general land-surface topography where appropriate.

Table 1. Stratigraphic column with descriptions of lithologic and geohydrologic properties of the Ozark aquifer and adjacent confining units within Arkansas (modified from Lamonds, 1972; Imes and Smith, 1990)

ERA	PERIOD	GEOLOGIC UNIT	GEOHYDROLOGIC UNIT	LITHOLOGY	THICKNESS (feet)	GEOHYDROLOGY
Paleozoic	Devonian	Chattanooga Shale	Ozark confining unit	Shale unit that crops out in a narrow band that outlines the Ozark aquifer and is missing where the Ozark aquifer is exposed at the surface.	0 - 200	Unit is relatively impermeable because of large shale content.
		Clifty Limestone	Ozark aquifer	Chert with lenses of limestone, dolomite, and cherty sandstone.	0 - 250	The residual cherty rubble, weathered from cherty limestone and sandstone of the unit, may yield 2 to 5 gallons per minute.
		Penters Chert				
	Silurian	Lafferty Limestone		Limestone, dolomite, sandstone, and minor amounts of shale	0 - 2,000	The limestones and dolomites commonly yield 5 to 10 gallons per minute from solution channels, bedding planes, and fractures. Similar yields may be obtained from the sandstone where it is porous or fractured. These units contain many springs. Yields from springs and some wells may exceed 50 gallons per minute.
		St. Clair Limestone				
		Brassfield Limestone				
	Ordovician	Cason Shale				
		Fernvale Limestone				
		Kimmswick Limestone				
		Plattin Limestone				
		Joachim Dolomite				
		St. Peter Sandstone				
		Everton Formation				
		Smithville Formation		Dolomite, dolomitic limestone, and minor amounts of sandstone and shale.	100 - 1,000	The solution channels and fractures in the dolomite and dolomitic limestone commonly yield 5 to 10 gallons per minute. Wells that tap large solution channels may yield more than 50 gallons per minute, but large yields are uncommon. These units yield water to several large springs.
		Powell Dolomite				
		Cotter Dolomite				
		Jefferson City Dolomite				
		Roubidoux Formation		Sandstone and sandy dolomite. Not exposed in Arkansas.	100 - 250	Yields of as much as 450 gallons per minute may be obtained from some wells, but yields are highly variable and generally average less than 150 gallons per minute.
		Gasconade Dolomite		Dolomite, sandy dolomite, and sandstone. Not exposed in Arkansas.	350 - 650	The most productive water-bearing part of this unit is the Van Buren Formation. Wells that tap into the Van Buren Formation commonly yield 150 to 300 gallons per minute and may yield as much as 500 gallons per minute.
		Van Buren Formation				
	Cambrian	Eminence Dolomite				
		Potosi Dolomite				
		Doe Run Dolomite	St. Francois confining unit	Shale and shaley dolomite, siltstone, and limestone conglomerate. Shales present both as distinct beds and disseminated throughout dolomite matrix. Not exposed in Arkansas.	0 - 750	Permeability is minimal to moderate. Unit is more permeable where transected by fault and fracture zones.
		Derby Dolomite				
		Davis Formation				

Table 2. Information pertaining to measured wells and springs in the Ozark aquifer in northwestern Arkansas, 2001

[NA, not applicable; --, not available; Aquifer code designations are: 357BFLD, Brassfield Limestone; 364STPR, St. Peter Sandstone; 364 EVRN, Everton Formation; 368PWLL, Powell Dolomite; 367CTTR, Cotter Dolomite; 367CRJF, Cotter-Jefferson City Dolomite; 368JFRC, Jefferson City Dolomite; 367RBDX, Roubidoux Formation; 367GNTR, Gunter Sandstone member of Van Buren Formation; 371POTS, Potosi Dolomite]

Latitude	Longitude	Station name	Well depth (feet below land surface)	Aquifer code	Water level altitude (feet above sea level)[1]	Depth to water (feet below land surface)	Land surface altitude (feet above sea level)	Date of measurement
			Baxter County Wells					
361610	921143	19N11W31DAA1	193	367CTTR	552	87.99	640	1/08/2001
361714	923026	19N14W29DBC1	1,625	367GNTR	663	56.55	720	1/23/2001
361757	921605	19N12W21DAB1	193	367CTTR	538	62.13	600	1/22/2001
362114	921423	20N11W35CCA1	295	367CTTR	559	40.94	600	1/08/2001
362309	921419	20N12W23CBA1	550	367RBDX	543	57.04	600	1/08/2001
362431	921912	20N13W13ABD1	209	367CTTR	541	79.24	620	1/08/2001
362435	922026	20N13W14ABC1	493	367CTTR	541	39.40	580	1/08/2001
362700	921558	21N12W33ACB1	500	367RBDX	558	52.14	610	1/08/2001
			Benton County Wells					
361954	940618	19N29W07DAA1	1,659	367GNTR	1,059	150.73	1,210	1/26/2001
362417	943607	20N34W21ABD1	380	364EVRN	996	26.48	1,022	1/30/2001
362456	942723	20N33W14ACD1	1,600	367GNTR	758	426.83	1,185	1/25/2001
362636	940138	21N29W35DDB2	1,769	367GNTR	1,064	341.49	1,405	1/30/2001
			Boone County Wells					
361150	930258	18N19W19BCC1	1,649	367GNTR	928	222.27	1,150	1/23/2001
362703	925503	21N18W20CCD1	1,415	371POTS	638	242.12	880	1/23/2001
			Carroll County Wells					
361918	932633	19N23W08ADD1	2,300	367GNTR	1,098	256.95	1,355	1/25/2001
362022	932604	19N23W04BAC1	1,587	367RBDX	1,360	5.06	1,365	1/25/2001
362313	934253	20N26W23ACA1	1,713	371POTS	1,048	286.95	1,335	1/25/2001
362340	934458	20N26W16DCA1	1,332	367GNTR	1,064	133.86	1,198	1/25/2001
362921	934641	21N26W17BCC1	1,058	367RBDX	971	39.25	1,010	1/25/2001
362939	934412	21N26W10CDC1	1,122	367GNTR	993	96.54	1,090	1/25/2001
			Fulton County Wells					
361728	913503	19N06W23AAD1	1,630	367GNTR	459	221.14	680	1/17/2001
361853	913416	19N06W12DBA1	160	367CTTR	407	112.80	520	3/22/2001

Table 2. Information pertaining to measured wells and springs in the Ozark aquifer in northwestern Arkansas, 2001--Continued

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Latitude	Longitude	Station name	Well depth (feet below land surface)	Aquifer code	Water level altitude (feet above sea level)[1]	Depth to water (feet below land surface)	Land surface altitude (feet above sea level)	Date of measurement
362009	913543	19N06W02BDB1	42	367CTTR	429	11.23	440	3/22/2001
362045	913528	20N06W35DBB1	180	367CTTR	438	67.37	505	3/21/2001
362128	913631	20N06W27DBC1	165	367CTTR	485	64.69	550	3/21/2001
362210	914923	20N08W27ABD1	1,282	367GNTR	641	21.15	662	1/17/2001
362402	915904	20N09W18BAD1	950	367RBDX	754	120.74	875	1/17/2001
		Fulton County Springs						
361908	913431	19N06W12BDA1SP	NA	367CTTR	400	0.0	400	3/21/2001
		Independence County Springs						
354949	913959	14N06W29BCC1SP	NA	367CTTR	340	0.0	340	3/23/2001
		Izard County Wells						
360031	914119	16N07W25ACD1	--	--	537	132.90	670	6/06/2001
360753	920626	17N11W13AAD1	1,729	367RBDX	499	39.30	538	1/18/2001
361323	915549	18N09W15BCB1	600	367CTTR	576	166.07	742	1/17/2001
		Marion County Wells						
361300	922940	18N14W08BCC1	198	367CTTR	584	115.92	700	2/01/2001
361442	924124	19N16W33CCB1	753	367RBDX	546	294.90	841	1/22/2001
361512	925050	19N18W36BDC1	1,392	367RBDX	719	36.17	755	1/23/2001
361634	923527	19N15W20ACC1	900	367RBDX	504	180.45	684	1/22/2001
361748	923222	19N15W14BAA1	--	--	492	147.74	640	2/01/2001
362225	924919	20N17W19ABC1	180	367CTTR	830	30.22	862	1/31/2001
362453	923951	20N16W03BBA	600	368JFRC	767	133.38	900	1/31/2001
		Newton County Wells						
360014	931130	16N21W34ABC1	190	364EVRN	810	60.40	870	1/24/2001
		Randolph County Wells						
361350	910944	18N02W02CAC1	128	367CRJF	310	51.31	361	1/16/2001
362440	905351	20N02E06AAC1	900	367RBDX	241	243.85	485	1/16/2001
		Searcy County Wells						
355126	923401	14N15W15AAC1	3,534	367GNTR	708	351.52	1,060	1/19/2001
355416	924025	15N16W34BAD1	485	357BFLD	813	186.77	1,000	5/09/2001

Table 2. Information pertaining to measured wells and springs in the Ozark aquifer in northwestern Arkansas, 2001--Continued

[NA, not applicable; --, not available; Aquifer code designations are: 357BFLD, Brassfield Limestone; 364STPR, St. Peter Sandstone; 364 EVRN, Everton Formation; 368PWLL, Powell Dolomite; 367CTTR, Cotter Dolomite; 367CRJF, Cotter-Jefferson City Dolomite; 368JFRC, Jefferson City Dolomite; 367RBDX, Roubidoux Formation; 367GNTR, Gunter Sandstone member of Van Buren Formation; 371POTS, Potosi Dolomite]

Latitude	Longitude	Station name	Well depth (feet below land surface)	Aquifer code	Water level altitude (feet above sea level)[1]	Depth to water (feet below land surface)	Land surface altitude (feet above sea level)	Date of measurement
355629	923709	15N15W18DBB1	500	357BFLD	1,002	128.35	1,130	5/09/2001
355654	923639	15N15W17BBB1	500	357BFLD	920	210.06	1,130	5/08/2001
355706	923449	15N15W09DDB1	500	357BFLD	819	141.07	960	5/08/2001
355717	923723	15N15W07CAC1	500	357BFLD	849	213.34	1,062	6/07/2001
355750	924133	15N16W09BBA1	950	364EVRN	788	137.06	925	5/09/2001
360014	923603	16N15W29ACB1	640	357BFLD	953	137.07	1,090	5/08/2001
			Searcy County Springs					
355833	924036	15N16W03BCB1SP	NA	367CTTR	620	0.0	620	3/14/2001
			Sharp County Wells					
355812	913318	15N05W06DDD1	482	364EVRN	543	101.74	645	1/17/2001
355910	913402	16N05W31CCA1	173	364EVRN	515	100.32	615	6/06/2001
355954	913457	16N06W25CDC2	--	--	578	41.91	620	6/06/2001
355955	913502	16N06W25CDC1	525	364EVRN	534	100.75	635	6/06/2001
355955	913715	16N06W26CCC1	2,700	367GNTR	510	230.15	740	5/16/2001
355959	913909	16N06W29DCC1	252	364EVRN	586	64.40	650	5/16/2001
360011	913620	16N06W26CBC1	800	368PWLL	545	104.57	650	5/14/2001
360022	913512	16N06W25BCD1	303	367CTTR	562	38.41	600	6/06/2001
360023	913654	16N06W27ACC1	1,000	364EVRN	557	92.95	650	5/15/2001
360047	913612	16N06W23CCD1	50	368JFRC	571	19.23	590	5/15/2001
360059	913437	16N06W24DCA1	360	364EVRN	489	155.55	645	3/28/2001
360105	913430	16N06W24DAC1	157	364EVRN	478	136.60	615	3/28/2001
360205	913534	16N06W14ADC1	165	364EVRN	479	91.04	570	3/28/2001
360222	913555	16N06W14BAD1	300	364EVRN	472	87.86	560	6/06/2001
360233	913338	16N05W06DCC1	1,110	368JFRC	408	41.66	450	3/30/2001
360301	913756	16N06W09DBB1	236	364EVRN	494	136.50	630	5/14/2001
360308	913815	16N06W09BDB1	165	364EVRN	471	159.36	630	5/14/2001
360308	913930	16N06W08BCD1	413	364EVRN	551	87.40	638	5/16/2001
360309	913927	16N06W08BCD1	400	364EVRN	569	73.38	642	5/16/2001
360349	913224	16N05W05DBA1	--	--	357	83.48	440	6/5/2001

Table 2. Information pertaining to measured wells and springs in the Ozark aquifer in northwestern Arkansas, 2001--Continued

[NA, not applicable; --, not available; Aquifer code designations are: 357BFLD, Brassfield Limestone; 364STPR, St. Peter Sandstone; 364 EVRN, Everton Formation; 368PWLL, Powell Dolomite; 367CTTR, Cotter Dolomite; 367CRJF, Cotter-Jefferson City Dolomite; 368JFRC, Jefferson City Dolomite; 367RBDX, Roubidoux Formation; 367GNTR, Gunter Sandstone member of Van Buren Formation; 371POTS, Potosi Dolomite]

Latitude	Longitude	Station name	Well depth (feet below land sur-face)	Aquifer code	Water level altitude (feet above sea level)[1]	Depth to water (feet below land surface)	Land surface altitude (feet above sea level)	Date of measure-ment
360350	913324	16N05W06ACD1	110	364EVRN	368	31.93	400	6/07/2001
360402	913825	16N06W04BCC1	78	364EVRN	508	19.48	527	6/07/2001
360551	913539	17N06W26ACB1	1,200	367RBDX	410	29.58	440	5/17/2001
360551	913539	17N06W26ACB2	107	368PWLL	408	32.20	440	5/17/2001
360557	913822	17N06W28BBC1	375	367CTTR	467	152.65	620	5/17/2001
360604	913854	17N06W29ABC1	900	368JFRC	445	80.17	525	5/16/2001
360707	913905	17N06W17CDD1	--	--	461	79.00	540	6/05/2001
360812	913741	17N06W09DBD1	375	367CTTR	539	160.90	700	6/05/2001
360818	912804	17N05W12BDC1	425	367CTTR	360	56.73	417	1/17/2001
361325	913638	18N06W10CBC1	1,525	367GNTR	483	141.88	625	1/17/2001
361813	912337	19N04W15BAA1	611	367RBDX	529	55.28	584	1/17/2001
361854	913332	19N05W07BDC2	77	367CTTR	434	71.21	505	3/22/2001
			Sharp County Springs					
360228	913211	16N05W17AAB1SP	NA	364STPR	495	0.0	495	4/18/2001
360325	913631	16N06W10AAA1SP	NA	364EVRN	435	0.0	435	3/19/2001
360325	913648	16N06W10ABB1SP	NA	364EVRN	455	0.0	455	3/20/2001
			Stone County Wells					
355805	921352	15N12W02BCA1	3,420	367GNTR	488	491.73	980	1/18/2001
355806	922402	15N13W06AC1	3,105	367RBDX	892	231.41	1,123	1/18/2001
			Washington County Wells					
355652	941858	15N31W30CAD1	2,485	367GNTR	1,150	15.32	1,165	1/29/2001
355903	941807	15N31W17BBD1	2,097	367GNTR	1,152	42.95	1,195	1/26/2001

[1]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.

The Ozark aquifer covers a large area in Arkansas and has variable thickness and hydrologic properties. Data point distribution is sparse in some areas. The potentiometric-surface map is intended to show the general configuration of the potentiometric surface and should not be used to estimate exact water-level altitude or depth to water at any given location. Direct comparisons with previous potentiometric-surface maps should be limited to wells that have water-level measurements for each potentiometric-surface map.

The extent of the potentiometric-surface map presented on plate 1 covers approximately half the defined study area. The Ozark aquifer in the southern portion of the study area is not a viable source of water because of the great depths and poorer water quality. Therefore, few wells have been constructed in that area and data are not available for contouring purposes.

The potentiometric-surface map reflects the general direction of ground-water flow within the Ozark aquifer, with ground-water movement perpendicular to the contours in the direction of the hydraulic gradient. The direction of regional ground-water flow generally is to the south and southeast in the eastern and central part of the study area and to the northwest and north in the western portion of the study area, except in areas where the unconfined part of the aquifer is hydraulically connected to the surface. In these areas, the flow direction is affected more by local topography (flowing from high altitudes toward stream valleys).

The potentiometric-surface map indicates the highest water-level altitude of about 1,360 feet above sea level in Carroll County. The water-level altitudes in this area are reflective of the influence of the land-surface topography and not the regional flow pattern of the aquifer. Water-level altitudes of less than 400 ft above sea level are mapped along the eastern and southeastern part of the study area in Lawrence, Randolph, and Sharp Counties. The lowest water level of 241 feet above sea level was measured in eastern Randolph County.

In most of the study area the general configuration of the potentiometric surface has changed little since 1995 or predevelopment times. A comparison of the predevelopment potentiometric surface (Imes, 1990) and the 2001 potentiometric surface indicates general agreement between the two surfaces with the exception of one area. This area (in Benton, Carroll, and Washington Counties) is an area of rapid population and agricultural growth since 1990. Population in these three counties has increased 36 to 57 percent from 1990 to 2000 (GIS Applications Laboratory, University of Arkansas at Little Rock, 2001). The potentiometric surface in 2001 was similar to the potentiometric surface in 1995 (Pugh, 1998). Potentiometric-surface differences could be attributed to differences in pumping related to changing population; differences in pumping for agricultural uses, time of year in which the water-level data were collected; pumping conditions just prior to a water-level measurement; and (or) interpretation resulting (in part) from different numbers and locations of water-level measurements used for constructing maps representing different times.

SUMMARY

From January to June of 2001, 90 ground-water levels of the Ozark aquifer in northern Arkansas were measured, mapped, and contoured, resulting in a potentiometric-surface map of the Arkansas portion of the Ozark aquifer. The Ozark aquifer in northern Arkansas is composed of dolomites, limestones, sandstones, and shales of Late Cambrian to Middle Devonian age which dip to the south and southeast away from the St. Francois Mountains of Missouri. The aquifer is complex, characterized by discrete hydrologic units with large variations in permeability. The principal recharge area for the aquifer is in central and south-central Missouri and north-central Arkansas, where the aquifer is hydraulically connected to the surface.

A potentiometric-surface map for 2001 of the Ozark aquifer in northern Arkansas indicates a maximum water-level altitude of about 1,360 ft in Carroll County, and a minimum altitude of about 241 ft in Randolph County. The direction of regional ground-water flow is generally to the south and southeast in the eastern half of the study area and to the northwest and north in the western half of the study area except in areas where the aquifer is unconfined. In these areas, the potentiometric surface mimics the land-surface topography. The 2001 potentiometric-surface map generally is similar in shape to a predevelopment potentiometric-surface map (Imes, 1990). Potentiometric-surface differences could be attributed to differences in pumping related to changing population from 1990 to 2000.

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