U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared in cooperation with the
LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

WATER-RESOURCES INVESTIGATIONS
REPORT 90-4183 (SHEET 1 OF 2)
SPARTA AQUIFER--POTENTIOMETRIC SURFACE

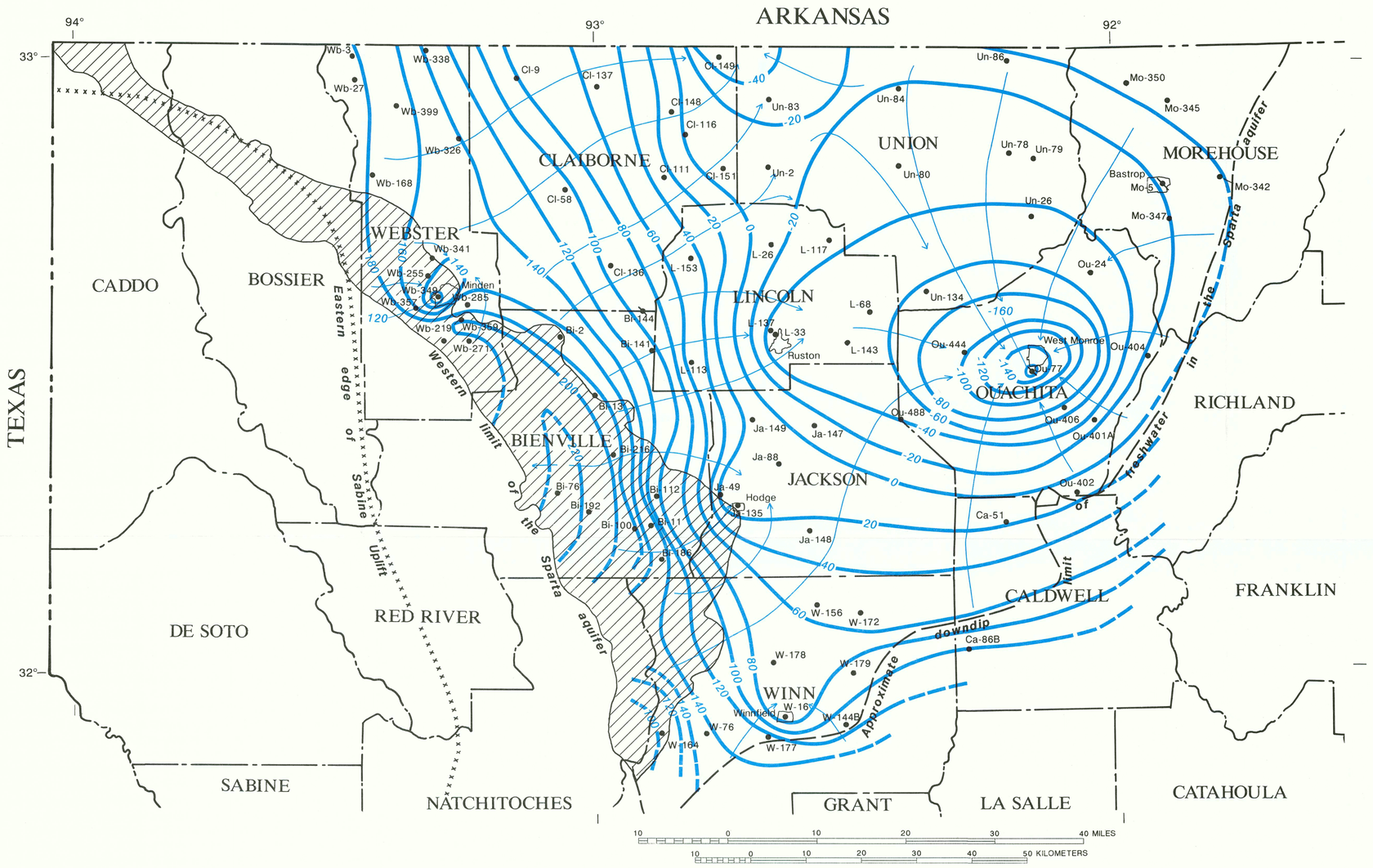

Figure 1.--Potentiometric surface of the Sparta aquifer, May through June 1989.

INDEX MAP OF LOUISIANA

EXPLANATION

- APPROXIMATE RECHARGE AREA OF THE SPARTA AQUIFER
- 40 POTENTIOMETRIC CONTOUR--Shows altitude to which water will rise in tightly cased wells. Dashed where approximately located. Contour interval 20 feet. Datum is sea level
- GENERAL DIRECTION OF GROUND-WATER MOVEMENT
- Un-26 CONTROL POINT AND WELL NUMBER
- Mo-5 OBSERVATION WELL FOR WHICH HYDROGRAPH IS SHOWN

INTRODUCTION

The Sparta aquifer is the principal source of ground water in north-central Louisiana. In 1985, the aquifer was extensively pumped for public supply (25 Mgal/d) and industrial use (29 Mgal/d, and 7 Mgal/d for other uses) (J.K. Lovelace, U.S. Geological Survey, written commun., 1989). More than 100 public supply systems, in 8 parishes, obtain water from the Sparta aquifer.

Large industrial pumpage from the Sparta aquifer began in 1922 at Bastrop (Sanford, 1973a, p. 60) and in about 1923 at West Monroe. Water levels in wells in the Sparta aquifer have been declining in these areas and in other parts of north-central Louisiana since the early 1920's, when industries began withdrawing large amounts of water. However, in Morehouse Parish the water levels in wells have been recovering since 1982 as a result of a 5 Mgal/d reduction in pumpage at Bastrop (J.K. Lovelace, U.S. Geological Survey, written commun., 1989).

Additional knowledge about ground-water flow and the effects of withdrawals on the Sparta aquifer is needed for assessment of ground-water development potential and protection of the resource. Potentiometric contour maps are used to determine direction of ground-water flow, ground-water gradients, and the effects of pumping on an aquifer system. The rate of ground-water movement can be estimated when the hydraulic conductivity of an aquifer is known.

This report presents data and maps that illustrate the potentiometric surface and water-level changes for the Sparta aquifer and is the third in a series of map reports that show potentiometric surface and water-level changes of aquifers in Louisiana (Fendick, 1989; Fendick and Nyman, 1987). These maps were prepared in cooperation with the Louisiana Department of Transportation and Development. Reports prepared as part of previous studies of northern Louisiana with emphasis on the Sparta aquifer are included in the Selected References.

These maps show the potentiometric surface in the spring of 1989 and water-level changes from 1980 to 1989 for the Sparta aquifer. The regional potentiometric surface of the Sparta aquifer, based on water-level measurements made during May through June 1989, is shown in figure 1. Ground-water flow directions are normal to the contours, from higher to lower head.

Water-level changes in wells in the Sparta aquifer from May 1980 to May 1989 are shown in figure 2. Three hydrographs (figs. 3-5) show general water-level trends for periods 1920-89, 1946-89, and 1970-89.

GEOHYDROLOGY

The Sparta aquifer (Sparta Formation) of Eocene age in northern Louisiana consists of very fine to medium sand, silty clay, lignite, and lesser amounts of clay. The Sparta aquifer is comprised 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 aquifer were deposited by shifting streams on a deltaic-fluvial flood plain (Payne, 1968, p. 3-4). These sands are mostly interconnected, but separately identifiable sands can be traced for only short distances (Snider and others, 1972, p. 13).

The Sparta aquifer generally dips to the east and southeast from the Sabine Uplift. (The Sabine Uplift is shown in figs. 1 and 2.) However, the dip along the northern border of the State is northeasterly. The Sparta aquifer is 50-300 ft thick within the recharge area and thickens to nearly 700 ft near the downdip limit of freshwater. The approximate downdip limit of freshwater is shown in figures 1 and 2. Below the downdip limit of freshwater, all sands in the Sparta aquifer contain saltwater; updip from the freshwater limit, sands in the upper part of the aquifer contain freshwater but sands in the lower part of the aquifer might contain saltwater.

POTENTIOMETRIC CONTOUR MAP

A regional potentiometric-surface map of the Sparta aquifer in northern Louisiana for May through June 1989 (fig. 1) was constructed using water-level measurements (table 1) made in wells screened in the middle or lower part of the aquifer. The water-level data were adjusted to sea level. The altitude of water levels in wells in the Sparta aquifer ranged from about 160 ft below sea level in an industrial area in West Monroe, Ouachita Parish, to more than 200 ft above sea level in the recharge area in central Bienville Parish. The lowest water levels in the Sparta aquifer are in Ouachita, Lincoln, and Union Parishes.

The natural ground-water flow in the Sparta aquifer in northern Louisiana generally is downdip in an easterly direction from the recharge area in the west toward the Mississippi River alluvial valley (Ryals, 1980). However, the general direction of ground-water movement (fig. 1) indicates that heavy pumpage at West Monroe in Ouachita Parish has altered or reversed the natural direction of flow. Flow in these areas is toward cones of depression in the potentiometric surface at the centers of pumping. Smaller cones of depression occur at pumping centers near Hodge in Jackson Parish, at Ruston in Lincoln Parish, at Winnfield in Winn Parish, and at Minden in Webster Parish. These depressions indicate minor alterations in the direction of flow.

Table 1.--Water-level data used to construct potentiometric surface of the Sparta aquifer, May through June 1989, for parishes in north-central Louisiana

Well number	Well depth (feet)	Water level (feet below land surface)	Water level (feet above or below sea level)	Date measured
Bienville				
Bi- 2	490	89.52	170.48	5-11-89
Bi- 11	195	17.40	152.60	5- 9-89
Bi- 13	462	134.93	190.03	5- 9-89
Bi- 76	110	49.38	230.62	5-11-89
Bi- 100	90	28.40	191.60	5-11-89
Bi- 112	348	113.45	101.55	5- 9-89
Bi- 141	660	242.60	107.40	5- 9-89
Bi- 144	630	226.62	93.38	5-11-89
Bi- 166	472	158.32	101.68	5-12-89
Bi- 186	216	39.41	140.59	5- 9-89
Bi- 192	153	70.42	214.58	5-11-89
Bi- 216	300	15.38	184.62	5- 9-89
Caldwell				
Ca- 51	500	161.33	100.30	5-10-89
Ca- 86B	545	79.70	76.45	5-10-89
Claiborne				
Cl- 9	670	283.55	76.45	5-10-89
Cl- 58	488	141.33	108.67	5-10-89
Cl- 111	570	280.34	29.66	5-11-89
Cl- 116	684	246.42	-1.42	5-10-89
Cl- 136	835	316.38	88.62	5-11-89
Cl- 137	639	224.84	55.16	5-10-89
Cl- 148	625	185.77	4.23	5-10-89
Cl- 149	736	275.75	-45.75	5-10-89
Cl- 151	719	193.03	-13.03	5-10-89
Jackson				
Ja- 49	570	140.17	19.83	5-12-89
Ja- 88	445	290.33	14.67	5-24-89
Ja- 135	380	163.60	16.40	6-23-89
Ja- 147	703	233.75	-13.75	5-12-89
Ja- 148	578	214.00	31.00	5-12-89
Ja- 149	478	176.03	18.97	5-12-89
Lincoln				
L- 26	686	168.23	-13.23	5-11-89
L- 33	811	337.68	-57.68	5-16-89
L- 68	770	227.34	-47.34	5-12-89
L- 113	750	306.36	48.64	5-11-89
L- 117	551	120. 5	-34.05	5-11-89
L- 137	600	281.28	-41.28	5-16-89
L- 143	6 5	271.59	-53.59	5-12-89
L- 153	535	227.22	52.78	5-10-89
Morehouse				
Mo- 5	860	148.14	-30.70	5- 9-89
Mo- 342	620	89.62	-1.28	5- 9-89
Mo- 345	786	104.48	9.17	5- 9-89
Mo- 347	833	162.55	-20.28	5- 9-89
Mo- 350	740	103.14	8.94	5- 9-89

Well number	Well depth (feet)	Water level (feet below land surface)	Water level (feet above or below sea level)	Date measured
Ouachita				
Ou- 24	688	129.32	-44.32	5- 9-89
Ou- 77	851	236.13	-161.13	5-10-89
Ou- 401A	397	97.96	-35.68	5-10-89
Ou- 402	750	50.40	12.90	5-10-89
Ou- 404	685	77.75	-16.86	5-10-89
Ou- 406	681	144.93	-78.27	5-10-89
Ou- 444	670	214.45	-96.45	5-11-89
Ou- 488	795	319.83	-39.23	5-10-89
Union				
Un- 2	581	241.02	-16.02	5-10-89
Un- 26	745	179.31	-45.39	5- 9-89
Un- 78	727	201.72	-26.72	5- 9-89
Un- 79	749	146.74	-28.74	5-11-89
Un- 80	710	225.40	-35.40	5-11-89
Un- 83	326	156.25	-34.75	5-10-89
Un- 84	696	233.30	-23.30	5- 9-89
Un- 86	655	92.36	-2.36	5- 9-89
Un- 134	585	290.99	-70.90	5-11-89
Webster				
Wb- 3	323	44.91	180.09	5-10-89
Wb- 27	311	52.36	192.64	5-10-89
Wb- 168	245	62.39	171.61	5-10-89
Wb- 219	136	3.59	186.41	5-11-89
Wb- 255	348	102.45	147.55	5-11-89
Wb- 271	220	82.45	195.55	5-11-89
Wb- 285	608	179.10	160.90	6-01-89
Wb- 326	470	113.25	146.75	5-10-89
Wb- 338	425	92.71	137.29	5-10-89
Wb- 341	470	92.10	147.90	5-10-89
Wb- 349	263	75.25	104.75	5-10-89
Wb- 357	167	15.18	149.82	5-10-89
Wb- 359	154	79.98	200.02	5-11-89
Wb- 399	298	43.68	161.32	5-10-89
Winn				
W- 16	583	63.62	71.38	5-12-89
W- 76	300	170.60	147.40	5-12-89
W- 144B	550	30.72	109.28	5-12-89
W- 156	829	199.19	57.81	6- 9-89
W- 164	210	93.72	102.28	5-12-89
W- 172	655	83.88	52.12	5-12-89
W- 177	695	53.05	131.95	5-12-89
W- 178	598	67.70	67.30	5-26-89
W- 179	585	101.79	93.21	5-12-89

For additional information write to:

District Chief
U.S. Geological Survey
P.O. Box 66492
Baton Rouge, Louisiana 70896

Water-Resources Section
Louisiana Department of Transportation
and Development
P.O. Box 94245
Baton Rouge, Louisiana 70804

Copies of this report can be purchased from:

U.S. Geological Survey
Books and Open-File Reports Section
Federal Center
P.O. Box 25425
Denver, Colorado 80225

LOUISIANA GROUND-WATER MAP NO. 3:
POTENTIOMETRIC SURFACE, 1989, AND WATER-LEVEL CHANGES, 1980-89, OF THE SPARTA AQUIFER IN NORTH-CENTRAL LOUISIANA

By Charles W. Smoot and Ronald C. Seanor

1991

☆U.S. GOVERNMENT PRINTING OFFICE: 1991-0-567-815