

Abstract

In the U.S. Geological Survey constructed the potentiometric surface of the Upland terrace and upper Ponchatoula aquifers and the “400-foot” sand using the altitude of water levels from 121 wells measured January 2014 to March 2015. Differences in water levels in the Upland terrace and upper Ponchatoula aquifers and “400-foot” sand were measured at 55 wells in 2009 and again at the same wells in 2014–15. Long-term hydrographs for most wells screened in the Upland terrace aquifer and “400-foot” sand show seasonal fluctuations and only minor changes in water levels.

The potentiometric surface of the “600-foot” sand was constructed by using the altitude of water levels from 14 wells measured from January 2014 to March 2015. Differences in water levels between 2009 and 2014–15 were determined in the “600-foot” sand by using measurements collected at seven wells. These differences do not necessarily indicate a trend but show water levels declined by more than 5 feet from 2009 to 2015. Long-term hydrographs for two wells screened in the “600-foot” sand show declines in water levels but vary in their drawdown and recovery based on location relative to areas of substantial groundwater withdrawal.

Hydrogeology

The Chicot equivalent aquifer system consists of southerly dipping unconsolidated deposits of silt, sand, and gravel that are separated by discontinuous units of clay and sandy clay. These deposits crop out throughout the study area except in floodplains of major streams where they are overlain by similar, younger alluvial deposits (Walters, 1995). The aquifer system is regionally extensive and extends north and east of the study area into Mississippi (Tomaszewski, 2011).

In the northern half of the study area, the Chicot equivalent aquifer system consists of upland terrace deposits (herein after referred to as the “Upland terrace aquifer”) that contain large amounts of sand and gravel and generally range from 100 to 400 feet (ft) in thickness (fig. 2). These sand and gravel deposits are hydraulically connected to the major streams in the area and supply base flow to many of them (Walters, 1995).

In the southern half of the study area, the Upland terrace aquifer dips beneath younger deposits of the Coastal Plain and becomes the subsurface equivalent of the “400-foot” and “600-foot” sands in the western part of the study area and the upper Ponchatoula aquifer in the eastern part of the study area (fig. 2). In the southernmost part of the study area, these deposits become finer grained, more discontinuous, and locally contain saline water.

Water in the Chicot equivalent aquifer system is confined except where the aquifer system crops out and water-table conditions exist. Recharge to the aquifer system occurs primarily in the northern half of the study area by infiltration of precipitation in areas where the aquifer crops out and by infiltration from overlying sandy deposits elsewhere (Tomaszewski, 2011). Recharge may also occur from the Mississippi River through the Mississippi River alluvial aquifer, which is hydraulically connected to the “400-foot” and “600-foot” sands (Kuniansky, 1989). Discharge from the Chicot equivalent aquifer system is primarily into streams and rivers and to pumping wells screened in the aquifer system.

Previous investigations (Whiteman, 1979; Tomaszewski, 1996) have shown the Baton Rouge Fault, (fig. 1) affects water levels, but south of the fault, water levels were only measured in two wells. The amount of effect in this area is not discussed herein, as the primary focus was on water levels north of the fault.

Table 1. Groundwater withdrawals from the Chicot equivalent aquifer system in southeast Louisiana, 2014 (Collier, 2018).

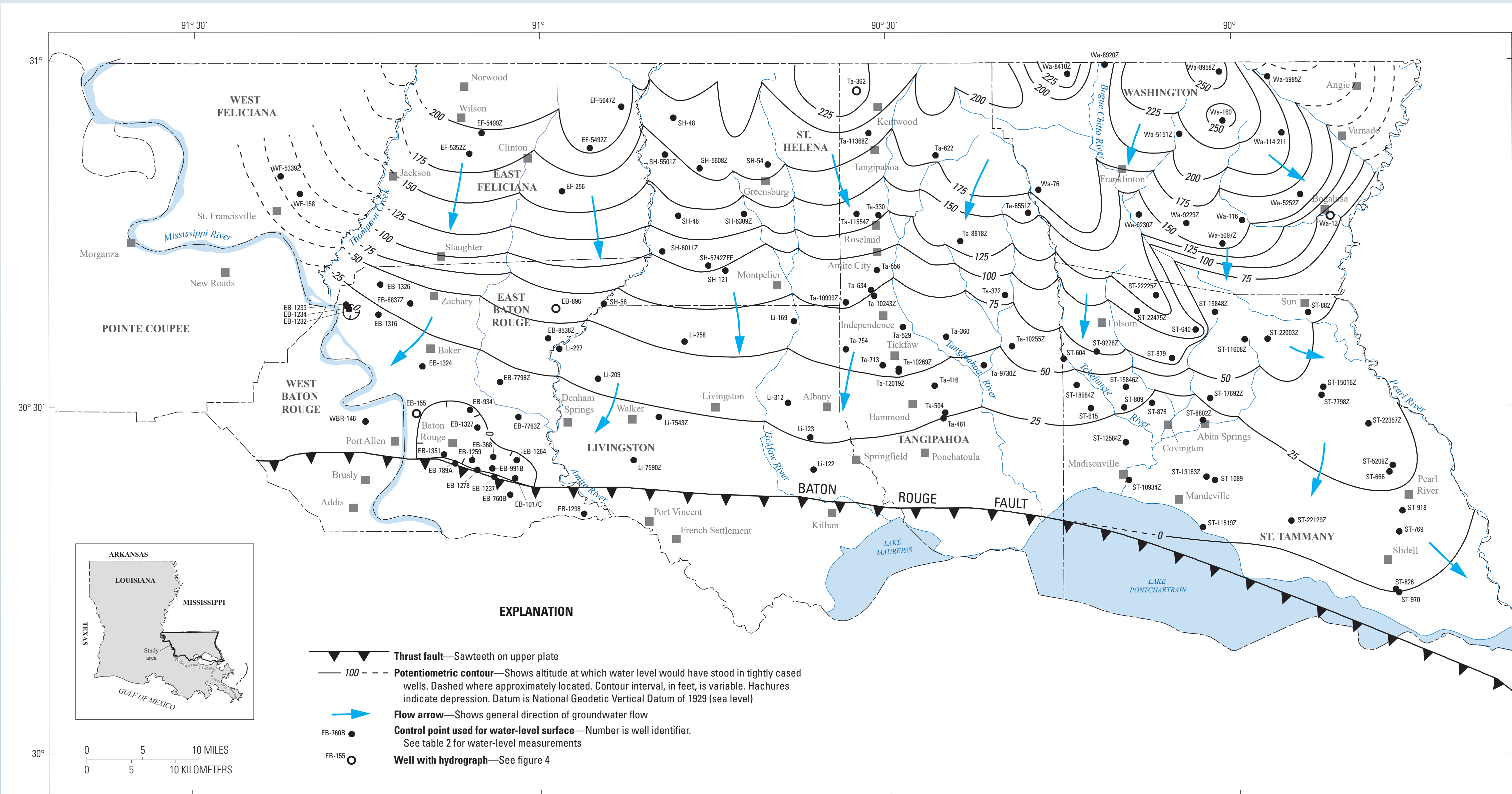
Parish	Withdrawals (Mgal/d)
East Baton Rouge	16.49
East Feliciana	0.44
Livingston	3.06
St. Helena	0.96
St. Tammany	5.41
Tangipahoa	4.47
Washington	7.66
West Baton Rouge	0.01
West Feliciana	0.02
Total	38.52

(Mgal/d, million gallons per day)

Potentiometric Surface of the Upland Terrace and Upper Ponchatoula Aquifers and “400-Foot” Sand of the Baton Rouge Area

The potentiometric surface of the Upland terrace and upper Ponchatoula aquifers and “400-foot” sand (fig. 1) was constructed by using the altitude of water levels measured in 121 wells from January 2014 through March 2015 (table 2). Water levels were measured by using a steel or electric tape marked with 0.01-ft graduations and were reported to one-hundredths of a foot, following the procedure in Cunningham and Schalk (2011). Water levels were only measured in wells that were not being pumped at the time of measurement. The altitude of water levels between –19.3 ft below the National Geodetic Vertical Datum of 1929 (NGVD 29) in East Baton Rouge Parish to 280.8 ft above NGVD 29 in Washington Parish.

Groundwater movement in the Upland terrace and upper Ponchatoula aquifers and “400-foot” sand is generally toward the south, toward local streams and rivers and toward areas of heavy withdrawals. In the northern part of the recharge area, stage readings from local rivers were consistent with water-level altitudes in the aquifers (data not shown). The resulting contours indicate that groundwater is generally contributing to streamflow. Localized cones of depression in the potentiometric surface, caused by heavy withdrawals, are located in northwestern and southeastern East Baton Rouge Parish. (fig. 1).



Base map modified from Louisiana (U) Soil Coordinates, Office of the Governor, Louisiana (SE CD). A Digital Map of the State, Version 2.0. Map Projection: North American Datum of 1983, Universal Transverse Mercator Zone 19.

Figure 1. Potentiometric surface of the Upland terrace and upper Ponchatoula aquifers and the “400-foot” sand of the Baton Rouge area in southeastern Louisiana, January 2014–March 2015.

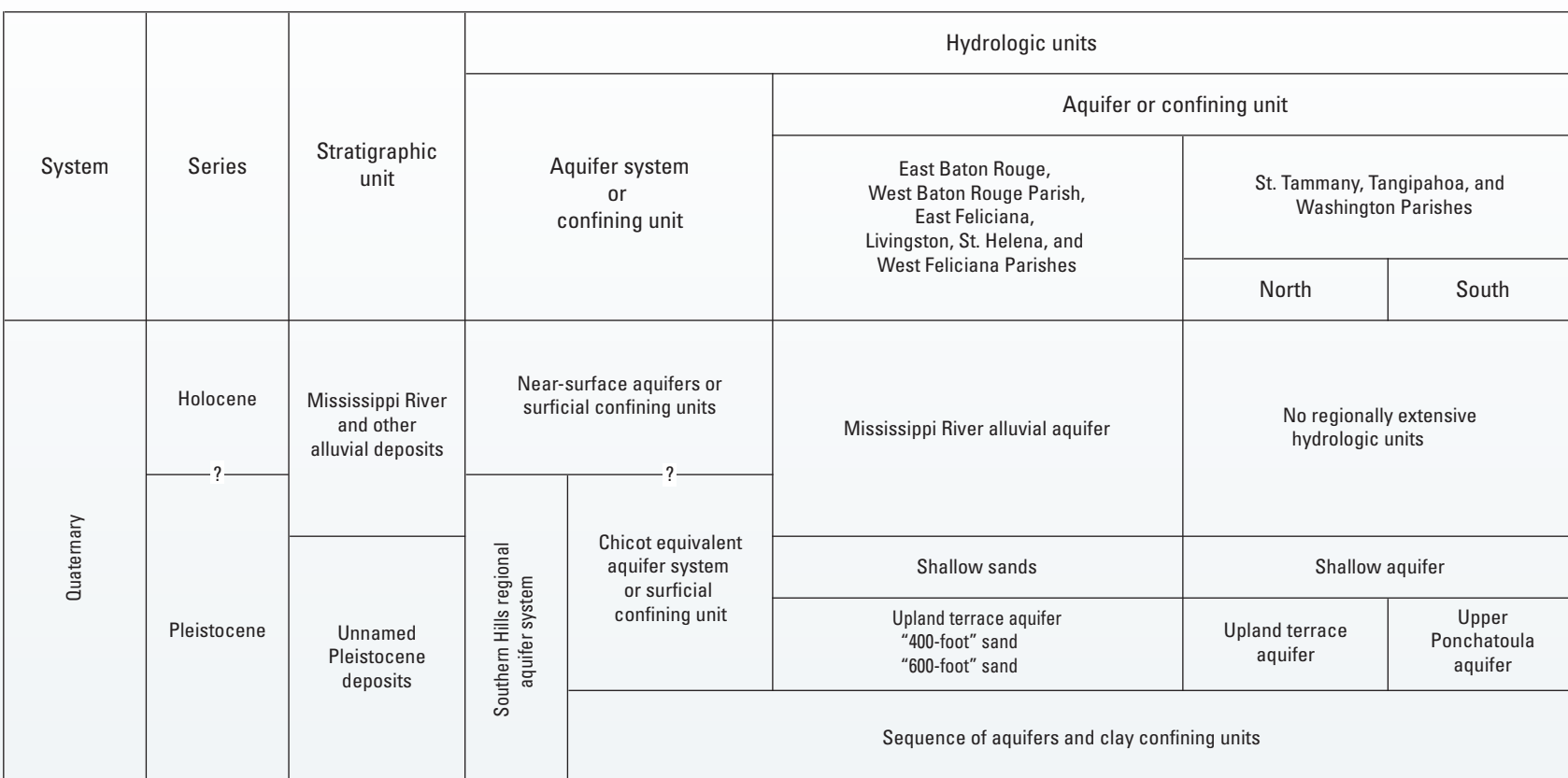


Figure 2. Correlation of hydrogeologic units in the Chicot equivalent aquifer system in southeastern Louisiana (modified from Tomaszewski, 2011).

Table 2. Water-level data used to construct maps of the potentiometric surface, January 2014 to March 2015, and water-level differences, 2009 to 2014–15, in the Upland terrace and upper Ponchatoula aquifers, and the “400-foot” sand of the Baton Rouge area in southeast Louisiana.

[Dates shown as month, day, year; USGS, U.S. Geological Survey; Aquifer codes: 11204BR, “400-foot” sand; 112PNCLU, upper Ponchatoula; 112UPTC, Upland terrace; NGVD 29, National Geodetic Vertical Datum of 1929; --, no data]

USGS station number	USGS station name	Aquifer code	Altitude of land surface (feet above NGVD 29)	Well depth (feet)	Date measured	2009 water level (feet above or below NGVD 29) ^a	Date measured	2014–15 water level (feet above or below NGVD 29) ^b	2014–15 water level difference (feet above or below NGVD 29) ^c	Difference in water level between 2009 and 2014–15 (feet) ^d
East Baton Rouge Parish										
302930091101501	EB-155	11204BR	60	412	2/19/2009	5.46	3/21/2014	59.05	0.95	–4.51
302557091035101	EB-368	11204BR	48	450	--	--	1/22/2014	51.74	–3.74	--
302225091021202	EB-760B	11204BR	30	640	--	--	1/17/2014	16.66	13.34	--
302511091070401	EB-789A	11204BR	37	711	2/6/2009	12.43	2/3/2014	22.04	14.96	2.53
303905090583301	EB-896	11204BR	82	73	2/5/2009	61.01	2/3/2014	18.99	63.01	2.00
302955091060501	EB-934	11204BR	51	385	2/5/2009	0.9	1/31/2014	52.30	–1.30	–2.20
302508091035402	EB-991B	11204BR	44	565	--	--	2/19/2014	47.37	–3.37	--
303406091021203	EB-107C	11204BR	36	567	--	--	2/19/2014	45.82	–9.82	--
303849091161301	EB-1232	11204BR	83	250	--	--	7/11/2014	102.30	–19.30	--
303910091164501	EB-1233	11204BR	94	250	--	--	7/11/2014	91.58	2.42	--
303853091165801	EB-1234	11204BR	97	250	2/11/2009	–6.64	2/11/2014	97.49	–0.49	6.15
302411091034501	EB-1237	11204BR	30	600	--	--	1/15/2014	22.20	7.80	--
302534091054502	EB-1259	11204BR	45	515	--	--	1/23/2014	60.15	–15.15	--
302543091015001	EB-1264	11204BR	38	498	2/5/2009	–3.29	1/31/2014	40.34	–2.34	0.94
302501091052601	EB-1278	11204BR	31	547	4/21/2009	–2.28	3/18/2014	33.09	–2.09	0.19
302105090560601	EB-1298	11204BR	15	695	--	--	2/20/2014	15.13	–0.13	--
303818091135001	EB-1316	11204BR	90	200	--	--	1/14/2014	66.65	23.35	--
303346091101101	EB-1324	11204BR	65	264	--	--	1/15/2014	50.66	14.34	--
304055091135501	EB-1326	11204BR	100	195	6/7/2009	33.99	2/7/2014	59.92	40.08	6.09
302825091053301	EB-1327	11204BR	50	500	--	--	1/15/2014	55.87	–5.87	--
302607091080501	EB-1351	11204BR	42	500	--	--	3/31/2015	46.77	–4.77	--
302929091015501	EB-7763Z	11204BR	50	325	--	--	1/15/2014	46.33	3.67	--
303245091031701	EB-7798Z	11204BR	60	380	--	--	3/10/2014	48.89	11.11	--
303613090591801	EB-8338Z	11204BR	70	180	--	--	1/14/2014	28.76	41.24	--
303912091113101	EB-8837Z	11204BR	85	228	--	--	1/31/2014	51.80	33.20	--
East Feliciana Parish										
304858090575601	EF-256	112UPTC	210	184	6/19/2009	162.59	2/18/2014	46.60	163.40	0.81
305212091055901	EF-5352Z	112UPTC	270	140	--	--	4/11/2014	77.21	192.79	--
305242090552301	EF-5492Z	112UPTC	300	130	--	--	2/19/2014	69.64	230.36	--
305400091045401	EF-5499Z	112UPTC	272	120	6/22/2009	200.24	1/16/2015	72.48	199.52	–0.72
305609090525301	EF-5647Z	112UPTC	250	140	--	--	1/16/2015	48.67	201.33	--
Livingston Parish										
302450090355601	LA-122	11204BR	11	500	5/15/2009	9.46	1/6/2014	2.58	8.42	–1.04
302737090363901	LA-123	11204BR	27	520	--	--	3/5/2014	1.20	25.80	--
303747090374801	LA-169	11204BR	85	260	2/26/2009	73.49	1/7/2014	13.31	71.69	–1.80
303247090544601	LA-209	11204BR	59	305	5/26/2009	30.32	1/6/2014	28.74	30.26	–0.06
303508090581801	LA-227	11204BR	67	225	--	--	2/5/2014	30.31	36.69	--
303558090471501	LA-258	11204BR	73	335	5/15/2009	53.26	1/6/2014	20.60	52.40	–0.86
303043090381001	LA-312	11204BR	50	375	--	--	3/5/2014	7.16	42.84	--
302923090490501	LA-7543Z	11204BR	40	280	--	--	3/5/2014	17.30	22.70	--
302660090513701	LA-7590Z	11204BR	25	380	--	--	2/3/2014	7.15	17.85	--
St. Helena Parish										
304651090475201	SH-46	112UPTC	185	120	5/1/2009	149.74	2/18/2014	36.50	148.50	–1.24
305519090481801	SH-48	112UPTC	245	92	5/26/2009	185.77	2/18/2014	59.75	185.25	–0.52
305118090400701	SH-54	112UPTC	235	100	5/1/2009	190.75	3/14/2014	54.43	180.57	–10.18
303912090542701	SH-56	112UPTC	177	160	5/26/2009	67.22	3/19/2014	6.70	70.30	3.08
304206090434701	SH-121	112UPTC	50	360	--	--	3/19/2014	51.08	98.92	--
305205090490201	SH-501Z	112UPTC	177	100	5/4/2009	168.19	2/18/2014	9.40	167.60	–0.59
305058090460601	SH-508Z	112UPTC	250	95	5/5/2009	178.16	2/18/2014	71.16	178.84	0.68
304232090451701	SH-5742Z	112UPTC	162	160	5/1/2009	112.76	2/18/2014	50.20	111.80	–0.96
304345090491601	SH-6011Z	112UPTC	120	80	--	--	3/13/2014	16.53	103.47	--
304701090421001	SH-6309Z	112UPTC	215	120	5/1/2009	147.76	3/13/2014	68.32	146.68	–1.08
St. Tammany Parish										
303425090143501	ST-604	112PNCLU	66	66	7/23/2009	52.57	3/13/2014	10.30	54.70	2.13
303010900120701	ST-615	112UPTC	38	34	--	--	3/13/2014	5.82	32.18	--
3037109001930201	ST-640	112UPTC	155	90	5/27/2009	120.75	3/12/2014	34.71	120.29	–0.46
303453090472901	ST-666	112PNCLU	45	350	--	--	2/23/2015	17.18	27.82	--
301940809453901	ST-769	112PNCLU	25	699	--	--	2/5/2015	4.12	20.88	--
3030130909091301	ST-809	112UPTC	30	135	--	--	3/12/2014	3.05	26.95	--
301450809455501	ST-826	112PNCLU	5	255	--	--	2/23/2015	0.01	4.99	--
303044090065501	ST-878	112PNCLU	39	110	6/3/2009	20.00	5/23/2014	16.50	22.50	2.50
303430900505901	ST-879	112UPTC	90	95	--	--	3/13/2014	11.50	78.50	--
303530908525301	ST-880Z	112PNCLU	75	300	--	--	2/6/2015	15.48	59.52	--
302214098454501	ST-918	112PNCLU	32	555	--	--	2/26/2015	9.49	22.51	--
301444098454501	ST-970	112PNCLU	5	730	--	--	1/28/2015	6.94	–1.94	--
302416090012501	ST-1089	112PNCLU	28	253	--	--	3/2/2015	9.75	18.25	--
302530809470201	ST-5209Z	112PNCLU	30	332	--	--	1/27/2015	4.97	25.03	--
303155089524401	ST-7798Z	112PNCLU	62	240	--	--	3/2/2015	15.41	46.59	--
3028570904903001	ST-802Z	112PNCLU	28	250	--	--	2/26/2015	15.50	12.50	--
30350900114101	ST-9236Z	112UPTC	100	95	6/3/2009	75.11	5/23/2014	23.84	76.16	1.05
302421090804502	ST-10934Z	112PNCLU	5	420	--	--	2/9/2015	–1.46	6.46	--
30208090023801	ST-11519Z	112PNCLU	6	440	--	--	2/5/2015	0.98	5.02	--
303630809585401	ST-11680Z	112UPTC	172	354	--	--	2/6/2015	107.70	64.30	--
302802090090301	ST-12584Z	112PNCLU	24	250	6/5/2009	12.98	1/27/2015	10.28	13.72	0.74
30243809002502	ST-13163Z	112PNCLU	25	240	--	--	2/27/2015	24.98	0.02	--
303220908525301	ST-15016Z	112PNCLU	60	250	--	--	3/6/2015	16.93	43.07	--
303151090085401	ST-15846Z	112PNCLU	50	245	--	--	2/26/2015	18.25	31.75	--
303842090010801	ST-15848Z	112PNCLU	150	420	--	--	2/27/2015	96.40	53.60	--
30311209002201	ST-17692Z	112PNCLU	45	90	6/3/2009	29.02	1/27/2015	14.56	30.44	1.42
303211091032701	ST-18964Z	112PNCLU	52	140	6/9/2009	40.71	5/23/2014	11.49	40.51	–0.20
303620890565101	ST-22003Z	112PNCLU	95	260	6/1/2009	70.23	5/27/2014	24.32	70.88	0.45
302105090584501	ST-22129Z	112PNCLU	25	560	--	--	2/5/2015	17.12	23.68	--
303007090077201	ST-22352Z	112UPTC	165	80	--	--	2/10/2015	23.55	141.45	--
30300509485801	ST-22357Z	112PNCLU	56	330	7/1/2009	31	2/6/2015	20.99	30.05	4.01
30383209008401	ST-22475Z	112PNCLU	129	440	--	--	2/25/2015	24.35	145.61	--

Water-Level Differences of the Upland Terrace and Upper Ponchatoula Aquifers and "400-Foot" Sand of the Baton Rouge Area

Temporal differences in water levels in the Upland terrace aquifer and upper Ponchatoula aquifers and the "400-foot" sand determined for 56 wells are listed in table 2 and shown on figure 3. Water-level differences were calculated by subtracting the 2009 water-level measurement from the 2014–15 water-level measurement. These differences do not necessarily indicate a trend but show whether water levels have increased or decreased from 2009 to 2014–15. Water-level differences at 73 percent of the wells were within ± 2 ft, indicating minimal change occurred during the period.

Water levels at well Ta-362 (fig. 4A), screened in the Upland terrace aquifer and located in northwestern Tangipahoa Parish (fig. 1), show fluctuations but little net change during 1999–2014. Water levels at well Wa-13 (fig. 4B), screened in the Upland terrace aquifer and located in southeastern Washington Parish (fig. 1), show an increase of less than 1.0 foot per year (ft/yr) for the 1970–99 period, and relatively no change since 1999. No long-term hydrographs were available for wells screened in the upper Ponchatoula aquifer.

The long-term hydrograph for well EB-896 (fig. 4C), screened in the "400-foot" sand located in the northeastern corner of East Baton Rouge Parish away from the industrial corridor along the Mississippi River (fig. 1), shows fluctuations of approximately 3 ft from 1972 to 1997, primarily because of seasonal withdrawals. No measurements were collected during the 1998–2002 period, but the water levels were about 4 to 5 ft lower when measurements resumed in 2003, indicating the effect of increased groundwater withdrawals (fig. 4C). The long-term hydrograph for well EB-155 (fig. 4D), also screened in the "400-foot" sand located in southwestern East Baton Rouge Parish (fig. 1), shows greater seasonal fluctuations when compared to EB-896 (approximately 50–60 ft) from 1963 to 1990, and an upward trend in water levels but minimal net change from 1990 to 2014.

Potentiometric Surface of the "600-Foot" Sand of the Baton Rouge Area

The potentiometric surface of the "600-foot" sand of the Baton Rouge area (fig. 5) was constructed by using the altitude of water levels from 14 wells measured from January 2014 to March 2015 (table 3). Water levels were measured following the same procedure mentioned earlier for wells that were not being pumped at the time of measurement. The altitude of water levels ranged from -47.48 ft below NGVD 29 to 47.33 ft above NGVD 29 in East Baton Rouge Parish.

Groundwater movement in the "600-foot" sand is generally toward the south and toward local streams, rivers, and areas of substantial withdrawal. Localized cones of depression in the potentiometric surface are located in southwestern East Baton Rouge Parish (fig. 5).

Water-Level Differences of the "600-Foot" Sand of the Baton Rouge Area

Temporal differences in water levels in the "600-foot" sand determined for seven wells in East Baton Rouge Parish are listed in table 3. Water-level differences were calculated by subtracting the 2009 water-level measurement from the 2015 water-level measurement. These differences do not necessarily indicate a trend but show water levels declined by more than 5 ft from 2009 to 2015 (table 3). Water levels at EB-827 (fig. 6A), located in the central area of the parish, north of areas with substantial withdrawals, declined more than 0.5 ft/yr from 1990 to 2015, while water levels in EB-945 (fig. 6B), located in the southwestern area of the parish, near the cones of depression and areas of substantial withdrawal, declined about 2 ft/yr for the same 1990–2015 period.

Table 3. Water-level data used to construct map of the potentiometric surface, January 2014 to March 2015, and water-level difference, 2009–15, in the "600-foot" sand of the Baton Rouge area in southeast Louisiana.

[Data shown as month, day, year; USGS, U.S. Geological Survey; Aquifer codes: 11206BR, "600-foot" sand; NGVD 29, National Geodetic Vertical Datum of 1929; --, no data]

USGS station number	Well number	Aquifer code	Altitude of land surface (feet above NGVD 29)	Well depth (feet)	Date measured	2009 water level (feet above or below NGVD 29)	Date measured	2014–15 water level (feet below land surface)	2014–15 water level (feet above or below NGVD 29)	Difference in water level between 2009 and 2014–15 (feet)
East Baton Rouge Parish										
302619091104003	EB-434	11206BR	45	611	1/6/2009	-24.21	3/12/2015	74.91	-29.91	-5.70
302719091103201	EB-793	11206BR	35	687	1/23/2009	-29.41	3/12/2015	72.78	-37.48	-8.07
303356091095301	EB-827	11206BR	64	370	4/22/2009	17.34	1/7/2015	53.84	10.12	-7.22
302729091100601	EB-870	11206BR	50	692	2/10/2009	-28.67	1/6/2015	89.25	-39.25	-10.58
302955091060601	EB-933	11206BR	51	603	2/5/2009	-17.52	1/7/2015	75.26	-24.26	-6.74
302933091101002	EB-945	11206BR	59	654	2/19/2009	-34.35	3/6/2015	106.48	-47.48	-13.13
303804091031701	EB-1272	11206BR	90	197	--	--	1/14/2014	43.70	46.30	--
303958091110101	EB-1315	11206BR	100	330	--	--	1/14/2014	52.67	47.33	--
303830091150201	EB-74992	11206BR	88	300	--	--	1/12/2015	82.58	5.42	--
Livingston Parish										
302822090481401	Li-198	11206BR	35	600	--	--	2/3/2015	12.40	22.60	--
302203090322001	Li-270	11206BR	12	634	--	--	3/21/2015	3.22	8.78	--
301946090411401	Li-286	11206BR	10	740	--	--	3/20/2015	6.66	3.34	--
302131090304001	Li-317	11206BR	10	690	--	--	2/20/2014	5.49	4.51	--
West Baton Rouge Parish										
302958091124802	WBR-161	11206BR	26	650	2/17/2009	-16.77	1/30/2015	50.28	-24.28	-7.51

¹Negative (-) numbers indicate water level below NGVD 29.

²Negative (-) numbers indicate a decline in water level from the 2009 measurement to the 2014–15 measurement.

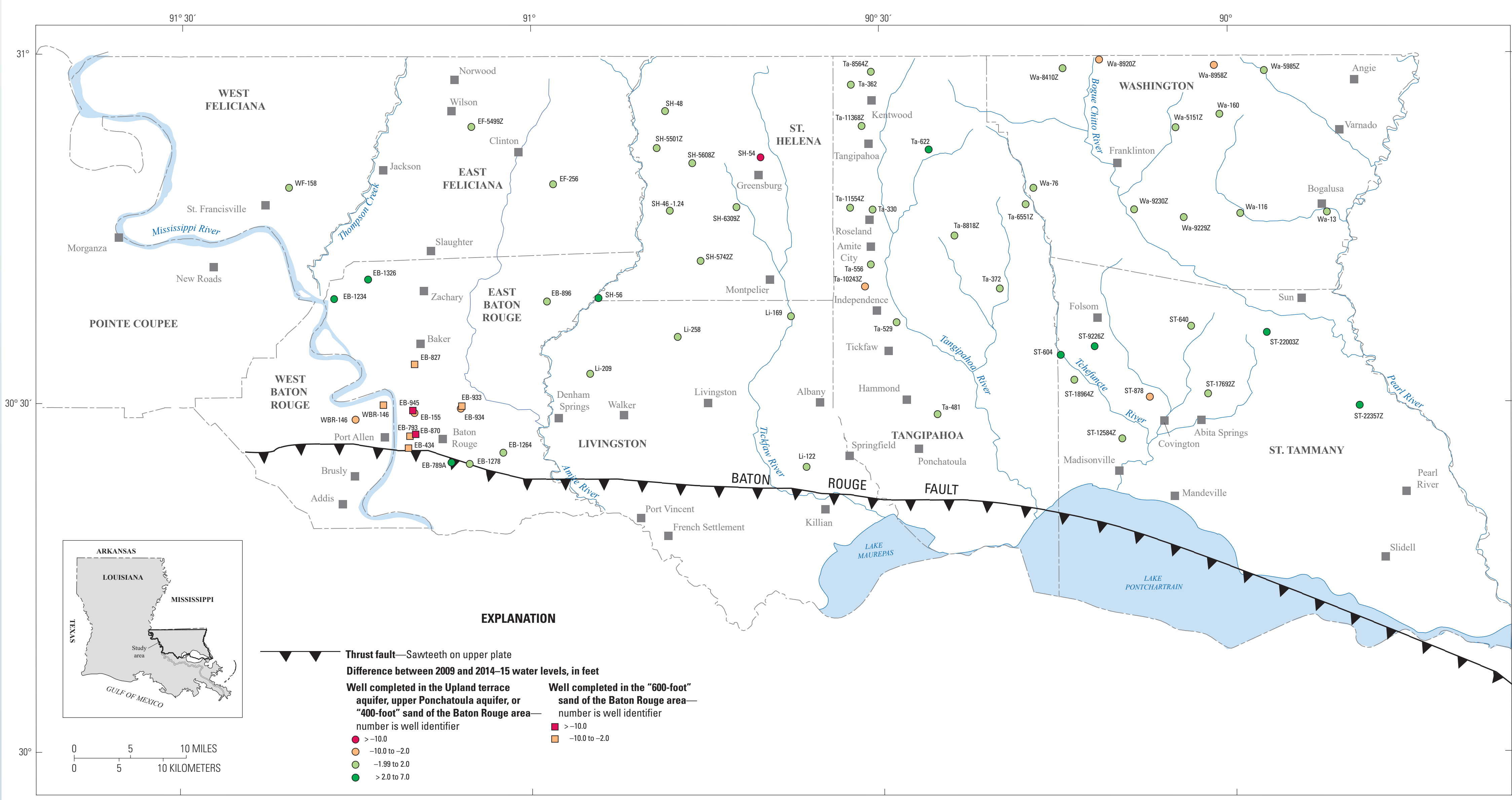


Figure 3. Water-level differences, 2009 to 2014–15, in the Upland terrace aquifer, upper Ponchatoula aquifer, and the "400-foot" and "600-foot" sands of the Baton Rouge area in southeast Louisiana.

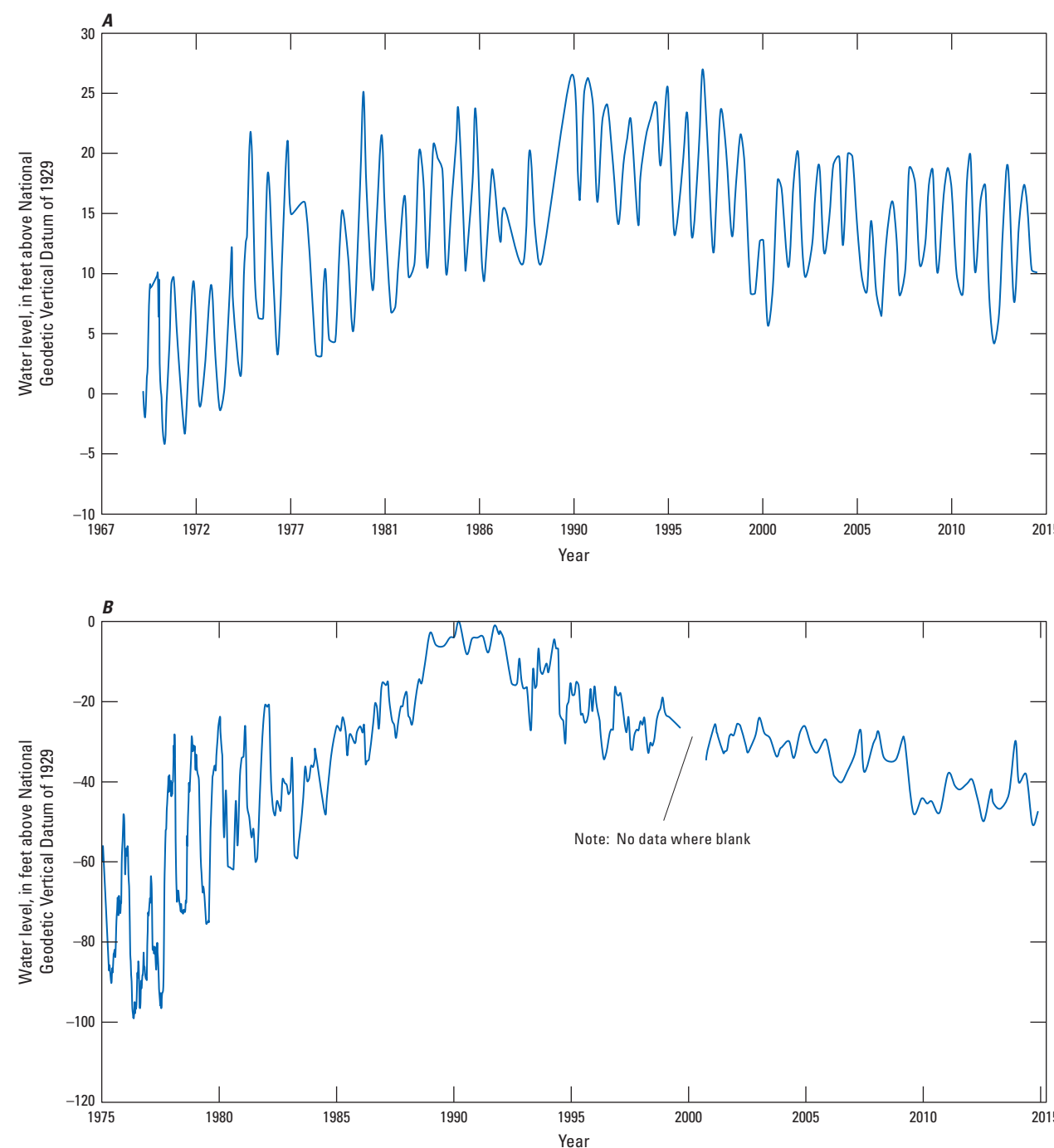


Figure 6. Hydrographs for wells A, EB-827, and B, EB-945, screened in the "600-foot" sand of the Baton Rouge area in southeast Louisiana.

Selected References

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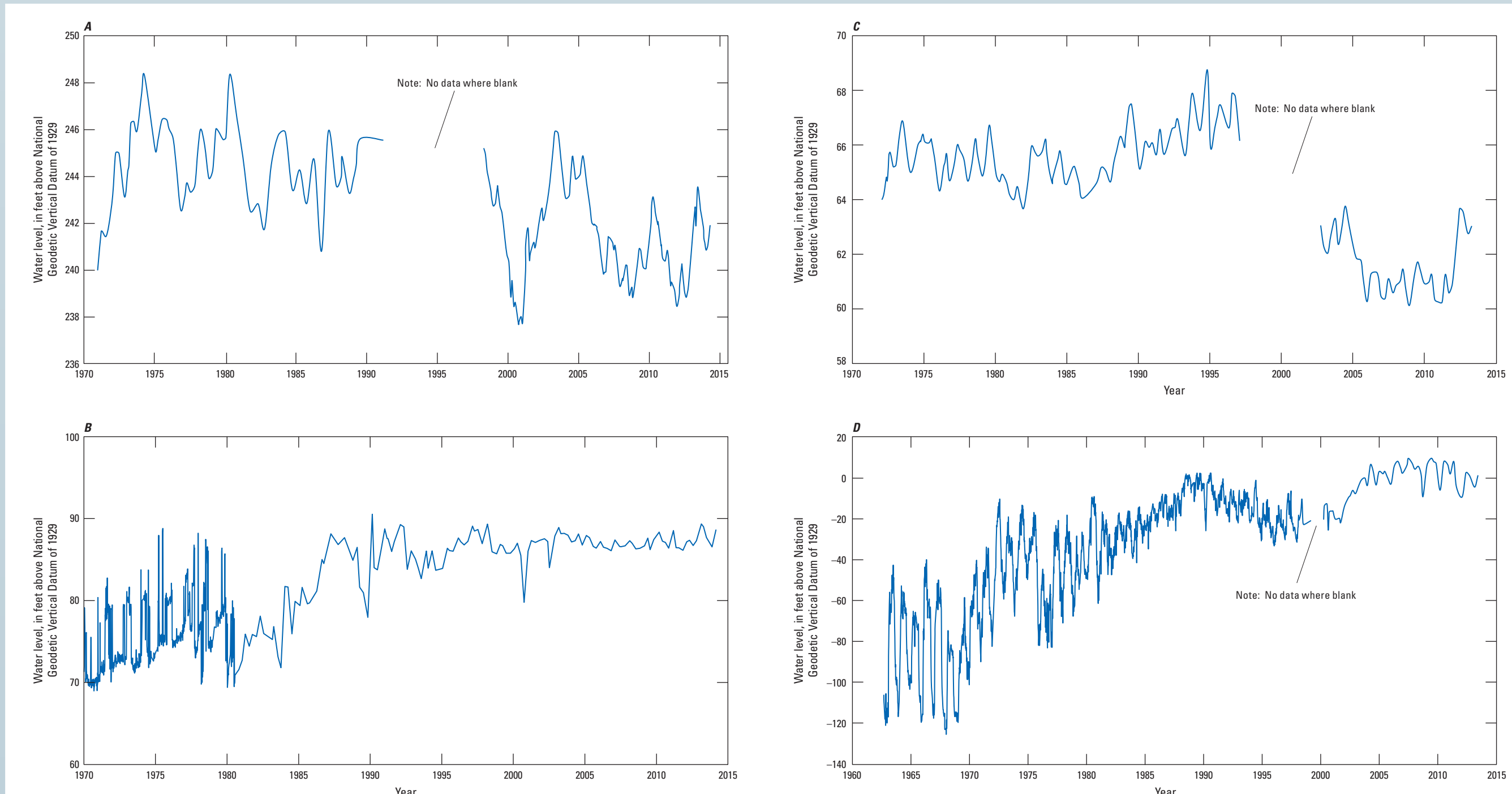


Figure 4. Hydrographs for wells A, Ta-362, B, Wa-13, C, EB-896, and D, EB-155, screened in the Upland terrace aquifer and the "400-foot" sand of the Baton Rouge area in southeast Louisiana.

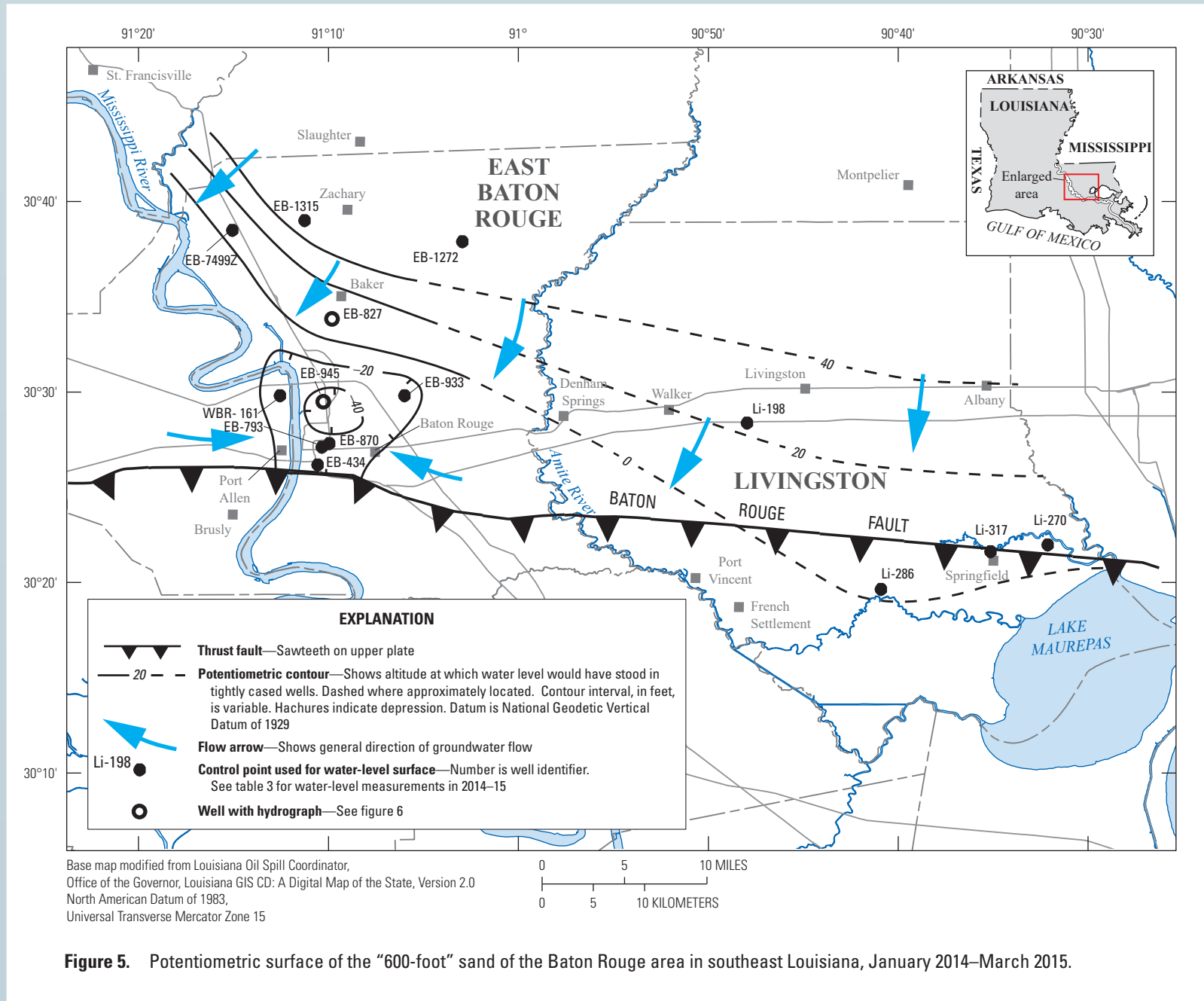


Figure 5. Potentiometric surface of the "600-foot" sand of the Baton Rouge area in southeast Louisiana, January 2014–March 2015.

Potentiometric Surface, 2014–15, and Water-Level Differences, 2009 to 2014–15, in the Chicot Equivalent Aquifer System in Southeastern Louisiana

By
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2022

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