UNITED STATES

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BACKGROUND HYDROLOGIC INFORMATION IN POTENTIAL LIGNITE MINING AREAS IN MISSISSIPPI, AUGUST 1981

by J.K. Arthur

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ABSTRACT

The U.S. Geological Survey, in cooperation with the Mississippi Bureau of Geology, is conducting a hydrologic data-collection program in potential lignite-producing areas in Mississippi. During the period August 24-31, 1981, hydrologic data consisting of channel characteristics and stream discharge were collected at 18 sites, and water and channel bottom material samples were collected at 15 sites on small streams draining potential lignite mining areas in east-central Mississippi.

Main channel widths ranged from 100 feet on Mill Creek near Louisville to 30 feet on Spring Creek near Bond. Maximum water depths varied from 12.5 feet on Pawticfaw Creek to 0.2 foot on Beasha Creek. The maximum stream discharge was 9.3 cubic feet per second on Moody Creek. Three sites had no discharge.

Specific conductance ranged from 100 micromhos on Lonsilocher Canal near Philadephia to 24 micromhos on Jofuska Creek near Arlington. Water temperatures varied from 22.5° C to 26° C. The lowest pH was 5.8 on Lobutcha Creek. The highest pH was 7.6 on Fulton and Lonsilocher Canals. The dissolved oxygen concentration was 3.8 milligrams per liter or higher at all sites. The concentration of suspended sediment did not exceed 38 milligrams per liter at any site. Concentrations of calcium, magnesium, potassium, sodium, chloride, and sulfate were less than 10 milligrams per liter in all samples. Channel bottom-material samples commonly contained iron, manganese, and zinc.

INTRODUCTION

During the period August 24-31, 1981, water samples and channel bottom samples were collected at 15 of 18 pre-selected stream sites in a three-county area in east-central Mississippi. These water-quality data sites, selected jointly by the U.S. Geological Survey and the Mississippi Bureau of Geology, are part of a series to be sampled to provide background hydrologic information in potential lignite mining areas in Mississippi.

Little surface-water hydrologic information is available in that part of Mississippi where recoverable deposits of lignite occur. The surface mining of lignite may require the removal of large amounts of previously unexposed materials and the disposal of large volumes of water. The massive excavations, weathering of overburden materials, and high volume dewatering will impact the hydrologic system. In order to assess this impact, it is essential that hydrologic information be collected prior to any mining activity. Sediment deposition and the effects on stream water quality are primary concerns.

OBJECTIVE AND SCOPE

The objective of this study is to collect background data on water quality and channel characteristics in many of the small streams draining areas of potential lignite mining. The collected data will be available to document pre-mining conditions in areas where little information is available. This information will be an invaluable data base for any future study of effects of surface mining in Mississippi.

The area of potential lignite mining in Mississippi is large, extending in a 40 to 100-mile wide band from the Alabama border in east-central Mississippi to the Tennessee line in the northwestern part of the state. About 15 small streams draining this area are sampled during the low-flow season each year. Emphasis will be on collecting a limited amount of information on a large number of streams throughout the multicounty area. Streams in the east-central part of the State were sampled in 1981, the second year of the project. In succeeding years, areas that have greatest mining potential will be studied.

AREA OF STUDY

The 18 sites visited in fiscal year 1981 are located in three counties in east-central Mississippi (figure 1). Ten sites are in Neshoba County, six in Winston and two in Kemper (table 1). Thirteen of the sites are in the Pearl River basin and five sites are in the Tombigbee River basin.

All sites are on small streams at bridge crossings. The largest drainage area at a sampling site is 42.2 mi^2 (square miles) on Lobutcha Creek and the smallest is 2.81 mi^2 on Spring Creek. The mean drainage area is 21.8 mi^2. All sites are in rural areas that drain farm or forest lands.

CHANNEL CROSS SECTIONS

Channel cross sections were delineated at each site at the time of sample collection (figure 2.) The cross sections were determined by measuring from a horizontal reference point on the bridge down to the ground surface. Main-channel width ranged from 100 feet on Mill Creek (site 02447090) to 30 feet on Spring Creek (site 02481865). Maximum water depths at sampling sites ranged from 12.5 feet on Pawticfaw Creek (site 02467240) to 0.2 foot on Beasha Creek (site 02481986). Channel bottoms principally consisted of sand and varying amounts of decayed vegetation. Most channel banks were steep and heavily vegetated. Flood plains near sampling points were either pasture land or heavily wooded. Photographs were taken at all sites and are available from the Mississippi Bureau of Geology and the U.S. Geological Survey in Jackson, MIssissippi.

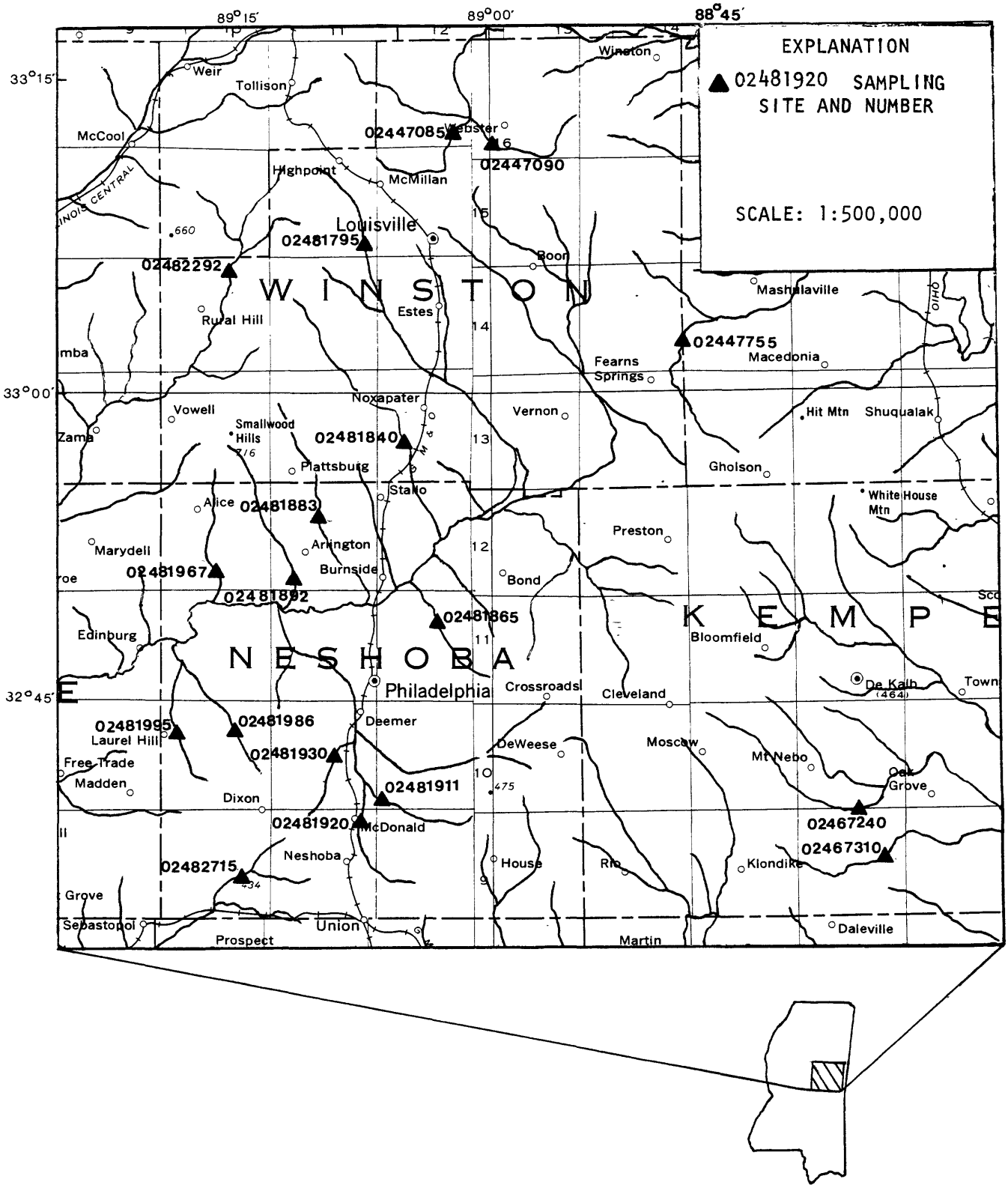

FIGURE 1.--LOCATION OF STUDY AREA AND SAMPLING SITES.

Table 1.--Sampling sites in study area, east-central Mississippi, August 24-31, 1981

Site No.	Name and location	County	Latitude	Longitude	Drainage area (mi^2)
02447085	Little Noxubee R near Webster, MS.	Winston	33°12'05"	89°02'05"	23.8
02447090	Mill Creek near Louisville, MS.	Winston	33°11'51"	88°59'40"	24.6
02447755	Moody Creek near Ferns Springs, MS.	Winston	33°02'41"	88°49'02"	17.9
02467240	Pawticfaw Creek near Blackwater, MS.	Kemper	32°39'50"	88°40'31"	34.7
02467310	Blackwater Creek near Klondike, MS.	Kemper	32°36'18"	88°40'52"	11.4
02481795	Tallahaga Creek near McMillan, MS.	Winston	33°07'07"	89°07'10"	22.6
02481840	Noxapater Creek near Noxapater, MS.	Winston	32°57'32"	89°05'04"	31.7
02481865	Spring Creek near Bond, MS.	Neshoba	32°49'39"	89°00'41"	2.81
02481883	Pinishook Creek near Arlington, MS.	Neshoba	32°54'18"	89°10'19"	34.6
02481892	Jofuska Creek near Arlington, MS.	Neshoba	32°51'08"	89°11'29"	18.9
02481911	Coonshuck Canal near House, MS.	Neshoba	32°40'22"	89°06'39"	17.3
02481920	Fulton Canal at McDonald, MS.	Neshoba	32°39'27"	89°07'41"	23.3
02481930	Lonsilocher Canal near Philadelphia, MS.	Neshoba	32°42'49"	89°08'59"	16.7
02481967	Lukfapa Creek near Arlington, MS.	Neshoba	32°51'42"	89°16'22"	16.5
02481986	Beasha Creek near Laurel Hill, MS.	Neshoba	32°44'24"	89°15'24"	21.6
02481995	Luneluah Creek at Laurel Hill, MS.	Neshoba	32°44'00"	89°18'35"	14.7
02482292	Lobutcha Creek near Rural Hill, MS.	Winston	33°06'16"	89°15'02"	42.2
02482715	Sipsey Creek near Dixon, MS.	Neshoba	32°36'40"	89°14'42"	18.0

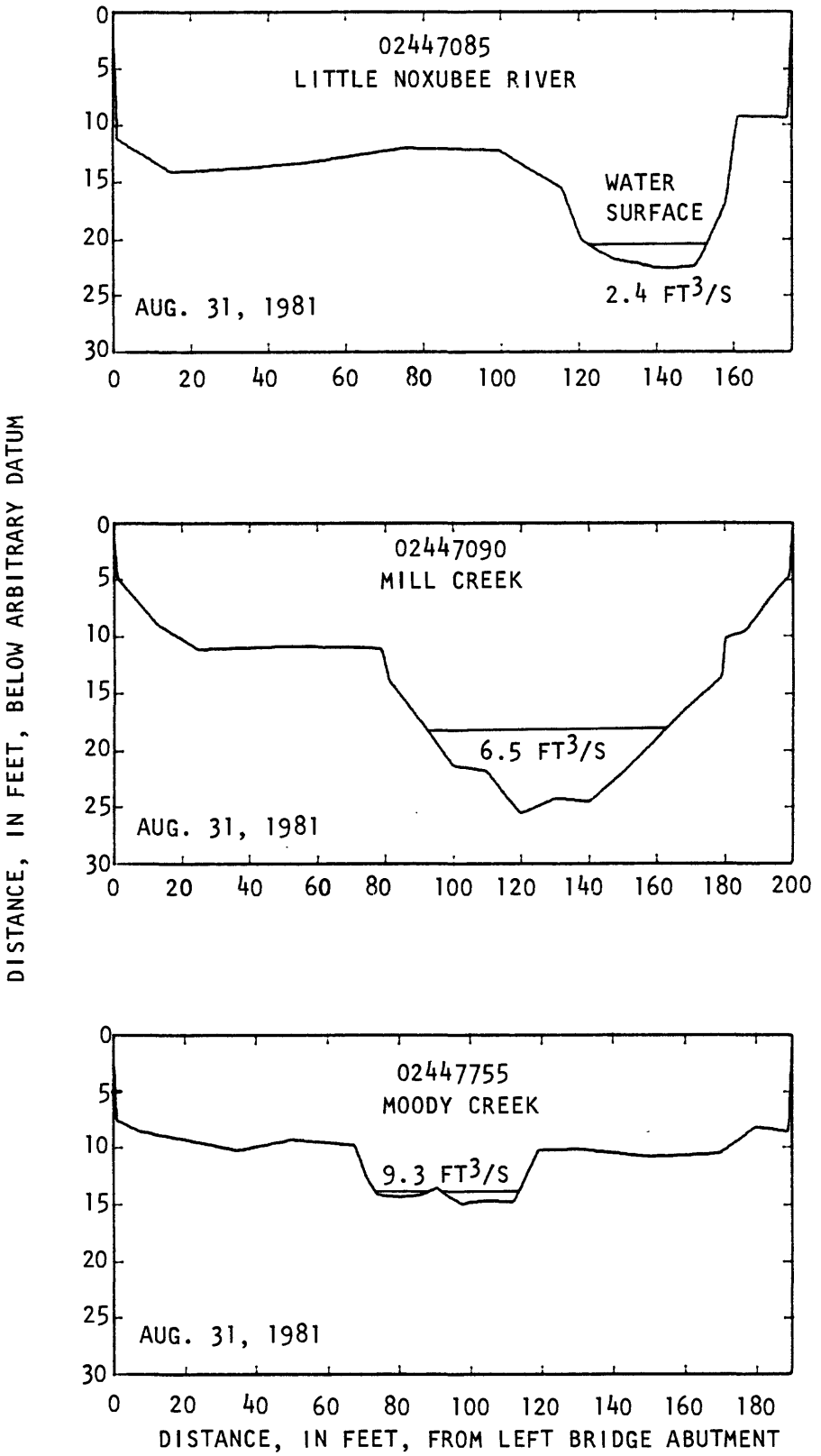

FIGURE 2.--CHANNEL CROSS SECTIONS AT SAMPLING SITES, EAST-CENTRAL MISSISSIPPI, AUGUST 24-31, 1981.

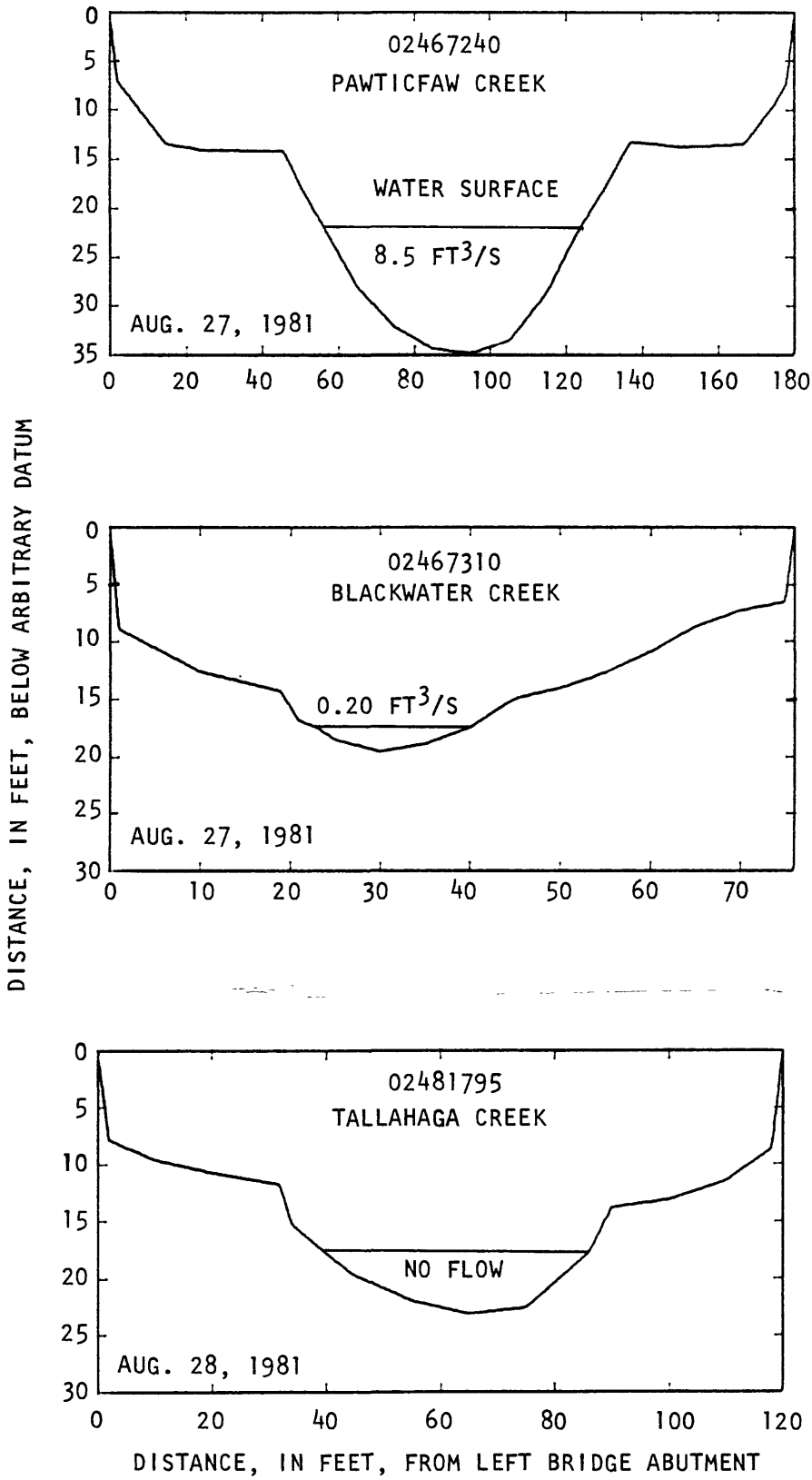

FIGURE 2.--CHANNEL CROSS SECTIONS AT SAMPLING SITES, EAST CENTRAL MISSISSIPPI, AUGUST 24-31, 1981 - CONT.--

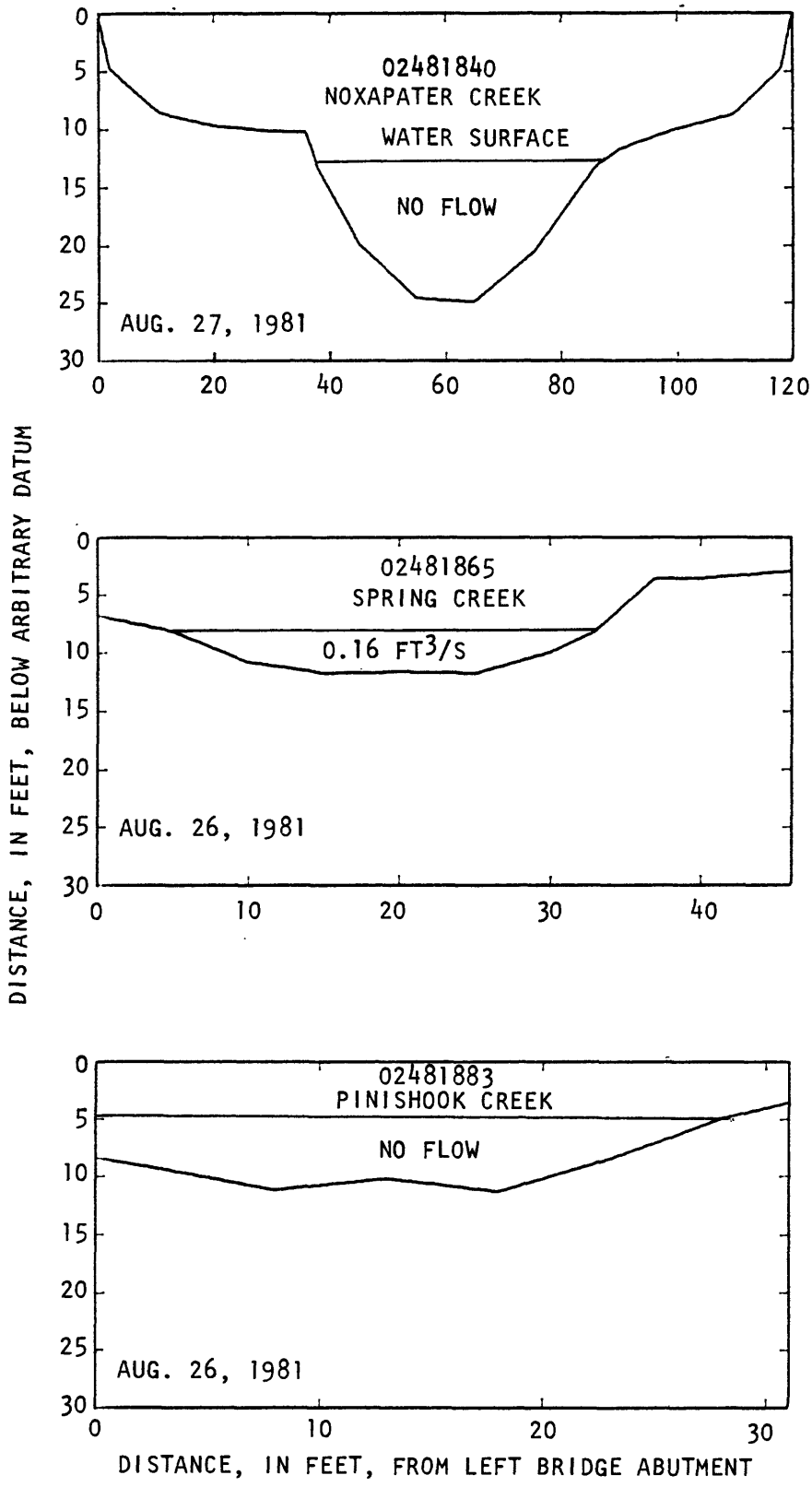

FIGURE 2.--CHANNEL CROSS SECTIONS AT SAMPLING SITES, EAST-CENTRAL MISSISSIPPI, AUGUST 24-31, 1981 - CONT.--

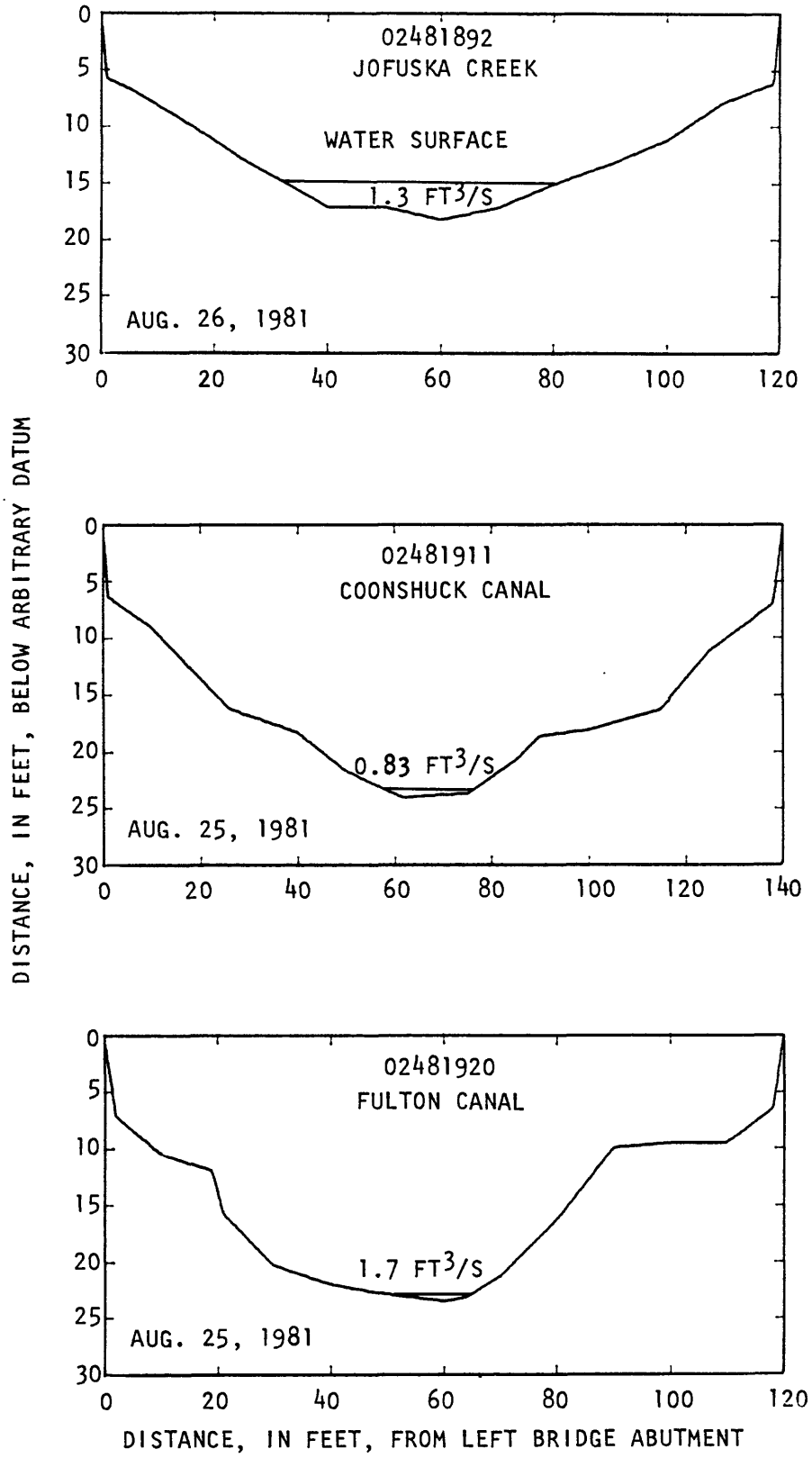

FIGURE 2.--CHANNEL CROSS SECTIONS AT SAMPLING SITES, EAST-CENTRAL MISSISSIPPI, AUGUST 24-31, 1981 - CONT.--

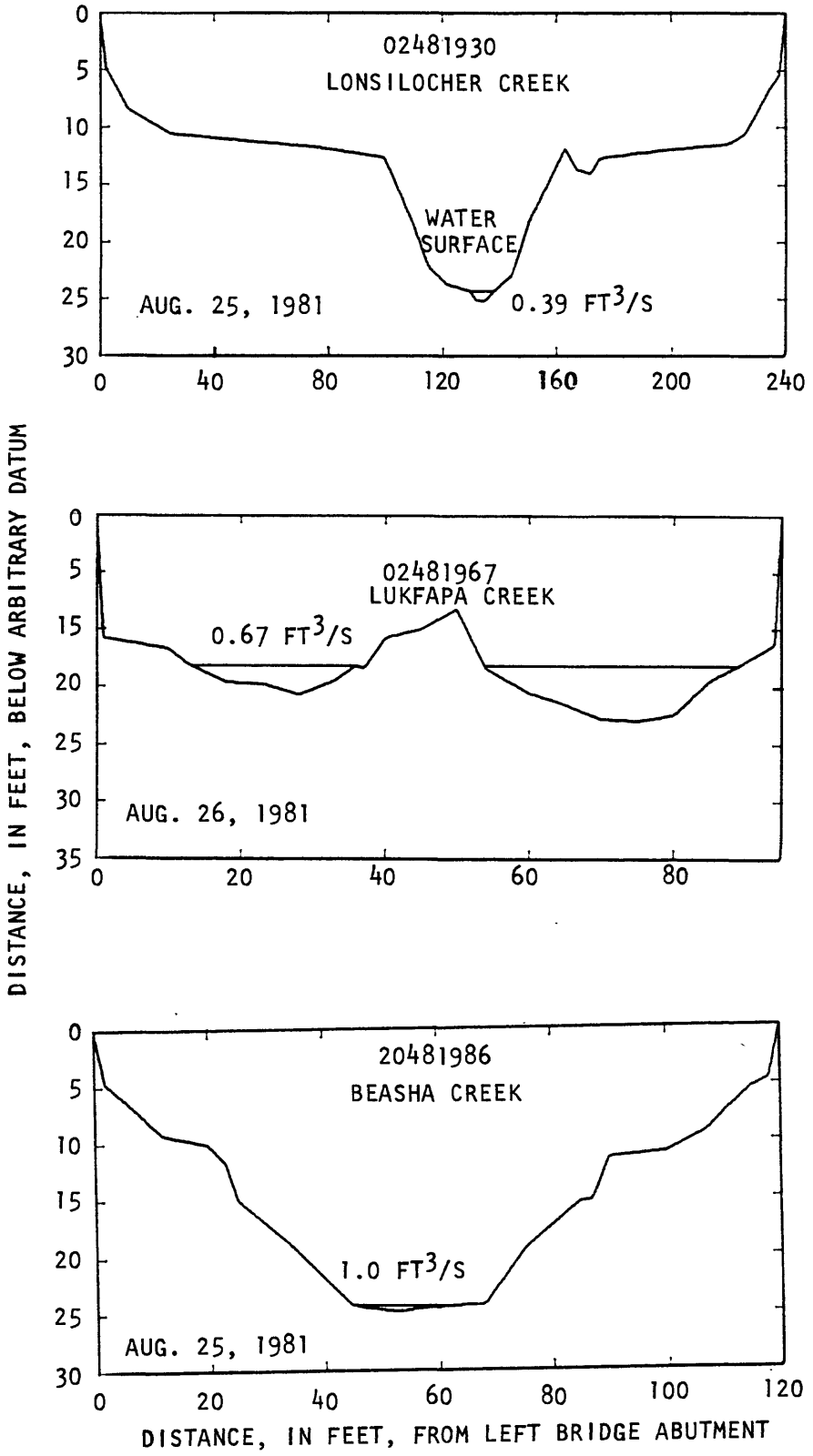

FIGURE 2.--CHANNEL CROSS SECTIONS AT SAMPLING SITES, EAST-CENTRAL MISSISSIPPI, AUGUST 24-31, 1981- CONT.--

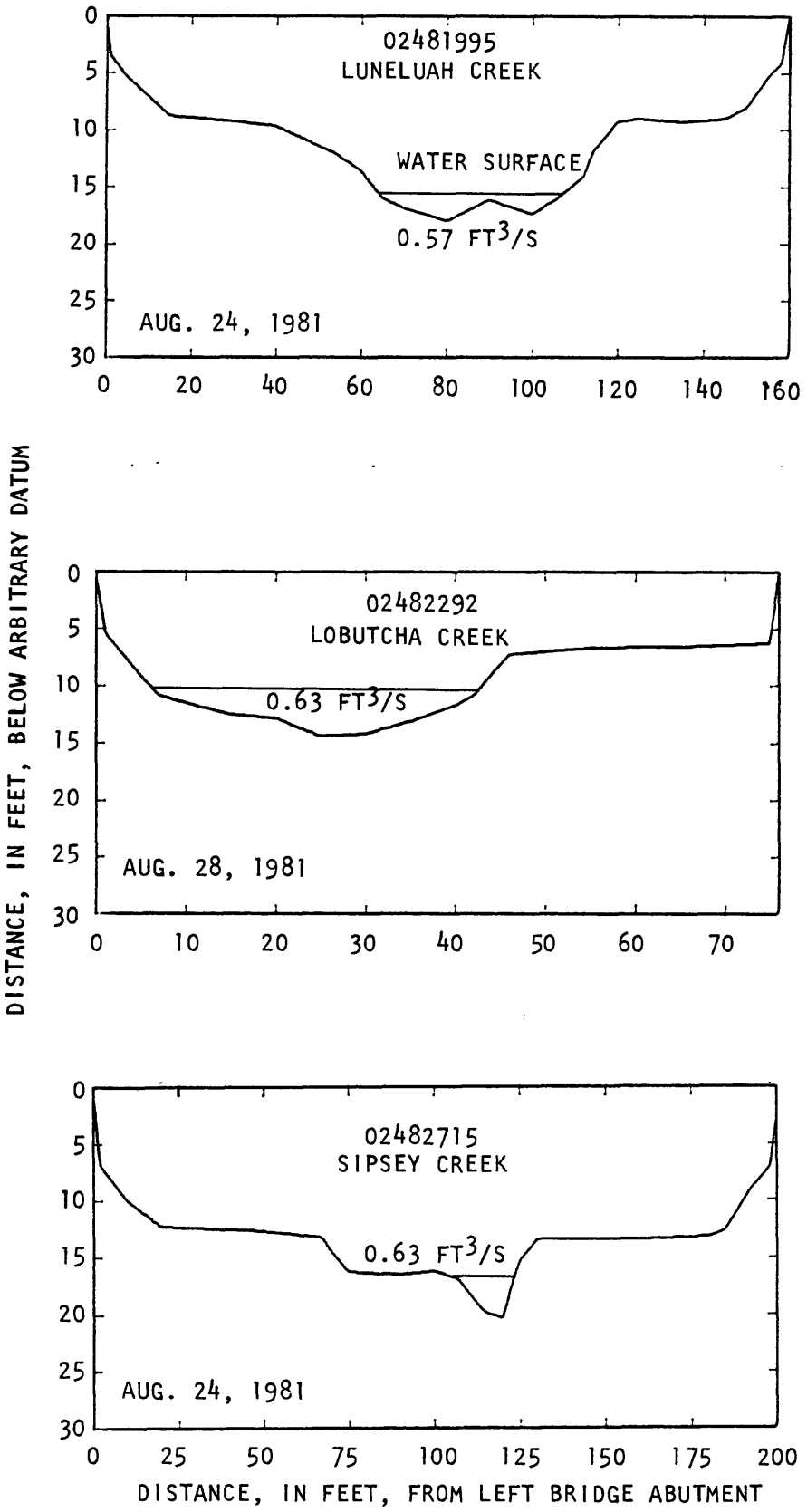

FIGURE 2.--CHANNEL CROSS SECTIONS AT SAMPLING SITES, EAST-CENTRAL MISSISSIPPI, AUGUST 24-31, 1981 - CONT.--

WATER QUALITY

Field determinations of stream discharge, water temperature, specific conductance, pH, and dissolved oxygen were made at each sampling site where there was streamflow. Water samples were collected for laboratory analysis of major chemical constituents and suspended sediment concentrations. Bottom material samples were collected for analysis of selected metals. Current meter discharge measurements were made at 15 of the 18 stream study sites (table 2). The three remaining sites (Tallahaga, Noxapater, and Pinishook Creeks) had no stream discharge at the time they were visited. The largest discharge measured was 9.3 ft^3/s (cubic feet per second) on Moody Creek (site 02447090). Pawticfaw Creek (site 02467240) had 8.5 ft^3/s, Mill Creek (site 02447090) 6.5 ft^3/s, and all other sites had less than 2.5 ft^3/s. Although the study was made in late summer, flow conditions in the area were not extremely low.

Water temperatures ranged from 22.5° C to 26° C at the time of the study (table 2). The lowest temperature was on Beasha Creek near Laurel Hill at site 02481986 at 0930 hours. The highest temperature was on Luneluah Creek at Laurel Hill at site 02481995 at 1700 hours. The mean temperature determined at the sampling sites was 24.0° C.

Specific conductance of the water ranged from 100 umhos (micromhos) at Lonsilocher Canal (site 02481930) near Philadephia to 24 umhos at Jofuska Creek (site 02481892) near Arlington (figure 3). Most of the sites in the study area had a specific conductance less than 50 umhos.

The streams sampled during the study had a relatively wide range of pH values (table 2). Lobutcha Creek near Rural Hill at site 02482292 had the lowest pH of 5.8 and Fulton Canal at McDonald (site 02481920) and Lonsilocher Canal near Philadephia (site 02481930) had the highest pH of 7.6. Twelve of the 15 sites sampled had a pH value of 7 or below.

Dissolved-oxygen concentrations ranged from 3.8 to 8.3 mg/L (table 2). The lowest concentration determined was at site 02481865 on Spring Creek near Bond. The mean value of the dissolved oxygen concentrations at the sites was 7.1 mg/L.

Turbidity values were less than 20 NTU (nephlometric turbidity units) at all but two sites (table 2). Site 02481865 on Spring Creek had a turbidity value of 35 NTU and site 02481995 on Luneluah Creek had a value of 24 NTU. The lowest value was 6 NTU on Fulton Canal (site 02481920) and Lonsilocher Canal (site 02481930). Color values ranged from 20 units at Fulton Canal (site 02481920) to 100 units at Spring Creek (site 02481865). Concentrations of suspended sediment ranged from 10 to 38 mg/L and exceeded 24 mg/L only at Moody Creek near Fearns Springs (site 02447755) and Spring Creek near Bond (site 02481865).

The results of laboratory analyses of the principal constituents in the water samples collected during the study are given in table 3. Concentrations of the constituents calcium, magnesium, potassium, sodium, chloride, and sulfate were less than 10 mg/L in all samples, but

Table 2.--Results of field and laboratory measurements of samples collected, east-central Mississippi, August 24-31, 1981

Site number	Date	Time	Water temperature °C	pH	Specific conductance (micromhos) at 25°C	Dissolved solids (mg/L)	Dissolved oxygen (mg/L)	Stream discharge (ft^3/s)	Suspended sediment (mg/L)	Color	Turbidity (NTU)
02447085	8-31-81	1530	24.0	6.9	77	58	6.8	2.4	19	42	14
02447090	8-31-81	1300	24.0	6.8	28	14	8.1	6.5	24	34	10
02447755	8-31-81	1030	24.0	6.3	27	16	8.3	9.3	38	25	9
02467240	8-27-81	1300	23.5	6.7	48	49	7.6	8.5	14	40	10
02467310	8-27-81	1030	24.5	6.8	85	79	5.4	.20	18	50	15
02481795	8-28-81	0800	--	--	--	--	--	0	--	--	--
02481840	8-27-81	1530	--	--	--	--	--	0	--	--	--
02481865	8-26-81	1000	22.5	6.6	44	37	3.8	.16	38	100	35
02481883	8-26-81	1200	--	--	--	--	--	0	--	--	--
02481892	8-26-81	1330	24.0	6.6	24	32	7.8	1.3	24	50	19
02481911	8-25-81	1600	24.5	7.0	56	56	8.0	.83	20	50	18
02481920	8-25-81	1400	25.5	7.6	77	63	8.0	1.7	16	20	6
02481930	8-25-81	1130	24.0	7.6	100	80	8.2	.39	16	30	6
02481967	8-26-81	1600	23.5	6.7	30	36	7.4	.67	17	50	8
02481986	8-25-81	0930	22.5	6.9	55	54	7.8	1.0	14	50	17
02481995	8-24-81	1700	26.0	7.0	33	36	7.0	.57	24	70	24
02482292	8-28-81	0930	23.5	5.8	51	50	4.5	.63	10	60	10
02482715	8-24-81	1330	24.0	7.3	38	35	7.5	.63	16	50	16

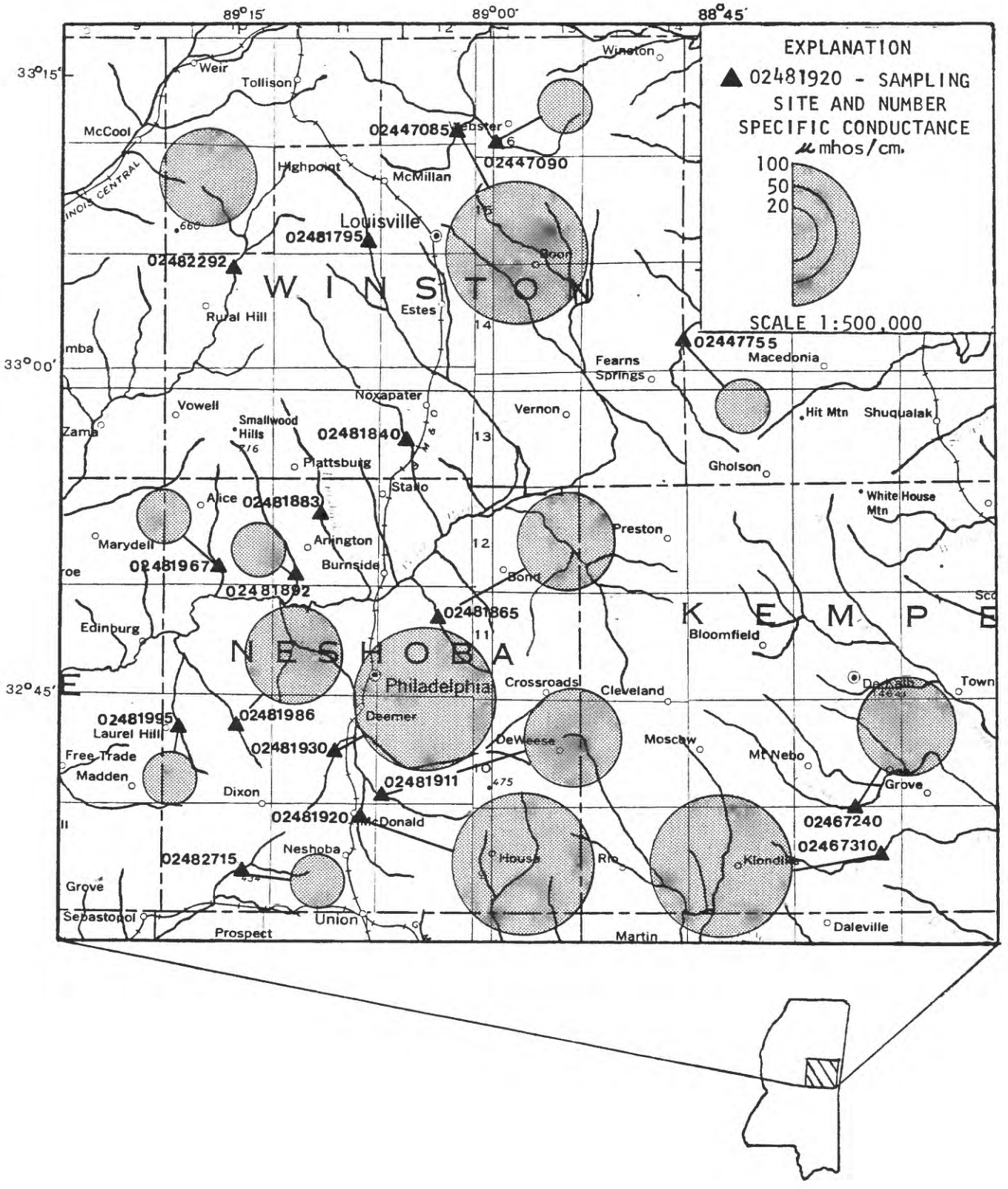

FIGURE 3.--SPECIFIC CONDUCTANCE AT SAMPLING SITES, AUGUST 24-31, 1981.

Table 3.--Results of laboratory analyses for common constituents on water samples collected, east-central Mississippi, August 24-31, 1981

In Milligrams per liter

Site number	Date of collection	Calcium, dissolved	Magnesium, dissolved	Potassium, dissolved	Sodium, dissolved	Chloride, dissolved	Sulfate, dissolved	Hardness, total	TOC	Nitrite + Nitrate, total	Iron, dissolved	Iron, suspended	Manganese, dissolved	Manganese, suspended
02447085	8-31-81	4.3	2.5	2.0	4.7	4.3	4.7	21	2.8	0.14	0.15	2.00	0.25	0.00
02447090	8-31-81	.8	.4	.7	2.3	2.8	.7	4	3.3	.13	.09	.17	.06	.02
02447755	8-31-81	.5	.4	.6	2.6	3.3	.8	3	1.9	.23	.07	2.30	.04	.02
02467240	8-27-81	2.4	1.6	1.8	3.4	2.8	4.4	13	1.3	.04	.09	1.30	.13	.00
02467310	8-27-81	4.4	2.8	2.4	5.0	4.2	6.8	23	4.6	.05	.72	1.50	.32	.00
02481795	8-28-81	--	--	--	--	--	--	--	--	--	--	--	--	--
02481840	8-27-81	--	--	--	--	--	--	--	--	--	--	--	--	--
02481865	8-26-81	1.8	1.2	2.1	2.3	3.1	.5	9	4.1	.27	.07	2.60	.29	.05
02481883	8-26-81	--	--	--	--	--	--	--	--	--	--	--	--	--
02481892	8-26-81	1.1	.7	.7	1.7	2.6	1.7	6	1.9	.15	.05	2.10	.10	.02
02481911	8-25-81	3.2	1.8	2.3	2.6	4.0	4.7	15	2.2	.30	.10	1.70	.16	.01
02481920	8-25-81	6.0	2.2	1.7	3.0	6.2	6.1	24	.9	.41	.31	.48	.70	.01
02481930	8-25-81	8.0	2.6	2.8	3.7	6.4	7.1	31	1.9	.31	.66	.64	.33	.00
02481967	8-26-81	1.7	1.0	.7	1.6	2.5	1.9	8	2.8	.08	.18	1.40	.12	.03
02481986	8-25-81	3.8	1.7	1.7	2.7	4.0	1.9	16	1.9	.28	.43	1.10	.10	.01
02481995	8-24-81	1.7	.9	.9	2.0	3.0	.7	8	2.4	.12	.17	1.60	.15	.02
02482292	8-28-81	2.6	1.6	1.4	3.4	4.7	3.2	13	5.5	.06	.22	1.60	.51	.01
02482715	8-24-81	2.6	1.3	1.2	2.7	3.8	.7	12	1.7	.28	.07	1.80	.15	.03

were highest at site 02481930 on Lonsilocher Canal near Philadephia. Total hardness was also highest on Lonsilocher Canal, but was less than 35 mg/L at all sites. TOC (total organic carbon) ranged from 0.9 mg/L at Fulton Canal (site 02481920) to 5.5 mg/L at Lobutcha Creek (site 02482292). Nitrate plus nitrate nitrogen concentration ranged from 0.04 to 0.41 mg/L. Dissolved iron and manganese were present in all samples, ranging from 0.05 to 0.72 mg/L for iron and 0.04 to 0.70 mg/L for manganese. Maximum suspended iron concentrations was 2.6 mg/L at site 02481865 on Spring Creek. The highest concentration of suspended manganese was less than 0.10 mg/L.

Table 4 lists the results of laboratory analyses for selected metals in channel bottom-material samples collected during the study. Most metals were either not present or concentrations were below the detection limit in the analytical procedure. Iron, manganese, and zinc were the metals found to be commonly present in appreciable amounts.

Table 4.--Results of laboratory analyses on bottom material collected, east-central Mississippi, August 24-31, 1981

In Micrograms per gram

Site number	Date of collection	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Selenium	Zinc
02447085	8-31-81	<1	<1	3	<10	2	2900	<10	140	<0.01	<1	<10
02447090	8-31-81	<1	<1	5	<10	1	2300	<10	110	<.01	<1	<10
02447755	8-31-81	<1	<1	3	<10	2	2500	<10	290	<.01	<1	<10
02467240	8-27-81	<1	<1	<10	<10	1	1000	<10	180	<.01	<1	4
02467310	8-27-81	<1	<1	<10	10	1	1700	<10	230	<.01	<1	10
02481795	8-28-81	--	--	--	--	--	--	--	--	--	--	--
02481840	8-27-81	--	--	--	--	--	--	--	--	--	--	--
02481865	8-26-81	<1	<1	<10	<10	2	500	<10	51	<.01	<1	3
02481883	8-26-81	--	--	--	--	--	--	--	--	--	--	--
02481892	8-26-81	<1	<1	<10	<10	<1	590	<10	110	<.01	<1	4
02481911	8-25-81	1	<1	<10	<10	1	700	<10	230	<.01	<1	4
02481920	8-25-81	1	<1	<10	10	1	310	<10	230	<.01	<1	3
02481930	8-25-81	<1	<1	<10	<10	1	390	<10	180	<.01	<1	2
02481967	8-26-81	<1	<1	<10	<10	<1	340	<10	70	<.01	<1	3
02481986	8-25-81	<1	<1	<10	<10	<1	200	<10	82	<.01	<1	2
02481995	8-24-81	<1	<1	<10	<10	<1	230	<10	42	<.01	<1	2
02482292	8-28-81	1	<1	<10	<10	1	430	<10	--	<.01	<1	5
02482715	8-24-81	<1	<1	<10	<10	<1	440	<10	89	<.01	<1	7