RECONNAISSANCE OF MINE DRAINAGE IN THE COAL FIELDS OF EASTERN PENNSYLVANIA

By Douglas J. Growitz, Lloyd A. Reed, and Mark M. Beard

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FACTORS FOR CONVERTING INCH-POUND UNITS TO

INTERNATIONAL SYSTEM UNITS (SI)

Multiply inch-pound units	By	To obtain SI units
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
acre	0.4047	hectare (ha)
ton (short)	0.9072	tonne (t)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
ton per square mile (ton/mi^2)	0.3502	megagram per square kilometer (Mg/km^2)
cubic foot per second per square mile [$(ft^3/s)/mi^2$]	0.01093	cubic meter per second per square kilometer [$(m^3/s)/km^2$]

RECONNAISSANCE OF MINE DRAINAGE IN THE COAL FIELDS OF EASTERN PENNSYLVANIA

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ABSTRACT

Anthracite has been extensively mined in four areas of eastern Pennsylvania. Almost all underground mining in the four areas, the Northern, Eastern Middle, Western Middle, and Southern Fields, has been discontinued and many mines are abandoned and flooded. Precipitation on much of the 408 square miles of coal fields infiltrates to the underground mine complexes, and is discharged as mine drainage from tunnels, mine entrances, and boreholes.

Mine drainage was measured and sampled at 251 sites that had a total discharge of 918 cubic feet per second, a total sulfate load of 1,470 tons per day, and a total iron discharge of 79 tons per day. The largest sulfate yield was 5.4 tons per day per square mile from the Western Middle Field. The yields from the Northern, Eastern Middle, and Southern Fields were 4.6, 3.6, and 1.4 tons per day per square mile, respectively.

INTRODUCTION

Anthracite has been mined in east-central Pennnsylvania for more than 150 years. Most mining was done by deep-mining methods, creating vast underground voids. Through 1944, 3.5, 0.5, 1.6, and 1.3 billion tons of coal were produced in the Nothern, Eastern Middle, Western Middle, and Southern Anthracite Fields, respectively. To prevent flooding, water that entered the mines was pumped to the surface. Between 1930 and 1960, nearly all deep mines were abandoned, pumping was discontinued, and the mines filled with water. Surface overflows developed, and mine drainage has degraded many streams.

Purpose and Scope

A study was begun in 1975 to locate, measure, and sample the mine discharges and major streams (the Susquehanna and Delaware Rivers and their tributaries) in the four coal fields in east-central Pennsylvania. Data collected during this study were compared to data collected during 1941 and 1946 to determine if any large changes had occurred in acid discharge. Water discharge, temperature, pH, and specific conductance were measured at each site sampled. Alkalinity, acidity, dissolved iron, and sulfate concentrations were determined for samples collected from the mine discharges. The study was conducted in cooperation with the U.S. Department of Energy and the Pennsylvania Department of Environmental Resources. This report summarizes the results of this study.

Methods of Study

Locations of mine-water discharges were compiled from published reports and from information obtained from State and Federal agencies, and were verified in the field prior to sampling. Generally, sites having discharges of less than 0.1 ft^3/s were not included in the 251 sites sampled during the study. Water-quality data were determined from unfiltered samples; except for dissolved iron, which was determined from filtered samples. Samples for laboratory analyses were collected and preserved following standard Geological Survey procedures. To supplement the sampling program, flow and water-quality data were collected monthly at 12 sites. The U.S. Bureau of Mines in Wilkes-Barre and Schuylkill Haven, and the Pennsylvania Department of Environmental Resources assisted with the data collection.

DESCRIPTION OF THE STUDY AREA

Coal Fields

The term "anthracite region" as used in this report includes the four anthracite fields and surrounding areas, as shown in figure 1. Anthracite has been extensively mined in four separate coal fields in east-central Pennsylvania--the Northern, Eastern Middle, Western Middle, and Southern. The coal fields underlie parts of 10 counties and extend from 20 mi northeast of Harrisburg to 20 mi northeast of Scranton. Their combined area is about 408 mi^2.

The four coal fields are part of the Valley and Ridge physiographic province; the coal is found in the Llewellyn and Pottsville Formations of Pennsylvania age. Both formations contain sandstone, conglomerate, shale, and several coal seams. Generally, coal underlies the center of the valleys. In the western part of the Southern Field, coal underlies the ridges as well as the valleys. Large quantities of coal were removed by deep mining methods that, in some areas, extended to depths below sea level, and created extensive voids that have filled with water. Locally, small hills have been created by storage of mine waste, and surface depressions have formed where the land has subsided. Surface depressions also have been created by surface mining. In many areas, surface soils have been covered or mixed with mine waste, and vegetation is sparse. Infiltration rates have been increased significantly by surface depressions, by the large-grained mine wastes on the surface, and by the lack of vegetation.

Coal Production

Since 1808, the coal industry has shipped over 6 billion tons of processed anthracite from the fields in eastern Pennsylvania (Rhodes and Davis, 1968, p. 61). Mining reached a peak in 1917 when 99.6 million tons were produced. Production then declined before peaking again in the 1940's, when about 60 million tons per year were mined. Production has declined since then; during 1976, about 6 million tons were mined. Through 1944, 3.5, 0.5, 1.6, and 1.3 billion tons of coal were produced in the Northern, Eastern Middle, Western Middle, and Southern Anthracite Fields, respectively. Edmunds (1972) estimated that anthracite reserves were about 16 billion tons.

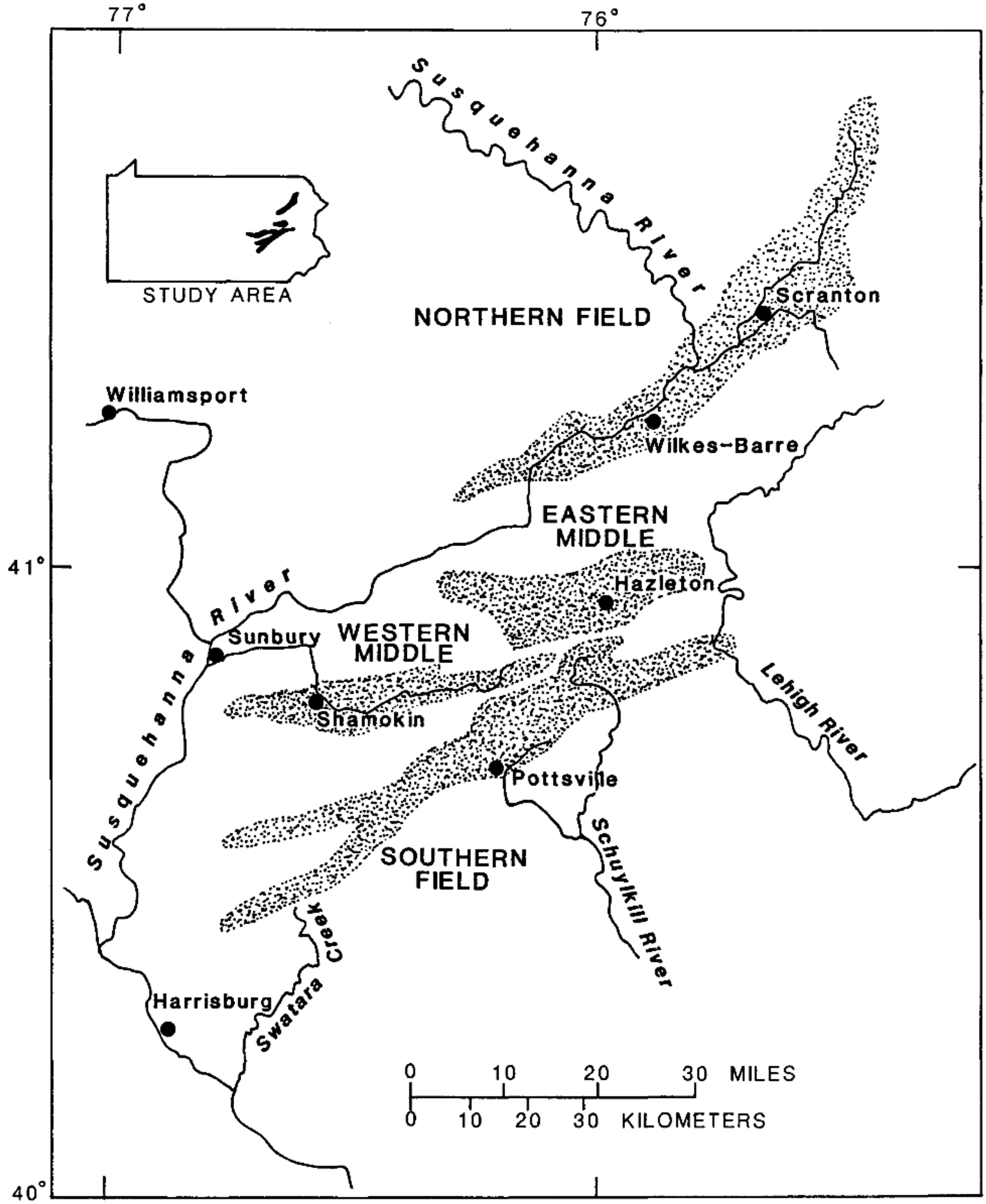

Figure 1.--Locations of the four coal fields in eastern Pennsylvania.

Through the 1800's, all coal was mined by underground methods. Strip mining of anthracite slowly increased from the early 1900's and peaked in 1948 when the output was 13.4 million tons--about one-fourth of the anthracite mined that year. Since 1961, surface mining has produced more coal than any other method.

MINE DRAINAGE

Sources

Precipitation percolates continuously from the surface to the voids left by the removal of coal. During active mining, the percolating water was removed by pumping. Pumping increased production costs and forced the closing of many deep mines as the demand for anthracite declined during 1930-60. When pumping stopped, water levels rose and filled the closed mines. Contiguous deep mines were separated along the property lines by barrier pillars, which are unmined columns about 160 ft wide. In some cases, the barrier pillars were not sufficient to withstand the buildup of water pressure between the abandoned and active mines. To maintain safe working conditions in the mines, water was pumped from the abandoned mines, or boreholes were drilled through the barrier pillars, and water levels were controlled by pumping from the active mines. The pumping increased operating costs; eventually, most underground operations were abandoned, and water levels rose until the water overflowed at the surface. The rate and direction of water movement through individual mines is controlled by precipitation continually percolating into the mines, the structure of the mined coal beds, mine tunnels, air shafts, boreholes, and local collapses.

Discharge and Water Quality

Northern Field

The Northern Field, an area of 160 mi^2 in the Susquehanna River basin, includes parts of Wayne, Susquehanna, Lackawanna, and Luzerne Counties (fig. 2). The Northern Field includes the 80 mi^2 Lackawanna Basin northeast of Scranton and the 80 mi^2 Wyoming Basin in the Wilkes-Barre area. Mine-water discharge sites in the Northern Field are shown on figure 2 and the data that were collected are discussed in the following paragraphs.

Forest City to Carbondale

Forest City and Carbondale are along the Lackawanna River, northeast of Scranton. Table 1 lists the results of sampling six discharge sites in that area. The highest discharge in the Forest City area (4 ft^3/s) was from the Vandling drift; the sulfate concentration was 92 mg/L. The upper Wilson Creek (Simpson) drift, and the lower Wilson Creek (Simpson) shaft are near Carbondale. The highest discharge in the Carbondale area (16 ft^3/s) was from the lower Wilson Creek shaft. Water discharge from the six sites totaled 24 ft^3/s; sulfate discharge totaled 8.9 tons/d. Dissolved iron concentrations at each of the six sites were less than 1 mg/L.

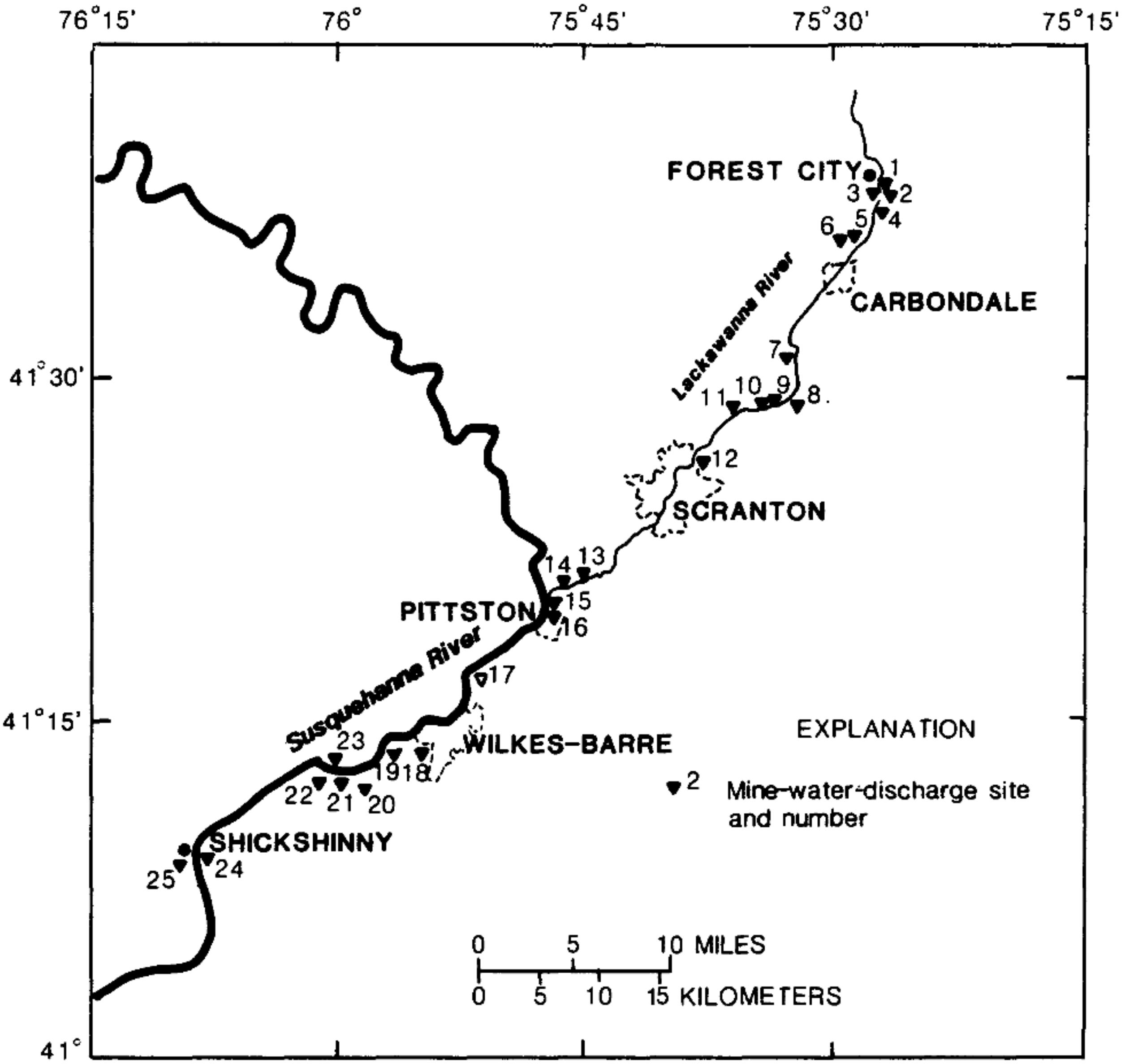

Figure 2.--Mine-water-discharge sites in the Northern Anthracite Field, east-central Pennsylvania.

Table 1.--Water-quality and discharge data from mine-drainage sites in the Northern Field between Forest City and Carbondale

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
1	Klondike Mine	collapsed drift	41°38'33" 75°27'25"	4-15-75	0.6	7.5	100	4.2	33	<1	0.05	0.0016	0	10	13
2	Klondike Mine	collapsed drift	41°38'23" 75°27'06"	4-15-75	.4	10.0	70	5.9	34	<1	.04	.0011	7	4.0	5.0
3	Klondike Mine	Vandling drift	41°38'15" 75°27'35"	4-15-75	4.0	9.5	185	4.7	92	<1	.99	.011	3	38	58
4	Klondike Mine	Gray slope-buried	41°37'38" 75°27'31"	4-15-75	.8	8.5	115	4.8	38	<1	.08	.0022	2	3.0	15
5	Coalbrook Mine	Upper Wilson Creek (Simpson) drift	41°36'11" 75°29'09"	4-15-75	2.6	10.0	450	6.3	190	<1	1.3	.0070	36	5	16
6	Coalbrook Mine	Lower Wilson Creek (Simpson) shaft	41°36'02" 75°29'13"	4-15-75	16	9.5	380	5.9	150	<1	6.4	.043	34	28	40
Subtotal					24						8.9	.066			

Carbondale to Scranton

Six mine-discharge sites were sampled between Carbondale and Scranton (table 2). Water discharge from the Jermyn slope (site 7) was estimated to be 39 ft^3/s by measuring the flow of the Lackawanna River above and below the mine discharge. Water discharge from the six sites totaled 65 ft^3/s, and the sulfate discharge was 35 tons/d. The mean water weighted concentration of sulfate was 200 mg/L.

Scranton to Pittston

Four mine-discharge sites were measured and sampled between Scranton and Pittston (table 3). The highest discharge was from the Old Forge borehole at Old Forge Mine. Water discharge was 97 ft^3/s when the sample was collected, and concentrations of dissolved iron and sulfate were 40 and 780 mg/L, respectively. Water discharge from the four sites totaled 140 ft^3/s, and sulfate discharge was 270 tons/d.

Wilkes-Barre

Seven mine-discharge sites were sampled in the Wilkes-Barre area (table 4). The largest water discharge, 39 ft^3/s, was from the Solomon Creek boreholes at the South Wilkes-Barre Mine, and the concentrations of dissolved iron and sulfate were 190 and 1,800 mg/L, respectively. Water discharge from the seven sites at the time of sampling totaled 98 ft^3/s, and the sulfate load was 410 tons/d.

Shickshinny

Two mine-discharges (table 5) were sampled near Shickshinny. The Macanaqua Tunnel drains the area east of Shickshinny, and the Salem Coal Company drift drains the area to the west. Water discharge from the two sites totaled 6.1 ft^3/s and the sulfate discharge was 11 tons/d.

Summary and Discussion

Cumulative water discharge from the 25 mine-drainage sites (tables 1-5) was 333 ft^3/s, the sulfate discharge was 740 tons/d, and the iron discharge was 51 tons/d. All mine discharges sampled in the Northern Field were gravity overflows; no pump discharges were known to exist at the time of sampling. Since 160 mi^2 are underlain by the coal field, the water, sulfate, and iron yields were 2.1 $(ft^3/s)/mi^2$, 4.6 $(tons/d)/mi^2$, and 0.32 $(tons/d)/mi^2$, respectively.

Felegy and others (1948) and Ash and others (1951) presented flow and water-quality data collected during 1941 from all known discharges in the Northern Field. Measured water discharge was 306 ft^3/s (90 percent was pumped from deep mines) and the measured acid discharge (as $CaCO_3$ to pH 8.3) was 390 tons/d (92 percent was pumped from deep mines). Total water and acid discharges during the sampling period in 1975 were 333 ft^3/s and 240 tons/d (no discharges were pumped from deep mines). During the sampling period in 1975, water discharge was about 10 percent more, and the acid discharge was about 35 percent less than during the sampling period in 1941.

Table 2.--Water-quality and discharge data from mine-drainage sites in the Northern Field between Carbondale and Scranton

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
7	Jermyn Mine	Jermyn slope	41°42'45" 75°32'49"	4-16-75	39	12.0	470	5.6	220	1.5	23	0.16	13	20	33
8	Riverside Mine	Mount Vernon shaft	41°28'54" 75°32'33"	4-16-75	.7	10.5	210	4.6	91	<1	.17	.0019	2	3.0	16
9	Gravity Slope Mine	slope	41°28'52" 75°33'48"	4-16-75	23	11.5	390	5.3	170	1	11.	.062	13	20	50
10	Gravity Slope Mine	6" borehole	41°28'55" 75°33'55"	4-16-75	.2	10.5	400	5.4	180	1	.10	.0005	10	15	40
11	Lackawanna Mine	Jerome Shaft	41°28'44" 75°33'55"	4-16-75	2.4	12.0	400	4.8	150	20	.97	.13	2	3.0	58
12	Underwood Mine	Pennsylvania Tunnel	41°26'17" 75°38'29"	4-16-75	.2	9.0	800	7.0	350	<1	.20	.0005	24	—	3.8
Subtotal					65						35	.35			

Table 3.--Water-quality and discharge data from mine-drainage sites in the Northern Field between Scranton and Pittston

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
13	Old Forge Mine	Old Forge borehole	41°21'36" 75°45'04"	4-24-75	97	16	1470	5.6	780	40	204	11	2	145	210
14	Seneca Mine	Duryea breech	41°20'51" 75°46'42"	4-17-75	34	15.5	1400	5.7	700	48	64	4.4	72	163	233
15	Seneca Mine	seepage	41°20'09" 75°47'25"	4-15-75	.01	11.0	1350	3.4	600	5	.02	.0001	—	155	170
16	No. 9 Mine	Pittston (Butler) water tunnel	41°19'36" 75°47'25"	4-15-75	8.7	10.5	700	4.9	265	2.5	6.2	.059	6.6	38	43
Subtotal					140						274	15			

Table 4.--Water-quality and discharge data from mine-drainage sites in the Northern Field near Wilkes-Barre

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
17	Mine	(Plainsville outlet)	41°17'03" 75°51'20"	4-15-75	9.2	14.5	1700	6.1	1100	85	27	2.1	123	176	318
18	South-Wilkes-Barre Mine	Solomon Creek boreholes	41°13'50" 75°55'20"	4-14-75	39	16.0	3000	5.2	1800	190	190	20	77	450	750
19	Nottingham-Button-wood Mine	Airshaft #22	41°13'34" 75°56'13"	4-15-75	27	17.0	2100	5.6	760	95	55	6.9	57	276	400
20	Truesdale Mine	Askam shaft borehole	41°11'58" 75°57'52"	4-14-75	11	16.5	3000	5.6	2000	>100	59	3.0	87	327	613
21	No. 7 Mine	seepage	41°12'33" 76°00'07"	4-14-75	3.5	12.5	2200	5.5	1400	40	13	.38	13	125	174
22	No. 7 Mine	Susquehanna No. 2 shaft	41°12'27" 76°00'22"	4-14-75	8.5	18.0	4800	6.0	2800	>100	64	2.3	212	438	750
23	Glen Nan Mine	West Nanticoke Gravity overflow	41°13'05" 76°00'24"	4-14-75	.3	8.5	875	3.1	320	0.25	.26	.0002	—	155	165
Subtotal					98						408	35			

Table 5.--Water-quality and discharge data from mine-drainage sites in the Northern Field near Shickshinny

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
24	West End Mine	Macanaqua Tunnel	41°09'01" 76°08'40"	4-14-75	5.8	11.0	1250	3.5	680	60	11	0.94	—	278	363
25	Salem Coal Co.	drift	41°08'36' 76°08'56"	4-14-75	.3	7.0	590	3.4	250	.5	.20	.0004	—	158	165
Subtotal					6.1						11	.94			

Eastern Middle Field

Hazleton is in the approximate center of the Eastern Middle Coal Field (fig. 3) that extends 10 mi east and west. Twenty-nine mine discharges from the Eastern Middle Field were sampled, there locations are shown on figure 3. Ten of the discharges drain into the Lehigh and Delaware River basin and nineteen into the Susquehanna River basin.

Freeland

Seven mine-discharge sites (table 6) were sampled near Freeland--five are in the Lehigh River basin and two in the Susquehanna River basin. Discharge from five sites drains into the Lehigh River through Pond Creek and Sandy Run. Water discharge from these sites totaled 20 ft^3/s, and sulfate discharge was 7.1 tons/d. Total water discharge from the two sites in the Susquehanna River basin, the McNair and Woodside Mines, was 0.6 ft^3/s, and the sulfate discharge was 0.11 tons/d. The largest sulfate discharge, 4.7 tons/d, was from the Owl Hole Tunnel at the East Block Creek Mine, and the largest water discharge, 13 ft^3/s, was from a strip mine pool overflow at the Pond Creek Mine.

Beaver Meadows

Five mine-discharge sites were sampled in the Beaver Meadows area; water quality and discharge data are listed in table 7. All drain into the Lehigh River. Water discharge from the five sites totaled 26 ft^3/s, and sulfate discharge totaled 7.4 tons/d. The largest water discharge of the five sites, 20 ft^3/s, was from the tunnel at the Beaver Meadows Mine; the sulfate concentration was 100 mg/L and sulfate discharge was 5.4 tons/d.

Hazleton

Seven mine-discharge sites were sampled in the area north and west of Hazleton, all are in the Susquehanna River basin; discharge and water quality data are listed in table 8. The largest mine discharge in that area is from the Jeddo Tunnel. At the time of sampling, the discharge was 65 ft^3/s, and concentrations of dissolved iron and sulfate were 6 and 430 mg/L, respectively. Sulfate discharge was 75 tons/d. Water discharge from the Jeddo Tunnel was recorded continuously from December 1973 to September 1979. Figure 4 shows the variations in the rate of discharge from October 1, 1974 to September 30, 1975. Water discharge recorded from Wapwallopen Creek near Wapwallopen (about 10 mi north of the Jeddo discharge) for the same period, also is plotted. Wapwallopen Creek drains an area of 43.8 mi^2; the measured mean discharge was 78 ft^3/s. Figure 4 shows the response of the discharge from the Jeddo Tunnel to periods of precipitation is considerably less than the response of the flow of Wapwallopen Creek. From October 1, 1974, to September 30, 1975 discharge from the Jeddo Tunnel ranged from 36 to 230 ft^3/s. Figure 4 shows that, during large storms, discharge from the Jeddo Tunnel peaked later than the stream discharge.

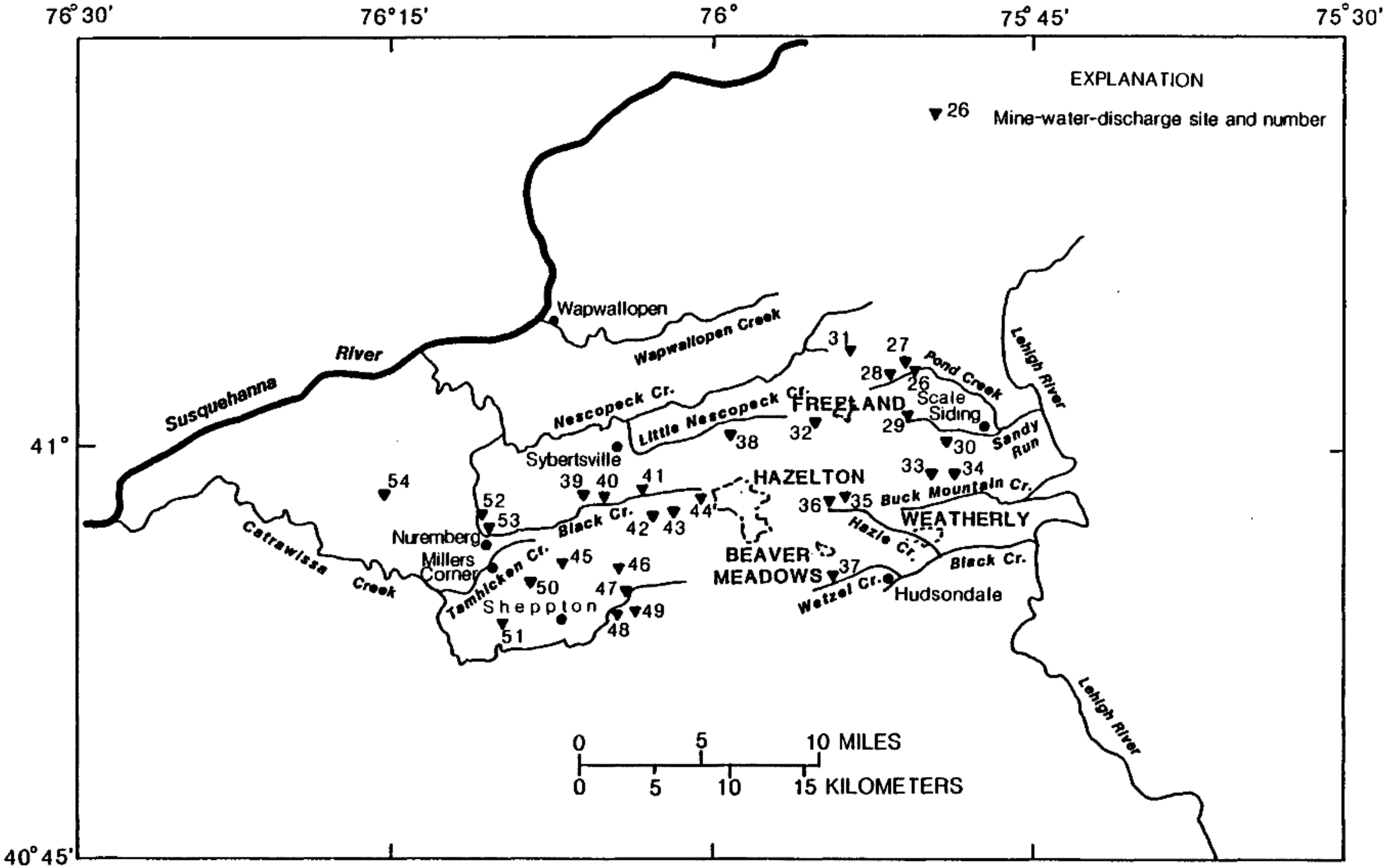

Figure 3.--Mine-water-discharge sites in the Eastern Middle Anthracite Field, east-central Pennsylvania.

Table 6.—Water-quality and discharge data from mine-drainage sites in the Eastern Middle Field near Freeland

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
26	Pond Creek Mine	strip pool overflow	41°02'26" 75°50'44"	4-16-75	0.6	8.0	165	4.4	45	<1	0.07	0.0016	—	20	28
27	Pond Creek Mine	collapsed tunnel	41°02'29" 75°50'44"	4-16-75	.1	7.5	150	4.3	37	<1	.01	.0003	—	15	22
28	Pond Creek Mine	strip pool overflow	41°02'14" 75°51'00"	4-16-75	13.	7.0	140	5.6	42	<1	1.5	.035	1.6	6	10
29	Sandy Run Mine	Sandy Run Tunnel	41°00'58" 75°50'55"	4-16-75	2.3	8.5	365	3.7	130	<1	.81	.0062	—	63	74
30	East Black Creek Mine	Owl Hole Tunnel	41°00'02" 75°49'11"	4-16-75	4.5	7.0	620	3.5	390	3	4.7	.036	—	267	274
31	McNair Mine	McNair Basin strip pool overflow	41°02'32" 75°53'52"	4-14-75	.5	9.0	380	3.0	84	1	.11	.0014	—	74	80
32	Woodside Mine	strip pool overflow	41°00'37" 75°54'59"	4-14-75	.1	5.0	40	5.1	12	1	.00	.0003	1.6	7.5	13
Subtotal					21						7.2	.081			

Table 7.—Water-quality and discharge data from mine-drainage sites in the Eastern Middle Field near Beaver Meadows

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
33	Hazle Brook Mine	Buck Mountain Tunnel	40°58'51" 75°49'27"	4-16-75	0.1	6.0	340	3.3	160	1	0.04	0.0003	—	110	110
34	Buck Mountain Mine	Buck Mountain Tunnel	40°58'53" 75°48'49"	4-16-75	1.7	9.0	660	3.3	260	5	1.2	.023	—	174	183
35	Stockton Mine	shaft	40°58'07" 75°53'53"	4-16-75	2.3	9.0	180	3.9	53	1	.33	.0062	—	38	53
36	Hazle-Brook Mine	Lehman & Kovel strip pool overflow	40°58'12" 75°53'51"	4-16-75	1.5	7.0	350	3.5	110	1	.45	.0041	—	79	88
37	Beaver Meadow Mine	Beaver Meadows Tunnel	40°55'09" 75°54'07"	4-16-75	20	9.0	520	3.7	100	<1	5.4	.05	—	93	110
Subtotal					26						7.4	.084			

Table 8.—Water-quality and discharge data from mine-drainage sites in the Eastern Middle Field near Hazleton

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
38	Jeddo Mine	Jeddo Tunnel	41°00'09" 75°59'38"	4-16-75	65	10.0	875	3.6	430	6	75	1.1	—	150	168
39	Dainty Slope Mine	collapsed slope	40°58'12" 76°06'30"	4-14-75	1.6	9.0	<50	4.5	8	<1	.03	.0043	—	3	5
40	Tomhicken Mine	strip pool overflow	40°57'55" 76°05'30"	4-15-75	2.7	8.5	225	5.6	66	12	.48	.088	21	38	59
41	Black Ridge Mine	strip pool overflow	40°58'21" 76°02'54"	4-15-75	1.2	8.0	180	3.9	30	<1	.10	.0032	—	125	150
42	Stony Creek Mine	Stony Creek and seepage	40°57'39" 76°02'19"	4-15-75	4.0	5.5	<50	4.4	9	1	.10	.011	—	5	6
43	Stony Creek Mine	strip pool overflow	40°57'41" 76°01'52"	4-14-75	.3	5.5	70	4.2	21	<1	.02	.0008	—	5	8
44	West Hazleton Mine	strip pool overflow	40°58'21" 76°00'33"	4-15-75	.1	5.0	305	4.1	150	<1	.04	.0003	—	13	150
Subtotal					75						76	1.2			

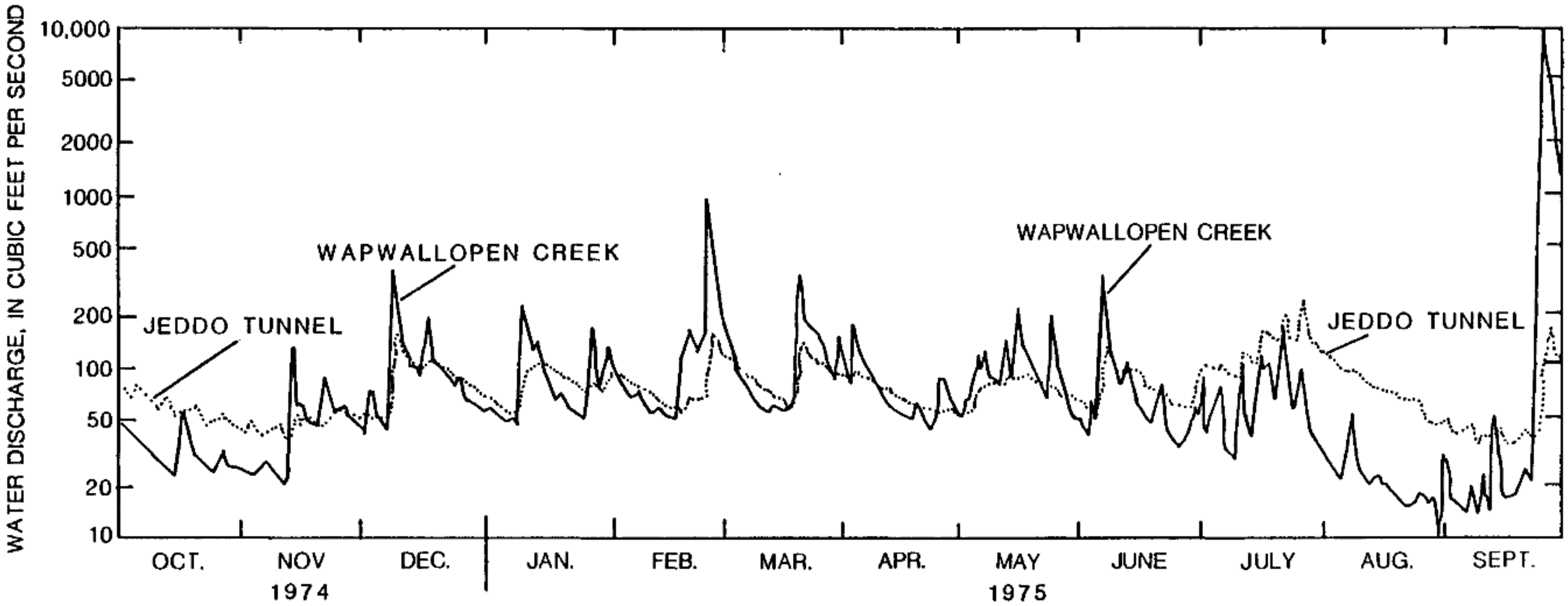

Figure 4.—Water discharge from the Jeddo Tunnel near Hazleton, and Wapwallopen Creek near Wapwallopen, Pennsylvania, October 1, 1974, to September 30, 1975.

Sheppton

Seven mine-discharge sites were sampled near Sheppton; all drain into the Susquehanna River basin. Water quality and discharge data are listed in table 9. The largest discharge, 19 ft^3/s, was from the Audenreid Tunnel. Water discharge from the seven sites totaled 38 ft^3/s, and the sulfate discharge was 17 tons/d. Continuous water-discharge data were collected from Oneida Mine Tunnel No. 3 near Oneida from July 1974 to October 1976. From October 1, 1975, to September 30, 1976, maximum daily mean discharge was 67 ft^3/s, and the minimum was 3.4 ft^3/s. Continuous water-discharge data were also collected from Catawissa Tunnel near Sheppton from July 1974 to September 1976; the minimum and maximum daily mean discharges were 0.55 and 6.2 ft^3/s, respectively.

Nuremberg

Three mine-discharge sites were sampled in the area near Nuremberg; all drain into the Susquehanna River basin. Water quality and discharge data are listed in table 10. Water discharge from the three sites totaled 16 ft^3/s, sulfate discharge was 8.7 tons/d. The largest discharge, 8.8 ft^3/s, was from the Derringer Mine tunnels.

Summary and Discussion

A total of 29 mine sites were sampled in the Eastern Middle Field. Water discharge totaled 176 ft^3/s, sulfate discharge was 120 tons/d, and iron discharge was 2.1 tons/d. Mine water discharge to the Lehigh River basin totaled 46 ft^3/s and the sulfate discharge totaled 14 tons/d; the rest drained to the Susquehanna River basin. Water yield from the entire 32 mi^2 coal field was 5.5 $(ft^3/s)/mi^2$, significantly more than the 2.1 $(ft^3/s)/mi^2$ measured for the Northern Field. Sulfate yield was 3.6 $(tons/d)/mi^2$, slightly less than the 4.6 $(tons/d)/mi^2$ measured in the Nothern Field.

Apparently, the high water yield from the mined area is due to water that enters the mines from other areas. The extra water does not seem to contribute to the sulfate yield, which was 3.6 $(tons/d)/mi^2$. All of the discharges sampled in the Eastern Middle Field were from drainage tunnels or natural overflows. No pumps were known to be in operation at the time of sampling.

Felegy and others (1948) and Ash and others (1951) collected flow and water-quality data during 1941 from all known discharges in the Eastern Middle Field. Total measured water discharge was 102 ft^3/s (20 percent was pumped from deep mines), and the measured acid discharge (as $CaCO_3$ to pH 8.3) was 190 tons/d (20 percent was pumped from deep mines). During the sampling period in 1975, water discharge was 176 ft^3/s (none was pumped), and acid discharge was 52 tons/d. Water discharge during 1975 was about 70 percent greater than 1941, but the discharge of acid was about 70 percent less. Water and acid discharges from the Jeddo Tunnel were measured and sampled on June 12, 1941, and on October 31, 1946. Water discharges were 26.4 and 25.3 ft^3/s, respectively, and acid dischafges were 67 and 58 tons/d, respectively. On April 16, 1975, water discharge from the Jeddo Tunnel was 65 ft^3/s,

Table 9.—Water-quality and discharge data from mine-drainage sites in the Eastern Middle Field near Sheppton

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
45	Oneida Mine	Oneida Tunnel 1	40°55'32" 76°07'25"	4-15-75	6.4	7.0	205	3.7	69	1	1.2	0.02	—	40	45
46	Humboldt Mine	strip pool overflow	40°55'24" 76°04'03"	4-15-75	.4	8.0	<50	5.0	5	<1	.01	.0011	3	3	4
47	Honey Brook Green Mountain	Catawissa Tunnel	40°54'39" 76°03'59"	4-15-75	.8	7.0	175	3.9	58	3	.13	.0065	—	50	60
48	Green Mountain Mine	Green Mountain Tunnel	40°53'52" 76°04'03"	4-15-75	2.1	9.0	210	3.6	76	1	.43	.0057	—	43	48
49	Audenreid Mine	Audenreid Tunnel	40°53'52" 76°03'59"	4-15-75	19	10.0	600	3.3	280	2	14	.10	—	108	118
50	Oneida Mine	Oneida Tunnel 3	40°55'06" 76°08'50"	4-16-75	9.1	8.0	170	4.3	53	.2	1.3	.0049	—	30	40
51	Oneida Mine	strip pool overflow	40°53'30" 76°09'38"	4-15-75	.2	7.0	40	4.1	13	<1	.01	.0005	—	4	6
Subtotal					38						17	.14			

Table 10.—Water-quality and discharge data from mine-drainage sites in the Eastern Middle Field near Nuremberg

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
52	Gowen Mine	Gowen Tunnel	40°56'54" 76°10'47"	4-15-75	6.6	8.0	300	3.8	110	2	2.0	.036	—	55	60
53	Derringer Mine	Derringer Tunnel	40°56'48" 76°10'43"	4-15-75	8.8	8.5	205	3.7	280	1	6.7	.024	—	30	33
54	McCauley Mountain Basin	Southeast stripping seepage	40°58'27" 76°15'17"	4-14-75	.7	7.0	55	4.0	19	<1	.04	.0019	—	50	63
Subtotal					16						8.7	.062			

and acid discharge was 29 tons/d. Water discharge was about 150 percent greater, and acid discharge was about 60 percent less than the discharges during 1941 and 1946.

Western Middle Field

The Western Middle Field (fig. 5) extends from east of Mahanoy City to just southwest of Trevorton and is entirely within the Susquehanna River Basin. About 75 mi^2 are underlain with coal; the total drainage area is about 100 mi^2. Most of the area that is not underlain with coal is along the top of the ridges, and the drainage is toward the coal measures. Forty-six mine discharges were measured and sampled; their locations are shown on figure 5, and the discharges are discussed by regions in the following paragraphs.

Mahanoy City

Three sites were sampled in the vicinity of Mahanoy City (table 11) during April 1975. All three are associated with the Vulcan-Buck Mountain Mine. Water discharge totaled 11 ft^3/s, sulfate discharge totaled 4.6 tons/d, and the mean concentration of sulfate was 160 mg/L. The largest discharge was from the Vulcan-Buck Mountain boreholes. Water discharge from the boreholes was 9.8 ft^3/s, and the sulfate discharge was 4.2 tons/d.

Shenandoah

Three mine-discharge sites were sampled near Shenandoah (table 12). The largest discharge was from the Gilberton pump. The pump was installed to prevent water levels from rising and flooding basements, and operates about 40 percent of the time. The discharge is 23 ft^3/s when the pump is operating, however, because the pump operates 40 percent of the time, the average discharge is about 9.2 ft^3/s. Samples of the discharge were collected and the concentrations of dissolved iron and sulfate were 54 and 1,000 mg/L, respectively.

Total water discharge from the three sites, assuming the pump operates 40 percent of the time, was 14 ft^3/s; sulfate discharge was 40 tons/d: and mean concentration of sulfate was 1,100 mg/L. The other two discharges in the Shenandoah area also have relatively high dissolved iron (20 mg/L) and sulfate concentations (1,200 and 1,300 mg/L).

Girardville

Seven mine-discharge sites were sampled in the Girardville area (table 13). The largest discharge, 45 ft^3/s, was from a breach and borehole at the the Packer No. 5 mine; the sulfate concentration was 1,300 mg/L and the sulfate discharge was 160 tons/d. Discharge from the Packer No. 5 mine probably originates from several mine complexes north and east of Girardville. A second large discharge near Girardville was from several seepages along the base of a spoil pile at the Girard mine, total discharge was 8.0 ft^3/s. Water discharge from the seven sites totaled 58 ft^3/s, and sulfate discharge was 180 tons/d.

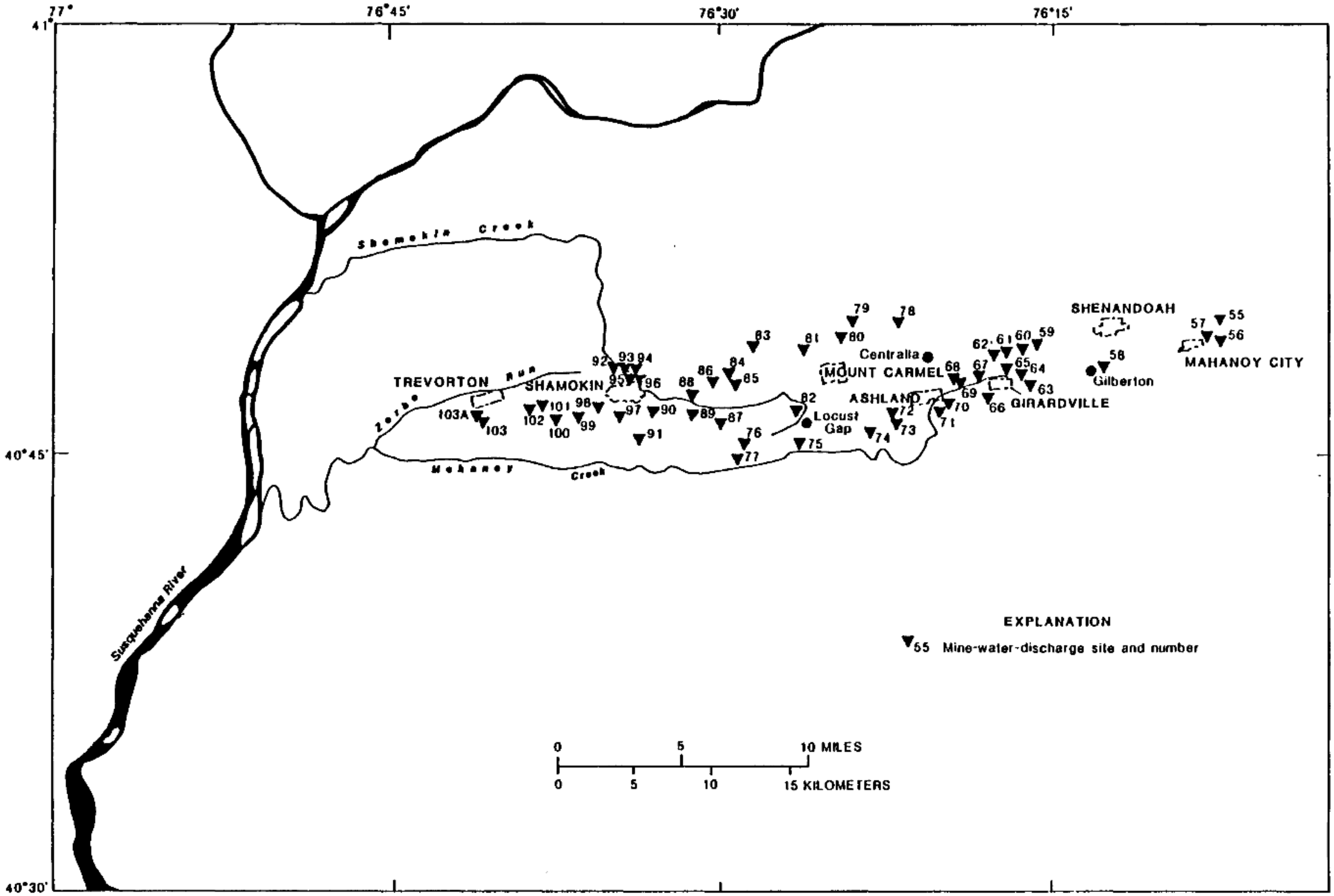

Figure 5.--Mine-water-discharge sites in the Western Middle Anthracite Field, east-central Pennsylvania.

Table 11.—Water-quality and discharge data from mine-drainage sites in the Western Middle Field near Mahanoy City

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (μmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
55	Vulcan-Buck Mountain Mine	Morris Tunnel	40°49'16" 76°07'17"	4-18-75	0.3	9.5	440	3.3	140	2	.11	.0016	—	105	110
56	Vulcan-Buck Mountain Mine	seepage	40°48'58" 76°07'25"	4-18-75	.6	10.0	460	4.0	160	8	.26	.013	—	80	90
57	Vulcan-Buck Mountain Mine	Vulcan-Buck Mountain boreholes	40°48'55" 76°07'35"	4-16-75	9.8	9.5	375	4.3	160	10	4.2	.26	—	63	68
Subtotal					11						4.6	.27			

Table 12.—Water-quality and discharge data from mine-drainage sites in the Western Middle Field near Shenandoah

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (μmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
58	Gilberton Mine	Gilberton Pump	40°48'01" 76°12'34"	4-18-75	23	14.0	1800	6.1	1000	54	62	3.4	102	108	240
		operates 40 percent of the time			9.2						24.8	1.36			
59	Weston Mine	Weston surface areas seepage	40°48'30" 76°14'49"	4-16-75	3.7	15.0	1900	6.1	1200	20	12	.20	62	65	118
60	Weston Mine	Lost Creek borehole	40°48'25" 76°14'49"	4-16-75	1.0	16.0	2150	6.1	1300	20	3.51	.05	177	132	230
Subtotal					28						78	3.6			
Subtotal with Gilberton pump in operation 40 percent of time					14						40				

Table 13.—Water-quality and discharge data from mine-drainage sites in the Western Middle Field near Girardville

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (μmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
61	Hammond Mine	Connerton Village boreholes	40°48'06" 76°16'04"	4-16-75	1.7	15.0	1950	6.3	1200	40	5.5	.18	205	88	210
62	Hammond Mine	Seepage	40°48'05" 76°16'20"	4-17-75	.2	13.0	2200	6.3	1100	20	.59	.011	138	5	19
63	Girard Mine	seepage	40°47'30" 76°16'26"	4-16-75	8.0	12.0	825	5.9	460	20	9.9	.43	71	105	155
64	Packer No. 5 Mine	breach and boreholes	40°47'40" 76°16'22"	4-18-75	45	15.0	2400	5.8	1300	40	158	4.9	167	68	174
65	Preston Mine	Preston No. 3 water-level drift	40°47'44" 76°16'13"	4-16-75	.4	16.5	2050	6.3	1300	30	1.4	.03	153	83	177
66	Preston Mine	tunnel	40°27'25" 76°17'34"	4-17-75	2.2	10.0	520	5.6	200	20	1.2	.12	46	40	80
67	Bast Mine	tunnel	40°47'29" 76°18'08"	4-17-75	.9	12.0	1800	3.4	930	40	2.3	.10	—	174	213
Subtotal					58						180	5.8			

Ashland

Nine mine-discharge sites were sampled in the Ashland area (table 14). Water discharge from three sites, one from the Centralia Mine, one from the Bast Mine, and one from the Tunnel Mine enter Mahanoy Creek above Ashland. Water discharge from these three sites totaled 19 ft^3/s, and the sulfate load was 31 tons/d. The largest discharge was from the Centralia Mine drainage tunnel; water discharge was 11 ft^3/s, and sulfate discharge was 17 tons/d. Discharge from the remaining six sites enters Mahanoy Creek below Ashland. Discharge from these sites totaled 21 ft^3/s, and the sulfate load was 41 tons/d.

Mount Carmel

Four mine-discharge sites were sampled near Mount Carmel (table 15). The highest discharge (5.9 ft^3/s) was from a tunnel at the Mid-Valley Mine. The other discharges listed in table 15 are relatively small.

Shamokin

Eighteen mine-discharge sites were sampled in the area around Shamokin (table 16). The two largest discharges were from the Rock Tunnel at the Scott Ridge Mine (15 ft^3/s) and a strip pool overflow at the Excelsior Mine (13 ft^3/s). Total water discharge from the 18 sites near Shamokin was 60 ft^3/s, and the average concentration of sulfate was 560 mg/L. Sulfate discharge was 91 tons/d.

Trevorton

Two mine discharges were sampled near Trevorton (table 17). Water discharge from the North Franklin Mine airshaft and borehole was 8.3 ft^3/s, and the concentrations of dissolved iron and sulfate were 22 and 560 mg/L, respectively. The mined area is about 3 mi^2. Water and sulfate yields were about 2.6 $(ft^3/s)/mi^2$ and 4.3 $(tons/d)/mi^2$.

Summary and Discussion

The Western Middle Field contains 75 mi^2 of coal measures. Water discharge from the mine drainage sites totaled 198 ft^3/s, the sulfate load was 410 tons/d, and the iron discharge was 19 tons/d. Water yield from the 75 mi^2 underlain by coal was 2.6 $(ft^3/s)/mi^2$ and the sulfate yield was 5.5 $(tons/d)/mi^2$. The sulfate yield was about 50 percent greater than the yields measured from the Northern and Eastern Middle Fields. Table 18 lists a summary of water and sulfate discharges from the Western Middle Field by drainage areas.

Felegy and others (1948) and Ash and others (1951) collected flow and water-quality data during 1941 and 1946 from all known discharges in the Western Middle Field. Measured water discharge during the sampling in 1941 was 120 ft^3/s (78 percent was pumped from deep mines) and measured acid discharge, as $CaCO_3$ to pH 8.3, was 229 tons/d (62 percent was pumped from deep mines). Measured water and acid discharges were considerably less when samples were collected in 1946. Water discharge was 61 ft^3/s (80 percent

Table 14.—Water-quality and discharge data from mine-drainage sites in the Western Middle Field near Ashland

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
68	Centralia Mine	tunnel	40°47'27" 76°19'26"	4-16-75	11	11.0	950	3.5	580	10	17	0.30	—	133	145
69	Bast Mine	Overflow site	40°47'11" 76°19'09"	4-17-75	.00	—	—	—	—	—	—	—	—	—	—
70	Bast Mine	Oakland Tunnel	40°47'06" 76°19'54"	4-17-75	6.6	14.0	1400	6.3	660	20	12	.36	118	58	110
71	Tunnel Mine	drain pool area and seepage	40°46'45" 76°20'12"	4-17-75	1.3	17.0	1250	6.5	640	30	2.2	.11	98	23	48
72	Potts Mine	West breach	40°46'34" 76°22'19"	4-17-75	.3	12.0	950	6.8	240	2	.19	.0016	46	3	18
73	Potts Mine	East breach	40°46'24" 76°22'15"	4-17-75	3.2	15.0	2400	6.6	960	40	8.3	.35	328	38	170
74	Lavelle Mine	Lavelle slope	40°45'58" 76°24'05"	4-17-75	.3	10.5	460	3.3	230	2	.19	.0016	—	45	50
75	Locust Gap Mine	Helfenstein tunnel	40°45'04" 76°26'12"	4-17-75	3.9	13.5	1200	7.2	670	10	7.1	.11	54	—	45
76	Locust Gap Mine	strip pool overflow	40°45'31" 76°28'29"	4-21-75	.2	12.0	530	3.6	250	2	.14	.0011	—	90	100
77	Locust Gap Mine	Doutyville tunnel	40°44'35" 76°28'38"	4-18-75	13	13.0	1280	3.6	700	12	25	.42	—	106	135
Subtotal					40						72	1.7			

Table 15.—Water-quality and discharge data from mine-drainage sites in the Western Middle Field near Mount Carmel

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
78	Mid-Valley Mine	seepage	40°49'17" 76°22'21"	4-17-75	0.2	17.5	1600	2.8	870	10	0.47	0.0054	—	395	429
79	Mid-Valley Mine	Mid-Valley Tunnel 4	40°49'05" 76°23'55"	4-17-75	.4	12.5	280	3.3	264	1	.29	.0011	—	40	48
80	Mid-Valley Mine	tunnel	40°48'48" 76°24'24"	4-17-75	5.9	10.5	600	3.3	280	15	4.5	.24	—	140	155
81	Richards's Shaft Mine	drift	40°48'17" 76°26'12"	4-17-75	.00	—	—	—	—	—	—	—	—	—	—
82	Alaska Mine	seepage	40°46'56" 76°26'50"	4-17-75	.1	8.0	900	2.7	380	5	.10	.0014	—	188	203
Subtotal					6.6						5.4	.25			

Table 16.—Water-quality and discharge data from mine-drainage sites in the Western Middle Field near Shamokin

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
83	Natalie Mine	drift	40°48'40" 76°28'10"	4-17-75	0.00	—	—	—	—	—	—	—	—	-	—
84	Scott Ridge Mine	breach	40°47'39" 76°29'19"	4-17-75	2.8	12.7	980	5.3	1190	50	9.0	0.38	16	165	210
85	Scott Ridge Mine	rock tunnel	40°47'39" 76°29'19"	4-17-75	15	12.7	980	5.3	490	45	20	1.8	16	115	165
86	Colbert Mine	breach	40°47'26" 76°29'41"	4-17-75	.9	12.0	900	5.3	510	40	1.2	.10	13	118	138
87	Excelsior Mine	strip pool overflow	40°46'25" 76°29'37"	4-18-75	13	12.0	810	4.9	400	44	14	1.5	5	158	185
88	Maysville Mine No. 1 & 2	borehole	40°47'03" 76°30'52"	4-16-75	3.3	11.2	1000	6.3	460	50	4.1	.45	133	125	200
89	Corbin Mine	Corbin water level drift	40°46'46" 76°30'53"	4-16-75	1.0	12.0	810	4.1	490	40	1.3	.11	—	210	230
90	Royal Oak Mine	seepage	40°46'57" 76°32'05"	4-16-75	.1	12.5	720	5.3	370	30	.10	.0081	35	115	135
91	Big Mountain Mine	No. 1 slope	40°46'19" 76°32'19"	4-16-75	2.0	11.5	700	3.4	300	20	1.6	.11	—	150	160
92	Cameron Mine	air shaft	40°47'44" 76°33'59"	4-16-75	4.0	12.2	1470	3.4	790	60	8.5	.65	—	355	385
93	Cameron Mine	drift	40°47'37" 76°33'55"	4-16-75	4.7	14.0	1700	4.1	1100	150	14	1.9	—	420	474
94	Cameron Mine	intermittent pump	40°47'35" 76°33'34"	4-16-75	.00	—	—	—	—	—	—	—	—	-	—
95	Cameron Mine	seepage	40°47'30" 76°33'52"	4-16-75	.01	12.5	1000	4.7	550	60	.00	.0000	5	230	255
96	Cameron Mine	drift and tunnel	40°47'31" 76°33'46"	4-16-75	1.1	14.5	1300	5.5	920	60	2.7	.18	38	185	210
97	Henry Clay Stirling Mine	pump slope	40°40'37" 76°34'07"	4-16-75	11	13.0	950	5.6	470	50	14	1.5	43	145	170
98	Henry Clay Stirling Mine	collapsed drift	40°46'43" 76°34'47"	4-16-75	.2	11.0	355	6.1	91	10	.05	.0054	79	33	65
99	Bear Valley Mine	seepage	40°46'14" 76°35'11"	4-16-75	.1	11.0	800	3.3	380	1	.10	.0003	—	120	123
100	Bear Valley Mine	North Mountain tunnel collapsed	40°46'18" 76°36'59"	4-15-75	.6	9.5	405	5.6	180	20	.29	.032	28	90	105
101	Bear Valley Mine	seepage	40°47'54" 76°37'28"	4-15-75	.1	7.0	160	5.7	61	1	.02	.0003	3	5	8
102	Bear Valley Mine	strip pool overflow	40°46'42" 76°37'30"	4-15-75	.05	9.0	180	5.5	78	1	.01	.0001	7	5	8
Subtotal					60						91	8.7			

Table 17.—Water-quality and discharge data from mine-drainage sites in the Western Middle Field near Trevorton

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
103	N. Franklin Mine	drift and borehole	40°46'17" 76°40'44"	4-18-75	7.3	12.5	980	3.7	580	25	11	0.49	—	150	175
103A	N. Franklin Mine	includes 103 and additional seeps	40°46'36" 76°40'58"	4-18-75	8.3	12.5	1100	3.5	560	22	13	.49	—	225	250
Subtotal					8.3						13	.49			

Table 18.—Summary of water and sulfate discharge from mine-drainage sites in the Western Middle Field

Drainage basin	Area underlain with coal measures (mi^2)	Total water discharge (ft^3/s)	Sulfate discharge (ton/d)	Water yield $(ft^3/s)/mi^2$	Sulfate yield $(tons/d)/mi^2$
Mahanoy Creek at Ashland	37	102	260	2.8	6.9
Lower Mahanoy Creek	9	21	41	2.3	4.5
Treverton	3	8.3	13	2.8	4.3
Mahanoy Creek Total	49	131	310	2.7	6.5
Shamokin Creek Mine drainage sites	26	67	96	2.6	3.7
Western Middle Field Total	75	198	406	2.6	5.4

was pumped from deep mines), and acid discharge was 98 tons/d (62 percent was pumped from deep mines). Apparently, some deep mines had stopped operating and the mines were filling with water during 1946. During the sampling in 1975, water discharge was 198 ft^3/s (78 percent more than 1941), and acid discharge was 93 tons/d (55 percent less than 1941). About 95 percent of the discharge in 1975 was from gravity overflows or drainage tunnels.

Southern Field

The Southern Coal Field (fig. 6) contains about 141 mi^2 of coal measures and extends from Jim Thorpe to Lykens, a distance of 56 miles. The larger part of coal fields, about 77 mi^2, drains toward the Delaware River. Drainage from the remaining 64 mi^2 flows toward the Susquehanna River. About 129 mi^2 are upslope from the coal fields, and the total drainage area is about 270 mi^2. The locations of the mine-discharge sites sampled in the Southern Coal Field are shown on figure 6, and they are discussed by areas in the following paragraphs.

Jim Thorpe

The Nesquehoning Tunnel, the only mine-discharge site sampled near Jim Thorpe, flows into the Lehigh River. At the time of sampling (table 19), the water discharge was 11 ft^3/s and the concentrations of dissolved iron and sulfate were 7 and 560 mg/L, respectively. The area underlain by coal measures is about 2.3 mi^2.

Coaldale

Three mine-discharge sites were sampled near Coaldale (table 20). The highest discharge was the pump discharge of the Greenwood Mine. Water discharge was 7.7 ft^3/s, and the concentrations of dissolved iron and sulfate were 33 and 1,600 mg/L, respectively. If pumping from the Greenwood Mine would be discontinued, discharges from other sites would increase or new discharges would develop. All three discharges drain to the Little Schuylkill River.

Ginther

Two mine-discharge sites were sampled in the vicinity of Ginther (table 21). Both sites drain the Silverbrook Mine. The higher discharge (4.2 ft^3/s) was from a buried mine opening. Both sites discharge into a tributary of the Little Schuylkill River.

Tamaqua

Seven mine-discharge sites were sampled near Tamaqua (table 22); all drain to the Little Schuylkill River Basin. The highest discharge (2.2 ft^3/s) was from the South Dip Tunnel at the Reevesdale Mine. The concentrations of dissolved iron and sulfate in the discharge from the South Dip Tunnel were 2 and 120 mg/L, respectively. A pump at the Tamaqua Mine was not in operation at the time samples were collected.

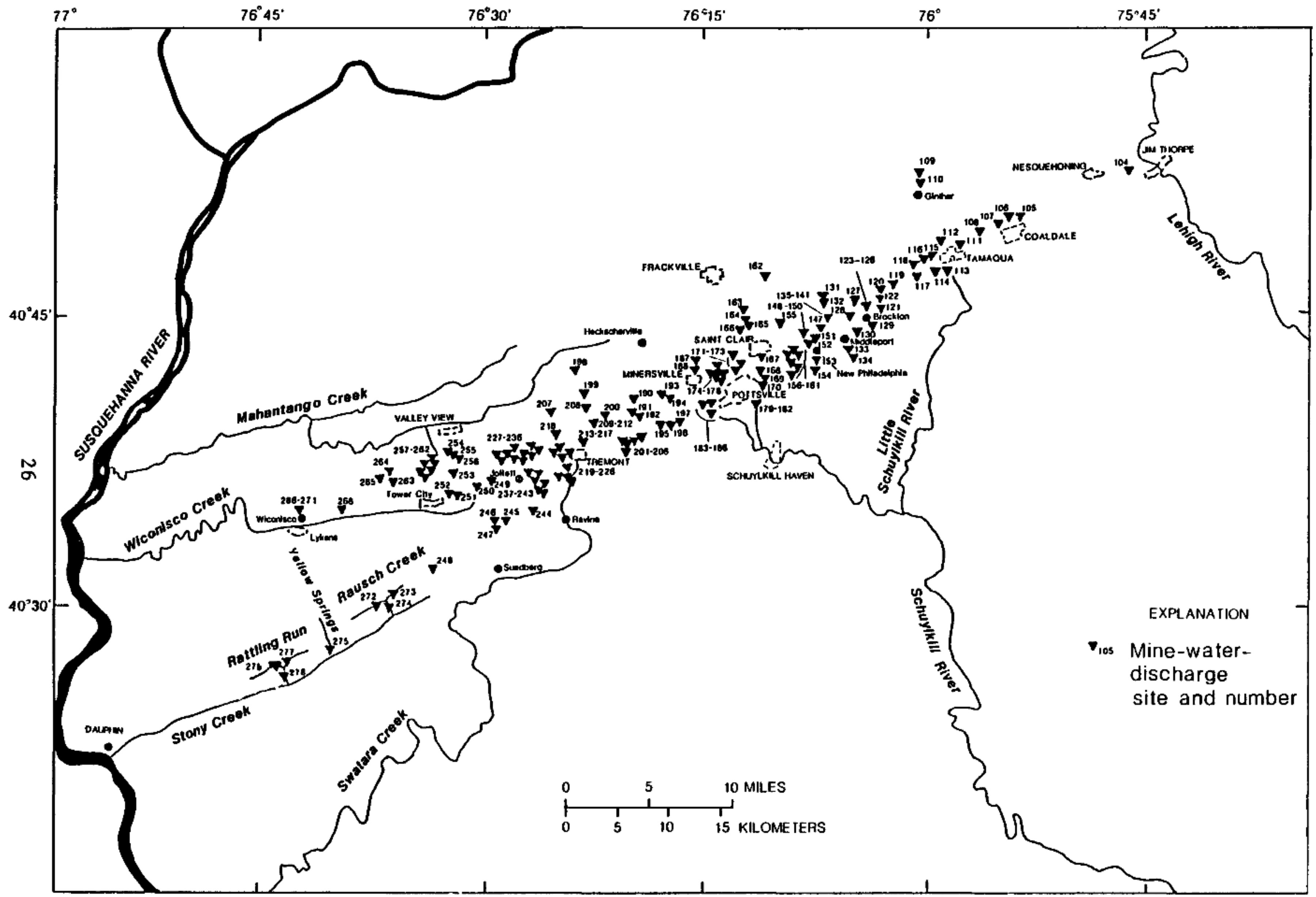

Figure 6.--Mine-water-discharge sites in the Southern Anthracite Field, east-central Pennsylvania.

Table 19.—Water-quality and discharge data from mine-drainage sites in the Southern Field near Jim Thorpe

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
104	Nesquehoning Mine	Nesquehoning Tunnel	40°52'29" 76°45'49"	4-22-75	11	12.5	1090	6.4	560	7	17	0.21	36	17	48

Table 20.—Water-quality and discharge data from mine-drainage sites in the Southern Field near Coaldale

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
105	Coaldale Mine	No. 9 water level tunnel	40°49'44" 75°53'49"	4-23-75	0.1	12.0	320	6.9	35	<1	0.01	0.0003	23	5	12
106	Coaldale Mine	No. 8 water level tunnel	40°49'43" 75°54'15"	4-23-75	.1	10.5	230	4.3	110	1	.03	.0003	—	58	69
107	Coaldale Mine	seepage	40°49'18" 75°55'10"	4-23-75	.00	—	—	—	—	—	.00	.0000	—	—	—
108	Greenwood Mine	Greenwood pump	40°49'09" 75°56'00"	4-23-75	7.7	16.5	2500	6.7	1600	33	33	.69	—	40	93
Subtotal					7.9						33	.69			

Table 21.—Water-quality and discharge data from mine-drainage sites in the Southern Field near Ginther

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
109	Silverbrook Mine	seepage-refuse bank	40°52'25" 76°00'17"	4-18-75	0.2	11.5	1100	3.0	510	8	0.28	0.0043	—	279	300
110	Silverbrook Mine	mine opening buried	40°52'24" 76°00'17"	4-18-75	4.2	9.6	305	3.8	110	10	1.2	.11	—	80	90
Subtotal					4.4						1.5	.11			

Table 22.—Water-quality and discharge data from mine-drainage sites in the Southern Field near Tamaqua

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
111	Tamaqua Mine	Tamaqua No. 14 pump	40°48'02" 75°57'31"	4-23-75	0.00	—	—	—	—	—	—	—	—	—	—
112	Farley Mine	collapsed mine opening	40°48'29" 75°58'24"	4-23-75	.3	10.0	230	3.8	100	1	0.08	0.0008	—	125	169
113	Smith Bear Mine	drifts and collapse	40°47'26" 75°58'03"	4-14-75	.4	11.5	1400	3.0	800	70	.86	.076	—	552	710
114	Newkirk Mine	Newkirk tunnel Novell Dip	40°47'28" 75°59'09"	4-23-75	1.1	9.5	750	3.1	300	12	.89	.036	—	220	230
115	Tamaqua Lands Mine	breach	40°47'30" 75°59'49"	4-24-75	.3	10.5	260	5.8	110	2	.09	.0016	16	22	30
116	Newkirk Mine	Newkirk tunnel South Dip	40°47'28" 75°59'59"	4-24-75	.7	10.5	280	5.1	120	5	.23	.0095	3	18	24
117	Reevesdale Mine	North Dip Tunnel collapsed	40°46'46" 76°00'11"	4-18-75	.2	15.8	540	3.4	190	5	.10	.0027	—	72	75
118	Reevesdale Mine	South Dip Tunnel	40°47'05" 76°00'32"	4-18-75	2.2	10.0	260	3.7	120	2	.71	.012	—	65	74
Subtotal					5.2						3.0	.14			

Brockton

Eleven mine discharges were sampled near Brockton (table 23). Water discharge from the 11 sites totaled 7.6 ft^3/s and the sulfate discharge was 3.2 tons/d. All discharges drain to tributaries of the Schuylkill River.

Middleport

Fifteen mine-discharge sites were sampled in the Middleport area (table 24). Water discharge from the 15 sites totaled 8.3 ft^3/s and sulfate discharge was 1.5 tons/d. The highest water discharge, 2.2 ft^3/s, was from a strip pool overflow; however, the concentration of sulfate was only 28 mg/L.

New Philadelphia

Thirteen mine-discharge sites were sampled in the vicinity of New Philadelphia (table 25). Water discharge from the 13 sites totaled 12.0 ft^3/s, and the discharge of sulfate was 10 tons/d. The largest discharge (4.6 ft^3/s) was from a tunnel at the Silver Creek Mine.

Frackville

One mine-discharge site was sampled on the southern side of Broad Mountain near Frackville (table 26). Water discharge was 15 ft^3/s, concentrations of dissolved iron and sulfate were 10 and 140 mg/L, respectively, and sulfate discharge was 5.7 tons/d.

Pottsville and St Clair

Seventeen mine-discharge sites were sampled in the Pottsville-St Clair area (table 27). Water discharge from the 17 sites totaled 22 ft^3/s, sulfate discharge was 38 tons/d. Two of the discharges sampled were pumps operated on an intermittent basis. A pump at the Pine Forest Mine had a discharge of 14 ft^3/s, and a pump at the Wadesville Mine had a discharge of 2.3 ft^3/s; the concentrations of dissolved iron were 5 and 1 mg/L, and the concentrations of sulfate were 780 and 630 mg/L, respectively. The percentage of the time the pumps operate is not known.

Minersville

Fifteen mine-discharge sites were sampled in the vicinity of Minersville (table 28). Water discharge from the 15 sites totaled 44 ft^3/s; the discharge of sulfate was 49 tons/d. All the discharges listed on table 28 drain to the West Branch of the Schuylkill River. The largest discharge, 26 ft^3/s, was from the Pine Knot Mine drainage tunnel. Discharge from the Oak Hill Mine was not sampled until November 11, 1975.

Heckscherville

One mine-discharge site was sampled near Heckscherville. The discharge was from a pump at the M & M Mine (table 29). The percentage of time the pump was operated is not known. Discharge from the Heckscherville site is to Hans Yost Creek, a tributary of the Mahantango Creek.

Table 23.—Water-quality and discharge data from mine-drainage sites in the Southern Field near Brockton

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
119	Mary D Mine	strip pool overflow	40°46'12" 76°01'56"	4-18-75	1.0	11.5	255	6.2	120	4	0.32	0.011	5	22	26
120	Tamaqua Mine	2 strip pool overflows	40°46'07" 76°02'24"	4-18-75	.05	11.0	315	4.2	120	1	.02	.0001	—	30	38
121	Bell Mine	Bell water level tunnel	40°45'12" 76°02'55"	4-21-75	2.1	9.5	380	3.6	140	2	.79	.011	—	55	66
122	Tuscarora	Tuscarora sinkhole	40°45'31" 76°02'57"	4-21-75	2.5	11.0	300	6.4	160	10	1.1	.068	9	24	34
123	Mary D Mine	strip pool overflow	40°45'25" 76°03'13"	4-21-75	.2	9.5	300	5.1	150	1	.08	.0005	3	9	13
124	Mary D Mine	seepage	40°45'24" 76°03'25"	4-21-75	.2	10.0	305	.1	130	3	.07	.0016	3	21	30
125	Mary D Mine	borehole	40°45'23" 76°03'27"	4-21-75	.7	9.0	300	5.1	130	5	.25	.0095	3	55	69
126	Mary D Mine	seepage	40°45'22" 76°03'30"	4-21-75	.1	9.0	300	5.3	130	4	.04	.0011	3	35	45
127	Mary D Mine	Mary D drift	40°46'03" 76°04'19"	4-21-75	.05	9.0	90	4.5	22	1	.00	.0001	—	20	30
128	Mary D Mine	strip pool oveflow	40°45'24" 76°03'52"	4-21-75	.4	15.0	280	4.2	110	1	.12	.0011	—	20	24
129	Brockton Mine	Brockton water level tunnel	40°44'43" 76°03'51"	4-22-75	.3	12.0	1150	3.4	530	30	.43	.0000	—	10	350
Subtotal					7.6						3.2	.10			

Table 24.—Water-quality and discharge data from mine-drainage sites in the Southern Field near Middleport

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
130	Brockton Mine	Upper Whitefield tunnel	40°45'03" 76°05'05"	4-21-75	0.1	10.0	120	4.1	28	2	0.01	0.0005	—	18	20
131	Brockton Mine	strip pool overflow	40°45'38" 76°06'39"	4-21-75	2.2	11.5	80	4.5	28	<1	.17	.0059	—	10	14
132	Brockton Mine	strip pool overflow	40°45'38" 76°06'37"	4-21-75	1.3	8.0	40	4.5	8	<1	.03	.0035	—	5	8
133	Lovel Mine	drift	40°43'53" 76°04'18"	4-21-75	.4	8.0	100	4.7	38	1	.04	.0011	1	18	20
134	Lovel Mine	stream through strip pit	40°43'59" 76°04'21"	4-21-75	.9	7.5	60	5.2	34	1	.08	.0024	3	5	6
135	Kaska Mine	Steinberg tunnel, collapsed	40°44'48" 76°05'38"	4-21-75	.2	9.0	260	3.6	88	5	.05	.0027	—	50	55
136	Kaska Mine	Clem Jones borehole	40°44'25" 76°05'53"	4-22-75	.3	12.0	460	6.3	140	10	.11	.0081	130	60	100
137	Kaska Mine	shaft tunnel	40°44'25" 76°05'53"	4-22-75	.1	12.0	490	6.4	150	8	.04	.0022	112	50	74
138	Kaska Mine	shaft	40°44'33" 76°05'50"	4-22-75	.00	—	—	—	—	—	—	—	—	—	—
139	Kaska Mine	shaft, buried	40°44'16" 76°05'48"	4-22-75	.8	10.0	440	6.1	250	<1	.54	.0022	18	10	20
140	Kaska Mine	abandoned settling pond	40°47'07" 76°05'48"	4-22-75	.00	—	—	—	—	—	—	—	—	—	—
141	Kaska Mine	seepage	40°43'58" 76°06'00"	4-22-75	.3	12.0	880	3.5	250	2	.20	.0016	—	30	35
142	Middleport Mine	seepage	40°43'19" 76°04'30"	4-22-75	.5	11.5	55	6.1	18	<1	.02	.0014	10	5	10
143	Middleport Mine	Rocktown water level tunnel	40°43'21" 76°04'30"	4-22-75	.2	8.5	155	4.2	49	<1	.03	.0005	—	33	50
144	Middleport Mine	Basquel Tunnel, collapsed	40°43'13" 76°04'43"	4-22-75	.8	10.5	250	5.8	84	15	.18	.032	15	30	40
145	Middleport Mine	strip pool overflow	40°43'15" 76°04'48"	4-22-75	.1	13.0	260	4.3	79	3	.02	.0008	—	24	28
146	Middleport Mine	Garenty Drift, collapsed	40°43'23" 76°04'49"	4-22-75	.05	9.2	225	3.9	110	2	.01	.0003	—	33	35
Subtotal					8.3						1.53	.065			

Table 25.—Water-quality and discharge data from mine-drainage sites in the Southern Field near New Philadelphia

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
147	Silver Creek Mine	seepage	40°43'54" 76°06'48"	4-22-75	0.4	14.5	675	4.0	400	15	0.43	0.016	—	100	110
148	Silver Creek Mine	seepage	40°44'03" 76°07'24"	4-22-75	.05	18.5	400	4.8	190	10	.03	.0014	2	28	31
149	Silver Creek Mine	tunnel	40°44'03" 76°07'24"	4-22-75	4.6	12.5	500	4.5	270	20	3.35	.25	—	30	45
150	Silver Creek Mine	settling pond overflow	40°43'52" 76°07'28"	4-22-75	.05	10.5	740	3.5	310	20	.04	.0027	—	105	130
151	New Philadelphia Mine	seepage	40°43'28" 76°51'22"	4-22-75	.01	10.5	410	4.5	180	10	.00	.0003	—	48	58
152	New Philadelphia Mine	seepage	40°43'28" 76°07'11"	4-22-75	.01	12.0	800	3.5	360	1	.01	.0000	—	125	130
153	Brockton Mine	collapsed drift	40°42'42" 76°07'28"	4-22-75	.2	18.0	440	5.6	200	<1	.11	.0005	7	3	5
154	Brockton Mine	collapsed drift	40°42'44" 76°07'30"	4-22-75	.00	—	—	—	—	—	—	—	—	—	—
155	Silver Creek Mine	drainage tunnel	40°44'22" 76°07'55"	4-22-75	0.05	11.0	140	3.9	48	<1	0.0065	0.0001	—	20	23
156	Port Carbon Mine	seepage	40°43'04" 76°08'51"	4-22-75	.3	14.0	1040	4.6	550	10	.45	.0081	5	88	135
157	Eagle Hill Mine	water level drift	40°42'58" 76°09'01"	4-22-75	1.8	12.5	850	5.4	430	6	2.1	.029	16	60	90
158	Port Carbon Mine		40°42'52" 76°09'05"	4-22-75	.00	—	—	—	—	—	—	—	—	—	—
159	Palmer View Mine	collapsed slope	40°42'38" 76°08'44"	4-23-75	.2	10.6	340	6.3	110	2	.06	.0011	66	24	40
160	Port Carbon Mine	Lucianna water level tunnel	40°42'17" 76°08'22"	4-23-75	2.7	12.0	750	5.3	430	30	3.1	.22	13	110	125
161	Reynolds Mine	slope	40°41'43" 76°09'10"	4-23-75	1.6	10.5	390	6.2	120	15	.52	.065	79	38	55
Subtotal					12.0						10.2	.59			

Table 26.—Water-quality and discharge data from mine-drainage sites in the Southern Field near Frackville

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (μmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
162	Morea Mine	strip pool overflow	40°46'57" 76°10'55"	4-16-75	15.	8.0	440	3.2	140	10	5.7	0.41	—	90	95

Table 27.—Water-quality and discharge data from mine-drainage sites in the Southern Field near Pottsville and St Clair

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
163	Repplier Mine	pool tunnel	40°44'25" 76°11'52"	4-23-75	1.3	9.3	100	3.9	28	<1	0.10	0.0035	—	22	30
164	Repplier Mine	collapsed drift	40°44'21" 76°11'56"	4-23-75	.00	—	—	—	—	—	—	—	—	—	—
165	Repplier Mine	collapsed drift	40°44'06" 76°11'56"	4-23-75	.05	8.7	250	3.6	110	<1	.01	.0001	—	50	53
166	Repplier Mine	Repplier water level tunnel	40°44'06" 76°12'02"	4-23-75	2.4	11.5	660	5.8	310	8	2.0	.052	30	60	74
167	Pine Forest Mine	Pump in borehole intermittent	40°43'20" 76°10'32"	4-23-75	14	13.0	1400	3.25	780	5	29	.19	—	105	125
168	Eagle Hill Mine	Diamond water level drift	40°42'34" 76°10'30"	4-23-75	.5	11.5	700	6.2	270	15	.36	.020	105	59	73
169	Port Carbon Mine	Snyder's water level drift	40°42'14" 76°10'30"	4-23-75	.2	11.5	595	6.0	250	1	.14	.0005	50	38	55
170	Salem Hill Mine	drainage tunnel	40°42'16" 76°10'39"	4-23-75	.2	11.6	830	6.8	160	1	.09	.0005	271	4	40
171	Wadesville Mine	intermittent pump	40°42'51" 76°12'21"	4-22-75	2.3	14.0	1500	7.1	630	1	3.9	.0062	380	—	85
172	Pottsville Mine	seepage	40°42'36" 76°11'50"	4-23-75	.1	7.8	470	6.3	82	2	.02	.0005	113	33	55
173	Pottsville Mine	shaft	40°42'30" 76°11'49"	4-23-75	0.1	9.0	280	4.5	123	<1	0.03	0.0003	—	15	22
174	Diamond Bed Mine	seepage	40°42'33" 76°13'44"	4-23-75	.05	9.6	1700	4.7	940	10	.13	.0014	6	140	164
175	Diamond Bed Mine	abandoned gangway and borehole	40°42'28" 76°13'44"	4-23-75	.2	9.5	2400	6.6	1300	60	.70	.032	4	110	125
176	Diamond Bed Mine	seepage	40°42'26" 76°13'44"	4-23-75	.01	—	—	—	—	—	—	—	—	—	—
177	Seltzer Mine	Peach Overland strip pool, seepage	40°42'08" 76°13'26"	4-24-75	.3	14.0	480	4.0	260	<1	.21	.0008	—	22	30
178	Seltzer Mine	seepage	40°45'52" 76°13'20"	4-24-75	.1	11.5	350	6.0	140	6	.04	.0016	44	35	55
179	Sherman Mine	Mammoth bed seepage	40°40'50" 76°11'21"	4-24-75	.3	11.0	700	7.0	280	4	.23	.0032	102	—	18
180	Sherman Mine	overflow	40°40'46" 76°11'32"	4-24-75	(not sampled)	—	—	—	—	—	—	—	—	—	—
181	Sherman Mine	Skidmore bed seepage	40°40'45" 76°11'12"	4-24-75	.1	19.5	150	5.8	30	2	.01	.0005	25	8	24
182	Sherman Mine	Buck Mtn. bed seepage	40°40'46" 76°11'23"	4-24-75	.2	12.5	560	6.5	250	5	.14	.0027	220	3	60
Subtotal					22.4						37.5	.31			

Table 28.—Water-quality and discharge data from mine-drainage sites in the Southern Field near Minersville

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
183	Salem Mine	drift	40°41'28" 76°14'41"	4-24-75	0.5	10.2	500	6.1	76	4	0.10	0.0054	99	35	60
184	Pottsville	Connecticut shaft	40°40'43" 76°14'02"	4-24-75	.05	10.0	150	5.8	34	<1	.0046	.0001	30	17	30
185	Cove Coal Co.	water level tunnel 16" culvert	40°39'56" 76°14'07"	4-24-75	.3	10.5	440	3.8	240	8	.19	.0065	—	50	55
186	Cove Coal Co.	water level tunnel collapsed	40°39'51" 76°14'08"	4-24-75	.1	10.5	140	4.3	54	<1	.015	.0003	—	19	28
187	Pine Knot Mine	Pine Knot drainage tunnel	40°42'24" 76°15'06"	4-21-75	26	10.5	720	5.2	370	9	26	.63	5	65	90
188	Oak Hill Mine	6 boreholes, shaft and seepage	40°42'12" 76°15'16"	11-19-75	7.8	16.0	1500	6.15	650	45	14	.95	153	139	227
189	Otto Mine	seepage	40°40'33" 76°19'44"	4-23-75	.4	14.0	800	4.9	450	20	.49	.022	5	80	100
190	Otto Mine	Otto airshaft	40°39'58" 76°19'14"	4-23-75	6.4	10.5	800	4.7	430	26	7.4	.45	10	123	163
191	Otto Mine	Stein's Pool strip pool overflow	40°40'20" 76°18'54"	4-23-75	.2	14.0	1320	6.3	130	13	.07	.0070	—	3	8
192	Otto Mine	muddy drift	40°40'07" 76°18'43"	4-23-75	.8	11.0	500	6.7	140	1	.30	.0022	100	4	13
193	Phoenix Pack Mine	3 strip mine overflows	40°40'37" 76°18'06"	4-23-75	.1	14.0	480	6.7	200	<1	.05	.0003	31	3	8
194	Phoenix Pack Mine	shaft diverted to a culvert	40°40'49" 76°17'14"	4-23-75	.01	8.5	390	6.5	180	1	.00	.0000	33	5	10
195	Blue Socks Mine	drift	40°38'59" 76°17'12"	4-24-75	.5	10.5	255	5.9	68	<1	.09	.0014	45	5	20
196	Blue Socks Mine	collapsed drift	40°39'05" 76°16'57"	4-24-75	.3	10.0	730	4.4	290	3	.23	.0024	—	50	56
197	Silverton Mine	collapsed drift	40°39'26" 76°15'53"	4-24-75	.3	10.0	320	6.1	120	20	.10	.016	29	38	55
Subtotal					44.2						48.84	2.129			

Table 29.—Water-quality and discharge data from mine-drainage sites in the Southern Field near Heckscherville

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
198	M & M Mine	intermittent pump	40°42'06" 76°23'55"	4-22-75	0.1	10.0	140	6.5	48	<1	0.01	0.0003	8	1	3

Tremont

Twenty-five mine-discharge sites were sampled near Tremont (table 30). Discharge from the 25 sites totaled 20 ft^3/s and the discharge of sulfate was 8.4 tons/d. The largest discharge (9.8 ft^3/s) was from an overflow at a strip mine pool at the Middle Creek Mine. The Kembel tunnel enters Pine Creek, a tributary to Mahantango Creek. The other 23 sites discharge to Swatara Creek. Four of the discharges are from pumps, but only two were operating at the time samples were collected. Water discharge from the two pumps totaled 0.06 ft^3/s.

Joliett

Fourteen mine-discharge sites were sampled in the vicinity of Joliett (table 31). Water discharge from the 14 sites totaled 11 ft^3/s and the mean concentration of sulfate was 160 mg/L. Sulfate discharge was 4.8 tons/d. The largest discharge (6.4 ft^3/s) was from the Rowe drainage tunnel at the Lincoln Mine. All the discharges sampled in the Joliett area drain to the Swatara Creek.

Suedberg

Four mine-discharge sites were sampled in the Suedberg area (table 32). Total water discharge from the four sites was 0.8 ft^3/s, and the sulfate discharge totaled 0.17 tons/d. All four discharges drain into Swatara Creek.

Tower City

Three mine-discharge sites were sampled in the vicinity of Tower City (table 33). The largest discharge (1.5 ft^3/s) was from the tunnel at the Tower City No. 1 Mine. The three discharges drain into Wiconisco Creek, the total water discharge was 3.1 ft^3/s, and sulfate discharge was 2.3 tons/d.

Valley View

Nine mine-discharge sites were sampled near Valley View (table 34). Three of the discharges were pumped. Water discharge from the pumps totaled 4.6 ft^3/s and the sulfate discharge was 8.1 tons/d. Total water discharge measured from the nine sites in the vicinity of Valley View was 16 ft^3/s, and the measured sulfate discharge was 14 tons/d. The largest discharge (7.2 ft^3/s) was from the Valley View Mine tunnel. All the discharges from the Valley View area enter Rausch Creek, a tributary to Mahantango Creek.

Wiconisco

Six mine-discharge sites were sampled in the vicinity of Wiconisco (table 35). The largest discharge (6.7 ft^3/s) was from the Big Lick Tunnel at the Lykens-Williamstown Mine. The concentration of sulfate in the discharge from the Big Lick Tunnel was 160 mg/L, and the concentration of dissolved iron was 15 mg/L. All six discharges drain into Wiconisco Creek. Water discharge from the six sites totaled 17 ft^3/s, and the discharge of sulfate was 8.0 tons/d.

Table 30.—Water-quality and discharge data from mine-drainage sites in the Southern Field near Tremont

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (μmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
199	Middle Creek Mine	seepage	40°40'32" 76°22'24"	4-24-75	0.6	10.0	300	4.6	95	40	0.15	0.065	3	118	155
200	Middle Creek Mine	collapsed drift	40°39'52" 76°21'22"	4-24-75	.2	9.5	620	3.45	310	1	.17	.0005	—	100	123
201	Blackwood Mine	strip pool overflow	40°38'58" 76°18'40"	4-24-75	.1	13.0	<50	5.2	12	<1	.00	.0003	7	17	75
202	Blackwood Mine	Blackwood water level tunnel	40°38'23" 76°19'36"	4-25-75	2.6	13.0	380	5.8	170	<1	1.2	.0070	17	50	74
203	Panther Creek	discharge from settling ponds	40°38'28" 76°19'44"	4-24-75	.9	11.5	65	6.25	14	<1	.03	.0024	11	22	58
204	Blackwood Mine	strip pool overflow	40°38'12" 76°20'44"	4-24-75	.1	12.0	170	6.1	66	1	.02	.0003	9	13	53
205	Blackwood Mine	strip pool overflow	40°38'02" 76°21'10"	4-24-75	.3	10.5	65	5.0	20	1	.02	.0008	17	13	24
206	Tremont Mine	Everett's tunnel collapsed slope	40°37'56" 76°21'31"	4-24-75	.1	11.0	360	3.6	120	1	.03	.0003	—	73	115
207	Tremont Mine	Kemble tunnel	40°39'51" 76°25'12"	4-23-75	.8	8.0	125	3.65	30	<1	.06	.0022	—	8	10
208	Tremont Mine	strip pool overflow	40°40'12" 76°22'45"	4-23-75	.1	11.0	200	5.6	90	<1	.02	.0001	5	3	8
209	Tremont Mine	intermittent pump	40°40'04" 76°22'42"	4-23-75	.01	12.0	195	6.3	90	<1	.00	.0000	5	1	3
210	Hatter Coal Co.	intermittent pump	40°39'51" 76°23'03"	4-23-75	.00	—	—	—	—	—	—	—	—	—	—
211	Buck Mtn. Mine	drift	40°39'21" 76°22'33"	4-23-75	.05	8.5	85	4.7	27	<1	.00	.0001	1	3	5
212	Middle Creek Mine	Middle Creek water level tunnel	40°39'11" 76°22'35"	4-23-75	.00	—	—	—	—	—	—	—	—	—	—
213	Middle Creek Mine	seepage	40°38'12" 76°22'56"	4-23-75	.2	9.5	200	4.1	63	1	.03	.0005	—	40	50
214	Middle Creek Mine	strip pool overflow	40°38'36" 76°23'02"	4-23-75	.2	10.5	75	6.45	21	<1	.01	.0005	10	3	10
215	Middle Creek Mine	strip pool overflow	40°38'20" 76°22'45"	4-23-75	9.8	9.5	490	4.2	180	<1	4.8	.026	—	63	100
216	Middle Creek Mine	strip pool overflow	40°38'25" 76°22'48"	4-23-75	.5	10.5	525	6.25	210	3	.28	.0041	44	15	40
217	Middle Creek Mine	seepage	40°38'22" 76°22'38'	4-23-75	.8	11.0	700	5.8	700	13	1.5	.028	33	58	90
218	Eureka Mine	drift	40°38'41" 76°24'30"	4-22-75	1.1	12.0	170	4.3	170	3	.54	.0069	—	13	15
Subtotal					18.8						8.1	.146			

Table 30.—Water-quality and discharge data from mine-drainage sites in the Southern Field near Tremont, Pennsylvania—(continued)

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
219	Colket Mine	Colket water level drift	40°38'25" 76°24'23"	4-22-75	0.4	11.5	440	5.4	180	20	0.19	0.022	10	63	72
220	Colket Mine	drift	40°38'07" 76°25'59"	4-22-75	.1	14.0	180	4.1	42	2	.01	.0005	—	15	18
221	Donaldson Mine	pump	40°38'21" 76°24'12"	4-22-75	.00	—	—	—	—	—	—	—	—	—	—
222	Tremont Mine	seepage	40°38'02" 76°24'01"	4-22-75	.5	11.0	190	5.6	72	<1	.10	.0014	7	8	15
223	Echo Valley Mine	Upper Laux slope, seepage	40°37'03" 76°22'30"	4-22-75	.05	6.5	<50	5.1	14	<1	.00	.0001	2	3	4
224	Echo Valley Mine	Lower Laux drift and seepage	40°36'59" 76°22'28"	4-22-75	.05	7.0	105	6.3	28	<1	.00	.0001	23	1	3
225	Echo Valley Mine	3 strip mine pool overflows	40°36'22" 76°24'19"	4-24-75	.2	16.0	150	6.3	56	4	.03	.0022	23	35	65
226	Echo Valley Mine	intermittent pump	40°36'31" 76°23'50"	4-22-75	.05	7.0	480	7.3	210	<1	.03	.0001	82	—	5
Subtotal					1.3						.34	.026			

Table 31.—Water-quality and discharge data from mine-drainage sites in the Southern Field near Joliett

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (μmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
227	Good Spring Mine	strip pool overflow	40°37'38" 76°28'08"	4-22-75	0.01	—	210	5.3	69	<1	0.00	0.0000	7	10	16
228	Good Spring Mine	Tracy airshaft intermittent pump	40°37'08" 76°28'03"	4-22-75	.3	11.0	375	5.85	150	15	.12	.012	21	28	63
229	Good Spring Mine	air shaft	40°37'45" 76°27'19"	4-22-75	.7	11.5	330	6.15	140	10	.26	.019	36	38	65
230	Good Spring Mine	3 strip pool overflows	40°37'50" 76°27'10"	4-22-75	.05	15.5	185	6.85	53	<1	.01	.0001	33	1	10
231	Donaldson Mine	strip pool overflow	40°37'49" 76°27'01"	4-22-75	.00	—	—	—	—	—	—	—	—	—	—
232	Donaldson Mine	2 strip pool overflows	40°37'43" 76°26'59"	4-22-75	.01	15.0	495	3.65	200	<1	.01	.0000	—	30	33
233	Donaldson Mine	strip pool overflow	40°37'33" 76°26'46"	4-22-75	.5	15.5	850	3.4	350	3	.47	.0041	—	58	65
234	Donaldson Mine	strip pool overflow	40°39'50" 76°26'47"	4-22-75	.00	—	—	—	—	—	—	—	—	—	—
235	Donaldson Mine	strip pool overflow	40°37'45" 76°26'21"	4-22-75	.00	—	—	—	—	—	—	—	—	—	—
236	Colket Mine	strip pool overflow	40°38'12" 76°26'08"	4-22-75	.00	—	—	—	—	—	—	—	—	—	—
237	New Lincoln Mine	New Lincoln drainage tunnel	40°37'07" 76°26'19"	4-21-75	.9	9.0	115	6.0	24	<1	.06	.0024	12	4	10
238	Rausch Creek East Franklin Mine	Lower Paoli Tunnel	40°36'40" 76°25'30"	4-21-75	1.4	11.0	625	3.45	310	35	1.2	.13	—	112	120
239	Jewel Ridge Coal Company	Holmes drift	40°36'37" 76°25'31"	4-21-75	.3	12.0	480	7.0	130	<1	.11	.0008	157	—	24
240	Ravine Mine	culvert	40°36'19" 76°25'13"	4-21-75	.3	12.0	440	6.4	160	15	.13	.012	72	45	65
241	Ravine Mine	Knorr Tunnel diverted to culvert	40°35'16" 76°25'27"	4-21-75	.3	11.0	490	5.9	230	10	.19	.0081	12	28	43
242	Ravine Mine	drift	40°36'16" 76°25'19"	4-21-75	.05	11.0	730	3.15	250	35	.03	.0047	—	113	120
243	Ravine Mine	drift	40°36'16" 76°25'14"	4-21-75	.1	13.0	135	6.0	36	3	.01	.0008	13	11	20
244	Lincoln Mine	Rowe drainage tunnel	40°35'42" 76°26'32"	4-21-75	6.4	11.0	340	4.5	130	10	2.2	.17	—	52	62
Subtotal					11.3						4.77	.365			

Table 32.—Water-quality and discharge data from mine-drainage sites in the Southern Field near Suedburg

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (μmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
245	Franklin Stump Mine	seepage out of collapsed drift	40°34'16" 76°23'49"	4-21-75	0.1	8.0	65	6.1	11	<1	0.00	0.0003	7	3	5
246	Dubbs and Heinback Mine	drift	40°34'09" 76°28'46"	4-21-75	.3	11.0	315	3.4	110	1	.09	.0008	—	48	55
247	Lorberry Mine	seepage	40°34'03" 76°28'45"	4-21-75	.2	11.0	580	2.9	120	3	.06	.0016	—	100	110
248	Gold Mine	seepage	40°32'01" 76°33'43"	4-24-75	.2	10.5	115	5.35	34	5	.02	.0027	11	63	74
Subtotal					.8						.17	.0054			

40

Table 33.—Water-quality and discharge data from mine-drainage sites in the Southern Field near Tower City

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (μmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
249	Tower City Mine	Keffers water level tunnel	40°36'31" 76°29'11"	4-21-75	0.7	12.0	300	3.45	100	7	0.19	0.013	—	53	60
250	Porter Mine	Porter water level tunnel	40°36'14" 76°30'23"	4-24-75	.00	—	—	—	—	—	—	—	—	—	—
251	Porter Mine	discharge from tunnel	40°36'19" 76°31'05"	4-24-75	.9	10.5	1120	2.95	550	50	1.3	.12	—	224	240
252	Tower City #1 Mine	tunnel	40°36'43" 76°31'04"	4-25-75	1.5	13.0	650	2.9	210	8	.85	.032	—	220	413
Subtotal					3.1						2.3	.16			

Table 34.—Water-quality and discharge data from mine-drainage sites in the Southern Field near Valley View

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (µmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
253	Erdman Coal Company	intermittent pump	40°37'13" 76°31'26"	4-25-75	2.1	13.0	1500	3.9	880	<50	5.0	0.28	—	237	424
254	Good Spring #1 Mine	collapsed drift	40°37'16" 76°31'20"	4-23-75	.05	9.5	225	6.6	35	1	.00	.0001	66	5	18
255	Good Spring #1 Mine	buried borehole	40°37'16" 76°31'33"	4-23-75	1.0	11.0	540	5.8	230	22.5	.62	.061	33	88	115
256	Good Spring #1 Mine	buried airshaft	40°37'16" 76°31'33"	4-23-75	.5	11.0	570	6.35	270	22.5	.36	.030	12	63	78
257	Valley View Mine	intermittent pump	40°36'47" 76°37'12"	4-24-75	2.4	13.0	925	3.5	470	40	3.0	.26	—	107	115
258	Valley View Mine	Valley View tunnel	40°36'50" 76°33'07"	4-24-75	7.2	12.0	320	6.1	110	22.5	2.1	.44	49	65	81
259	Markson Mine	Markson Columnway	40°37'09" 76°33'02"	4-23-75	2.4	11.0	950	3.6	410	32	2.6	.21	—	182	210
260	Markson Mine	intermittent pump	40°37'10" 76°32'28"	4-25-75	.00	—	—	—	—	—	—	—	—	—	—
261	Markson Mine	seepage	40°37'16" 76°32'28"	4-25-75	.00	—	—	—	—	—	—	—	—	—	—
262	H & R Coal Co.	intermittent pump	40°37'22" 76°32'28"	4-25-75	.1	12.0	725	3.2	250	5	.07	.0014	—	202	374
263	Valley View Mine	strip pool overflow	40°36'39" 76°34'53"	4-24-75	.00	—	—	—	—	—	—	—	—	—	—
264	B & H Mine	active drift	40°36'48" 76°35'26"	4-24-75	.6	11.0	400	3.4	140	5	.23	.0081	—	55	63
265	D & R Mine	slope	40°36'42" 76°35'50"	4-24-75	.00	—	—	—	—	—	—	—	—	—	—
Subtotal					16						14	1.3			

Table 35.—Water-quality and discharge data from mine-drainage sites in the Southern Field near Wiconisco

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (μmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
266	Lykens-Williamstown Mine	Big Lick tunnel	40°34'59" 76°39'03"	4-17-75	6.7	11.8	565	6.2	160	15	2.9	0.27	115	45	70
267	Lykens-Williamstown Mine	Lykens water level drift	40°35'07" 76°41'58"	4-17-75	2.1	10.5	280	5.2	110	15	.62	.085	10	74	90
268	Lykens-Williamstown Mine	seepage	40°42'00" 76°35'04"	4-17-75	.05	13.0	145	6.1	111	20	.02	.0027	26	69	80
269	Lykens-Williamstown Mine	airshaft and pump station	40°34'51" 76°41'59"	4-17-75	6.0	13.6	640	6.2	200	30	3.2	.49	136	80	100
270	Lykens-Williamstown Mine	seepage	40°34'48" 76°42'00"	4-17-75	2.2	13.8	570	6.4	210	20	1.2	.12	134	70	105
271	Lykens-Williamstown Mine	water level drift collapsed	40°34'48" 76°41'57"	4-17-75	.1	14.5	650	6.6	220	20	.06	.0054	131	24	55
Subtotal					17						8.0	.97			

Stony Creek near Dauphin

Most coal mining in the Stony Creek basin occurred between 1840 and 1860 (Taylor 1981). Areas in the headwaters of Rausch Creek, Yellow Springs, and Rattling Run were affected but the extent of the affected area is not known. Five sites that are affected by mine drainage were sampled in April 1981. Two of the sites are on Rausch Creek, one is on Yellow Springs, and two are on Rattling Run (table 36). Samples were also collected from Rausch Creek and Rattling Run (table 36).

Summary and Discussion

The Southern Coal Field has a total drainage area of about 270 mi^2 of which about 141 mi^2 are coal measures, and about 129 mi^2 are upslope from the coal fields. The Southern Field can be subdivided into seven drainage areas. Water and sulfate yields are listed in table 37 for each of the seven drainage areas. Some of the variations in table 37 could be caused by pumps which operated on an intermittent basis to control mine water elevations. Steady-state conditions may not exist at these sites. Samples were collected from 152 sites in the Southern Field, water discharge totaled 210 ft^3/s, sulfate discharge was 200 tons/d, and iron discharge was 7.2 tons/d. Table 38 lists water, sulfate, acid, and iron yields from the four coal fields.

Felegy and others (1948) and Ash and others (1951) collected flow and water-quality data during 1941 and 1946 from all known discharges in the Southern Field. During the period when samples were collected in 1941, water discharge was 141 ft^3/s (86 percent was pumped), and acid discharge was 150 tons/d (94 percent was pumped). Data collected during 1946 indicated water and acid discharges of 42 ft^3/s and 46 tons/d, respectively, significantly less than the 1941 data. During the period of sample collection in 1975, water discharge was 206 ft^3/s (30 percent greater than 1941), and acid discharge was 55 tons/d (60 percent less than 1941).

EFFECTS OF MINE DRAINAGE ON STREAMS

Most of the mine discharge from the four coal fields enters the Susquehanna River. The Northern and Western Middle Fields are entirely within the Susquehanna River basin, as is most of the Eastern Middle Field. A small part of the Eastern Middle Field and most of the Southern Field are in the Delaware River basin. When samples of the mine discharges were collected, samples also were collected from a few of the receiving streams, downstream from the mine drainage. At some locations samples were collected from the receiving stream above and below the mine drainage inflows.

The Susquehanna River and its Tributaries

Samples were collected from the Susquehanna River above and below the Northern Field when the mine discharges were sampled. Water discharge in the Susquehanna River above the coal field was 14,500 ft^3/s, the pH was 7.7, the alkalinity as $CaCO_3$ was 59 mg/L, the concentration of sulfate was 18 mg/L, and the sulfate discharge was 700 tons/d.

Table 36.—Water-quality and discharge data from mine-drainage sites in the Southern Field near Dauphin

Site number	Name	Location: Description	Location: Lat-Long.	Sampling date	Discharge (ft^3/s)	Water temperature (°C)	Specific conductance (μmhos)	pH	Concentration, in mg/L: sulfate	Concentration, in mg/L: iron	Loads, in tons per day: sulfate	Loads, in tons per day: iron	Alkalinity to pH 4.5 as $CaCO_3$ (mg/L)	Acidity to indicated pH as $CaCO_3$ (mg/L): 7.0	Acidity to indicated pH as $CaCO_3$ (mg/L): 8.3
272	Rausch Creek	Above East Branch	40°30'16" 76°36'13"	4-21-81	3.3	7.0	51	4.4	12	0.02	0.11	0.0002	—	—	19
273	East Branch Rausch Creek	At Horseshoe Trail	40°30'18" 76°36'05"	4-21-81	1.6	7.5	38	4.8	8.7	.01	.04	.0000	—	—	16
274	Rausch Creek	At Horseshoe Trail (includes 291, 292)	40°29'54" 76°35'52"	4-21-81	5.4	8.0	48	4.6	13	.04	.19	.0006	—	—	17
275	Yellow Springs	At Stony Creek Road	40°27'41" 76°39'57"	4-10-81	.80	9.0	40	4.5	9.2	.06	.02	.0001	—	—	12
276	Rattling Run	At Stage Coach Road	40°26'51" 76°43'29"	4-9-81	.22	9.0	35	4.4	6.7	.05	.00	.0000	—	—	9
277	Devils Race Course	At Stage Coach Road	40°26'53" 76°43'20"	4-9-81	.3	9.5	39	4.3	6.7	.01	.01	.0000	—	—	20
278	Rattling Run	At Stony Creek Road (includes 295, 296)	40°26'09" 76°43'01"	4-9-81	2.7	9.5	38	4.2	8.4	.04	.06	.0003	—	—	10
Subtotal					6.2						.18	.0003			

Table 37.--Summary of water and sulfate discharge from mine-drainage sites in the Southern Field.

Basin of receiving stream	Drainage area underlain by coal measures (mi^2)	Number of mine drainage sites	Yields of water $(ft^3/s)/mi^2$	Yields of sulfate $(tons/d)/mi^2$
Lehigh	2.3	1	4.8	7.2
Little Schuylkill	13	12	1.3	2.9
Main Stem Schuylkill River	36	57	1.8	1.6
West Branch Schuylkill River	34	15	1.3	1.4
Swatara Creek	33	43	1.0	.4
Mahantango Creek	10	10	1.6	1.4
Wisconisco	11	9	1.8	1.0
Stony Creek above Dauphin	2(Est)	5	3.1	.09
Total	141	152	1.5	1.4

Table 38.—Summary of coal production, water, sulfate, acid, and iron yields from the four anthracite fields in eastern Pennsylvania.

Field	Coal production to 1944 in 10^6 tons	Area of coal measures (mi^2)	Coal production in 10^6 tons/mi^2	Yields of: Water $(ft^3/s)/mi^2$	Sulfate $(tons/d)/mi^2$	Acid $(tons/d)/mi^2$	Iron $(tons/d)/mi^2$
Northern	3.5	160	21.9	2.1	4.6	1.5	0.32
Eastern Middle	.50	32	15.6	5.5	3.6	1.6	.066
Western Middle	1.6	75	21.3	2.6	5.4	1.2	.25
Southern	1.3	141	.93	1.5	1.4	.38	.051

Water discharge in the Susquehanna River below the Northern Coal Field was 15,000 ft^3/s, the pH was 7.4, the alkalinity as $CaCO_3$ was 50 mg/L, the concentration of sulfate was 40 mg/L, and the sulfate discharge was 1,620 tons/d. The sulfate discharge in the Susquehanna River below the Northern Field was close to the expected discharge of 1,440 tons/d--the sum of the discharge above the coal field (700 tons/d), and the discharge from the 25 mine drainage sites (740 tons/d). The difference between the measured and expected discharges, 180 tons/d, could be from measuring and sampling errors or from unsampled mine discharges. It is possible that such discharge could go unnoticed if it occurred in the bottom of the Lackawanna or Susquehanna Rivers; however, in the winter it would produce an ice-free condition.

The concentration of dissolved iron was the same in both samples, 0.6 mg/L. The concentration of total iron in the Susquehanna River above the Northern Field was not determined, but samples collected from the Susquehanna River below the Northern Field during April 1975 had a total iron concentration of 2.2 mg/L. The suspended iron concentration was, therefore, 1.6 mg/L, and the suspended iron discharge, 65 tons/d. The measured iron discharge from mines in the Northern Field was 51 tons/d.

Nescopeck Creek

Nescopeck Creek is a tributary to the Susquehanna River and receives mine drainage from eight sites in the Eastern Middle Field. The Jeddo Tunnel discharges to the Little Nescopeck Creek and seven sites discharge to Black Creek; both tributaries to Nescopeck Creek. Little Nescopeck Creek was measured and sampled at Sybertsville, about 5 miles below the Jeddo Tunnel. Water discharge was 81 ft^3/s, the pH was 3.4, the concentrations of dissolved iron and sulfate were 5 and 400 mg/L, respectively; and the acidity was 152 mg/L. The sulfate discharge was 87 tons/d, 12 tons/d more than measured from the Jeddo Tunnel.

Black Creek receives mine drainage from seven sites, the largest of which are the Gowen and Derringer Tunnels. Water discharge from the two tunnels totaled 15 ft^3/s, and the sulfate discharge was 8.7 tons/d. Water discharge from the other five sites totaled 9.8 ft^3/s, the sulfate discharge was 0.73 ton/d. Black Creek was measured and sampled near Rock Glen; the water discharge was 50 ft^3/s and the pH was 6.6. Nescopeck Creek was not sampled but the sulfate load discharged to it by Little Nescopeck and Black Creek totaled 96 tons/d.

Catawissa Creek

Catawissa Creek receives mine drainage from Tomhicken Creek and from four mine drainage sites near Sheppton (fig. 3). Oneida Tunnels No. 1 and No. 3 discharge to Tomhicken Creek. Water discharge from the tunnels totaled 16 ft^3/s and the sulfate discharge was 2.5 tons/d. Tomhicken Creek was measured and sampled near Millers Corner. Water discharge was 26 ft^3/s, the pH was 4.3, and the concentrations of dissolved iron and sulfate were 0.25 and 40 mg/L, respectively. Sulfate discharge was 2.8 tons/d.

The largest mine discharge that enters Catawissa Creek directly is from the Audenreid Tunnel. When samples were collected, water discharge from the tunnel was 19 ft^3/s and the sulfate discharge was 14 tons/d. Water discharge from all four sites was 22 ft^3/s, and sulfate discharge was 15 tons/d. Catawissa Creek was measured and sampled 2 mi above the Tomhicken Creek inflow. Water discharge was 41 ft^3/s, the pH was 3.7, and the concentrations of dissolved iron and sulfate were 1 and 120 mg/L, respectively. Sulfate discharge was 13 tons/d.

Shamokin Creek

All 18 sites sampled in the Shamokin area, (table 16), the 4 sites near Mount Carmel (table 15), and 1 small discharge from the Locust Gap Mine (table 14), drain into Shamokin Creek. The water discharge from the 23 mine-drainage sites that drain into Shamokin Creek was 67 ft^3/s, the sulfate discharge was 96 tons/d, and the discharge of dissolved iron was 9.0 tons/d. Shamokin Creek was measured and sampled near Shamokin (fig. 5). Water discharge was 117 ft^3/s, the pH was 4.2, sulfate discharge was 130 tons/d, and the discharge of dissolved iron was 3.6 tons/d, suspended iron was not determined. Some of the difference in water discharge could be from unsampled mine discharges or from surface streams in the area west of Shamokin that are not affected by mine drainage. The difference in sulfate discharge could be unsampled mine discharges.

Mahanoy Creek

Sixteen mine discharges (tables 11-14) that drain the 37 mi^2 coal fields above Ashland enter Mahanoy Creek. Water discharge from the sixteen sites totaled 116 ft^3/s, sulfate discharge totaled 290 tons/d, and the iron discharge totaled 10 tons/d. Mahanoy Creek was measured and sampled at Ashland, the water discharge was 140 ft^3/s, sulfate concentration was 880 mg/L, sulfate discharge was 330 tons/d, the concentration of dissolved iron was 18 mg/L, and the discharge of dissolved iron was 6.8 tons/d.

Mahanoy Creek and several of its tributaries originate upslope from the mined area. Some tributaries flow across the mined area in defined channels, and some infiltrate into the mine workings. The tributaries that flow across the mined area in defined channels account for the additional water discharge of Mahanoy Creek at Ashland. The sampled mine discharges account for nearly all of sulfate discharge measured at Ashland.

Drainage from a 9 mi^2 area mined near Locust Gap enters Mahanoy Creek just below Ashland, and drainage from a 3 mi^2 area near Trevorton enters Mahanoy Creek near the Susquehanna River. Water discharge from the Locust Gap area was 21 ft^3/s, the sulfate discharge was 41 tons/d, and the iron discharge was 1.0 ton/d. Water discharge from the mines in the Trevorton area enters Zerbe Run at Trevorton. Zerbe Run was measured and sampled below Trevorton; the water discharge was 17 ft^3/s, the sulfate and dissolved iron concentrations were 330 and 25 mg/L, respectively, and the pH was 3.6. The loads of sulfate and dissolved iron were 15 and 0.38 ton/d, close to the loads measured from the mine discharges at Trevorton (table 17).

Mahanoy Creek was not measured or sampled near the Susquehanna River, but the water discharge from the 49 mi^2 mined area in the Western Middle field totaled 131 ft^3/s, the sulfate discharge totaled 310 tons/d and the discharge of dissolved iron totaled 9.9 tons/d.

Mahantango Creek

Mahantango Creek, a tributary to the Susquehanna River, receives mine drainage from three areas, one near Heckscherville, a second north of Tremont, and a third near Valley View. Rausch Creek, a tributary that drains the Valley View area, was sampled above and below a treatment plant. Above the plant, the pH was 4.1 and the concentration of dissolved iron was 16 mg/L. Below the plant, the pH was 6.7 and the concentration of dissolved iron was 0.05 mg/L. Above the plant the water discharge was 18 ft^3/s and the concentration of dissolved sulfate was 270 mg/L; the sulfate discharge of 13 tons/d almost equals the sulfate discharge measured for the mine-discharges that enter Rausch Creek (table 34).

Mine-water discharge from the three areas was 19 ft^3/s, and the sulfate discharge was 16 tons/d. As most of the mine discharge is from the Valley View area and is treated, the impact of mine drainage on Mahantango Creek is probably small.

Wiconisco Creek

Measured water discharge from the nine mine drainages that flow into Wiconisco Creek near Tower City and Wiconisco totaled 20 ft^3/s and the sulfate discharge was 10 tons/d. About 11 mi^2 have been affected by mining in the Wiconisco Creek basin. Wiconisco Creek was sampled at Lykens, and the water discharge was 71 ft^3/s, the pH was 6.2, and the concentrations of dissolved iron and sulfate were 2 and 94 mg/L, respectively. The sulfate discharge was 18 tons/d.

Stony Creek near Dauphin

Samples were collected from three tributaries to Stony Creek, Rausch Creek (a different Rausch Creek from the one in the Mahantango Creek basin), Yellow Springs, and Rattling Run. Rausch Creek was measured and sampled at the Appalachian Trail. The water discharge was 5.4 ft^3/s, the pH was 4.6, and the concentrations of sulfate and iron were 13 and 0.04 mg/L, respectively. Yellow Springs was measured and sampled at Stony Creek Road. The water discharge was 0.80 ft^3/s, the pH was 4.5, and the concentrations of sulfate and iron were 9.2 and 0.06 mg/L, respectively. Rattling Run also was measured and sampled at Stony Creek Road. The water discharge was 2.7 ft^3/s, the pH was 4.2, and the concentrations of sulfate and iron were 8.4 and 0.04 mg/L, respectively.

Swatara Creek

Forty-three mine discharges that drain to Swatara Creek were sampled. Water discharge totaled 32 ft^3/s and the discharge of sulfate was 14 tons/d. Swatara Creek was measured and sampled at Ravine. Water discharge was 54 ft^3/s, the pH was 5.1, and the concentrations of dissolved iron and sulfate were 1.2 and 110 mg/L, respectively. Sulfate discharge was 16 tons/d.

The Delaware River and its Tributaries

Mine drainage from 10 sites in the Eastern Middle Field discharges to tributaries of the Lehigh River. One site in the Southern Field discharges directly to the Lehigh River, and 84 sites from Coaldale to Minersville discharge to tributaries of the Schuylkill River.

Lehigh River

Pond Creek (fig. 3) receives discharge from three mine-drainage sites at the Pond Creek Mine in the Eastern Middle Field. Water discharge from the three sites totaled 14 ft^3/s, the largest discharge, 13 ft^3/s, was from a strip pool overflow. Sulfate discharge from the three sites totaled 1.6 tons/d. Pond Creek was measured and sampled near Scale Siding. The water and sulfate discharges were 16 ft^3/s and 1.7 tons/d, the pH was 4.8, and the concentration of dissolved iron was 1 mg/L.

Sandy Run receives mine drainage from two sites, the Owl Hole tunnel and the Sandy Run tunnel. Water and sulfate discharge from the two sites totaled 6.8 ft^3/s and 5.5 tons/d. Sandy Run was measured and sampled near Scale Siding; the water discharge was 17 ft^3/s, the pH was 5.1, and the concentrations of dissolved iron and sulfate were 1 and 140 mg/L, respectively. Sulfate discharge was 6.4 tons/d.

Buck Mountain Creek receives mine drainage from two sites; both discharge from the Buck Mountain tunnel. Water discharge from the two sites was 1.8 ft^3/s, and the sulfate discharge was 1.2 tons/d. Buck Mountain Creek was measured and sampled near Weatherly, about 2 mi downstream from the tunnels. Water discharge was 8.0 ft^3/s, the pH was 6.0, and the concentrations of dissolved iron and sulfate were less than 1 and 65 mg/L, respectively. Sulfate discharge was 1.4 tons/d.

Wetzel Creek, a tributary to Black Creek, receives mine drainage from one site, the Beaver Meadows tunnel. Water and sulfate discharge from the tunnel totaled 20 ft^3/s and 5.4 tons/d. Wetzel Creek was measured and sampled at Hudsondale. Water discharge was 19 ft^3/s, the pH was 3.4, and the concentrations of dissolved iron and sulfate were 1 and 170 mg/L, respectively. Sulfate discharge was 5.0 tons/d. Two sites, a shaft at the Stockton Mine and a strip mine pool at the Hazle Brook Mine discharge to Hazle Creek, also a tributary to Black Creek. Water discharge from these two sites totaled 3.8 ft^3/s and the sulfate discharge was 0.78 ton/d.

The Nesquehoning tunnel, in the Southern Field, discharges directly to the Lehigh River near Jim Thorpe. Its water discharge was 11 ft^3/s, and the concentrations of dissolved iron and sulfate were 7 and 560 mg/L, respectively. Sulfate discharge was 17 tons/d. Total water and sulfate discharge from mines in the Lehigh River basin was 57 ft^3/s and 31 tons/d.

Schuylkill River

The Schuylkill River receives discharge from 83 mi^2 of coal measures in the Southern field. The drainage area of the Little Schuylkill River at Tamaqua is about 50 mi^2, and the area containing coal measures is 13 mi^2. Water discharge from the 12 sampled mine-drainage sites near Coaldale, Ginther, and Tamaqua totaled 18 ft^3/s, and the sulfate load was 38 tons/d. The Little Schuylkill River was measured and sampled below Tamaqua. The water discharge was 79 ft^3/s, the pH was 5.4, the concentration of sulfate was 240 mg/L, and the sulfate discharge was 51 tons/d. Most of the difference in water discharge (61 ft^3/s), and some of the difference in sulfate discharge (13 tons/d), is due to discharges from the 37 mi^2 area outside the coal field, but some is probably due to unsampled discharges in the coal field.

The drainage area of the main stem of the Schuylkill River above Pottsville is 53 mi^2 about 36 mi^2 of which contain coal reserves. Mine drainage was measured and sampled at 55 sites. Water discharge totaled 65 ft^3/s, and the sulfate discharge was 58 tons/d. About half the sulfate discharge came from the pump discharge at the Pine Forest Mine near St Clair.

The West Branch of the Schuylkill River drains an area of about 34 mi^2 that is underlain by coal measures. Mine water discharge was measured and sampled at 15 sites that drain to the West Branch Schuylkill River. Water discharge from the 15 sites totaled 44 ft^3/s; the discharge of sulfate was 49 tons/d. The Schuylkill River at Schuylkill Haven was measured and sampled when samples were collected from the mine discharges. The water discharge was 167 ft^3/s, the concentration of sulfate was 250 mg/L, and the discharge of sulfate was 110 tons/d. Water discharge from the 72 mine discharges above Schuylkill Haven was 109 ft^3/s, and the measured sulfate discharge was 110 tons/d. The sulfate discharge measured from the mines almost equals the discharge measured at Schuylkill Haven.

SUMMARY

Anthracite has been mined in east-central Pennsylvania for more than 150 years. Most mining was done by deep mining methods, creating vast underground voids. Through 1944, 3.5, 0.5, 1.6, and 1.3 billion tons of coal were produced in the Northern, Eastern Middle, Western Middle, and Southern Anthracite Fields, respectively. To prevent flooding, water that entered the mines was pumped to the surface. Between 1930 and 1960, nearly all deep mines were abandoned, pumping was discontinued, the mines filled with water, and surface overflows developed. Most of the mine discharge from the four coal fields enters the Susquehanna River. The Nothern and Western Middle Fields are entirely within the Susquehanna River basin, as is most of the Eastern Middle Field. A small part of the Eastern Middle Field, and most of the Southern Field is in the Delaware River basin.

Cumulative water discharge from 25 mine-drainage sites in the Northern Anthracite Field was 333 ft^3/s, the sulfate discharge was 740 tons/d, and the iron discharge was 51 tons/d. All mine discharges sampled in the Northern Field were gravity overflows; no pump discharges were known to exist at the time of sampling. As 160 mi^2 are underlain by the coal field, the water and sulfate yields were 2.1 $(ft^3/s)/mi^2$ and 4.6 $(tons/d)/mi^2$, respectively.

Measured water discharge from mines in the Northern Field in 1941 was 306 ft^3/s (90 percent was pumped from deep mines) and the measured acid discharge was 390 tons/d (92 percent was pumped from deep mines). Total water and acid discharges during sampling in 1975 were 333 ft^3/s and 240 tons/d (no discharges were pumped from deep mines). During the sampling period in 1975, water discharge was about 10 percent more, and the acid discharge was about 35 percent less than during the sampling period in 1941.

A total of 29 mine sites were sampled in the Eastern Middle Field. Ten of the discharges drain into the Lehigh and Delaware River basin, and 18 into the Susquehanna River basin. Water discharge totaled 176 ft^3/s, the sulfate discharge was 120 tons/d, and the iron discharge was 2.1 tons/d. Mine water discharge to the Lehigh River basin totaled 46 ft^3/s and the sulfate discharge totaled 14 tons/d; the rest drained to the Susquehanna River basin. Water yield from the entire 32 mi^2 coal field was 5.5 $(ft^3/s)/mi^2$, significantly more than the 2.1 $(ft^3/s)/mi^2$ measured for the Northern Field. Sulfate yield was 3.6 $(tons/d)/mi^2$, slightly less than the 4.6 $(tons/d)/mi^2$ measured in the Nothern Field. Apparently, the high water yield is due to water that enters the mines from areas outside the coal measures. The extra water does not seem to contribute to the sulfate yield.

Total measured water discharge from mines in the Eastern Middle Field in 1941 was 102 ft^3/s (20 percent was pumped from deep mines), and the measured acid discharge (as $CaCO_3$ to pH 8.3) was 190 tons/d (20 percent was pumped from deep mines). During the sampling period in 1975, water discharge was 176 ft^3/s (none was pumped), and acid discharge was 52 tons/d. Water discharge during 1975 was about 70 percent greater than 1941, but the discharge of acid was about 70 percent less.

The Western Middle Field is entirely within the Susquehanna River Basin. About 75 mi^2 are underlain with coal; the total drainage area is about 100 mi^2. Forty-five mine discharges were measured and sampled. Water discharge from the mine-drainage sites totaled 198 ft^3/s, the sulfate load was 410 tons/d, and the iron discharge was 19 tons/d. Water yield from the 75 mi^2 underlain by coal was 2.6 $(ft^3/s)/mi^2$ and the sulfate yield was 5.4 $(ton/d)/mi^2$. The sulfate yield was about 50 percent greater than the yields measured from the Northern and Eastern Middle Fields.

Measured water discharge from mines in the Western Middle Field during the sampling in 1941 was 120 ft^3/s (78 percent was pumped from deep mines) and measured acid discharge, as $CaCO_3$ to pH 8.3, was 229 tons/d (62 percent was pumped from deep mines). Samples were also collected in 1946 and measured water and acid discharges were considerably less. Water discharge was 61 ft^3/s (80 percent was pumped from deep mines) and acid discharge was 98 tons/d (62 percent was pumped from deep mines). Apparently, some deep mines had stopped operating and the mines were filling with water during 1946. During the sampling in 1975, water discharge was 198 ft^3/s (78 percent more than 1941) and acid discharge was 93 tons/d (55 percent less than 1941). About 95 percent of the discharge in 1975 was from gravity overflows or drainage tunnels.

The Southern Coal Field contains about 141 mi^2 of coal measures and extends from Jim Thorpe to Lykens, a distance of 56 miles. The larger part of the coal fields, about 77 mi^2, drain toward the Delaware River. Drainage from the remaining 64 mi^2 flows toward the Susquehanna River. About 129 mi^2 are upslope from the coal fields, and the total drainage area is about 270 mi^2. Samples were collected from 151 sites in the Southern Field, water discharge totaled 210 ft^3/s, sulfate discharge was 200 tons/d, and iron discharge was 7.2 tons/d.

Samples of the discharge from mines in the Southern Field were collected in 1941, water discharge was 141 ft^3/s (86 percent was pumped), and acid discharge was 150 tons/d (94 percent was pumped). Samples were also collected during 1946, water and acid discharges were 42 ft^3/s and 46 tons/d, respectively, significantly less than the 1941 data. During the sample collection in 1975, water discharge was 206 ft^3/s (30 percent greater than 1941) and acid discharge was 55 tons/d (60 percent less than 1941).

Mine drainage was measured and sampled at 251 sites in the Northern, Eastern Middle, Western Middle, and Southern Coal Fields. Total water discharge was 918 ft^3/s, the total sulfate load was 1,470 tons/d, and the total iron discharge was 79 tons/d.

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