DISTRIBUTION OF VALUES OF ACID MINE-DRAINAGE INDICATORS

There are 13 sites in the West Branch Susquehanna River basin where the four AMD standards in table 2 were equaled or exceeded and 15 sites where three were equaled or exceeded. Only 23 of the 105 sites (22 percent) did not exceed any of the water-quality standards.

The distribution of values of the four AMD water-quality indicators is shown separately on figures 6–9.

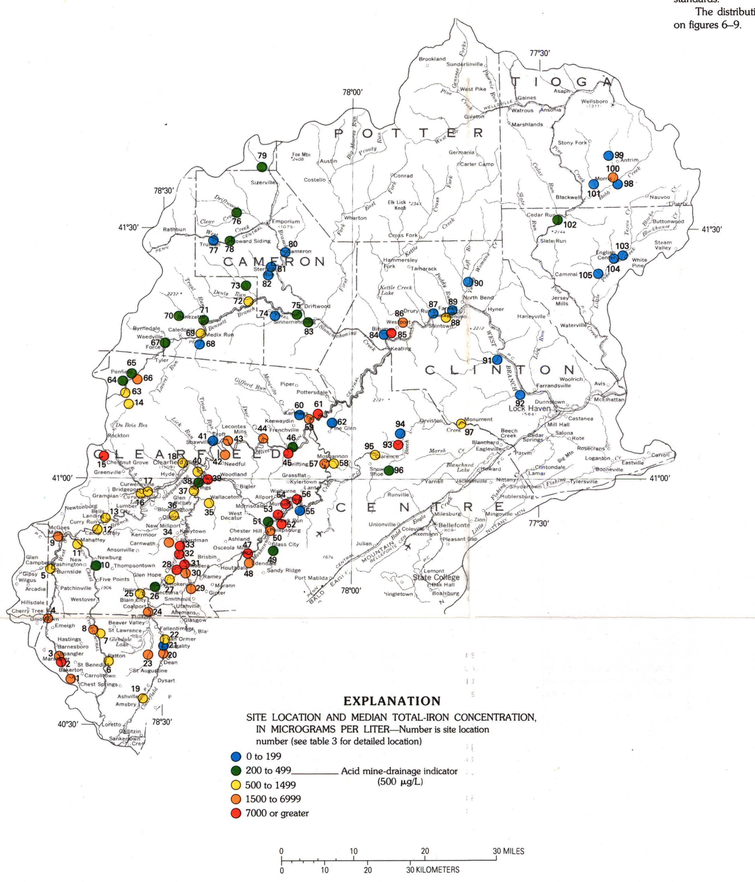

FIGURE 6.—Median total-iron concentrations for selected stream-sampling sites in the West Branch Susquehanna River basin.

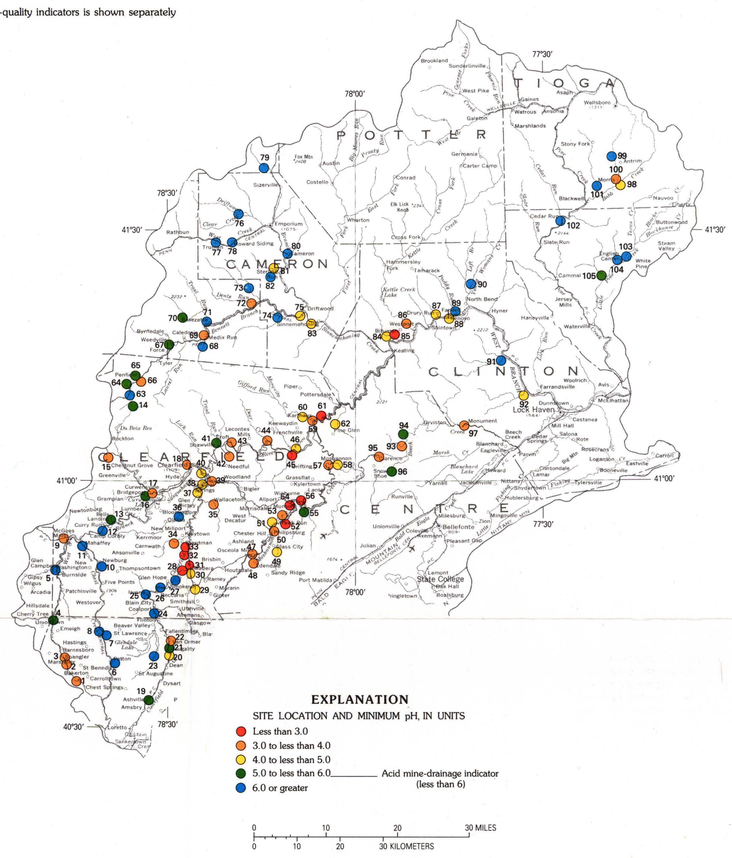

FIGURE 7.—Minimum pH values for selected stream-sampling sites in the West Branch Susquehanna River basin.

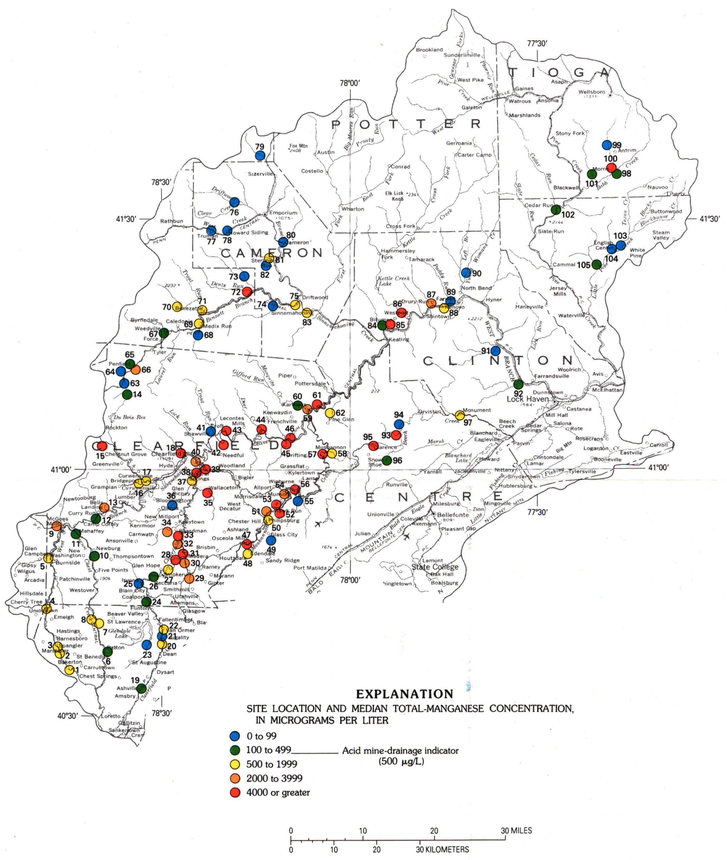

FIGURE 8.—Median total-manganese concentrations for selected stream-sampling sites in the West Branch Susquehanna River basin.

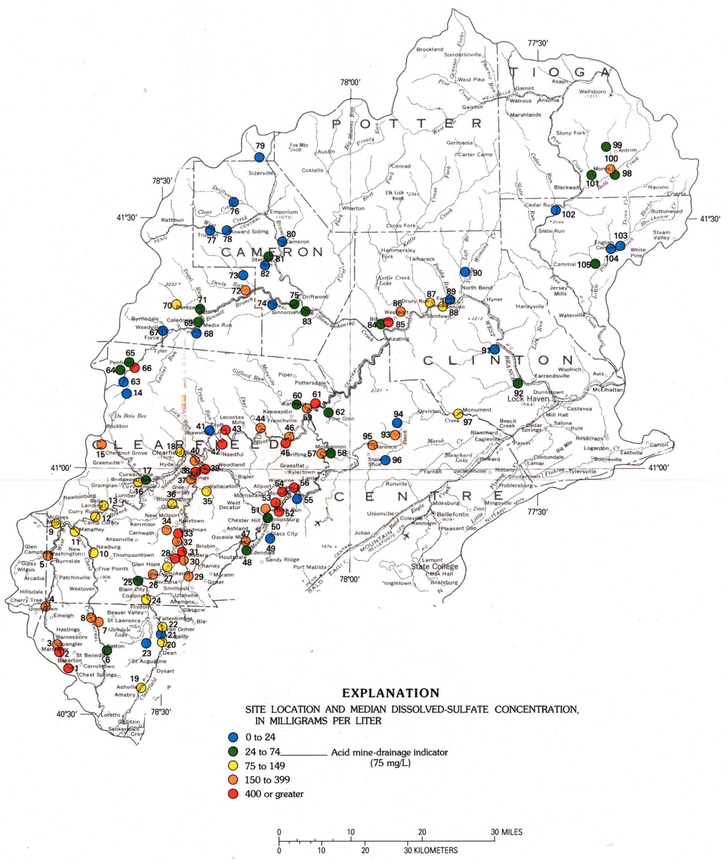

FIGURE 9.—Median dissolved-sulfate concentrations for selected stream-sampling sites in the West Branch Susquehanna River basin.

WEST BRANCH SUSQUEHANNA RIVER IN COAL AREA 1

The major drainage basin most affected by mine drainage in the Eastern Coal Province is the West Branch Susquehanna River above Lock Haven, Pennsylvania (part of Coal Area 1). The drainage area of the West Branch Susquehanna River at Lock Haven is 3,345 mi². Five of the 105 sampling sites within this area are on the main stem (table 3). The Clearfield and Moshannon Creek basins contain most of the water quality problem areas as shown in figure 4. In these basins many large surface mines contribute to the mine-drainage problem.

TABLE 3.—Water-quality sampling sites in the West Branch Susquehanna River basin, Coal Area 1

Site number	USGS station number	Station name	Latitude	Longitude
1	01540590	Lesle Run near Carrolltown, Pa	403622	0784510
2	01540592	West Branch Susquehanna River near Spangler, Pa	403742	0784556
3	01540595	Fox Run at Spangler, Pa	403819	0784604
4	01540640	West Branch Susquehanna River at Cherry Tree, Pa	404226	0784810
5	01540710	Cush Creek near Glen Campbell, Pa	404951	0784727
6	01540715	Chest Creek at Patton, Pa	403802	0783850
7	01540720	Brubaker Run near Hastings, Pa	404215	0784135
8	01540723	Little Brubaker Run near Hastings, Pa	404221	0784142
9	01540753	South Branch Bear Run at McGees Mills, Pa	405301	0784556
10	01540800	Wilson Run at Newburg, Pa	405005	0784040
11	01540823	Chest Creek at Mahaffey, Pa	405206	0784314
12	01541000	West Branch Susquehanna River at Bower, Pa	405349	0784038
13	01541100	Bell Run at Bells Landing, Pa	405500	0783800
14	01541207	Anderson Creek near Penfield, Pa	410751	0783614
15	01541220	Little Anderson Creek near Rockton, Pa	410311	0783924
16	01541245	Kratzer Run at Bridgeport, Pa	405830	0783306
17	01541248	Anderson Creek at Curwensville, Pa	405831	0783150
18	01541305	Moose Creek at Clearfield, Pa	410210	0782656
19	01541320	Clearfield Creek at Ashville, Pa	403340	0783305
20	01541322	Clearfield Creek at Frugality, Pa	403913	0782947
21	01541323	Sandy Run at Van Ormer, Pa	404000	0782937
22	01541324	Powell Run at Van Ormer, Pa	404019	0782934
23	01541335	Slate Lick Run near Frugality, Pa	403816	0783215
24	01541361	Blain Run at Coalport, Pa	404435	0783202
25	01541362	North Witmer Run at Irvona, Pa	404620	0783320
26	01541372	Dotts Hollow near Irvona, Pa	404717	0783132
27	01541410	Clearfield Creek near Madera, Pa	404830	0782814
28	01541414	Shoff Mine at Madera, Pa	404930	0782659
29	01541418	Little Muddy Run at Smoke Run, Pa	404732	0782542
30	01541420	Muddy Run at Madera, Pa	404911	0782615
31	01541425	Japling Run at Madera, Pa	404945	0782610
32	01541430	Pine Run near Madera, Pa	405104	0782650
33	01541435	Lost Run at Madera, Pa	405137	0782643
34	01541475	Potts Run at Kellytown, Pa	405254	0782738
35	01541480	Morgan Run near Mineral Springs, Pa	405727	0782228
36	01541485	Little Clearfield Creek near Glen Richey, Pa	405551	0752753
37	01541500	Clearfield Creek at Dimeling, Pa	405818	0782422
38	01541513	Long Run at Mount Hope, Pa	405934	0782422
39	01541520	Roaring Run at Mineral Springs, Pa	405948	0782140
40	01541550	Clearfield Creek at Clearfield, Pa	410104	0782428
41	01541695	Trout Run at Shawville, Pa	410425	0782143
42	01541710	Millstone Run near Shawville, Pa	410302	0782021
43	01541720	Surveyor Run at Surveyor, Pa	410426	0781939
44	01541750	Deer Creek near Frenchville, Pa	410442	0781411
45	01541900	Rolling Stone Run near Rolling Stone, Pa	410325	0780936
46	01541950	Mowry Run at Rolling Stone, Pa	410323	0780919
47	01542000	Moshannon Creek at Osceola Mills, Pa	405058	0781605
48	01542004	Trout Run at Edendale, Pa	405012	0781606
49	01542006	Cold Stream above Glass City, Pa	405204	0781226
50	01542008	Cold Stream at Philipsburg, Pa	405411	0781239
51	01542100	Emigh Run at Hawk Run, Pa	405517	0781238
52	01542105	Onemile Run near Philipsburg, Pa	405449	0781202
53	01542108	Hawk Run near Hawk Run, Pa	405518	0781133
54	01542200	Unnamed Trib to Moshannon Creek at Munson, Pa	405714	0781025
55	01542204	Black Bear Run near Winburne, Pa	405640	0780810
56	01542207	Sulphur Run near Winburne, Pa	405739	0780833
57	01542300	Moshannon Creek near Moshannon, Pa	410210	0780336
58	01542400	Black Moshannon Creek at Moshannon, Pa	410208	0780322
59	01542500	West Branch Susquehanna River at Karthaus, Pa	410703	0780633
60	01542508	Mosquito Creek near Karthaus, Pa	410745	0780759
61	01542520	Saltlick Run near Pottersdale, Pa	410915	0780600
62	01542524	Sterling Run near Pine Glen, Pa	410659	0780251
63	01542610	South Branch Bennett Branch Sinnemahoning Creek near Penfield, Pa	411027	0783500
64	01542615	Mountain Run near Penfield, Pa	411140	0783602
65	01542721	Wilson Run near Penfield, Pa	411232	0783430
66	01542725	Moose Run at Penfield, Pa	411224	0783414
67	01542732	Kersey Run at Weedville, Pa	411629	0782937
68	01542748	Medix Run near Medix Run, Pa	411629	0782406
69	01542750	Bennett Branch Sinnemahoning Creek at Medix Run, Pa	411721	0782348
70	01542755	Spring Run near Weedville, Pa	411927	0782728
71	01542760	Trout Run at Benezette,Pa	411850	0782305
72	01542770	Dents Run at Dents Run, Pa	412120	0781547
73	01542775	East Branch Hicks Run near Huston Hill, Pa	412247	0781646
74	01542780	Mix Run near Driftwood, Pa	412010	0781153
75	01542790	Bennett Branch Sinnemahoning Creek at Driftwood, Pa	412002	0780808
76	01542800	Driftwood Branch Sinnemahoning Creek near Lockwood, Pa	413202	0781847
77	01542835	Big Run at Truman, Pa	412838	0782208
78	01542845	West Creek at Howard Siding, Pa	412837	0781928
79	01542886	Parker Run at Gardeau, Pa	413716	0781333
80	01542990	Hunts Run at Cameron, Pa	412708	0781029
81	01543004	Sterling Run near Sterling Run, Pa	412524	0781311
82	01543008	Tannery Hollow Run near Sterling Run, Pa	412519	0781324
83	01543500	Sinnemahoning Creek at Sinnemahoning, Pa	411909	0780503
84	01544204	Cooks Run near Keating, Pa	411716	0775416
85	01544208	Crowley Hollow near Keating, Pa	411722	0775400
86	01545017	Twomile Run near Westport, Pa	411857	0775130
87	01545490	Drury Run at Drury Run, Pa	411945	0774647
88	01545500	West Branch Susquehanna River at Renovo, Pa	411928	0774503
89	01545504	Paddy Run near Renovo, Pa	411950	0774342
90	01545600	Young Womans Creek near Renovo, Pa	412322	0774128
91	01545660	Baker Run near Hyner, Pa	411445	0773630
92	01545680	Tangascootack Creek near Lock Haven, Pa	411032	0773253
93	01547704	Sandy Run near Snow Shoe, Pa	410424	0775212
94	01547706	Wolf Run near Snow Shoe, Pa	410522	0775207
95	01547760	North Fork Beech Creek at Clarence, Pa	410302	0775625
96	01547800	South Fork Beech Creek near Snow Shoe, Pa	410130	0775415
97	01547950	Beech Creek at Monument, Pa	410642	0774209
98	01548403	Babb Creek at Morris, Pa	413543	0771739
99	01548408	Wilson Creek above Sand Run near Antrim, Pa	413851	0771826
100	01548423	Wilson Creek at Morris, Pa	413551	0771750
101	01548427	Stony Fork near mouth near Blackwell, Pa	413456	0772046
102	01548500	Pine Creek at Cedar Run, Pa	413118	0772652
103	01549543	Little Pine Creek near English Center, Pa	412605	0771720
104	01549547	English Run at English Center, Pa	412608	0771725
105	01549560	Otter Run at Carsontown, Pa	412425	0782005

pH

Minimum pH values for selected sites in the West Branch Susquehanna River drainage basin are shown in figure 10. The collected data are representative of a reach on the West Branch Susquehanna River from Spangler downstream to Tangascootack Creek near Lock Haven.

The headwaters of the West Branch Susquehanna River are acidic, as indicated by the minimum pH values at Spangler (site 2) and Cherry Tree (site 4) (fig. 10). Inflows between Cherry Tree and Bower (site 12) raise the pH of the mainstem to 6.1 at Bower, but most inflows downstream from Bower have pH values below 4.0 and reduce the pH of the mainstem to a minimum of 3.4 at Karthaus (site 59). The pH of most inflows downstream from Renovo are above 6.0.

Of the 16 tributary streams sampled, 6 have a pH of 4.0 or less, 5 are between 4.1 and 5.9, and 5 are 6.0 or greater. The average minimum pH of all the tributaries and the sites on the West Branch Susquehanna River is 4.8 and 4.5, respectively. Moshannon Creek had the lowest pH, 3.0, and Chest Creek had the highest pH, 6.8.

NET ALKALINITY

The alkalinity and acidity of a stream are measures of its buffering capacity—its ability to assimilate additions of acid or base without a corresponding change in pH.

A stream that has a pH between 4.5 and 8.3 exhibits the characteristics of both acidity and alkalinity. If the pH is greater than 8.3, the stream contains only alkalinity and no acidity. If the pH is less than 4.5, the stream contains only acidity and no alkalinity. Combinations of sulfuric, carbonic, and other acids, and many types of mineral complexes may be present.

The net alkalinity of a stream can be computed as follows:

$$\text{Net alkalinity (mg/L as } CaCO_3) = \text{Alkalinity (mg/L as } CaCO_3) - \text{Acidity (mg/L as } CaCO_3)$$

A positive net alkalinity indicates that a stream is more alkaline than acidic, whereas a negative net alkalinity indicates that a stream is more acidic than alkaline.

The net alkalinity of all 105 sites in the West Branch Susquehanna River basin is shown on figure 11. Sites above the zero line have a positive net alkalinity and sites below have a negative net alkalinity. Insufficient data were available to compute a net alkalinity for six sites. Two of the streams, Mosquito Creek near Karthaus (site 60) and Kersey Run at Weedville (site 67), have zero net alkalinity. Shoff Mine at Madera (site 28) has the greatest negative net alkalinity at −1,615 mg/L (pH 2.3). West Branch Susquehanna River at Cherry Tree (site 4) and Wilson Creek above Sand Run near Antrim (site 99) have the greatest positive net alkalinity at 42 mg/L (pH 5.8 and 6.4, respectively).

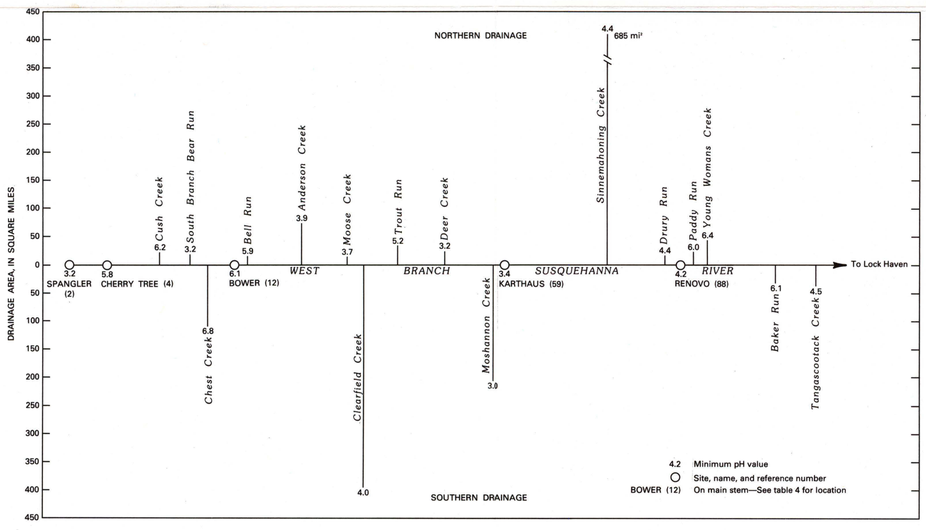

FIGURE 10.—Minimum pH values at selected sites in the West Branch Susquehanna River basin.

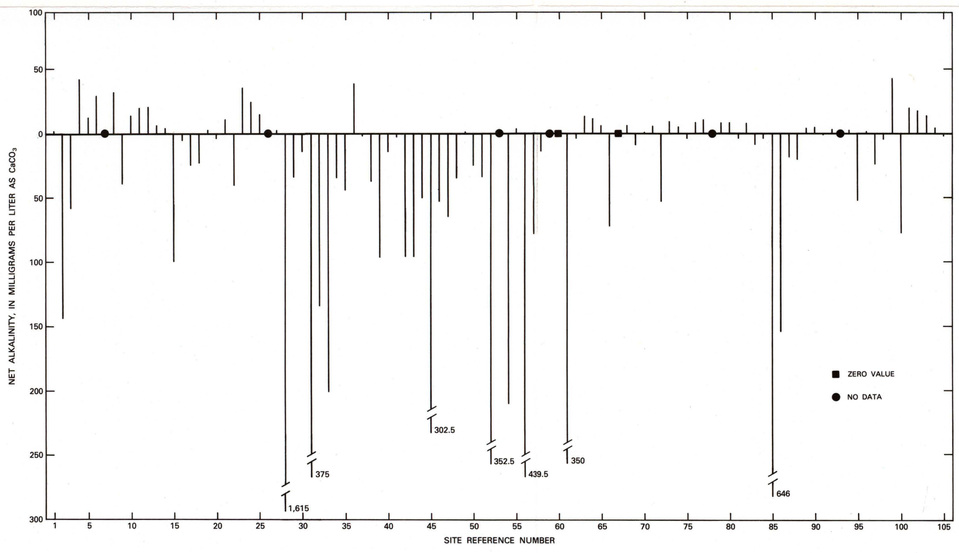

FIGURE 11.—Net alkalinity at sites in the West Branch Susquehanna River basin.

Base from U.S. Geological Survey
State Base Map, 1975

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA.—1989

DISTRIBUTION OF WATER-QUALITY CHARACTERISTICS THAT MAY INDICATE THE PRESENCE OF ACID MINE DRAINAGE IN THE EASTERN COAL PROVINCE OF THE UNITED STATES

By
Kim L. Wetzel and Scott A. Hoffman
1989