

GUM BOOT RUN SUB-BASIN INDEX

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GUM BOOT RUN SUB-BASIN

Discussion of Sub-Basin

Gum Boot Run has a drainage area of approximately 1, 188 acres. The sources of pollution within the sub-basin are the abandoned Gum Boot Mines and associated mine waste material.

The acid discharges from these sources are responsible for approximately four percent of the total acid mine drainage pollution in the East Branch Clarion River Watershed.

Water Quality Sampling Stations

Nine sampling stations were established in the Gum Boot Run Sub-basin to determine the quantity of acid discharge and its effect on the water quality of East Branch Clarion River,

The location, drainage area and summary of water quality test results for each of the sampling stations are:

Station 5938 was located about 1, 800 feet upstream of the Gum Boot Mines at a point sampling a drainage area of approximately 169 acres. This station was sampled 13 times between December 12, 1968 and October 23, 1969. Water quality tests indicated the average daily acid discharge at this point in 1969 was approximately 2 lbs, per day. Minimum and maximum values of the water quality tests were as follows:

	<u>Minimum</u>	<u>Maximum</u>
pH	4.60	5.05
Total Acidity (mg/l)	2.0	4.3
Free Acidity (mg/l)	0.0	0.2
Alkalinity (mg/l)	0.0	0.0
Sulfate (mg/l)	3.	8.
Total Iron (mg/l)	0.01	0.17
Flow (cfs)	0.02	1.02

Station 5939 was located approximately 800 feet upstream of the Gum Boot Mines and about 150 feet downstream of a pond formed by the embankment of an abandoned railroad spur line. This embankment was constructed of mine waste material, Gum Boot Run reappears below the embankment after seeping through the mine waste material. The drainage area at this point is approximately 214 acres, Station 5939 was sampled 16 times between November 19, 1968 and November 18, 1969. The estimated average daily acid discharge at this point was 5 lbs. per day and the range of the water quality tests were as follows:

Station 5940 was established on a small tributary of Gum Boot Run which receives drainage from the large mine waste bank at the north mine heading on the east side of the valley (Area 43D). The drainage area at this point was approximately 122 acres. Minimum and

	<u>Minimum</u>	<u>Maximum</u>
pH	4.55	4.95
Total Acidity (mg/l)	3.0	7.2
Free Acidity (mg/l)	0.0	0.5
Alkalinity (mg/l)	0.0	0.0
Sulfate (mg/l)	6.	18.
Total Iron (mg/l)	0.04	0.29
Flow (cfs)	0.02	1.27

maximum values on water quality tests taken on 16 samples between November 19, 1968 and November 19, 1969 were as follows: These results indicated the average daily acid discharge at this point was approximately 22 lbs. per day in 1969.

	<u>Minimum</u>	<u>Maximum</u>
pH	3.30	4.35
Total Acidity (mg/l)	9.0	65.0
Free Acidity (mg/l)	2.0	49.0
Alkalinity (mg/l)	0.0	0.0
Sulfate (mg/l)	13.	107.
Total Iron (mg/l)	0.19	2.07
Flow (cfs)	0.0	0.74

Station 5941 was established to measure the flow from the mine seal of the north heading on the westside of the valley (Area. 4.3B). Station 5941 was sampled eight times between December 20, 1968 and June 25, 1.969 with test results indicating the average daily acid discharge to be approximately 5 lbs. per day. Minimum and maximum test results were as follows:

Station 5942 was located to measure the flow from the mine seal of

	<u>Minimum</u>	<u>Maximum</u>
pH	3.35	3.65
Total Acidity (mg/l)	24.0	46.0
Free Acidity (mg/l)	17.0	31.0
Alkalinity (mg/l)	0.0	0.0
Sulfate (mg/l)	62.	112.
Total Iron (mg/l)	0.29	1.60
Flow (cfs)	0.008	0.069

the south heading on the eastside of the valley (Area 43C). This station was sampled 17 times between November 19, 1968 and November 18, 1969. Test results indicated the average daily acid discharge at this point was 154 lbs. per day during the testing period. Minimum and maximum test results were as follows.

Station 5943 was located about 200 feet downstream of the Gum Boot Mines at a point having a drainage area of approximately 393 acres. This station was sampled

	<u>Minimum</u>	<u>Maximum</u>
pH	2.75	3.40
Total Acidity (mg/l)	190.0	360.0
Free Acidity (mg/l)	135.0	260.0
Alkalinity (mg/l)	0.0	0.0
Sulfate (mg/l)	262.	630
Total Iron (mg/l)	61.00	127.00
Flow (cfs)	0.094	0.135

16 times between November 19, 1968 and November 18, 1969. Test results indicated the average daily acid discharge at this point in 1969 to be about 153 lbs. per day. These water quality tests indicated the minimum and maximum values to be as follows:

	<u>Minimum</u>	<u>Maximum</u>
pH	3.05	3.85
Total Acidity (mg/l)	20.0	129.0
Free Acidity (mg/l)	8.0	95.0
Alkalinity (mg/l)	0.0	0.0
Sulfate (mg/l)	30.	180.
Total Iron (mg/l)	0.38	23.50
Flow (cfs)	0.04	2.34

Station 5944 was established near the mouth of Gum Boot Run at a point approximately 250 feet upstream of East Branch Clarion River. The drainage area at this point is approximately 1,165 acres. This station was sampled 19 times between November 22, 1968 and October 23, 1969 with test results indicating the average daily acid discharge to be approximately 225 lbs, per day. Minimum and maximum test results were as follows:

Station 59766 was established to measure a very slight amount of

	<u>Minimum</u>	<u>Maximum</u>
pH	3.45	4.10
Total Acidity (mg/l)	11.0	45.0
Free Acidity (mg/l)	4.0	28.0
Alkalinity (mg/l)	0.0	0.0
Sulfate (mg/l)	17.	81.
Total Iron (mg/l)	0.23	1.60
Flow (cfs)	0.16	9.26

seepage on May 29, 1969, from the north mine heading on the east side of the valley (Area 43D). Results of water quality tests of this sample were:

pH 3.10, total acidity 87.0 mg/l, free acidity 69.0 mg/l, sulfates 116 mg/l and total iron 4.04 mg/l. At no other time was seepage observed at this point.

Station 5977 was located on March 6, 1969 to sample the water from the west branch of Gum Boot Run which has a drainage area of approximately 410 acres. Water quality tests of this sample, were: pH 4.50, total acidity 5.0 mg/l, free acidity 1.0 mg/l, sulfates 6 mg/l and total iron 0.06 mg/l.

Coal Production from Gum Boot Mines

There are no coal production records available for the Gum Boot Mines, but it is very possible the coal production credited to the Instantur Mines includes production from the Gum Boot Mines. The bituminous mine inspector records in the files of the Pennsylvania Department of Mines and Mineral Industries states the coal production is from four mines. The Instantur Mines on Twomile Run should be considered as two mines, one on each side of the valley, and each mine having two entries. The Gum Boot Mines on Gum Boot Run are of the same arrangement. The mine waste banks on Gum Boot Run cover a larger area and contain more mine waste. This could mean the coal production of the Gum Boot Mines was greater than that of the Instantur Mines, but the volume of the mine waste is no sure indication of coal production or of the areal extent of an underground mining operation because it was common practice in the 19th and early 20th centuries to retain material extracted during the mining operation, other than coal, in the underground workings.

The Gum Boot Mines were opened sometime after 1884 as they are not shown on the topographical sketch map of the "Fifth Bituminous Coal Basin" constructed by Robert P. Field, Mining Engineer in 1884 (Plate IX, Report RR of the Second Geological Survey of Pennsylvania, 1885). The Old McKean and Buffalo Railroad Company constructed a spur line to the Gum Boot Mines to connect with their railroad siding at the village of Clermont.

Source of Pollution

AREA 43

The sources of acid mine drainage pollution in the Gum Boot Run sub-basin are 1) the abandoned railroad bed constructed in part of mine waste material, 2) flow from the mine headings, 3) seepage along the cropline between the 43C and 43D mine seals, and 4) the coal mine waste banks associated with the four headings of Gum Boot Mines. Although acid pollution contribution is from a number of sources, only the Area 43C mine heading is considered a significant source of acid mine drainage pollution.

The average daily acid discharge into the East Branch Clarion River from the Gum Boot Run sub-basin is estimated to be 225 lbs. per day. Discharge from the mine headings contribute about 160 lbs. per day, the mine waste banks approximately 55 lbs. per day and the abandoned railroad embankment about 10 lbs. per day.

The mine headings on the westside of the valley are very minor sources of acid mine drainage pollution. There was no seepage from the 43A mine heading however "yellow boy" deposits below the heading indicate seepage occurred at some time. It appears the sealing of the mine headings on the west side of the valley has been effective in abating acid mine pollution from the mine.

The mine headings on the east side of the valley are a significant source of acid mine drainage pollution. The 43C mine seal had an average daily acid discharge of approximately 154 lbs. per day during the sampling period. Seepage was noted only one time from 43D mine, however, it appears if the flow from the 43C mine seal were to be completely stopped, the mine water would then flow from 43D heading. Seepage presently occurs along the crop line between the 43C and 43D mine headings.

The coal mine waste banks are approximately 70 years old and the one located on the west side of the valley shows evidence of having been on fire at one time. The total area of the mine waste banks is about 2.8 acres and completely void of vegetation. Laboratory experiments were performed on material from the large mine waste bank on the east side of the valley. A report of these experiments is included in Appendix C of this report. These tests indicated that, in spite of the age of this mine waste material, it had acid producing properties.

Recommended Abatement Measures - The average acid discharge from these sources is estimated, on the basis of water quality tests performed over a one year period, to be approximately 225 lbs. per day or approximately four percent of the total average daily acid load contributed by pollution sources in the East Branch Clarion River Watershed.

It is recommended both of the mine headings on the east side of the valley be sealed by constructing double bulkhead grout seals and a grout curtain be constructed in the area between the two double bulkhead grout seals.

The doubt expressed in the section of this report covering the Twomile Run Sub-Basin, concerning the economic consideration of attempting to abate pollution from the mine waste banks, also applies to the Gum Boot Sub-Basin. These considerations are: 1) the inaccessibility of the area, 2) the low average daily acid discharge from the banks, and 3) the water quality of East Branch Clarion River improves greatly by the time it reaches the East Branch Reservoir.

If it is deemed desirable to reduce the acid discharges from the mine waste banks it is recommended the following be performed:

Reclamation Requirements
(Waste Banks Area)

Earthwork

Cover mine waste banks with an average of 3 feet of soil.

Soil Treatment

Standard Ground Limestone (total application of 5 tons per acre to contain a minimum of 240 lbs. magnesium per acre.)

50-50-50 in lbs. N-P₂O₅-K₂O per acre. Planting

Creeping red fescue	100 lbs.
Birdsfoot trefoil •	35 lbs.

Planting Tree Seedlings (the following year)

Black Locust	450
Autumn Olive	2,700

An alternate to the above recommended reclamation requirements for the waste bank areas is to seal the mine waste banks by spraying with a bituminous material to prevent waste infiltration. Ground limestone should be spread on the mine waste banks prior to application of the bituminous material. The effectiveness of this method of abating acid mine drainage pollution over a long period of time is questionable due to lack of such performance data.

Cost of Methods of Abatement

<u>Description</u>	<u>Estimated Percent Abatement</u>	<u>Estimated Cost</u>
<u>AREA 43</u>		
Double bulkhead mine seals and grout curtain between seals at headings on eastside of valley, cover mine waste banks, soil treatment and planting	90%	\$150, 000



