Mining

The available deep mine maps of the Pittsburgh Coal seam were obtained. These maps were furnished by Consolidation Coal Company which owned the mineral rights to the Pittsburgh Coal in the Piersons Run watershed. The main entries and limits of the mine workings were traced from the available maps and are shown on Drawings 69-209-Bl through B6. The deep mine map for the central portion of the area could not be located and, hence, no details are shown. The base of coal contours shown are based on survey data from the original mine maps. The Pittsburgh Coal generally rises to the east. Within the park, it rises from elevation 1150 at the northwest corner of the watershed to elevation 1200 at the southeast corner. The average dip is about one-half degree (1 vertical to 100 horizontal). Watercourses were established at various locations in the mine and are now the principal sources of acid water discharge from the abandoned deep mines. Stripping operations were performed between 1941 and 1948. During 1945 to 1950, the strip mines were partially backfilled. The backfill operations in the western portion of the watershed, where the park is presently utilized for skiing and picnicking, consisted of regarding to original ground surface contours. These strip mines have been revegetated and blend into the existing topography. The strip mines in the eastern portion of the area were regraded leaving a highwall exposed having a maximum height of 25 feet. The coal and collapsed mine workings are exposed along the highwall. The ground surface slopes at about one per cent from the highwall except for three small areas designated A, B, and C, shown in dotted yellow shading on Drawings 69-209-B1, B2, and B4. Although the stripped area designated as B on Drawings 69-209-Bl and B2 is outside of the Piersons Run watershed, water entering the mine in this area will, because of the dip of the coal, seep out into the western polluted tributaries of Piersons Run.

Consolidation Coal Company is the owner of the mineral rights for the Upper Freeport Coal in the northern portion of the watershed. The approximate extent of entries being driven under the watershed as of November 1970, are shown on Drawings 69-209-Bl, B2 and B3. Future mining plans are to complete the driving of the entries to the southern limit of the Consolidation Coal Company property which is south of the watershed. It is estimated by the Consolidation Coal

Company that ten years may be required to complete mining beneath the park area. Coal pillars will be left to support the existing park structures.

The Upper Freeport Coal in the southeastern portion of the park is reported to be thin. This situation will limit future mining in this area.

Field Survey and Sampling

A detailed survey was conducted at the beginning and at the end of the study. The initial survey was conducted to locate all major seeps within the watershed and to obtain preliminary information on the extent and effect of stripping and deep mining within the area. After the field sampling was completed and the results compared to the other information obtained during the study, a final detailed survey was conducted to examine field conditions with respect to acquired data. At this time, entries and watercourses shown on the mine maps were examined, areas of potential subsidence observed to determine the degree of surface subsidence which had occurred, and strip mines checked with respect to backfill, slope, drainage, and lateral extent.

Originally, 21 sampling points were selected to monitor the amount and quality of acid mine drainage at various points throughout the watershed. The locations of these sampling points are shown on Drawings 69-209-B1 through B6, and on Plate 2. These points included sources, tributaries, and locations along Piersons Run. Examination of the test results and flow measurements of the first and second set of samples obtained in early August and early September 1970, indicated that some sampling points yielded insignificant information. The number of sampling points was then reduced by eliminating collection of water at Sample Points 2, 3, 4, 6, 7, 10, 14, and 21. Samples from the other sampling points were again collected in October and November 1970. Sampling over this period of time provided measurements at periods of low and high flow and permitted a comparison of the relative effect of flow variation on mine acid pollution concentration and water quality.

The water samples were tested by Seewald Testing Laboratories and Associates in Williamsport, Pennsylvania. Tests were conducted to determine pH and concentrations of acidity, alkalinity, sulfate, and total iron in the samples. The results of these tests and the flow measurements are presented in Table I, on Drawings 69-209-B7 and B8. In addition, the test results are shown graphically for Sample

Points 8, 9, 11, 12, 13, 15, 16, 17, 18, 19, and 20 on Figs. 1 through 11 in the appendix of this report. These sampling points are all within the two polluted tributaries of the stream. Table II on Drawing 69-209-B9 shows the maximum and minimum load of sulfate, total iron, acidity, and alkalinity for the sampling points.

DATA ANALYSIS

This section presents an analysis of the information collected on the factors contributing to pollution in Piersons Run, the characteristics of the pollution, and the requirements and limitations imposed upon possible abatement measures.

Piersons Run is an alkaline stream at its confluence with Abers Creek because of self-neutralization and dilution by its non-polluted tributaries. The non-polluted tributaries are the first two eastern unnamed tributaries which join Piersons Run at Sample Points 2 and 6, respectively, as shown on Plate 2. The maximum measured pH at the confluence of Piersons Run and Abers Creek, Sample Point 1, was 7.2 while the minimum was 6.2. The stream water remains above a pH of 6.0 at all sampling points downstream from Sample Point 7. At Sample Point 7, the junction of the unnamed tributary which drains the eastern undeveloped area of Boyce Park and the unnamed tributary which drains the western developed area of the park, the pH varied from a high of 6.4 to a low of 4.4. The pH of the tributary which drains the eastern area varied from a high range of 6.4 to 5.8 at Sample Point 8 to a low of 2.9 at the origin of the tributary at Sample Point 12. The pH of the tributary draining the western area of the park varied from a high of 4.7 at Sample Point 9 to lows of 2.9 at Sample Point 18 and 2.8 at Sample Point 20. Sample Points 18 and 20 are the origins of this tributary. A comparison of the data between Sample Point 13 and Sample Point 9, located about 1000 feet downstream from Sample Point 13, (Figures 2 and 5 in the Appendix or Table I) indicates that total iron and acidity generally decrease downstream. Similar decreases are noted in comparing Sample Point 11. Data comparisons between Sample Point 15 and Sample Points 16 and 18 indicate the same trend. Sample Point 15 is located about 400 feet downstream from Sample Point 16 and over one thousand feet downstream from Sample Point 18.

Examination of the test results presented in the Appendix (Figures 1 through 11) indicates that iron concentration is independent of flow rate, pH is directly proportional to flow rate, and acidity and sulfate concentrations are inversely proportional to flow rate.

Deep mining has removed the majority of the Pittsburgh Coal beneath the watershed. The entries and some of the watercourses created during these operations have been backfilled, with the exception of an entry at the eastern side

of the seam which is partially open and shown on Drawing 69-209-B2. However, these openings were not sealed and it is evident, in the areas where mine maps are available, that they are the source of the pollution discharge. Mining has. also resulted in extensive subsidence of the ground surface in some areas and imposes a high risk of future subsidence in other areas. In the majority of the undermined area, where the overburden above the mine exceeds 50 feet, subsidence effects are difficult to detect. In the remaining undermined area, where the cover is less than 50 feet, localized subsidence has produced sinkholes. This has occurred extensively in the eastern portion of the park (Drawing 69-209-B4) which is presently undeveloped. These sinkholes create a hazard to the public utilizing the park facilities and provide points for water to enter the mine. Water which seeps into the mine through these sinkholes ultimately emerges as acid mine discharge polluting Piersons Run.

Strip mining has occurred along most of the outcrop of the coal as shown in yellow on Drawings 69-209-Bl through B6. For the most part, these strip mines have been backfilled to provide drainage away from the high wall and the deep mine. In the area of the western branch of Piersons Run, the strip mines have been regraded to previous ground surface contours. In the remainder of the watershed, the highwall has been left exposed. Improperly backfilled strip mines exist in two areas. At the northern outcrop of the seam, some of the strip mines have been improperly backfilled, but being at a low point of the seam, these create little or no problem. In the eastern portion of the park, a strip mine which has not been backfilled occurs at the high end of the coal outcrop and is a potential major source of water entering the mine.

Based upon the laboratory analysis of the water samples and a review of the mine maps and field conditions, six major sources of pollution exist. These sources, shown on-Drawings 69-209-Bl, B2, and B3, are Sample Points 12, 16, 17, 18, 20, and the abandoned watercourse upstream from Sample Point 11. At Sample Points 16, 17, and 18, the mine map is unavailable and the subsurface conditions contributing to the discharge of acid mine drainage at these points are uncertain.

It is important to note that the existing discharge locations which are areas of least resistance to flow are the result of a number of conditions. If these conditions are altered, discharges will develop at other locations. At the present time, however, no additional sources were noted during any phase' of the field survey program. The individual

characteristics of the pollution sources are as follows:

Abandoned Watercourse

Upstream of Sample Point 11, an abandoned watercourse which has been backfilled but not sealed, continues to drain the mine. Water emerging at this point seeps through and across the top of the strip mine backfill and forms the headwaters of a small stream. Flows varied from two to sixteen gallons per minute with maximum pollutant concentrations of 1500 milligrams per liter of sulfate, 5 milligrams per liter of iron, and 320 milligrams per liter of acid., as indicated in Table I. This stream merges with the flow from Sample Point 12 at Sample Point 10 and drains the eastern strip mine area.

Sample Point 12

The acid source in the vicinity of Sample Point 12 is also an abandoned watercourse which is backfilled, but not sealed, and continues to drain the mine. Water leaving the mine at this point is temporarily impounded before being carried through a culvert and into the east stream channel. The mine drainage is the headwater of the stream which drains the eastern strip mine area. During the period of study, the flows varied from three to eight gallons per minute and maximum concentrations of pollutants were 1800 milligrams per liter sulfate, 18 milligrams per liter iron, and 700 milligrams per liter acid.

Sample Point 16

A series of springs merge to form a small stream which is the easterly headwater of the western tributary of Piersons Run. While the deep mine data is unavailable for this area, it is believed that the deep mine drains into the strip mine backfill and the flow finally emerges at Sample Point 16. Observed flows varied from one to nine gallons per minute with maximum pollutant concentrations of 2700 milligrams per liter sulfate, 35 milligrams per liter iron, and 900 milligrams per liter acid.

Sample Points 17 and 18

Both of these sources are drains installed into and possibly through the strip mine backfill. Detailed data on the mining is not available at these locations. Flows varied from five to nine gallons per minute at Sample Point 17 and six to fourteen gallons per minute at Sample Point 18. At Sample Point 17, the maximum observed sulfate, iron, and acid concentrations were 2700 milligrams per liter, 2.8 milligrams per liter, and 200 milligrams per liter, respectively. At Sample Point 18, the maximum concentrations were 1700 milligrams per liter sulfate, 25 milligrams per liter iron, and 600 milligrams per liter acid as shown in Table I. In relatively dry periods, the sources at Sample Points 16, 17, and 18 contribute nearly all of the flow in the western tributary of Piersons Run.

Sample Point 20

The deep mine is drained at Sample Point 20 through an abandoned entry or watercourse which has been backfilled but not sealed. Flows from this source were observed to be relatively low, fluctuating between one and two gallons per minute. The maximum observed concentration of each pollutant was 2000 milligrams per liter of sulfate, 40 milligrams per liter of iron, and 50 milligrams per liter of acid.

Because of dilution, the concentration of pollutants generally decreases as flow increases. However, when wet weather is preceded by an extended dry period, increased flows may be accompanied by an increased concentration of pollutants. This phenomenon, called "slugging", is caused by subsurface water flushing pollutants from the mine that were above the water level in the mine during the dry period. Using the maximum observed flow rates and concentrations at the sources as their potential slugging_ ability, the possible combined parameters are a 58 gallons per minute flow rate with 1378 pounds per day sulfate, 12 pounds per day iron, and 366 pounds per day acid. These figures are approximately 30 to 50 per cent higher than the sum of the maximum observed quantities at the sources.

Respectfully submitted,
General Analytics, Inc.

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