GENERAL SUMMARY OF REPORT

PURPOSE

This report presents the results of an engineering study which was performed to:

1. Determine sources and amounts of pollution
2. Analyze the results of the pollution survey
3. Formulate recommendations for the abatement of acid mine drainage in the Upper Swatara Creek Watershed, Schuylkill County

The area of study (14.9 square miles) consisted of the headwater streams for Swatara Creek from a point below Tremont to their rise. The principal streams involved are Good Spring Creek, Middle Creek and their tributaries.

Some of the largest coal reserves are reported to be in the Southern Anthracite Field; howver, it is also some of the most difficult coal to mine. The dips vary from near zero to vertical to overturned. This folding also serves to produce a complex problem in tracing acid sources, flow routes, etc.

One of the main purposes in undertaking an acid mine drainage study in this area concerns a proposed recreational and water supply lake and dam at the north end of Swatara Gap. Improvement of the water quality of Swatara Creek is understood to be a prime factor in the full implementation of the this plan.

BRIEF RESULTS OF POLLUTION SURVEY

At the southern limit of the study area a maximum acid load during the water year of sampling of over 50,000 lbs/day was recoded and the mazximum iron load was 10, 870 lbs/day. The average acid load at this same point was 8,692 lbs/day and the average iron load was 953 lbs/day. The pH range was 3.3 to 4.4. The acidity range was 28 to 120 mg/L, the total iron range was a trace to 8.5 mg/L and the sulfates ranged from 130 mg/L to 2600 mg/L.

The best stream in the study area for water quality is the Poplar Creek which contains no AMD. The most polluted stream in the study area is Coal Run, which is a tributary of Middle Creek. Coal Run's poor quality water is due to the fact that it receives the overflow from two of the five large mine water pools which discharge within the study area.

ABANDONED MINES AND MINE WATER POOLS

It became apparent early in the study that abandoned deep mines and specifically, mine pool overflows, were the most serious problems in the study area. The five mine pools coletively are estimated to contain in excess of 2,599,000,000 gallons of water with the individual mine pools containing amounts varying from 471,000,000 gallons to 915,000,000 gallons of water. These abandoned mine pool discharges were estimated collectively to produce 60% of the flow and 61% of the acid load and are as follows:

Mine Water Pool	Estimated Volume (Gallons)	Average Recorded Acid Load at Mine Pool Overflow (lbs/day)	Sampling Station
Middle Creek	700,000,000	4,294	C-34 (Tracy Overflow)
Indian Head	(unknown)	399	C-37, C-38 (Marshfield Slope)
Colket	513,000,000	382	MR-53 (Colket Water Tunnel
Good Spring No. 3	471,000,000	794	GS-95 (Tracy Airhole)
Good Spring No.1	915,000,000	40	GS-96 (Unnamed Airway)

Of these mine pools described above the overflow from the Middle Creek Mine Water Pool is by far the worst source with respect to water quality in the entire study area. This overflow point is known as the Tracy Overflow (sampling station C-34) where a maximum acid load of 11, 580 lbs/day was record4ed and the maximum iron load was 1,689 lbs/day. The average acid load was 4,294 lbs/day and the average iron load was 447 lbs/day/ The pH range was 2.7 to 3.9. The acidity range was 32 to 250 mg/L and the total iron range was a trace to 57.5 mg/L. (The highest limit of acidity of 1000 mg/L was not recorded here during the study but at several small sources. The highest corresponding total iron was 80 mg/L at one of these small sources.

The study shows that the concentrations of acidity from the mine pools is fairly constant even with increased flow. Apparently the flush out of acid salts from the exposed bony material offsets the dilution factor.

COAL MINE REFUSE

Coal mine refuse accounts for the second worst source of AMD or 32 % of the total acid load. This was also perhaps one of the more surprising results of the survey. Coal refuse covers some 420 acres with an estimate 18,730,000 cu.yds. within the study area. It is estimated that refuse has an average daily production of 3144 lbs/day of acid.

STRIP MINES

Of the total study area some 32% has been disturbed by strip mining. The vast bulk of this strip mining occurred during the Second World War and directly thereafter. At the time of this report, there was limited active stripping in only one portion of the study area.

However, abandoned overflowing strippings do account for 16% of the discharge and 4% of the acid. By this evaluation, stripping ranks third behind mine pool overflows and refuse banks with respect to total production of AMD. The contribution of strippings is undoubtedly deep mines and mine pools is connecting deep mines and mine pools is considered. It is estimated that 83% of the runoff in the study area is trapped by the extensive strippings.

RANKING OF POLLUTION SOURCES

The water quality sampling results of the some ninety sources are submitted in this report. However, many more than these were sampled during the course of the water year. Some of these were discontinued due to restricted flow or relatively good water quality. The standard series of tests performed included: pH, alkalinity, acidity, iron and sulfates.

In choosing candidates for abatement measures the more significant sources were ranked from the highest at 11,580 lbs/day and thence in decreasing order in terms of their maximum acid loads. The number of sources and their ranking by maximum acid load range are as follows:

Number of Significant Sources	Tange of Maximum Acid Load (lbs/day)
1	>5,000
3	1,000 – 5,000
2	500 – 1,000
10	100 – 500
2	50 –100
20	10 – 50

ACTIVE MINES

In completing the survey we were asked to sample and report on the water quality from active mines as well as abandoned sources. Some 20 different coal veins have been mined in th area at one time or another. The active mines in the study area produced an average yearly tonnage of 90,000 tons of coal fro the years `1969-70. This yield is about 1% of the total production from the entire anthracite region. During this period, there were nine small deep mining operations with an average production of 10,000 tons per year per mine. These mines employed an average of 7men.

Of the nine mines sampled, one was consistently acid, one was consistently alkaline and the others were alternately acid or alkaline. Another mine, the Renninger Mine, ceased operations during the course of the study, however, it continues to have acid mine drainage by gravity flow. The major AMD source among the active mines is the Mercury mine which has combination pumped and gravity flow.

Since April, 1968, all companies operating active mines which have discharges for whi the Environment Quality Board would normally require treatment and which are situatied on ten watersheds in the Anthracite Region, have been contributing 15 cents for every ton of coal mined. This contribution was in lieu of treatment. The money has been paid to the General Fund and collected by the former Departmen of Mines and Mineral Industries and its successor the Department of Environmental Resources.

Information on water quality is given in the report for the active mines in this study area along with the estimated treatment cost data. The analysis of sampling data indicates that the active mines contribute less than 2% of the average acid load from the study area.

APPROACH TO ABATEMENT MEASURES

In Section VI-A, General Approach to Abatement Measures Section of the report, three areas are listed where AMD can be abated:

1. Prevention or minimizing AMD formation at the source.
2. Once it is formed, minimize or prevent its entry into streams
3. If no other remedial action is adaptable to a specific source, treat it just before it enters the streams.

In the report we have endeavored to propose all feasible “Civil Engineering” types of projects first. We are not enthused about the concept of treatment due to its apparent “Ad infinitum” feature.

However, this report has established that only one of the 5 mine pools lends itself to complete remedial action. The remaining pools, within the limits of existing technology, do not appear to lend themselves to feasibly and/or economical direct solutins, although their total acid loads can be partially reduced by the various recommended “Civil Engineering” projects. As as example, one mine pool overflow – The Tracy Overflow from the Middle Creek mine pool – with an average flow of 2,471 gpm, discharges 44 % of the total acid load. This fact reluctantly has led to recommend a central treatment plant to collect and neutralize the remaining acid flows from 5 sources – three mine pools, one abandoned mine, and one active mine. These five sources account for 53% of the total acid discharge during the sampling year.

<u>TYPE OF ABATEMENT MEASURES</u>

In recommending abatement measures it is necessary to study the particular site in question since no one measure will apply to every situation. Some of the different types of remedial measures recommended in the report area as follows:

1. Interceptor ditches above the major stripping areas.
2. Flumes across heavily strip mined areas to collect drainage from the interceptor ditches and discharge it to the streams.
3. Stream and ditch restoration. Drainage presently lost to strip mines usually ends up as AMD emanating from the a mine pool overflow.
4. Impervious lining in streams to prevent water loss through the stream beds. In many cases streams cross through formerly loose spoil material which overlies a mine pool.
5. Partial regarding of strip pits using available material to provide for positive drainage control to the area.
6. Bury scattered refuse material preferably inundating it in strip pits which have standing water at all times or do not overlie deep mining.
7. Hydroseeing or chemical bonding of large refuse banks and the perimeter slopes of large refuse slush dams. (In lieu of this the banks could also be regarded into a lower mound, covered with a layer of spoil and planted).
8. Impervious dikes and grout curtains adjacent to refuse banks in order to contain AMD seepage from beneath the banks and from acid salt flushout due to storm runoff. Low impervious dikes an grout curtains are recommended to contain all but the most severe low frequency storm runoff and to provide an evaporation basin.
9. Impervious dikes and plugs at strip pit overflows. This procedure is limitied to the headwaters of streams near the mountain crests where the ground water is usually somewhat depressed.
10. Hydraulic Mine Seals. This is a means of water flooding in the mine workings to eliminate or minimize direct are contact with the remaining exposed carbonceousshale in the mine and hence reduce the formation of acid salts. In at

least one case the remote placement of a mine seal through boreholes is recommended as necessary.

11. Relocate surface ponding away from mine pools. This occurs in one area where a permanent pond in a slush dam lies directly over or adjacent to a mine pool.

12. Treatment. In the case of some mine pool overflows and othe sources for which there appears to be no feasible and/or economical abatement measure, threatement is necessary to comply with the Clean Streams Law as amended.

QUICK START PROJECT

One quick start project is presently underway. This is a four phase program for the proposed construction of a hydraulic mine seal in the water level tunnel of the abandoned Bowman and Coleman Mine.