REPORT ABSTRACT

INTRODUCTION (See Page 1)

This report culminates a 12 month study of mine drainage pollution problems in the Alder Run Watershed, in Clearfield County, a tributary of the West Branch Susquehanna River. The study was wholly financed under Pennsylvania Act 443 of 1967, the "Land and Water Conservation and Reclamation Act".

Pollution of the West Branch Susquehanna River is intimately associated with pollution of its many tributaries, including Alder Run. The principal source of mine drainage pollution in the Alder Run basin is abandoned deep mines. Alder Run was known to be polluted as far back as public records of chemical analyses of the stream are available -- approximately 21 years. Records also indicate the quality of the West Branch has been improving. The improvement is probably due principally to the requirement since 1964 for complete restoration of surface mines, and for neutralization of acid drainage from active deep and surface mines since 1966.

Purpose

The purpose of this study was to determine the extent and severity of mine drainage pollution of Alder Run and its tributaries, the effect of this pollution on the West Branch Susquehanna River, develop remedial measures for each significant source of pollution which would reduce or eliminate the pollution, and develop and recommend an abatement plan for the watershed.

BASIN DESCRIPTION (See Page 5)

Alder Run is situated in Clearfield County, Pennsylvania. The basin is irregularly shaped and encompasses 24 square miles. The watershed lies entirely within the Appalachian Plateaus Province, and is basically a high plateau, extensively dissected by streams. This area has extremely cold weather for Pennsylvania and above State average snowfall More than 98 inches of snow fell in the watershed during the 1969-1970 winter, as compared to the State 30 year snowfall average of 45.8 inches.

The most important geologic formations are of the Allegheny and Pottsville Groups in the Pennsylvanian series which are the coal bearers. Structurally, the area is controlled by the northeast - striking Laurel Hill Anticlinorium, flanked on the north and south, respectively, by the Clearfield and Houtzdale-Snowslage Synclinoriums.

Mining History

Coal mining has been a major factor in the economy of Clearfield County since the turn of the century. The Lower Kittanning or "B" seam was extensively deep mined because of its high quality and persistent thickness. Deep mining ceased during World War II, and strip mining presently dominates the industry in this watershed.

METHODS OF STUDY (See Page 15)

The study of the watershed was carried out in seven phases, not including those extra activities involved in the planning and initiation of "quick start" projects.

Phase I - The extent of mining on the watershed was identified by the acquisition and review of mine maps and aerial photographs.

Phase II - Historical data concerning water quality and mining were acquired for study from various State, Federal and local agencies.

Phase III - The pollution source inventory and sampling portion of the study was conducted over one climatic year, including a preliminary reconnaissance of the watershed. Weirs were installed at twenty-five (25) locations.

Sampling stations were established at discharges from mines which were significant pollution contributors. Forty-three (43) sampling points were established, samples collected, and flow measurements taken regularly.

Phase IV - A mine development and pollution source map was prepared which includes structure contours, the areas disturbed by surface and deep mining, and the locations of portals and airways into the deep mines. The map shows surface contours, stream pollution sources, sampling points, and other appropriate topographic features.

Phase V - Field explorations were conducted to verify the conditions shown on available maps, and to gather geologic and subsurface water information, including walking all streams and crop lines to locate sources of water and tracing all flowing water to its source. Test borings were taken to determine ground water elevations and geological conditions in conjunction with possible mine sealing recommendations.

Phase VI - After completion of the technical data gathering portion of the study, a comprehensive evaluation of the data was undertaken in order to identify and rank the sources of pollution in order of descending magnitude, determine costs for abatement of each pollution source or group of sources, and establish a recommended priority list of abatement projects to be undertaken.

Phase VII - This phase involved report preparation with all maps, graphs, charts, tables and other exhibits, including specific recommendations and cost figures for abatement of mine drainage pollution in Alder Run.

STUDY RESULTS (See Page 23)

Stream Quality

The analyses of stream samples collected during the year's sampling survey (July 1969 through June 1970) indicate that the main stem of Alder Run and all of its tributaries, with two exceptions, are severely polluted by mine drainage.

The study analyses indicate the acid pollution load contributed by Alder Run to the West Branch averaged 16,470 #/day during the survey. year with a maximum and minimum of 65,219 #/day and 3,381 #/day, respectively. This increases the acid load in the West Branch by 8%.

The importance of reducing pollution loads from all acid tributaries of the West Branch Susquehanna River is emphasized by the recovery of the West Branch from its headwaters to the confluence of Clearfield Creek, a distance of over 70 miles. If the acid loads from Alder Run and other tributaries in this stretch of river can be reduced, there is an excellent chance that 30 miles of this large river can recover to the point where it will support a game fishery.

A discouraging revelation of the study was the complete absence of alkaline streams on the entire Alder Run Watershed. Also, the geologic configuration of the watershed is such that natural sources of alkalinity ore practically nonexistent.

Sampling and Measuring Results

The study of the watershed revealed fifty eight (58) significant sources of mine drainage pollution from both deep and surface mined areas. Browns Run contributes 56% of the total pollution load of the Alder Run Watershed.

THE ABATEMENT PLAN (See Page 45)

The pollution sources are shown on the Mine Development and Pollution Source Map in back of this report. Each area has been individually evaluated to ascertain the most feasible method of pollution reduction or abatement, which are:

(1) Mine Sealing - the construction of a barrier within a mine portal. The deep mine seals will prevent the discharge of almost 70% of the acid load to Alder Run.

(2) Surface Mine Restoration - the draining, backfilling, grading and revegetating of excavations resulting from surface coal mining.

(3) Removal of Refuse Piles - the removal of accumulations of sulfuritic or acid forming materials.

(4) Stream Diversion - the movement of the established course of a stream to eliminate pollution of the stream.

(5) Complete stripping out of small shallow deep mines.

(6) Treatment of mine drainage at sources of pollution or in the stream is sometimes feasible. This study indicated, however, that extensive pollution abatement by reclamation is feasible and treatment should only be re-evaluated if a need for high quality water is indicated after reclamation.

Grassflat Mines Complex

The Grassflat Mines complex is a large system of abandoned mine workings which is responsible for the vast majority of the pollution loads to Moravian, Grassflat and Sulfur Runs, (tributaries of Moshannon Creek), and for 56% of the pollution load to Alder Run. It is proposed the openings to the mine situatedon Alder Run watershed be closed with watertight seals to raise the water level in the western portion of this complex until sufficient elevation is reached to allow the water to flow down dip. The flow will be toward the Moravian Run, Grassflat Run, and Sulfur Run discharge points, on the Moshannon Creek watershed.

Core borings were taken near and in the portals which indicate that seals are feasible, but some grout curtain construction will be necessary to achieve an acceptable degree of imperviousness.

Source Descriptions, Abatement Measures and Costs

The specific pollution sources are completely described in this section, with pollution loads, proposed method of abatement and the estimated cost of abatement. The total abatement cost is estimated to be $1,612,000.

Also included with this section are names of property owners affected by proposed reclamation, and an analysis of the possibilities of treating the water.

Priorities of Abatement Projects

One of the major factors used in forming project abatement priorities was the ratio of abatement costs to amount of pollution expected to be eliminated. The obvious weakness in using such parameters solely is that all pollution is not readily detectable. Some pollution enters the waterways through ground water movement, including that which reaches deep mine workings and may travel considerable distances prior to discharge to surface streams.

Another factor considered was the probable effect of abatement measures and reclamation on the residents in the area; their use of the land near the streams and the over-all aesthetic factors. A further consideration in establishing priorities is the relationship and interlocking of one abatement measure with another.

Also, those abatement projects involving extensive backfilling which presently do not have favorable cost/abatement ratios would be considerably enhanced by resumption of surface mining and required complete restoration in these areas.

Five (5) "Quick Start" Projects have been initiated, the first of which is now in the construction phase. They are listed under Priority No. 1 in the tabulation shown in the body of this report.

The abatement measures listed involving strip mine reclamation work include only sufficient restoration to abate most of the pollution . I f in the future it becomes desirable to restore all of the acreage disturbed by surface mining, the estimated cost of this additional work is $2,400,000 for a total project cost of $4,012,000.

Quick Start Projects

Project No. 1

The headwaters of Alder Run were strip mined in 1956 and intercepted old deep mine workings with the result that the headwaters are diverted to the workings and off the watershed. It was proposed to re-channel the submergence area (source 158) to return these headwaters to the Alder Run watershed. The channel is presently (June, 1970) under construction and approximately 50% completed. The total cost of the project is $117,100.

Project No. 2

The origin is a large strip pond 200 feet long by 250 feet wide. The area has been extensively strip mined, and the area to the east has also been deep mined.

The source area contributes 1019 pounds of acid and 1746 pounds of sulfate daily into Mons Run. Recommended abatement method is to excavate, remove, and bury the acid producing material; backfill the pit and regrade to terrace the area outlined on the exhibit; provide drainage facilities and planting. The estimated construction cost for this work is $60,000.

Project No. 3

The source is similar to the Quick Start No. 2 source, with a large strip pond discharging into Alder Run. This pollution source contributes an average 300 pounds of acid daily (2%of the total), and 948 pounds of sulfate per day. In order to accomplish abatement at this location, the acid forming material will be segregated and buried near the high wall, and the strip pond and pit wiII have to be backfilled. The top portion of the high wall will be removed and used as backfill, and the ground water level restored to its approximate previous height. The estimated construction cost of this work is $37,000.

Project No. 4

For a length of nearly 3000' Flat Run is swampy and passes along and through spoil banks and old refuse piles. A strip pond just above Flat Run in this location discharges to Flat Run and compounds the problem. Daily contribution from this source is 332 pounds of acid, and 930 pounds of sulfate. Removal and burial of the spoil and refuse piles, backfilling and grading the strip pond and pit will effectively reduce this pollution load. Estimated construction cost of this work is $76,000.

Project No. 5

This area involves a deep mine tipple which was constructed on spoil piles in the stream. The stream now must pass along the spoil bank, acquiring acidity. By removing the mine spoils from a long the length of the stream, or by relocating the stream away from the spoil, approximately 220 pounds of acid per day can be eliminated from Browns Run. The relatively minor construction cost of removal of the spoils is $2,000. Plans and specifications for removal are now being prepared for this project.

CONCLUSIONS (See Page 97)

Extent and Severity of Pollution

Alder Run is severely polluted by mine drainage almost entirely emanating from abandoned surface and deep bituminous coal mines. The streams and tributaries

of Alder Run contain acid in concentrations ranging from -10 mg/L to 2100 mg/L; iron concentrations ranging from 0.1 mg/L to 500 mg/L; and sulfates of 12 mg/L to 3800 mg/L. With the exception of Hubler Run the streams of the watershed are not fished, since their pollution levels are too high to support a sport fishery. This area of the state is in need of more waters supporting a sport fishery.

The watershed is practically devoid of natural alkalinity sources such as limestone formations and other potentially alkaline deposits. This situation has resulted in surface and ground waters being too low in buffering capacity to counteract the effect of the acid forming constituents exposed by mining. Whether a sufficient amount of natural alkalinity reserve is present in the Alder Run watershed to raise the quality of its waters high enough to support a game fishery is not certain. Analyses of Hubler Run, a tributary not affected by mining, are not encouraging on this point.

The Pollution Source Inventory

The four season study of the watershed revealed fifty-eight (58) sources of pollution or other adverse conditions which have some detrimental effect upon Alder Run or its tributaries. Fifteen (15) of these pollution sources emanate from openings in deep mines and account for almost 70% of the average pollution load of the entire watershed. The magnitude of the deep mine pollution load is significantly increased by unrestored surface mines which funnel rain and ground water to the deep mines.

Remedial Measures

The cost for implementation of the total pollution abatement program is $1,612,000, including the $117,100 already authorized under the "Quick Start" No. 1 project. Consideration was given to in-stream treatment in order to achieve desired water quality goals. It is concluded that treatment is unjustified at this time, but should be re-evaluated if reclamation measures fail to achieve desired water quality levels and the concomitant establishment of a sport fishery.

RECOMMENDATIONS (See Page 105)

The study has established that: Alder Run is grossly polluted negating almost all of its usefulness as a water source. For a cost of $1,612,000, 90% of the pollution load can be abated from the watershed.

It is therefore recommended that: (1) All of the priority projects listed in the abatement plan be implemented; (2) The probability that polluting portions of the

watershed will be reaffected by surface mining should be investigated. This will insure that effective reclamation efforts can be coordinated between the prospective miner and the Department of Mines and Mineral Industries; (3) A water quality improvement evaluation program should be developed to monitor both the chemical quality and the aquatic life in Alder Run, as pollution abatement measures are implemented; (4) A water quality improvement evaluation program should alsoo be developed to monitor chemical qualityand aquatic life in the 30 mile stretch of the West Branch Susquehanna River from Clearfield Creek to Moshannon Creek; and (5) The effect of the Grassflat Mines on Moshannon Creek and the West Branch Susquehanna River should be evaluated and pollution abatement measures developed.