III RECOMMENDATIONS

ACID MINE DRAINAGE ABATEMENT MEASURES

The following are the various acid mine drainage abatement/treatment methods considered for implementation on the Mill Creek Watershed. These were considered singularly and in combination to prevent or abate acid mine drainage pollution in the study area. The principle in abatement is dichotomous: first, the prevention of further oxidation of pyritic materials by eliminating oxygen contact; and second, the prevention of surface or ground water from coming in contact with acidic materials and carrying acid to streams, wells, or springs. The concept behind this two-fold approach to abatement of acid mine drainage is incorporated into most of the following recommended abatement procedures.

1. Restore strip mine areas by contour or terrace backfilling.
The purpose here is to promote runoff of surface water rather than impoundment and percolation. This is accomplished by backfilling strip mine areas to the desired grade thus eliminating cuts and surface depressions which serve to impound water and direct the water by percolation through the acid forming material.

2. Move refuse material to strip mine areas.
By burying deep mine refuse materials in old strip mines, surface water cannot come into contact with the acid forming material, thus eliminating the production of acid mine drainage. The refuse can also be a source of backfilling material for areas which do not have sufficient material to properly backfill.

3. Construct surface water diversion ditches.
The purpose of a diversion ditch is to convey surface water around the strip mined area avoiding contact with acid producing materials. This is a very desirable abatement measure whether used alone or to compliment restoration by backfilling.

4. Install slope drain flumes with diversion ditches.

Flumes constructed to carry surface: water-from diversion ditches across spoil or backfilled areas prevent the contact of surface water with acidic materials. This measure also reduces erosion of recently backfilled slopes-and percolation of surface water through the spoil material.

5. Construction of dewatering trenches.

Construction of dewatering trenches in otherwise unreclaimed strip mine areas serves to collect surface water and promote rapid runoff. This will prevent, to some degree, impounding and infiltration of surface water and limits the time of contact with acidic materials.

6. Chemical neutralization of strip mine areas.

Neutralization is accomplished by treating impounded water with a lime slurry and spreading lime over spoil areas.

This method may prove beneficial for large strip areas but the cost may be out of proportion if used in areas where much of the acid potential has leached out.

7. Pressure treat spoils by lime slurry injection.

A slurry composed of 5 to 10% hydrated lime, 90 to 95% pulverized limestone, and-water is injected into spoils at regularly spaced intervals. This serves to fill voids and water passageways reducing considerably the amount of percolation and seepage. This procedure also serves to neutralize and coat the acid producing materials in the spoils. This method has been used successfully by the Department of Environmental Resources on Tom's Run but because of its high cost is applicable only in areas of very high acid discharge where other means of abatement are inappropriate.

8. Seal deep mine entries.

Placing of impervious seals at mine entries is designed to prevent discharges from the mine or incursions of surface water into the workings where it can pick up acid. Seals also serve to inundate the workings

preventing further oxidation of pyritic materials and generally improving the quality of water if breakouts should occur at higher elevations. This method is limited by other openings into the workings, either man-made or natural, such as fractures in the surrounding rock, joint systems, drill holes, high hydraulic head, etc.

9. Eliminate deep mine workings.

The purpose of this is to prevent infiltration by eliminating water routes through deep mine workings. Deep mine workings can be eliminated by excavation, or strip mining of remaining in-place pillars and subsequent reclamation.

This procedure is generally quite costly and therefore not feasible except in the most severe cases, or if the value of remaining in-place coal is such to offset the cost of reclamation.

10. Excavate and restore subsidence areas,

Surface water is often impounded in subsidence areas and subsequently channeled into underground workings where it becomes acid. These areas can be excavated, sealed, and regraded to induce runoff.

11. Cover refuse material.

Occasional acid discharges from refuse piles can be prevented by covering the material with an impermeable substance and constructing a diversion ditch to carry surface water away from the pile.

A factor to be considered is the possibility of spontaneous combustion, to which such a covered refuse pile is sometimes susceptible.

12. Reconstruct stream channels.

In areas where a stream enters deep mine workings or a strip mined area the stream channel should be lined, repaired, or relocated as necessary to prevent the water from flowing through acid producing materials.

13. Chemically neutralize acid mine drainage at on-stream facilities.
This method calls for treatment of the acid water before discharging into a stream. Chemical treatment facilities can be any of several types.

One of the problems involved with this type of operation is the continuing cost of operation and maintenance, as the chemicals needed for neutralization as well as personnel to maintain the equipment must be supplied over the life of the system. Also, chemical treatment usually results in the precipitation of solids which present a problem of disposal.

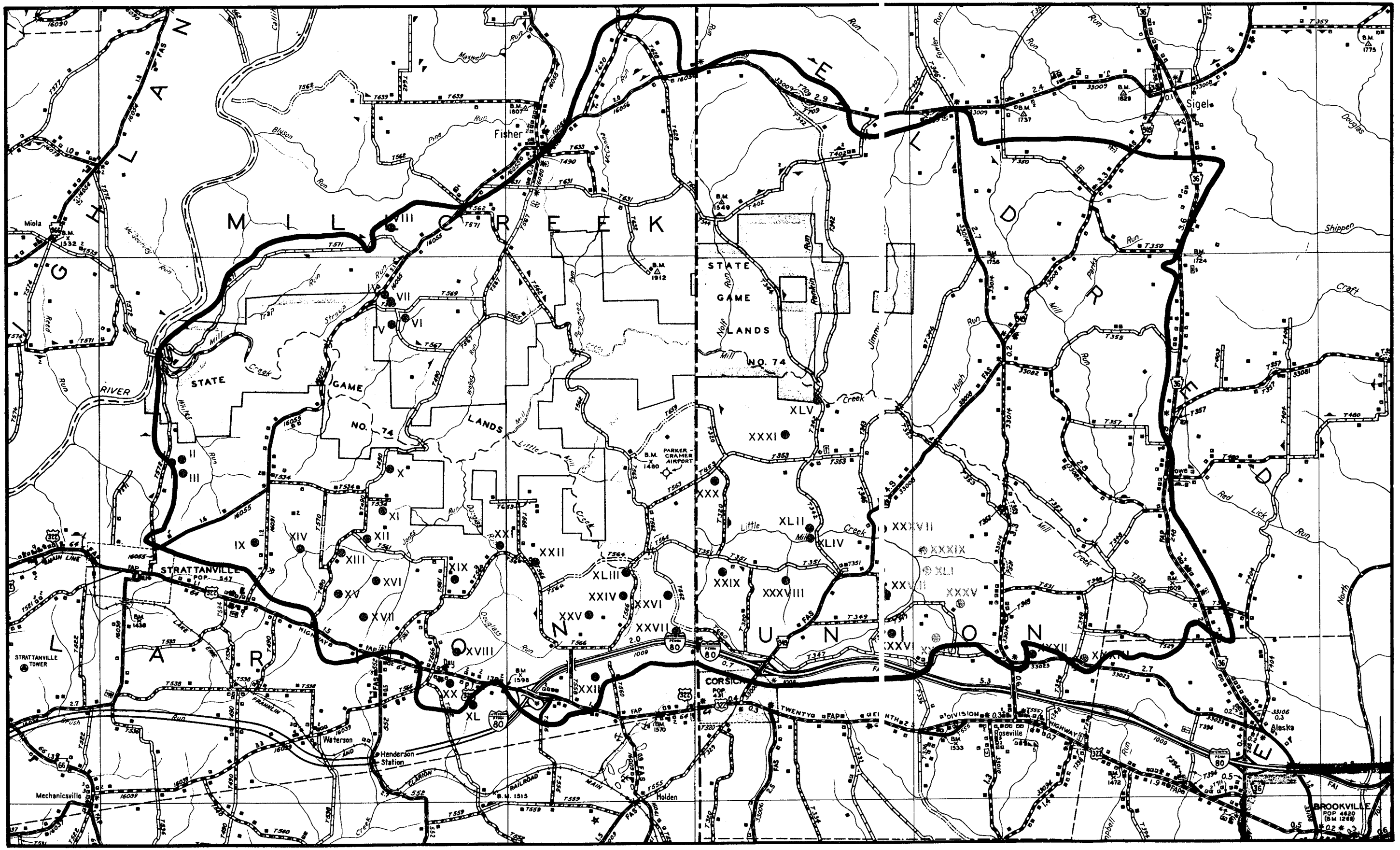
14. Sealing of abandoned gas wells.
Gas wells discharging acid water can be re-drilled and filled with cement to prevent further discharge. Care must be taken to note the condition of the bedrock around the well as the acid mine drainage may break out as a spring or from an adjacent unsealed well if the rock surrounding the well is sufficiently pervious or fractured,

15. Establish Vegetative Cover
Appropriate acid-tolerant grasses and/or trees can be planted on strip mined areas to utilize the natural processes of interception, evaporation, transpiration, and absorption to minimize the amount of surface water available for infiltration into the spoils, and to prevent erosion of reclaimed areas.

16. Construction of Limestone Barriers in Streams
Limestone barriers may be placed across streams made slightly acid by mine drainage. In such streams water quality may be improved by the neutralization and aeration provided by these barriers Effectiveness of such barriers may be reduced by the coating of the limestone that occurs if iron concentrations in the water are high.

PROPOSED ACID MINE DRAINAGE ABATEMENT MEASURES

Each Project Area was evaluated in light of its own distinguishing characteristics and the most appropriate methods of abatement were selected for use. A description of each area and the recommended methods for abatement follows.



PROJECT AREA LOCATION MAP

SCALE
1 0 1 2 miles
1" = 1 Mile