In order to effectively evaluate these two abatement techniques and determine their applicability to the Passmore Mine, much more information pertaining to the immediate vicinity of the mine would be required. An intensive search for mine mapping information would be necessary to more accurately define the extent of the deep mine workings. Core borings would also help determine the extent of the workings and the quality of the remaining clay. All possible information sources would be tapped in an effort to determine the quality, thickness and reserves of clay left in the mine. Accurate surface information would be obtained from 100 ft/in scale photogrammetric mapping, upon which could be plotted any data deemed relevant during field explorations of the entire mapped area. Careful examination of this combined information would determine the feasiblity of using one or both of the suggested abatement techniques to eliminate the acid emanating from the Passmore Mine.

Estimated Construction Cost

Costs are presented here for the first step of the abatement plan only -- the surface reclamation.

Regrade, roto-fill limestone, fertilize, revegetate, construct diversion ditches or flumes as required in bony areas.

8 Ac @ $2600/ Ac = $20,800

Backfill, regrade, lime, fertilize, revegetate, construct diversion ditches and flumes as required in unreclaimed strip mine.

148 Ac @ $2600/ Ac = $384,800

Total Cost = $404,560

Total Estimated Cost, Abatement Area 0 Surface Reclamation =

$405,600

Call: $406,000

Cost Effectiveness

$20,800 per 70 lbs/day = $297 per lb/day acid abated.

$384,800 per 520 lbs/day = $740 per lb/day acid abated.

Overall Cost Effectiveness

$406,000 per 590 lbs/day = $688 per lb/day acid abated.

CLEARFIELD CREEK WATERSHED

ABATEMENT AREA P
KREBS AND LONG RUNS

Location

Abatement Area P consists of 257 Ac strip mine # 44 between Long Run and Krebs Run, two small tributaries near the mouth of Clearfield Creek. The area is flanked on the northwest by Clearfield Creek and is situated about one-half mile southeast of Mount Hope in Boggs Township, Clearfield County.

Geology

All Allegheny Group coals from the Clarion-Brookville to the Lower Freeport outcrop on the hill. The "A" coal is split into three seams in this portion of the Clearfield Creek Watershed, and its mudstone, shale and sandstone overburden are pyritic in nature. The local strata strike northeast-southwest and dip 1½ ° to the northwest.

The entire northeastern portion of the Clearfield Creek Watershed is faulted, but the only fault actually lying within the abatement area trends northwest-southeast through the eastern end of the area. The vertical offset along this fault is around 40 feet.

Mining

No evidence of deep mining exists in the abatement area but all seams were stripped in the 1950's by Aughenbaugh Coal Company and by Maple Hill Coal Company. The lowest split of the "A" seam was also auger mined in this area. Very little backfilling or regrading was done but some planting was accomplished. Presently the northwestern highwall on the "A" seam facing Clearfield Creek is owned and kept open by Penn State University's Department of Geosciences and serves an educational purpose.

Mine Drainage and Hydrology

Extensive stripping allows nearly all precipitation intercepted by the 257 Ac area to infiltrate into the hill or become temporarily trapped in ponds. Trapped water seeps through spoil toward the lower northwest portion of the hill where it comes into contact with the high sulfur spoil of the "A" seam. Water also infiltrates downward and eventually comes into contact with acid forming materials in the lower seams. Acid mine drainage originating from both subsurface and near surface drainage discharges from the northwest downdip end of the hill and drains into Long Run, Krebs Runs, and Clearfield Creek.

Water Quality

Skelly and Loy's point source sample station 63.1 indicates that an adjusted 1,150 lbs/day acid load emanates from the north side of the hill. Sample station 62.1 indicates that an adjusted average of 400 lbs/day acid comes from the southern side of the hill, yielding a total of 1,550 lbs/day acid (adjusted) from Abatement Area P.

Recommended Abatement

The abatement plan here calls for completion of an efficient drainage network within the area. Minimum earthwork type backfilling and regrading should be used to promote run-off and decrease infiltration. Downdip or northwest facing highwalls should have diversion ditches placed to prevent water from contacting acid producing materials. All exposed bony should be buried and sealed with a clay size material to minimize its contact with water. Strip mine surfaces should then be fertilized and vegetated as required. Fluming can conduct water, collected by ditches and swales, out of the strip mines into natural drainage channels to Krebs and Long Runs. This abatement plan should eliminate 65% of the acid emanating from the area, or 1,000 lbs/ day.

Krebs and Long Runs Mine Drainage Data

SAMPLE			ACID LOAD	
Station #	Description	Strip Mine #	Unadjusted	Adjusted
62.1	trib to Clearfield Creek	44	640	400
63.1	seepage from	44	480	1150

Estimated Construction Cost

Strip Mine #44

Backfill and regrade as required to maximize run-off, fertilize, revegetate, construct diversion ditches and flumes as required.

257 Ac @ $2,700/ Ac - $693,900

Total Estimated Cost, Abatement Area P = $693,900

Call = $694,000

Cost Effectiveness

$694,000 per 1,000 lbs/day= $694 per lb/day acid abated.

CLEARFIELD CREEK WATERSHED

ABATEMENT AREA Q
ROARING RUN

Location

Abatement Area Q consists of 321 Ac of strip mines that discharge acid mine drainage into Roaring Run. Strip mine #45 lies in the head-waters of Roaring Run just south of Bigler and east of Pennsylvania Route 970 on the Boggs-Bradford Township line. Strip mines #46, 47, 48, 49 and 50 lie on the southeast side of Valley Fork Run, a major tributary to Roaring Run situated just northeast of Woodland in Bradford Township.

Geology

Allegheny Group rocks, from the Clarion-Brookville to the Middle Kittanning, outcrop in the abatement area, which is structurally situated on the northwest flank of the Laurel Hill Anticline. All units in the vicinity generally strike northeast-southwest and dip slightly to the northwest. Overburden in the area consists of both shale and sandstone with shales predominating on the "A" seam. This northeastern portion of Clearfield Creek's Watershed is extensively faulted, and numerous northwest trending wrench and splay faults lie within the abatement area.

Mining

There are apparently several small, old deep mines in the area's "A" coal and underclay and "B" coal for which mine mapping could not be located. Strip mine #46 apparently cut into an "A" seam deep mine known as "Plane #1". Helmar Johnson and J. A. Owens operated a "B" seam deep mine at the site of strip mine #50.

Later strip mining removed portions of the Clarion-Brookville coal and its underclay and the Lower Kittanning coal. Reclamation work in these strip mines was minimal and they are still sparsely vegetated on strip mine # 45. No active mining operations exist here although Harbison-Walker Refractories Company has posted a sanitary water permit in the southern portion of the area.

Mine Drainage and Hydrology

The five unreclaimed strip mines, with a combined total area of 321 Ac effectively trap all runoff from the strip areas and the slopes above. The water either seeps through the acid Clarion-Brookville and Lower Kittanning strip mine spoil or infiltrates downward into underlying deep mines. The water is rendered acid in both the spoil material and the old deep mine workings, and generally seeps toward the downdip end of the stripping and enters Roaring Run. Surface runoff from Interstate 80's west bound lane and berm area, totaling six acres, drains through strip mine

#49 and a portion of strip mine #50. Using 44 inches of annual rainfall and snow melt or an. average annual flow of 0.00506 cfs/Ac, this translates to 0.03 cfs flowing into the two strip mines from the I-80 area. Some of this runoff may become acid and would be properly diverted into Valley Fork Run by abatement work.

Water Quality

Water quality data for this area was obtained by Skelly and Loy during their intensive sampling program. An adjusted average of 6142 lbs/day acid was observed at the mouth of Valley Fork Run at station 72, making this tributary one of the major pollution sources in the Roaring Run Watershed. Most of this acid emanates from the southeast or down-dip side of the Valley Fork Run Watershed, and is mainly attributed to strip mines #46, 47, 48, 49 and 50.

Skelly and Loy's sample station 74.2 averaged an adjusted 4886 lbs/day acid downstream from strip mine #45 in the abatement area. This station was chosen as representative of the area because it best represented the total acid load of all seepage into the headwaters portion of Roaring Run.

Thus, the six strip mines in Abatement Area Q are the combined source of over 10,235 lbs/day acid (adjusted). Since total pollution loads from this abatement area were obtained from main stream (station 74.2) sampling points, the determination of acid loads from individual strip mines

cannot be made with any degree of validity. Since the strip mines are all located in a potentially acid-producing seam, strip mine loadings can only be estimated by proportioning among each strip area as was previously done for individual strip mines.

Recommended Abatement

The recommended abatement plan for this area's strip mines will eliminate 40% of the acid (3,580 lbs/day adjusted) observed in Roaring Run below the abatement area by improving the area's natural hydrologic system. Ponds should be drained and the unreclaimed stripping backfilled and re-graded to promote rapid runoff. The strip mined surfaces should be limed, fertilized, and planted as local conditions dictate. Diversion ditches should be constructed and drainage flumed across strippings where appropriate.

Spoil material from the stripped areas, mines #45 through #50 contains much large blocky sandstone. If sufficient finer material does not underly this massive material for reclamation, added costs per acre will be required to acquire the needed finer material. The $3,000 per acre cost may increase to $3,600, increasing the cost effectiveness to $260 per lb/day acid abated. Higher costs are unlikely since the area was previously used for farming indicating a presence of soil cover disturbed by surface mining.

Estimated Construction Cost

Backfill and regrade to maximize runoff, add limestone and fertilizers as necessary, revegetate, construct diversion ditches and flumes as required.

Strip Mine #45

141 Ac @ $3000/ Ac = $432,000

Strip Mine #46

14 Ac @ $3000/ Ac = $42,000

Strip Mine #47

4 Ac @ $3000/Ac = $12,000

Strip Mine #48

43 Ac @ $3000/Ac = $129,000

Strip Mine #49

8 Ac @ $3000/Ac = $24,000

Strip Mine #50

111 Ac @ $3000/ Ac = $333,000

Total Estimated Cost, Abatement Area Q = $972,000

Cost Effectiveness

Strip Mine #45

$432,000 per 1970 lbs/day = $219 per lb/day acid abated.

Strip Mine #46

$42,000 per 192 lbs/day= $219 per lb/day acid abated.

Strip Mine #47

$12,000 per 55 lbs/day=$219 per lb/day acid abated.

Strip Mine #48

$129,000 per 590 1bs/day = $219 per lb/day acid abated.

Strip Mine #49

$24,000 per no lbs/day = $219 per lb/day acid abated.

Strip Mine #50

$333,000 per 1520 lbs/day = $219 per lb/day acid abated.

Overall Cost Effectiveness

$972,000 per 3582 lbs/day = $270 per lb/day acid abated.

CLEARFIELD CREEK WATERSHED

ABATEMENT AREA COST SUMMARY

Abatement Area	At Source Acid Load (lbs/day)	Estimated Construction Cost
A*	5,841	Unknown
B	9,060	$1,235,000
C	9,500	1,050,000
D	600	15,000
E	2,700	293,000
F	5,600	516,000
G	2,580	161,000
H	300	141,300
I *	38,200	Unknown
J	8,500	273,000
K	4,045	156,000
L	11,700	710,500
M	1,763	226,000
N	6,000	532,000
0	5,210	406,000
P	1,550	694,000
Q	10,235	972,000
Total	123,385	$7,335,800
		Call: $7,300,000

Total Acid to be Abated (for recommended projects) = 42% of 79,343 lbs/day or 33,940 lbs/day.

Total Project Cost (for recommended projects) = $7,300,000

Total Cost Effectiveness = $215 per lb/day acid abated.

*projects not recommended