CLEARFIELD CREEK

WATERSHED

CLEARFIELD CREEK WATERSHED

ABATEMENT AREA A
TRAPP RUN

Location

Trapp Run is the southernmost source of acid mine drainage in the Clearfield Creek Watershed, located just northwest of Cresson in Cambria County. Deep mine discharges to this tributary contribute large amounts of acid to Clearfield Creek's headwaters, severely degrading the creek and Cresson Lake, just below the mouth of Trapp Run. Although little or no acid is evident in Clearfield Creek north of Cresson Lake, the water quality, not only just north of the lake but as far north as Glen Hope, would be considerably improved if the acid discharging from Trapp Run could be eliminated.

Geology

The strata in the Trapp Run Watershed are structurally situated fairly low on the southeastern flank of the Houtzdale Syncline. The locally shaft mined seams, the Lower Kittanning and Upper Freeport coals of the Allegheny Group, are far below the surface in this area, outcropping slightly over two miles east of Cresson. The strata strike northeast-southwest and dip sharply at over 4 degrees to the northwest. No formalized geologic work has been done for this area and no information on faults was obtained.

Mining

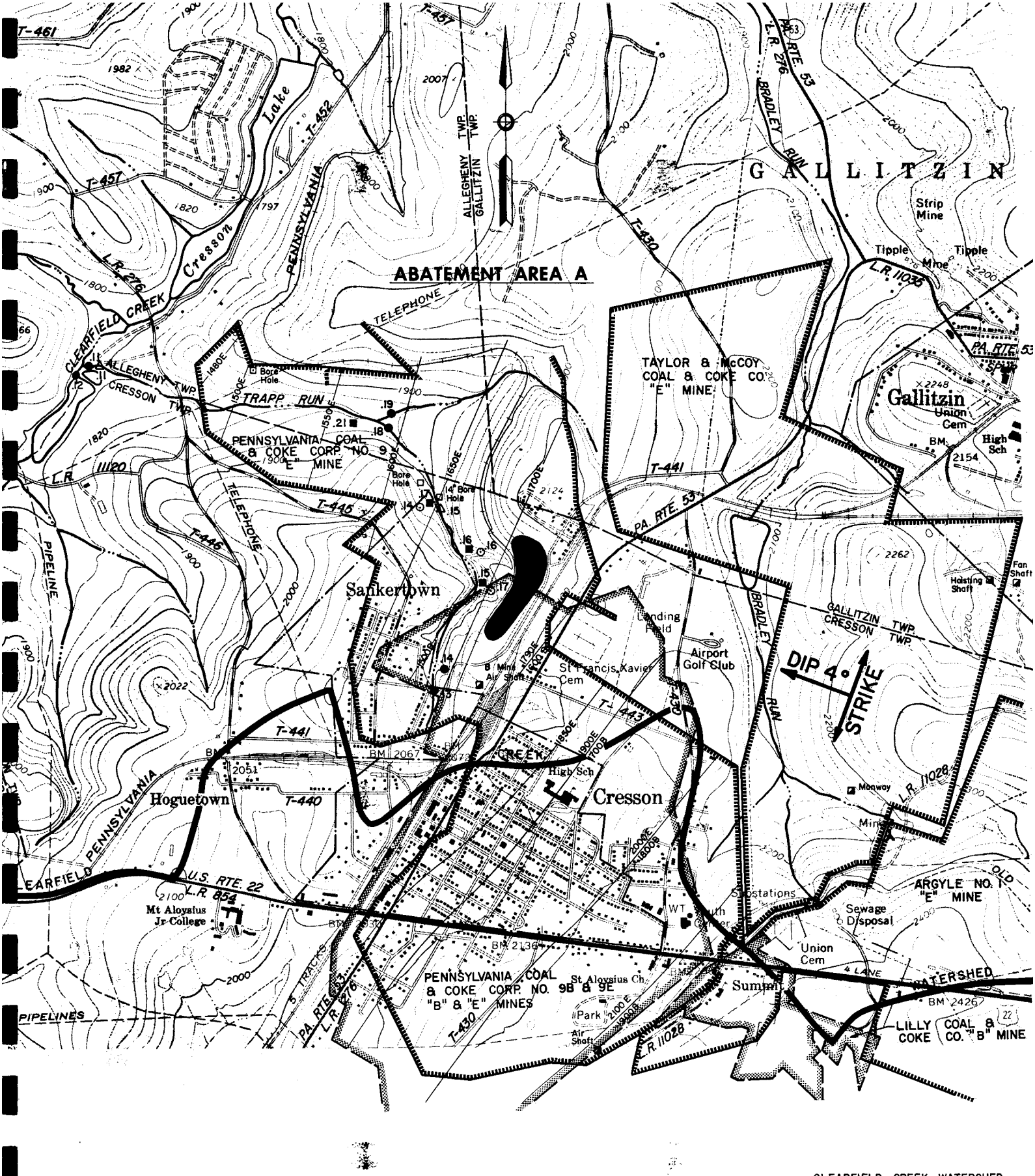
The area from Trapp Run east past Gallitzin, north nearly to Ashville and south past Lilly has been almost completely undermined on the Upper Freeport seam by the Pennsylvania Coal and Coke Company and the Taylor and McCoy Coal and Coke Company. Several large Lower Kittanning deep mines were also operated by Pennsylvania Coal and Coke Company and Lilly Coal and Coke Company south of Cresson. The mines in the Trapp Run vicinity are all deep shaft mines which operated through the early and middle 1900's. Only the portion of the mine mapping actually in the Cresson area was plotted on the MOD, but "E" seam workings, which are probably interconnected, are quite extensive within the southeastern portion of Clearfield Creek Watershed. Most of these mines apparently closed down at least ten years ago and no known recent active mining has occurred in the Trapp Run area.

Mine Drainage and Hydrology

The natural hydrologic system of the entire southeastern Clearfield Creek Watershed has been altered by deep mining activities. Strip mines along the Allegheny Group coal outcrops several miles east of Cresson serve as catchment areas that allow rainfall and runoff to enter the "E" seam deep mines. In addition, ground water is also intercepted by these deep mines. The mine workings act as underdrains that channel

nearly all runoff downdip toward Clearfield Creek. In portions of the" E" seam workings that overlie the "B" seam mines, fractures developed from caving and small faults allow much water to pass downward into the "B" seam workings beneath Cresson. This water again flows downdip, now becoming acid through its contact with the pyritic "B" seam coal, bony and overburden material. The western limits of the mapped" B" seam mining, beneath Sankertown, could possibly be inaccurate, as the two major discharges to Trapp Run at stations 0.17 and 0.21 are north-west of the mapped " B" seam workings. The unusual nature of the discharge at sample station 0.21, where acidity was 400 mg/l and alkalinity was 100 mg/l, suggests that the mine drainage discharging at that point is a combination of both the "B" and" E" seam water. The discharge at station 0.17 is more highly acid, with 700 mg/l acidity, and is more characteristic of a "B" seam deep mine discharge.

Any explanation of the unusual water quality at station 0.21 and the great difference between it and the water quality at station 0.17 would be, based on the actual data obtained in the pilot program, only speculation. However, it is obvious from known coal structure contour data that if the "B" seam deep mine shown on the MDD were only one-third flooded it would have sufficient hydraulic head to drive water upward to the "E" seam workings through any available bore hole or shaft on the "B" seam mine's downdip end. It is also possible, that the "B" seam workings



LEGEND

- E.P.A. Stream Sample Station
- E.P.A. Mine Discharge Point
- Point Source Sample Station
- Module Sample Station
- Mine Shaft
- Portal
- Bony Pile
- Deep Mine Limit ("B" Seam)
- Deep Mine Limit ("E" Seam)
- -1900B— Coal Structure Contours (Seam "B" or "E")
- —·—·— Corporate Line

CLEARFIELD CREEK WATERSHED
ABATEMENT AREA A
MINE DEVELOPMENT DRAWING

1000 0 1000 2000
Scale in Feet

PREPARED BY
Shelly and Loy
ENGINEERS CONSULTANTS
HARRISBURG PENNSYLVANIA

are more extensive to the west than shown and directly responsible for one or both of the acid discharges. The actual situation here can only be ascertained after a much more exhaustive study of the Cresson area.

Water Quality

EPA sampling in early 1967 attributed 1200 lbs/day acid to the mouth of Trapp Run, and 1100 lbs/day acid to three point sources of pollution within the abatement area EPA stations 0.14, 0.16 and 0.17. Skelly and Loy's sampling program revealed an unadjusted 1700 lbs/day acid at Trapp Run's mouth. Intensive sampling also revealed an unadjusted acid load of 5800 lbs/day emanating from point sources at stations 0.15, 0.16, 0.17 and 0.21. These acid loads are sufficient to severely degrade the immediate downstream reach of Clearfield Creek.

Recommended Abatement

The abatement plan for the Trapp Run Watershed is very general in nature because sufficient specific data could not be obtained within the scope of the study. For the same reason abatement costs and cost effectiveness are not presented. General knowledge of the area indicates that it should be feasible to safely and effectively seal the deep mine discharges, thereby flooding these very deep shaft mines and limiting the production of acid within them.

Prior to any specific decision regarding abatement within the Trapp Run Watershed, a study to determine the feasibility of sealing these deep mines is recommended. The study should include the location and use of all available deep mine mapping, photogrammetric mapping of the deep mines and coal crop areas, an intensive field study of the entire deep mined area east to the outcrop of the Allegheny Group rocks, interviews with local miners to glean as much information on these deep mines as possible, and extensive test borings to ascertain the deep mine configuration and feasibility of sealing.

A feasibility study of this nature was initiated at one time by the Environmental Protection Agency and the United States Geological Survey. The study program was canceled after much effective work and data gathering had been accomplished. Cancellation of the project resulted from policy decisions against performing any further abatement studies or work, not because the project was not feasible. The work that was accomplished by these two organizations will be extremely helpful in providing a sound base for the recommended feasibility study.

The effective elimination of the Trapp Run deep mine discharges will be readily apparent in Clearfield Creek. The water quality of the headwaters portion of the creek, including Cresson Lake, will be free of the effects of AMD and the creek's water quality will noticeably improve at least as far south as Muddy Run.

CLEARFIELD CREEK WATERSHED

ABATEMENT AREA B
BRUBAKER AND LITTLE LAUREL RUNS

Location

Abatement Area B consists of approximately 615 acres of strip mines along Brubaker and Little Laurel Runs, in the southern portion of the Clearfield Creek Watershed. The largely unreclaimed strip mines lie partially within State Games Lands No. 108 and 184 between the towns of Dean and Buckhorn in Cambria County, Pennsylvania. Thirty-eight acres of strip mines in the Tubb Run Watershed of the Little Juniata River Basin presently drain toward Brubaker Run, and have been included in the recommended abatement work.

Brubaker and Little Laurel Runs are major polluters of Clear field Creek south of Glen Hope. Sources listed in the mine drainage data section for Brubaker and Little Laurel Runs contribute an adjusted average yearly acid load of 5,940 and 3,120 lbs/day to these streams respectively. These same sources contribute an unadjusted 2,330 lbs/day acid to Brubaker Run and an unadjusted 680 lbs/day acid to Little Laurel Run. The relative locations of these two tributaries near Clearfield Creek's headwaters makes the acid load they discharge particularly critical, because they pollute the entire downstream length of the creek. Conversely, any successful abatement will have the farthest reaching effects, in terms of stream miles improved, and will be clearly evident as far north in Clearfield Creek as the town of Irvona .

The degrading effect of these two tributaries on Clearfield Creek is indicated by sample data obtained at main stream stations 1.1 and 10.0, located upstream and downstream from the abatement area, respectively. Nearly 25 tributaries, most of which are alkaline, enter Clearfield Creek between these stations, tripling its flow. The average net alkalinity of the stream decreases by 6 mg/l from station 1.1 to 10.0, despite the alkaline tributaries, which are responsible for at least two thirds of the stream's flow.

The effects of the acid loads of Brubaker and Little Laurel Runs on Clearfield Creek are evident as far downstream as station 29.71, just south of Muddy Run. Most of the tributaries entering Clearfield Creek in this interval are alkaline, as shown on the creek's Index Map of subwatershed modules, and some are fairly large. Despite the large alkaline load entering Clearfield Creek from these tributaries, the average net alkalinity at station 29.71 is only 2 mg/l higher than that recorded at station 1.1. Thus, although Clearfield Creek's water quality is actually marginal to good at station 29.71, the numerous alkaline tributaries to Clearfield Creek in this stretch are only sufficient to maintain the existing water quality by neutralizing acid, and only minimal improvement of the stream results. In addition, the stream has such a very low buffering capacity due to the acid that it is particularly vulnerable to acid slugs.

Geology

Brubaker and Little Laurel Runs are structurally situated on the southeast limb of the Houtzdale Syncline. Relief is extreme and all coals of the Allegheny Group from the Brookville-Clarion to the Upper Freeport outcrop within the two tributary watersheds. These same Allegheny Group rocks have been removed by erosion in the anticline just east of the abatement area. The strata in both Brubaker and Little Laurel Run Watersheds strike northeast-southwest and dip rather steeply to the northwest. No formal geologic work has been done in this abatement area, but some geologic information was obtained from old WPA mapping, recent mining permits, and the field investigation of the area. Relatively little of this information was deemed reliable and accurate enough to include on the Mine Development Drawing.

Mining

Much of the acid mine drainage in both watersheds emanates directly or indirectly from old deep mines. The entire area contains numerous drifts of extremely old and probably small deep mines on nearly all seams. There were also larger deep mines on several seams, and those in the acid "A" and "B" coals are now the major sources of acid mine drainage in this area.

Much of Brubaker Run's acid mine drainage discharges from the Red Ridge Mines and an unnamed deep mine northeast of its sample station 6.71, all of which were "B" seam workings. The acid entering the Little Laurel Run near the mouth is discharging from an "A" seam deep mine underlying strip mine #3, while "B" seam deep mines underlying strip mine #2 are discharging some of the acid entering the northern side of the stream. AMD polluting the headwaters of Little Laurel Run emanates from strip mine #1 at Buckhorn and also a deep mine bore hole and seepage area, probably associated with the "A" seam. Deep mine mapping was not available for this mine which apparently underlies part of strip mine #1 .

Strip mining in the Southern Clearfield Creek area began to replace deep mining early in the 1940's. Outcrops adjacent to and over many of the area's deep mines were stripped before reclamation was practiced, and most of the strip mines within both watersheds are unreclaimed. Within the Brubaker and Little Laurel Run abatement area, strip mines #2, 3, 5, 6, and 9, are totally unreclaimed, while varying degrees of reclamation work have been completed on strip mines #1, 4, 7, and 8.

Ridge Mining Company presently holds Water Permit 4272BSM8 and an 18.2 acre strip mining permit as shown adjacent to strip mine #5. There should be no difficulty in coordinating the Department of Environmental Resources's abatement work with the strip operations.

Mine Drainage and Hydrology

Deep and strip mines greatly alter the natural hydrologic system of the entire area. The unreclaimed and poorly vegetated strip mines intercept runoff from a large drainage area. Some of this water seeps downdip above impermeable underclays to the western ends of the strip mines, where it discharges from the spoil and enters the surface drainage network. This contact with spoil, particularly in the "A" and "B" seam strippings, results in acid formation, degrading the quality of the water exiting the strippings. The remaining runoff infiltrates downward into underlying deep mines which act as underdrains for the area. Where more than one seam has been deep mined, the water. generally passes through joints and fractures opened by caving to the lowest level of deep mining, which in this area is commonly the acid "A" or "B" seam. The water is channeled downdip through acid forming coal, bony and spoil material in the lower deep mines, and emerges as highly acid discharges at downdip or western crops of the deep mines. Several of these deep mine discharges also flow across or through acid producing bony material or strip mine spoil, further degrading water quality.

Water Quality

Unadjusted Environmental Protection Agency stream sample data collected between October 1966 and August 1967 attributed 2982 lbs/day

acid to the abatement area. Environmental Protection Agency's pollution source sampling for the same period revealed 1782 lbs/day acid discharging from the abatement area. Skelly and Loy's sample data for the mouths of Brubaker and Little Laurel Runs, collected between July and December 1972, and adjusted to represent a yearly average flow, showed the two combined streams to be the source of 3070 and 3750 lbs/day acid respectively.

Skelly and Loy's intensive pollution source sampling data for Brubaker Run, adjusted to a yearly average, showed that portion of the abatement area containing strip mines #4 through 9 to be contributing 5,940 lbs/day acid to Brubaker Run from eight discharges: 6.21, 6.23, 6.65, 6.69, 6.71,6.72,6.73, and 6.81. These discharges accounted for over 90% of the acid mine drainage entering Brubaker Run at the time of sampling.

Water quality data for Little Laurel Run was obtained in September and was adjusted to represent a yearly average. The data indicated acid discharges at the following sample stations: 6.11, 6.12, 6.13, 6.15, 6.32, 6.33, 6.35, 6.39, 6.43, 6.52, and 29.95. Discharges sampled at these locations accounted for 3,120 lbs/day acid.

Recommended Abatement

The abatement plan for Brubaker and Little Laurel Runs involves the improvement of each watershed's drainage network to promote

natural runoff. Reclamation will entail eliminating seepage through the strip mine spoil material and minimizing the amount of water that infiltrates downward into underlying deep mines.

The goals of the abatement plan will be achieved by the complete surface restoration pf 615 acres of strip mines within the two watersheds. This restoration will have the following results:

1. Decrease acid production in the strip area.
2. Increase runoff from strip mine surfaces.
3. Restore surface sufficiently to establish good vegetative cover.
4. Provide drainage diversion ditches and reconstruct surface channel areas to pass surface flow across and around strip mines.
5. Decrease infiltration through spoil into underlying deep mines.
6. Establish vegetation and return land to usefulness.

Minimum earthwork concepts win be employed as appropriate to decrease the permeability of the strip mine surfaces and effect quick runoff from the mines. The few bony piles within the abatement area will be buried to prevent contact with runoff and oxygen.

Surface restoration will be suited to the requirements of each particular strip mine within the abatement area. Limestone surface treatment is recommended for some of the "A" and "B" seam strippings because of associated high acidities. All regraded strip mine surfaces should be treated to obtain proper soil pH, then fertilized and seeded with grasses, legumes and gamefood species. Trees should be planted

with the ground cover where necessary to achieve slope stability. High-wall diversion ditches should collect surface flow and channel it directly to the receiving tributaries, thus eliminating contact with spoil material.

These steps will effectively minimize the interception of surface runoff by the area strip mines, and will reduce acid production by decreasing oxygen availability, burial of acid forming materials and by reducing the amount of water passing through acidic materials in the strip mines and the underlying deep mines.

The abatement plan should eliminate roughly 30%, or 1,782 lbs/day of the acid discharged from Brubaker Run and 35%, or 840 lbs/day, of the acid discharged from Little Laurel Run. The elimination of this 2,880 lbs/day acid from the mouths of Brubaker and Little Laurel Runs will significantly improve the water quality of Clearfield Creek all of the way downstream to Muddy Run. The net alkalinity of Clearfield Creek at station 29.71, 15 miles downstream from the abatement area, should increase by at least 18 mg/l. Such an increase in alkalinity at this point in Clearfield Creek would mean an additional alkaline load of over 5,000 lbs/day, and would greatly improve the present marginal quality of the stream at that station.

MINE DRAINAGE DATA

Little Laurel Run - strip mines 1-3

	SAMPLE		ACID	LOAD
Station #	Description	Strip Mine #	Unadjusted	Adjusted
6.11	strip seepage	2	9	48
6.12	strip seepage	2	29	156
6.13	strip seepage to L. L. Run	2	264	1425
6.15	seepage from strip mine	2	2	12
6.32	seepage from strip mine	1	40	216
6.35	seepage	1	10	54
6.43	unnamed trib to L. L. Run	2	20	108
6.52	seepage	3	10	54
29.95	deep mine discharge	-	128	128
6.39	strip seepage	2	31	167

Brubaker Run - strip mines 4-9

6.21	unnamed trib to Brubaker Run	4	95	600
6.23	unnamed trib to Brubaker Run	7,5	290	562
6.65	seepage	5	2	13
6.69	unnamed trib to Brubaker Run	5	10	63
6.71	air seal overflow	5,8,9,	1416	1416
6. 72	seep from bony	-	333	2105
6.73	spoil seepage	9	163	1030
6.81	Clearfield Creek	-	24	151

Estimated Construction Cost

Little Laurel Run

Strip Mine #1

Fertilize and revegetate partially reclaimed strip mine.

80 Ac @ $400/Ac = $32,000

Strip Mine #2

Backfill, regrade, add fertilizers and limestone, revegetate, construct diversion ditches, and flumes as required.

115 Ac @ $2500/ Ac = $287,500

Strip Mine #3

Backfill, regrade, add limestone and fertilizers, revegetate, construct diversion ditches and flumes as necessary.

84 Ac @ $2600/ Ac = $218,400

Total Cost, Strip Mines #1-3 = $537,900

Brubaker Run

Strip Mine #4

Fertilize and revegetate 33 Ac of previously regraded stripping.

33 Ac @ $500/Ac = $16,500

Backfill highwall, regrade, fertilize, revegetate, construct diversion ditches and flumes as necessary in strip with rounded spoil piles.

17 Ac @ $2 100/ Ac = $35,700

Strip Mine #5

Backfill, regrade, add limestone and fertilizers, revegetate, construct diversion ditches and flumes as necessary.

123 Ac @ $3000/ Ac = $369,000

Backfill, regrade, add fertilizers and limestone, and revegetate stripping with rounded spoil piles.

41 Ac @ $2600/Ac = $106,600

Strip Mine #6

Backfill to bury bony material, regrade, fertilize, revegetate, construct diversion ditches and flumes as required.

7.4 Ac @ $2600/Ac =$19,240

Strip Mine #7

Regrade as necessary, add limestone and fertilizers, revegetate partially reclaimed strip mine.

69 Ac @ $1200/Ac = $82,800

Strip Mine #8

Regrade as necessary, add limestone and fertilizers, revegetate, construct diversion ditches and flumes as necessary, partially reclaimed strip mine.

28 Ac @ $1200/Ac = $33,600

Strip Mine #9

Backfill, regrade, add limestone and fertilizers, and revegetate single strip cut.

13 Ac @ $2600/ Ac = $33,800

Fertilize and revegetate easternmost 4 Ac

4 Ac @ $355/Ac = $1420

Total Cost, Strip Mines #4-9 = $698,660

Total Estimated Cost, Abatement Area B = $1,234,520

Call: $1,235,000

Cost Effectiveness

Strip Mine #1

$49,200 per 94 lbs/day = $520 per lb/day acid abated.

Strip Mine #2

$287,500 per 670 lbs/day = $430 per lb/day acid abated.

Strip Mine #3

$218,400 per 19 lbs/day = $11,500 per lb/day acid abated.

Strip Mine #4

$52,200 per 180 lbs/day = $290 per lb/day acid abated.

Strip Mine #5

$475,600 per 1,224 lbs/day = $388 per lb/day acid abated.

Strip Mine #6

Cost effectiveness is difficult to estimate. The mine area is close to an active site and may be reclaimed by the operator.

Strip Mine #7

$82,800 per 84 lbs/day = $985 per lb/day acid abated.

Strip Mine #8

$36,600 per 142 lbs/day = $237 per lb/day acid abated.

Strip Mine #9

$35,220 per 450 lbs/day = $78 per lb/day acid abated.

Overall Cost Effectiveness

$1,235,000 per 2620 lbs/day = $471 per lb/day acid abated.