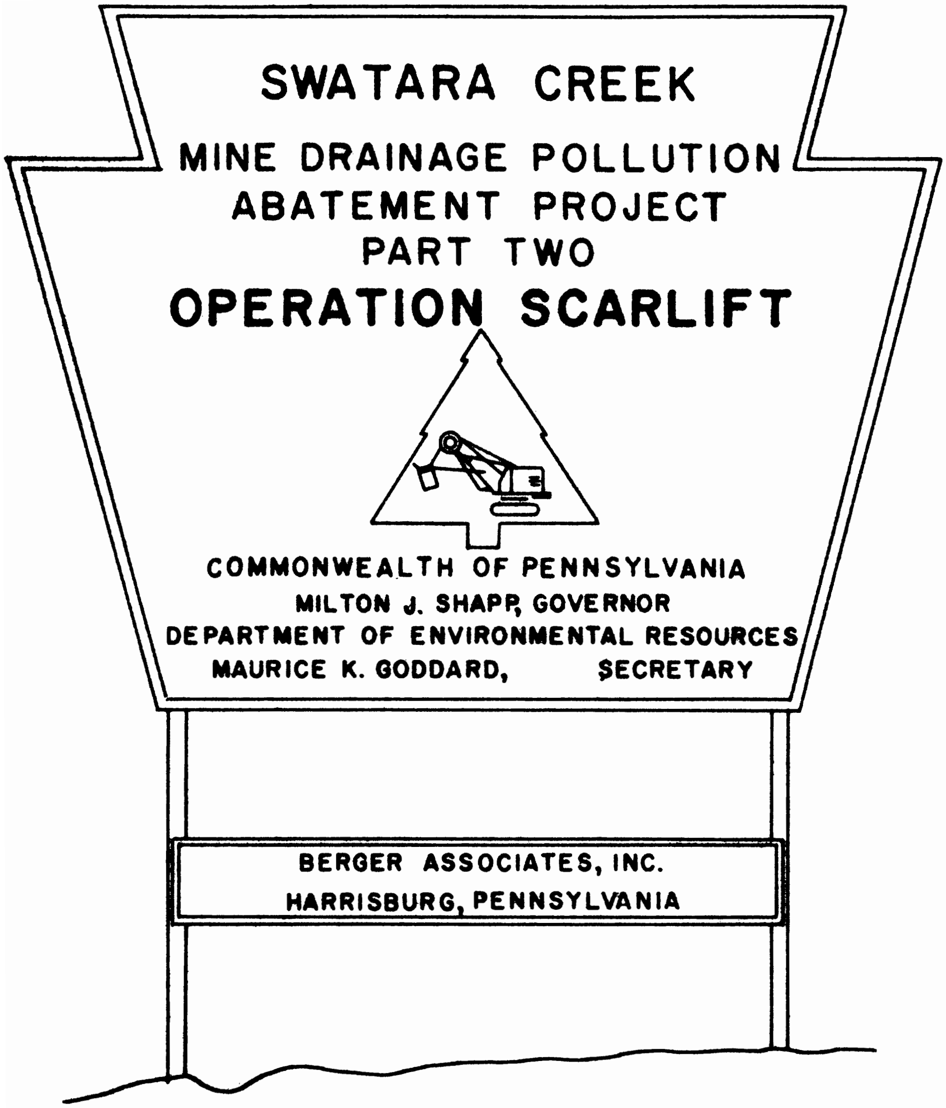

RECOMMENDATIONS

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GENERAL

The report recommends a remedial program by individual sub-areas wuch as mine pools or strip pit regions. In this manner remedial work can be concentrated in a given sub-area before work is undertaken in another sub-area.

In the event that the DER may not wish to proceed on a sub area basis a list has been included at the end of this section indicating an alternative program consisting of a series of individual Civil Engineering remedial projects.

PRIORITIES

In considering priorities of sub-areas a combination of factors was considered. These include the relative total acid produced, cost per pound of acid abated and location of the sub-area with respect to populated areas. (Potential land use is a byproduct factor of AMD reclamation and is not a stated objective of the Clean Streams Law). Consideration was also given to sub-areas which contribute potential acidic water to the more sever mine pool overflows.

A complete listing of the priorities is contained in the Cost Analysis Section VI-D at the end of the report, including Tables A, B, C and D. The mine pools and/or strip pit regions are as follows:

Priority	Sub Area
1	Middle Creek Mine Pool
2	Good Spring No.3 Mine pool
3	Indian Head Mine Pool
4	Colket Mine Pool
5	Westwood Area
6	Northern Strip Pit Area
7	Donaldson Strip Area
8	Southern Strip Pit Area
9	Good Spring No.1 Mine Pool

The Middle Creek Mine Pool area was recommended for first priority since its overflow point, the Tracy overflow, contributes more than approximately 44 percent of the total acid from the study area. While the cost of remedial work in this area is high, the cost ratio, is generally good. The cost of reclamation work is high due to the multiple coal veins involved (6-10) and the steep terrain. It is felt that remedial work in this area attacks the most serious problem first and therefore should yield the greatest reduction in total acid produced in the study area.

RECOMMENDED REMEDIAL PROGRAM COSTS

The recommended remedial program is presented in two phases with an alternative first phase.

The First Phase includes all Civil Engineering types of projects and is estimated to cost $5,217,800 and should abate 45% of the AMD being discharged in the study area:

A, Partial Regrading of Specific Strip Pits	$268,600
B. Partial Regrading of Large Areas Over Mine Pools	$2,376,850
C. Planting Disturbed Areas (2,265 Acres)	$501,150
D. Stream and Ditch Construction, Restoration (Linings, Flumes) and Relocations	$950,500
E. Hydraulic Mine Seals	$459,700
F. Hydroseeding of Inactive Refuse Banks and Perimeter of Slush Dams	$435,700
G. Other – Impervious Dikes, Plugs, grout Curtains, Pond Relocations in Slush Dams, etc.	$226,000
TOTAL FIRST PHASE	$5,217,800

NOTES

Costs have also been presented for a First Phase (Alternative) which includes the additional costs of total regarding and an alternative procedure for refuse banks and slush dams if a successful hydroseeding procedure cannot be developed. The additional costs is $7,728,900 for a total First Phase Cost of $12,946,700.

A. (First Phase)	$5,217,800
B. Total Regrading of Strip Pits add an additional	$4,898,700
C. Spread Out Inactive Refuse Banks, Cover with Spoil and Plant	$1,040,700
D. Regrade perimeter banks of Inactive Slush Dams, cover with spoil and plant	$1,789,500
TOTAL FIRST PHASE	$12,946,700

Total regarding of a type of approaching contour regarding is not recommended due to the high costs and the fact that it is not necessary for AMD abatement. A slightly higher abatement percentage is estimated – 48% of the pollution load but the additional expense is not warranted.

The alternative procedure of spreading out refuse material to a maxium 3:1 slope covering with 8-10 feet of soil and planting may be warranted since the feasibility of successful direct hydroseeding of refuse material is in doubt. This is especially true of refuse material existing within steep slopes. Again, the cost of spreading out, covering and planting appears high but the cost ratio for this remedial work is good when the total acid produced is considered.

The Second Phase is recommended to include the construction of a central lime neutralization treatment plant and collection system. This will cost an estimated $1,844,000 and is estimated to abate an additional 41% of the pollution load. Total annual costs are estimated to be $226,500, including operation, maintenance, and debt service.

A. Lime Neutralization Plant	$1,600,000
B. Collection System	$244,000
TOTAL	$1,844,000

The implementation of the recommended First and Second Phase will cost a total of $7,061,800 and is estimated to abate a total of 86% of the pollution load. If refuse material is spread out, covered and planted the total program cost is $9,892,000.

ALTERNATIVE PROGRAM (Series of Individual Projects)

In the even that the Department may not wish to proceed with a remedial program of complete sub-areas, a list has been included indicating a series of individual Civil Engineering type remediation. The list is arranged by increasing cost pre pound of acid abated. No attempt has been made to define relative project feasibility, etc. and the actual order of priorities may be somewhat different after all factors are considered.

~~priorities may be somewhat different after all factors are considered.~~ On the assumption that refuse hydroseeding may not be successful, costs have been included for the alternative method of spreading out refuse, covering with earth and planting. The list provides a reference from which individual remedial projects can be selected.

In considering remedial projects a cost/abatement ratio of $1,000 per pound of acid abated is often mentioned, particularly with respect to the Bituminous Regions of the state. However, it is believed that a controlling cost/abatement ratio much higher than this must be used when considering projects in the Anthracite Region. This occurs for several reasons:

1. Generally weaker acid discharges than those encountered in the Bituminous Regions. (Although the area streams are no less devoid of aquatic life).

2. In some areas multiple vein strippings were made in close proximity to each other and were carried to greater depths (as previously discussed). This causes a considerable grading deficiency when reclaiming abandoned strippings.

3. Due to the steep dip of coal veins as exists in the Southern Anthracite Field a much greater amount of previously unexcavated material must be moved if it is desired to achieve either contour backfilling or the standard type of terrace backfilling. This is not the case in the Bituminous Regions where the coal veins lie relatively horizontal.

Project	Est. Cost $	Est. Acid (lbs/ Day)	Est. Efficiency (%)	Est. Acid Abated (lbs/ Day	Cost/lb Acid Abated $	Percent of Total Abatement
No.1 - Martins Run flume across Mammoth Vein Strippings C-34	58,900	(1)	(1)	(1)	100 Est.	(1)
No.2 - Clay plugs in ends of strip pits, dike around lower strip pit, grout curtain across syncline seepage. GS-119A	30,000	319	0.70	223	135	2.50
No.3 - Relocate Gebhard Run adjacent to Indian Head "Rock Pile" and Slush Dam C-37/C-38	61,500	(2)	(2)	(2)	240 Est.	(2)

Project	Est. Cost	Est. Acid (lbs/ Day)	Est. Effi- ciency (%)	Est. Acid Abated (lbs/ Day	Cost/lb Acid Abated	Percent of Total Abate- ment
No.4 - Hydraulic Mine Seal at Fasnacht Drift No.1 GS-62	15,000	56	0.90	50	300	0.60
No.5 - Remotely placed hydraulic mine seal in First Lift Tunnel GS-95	125,000	397	0.90	357	350	3.90
No.6 - Hydraulic mine seal in No.1 Tunnel GS-95	45,000	199	0.95	189	238	2.10
No.7 - Hydraulic mine seal in abandoned drift mine GS-79	10,000	23	0.90	21	477	0.20
No.8 - Regrade spoil into lake, open trench and plant. MC-1	37,200	105	0.60	63	590	0.70
No.9 - Regrade Donaldson Refuse Banks and Slush Dams, cover with earth and plant GS-112	370,500	1,012	0.60	607	610	6.83
No.10 - Hydraulic mine seal in abandoned drift mine GS-78	10,000	19	0.80	15	667	0.16
No.11 - Middle Creek channel lining across Mammoth Vein strippings C-34	99,714	(3)	(3)	(3)	1,110 Est.	(3)
No.12 - Regrade proving trench GS-120	2,500	2	0.70	2	1,250	0.01
No.13 - Regrade PenAg Refuse and Slush Dam, cover with earth and plant GS-95	383,300	548	0.55	300	1,280	3.20
No.14 - Interceptor ditches, regrade strippings over mine pool. C-34	1,499,800	1,920	0.45	865	1,730	8.90
No.15 - Regrade strippings on hill above mine including impervious seal. GS-72	17,250	12	0.70	9	1,920	0.10

Project	Est. Cost	Est. Acid (lbs/ Day)	Est. Efficiency (%)	Est. Acid Abated (lbs/ Day	Cost/lb Acid Abated	Percent of Total Abatement
No.16 - Regrade southern strip pit region of 552 Acres GS-106 etc.	280,500	206	0.70	145	1,935	1.60
No.17 - Regrade Good Spring No.1 Refuse, cover with earth and plant GS-96	217,200	224	0.50	112	1,940	1.30
No.18 - Regrade strippings on hill above mine including impervious seal GS-73	17,250	11	0.70	8	2,160	0.09
No.19 - Regrade stripping and flume ditch across the area GS-122	47,450	(4)	(4)	(4)	2,220 Est.	(4)
No.20 - Regrade stripping including impervious seal. GS-118	17,900	11	0.70	8	2,240	0.09
No.21 - Regrade Westwood Refuse and Slush Dam, cover with earth and plant. GS-119A	369,700	391	0.40	156	2,370	1.80
No.22 - Regrade strippings over mine pool, dike at shaft, move basin, etc. C-37/C-38	135,800	184	0.30	55	2,470	0.60
No.23 - Hydraulic mine seal in abandoned mine GS-23	10,000	5	0.90	4	2,500	0.04
No.24 - Middle Creek channel lining adjacent to Indian Head Pool and Indian Head Slush Dam C-37/C-38	270,186	(5)	(5)	(5)	2,620 Est.	(5)
No.25 - Regrade spoil into lake and plant MC-2	5,500	3	0.70	2	2,750	0.01
No.26 - Regrade Indian Head Refuse and Slush Dam, cover with earth and plant C-37/C-38	2,097,200	1,288	0.55	705	2,980	7.80

Project	Est. Cost	Est. Acid (lbs/ Day)	Est. Effi- ciency (%)	Est. Acid Abated (lbs/ Day	Cost/lb Acid Abated	Percent of Total Abate- ment
No.27 - Interceptor ditches, flumes, regrade strippings over mine pool. MR-53	394,750	355	0.35	127	3,110	1.40
No.28 - Hydraulic mine seal, in Tracy Airhole and unnamed airway GS-95	70,000	(6)	(6)	(6)	3,230 Est.	(6)
No.29 - Interceptor ditches, regrade strip- pings over mine pool. (No hydraulic mine seals) GS-95	344,900	(7)	(7)	(7)	3,530 Est.	(7)
No.30 - Regrade including adjacent stripping GS-100	31,700	11	0.70	8	3,970	0.09
No.31 - Regrade northern strip pit region of 173 acres. MC-1	87,100	40	0.50	20	4,350	0.22
No.32 - Regrade stripping including impervious seal. GS-117	35,900	7	0.60	4	9,000	0.04
No.33 - Regrade nearby strippings leaching acid G-21	37,200	6	0.70	4	9,300	0.04
No.34 - Three hydraulic mine seals GS-96	174,000	40	0.45	18	9,680	0.20
No.35 - Interceptor ditches, flumes, regrade strippings over mine pool. GS-96	441,100	146	0.30	44	10,000	0.45
No.36 - Regrade strips to drain including im- pervious seal. GS-116	21,900	2	0.70	2	10,950	0.02
No.37 - Regrade strip- ping including impervious seal. GS-136	61,900	8 (8)	0.60	5	12,400	0.06

Project	Est. Cost	Est. Acid (lbs/ Day)	Est. Effi- ciency (%)	Est. Acid Abated (lbs/ Day	Cost/lb Acid Abated	Percent of Total Abate- ment
No.38 - Regrade strippings including impervious seal. GS-137	17,900	1 (8)	0.70	1	18,000	0.01
No.39 - Regrade stripping including energy dissipators left and right of I-81. GS-138	95,300	2 (8)	0.70	2	47,600	0.01
	$8,048,000	9,403		4,131		45.07%

Footnote:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Included in Project Number:	21	26	14	27	22	5 & 6	5, 6 & 28

(8) Acid is from strip mine overflow only. Would be considerably higher if contribution of mine pool were included.

OTHER

1. A water quality improvement evaluation program should be implemented to monitor the stream quality as the various recommended pollution abatement projects are completed.

2. A maintenance program should be undertaken to periodically inspect partial regrading where crop falls may have developed resulting in loss of drainage. An example is the eastern end of the PenAg stripping in the Lykens Valley 2 Vein, regraded after World War II, where drainage is lost just before the drainage from the regraded stripping was intended to outlet. (This should be remedied in conjunction with other projects undertaken in the area).

3. An In-Situ Treatment Plant has been seriously considered in the Middle Creek Mine Pool. The logical location would have been a tunnel near the southern limit of the main part of the pool since all of the water must pass through this point.

We still believe that this type of treatment has merit but the procedure is of a research and development nature. It is recommended that more general research be completed on this process. The vast Middle Creek Mine Pool (3 miles long and one half mile wide) is felt to be too large for experimentation. Short circuiting could possibly occur through the remainder of the pool to the Tracy Overflow causing a severe restriction in capacity to store precipitated sludge. (In its fully hydrated form lime sludge may be as much as one third the total volume, and would likely reduce the effectiveness and life of the treatment facility).

Advantages of in-situ treatment include savings in land costs, plant equipment (clarifier, sludge basins, sludge disposal equipment), and operating costs.