III RECOMMENDATIONS

ACID MINE DRAINAGE ABATEMENT MEASURES

The following are possible methods of treating or abating acid mine drainage considered for implementation on the Anderson Creek Watershed. These were considered singularly and in combination with other methods to prevent or abate acid mine drainage pollution in the study area. The principle in abating acid mine drainage is primarily two-fold: 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 which carry acid to streams, wells, or springs. The concept behind this two-fold approach to abatement of acid mine drainage is incorporated in most of the following recommended abatement procedures.

1. Restore strip mine areas.

   The purpose here is to induce runoff of surface water rather than impoundment. 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 refuse pile materials in old strip mines surface water cannot come into contact with the acid forming materials 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 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 area prevent the contact of surface water with acidic materials. This measure also red uces the quantity of water percolating down through the acid producing materials.

5. Chemical neutralization of strip 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.

6. Pressure treat spoils by lime slurry injection.

A slurry composed of 5 to 10% hydrated lime, 90 to 95% pulv erized 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 but the cost of such an operation is often prohibitive.

7. Inundate deep mine workings.

Inundation of deep mine workings raises the ground water table and prevents atmospheric oxygen from coming into contact with acid producing material, thus improving the quality of discharges at higher elevations should they occur. The mine entries are sealed by curtain grouting, excavating and placing impermeable material around the periphery of deep mine workings, to the extent necessary to inundate the workings.

This method is very effective when inactive workings are completely inundated. The application of this method is limited in areas where overburden or surrounding material is highly fractured or fissured.

8. Close deep mine entries.

Placing impervious seals at mine entries prevents discharges from the mine as well as incursions of surface water into the workings where it can pick up acid. This method is limited by other openings into the workings, either man-made or natural.

In Exhibit No. 10 a typical deep mine seal is shown.

9. Construct barriers in deep mines.

Barriers serve to inundate portions of the deep mine workings prohibiting oxidation of acid forming materials. These barriers may also be used to divert flow of water from areas of the workings where acid is heavy to areas where the problem is less severe.

This procedure is generally not feasible because it often requires considerable preparation to insure the safety of the individuals installing the barriers.

10. Air seal deep mine openings.

The intent of constructing air tight seals is to prevent atmospheric oxygen contact with acid producing materials.

This measure has met with limited success because of the many ways air can reach the workings such as through fissures in the overburden, air holes, and breakthrough areas.

11. 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 strip mining. This will require the use of heavy equipment to excavate overburden or collapsing with explosives.

This procedure is quite costly and therefore not feasible except in the most severe cases.

12. 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 and regraded to induce runoff.

13. 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.

14. 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.

15. Chemically neutralize acid mine drainage at on-stream facilities.

This method calls for treatment of the acid water before discharging it into a stream. Chemical treatment facilities may be of several types.

One of the problems involved with this type of operation is the continuing cost of operation and maintenance. Also, chemical treatment usually results in the precipitation of solids which present a problem of disposal.

16. Deep well injection.

Significant amounts of acid mine drainage may be injected into deep seated disposal wells which penetrate the strata sufficiently deep to prevent the acid water from entering the aquifers of the area.

17. Controlled discharge.

In places where acid water is discharging into a relatively unpolluted stream the amount of discharge may be regulated to allow only that amount of acid water to enter the stream as the stream can accept without substantially lowering its pH.

Obviously, this procedure would be useless in areas producing constant, large amounts of acid mine drainage.

18. Spraying of acid mine drainage over a large area of ground.

This procedure uses the natural process of absorption, evaporation, and transpiration to harmlessly dispose of acid water.

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.

AREA I

This area north of Anderson Creek just west of Curwensville has been the site of deep mining, probably for the Mercer clay. The workings are quite old with six openings present, two of which are distinguishable. Attempts to locate information concerning this operation proved unsuccessful and it is therefore assumed that all of the entries lead to one mine complex.

Acid mine drainage is being discharged from one of the deep mine entries. Although the water quality is quite poor the flow is so small that the problem is not serious. The average flow from this opening is 2 g.p.m. producing an acid load of 3 pounds per day.

To abate the acid mine drainage from this deep mine and to insure against possible break, outs all six entries should be sealed. Sealing the entries could be done most economically by installing a clay barrier approximately fifteen feet high and ten feet thick along the base of the hill into which the drifts enter. This barrier should be placed just inside the openings and excavated a few feet into the floor of the drift. Where the availability of material permits, the drift area should be backfilled over the barrier to serve as additional reinforcement. The small discharge and the attitude of the drifts with respect to the general dip of the strata in the area indicate that the clay was mined to the dip. The resulting hydraulic head would be insignificant allowing the clay barrier to contain the little water which is escaping. See Project Map No. 1 on page 120.

Estimated Cost:

800 L.F. of clay barrier (approximate 15' x 10') @ $800/100 ft.	$6,400
Backfill 1 acre @ $300/acre	300
Total	$6,700
Projected cost per lb. of acid/day	$2,230

AREA II

This area is the site of the Way Mine, a deep mine once operated by the Harbison Walker Refractories Company in the Mercer clay seam. The mine is essentially two main headings, to the rise, with more extensive workings in only two places.

Acid mine drainage flows from the entry of the mine workings. The average flow of acid water is 30 g.p.m. or about 5 pounds of acid per day.

Although the flow from, the mine is not particularly great the ultimate hydraulic head could reach 150 feet. A mine seal at the entry of the mine alone would not be adequate due to the magnitud e of the hydraulic head; therefore, two seals should be used. The second seal should be placed approximately 1700 feet from the entry. The seal should be placed from the surface 'by drilling. After this seal is in place a concrete block and clay seal may b e safely installed a short distance inside the mine opening. Two seals at the locations specified would, in fact, reduce the hydraulic head on each seal to 75 feet. Sealing of the mine will result in the inundation of the mine workings, thus covering the acid producing materials. It should be noted, however, that failure of the upper seal would place the entire hydraulic head on the entry seal greatly increasing the possibility of a break out. See Project Map No. 1 on page 120.

Estimated Costs:

1 Deep Mine Seal @ $25,000 ea.	$25,000
1 Deep Mine Seal @ $50,000 ea.	50,000
Total	$75,000
Projected cost per lb. of acid/day	$15,000

AREA III

No mining activities ere apparent in this area. The discharge sampled is e spring originating in the Homewood Sandstone. The spring was sampled for e period of four months to investigate the relative acid contribution from e non-mining source.

During the period monitored, this spring had en average flow of 204 g.p.m. end contributed 13 pounds of acid daily.

Although there is no apparent solution for the abatement of acid from e source of this type it serves to substantiate the existence of "natural acidity" which can greatly effect the quality of ground water. No reclamation measures were proposed for this Area. This area contained sampling point No. 102. See Project Map 2, page 121.

AREA IV

Mining activities in this area consisted of both strip and deep mines in the Mercer clay seam. Only one deep mine opening is apparent and danger of breakouts along the strip cut exists if the deep mine opening is sealed since stripping has occurred very close to the deep mine workings.

At present acid water is flowing from the deep mine entry at an average rate of 47 g.p.m., constituting an average acid output of 32 lbs./day. Acid water is also flowing from the strip cut in two places with a combined average flow of about 3 g.p.m. contributing 2 pounds of acid per day.

The deep mine entry should be sealed, using a concrete block and clay seal to fill the opening with water and thus prevent or limit oxidation and subsequent acid production.

A clay barrier approximately 25 feet high and 20 feet thick at its base should be constructed along the highwall at locations contiguous to the deep mine workings to prevent breakouts after the deep mine has been sealed.

The entire area should then be backfilled and compacted, as high up the highwall as the availability of material will permit, to provide adequate drainage and to reinforce the clay barrier. Slopes should then be planted with suitable grasses to control erosion. A diversion ditch should be constructed along the top of the highwall to divert surface drainage away from the backfilled material. See Project Map No. 2 on page 121.

Estimated Costs:

1 concrete block deep mine seal (including excavation)	$12,500
600 feet clay barrier @ $1200/100 feet	7,200
Backfilling and planting 4.2 acres @ $1000/acre	4,200
Total	$23,900
Projected cost per lb. of acid/day	$ 700

AREA V

This area has apparently been deep mined for the Mercer clay in the past but has since been stripped. There is no evidence of deep mine workings. Stripping operations have resulted in several cuts and depressions.

Acid water flows from one of the cuts. The flow is not large, averaging 5 g.p.m. and producing 5 lbs. of acid/day.

This area should be backfilled to provide positive drainage for surface water and limit percolation through the spoils.

A diversion ditch should be constructed to carry surface water around the affected area.

Finally, the backfilled area should be planted with grasses to control erosion. See Project Map No. 2 on page 121.

Estimated costs:

Backfill and plant	$3,000
Projected cost per lb. of acid/day	$ 600

AREA VI

This area has been strip mined for coal and has been partially restored. A thick growth of evergreens covers much of the spoil area. Water is emerging from the spoil at one major location and surface runoff from the stripped area collects in a swampy area that forms the headwaters of a small tributary to Anderson Creek.

The average flow of the total acid discharge at this location is 14 g.p.m. with a daily acid load of 20 pounds.

The Clearfield Clay Products Company of Clearfield, Pennsylvania is planning to strip mine clay at this location. No reclamation plan is being presented for this area since the reclamation of the anticipated clay mining operation will undoubtedly abate the acid mine drainage problem associated with the abandoned coal operation. See Project Map No. 4 page 123.

AREA VII

This area has experienced limited strip mining and includes a small drift mine not more than 40 feet long. An adjacent spring has formed a pond in a depression at the entry to the deep mine.

Acid water is presently flowing from a long narrow strip cut along the old highwall. The average flow is 19 g.p.m. yielding approximately 3 lbs. acid/day.

The area should be backfilled to provide positive drainage for surface water.

Slopes and graded area should be planted with grasses to prevent erosion.

A channel should be provided for the spring to divert the water away from restored area. See Project Map No. 3 on page 122.

Estimated Cost:

Backfill and plant	$1,800
Projected cost per lb. of acid/day	$ 600

AREA VIII

This area is a small deep mine which has apparently been inactive for some time. Only one entry is apparent and the size of the refuse pile suggests that the mine was not very extensive. The workings were apparently in the Mercer clay.

Acid water is discharging from the mine opening at the rate of 15 g.p.m. contributing 11 lbs. of acid daily.

The deep mine entry should be sealed by excavating behind the subsidence area and placing a concrete block and clay seal. The seal will cause flooding of the workings thus eliminating oxidation of pyrite and subsequent acid production. See Project Map No. 5 on page 124.

Estimated Costs:

Deep Mine Seal	$10,000
Projected cost per pound of acid/day	$ 910

AREA IX

These two small deep mines were operated privately from 1940 to 1946. According to the land owner and former operator they are about 150 feet and 500 feet long. The entries are located about 30 feet apart but the two drifts are not connected.

At present acid drainage is coming from one entry. The average flow is about 10 g.p.m. which constitutes 5 lbs. acid/day.

Concrete block and clay deep mine seals should be installed in the two drifts to prevent the discharge of acid water. These seals should be placed by excavation at a point above the last subsidence area. See Project Map No. 4 on page 123.

Estimated Cost:

2 concrete block and clay deep mine seals @ $7500	$15,000
Projected cost per lb. of acid/day	$ 3,000

AREA X

This area has been strip mined for Upper Kittanning and Lower Freeport coal as well as the underclay. Three strip cuts serve as gravity drains for the area and discharge acid water. The average flow of these discharges are 34 g.p.m., 6 g.p.m., and 14 g.p.m. and account for a combined average acid output of 8 lbs/day.

Anticipated mining operations of Union Clay Company, presently active at this location, should abate the acid mine drainage from this source. No reclamation measures were proposed for this Area. See Project Map No. 5 on page 124.

AREA XI

This project is a strip mined area completely surrounding a hilltop with a highwall ranging from 25 feet high to 50 feet high. Water collects in the strip cut on the southeast side of the hill percolating through the spoil material and out at the toe of the spoil bank.

The average flow for this discharge is 12 g.p.m. producing an acid load of 130 lbs. of acid per day.

A clay barrier should be constructed along the highwall on the southern (downdip) side of the hill to prevent the water from seeping through the highwall.

The stripped area should then be backfilled as high up the highwall as the availability of material will permit, to reinforce the clay barrier and provide positive drainage.

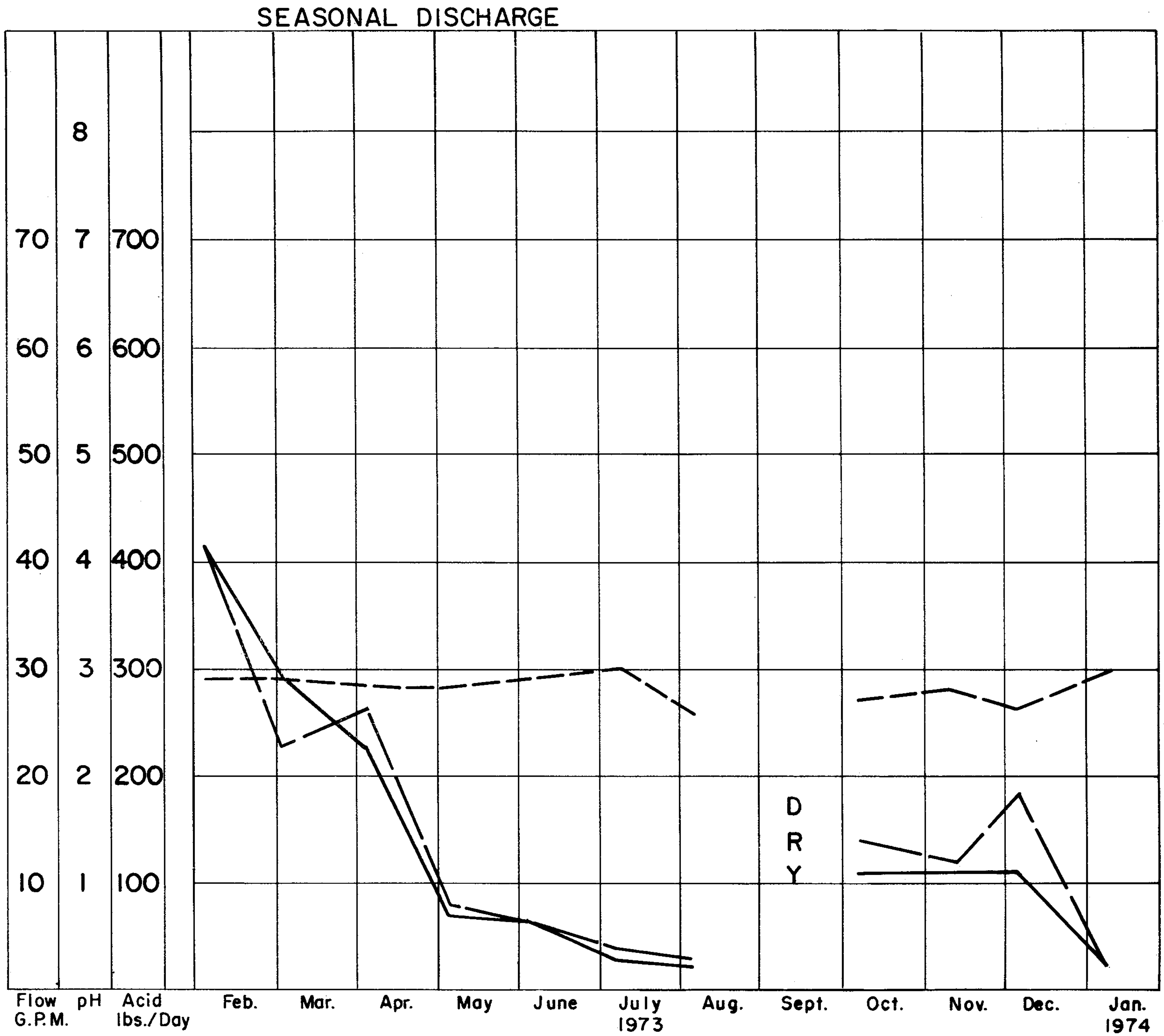
A diversion ditch should be constructed along the top of the highwall to prevent surface water from eroding the restored area. A slope drain flume will be needed to carry the water from the diversion ditch across the spoil material.

The slopes should then be planted with grass to control erosion.
See Project Map No. 5 on page 124.

Estimated Costs:

Backfill and plant	12.5 acres @ $2000/acre	$25,000
Clay Barrier 15 feet high, 10 feet wide at base 1050 L.F. @ $800/100'		8,400
Slope Drain Flume , section pipe 300 L.F. @ $15.00/L.F.		4,500
	Total	$37,900
Projected cost per lb. of acid/day		$ 290

PROJECT AREA XI
DISCHARGE NO. 204



AREA XII

This area has been strip mined and replanted with evergreens which are, in places, 6 to 8 feet tall. Surface water collects in the trough along the base of the highwall and filters down through the spoil seeping out along the toe.

Acid water emerges from the spoil at two defined points with an average discharge of 14 g.p.m. and 15 g.p.m. The combined average acid output is 2 lb/day.

The stripped area should be backfilled, sloping away from highwall to eliminate surface depressions and provide positive drainage.

A diversion ditch constructed along the top of the highwall will divert surface water away from the backfilled area.

A suitable grass mixture should be planted to prevent erosion. See Project Map No. 6 on page 125.

Approximate Cost:

Backfill and Plant	7.8 Acres @ $1500/acre	$11,700
Projected cost per lb. of acid/day		$ 5,850

AREA XIII

This tract was strip mined for coal. There is a 20 foot highwall and the area has been partially backfilled and planted with evergreens. At present the trees range to a height of 10 feet.

Water collecting in the strip cut consists of both surface runoff and seepage from the highwall. This water seeps through the spoil material emerging eventually at the toe of the spoil. Average flow for this discharge is 12 g.p.m., producing 1 lb. of acid daily.

A clay barrier constructed along the highwall will prevent seepage of acid water. This barrier should be about 15 feet high and 10 feet thick at its base.

The area should be backfilled to provide positive drainage for surface water and to reinforce the clay barrier.

A diversion ditch should be constructed to divert_ surface drainage away from backfilled area.

The slopes should be planted with a suitable grass mixture to control erosion. See Project Map No. 6 on page 125.

Estimated Costs:

Clay Barrier 650 L.F. @ $800/100 ft.	$5,200
Backfill and Plant 3 Acres @ $1200/acre	3,600
Total	$8,800
Projected cost per lb. of acid/day	$8,800

AREA XIV

This area has been strip mined for coal and partially backfilled, and has a growth of small evergreens. Water collects in depressions at the base of a relatively low highwall and eventually travels through the spoil emerging as acid water. The water collects in a pond and is discharged.

Acid water is discharged from the pond at an average of 45 g.p.m. which contributes 18 lbs/day of acid to Bilger Run.

The entire area should be backfilled to provide positive drainage away from the highwall. The pond should be backfilled.

A diversion ditch should be constructed along the top of the highwall to carry surface drainage away from spoil material.

Slopes should be planted with a suitable grass mixture to prevent erosion. See Project Map No. 6 on page 125.

Estimated Cost:

Backfill & Plant	10.8 acres @ $1000/acre	$10,800
Projected cost per lb. of acid/day		$ 600

AREA XV

This area was deep mined for coal. There are two openings present. The area surrounding one opening has been slightly stripped.

Acid water is emerging from one opening. The average flow is 3 g.p.m. and the acid load averages 1 lb. per day.

Deep mine seals of concrete block & clay should be installed in each entry by excavation to prevent drainage from the mine. See Project Map No. 6 on page 125.

Estimated Costs:

Install 2 Deep Mine Seals @ $8,000 ea.	$16,000
Projected Cost per lb. Of acid/day	$16,000

AREA XVI

This project is a large strip mined area. Two or more seams of coal were apparently mined here, and were probably the Brookville and one or more of the Kittanning seams. It has been fairly well backfilled and contains a sparse growth of small evergreens.

Acid mine drainage flows from the spoil in numerous locations with 4 major discharges. The discharges represent a very significant flow of acid water which eventually flows into Bilger Run. The average flow is 253 g.p.m. and the average daily acid output is 904 lbs. of acid.

The strip area should be backfilled and graded to eliminate surface depressions and water pockets thereby providing positive drainage.

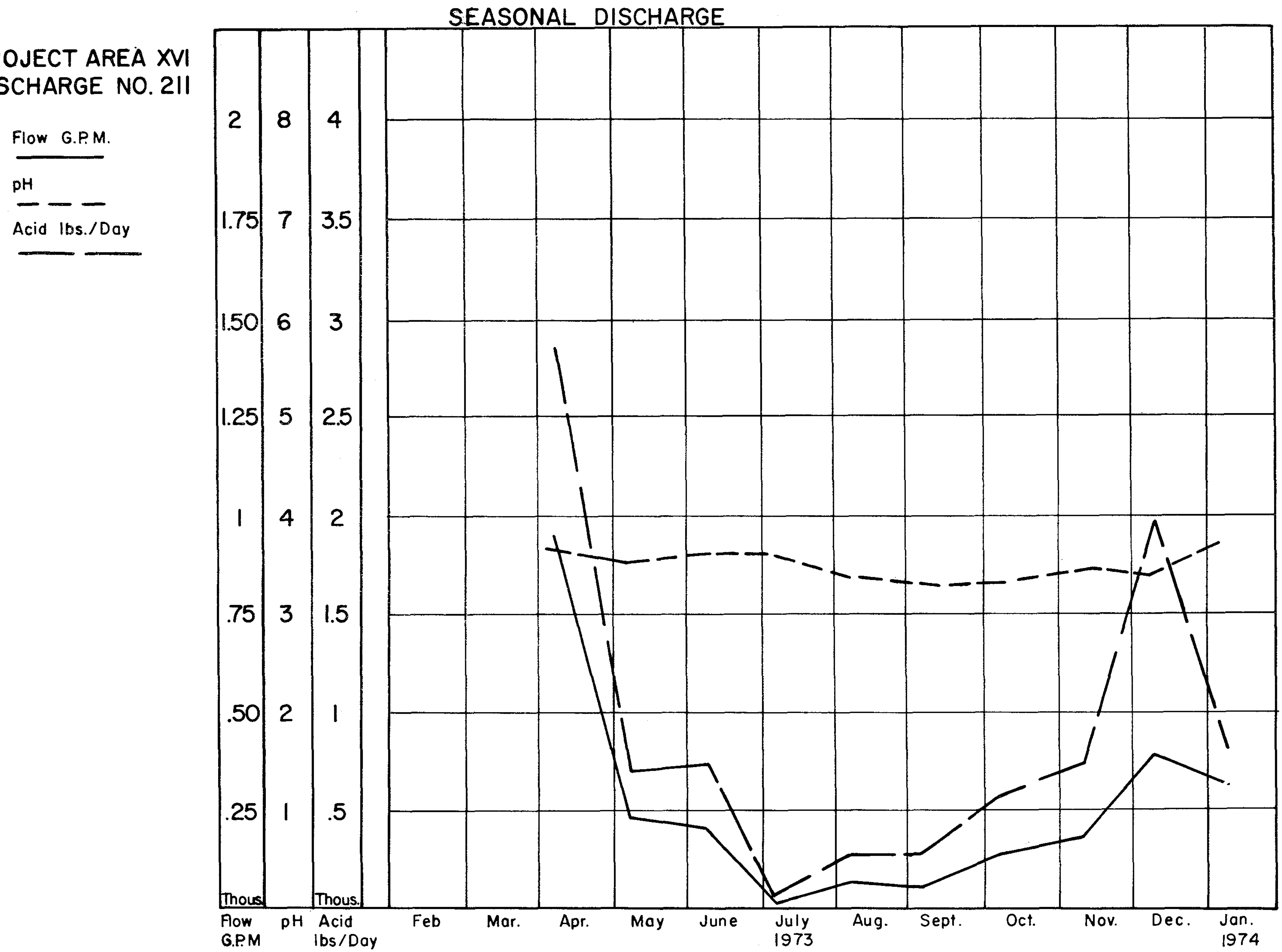
The stripped area should be pressure treated by pumping lime slurry into spoil to fill voids and water passages as well as to neutralize and coat acid producing material.

The entire affected area should be planted with grasses. See Project Map No. 6 on page 125.

Estimated Costs:

Backfill, Grade and Plant	72 acres @ $1000/acre	$72,000
Lime Slurry Injection	72 acres @ $4000/acre	288,000
	Total	$360,000
Projected cost per lb. of acid/day		$ 400

PROJECT AREA XVI
DISCHARGE NO. 211



AREA XVII

This area was extensively strip mined at two levels. It is possible that all three Kittanning coal seams as well as the Lower Freeport seam were stripped here. The lower level contains several surface depressions one of which is a perennial pond, and several drainage cuts. Highly concentrated acid mine drainage flows from one of the cuts. The upper level of the operation has been partially backfilled but still has a few minor surface depressions as well as three major open strip cuts. Although the upper area appears dry it must surely contribute some water which eventually breaks out in the lower section.

The acid mine drainage flows from the cut at an average rate of 46 g.p.m. This flow contributes 91 lbs. per day of acid.

In order to attempt to eliminate this discharge at a reasonable expenditure, restoration of only the lower section should be considered. This area should be backfilled to eliminate surface depressions including the existing pond and then planted with grass to retard erosion.

Curtain grouting should be used in the area surrounding the discharge to eliminate what appears to be the only existing major subsurface water route.

To prevent further discharges in the lower area, the entire upper section should be backfilled to eliminate surface depressions and facilitate proper drainage. This area should also be planted. See Project Map No. 6 on page 125.

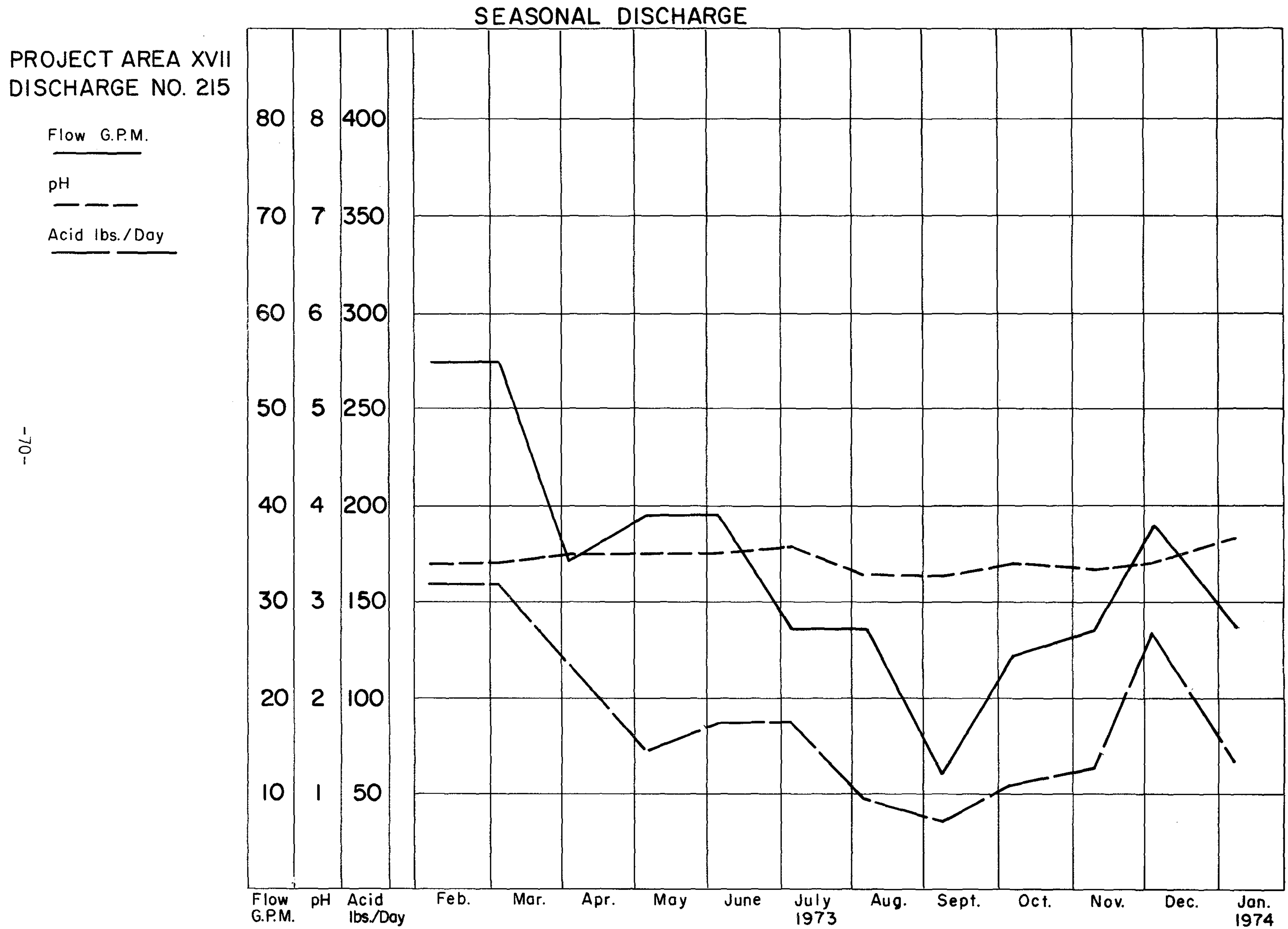
Estimated Costs:

Backfill and Plant (lower area) 4 acres @ $300/acre	$ 1,200
Curtain grouting 200 ft. @ $100/ft.	20,000
Total	$21,200

I f necessary:

Backfill and Plant (upper area) 76 acres @ $1800/acre	$136,800
Combined Total	$158,000
Projected cost per lb. of acid/day	
To Restore Lower Section	$ 230
To Restore Upper & Lower Sections	$ 1,470

PROJECT AREA XVII
DISCHARGE NO. 215



AREA XVIII

This is the location of the Rankin Mine, a deep mine once operated by the North American Refractories Company in the Mercer clay seam. The mine is a slope entering the ground at an elevation of 1750 feet and descending to a low of about 1669 feet. The mine heading changed directions at this point and the operation continued to the rise reaching an elevation of about 1694 feet.

A pond and spring in the vicinity of the air shaft have both become acidic since the completion of operations here. In addition, acid water is seeping from the back of a roadside drainage ditch below the pump house. Flows were measured from this seepage and from the overflow of the pond. These two sampling points have average flows of 13 g.p.m. and 32 g.p.m. respectively and contribute a total of 21 pounds of acid per day.

To abate the acid mine drainage originating from this deep mine complex three mine seals should be installed from the surface. Two of the seals should be placed in the headings at the point where the mining begins to the rise. This should flood the upper reaches of the mine beyond that point. The third seal should be placed in the single entry near the air shaft, flooding the entry and, in essence, isolating the section where the present problem is probably originating. In both of these instances the results would be flooding of portions of the mine which would eliminate or reduce atmospheric oxygen contact with pyritic materials thus improving water quality should breakouts occur into the groundwater system at higher elevations. See Project Map No. 7 on page 126.

Estimated Cost:

Install 3 Deep Mine Seals @ $20,000 each	$60,000
Projected cost per lb. of acid/day	$ 2,860

AREA XIX

This is the location of the Widemire Mine operated by Harbison Walker Refractories Company until about 1955. The area has been extensively deep mined for the Mercer clay with one small strip mined area at one of the deep mine openings. A total of eight openings are included in the deep mine complex.

Presently, acid mine drainage is flowing from two of the entries and a small amount of acid water is seeping from one of the others. Most of the mine water discharged enters a small unnamed tributary of Kratzer Run. One entry has a high flow of acid water, discharging at the average rate of 1067 g.p.m. The average combined acid load of these discharges totals 1086 pounds of acid daily. This represents approximately 14% of the total acid contributed to Anderson Creek from mining sources, and 48% of the total recorded acid entering Kratzer Run.

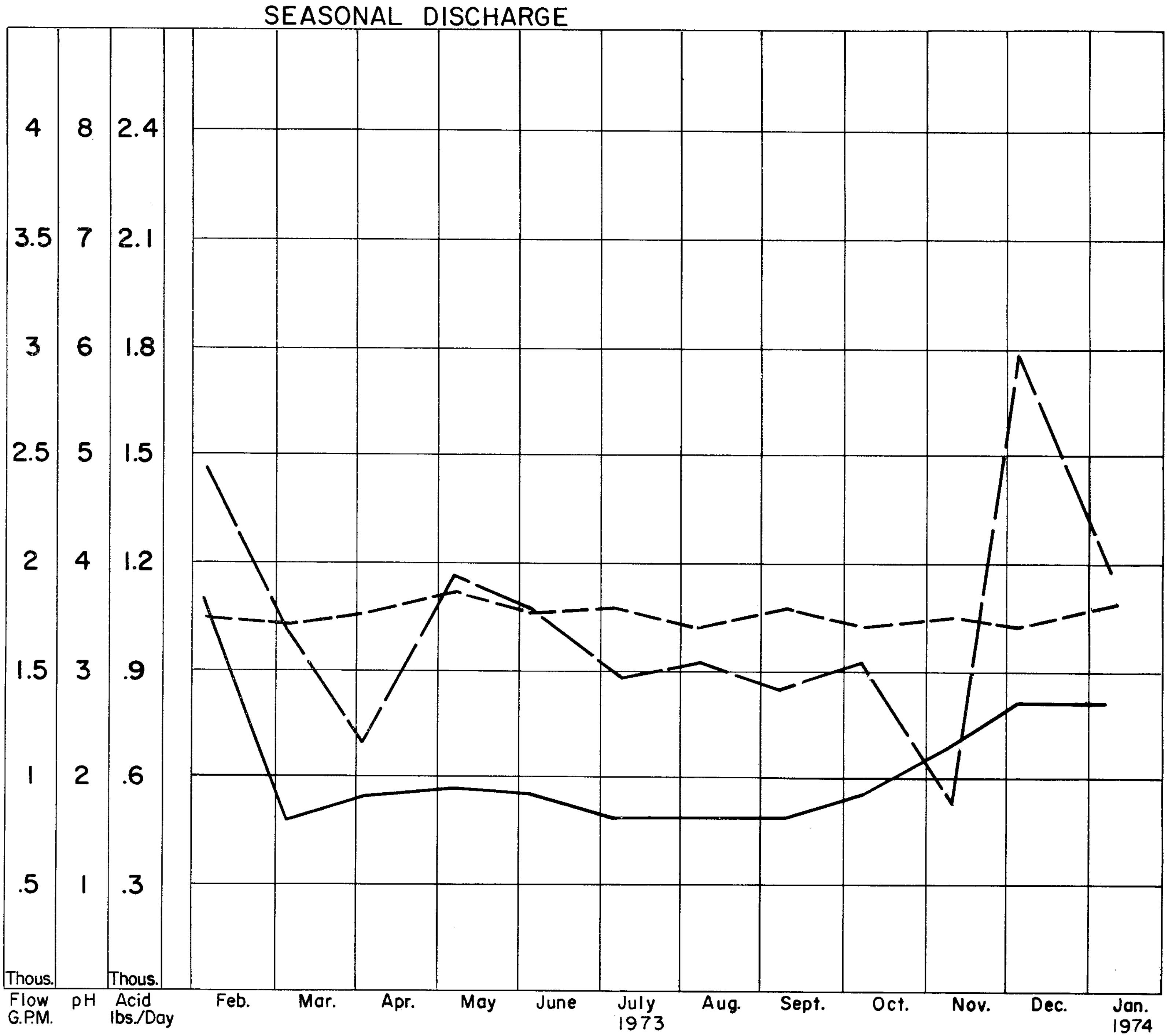
To abate the acid mine drainage at this location mine seals should be placed in all eight deep mine entries. Data taken from mine maps indicate a maximum hydraulic head of 30 feet. Concrete block and clay seals should be adequate. This sealing will result in at least partial flooding of the mine and eliminate the acid mine discharge. If the water should break out at any point above the workings the water quality should be such as not to present a pollution problem. Since the terrain rises over the workings, it is unlikely that any problem with breakouts will occur, provided that seals are placed a sufficient distance inside the entries. See Project Map No. 8 on page 127.

Estimated Costs:

8 concrete block deep mine seals @ $20,000 each	$160,000
Projected cost per lb. of acid/day	$ 150

PROJECT AREA XIX
DISCHARGE NO. 220

Flow G.P.M. ————
pH — — —
Acid lbs./Day —— ——



AREA XX

This discharge is draining from a recently completed strip mine operation. The area was strip mined for coal by the Hepburnia Coal Company. It appears that the area may have been stripped at an earlier date also and therefore responsibility is questionable.

The flow itself is of marginal quality flowing only during the wetter months of the year. This discharge averages 4 g.p.m. with a corresponding acid load of less than 1 lb. per day.

Due to the nature of the discharge and particularly its inconsistent flow and low acid load, the feasibility of initiating any abatement measures for this location is questionable. The area has been recently backfilled and given time to stabilize, the problem may decrease in intensity or perhaps be alleviated entirely. No reclamation measures are proposed for this area. See Project Map No. 9 on page 128.

AREA XXI

Acid mine drainage in this area is derived from a very old strip area which is quite heavily forested. Acid water is seeping from the toe of the spoil in several places with an average flow of 23 g.p.m., carrying 5 lbs. of acid per day. The pH ranges from 4.6 to 5.7.

Since the quality of the water is not significantly acid and the area is so well forested, there is no reasonable solution to the acid discharge at this location; it therefore, would be both practical and wise to leave this area in its present condition. No reclamation measures are proposed for this area. See Project Map No. 9 on page 128.

AREA XXII

This is a small old strip mined area with a good growth of large trees. A pond on the top of the spoil collects surface water and allows it to percolate through the spoil. The water emerges some distance below the toe of the spoil.

Acid water seeps out of the ground about 60 feet below the toe of the spoil as well as along an adjacent road cut. The flow averages 6 g.p.m. with an acid load of 4 lbs/day.

The pond area should be backfilled and graded to permit drainage of surface water off the spoil area rather than through it.

The restored area should then be replanted with grasses. See Project Map No. 10 on page 129.

Estimated Cost:

Backfill pond and plant	$4,000
Projected cost per lb. of acid/day	$1,000

AREA XXIII

This is the location of the Draucker #1 Mine once operated by North American Refractories Company. This area was originally deep mined and later stripped for the Mercer clay. The area of the single entry was stripped out back to the main workings. The ground above the main work ings indicates severe subsidence.

Acid water flows from the stripped out entry to the old drift at an average rate of 140 g.p.m. Mine drainage, possibly originating in the adjacent deep mine workings, also flows from the strip mine area. The acid load of the water from this discharge averages 1650 lbs. per day.

It must be noted that the workings of the Draucker #1 Mine were intercepted in three places by the workings of the Harbison Walker Refractories Company, Pearce Mine. Within these combined workings there is a local structural high resulting in acid water flowing in both directions, hence, from both entries. Any workable reclamation plan for the Draucker #1 Mine must, then, be complemented by reclamation of the Pearce Mine (Area XXV) as well.

The entry to the Draucker #1 workings should be sealed with a concrete block and clay deep mine seal to flood the workings.

A clay barrier approximately 25 feet high and 20 feet thick at its base should be constructed along the highwall in the area adjacent to the deep mine workings to seal possible seepage of acid water.

The strip mined area should then be backfilled to the top of the highwall to insure proper drainage and reinforce the clay barrier.

A diversion ditch should be constructed along the top of the highwall to prevent surface water from flowing over the restored area.

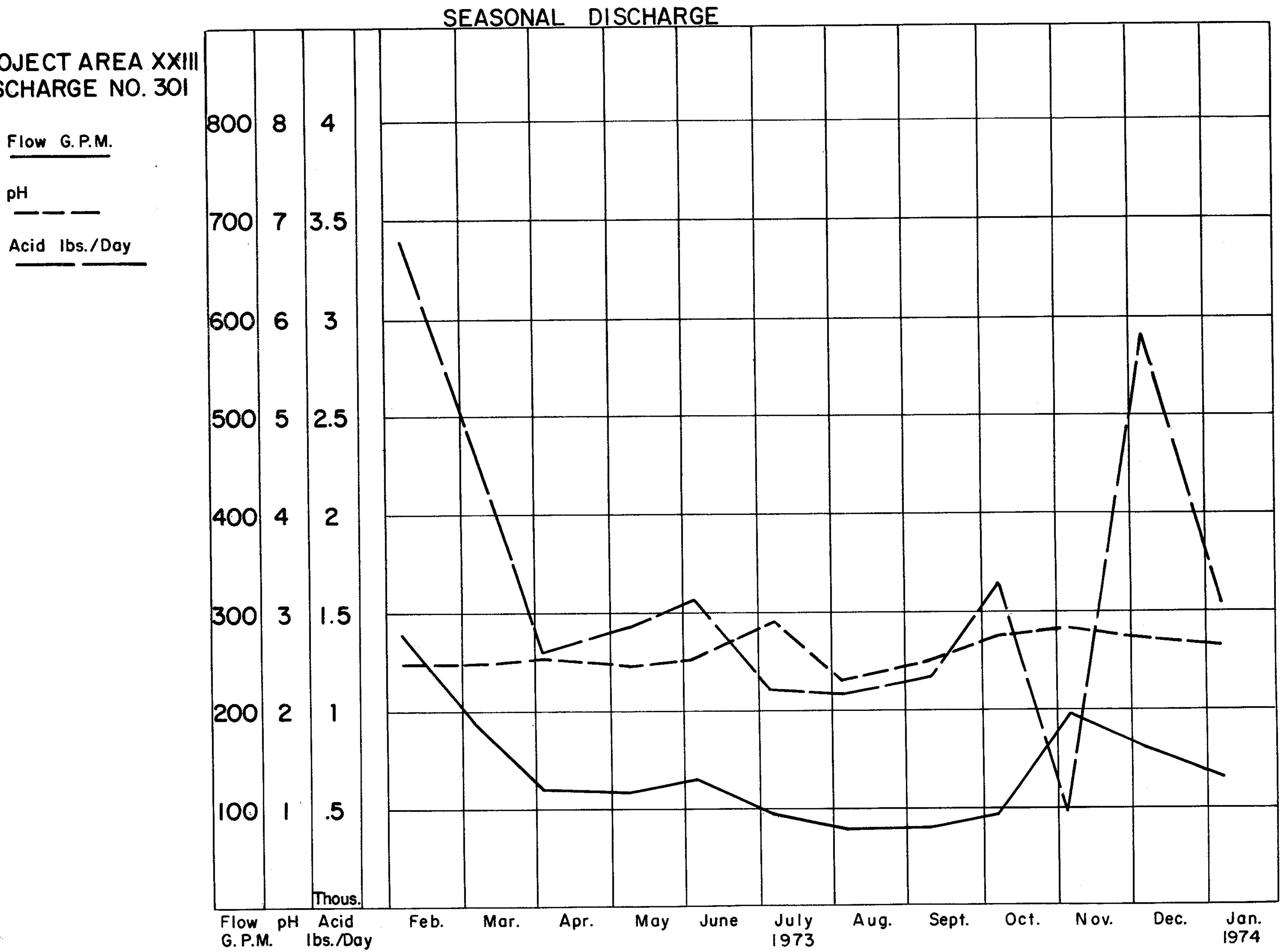
The backfilled area should be planted with a suitable grass mixture to prevent erosion.

Due to extensive strip mining adjacent to the deep mine workings and severe subsidence above much of the drift area it is unlikely that the water will be contained within the workings, but the water quality should be greatly improved if outbreaks occur at higher elevations. The maximum hydraulic head placed on the seal at either the Draucker #1 or Pearce entry would be approximately 20 feet. See Project Map No. 15 on page 134.

Estimated Costs:

Clay Barrier 825 feet @ $1200/100 feet	$ 9,900
Backfill and Plant 10.6 acres @ $2000/acre	21,200
1 Deep Mine Seal (concrete block and clay)	12,000
TOTAL	$43,100
Projected cost per lb. of acid/day	$ 30

PROJECT AREA XXIII
DISCHARGE NO. 301



AREA XXIV

This is the location of a slope mine, the Draucker #2 Mine, once operated by North American Refractories Company in the Mercer clay seam. At present the entry to the mine is filled with water contributed in part, by an adjacent stream. A few sinkholes are evident immediately above the entry.

The average flow of water from the entry is 197 g.p.m., contributing 89 pounds of acid daily to Little Anderson Creek.

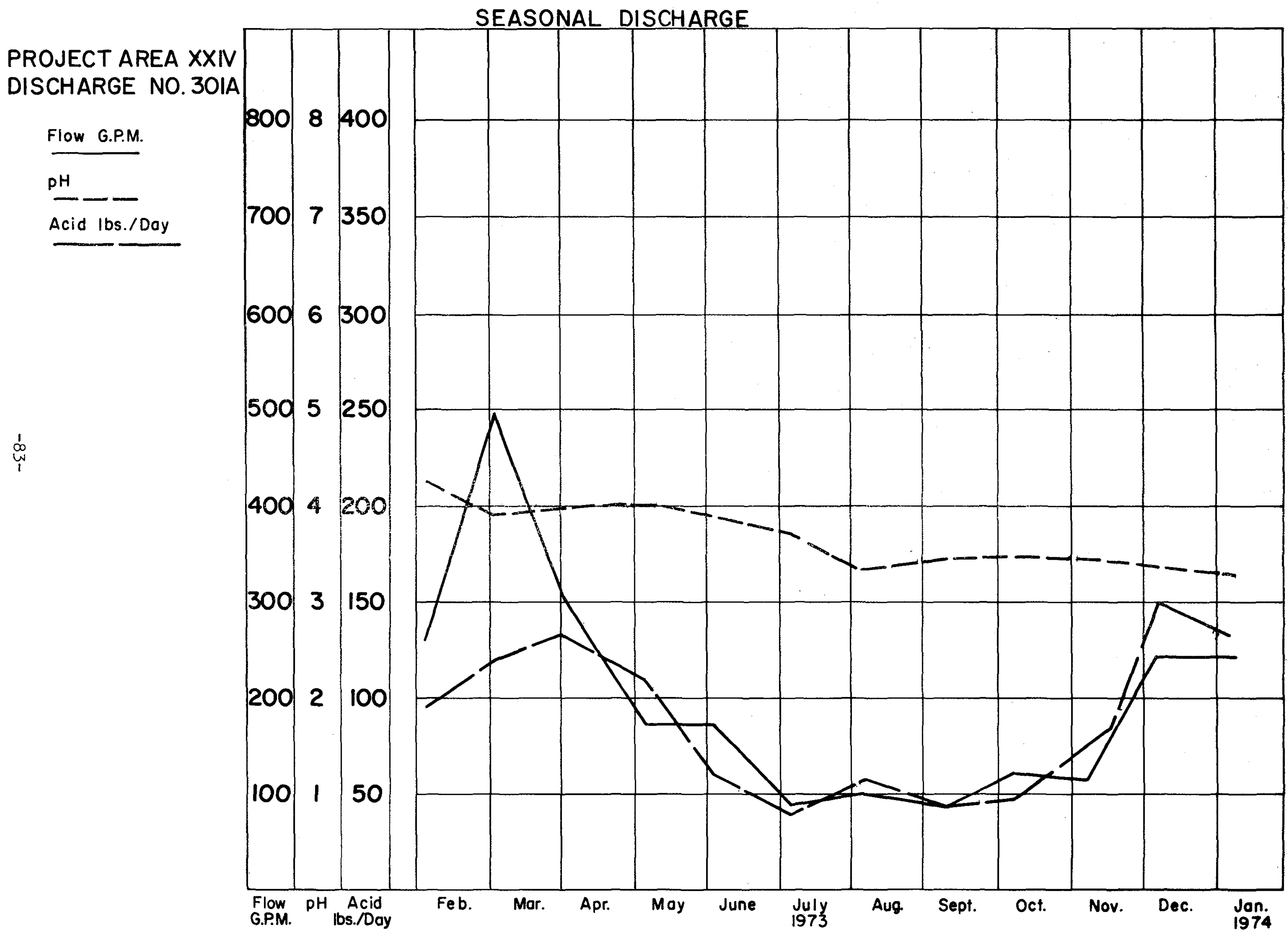
A concrete block and clay deep mine seal should be installed above the last subsidence area to prevent any further drainage from the mine workings.

To compliment the sealing of this mine a concrete cap should be installed on the air shaft to air seal the mine workings.

The adjacent stream should be relocated slightly to flow away from the mine entry. See Project Map No. 15 on page 134.

Estimated Costs:

Install 1 Deep Mine Seal (concrete block and clay)	$15,000
Install Concrete Cap on Air Shaft 3,500 Relocate Stream	_ 3,500
TOTAL	$22,000
Projected cost per lb. of acid/day	$ 250


PROJECT AREA XXIV
DISCHARGE NO. 301A
Flow G.P.M.
pH
Acid lbs./Day
SEASONAL DISCHARGE
800 8 400
700 7 350
600 6 300
500 5 250
400 4 200
300 3 150
200 2 100
100 1 50
Flow G.P.M.
pH
Acid lbs./Day
Feb.
Mar.
Apr.
May
June
July 1973
Aug.
Sept.
Oct.
Nov.
Dec.
Jan. 1974

AREA XXV

This is the location of Harbison Walker Refractories Company Pearce Mine. This deep mine was a drift into the Mercer clay seam. At its extremities the Pearce Mine intersects the workings of the North American Refractories Company Draucker #1 Mine. As mentioned before, any reclamation at this location must be accompanied by reclamation of the Draucker #1 site (Area XXIII) if it is to be successful.

The flow of acid water from the Pearce Mine entry averages 8 g.p.m. which includes one dry sampling period. The flow carries an acid load of 61 lbs. per day.

A concrete block and clay deep mine seal should be in I stalled above the last subsidence area in the Pearce Mine entry to flood the mine workings and improve the quality of water should it escape at any higher elevation. See Project Map No. 15 on page 134.

Estimated Costs:

Install deep mine seal	$12,000
Projected cost per pound of acid/day	$ 200
Combined Reclamation cost for Areas XXIII & XXV	$55,100
Projected cost per lb of acid/day	$ 40

AREA XXVI

This area has been strip mined for the Mercer clay. A small deep mine is also present here which has been partially stripped out. The strip cuts which are deep and completely unreclaimed have formed several ponds that contact the exposed coal seam. A stream which forms in a swamp just above the strip operation flows down over the highwall, across the 24 inch exposed coal seam into the ponds.

Water from the ponds collect in a single drainage ditch. A rectangular weir was needed to handle the flow which averages 261 g.p.m. These combined discharges contribute 658 lbs. of acid to Little Anderson Creek daily.

To abate the acid mine drainage at this location a clay barrier approximately 25 feet high and 20 feet thick at the base should be constructed along the highwall in the area where the drift was intersected. This barrier, then, should contain any acid water which may form in the deep mine workings, although at present the workings appear dry.

The strip mined area should be backfilled to the top of the highwall to cover the exposed coal seams, insure proper drainage and reinforce the clay barrier.

A diversion ditch should be constructed along the top of the highwall to prevent surface water from flowing over the restored area.

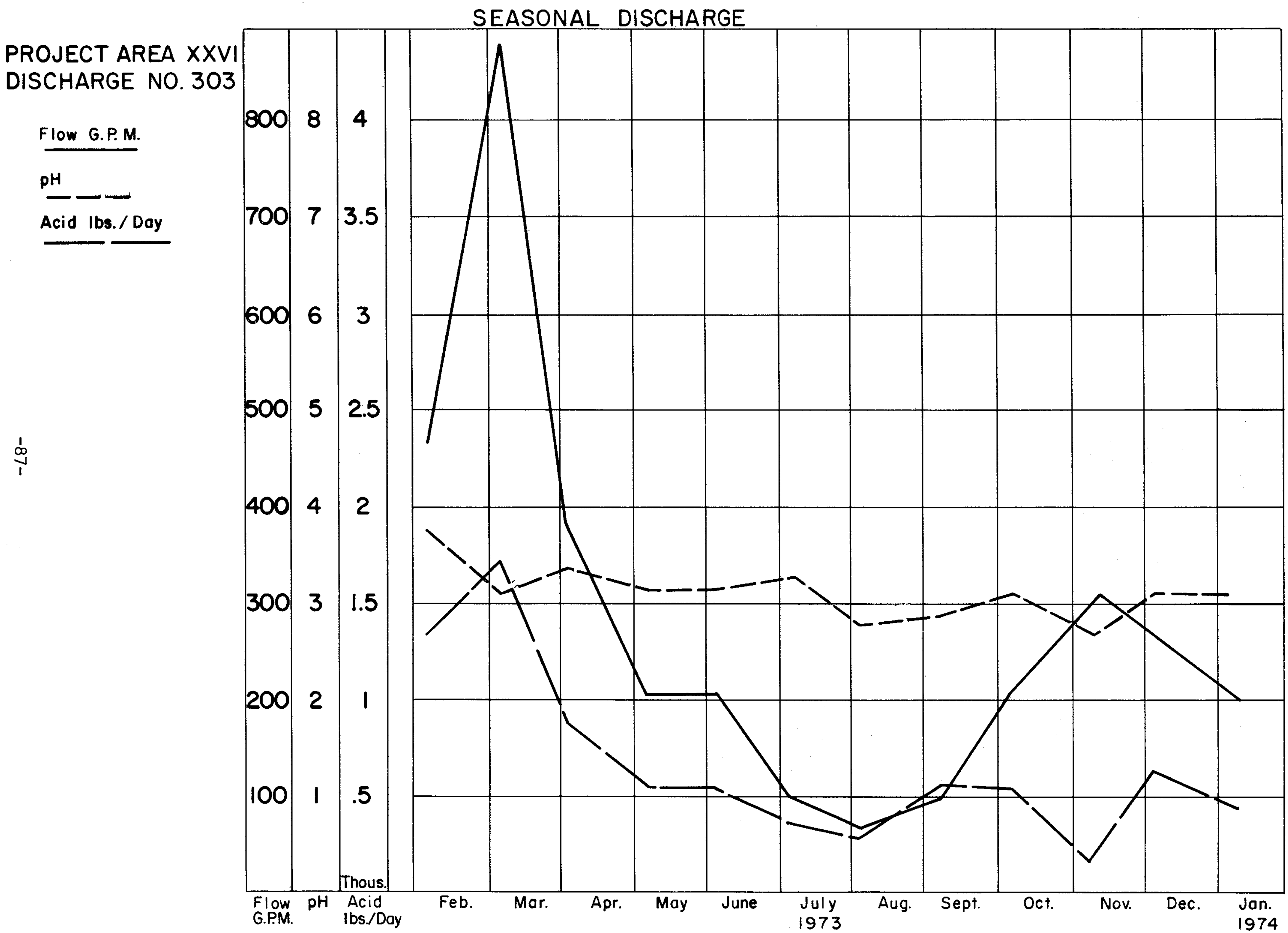
Two slope drain flumes will be needed to carry water from the diversion ditch across the spoil material.

The slopes should be seeded with a suitable grass mixture to prevent - erosion. See Project Map No. 11 on page 130.

Estimated Costs:

Clay Barrier 1000 feet @ $1200/100 ft.	$12,000
Backfill and Plant 24 acres @ $2500/acre	60,000
Slope Drain Flumes 1200 L.F. @ $15.00/L.F.	19,500
Total	$91,500
Projected cost per lb. of acid/day	$ 140

PROJECT AREA XXVI
DISCHARGE NO. 303



AREA XXVII

This area is adjacent to Area XXVI and has also been both deep and strip mined for the Mercer clay. The deep mine is not very extensive and has been partially stripped out. The remaining workings parallel the highwall. The Mercer and Brookville coals are both exposed at places on the highwall.

Water seeps from the highwall, collects in the strip cuts, and flows from the stripped area through a series of drain cuts. Three such cuts presently discharge water. The combined flows of these three discharges total 18 g.p.m. with an acid load averaging 127 lbs. of acid per day.

A clay barrier approximately 15 feet high and 10 feet thick at the base should be constructed along the highwall contiguous to the old deep mine workings.

The stripped area should then be backfilled to the top of the highwall, burying the material from the three small refuse piles associated with the deep mine. This will prevent surface water from coming into contact with the acid forming material.

A diversion ditch should be constructed to divert surface water away from backfilled area.

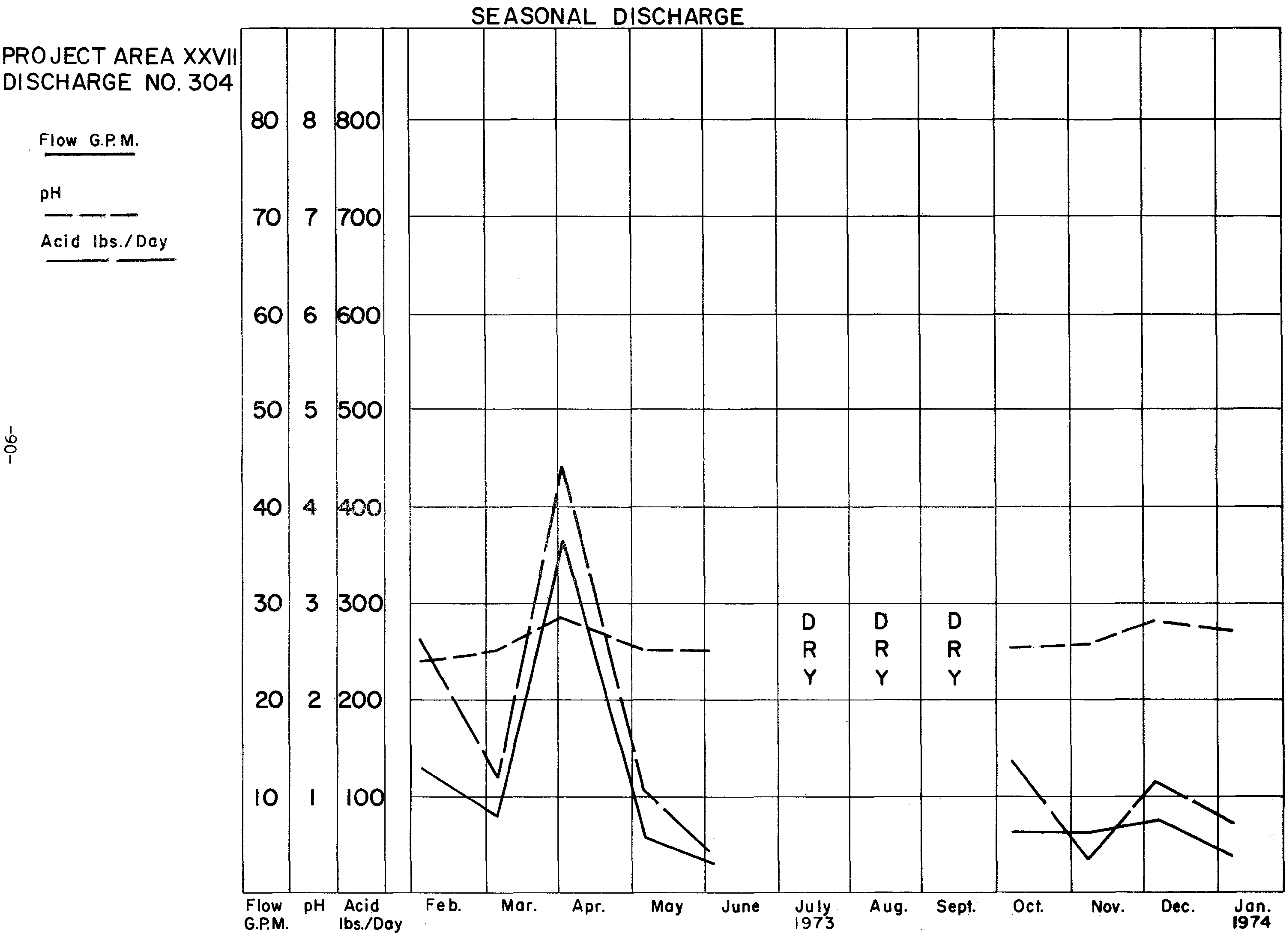
Slopes should be planted with grass to retard erosion.

A slope drain flume will be needed at the southwest end of the workings to convey surface water across the restored area. See Project Map No. 11 on page 130.

Estimated Costs:

Clay Barrier 500 L.F. @ $800/100 L.F.	$ 4,000
Backfill and Plant 11 Acres @ $2500/acre	27,500
Slope Drain Flume 650 L.F. @ $15.00/L.F.	9,750
Total	$41,250
Projected cost per lb. of acid/day	$ 320

PROJECT AREA XXVII
DISCHARGE NO. 304



AREA XXVIII

This area has been strip mined for the Mercer clay. The remains of the mining operation is a circular depression filled with water and a cut through which the water may drain when it reaches a certain depth. The water flows from the pond through the cut only during the wet seasons of the year.

The average flow from this pond is 1 g.p.m. which includes the month of August at which time there was no flow from the pond. This flow produces less than 1 pound of acid per day.

To reclaim this area the water in the pond should be treated and discharged. The depression should then be backfilled and planted with grass. See Project Map No. 11 on page 130.

Estimated Costs:

Treat & Pump water from pond	$1,500
Backfill & Plant 2 acres @ $800/acre	1,600
Total	$3,100
Projected cost per lb. of acid/day	$3,100

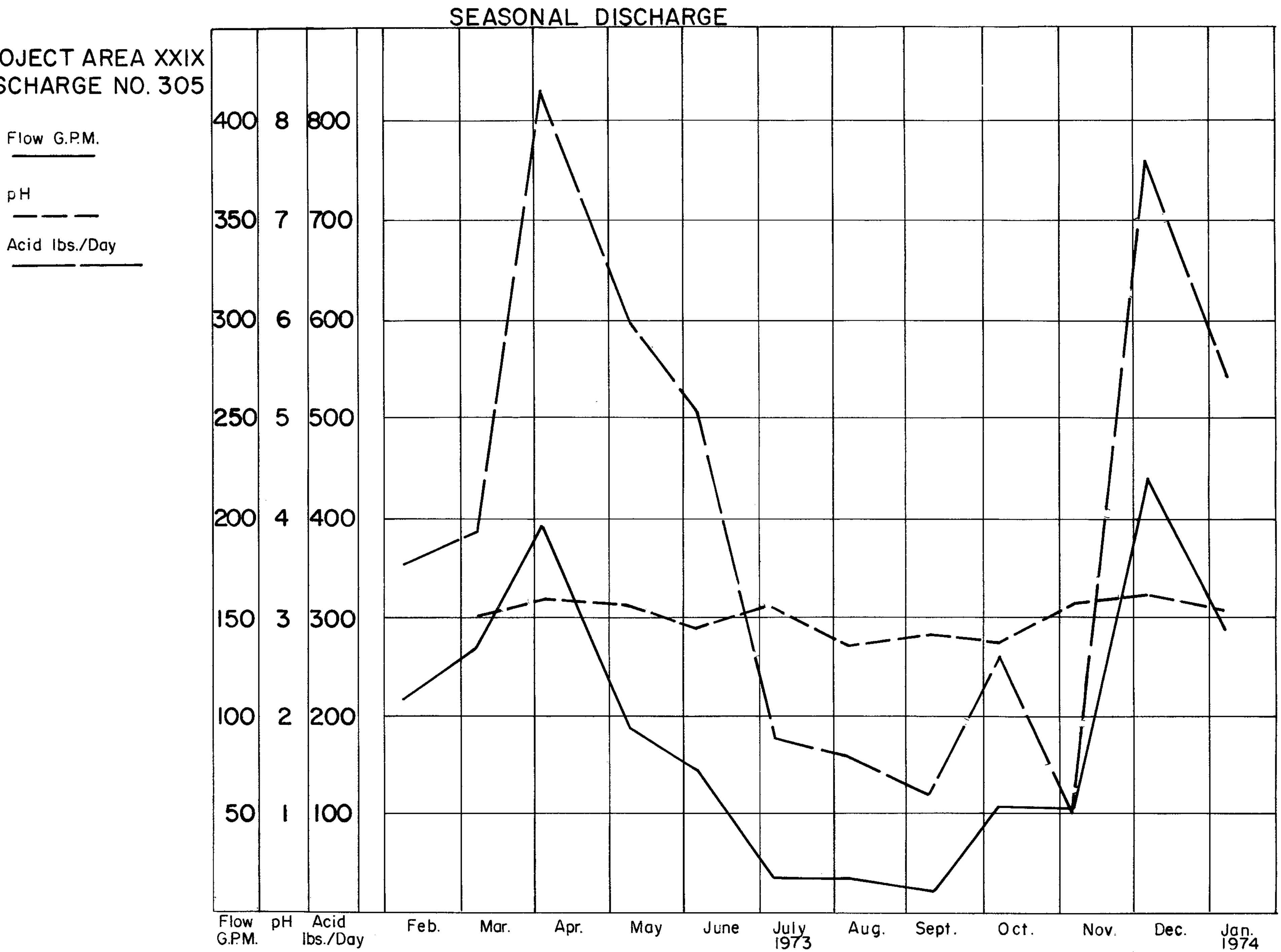
AREA XXIX

This area was strip mined a number of years ago and again within the past two years. The area has been almost completely backfilled.

Acid mine drainage seeps out of the ground below the stripped area and is joined by surface water which has eroded a ditch across a coal seam. The water forms the headwaters of an unnamed tributary of Little Anderson Creek. The flow averages 88 g.p.m. with an acid load of 397 lbs. daily.

The abatement of the acid mine drainage at this location may be the responsibility of J. H. France Refractories Co. of Snowshoe, Pa. who has only recently completed their strip mining operations. At this time there is a question of liability as there was a previous adjacent mining operation and the true source of the acid mine drainage is questionable. No reclamation measures were proposed for this area. See Project Map No. 11 on page 130.

PROJECT AREA XXIX
DISCHARGE NO. 305



AREA XXX AND AREA XXXV

These areas are roadside ditches carrying runoff from adjacent strip mined areas. The stripped areas are for the most part restored, with moderately heavy growths of evergreens. These flows are basically dependent on precipitation, although the Area XXXV discharge has been perennial with a great seasonal fluctuation.

The average flows of these ditches is 3 g.p.m. and 21 g.p.m. respectively. The average acid loads of these flows are less than 1 lb. per day and 7 lbs. per day respectively.

The purpose of this sampling was to give an indicat ion of acid contribution by surface runoff from a relatively restored area. Due to the nature of the source no reclamation plan has been proposed since complete abatement is neither likely nor, economically feasible. See Project Map No. 11 on page 130.

AREA XXXI

This discharge originates in a partially restored strip mined area. The spoil pile has been planted with evergreens which are now quite thick and well established.

Surface water which runs off the spoil pile flows along a roadside ditch and gathers in a swampy area before crossing under the road. The average flow is 12 g.p.m. carrying less than 1 lb. of acid per day.

Since the flow of this discharge is quite variable and acid loads are low it would not be economically reasonable to propose a reclamation plan for this specific area. See Project Map No. 11 on page 130.

AREA XXXII

This area has been extensively strip mined, partially backfilled, and planted with evergreens. It is believed that the A coal and underclay were strip mined at this location. A portion of the acid mine drainage in this area may be eliminated by an active mining operation in progress. Acid mine drainage also seeps from the spoil bank in the area which will not be affected by the active mining operation.

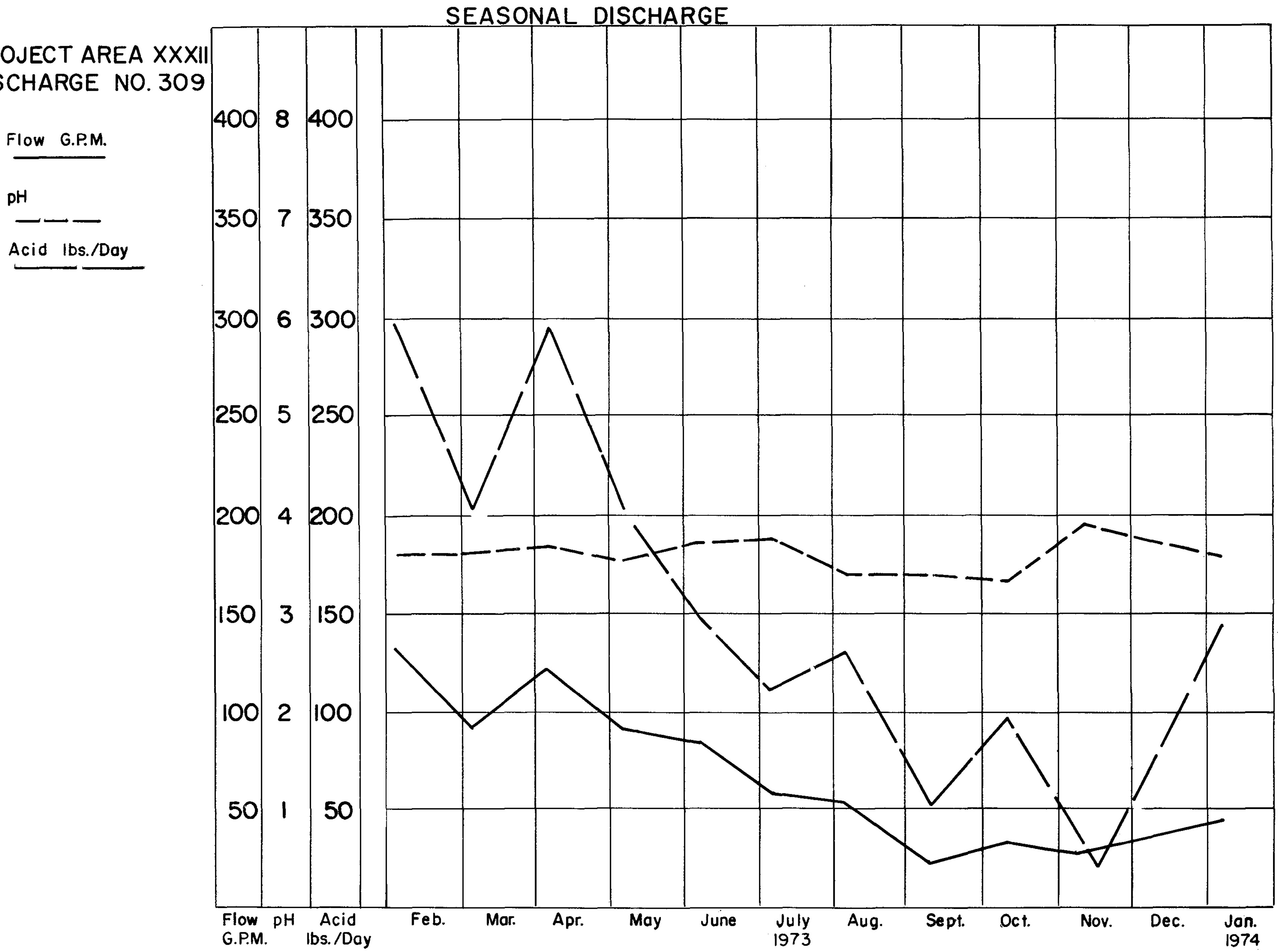
The average flow of this discharge is 71 g.p.m. carrying an acid load of 85 lbs. per day.

In order to abate the acid mine drainage in this area the spoil should be pressure treated by lime slurry injection to fill voids through which acid water may travel and to coat and neutralize acid producing materials. See Project Map No. 11 on page 130.

Estimated Cost:

Pressure treatment of spoil by lime slurry injection 6.5 acres @ $3500/acre	$22,750
Projected cost per lb. of acid/day	$ 270

PROJECT AREA XXXII
DISCHARGE NO. 309



AREA XXXIII

This project was originally assumed to be an acid discharge flowing into Rock Run from a swampy area adjacent to a large strip mined area.

Upon further investigation, however, it was discovered that this flow was, in fact, derived from Rock Run. A small portion of the flow of Rock Run breaks off and flows into a broad low lying area forming a swamp and later flows back into the main stream.

No reclamation plan is needed for this area since the water is not derived from mining operations but, rather, is a stream. See Project Map No. 11 on page 130.

AREA XXXIV

This is a strip mined area which has been backfilled and planted with evergreens. The trees are moderately well developed, many being 6 to 10 feet high, and closely spaced.

Acid mine drainage is seeping from the toe of the spoil in several places, with three major discharge points. The discharges produce 4 g.p.m., 20 g.p.m., and 16 g.p.m. The combined acid load is 137 lbs/day.

Since the area has already been satisfactorily backfilled and planted, the spoil should be pressure treated by lime slurry injection to fill voids and water passages, and to aid in the neutralizing of acid forming materials. See Project Map No. 11 on page 130.

Estimated Costs:

Pressure treat by Lime Slurry Injection 33 acres @ $3500/acre	$115,500
Projected cost per lb. of acid/day	$ 840

AREA XXXVI

This area has been heavily strip mined and has recently undergone auger mining for coal, probably the Brookville seam. A series of elongated ponds are located along the base of the highwall and surrounded by spoil piles.

The water from the ponds seeps through the spoil and flows out at three major discharge points which converge to form one major flow. A trench cut through the spoil serves as a gravity drain for water from the strip cut. This water does not join the other flow. The average flows of the two discharges are 19 g.p.m. and 16 g.p.m., and the combined acid discharge totals 21 lbs/day.

The strip cuts should be backfilled, as high up the highwall as available material will allow, to eliminate the ponds and other surface depressions which collect and channel surface water through spoil materials.

A diversion ditch should be constructed along the top of the highwall to prevent surface water from crossing over backfilled material.

A slope drain flume may be needed to carry the water from the diversion ditch across the backfilled area.

The slopes should be planted with grasses to check erosion. See Project Map No. 12 on page 131.

Estimated Costs:

Backfill and Plant 20.5 acres @ $1800/acre	$36,900
Slope Drain Flume 500 L.F. @ $15.00 L.F.	7,500
Total	$44,400
Projected cost per lb. of acid/day	$ 2,110

AREA XXXVII

This location has experienced-heavy strip mining for coal. There is a highwall approximately 40 feet high. This highwall is separated from a 20 to 25 foot high spoil pile by a strip cut containing water. Several cuts serve as gravity drains through the spoil and one of the ponds channels water through the spoil with water seeping out about 30 feet away. There is an assortment of vegetation and brush in vari ous stages of growth present in some areas.

The area should be backfilled, as high up the highwall as the availability of material will permit, to eliminate the open strip cut and insure proper drainage.

A diversion ditch should be constructed along the t op of the highwall to prevent surface runoff from crossing spoil material.

Two slope drain flumes will probably be needed to carry the water from the diversion ditch across the spoil material.

The slopes should be planted with a suitable grass mixture to p revent erosion.

The combined drainage from these discharges averages 110 g.p.m. and the average daily combined acid load is 47 lbs. See Project Map No. 12 on page 131.

Estimated Costs:

Backfill and plant 10.8 acres @ $2,200/acre	$23,760
Slope Drain Flumes (2) total 530 L.F. @ $15.00/L.F.	7,950
Total	$31,710
Projected cost per lb. of acid/day	$ 670

AREA XXXVIII

This discharge carries with it surface runoff from a recently completed strip mined area. The strip mined area has been restored and exhibits no acid discharges.

The average flow from this "wet weather" discharge is about 1 g.p.m. However, the discharge contributes no acid to the stream of the watershed.

The pH of this flow averages 6.7 and the discharge generally carries 1 lb. per day of alkalinity. This was the only discharge monitored having a net alkalinity.

Sampling at this location was discontinued following the seventh sample cycle. No reclamation is necessary at this location. See Project Map No. 13 on page 132

AREA XXXIX

This area, the site of the Spencer Mine of Harbison Walker Refractories Company, has, been both deep and strip mined for the Mercer clay. There are three openings to the deep mine workings. The updip portion of the Spencer Mine has been almost entirely stripped out leaving nearly 20 acres of essentially unreclaimed strip mined area.

Acid water is presently flowing from one of the three mine entries. Surface water collects in depressions left by the strip mine operation and flows through the strip cuts collecting acid from the exposed material. Although the discharge from the strip area is not constant it could contribute heavy acid loads during and immediately following periods of rainfall. The average discharge from the deep mine opening is 28 g.p.m. and from the strip area 5 g.p.m. These flows produce, on the average, 270 and 25 lbs. of acid per day, respectively.

To abate the acid mine drainage from the Spencer deep mine a clay barrier should be installed along the highwall produced by stripping around the entries to the deep mine. This barrier should be constructed by excavating a trench into the clay seam and building the barrier approximately 15 feet high and 10 feet wide at the base. The barrier should be constructed along the length of the highwall at the west end of the mined area where two of the three entries are located. The barrier should then be backfilled for reinforcement and for proper runoff of surface water. At the third entry the adjacent strip cut should be backfilled and compacted to seal that area.

The large strip mined area above the deep mine should be backfilled to eliminate surface depressions and provide adequate drainage of surface water. The area should be planted with a suitable grass mixture to prevent erosion.

Due to the stripped out portions of the deep mine and the numerous sinkholes immediately above the mine entries, the water will not be contained in the workings. The clay barrier, however, will serve to raise the water level in the mine sufficiently to improve the quality

of the water by covering most of the acid forming materials. See Project Map No. 13 on page 132.

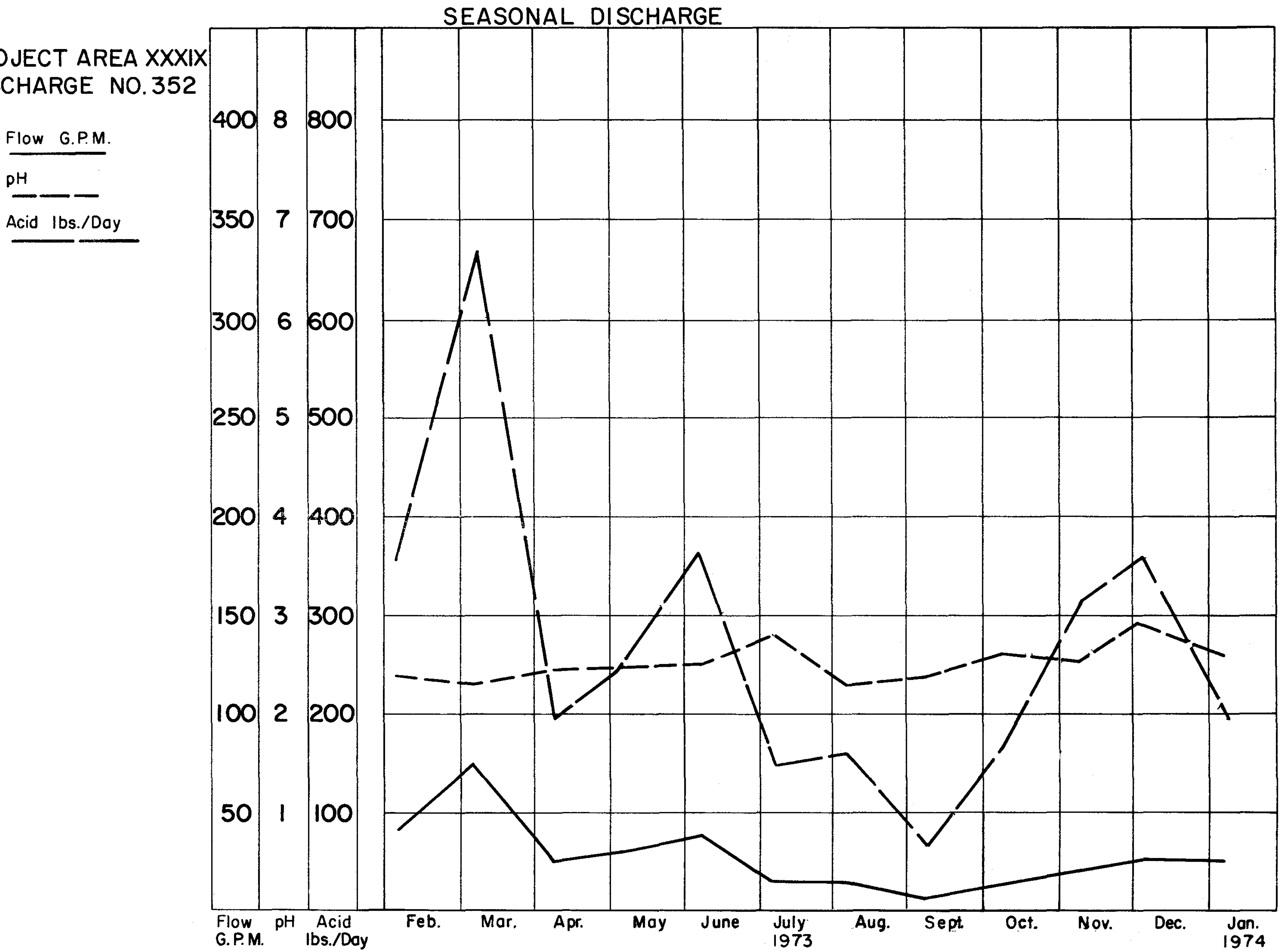
Estimated costs:

400 L. F. Clay Barrier @ $800/100 L. F.	$ 3,200
Backfill stripped area around deep mine entries 6 acres @ $750/acre (incl. planting)	4,500
Backfill upper stripped area, 19.1 acres @ $800/acre, grade and plant	15,280
Total	$22,980

Projected cost per lb. of acid/day

Deep mine area $ 30 Strip mine area $ 610 Total Project $ 80

PROJECT AREA XXXIX
DISCHARGE NO. 352



AREA XL

This area was strip mined and backfilled; however, there is a discharge of acid water from the base of the spoil. Above the discharge is a small pond which could be the source of the discharge. This pond is the only apparent source of the acid water. Surface water enters the pond and percolates through the spoil, becoming acid.

The acid discharge at this location is perennial but diminishes during dry weather. The average flow from this discharge is 7 g.p.m. and the acid load is about 17 lbs. per day.

It is assumed that the pond present is the contributing source for the discharge and should be eliminated. The water in the pond should be neutralized and drained. The area should then be backfilled and graded. If there is a subsurface fresh water source for the pond it should be diverted away from the spoil material and conveyed by flume to a larger pond below the stripped area. See Project Map No. 14 on page 133.

Estimated Costs:

Treat, drain and backfill pond	$ 1,000
Flume to convey water to large pond 650 feet @ $15/ft.	9,750
Total	$10,750
Projected cost per lb. of acid/day	$ 630

If it is found that the pond does not represent the source of the water that is discharged at the base of the spoil some other means must be sought to stop the flow of water. The spoil should be pressure treated by the injection of a lime slurry to fill the voids and water passages. This would also serve to coat and neutralize the acid materials in the spoil. In conjunction with this program the area should be graded where necessary and planted with suitable grasses.

Estimated Costs:

Lime slurry injection		
Grade and plant	52 acres @ $3,800	$197,600
Projected cost per lb. of acid		$ 11,620

AREA XLI

This area is a strip mined area. It is adjacent to a recently completed strip operation of Benjamin Coal Co. who primarily mined the Lower Kittanning coal. A portion of this area is located just north of Benjamin's operation and the remaining portion borders that operation to the west.

Acid mine drainage emerges from the toe of the spoil in several places. In most cases this is water that has collected in depressions at the base of the old highwall and has percolated down through the spoil. Four acid discharges were located and monitored. They had average flows of 26 g.p.m., 57 g.p.m., 7 g.p.m., and 5 g.p.m. The average combined acid discharge to Little Anderson Creek measured 139 lbs. per/day.

The northern area should be backfilled to the top of the highwall to eliminate the collecting basin at the base of the highwall. The western area should be backfilled and leveled to remove surface depressions and facilitate proper drainage.

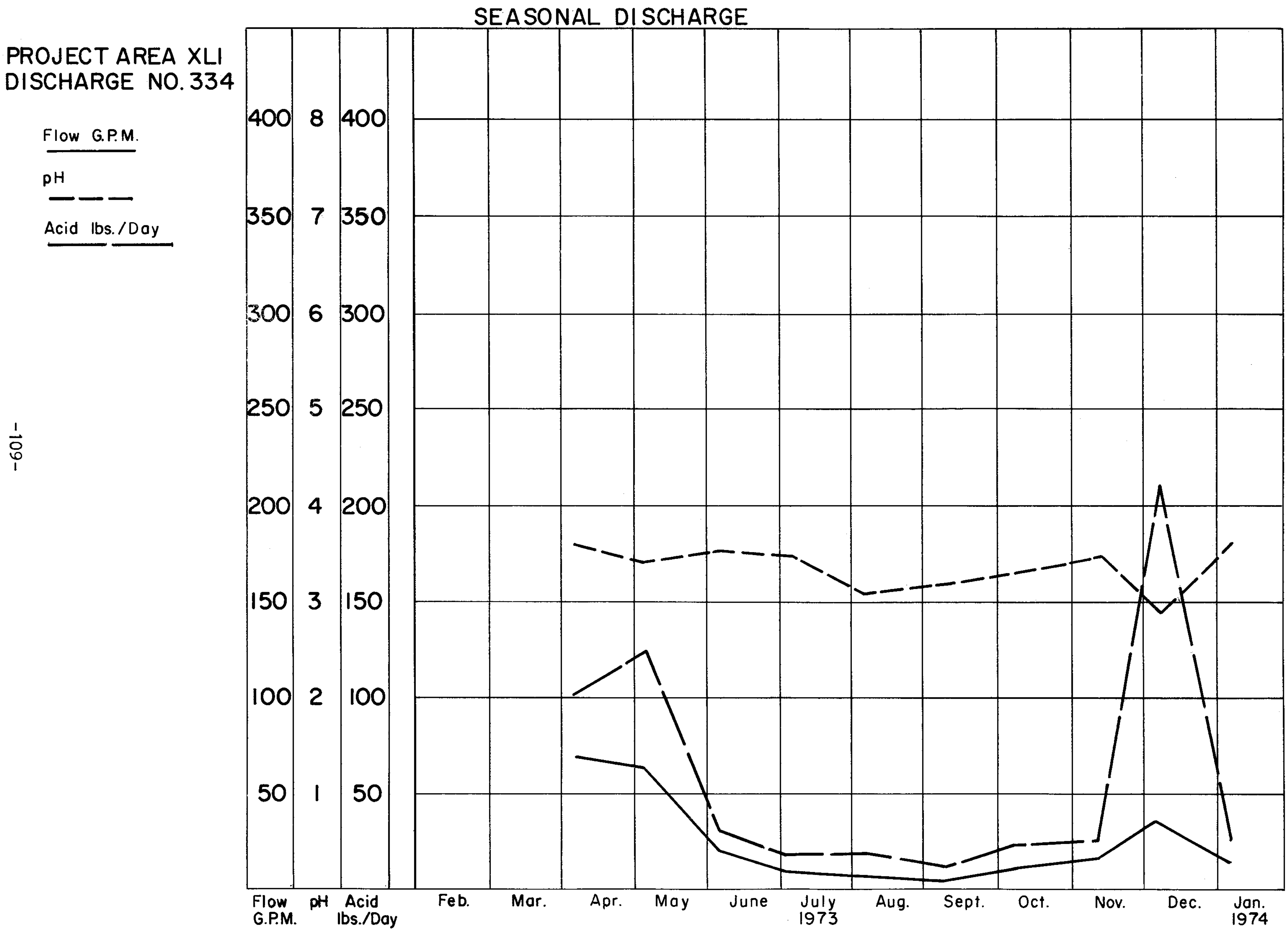
A drainage ditch should be constructed along the top of the highwall to serve as a diversion to surface water.

The area should be planted with a suitable grass mixture. See Project Map No. 15 on page 134.

Estimated Cost:

Backfill and plant (north end)	13.6 acres @ $1500/acre	$20,400
Backfill and plant (west end)	3.9 acres @ $ 600/acre	2,240
Total		$22,740
Projected cost per lb. of acid/day		$ 160

PROJECT AREA XLI
DISCHARGE NO. 334



AREA XLII

This is a strip mined area which is. fairly level and is surrounded by a drainage cut. There is a little vegetation present on the spoil and surface water drains from the spoil into the cut. Water flowing through the cut becomes acid.

The average discharge from the cut is 29 g.p.m. This produces about 3 lbs. of acid/day.

The cut should be filled with material from the adjoining area. The entire area should then be leveled and planted with grasses to control erosion. See Project Map No. 14 on page 133.

Estimated Cost:

Backfill, level and plant	14.4 acres @ $1500/acre	$21,600
Projected cost per lb. of acid/day		$ 7,200

AREA XLIII

This area has been strip mined for coal. There are three ponds and a number of strip cuts. One large pond discharges water from the low point of the operation. Water collects in the strip cuts and discharges by gravity through a drainage cut.

A total of three discharges with flows of 4 g.p.m., 57 g.p.m. and 6 g.p.m. produce 184 lbs. of acid per day.

The water in the large pond should be neutralized prior to backfilling. The area should be backfilled to eliminate strip cuts and other surface depressions, and provide positive drainage.

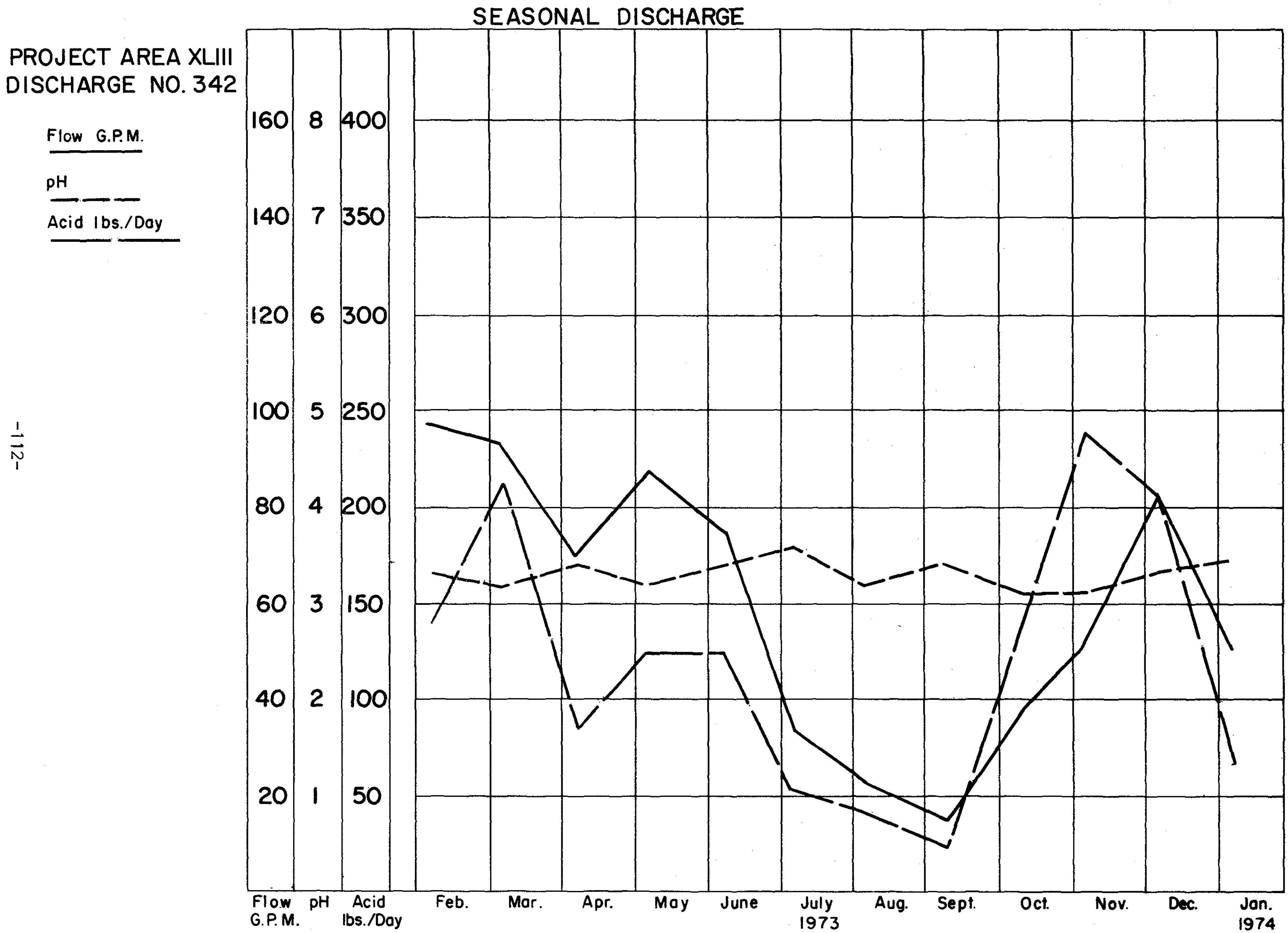
The backfilled area should be planted with grasses to check erosion.

Diversion ditches should be constructed where feasible to prohibit surface runoff from crossing backfilled spoil material. See Project Map No. 14 on page 133.

Estimated Cost:

Backfill and Plant	7 acres @ $1000/acre	$ 7,000
Drain Pond & Treat Water		6,000
	Total	$13,000
Projected Cost per lb. of acid/day		$ 70

PROJECT AREA XLIII
DISCHARGE NO. 342



AREA XLIV

This area represents a small portion of a rather large strip mined area. For the most part the surrounding area has been backfilled and planted with evergreens. There is, however, an open strip cut which captures part of the water from a stream flowing through the area.

In passing through the strip cut and the pond area the stream increases in acidity. The flow leaving the cut averages 176 g.p.m. and carries 38 pounds of acid daily.

To prevent the pollution-of the small unnamed stream which flows through this area, the stream must be diverted slightly around the strip cut. The pond should then be treated and drained. The cut itself should be backfilled and the area planted with a suitable grass mixture. See Project Map No. 14 on page 133.

Estimated Cost:

AREA XLV

This hill is the site of an active coal strip mine in the B Seam operated by Thomas Bros. Coal Company.

A series of discharges around the periphery of the hill are apparently associated with a previous mining operation. The combined average discharge of these sampling points is 48 g.p.m. This combined discharge totals 39 lbs. per day of acid.

It is well within the realm of possibility that the completion and reclamation of the active mining operation of Thomas Bros. might eliminate a large percentage of acid discharging from the area.

Reclamation plans for this operation should be delayed until such time as the impact of the active operation, with respect to the acid discharges, can be determined. See Project Map No. 16 on page 135.

AREA XLVI

This area is the site of the Korb Mine which was operated by Harbison Walker Refractories Company. The area was extensively deep mined and presently there are three active strip mine operations in the general area. The Mercer clay was mined here. Very limited strip mining was done around the entries to the deep mine. There are five openings into the Korb Mine along the southern end of the mining complex and one opening at the northern end where the Korb and Spencer Mines are connected.

Acid discharges were noted at the three southern entries and at the single northern opening. This dual discharge is due to a local structural high within the mine which produces a small anticline striking northeast southwest. The combined average flow of the three entries to the south is 46 g.p.m. producing about 453 lbs. of acid daily. The single northern opening discharges about 86 g.p.m. and contributes 810 lbs. of acid per day.

To reduce or eliminate the acid mine drainage all six of the openings should be sealed. The openings should be excavated and concrete block seals placed in each. The seals will inundate the workings, eliminating atmospheric contact with acid producing material, and thus improve the quality of outflows at higher elevations should they occur.

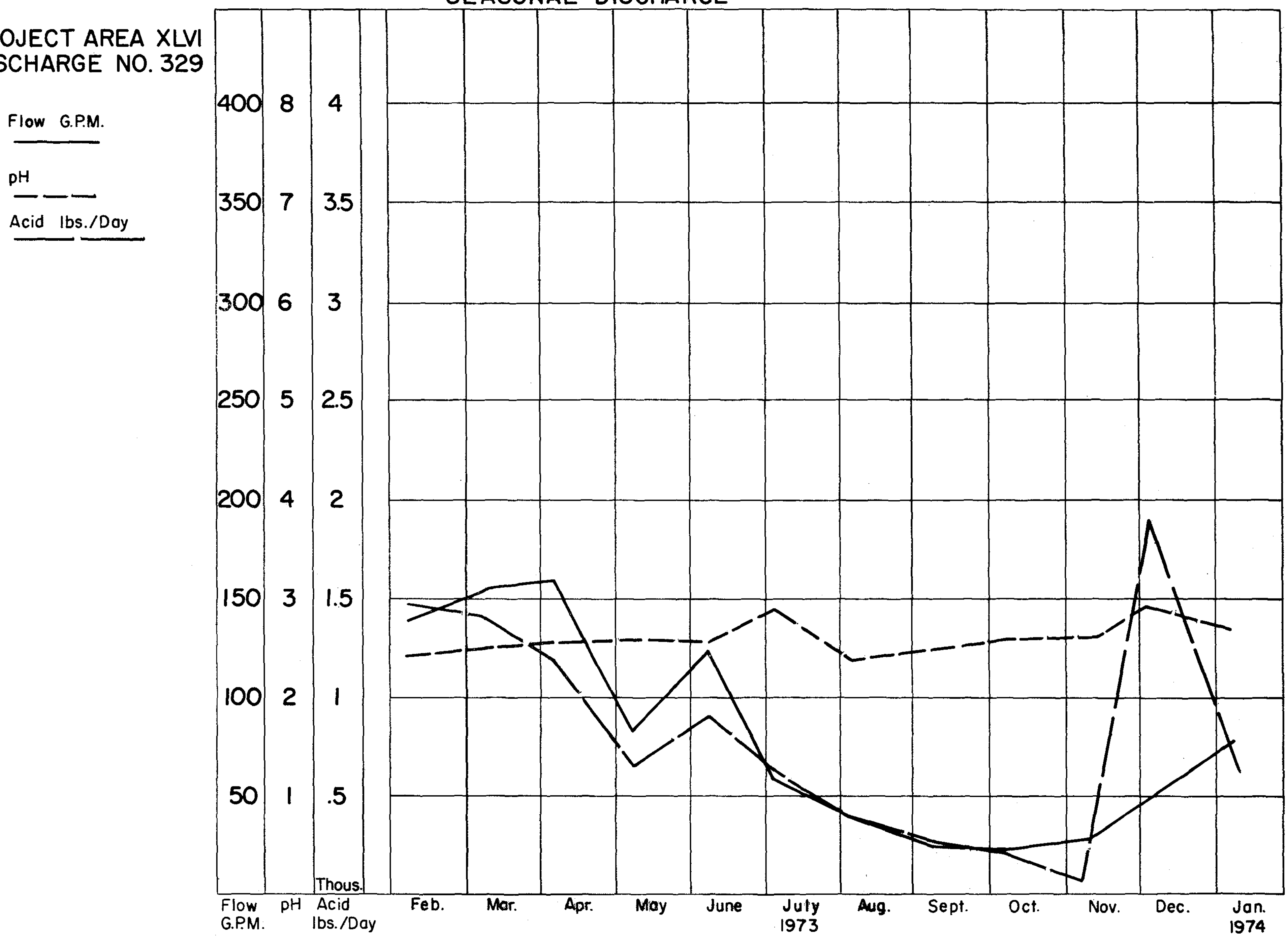
The area around the entries that has been stripped should then be backfilled up the highwall to the extent that the availability of material will allow. The slopes should be planted with a suitable grass mixture to retard erosion. See Project Map No. 13 on page 132

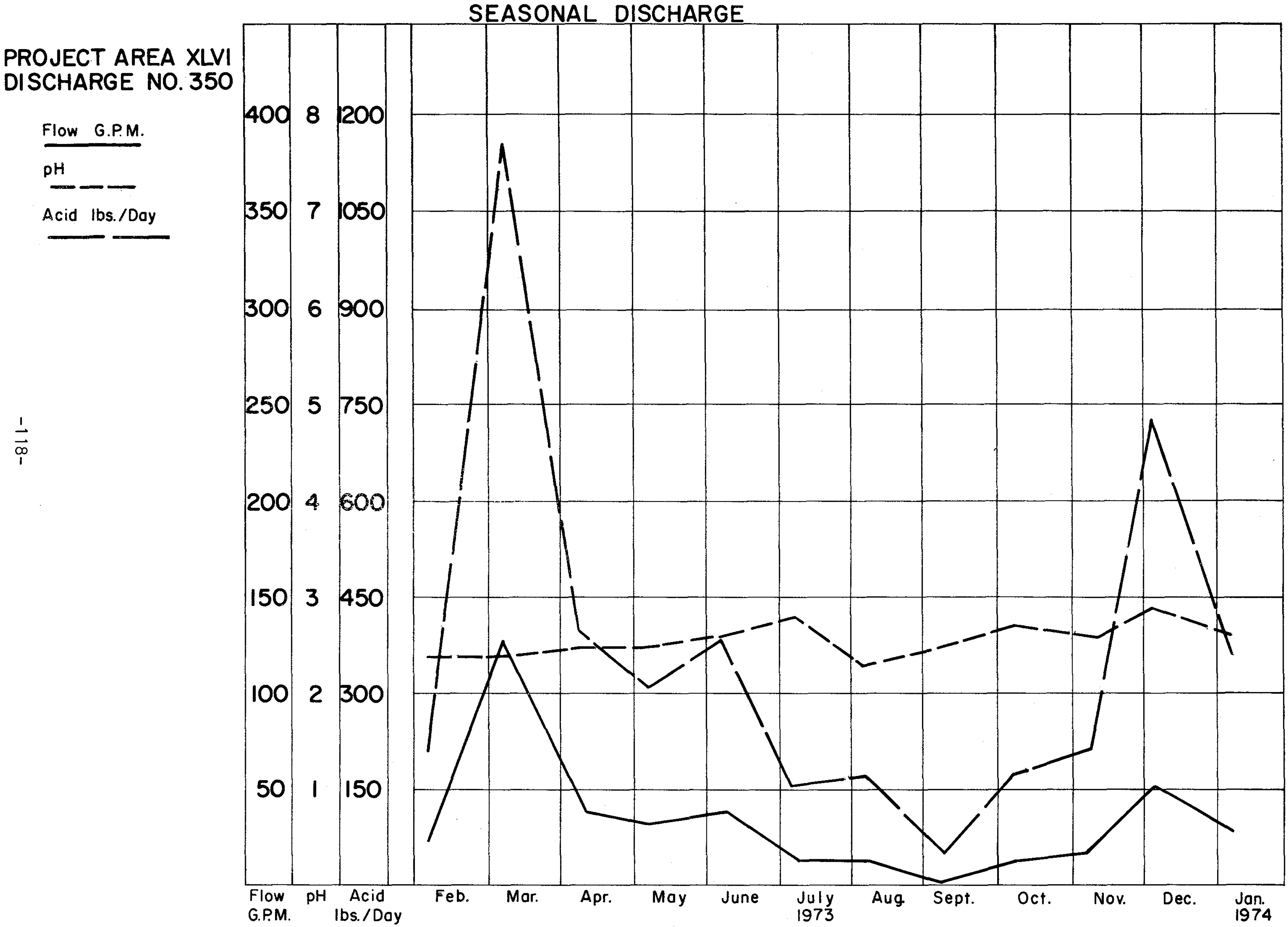
Estimated Costs:

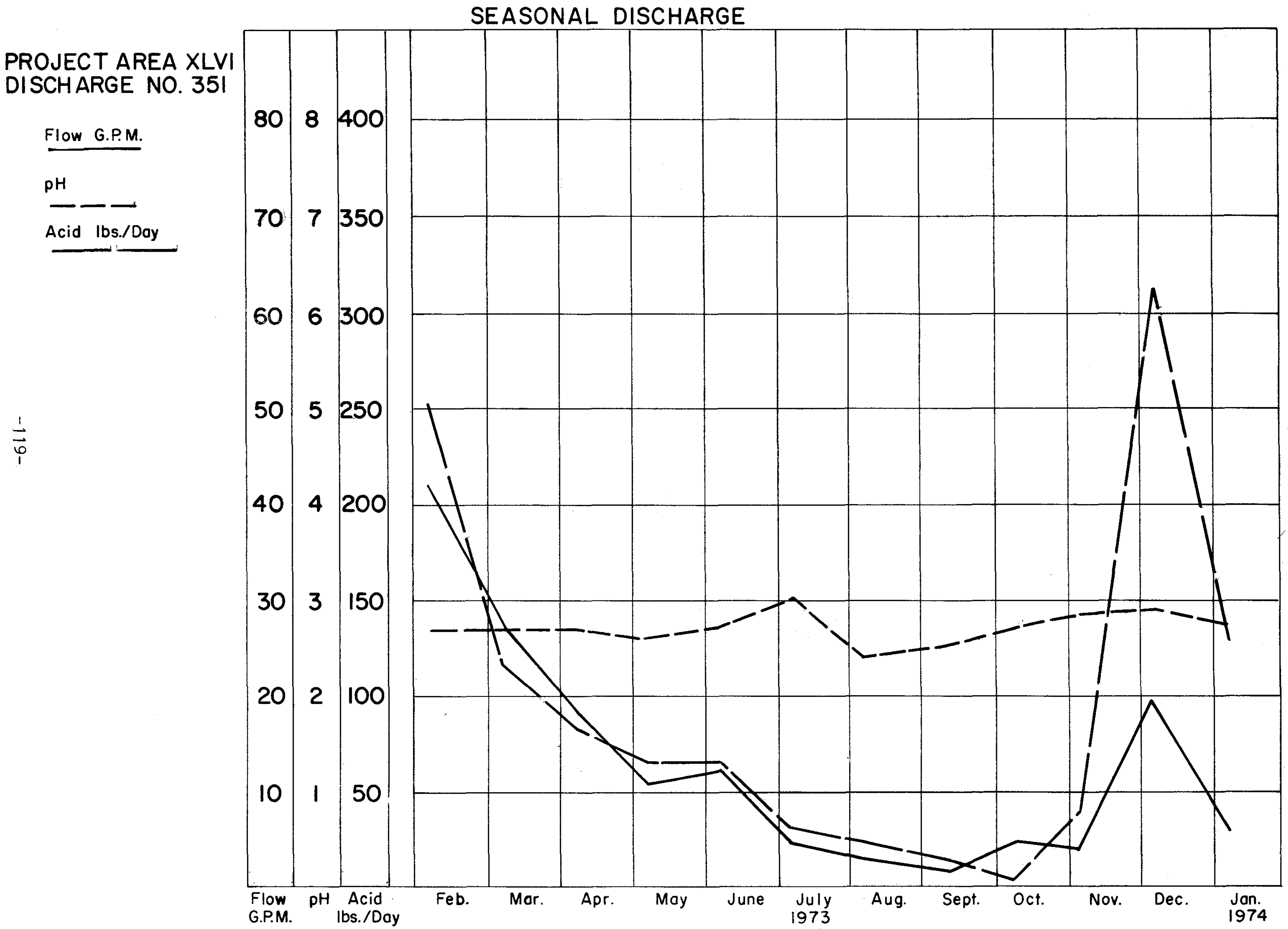
1 concrete block deep mine seal (north entry) @ $20,000	$20,000
5 concrete block deep mine seals (south entries) @ $15,000	75,000
Backfill & Plant 4.7 acres @ $1200/acre	5,640
Total	$100,640
Projected cost per lb. of acid/day	$ 80

PROJECT AREA XLVI
DISCHARGE NO. 329

SEASONAL DISCHARGE




PROJECT AREA XLVI
DISCHARGE NO. 350
Flow G.P.M.
pH
Acid lbs./Day
SEASONAL DISCHARGE
400 8 1200
350 7 1050
300 6 900
250 5 750
200 4 600
150 3 450
100 2 300
50 1 150
Flow G.P.M.
pH
Acid lbs./Day
Feb.
Mar.
Apr.
May
June
July 1973
Aug.
Sept.
Oct.
Nov.
Dec.
Jan. 1974


PROJECT AREA XLVI
DISCHARGE NO. 351
Flow G.P.M.
pH
Acid lbs./Day
SEASONAL DISCHARGE
80 8 400
70 7 350
60 6 300
50 5 250
40 4 200
30 3 150
20 2 100
10 1 50
Flow G.P.M.
pH
Acid lbs./Day
Feb.
Mar.
Apr.
May
June
July 1973
Aug.
Sept.
Oct.
Nov.
Dec.
Jan. 1974