

II. SYNOPSIS

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The basis for this report is the data derived from field investigations, subsurface exploration, a water sampling and testing program and maps of the deep and surface mines within the project area.

From this data it was found that Dagus Mines were the major source of stream pollution and that the largest part of the acid, iron and sulfate loads are reaching Little Toby Creek via Hays Run and Kyler Run. Both runs are being fed from the Kyler Mine portion of the Dagus Mines. Statistics bearing this out are summarized below and shown on the schematic on Page 6.

MAJOR POLLUTION SOURCES TO LITTLE TOBY CREEK BASED ON FLOWS TO DATE

	ACID <u>#/Day - %</u>	IRON <u>#/Day - %</u>	SULFATE <u>#/Day - %</u>
Little Toby Above Limestone Run (104,77,78,80,81,83,84,67,68,54)	1,145 - 7	146 - 5	7,671 - 15
Limestone Run (76 and 112)	1,553 -10	127 - 6	3,937 - 8
Kyler Run (75)	5,576 -37	580 -37	13,858 - 26
Toby Mine (74,43)	1,701 -11	132 - 5	7,124 - 13
Hays Run (107)	4,652 -31	1,426 -38	14,517 - 27
Cartwright Mine (11)	3 - 0	1 - 0	12 - 0
Sawmill Run (73)	595 - 4	37 - 2	5,469 - 11
	<u>15,222 -100</u>	<u>2,449 -100</u>	<u>52,588 -100</u>

() Indicates sampling point numbers

Due to the wide variances in acid loads being emitted and due to the physical conditions found in the field the project area has been divided into five project sub-areas which are referred to throughout the report as Cartwright Mine, Toby Mine, Dagus Mine-Limestone Run, Dagus Mine-Upper Little Toby Creek, and Kyler Mine.

Pollution sources in the Cartwright Mine Area consist of the Cartwright Mine and two surface mines to the south of Sawmill Run. As shown in the above table neither source contributes significantly to the pollution and no abatement measures are proposed.

Pollution sources in the Toby Mine Area consist of a deep mine in the Lower Kittanning Coal Seam plus surface mines in the Lower, Middle and Upper Kittanning and Lower Freeport Seams. Impervious surface seals, diversion ditches, and channels of conveyance are recommended to reduce flow into and through the mine, and reduce seepage to Sawmill Run. Two seals on the down dip side of the mine will be used as outlet structures from which pipes will convey the discharges to a treatment plant near Kyler Run. Complete sealing and flooding was ruled out due to the potential existence of excessive pressure heads (over 200 ft.), the vast amount of surface mining which has removed the remaining Lower Kittanning outcrop barrier and the high permeability of non-stripped barriers remaining on the periphery of the mine.

The effects of the Dagus Mine on Limestone Run appear to be relatively minor. Mine workings appear near the outcrop on the old mine maps of this area thereby precluding complete sealing without a massive grouting program. It is therefore recommended to divert the flow from an old WPA air seal through a pipeline to a treatment plant on Kyler Run.

From this area northward the acid discharges of the Dagus Mine directly affect the headwaters of Little Toby Creek. Water from caved openings, WPA air seals, refuse piles and strip mines all contribute to the pollution load in this area. A sealing program has been ruled out in this area also due to potential heads of over two hundred feet, crop barriers varying from under ten to forty feet and innumerable breakthroughs and/or drifts. Since numerous surface mine operators have obtained mine drainage permits on much of the area overlaying the mine, reclamation of the unreclaimed surface mines is not recommended. Two types of refuse pile reclamation are recommended. The first is the removal of the refuse and stream re-channelization. The second method consists of re-contouring, soil neutralization, covering and revegetation coupled with stream re-channelization. This type of reclamation has been completed in one area along Little Toby Creek as shown on Plate 4.

The remainder of the project is designated as Kyler Mine and it is the major problem as approximately 68% of the acid load found in Little Toby Creek within the project area emanates from sources within this sub-area.

Once again complete sealing was ruled out as hydraulic heads of 300 feet are possible and old surface mines have removed practically all barriers along Kyler Run.

Partial sealing along Hays Run is considered practical and can be accomplished by installing one double bulkhead seal and a minor amount of grouting. This will divert flow to the Kyler Run side of the mine. From the discharge point it will be piped downstream to a treatment plant. Two other discharge points on the eastern side of Kyler Run will be handled in a similar manner.

A treatment plant will then be required to provide abatement on Kyler Run. Recently completed strip mine reclamation and re-channelization of Kyler Run will reduce the acid load above the treatment plant. The implementations of the overall plan included herein is expected to reduce the average daily acid load from 15,225 lbs. to 2293 lbs. while recently completed reclamation measures should further reduce the remaining loads. The treatment plant itself will be responsible for 9988 lbs. of the overall reduction.

All reclamation work proposed in the individual areas of this plan have been listed according to their priority. The rationale for these priority assignments is as follows.

Before determining the final location and capacity of a treatment plant it should be know what the quantity and quality of the water is after being diverted from the discharge point on Hays Run. Likewise the quantity of water being discharged from the Toby Mine could be substantially reduced upon completion of the proposed surface mine reclamation. Knowing the degree of improvement in water quality in Little Toby Creek after completion of the surface reclamation work at Coal Hollow will be beneficial in determining if over treatment may be required at the proposed plant.

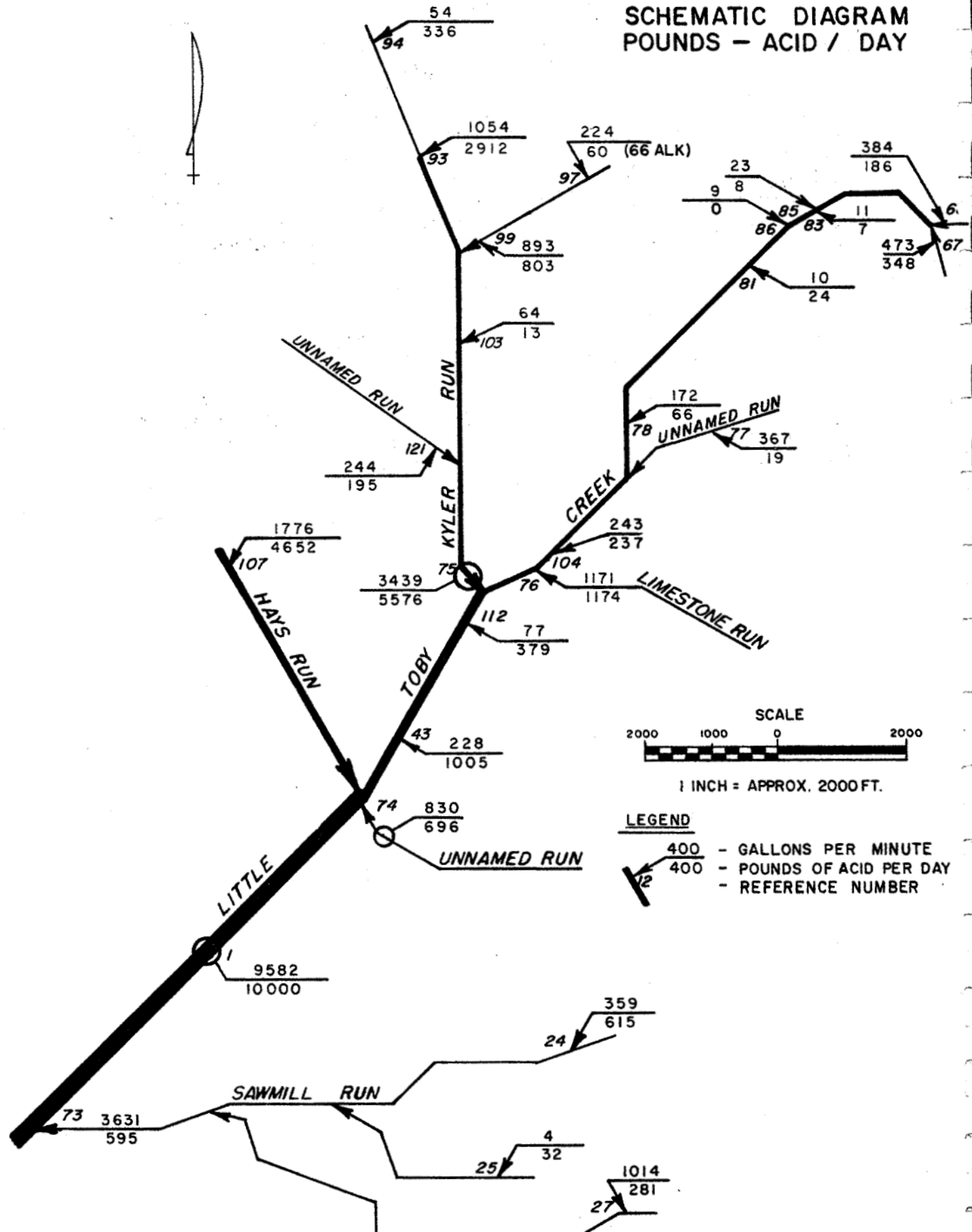
The cost of the measures proposed totals \$2,446,680 which equates to a first cost of \$189 per pound. Operational costs for the treatment plant are expected to total \$390 per day or \$0.039 per pound.

Stream improvement will total over 10 miles as this work coupled with the McCauley Run Reclamation will provide sufficient abatement for aquatic life on Little Toby Creek from Limestone Run to Brandy Camp Run. Sawmill Run, Hays Run and other minor unnamed streams will also be revitalized and have been included in the ten miles.

PROJECT SL 132-5

LITTLE TOBY CREEK

SCHEMATIC DIAGRAM POUNDS - ACID / DAY



III. LOCATION AND DESCRIPTION OF THE PROJECT AREA

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A. Location

The project area encompasses the entire central portion of Fox Township in Elk County, Pennsylvania. It is irregular in shape due to its designated boundaries which are listed hereunder.

- (1) Sawmill Run to the South
- (2) Little Toby Creek Surface Drainage Divide to the East
- (3) Old grade of the P.S. & N. Railroad to the North
- (4) Township Route T-376 to the West

The described boundary totaling 19 miles is depicted on the enclosed index map. The area it encompasses totals 15 square miles.

B. Topography

Elk County is situated in the Appalachian Plateau Province. The western two-thirds of the county, including the Study Area, is drained by tributaries of the Ohio River.

The Study Area is the headwaters of Little Toby Creek. The eastern boundary of the drainage system is Boone Mountain which strikes in a northeast-southwest direction. Boone Mountain forms the continental divide and is the major structural feature of the Study Area.

The northern boundary of the watershed generally parallels State Route 948, which runs east-west through the villages of Dagus and Kersey. The western boundary is a ridge, much less prominent than Boone Mountain, which separates Toby Valley from Shawmut Valley.

As in other areas of Elk County, nearly all hills are above 1800 feet, and on the higher areas the hill tops exceed 2000 feet. The low point in the project area being 1540 feet at the junction of Little Toby Creek and Sawmill Run and a high point with an elevation of 2079 is located one mile southeast of Kersey.

The topography is characterized by a typical dendritic stream pattern. This generally is indicative of high, flat-topped divides separated by steep sided valleys in which flow deeply entrenched streams.

C. Climatology

The climate in Elk County is characterized by cold winters and temperate summers. Annual temperatures average out at 42.2 degrees, while precipitation totals 41.28 inches.

The official weather station is located at Ridgway Borough, some six miles northwest from the project area.

Precipitation records from the Ridgway Station were obtained and presented hereunder in tabular form. This information was utilized in correlating discharges with precipitation.

SAMPLE SERIES	DATE	TOTAL PRECIPITATION IN INCHES DURING PRECEEDING		
		WEEK	2 WEEKS	MONTH
A	5-31-73	0.80	1.93	4.02
B	6-27-73	0.78	2.63	4.35
C	7-12-73	0.09	1.00	4.79
D	8-2-73	0.83	1.87	3.51
E	9-7-73	0.69	0.69	3.99
F	10-19-73	0.41	0.94	2.53
G	11-25-73	0.05	0.32	2.74
H	12-9-73	0.05	1.74	2.15
I	12-28-73	1.62	2.08	3.85
J	1-27-74	0.47	1.78	3.20
K	2-16-74	0.14	0.39	2.23
L	3-23-74	1.39	3.95	5.14

D. Geology

Structure: The Second Geological Survey of Pennsylvania (Ashburner, 1885) recognized the "Boone Mountain anticlinal" and the "Fourth Bituminous coal basin, which in Fox Township is locally named the Toby or Toby Creek coal basin, from the fact that the Toby Creek flows very nearly along the center of the basin, its general direction being parallel to that of the axis of the synclinal."

Cathcart (Bulletin 108, 1934) in his map of the geologic structure in north-central Pennsylvania, shows Boone Mountain as the Sabinsville Anticline, a major structural feature extending northeast to the New York State line. Cathcart also recognized the Toby Creek and Shawmut Synclines as discontinuous structural features in southwestern Elk County.

Stratigraphy: Rocks of the Devonian, Mississippian and Pennsylvania Systems are known to outcrop in Elk County. The older Devonian rocks have only limited exposures in some of the deeper valley bottoms. The Pennsylvanian rocks have received the most geologic attention because of their coal resources, which have been exploited since the 1800' s.

Within the Study Area, the surface rocks belong to the Pottsville and Allegheny Groups of the Pennsylvanian System, as defined by the Pennsylvania Geologic Survey. These groups are further subdivided into formations, based primarily on the underclays below the important coal seams. The formations carry the familiar names of these coals; Freeport, Clarion, Kittanning, etc. These formations have been recently defined in the Clearfield and Houtzdale 15-minute quadrangles (Edmunds, 1968; Glover, 1970), but the detailed geologic field work has not been extended north into the Study Area.

During the drilling program which was conducted as part of this project personnel from U.S.G.S. examined cores and prepared their own descriptive logs and gamma logged numerous rotary holes. This was done to assist them in the preparation of geologic and ground water maps of the area.

Of particular interest to this study are the water bearing characteristics of the rocks within the watershed. Although detailed field studies would be necessary to delineate the specific characteristics, certain generalities can be drawn from the published literature. The Allegheny Group in north-central Pennsylvania is described (Lohman, 1939) as a variable sequence of sandstone, shale, limestone, clay and coal. The sandstones are locally productive as ground-water aquifers in Elk County. The ground-water quality is considered poor near coal mines, with considerable iron and hydrogen sulfide content.

One of the most distinctive regional marker beds in western Pennsylvania and eastern Ohio is the Vanport limestone. The Vanport occurs in the Allegheny Group, and in areas where it is well developed, is found between the Lower Kittanning and Clarion Coals. The Study Area is at the extreme eastern end of the outcrop limit of the Vanport Limestone (O'Neill, 1964). However at least two locations in or adjacent to the Study Area are recorded in the literature where the Vanport has been identified and sampled. The average interval between the Lower Kittanning Coal and the Vanport Limestone in the Study Area was reported as being approximately fifty feet. During the course of the drilling program described on pages 68 through 74 of the report two holes were drilled to a sufficient depth to determine if the Vanport Limestone did exist. In hole J limestone was encountered 45 feet below the Lower Kittanning Coal Seam while in hole R-1 it was encountered 51 feet below the Lower Kittanning Coal Seam.

The Vanport Limestone is marine in origin and is the only limestone of economic importance in Western Pennsylvania. A few fresh water origin limestones have been noted in the literature, but they are generally thin and variable over relatively short distances. Of little importance economically, they are probably ignored or go unrecognized in outcrop or drill core, although they may have a significant effect on the local ground-water chemistry.

Stratigraphically below the Vanport is a coal variously reported to be equivalent to the Clarion or Brookville seam. This coal is economically important in the St. Marys area but is not significant in the Study Area.

The Pottsville Group is represented by three coals, approximately at the horizon of the Mercer Coals, known locally as the Alton Seams. These coals are important only locally in parts of Elk County and are not significant in the Study Area. Sandstones of Pottsville age are considered good ground-water aquifers in most of the Elk County Area. The geological cross sections found on pages 12 and 13 were derived from Drill Hole Data obtained from Northeast Mining and Exchange Company.

E. Mining History

Prior to 1884 extensive mining of the Lower Kittanning Coal occurred in the northeastern section of the project area. According to the Second Geological Survey of Pennsylvania, these mines were known as the Eureka, being operated by D. Eldridge, Esquire, while the larger Dagus complex was operated by Northwest Mining and Exchange Company. Reportedly the first opening was made by a Dr. Earles in 1848 near the headwaters of Little Toby Creek.

The mining of the Middle Kittanning Coal was carried out by Northwest Mining and Exchange Company to a limited degree during this time interval at various locations above the Dagus Mines.

Northwest Mining and Exchange Company continued its operation in the Dagus mine and into the Kyler and Toby mines. The Dagus and Kyler being joined by numerous headings in the north central section of the project area. The Dagus and Toby Mines were interconnected by a tram road constructed over Limestone Run. Naturally these mines were all in the Lower Kittanning Coal. The only other mine of any consequence in this vein was Ridgway Coal Company's "Cartwright Mine" located between Sawmill Run and Little Toby Creek in the southern portion of the Study Area. Apparently this mining operation occurred between 1919 and 1926.

Other known deep mines believed to be in the Middle Kittanning seam as shown on the enclosed mine map (Plate 19) are known as the Ticossi Mine and the Malone and Pontzer Mine. Maps indicate that these operations occurred in the later 1930's and early 1940's.

The Eureka No. 2 mine ran from its outcrop above Kyler Run eastward to an exit above Little Toby Creek.

Maps of the above mentioned mines are on file at the offices of Lee-Simpson Associates in DuBois, Pennsylvania and/or the Northwest Mining and Exchange Company offices at Stump Creek, Pennsylvania.

Other mines, about which little seems to have been recorded, are the Taylor drift in the northeast section and the Enos Hayes operation in the west central portion. From our field inspection of the project area it appears that unrecorded country banks are prevalent throughout the Project Area.

Open pit mining has likewise been carried out extensively throughout the project area, throughout the study period there were six active operations. The Smith and Rogas operation permitted in 1962, is located above the western section of the Kyler Mine. Coal seams reportedly mined or to be mined are Lower Kittanning, Middle Kittanning, Upper Freeport, Brush Creek and a cap seam. Previously New Shawmut Mining Company was active in this area.

Tamburlin Brothers current operation is located in the east central section of the project area and involves the Lower and Middle Kittanning seams.

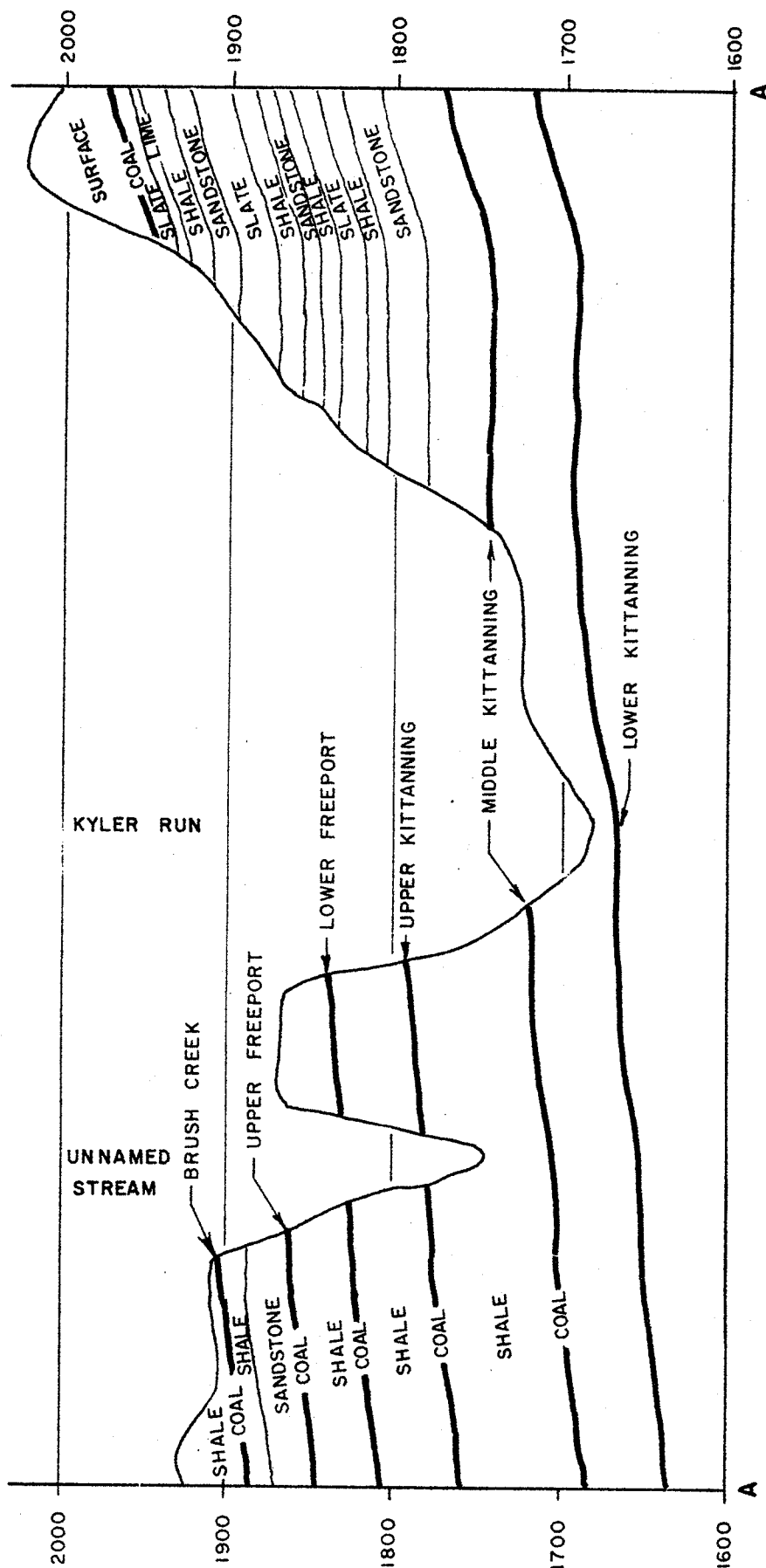
The third active operation is being carried out by Lawrence Vollmer along the headwaters of Limestone Run. His mine drainage permit indicates mining in the Lower and Upper Kittanning seams of coal.

The fourth operation is being carried out by the Fairview Coal Co. over the west central portion of the Kyler Mine. The permit indicates that they are to remove the Brush Creek and Upper Freeport Seams.

Glen Irvan Corporation is the fifth operator in the area. They are currently stripping an area over the northern portion of the Kyler Mine and along its periphery south of Earlyville. Their permit calls for the removal of the Lower Freeport Seam.

A mine drainage permit was also issued to Hepburnia Coal Co. in 1976 to mine the Lower Freeport, Middle Kittanning and Lower Kittanning and Lower Kittanning Coal Seams in an area between Kyler Run and Little Toby Creek.

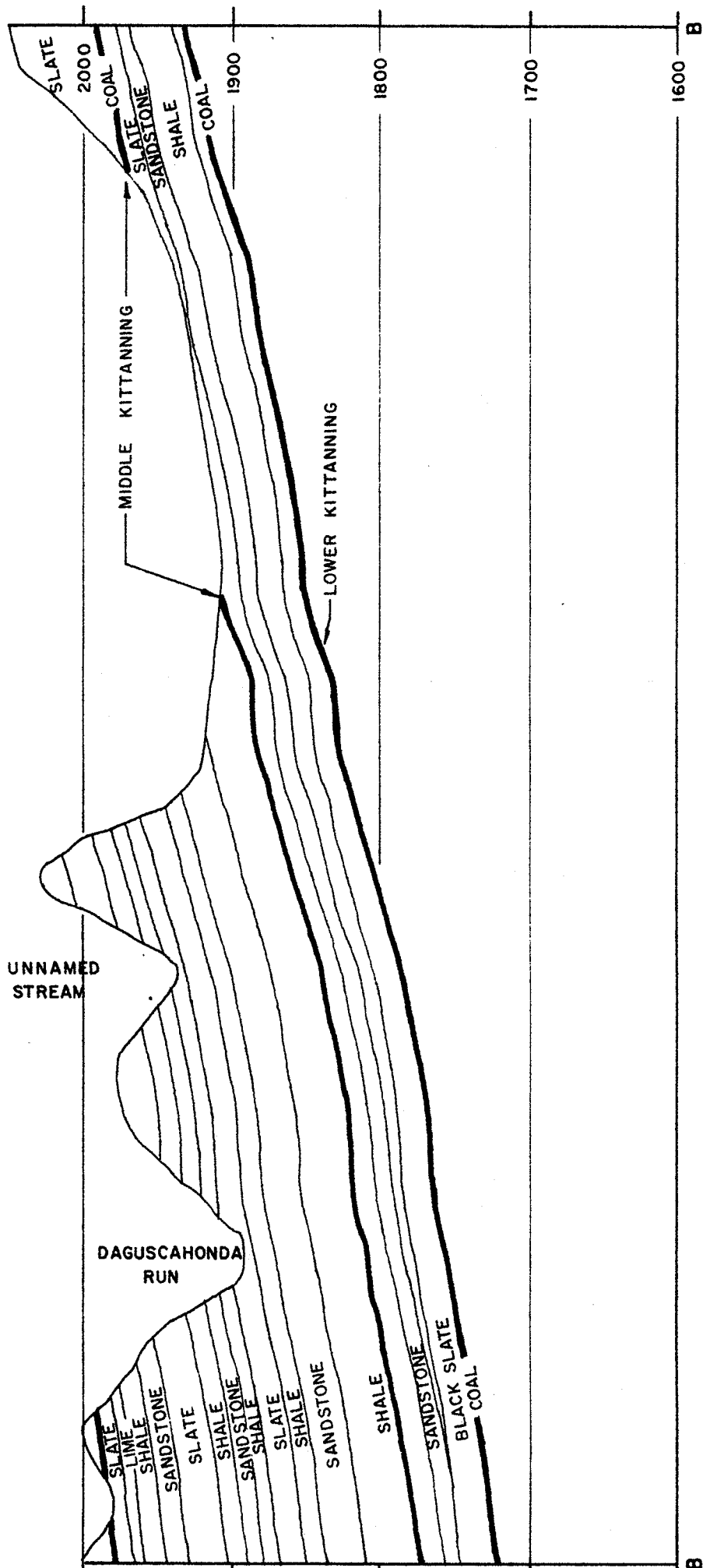
In addition to these active operations previous surface mining operations of Shawmut Coal Company, Tamburlin Brothers, Perry and Vaslander, Bona, Carl and Arnold James, and H. Mottern are shown on Plate 20 in the Appendix of the Report, along with other companies receiving Mine Drainage Permits.



CROSS SECTION A-A

SEE PLATE 18 FOR LOCATION

SCALE
 HOR. 1"=1000'
 VERT. 1"=10'



CROSS SECTION B-B

SEE PLATE 16 FOR LOCATION

SCALE
 HOR. 1"=1000'
 VERT. 1"=10'

GEOLOGIC CROSS SECTIONS