The Effects of Coal Mining Activities on the Water Quality of Streams in the Western and Eastern Coalfields of Kentucky

A Report Prepared By:

Kentucky Department for Natural Resources
and Environmental Protection

Division of Water

Under a Memorandum of Agreement with:

Kentucky Department for Natural Resources
and Environmental Protection

Division of Abandoned Lands

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Introduction

This report contains the information gathered by the Kentucky Division of Water under a Memorandum of Agreement with the Kentucky Division of Abandoned Lands. The information was generated to aid in the preparation of the Kentucky Plan for Abandoned Mine Land Reclamation (State Plan). It addresses certain water related components mentioned as a necessary part of the State Plan in the regulations governing the Abandoned Mine Land Reclamation Program (Federal Register, Vol. 43, No. 201, October 25, 1978). These components are; (1) maps showing the general location at a scale of 1:250,000 of surface streams which are known to be affected by coal mining activities in the western and eastern coalfields (2) a general description of the water quality problems associated with the affected streams (3) tables summarizing the miles of streams with water quality problems associated with coal mining activity, and (4) brief discussions of aquatic fauna found in streams sampled during the project and a fisheries evaluation of third order coalfield streams. In addition, detailed reports of conditions at streams surveyed in the summer of 1980 are presented. An Appendix contains pertinent data collected by others which were used in assessing water quality conditions in the project area. Location information on third order streams identified during the course of the project are available in Division of Water files.

Information on the present location of abandoned mine lands in Kentucky was incomplete at the onset of this project. As a result, those streams affected by abandoned lands were not separated from those affected by present mining activities. As the information becomes available, the separation should be possible.

Methods and Materials

Mapping of Streams Affected by Coal Mining Activities

An initial survey of published material on water quality relating to coal mining activities revealed that there was a lack of current information. In order to design a field survey for gathering more information, the survey was directed at third order watersheds. This decision was based on the idea that such watersheds represent a manageable area for reclamation activities and would also have continuous flow during the summer months when the survey sampling was to take place.

As a result of this decision third order streams in the western and eastern coalfields were identified from USGS 7.5 minute series topographic maps in the Geography Department at Eastern Kentucky University. Third order streams were already located on these maps as a result of other work being done for the Kentucky Department for Natural Resources and Environmental Protection. Stream order was determined by the classification system as described by Horton (1945) and Lotrich (1973). Stream names were then compiled by major river basin and their lengths in miles were tabulated after measurements were taken using a map plan measure. These streams were then located and marked on the base map (scale 1:250,000) developed for the project.

In order to choose streams for sampling in the field survey, the locations of sampling sites established by other agencies were marked on overlays for the base maps. Sites were then chosen to prevent duplication of information and to represent areas where very little water quality data had been collected or were of particular interest.

Data from current water quality studies and the field survey were assembled and organized by major river basins. Water quality was determined to be affected by past and present coal mining activities according to the following criteria:

Parameter	Value
pH	Less than 6.0 standard units
Acidity	Greater than alkalinity
Sulfate	Greater than 60 mg/l
Total Iron	Greater than 0.5 mg/l
Total Manganese	Greater than 0.5 mg/l
Specific Conductance	Greater than 350 µS/cm (µmhos/cm)

The literature was reviewed before establishment of the above criteria. This included the U. S. Department of the Interior (1968)(1969), Appalachian Regional Commission (1969), L. Robert Kimball, Consulting Engineers (1974), Eastern Kentucky University (1975), Dyer and Curtis (1977) and Harker et al. (1979). The goal was to establish criteria which reflected a change from natural background water quality due to coal mining activities. Affected streams were therefore defined as those streams which had the identified changes. Since acid mine drainage is a well known consequence of coal mining activities in Kentucky, a pH depression below 6.0 was established as one criterion. This is also reflected in an acidity value which is greater than alkalinity. A further consequence of coal mining is an elevated level of sulfate, iron and manganese concentrations (Dyer and Curtis, 1977). Sulfate concentrations of the streams monitored in the field survey, conducted as part of this project, were plotted on a scatter diagram. Unimpacted streams fell into a group which had sulfate concentrations of 60 mg/l or less. This was in agreement with the findings of Harker et al. (1979). A sulfate concentration of greater than 60 mg/l was therefore established as an indication of affected waters. Iron and manganese criteria were established in agreement with the U. S. Department of the Interior (1968). The specific conductance criterion was established in agreement with U.S. Department of the Interior (1968) and Harker et al. (1979). An elevated level of specific conductance is a result of the increase in sulfate, iron, manganese and other ions associated with coal mining activity.

The sulfate concentration was the primary criterion used to designate affected streams. Grubb and Ryder (1972), Nichols and Burlow (1973), and Curtis (1977), among others, have indicated that sulfate concentrations are an excellent indicator of stream pollution from coal mining activities. The other listed criteria were used to verify the designation. Streams with recorded pH values of less than 6.0 were additionally designated as impacted by acid mine drainage.

Once a stream was designated as being affected by coal mining activities, its location and approximate segment length were outlined on an overlay of the base map. The length of segment was determined from certain assumptions made in producing the tables which list the miles of streams affected by coal mining activities. These assumptions are explained in the following paragraphs.

Tabulation of Stream Miles Affected by Coal Mining Activities

Stream mileages were measured on 7.5 minute series USGS topographic maps. If the stream in question was indexed in the Division of Water River Mile Index System, miles were taken directly from those maps. If not, the lengths were measured with a map plan measure.

The basic assumptions used in determining the length of a stream designated as being affected by coal mining activities are listed below:

1. The entire stream length above the sampling site was assumed to be affected and its furthest mainstem reach was measured. If the stream had major branches the reach up to these branches was measured.

2. The mainstem stream length below the site was measured until it reached or became a higher order stream. It was assumed that lower order streams flowing into the stream would not have a major diluting effect while higher order streams could.

3. When a stream had more than one sampling site and the sampling site upstream indicated the stream was not affected while the lower site did indicate the stream was affected, one half of the distance between the sites was assumed to be affected. If another affected stream entered that stream between the two sites then the distance to that site was assumed to be affected.

Current water quality data were given the most importance in determining affected streams. Sources for the most current data include the USGS Coal Hydrology studies conducted for water year 1979, Kentucky Nature Preserves Commission studies conducted in 1978 and 1979 and Division of Water studies conducted in 1978 and 1980. Where current data were not available, less current studies were used. The sources used to determine affected streams are cited in the tables. Appendix A contains excerpted USGS data from the Coal Hydrology studies. Appendix B contains the data collected by the Division of Water in 1978. The Division of Water data collected in 1980 is included in the main body of this report.

Field Survey Methods and Materials

During the period of 4/Jun/80 through 23/Jul/80, a total of 117 stream sites were surveyed in the eastern and western coalfield physiographic regions of Kentucky. Of these 117 sites, 109 were actually sampled with the remaining 8 sites being dry. Stream survey sites were located in third order stream segments generally in the lower sections of said segments near their continuum into fourth order segments.

The field water collections consisted of either directly taking cubitainer grabs or utilizing a Lab-Line bucket type water sampler. The water sampler was used at sites which were physically inaccessible. At each site two samples were taken. One sample to be analyzed for total iron and manganese was preserved by the addition of 3 ml of nitric acid; the other sample, which was to be analyzed for sulfates, alkalinity, and acidity was stored on ice. Turbidity and specific conductance were measured in the laboratory on a few occassions when the equipment failed in the field.

Following water sample collection, several parameters were measured in the field. A Beckman Chem-Mate pH meter was used to measure pH. Conductivity and temperature were measured with a Yellow Springs Model 33 conductivity meter. Specific conductance was later adjusted to 25°C. The Yellow Springs 54A Oxygen Meter registered dissolved oxygen. Turbidity was measured with an HF Instrument Model DRT 15 turbidimeter. A visual approximation of substrate type (bedrock, boulder, cobble, rubble, sand, gravel, silt) in pools and riffles in the immediate survey area was recorded. In addition, the type and degree of sedimentation were subjectively noted. Pool-riffle ratios were also noted. Measurements of width and depth (mid-stream) were taken along with canopy coverage.

At 104 of the sample sites, a cursory biotic survey was conducted. Benthic macroinvertebrates were collected by the kick method utilizing a D-frame net and by hand picking attached organisms from rocks and other substrates. Fishes were collected with a habitat seine. Organisms to be brought back to the laboratory were preserved in 10% formalin.

Standard methods of chemical analysis were used to determine total acidity (electrometric endpoint pH 8.2), total alkalinity (electrometric endpoint pH 4.5), sulfates (turbidimetric method), and total iron and manganese with digestion followed by atomic absorption (Environmental Protection Agency 1974, APHA, et al. 1975). The aforementioned analyses were

conducted by the analytical laboratory of the Kentucky Department for Natural Resources and Environmental Protection, Division of Water. In the laboratory, turbidity was measured with an HF Instrument Model DRT 100 turbidimeter, while conductivity was registered by the Conductivity Bridge Instrument RC 16.

To evaluate the fishery potential of third order streams in the coalfield regions, a questionnaire was sent to conservation officers in counties of the study area. The questionnaire included: (1) an estimation of present and past fisheries status (excellent, good, fair, poor, unknown), (2) primary species sought (largemouth bass, smallmouth bass, panfish, walleye, muskie, sucker, catfish, trout, other), and (3) mining impact (silt, acid, none). Ninety percent (55 of 61) of the requested county evaluations were returned by the conservation officers.

Results and Discussion

This section is organized to address the elements which were directed toward fulfilling the information requirements of the State Plan. The mapping exercise, presentation of tables which indicate the miles of streams affected by coal mining activities, descriptions of the water quality problems identified in affected streams and the information collected in the 1980 summer field survey will be addressed.

Mapping of Streams Affected by Coal Mining Activities

The maps prepared for the State Plan are presented as special attachments to that report because of their size. The identification of third order streams revealed some interesting information. Table 1 summarizes this information. There were a total of 1,765 identified third order watersheds in the coalfields. The eastern coalfields contained 1,117 of these and the western coalfields contained the remaining 648 watersheds. These watersheds represent a total length of 3,563 miles of streams. A frequency analysis showed that approximately 60% of the third order segments were less than two miles in length. The names of the third order streams, their locations by 7.5 minute series USGS topographic maps and segment lengths are available from the Division of Water files.

Table 1

Number and Miles of Third Order Streams
in the Coalfields of Kentucky

River Basin	Number of Third Order Streams	Miles	Mean Mileage
Western Coalfield			
Tradewater	158	229.1	1.4
Green	363	724.1	2.0
Lower Ohio	127	206.6	1.6
TOTAL	648	1159.8	1.8
Eastern Coalfield			
Kentucky	346	745.5	2.2
Upper Cumberland	286	660.0	2.3
Big Sandy	166	422.0	2.5
Little Sandy	77	166.3	2.2
Licking	158	269.9	1.7
Tygarts Creek	43	76.2	1.8
Upper Ohio	41	63.5	1.6
TOTAL	1117	2403.4	2.2
GRAND TOTAL	1765	3563.2	2.0

The maps represent the most current assessment of the location of streams affected by coal mining activities. More streams are included than in previous work because of the criterion used to define an affected stream and because there was a greater data base. However, the map's are undoubtedly conservative because a great number of streams have yet to be surveyed. The placement of known sampling sites on the maps is intended to show where current information on water quality exists and where stream information is nonexistent. Future stream studies or studies unknown to the writers can easily be indicated on the maps as they become available.

The location of abandoned lands will be identified through the continuing efforts of the Division of Abandoned Lands Phase II inventory. The maps can be utilized to help assess where reclamation efforts can best be directed to improve water quality. For instance, affected watersheds with a high proportion of abandoned lands might be better candidates for reclamation aimed at improving water quality than those where active mining is the predominant source of poor water quality.

A discussion of the problems associated with the affected streams will follow in further sections of this report. They will be included in the analysis of each major river basin within the coalfields.

Tabulation of Miles of Streams Affected by Coal Mining Activities

The streams have been organized on a separate table for each major river basin. In each table, subbasins and streams within subbasins are organized in a stair-step fashion. They have generally been listed from the most headwater subbasin in downstream order.

Table 2 is a summary table listing the total miles of affected streams and the miles which are impacted by acid mine drainage. The other tables (3-9) list the actual streams and distances affected and also identify those streams which have acid mine drainage problems.

It is evident from the data in Table 2 that the river basins in the western coalfield have a more serious problem with acid mine drainage (AMD) than those in the eastern coalfield. The Green River Basin has the greatest number of miles of streams impacted by AMD, while the Tradewater River Basin has the greatest percentage (79%) of its known affected stream miles impacted by AMD.

Table 2

Summary of Stream Mileages Known to be Affected
by Coal Mining Activities in Major River Basins of Kentucky

River Basin	Total Miles Affected	Miles Affected by Acid Mine Drainage
Western Coalfield		
Tradewater	309.9	244.1
Green	583.6	271.2
Lower Ohio	60.4	16.0
Eastern Coalfield		
Kentucky	673.0	18.5
Upper Cumberland	667.2	27.3
Big Sandy	749.4	9.6
Little Sandy	48.6	0
Licking	38.9	0

Table 3

Stream Mileages Known to be Affected by
Coal Mining Activities.

TRADEWATER RIVER BASIN

Name of Stream	Source	Miles Affected	Acid Mine Drainage Impact
Tradewater River	3	109.2	*
Castleberry Creek	3	9.0	-
Unnamed tributary	2	0.8	-
Buffalo Creek	2	8.6	*
Cany Creek	2	11.3	*
Unnamed tributaries (2)	2	1.4	*
Fox Run	2	2.1	*
Unnamed tributary	2	1.0	*
Cane Run	2	3.4	*
Unnamed tributary	2	1.7	-
Copperas Creek	2	3.6	*
Unnamed tributaries (2)	2	3.3	-
Hurricane Creek	2	3.3	*
Brooks Creek	1	4.3	*
Clear Creek	2,3	25.8	*
Unnamed tributaries (2)	2	2.9	*
Sugar Creek	2	5.3	*
Richland Creek	2	7.4	-
Copper Creek	2	2.7	*
Greasy Creek	2	6.2	-
Pogue Creek	2	4.6	*
Unnamed tributaries (3)	2	1.2	*
Lamb's Creek	2	4.8	*
Unnamed tributary	2	1.6	*
Pond Creek	2	4.6	*
Unnamed tributary	2	1.3	*
Lick Creek	1,2,3	18.1	*
Unnamed tributaries (6)	2	10.2	*
Unnamed tributaries (4)	2	6.8	*
Owens Creek	2	4.1	-
Unnamed tributaries (3)	2	3.6	*
Whiteside Creek	2	2.8	-
Vaughn Ditch and Craborchard Creek	3	18.7	-
Unnamed tributaries (2)	2	3.9	-
Slover Creek	2	5.5	-

Table 3 continued

TRADEWATER RIVER BASIN

Name of Stream	Source	Miles Affected	Acid Mine Drainage Impact
Unnamed tributary	2	2.4	*
Wynn Ditch	2	2.4	-

1. Division of Water (1980)
2. Division of Water (1978)
3. U.S.G.S. (1980)

*pH < 6.0
-pH $\geq$ 6.0

Table 4

Stream Mileages Known to be Affected
by Coal Mining Activities

GREEN RIVER BASIN

Name of Stream	Source	Miles Affected	Acid Mine Drainage Impact
Green River near Beechgrove to Pond River	3	5.9	-
Muddy Creek	2	17.5	-
Persimmon Creek	2	2.0	-
Unnamed tributary	2	0.7	*
Mud River			
Hazel Creek	1	6.0	-
Little Hazel Creek	2	3.9	*
Jacobs Creek	1	4.8	-
Pond Creek	2,3	20.0	*
Unnamed tributaries (4)	2	10.3	*
Caney Creek	2	7.0	*
Beech Creek	2	3.4	*
Unnamed tributaries (2)	2	1.7	*
Nelson Creek	2	4.3	-
Pond River	2,3	57.0	*
Cypress Creek	2	33.3	*
Unnamed tributaries (2)	2	5.9	*
Little Cypress Creek	1,2	10.4	*
Harris Branch	2	2.4	*
Brier Creek	2	4.7	*
Isaacs Creek	2	5.8	*
Unnamed tributary	2	2.1	*
Flat Creek	2	10.6	-
Unnamed tributaries (2)	2	1.7	*
Unnamed tributary to Pond River	2	2.6	-
Unnamed tributary to Pond River	2	3.4	-
Drakes Creek	2,3	20.7	*
Unnamed tributaries (8)	2	12.1	*

Table 4

GREEN RIVER BASIN CONTINUED

Name of Stream	Source	Miles Affected	Acid Mine Drainage Impact
Pleasant Run	2	7.9	*
Unnamed tributaries (3)	2	5.2	*
Craborchard Creek	2	7.6	*
Unnamed tributary to Pond River	2	3.4	-
Thompson Creek	2	6.0	*
Unnamed tributaries (2)	2	4.3	*
West Fork Pond River	3	26.0	-
Grays Branch McFarland Ck.	1	4.3	-
Long Creek to East Fork Pond River	3	12.2	-
Nolin River			
Dismal Creek	1	2.3	-
Little Reedy Creek	3	12.0	-
Rough River	2	44.3	-
Muddy Creek	2,3	14.1	-
Unnamed tributary	2	2.8	*
Unnamed tributary to Pigeon Creek	2	2.7	*
Three Lick Fork	2	6.1	-
North Fork	1	7.9	-
Bens Lick Creek	2	2.6	-
Barnett Creek	3	13.4	-
North Fork	3	6.1	-
Slaty Creek	2	4.1	-
Unnamed tributary	2	2.1	*
Bull Run Creek	2	4.6	-
Unnamed tributary	2	0.1	-
Spur Creek	1	6.1	-
Pond Run Creek	2	4.4	-
Unnamed tributary	2	0.7	-
Lewis Creek	2,3	11.0	*
Unnamed tributaries (3)	2	2.7	*
Render Creek	2	3.3	*
Unnamed tributaries (2)	2	2.4	-
Southards Creek	2	1.8	*
Williams Creek	2+	5.3	*
Unnamed tributary to East Fork	2+	0.1	*

Table 4

GREEN RIVER BASIN CONTINUED

Name of Stream	Source	Miles Affected	Acid Mine Drainage Impact
Buck Creek	3	11.0	-
Long Falls Creek	3	11.7	-
Brush Fork	2	4.0	-
Panther Creek	3	22.0	-
North Fork	3	18.2	-
Joes Run Creek	2	4.3	*
Unnamed tributary to South Fork	2	1.0	*
Old Panther Creek	1	8.5	-
Unnamed tributary to Flat Lick Creek	2	0.8	-
Unnamed tributary to Crooked Creek	2	0.6	*
Knoblick Creek	3	2.0	-

1. Division of Water (1980)
2. Division of Water (1978)
2+. Division of Water, Earlington Field Office Data (1980)
3. U.S.G.S. (1980)

* pH < 6.0
- pH $\geq$ 6.0

Table 5

Stream Mileages Known to be Affected by
Coal Mining Activities

LOWER OHIO RIVER BASIN

Name of Stream	Source	Miles Affected	Acid Mine Drainage Impact
Highland Creek			
Casey Creek	3	5.5	-
Pup Creek			
Unnamed tributary	2	2.3	*
Blackford Creek	2	28.7	-
Unnamed tributary	2	2.8	*
Caney Creek	2	7.3	*
Unnamed tributary	2	1.3	*
Driskell Branch	2	2.4	-
Butchers Branch	2	2.3	*
Yellow Creek	2	5.8	-
South Fork	2	2.0	-

2. Division of Water (1978)
3. U.S.G.S. (1980)
* pH < 6.0
- pH $\geq$ 6.0

Table 6

Stream Mileages Known to be Affected
by Coal Mining Activities

KENTUCKY RIVER BASIN

Name of Stream	Source	Miles Affected	Acid Mine Drainage Impact
North Fork Kentucky River above Hazard, Ky.	3,6	65.2	-
Yonts Fork	6	4.4	-
Boone Fork	6	2.4	-
Wright Fork	6	4.7	-
Millstone Creek	6	4.6	-
Smoot Creek	6	7.4	*
Rockhouse Creek	1,3,6	24.2	-
Camp Branch	1	4.6	-
Leatherwood Creek	3	12.0	-
Clover Fork	1	3.8	-
Right Fork Maces Creek	3	7.1	-
Carr Fork	4,6	27.1	-
Little Carr Fork	1	4.8	-
Irishman Creek	6	4.0	*
North Fork Kentucky River above Jackson, Ky.	3	52.5	-
Upper Second Creek	1	4.4	-
Lotts Creek	3	13.1	-
Big Creek	3	8.9	-
Big Willard Creek	1	4.3	-
Grapevine Creek	3	8.4	-
Troublesome Creek	3,4	31.5	-
Clear Creek	1	5.1	-
Balls Fork	3	19.4	-
Buckhorn Creek	3	13.9	-
Lost Creek	1,3	18.7	-
South Fork Quicksand Creek	3,7	15.1	-
North Fork Quicksand Creek			
Spring Fork	3,7	17.8	-
Middle Fork	3	18.6	-
Beech Fork	3	14.4	-
Rockhouse Creek	3	8.5	-
Cutshin Creek	3,4	26.6	-
Polls Creek	1	4.9	-
Wooton Creek	1	6.8	-
Squabble Creek	4	6.8	-
South Fork			
Red Bird River	1,3	87.7	-
Upper Jacks Creek	1	4.1	-

Table 6

KENTUCKY RIVER BASIN CONTINUED

Name of Stream	Source	Miles Affected	Acid Mine Drainage Impact
Big Creek	3	4.3	-
Bobs Fork	1	3.2	-
Ulysses Creek	1	3.6	-
Goose Creek	3,4	21.7	-
Horse Creek	6	5.5	*
Little Goose Creek	1,6	14.6	-
Urban Fork	1	1.9	-
Grays Fork	1	4.7	-
Rader Creek	1	8.4	-
Sexton Creek	3	22.5	-
Huckleberry Branch	10	1.6	*
Buck Creek	4	7.6	-
Little Sturgeon Creek	1	5.6	-

1. Division of Water (1980)
3. U.S.G.S. (1980)
4. Harker et al. (1979)
6. Appalachian Regional Commission (1969)
7. Eastern Kentucky University (1975)
10. Kentucky Department of Fish and Wildlife Resources, Fish Kill Investigation Report, 1974

* pH < 6.0
\- pH $\geq$ 6.0

Table 7

Stream Mileages Known to be Affected
by Coal Mining Activities

UPPER CUMBERLAND RIVER BASIN

Name of Stream	Source	Miles Affected	Acid Mine Drainage Impact
Poor Fork	1,3	41.7	-
Franks Creek	1	4.7	-
Colliers Creek	4	3.8	-
Looney Creek	6	8.9	-
Clover Fork	1,3	34.0	-
Yocum Creek	1	7.5	-
Martins Fork	3,6	7.1	-
Cranks Creek	4	13.0	-
Crummies Creek	1	6.4	-
Cumberland River above Pineville, Ky.	1,3	39.7	-
Wallins Creek	1	6.4	-
Puckett Creek	3	11.0	-
Brownies Creek	3	16.2	-
Yellow Creek	3,6	17.5	-
Bennetts Fork	6	6.3	-
Stoney Fork	6	8.7	*
Clear Fork	4	8.6	-
Little Clear Creek	3	7.0	-
Straight Creek	1,6	24.0	-
Left Fork	1,6	13.3	-
Cumberland River above Barbourville, Ky.	3	19.4	-
Stinking Creek	5	18.8	-
Middle Fork	3	7.1	-
Road Fork Creek	3	9.1	-
Brush Creek	1	13.1	-
Cumberland River above Williamsburg, Ky.	3	44.8	-
Big Indian Creek	1,4	15.3	-
Little Indian Creek	3	6.2	-
Four Mile Branch Little Popular Creek	3	0.9	-
Maple Creek	1	5.5	-
Patterson Creek	1	7.7	-
Rose Creek	6	2.6	-
Clear Fork	1,3	26.6	-
Laurel Fork	1	17.1	-
Cumberland River above Cumberland Falls	3	30.2	-

Table 7

UPPER CUMBERLAND RIVER BASIN CONTINUED

Name of Stream	Source	Miles Affected	Acid Mine Drainage Impact
Watts Creek	3	12.7	-
Jellico Creek	3,6	17.9	-
Indian Creek	6	2.4	*
Jacks Creek	6	2.5	*
Marsh Creek	3,5,6	17.5	-
Barren Fork Indian Creek	1	5.3	*
Cane Creek to Laurel River	1	3.3	-
Negro Creek to Lynn Camp Creek	1	2.0	-
South Fork Rockcastle River	3	28.5	-
Raccoon Creek	1,6	7.4	-
Little Raccoon Creek	1,6	7.8	-
Gravel Lick Branch, Horse Lick Creek	1	3.0	-
Woods Creek	6	5.1	-
Powder Mill Creek to Sinking Creek	1	4.6	*
Big South Fork	3,5	29.2	-
Devils Creek	1	2.4	*
Roaring Paunch Creek	1,8	1.4	*
Rock Creek	4,6	4.0	-

1. Division of Water (1980)
3. U.S.G.S. (1980)
4. Harker et al. (1979)
5. Harker et al. (1980)
6. Appalachian Regional Commission (1969)
8. Carter and Jones (1969)

* pH < 6.0
\- pH $\geq$ 6.0

Table 8

Stream Mileages Known to be Affected
by Coal Mining Activities

BIG SANDY RIVER BASIN

Name of Stream	Source	Miles Affected	Acid Mine Drainage Impact
Levisa Fork	3	112.0	-
Feds Creek	1	4.3	-
Lick Creek	1	4.6	-
Grapevine Creek	3	6.5	-
Russell Fork	3	16.0	-
Elkhorn Creek	1,3,4	27.4	-
Marrowbone Creek	3	11.9	-
Greasy Creek	3	7.3	-
Shelby Creek	1	27.3	-
Beefhide Creek	1	4.9	-
Long Fork	3	7.4	-
Caney Creek	1	5.8	-
Robinson Creek	3	7.8	-
Mud Creek	3	17.0	-
Toler Creek	3	6.9	-
Island Creek	1	6.7	-
Beaver Creek	3	7.0	-
Left Fork	3	27.0	-
Spurlock Creek	4	4.0	-
Right Fork	3	36.8	-
Caney Fork	3	11.4	-
Arkansas Creek	1	3.3	-
Middle Creek	9	3.6	-
Left Fork	3,9	5.3	*
Lick Fork	1	2.0	*
Johns Creek	1,3	52.1	-
Stinking Branch	1	2.3	*
Brushy Fork	1	18.5	-
Buffalo Creek	3	11.0	-
Daniels Creek	3	2.1	-
Paint Creek			
Jenny Creek	4	10.9	-
Mudlick Creek	1	11.2	-
Toms Creek	1,3	11.4	-
Nats Creek	1	7.1	-
Left Fork	1	3.1	-

Table 8

BIG SANDY RIVER BASIN

Name of Stream	Source	Miles Affected	Acid Mine Drainage Impact
Tug Fork	3	94.0	-
Peter Creek	3	5.5	-
Left Fork	3	7.1	-
Right Fork	3	4.0	-
Pond Creek	3	14.6	-
Big Creek	1,3	16.0	-
Wolf Creek	3	20.5	-
Emily Creek	1	6.9	-
Rockcastle Creek	4	16.7	-
Middle Fork	1,3	16.4	-
Rockhouse Creek	3	17.0	-
Big Sandy River below Louisa, Ky.	3,9	26.8	-

1. Division of Water (1980)
3. U.S.G.S. (1980)
4. Harker et al. (1979)
9. Evenhuis (1973)

* pH < 6.0
\- pH $\geq$ 6.0

Table 9

Stream Mileages Known to be Affected
by Coal Mining Activities

LITTLE SANDY AND LICKING RIVER BASINS

Name of Stream	Source	Miles Affected	Acid Mine Drainage Impact
Little Sandy River	1,3,4	30.0	-
East Fork			
Williams Creek	1,3	14.2	-
Culp Creek	1	4.4	-
Licking River	3,4	34.2	-
Big Half Mountain Creek	1	4.7	-

1. Division of Water (1980)
3. U.S.G.S. (1980)
4. Harker et al. (1979)
* pH < 6.0
- pH $\geq$ 6.0

Problems Associated with Streams Affected by Coal Mining Activities

The major problems that the affected streams have will be associated with violations of water quality standards. Kentucky's newly adopted water quality standards provide for the protection of various water uses. The water uses most susceptible to impairment by coal mining activities are uses for aquatic life and domestic water supply. Specific numerical criteria most likely to be violated are alkalinity, pH, and total iron for aquatic life and total manganese, total sulfate and total dissolved solids for domestic water supply (see Table 10).

Table 10

Numerical Water Quality Criteria Most Likely to be Violated by Coal Mining Activities

Maximum Levels Not to be Exceeded			
Aquatic Life Criteria		Domestic Water Supply Criteria	
Alkalinity:	No more than 25% reduction of natural alkalinity*	Total Manganese:	.05 mg/l
pH:	6.0 - 9.0	Total Sulfate:	250 mg/l
Total Iron:	1 mg/l**	Total Dissolved Solids:	750 mg/l

*If natural alkalinity is below 20 mg/l, no reduction is allowed.

**3.5 mg/l for low flow streams when it is established that aquatic life is not damaged.

Another potential pollutant is suspended solids. Earth disturbing activities associated with mining have a potential to release sediments into streams which can destroy aquatic habitat and smother certain forms of aquatic life. An excellent study showing the detrimental effects of sedimentation on aquatic life was reported by Henley (1970). It dealt with strip mining of coal in the Cave Branch Basin of Beaver Creek in the Upper Cumberland River Basin of Kentucky. Blackwater releases can also cause fish kills, destroy habitat and harm other aquatic organisms. There is not a numerical criterion established for suspended solids in the Kentucky standards. As a result a violation of this standard has to be dealt with on a case by case basis with field investigations. It was beyond the scope of this

project to specifically assess the extent of suspended solids problems in the coalfields. The field survey of third order streams however, did make an assessment of stream bottom type and degree of sedimentation at each sampling site. The assessment represents those streams under summer low flow conditions. Significant findings are discussed in the sections of this report dealing with the survey site descriptions.

The following discussion addresses water quality problems associated with coal mining activities in the major river basins within the western and eastern coalfields.

Tradewater River Basin. Previous reports, Grubb and Ryder, (1972) and Metcalf and Eddy, Inc. (1975), have stated that the major water quality problems in this area are low pH, high sulfate and total dissolved solids and increasing sedimentation. Metcalf and Eddy, Inc. (1975) concluded that acid mine drainage (AMD) has caused the destruction of fish and other aquatic life and has also made much of the water resource undesirable for public, industrial, or domestic use. The U. S. Army Corps of Engineers (1974) reported that 190 miles of streams in this basin were affected by mine drainage pollution. Acid mine drainage and sedimentation were identified as the major pollutants. This report which dealt with both the coalfields of Kentucky relied for the most part on existing information.

Present conditions indicate that the above problems have been persistent and are still the major problems in the river basin. The Tradewater River is intermittently affected by low pH. The Clear Creek subbasin is the most seriously AMD impacted drainage in the basin. This study found 310 miles of streams affected by coal mining activities. Of this total, acid mine drainage affected 244 stream miles. The Tradewater River Basin is the most severely acid mine drainage impacted basin in the Commonwealth.

Green River Basin. Acid mine drainage is a significant problem in this river basin. It has been reported that there were 178 miles of streams affected by acid mine drainage (U.S. Department of Agriculture, 1975). The U.S. Army Corps of Engineers (1974) reported that 290 miles of streams were affected by mine drainage pollution. AMD and sedimentation were the major pollutants. The present study found a total of 584 miles of streams affected by coal mining activities of which 271 miles were affected by acid mine drainage.

The Pond River subbasin has been reported to be one of the most severely impacted streams in the area. Ray F. Weston, Inc. (1975) reported that it was continuously affected by low pH, extreme acidity and high iron and sulfate concentrations. In addition to being severely impacted by AMD, it has been seriously affected by high sediment loadings (Ohio River Basin Commission, 1977). Present conditions indicate that these are still the main problems in the subbasin.

Lower Ohio River Basin. Metcalf and Eddy, Inc. (1975) reported that the major problems in this area's streams were low pH and high sulfate concentrations. Acid mine drainage was a problem in Pup Creek and Blackford Creek.

This study found the same problems as the study mentioned above. However, Pup Creek has recovered from AMD except for one unnamed tributary. The Blackford Creek subbasin still has AMD problems, especially in Cany Creek and Butchers Branch.

The other affected streams have elevated sulfate concentrations but do not generally exceed the domestic water supply criterion.

Kentucky River Basin. In 1969 it was reported that there were 495 miles of streams significantly polluted by coal mining activities in this river basin (U. S. Department of the Interior 1969). Some of the problems noted were pH values below 6.0, sulfate values above 250 mg/l and iron values well above 1.0 mg/l. Fish kills due to mine drainage were reported in Goose Creek, which is in the South Fork subbasin.

The Appalachian Research Commission (1969) reported that sedimentation is a bigger problem than acidity in eastern Kentucky streams.

The U. S. Army Corps of Engineers (1974) reported that 440 miles of streams were affected by sedimentation and acid pollution from coal mining activities. The drainage areas of the North, Middle and South Forks of the Kentucky River were considered to be key areas in need of remedial action.

Suspended sediments have been reported as a problem in the Quicksand drainage of the North Fork subbasin (Eastern Kentucky University, 1975). Sulfate and total dissolved solids concentrations which would violate the domestic drinking water criteria were also found.

A study by Miller, Wihry and Lee, Inc. (1975) found acid mine drainage and sediment problems in several areas of the Kentucky River Basin. Their information was drawn from reports by the Appalachian Research Commission (1969) and Jones (1973). Abandoned deep mines were noted as the main source of acid pollution, while coal haul roads were a major source of sediment.

A more recent report has also listed acid mine drainage and strip mine sediment as polluting streams in the Kentucky River Basin (U.S. Department of Agriculture, 1978). Of the 25 streams listed as polluted, 18 were noted as being polluted by coal mining activities. Strip mine sediment polluted eight of these streams, acid mine drainage nine and coal washer wastes one.

Present water quality data indicate that acid problems are still found in this river basin but the extent of the problem is not as severe as previously reported by the Appalachian Regional Commission (1969). This is due to fewer acid producing coal seams being mined from that period to the present. Problems with acid mine drainage are more prevalent in the western coalfields. Impairment of domestic drinking water supplies is a potential problem. Sedimentation problems were not assessed, but sedimentation is assumed to be a persistent problem which can pose threats to aquatic life. The present study found 673 miles of streams affected by coal mining activities.

Upper Cumberland River Basin. It has been previously reported that there were 510 miles of significantly polluted streams in this river basin (U.S. Department of the Interior 1969). The water quality problems noted in the report were high sulfate and iron concentrations. Several streams were also affected by acid mine drainage.

The U. S. Army Corps of Engineers (1974) reported significant stream pollution problems in Wood, Little Raccoon and Raccoon Creeks in the Rockcastle River subbasin. They reported mild acid problems in the Big South Fork Cumberland River embayment of Lake Cumberland due to mining near Burnside, Kentucky. Annual losses in project fishery benefits were estimated to be about $150,000. The Big South Fork subbasin was considered to be a key area in need of early remedial action. Strip mining along Bennetts and Stony Forks of Yellow Creek were reported to cause increased sedimentation in the Corps Yellow Creek Diversion Project at Middlesboro, Kentucky. This increased annual maintenance costs by about $20,000. The report concluded

that sedimentation was the most extensive mining related problem in the basin, with acid problems generally confined to the smaller tributaries.

Mayes, Sudderth and Etheredge, Inc. (1975) indicated that sediment was the most significant nonpoint source pollutant in the basin. They listed several streams where strip mines were the source of this pollution. Acid mine drainage was also noted, but it was not a major problem due to neutralization by naturally present alkaline materials such as limestone beds and calcareous shale formations. Problems with blackwater discharges were also reported. A total of 408 miles of fishing streams were listed as being significantly degraded by mining activity.

This report found that 667 miles of streams are affected by coal mining activity. Some acid mine drainage problems were found. The major problem is still related to high sulfate and iron concentrations which decrease the potential for domestic water supply use. Although sedimentation was not assessed it is felt that it is a persistent problem affecting aquatic life in the basin.

Big Sandy River Basin. It has been reported that approximately 500 miles of streams are polluted by coal mining activities in this basin (U. S. Department of the Interior, 1969). Acid mine drainage was not reported as a major problem. Coal mine drainage in the upper watersheds of the Tug Fork and Levisa Fork affected lower reaches with high concentrations of sulfate and iron.

The U.S. Army Corps of Engineers (1974) reported that sedimentation was a major mining induced problem in this basin. The Corps determined that about 300 miles of stream were significantly impacted by sedimentation and turbidity in the Levisa Fork subbasin. It was felt that remedial action was economically feasible and that it would prevent extreme losses in recreational uses in the Corps-operated impoundments within the subbasin, reduce treatment costs by downstream domestic water supply users in the Big Sandy River and lower dredging maintenance costs in the lower Big Sandy navigational pool. The Levisa Fork was noted as a key area in need of early remedial action.

Curtis et al. (1978) found that streams in active surface mined areas of the Levisa Fork had higher sediment loads than those in unmined areas. Effects of these loadings on Fishtrap and Dewey Lakes had caused a great deal of concern

about impaired water quality and reservoir operations. Sixty-three percent of the sediment inflow to Fishtrap Lake during 1974 and 1975 came from Virginia which complicates remedial action. An increase in sulfate and total dissolved solids was associated with mining activities in the Levisa Fork subbasin. Low sulfur coal in the Johns Creek subbasin resulted in only a small effect of mining on stream water quality from mining in that area.

Proctor-Davis-Ray and W. E. Gates and Associates (1975) have mapped streams potentially or intermittently affected by mine drainage. They reported a total of 250 miles of stream affected by acid mine water and sediment.

Present data indicates that 749 miles of stream are affected by coal mining activities. Sedimentation, high concentrations of sulfate, iron and manganese are still major problems. Some acid mine drainage is also present. We would have to agree with the assessment made by the U.S. Department of Interior (1969) that "mine drainage pollution would not be expected to be substantially different in 1980" than at the time of their report.

Little Sandy River Basin. Metcalf and Eddy, Inc. (1975) reported that the Little Sandy River exhibited high sulfate concentrations and low pH which indicated pollution from acid mine drainage. Their maps indicate that the Middle Fork and Little Fork drainages were the source of the pollution. Grayson Lake is also shown to be impacted. It should be pointed out that one of their maps (Exhibit B - 8.1 m) is in error, as it does not show the presence of Grayson Lake.

Present knowledge indicates that Grayson Lake is not affected by coal mining activities (Kentucky Division of Water, 1980). The East Fork drainage is affected by coal mining activities. This is evidenced by higher than natural sulfate, total iron and manganese concentrations. The elevated concentrations do not appear to be a threat to domestic water supply uses.

The Middle Fork and Little Fork subbasin and the Little Sandy River do not appear to be presently affected by coal mining activities.

Licking River Basin. Proctor-Davis-Ray and W. E. Gates and Associates (1975) reported that there were no deleterious effects on streams in this basin from acid mine drainage. This was in large part due to the limited mining activity in the area. The U.S. Army Corps of Engineers (1974) felt that there were no significant instream problems related to mining activities in the Licking River basin. Present data indicate that this is true although natural levels of sulfate have been elevated. There is an indication that sediment loading to the Licking River from coal mining activities may be degrading the fisheries resource (Harker et al. 1979). However, other land use practices, such as agricultural activities and gas and oil extraction also contribute to the sediment problem.

Tygarts Creek Basin. A small amount of coal mining has taken place in this area. Metcalf and Eddy, Inc. (1975) did not report any water quality problems associated with coal mining. Current data from U.S.G.S. (1980) has not shown any of their sites to be affected.

Harker et al. (1979) sampled three sites in the basin and also found no detectable impacts.

At present it appears that the streams in this area are not affected by coal mining activities.

Field Surveys and Fisheries Evaluations of Third Order Streams in the Western and Eastern Coalfields

For each major basin within the coalfield regions an introduction to water quality and fisheries potential is presented. Provided within the water quality introduction are: (1) a summary of physicochemical parameters surveyed, (2) general comments in regard to water quality problems and observations, and (3) a listing of the worst case streams. Provided within the fisheries introduction are: (1) general comments of third order streams and their fisheries significance, (2) a summary of the evaluations of sports fishery status (i.e. poor, fair, good, excellent), (3) a listing of trout streams within the basin, and (4) a summary of the assessments of whether the streams were impacted by acid and/or silt mine drainage. A listing of the third order streams which were evaluated is provided in tabular form. One set of tables list streams rated as good to excellent while another set lists those rated as fair to poor and also provide an assessment of mining impacts. The tables listing the evaluated streams summarize the questionnaires sent to the conservation officers. Some streams are

not listed because the information on the returned forms was imcomplete or not received for a particular county. In addition, streams with third order segments less than one mile in length were not included in the questionnaire. While reviewing the fisheries evaluations, it should be kept in mind that these are subjective evaluations based on the past experience of conservation officers in the counties within the study area.

Following each basin introduction, a detailed account of survey sites sampled within that basin will be presented. Provided within each site description are: (1) a brief topographical setting including presence or absence of mining, type of mining, and extent of surface disturbance, (2) habitat analysis including pool-riffle ratio, stage and flow, and substrate composition, (3) physicochemical results and determination of mining impact, (4) results of the biotic survey and (5) fisheries status of the stream.

Tradewater River Basin - Water Quality. A summary of physicochemical parameters surveyed in the Tradewater drainage is presented in Table 11. A total of five third order streams were surveyed of which two were considered to be impacted by mine drainage.

Grubb and Ryder (1972) characterized the water quality of mining impacted streams in the Tradewater drainage as highly mineralized and of generally low pH. Our results for streams draining recently mined areas (Brooks Creek) appear to verify these observations. Streams draining abandoned mine areas (Lick Creek) may also be highly mineralized while exhibiting neutral pH values.

Tradewater River Basin - Fishery Evaluation. A total of 50 third order streams representing 136.9 stream miles in 5 counties were evaluated for their fishery potential. Generally, most third order streams in the Tradewater Basin are of little fisheries significance. Many third order streams in the basin are channelized and are dry during the summer. Of the streams evaluated, conservation officers considered 14 streams (21%) to be poor, 10 streams (15%) to be fair, and 2 streams (3%) to be good fishery streams. No stream is considered to support an excellent fishery. Streams of fair to good fisheries quality are located primarily in the western half of the basin in areas where mining perturbations are largely absent. Streams of good sports fishery quality are Donaldson Creek, Ward Creek, and East Fork of Flynn Fork (Caldwell County). Streams of poor to fair fishery quality are listed in Table 12. There are no trout streams in the basin.

Approximately 34 miles of third order streams are considered by conservation officers to be impacted by mine drainage. Acid water is listed as the sole source of fishery impaction. Streams considered to be impacted by mine drainage are confined to Hopkins and Webster counties (Table 12).

Table 11

Summary of Mean and Range Data for Physicochemical Parameters Surveyed in Third Order Streams in the Tradewater River Basin

	Impacted Streams (2)		Unimpacted Streams (3)	
Parameter	Mean	Range	Mean	Range
pH	5.0	3.0-7.0	7.4	6.6-8.3
Alkalinity (mg/l $CaCO_3$)	17.8	0-35.6	165.7	54-344
Acidity (mg/l)	101.8	4.6-199.0	9.7	6.2-14.8
Sulfates (mg/l)	1379.5	714-2045	40.4	30.1-48.2
Total Iron (mg/l)	7.89	1.18-14.60	0.80	0.62-0.94
Total Manganese (mg/l)	13.25	1.99-24.50	1.26	0.94-1.47
Specific Conductance (μmhos/cm)	2314	880-3747	462	242-788

( ) Number of streams sampled

Table 12

Third Order Streams with Fair to Poor Fisheries in the Tradewater River Basin with an Assessment of Mining Impact

River Basin	County	Stream	Fishery		Mining Impact		
			Fair	Poor	Silt	Acid	None
Tradewater							
	Hopkins	.Buffalo Ck.		x		x	
		Cane Run		x		x	
		Caney Ck.		x		x	
		Clear Ck.		x		x	
		Copper Ck.		x		x	
		Copperas Ck.		x		x	
		East Fork, Bull Ck.		x			x
		East Fork, Hurricane Ck.		x		x	
		Greasy Ck.		x		x	
		Lambs		x		x	
		Lick Ck.		x		x	
		Pieburn Ck.		x			x
		Richland Ck.		x		x	
	Caldwell	Black Ck.	x				x
		Elk Ck.		x			x
		Holeman Branch, Donaldson Ck.		x			x
		Piney Ck.	x				x
		Pratt Ck.		x			x
		Reed Ck.		x			x
		Stephenson Ck.		x			x
		Unnamed tributary near Wilson Bridge		x			x
		West Fork, Donaldson Ck.		x			x
		Wiley Ck.		x			x

Table 12 continued

River Basin	County	Stream	Fishery		Mining Impact		
			Fair	Poor	Silt	Acid	None
	Crittenden	Buggs Branch, Piney Ck.		x			x
		Butler Ck.		x			x
		Dean Branch, Piney Creek		x			x
		Little Piney Ck.	x				x
		Long Branch, Tradewater R.		x			x
		Pigeon Roost Ck.	x				x
		Piney Ck.	x				x
		Tribune Ck.	x				x
	Webster	Ditch to Craborchard Ck.		x		x	
		Slover Ck.		x		x	
	Union	Bishop Ditch		x			x
		Bordley Ditch		x			x
		Corbett Ditch		x			x
		Dyson Ck.		x			x
		Hazel Branch		x			x
		Hopgood Ditch		x			x
		Tradewater Tributary opposite Caney Branch	x				x
		Smith Ditch Tributary		x			x

10010912

Brooks Creek

Drainage System:	Tradewater River
County:	Hopkins
7.5 Min. Quadrangle Name:	Dalton
Latitude:	37° 15' 49" N
Longitude:	87° 46' 34" W
Location:	at Logan Road bridge .8 km south of junction with KY 70 4.8 km southwest of Dalton, Kentucky
Survey Date:	18/Jun/80

Brooks Creek heads in westcentral Hopkins County at an elevation of 155.5 m. The stream flows in a westerly direction to its confluence with the Tradewater River northeast of Fryer, Kentucky. The third order segment is 4.37 km in length. Approximately 70% of this watershed has been surface mined. Recent surface mining has occurred on the north slope above Logan Road to the headwaters; inactive mines are located to the east of Kirkwood Springs Road. The mined areas have been revegetated.

The stream sampling site was situated in a floodplain of moderate width. The floodplain is relatively low in relief and somewhat swampy. Wooded slopes rise to the north and south. Approximately 25% of the watershed is forested. Agriculture accounts for 5% of the land usage. The watershed is relatively unpopulated. Riparian vegetation afforded 50-75% shade.

Brooks Creek is a stream of low gradient with the study section characterized by long pools with slow flow. At the time of sampling, the stream was at moderate stage. Substrate consisted of clay with rubble and boulders. Only a very small amount of silt was present; however, yellowboy sedimentation was moderate.

Table T1

Survey Site Physical Morphology and Percentage Substrate Composition in Brooks Creek, Hopkins County, Kentucky, 18/Jun/80.

Stream:	Width	3.84 m	Depth	.60 m
Bottom Type (%):	Bedrock	0	Boulder	5
	Cobble	0	Rubble	15
	Gravel	0	Sand	0
	Silt	0	Clay	80

Physicochemical analyses indicate that the water quality of Brooks Creek is severely degraded. Elevated values for specific conductance, sulfates, iron, and manganese were observed. Acidity exceeded alkalinity, while pH was depressed.

Table T2

Analytical Results for Certain Physicochemical Parameters Surveyed in Brooks Creek, Hopkins County, Kentucky, 18/Jun/80.

Temp °C	24.5	Specific Conductance (μmhos/cm)	3747
Turbidity (NTU)	20 (Field)	pH	3.0 (Field) 3.2 (Lab)
Dissolved Oxygen (mg/l)	5.6	Total Alkalinity (mg/l)	0
Total Acidity (mg/l)	199	Sulfates (mg/l)	2045.0
Total Iron (mg/l)	14.6	Total Manganese (mg/l)	24.5

A cursory biotic survey revealed a benthos typical of streams in swamp areas impacted by mine drainage. Odonates, including dragonflies and damselflies, megalopterans including the fishfly (Chauloides) and alderfly (Sialis), and a belostomatid beetle were present. Fishes were conspicuously absent.

Due to its small size and impacted condition, it is doubtful whether Brooks Creek supports a fishery of any significance.

10008912

Rose Creek

Drainage System:	Tradewater River
County:	Hopkins
7.5 Min. Quadrangle Name:	Coiltown
Latitude:	37° 22' 26" N
Longitude:	87° 41' 13" W
Location:	at Schmetzer Crossing Road bridge, 1.2 km south of junction with US Alternate 41; southwest of Nebo, Kentucky
Survey Date:	19/Jun/80

Rose Creek heads in northcentral Hopkins County at an elevation of 129.5 m. The stream flows in a general westerly direction to its confluence with Weirs Creek west of Nebo, Kentucky. The third order stream segment is 4.59 km in length. Surface mining disturbs less than 5% of the Rose Creek watershed. Mines are located in the area around Coiltown, Kentucky. Mine drainage for the most part is diverted into lakes. During wet weather these may overflow into tributaries of Rose Creek. A small surface mine area (reclaimed) is located north of the stream along the east side of Schmetzer Crossing Road.

The stream sampling site was situated in a swampy section of Rose Creek. The swamp extends from the confluence to 2.6 km upstream. Dense stands of lizards-tail (Saururus cernuus) crowd the waterway. A railroad track parallels the northern edge of the swamp, while intensive agriculture is located to the south. Riparian vegetation afforded 25-50% shade.

Rose Creek is a stream of low gradient characterized in the study section by long pools and very slow flow. At the time of sampling, the stream was at low stage. Subsequent visits by Kentucky Nature Preserves (pers. comm.) and McCoy and McCoy Associates (pers. comm.) revealed water in the stream to be largely confined to a pool beneath the Schmetzer Crossing Road Bridge. Western Kentucky has experienced a long, dry, hot summer. The substrate was largely mud. Silt sedimentation was moderate.

Table T3

Survey Site Physical Morphology and Percentage Substrate Composition in Rose Creek, Hopkins County, Kentucky, 19/Jun/80.

Stream:	Width 26.58 m	Depth .76 m
Bottom Type (%):	Bottom type not determined; mostly mud.	

Physicochemical analyses appear to indicate that Rose Creek is not impacted by mining. Elevated levels for specific conductance, iron, and manganese were observed, sulfates were within an acceptable level for unimpacted streams.

Table T4

Analytical Results for Certain Physicochemical Parameters Surveyed in Rose Creek, Hopkins County, Kentucky, 19/Jun/80.

Temp °C	20.5	Specific Conductance (μmhos/cm)	355
Turbidity (NTU)	4.9 (Lab)	pH	6.6 (Field)
Dissolved Oxygen (mg/l)	2.5	Total Alkalinity (mg/l)	99.0
Total Acidity (mg/l)	8.0	Sulfates (mg/l)	43.0
Total Iron (mg/l)	.95	Total Manganese (mg/l)	1.47

Biotic sampling was not conducted at this site. Kentucky Nature Preserves (in press) conducted an intensive biological survey at this site later in the summer of 1980.

Little is currently known of the fishery in this stream.

10008913

Lick Creek

Drainage System:	Tradewater River
County:	Hopkins
7.5 Min. Quadrangle Name:	Dawson Springs
Latitude:	37° 14' 26" N
Longitude:	87° 40' 28" W
Location:	at Lick Creek Road bridge .1 km east of junction with KY 109; 3.2 km south of Beulah, Kentucky
Survey Date:	18/Jun/80

Lick Creek heads in southcentral Hopkins County at an elevation of 143.3 m. The stream flows in a northwesterly direction to its confluence with Clear Creek north of Dalton, Kentucky. The third order stream segment is 6.44 km in length. Surface mining has been conducted at 3 locations above the stream site. The Bennett and Jenkins mines (inactive) are located northeast of Charleston, Kentucky, about 1.3 km upstream; the Dawson-Daylight mines (inactive) are located to the east of Charleston. Several lakes are located in the mine areas and have a coppery or blackish appearance. Active mining is not currently being conducted above the site.

The stream sampling site was situated in a relatively broad floodplain with wooded slopes to the east. Approximately 50% of the watershed above the site is forested with about 30% of this in reclaimed mine areas. The study section of Lick Creek has been channelized. Hay fields are on the adjoining floodplains directly above the site. A railroad spur and coal loading area are situated at the east slope base. KY 109 parallells the west bank, crossing the stream .4 km below the site. Riparian vegetation consisting of overhanging grasses afforded 0-5% shade.

Lick Creek is a stream of low to moderate gradient characterized by long pools. At the time of sampling, the stream stage was low, with moderate flow. Substrate consisted of sand and gravel overlain by about .3 m of silt. Silt sedimentation was very heavy. A small amount of yellowboy was present.

Table T5

Survey Site Physical Morphology and Percentage Substrate Composition in Lick Creek, Hopkins County, Kentucky, 18/Jun/80.

Stream:	Width	3.84 m	Depth	.20 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	5	Sand	5
	Silt	90	Clay	0

Physicochemical analyses indicate Lick Creek to be severely impacted by mine drainage. Elevated values for specific conductance, sulfates, iron, and manganese were observed.

Table T6

Analytical Results for Certain Physicochemical Parameters Surveyed in Lick Creek, Hopkins County, Kentucky, 18/Jun/80.

Temp °C	22.1	Specific Conductance (µmhos/cm)	880
Turbidity (NTU)	100 (Field)	pH	7.0
Dissolved Oxygen (mg/l)	8.3	Total Alkalinity (mg/l)	35.6
Total Acidity (mg/l)	4.6	Sulfates (mg/l)	714.0
Total Iron (mg/l)	1.18	Total Manganese (mg/l)	1.99

A cursory biotic survey did not reveal the presence of either macroinvertebrates or fish. Silt deposits from mining have rendered the benthic zone relatively abiotic.

Hopkins County conservation officer Eddy Young (pers. comm.) reported the fishery of Lick Creek to be nonexistent due to acid pollution from mining.

10002912

Hazel Branch of Smith Ditch

Drainage System:	Tradewater River
County:	Union
7.5 Min. Quadrangle Name:	Sturgis
Latitude:	37° 31' 33" N
Longitude:	87° 57' 25" W
Location:	at Goad Road bridge .1 km east of junction with KY 109; 3.2 km southeast of Sturgis, Kentucky
Survey Date:	18/Jun/80

Hazel Branch of Smith Ditch heads in southeastern Union County at an elevation of 139.6 m. The stream flows in a northwesterly direction to its confluence with Smith Ditch southeast of Sturgis, Kentucky. The third order stream segment is 2.75 km in length. Approximately 40% of the watershed surface has been disturbed by mining.

The stream sampling site was situated on a plain of rather low relief. Farming is intensively conducted with 40% of the land use in agriculture. Hazel Branch has been channelized throughout its length so as to enhance runoff. Wooded areas are rather scarce, being limited to stream divides and reclaimed mining areas. Riparian vegetation afforded 25-50% shade at the site.

Hazel Branch is a stream of low gradient with a pool-riffle ratio of 70% pool to 30% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted of rubble with sand. Silt sedimentation was negligible.

Table T7

Survey Site Physical Morphology and Percentage Substrate Composition in Hazel Branch of Smith Ditch, Union County, Kentucky, 18/Jun/80.

Stream:	Width	.66 m	Depth	.11 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	60
	Gravel	0	Sand	30
	Silt	10	Clay	0

Physicochemical analyses revealed elevated levels for specific conductance, iron, and manganese, while sulfates were at a level consistent with unimpacted streams. It is uncertain whether increases in the above parameters are associated solely with mining. Dyer and Curtis (1977) noted that specific conductance, iron, and manganese may increase in advance of sulfates in newly mined areas. Recent mining has occurred 2.5 km above the site. The observed parameter increases may reflect a response from both mining and intensive agriculture. Additional study may later show an increase in sulfate levels.

Table T8

Analytical Results for Certain Physicochemical Parameters Surveyed in Hazel Branch of Smith Ditch, Union County, 18/Jun/80.

Temp °C	24.3	Specific Conductance (μmhos/cm)	788
Turbidity (NTU)	170 (Field)	pH	8.3 (Field)
Dissolved Oxygen (mg/l)	9.5	Total Alkalinity (mg/l)	344
Total Acidity (mg/l)	14.8	Sulfates (mg/l)	30.1
Total Iron (mg/l)	.94	Total Manganese (mg/l)	1.37

A cursory biotic survey revealed a benthic macroinvertebrate fauna typical of enriched streams. Bottom organisms included isopods, snails, and chironomids.

Union County conservation officer Donan Jenkins (pers. comm.) considered the fishery of Hazel Branch to be poor, being limited to the taking of minnows for fish bait.

10001912

Caney Branch of Tradewater River

Drainage System:	Tradewater River
County:	Crittenden
7.5 Min. Quadrangle Name:	Dekoven
Latitude:	37° 30' 39" N
Longitude:	88° 01' 07" W
Location:	at Green Chapel Road bridge .6 km west of junction with KY 365; 6.0 km southwest of Sturgis, Kentucky
Survey Date:	18/Jun/80

The Caney Branch of the Tradewater River heads in northcentral Crittenden County at an elevation of 193.6 m. The stream flows in a northerly direction to its confluence with the Tradewater River southwest of Grangertown, Kentucky. The third order stream segment is 4.70 km in length. A small surface mine (inactive for several decades [McFarlan 1943]) is situated 2.5 km above the site with a tailings area 1.0 km upstream. Less than 5% of the surface has been disturbed by mining.

The stream sampling site was situated in a floodplain of moderate width. Steep, forested slopes rise to the east. Approximately 70% of the watershed is forested. A short section of stream above the site has been channelized. Agriculture is largely limited to the headwaters, accounting for 25% of the land usage. Riparian vegetation afforded 75-100% shade.

Caney Branch is a stream of low gradient with a pool-riffle ratio of 70% pool to 30% riffle. At the time of sampling, the stream was at low stage with slow flow. The substrate consisted of sand and gravel with rubble. Silt sedimentation was very slight.

Table T9

Survey Site Physical Morphology and Percentage Substrate Composition in Caney Branch of Tradewater River, Crittenden County, Kentucky, 18/Jun/80.

Stream:	Width	2.62 m	Depth	.5 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	10
	Gravel	40	Sand	50
	Silt	0	Clay	0

Physicochemical analyses do not indicate Caney Branch to be impacted by mine drainage. Specific conductance and sulfates were at levels consistent with unimpacted streams. Iron and manganese levels were slightly elevated, however, this may reflect background concentrations.

Table T10

Analytical Results for Certain Physicochemical Parameters Surveyed in Caney Branch of Tradewater River, Crittenden County, Kentucky, 18/Jun/80.

Temp °C	23	Specific Conductance (µmhos/cm)	242
Turbidity (NTU)	60 (Field)	pH	7.2 (Field)
Dissolved Oxygen (mg/l)	4.8	Total Alkalinity (mg/l)	54
Total Acidity (mg/l)	6.2	Sulfates (mg/l)	48.2
Total Iron (mg/l)	.62	Total Manganese (mg/l)	.94

A cursory biotic survey revealed the presence of hemiptera, dipterans, odonates, isopods, and crayfish. Fishes included Fundulus and the green sunfish (Lepomis cyanellus).

The fishery of Caney Branch is limited to that section near its confluence with the Tradewater River. Schlinger and Underwood (1980) report that the fishery of the Tradewater River is limited by acid water from abandoned strip mines. The Tradewater fishery improves in the lower stream sections with largemouth bass, crappie, bluegill, catfish and sauger of prime interest.

Green River Basin - Water Quality. A summary of physico-chemical parameters surveyed in the Green River Basin is presented in Table 13. A total of 15 third order streams and an old meander slough were surveyed of which 10 streams were considered to be impacted by mine drainage.

Among those streams found most seriously impacted by mine drainage are: Old Panther Creek (Lower Section) - Mosleyville Slough (Daviess County), an unnamed tributary to Pond Creek and Little Cypress Creek (Muhlenberg County), and Spur Creek (Ohio County).

One third order stream was surveyed in the Lower Ohio River Basin. It's site description and water quality characteristics are included at the end of this section.

Green and Lower Ohio River Basins - Fishery Evaluation. A total of 213 third order streams representing 577.6 stream miles in 15 counties were evaluated for their fishery potential. Due to channelization and mining impaction, a large portion of the third order streams in the Green River - Lower Ohio River Basins are of little fisheries significance. Of the streams evaluated, conservation officers considered 67 streams (32%), to be poor, 40 streams (19%) to be fair, and 17 streams (8%) to be good fisheries streams. No streams are considered to support an excellent fishery. Streams which support good fisheries are listed in Table 14. Streams which support poor to fair fisheries are listed in Table 15. Trout are stocked in Beaverdam Creek, Edmonson County, and in the tailwaters of Rough River and Nolin Reservoirs (Kentucky Department of Fish and Wildlife Resources pers. comm.).

Muskellunge populations are present in the Green River above Lock 4 (RMI 149.1), in the Nolin River below Nolin Reservoir to its confluence with the Green River and in the Barren River which includes that portion within the western coalfield.

Approximately 43 miles of third order streams are considered by conservation officers to be impacted by mine drainage. Of the impacted streams, 27% of the mileage is impacted by acid, 12% by silt, and 62% by acid and silt.

Table 13

Summary of Mean and Range Data for Physicochemical Parameters Surveyed in Third Order Streams in the Green River Basin

	Impacted Streams (11)		Unimpacted Streams (6)	
Parameter	Mean	Range	Mean	Range
pH	7.0	4.8-7.8	7.3	6.8-8.2
Alkalinity (mg/l $CaCO_3$)	97.4	0-338.4	88.4	31.8-154.0
Acidity (mg/l)	11.0	3.6-52.0	7.2	4.8-11.2
Sulfates (mg/l)	676.6	62.0-1905.0	32.5	22.5-38.5
Total Iron (mg/l)	2.04	0.01-13.30	0.83	0.22-1.61
Total Manganese (mg/l)	1.98	0.14-6.87	1.78	0.06-3.52
Specific Conductance (μmhos/cm)	1431	296-3343	290	185-427

( ) Number of streams surveyed

Table 14

Sports Fisheries Streams Rated as Good in the
Green River Basin and Tributaries to the
Lower Ohio River Basin (Breckinridge-Union Counties)

River Basin	County	Stream
Green	Edmonson	Beaverdam Creek
	Butler	West Prong Indian Camp Creek
		North Prong Indian Camp Creek
	Hopkins	Otter Creek
	Breckinridge	Rock Lick Creek
		Black Lick Creek
		North Fork Panther Creek
		Old Panther Creek
		*UT - South Fork Panther Creek
	Henderson	Lick Creek
		Richmond Slough
Lower Ohio	Breckinridge	Tar Fork, Clover Creek
		Beech Fork, Clover Creek
		Cany Fork, Shot Paunch Creek
		Clover Creek
	Henderson	North Fork Canoe Creek
	Union	UT - Ohio River

*UT - Unnamed Tributary

Table 15

Third Order Streams with Fair to Poor Fisheries in the Green and Lower Ohio River Basins with an Assessment of Mining Impact

River Basin	County	Stream	Fishery		Mining Impact		
			Fair	Poor	Silt	Acid	None
Green	Edmonson	Alexander Ck.		x			x
		Beaverdam Ck. South of Blackgold, KY.		x			x
		Big Reedy Br., Big Reedy Creek		x			x
		Belcher Ck.		x			x
		Big Reedy Ck.		x			x
		Clifty Ck.		x			x
		Little Beaverdam Ck.		x			x
		Lost Ck.		x			x
		Rays Br., Barren R.		x			x
		Reeves Ck.		x			x
		Salt Lick Ck.		x			x
		West Fork, Big Reedy Ck.		x			x
	Warren	Little Beaverdam Ck.	x				x
		Lost Ck.		x			x
		Rays Br., Barren R.		x			x
	Butler	Big Branch, Muddy Ck.	x				x
		Big Bull Ck.	x				x
		Biggerstaff Ck.		x			x
		Brushy Pond Ck.	x				x
		Cane Ridge Ck.		x			x
		Deer Lick Ck.		x			x
		Forgys Branch, Mud River	x				x
		Grassy Lick Ck.	x				x
		Green River Trib. opposite Welch Ck.	x				x
		Hickory Camp Ck.		x	x	x	
		Little Reedy Ck.	x				x
		Little Bull Ck.	x				x
		Muddy Ck.	x				x
		Panther Ck.	x				x
		Sixes Ck.		x			x
		Welch Ck.	x				x
		Woolsey Ck.	x				x

Table 15 continued

River Basin	County	Stream	Fishery		Mining Impact		
			Fair	Poor	Silt	Acid	None
Green	Grayson	Alder Ck.	x				x
		Brushy Pond Ck.	x				x
		Buck Ck.	x				x
		Clay Lick Br., Bear Ck.		x			x
		Dog Ck.	x				x
		Dry Fork of Spring Fk.	x				x
		Mistaken Ck.	x				x
		N. Fork, Caney Ck.	x				x
		Raymers Fk., Alder Ck.		x			x
		Richland Ck.	x				x
		Sunfish Ck.		x			x
		Taylor Fk., Bear Ck.		x			x
		Short Ck.		x			x
		South Fork, Caney Ck.	x				x
		West Fork, Big Reedy Ck.	x				x
	Logan	Rawhide Ck.		x			x
		Tributary, Rawhide Ck.		x			x
		Muddy Ck.		x			x
	Muhlenberg	Cypress Ck.		x	x	x	
		Trib. to Cypress Ck.		x	x	x	
		Harris Br., Cypress Ck.		x			x
		Hazel Ck.		x	x	x	
		Hooper Ck.		x	x	x	
		Isaacs Ck.		x			x
		Little Cypress Ck.		x		x	
		Long Ck.		x	x	x	
		Pond R. Tributary		x			x
		Thompson Ck.		x			x
		Pryor Ck.		x			x
		Rocky Ck. Tributary		x			x

Table 15 continued

River Basin	County	Stream	Fishery Fair	Fishery Poor	Mining Impact Silt	Mining Impact Acid	Mining Impact None
Green	Todd	Long Ck.	x				x
	Hopkins	Crab Orchard Ck.		x		x	
		Drakes Ck.		x		x	
		East Fork, Deer Ck.		x			x
		Elk Ck.	x				x
		Grays Branch, McFarland Ck.		x			x
		Narge Ck.		x			x
		Otter Ck.	x				x
		Pleasant Run		x		x	
	Webster	Grane Ck.		x			x
		Groves Ck.		x			x
		Knoblick Ck.		x			x
		Melton Ditch		x			x
		Pitman Ck.		x			x
		Sugar Camp Ck.		x			x
	McClean	Abe Ck.		x			x
		Brush Fork, Long Falls Ck.		x			x
		Buck Ck.		x			x
		Buck Ck. Tributary		x			x
		Cypress Ck. Tributary		x			x
		Delaware Ck.		x			x
		Hainer Ck.		x			x
		Long Falls Ck.		x	x	x	
		Pond Drain		x			x
		Porters Ditch		x			x
		Yellow Ck.		x			x
		West Fork, Buck Ck.		x			x
		West Fork, Knoblick Ck.		x			x
	Breckinridge	Daniels Ck.	x				x
		Harris Fk., Rock Lick Ck.		x			x
		Pipe Run		x			x
		Pond Run		x			x
	Hancock	North Br., SF Panther Ck.		x			x
		South Br., SF Panther Ck.		x			x

Table 15 continued

River Basin	County	Stream	Fishery Fair	Fishery Poor	Mining Impact Silt	Mining Impact Acid	Mining Impact None
	Daviess	Caney Ck.		x			x
		Cane Run		x			x
		Delaware Ck.	x				x
		Flat Br., South Fk. Panther Ck.		x			x
		Flat Lick Ck.		x			x
		Hagan Ditch		x			x
		Horse Fork, Panther Ck.		x			x
		Hurricane Br., North Fork Panther Ck.		x			x
		Joes Br., North Fk. Panther Ck.		x			x
		Joes Run		x			x
		Katie Meadows Slough		x			x
		N. Fork, Panther Ck.		x			x
		Rhodes Ck.		x			x
		Sweepstakes Br.		x			x
		Shoemaker Br.		x			x
		Smock Ck.		x			x
		Two Mile Ck.		x			x
		West Fork, Knoblick Ck.		x			x
	Henderson	Cash Ck.		x			x
		Race Ck.	x				x
Lower Ohio	Breckinridge	Honey Locust Ck.		x			x
	Hancock	Bates Hollow		x			x
		Blackford Ck.	x				x
		Butchers Br.		x			x
		Caney Ck.		x			x
		Horse Fk., Blackford Ck.		x			x
		Indian Ck.	x				x
		Lead Ck.		x			x
		Little Caney Ck.		x			x
		Sandy Br., Indian Ck.	x				x
	Daviess	Fulkerson Ditch		x			x
		Little Blackford Ck.	x				x
		Pup Ck.		x			x

Table 15 continued

River Basin	County	Stream	Fishery		Mining Impact		
			Fair	Poor	Silt	Acid	None
Lower Ohio	Union	Anderson Ck.		x			x
		Casey Ck.	x				x
		Clements Br., Lost Ck.	x				x
		Eagle Ck.		x			x
		Goose Pond Ditch	x				x
		Little Mason Ck.		x			x
		Mason Ck.	x				x
		Sibley Ck.		x			x
		Sugg Ck.		x			x
		Wash Ck.		x			x
		Wathen Ditch		x			x
	Henderson	Barrett Ditch		x			x
		Beaverdam Ck.	x				x
		Camp Ck.		x			x
		Canoe Ck.		x	x		
		Cash Ck.		x			x
		East Fork, Canoe Ck.		x			x
		Elam Ditch	x				x
		Mound Slough	x				x
		Opossum Ck.		x			x
		Pond Ck.		x			x
		Race Ck.	x				x
		Whitelick Ck.	x		x		
	Crittenden	Butler Ck.		x			x
		Crooked Ck.	x				x
		Mattoon		x			x

03025912

Dismal Creek

Drainage System:	Nolin River
County:	Edmonson
7.5 Min. Quadrangle Name:	Bee Spring
Latitude:	37° 16' 34" N
Longitude:	86° 15' 00" W
Location:	above gravel road bridge off KY 728, .3 km below Nolin Reservoir Dam near Kyrock, Kentucky
Survey Date:	11/Jun/80

Dismal Creek heads in northcentral Edmonson County at an elevation of 173.7 m. The stream flows in a southeasterly direction to its confluence with the Nolin River below Nolin Reservoir Dam. The third order stream segment is 1.27 km in length. Coal mining in the Dismal Creek watershed has been restricted to a headwater tributary 3.2 km above the site. The Main Nolin Coal is the primary seam mined in the area. Less than 5% of the watershed surface has been disturbed by mining. Quarries are located .7 to .9 km upstream of the site.

The stream sampling site was situated in a floodplain of moderate width with steep, forested slopes rising to the west. Approximately 60% of the watershed is forested. Agriculture is restricted to the stream divides. KY 728 crosses the stream .5 km above the site and parallels the stream along its east slopes to the Nolin River. Riparian vegetation afforded 75-100% shade.

Dismal Creek is a stream of moderate gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate in pools was composed of sand with some detritus. Riffle bottoms were of sand and gravel. Iron deposits were scattered along the shore. Some coal chunks were present. Silt sedimentation was negligible.

Table G1

Survey Site Physical Morphology and Percentage Substrate Composition in Dismal Creek, Edmonson County, Kentucky, 11/Jun/80.

Stream:	Width	1.31 m	Depth	.5 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	20	Sand	80
	Silt	0	Clay	0

Physicochemical analyses indicate that the water quality of Dismal Creek is impacted by mine drainage. Elevated values for specific conductance and sulfates were observed. Iron and manganese concentrations were at levels consistent with unimpacted streams. Dyer and Curtis (1977) noted that these parameters return to normal within a year following cessation of mining.

Table G2

Analytical Results for Certain Physicochemical Parameters Surveyed in Dismal Creek, Edmonson County, Kentucky, 11/Jun/80.

Temp °C	16	Specific Conductance (μmhos/cm)	431
Turbidity (NTU)	49	pH	7.7 (Field) 7.5 (Lab)
Dissolved Oxygen (mg/l)	8.9	Total Alkalinity (mg/l)	112
Total Acidity (mg/l)	4.6	Sulfates (mg/l)	62.0
Total Iron (mg/l)	.23	Total Manganese (mg/l)	.245

A cursory biotic survey revealed the presence of plecopterans, decapods, hemipterans, and cyprinids.

Dismal Creek does not support a fishery of significance, save at its mouth, due to its small size. Sehlinger and Underwood (1980) state that black basses (smallmouth, Kentucky, largemouth), panfish, catfish, and white bass are of prime interest in the lower Nolin River.

03012912

Hazel Creek

Drainage System:	Mud River
County:	Muhlenberg
7.5 Min. Quadrangle Name:	Rochester
Latitude:	37° 08' 50" N
Longitude:	86° 58' 43" W
Location:	.2 km downstream from confluence with Little Hazel Creek on farm at end of gravel road off Union Ridge Road 2.6 km east off US 431
Survey Date:	12/Jun/80

Hazel Creek heads in southeastern Muhlenberg County at an elevation of 151.5 m. The stream flows in a general southeasterly direction to its confluence with Mud River northeast of Union Ridge, Kentucky. The third order stream segment is 5.63 km in length. Surface mines are centered around the community of Belton, Kentucky, 5.8 km upstream of the site on Hazel Creek. Extensive surface mining has occurred at the head of Little Hazel Creek; this area has been revegetated in pines. Approximately 10% of the surface has been disturbed by mining.

The stream sampling site was situated in a floodplain of moderate width at the edge of an alluvial woodland area which extends downstream to the confluence with Mud River. Approximately 50% of the watershed is forested. Intensive agriculture is practiced on about 35% of the watershed surface. The floodplain immediately above the site is in cultivation. Riparian vegetation afforded 50-75% shade at the site.

Hazel Creek is a stream of low gradient with a pool-riffle ratio of 70% pool to 30% riffle. At the time of sampling, the stream was at low stage with slow flow. Substrate consisted of silt and clay. Silt sedimentation was moderate.

Table G3

Survey Site Physical Morphology and Percentage Substrate Composition in Hazel Creek, Muhlenberg County, Kentucky, 12/Jun/80.

Stream:	Width	2.13 m	Depth	.16 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	0	Sand	0
	Silt	50	Clay	50

Physicochemical analyses indicate the water quality of Hazel Creek to be impacted by mine drainage. Elevated values for specific conductance, sulfates, iron, and manganese were observed.

Table G4

Analytical Results for Certain Physicochemical Parameters Surveyed in Hazel Creek, Muhlenberg County, Kentucky, 12/Jun/80.

Temp °C	20	Specific Conductance (µmhos/cm)	428
Turbidity (NTU)	179 (Field)	pH	6.8 (Field) 6.5 (Lab)
Dissolved Oxygen (mg/l)	7.9	Total Alkalinity (mg/l)	16.6
Total Acidity (mg/l)	4.2	Sulfates (mg/l)	163.0
Total Iron (mg/l)	.76	Total Manganese (mg/l)	1.93

A cursory biotic survey revealed the presence of ephemeropterans, odonates, coleopterans, and decapods. Fishes included the topwater minnow (Fundulus), the mosquito fish (Gambusia), the creek chub (Semotilus atromaculatus), and a darter.

The fishery of Hazel Creek is largely limited to that section near its confluence with Mud River. Panfish and baitfish are of prime interest. Stragglers off Mud River may also be taken. Mud River supports a fishery for both game and commercial species (Kentucky Department of Fish and Wildlife Resources 1979).

03023912

Beaverdam Creek

Drainage System:	Green River
County:	Edmonson
7.5 Min. Quadrangle Name:	Bee Spring
Latitude:	37° 15' 13" N
Longitude:	86° 20' 56" W
Location:	above Grassland-Black Gold- Sweeden Road bridge 1.8 km southwest of Black Gold, Kentucky
Survey Date:	11/Jun/80

Beaverdam Creek heads in westcentral Edmonson County at an elevation of 204.2 m. The stream flows in a general westerly direction to its confluence with Bear Creek southwest of Black Gold, Kentucky. The third order segment is 3.22 km in length. A surface mine of moderate size is located 1.2 km above the site near Black Gold. Approximately 10% of the surface has been disturbed by mining.

The stream sampling site was situated in a narrow floodplain with steep, forested slopes to the north and south. Approximately 40% of the watershed is forested. Agriculture is restricted to upland areas and accounts for 50% of the watershed usage. Riparian vegetation afforded 50-75% shade.

Beaverdam Creek is a stream of low gradient with a pool-riffle ratio of 80% pool to 20% riffle. The survey section was characterized by slow flow and fallen trees impeding water movement. Stream stage was low. Substrate consisted of silt clay, and detritus. Silt sedimentation was very heavy. A small amount of iron deposit was present.

Table G5

Survey Site Physical Morphology and Percentage Substrate Composition in Beaverdam Creek, Edmonson County, Kentucky, 11/Jun/80.

Stream:	Width	4.12 m	Depth	.3 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	0	Sand	0
	Silt	60	Clay	40

Physicochemical analyses indicate the presence of mine drainage impact on the water quality of Beaverdam Creek. Sulfates, iron, and manganese were observed to be at elevated levels.

Table G6

Analytical Results for Certain Physicochemical Parameters Surveyed in Beaverdam Creek, Edmonson County, Kentucky, 11/Jun/80.

Temp °C	16	Specific Conductance (μmhos/cm)	296
Turbidity (NTU)	61	pH	6.8 (Field) 6.8 (Lab)
Dissolved Oxygen (mg/l)	6.8	Total Alkalinity (mg/l)	37.8
Total Acidity (mg/l)	5.8	Sulfates (mg/l)	71.0
Total Iron (mg/l)	.55	Total Manganese (mg/l)	1.48

A cursory biotic survey revealed only the presence of decapods and creek chubs.

Edmonson County conservation officer Ray Meredith (pers. comm.) considered the fishery of Beaverdam Creek to be poor. Panfish and catfish are of prime interest.

03010913

Spur Creek

Drainage System:	Green River
County:	Ohio
7.5 Min. Quadrangle Name:	Rochester
Latitude:	37° 14' 11" N
Longitude:	86° 55' 34" W
Location:	across floodplain from gravel road 2.4 km south of junction with Wysox-Cool Springs Road; 9.7 km southwest of Cool Springs, Kentucky
Survey Date:	11/Jun/80

Spur Creek heads in southcentral Ohio County at an elevation of 153.3 m. The stream flows in a southwesterly direction to its confluence with the Green River below Rochester, Kentucky. The third order stream segment is 5.07 km in length. Approximately 50% of the Spur Creek watershed has been surface mined with practically all activity confined to the eastern half of the drainage. A large last-cut lake parallels the east bank for most of its length.

The stream sampling site was situated at the mouth of the Spur Creek floodplain. The expansive Green River floodplain to the west is intensively farmed. Agriculture is concentrated in the lower section of Spur Creek. Forests cover about 30% of the watershed, with wooded areas confined to the extreme headwaters, west slope, and lower stream course. The upper 60% of the stream and a section at the survey site have been channelized. Riparian vegetation afforded 0-5% shade at the site.

Spur Creek is a stream of moderate gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted of silt and clay with coal. Silt sedimentation was moderate. Red water was seeping from the east bank into the stream.

Table G7

Survey Site Physical Morphology and Percentage Substrate Composition in Spur Creek, Ohio County, Kentucky, 11/Jun/80.

Stream:	Width	2.20 m	Depth	.22 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	5
	Gravel	0	Sand	0
	Silt	40	Clay	40
	Coal	15		

Physicochemical analyses indicate the water quality of Spur Creek to be impacted by mine drainage. Elevated values for specific conductance and sulfates were observed.

Table G8

Analytical Results for Certain Physicochemical Parameters Surveyed in Spur Creek, Ohio County, Kentucky, 11/Jun/80.

Temp °C	22	Specific Conductance (µmhos/cm)	3035
Turbidity (NTU)	175 (Field)	pH	7.8 (Field) 8.0 (Lab)
Dissolved Oxygen (mg/l)	8.9	Total Alkalinity (mg/l)	134.2
Total Acidity (mg/l)	6.8	Sulfates (mg/l)	116.0
Total Iron (mg/l)	.30	Total Manganese (mg/l)	.14

A cursory biotic survey revealed the presence of whirligigs, backswimmers, blackfly larvae, isopods, trichopterans, decapods, and relict Corbicula shells. Fishes included the bluegill (Lepomis macrochirus) and mosquito fish (Gambusia affinis). A heavy algal growth covered rocks in the riffles.

The fishery of Spur Creek is limited to that section near its confluence with the Green River. Sehlinger and Underwood (1980) report that bass, panfish, sauger, white bass, rockfish, catfish, and drum are of interest to anglers in this section of the Green River.

03010912

Jacobs Creek

Drainage System:	Green River
County:	Muhlenberg
7.5 Min. Quadrangle Name:	Rochester
Latitude:	37° 14' 50" N
Longitude:	86° 58' 33" W
Location:	below culvert on coal haul road across from Peabody Sinclair deep mine; 2.4 km southeast from junction KY 176/ Paradise Stream Plant Road; near Paradise, Kentucky
Survey Date:	11/Jun/80

Jacobs Creek heads in eastcentral Muhlenberg County at an elevation of 140.8 m. The stream flows in a general northerly direction to its confluence with Green River above Paradise, Kentucky. The third order stream segment is 4.36 km in length. Extensive surface mining has occurred along the eastern slopes of Jacobs Creek. Approximately 60% of the surface has been disturbed by mining. Mined areas have been revegetated. The Peabody Coal Company Sinclair deep mine is located above the coal haul road culvert on the east bank. Jacobs Creek has been channelized in many sections so as to receive slurry disposal waters. Slurry disposal areas are located above the coal haul road culvert to the west of the stream.

The stream sampling site was located in a slough off the Green River. The slough is backed to the south by a coal haul road under which a culvert allows the northward flow of Jacobs Creek. A slurry disposal area for the Paradise Steam Plant is located on the west bank. Approximately 40% of the watershed is forested. Riparian vegetation, mostly willows, afforded 25-50% shade.

Jacobs Creek is a stream of moderate gradient. At the time of sampling, the stream was at low stage with fast flow. Substrate consisted of gravel and sand with silt and clay. Silt sedimentation was negligible.

Table G9

Survey Site Physical Morphology and Percentage Substrate Composition in Jacobs Creek, Muhlenberg County, Kentucky, 11/Jun/80.

Stream:	Width	undeterminable	Depth	1.0 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	40	Sand	40
	Silt	10	Clay	10

Physicochemical analyses indicate the water quality of Jacobs Creek to be impacted by mine drainage. Elevated values for specific conductance and sulfates were observed. Iron and manganese were at levels consistent with unimpacted streams. Dyer and Curtis (1977) have noticed the return to normal by these parameters a year after cessation of mining. The water was noticeably warmer than previous streams visited that day.

Table G10

Analytical Results for Certain Physicochemical Parameters Surveyed in Jacobs Creek, Muhlenberg County, Kentucky, 11/Jun/80.

Temp °C	27	Specific Conductance (µmhos/cm)	414
Turbidity (NTU)	-	pH	7.1 (Field) 7.6 (Lab)
Dissolved Oxygen (mg/l)	8.9	Total Alkalinity (mg/l)	84.2
Total Acidity (mg/l)	3.6	Sulfates (mg/l)	186.5
Total Iron (mg/l)	.31	Total Manganese (mg/l)	.14

A cursory biotic survey revealed the presence of damselflies and bluegills.

The fishery of Jacobs Creek is limited to that section of stream below the coal haul road culvert. Several persons were observed fishing at the survey site during our visit. Their catch was composed of many hand-size bluegill. The fishery of the slough area is probably quite similar to that in the Green River where catfish, white bass, and drum are important creel species. The slough may also serve as a nursery area for riverine fishes.

03011912

Unnamed tributary to Pond Creek

Drainage System:	Green River
County:	Muhlenberg
7.5 Min. Quadrangle Name:	Central City E
Latitude:	37° 16' 24" N
Longitude:	87° 04' 05" W
Location:	.3 km below Roll School Road, 4.8 km east off KY 2107 (access via coal haul roads); northeast of Cleaton, Kentucky
Survey Date:	19/Jun/80

This stream heads in eastcentral Muhlenberg County at an elevation of 138.7 m. Flowing in an easterly direction, the stream reaches its confluence with Pond Creek northeast of Cleaton, Kentucky. The third order segment is 2.08 km in length. Practically all of the watershed lies within property owned by the Peabody Coal Company (Gibraltar Mine) and has been extensively surface mined. Approximately 80% of the watershed has been disturbed by mining with all areas reclaimed. Two silt dams (.7 and 1.8 km above the survey site) are located in the headwaters.

The stream sampling site was situated in a floodplain of relatively broad width with forested slopes to the south. Approximately 10% of the watershed is forested. Agriculture is intensive in the floodplain below Rose Cemetery to within .3 km of the stream confluence with Pond Creek. A narrow row of trees follows the stream, affording 75-100% shade at the site.

Channelized for much of its course, this tributary of Pond Creek is a stream of moderate gradient with a pool-riffle ratio of 75% pool to 25% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted of shifting sand with gravel. Silt sedimentation was slight.

Table G11

Survey Site Physical Morphology and Percentage Substrate Composition in Unnamed tributary to Pond Creek, Muhlenberg County, Kentucky, 19/Jun/80.

Stream:	Width	1.43 m	Depth	.06 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	20	Sand	80
	Silt	0	Clay	0

Physicochemical analyses indicate the stream water quality to be impacted by mine drainage. Elevated values for specific conductance and sulfates were observed. Manganese was at a slightly elevated concentration, while iron levels were particularly low. Dyer and Curtis (1977) noted that these metals return to normal levels within a year following cessation of mining.

Table G12

Analytical Results for Certain Physicochemical Parameters Surveyed in Unnamed tributary to Pond Creek, Muhlenberg County, Kentucky, 19/Jun/80.

Temp °C	22	Specific Conductance (μmhos/cm)	2402
Turbidity (NTU)	1 (Lab)	pH	7.2
Dissolved Oxygen (mg/l)	7.9	Total Alkalinity (mg/l)	58.6
Total Acidity (mg/l)	4.4	Sulfates (mg/l)	1210.0
Total Iron (mg/l)	.01	Total Manganese (mg/l)	.53

A cursory biotic survey revealed the presence of isopods, decapods, and a few cyprinids.

This tributary to Pond Creek does not support a fishery. Pond Creek today is a channelized ditch whose waters are impacted by acid mine drainage and is essentially abiotic in the lower half of the drainage.

03001913

East Fork Deer Creek

Drainage System:	Green River
County:	Hopkins
7.5 Min. Quadrangle Name:	Slaughters
Latitude:	37° 27' 00" N
Longitude:	87° 32' 19" W
Location:	at John Thomas Road bridge .6 km west of junction with KY 1069 southwest of Slaughters, Kentucky.
Survey Date:	19/Jun/80

East Fork Deer Creek heads in northcentral Hopkins County against the Tradewater River divide at an elevation of 164.6 m. The stream flows in a general northerly direction to its confluence with Deer Creek south of Sebree, Kentucky. The third order stream segment is 2.53 km in length. A small inactive surface mine is located 3.1 km above the site. Less than 5% of the watershed has been disturbed by mining.

The stream sampling site was situated in a floodplain of moderate width. Much of the stream course has been channelized so as to enhance drainage. Agriculture is rather intensively practiced, and accounts for 45% of the watershed usage. The floodplain directly above the site was in cultivation. Forests are largely restricted to the uplands with scattered woodlands on the floodplain. Riparian vegetation afforded 5-25% shade.

East Fork Deer Creek is a stream of low gradient with a pool-riffle of 90% pool to 10% riffle. Substrate consisted of sand with silt and gravel. Silt and yellowboy sedimentation were slight to moderate. Oil was present in riffle substrates.

Table G13

Survey Site Physical Morphology and Percentage Substrate Composition in East Fork Deer Creek, Hopkins County, Kentucky, 19/Jun/80.

Stream:	Width	1.59 m	Depth	.13 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	5	Sand	85
	Silt	10	Clay	0

Physicochemical analyses indicate that iron and manganese levels are elevated. Specific conductance and sulfates are at levels considered indicative of unimpacted streams. Elevated metal levels may reflect natural background concentrations or perturbation from oil production or farming.

Table G14

Analytical Results for Certain Physicochemical Parameters Surveyed in East Fork Deer Creek, Hopkins County, 19/Jun/80.

Temp °C	23	Specific Conductance (µmhos/cm)	185
Turbidity (NTU)	4.5 (Lab)	pH	7.0 (Field)
Dissolved Oxygen (mg/l)	4.4	Total Alkalinity (mg/l)	67.4
Total Acidity (mg/l)	11.2	Sulfates (mg/l)	26.1
Total Iron (mg/l)	1.61	Total Manganese (mg/l)	2.83

A cursory biotic survey revealed the presence of trichopterans, chironomids, riffle beetles, and crayfish. Fishes collected were the creek chub, blackstripe topminnow (Fundulus notatus), and creek chubsucker (Erimyzon oblongus).

Hopkins County conservation officer Eddie Young (pers. comm.) considered the East Fork Deer Creek fishery to be poor. Webster County conservation officer James Engle (pers. comm.) reported that Deer Creek supports a good rough fish population in its lower reaches. Game fish, primarily crappie, are caught in the spring. Deer Creek is periodically impacted by oilfield brine from wells northwest of Sebree, Kentucky.

03002912

Middle Fork Knoblick Creek

Drainage System:	Green River
County:	Daviess
7.5 Min. Quadrangle Name:	Curdsville
Latitude:	37° 41' 02" N
Longitude:	87° 41' 04" N
Location:	at New Cut Road bridge, .3 km west of Mulligan Road, southeast of Saint Joseph, Kentucky
Survey Date:	18/Jun/80

Middle Fork Knoblick Creek heads in southwestern Daviess County at an elevation of 150.9 m. The stream flows in a general northerly direction to its confluence with East Fork Knoblick Creek east of Saint Joseph, Kentucky. The third order stream segment is 3.85 km in length. Mining has not been conducted in this watershed. Numerous oil wells are scattered throughout the floodplain.

The stream sampling site was situated in a broad floodplain tabletop-like relief. Woodland areas are for the most part restricted to headwater areas. Approximately 30% of the watershed is in woodlands. Agriculture is intensively conducted on the floodplains. Approximately 70% of the land usage is devoted to farming. Much of the stream course has been channelized so as to enhance runoff. Riparian vegetation, save for grasses, was absent.

Middle Fork Knoblick Creek is a stream of low gradient with a pool-riffle ratio of 90% pool to 10% riffle. At the time of sampling, the stream was at low stage with very slow to no flow. Substrate consisted of clay with sand and silt. Silt sedimentation was moderate.

Table G15

Survey Site Physical Morphology and Percentage Substrate Composition in Middle Fork Knoblick Creek, Daviess County, Kentucky, 18/Jun/80.

Stream:	Width	1.83 m	Depth	.20 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	0	Sand	10
	Silt	20	Clay	70

Physicochemical analyses indicated the water quality of Middle Fork Knoblick to be unimpacted by mine drainage. Sulfates and manganese were at unimpacted levels. Elevated values for specific conductance and iron were observed. Increases in these parameters are most probably a reflection of oil well production. Charles (1964) noted increases in specific conductance and iron in a tributary of the Green River receiving oilfield brines.

Table G16

Analytical Results for Certain Physicochemical Parameters Surveyed in Middle Fork of Knoblick Creek, Daviess County, 18/Jun/80.

Temp °C	25.5	Specific Conductance (µmhos/cm)	427
Turbidity (NTU)	150 (Field)	pH	8.2 (Field)
Dissolved Oxygen (mg/l)	12.6	Total Alkalinity (mg/l)	117.8
Total Acidity (mg/l)	5.2	Sulfates (mg/l)	43.2
Total Iron (mg/l)	.56	Total Manganese (mg/l)	.06

A cursory biotic survey was not conducted at this site.

Daviess County conservation officer Clark Boggs (pers. comm.) reported that Middle Fork Knoblick Creek did not support a fishery. He referred to the stream as a farm ditch.

03002913

Old Panther Creek (Lower Section) - Mosleyville Slough

Drainage System:	Green River
County:	Daviess
7.5 Min. Quadrangle Name:	Panther
Latitude:	37° 40' 54" N
Longitude:	87° 11' 59" W
Location:	off farm road, 3.3 km south from junction with Waynes Bridge Road and .3 km south of Wayne Bridge Road crossing of Old Panther Creek
Survey Date:	18/Jun/80

Panther Creek is formed by the confluence of its North and South Forks southeast of Owensboro, Kentucky. The stream flows in a westerly direction to its confluence with the Green River at Curdsville, Kentucky, a distance of 36.37 km. Much of the stream course has been channelized. Numerous old meanders or sloughs remain along the stream course and are connected to it. The stream sampling site was on one such slough. Extensive surface mining (Green Coal Company, Panther Mine) has been conducted to the southwest of the slough area. Approximately 30% of the slough watershed has been disturbed by mining.

The stream sampling site was located in the downstream section Panther Creek - Mosleyville Slough below the confluence of Flat Lick Creek. This feeder stream receives drainage from a large section of the surface mined area. The floodplain is quite level, supporting intensive agriculture. Approximately 50% of the watershed usage is agricultural. Forested areas are restricted to the slough and reclaimed mine areas. Riparian vegetation at the site afforded 25-50% shade.

During times of low rainfall, the slough may be separated into upper and lower sections. The stream separation occurs 6.4 km above the site at a powerline crossing. The survey was conducted in a period of little rainfall. The lower slough section was characterized by moderate flow with a pool-riffle ratio of 70% pool to 30% riffle. There was a considerable amount of brush and fallen trees in the stream course. Substrate consisted of clay with silt. Silt sedimentation was moderate.

Table G17

Survey Site Physical Morphology and Percentage Substrate Composition in Old Panther Creek (Lower Section) - Mosleyville Slough, Daviess County, Kentucky, 18/Jun/80.

Stream:	Width	3.29 m	Depth	.35 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	0	Sand	0
	Silt	30	Clay	70

Physicochemical analyses revealed the water quality of this section as impacted by mine drainage. Elevated values for specific conductance, sulfates, iron, and manganese were observed. Much of this impact originates in the Flat Lick Creek watershed.

Table G18

Analytical Results for Certain Physicochemical Parameters Surveyed in Old Panther Creek - Mosleyville Slough (D), Daviess County, Kentucky, 18/Jun/80.

Temp °C	29	Specific Conductance (µmhos/cm)	3078
Turbidity (NTU)	425 (Field)	pH	7.8 (Field)
Dissolved Oxygen (mg/l)	11.1	Total Alkalinity (mg/l)	338.4
Total Acidity (mg/l)	15.2	Sulfates (mg/l)	1735.0
Total Iron (mg/l)	2.44	Total Manganese (mg/l)	1.85

A cursory biotic survey revealed the presence of aquatic beetles and chironomids.

The sloughs and cutoffs along Panther Creek support a varied fish fauna. A local resident informed the investigator that he had caught several species at this site including the following: panfish (bluegill, rock bass, crappie), gamefish (largemouth and smallmouth bass), and rough fish (channel and blue catfish, bullheads, carp, and grinnel).

03002914

Old Panther Creek (Upper Section) - Mosleyville Slough

Drainage System:	Green River
County:	Daviess
7.5 Min. Quadrangle Name:	Panther
Latitude:	37° 40' 20" N
Longitude:	87° 11' 26" W
Location:	at KY 81 bridge, 1.0 km north of Mosleyville, Kentucky
Survey Date:	18/Jun/80

An old meander slough of Panther Creek, this section receives flow from the channelized section of Panther Creek north of Mosleyville, Kentucky, during periods of high rainfall. As was mentioned under the previous site description, the slough is separated into upper and lower sections except during high water. The upper section is characterized by very slow to no flow and by much broader width. Woodland areas are restricted to areas along the stream course. Riparian vegetation afforded 5-25% shade at the site. Substrate consists of clay with silt. Silt sedimentation is heavy. Floodplains bordering the slough are flat and intensively farmed. Surface mining (Green Coal Company - Panther Mine) has been conducted along a section of the west slope 2.1 km below the site.

Table G19

Survey Site Physical Morphology and Percentage Substrate Composition in Old Panther Creek (Upper Section) - Mosleyville Slough, Daviess County, Kentucky, 18/Jun/80.

Stream:	Width 13+ m	Depth	Not Determined
Bottom Type (%):	Bottom Type not determined, mostly mud.		

Physicochemical analyses indicate the presence of mine drainage impact in this section. Specific conductance, sulfates, and iron exceeded levels for unimpacted streams.

Table G20

Analytical Results for Certain Physicochemical Parameters Surveyed in Old Panther Creek (Upper Section) - Mosleyville Slough, Daviess County, Kentucky, 18/Jun/80.

Temp °C	27	Specific Conductance (µmhos/cm)	583
Turbidity (NTU)	765 (Field)	pH	7.6 (Field)
Dissolved Oxygen (mg/l)	4.6	Total Alkalinity (mg/l)	159.6
Total Acidity (mg/l)	11.8	Sulfates (mg/l)	364.0
Total Iron (mg/l)	1.96	Total Manganese (mg/l)	.39

A cursory biotic survey was not conducted.

Sehlinger and Underwood (1980) state that the numerous oxbows and cutoffs along Panther Creek support a variety of game and commercial species.

03015912

South Fork Caney Creek

Drainage System:	Rough River
County:	Grayson
7.5 Min. Quadrangle Name:	Caneyville
Latitude:	37° 24' 55" N
Longitude:	86° 27' 47" W
Location:	on farm at end of gravel road .6 km south of US 62, 1.6 km east of Caneyville, Kentucky
Survey Date:	11/Jun/80

South Fork Caney Creek heads in westcentral Grayson County at an elevation of 219.5 m. The stream flows in a westerly direction to its confluence with North Fork Caney Creek, forming Caney Creek at their union just east of Caneyville, Kentucky. The third order stream segment is 11.09 km in length. Mining has not been conducted in this watershed.

The stream sampling site was situated in a floodplain with forested slopes rising to the north and south. Approximately 50% of the watershed is covered by woodlands. Agriculture is intensive on the floodplains and on the relatively level uplands. Approximately 45% of the watershed usage is agricultural. Caney Creek Flood Retarding Lakes #13 and 3 are located on Caney and Dunns Forks 3.9 and 5.2 km above the stream site respectively. Riparian vegetation at the stream site afforded 50-75% shade.

South Fork Caney Creek is a stream of low gradient characterized at the stream site by one long continuous pool. At the time of sampling, the stream was at moderate stage with very slow to no flow. Substrate was composed of silt and clay. Silt sedimentation was moderate to heavy.

Table G21

Survey Site Physical Morphology and Percentage Substrate Composition in South Fork Caney Creek, Grayson County, Kentucky, 11/Jun/80.

Stream:	Width	7.01 m	Depth	.86 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	0	Sand	0
	Silt	50	Clay	50

Physicochemical analyses do not reflect mining impact. Specific conductance and sulfates were within levels acceptable for unimpacted streams. While iron and manganese concentrations were exceeding limits for unimpacted streams, they do not appear to be the result of mine drainage so much as possibly a reflection of natural background levels or agricultural disturbance.

Table G22

Analytical Results for Certain Physicochemical Parameters Surveyed in South Fork of Caney Creek, Grayson County, 11/Jun/80.

Temp °C	19	Specific Conductance (µmhos/cm)	215
Turbidity (NTU)	225 (Field)	pH	6.9 (Field) 6.9 (Lab)
Dissolved Oxygen (mg/l)	2.4	Total Alkalinity (mg/l)	62.2
Total Acidity (mg/l)	9.6	Sulfates (mg/l)	22.5
Total Iron (mg/l)	.53	Total Manganese (mg/l)	2.57

A cursory biotic survey was not conducted at this site.

Grayson County conservation officer Harold Belt (pers. comm.) considered the fishery of South Fork Caney Creek to be fair for largemouth bass, panfish, sucker, and catfish. The fishery is not being impacted by mine drainage.

03009912

North Fork Muddy Creek

Drainage System:	Rough River
County:	Ohio
7.5 Min. Quadrangle Name:	Hartford
Latitude:	37° 26' 26" N
Longitude:	86° 52' 46" W
Location:	at Old Beaver Dam and Hartford Road bridge .6 km south off KY 1543 east of Hartford, Kentucky
Survey Date:	11/Jun/80

North Fork Muddy Creek heads in eastcentral Ohio County at an elevation of 211.8 m. The stream flows in a general westerly direction to its confluence with Muddy Creek south of Hartford, Kentucky. The third order stream segment is 9.54 km in length. Surface mines (recent and inactive) are restricted to that section of the watershed east of the Green River Parkway. Approximately 25% of the surface has been disturbed by mining.

The stream sampling site was situated in a rather broad floodplain shared by the North Fork and Muddy creeks. The North Fork has been channelized much of its length to enhance drainage. That section of the floodplain above the survey site to west of the Green River Parkway is intensively farmed. Forested areas are largely restricted to the headwaters and cover approximately 20% of the watershed. The North Fork west of the site has also been channelized. The lower section of North Fork and Muddy Creek in earlier days formed a rather expansive swampy area between Hartford and Beaver Dam. Riparian vegetation afforded 50-75% shade at the site.

North Fork Muddy Creek is a stream of low gradient with the survey section one long continuous ditch. At the time of sampling, the stream was at low stage with very slow flow. Substrate consisted of gravel, clay, and silt. Silt sedimentation was heavy.

Table G23

Survey Site Physical Morphology and Percentage Substrate Composition in North Fork, Muddy Creek, Ohio County, Kentucky, 11/Jun/80.

Stream:	Width	4.57 m	Depth	.65 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	50	Sand	0
	Silt	25	Clay	25

Physicochemical analyses indicate North Fork to be impacted by mine drainage. Elevated levels for specific conductance, sulfates, iron, and manganese were observed. Increases in these paramters have been associated with mine drainage (Dyer and Curtis 1977).

Table G24

Analytical Results for Certain Physicochemical Parameters Surveyed in North Fork, Muddy Creek, Ohio County, Kentucky, 11/Jun/80.

Temp °C	22	Specific Conductance (µmhos/cm)	473
Turbidity (NTU)	560 (Field)	pH	7.1 (Field) 7.2 (Lab)
Dissolved Oxygen (mg/l)	5.9	Total Alkalinity (mg/l)	57.6
Total Acidity (mg/l)	4.0	Sulfates (mg/l)	151.0
Total Iron (mg/l)	1.42	Total Manganese (mg/l)	1.03

A cursory biotic survey revealed the presence of odonates, topwater minnows and mosquito fish.

The fishery of the North Fork of Muddy Creek is largely limited to that section near its confluence with Muddy Creek. Laflin (1980) states that fishing in Muddy Creek is limited to the backwaters and spring movement of fish from Rough River.

03004915

Grays Branch of McFarland Creek

Drainage System:	Pond River
County:	Hopkins
7.5 Min. Quadrangle Name:	Nortonville
Latitude:	37° 07' 58" N
Longitude:	87° 23' 42" W
Location:	at Grays Branch Road bridge 6.67 km southwest of White Plains, Kentucky
Survey Date:	12/Jun/80

Grays Branch of McFarland Creek heads in northcentral Christian County at an elevation of 170.1 m. The stream flows in a general easterly direction to its confluence with McFarland Creek south of White Plains, Kentucky. The third order stream segment is 3.11 km in length. Extensive surface mining has been conducted on the south slopes west of Grays Branch Road. A small surface mine is located on the north slope 1.9 km above the site. Approximately 30% of the surface has been disturbed by mining. The Cates Coal is the primary seam mined within this watershed (McFarlan 1961).

The stream sampling site was situated in a floodplain of relatively broad width. A large section of the floodplain above Grays Branch Road has been flooded by restricted flow at the road culvert. Woodland areas cover approximately 50% of the watershed above the site. Agriculture is rather limited, accounting for only 20% of the land usage. The West Fork Pond River Flood Retarding Lake No. 7 is situated 2.6 km above the site. Periodic discharge of acid mine water may be released from the lake during times of high rainfall. Riparian vegetation afforded 25-50% shade at the site.

Grays Branch is a stream of low gradient. The stream site was characterized by its flooded nature and lack of flow. There were no riffle areas. Substrate consisted of silt and clay with coal. Silt sedimentation was heavy.

Table G25

Survey Site Physical Morphology and Percentage Substrate Composition in Gray's Branch of McFarland Creek, Hopkins County, Kentucky, 12/Jun/80.

Stream:	Width	Not Determined	Depth	.84 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	0	Sand	0
	Silt	50	Clay	30
	Coal	20		

Physicochemical analyses indicate the water quality of Grays Branch to be impacted by mine drainage. Elevated levels for specific conductance, sulfates, iron and manganese were observed.

Table G26

Analytical Results for Certain Physicochemical Parameters Surveyed in Gray's Branch of McFarland Creek, Hopkins County, Kentucky, 12/Jun/80.

Temp °C	18	Specific Conductance (µmhos/cm)	1255
Turbidity (NTU)	255	pH	6.8 (Field) 6.9 (Lab)
Dissolved Oxygen (mg/l)	4.4	Total Alkalinity (mg/l)	8.8
Total Acidity (mg/l)	8.8	Sulfates (mg/l)	435.0
Total Iron (mg/l)	1.11	Total Manganese (mg/l)	6.59

A cursory biotic survey revealed the presence of odonate nymphs, isopods, amphipods, unionid mussels, fingernail clams, gastropods, decapods, and the topwater minnow (Fundulus).

Hopkins County conservation officer Eddie Young (pers. comm.) considered the fishery of Grays Branch to be poor with panfish and catfish of prime interest. The close proximity of Grays Branch to the West Fork of Pond River lends itself to the possibility that stragglers off Pond River may be caught at the Grays Branch confluence. The Kentucky Division of Water (1980) has collected both game and commercial species in the Pond River near Apex, Kentucky.

03004914

Halls Creek

Drainage System:	Pond River
County:	Muhlenberg
7.5 Min. Quadrangle Name:	Graham
Latitude:	37° 09' 03" N
Longitude:	87° 15' 15" W
Location:	below gravel road bridge, .4 km east off KY 189, 1.6 km south of Bancroft, Kentucky
Survey Date:	12/Jun/80

Halls Creek heads in westcentral Muhlenberg County at an elevation of 158.5 m. The stream flows in a southwesterly direction to its confluence with Jarrels Creek southwest of Bancroft, Kentucky. The third order stream segment is 6.16 km in length. Small surface mines are centered in the vicinity of Bancroft. Additional small surface mines are located above the East Fork Pond River Flood Retarding Lake No. 11, 4.6 km above the site. Approximately 5% of the surface has been disturbed by mining.

The stream sampling site was situated in a floodplain of moderate width. Much of the stream has been channelized below the East Fork Pond River Lake. Agriculture is intensive on the floodplain accounting for 50% of the land usage. The floodplain at the stream site was under cultivation. Forested areas are restricted largely to the headwaters and eastern slopes. Riparian vegetation afforded 0-5% shade at the site. KY 189 parallels the stream along its west slope divide.

Halls Creek is a stream of low gradient with a pool-riffle ratio of 80% pool to 20% riffle. The stream is channelized at the site. At the time of sampling, the stream was at low stage with very slow flow. Substrate consisted of gravel and sand with silt. Silt sedimentation was heavy. Some coal was present.

Table G27

Survey Site Physical Morphology and Percentage Substrate Composition in Halls Creek, Muhlenberg County, Kentucky, 12/Jun/80.

Stream:	Width	2.44 m	Depth	.1 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	40	Sand	40
	Silt	20	Clay	0

Physicochemical analyses do not indicate that Halls Creek is impacted by mine drainage. Specific conductance, sulfates, iron, and manganese were at levels considered indicative of unimpacted streams.

Table G28

Analytical Results for Certain Physicohemical Parameters Surveyed in Halls Creek, Muhlenberg County, Kentucky, 12/Jun/80.

Temp °C	21	Specific Conductance (μmhos/cm)	220
Turbidity (NTU)	165 (Field)	pH	7.5 (Field) 7.1 (Lab)
Dissolved Oxygen (mg/l)	8.5	Total Alkalinity (mg/l)	31.8
Total Acidity (mg/l)	4.8	Sulfates (mg/l)	38.5
Total Iron (mg/l)	.22	Total Manganese (mg/l)	.375

A cursory biotic survey revealed the presence of isopods, dipterans, ephemeropterans, decapods, and creek chubs.

Muhlenberg County conservation officer Clark Bailey (pers. comm.) considered Halls Creek to be a stream of poor fishery quality. This stream serves only as a baitfish source.

03004913

Log Creek

Drainage System:	Pond River
County:	Muhlenberg
7.5 Min. Quadrangle Name:	Millport
Latitude:	37° 22' 06" N
Longitude:	87° 17' 08" W
Location:	below Millport-Sacramento Road bridge 1.1 km northeast of Millport, Kentucky
Survey Date:	19/Jun/80

Log Creek heads in northwestern Muhlenberg County at an elevation of 142.3 m. The stream flows in a general northwesterly direction to its confluence with Pond River northwest of Millport, Kentucky. The third order segment is 6.44 km in length. Most of the stream course has been channelized. Coal mining does not appear to have been conducted in this watershed, save possibly a small area along the Brier Creek divide.

The stream sampling site was situated in a floodplain of broad width at the edge of an alluvial woods along Pond River. Intensive farming is conducted in the watershed above the Millport-Sacramento Road. Approximately 80% of the land usage is agricultural. Forested areas, largely restricted to the headwaters and lower section, cover 20% of the watershed. Riparian vegetation afforded 25-50% shade at the stream site.

Log Creek is a stream of low gradient. At the time of sampling, the stream was at low stage with no flow. Water was restricted to that stretch of stream below the Millport-Sacramento Road bridge. Substrate consisted of silt with sand and clay. Silt sedimentation was heavy.

Table G29

Survey Site Physical Morphology and Percentage Substrate Composition in Log Creek, Muhlenberg County, Kentucky, 19/Jun/80.

Stream:	Width	5.64 m	Depth	.38 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	0	Sand	10
	Silt	80	Clay	10

Physicochemical analyses do not indicate the presence of mining impact on the water quality of Log Creek. Although iron, and manganese exceeded levels for unimpacted streams, this seems to be a reflection of intensive agriculture conducted within the watershed. Aerial surveys do not indicate the presence of mining.

Table G30

Analytical Results for Certain Physicochemical Parameters Surveyed in Log Creek, Muhlenberg County, 19/Jun/80.

Temp °C	23	Specific Conductance (μmhos/cm)	314
Turbidity (NTU)	16.4 (Lab)	pH	7.0 (Field)
Dissolved Oxygen (mg/l)	6.2	Total Alkalinity (mg/l)	97.4
Total Acidity (mg/l)	6.0	Sulfates (mg/l)	26.8
Total Iron (mg/l)	1.25	Total Manganese (mg/l)	1.40

A cursory biotic survey revealed a varied macroinvertebrate fauna, including the ephemeropteran (Hexagenia), odonates, amphipods, coleopterans, and decapods including both crayfish and the freshwater prawn (Palaemonetes).

Muhlenberg County conservation officer Clark Bailey (pers. comm.) reported the fishery of Log Creek to be poor, with panfish and baitfish of prime interest. Stragglers off Pond River may also be expected in the lower section of Log Creek. In spite of the statement by Sehlinger and Underwood (1980) that Pond River "does not support fish life" due to mining impact, the Kentucky Division of Water (1980) has collected both game and commercial species in this stream.

03004912

Otter Creek

Drainage System:	Pond River
County:	Hopkins
7.5 Min. Quadrangle Name:	Hanson
Latitude:	37° 26' 03" N
Longitude:	87° 27' 33" W
Location:	across cornfield from gravel road, 2.5 km northeast of junction with KY 260, northeast of Hanson, Kentucky
Survey Date:	19/Jun/80

Otter Creek heads in northcentral Hopkins County at an elevation of 163.1 m against the Tradewater River divide. The stream flows in a northeasterly direction to its confluence with Pond River above Jewel City, Kentucky. The third order segment is 8.63 km in length. Two small inactive surface mines are located in the headwaters. Less than 5% of the surface has been disturbed by mining. Numerous oil wells are scattered throughout the drainage.

The stream sampling site was situated in a floodplain of broad width and relatively level profile. Practically all of the streams in this watershed have been channelized so as to enhance drainage. Woodland areas are largely restricted to the uplands with a few wooded areas along Otter Creek. Riparian vegetation at the stream site afforded 50-75% shade. Floodplains including those at the survey site are intensively farmed. Approximately 50-60% of the watershed usage is agricultural.

Otter Creek is a stream of low gradient with very slow flow. There were no riffles at the stream site. Substrate consisted of sand and silt. Silt sedimentation was heavy. Oil and grease were present in the sediment.

Table G31

Survey Site Physical Morphology and Percentage Substrate Composition in Otter Creek, Hopkins County, Kentucky, 19/Jun/80.

Stream:	Width	3.11 m	Depth	.20 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	0	Sand	80
	Silt	20	Clay	0

Physicochemical analyses revealed elevated levels for specific conductance, iron, and manganese. While increases in these parameters have been associated with surface mining (Dyer and Curtis 1977), the observed values may represent the combined effect of agriculture and oil production. The sulfate concentration indicates that the creek is not impacted by mining.

Table G32

Analytical Results for Certain Physicochemical Parameters Surveyed in Otter Creek, Hopkins County, Kentucky, 19/Jun/80.

Temp °C	18	Specific Conductance (μmhos/cm)	380
Turbidity (NTU)	4.5 (Lab)	pH	-
Dissolved Oxygen (mg/l)	2.6	Total Alkalinity (mg/l)	154
Total Acidity (mg/l)	6.4	Sulfates (mg/l)	37.8
Total Iron (mg/l)	.81	Total Manganese (mg/l)	3.52

A cursory biotic survey revealed the presence of isopods, heptagenid and caenid mayflies, odonate nymphs, and aquatic coleopterans. Numerous culicid larvae and adults were also present. Fishes were not observed.

Hopkins County conservation officer Eddie Young (pers. comm.) considered the fishery of Otter Creek to be fair to good for panfish and catfish. The fishery was reported as not impacted by mining.

03005912

Little Cypress Creek

Drainage System:	Pond River
County:	Muhlenberg
7.5 Min. Quadrangle Name:	Central City W
Latitude:	37° 16' 25" N
Longitude:	87° 09' 03" W
Location:	at the Western Kentucky Parkway bridge southwest of Central City, Kentucky
Survey Date:	12/Jun/80

Little Cypress Creek heads in northcentral Muhlenberg County at an elevation of 153.9 m. The stream course roughly resembles a semicircle with its confluence discharging into Cypress Creek northwest of Central City, Kentucky. The third order stream segment is 6.1 km in length. Approximately 80% of the watershed above the stream site has been disturbed by surface mining (Peabody Coal Company - River Queen Mine). Much of the mined area has been reclaimed through pine or grass establishment. An inactive deep mine is situated on the east slope 1.0 km above the site.

The stream sampling site was located in a floodplain of moderate width. Much of the stream course above the site has been channelized so as to enhance runoff. Woodlands cover approximately 50% of the watershed with much of this in reclaimed mine areas. Riparian vegetation at the stream site afforded 25-50% shade. Agriculture is largely restricted to an area south of Hillsdale, Kentucky. The Western Kentucky Parkway parallels the stream along its north slope, crossing at the stream site. A railroad track parallels the east bank at the site.

Little Cypress Creek is a low gradient stream with the survey section channelized. Riffle areas were not present. At the time of sampling, the stream was at low stage with flow very slow to stagnant. Substrate was composed of silt with clay and rubble. Sedimentation of silt and yellowboy was heavy.

Table G33

Survey Site Physical Morphology and Percentage Substrate Composition in Little Cypress Creek, Muhlenberg County, Kentucky, 12/Jun/80.

Stream:	Width	10+ m	Depth	1.0+ m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	10
	Gravel	0	Sand	0
	Silt	60	Clay	30

Physicochemical analyses indicate Little Cypress Creek to be severely degraded by acid mine drainage. The highest recorded values for specific conductance, sulfates, iron, and manganese in the Green River Basin field survey were observed at this stream. Acidity exceeded alkalinity, while pH was depressed. These conditions are classical for streams impacted by acid mine drainage (Appalachian Regional Commission 1969;Corbett 1969).

Table G34

Analytical Results for Certain Physicochemical Parameters Surveyed in Little Cypress Creek, Muhlenberg County, 12/Jun/80.

Temp °C	19	Specific Conductance (µmhos/cm)	3343
Turbidity (NTU)	93 (Field)	pH	4.8 (Field) 3.8 (Lab)
Dissolved Oxygen (mg/l)	8.2	Total Alkalinity (mg/l)	0
Total Acidity (mg/l)	52	Sulfates (mg/l)	1905
Total Iron (mg/l)	13.3	Total Manganese (mg/l)	6.87

A cursory biotic survey revealed only the presence of whirligig beetles.

Northwest Fisheries Biologist David Bell (pers. comm.) considered the fishery of Little Cypress Creek to be fair for both game and commercial fish. His collections were made at the Fairground Road Bridge 4.0 km below the study site this past summer. Robert Ware of the Kentucky Division of Water (pers. comm.) reported a pH of 7.6 at the fisheries site. Reasons for such discrepancies in observed physicochemical parameters and biotic communities between sites are not known.

08028912

Little Caney Creek

Drainage System:	Lower Ohio River
County:	Hancock
7.5 Min. Quadrangle Name:	Pellville
Latitude:	37° 48' 24" N
Longitude:	86° 44' 27" W
Location:	on Thruman Young Road .8 km east of junction with KY 69; east of Goering, Kentucky
Survey Date:	18/Jun/80

Little Caney Creek heads in eastcentral Hancock County at an elevation of 182.9 m. The stream flows in a southwesterly direction to its confluence with Blackford Creek. The third order stream segment is 1.95 km in length. A small inactive surface mine was located on a south draining tributary 3.7 km above the site. A local resident said recent exploration on his property had disclosed deposits of cannel coal in north slopes of Little Caney Creek.

The stream sampling site was situated in a floodplain of moderate width with forested hills to the north and south. Much of Little Caney Creek has been channelized with the adjoining floodplains intensively farmed. A small feeder stream entered just above the site. A hog lot was located near the head of this stream. Riparian vegetation consisting largely of shrubs afforded 0-5% shade.

Little Caney Creek is a stream of low to moderate gradient with a pool-riffle ratio of 70% pool to 30% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted of sand and silt. Silt sedimentation was moderate resulting mostly from agricultural runoff. Some coal was present in the stream.

Table L01

Survey Site Physical Morphology and Percentage Substrate Composition in Little Caney Creek, Hancock County, Kentucky, 18/Jun/80.

Stream:	Width	1.71 m	Depth	.12 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	0	Sand	50
	Silt	50	Clay	0

Physicochemical analyses do not indicate the presence of mining impact on the water quality of Little Caney Creek. Specific conductance and sulfates are within levels accepted for unimpacted streams. Although manganese and iron exceeded acceptable levels, it is uncertain whether this reflects mining impact or background levels.

Table L02

Analytical Results for Certain Physicochemical Parameters Surveyed in Little Caney Creek, Hancock County, Kentucky, 18/Jun/80.

Temp °C	20	Specific Conductance (μmhos/cm)	160
Turbidity (NTU)	470 (Field)	pH	6.7 (Field)
Dissolved Oxygen (mg/l)	6.0	Total Alkalinity (mg/l)	23.6
Total Acidity (mg/l)	5.6	Sulfates (mg/l)	32.4
Total Iron (mg/l)	1.32	Total Manganese (mg/l)	.86

A cursory biotic survey revealed the presence of the ephemeropteran (Hexagenia), odonates including both dragonflies and damselflies, dipterans, hemipterans, tricopterans, plecopterans, and decapods. Fishes present included the topwater minnow (Fundulus olivaceus) and bluegills.

The fishery of Little Caney Creek is largely restricted to the lower section near the confluence with Blackford Creek. Acting Hancock County conservation officer Billy Ray Hudson (pers. comm.) considered the fishery of Blackford Creek to be fair and unimpacted by mining. Primary species sought include largemouth bass, panfish, sucker, catfish, and drum.

Kentucky River Basin - Water Quality. A summary of physicochemical parameters surveyed in the Kentucky River Basin is presented in Table 16. A total of 28 third order streams were surveyed of which 17 streams were found to be impacted by mine drainage.

Miller, Wihry, and Lee, Inc. (1975) listed acid mine drainage and siltation as the major problems associated with mining in the Kentucky River Basin. They noted that since enactment and enforcement of strip mine regulations, a tremendous improvement in water quality within the basin has been realized. Our results indicate that the mining-impacted third order streams of this basin, while highly mineralized, are not seriously affected by acid drainage. The pH values for several streams considered to be impacted were actually elevated.

The streams found in this study to be most severely impacted were: Camp Branch and Rockhouse Creek (Letcher County), Clear Creek (Knott County), Upper Second and Lost Creeks (Perry County), and Upper Jacks Creek (Leslie County). These streams exhibited high sulfate concentrations and high specific conductance.

Kentucky River Basin - Fishery Evaluation. A total of 162 third order streams representing 477 stream miles in 17 counties were evaluated for their fishery potential. Evaluations for streams in Breathitt, Jackson, and Lee counties were not available. Jones (1973) stated that many third order streams are of little fisheries significance due to their small size. Most third order streams considered to be of fisheries importance are classified as trout streams. Third order streams generally serve as sources of baitfish and spring sucker fishery; they may also serve as spawning and nursery sites.

Of the streams evaluated, conservation officers considered 97 streams (60%) to be poor, 34 streams (21%) to be fair, 22 streams (14%) to be good, and 4 streams (3%) to be excellent fishery streams. Third order streams reported to support good sport fisheries and high quality streams from Jones (1973) are listed in Table 17. Streams of poor to fair quality are listed in Table 18. Streams which are stocked with trout include: Right Fork Buffalo Creek (Owsley County), Laurel Fork (Harlan County), Greasy Creek (Leslie County), Station Camp Creek (Estill County), Sturgeon Creek (Lee County), Big Double Creek (Clay County), Indian Creek and War Fork (Jackson County), Middle Fork Red River (Powell County), Swift Camp Creek and Parch Corn Creek (Wolfe County), and East Fork Indian Creek and Leatherwood Fork (Menifee County) (Kentucky Department of Fish and Wildlife, pers. comm.). A large portion of Kentucky's muskellunge waters are located within the Kentucky River drainage. Streams in which muskellunge occur

naturally or are stocked include the Kentucky River (section between Red River and Beattyville), Big Goose Creek, Collins Fork, North Fork Kentucky River, Red River, Sexton Creek, South Fork Kentucky River, Station Camp Creek and Sturgeon Creek (Jones 1973).

Approximately 255 miles of third order streams are considered by conservation officers to be impacted by mine drainage. Of this total, 78% of the mileage is impacted by siltation, 2% by acid, and 21% by acid and siltation. Blackwater is reported to occur in eight streams. Reflecting on the fishery of the Kentucky River, Estill County Conservation Officer W. R. Wise (pers. comm.) stated that the fishery has experienced a decline in the past 20 years. The decline has been especially rapid in the last 10 years and may be reflective of mining impact. Wise noted that the river once supported an excellent fishery; however, today the fishery is very poor.

Table 16

Summary of Mean and Range Data for Physicochemical Parameters Surveyed in Third Order Streams in the Kentucky River Basin

	Impacted (17)		Unimpacted (11)	
Parameter	Mean	Range	Mean	Range
pH	7.9	7.1-8.5	7.5	6.7-7.9
Alkalinity (mg/l)	94.3	26.0-174.2	68.0	17.8-118.2
Acidity (mg/l)	9.6	3.6-24.4	7.3	3.8-12.4
Sulfates (mg/l)	302.2	64.5-946.0	25.8	7.4-53.6
Total Iron (mg/l)	0.46	0.04-2.15	0.39	0.11-1.12
Total Manganese (mg/l)	0.31	0.02-1.64	0.07	0.01-0.19
Specific Conductance (μmhos/cm)	750	216-1232	221	103-332

( ) Number of streams sampled

Table 17

Sports Fisheries Streams Rated as Good to Excellent
in the Kentucky River Basin

River Basin	County	Stream
Kentucky	Perry	Grapevine Ck.
		Squabble Ck.
	Leslie	Beech Fork
		Greasy Ck.*
		Abner Branch
		Laurel Fork*
		Rockhouse Ck.
		Cutshin Ck.*
		Raccoon Ck.
		MacIntosh Ck.
		Hell for Certain Ck.
		Grassy Br., Middle Fork, Kentucky River
		Elkhorn Ck.
		Rush Ck.
		Bowen Ck.
	Clay-Owsley	South Fork, Kentucky R.
	Clay	Red Bird River*
	Clay-Leslie	Phillips Fork
	Clay	Big Double Ck.
		Collins Fork*
	Knott	Buckhorn Ck.*
		Coles Fork
		Laurel Fk., Quicksand Ck.
	Wolf-Estill-Clark	Red River*
	Wolf	Swift Camp Ck.
	Lee to Madison	Kentucky River*
	Jackson-Lee	Sturgeon Ck.*
	Jackson	Station Camp Ck.
	Garrard-Madison	Paint Lick Ck.

Table 17 continued

River Basin	County	Stream
	Rockcastle-Lincoln	Dix River*
	Rockcastle	Negro Ck.
		Little Negro Ck.
		Cooper Ck.
	Lincoln	Fall Lick Ck.

*Streams considered by Jones (1973) to be of good to excellent quality.

Table 18

Third Order Streams with Fair to Poor Fisheries in the Kentucky River Basin with an Assessment of Mining Impacts

River Basin	County	Stream	Fishery		Mining Impact		
			Fair	Poor	Silt	Acid	None
Kentucky							
	Letcher	Boone Fk., NF Kentucky R.		x	x		
		Camp Branch, Rockhouse Ck.		x	x		
		Cowan Creek		x	x		
		Kings Creek		x	x		
		Line Creek	x		x		
		North Fork, Kentucky R.	x		x		
		Rockhouse Creek		x	x		
	Harlan	Big Laurel Ck.	x				x
		Laurel Fk., Greasy Ck.	x		x		
	Leslie	Bobs Fk., Big Ck.	x		x		
		Browning Fk., Second Fk., Wooten Ck.	x		x	x	
		Hals Fork, Big Ck.	x		x		
		Hurricane Ck.	x		x	x	
		Left Fork, Elkhorn Ck.	x		x		
		Middle Fork, KY. R.	x		x		
		Polls Ck.		x	x	x	
		Wolf Ck.	x		x	x	
	Perry	Big Ck.		x	x	x	
		Big Willard Ck.	x		x		
		Leatherwood Ck.		x	x		
		Lick Br., North Fk., Kentucky River		x	x		
		Little Leatherwood Ck.		x	x		
		Lost Ck.		x	x		
		Lotts Ck.	x		x		
		Middle Fork, Maces Creek	x				x

Table 18 continued

River Basin	County	Stream	Fishery Fair	Fishery Poor	Mining Impact Silt	Mining Impact Acid	Mining Impact None
	Clay	Beech Creek		x	x		
		Big Double Ck.	x				x
		Blue Hole Ck.	x		x		
		Bray Ck.		x	x		
		Bullskin Creek	x		x		
		Buzzard Creek		x	x		x
		Crane Creek		x			
		Flat Creek		x	x		
		Goose Creek	x		x		
		Grays Fork, Little Goose Ck.		x	x	x	
		Hector Br., Red Bird River		x	x		
		Horse Creek		x	x	x	
		Island Creek		x	x	x	
		Jacks Creek		x	x	x	
		Laurel Creek	x		x		
		Little Bullskin Ck.		x			x
		Little Goose Ck.		x	x	x	
		Lockards Ck.		x	x		
		Lower Teges Ck.		x			x
		Martins Creek		x	x		
		Newfound Ck.		x	x		
		Phillips Fork, Red Bird River		x	x		
		Rader Creek		x	x	x	
		Red Bird River	x		x		
		Robinsons Creek		x	x	x	
	Knott	Betty Troublesome Creek		x	x	x	
		Breeding Creek		x	x	x	
		Clear Creek		x	x	x	
		Little Carr Fork	x		x	x	

Table 18 continued

River Basin	County	Stream	Fishery		Mining Impact		
			Fair	Poor	Silt	Acid	None
	Owsley	Indian Creek		x	x		
		Left Fork, Cow Ck.		x	x		
		Lower Island Ck.		x	x		
		Lucky Branch, LF Buffalo Ck.		x	x		
		Poletown Fork, Meadow Creek		x	x		
		Right Fork, Buffalo Creek	x		x		
		Right Fk., Cow Ck.		x	x		
		Rowlette Br., Little Sturgeon Ck.		x	x		
		Spencer Ck.		x	x		
		Wild Dog Ck.		x	x		
	Wolfe	Banks Fork, Red River		x	x		
		Baptist Fork, Stillwater Ck.		x			x
		Bear Pen Ck.		x			x
		Clifty Creek		x			x
		Dog Fork, Swift Camp Creek		x		x	
		Gillmore Ck.		x	x		x
		Greenbriar Branch, Rose Ck.		x			x
		Hunting Fork, Holly Ck.		x			x
		Landsaw Ck.		x			x
		Laurel Fork, Stillwater Ck.		x			x
		Little Fork, Lower Devil Ck.		x	x	x	
		Lower Devil Ck.		x	x		
		Mandy Holland Fork, Holly Ck.		x			x
		Middle Fork, Red R.		x			x
		Mill Ck.		x			x
		Murphy Fork, Stillwater Ck.		x			x
		Red River		x	x		

Table 18 continued

River Basin	County	Stream	Fishery		Mining Impact		
			Fair	Poor	Silt	Acid	None
	Wolfe (continued)	Right Fork, Chimney Top Ck.		x			x
		Right Fork, Upper Devil Ck.		x			x
		Rockridge Fork, Swift Camp Ck.		x			x
		Rose Fork, Red R.		x			x
		Stillwater Ck.		x			x
		Tributary, Swift Camp Ck.		x			x
	Menifee	East Fork, Indian Creek	x				x
		Gladie Ck.	x				x
		Spas Ck.		x			x
	Powell	Copperas Ck.		x			x
		Hardwick Ck.	x				x
		Hatcher Ck.	x				x
		Hatton Ck.	x				x
		Lower Cane Ck.	x				x
		Middle Fork, Cane Ck.	x				x
		Morris Ck.	x				x
		Right Fork, Cane Ck.		x			x
		Sandlick Fork, South Fork Red River		x			x
		Short Ck.		x			x
		Snow Ck.		x			x
		Spas Ck.		x			x
		South Fork, Red River		x			x
	Clark	Log Lick Ck.		x			x
	Estill	Billy Fork, Big Sinking Ck.		x			x
		Buck Ck.	x				x
		Clear Ck.		x			x
		Cow Ck.		x			x

Table 18 continued

River Basin	County	Stream	Fishery		Mining Impact		
			Fair	Poor	Silt	Acid	None
	Estill (continued)	Crooked Ck.		x			x
		Furnace Fork, Big Sinking Ck.		x			x
		Middle Fork, Station Camp Ck.		x			x
		Nolan Ck.		x			x
		Possum Run		x			x
	Madison	Brushy Fork, Silver Ck.		x			x
		Cowbell Ck.		x			x
		Floyd Br., Red Lick Ck.		x			x
		Hays Fork, Silver Creek	x				x
		McCarter Br., Red Lick Ck.	x				x
		Muddy Ck.	x				x
		Owsley Fork, Red Lick Ck.		x			x
		Red Lick Creek		x			x
	Montgomery	Hog Ck.		x			x
		Lulbegrud Ck.	x				x
		North Branch, Lulbegrud Ck.		x			x

04059914

Cowan Creek

Drainage System:	North Fork Kentucky River
County:	Letcher
7.5 Min. Quadrangle Name:	Whitesburg
Latitude:	37° 06" 18" N
Longitude:	82° 51' 37" W
Location:	at gravel road bridge off KY 931, .6 km south of KY 588 - KY 931 junction near Ice, Kentucky
Survey Date:	1/Jul/80

Cowan Creek heads in southcentral Letcher County at an elevation of 466.3 m. The stream flows in a northeasterly direction along the north base of Pine Mountain east of Day, Kentucky. The stream swings northwestward to its confluence with the North Fork of the Kentucky River at Ice, Kentucky. The third order stream segment is 6.89 km in length. Topographic maps indicate the presence of deep mines 4.14 km upstream from the site on Bartesta Branch. Contour and mountain top surface mining has been extensive on the western slopes. Small surface mines are located in the headwaters of Little Cowan Creek. Approximately 20% of the watershed surface has been disturbed.

The stream sampling site was situated in a floodplain of moderate width. Steep, forested slopes rise to the north and south. KY 931 parallels the stream along the north slope base. Forest covers approximately 60% of the watershed. Brown Branch enters just above the stream site. Riparian vegetation afforded 25-50% shade.

Cowan Creek is a low to moderate gradient stream with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with slow flow. Substrate consisted of boulders, rubble, sand and silt. Silt sedimentation was moderate.

Table K1

Survey Site Physical Morphology and Percentage Substrate Composition in Cowan Creek, Letcher County, Kentucky, 1/Jul/80.

Stream:	Width	2.26 m	Depth	.09 m
Bottom Type (%):	Bedrock	0	Boulder	30
	Cobble	0	Rubble	30
	Gravel	0	Sand	20
	Silt	20	Clay	0

Physicochemical analyses do not clearly indicate the presence of mining impact in Cowan Creek. Iron was elevated. Sulfates, often used as an indicator of surface mining, were at levels consistent with unimpacted streams. Further study should be conducted to determine whether Cowan Creek is presently impacted by mining.

Table K2

Analytical Results for Certain Physicochemical Parameters Surveyed in Cowan Creek, Letcher County, Kentucky, 1/Jul/80.

Temp °C	23	Specific Conductance (µmhos/cm)	324
Turbidity (NTU)	2.7 (Lab)	pH	8.2 (Field) 7.7 (Lab)
Dissolved Oxygen (mg/l)	6.2	Total Alkalinity (mg/l)	118.2
Total Acidity (mg/l)	11.9	Sulfates (mg/l)	22.0
Total Iron (mg/l)	1.12	Total Manganese (mg/l)	.09

A cursory biotic survey of the benthos revealed the presence of members of the Ephemeroptera, Diptera, and Decapoda orders.

Letcher County conservation officer Jerry Coots (pers. comm.) considered the fishery of Cowan Creek to be poor and impacted by silt pollution from mining. Suckers and catfish are of prime interest.

04059913

Rockhouse Creek

Drainage System:	North Fork Kentucky River
County:	Letcher
7.5 Min. Quadrangle Name:	Mayking
Latitude:	37° 13' 21" N
Longitude:	82° 51' 24" W
Location:	KY 7 bridge at Colson, Kentucky
Survey Date:	2/Jul/80

Rockhouse Creek heads against the Big Sandy River divide at an elevation of 536.1 m in northcentral Letcher County. The stream flows in a southwesterly direction to its confluence with the North Fork of the Kentucky River opposite the community of Blackey, Kentucky. The third order stream segment is 10.80 m in length. Topographic maps indicate the presence of numerous deep mines scattered throughout the watershed above the stream site. Surface mining has been conducted in the extreme headwaters of Rockhouse Creek above Stevens Fork. Mountain top stripping has been conducted between Rockhouse Creek and Camp Branch north of Polly, Kentucky. Headwater surface mining has also occurred on Buck Creek, Razorblade Branch, and Indian Creek. A small surface mine is located .9 km upstream from the site. A tipple operation is situated 9.0 km above the site. Approximately 20% of the watershed has been disturbed by mining.

The stream sampling site was located in a relatively wide floodplain with forested slopes rising to the southeast and west. Approximately 60% of the watershed is in forest. Two deep mines are located just above the KY 7 bridge. A railroad track parallels the east slope base. An abandoned tipple is situated on the south bank. Riparian vegetation afforded 0-5% shade.

Rockhouse Creek is a stream of moderate width with a pool-riffle ratio of 70% pool to 30% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted of rubble, gravel, and sand with boulders and silt. Silt sedimentation was moderate.

Table K3

Survey, Site Physical Morphology and Percentage Substrate Composition in Rockhouse Creek, Letcher County, Kentucky, 2/Jul/80.

Stream:	Width	4.7 m	Depth	.15 m
Bottom Type (%):	Bedrock	0	Boulder	10
	Cobble	0	Rubble	40
	Gravel	20	Sand	20
	Silt	10	Clay	0

Physicochemical analyses indicate that Rockhouse Creek is impacted by mine drainage. Elevated values for specific conductance, sulfates, iron, and manganese were observed. The Appalachian Regional Commission (1969) listed the section of Rockhouse Creek above Camp Branch as continuously affected by mine drainage. Jones (1973) reported the upper section of this stream as being periodically impacted by deep mine acid water.

Table K4

Analytical Results for Certain Physicochemical Parameters Surveyed in Rockhouse Creek, Letcher County, Kentucky, 2/Jul/80.

Temp °C	20	Specific Conductance (μmhos/cm)	1232
Turbidity (NTU)	1.2 (Lab)	pH	7.3 (Field) 7.8 (Lab)
Dissolved Oxygen (mg/l)	7.4	Total Alkalinity (mg/l)	174.2
Total Acidity (mg/l)	6.2	Sulfates (mg/l)	477.0
Total Iron (mg/l)	1.31	Total Manganese (mg/l)	.83

A cursory biotic survey revealed the presence of dipterans, trichopterans, and decapods. Creek chubs were the only fish collected.

Letcher County conservation officer Jerry Coots (pers. comm.) reported the fishery of Rockhouse Creek to be poor and impacted by silt from mining. Suckers and catfish are the primary species of interest.

04059912

Camp Branch of Rockhouse Creek

Drainage System:	North Fork Kentucky River
County:	Letcher
7.5 Min. Quadrangle Name:	Mayking
Latitude:	37° 12' 45" N
Longitude:	82° 51' 07" W
Location:	KY 7 bridge 1.38 km south of Colson, Kentucky
Survey Date:	2/Jul/80

Camp Branch heads in northcentral Letcher County at an elevation of 500 m. The stream flows in a westerly direction to its confluence with Rockhouse Creek south of Colson, Kentucky. The third order stream segment is 2.75 km in length. This watershed has been extensively mined both by deep mines and surface mines. Deep mines extend upstream from the confluence with Rockhouse Creek 4.5 km. Mountain top surface mining is centered around Polly, Kentucky 2.9 km upstream from the survey site. Approximately 30% of the surface has been disturbed by mining.

The stream sampling site was situated in a floodplain of moderate width with steep, forested slopes rising to the north and south. Approximately 50% of the watershed is forested. Activities associated with mining are scattered throughout the floodplain; agriculture is rather limited. Deep mines are located at the site on the south slope and just upstream on the north slope. KY 931 parallels the stream along the north slope base, while a railroad track follows the south slope base. Riparian vegetation afforded 25-50% shade.

Camp Branch is a stream of moderate gradient with a pool-riffle ratio of 50% pool to 50% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted of rubble, gravel, and sand. Sedimentation in the form of silt and iron flocculent was slight to moderate. Rocks were heavily encrusted by iron deposits.

Table K5

Survey Site Physical Morphology and Percentage Substrate Composition in Camp Branch of Rockhouse Creek, Letcher County, Kentucky, 2/Jul/80.

Stream:	Width	3.55 m	Depth	.11 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	40
	Gravel	30	Sand	30
	Silt	0	Clay	0

Physicochemical analyses indicate Camp Branch to be impacted by mine drainage. Parameters associated with active surface mining (conductivity, sulfates, iron, and manganese) were elevated. The total acidity level observed was the highest of any stream in the Kentucky River drainage. Jones (1973) stated that the upper section of Rockhouse Creek is periodically impacted by deep mine acid flow.

Table K6

Analytical Results for Certain Physicochemical Parameters Surveyed in Camp Branch of Rockhouse Creek, Letcher County, Kentucky, 2/Jul/80.

Temp °C	17.8	Specific Conductance (μmhos/cm)	1083
Turbidity (NTU)	2.7 (Lab)	pH	7.1 (Field) 7.3 (Lab)
Dissolved Oxygen (mg/l)	8.0	Total Alkalinity (mg/l)	74.4
Total Acidity (mg/l)	24.4	Sulfates (mg/l)	508.0
Total Iron (mg/l)	2.15	Total Manganese (mg/l)	1.64

A cursory biotic survey revealed a notable absence of benthic macroinvertebrates. Fishes collected included creek chubs and a single blacknose dace (Rhinichthyes atratulus). The occurrence of the blacknose dace in Camp Branch is rather interesting. Smith (1979), commenting on the ecology of the blacknose dace in Illinois, considered this species as a characteristic inhabitant of clear, fast, gravelly brooks or runs, occurring also over mixed sand and gravel in pools. He stated that the fish is intolerant of silt or high temperatures. Food items commonly utilized by the blacknose dace include immature aquatic insects and amphipods (Tarter 1970). Clay (1975) stated that this species is probably unable to maintain itself in parts of Eastern Kentucky where coal has been mined. The Kentucky Nature Preserves Commission (1979) noted that the occurrence of this cyprinid may not be limited so much by turbidity as it is by siltation. It is doubtful that Camp Branch, in view of its rather impacted substrate condition and lack of benthic macroinvertebrates, provides suitable habitat for supporting a breeding population of the blacknose dace. The observed specimen was most probably a straggler off Rockhouse Creek. Creek chubs are noted for their persistence in streams in which other species have been extirpated due to mine drainage (Branson and Batch, 1972).

Letcher County conservation officer Jerry Coots (pers. comm.) considered the fishery of Camp Branch to be poor due to silt pollution from mining. Suckers are the species of interest.

04055913

Clover Fork of Leatherwood Creek

Drainage System:	North Fork Kentucky River
County:	Perry
7.5 Min. Quadrangle Name:	Leatherwood
Latitude:	37° 02' 50" N
Longitude:	83° 07' 47" W
Location:	.2 km west of KY 699/463 junction at Leatherwood School; near Leatherwood, Kentucky
Survey Date:	1/Jul/80

The Clover Fork of Leatherwood Creek heads at an elevation of 518.2 m within property owned by the Blue Diamond Coal Company at the company community of Leatherwood, Kentucky. The stream flows in an easterly direction to its confluence with Leatherwood Creek. The third order stream segment is 1.14 km in length. Topographic maps reveal the presence of several deep mines centered around Leatherwood. A tipple and coal preparation facility are also located at this community. Contour surface mining has been conducted on north and west slopes of Clover Flork. Surface mining has occurred on east slopes at Leatherwood. Approximately 30% of the surface has been disturbed by mining.

The stream sampling site was situated in a floodplain of moderate width at the mouth of Clover Fork. Slopes to the south and north are steep and forested. Approximately 60% of the watershed is covered in forest. The floodplain above the site is narrow with houses scattered along its length. The stream follows the south slope with KY 699 paralleling the south bank. Leatherwood School is located on the north floodplain. A railroad track follows the north slope base. Riparian vegetation consisted largely of grasses, with trees in the schoolyard; these afforded 5-25% shade.

Clover Fork is a stream of moderate gradient with a pool-riffle ratio of 70% pool to 30% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate was varied with rubble predominating. Silt sedimentation was moderate.

Table K7

Survey Site Physical Morphology and Percentage Substrate Composition in Clover Fork of Leatherwood Creek, Perry County, Kentucky, 1/Jul/80.

Stream:	Width	3.33 m	Depth	.17 m
Bottom Type (%):	Bedrock	0	Boulder	20
	Cobble	0	Rubble	40
	Gravel	10	Sand	15
	Silt	15	Clay	0

Physicochemical analyses indicate that Clover Fork is impacted by mine drainage. Elevated specific conductance and sulfate values were observed. Iron and manganese levels were not elevated.

Table K8

Analytical Results for Certain Physicochemical Parameters Surveyed in Clover Fork of Leatherwood Creek, Perry County, Kentucky, 1/Jul/80.

Temp °C	25	Specific Conductance (µmhos/cm)	440
Turbidity (NTU)	0.7 (Lab)	pH	8.5 (Field) 8.1 (Lab)
Dissolved Oxygen (mg/l)	8.5	Total Alkalinity (mg/l)	117.6
Total Acidity (mg/l)	6.4	Sulfates (mg/l)	102.5
Total Iron (mg/l)	.04	Total Manganese (mg/l)	.015

A cursory biotic survey revealed the presence of ephemeropterans, dipterans, trichopterans, plecopterans, decapods, the cyprinids (Semotilus atromaculatus) and (Rhinichthyes atratulus), and darters.

The fishery of Clover Fork is primarily restricted to that section near its confluence with Leatherwood Creek. Perry County conservation officer William Braswell (pers. comm.) considered the fishery of Leatherwood Creek to be poor and impacted by silt and blackwater from mining. The stream formerly supported a high quality fishery. Largemouth bass, panfish, suckers, catfish, and baitfish are of prime interest.

04055912

Little Leatherwood Creek

Drainage System:	North Fork Kentucky River
County:	Perry
7.5 Min. Quadrangle Name:	Tilford
Latitude:	37° 06' 27" N
Longitude:	83° 03' 52" W
Location:	on Little Leatherwood Creek Road 2.7 km east off KY 699 at former site of Huff School; near Daisy, Kentucky
Survey Date:	1/Jul/80

Little Leatherwood Creek heads in southeastern Perry County at an elevation of 484.6 m. The stream flows in a northwesterly direction to its confluence with Leatherwood Creek near Daisy, Kentucky. The third order stream segment is 5.97 km in length. Topographic maps reveal the presence of deep mines on Upper Twin and Lower Twin branches 3.9 km above the site. The watershed has been extensively contour surface mined. Approximately 25% of the watershed surface has been disturbed by mining.

The stream sampling site was situated in a narrow floodplain with forested slopes rising to the east and west. Approximately 60% of the watershed is forested. Little Leatherwood Creek Road parallels the stream along the west slope. The floodplain is sparsely populated. Riparian vegetation afforded 25-50% shade.

Little Leatherwood Creek is a stream of low to moderate gradient with a pool-riffle ratio of 50% pool to 50% riffle. At the time of sampling, the stream was at low stage with slow flow. Substrate consisted of gravel with silt and sand. Silt sedimentation was moderate.

Table K9

Survey Site Physical Morphology and Percentage Substrate Composition (field approximation) in Little Leatherwood Creek, Perry County, Kentucky, 1/Jul/80.

Stream:	Width	2.52 m	Depth	.25 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	70	Sand	10
	Silt	20	Clay	0

Physicochemical analyses do not clearly indicate that Little Leatherwood Creek is impacted by mine drainage. Sulfates were at levels associated with unimpacted streams. Alkaline conditions may exist when the bedrock is rich in carbonate and the coal is low in sulfur (Eastern Kentucky University, 1975). Such is probably the case in Little Leatherwood Creek.

Table K10

Analytical Results for Certain Physicochemical Parameters Surveyed in Little Leatherwood Creek, Perry County, Kentucky, 1/Jul/80.

Temp °C	23.8	Specific Conductance (μmhos/cm)	321
Turbidity (NTU)	1.4 (Lab)	pH	8.4 (Field) 7.9 (Lab)
Dissolved Oxygen (mg/l)	6.3	Total Alkalinity (mg/l)	117.6
Total Acidity (mg/l)	9.8	Sulfates (mg/l)	14.5
Total Iron (mg/l)	.45	Total Manganese (mg/l)	.075

A cursory biotic survey revealed the presence of plecopterans, ephemeropterans, trichopterans, dipterans, decapods, and the cyprinid (Semotilus atromaculatus).

Perry County conservation officer William Braswell (pers. comm.) considered the fishery of Little Leatherwood Creek to be poor due to the impact of silt from mining and oil exploration. Panfish, suckers, catfish, and baitfish are of prime interest.

04058912

Little Carr Fork

Drainage System:	North Fork, Kentucky River
County:	Knott
7.5 Min. Quadrangle Name:	Blackey
Latitude:	37° 14' 34" N
Longitude:	82° 56' 34" W
Location:	.5 km east of KY 160-KY 1410 junction near Littcarr, Kentucky
Survey Date:	2/Jul/80

Little Carr Fork heads in southcentral Knott County at an elevation of 411.5 m. The stream flows in a westerly direction to its confluence with Carr Fork at Littcarr, Kentucky, just above Carr Fork Lake. The third order stream segment is 2.53 km in length. Deep mines are scattered along the stream course with the closest .3 km upstream from the site. Extensive surface mining has been conducted in the watershed through contour and mountain top stripping. Approximately 25% of the surface has been disturbed by mining.

The stream sampling site was situated along the south slope base in a floodplain of moderate width. Slopes to the north and south are steep and forested. Approximately 60% of the watershed is forested. KY 1410 parallels the stream along the north slope base. The floodplain appeared to have been used by heavy machinery, probably during reservoir construction. The floodplain is revegetated. Riparian vegetation afforded 25-50% shade.

Little Carr Fork is a stream of low to moderate gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with slow flow. Substrate consisted largely of sand, gravel, and rubble. Silt sedimentation was slight to moderate. Iron flocculent was scattered along the shore.

Table K11

Survey Site Physical Morphology and Percentage Substrate Composition in Little Carr Fork, Knott County, Kentucky, 2/Jul/80.

Stream:	Width	4.12 m	Depth	.25 m
Bottom Type (%):	Bedrock	0	Boulder	5
	Cobble	0	Rubble	15
	Gravel	20	Sand	25
	Silt	5	Clay	0

Physicochemical analyses indicate that Little Carr Fork is impacted by mine drainage. Elevated values for specific conductance, sulfates, and iron were observed.

Table K12

Analytical Results for Certain Physicochemical Parameters Surveyed in Little Carr Fork, Knott County, Kentucky, 2/Jul/80.

Temp °C	20.2	Specific Conductance (µmhos/cm)	561
Turbidity (NTU)	1.1 (Lab)	pH	7.7 (Field) 7.7 (Lab)
Dissolved Oxygen (mg/l)	7.0	Total Alkalinity (mg/l)	135.2
Total Acidity (mg/l)	15.8	Sulfates (mg/l)	147.5
Total Iron (mg/l)	.51	Total Manganese (mg/l)	.395

A cursory biotic survey revealed the presence of members of the Diptera, Ephemeroptera, Trichoptera, and Decapoda orders. Fishes included the creek chub (Semotilus atromaculatus), silverjaw minnow (Ericymba buccata), and steelcolor shiner (Notropis whipplei).

Knott County conservation officer Cordell Gayheart (pers. comm.) considered the fishery of Little Carr Fork to be fair although impacted by silt and acid. The stream serves as a baitfish source.

04048914

Upper Second Creek

Drainage System:	North Fork Kentucky River
County:	Perry
7.5 Min. Quadrangle Name:	Hazard N
Latitude:	37° 16' 31" N
Longitude:	83° 11' 13" W
Location:	on KY 1440 1.1 km south off KY 476 near Darfork, Kentucky
Survey Date:	2/Jul/80

Upper Second Creek is formed by the confluence of its Left Fork and Right Fork at an elevation of 289.6 m in eastcentral Perry County. The stream flows in a northwesterly direction to its confluence with North Fork Kentucky River south of Darfork, Kentucky.

The stream sampling site was located in a floodplain of only moderate width with forested slopes rising to the north and south. The stream flows against the south slope base at the site; KY 1440 parallels the north slope base. A wooden bridge is located directly upstream. Deep mines are located .3 km upstream. Riparian vegetation afforded 25-50% shade.

Upper Second Creek is a stream of moderate gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate was composed of sand with cobble, gravel, rubble, and silt. Silt sedimentation was moderate. A small amount of yellowboy was scattered along the shore.

Table K13

Survey Site Physical Morphology and Percentage Substrate Composition in Upper Second Creek, Perry County, Kentucky, 2/Jul/80.

Stream:	Width	2.10 m	Depth	.32 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	20	Rubble	15
	Gravel	15	Sand	40
	Silt	10	Clay	0

Physicochemical analyses indicate that the stream is impacted by mine drainage. Elevated specific conductance and sulfate values were found. Iron and manganese were at levels consistent with unimpacted streams. These parameters have been observed to return to normal levels within a year following mining cessation (Dyer and Curtis 1977).

Table K14

Analytical Results for Certain Physicochemical Parameters Surveyed in Upper Second Creek, Perry County, Kentucky, 2/Jul/80.

Temp °C	24	Specific Conductance (μmhos/cm)	1122
Turbidity (NTU)	0.9	pH	8.5 (Field) 8.2 (Lab)
Dissolved Oxygen (mg/l)	8.6	Total Alkalinity (mg/l)	150
Total Acidity (mg/l)	20.4	Sulfates (mg/l)	515.0
Total Iron (mg/l)	.21	Total Manganese (mg/l)	.09

A cursory biotic survey revealed the presence of dipterans, trichopterans, odonates, ephemeropterans, catostomids (Catostomus commersoni) and cyprinids (Semotilus atromaculatus). Rocks in riffles were covered by algae.

Upper Second Creek does not appear to support a significant fishery. It is a source of baitfish. A local resident said the stream provided good fishing prior to mining.

04048913

Big Willard Creek

Drainage System:	North Fork Kentucky River
County:	Perry
7.5 Min. Quadrangle Name:	Krypton
Latitude:	37° 15' 34" N
Longitude:	83° 17' 56" W
Location:	.6 km above confluence with Hurricane Branch off KY 2021 near Busy, Kentucky
Survey Date:	1/Jul/80

Big Willard Creek heads in westcentral Perry County at an elevation of 390.1 m. The stream flows in a northeasterly direction to its confluence with the North Fork of the Kentucky River at Busy, Kentucky. The third order stream segment is 4.25 km in length. Topographic maps revealed the presence of deep mines on Stacy Branch and Big Willard Creek, 1.0 and 2.7 km above the stream site respectively. The extent of surface mining within the watershed is not known.

The stream sampling site was situated in a floodplain of narrow width with forested slopes rising to the east and west. Forests cover approximately 70% of the watershed. A gravel road ford crosses the stream directly below the site. KY 2021 parallels the stream along the east bank. Riparian vegetation afforded 25-50% shade.

Big Willard Creek is a stream of moderate gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with slow flow. Substrate consisted primarily of bedrock with rubble, boulders, gravel, sand, and silt. Silt sedimentation was moderate.

Table K15

Survey Site Physical Morphology and Percentage Substrate Composition in Big Willard Creek, Perry County, Kentucky, 1/Jul/80.

Stream:	Width	3.75 m	Depth	.16 m
Bottom Type (%):	Bedrock	40	Boulder	10
	Cobble	0	Rubble	20
	Gravel	10	Sand	10
	Silt	10	Clay	0

Physicochemical analyses indicate the water quality of Big Willard Creek to be impacted by mine drainage. Elevated values for specific conductance and sulfates were found. Iron and manganese were found at levels consistent with those of unimpacted streams.

Table K16

Analytical Results for Certain Physicochemical Parameters Surveyed in Big Willard Creek, Perry County, Kentucky, 1/Jul/80.

Temp °C	20	Specific Conductance (µmhos/cm)	671
Turbidity (NTU)	1.0 (Lab)	pH	8.1 (Field) 7.8 (Lab)
Dissolved Oxygen (mg/l)	9.5	Total Alkalinity (mg/l)	140.0
Total Acidity (mg/l)	5.6	Sulfates (mg/l)	204.0
Total Iron (mg/l)	.20	Total Manganese (mg/l)	.14

A cursory biotic survey revealed the presence of the following benthic macroinvertebrates: ephemeropterans, trichopterans, decapods, and chironomids. Fishes collected were creek chubs, white suckers, and darters.

Perry County conservation officer William Braswell (pers. comm.) considered Big Willard Creek to be a fair source of baitfish. He noted however, that the stream is impacted by mining silt and occasionally experiences blackwater discharges.

04050913

Clear Creek

Drainage System:	North Fork Kentucky River
County:	Knott
7.5 Min. Quadrangle Name:	Carrie
Latitude:	37° 19' 49" N
Longitude:	83° 06' 07" W
Location:	on KY 721 .3 km south off KY 80 near Fisty, Kentucky
Survey Date:	2/Jul/80

Clear Creek heads in westcentral Knott County at an elevation of 396.2 m. Flowing in a northwesterly direction, Clear Creek reaches its confluence with Troublesome Creek at Fisty, Kentucky. The third order stream segment is 4.36 km in length. Topographic maps revealed deep mines in Honey Gap Hollow and along Hickory With Branch, 3.7 and 4.6 km above the stream site respectively. A deep mine was also located at the head of Clear Creek 7.8 km upstream from the site. Contour surface mining has been conducted along the west slope of Cockerell Trace Branch and the north slopes of Clear Creek. Extensive surface mining has occurred in Honey Gap Hollow and hollows of lower Dicks Fork. Mountain top removal mining has occurred between Chestnut Log Branch and Walkers Branch. Approximately 25% of the surface has been disturbed by mining.

The stream sampling site was situated on a narrow floodplain forested slopes rising to the east and west. Approximately 50% of the watershed is forested. KY 721 parallels the east bank. A gravel road crossed the stream above the site. Riparian vegetation afforded 25-50% shade.

Clear Creek is a stream of low to moderate gradient with a pool to riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with low flow. Substrate consisted largely of cobble, gravel, and silt. Silt sedimentation was moderate.

Table K17

Survey Site Physical Morphology and Percentage Substrate Composition in Clear Creek, Knott County, Kentucky, 2/Jul/80.

Stream:	Width	4.03 m	Depth	.37 m
Bottom Type (%):	Bedrock	0	Boulder	10
	Cobble	30	Rubble	10
	Gravel	20	Sand	10
	Silt	20	Clay	0

Physicochemical analyses indicate that Clear Creek is impacted by mine drainage. Elevated values for specific conductance and sulfates were observed. Clear Creek exhibited the highest sulfate reading of all streams surveyed in the Kentucky River drainage. Iron and manganese values were not elevated.

Table K18

Analytical Results for Certain Physicochemical Parameters Surveyed in Clear Creek, Knott County, Kentucky, 2/Jul/80.

Temp °C	25.2	Specific Conductance (µmhos/cm)	1780
Turbidity (NTU)	0.9 (Lab)	pH	7.9 (Field) 7.5 (Lab)
Dissolved Oxygen (mg/l)	9.2	Total Alkalinity (mg/l)	72.6
Total Acidity (mg/l)	14.0	Sulfates (mg/l)	946.0
Total Iron (mg/l)	.21	Total Manganese (mg/l)	.16

A cursory biotic survey revealed the presence of dipterans, trichopterans, decapods, cyprinids, white suckers, and the greenside darter (Etheostoma blennioides).

Knott County conservation officer Cordell Gayheart (pers. comm.) considered the fishery of Clear Creek to be poor and impacted by silt and acid. The stream is too small to support a sport fishery. Jones (1973) reported the headwater section of nearby Troublesome Creek as silt laden from inactive surface mines, thus rendering the fishery poor.

04050912

Lost Creek

Drainage System:	North Fork Kentucky River
County:	Perry
7.5 Min. Quadrangle Name:	Hazard N
Latitude:	37° 21' 57" N
Longitude:	83° 15' 32" W
Location:	on KY 1146/267 .5 km east of Dice, Kentucky.
Survey Date:	2/Jul/80

Lost Creek heads in northcentral Perry County at an elevation of 411.5 m. The stream flows in a northwesterly direction to its confluence with Troublesome Creek at the community of Lost Creek, Kentucky. The third order stream segment is 5.17 km in length. Topographic maps revealed the presence of several deep mines scattered along Lost Creek and its headwater tributaries. Extensive contour surface mining has occurred along Lost Creek. Contour mines parallel 5.8 km of the stream about the site. Approximately 40% of the surface has been disturbed by mining.

The stream sampling site was situated in a floodplain of narrow to moderate width with forested slopes rising to the north and south. Approximately 50% of the watershed is in forest. The north floodplain above the site is cultivated. Riparian vegetation afforded 50-75% shade.

Lost Creek is a stream of moderate gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate was composed of rubble, gravel, and silt with cobble. A pool located above the site was extensively silted. Silt sedimentation in general was moderate. Red dog was present in the stream.

Table K19

Survey Site Physical Morphology and Percentage Substrate Composition in Lost Creek, Perry County, Kentucky, 2/Jul/80.

Stream:	Width	2.74 m	Depth	.10 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	10	Rubble	35
	Gravel	35	Sand	0
	Silt	20	Clay	0

Physicochemical analyses indicate that Lost Creek is impacted by mine drainage. Elevated values for specific conductance and sulfates were observed. Iron and manganese were at levels consistent with unimpacted streams. Dyer and Curtis (1977) noted that these parameters return to normal levels soon after cessation of mining.

Table K20

Analytical Results for Certain Physicochemical Parameters Surveyed in Lost Creek, Perry County, Kentucky, 2/Jul/80.

Temp °C	27	Specific Conductance (µmhos/cm)	1019
Turbidity (NTU)	0.9	pH	7.6 (Field) 7.5 (Lab)
Dissolved Oxygen (mg/l)	7.4	Total Alkalinity (mg/l)	50.6
Total Acidity (mg/l)	11.4	Sulfates (mg/l)	504.0
Total Iron (mg/l)	.11	Total Manganese (mg/l)	.37

A cursory biotic survey revealed a rather depauperate community. Only a few trichopterans and crayfish were collected among the benthos. Fishes were represented by creek chubs. These fishes are noted for their persistence in streams impacted by mining (Branson and Batch 1972).

Jones (1973) reported Lost Creek to support a limited amount of good fishing for rockbass and smallmouth from the Perry-Breathitt County line to the mouth. Perry County conservation officer William Braswell (pers. comm.) considered the fishery of Lost Creek to be poor and impacted by silt and blackwater. Baitfish are of prime interest. The stream was formerly considered to support a high quality fishery.

04054912

Big Laurel Creek

Drainage System:	Middle Fork Kentucky River
County:	Harlan
7.5 Min. Quadrangle Name:	Nolansburg
Latitude:	36° 59' 04" N
Longitude:	83° 12' 27" W
Location:	On KY 221 1.1 km above confluence with Greasy Creek near Big Laurel, Kentucky
Survey Date:	1/Jul/80

Big Laurel Creek heads in northcentral Harlan County at an elevation of 583.7 m. The stream flows in a southwesterly direction to its confluence with Greasy Creek at Big Laurel, Kentucky. The third order segment of this stream is 6.78 km in length. Topographic maps do not reveal the presence of mining activity in this watershed.

The stream sampling site was situated in a narrow floodplain steep, forested slopes rising to the north and south. Approximately 80% of the watershed is forested. KY 221 parallels the stream course along the north bank. An oil well is located .9 km upstream. Riparian vegetation afforded 50-75% shade.

Big Laurel Creek is a stream of moderate to high gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted of rubble with boulders, gravel, and sand. Silt sedimentation was negligible.

Table K21

Survey Site Physical Morphology and Percentage Substrate Composition in Big Laurel Creek, Harlan County, Kentucky, 1/Jul/80.

Stream:	Width	2.39 m	Depth	.16 m
Bottom Type (%):	Bedrock	0	Boulder	30
	Cobble	0	Rubble	40
	Gravel	20	Sand	10
	Silt	0	Clay	0

Physicochemical analyses indicate that the quality of water in Big Laurel Creek is excellent. Parameters found to be indicative of streams impacted by mining were not elevated. Jones (1973) also reported that the water quality of nearby Greasy Creek was excellent with no known pollution. Harker et al. (1979) found that 20-35% of the Greasy Creek watershed had been surface mined. Although surface mining had occurred in this watershed, water quality did not appear to be seriously impacted.

Table K22

Analytical Results for Certain Physicochemical Parameters Surveyed in Big Laurel Creek, Harlan County, Kentucky, 1/Jul/80.

Temp °C	22.5	Specific Conductance (μmhos/cm)	103
Turbidity (NTU)	0.8 (Lab)	pH	7.3 (Field) 7.2 (Lab)
Dissolved Oxygen (mg/l)	6.2	Total Alkalinity (mg/l)	40.8
Total Acidity (mg/l)	9.6	Sulfates (mg/l)	7.4
Total Iron (mg/l)	.31	Total Manganese (mg/l)	.05

A cursory biotic survey revealed the presence of caddisflies, mayflies, helgramites, and crayfish. The ichthyofauna included creek chubs, (Rhinichthyes atratulus) blacknose dace, and rainbow and snubnose darters. Clay (1975) noted that the blacknose dace in common with other species requiring clean water, is probably unable to maintain itself in streams of coal mining areas. Its presence indicates the excellent water quality of this stream.

Harlan County conservation officer Roy Harris (pers. comm.) considered the fishery of Big Laurel Creek to be fair. The stream serves primarily as a source of baitfish. Fishing is largely limited to that area near its confluence with Greasy Creek.

04053915

Polls Creek

Drainage System:	Middle Fork Kentucky River
County:	Leslie
7.5 Min. Quadrangle Name:	Hyden E.
Latitude:	37° 08' 04" N
Longitude:	83° 16' 25" W
Location:	on KY 2057 1.0 km off KY 699 near Smilax, Kentucky
Survey Date:	1/Jul/80

Polls Creek is formed by the confluence of Stratton and Engle Forks in eastcentral Leslie County at an elevation of 378.0 m. The stream flows in a general westward direction to its confluence with Cutshin Creek at Smilax, Kentucky. The third order stream segment is 2.75 km in length. Topographic maps indicate the presence of deep mines 1.6 - 2.0 km above the site. Extensive mountain top removal mining has been conducted along the north and south slopes. A coal haul road parallels Collins Branch. Approximately 30% of the surface has been disturbed by mining.

The stream sampling site was situated in a floodplain of moderate width. Steep, forested slopes rise to the north and south. Approximately 50% of the watershed is forested. Cultivated fields lie on the south floodplain above the site. KY 2057 parallels the north bank and was separated from the stream by a row of trees. Riparian vegetation afforded 0-5% shade.

Polls Creek is a stream of moderate gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted of rubble and boulders with gravel, sand, and silt. Silt sedimentation was slight to moderate.

Table K23

Survey Site Physical Morphology and Percentage Substrate Composition in Polls Creek, Leslie County, Kentucky, 1/Jul/80.

Stream:	Width	1.92 m	Depth	.12 m
Bottom Type (%):	Bedrock	0	Boulder	20
	Cobble	0	Rubble	40
	Gravel	15	Sand	15
	Silt	10	Clay	0

Physicochemical analyses indicate that Polls Creek is impacted by mine drainage. Elevated values for specific conductance and sulfates were observed.

Table K24

Analytical Results for Certain Physicochemical Parameters Surveyed in Polls Creek, Leslie County, Kentucky, 1/Jul/80.

Temp °C	30	Specific Conductance (µmhos/cm)	506
Turbidity (NTU)	1.1 (Lab)	pH	8.5 (Field) 7.7 (Lab)
Dissolved Oxygen (mg/l)	7.9	Total Alkalinity (mg/l)	90.2
Total Acidity (mg/l)	10.0	Sulfates (mg/l)	115.5
Total Iron (mg/l)	.26	Total Manganese (mg/l)	.045

A cursory biotic survey revealed the presence of ephemeropterans, trichopterans, plecopterans, dipterans, decapods, cyprinids, and darters. A profuse algal growth covered the riffles.

Leslie County conservation officer Billy Joe Napier (pers. comm.) considered the fishery of Polls Creek to be poor and impacted by silt and acid from mining. Baitfish are of prime concern. Jones (1973) considered the fishery of Cutshin Creek in the mouth of Polls Creek section as fair. Species most often taken by anglers included: smallmouth bass, suckers, white bass, bullheads, and panfish. Cutshin Creek was degraded due to siltation and acid drainage from strip mines.

04053914

Raccoon Creek

Drainage Sytem:	Middle Fork Kentucky River
County:	Leslie
7.5 Min. Quadrangle Name:	Hyden East
Latitude:	37° 08' 31" N
Longitude:	83° 17' 55" W
Location:	on gravel road off Cinda-Big Fork Road 1.0 km south of junction with KY 699; near Cinda, Kentucky
Survey Date:	1/Jul/80

Raccoon Creek heads in eastcentral Leslie County at an elevation of 460.3 m. The stream flows in a northerly direction to the community of Cinda, Kentucky, where it is joined by Wolf Creek a major tributary; continuing northward, Raccoon Creek reaches its confluence with Cutshin Creek near Smilax, Kentucky. The third order stream segment is 5.05 km in length. Topographic maps revealed a few deep mines widely scattered in the headwaters of Wolf Creek. Extensive surface mining through mountain top removal and contour stripping has occurred throughout the watershed. Approximately 40% of the surface has been disturbed by mining.

The stream sampling site was located in a narrow floodplain with steep, forested slopes rising to the east and west. Approximately 50% of the watershed is forested. A large portion of the stream bed was dry. The Cinda-Big Fork Road parallels the stream on the east slope. A gravel road parallels the stream along the west bank. A small surface mine was located in a west-facing hollow 1.2 km above the site. Riparian vegetation afforded 0-5% shade.

Raccoon Creek is a stream of low to moderate gradient with a pool-riffle ratio of 70% pool to 30% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted of bedrock and boulders with rubble and silt. Silt sedimentation was moderate. A large amount of coalfines were present in pools. Some iron flocculent was scattered along the shore.

Table K25

Survey Site Physical Morphology and Percentage Substrate Composition in Raccoon Creek, Leslie County, Kentucky, 1/Jul/80.

Stream:	Width -		Depth .05 m	
Bottom Type (%):	Bedrock	40	Boulder	30
	Cobble	0	Rubble	20
	Gravel	0	Sand	0
	Silt	10	Clay	0

Physicochemical analyses do not indicate that Raccoon Creek is impacted by mine drainage. Sulfates were within levels accepted for unimpacted streams, although slightly elevated. A pH of 8.4 reflected the presence of alkaline conditions. Iron and manganese were at levels accepted for unimpacted streams.

Table K26

Analytical Results for Certain Physicochemical Parameters Surveyed in Raccoon Creek, Leslie County, Kentucky, 1/Jul/80.

Temp °C	30	Specific Conductance (μmhos/cm)	285
Turbidity (NTU)	2.2 (Lab)	pH	8.4 (Field) 7.9 (Lab)
Dissolved Oxygen (mg/l)	7.7	Total Alkalinity (mg/l)	87.6
Total Acidity (mg/l)	8.0	Sulfates (mg/l)	41.5
Total Iron (mg/l)	.26	Total Manganese (mg/l)	.055

A cursory biotic survey revealed the presence of ephemeropterans, trichopterans, dipterans, plecopterans, cyprinids, and darters.

Leslie County conservation officer Billy Joe Napier (pers. comm.) considered the fishery of Raccoon Creek to be good although impacted by mine silt. Suckers, panfish, and catfish are of prime interest.

04053913

Wooton Creek

Drainage System:	Middle Fork Kentucky River
County:	Leslie
7.5 Min. Quadrangle Name:	Hyden E
Latitude:	37° 10' 50" N
Longitude:	83° 15' 53" W
Location:	on KY 1807 5.5 km east off KY 80 near Wooton, Kentucky
Survey Date:	1/Jul/80

Wooton Creek heads in eastcentral Leslie County at an elevation of 420.6 m. The stream flows in a general westward course to its confluence with Cutshin Creek at Wooton, Kentucky. The third order stream segment is .9 km in length. Topographic maps indicated the presence of deep mines .2 km above the site. An abandoned tipple site is located .1 km upstream. Contour surface mining has been conducted on Big Two Branch, Laurel Fork, and along Wooton Creek on the Middle Fork Kentucky River and North Fork Kentucky River divide. Approximately 10% of the watershed surface has been disturbed by mining.

The stream sampling site was situated in a narrow valley at the mouth of Cane Branch. Forested slopes rise to the north and south. Approximately 60% of the watershed is in forest. Riparian vegetation afforded 25-50% shade.

Wooton Creek is a stream of moderate to high gradient with a pool-riffle ratio of 50% pool to 50% riffle. At the time of sampling, the stream was at low stage with moderate to fast flow. Substrate consisted of boulders and rubble with sand and silt. Silt sedimentation was slight to moderate. An iron red deposit was on one shoal.

Table K27

Survey Site Physical Morphology and Percentage Substrate Composition in Wooton Creek, Leslie County, Kentucky, 1/Jul/80.

Stream:	Width	2.35 m	Depth	.10 m
Bottom Type (%):	Bedrock	0	Boulder	40
	Cobble	0	Rubble	30
	Gravel	0	Sand	20
	Silt	10	Clay	0

Physicochemical analyses indicate the presence of mining impact on Wooton Creek. Specific conductance and sulfates were at elevated levels. Iron and manganese, although within accepted levels for unimpacted streams, were slightly elevated. Dyer and Curtis (1977) found these parameters to return to normal levels within a year following mining cessation.

Table K28

Analytical Results for Certain Physicochemical Parameters Surveyed in Wooton Creek, Leslie County, Kentucky, 1/Jul/80.

Temp °C	24	Specific Conductance (μmhos/cm)	969
Turbidity (NTU)	1.0 (Lab)	pH	8.1 (Field) 7.9 (Lab)
Dissolved Oxygen (mg/l)	10.7	Total Alkalinity (mg/l)	87.8
Total Acidity (mg/l)	8.0	Sulfates (mg/l)	400.0
Total Iron (mg/l)	.33	Total Manganese (mg/l)	.245

A cursory biotic survey revealed the presence of trichopterans, plecopterans, ephemeropterans, dipterans, decapods, and cyprinids.

The fishery of Wooton Creek is probably only fair due to its small size and the impact of mine silt. Fishing that does occur in this stream undoubtedly is limited to that section near the mouth with a catch similar to that taken in Cutshin Creek. Jones (1973) reported the fishery of Cutshin Creek as degraded by siltation and acid drainage from strip mines; fishes most often taken by anglers included: smallmouth bass, suckers, white bass, bullheads, and panfish.

04053912

MacIntosh Creek

Drainage System:	Middle Fork Kentucky River
County:	Leslie
7.5 Min. Quadrangle Name:	Hyden E.
Latitude:	37° 12' 22" N
Longitude:	83° 20' 03" W
Location:	on MacIntosh Road 3.9 km off KY 80 northwest of Wooton, Kentucky
Survey Date:	1/Jul/80

MacIntosh Creek heads in northeastern Leslie County at an elevation of 448.1 m. The stream flows in a westerly direction to its confluence with Cutshin Creek at Buckhorn Reservoir. The third order stream segment is 4.36 km in length. Topographic maps indicated the presence of several deep mines near the stream confluence; 4 of these mines are above the study site. A deep mine is located 4.6 km upstream. An inactive revegetated contour surface mine is situated in a hollow to the southeast of the stream site. Less than 5% of the surface has been disturbed by mining.

The stream sampling site was located in a floodplain of moderate width with steep, forested slopes rising to the north and south. Approximately 70% of the watershed is in forest. The floodplain is sparsely populated, with light agriculture being concentrated near the mouth. MacIntosh Road parallels the stream along the north bank. Riparian vegetation afforded 5-25% shade.

MacIntosh Creek is a stream of low to moderate gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream stage was low with slow flow. Substrate was largely bedrock with boulder, rubble, and gravel. Sedimentation was negligible to slight.

Table K29

Survey Site Physical Morphology and Percentage Substrate Composition in MacIntosh Creek, Leslie County, Kentucky, 1/Jul/80.

Stream:	Width	2.77 m	Depth	.12 m
Bottom Type (%):	Bedrock	60	Boulder	20
	Cobble	0	Rubble	5
	Gravel	5	Sand	0
	Silt	0	Clay	0

Physicochemical analyses do not indicate the presence of mining impact in this drainage. Specific conductance, sulfates, iron, and manganese were at levels consistent with unimpacted streams. A pH value of 8.3 was similar to that observed in many streams in the eastern coalfield region. Dyer and Curtis (1977) noted elevated pH values following surface mining in Breathitt County.

Table K30

Analytical Results for Certain Physicochemical Parameters Surveyed in MacIntosh Creek, Leslie County, Kentucky, 1/Jul/80.

Temp °C	27	Specific Conductance (μmhos/cm)	332
Turbidity (NTU)	1.2 (Lab)	pH	8.3 (Field)
Dissolved Oxygen (mg/l)	10.0	Total Alkalinity (mg/l)	82.2
Total Acidity (mg/l)	12.4	Sulfates (mg/l)	22.2
Total Iron (mg/l)	.105	Total Manganese (mg/l)	.035

A cursory biotic survey revealed the presence of ephemeropterans, trichopterans, decapods, gastropods, cyprinids, and darters.

Leslie County conservation officer Billy Joe Napier (pers. comm.) considered the fishery of MacIntosh Creek to be good and unimpacted by mining. Baitfish are of prime interest.

04046913

Elkhorn Creek

Drainage System:	Middle Fork Kentucky River
County:	Leslie
7.5 Min. Quadrangle Name:	Buckhorn
Latitude:	37° 15' 30" N
Longitude:	83° 27' 00" W
Location:	on Confluence - Shoal - Sizerock Road .46 km above confluence with LF Elkhorn Creek near former site of Shoal, Kentucky
Survey Date:	9/Jul/80

Elkhorn Creek heads in northcentral Leslie County at an elevation of 405.4 m. The stream flows in a northerly direction to its confluence with the Middle Fork Kentucky River at Burkhorn Reservoir. The third order stream segment is 1.95 km in length. Deep mines are not present in this watershed. Aerial surveys revealed the presence of contour mining along the east slopes of Licklog Fork. Recent surface mining has also been conducted along Elkhorn Creek 4.1 km above the stream site. A local resident informed the investigator that surface mining had been conducted the summer of 1979 on Jack and Licklog Forks. Approximately 10% of the surface has been disturbed by mining.

The stream sampling site was situated at the head of the easement boundary of Buckhorn Reservoir in a narrow floodplain. Steep forested slopes rise to the east and west. Approximately 70% of the watershed is forested. A ford is directly below the site. The floodplain is sparsely populated and is not farmed. Riparian vegetation afforded 25-50% shade.

Elkhorn Creek is a stream of moderate to high gradient. At the time of sampling, the stream was at low stage with flow moderate. Substrate consisted largely of cobble, rubble, and gravel with sand. Silt sedimentation was slight to moderate.

Table K31

Survey Site Physical Morphology and Percentage Substrate Composition in Elkhorn Creek, Leslie County, Kentucky, 9/Jul/80.

Stream:	Width	1.71 m	Depth	.10 m
Bottom Type (%):	Bedrock	0	Boulder	5
	Cobble	30	Rubble	30
	Gravel	20	Sand	10
	Silt	5	Clay	0

Physicochemical analyses do not indicate an impact from mining. Parameters observed were consistent with those of unimpacted streams.

Table K32

Analytical Results for Certain Physicochemical Parameters Surveyed in Elkhorn Creek, Leslie County, Kentucky, 9/Jul/80.

Temp °C	22.2	Specific Conductance (µmhos/cm)	110
Turbidity (NTU)	2.5 (Lab)	pH	6.9 (Field) 7.1 (Lab)
Dissolved Oxygen (mg/l)	8.0	Total Alkalinity (mg/l)	20.0
Total Acidity (mg/l)	4.0	Sulfates (mg/l)	26.4
Total Iron (mg/l)	.48	Total Manganese (mg/l)	.045

A cursory biotic survey revealed the presence of riffle beetles, trichopterans, decapods, the stonefly (Acroneuria), ephemeropterans including the burrowing mayfly (Hexagenia), dipterans, and cyprinids.

Leslie County conservation officer Billy Joe Napier (pers. comm.) reported the fishery of Elkhorn Creek to be good although impacted by silt from mining. Of angling interest are the largemouth bass, panfish, suckers, and catfish.

04046912

Right Fork of Leatherwood Creek

Drainage System:	Middle Fork Kentucky River
County:	Perry
7.5 Min. Quadrangle Name:	Buckhorn
Latitude:	37° 16' 42" N
Longitude:	83° 29' 41" W
Location:	above KY. 484 bridge .9 km north of Saul, Kentucky
Survey Date:	9/Jul/80

The Right Fork of Leatherwood Creek heads in the western panhandle of Perry County at an elevation of 381.0 m. The stream flows in an easterly direction to its confluence with Leatherwood Creek near Saul, Kentucky. The third order segment of this stream is 1.21 km in length. Contour surface mines in the headwaters have disturbed approximately 5% of the watershed. There are no deep mines.

The stream sampling site was situated in a narrow floodplain with forested slopes rising to the north and south. Forests cover 80% of the watershed. A gravel road parallels the north bank, while the south floodplain is cultivated in tobacco. Riparian vegetation afforded 50-75% shade.

The Right Fork of Leatherwood Creek is a stream of moderate to high gradient with a pool-riffle ratio of 50% pool to 50% riffle. At the time of sampling, the stream was at low stage with moderate to fast flow. Substrate consisted of bedrock and boulders with sand, rubble, and silt. Silt sedimentation was slight.

Table K33

Survey Site Physical Morphology and Percentage Substrate Composition in Right Fork of Leatherwood Creek, Perry County, Kentucky, 9/Jul/80.

Stream:	Width	1.0 m	Depth	.08 m
Bottom Type (%):	Bedrock	30	Boulder	30
	Cobble	0	Rubble	10
	Gravel	10	Sand	20
	Silt	0	Clay	0

Physicochemical analyses do not indicate the presence of mining impact. All parameters (specific conductance, sulfates, iron and manganese) were within levels considered indicative of unimpacted streams.

Table K34

Analytical Results for Certain Physicochemical Parameters Surveyed in Right Fork of Leatherwood Creek, Perry County, Kentucky, 9/Jul/80.

Temp °C	20.4	Specific Conductance (µmhos/cm)	113
Turbidity (NTU)	1.1 (Lab)	pH	6.6 (Field) 6.7 (Lab)
Dissolved Oxygen (mg/l)	8.0	Total Alkalinity (mg/l)	17.8
Total Acidity (mg/l)	4.8	Sulfates (mg/l)	12.8
Total Iron (mg/l)	.15	Total Manganese (mg/l)	.02

A cursory biotic survey revealed the presence of trichopterans, dipterans, ephemeropterans, crayfish, and creek chubs.

The small size of this stream precludes it from being an important fishery.

04052915

Red Bird Creek

Drainage System:	South Fork, Kentucky River
County:	Clay
7.5 Min. Quadrangle Name:	Beverly
Latitude:	36° 59' 30" N
Longitude:	83° 32' 12" W
Location:	above KY 1524 bridge 3.1 km downstream from Gardner, Kentucky
Survey Date:	9/Jul/80

Red Bird Creek heads against the Cumberland River divide at an elevation of 509.0 m in extreme northcentral Bell County. The stream flows in a northwesterly direction, becoming Red Bird River at the confluence of Phillips Fork near Queensdale, Kentucky. Red Bird River joins with Goose Creek at the community of Oneida, Kentucky, to form the South Fork Kentucky River. The third order stream segment is 7.58 km in length. Topographic maps reveal the presence of deep mines along Lawson Creek 6.7 km above the site. Active surface mining is being conducted in the headwaters of Red Bird Creek. Approximately 25% of the watershed has been disturbed by mining. The Sandy Fork preparation plant is located at Gardner, Kentucky. Coal waste disposal areas are located on Laurel Fork and Snake Hollow.

The stream sampling site was situated in a floodplain of narrow width. Steep forested slopes rise to the east and west. Approximately 50% of the watershed is forested. KY 66 parallels the stream along the east bank. The floodplain is rather sparsely populated. Riparian vegetation afforded 0-5% shade.

Red Bird Creek is a stream of moderate gradient with a pool-riffle ratio of 50% pool to 50% riffle. Much of the stream bedrock was exposed due to dry conditions. At the time of sampling, the stream was at low stage with slow flow. Substrate consisted of rubble, cobble, boulders, and gravel with sand and silt. Silt sedimentation was moderate.

Table K35

Survey Site Physical Morphology and Percentage Substrate Composition in Red Bird Creek, Clay County, Kentucky, 9/Jul/80.

Stream:	Width	4.27 m	Depth	.11 m
Bottom Type (%):	Bedrock	0	Boulder	15
	Cobble	30	Rubble	40
	Gravel	15	Sand	5
	Silt	5	Clay	0

An environmental impact study for the Gardner preparation plant (Brent and Howell, 1976) provides excellent background data. These data are summarized in Table K34. The water quality of Red Bird Creek was considered good in comparison with that for other tributaries of the Kentucky River. It was proposed that effluent from the plant would be eliminated by a closed loop washer system. Some increase in suspended and dissolved solids was predicted from waste disposal runoff into Lick Fork.

Table K36

Preinstallation Physicochemical Mean Data for Red Bird Creek, Clay County, Kentucky, in vicinity of Gardener Coal Preparation Plant (30/Aug/75). Data from Brent and Howell (1976).

Temp °C	25	Specific Conductance (μmhos/cm)	193
Turbidity (NTU)	30	pH	7.1
Sulfates (mg/l)	25.0		

Physicochemical analyses indicate that Red Bird Creek is impacted by mining activities. Sulfates were elevated. The pH (8.2) was somewhat elevated in comparison to that observed in the unimpacted stream. Dyer and Curtis (1977) found that surface mining in eastern Kentucky consistently caused an increase in the pH of stream water.

Table K37

Analytical Results for Certain Physicochemical Parameters Surveyed in Red Bird Creek, Clay County, Kentucky, 9/Jul/80.

Temp °C	29	Specific Conductance (μmhos/cm)	339
Turbidity (NTU)	1.0 (Lab)	pH	8.2 (Field) 7.9 (Lab)
Dissolved Oxygen (mg/l)	8.7	Total Alkalinity (mg/l)	76.0
Total Acidity (mg/l)	8.4	Sulfates (mg/l)	93.0
Total Iron (mg/l)	.205	Total Manganese (mg/l)	.05

A cursory biotic survey revealed the presence of mayflies, chironomids, and crayfish. Fishes included cyprinids and darters.

An intensive survey of the Red Bird Creek biota (Brent and Howell, 1976) revealed a rather diverse assemblage. Benthic macroinvertebrates were represented by 10 orders of which, 25 families contained 37 identifiable genera and 23 identifiable species. Megalopterans were abundant in pools, while plecopterans and trichopterans were low in number. Ichthyofaunal surveys revealed 5 families and 27 species. Cyprinids comprised 66% of the fish fauna, with etheostomids making up 14% of the total. The report pictured Red Bird River as a pollution-free ecosystem with habitat capable of supporting a good fish fauna.

Clay County conservation officer Joe Burchell (pers. comm.) considered the fishery of Red Bird Creek to be fair although impacted by silt pollution from mining. The stream formerly supported a high quality fishery.

04052914

Upper Jacks Creek

Drainage System:	South Fork Kentucky River
County:	Leslie
7.5 Min. Quadrangle Name:	Creekville
Latitude:	37° 01' 31" N
Longitude:	83° 31' 31" W
Location:	on KY 406 .2 km east of junction with KY 66; near Roark, Kentucky
Survey Date:	9/Jul/80

Upper Jacks Creek heads in westcentral Leslie County at an elevation of 426.7 m. The stream flows in a general westerly direction to its confluence with Red Bird River north of Queensdale, Kentucky. The third order stream segment is 3.40 km in length. A deep mine is indicated by topographic maps to be located on Oakley Cave Branch 3.7 km above the stream site. Small surface mines are located on Rocklick Branch, Birch Fork and an unnamed hollow just below Long Hollow. Less than 5% of the watershed has been disturbed by mining.

The stream sampling site was situated in a floodplain of moderate width with steep, forested slopes rising to the north and south. Approximately 60% of the watershed is forested. KY 406 parallels the north bank. Riparian vegetation afforded 25-50% shade.

Upper Jacks Creek is a stream of moderate to high gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with moderate to fast flow. Substrate consisted largely of cobble, rubble, and gravel. Silt sedimentation was slight to moderate.

Table K38

Survey Site Physical Morphology and Percentage Substrate Composition in Upper Jacks Creek, Leslie County, Kentucky, 9/Jul/80.

Stream:	Width	3.05 m	Depth	.17 m
Bottom Type (%):	Bedrock	0	Boulder	5
	Cobble	35	Rubble	30
	Gravel	20	Sand	5
	Silt	5	Clay	0

Physicochemical analyses indicate that Upper Jacks Creek is impacted by mine drainage. Values for specific conductance and sulfates were elevated. Iron and manganese were at levels consistent with unimpacted streams. These parameters are known to return to normal levels not long after cessation of mining (Dyer and Curtis 1977).

Table K39

Analytical Results for Certain Physicochemical Parameters Surveyed in Upper Jacks Creek, Leslie County, Kentucky, 9/Jul/80.

Temp °C	27	Specific Conductance (μmhos/cm)	1067
Turbidity (NTU)	2.1 (Lab)	pH	8.1 (Field) 8.1 (Lab)
Dissolved Oxygen (mg/l)	9.0	Total Alkalinity (mg/l)	132.2
Total Acidity (mg/l)	3.6	Sulfates (mg/l)	486.0
Total Iron (mg/l)	.39	Total Manganese (mg/l)	.08

A cursory biotic survey revealed the presence of dipterans, plecopterans, ephemeropterans, decapods, and cyprinids. There was a conspicuous absence of darters, although the physical habitat appeared suitable.

The fishery of Upper Jacks Creek is impacted by siltation from mining. This stream probably serves as a source of baitfish.

04052913

Bobs Fork of Big Creek

Drainage System:	South Fork Kentucky River
County:	Leslie
7.5 Min. Quadrangle Name:	Big Creek
Latitude:	37° 09' 56" N
Longitude:	83° 30' 55" W
Location:	on KY 1482 .6 km north of junction with US 421/KY 80 at Bobs Fork, Kentucky
Survey Date:	8/Jul/80

Bobs Fork heads in westcentral Leslie County at an elevation of 414.5 m. The stream flows in a general southwestly direction to its confluence with Hals Fork at Bobs Fork, Kentucky, to form Big Creek. The third order stream segment is 2.08 km in length. Topographic maps reveal the presence of deep mines 1.7 - 2.5 km above the site on Bobs Fork. Deep mines on Couch Fork are 2.3 and 3.0 km upstream from the site. Contour surface mines parallel Bobs Fork upstream from the site to just above Johnson Branch, a distance of 3.0 km. Contour surface mines parallel Couch Branch for a distance of 1.4 km. Recent surface mining has been conducted along the Bullskin and Hell for Certain divides; additional recent mining has occurred along Jones Branch, Couch Branch, and an unnamed north flowing tributary at Jason, Kentucky, on Hollins Fork. Hollins Fork Road is being used to haul out coal. Approximately 10% of this watershed has been disturbed by mining.

The stream sampling site was located in a floodplain of moderate width with steep, forested slopes rising to the east and west. Approximately 60% of the watershed is forested. KY 1482 parallels the west bank. The stream at this site has been channelized for road construction. The Daniel Boone Parkway follows the east slope base. Riparian vegetation was largely composed of grasses and afforded little shade.

Bobs Fork is a stream of moderate to high gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted largely of rubble, cobble, and gravel. Silt sedimentation was slight. A moderate amount of coalfines were present in stream.

Table K40

Survey Site Physical Morphology and Percentage Substrate Composition in Bobs Fork of Big Creek, Leslie County, Kentucky, 8/Jul/80.

Stream:	Width	4.57 m	Depth	.26 m
Bottom Type (%):	Bedrock	0	Boulder	10
	Cobble	20	Rubble	30
	Gravel	20	Sand	5
	Silt	5	Clay	0

Physicochemical analyses indicate that Bobs Fork is impacted by mine drainage. Values for specific conductance and sulfates were elevated. Iron and manganese were at levels consistent with unimpacted streams. Dyer and Curtis (1977) found these parameters to return to normal levels soon after mining.

Table K41

Analytical Results for Certain Physicochemical Parameters Surveyed in Bobs Fork of Big Creek, Leslie County, Kentucky, 8/Jul/80.

Temp °C	29	Specific Conductance (μmhos/cm)	493
Turbidity (NTU)	1.2 (Lab)	pH	8.1 (Field) 8.0 (Lab)
Dissolved Oxygen (mg/l)	7.0	Total Alkalinity (mg/l)	115.6
Total Acidity (mg/l)	7.0	Sulfates (mg/l)	129.0
Total Iron (mg/l)	.145	Total Manganese (mg/l)	.05

A cursory biotic survey revealed the presence of trichopterans, plecopterans, dipterans, megalopterans, decapods, cyprinids, hog suckers, and darters.

Leslie County conservation officer Billy Joe Napier (pers. comm.) reported the fishery of Bobs Fork to be fair although impacted by silt from mining. Panfish and baitfish are of prime interest.

04052912

Ulysses Creek

Drainage System:	South Fork Kentucky River
County:	Leslie
7.5 Min. Quadrangle Name:	Big Creek
Latitude:	37° 10' 07" N
Longitude:	83° 32' 21" W
Location:	1.1 km off US 421-KY 80 on Ulysses Creek Road near Bear Branch, Kentucky
Survey Date:	8/Jul/80

Ulysses Creek heads in westcentral Leslie County at an elevation of 463.3 m. The stream flows in a southwesterly direction to its confluence with Big Creek east of Bear Branch, Kentucky. The third order segment of this stream is 2.75 km in length. A couple of deep mines are located 3.5 km above the site on an unnamed tributary; another deep mine is located on the main stream course 4.1 km upstream. Contour surface mining has been conducted along practically all the stream course. Approximately 10% of the surface has been disturbed by mining.

The stream sampling site was situated at the base of the south slope in a floodplain of moderate width. North and south slopes are steep and forested. Approximately 70% of the watershed is forested. The LF Ulysses Creek enters just above the stream site. A cultivated field lay to the west of the stream and is separated from the stream by Ulysses Creek Road. Riparian vegetation afforded 25-50% shade.

Ulysses Creek is a stream of moderate gradient with a pool-riffle of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted of gravel, rubble, and sand with cobble. Sedimentation was slight in the form of silt and coalfines.

Table K42

Survey Site Physical Morphology and Percentage Substrate Composition in Ulysses Creek, Leslie County, Kentucky, 8/Jul/80.

Stream:	Width	4.88 m	Depth	.13 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	5	Rubble	30
	Gravel	40	Sand	25
	Silt	0	Clay	0

Physicochemical analyses indicate that Ulysses Creek is impacted by mining. Elevated values for specific conductance, sulfates, and iron were observed. A specific conductance value of 370 µmhos/cm was recorded in the nearby Left Fork of Ulysses Creek.

Table K43

Analytical Results for Certain Physicochemical Parameters Surveyed in Ulysses Creek, Leslie County, Kentucky, 8/Jul/80.

Temp °C	29	Specific Conductance (µmhos/cm)	390
Turbidity (NTU)	1.2 (Lab)	pH	7.9 (Field) 7.7 (Lab)
Dissolved Oxygen (mg/l)	6.7	Total Alkalinity (mg/l)	78.0
Total Acidity (mg/l)	6.6	Sulfates (mg/l)	93.3
Total Iron (mg/l)	.94	Total Manganese (mg/l)	.04

A cursory biotic survey revealed benthos of the orders Diptera, Ephemeroptera, Trichoptera, and Plecoptera. Fishes included cyprinids, darters, and the white sucker (Catostomus commersoni).

0405915

Little Goose Creek

Drainage System:	South Fork Kentucky River
County:	Clay
7.5 Min. Quadrangle Name:	Manchester
Latitude:	37° 08' 58" N
Longitude:	83° 51' 16" W
Location:	above Urban Road bridge .2 km off KY 687 near Urban, Kentucky
Survey Date:	9/Jul/80

Little Goose Creek heads against the Cumberland River divide in westcentral Clay County at an elevation of 364.2 m. The stream flows in an easterly direction to its confluence with Goose Creek at Manchester, Kentucky. The third order stream segment is 5.52 km in length. Extensive contour surface mining has been conducted for 3.1 km upstream from the site. Deep mining has not occurred above the stream sampling site. Approximately 10% of the upstream watershed has been disturbed by mining.

The stream sampling site was situated in a floodplain of moderate width. Slopes to the north and south are steep, forested and have been contour surface mined. Approximately 50% of the watershed is forested. KY 687 parallels the stream along the north slope base. Riparian vegetation afforded 5-25% shade.

Little Goose Creek is a low to moderate gradient stream with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream stage was low with slow flow. Substrate consisted of cobble, rubble, and gravel with sand, silt and boulders. Silt sedimentation was moderate.

Table K44

Survey Site Physical Morphology and Percentage Substrate Composition in Little Goose Creek, Clay County, Kentucky, 9/Jul/80.

Stream:	Width	2.90 m	Depth	.10 m
Bottom Type (%):	Bedrock	0	Boulder	5
	Cobble	30	Rubble	25
	Gravel	20	Sand	10
	Silt	10	Clay	0

Physicochemical analyses indicate that Little Goose Creek is impacted by mining. Elevated values for sulfates were observed. Iron and manganese levels were not elevated. These elements return to normal levels a year following cessation of mining (Dyer and Curtis 1977). Urban Fork (an adjacent stream) was impacted by contour surface mining. It had a specific conductance of 950 µmhos/cm.

Table K45

Analytical Results for Certain Physicochemical Parameters Surveyed in Little Goose Creek, Clay County, Kentucky, 9/Jul/80.

Temp °C	30	Specific Conductance (µmhos/cm)	308
Turbidity (NTU)	1.6 (Lab)	pH	7.1 (Field) 7.2 (Lab)
Dissolved Oxygen (mg/l)	5.8	Total Alkalinity (mg/l)	26.0
Total Acidity (mg/l)	5.4	Sulfates (mg/l)	120.5
Total Iron (mg/l)	.26	Total Manganese (mg/l)	.405

A cursory biotic survey revealed the presence of mayflies, stoneflies, water pennies, crayfish, creek chubs, and cyprinids.

Clay County conservation officer Joe Burchell (pers. comm.) considered the fishery of Little Goose Creek to be poor. Sought after species include largemouth bass, smallmouth bass, sucker and catfish. The fishery is impacted by silt and acid. The stream formerly supported a high quality fishery.

04051914

Grays Fork - Little Goose Creek

Drainage System:	South Fork Kentucky River
County:	Clay
7.5 Min. Quadrangle Name:	Manchester
Latitude:	37° 09' 47" N
Longitude:	83° 50' 51" W
Location:	1.6 km off KY 687 on Grays Fork Road near Urban, Kentucky
Survey Date:	9/Jul/80

Grays Fork heads in westcentral Clay County against the Cumberland River divide at an elevation of 347.5 m. The stream flows in a southeasterly direction to its confluence with Little Goose Creek near the community of Urban, Kentucky. The third order segment of this stream is 5.75 km in length. Extensive contour surface mining has occurred in this watershed. Approximately 30% of the surface has been disturbed by mining.

The stream sampling site was located in a floodplain of moderate width. Slopes to the east and west are partially forested. Approximately 40% of the watershed is in forest. Cultivated fields are located above and below the stream site. A first order tributary enters Grays Fork from the west at the stream site. Riparian vegetation afforded 25-50% shade. The stream had an unusually greenish cast possibly indicating organic pollution from an upstream hog parlor operation.

Grays Fork is a stream of low gradient with a pool-riffle ratio of 90% pool to 10% riffle. At the time of sampling, the stream was at low stage with slow flow. Substrate consisted of gravel with rubble, sand and silt. Silt sedimentation was moderate.

Table K46

Survey Site Physical Morphology and Percentage Substrate Composition in Grays Fork of Little Goose Creek, Clay County, Kentucky, 9/Jul/80.

Stream:	Width	4.27 m	Depth	.20 m
Bottom Type (%):	Bedrock	0	Boulder	10
	Cobble	5	Rubble	15
	Gravel	50	Sand	10
	Silt	10	Clay	0

Surface mining does not appear to have had a noticeable effect on water quality in Grays Fork. Although sulfates and specific conductance were slightly elevated, these parameters were within acceptable levels for unimpacted streams. The high pH and oxygen concentration were probably due to high primary productivity caused by nutrient enrichment.

Table K47

Analytical Results for Certain Physicochemical Parameters Surveyed in Grays Fork of Little Goose Creek, Clay County, Kentucky, 9/Jul/80.

Temp °C	27	Specific Conductance (µmhos/cm)	238
Turbidity (NTU)	2.4 (Lab)	pH	8.7 (Field)
Dissolved Oxygen (mg/l)	10.6	Total Alkalinity (mg/l)	54.6
Total Acidity (mg/l)	3.8	Sulfates (mg/l)	53.6
Total Iron (mg/l)	.34	Total Manganese (mg/l)	.185

A cursory biotic survey revealed the presence of mayflies, tabanid larvae, chironomids, crayfish, minnows, and green sunfish.

Joe Burchell, Clay County conservation officer (pers. comm.) considered the fishery of Grays Fork as poor with heavy silt and some acid impact from mining. Species sought include smallmouth bass and suckers. Fish kills have been reported in this stream due to oxygen depletion. Grays Fork formerly supported a high quality fishery.

04051913

Rader Creek

Drainage System:	South Fork Kentucky River
County:	Clay
7.5 Min. Quadrangle Name:	Manchester
Latitude:	37° 09' 49" N
Longitude:	83° 48' 22" W
Location:	at KY 687 bridge 4.8 km west of Manchester, Kentucky
Survey Date:	9/Jul/80

Rader Creek heads in westcentral Clay County at an elevation of 356.6 m. The stream flows in a southeasterly direction to its confluence with Little Goose Creek west of Manchester, Kentucky. The third order segment of this stream is 5.29 km in length. Extensive contour surface mining has been conducted in this watershed. A few deep mines are scattered along the stream course. Approximately 25% of the surface has been disturbed by mining.

The stream sampling site was situated in a relatively wide floodplain with steep, forested slopes rising to the east and west. These slopes have been surface mined. Approximately 50% of the watershed is forested. The area is underlain by the Clay County gas field. Numerous gas wells are located within the drainage. A cultivated field is located on the west floodplain. Riparian vegetation afforded 25-50% shade.

Rader Creek is a stream of moderate gradient with a pool-riffle ratio of 70% pool to 30% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted of gravel with red dog, sand, silt, and rubble. Silt sedimentation was moderate. Some iron flocculent was present in backwater areas.

Table K48

Survey Site Physical Morphology and Percentage Substrate Composition in Rader Creek, Clay County, Kentucky, 9/Jul/80.

Stream:	Width	2.04 m	Depth	.24 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	15
	Gravel	60	Sand	15
	Silt	10	Clay	0

Physicochemical analyses indicate that Rader Creek is impacted by mine drainage. Elevated values for specific conductance, sulfates, and manganese were observed.

Table K49

Analytical Results for Certain Physicochemical Parameters Surveyed in Rader Creek, Clay County, Kentucky, 9/Jul/80.

Temp °C	27.5	Specific Conductance (µmhos/cm)	557
Turbidity (NTU)	1.6 (Lab)	pH	7.5 (Field) 7.5 (Lab)
Dissolved Oxygen (mg/l)	6.8	Total Alkalinity (mg/l)	45.4
Total Acidity (mg/l)	6.0	Sulfates (mg/l)	232.0
Total Iron (mg/l)	.31	Total Manganese (mg/l)	.665

A cursory biotic survey revealed the presence of caddisflies, mayflies, stoneflies, riffle beetles, tabanid larvae, crayfish, cyprinids, and the fantail darter (Ethestoma flabellare).

Clay County conservation officer Joe Burchell (pers. comm.) considered the fishery of Rader Creek to be poor and impacted by silt and acid from mining. The stream does serve as a baitfish source.

04051912

Laurel Creek

Drainage System:	South Fork Kentucky River
County:	Clay
7.5 Min. Quadrangle Name:	Barcreek
Latitude:	37° 13' 04" N
Longitude:	83° 43' 07" W
Location:	.2 km above confluence with Goose Creek on gravel road off KY 11 near Tanksley, Kentucky
Survey Date:	9/Jul/80

Laurel Creek is formed by the confluence of Mize Branch and Hogskin Branch in northcentral Clay County at an elevation of 276.8 m. The stream flows in an easterly direction to its confluence with Goose Creek near Tanksley, Kentucky. The third order segment of this stream is 7.93 km in length. Numerous small surface mines and deep mines are scattered along the stream course. Surface mines and a deep mine are located on slopes adjacent to the stream site. Approximately 8% of the surface has been disturbed by mining.

The stream sampling site was situated in a relatively wide floodplain. Slopes to the north and south were partially forested. Approximately 50% of the watershed is in forest. Riparian vegetation afforded 5-25% shade. KY 11 parallels the stream along the north slope base. The floodplain is intensively farmed.

Laurel Creek is a stream of low to moderate gradient with a pool-riffle ratio of 40% pool to 60% riffle. At the time of sampling, the stream was at low stage with slow flow. A thunderstorm had passed through the night before the survey. Substrate consisted of rubble, cobble, and gravel with sand and silt. Some coal was present. Silt sedimentation was moderate.

Table K50

Survey Site Physical Morphology and Percentage Substrate Composition in Laurel Creek, Clay County, Kentucky, 9/Jul/80.

Stream:	Width	4.79 m	Depth	.07 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	30	Rubble	40
	Gravel	20	Sand	5
	Silt	5	Clay	0

Physicochemical analyses did not indicate Laurel Creek to be impacted by mining. Specific conductance, sulfate, and manganese levels were within the range consistent for unimpacted streams. Iron, although slightly elevated, may reflect natural background levels.

Table K51

Analytical Results for Certain Physicochemical Parameters Surveyed in Laurel Creek, Clay County, Kentucky, 9/Jul/80.

Temp °C	22	Specific Conductance (μmhos/cm)	239
Turbidity (NTU)	6.5 (Lab)	pH	7.0 (Field) 7.5 (Lab)
Dissolved Oxygen (mg/l)	6.6	Total Alkalinity (mg/l)	68.4
Total Acidity (mg/l)	7.8	Sulfates (mg/l)	44.0
Total Iron (mg/l)	.59	Total Manganese (mg/l)	.10

A cursory biotic survey revealed the presence of caddisflies, mayflies, chironomids and crayfish among the benthos. Fishes included cyprinids, rainbow darters and fantail darters.

Clay County conservation officer Joe Burchell (pers. comm.) reported that Laurel Creek supports a fair fishery for smallmouth bass, sucker, catfish, and rockbass. The fishery is impacted by silt.

04044912

Right Fork Buffalo Creek

Drainage System:	South Fork Kentucky River
County:	Owsley
7.5 Min. Quadrangle Name:	Mistletoe
Latitude:	37° 20' 49" N
Longitude:	83° 37' 31" W
Location:	on RF Buffalo Creek Road 1.5 km above confluence with Left Fork Buffalo Creek; near Mistletoe, Kentucky
Survey Date:	8/Jul/80

Right Fork Buffalo Creek heads in southwestern Owsley County at an elevation of 414.5 m. The stream flows in a northwesterly course to its confluence with Left Fork Buffalo Creek to form Buffalo Creek near the community of Sebastian, Kentucky. The third order stream length is 13.21 km. Contour surface mining has occurred in the extreme headwaters of Right Fork Buffalo Creek. Less than 5% of the surface has been disturbed by mining. Oil exploration is currently underway in the watershed.

The stream sampling site was situated in a floodplain of narrow width with steep forested slopes rising to the east and west. Forest covers approximately 70% of the watershed. The watershed is sparsely populated. Agriculture is practically nonexistent. Riparian vegetation afforded 25-50% shade.

Right Fork Buffalo Creek is a stream of moderate gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate was largely composed of cobble, boulder, rubble, and gravel. Silt sedimentation was slight to moderate.

Table K52

Survey Site Physical Morphology and Percentage Substrate Composition in Right Fork Buffalo Creek, Owsley County, Kentucky, 8/Jul/80.

Stream:	Width	4.57 m	Depth	.11 m
Bottom Type (%):	Bedrock	0	Boulder	15
	Cobble	50	Rubble	15
	Gravel	10	Sand	5
	Silt	5	Clay	0

Physicochemical analyses indicate that Right Fork Buffalo Creek is of high water quality. Specific conductance, sulfates, iron, and manganese were at levels indicative of unimpacted streams.

Table K53

Analytical Results for Certain Physicochemical Parameters Surveyed in Right Fork Buffalo Creek, Owsley County, Kentucky, 8/Jul/80.

Temp °C	29	Specific Conductance (μmhos/cm)	93
Turbidity (NTU)	2.0 (Lab)	pH	7.8 (Field) 7.4 (Lab)
Dissolved Oxygen (mg/l)	7.1	Total Alkalinity (mg/l)	34.0
Total Acidity (mg/l)	3.8	Sulfates (mg/l)	12.4
Total Iron (mg/l)	.11	Total Manganese (mg/l)	.01

A cursory biotic survey revealed the presence of a diverse community. Benthic macroinvertebrates included riffle beetles, ephemeropterans, trichopterans, helgramites, and decapods. Fishes collected included the river chub (Nocomis micropogon), the blacknose dace (Rhinichthyes atratulus), the snubnose darter (Etheostoma ulocentra), the varigate darter (Etheostoma variatum), and assorted cyprinids.

Acting Owsley County conservation officer Joe Burchell (pers. comm.) stated that Right Fork Buffalo Creek formerly supported a high quality fishery; however, today the fishery is only fair, with a slight impact from mine silt. Smallmouth bass, panfish, sucker, catfish, redeye, and trout are of prime interest.

Subsequent to our survey, Jim Sproles of the Division of Water's London Area District Office informed the investigator of a fish kill in Right Fork Buffalo Creek near Mistletoe, Kentucky, in September. It is thought that the kill may have resulted from thermal shock or brine water release from oil exploration operations.

04038912

Little Sturgeon Creek

Drainage System:	Kentucky River
County:	Owsley
7.5 Min. Quadrangle Name:	Sturgeon
Latitude:	37° 26' 46" N
Longitude:	83° 47' 23" W
Location:	KY. 30 bridge .5 km south of Travellers Rest, Kentucky
Survey Date:	8/Jul/80

Little Sturgeon Creek heads in western Owsley County at an elevation of 317.0 m. The stream flows in a general northwestwardly direction to its confluence with Sturgeon Creek northwest of Travellers Rest, Kentucky. The third order stream segment is 3.22 km in length. Topographic maps do not reveal the presence of deep mines. Contour surface mining has been conducted along the west slopes below Sturgeon, Kentucky. Less than 5% of the watershed above the stream site has been disturbed by mining.

The stream sampling site was situated in a floodplain of moderate to broad width. Partially forested slopes rise to the east and west. Approximately 50% of the watershed is forested. The stream follows the east slope base at the site with the adjoining west floodplain above the site in pasture. KY 30 and KY 846 parallel the stream along the east slope base. Riparian vegetation afforded 25-50% shade.

Little Sturgeon Creek is a stream of low gradient with a pool-riffle ratio of 80% pool to 20% riffle. At the time of sampling, the stream was at low stage with slow flow. Substrate consisted of bedrock and cobble overlain by silt in pools and rubble with gravel in riffles. Silt sedimentation was moderate.

Table K54

Survey Site Physical Morphology and Percentage Substrate Composition in Little Sturgeon Creek, Owsley County, Kentucky, 8/Jul/80.

Stream:	Width	3.96 m	Depth	.13 m
Bottom Type (%):	Bedrock	30	Boulder	5
	Cobble	15	Rubble	20
	Gravel	20	Sand	0
	Silt	20	Clay	0

Physicochemical analyses indicate that Little Sturgeon Creek is marginally impacted by mine drainage. Sulfates exceeded levels accepted for unimpacted streams. Specific conductance, although within levels for unimpacted streams, was elevated. Iron and manganese were not elevated. These parameters return to normal levels within a year following mine cessation (Dyer and Curtis 1977).

Table K55

Analytical Results for Certain Physicochemical Parameters Surveyed in Little Sturgeon Creek, Owsley County, Kentucky, 8/Jul/80.

Temp °C	31	Specific Conductance (μmhos/cm)	216
Turbidity (NTU)	2.4 (Lab)	pH	7.7 (Field) 7.4 (Lab)
Dissolved Oxygen (mg/l)	7.6	Total Alkalinity (mg/l)	37.8
Total Acidity (mg/l)	4.0	Sulfates (mg/l)	64.5
Total Iron (mg/l)	.23	Total Manganese (mg/l)	.07

A cursory biotic survey revealed the presence of ephemeropterans, trichopterans, megalopterans, decapods, cyprinids, and darters.

Jones (1973) reported that Little Sturgeon Creek supported a limited amount of good fishing for rock bass, smallmouth, and suckers. Joe Burchell acting Owsley County conservation officer (pers. comm.), considered the fishery to be poor and impacted by mine silt. Suckers and panfish are of prime interest.

04036912

South Fork Station Camp Creek

Drainage System:	Kentucky River
County:	Jackson
7.5 Min. Quadrangle Name:	Alcorn
Latitude:	37° 32' 20" N
Longitude:	84° 00' 37" W
Location:	on gravel road 2.1 km northwest off KY 89 near Sand Springs, Kentucky
Survey Date:	8/Jul/80

South Fork Station Camp Creek heads against the Cumberland River divide in northwestern Jackson County at an elevation of 433.4 m. The stream flows in an easterly direction to near Brazil, Kentucky, where it swings northeastward to its confluence with War Fork, forming Station Camp Creek in northeastern Jackson County. The third order stream segment is 21.61 km in length. South Fork Station Camp Creek flows through an entrenched winding valley; the floodplain is narrow. Slopes are very steep in most sections below the headwaters north of Clover Bottom, Kentucky; the watershed is heavily forested in the middle and lower sections. Approximately 60% of the watershed is in forest.

Topographic maps reveal deep mines to the west of Dry Fork. Aerial surveys indicate the presence of several surface mines along the Sandgap-Brazil Road on the plateau separating Rock Lick Creek and South Fork Station Camp Creek. Most of these mines are small in size. A rather large surface mine operation is located to the west of Long Branch, north of Clover Bottom, Kentucky. A small surface mine is situated on a north draining tributary east of Durham Ridge, northwest of Sandgap, Kentucky. Approximately 5% of the surface has been disturbed by mining. A quarry is located on the south slope near Clover Bottom, Kentucky.

The stream sampling site was located on a comparatively wide section of floodplain at the confluence of Rock Lick Creek, a third order stream. A large pool is located at the stream confluence. An unimproved gravel road crosses the stream above the pool. Riparian vegetation afforded 25-50% shade. Steep, forested slopes rise

to the north and south. The northern floodplain is largely sand and gravel with a thick growth of river cane (Arudinaria gigantea).

South Fork Station Camp Creek is a stream of high gradient with a pool-riffle ratio of 40% pool to 60% riffle. At the time of sampling, the stream was at low stage with fast flow. Substrate consisted largely of cobble with rubble, and gravel. Silt sedimentation was slight.

Table K56

Survey Site Physical Morphology and Percentage Substrate Composition in South Fork Station Camp Creek, Jackson County, Kentucky, 8/Jul/80.

Stream:	Width	4.57 m	Depth	.50 m
Bottom Type (%):	Bedrock	0	Boulder	10
	Cobble	50	Rubble	15
	Gravel	15	Sand	10
	Silt	0	Clay	0

Physicochemical analyses do not indicate the presence of mining impact in South Fork Station Camp Creek. Indicator parameters were at levels consistent with unimpacted streams.

Table K57

Analytical Results for Certain Physicochemical Parameters Surveyed in South Fork Station Camp Creek, Jackson County, Kentucky, 8/Jul/80.

Temp °C	24	Specific Conductance (µmhos/cm)	270
Turbidity (NTU)	1.2 (Lab)	pH	7.7 (Field) 7.9 (Lab)
Dissolved Oxygen (mg/l)	7.6	Total Alkalinity (mg/l)	107.2
Total Acidity (mg/l)	4.6	Sulfates (mg/l)	27.0
Total Iron (mg/l)	.32	Total Manganese (mg/l)	.035

A cursory biotic survey revealed the presence of ephemeropterans, plecopterans, trichopterans, dipterans, riffle beetles, decapods, and gastropods. Fishes included cyprinids, centrachids, and darters.

South Fork Station Camp Creek has been reported to support a good fishery for smallmouth bass and rock bass in its lower section (Carter 1970).

Upper Cumberland River Basin - Water Quality. A summary of physicochemical parameters surveyed in the Cumberland River Basin is presented in Table 19. A total of 25 third order streams were surveyed of which 21 streams were found to be impacted by mine drainage.

Mayes, Sudderth, and Etheredge, Inc. (1975) stated that siltation and acid drainage from mining constitute the most widespread and serious threat to water quality in streams of the Upper and Middle Cumberland River Basin. They noted a trend towards higher pH values for certain streams. Our results indicate two general patterns of contrasting mine drainage impacts. Most streams impacted east of Pine Mountain and above Pineville, Kentucky, (Franks Creek, Yocum Creek, Crummies Creek, Clover Fork) were characterized by elevated pH and alkalinity values and zero acidity values. Coals of this region are generally of low sulfur content (Brant and Hester 1980). Acid drainage at present does not appear to be a serious problem in this section of the Cumberland River basin. Blackwater is a periodic problem in Clover Fork. In sharp contrast to the well buffered streams east of Pine Mountain, three streams of the Cumberland Plateau (Devils Creek, Barren Fork, Powder Mill Creek) were found to be impacted by acid mine drainage. Devils Creek and Barren Fork receive drainage from deep mines and are severely impacted. These streams are characterized by depressed pH values, elevated metals, and zero alkalinity values. Other streams impacted within the Cumberland Plateau are characterized by elevated alkalinity, acidity, and metals. The pH values, while elevated, did not exceed 8.0. Acid mine drainage was not detected.

The streams found in this study to be most severely impacted were: Clear Fork of Cumberland River and Left Fork Straight Creek (Bell County), Little Raccoon Creek (Laurel County), and Devils Creek and Barren Fork of Indian Creek (McCreary County).

Upper Cumberland River Basin - Fishery Evaluation. A total of 198 third order streams representing 575.5 stream miles in 12 counties were evaluated for their fishery potential. A fishery evaluation for Jackson County was not received. Carter and Jones (1969) state that third order streams for the most part only support sport fisheries in short sections. Third order streams generally serve as sources of baitfish and may support angling pressure for suckers and panfish; they may also serve as spawning and nursery sites.

Of the streams evaluated, conservation officers considered 72 streams (60%) to be poor, 29 streams (24%) to be fair, 15 streams (13%) to be good, and 4 streams (3%) to be excellent fishery streams. Third order streams reported as supporting good or excellent sport fisheries and high quality streams from Jones (1973) are listed in Table 20. Streams with fair to poor fisheries with an assessment of mining impacts are listed in Table 21. Streams which are stocked with trout include: Beaver Creek and Canada Creek (Wayne County), Fugitt Creek (Harlan County), Little South Fork, Rock Creek, Beaver Creek, and Laurel Fork (McCreary County), Dogslaughter Creek and Bark Camp Creek (Whitley County), Cane Creek and Hawk Creek (Laurel County), and Clover Bottom Creek and Buck Lick Creek (Jackson County).

Approximately 181 miles of third order streams are considered by conservation officers to be impacted by mine drainage. Of this total, 48% of the mileage is impacted by siltation, 21% by acid, and 31% by acid and siltation.

Table 19

Summary of Mean and Range Data for
Physicochemical Parameters Surveyed in Third
Order Streams in the Upper Cumberland River Basin

	Impacted (21)		Unimpacted (4)	
Parameter	Mean	Range	Mean	Range
pH	7.2	3.1-8.6	7.3	6.7-8.0
Alkalinity (mg/l $CaCO_3$)	68.6	0-156.2	53.4	23.6-100.4
Acidity (mg/l)	9.5	0-86.2	5.2	2.4-6.6
Sulfates (mg/l)	198.1	68.5-624.0	17.1	8.3-30.6
Total Iron (mg/l)	1.08	0.09-6.24	0.55	0.21-1.2
Total Manganese (mg/l)	0.88	0.02-8.00	0.22	0.04-0.72
Specific Conductance (μmhos/cm)	529	175-1300	153	64-240

( ) Number of streams sampled

Table 20

Sports Fisheries Streams Rated as Good to Excellent in the Upper Cumberland River Basin

River Basin	County	Stream
Upper Cumberland	Harlan	Martins Fork (headwaters)*
	Bell	Brownies Ck.
	Whitley	Bark Camp Ck. Becks Ck. Spruce Ck. Watts Ck.
	Jackson	Horse Lick Ck.
	Rockcastle	Roundstone Ck. Renfro Ck. Crooked Ck.
	Laurel	Wood Ck. Cane Ck.* Rockcastle River*
	Pulaski	Buck Ck.* Fishing Ck.*
	McCreary	Big South Fork Cumberland River * Rock Ck.* Little South Fork, Cumberland River*
	Wayne	Beaver Ck. Duncan Branch, Beaver Ck. Kennedy Ck. Otter Ck.

*Streams rated by Carter and Jones (1969) as high quality fishing streams.

Table 21

Third Order Streams with Fair to Poor Fisheries in the Upper Cumberland River Basin with an Assessment of Mining Impact

River Basin	County	Stream	Fishery		Mining Impact		
			Fair	Poor	Silt	Acid	None
Upper Cumberland							
	Letcher	Poor Fork, Cumberland R.	x		x		
	Harlan	Clover Fork, Cumberland R.		x	x	x	
		Clover Lick Ck.		x	x	x	
		Cranks Ck.		x	x		
		Crummies Ck.		x	x		
		Fugitt Ck.	x		x		
		Looney Ck.		x	x	x	
	Bell	Cannon Ck.	x				x
		Laurel Fork of Clear Fk.	x				x
		Left Fk., Straight Ck.		x	x	x	
		Little Clear Ck.		x	x		
		Yellow Ck.		x			x
	Clay	Baker Ck.		x	x		
		Mill Ck.		x	x		
	Knox	Big Indian Ck.		x	x		
		Billies Branch, Richland Ck.		x			x
		Bull Ck.		x			x
		East Fork, Lynn Camp Ck.		x	x		
		Flat Ck.		x	x	x	
		Hazel Fork, East Fork, Lynn Camp Ck.		x			x
		Helton Br., Big Indian Ck.		x	x		
		Hubbs Ck.		x	x	x	

Table 21 continued

River Basin	County	Stream	Fishery Fair	Fishery Poor	Mining Impact Silt	Mining Impact Acid	Mining Impact None
Upper Cumberland continued							
	Knox	Indian Ck.		x	x		
		Little Brush Ck.		x	x		
		Little Indian Ck.		x	x		
		Little Richland Ck.	x				x
		Middle Fork, Richland Ck.	x				x
		Middle Fork, Stinking Ck.		x	x		x
		Moore Ck.		x	x		
		Pigeon Fork, Stinking Ck.		x	x		
		Richland Ck.		x	x		
		Salt Gum Ck.		x	x		
		Spider Ck.		x			x
		Stinking Ck.		x	x	x	
		Turkey Ck.		x	x		
	Whitley	Archer Ck.	x				x
		Bennetts Branch, Rose Ck.		x	x	x	
		Blake Fork		x			x
		Brier Ck.		x			x
		Browns Ck.		x			x
		Bunches Ck.	x				x
		Calf Pen Ck.		x			x
		Clear Fk., Elk Ck.	x				x
		Corn Ck.		x		x	
		Goldens Ck.		x		x	
		Little Patterson Ck.		x		x	
		Maple Ck.		x			x
		Meadow Ck.		x			x
		Mulberry Ck.		x		x	
		Patterson Ck.		x		x	
		Pleasant Run, Jellico Ck.		x	x		
		Popular Ck.		x		x	
		Ryan Ck.	x				x
		Wolf Ck.		x		x	

Table 21 continued

River Basin	County	Stream	Fishery		Mining Impact		
			Fair	Poor	Silt	Acid	None
	McCreary	Alum Ck.		x	x		
		Barren Fork, Indian Ck.		x		x	
		Bear Ck.		x	x	x	
		Cooper Ck.		x			x
		Indian Ck.	x				x
		Jellico Ck.		x	x	x	
		Lick Ck.	x				x
		Little Hurricane Ck.		x			x
		Marsh Ck.		x	x	x	
		Middle Fork, Beaver Ck.	x			x	
		Wolf Ck.		x	x	x	
	Rockcastle	Brush Ck.	x				x
		Brushy Ck.	x				x
		Buffalo Branch, Line Ck.	x				x
		Dry Fork, Skegg Ck.		x		x	
		Eagle Ck.		x			x
		East Fork, Skegg Ck.		x			x
		Lacy Fork, Line Ck.		x			x
		Line Ck.		x			x
		Pitman Branch, Skegg Ck.		x			x
		West Fork, Skegg Ck.		x			x
	Pulaski	Bake Hollow Ck.		x			x
		Beech Ck.		x			x
		Clifty Ck.		x			x
		Flat Lick Ck.	x				x
		Indian Ck.		x			x
		Lick Ck.		x			x
		Martin Ck.		x			x
		Pitman Ck.	x				x
		Whetstone Ck.		x			x

Table 21 continued

River Basin	County	Stream	Fishery		Mining Impact		
			Fair	Poor	Silt	Acid	None
	Wayne	Dry Fork, Sinking Ck.		x		x	
		Elk Spring Ck.	x				x
		Gap Ck.	x				x
		Langham Branch, Little South Fk.	x				x
		Meadow Ck.		x			x
	Clinton	Duvall Ck.		x	x	x	
		Koger Ck.	x				x
		Smith Ck.	x				x

02046913

Poor Fork of Cumberland River

Drainage System:	Upper Cumberland
County:	Letcher
7.5 Min. Quadrangle Name:	Whitesburg
Latitude:	37° 03' 32" N
Longitude:	82° 48' 12" W
Location:	above KY 806 bridge at Oven Fork, Kentucky
Survey Date:	22/Jul/80

The Poor Fork of the Cumberland River heads within the Jefferson National Forest against the Kentucky River and Pound River divides at an elevation of 902.2 m. The stream flows in a southwesterly course from its source in southcentral Letcher County to its confluence with Clover Fork at Harlan, Kentucky, giving rise to the mainstem of the Cumberland River. Poor Fork flows through a narrow valley bounded on the north by Pine Mountain and on the south by Black Mountain. The third order segment of this stream is 12.18 km in length. Coal mining above the survey site is indicated by topographic maps to be limited to Roberts Branch. A deep mine is situated 6.8 km above the stream site, while contour surface mines were 9.0 km upstream. Less than 5% of the Poor Fork watershed above the site has been disturbed by mining.

The stream sampling site was situated in a narrow floodplain with steep forested slopes rising to the north and south. Approximately 60% of the upper watershed is forested. The stream parallels the south slope base. US 119 follows the north bank. KY 806 crosses just downstream. Riparian vegetation afforded 25-50% shade.

Poor Fork is a stream of moderate to high gradient with a pool-riffle ratio of 50% pool to 50% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted largely of cobble, rubble, and gravel. Silt sedimentation was slight to moderate in pools.

Table C1

Survey Site Physical Morphology and Percentage Substrate Composition in Poor Fork of Cumberland River, Letcher County, Kentucky, 22/Jul/80.

Stream:	Width	2.59 m	Depth	.12 m
Bottom Type (%):	Bedrock	5	Boulder	5
	Cobble	40	Rubble	20
	Gravel	20	Sand	5
	Silt	5	Clay	0

Physicochemical analyses indicate Poor Fork to be of good water quality. All parameters were within levels consistent with unimpacted streams.

Table C2

Analytical Results for Certain Physicochemical Parameters Surveyed in Poor Fork of Cumberland River, Letcher County, Kentucky, 22/Jul/80.

Temp °C	24.8	Specific Conductance (μmhos/cm)	80
Turbidity (NTU)	3.4 (Lab)	pH	7.4 (Field) 7.0 (Lab)
Dissolved Oxygen (mg/l)	5.7	Total Alkalinity (mg/l)	23.6
Total Acidity (mg/l)	6.0	Sulfates (mg/l)	8.3
Total Iron (mg/l)	.481	Total Manganese (mg/l)	.04

A cursory biotic survey revealed the presence of dipterans, trichopterans, ephemeropterans, gastropods, cyprinids, centrachids, and percids (darters), including the arrow darter (Etheostoma sagitta). Babcock (1977) lists the status of the arrow darter as depleted. The gravel-rubble substrate composition at the stream site is typical of habitats with which the arrow darter is most often associated (Lee et al. 1980). Etnier (unpublished taxonomic key, 1972) stated that coal mine pollution has probably eliminated this darter from several streams in Tennessee.

Letcher County conservation officer Jerry Coots (pers. comm.) considered the fishery of Poor Fork to be fair, although impacted by silt from mining. Black bass, panfish, suckers, and catfish are of prime interest. Jones and Carter (1969) reported that fair populations of rock bass and smallmouth bass existed in sections of Poor Fork not severely impacted by mine drainage.

02046912

Franks Creek

Drainage System:	Upper Cumberland
County:	Letcher
7.5 Min. Quadrangle Name:	Whitesburg
Latitude:	37° 03' 03" N
Longitude:	82° 48' 20" W
Location:	gravel road off KY 806 1.0 km south of US 119/KY 806 junction at Oven Fork, Kentucky
Survey Date:	22/Jul/80

Franks Creek rises on Black Mountain against the Tennessee River divide in southcentral Letcher County at an elevation of 902.2 m. The stream flows in a generally northward direction to its confluence with the Poor Fork of the Cumberland River at Oven Fork, Kentucky. The third order stream segment is 2.30 km in length. Topographic maps indicate the presence of deep mines 2.9 - 3.9 km above the stream site. Extensive surface mining has been conducted in the watershed. Contour surface mines are present in the headwaters of Trace and Little Forks. Surface mining has occurred in the stream course of Franks Creek 5.0 km above the study site. Mountain top removal mining has occurred on western slopes along the middle stream section. Contour surface mining has occurred to within .3 km of the site. Approximately 25% of the surface has been disturbed by mining.

The stream sampling site was situated in a floodplain of moderate width with steep, forested slopes rising to the east and west. A gravel road parallels the stream along the east bank. KY 806 follows the east slope base. Cultivated fields lie on the east floodplain above the site. Approximately 50% of the watershed is forested. Riparian vegetation afforded 25-50% shade.

Franks Creek is a stream of moderate to high gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with moderate gradient. A shower was in progress. Substrate consisted largely of rubble, sand, gravel and silt. Silt sedimentation was moderate.

Table C3

Survey Site Physical Morphology and Percentage Substrate Composition in Franks Creek, Letcher County, Kentucky, 22/Jul/80.

Stream:	Width	3.81 m	Depth	.15 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	5	Rubble	35
	Gravel	20	Sand	30
	Silt	30	Clay	0

Physicochemical analyses indicate Franks Creek to be impacted by mine drainage. Elevated values for specific conductance and sulfates were observed.

Table C4

Analytical Results for Certain Physicochemical Parameters Surveyed in Franks Creek, Letcher County, Kentucky, 22/Jul/80.

Temp °C	25.2	Specific Conductance (µmhos/cm)	362
Turbidity (NTU)	1.1 (Lab)	pH	8.5 (Field) 8.3 (Lab)
Dissolved Oxygen (mg/l)	6.8	Total Alkalinity (mg/l)	66.4
Total Acidity (mg/l)	0	Sulfates (mg/l)	100
Total Iron (mg/l)	.26	Total Manganese (mg/l)	.03

A cursory biotic survey revealed the presence of plecopterans, ephemeropterans, trichopterans, simulid larvae, and cyprinids including the creek chub (Semotilus atromaculatus), the common shiner (Notropis chrysocephalus), and the rosyface minnow (Notropis rubellus).

The fishery of Franks Creek is largely restricted to near its confluence with the Poor Fork of the Cumberland River. A rock bass - smallmouth bass fishery, similar to that reported by Jones and Carter (1969) for sections of the Poor Fork not severely impacted by mine drainage, may also be expected in Franks Creek.

02044913

Clover Fork of Cumberland River

Drainage System:	Upper Cumberland
County:	Harlan
7.5 Min. Quadrangle Name:	Louellen
Latitude:	36° 53' 26" N
Longitude:	83° 03' 36" W
Location:	on KY 38 .2 km above confluence with Childs Branch near Georgetown, Kentucky
Survey Date:	17/Jul/80

The Clover Fork of the Cumberland River heads against the Tennessee River divide at an elevation of 1039.4 m. The stream flows in a generally westward direction off Little Black Mountain in eastcentral Harlan County to its confluence with Poor Fork at Harlan, Kentucky, forming the mainstem of the Cumberland River. The third order stream segment is 13.92 km in length. The headwaters of Clover Fork have been rather extensively mined. Numerous deep mines are scattered along the stream and its tributaries. More recently, surface mining has been conducted along the stream slopes. Intensive surface mining has been conducted on Clark Fork, Louder Creek, Heads Creek, and Upper Trace Branch. A tipple and coal preparation facility are located 15.0 km upstream. Approximately 20% of the watershed surface above the site has been disturbed by mining.

The stream sampling site was situated in a floodplain of moderate width with steep forested slopes to the northeast and southwest. Approximately 60% of the watershed is covered by forest. The floodplain is fairly heavily populated. Surface mines are situated parallel to the site on the north slope. Deep mines are located along Fanny Wynn Branch 1.0 km upstream of the site. KY 38 parallels the north slope base. Riparian vegetation afforded 0-5% shade.

Clover Fork is a stream of moderate to high gradient with a pool-riffle ratio of 40% pool to 60% riffle. At the time of sampling, the stream was at low stage with fast flow. Much of the stream bottom was exposed. Substrate consisted largely of bedrock. Silt sedimentation was negligible.

Table C5

Survey Site Physical Morphology and Percentage Substrate Composition in Clover Fork of Cumberland River, Harlan County, Kentucky, 17/Jul/80.

Stream:	Width	5.15 m	Depth	.40 m
Bottom Type (%):	Bedrock	60	Boulder	10
	Cobble	0	Rubble	20
	Gravel	10	Sand	0
	Silt	0	Clay	0

Physicochemical analyses indicate the presence of mining impact on the water quality of Clover Fork. Sulfates exceed levels for unimpacted streams. The pH value observed is high in comparison with unimpacted streams in the Cumberland River drainage. An elevated pH level for streams impacted by surface mining has been encountered in earlier studies (Dyer and Curtis 1977; Minear and Tschartz 1976).

Table C6

Analytical Results for Certain Physicochemical Parameters Surveyed in Clover Fork of Cumberland River, Harlan County, Kentucky, 17/Jul/80.

Temp °C	39	Specific Conductance (μmhos/cm)	288
Turbidity (NTU)	1.2 (Lab)	pH	8.5 (Lab)
Dissolved Oxygen (mg/l)	-	Total Alkalinity (mg/l)	95.8
Total Acidity (mg/l)	0	Sulfates (mg/l)	78
Total Iron (mg/l)	.18	Total Manganese (mg/l)	.015

A cursory biotic survey revealed the presence of trichopterans, ephemeropterans, dipterans, cyprinids, and centrachids. A heavy periphyton growth carpeted the bottom.

Clover Fork has a past history of severe degradation from mining (Carter and Jones 1969). Carter and Jones noted that surface mine and coal washer pollution had plagued this stream for several years and although coal washer waste appeared lessened in severity, periodic pollution still existed. During the present study, blackwater was seen entering Clover Fork from a coal operation near Highsplint, Kentucky. Carter and Jones (1969) stated that Clover Fork provided very little fishing. Harlan County conservation officer Roy Harris (pers. comm.) considered the fishery of Clover Fork to be poor due to impacts from mining silt and acid. Largemouth bass, smallmouth bass, panfish, suckers, and catfish provide the most interest.

02044912

Yocum Creek

Drainage System:	Upper Cumberland
County:	Harlan
7.5 Min. Quadrangle Name:	Evarts
Latitude:	36° 51' 46" N
Longitude:	83° 11' 17" W
Location:	.6 km above confluence with Clover Fork Cumberland River; below bridge off KY 215 at Yocum Creek Church of God, Evarts, Kentucky.
Survey Date:	17/Jul/80

Yocum Creek heads at an elevation of 847.3 m on Little Black Mountain in eastcentral Harlan County. The stream flows in a northwesterly direction to its confluence with Clover Fork Cumberland River at Evarts, Kentucky. Total stream length is 11.9 km with a third order segment of 7.31 km. Both deep and surface mining have been conducted in the Yocum Creek watershed. Deep mines are located along Laurel Branch, Pounding Mill Branch, Yocum Creek at Kenvir, Kentucky, Sharps Branch and Reds Creek. Surface mining, primarily by contour stripping, has been conducted in sections of the watershed. Sharps Branch has been extensively surface mined. Approximately 10% of the surface has been disturbed by mining.

The stream sampling site was situated in a floodplain of moderate width. Steep, forested slopes rise above the valley floor. Approximately 60% of the watershed is forested. The floodplain is rather heavily populated with several small communities scattered along its length. KY 215 and a railroad track parallel the stream along its south slope. Houses are located along both the north and south bank. Riparian vegetation afforded 5-25% shade.

Yocum Creek is a stream of moderate gradient with a pool-riffle ratio of 50% pool to 50% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted of cobble, gravel, and rubble with boulders and sand. Silt sedimentation was slight to moderate. Red dog was present.

Table C7

Survey Site Physical Morphology and Percentage Substrate Composition in Yocum Creek, Harlan County, Kentucky, 17/Jul/80.

Stream:	Width	64.0 m	Depth	1.65 m
Bottom Type (%):	Bedrock	-	Boulder	10
	Cobble	30	Rubble	20
	Gravel	25	Sand	10
	Silt	5	Clay	0

Physicochemical analyses indicate that the water quality of Yocum Creek is impacted by mine drainage. Elevated values for specific conductance and sulfates were observed. Acidity was zero.

Table C8

Analytical Results for Certain Physicochemical Parameters Surveyed in Yocum Creek, Harlan County, Kentucky, 17/Jul/80.

Temp °C	30.5	Specific Conductance (μmhos/cm)	464
Turbidity (NTU)	1.2	pH	8.6
Dissolved Oxygen (mg/l)	-	Total Alkalinity (mg/l)	156.2
Total Acidity (mg/l)	0	Sulfates (mg/l)	97.5
Total Iron (mg/l)	.11	Total Manganese (mg/l)	.015

A cursory biotic survey revealed the presence of trichopterans, chironomids, ephemeropterans, and cyprinids.

Harlan County conservation officer Roy Harris (pers. comm.) considered the fishery of Yocum Creek to be impacted by siltation from mining. Two small boys fishing near the survey site said they had caught bullheads, bass, hogsuckers, and bluegill in this stream.

02043912

Crummies Creek

Drainage System:	Upper Cumberland
County:	Harlan
7.5 Min. Quadrangle Name:	Evarts
Latitude:	36° 46' 59" N
Longitude:	83° 13' 41" W
Location:	at US 421 bridge, Cawood, Kentucky
Survey Date:	17/Jul/80

Crummies Creek heads in southcentral Harlan County on Little Black Mountain at an elevation of 840.6 m. The stream flows in a southwesterly direction to its confluence with Martins Fork at Cawood, Kentucky. The third order stream segment is 2.91 km in length. Topographic maps reveal the presence of two deep mines, .5 and 1.1 km above the stream site. Extensive contour surface mining has been conducted on north and south slopes. Approximately 30% of the surface has been disturbed by mining.

The stream sampling site was situated in a floodplain of moderate width. The community of Cawood, Kentucky, is located on the west floodplain. A house was situated directly on the west bank. Forested slopes rise to the east. Approximately 50% of the watershed is covered by forest. Riparian vegetation afforded 50-75% shade.

Crummies Creek is a stream of moderate to high gradient with a pool-riffle ratio of 50% pool to 50% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate was variable consisting largely of cobble, rubble, and gravel with sand. Silt sedimentation was slight to moderate. Red dog was present.

Table C9

Survey Site Physical Morphology and Percentage Substrate Composition in Crummies Creek, Harlan County, Kentucky, 17/Jul/80.

Stream:	Width	7.01 m	Depth	.15 m
Bottom Type (%):	Bedrock	0	Boulder	5
	Cobble	30	Rubble	30
	Gravel	20	Sand	10
	Silt	5	Clay	0

Physicochemical analyses indicate Crummies Creek to be impacted by mine drainage. Elevated values for specific conductance, sulfates, and iron were observed.

Table C10

Analytical Results for Certain Physicochemical Parameters Surveyed in Crummies Creek, Harlan County, Kentucky, 17/Jul/80.

Temp °C	27	Specific Conductance (μmhos/cm)	1062
Turbidity (NTU)	1.2 (Lab)	pH	8.3 (Lab)
Dissolved Oxygen (mg/l)	-	Total Alkalinity (mg/l)	108.8
Total Acidity (mg/l)	0	Sulfates (mg/l)	190.5
Total Iron (mg/l)	.54	Total Manganese (mg/l)	.025

A cursory biotic survey revealed the presence of trichopterans, ephemeropterans, dipterans, cyprinids, and catostomids.

Harlan County conservation officer Roy Harris (pers. comm.) considered the fishery of Crummies Creek to be poor and impacted by mine silt. The sport fishery of this stream is largely restricted to that section below US 421 with a creel somewhat similar in composition to that caught in Martins Fork. Black bass, panfish, suckers, and catfish are of prime interest. Jones and Carter (1969) reported that Martins Fork below Turtles Creek was impacted periodically by coal washer waste. The section above Turtle Creek to Cranks Creek supports a significant black bass and catfish fishery. Upper sections of Martins Fork support the only known Kentucky population of coosa bass (Micropterus coosae).

02042912

Wallins Creek

Drainage System:	Upper Cumberland
County:	Harlan
7.5 Min. Quadrangle Name:	Wallins Creek
Latitude:	36° 49' 31" N
Longitude:	83° 24' 54" W
Location:	KY 2007 bridge at Wallins Creek, Kentucky
Survey Date:	17/Jul/80

Wallins Creek heads in westcentral Harlan County on Little Black Mountain at an elevation of 762.0 m. The stream flows in a general northerly direction to its confluence with the Cumberland River at Wallins Creek, Kentucky. The third order stream segment is 5.33 km in length. Deep mines are located at stream kilometer 1.3 and along Camp Branch 2.9 km above the site. Extensive contour surface mining has been conducted on east and west slopes about stream kilometer 2.4. Approximately 25% of the surface has been disturbed by mining.

The stream sampling site was situated in a floodplain of moderate width with partially forested slopes to the west. Approximately 50% of the watershed is forested. The stream flows against the west slope with the community of Wallins Creek located on the adjoining east floodplain. The floodplain above the site is rather heavily populated.

Wallins Creek is a stream of moderate to high gradient with a pool-riffle ratio of 50% pool to 50% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate was variable, consisting largely of cobble, rubble, and gravel. Silt sedimentation was slight. Red dog was present.

Table C11

Survey Site Physical Morphology and Percentage Substrate Composition in Wallins Creek, Harlan County, Kentucky, 17/Jul/80.

Stream:	Width	2.13 m	Depth	.21 m
Bottom Type (%):	Bedrock	0	Boulder	5
	Cobble	30	Rubble	30
	Gravel	25	Sand	5
	Silt	5	Clay	0

Physicochemical analyses indicate Wallins Creek to be impacted by mine drainage. Sulfates were observed to be at elevated levels. Iron and manganese were at levels consistent with unimpacted streams. Dyer and Curtis (1977) noted that these parameters return to normal levels within a year following cessation of mining.

Table C12

Analytical Results for Certain Physicochemical Parameters Surveyed in Wallins Creek, Harlan County, Kentucky, 17/Jul/80.

Temp °C	27	Specific Conductance (μmhos/cm)	344
Turbidity (NTU)	0.5 (Lab)	pH	7.7
Dissolved Oxygen (mg/l)	-	Total Alkalinity (mg/l)	77.2
Total Acidity (mg/l)	5.2	Sulfates (mg/l)	99
Total Iron (mg/l)	.09	Total Manganese (mg/l)	.045

A cursory biotic survey revealed the presence of ephemeropterans, dipterans, decopods, centrachids, and cyprinids including Rhinichthyes atratulus.

The fishery of Wallins Creek is largely restricted to the lower .5 km of the stream. The fishery of this stream is probably somewhat similar to that in the Cumberland River. Jones and Carter (1977) stated that the Cumberland River provides a fair fishery for catfish and panfishes in Bell County.

02039913

Straight Creek

Drainage System:	Upper Cumberland
County:	Bell
7.5 Min. Quadrangle Name:	Balkan
Latitude:	36° 49' 48" N
Longitude:	83° 32' 09" W
Location:	concrete ford on gravel road south off KY 221 at Stoney Fork, Kentucky
Survey Date:	22/Jul/80

Straight Creek heads in northwestern Harlan County at an elevation of 657.8 m against the Kentucky River divide. The stream flows in a southwesterly direction to its confluence with the Cumberland River opposite Pineville, Kentucky. The third order stream segment is 5.38 km in length. Extensive mountain top and contour surface mining has been conducted on the north slopes between Ben Howard Branch and Big Branch for a distance of 10.1 km. Active deep mines are located 1.9 and 4.0 km above the site. Approximately 30% of the watershed surface above the site has been disturbed by mining.

The stream sampling site was situated in a floodplain of moderate width at the community of Stoney Fork, Kentucky. The stream course is rather straight, with Pine Mountain forming the southern slope. Forests cover approximately 60% of the watershed. Gravel bars above the site supported stands of Justicia americana. Riparian vegetation afforded 0-5% shade at the site.

Straight Creek is a stream of low to moderate gradient with a pool-riffle ratio of 80% pool to 20% riffle. At the time of sampling, the stream was at low stage with slow to moderate flow. Showers were in progress. Substrate consisted largely of cobble with rubble, gravel, and sand. Silt sedimentation was slight to moderate.

Table C13

Survey Site Physical Morphology and Percentage Substrate Composition (Field Approximation) in Straight Creek, Bell County, Kentucky, 22/Jul/80.

Stream:	Width	3.87 m	Depth	.15 m
Bottom Type (%):	Bedrock	0	Boulder	5
	Cobble	40	Rubble	20
	Gravel	20	Sand	10
	Silt	5	Clay	0

Physicochemical analyses indicate the water quality of Straight Creek to be impacted by mine drainage. Specific conductance, sulfates, and iron were observed to be at elevated levels. Increases in these parameters have been associated with surface mining (Dyer and Curtis 1977).

Table C14

Analytical Results for Certain Physicochemical Parameters Surveyed in Straight Creek, Bell County, Kentucky, 22/Jul/80.

Temp °C	23.5	Specific Conductance (μmhos/cm)	424
Turbidity (NTU)	4.3 (Lab)	pH	7.5 (Field) 7.2 (Lab)
Dissolved Oxygen (mg/l)	5.7	Total Alkalinity (mg/l)	44.4
Total Acidity (mg/l)	6.2	Sulfates (mg/l)	164.5
Total Iron (mg/l)	.65	Total Manganese (mg/l)	.25

A cursory biotic survey revealed the presence of trichopterans, ephemeropterans, decapods, cyprinids, and catostomids.

Jones and Carter (1969) reported that although Straight Creek was impacted by surface mine siltation, the stream provided a moderate amount of fishing pressure for panfish, suckers, and bait minnows.

02039912

Left Fork Straight Creek

Drainage System:	Upper Cumberland
County:	Bell
7.5 Min. Quadrangle Name:	Pineville
Latitude:	36° 50' 17" N
Longitude:	83° 38' 03" W
Location:	1.1 km above confluence with Sims Fork on KY 66 at Rella, Kentucky
Survey Date:	22/Jul/80

Left Fork Straight Creek heads in northcentral Bell County at an elevation of 551.7 m. The stream flows in a southwesterly direction to its confluence with Straight Creek at Straight Creek, Kentucky. The third order stream segment is 5.81 km in length. Extensive mountain top and contour surface mining has been conducted on both east and west slopes above the site. Active deep mine and tipple operations are located just above Rella and at Field, Kentucky, .8 and 8.1 km upstream from the site, respectively. Approximately 40% of the surface has been disturbed by mining.

The stream sampling site was situated in a narrow floodplain with steep, forested slopes to the east and west. Forest covers approximately 50% of the watershed surface above the site. A small chapel is situated immediately upstream on the east bank. The floodplain is not heavily populated above the site; agriculture is very limited. KY 66 parallels the east slope base, while a railroad track follows the west slope base. Riparian vegetation at the site afforded 5-25% shade.

Left Fork Straight Creek is a stream of moderate gradient with a pool-riffle ratio of 40% pool to 60% riffle. At the time of sampling, the stream was at low stage with moderate flow. A shower was in progress. The water had a grayish appearance. Substrate consisted of rubble, cobble, and gravel with sand and silt. Silt and coalfine sedimentation was moderate. Red dog was present.

Table C15

Survey Site Physical Morphology and Percentage Substrate Composition in Left Fork Straight Creek, Bell County, Kentucky, 22/Jul/80.

Stream:	Width	5.58 m	Depth	.21 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	30	Rubble	40
	Gravel	20	Sand	10
	Silt	10	Clay	0

Physicochemical analyses indicate Left Fork Straight Creek to be impacted by mine drainage. Elevated values for specific conductance, sulfates, iron, and manganese were observed.

Table C16

Analytical Results for Certain Physicochemical Parameters Surveyed in Left Fork Straight Creek, Bell County, Kentucky, 22/Jul/80.

Temp °C	25.0	Specific Conductance (μmhos/cm)	1300
Turbidity (NTU)	3.6 (Lab)	pH	7.8 (Field) 7.7 (Lab)
Dissolved Oxygen (mg/l)	6.4	Total Alkalinity (mg/l)	77.6
Total Acidity (mg/l)	7.4	Sulfates (mg/l)	498
Total Iron (mg/l)	3.07	Total Manganese (mg/l)	.88

A cursory biotic survey revealed a rather depauperate fauna consisting of chironomids, crayfish, one white sucker, and many creek chubs. Branson and Batch (1972) have commented on the persistence of the creek chub in mining impacted streams.

Albert Jones, Southeast Fisheries District Biologist (pers. comm.) considered the fishery of Left Fork Straight Creek to be poor due to silt and acid mining impact. This stream formerly supported a high quality fishery.

02034912

Brush Creek

Drainage System:	Upper Cumberland
County:	Knox
7.5 Min. Quadrangle Name:	Artemus
Latitude:	36° 47' 56" N
Longitude:	83° 50' 38" W
Location:	.5 km above confluence with Little Brush Creek; on KY 225 3.9 km south of Artemus, Kentucky
Survey Date:	23/Jul/80

Brush Creek heads in southcentral Knox County at an elevation of 372.5 m. The stream flows in a northerly direction to its confluence with the Cumberland River at Artemus, Kentucky. The third order segment of this stream is 12.52 km in length. Extensive contour surface mining has been conducted along the slopes of Brush Creek. Several deep mines in the headwaters have been stripped. Approximately 25% of the surface has been disturbed by mining.

The stream sampling site was situated in a floodplain of moderate width with forested slopes to the east and west. Approximately 60% of the watershed is covered by forest. A ford crosses the stream directly above the site. A large pool is located above the ford. The floodplain supports light agriculture and is sparsely populated. Riparian vegetation afforded 25-50% shade.

Brush Creek is a stream of low gradient with a pool-riffle ratio of 70% pool to 30% riffle. At the time of sampling, the stream was at low stage with slow flow. Substrate was varied with rubble and gravel predominating. Silt sedimentation was moderate. Red dog and coal were present.

Table C17

Survey Site Physical Morphology and Percentage Substrate Composition in Brush Creek, Knox County, Kentucky, 23/Jul/80.

Stream:	Width	2.32 m	Depth	.15 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	10	Rubble	40
	Gravel	30	Sand	15
	Silt	5	Clay	0

Physicochemical analyses indicate the water quality of Brush Creek to be impacted by mine drainage. Sulfates and manganese were observed to be at elevated levels. Iron, although within acceptable levels for unimpacted streams, was slightly elevated.

Table C18

Analytical Results for Certain Physicochemical Parameters Surveyed in Brush Creek, Knox County, Kentucky, 23/Jul/80.

Temp °C	23.4	Specific Conductance (μmhos/cm)	288
Turbidity (NTU)	3.8 (Lab)	pH	7.4 (Field) 7.4 (Lab)
Dissolved Oxygen (mg/l)	4.5	Total Alkalinity (mg/l)	74.0
Total Acidity (mg/l)	6.8	Sulfates (mg/l)	68.5
Total Iron (mg/l)	.44	Total Manganese (mg/l)	.705

A cursory biotic survey revealed the presence of ephemeropterans, trichopterans, plecopterans, dipterans, megalopterans, the cyprinid (Semotilus atromaculatus) and darters.

Knox County conservation officer Steve Lundy (pers. comm.) considered the fishery of Brush Creek to be poor and impacted by mine silt. Panfish, sucker, and catfish are of prime interest.

02032912

Little Richland Creek

Drainage System:	Upper Cumberland
County:	Knox
7.5 Min. Quadrangle Name:	Heidrick
Latitude:	36° 53' 46" N
Longitude:	83° 52' 32" W
Location:	on gravel road off KY 11 2.1 km east of junction with US 25E; near Heidrick, Kentucky
Survey Date:	23/Jul/80

Little Richland Creek heads in eastcentral Knox County at an elevation of 315.5 m. The stream course resembles a semicircle, flowing initially in a northward direction, ultimately flowing southwestward to its confluence with Richland Creek north of Barbourville, Kentucky. The third order stream segment is 12.75 km in length. Topographic maps reveal the presence of deep mines on Trace Branch, Tulley Branch, Pumpkin Run, Long Branch, and Hughes Branch. Aerial surveys indicate the presence of small surface mines on Pumpkin Run, Long Branch at Bailey Hollow, along the east slope above Parrott Branch, and along the west slope opposite Paynes Branch. Approximately 5% of the surface has been disturbed by mining.

The stream sampling site was situated in a relatively broad floodplain with forested slopes rising to the southeast and northwest. Approximately 50% of the watershed is covered by forest. The floodplain is intensively farmed. Floodplain adjacent to the site is in pasture. KY 11 and a railroad track parallel the eastern slope base. Riparian vegetation consisted largely of shrubs affording 0-5% shade. A stand of bur reed (Sparganium) was growing in flowing water at the site.

Little Richland Creek is a stream of low gradient with a pool-riffle ratio of 90% pool to 10% riffle. At the time of sampling, the stream was at moderate stage with slow flow. The stream was rather turbid, owing possibly to agricultural or surface mine runoff. Showers had passed through the area the previous day. Substrate consisted of silt with clay. Silt sedimentation was heavy with an unconsolidated bottom. Much detritus was present in the sediment.

Table C19

Survey Site Physical Morphology and Percentage Substrate Composition in Little Richland Creek, Knox County, Kentucky, 23/Jul/80.

Stream:	Width	3.23 m	Depth	.37 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	0	Sand	0
	Silt	80	Clay	20

Physicochemical analyses revealed elevated values for iron and manganese. Sulfates and specific conductance were not elevated. It has been observed that sulfate increase may lag following initiation of mining (Dyer and Curtis 1977). The iron and manganese values may have been associated with the sediment runoff. Further study should be done to verify the presence of mining impact in this stream.

Table C20

Analytical Results for Certain Physicochemical Parameters Surveyed in Little Richland Creek, Knox County, Kentucky, 23/Jul/80.

Temp °C	22.8	Specific Conductance (μmhos/cm)	237
Turbidity (NTU)	50	pH	7.2 (Field) 7.1 (Lab)
Dissolved Oxygen (mg/l)	4.2	Total Alkalinity (mg/l)	65.2
Total Acidity (mg/l)	6.6	Sulfates (mg/l)	30.6
Total Iron (mg/l)	1.2	Total Manganese (mg/l)	.715

A cursory biotic survey revealed the presence of odonates, trichopterans, coleopterans, leeches, gastropods, decapods and pelecypods. Fishes were not collected.

Knox County conservation officer Steve Lundy (pers. comm.) considered the fishery of Little Richland Creek to be fair and unimpacted by mining. Largemouth bass, panfish, suckers, and catfish are of prime interest.

02031914

Big Indian Creek

Drainage System:	Upper Cumberland
County:	Knox
7.5 Min. Quadrangle Name:	Barbourville
Latitude:	36° 51' 27" N
Longitude:	83° 58' 16" W
Location:	.5 km above confluence with Helton Branch off gravel road .1 km from junction with KY 459, southwest of Dishman Springs, Kentucky.
Survey Date:	23/Jul/80

Big Indian Creek heads in westcentral Knox County at an elevation of 338.3 m. The stream flows in a generally southward direction to its confluence with the Cumberland River at Cumberland River mile 623.8. The third order stream segment is 1.84 km in length. Extensive surface mining has been conducted in the headwaters of the Big Indian Creek watershed and in Brown and Engle hollows. Numerous deep mines are scattered throughout the drainage. Approximately 30% of the surface has been disturbed by mining.

The stream sampling site is situated in a floodplain of moderate width with forested slopes rising to the northeast and southwest. The floodplain at the stream ite was forested, riparian vegetation affording 25-50% shade. Approximately 60% of the watershed is forested. KY 6 parallels the stream along the north slope base.

Big Indian Creek is a stream of low to moderate gradient with a pool-riffle ratio of 80% pool to 20% riffle. At the time of sampling, the stream was at low stage with slow to moderate flow. Substrate consisted largely of clay and silt with sand. Silt sedimentation was heavy. A large amount of detritus was present.

Table C21

Survey Site Physical Morphology and Percentage Substrate Composition in Big Indian Creek, Knox County, Kentucky, 23/Jul/80.

Stream:	Width	7.07 m	Depth	.26 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	0	Sand	10
	Silt	40	Clay	50

Physicochemical analyses indicate that the water quality of Big Indian Creek is impacted by mine drainage. Elevated values for specific conductance, sulfates, iron, and manganese were observed.

Table C22

Analytical Results for Certain Physicochemical Parameters Surveyed in Big Indian Creek, Knox County, Kentucky, 23/Jul/80.

Temp °C	22.5	Specific Conductance (μmhos/cm)	470
Turbidity (NTU)	6.2 (Lab)	pH	7.3 (Field) 7.2 (Lab)
Dissolved Oxygen (mg/l)	4.6	Total Alkalinity (mg/l)	72.8
Total Acidity (mg/l)	7.0	Sulfates (mg/l)	168.0
Total Iron (mg/l)	1.14	Total Manganese (mg/l)	1.33

A cursory biotic survey revealed odonates, coleopterans, and decapods as the benthic macroinvertebrate assemblage. Fishes collected included sunfish and creek chubs.

Knox County conservation officer Steve Lundy (pers. comm.) considered the fishery of Big Indian Creek to be poor and impacted by mining siltation. The stream provides angling for panfish and suckers.

02031913

Maple Creek

Drainage System:	Upper Cumberland
County:	Whitley
7.5 Min. Quadrangle Name:	Saxton
Latitude:	36° 45' 36" N
Longitude:	84° 03' 36" W
Location:	at Deep Branch Road bridge; 2.5 km north of KY 92/Maple Creek Road junction; west of Louden, Kentucky
Survey Date:	16/Jul/80

Maple Creek heads in eastcentral Whitley County at an elevation of 338.3 m. The stream flows in a southerly direction to its confluence with the Cumberland River east of Julip, Kentucky. The third order stream segment is 4.94 km in length. Topographic maps reveal the presence of deep mines scattered along the stream course. Aerial surveys reveal extensive surface mining on east slopes above Perkins, Kentucky; extensive surface mining in Berry Hollow; and surface mining and clearing opposite Berry Hollow with contour stripping along the stream divide. Contour mining has been conducted on east slopes to near KY 92. Approximately 40% of the surface has been disturbed by mining.

The stream sampling site was situated in a floodplain of moderate width; eastern slopes were forested. Approximately 30% of the watershed is forested. The stream follows the east slope at the site with Maple Creek Road paralleling the east bank. Agriculture is rather intensively conducted on the floodplain below the site. The adjacent west floodplain is in fallow pasture. Riparian vegetation afforded 25-50% shade.

Maple Creek is a stream of low to moderate gradient with a pool-riffle ratio of 50% pool to 50% riffle. At the time of sampling, the stream was at low stage with slow flow. Substrate consisted largely of bedrock and boulders with some silt. Silt sedimentation was moderate.

Table C23

Survey Site Physical Morphology and Percentage Substrate Composition in Maple Creek, Whitley County, Kentucky, 16/Jul/80.

Stream:	Width	1.43 m	Depth	.05 m
Bottom Type (%):	Bedrock	60	Boulder	20
	Cobble	0	Rubble	5
	Gravel	5	Sand	0
	Silt	10	Clay	0

Physicochemical analyses indicate that Maple Creek is impacted by mine drainage. Elevated values for specific conductance and sulfates were observed. Iron and manganese were at levels consistent with unimpacted streams. These parameters were found by Dyer and Curtis (1977) to return to normal levels within a year following cessation of mining.

Table C24

Analytical Results for Certain Physicochemical Parameters Surveyed in Maple Creek, Whitley County, Kentucky, 16/Jul/80.

Temp °C	27	Specific Conductance (μmhos/cm)	438
Turbidity (NTU)	1.8 (Lab)	pH	7.4 (Lab)
Dissolved Oxygen (mg/l)	-	Total Alkalinity (mg/l)	102.4
Total Acidity (mg/l)	10.4	Sulfates (mg/l)	115.0
Total Iron (mg/l)	.245	Total Manganese (mg/l)	.32

A cursory biotic survey revealed the presence of trichopterans, ephemeropterans, coleopteran larvae, and cyprinids.

Whitley County conservation officer Kenneth Mobley (pers. comm.) considered the fishery of Maple Creek to be poor. Carter and Jones (1969) reported the fishery in the Cumberland River above Williamsburg, Kentucky, as fair for panfish and catfish.

02031912

Patterson Creek

Drainage System:	Upper Cumberland
County:	Whitley
7.5 Min. Quadrangle Name:	Saxton
Latitude:	36° 40' 43" N
Longitude:	84° 02' 46" W
Location:	on Keswick - Gatliff Road; .5 km above confluence with Bennetts Branch near Nevisdale, Kentucky
Survey Date:	16/Jul/80

Patterson Creek heads in southeastern Whitley County at an elevation of 350.5 m. The stream flows in a general northerly direction to its confluence with the Cumberland River at Verne, Kentucky. The third order stream segment is 2.64 km in length. The Patterson Creek watershed has been extensively mined above the site. Deep mines are located along an unnamed tributary above Polly Camp, Kentucky; on west facing slopes opposite Polly Camp; near the head of Rose Creek; and at the head of Patterson Creek. Surface mining has been conducted along slopes overlooking Polly Camp; along west facing slopes opposite Polly Camp; along west slopes of Patterson Creek above confluence with Rose Creek; southeast of the Rose Creek-Patterson Creek confluence; along Ben Rose Branch; and around the summit of the north slopes above Long Rocky Branch. Approximately 30% of the surface has been disturbed by mining activities.

The stream sampling site was situated in a floodplain of moderate width. Forested slopes rise to the east and west. Approximately 50% of the watershed is forested. The stream follows the western slope with the Keswick-Gatliff Road paralleling the west bank. The adjoining eastern floodplain is in pasture. The section of Patterson Creek above the site is sparsely populated. A cattle crossing is located directly below the site. Riparian vegetation afforded 25-50% shade.

Patterson Creek is a stream of low gradient with a pool-riffle ratio of 70% pool to 30% riffle. At the time of sampling, the stream was at low stage with slow flow. Substrate consisted largely of rubble, gravel, sand, and silt. Silt sedimentation was moderate.

Table C25

Survey Site Physical Morphology and Percentage Substrate Composition in Patterson Creek, Whitley County, Kentucky, 16/Jul/80.

Stream:	Width	.91 m	Depth	.25 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	5	Rubble	30
	Gravel	30	Sand	20
	Silt	15	Clay	0

Physicochemical analyses indicate Patterson Creek to be impacted by mine drainage. Elevated values for specific conductance, sulfates, and iron were observed. Manganese, although within levels accepted for unimpacted streams, was slightly elevated.

Table C26

Analytical Results for Certain Physicochemical Parameters Surveyed in Patterson Creek, Whitley County, Kentucky, 16/Jul/80.

Temp °C	30	Specific Conductance (μmhos/cm)	483
Turbidity (NTU)	3.4 (Lab)	pH	7.2 (Lab)
Dissolved Oxygen (mg/l)	-	Total Alkalinity (mg/l)	79.8
Total Acidity (mg/l)	7.0	Sulfates (mg/l)	170.5
Total Iron (mg/l)	.595	Total Manganese (mg/l)	.45

A cursory biotic survey revealed the presence of minnows and mayflies. A heavy periphyton growth covered rocks.

Whitley County conservation officer Kenneth Mobley (pers. comm.) considered the fishery of Patterson Creek to be poor and impacted by acid.

02035913

Clear Fork

Drainage System:	Upper Cumberland
County:	Bell
7.5 Min. Quadrangle Name:	Eagan
Latitude:	36° 35' 17" N
Longitude:	83° 53' 51" W
Location:	on KY 90 .2 km north of the Kentucky - Tennessee state line at Pruden, Kentucky
Survey Date:	17/Jul/80

Clear Fork heads in southwestern Bell County at an elevation of 759.0 m. The stream flows in a southwesterly course to the state line near Pruden, Kentucky. Swinging in an arch across northern Claiborne and Campbell counties in Tennessee, the stream flows northward back into Kentucky towards its confluence with the Cumberland River near Williamsburg, Kentucky. The total stream length is 73.57 km with the third order stream segment being 3.44 km in length. Extensive surface mining has been conducted on slopes overlooking the communities of Pruden and Fonde. A large abandoned tipple and coal preparation site are located along Back Creek .5 km above the stream site. Approximately 30% of the watershed above the site has been disturbed by mining.

The stream sampling site at Pruden was situated in a floodplain of moderate width with the south slope formed by Rich Mountain in Tennessee and Log Mountain forming the north slope. Forests cover 60% of the watershed. Riparian vegetation afforded 0-5% shade. KY 74 parallels the west bank. A gravel road paralleling the east bank crossed the stream directly below the site. The floodplain is moderately populated, with much of its surface reflecting signs of more active times when coal was mined on the slopes above the towns.

Clear Fork is a stream of moderate gradient with a pool-riffle ratio of 70% pool to 30% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate was composed largely of coalfines, cobble, and silt. Sedimentation of silt, yellowboy, and coalfines was heavy. Rocks were stained red.

Table C27

Survey Site Physical Morphology and Percentage Substrate Composition in Clear Fork of Cumberland River, Bell County, Kentucky, 17/Jul/80.

Stream:	Width	5.27 m	Depth	.10 m
Bottom Type (%):	Bedrock	0	Boulder	5
	Cobble	15	Rubble	0
	Gravel	30	Sand	10
	Silt	15	Clay	0
	Coal	25		

Physicochemical analyses reflected the severely degraded nature of Clear Fork. Elevated values for specific conductance, sulfates, iron, and manganese were observed. Turbidity was also elevated.

Table C28

Analytical Results for Certain Physicochemical Paramters Surveyed in Clear Fork of Cumberland River, Bell County, Kentucky, 17/Jul/80.

Temp °C	22	Specific Conductance (μmhos/cm)	795
Turbidity (NTU)	27.0 (Lab)	pH	6.9 (Lab)
Dissolved Oxygen (mg/l)	-	Total Alkalinity (mg/l)	62.2
Total Acidity (mg/l)	9.0	Sulfates (mg/l)	402.0
Total Iron (mg/l)	5.89	Total Manganese (mg/l)	1.27

A cursory biotic survey did not indicate the presence of benthos or fish. A large water snake and snapping turtle were observed. Examination of algae encrusting rocks provided the following genera: Ulothrix, Stigeoclonium, Synedra, Amphipleura, Nitzchia, Oscillatoria, Lynbya and Melosira.

Jones and Carter (1969) reported Clear Fork as carrying a heavy silt load due to surface mining. Fishing success was low with very little angling pressure.

02035912

Laurel Fork

Drainage System:	Upper Cumberland
County:	Whitley
7.5 Min. Quadrangle Name:	Frakes
Latitude:	36° 37' 11" N
Longitude:	83° 58' 18" W
Location:	on Laurel Fork Road 2.6 km southwest of junction with KY 1595 near Pearl, Kentucky
Survey Date:	17/Jul/80

Laurel Fork heads in southwestern Bell County at an elevation of 731.5 m. The stream flows in a southwesterly direction along the east slope base of Pine Mountain to its confluence with Clear Fork in northeastern Campbell County Tennessee. The third order stream segment is 15.18 km in length. Extensive surface mining has been conducted between the headwaters of Tiny Branch and Laurel Fork and along Wheeler Creek below Blue Hollow. Small surface mines are scattered along the stream course. Approximately 15% of the surface has been disturbed by mining.

The stream sampling site was situated in a constricted section of the floodplain with forested slopes rising to the east. Approximately 50% of the watershed is in forest. The stream follows the east slope base with Laurel Fork Road paralleling the east bank. The floodplain below the site and in the area around Pearl is intensively farmed. The floodplain below Pearl is sparsely populated. Riparian vegetation afforded 50-75% shade.

Laurel Fork is a stream of moderate gradient with a pool-riffle ratio of 70% pool to 30% riffle. At the time of sampling, the stream was at low stage with slow to moderate flow. Substrate consisted of rubble and gravel with sand and silt. Silt sedimentation was moderate.

Table C29

Survey Site Physical Morphology and Percentage Substrate Composition in Laurel Fork of Clear Fork Cumberland River, Whitley County, Kentucky, 17/Jul/80.

Stream:	Width	4.54 m	Depth	.6 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	5	Rubble	40
	Gravel	30	Sand	15
	Silt	10	Clay	0

Physicochemical analyses indicate Laurel Fork to be impacted by mine drainage. Elevated values for specific conductance, sulfates, and manganese were observed. Iron was at a slightly elevated level comparable to that in unimpacted streams.

Table C30

Analytical Results for Certain Physicochemical Parameters Surveyed in Laurel Fork of Clear Fork Cumberland River, Whitley County, Kentucky, 17/Jul/80.

Temp °C	25	Specific Conductance (μmhos/cm)	550
Turbidity (NTU)	2.8 (Lab)	pH	7.2 (Lab)
Dissolved Oxygen (mg/l)	-	Total Alkalinity (mg/l)	91.6
Total Acidity (mg/l)	8.0	Sulfates (mg/l)	218.0
Total Iron (mg/l)	.36	Total Manganese (mg/l)	.51

A cursory biotic survey revealed the presence of ephemeropterans, trichopterans, decapods, and cyprinids including the creek chub (Semotilus atromaculatus).

A local resident informed the investigator that a fair to good fishery exists in Laurel Fork during the spring, primarily for suckers.

02013913

Barren Fork of Indian Creek

Drainage System:	Upper Cumberland
County:	McCreary
7.5 Min. Quadrangle Name:	Wiborg
Latitude:	36° 46' 35" N
Longitude:	84° 25' 34" W
Location:	.1 km above confluence with Pigeon Roost Branch; above 4-H Camp Road ford 2.1 km north of junction with KY 700; northeast of Whitley City, Kentucky
Survey Date:	16/Jul/80

Barren Fork of Indian Creek heads in central McCreary County at an elevation of 384.1 m. The stream flows in a northeasterly direction to its confluence with Indian Creek southeast of Beulah Heights, Kentucky. The third order stream segment is 4.23 km in length. Numerous deep mines are indicated by topographic maps to be located .46 to 4.6 km above the stream site on Barren and Railroad Forks. Surface mining has also occurred in this watershed.

The stream sampling site was situated in a narrow floodplain with steep, forested slopes rising to the north and south. Over 90% of the upper watershed is forested. Rhododendrons provided a canopy above the stream affording 75-100% shade.

Barren Fork is a stream of low to moderate gradient with a pool-riffle ratio of 70% pool to 30% riffle. At the time of sampling, the stream was at low stage with slow to moderate flow. Substrate consisted largely of sand, rubble, gravel, and cobble. Silt sedimentation was slight to moderate. Some coal and red dog were present.

Table C31

Survey Site Physical Morphology and Percentage Substrate Composition in Barren Fork of Indian Creek, McCreary County, Kentucky, 16/Jul/80.

Stream:	Width	2.44 m	Depth	.08 m
Bottom Type (%):	Bedrock	5	Boulder	5
	Cobble	10	Rubble	30
	Gravel	15	Sand	30
	Silt	5	Clay	0

Physicochemical analyses indicate Barren Fork to be impacted by mine drainage. Elevated values for sulfates and iron were observed. Acidity exceeded alkalinity while pH was depressed. Specific conductance was interestingly within levels accepted for unimpacted streams.

Table C32

Analytical Results for Certain Physicochemical Parameters Surveyed in Barren Fork of Indian Creek, McCreary County, Kentucky, 16/Jul/80.

Temp °C	24	Specific Conductance (μmhos/cm)	175
Turbidity (NTU)	1.2 (Lab)	pH	4.2 (Lab)
Dissolved Oxygen (mg/l)	10.1	Total Alkalinity (mg/l)	0
Total Acidity (mg/l)	7.8	Sulfates (mg/l)	93.0
Total Iron (mg/l)	.59	Total Manganese (mg/l)	.46

A cursory biotic survey revealed an absence of benthic macroinvertebrates and fish. A few water striders (Gerris) were present. Cyprinids were noted in the fourth order segment below Pigeon Roost Branch.

McCreary County conservation officer Lowell Dolen (pers. comm.) considered the fishery of Barren Fork to be poor and impacted by acid. Jones and Carter (1969) reported Indian Creek as polluted by surface mines on Barren Fork resulting in a degradation of its fishery.

02013912

Kilburn Fork of Indian Creek

Drainage System:	Upper Cumberland
County:	McCreary
7.5 Min. Quadrangle Name:	Wiborg
Latitude:	36° 48' 57" N
Longitude:	84° 23' 03" W
Location:	.1 km above KY 1045 bridge southwest of Honeybee, Kentucky
Survey Date:	16/Jul/80

Kilburn Fork of Indian Creek heads in northcentral McCreary County at an elevation of 368.8 m. The stream flows in a southeasterly direction to its confluence with Indian Creek southwest of Honeybee, Kentucky. The third order segment is 6.94 km in length. Topographic maps indicate the presence of a deep mine 9.3 km above the site.

The stream sampling site was situated in a floodplain of narrow width with forested slopes rising to the east and west. Riparian vegetation afforded 50-75% cover. Over 90% of the watershed is forested. The watershed is sparsely populated and does not support a significant amount of agriculture.

Kilburn Fork is a stream of low to moderate gradient with a pool-riffle ratio of 50% pool to 50% riffle. At the time of sampling, the stream was at low stage with slow flow. Substrate type was varied. Silt sedimentation was slight.

Table C33

Survey Site Physical Morphology and Percentage Substrate Composition in Kilburn Fork of Indian Creek, McCreary County, Kentucky, 16/Jul/80.

Stream:	Width	4.60 m	Depth	.16 m
Bottom Type (%):	Bedrock	0	Boulder	20
	Cobble	20	Rubble	30
	Gravel	20	Sand	10
	Silt	0	Clay	0

Physicochemical analyses indicate Kilburn Fork to be of good water quality. Specific conductance, sulfates, iron, and manganese were at levels consistent with unimpacted streams.

Table C34

Analytical Results for Certain Physicochemical Parameters Surveyed in Kilburn Fork of Indian Creek, McCreary County, Kentucky, 16/Jul/80.

Temp °C	29	Specific Conductance (μmhos/cm)	59
Turbidity (NTU)	0.6 (Lab)	pH	6.7 (Lab)
Dissolved Oxygen (mg/l)	7.7	Total Alkalinity (mg/l)	24.0
Total Acidity (mg/l)	2.4	Sulfates (mg/l)	12.4
Total Iron (mg/l)	.29	Total Manganese (mg/l)	.07

A cursory biotic survey revealed the presence of trichopterans, ephemeropterans, decapods, gastropods, cyprinids, centrachids, and darters.

Jones and Carter (1969) reported on the fishery of Indian Creek noting the impact of mine pollution originating in the Barren Fork watershed. The fishery of Indian Creek was considered degraded. In an interview with a local resident, it was noted that Kilburn Fork provides a fishery for sunfish, bass, and suckers. Trout have been caught in the fourth order segment of this stream although they have not been stocked in recent times.

02026913

Cane Creek

Drainage System:	Laurel River
County:	Laurel
7.5 Min. Quadrangle Name:	Blackwater
Latitude:	37° 03' 50" N
Longitude:	83° 56' 28" W
Location:	at KY 1189 bridge 2.07 km southwest of Lida, Kentucky
Survey Date:	9/Jul/80

Cane Creek heads in eastcentral Laurel County at an elevation of 379.5 m. The stream flows in a general northwesterly direction to its confluence with Laurel River below Lida, Kentucky. The third order stream segment is 2.01 km in length. Extensive surface mining has been conducted along the slopes of Cane Creek. Approximately 30% of the surface has been disturbed by mining. Deep mines are not present in the watershed.

The stream sampling site was situated in a floodplain of relatively broad width. Floodplains above the site are low and poorly drained. Forests cover 20% of the watershed. The floodplain supports light agriculture; population is sparse. KY 1189 parallels the east slope base. Riparian vegetation afforded 50-75% shade.

Cane Creek is a stream of low gradient with a pool-riffle ratio of 90% pool to 10% riffle. At the time of sampling, the stream was at low stage with slow flow. Substrate consisted of silt, presumably from mining. Silt sedimentation was very heavy.

Table C35

Survey Site Physical Morphology and Percentage Substrate Composition in Cane Creek, Laurel County, Kentucky, 9/Jul/80.

Stream:	Width	1.07 m	Depth	.22 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	0	Sand	0
	Silt	100	Clay	0

Physicochemical analyses indicate Cane Creek to be impacted by mine drainage. Elevated values for specific conductance, sulfates, and iron were observed.

Table C36

Analytical Results for Certain Physicochemical Parameters Surveyed in Cane Creek, Laurel County, Kentucky, 9/Jul/80.

Temp °C	27	Specific Conductance (μmhos/cm)	388
Turbidity (NTU)	1.6 (Lab)	pH	7.8 (Lab)
Dissolved Oxyben (mg/l)	6.7	Total Alkalinity (mg/l)	74.0
Total Acidity (mg/l)	7.8	Sulfates (mg/l)	97.5
Total Iron (mg/l)	.64	Total Manganese (mg/l)	.22

A cursory biotic survey revealed the presence of oligochaetes, dipterans (chironomids) odonates, sphaerid clams, and creek chubs.

Cane Creek may support a limited fishery at its confluence with Laurel River, however, it is doubtful that the stream is of significance to anglers in view of its small size and impacted condition.

02028912

Negro Creek

Drainage System:	Laurel River
County:	Knox
7.5 Min. Quadrangle Name:	Corbin
Latitude:	36° 55' 33" N
Longitude:	84° 01' 58" W
Location:	.2 km above Negro Creek Road bridge; 1.5 km southeast of junction Negro Creek Road and KY 830 near Siler, Kentucky
Survey Date:	23/Jul/80

Negro Creek heads in westcentral Knox County at an elevation of 359.7 m. The stream flows in a northerly direction to its confluence with the East Fork Lynn Camp Creek near Siler, Kentucky. The third order stream segment is .8 km in length. Topographic maps did not reveal the presence of deep mines above the site. Extensive surface mining has been conducted along the east and west slopes. Approximately 30% of the watershed surface above the site has been disturbed by mining.

The stream sampling site was situated in a floodplain of relatively broad width. The west slope was partially forested. Approximately 40% of the watershed is forested. A small wooded area is located upstream from the Negro Creek Road Bridge. The floodplain at the site is of low relief and is poorly drained. Riparian vegetation afforded 75-100% shade.

Negro Creek is a stream of low to moderate gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted largely of silt with clay, coal, and sand. Silt sedimentation was moderate.

Table C37

Survey Site Physical Morphology and Percentage Substrate Composition in Negro Creek, Knox County, Kentucky, 23/Jul/80.

Stream:	Width	1.07 m	Depth	.08 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	5	Rubble	0
	Gravel	20	Sand	10
	Silt	45	Clay	20

Physicochemical analyses indicate the presence of mining impact on the water quality of Negro Creek. Elevated levels for specific conductance and sulfates were observed. Although iron and manganese were within levels accepted for unimpacted streams, these parameters were slightly elevated. Dyer and Curtis (1977) found iron and manganese at normal levels within a year following cessation of mining.

Table C38

Analytical Results for Certain Physicochemical Parameters Surveyed in Negro Creek, Knox County, Kentucky, 23/Jul/80.

Temp °C	22.5	Specific Conductance (μmhos/cm)	578
Turbidity (NTU)	2.5 (Lab)	pH	7.8 (Field) 7.8 (Lab)
Dissolved Oxygen (mg/l)	7.6	Total Alkalinity (mg/l)	82.2
Total Acidity (mg/l)	5.6	Sulfates (mg/l)	240.0
Total Iron (mg/l)	.29	Total Manganese (mg/l)	.315

A cursory biotic survey revealed the presence of trichopterans, ephemeropterans, odonates, amphipods, decapods, and the cyprinid (Semotilus atromaculatus). Branson and Batch (1972) noted the presence of creek chubs in streams impacted by silt from mining.

Negro Creek probably serves only as a baitfish source due to its small size.

02025913

Raccoon Creek

Drainage System:	Rockcastle River
County:	Laurel
7.5 Min. Quadrangle Name:	London
Latitude:	37° 12' 15" N
Longitude:	84° 00' 58" W
Location:	on Taylor School Road .6 km east of junction with KY 638; south of McWhorter, Kentucky
Survey Date:	23/Jul/80

Raccoon Creek heads in eastcentral Laurel County at an elevation of 359.7 m on Raccoon Mountain. Flowing in a northwesterly direction for 11.9 km, the stream reaches its confluence with South Fork of Rockcastle River below McWhorter, Kentucky. The third order stream segment is 4.60 km in length. Extensive surface mining has been conducted along the slopes and in the headwaters of Raccoon Creek. Approximately 25% of the watershed above the stream site has been disturbed by mining. Deep mines were not indicated by topographic maps.

The stream sampling site was situated in a constricted section of floodplain to the east of the confluence of Slate Lick. Forest covers 50% of the watershed. The floodplain above the site is in pasture. A cattle crossing is located near the site. Taylor School Road parallels the east slope base. Riparian vegetation afforded 50-75% shade.

Raccoon Creek is a stream of low gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with slow flow. Substrate consisted of sand and clay with gravel and silt. Silt sedimentation was moderate. Some coalfines were present.

Table C39

Survey Site Physical Morphology and Percentage Substrate Composition in Raccoon Creek, Laurel County, Kentucky, 23/Jul/80.

Stream:	Width	2.38 m	Depth	.06 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	20	Sand	40
	Silt	10	Clay	30

Physicochemical analyses indicate Raccoon Creek to be impacted by mine drainage. Elevated levels for specific conductance and sulfates were observed. Iron and manganese, while slightly elevated, were within acceptable limits for unimpacted streams.

Table C40

Analytical Results for Certain Physicochemical Parameters Surveyed in Raccoon Creek, Laurel County, Kentucky, 23/Jul/80.

Temp °C	28	Specific Conductance (μmhos/cm)	475
Turbidity (NTU)	4.8 (Lab)	pH	8.0 (Field) 7.8 (Lab)
Dissolved Oxygen (mg/l)	8.4	Total Alkalinity (mg/l)	115.2
Total Acidity (mg/l)	10.0	Sulfates (mg/l)	189.0
Total Iron (mg/l)	.345	Total Manganese (mg/l)	.39

A cursory biotic survey revealed a benthic macroinvertebrate assemblage composed of ephemeropterans, trichopterans, coleopterans, odonates, dipterans including chironomids and tipulids, and gastropods. Fishes included the striped shiner (Notropis chrysocephalus), creek chubs (Semotilus atromaculatus), and green sunfish (Lepomis cyanellus).

Jones and Carter (1969) reported that although a quality fishery occurred earlier in Raccoon Creek, the fishery was now poor due to acid mine drainage and siltation from surface and shaft mines.

02025912

Little Raccoon Creek

Drainage System:	Rockcastle River
County:	Laurel
7.5 Min. Quadrangle Name:	London
Latitude:	37° 14' 25" N
Longitude:	84° 01' 48" W
Location:	at KY 578 bridge, .2 km east of junction with KY 30; near Greenmont, Kentucky
Survey Date:	23/Jul/80

Little Raccoon Creek heads in northcentral Laurel County at an elevation of 382.5 m. The stream flows in a northeasterly direction to its confluence with the South Fork of Rockcastle River above Greenmont, Kentucky. The third order segment is 4.25 km in length. Extensive surface mining has occurred in the Little Raccoon drainage. Surface mines are present on Freeman Branch above Twin Branch Road; along the west slope 2.5 to 7.1 km above the site; and on east slopes from 5.4 to 10.3 km above the site. Approximately 35% of the watershed surface has been disturbed by mining.

The stream sampling site was situated in a floodplain of relatively broad width. A small waterfall is located directly above the site where the stream dropped off limestone bedrock into a small pool. Forests cover 40% of the watershed. The floodplain is intensively farmed. KY 30 parallels the stream along the west slope base. Riparian vegetation afforded 50-75% shade.

Little Raccoon Creek is a stream of moderate gradient with a pool-riffle ratio of 80% pool to 20% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate largely consisted of gravel and cobble with bedrock. Silt sedimentation was slight to moderate.

Table C41

Survey Site Physical Morphology and Percentage Substrate Composition in Little Raccoon Creek, Laurel County, Kentucky, 23/Jul/80.

Stream:	Width	6.10 m	Depth	.24 m
Bottom Type (%):	Bedrock	20	Boulder	10
	Cobble	20	Rubble	10
	Gravel	30	Sand	5
	Silt	5	Clay	0

Physicochemical analyses indicate the presence of mining impact on the water quality of Little Raccoon Creek. Specific conductance, sulfates, and manganese were observed to be at elevated levels. Analysis of water from Freeman Branch at Twin Branch Road and a small tributary .1 km east revealed conductivity values of 700 µmhos/cm and 395 µmhos/cm respectively.

Table C42

Analytical Results for Certain Physicochemical Parameters Surveyed in Little Raccoon Creek, Laurel County, Kentucky, 23/Jul/80.

Temp °C	25	Specific Conductance (µmhos/cm)	900
Turbidity (NTU)	1.9 (Lab)	pH	7.3 (Field) 7.0 (Lab)
Dissolved Oxygen (mg/l)	6.4	Total Alkalinity (mg/l)	23.4
Total Acidity (mg/l)	5.2	Sulfates (mg/l)	624.0
Total Iron (mg/l)	.115	Total Manganese (mg/l)	.69

A cursory biotic survey revealed the presence of a rather depauperate fauna. Benthic macroinvertebrates were represented by chironomids, damselflies, and crayfish. Fishes included the striped shiner (Notropis chrysocephalus), rosefin shiner (Notropis ardens), and creek chub (Semotilus atromaculatus). Darters were conspicuously absent. The fishes collected are mobile and probably swim up into Little Raccoon Creek from the South Fork of Rockcastle River when mining impact is not exclusive.

Jones and Carter (1969) reported the fishery of Little Raccoon Creek to be impacted by mine drainage from old strip mines. The fishery of this stream is mostly confined to that stretch below KY 578.

02023912

Gravel Lick Branch

Drainage System:	Rockcastle River
County:	Jackson
7.5 Min. Quadrangle Name:	Sandgap
Latitude:	37° 26' 41" N
Longitude:	84° 06' 13" W
Location:	above Clover Bottom Creek Road ford, 5.3 km south off US 421; southwest of Sandgap, Kentucky
Survey Date:	8/Jul/80

Gravel Lick Branch heads in northwestern Jackson County against the Kentucky River divide at an elevation of 406.9 m. The stream flows in a general southwesterly direction to its confluence with Clover Bottom Creek. The third order segment is 2.53 km in length. Topographic maps reveal the presence of deep mines along an eastern tributary and at the head of Gravel Lick Branch, 3.2 and 4.4 km above the stream site, respectively. More recent surface mining has been conducted at these deep mine sites. In addition, surface mining has been conducted on the east slope of Gravel Lick Branch 3.5 km upstream. Approximately 10% of the surface has been disturbed by mining.

The stream sampling site was situated in a narrow floodplain with forested slopes rising to the east and west. Approximately 50% of the watershed is covered by forest. The stream sunk beneath a large rock about 61 m below the site. Gravel Lick Road parallels the west slope base. The floodplain is forested. Light agriculture is conducted on the floodplain 1.4 km upstream. Riparian vegetation afforded 50-75% shade.

Gravel Lick Branch is a stream of moderate gradient with a pool-riffle ratio of 70% pool to 30% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted largely of gravel and rubble with silt. Some coal was present. Silt sedimentation was moderate.

Table C43

Survey Site Physical Morphology and Percentage Substrate Composition in Gravel Lick Branch of Clover Bottom Creek, Jackson County, Kentucky, 8/Jul/80.

Stream:	Width	1.71 m	Depth	.12 m
Bottom Type (%):	Bedrock	0	Boulder	5
	Cobble	0	Rubble	20
	Gravel	60	Sand	0
	Silt	15	Clay	0

Physicochemical analyses indicate the water quality of Gravel Lick Branch to be marginally impacted by mine drainage. Sulfates were at a slightly elevated level. Dyer and Curtis (1977) found that sulfate levels may continue to increase after mining cessation for as long as 2 years. Specific conductance, iron, and manganese were within levels accepted for unimpacted streams.

Table C44

Analytical Results for Certain Physicochemical Parameters Surveyed in Gravel Lick Branch - Clover Bottom Creek, Jackson County, Kentucky, 8/Jul/80.

Temp °C	21	Specific Conductance (μmhos/cm)	207
Turbidity (NTU)	3.7 (Lab)	pH	6.7
Dissolved Oxygen (mg/l)	6.7	Total Alkalinity (mg/l)	33
Total Acidity (mg/l)	3.6	Sulfates (mg/l)	70.5
Total Iron (mg/l)	.425	Total Manganese (mg/l)	.03

A cursory biotic survey revealed the presence of trichopterans, plecopterans, riffle beetles, and creek chubs.

The small size and relative inaccessibility of Gravel Lick Creek to downstream invasion render its fishery to be nonexistent. Jones and Carter (1969) reported that Clover Bottom Creek is stocked in its lower reaches with trout by the U.S. Forest Service.

02022912

Crooked Creek

Drainage System:	Rockcastle River
County:	Rockcastle
7.5 Min. Quadrangle Name:	Livingston
Latitude:	37° 22' 03" N
Longitude:	84° 12' 43" W
Location:	at KY 1004 bridge 6.6 km above confluence with Roundstone Creek; near Great Saltpetre Cave
Survey Date:	23/Jul/80

Crooked Creek heads in northeastern Rockcastle County at an elevation of 394.7 m. The stream flows in a southerly direction to its confluence with Roundstone Creek near Mullins, Kentucky. The total stream length is 19.47 km with a third order segment 14.95 km in length. Topographic maps indicate the presence of deep mines at the head of Dry Fork and at the head of an unnamed stream which flows to the southeast. This stream and several others in the immediate area sink. A possible southeasterly-flowing underground tributary to Crooked Creek is suggested by surface topography. Surface mines are located along Crooked Creek 7.1 and 9.2 km above the site. Surface mines are also situated at the head of Dry Fork and the unnamed stream previously mentioned. Approximately 10% of the surface has been disturbed by mining.

The stream sampling site was situated in a floodplain of moderate width with forested slopes to the east and west. Approximately 70% of the watershed is forested. Riparian vegetation afforded 0-5% shade. The floodplain is lightly farmed. A cultivated field lies along the west floodplain above the site. KY 1004 crossed directly upstream. Gravel bars supporting thick growths of Justicia americana were located above the site.

Crooked Creek is a stream of low to moderate gradient with a pool-riffle ratio of 70% pool to 30% riffle. At the time of sampling, the stream was at low stage with slow flow. Substrate consisted largely of rubble and gravel with sand and silt. Silt sedimentation was slight to moderate. Some iron floculent was deposited along the shore.

Table C45

Survey Site Physical Morphology and Percentage Substrate Composition in Crooked Creek, Rockcastle County, Kentucky, 23/Jul/80.

Stream:	Width	3.26 m	Depth	.12 m
Bottom Type (%):	Bedrock	0	Boulder	5
	Cobble	5	Rubble	40
	Gravel	30	Sand	10
	Silt	10	Clay	0

Physicochemical analyses indicate Crooked Creek to be of good water quality. Specific conductance, sulfates, iron, and manganese were at levels consistent with unimpacted streams.

Table C46

Analytical Results for Certain Physicochemical Parameters Surveyed in Crooked Creek, Rockcastle County, Kentucky, 23/Jul/80.

Temp °C	26	Specific Conductance (μmhos/cm)	235
Turbidity (NTU)	2.4 (Lab)	pH	8.0 (Field) 7.7 (Lab)
Dissolved Oxygen (mg/l)	6.7	Total Alkalinity (mg/l)	100.4
Total Acidity (mg/l)	6.0	Sulfates (mg/l)	17.1
Total Iron (mg/l)	.21	Total Manganese (mg/l)	.05

A cursory biotic survey revealed a bottom fauna of tipulid larvae, riffle beetles, gastropods, and decapods. Fishes collected include the smallmouth bass, stoneroller, common shiner, rosefin shiner, and darters.

Jones and Carter (1969) reported the fishery of Crooked Creek as fair for smallmouth and rock bass. Jones and Carter stated that this stream carried a moderate silt load. Trout have been stocked in the past. Rockcastle County conservation officer Freddie Noe (pers. comm.) considered the fishery of Crooked Creek to be good and unimpacted by mining. Smallmouth bass, panfish, suckers are of prime interest.

02019912

Powder Mill Creek

Drainage System:	Rockcastle River
County:	Laurel
7.5 Min. Quadrangle Name:	London SW
Latitude:	37° 07' 14" N
Longitude:	84° 09' 25" W
Location:	at County Farm Spur bridge .9 km east of junction with KY 1535; southeast of Bernstadt, Kentucky
Survey Date:	23/Jul/80

Powder Mill Creek heads in central Laurel County at an elevation of 362.7 m. The stream flows in a southerly direction to its confluence with Sinking Creek west of London, Kentucky. The third order stream segment is 5.05 km in length. Small surface mines were indicated by topographic maps to be located at the head of Powder Mill Creek. Less than 5% of the surface has been disturbed by mining.

The stream sampling site was situated in a narrow entrenched floodplain. Slopes to the east and west were steep and forested. Approximately 40% of the watershed is forested. Uplands along the stream course are relatively flat and are intensively farmed. A log jam blocked flow downstream from the site. Riparian vegetation afforded 75-100% shade.

Powder Mill Creek is a stream of low to moderate gradient with a pool-riffle ratio of 70% pool to 30% riffle. At the time of sampling, the stream was at low stage with slow flow. Substrate in pools consisted of bedrock overlain by sand and silt. Riffle substrate consisted of rubble and gravel with cobbles and boulders. Silt sedimentation was moderate to heavy.

Table C47

Survey Site Physical Morphology and Percentage Substrate Composition in Powder Mill Creek, Laurel County, Kentucky, 23/Jul/80.

Stream:	Width	3.29 m	Depth	.15 m
Bottom Type (%):	Bedrock	0	Boulder	5
	Cobble	5	Rubble	10
	Gravel	10	Sand	40
	Silt	30	Clay	0

Physicochemical analyses indicate Powder Mill Creek to be impacted by mine drainage. Sulfates and manganese levels were observed to be elevated. Acidity exceeded alkalinity; pH was depressed.

Table C48

Analytical Results for Certain Physicochemical Parameters Surveyed in Powder Mill Creek, Laurel County, Kentucky, 23/Jul/80.

Temp °C	21	Specific Conductance (μmhos/cm)	227
Turbidity (NTU)	6.4 (Lab)	pH	5.3 (Field) 5.1 (Lab)
Dissolved Oxygen (mg/l)	7.5	Total Alkalinity (mg/l)	3.8
Total Acidity (mg/l)	6.4	Sulfates (mg/l)	105
Total Iron (mg/l)	.33	Total Manganese (mg/l)	2.63

A cursory biotic survey revealed the presence of ephemeropterans, riffle beetles, tipulid larvae, odonates, chironomids, and decapods. Fishes were not observed.

02008912

Devils Creek

Drainage System:	Big South Fork Cumberland River
County:	McCreary
7.5 Min. Quadrangle Name:	Barthell
Latitude:	36° 40' 25" N
Longitude:	84° 32' 59" W
Location:	opposite Blue Heron, Kentucky, on Big South Fork of Cumberland River; 12.2 km west on KY 742 from junction with KY 92
Survey Date:	16/Jul/80

Devils Creek heads in southcentral McCreary County at an elevation of 394.7 m. The stream flows initially in a northward direction towards Devils Knob, whence it swings easterly to its confluence with the Big South Fork of Cumberland River opposite Blue Heron, Kentucky, the site of a once active mining center. This section of the Big South Fork of Cumberland River has been designated as a Wild River. The third order stream segment is 1.61 km in length. Deep mines connected by narrow gage railroad are scattered along the Big South Fork from river mile 44.3 to 47.4. These mines were serviced by tipple operations at Blue Heron.

The stream sampling site was situated at the mouth of the Devils Creek floodplain. The stream crosses a gravel bar to its confluence. The floodplain is narrow with steep forested slopes rising to the north and south. Narrow gage railroad tracks cross the stream .2 km above the site. The floodplain is sparsely populated with light agriculture confined to an area 1.6 km above the site. Riparian vegetation afforded 50-75% shade.

Devils Creek is of low to moderate gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with slow flow. Substrate consisted largely of sand, rubble, gravel, and silt. Sedimentation in the form of silt and yellowboy was moderate.

Table C49

Survey Site Physical Morphology and Percentage Substrate Composition in Devils Creek, McCreary County, Kentucky, 16/Jul/80.

Stream:	Width	2.35 m	Depth	.16 m
Bottom Type (%):	Bedrock	0	Boulder	5
	Cobble	5	Rubble	30
	Gravel	10	Sand	40
	Silt	10	Clay	0

Physicochemical analyses indicate Devils Creek to be severely impacted by mine drainage. Elevated values for specific conductance, sulfates, iron and manganese were observed. Acidity exceeded alkalinity while pH was depressed.

Table C50

Analytical Results for Certain Physicochemical Parameters Surveyed in Devils Creek, McCreary County, Kentucky, 16/Jul/80.

Temp °C	25	Specific Conductance (μmhos/cm)	890
Turbidity (NTU)	9.5 (Lab)	pH	3.1 (Lab)
Dissolved Oxgen (mg/l)	-	Total Alkalinity (mg/l)	0
Total Acidity (mg/l)	86.2	Sulfates (mg/l)	371.0
Total Iron (mg/l)	6.29	Total Manganese (mg/l)	8.01

A cursory biotic survey revealed a depauperate community. Benthic organisms included single specimens of water pennies and crayfish. Fish were not present.

The fishery of Devils Creek is poor to nonexistent due to acid impact in the lower section. Jones and Carter (1969) noted that the Big South Fork of Cumberland River receives pollution from strip mines in Tennessee and acid drainage from abandoned mines in Kentucky. The South Fork was formerly known for its walleye and white bass runs. Recently the Kentucky Department of Fish and Wildlife has attempted to restore the walleye fishery in this stream. Initial reports appear promising. Fishing is considered fair for black basses and catfishes. Jones and Carter (1969) stated that the Big South Fork is one of the best streams in the Cumberland River drainage.

Big Sandy River Basin - Water Quality. A summary of physicochemical parameters surveyed in the Big Sandy drainage is presented in Table 22. A total of 22 streams were sampled, of which 17 streams were found to be impacted by mine drainage.

The Appalachian Regional Commission (1969) reported streams in the Big Sandy Basin as highly mineralized, although they are not characterized by high acidity concentrations. Our results appear to verify these observations. Generally, it may be stated that (1) mining impacted third order streams in the Big Sandy Basin exhibit elevated alkalinity, sulfates, metals, and specific conductance and (2) they are not seriously impacted by acid mine drainage.

Third order streams most severely impacted by mine drainage include: Lick Fork of Left Fork Middle Creek (Floyd County), Middle Fork Rockcastle Creek and Emily Creek (Martin County), and Johns Creek (Pike County).

Big Sandy River Basin - Fishery Evaluation. A total of 125 third order streams representing 413.8 stream miles in 10 counties were evaluated for their fishery potential. Generally, third order streams in the Big Sandy Basin are too shallow to support significant fisheries except at their confluence with higher order streams. Third order streams for the most part serve as sources of baitfish and suckers and as possible spawning and nursery sites. Of the streams evaluated, conservation officers considered 53 streams (42%) to be poor, 26 streams (21%) to be fair, 12 streams (10%) to be good, and 1 stream (1%) to be excellent. Third order streams considered to be supporting good or excellent sport fisheries and high quality streams from Evenhuis (1973) are listed in Table 23. Streams of poor to fair fishery quality are listed in Table 24. Russell Fork (Pike County) and Hood Creek (Johnson County) are stocked with trout (Kentucky Department of Fish and Wildlife, pers. comm.).

Approximately 222 miles of third order streams are considered by conservation officers to be impacted by mine drainage. Of this total, 69% of the mileage is impacted by siltation, 21% is impacted by acid, and 10% is impacted by both siltation and acid. Blackwater is reported to occur in six streams.

Table 22

Summary of Mean and Range Data for Physicochemical Parameters Surveyed in Third Order Streams in the Big Sandy River Basin

	Impacted (17)		Unimpacted (5)	
Parameter	Mean	Range	Mean	Range
pH	7.2	3.1-8.5	7.1	6.6-7.6
Alkalinity (mg/l $CaCO_3$)	108.1	0-338.0	80.6	40.0-153.0
Acidity (mg/l)	20.8	0-346.0	5.0	1.6-8.6
Sulfates (mg/l)	296.0	50.6-966.0	19.7	14.1-29.7
Total Iron (mg/l)	2.66	0.06-30.7	1.38	0.40-3.05
Total Manganese (mg/l)	0.88	0.02-6.5	0.52	0.07-0.81
Specific Conductance (μmhos/cm)	726	281-2288	231	135-390

( ) Number of streams surveyed

Table 23

Sports Fisheries Streams Rated as Good to Excellent in the Big Sandy River Basin

River Basin	County	Stream
Big Sandy	Pike	Russell Fork*
	Knott	Right Fork Beaver Ck.
		Saltlick Ck.
	Johnson	Hood Ck.*
		Paint Ck.*
	Martin	Rockcastle Ck.*
		Middle Fork of Rockcastle Ck.
		Wolf Ck.
		Pigeonroost Fk.
	Lawrence	Blaine Ck.*
		Cat Fork
		Hood Ck.*
		Rockcastle Ck.*
	Boyd	Bear Ck.
		Chadwick Ck.
		Durbin Ck.

*Streams higher than third order rated by Evenhuis (1973) as high quality fishing streams.

Table 24

Third Order Streams with Fair to Poor Fisheries in the Big Sandy River Basin with an Assessment of Mining Impact

River Basin	County	Stream	Fishery		Mining Impact		
			Fair	Poor	Silt	Acid	None
Big Sandy	Letcher	Elkhorn Ck.		x	x		
	Knott	Bill D Br., Right Fork, Beaver Ck.	x		x		
		Caney Fork, Right Fork, Beaver Ck.	x		x	x	
		Jones Fork, Right Fork, Beaver Ck.	x		x		
	Pike	Andy Trenh Br., Tug Fork.		x	x		
		Beefhide Ck.		x	x		
		Big Ck.		x	x		
		Blackberry Fork, Pond Ck.		x	x		
		Brushy Fork, Johns Ck.		x	x		
		Buffalo Ck.		x	x		
		Caney Ck.		x	x		
		Caney Fork, Johns Ck.		x	x		
		Feds Creek		x	x		
		Ferrel Ck.		x	x	(and blackwater)	
		Greasy Ck.		x	x		
		Indian Ck.		x	x		
		Johns Ck.		x	x		
		Left Fork, Blackberry Ck.		x			x
		Left Fork, Long Ck.	x				x
		Left Fork, Peter Ck.	x				x
		Lick Ck.		x		x	
		Long Fk., Shelby Ck.	x				x
		Lower Chloe Ck.	x				x
		Lower Elk Ck.		x	x		
		Meathouse Fk., Johns Ck.	x			x	

Table 24 continued

River Basin	County	Stream	Fishery Fair	Fishery Poor	Mining Impact Silt	Mining Impact Acid	Mining Impact None
Big Sandy	Pike (continued)	Mullen Fork, Pond Ck.		x			x
		Pond Ck.		x		x	
		Right Fork, Blackberry Ck.	x			x	
		Right Fork, Peter Ck.	x			x	
		Road Fork, Pond Ck.	x			x	
		Robinson Ck.		x		x	
		Shelby Ck.	x			x	
		Smith Fork, Right Fork, Peter Ck.		x		x	
		Sycamore Ck.	x		x		
	Floyd	Abbott Ck.	x				x
		Arkansas Ck.		x			x
		Left Fork, Beaver Ck.		x	Blackwater		
		Buffalo Ck.		x	x		
		Bull Ck.		x	x		
		Cow Ck.		x	x		
		Frasure Ck.		x			x
		Jacks Ck.		x			x
		Left Fork, Middle Ck.		x		x	
		Little Mud Ck.		x	x (and blackwater)		
		Little Paint Ck.		x			x
		Mare Ck.		x	x		
		Middle Ck.	x				x
		Mud Ck.		x	x (and blackwater)		
		Prater Ck.		x	x		
		Salt Lick Ck.		x			x
		Spurlock Ck.		x			x
		Toler Ck.		x	x		
	Morgan	Lacey Ck.		x			x
		Smith Creek		x	x		
		Upper Sandlick Ck.		x	x		

Table 24 continued

River Basin	County	Stream	Fishery Fair	Fishery Poor	Mining Impact Silt	Mining Impact Acid	Mining Impact None
Big Sandy	Magoffin	Big Mine Fork, Litteral Fork		x			x
	Lawrence	Bear Ck.	x				x
		Brushy Ck.	x				x
		Cains Ck.		x	x		
		Cherokee Ck.	x				x
		Cooksey Fork, Cat Fork		x			x
		Evans Fork, Nat Ck.		x	x		
		Greenbrier Ck.		x			x
		Irish Ck.	x				x
		Left Fork, Little Blaine Ck.		x			x
		Left Fork, Nats Ck.		x	x		
		Lick Ck.	x				x
		Little Cat Fork, Cat Fork		x			x
		Morgan Ck.		x			x
		Nats Ck.		x			x
		Rich Ck.		x			x
		Burgess Fork, Griffith Ck.		x			x
		Right Fork, Georges Ck.		x	x		
		Right Fork, Little Blaine Ck.	x				x
		Roe Ck.	x				x
		Two Mile Ck.		x			x
		Upper Laurel Ck.		x			x
		Upper Twin Branch, Blaine Ck.	x				x
	Boyd	Upper Chadwick Ck.	x				x
	Martin	Coldwater Fork, Rockcastle Ck.		x	x		
		Emily Ck.	x				x
		Laurel Fork, M. Fork, Rockcastle Ck.		x	x		

Table 24 continued

River Basin	County	Stream	Fishery		Mining Impact		
			Fair	Poor	Silt	Acid	None
Big Sandy	Martin (continued)	Magnard Fork, Wolf Ck.		x	x		
		Petercave Fork, Pigeon Roost Fk.		x			x
		Rockhouse Fork, Rockcastle Ck.		x	x		
		Stafford Fork, Rockhouse Ck.		x			x
	Johnson	Barnetts Ck.		x			x
		Buffalo Ck.		x	x	x	
		Greasy Ck.	x		x		
		Jerrys Ck.	x		x		
		Little Paint Ck.		x			x
		Mudlick Ck.		x			x
		Right Fork, Daniels Ck.		x	x	x	
		Toms Ck.		x	unknown		

01030912

Feds Creek

Drainage System:	Levisa Fork - Big Sandy River
County:	Pike
7.5 Min. Quadrangle Name:	Jamboree
Latitude:	37° 24' 02" N
Longitude:	82° 14' 23" W
Location:	on KY 366 1 km east of junction with US 460 at Feds Creek, Kentucky
Survey Date:	26/Jun/80

Feds Creek is formed in eastcentral Pike County by the confluence of Dicks Fork and Jones Fork, which rise against the Tug Fork and Rocklick Creek divides, respectively. Flowing in a westerly direction from an elevation of 350.5m, Feds Creek reaches its confluence with the Levisa Fork at the community of Feds Creek, Kentucky. The third order segment of this stream is 6.44 km in length. Topographic maps reveal scattered underground mines along headwater areas. Aerial surveys indicate both recent and revegetated contour surface mining areas on the south slope of the watershed. Approximately 5% of the surface is disturbed by mining. An active underground mine is located on the south slope at the stream site.

The stream at the sample site flows through a floodplain of moderate width. A railroad track follows the stream along its south bank to 1.6 km above the mouth. KY 366 parallels the stream along its northern bank. An inactive coal tipple is located between the south slope and the stream. Coal refuse covers the south bank. Slopes to the north and south are forested. Approximately 60% of the watershed is in forest. Riparian vegetation affords 25-50% shade at the site.

Feds Creek is a high gradient stream with a pool-riffle ratio of 30% pool to 70% riffle. At the time of sampling, the stream was at low stage with fast velocity. Substrate was predominately bedrock with rubble and sand. Silt sedimentation was slight.

Table BS1

Survey Site Physical Morphology and Percentage Substrate Composition in Feds Creek, Pike County, Kentucky, 26/Jun/80.

Stream:	Width	3.96 m	Depth	.10 m
Bottom Type (%):	Bedrock	70	Boulder	0
	Cobble	0	Rubble	25
	Gravel	0	Sand	5
	Silt	0	Clay	0

Physicochemical analyses reveal that Feds Creek is impacted by mine drainage. Specific conductance and sulfates were elevated. Iron and manganese concentrations were not elevated. Dyer and Curtis (1977) noted that levels of these cations return to normal about one year after cessation of mining.

Table BS2

Analytical Results for Certain Physicochemical Parameter Surveyed in Feds Creek, Pike County, Kentucky, 26/Jun/80.

Temp °C	18	Specific Conductance (μmhos/cm)	638
Turbidity (NTU)	1.3	pH	8.4 (Field) 8.2 (Lab)
Dissolved Oxygen (mg/l)	9.3	Total Alkalinity (mg/l)	99.0
Total Acidity (mg/l)	5.4	Sulfates (mg/l)	269.0
Total Iron (mg/l)	.06	Total Manganese (mg/l)	.02

A cursory biotic survey revealed the presence of stoneflies, mayflies, snails and minnows.

The small size of Feds Creek, coupled with silt pollution, render this stream a poor fishery. Primary warmwater species caught are suckers and minnows (William Deskins - Pike County Conservation Officer, pers. comm.).

01028912

Lick Creek

Drainage System:	Levisa Fork - Big Sandy River
County:	Pike
7.5 Min. Quadrangle Name:	Lick Creek
Latitude:	37° 23' 56" N
Longitude:	82° 18' 15" W
Location:	on KY 1373 2.4 km north of junction with US 460
Survey Date:	26/Jun/80

Lick Creek heads in southcentral Pike County at an elevation of 463.3 m. Flowing northward, Lick Creek discharges into Fishtrap Reservoir near the community of Lick Creek, Kentucky. The third order segment of Lick Creek is 4.6 km in length. Topographic maps and aerial surveys reveal extensive surface mining in the headwaters and along Schoolhouse and Riles Forks. A coal haul road is located .23 km above the site.

The stream at the survey site flows through a relatively narrow floodplain. Trees and shrubs lining the banks afforded 25-50% shade. Lick Creek Road follows the stream and lies to the east. Slopes to the east and west are steep and forested.

Lick Creek is a high gradient stream with a pool-riffle ratio of 20% pool to 80% riffle. At the time of sampling, the stream was at low stage with fast velocity. The substrate was predominately bedrock with cobble, rubble and gravel. Sedimentation was slight to moderate in pools and was composed of silt with a small amount of coalfines.

Table BS3

Survey Site Physical Morphology and Percentage Substrate Composition in Lick Creek, Pike County, Kentucky, 26/Jun/80.

Stream:	Width	4.27 m	Depth	.22 m
Bottom Type (%):	Bedrock	40	Boulder	5
	Cobble	10	Rubble	20
	Gravel	15	Sand	5
	Silt	5	Clay	0

Water quality analyses indicate that this stream is affected by coal mining activities. Elevated values of specific conductance, iron and sulfates were found. Manganese was not elevated.

Table BS4

Analytical Results for Certain Physicochemical Parameters Surveyed in Lick Creek, Pike County, Kentucky, 26/Jun/80.

Temp °C	19	Specific Conductance (μmhos/cm)	627
Turbidity (NTU)	1.3	pH	8.5 (Field) 8.1 (Lab)
Dissolved Oxygen (mg/l)	9.3	Total Alkalinity (mg/l)	112
Total Acidity (mg/l)	3.0	Sulfates (mg/l)	310.0
Total Iron (mg/l)	.80	Total Manganese (mg/l)	.03

A cursory biotic survey at the site revealed the presence of stoneflies, crayfish and minnows.

Lick Creek supports a poor warmwater fishery due to its small size and acid mining impact (Don Bevins, Pike County conservation officer, pers. comm.).

01032912

Elkhorn Creek

Drainage System:	Levisa Fork - Big Sandy River
County:	Pike
7.5 Min. Quadrangle Name:	Jenkins E.
Latitude:	37° 14' 11" N
Longitude:	82° 31' 12" W
Location:	on KY 197 .46 km above confluence with Pigeon Branch near Hylton, Kentucky
Survey Date:	26/Jun/80

Elkhorn Creek heads against the Kentucky River divide at an elevation of 548.6 m in eastern Letcher County. Flowing northeasterly for 34.8 km, Elkhorn Creek reaches its confluence with Russell Fork at Elkhorn City, Kentucky in southcentral Pike County. The third order segment of this stream is 13.0 km in length. Extensive surface mines (Beth - Elkhorn, Jenkins Mine) and coal related facilities are located in the headwaters of Elkhorn Creek centered around the city of Jenkins, Kentucky. Numerous deep mines are scattered along tributaries above the survey site. The Levisa Stone Corporation quarry is 9.7 km upstream from the site. Approximately 30% of the surface has been disturbed by mining and quarry activities.

The stream sampling site was in a narrow, winding floodplain with steep, forested slopes rising to the north and south. Pine Mountain rises to the south. Approximately 50% of the watershed above the site is in forest. A ford is located immediately upstream. Riparian vegetation afforded 0-5% shade.

Elkhorn Creek is a stream of moderate to high gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream stage was low with fast flow. Substrate was predominantly rubble with gravel, sand, and silt. Silt sedimentation was moderate.

Table BS5

Survey Site Physical Morphology and Percentage Substrate Composition in Elkhorn Creek, Pike County, Kentucky, 26/Jun/80.

Stream:	Width	7.62 m	Depth	.14 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	70
	Gravel	20	Sand	5
	Silt	5	Clay	0

Physicochemical analyses indicate that Elkhorn Creek is impacted by mine drainage. Elevated specific conductance and sulfate values were observed. Iron and manganese levels were not elevated. Dyer and Curtis (1977) found that these cations return to normal levels about one (1) year after cessation of mining.

Table BS6

Analytical Results for Certain Physicochemical Parameters Surveyed in Elkhorn Creek, Pike County, Kentucky, 26/Jun/80.

Temp °C	19	Specific Conductance (μmhos/cm)	560
Turbidity (NTU)	1.6	pH	8.0 (Field) 8.0 (Lab)
Dissolved Oxygen (mg/l)	9.3	Total Alkalinity (mg/l)	185.0
Total Acidity (mg/l)	7.0	Sulfates (mg/l)	104.0
Total Iron (mg/l)	.265	Total Manganese (mg/l)	.04

A cursory biotic survey revealed the presence of mayflies, stoneflies, blackflies, crayfish and a leech. No fish were observed. Many large dead crayfish were observed.

Elkhorn Creek formerly supported a high quality fishery. Today the fishery in this stream is considered fair due to silt pollution from surface mining and quarry activities. Fish kills have occurred in recent years. Primary species sought are smallmouth bass, sucker, catfish, and trout which are stocked in early spring (William Deskins, Pike County conservation officer, pers. comm).

01026914

Shelby Creek

Drainage System:	Levisa Fork - Big Sandy River
County:	Pike
7.5 Min. Quadrangle Name:	Dorton
Latitude:	37° 17' 13" N
Longitude:	82° 35' 37" W
Location:	on US 23/119 .6 km southeast of Myra, Kentucky
Survey Date:	26/Jun/80

Shelby Creek heads on the north face of Shelby Gap at an elevation of 420.6 m in southwestern Pike County. Shelby Gap is utilized both as a railroad and highway corridor to the south through the mountains. Flowing in a general northeasterly direction, Shelby Creek reaches its confluence with Levisa Fork at Shelbiana, Kentucky. The stream is 42.3 km in total length with a third order segment length of 5.75 km. Numerous deep mines and gas wells are indicated above the survey site on topographic maps. Aerial surveys reveal that approximately 30% of the surface above the stream site had been disturbed by strip mining.

The stream at the survey site flows through a floodplain of moderate width. Steep, forested slopes rise to the east and west. Approximately 50% of the watershed is in forest. Riparian vegetation affords 25-50% shade. The west bank is rather steep; US 23 parallels the stream at the base of the west slope. A railroad track parallels the stream on the east side of the floodplain. The community of Dorton is located 1.84 km upstream.

Shelby Creek is a stream of moderate to high gradient with a pool-riffle ratio of 50% pool to 50% riffle. At the time of sampling, Shelby Creek was at low stage with moderate flow. Substrate was composed of rubble, gravel, and silt. Silt sedimentation was moderate with a small amount of yellowboy present.

Table BS7

Survey Site Physical Morphology and Percentage Substrate Composition in Shelby Creek, Pike County, Kentucky, 26/Jun/80.

Stream:	Width	3.54 m	Depth	.10 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	40
	Gravel	30	Sand	0
	Silt	30	Clay	0

Physicochemical analyses indicate that Shelby Creek is impacted by mine drainage. Elevated values for specific conductance and sulfates were observed. Iron and manganese concentrations were not elevated. Dyer and Curtis (1977) found these cations returned to normal levels about one (1) year after cessation of mining.

Table BS8

Analytical Results for Certain Physicochemical Parameters Surveyed in Shelby Creek, Pike County, Kentucky, 26/Jun/80.

Temp °C	19	Specific Conductance (μmhos/cm)	437
Turbidity (NTU)	2.0	pH	7.6 (Field) 7.8 (Lab)
Dissolved Oxygen (mg/l)	9.3	Total Alkalinity (mg/l)	128
Total Acidity (mg/l)	5.8	Sulfates (mg/l)	80.0
Total Iron (mg/l)	.40	Total Manganese (mg/l)	.10

A cursory biotic survey revealed the presence of stoneflies, caddisflies, mayflies, and crayfish.

Pike County conservation officer Don Bevins (pers. comm.) considered the Shelby Creek fishery to be fair, although impacted by acid drainage. The stream serves as a baitfish source. Evenhuis (1973) noted that the sport fishery potential of Shelby Creek was reduced by acid drainage and for the most part it was non-existent except in lower sections during periods of no acid flow.

01026913

Beefhide Creek

Drainage System:	Levisa Fork - Big Sandy River
County:	Pike
7.5 Min. Quadrangle Name:	Dorton
Latitude:	37° 17' 14" N
Longitude:	82° 36' 06" W
Location:	on Beefhide Creek Road .2 km southwest of junction with US 23/119 at Myra, Kentucky
Survey Date:	26/Jun/80

Beefhide Creek is formed by the confluence of Andy Wright and Middle Forks in southwestern Pike County at an elevation of 390.1 m. Flowing in a northeasterly direction, Beefhide Creek reaches its confluence with Shelby Creek at Myra, Kentucky. The third order segment of this stream is 6.33 km in length. Topographic maps and aerial surveys reveal extensive surface mining activity in this watershed, 20% of the surface being disturbed. Several underground mines are indicated on Orchard Branch, 1.6 km above the site with scattered mines along headwater areas.

The stream at the survey site flows against the base of a steep, forested north-facing slope. Beefhide Creek Road follows the north bank. The moderately wide floodplain supports light agriculture and other human related activities accounting for 20% of the watershed surface usage. A gas pumping station and adjoining trailer court are located across from the site on the north side of the floodplain. South-facing slopes are steep and forested. Riparian vegetation affords 5-25% shade at the site.

Beefhide Creek is a moderate gradient stream with a pool-riffle ratio of 50% pool to 50% riffle. At the time of sampling, the stream was at low stage with moderately fast flow. Substrate was composed of rubble, gravel and sand. Silt sedimentation was slight.

Table BS9

Survey Site Physical Morphology and Percentage Substrate Composition in Beefhide Creek, Pike County, 26/Jun/80.

Stream:	Width	5.03 m	Depth	.12 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	40
	Gravel	40	Sand	20
	Silt	0	Clay	0

Physicochemical analyses indicate that Beefhide Creek is impacted by mine drainage. Elevated specific conductance and sulfate values were observed. Values for iron and manganese were not elevated. Dyer and Curtis (1977) noted that iron and manganese levels return to normal about one (1) year after cessation of mining.

Table BS10

Analytical Results for Certain Physicochemical Parameters Surveyed in Beefhide Creek, Pike County, Kentucky, 26/Jun/80.

Temp °C	20	Specific Conductance (µmhos/cm)	539
Turbidity (NTU)	1.2	pH	7.9 (Field) 8.0 (Lab)
Dissolved Oxygen (mg/l)	9.2	Total Alkalinity (mg/l)	164
Total Acidity (mg/l)	7.4	Sulfates (mg/l)	155.0
Total Iron (mg/l)	.10	Total Manganese (mg/l)	.03

A cursory biotic survey revealed the presence of caddisflies, mayflies, stoneflies, and chironomids. Fishes collected included the rainbow darter (Etheostoma caeruleum), sand shiner (Notropis stramineus), creek chub (Semotilus atromaculatus), silverjaw minnow (Ericymba buccata), and white sucker (Catostomus commersoni). The rainbow darter, sand shiner, and silverjaw minnow are fishes most often associated with clear permanently flowing streams with sand, gravel and rubble bottoms (Smith 1979). These fishes are usually precluded from streams with heavy silt accumulations. The silverjaw minnow can tolerate some pollution and even mine wastes (Smith 1979).

Pike County conservation officer William Deskins (pers. comm.) considered the Beefhide Creek fishery to be poor and impacted by silt. Silt sedimentation was not serious at the site surveyed for this report.

01026912

Caney Creek

Drainage System:	Levisa Fork - Big Sandy River
County:	Pike
7.5 Min. Quadrangle Name:	Dorton
Latitude:	37° 21' 10"
Longitude:	82° 33' 16"
Location:	at old KY 611 bridge; 1 km south of KY 611-1496 junction at Penny, Kentucky
Survey Date:	26/Jun/80

Caney Creek arises at the confluence of Pine Fork and Flat Fork at an elevation of 350.5 m in southwestern Pike County. Flowing in a northerly direction, Caney Creek reaches its confluence with Shelby Creek at Penny, Kentucky. The third order segment of this stream is 6.95 km in length. Several underground mines are scattered along headwater areas, as indicated by topographic maps. Aerial surveys reveal extensive active surface mining on Rob Fork (Beth-Elkhorn #29 Mine) with scattered surface mines in headwater areas. Approximately 30% of this watershed has been disturbed by surface mining.

The stream at the survey site flows through a floodplain of moderate width. The site was located just above the KY 611 bridge. A four-lane extension of US 23 has been constructed from Robinson Creek, Kentucky, up the Shelby and Caney Creek valleys to Dorton Creek. This highway parallels Caney Creek to the east. Steep, forested slopes rise to the east and west. Forests cover approximately 50% of the watershed surface. Riparian vegetation affords 25-50% shade at the site.

Caney Creek is a stream of moderate to high gradient with a pool-riffle ratio of 30% pool to 70% riffle. At the time of sampling, the stream was at low stage with fast velocity. Substrate was cobble with rubble, gravel, sand and silt. Silt sedimentation was moderate. Some yellowboy was scattered along the shore.

Table BS11

Survey Site Physical Morphology and Percentage Substrate Composition in Caney Creek, Pike County, Kentucky, 26/Jun/80.

Stream:	Width	3.57 m	Depth	.19 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	40	Rubble	20
	Gravel	10	Sand	10
	Silt	20	Clay	0

Physicochemical analyses indicate that Caney Creek is impacted by mine drainage. Elevated values for specific conductance and sulfates were observed. Values for iron and manganese were not elevated. Dyer and Curtis (1977) noted that iron and manganese levels return to normal about one (1) year after cessation of mining.

Table BS12

Analytical Results for Certain Physicochemical Parameters Surveyed in Caney Creek, Pike County, Kentucky, 26/Jun/80.

Temp °C	18	Specific Conductance (μmhos/cm)	513
Turbidity (NTU)	1.6	pH	7.2 (Lab)
Dissolved Oxygen (mg/l)	8.5	Total Alkalinity (mg/l)	142
Total Acidity (mg/l)	10.8	Sulfates (mg/l)	120.0
Total Iron (mg/l)	.10	Total Manganese (mg/l)	.10

A cursory biotic survey revealed the presence of mayflies, stoneflies, caddisflies, blackflies, crayfish, longear sunfish (Lepomis megalotis) and cyprinids.

Pike County conservation officer William Deskins (pers. comm.) reported that Caney Creek formerly supported a high quality fishery. Today a poor fishery exists with largemouth bass, panfish, sucker and catfish the primary species sought. Silt pollution from mining and road construction is having some affect on the fishery.

01025912

Island Creek

Drainage System:	Levisa Fork - Big Sandy River
County:	Pike
7.5 Min. Quadrangle Name:	Pikeville
Latitude:	37° 27' 06" N
Longitude:	82° 32' 11" W
Location:	on Island Creek Road 1.8 km southwest of junction with KY 1426 at Titan Landing, Kentucky
Survey Date:	26/Jun/80

Island Creek heads at an elevation of 365.8 m in westcentral Pike County. Flowing northeastwards, Island Creek reaches its confluence with Levisa Fork at Titan Landing, Kentucky. The third order segment of this stream is 5.05 km in length. Numerous underground mines above the survey site are revealed on topographic maps. About 30% of the headwater areas of Island Creek have been disturbed by surface mining.

The stream at the sampling site flows through a floodplain of moderate width on which light agriculture is conducted; numerous dwellings are scattered along the stream course. Steep, forested slopes rise to the north and south covering 55% of the watershed surface. Island Creek Road parallels the stream along the north bank. Riparian vegetation afforded 5-25% shade at the sampling site. A coal refuse disposal pile is located on the north bank directly above the site.

Island Creek is a moderate gradient stream with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with moderate velocity. Substrate consisted of gravel, sand, and silt. Sedimentation of silt was considered moderate.

Table BS13

Survey Site Physical Morphology and Percentage Substrate Composition in Island Creek, Pike County, Kentucky, 26/Jun/80.

Stream:	Width	4.51 m	Depth	.10 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	40	Sand	40
	Silt	20	Clay	0

Physicochemical analyses indicate that Island Creek is impacted by mine drainage. Elevated values for specific conductance and sulfates were observed. Values for iron and manganese were not elevated. Dyer and Curtis (1977) noted that iron and manganese levels return to normal about one (1) year after cessation of mining.

Table BS14

Analytical Results for Certain Physicochemical Parameters Surveyed in Island Creek, Pike County, Kentucky, 26/Jun/80.

Temp °C	18	Specific Conductance (μmhos/cm)	445
Turbidity (NTU)	1.4	pH	7.4 (Lab)
Dissolved Oxygen (mg/l)	7.5	Total Alkalinity (mg/l)	142
Total Acidity (mg/l)	6.8	Sulfates (mg/l)	208.0
Total Iron (mg/l)	.33	Total Manganese (mg/l)	.25

A cursory biotic survey at the site revealed the presence of crayfish and minnows. Attached filamentous algae were growing in the riffles.

Pike County conservation officer William Deskins (pers. comm.) considered the fishery of Island Creek to be fair for suckers.

01021912

Arkansas Creek

Drainage System:	Levisa Fork - Big Sandy River
County:	Floyd
7.5 Min. Quadrangle Name:	Harold
Latitude:	37° 34' 30" N
Longitude:	82° 43' 57" W
Location:	on Arkansas Creek Road .5 km south of junction with KY 80 1.5 km east of Martin, Kentucky
Survey Date:	25/Jun/80

Arkansas Creek heads in southcentral Floyd County at an elevation of 335.3 m. The stream flows in a northwesterly direction to its confluence with Beaver Creek east of Martin, Kentucky. Numerous deep mines are located along the lower and middle sections of Arkansas Creek with a few mines scattered in the headwaters. Extensive surface mining has been conducted in the Cane Fork drainage. Approximately 20% of the surface has been disturbed by mining.

The stream sampling site was in a floodplain of moderate width with forested slopes rising to the east and west. Approximately 50% of the watershed is in forest. Arkansas Creek Road parallels the stream along the east slope base. Cultivated fields are located on the adjoining west floodplain above the site. Riparian vegetation afforded 0-5% shade.

Arkansas Creek is a stream of low gradient with a pool-riffle ratio of 80% pool to 20% riffle. At the time of sampling, the stream was at low stage with very slow flow. Flow ended 15 m below the site. Substrate consisted largely of silt with rubble, coal and gravel. Sedimentation in the form of silt with a little yellowboy was moderate to heavy.

Table BS15

Survey Site Physical Morphology and Percentage Substrate Composition in Floyd County, Arkansas Creek, Kentucky, 25/Jun/80.

Stream:	Width	2.99 m	Depth	.9 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	20
	Gravel	20	Sand	0
	Silt	60	Clay	0

Physicochemical analyses indicate that Arkansas Creek is marginally impacted by mine drainage. Specific conductance, iron, and manganese were observed to be at elevated levels. Sulfates were not elevated.

Table BS16

Analytical Results for Certain Physicochemical Parameters Surveyed in Floyd County, Arkansas Creek, 25/Jun/80.

Temp °C	21.0	Specific Conductance (μmhos/cm)	390
Turbidity (NTU)	2.1	pH	7.1 (Field) 7.4 (Lab)
Dissolved Oxygen (mg/l)	6.2	Total Alkalinity (mg/l)	153.0
Total Acidity (mg/l)	8.6	Sulfates (mg/l)	29.7
Total Iron (mg/l)	.75	Total Manganese (mg/l)	.64

A cursory biotic survey revealed the presence of dipterans, decapods, gastropods, and cyprinids.

Floyd County conservation officer Kevin Brumley (pers. comm.) reported that Arkansas Creek supports a fishery of poor quality. Fishing only occurs at its confluence with Beaver Creek. Suckers, carp, and catfish are of prime interest. Evenhuis (1973) reported the fishery of nearby Beaver Creek to be degraded by coal washer silt or oil from a railroad yard at Martin, Kentucky. He considered success fair for blackbass, sunfish, suckers, and catfish.

01020912

Cow Creek

Drainage System:	Levisa Fork - Big Sandy River
County:	Floyd
7.5 Min. Quadrangle Name:	Lancer
Latitude:	37° 38' 10" N
Longitude:	82° 41' 29" W
Location:	.3 km east of Alvin, Kentucky, on KY 194 above former site of Lower Cow Creek School
Survey Date:	25/Jun/80

Cow Creek heads in northcentral Floyd County at an elevation of 298.7 m. Flowing in a westerly direction, Cow Creek reaches its confluence with Levisa Fork at the community of Alvin. The third order segment of this stream is 3.2 km in length. Topographic maps reveal the presence of two deep mines 1.6 km above the stream site. A small surface mine is located on the north floodplain 1.7 km above the site. Less than 5% of the surface has been disturbed by mining in this watershed.

The stream sampling site was in a floodplain of moderate width. Forested slopes rise to the north and south. Approximately 60% of the watershed is in forest. Riparian vegetation afforded 25-50% shade. Ky 194 parallels the stream along the north slope.

Cow Creek is a stream of low gradient with a pool-riffle ratio of 80% pool to 20% riffle. At the time of sampling, the stream stage was low with very slow flow. Substrate consisted largely of sand with gravel and silt. Sedimentation of silt and yellowboy was moderate.

Table BS17

Survey Site Physical Morphology and Percentage Substrate Composition in Cow Creek, Floyd County, Kentucky, 25/Jun/80.

Stream:	Width	3.41 m	Depth	.21 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	20	Sand	70
	Silt	10	Clay	0

Physicochemical analyses indicate that Cow Creek is not impacted by coal mining activities. Iron and manganese levels were elevated, however, sulfates and specific conductance were at levels representative of unimpacted streams.

Table BS18

Analytical Results for Certain Physicochemical Parameters Surveyed in Cow Creek, Floyd County, Kentucky, 25/Jun/80.

Temp °C	26	Specific Conductance (μmhos/cm)	176
Turbidity (NTU)	6.8	pH	6.7 (Field) 6.9 (Lab)
Dissolved Oxygen (mg/l)	4.7	Total Alkalinity (mg/l)	61.4
Total Acidity (mg/l)	7.6	Sulfates (mg/l)	14.5
Total Iron (mg/l)	1.97	Total Manganese (mg/l)	.810

A cursory biotic survey revealed the presence of damselfly nymphs, mayflies, crayfish, and minnows.

Floyd County conservation officer Kevin Brumley (pers. comm.) reported the fishery of Cow Creek to be poor and limited to the lower .46 m above the mouth. Primary species sought include suckers, catfish, and carp.

01019912

Lick Fork of the Left Fork of Middle Creek

Drainage System:	Levisa Fork - Big Sandy River
County:	Floyd
7.5 Min. Quadrangle Name:	Martin
Latitude:	37° 36' 06" N
Longitude:	82° 51' 59" W
Location:	.2 km west of Goodloe on KY 404
Survey Date:	5/Jun/80

Lick Fork heads against the Licking River divide at an elevation of 243.8 m in westcentral Floyd County. Flowing eastwards, Lick Fork joins the Left Fork of Middle Creek at Goodloe, Kentucky. The third order segment of this stream is 1.4 km in length. Topographic maps indicate the presence of several deep mines in the area around David, Kentucky. Active surface mining is being conducted on headwater slopes above David. A tipple and coal preparation facility are located 1.6 km above the stream site.

The stream sampling site was in a relatively wide floodplain. Forested slopes rise to the north and south. Approximately 50% of the watershed is in forest. The stream appears to have been channelized with floodplains composed of coal refuse. The floodplains have been revegetated with grasses. Red water was leaching from gob piles and entering the stream. KY 404 parallels the north slope base. The stream does not receive any shade.

Lick Fork is a stream of moderate gradient with a pool-riffle ratio of 80% pool to 20% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted of silt and gravel. Sedimentation of silt and yellowboy was heavy. Coalfines were present. Rocks in the streams were covered by a deposit of iron.

Table BS19

Survey Site Physical Morphology and Percentage Substrate Composition in Lick Fork of Left Fork Middle Creek, Floyd County, Kentucky, 5/Jun/80.

Stream:	Width	2.10 m	Depth	.14 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	50	Sand	0
	Silt	50	Clay	0

Physicochemical analyses verified Lick Fork to be one of the mostly seriously impacted streams surveyed in the Big Sandy drainage. Elevated values for specific conductance, sulfates, iron and manganese were observed. Alkalinity was zero with acidity elevated. A pH of 3.1 was the lowest recorded pH at any site in the Big Sandy drainage. The observed values in Lick Fork are classical for streams receiving acid mine drainage (Appalachian Regional Commission 1969).

Table BS20

Analytical Results for Certain Physicochemical Parameters Surveyed in Lick Fork of Left Fork Middle Creek, Floyd County, Kentucky, 5/Jun/80.

Temp °C	24	Specific Conductance (μmhos/cm)	1846
Turbidity (NTU)	16.0	pH	3.1 (Field) 3.1 (Lab)
Dissolved Oxygen (mg/l)	7.2	Total Alkalinity (mg/l)	0
Total Acidity (mg/l)	346	Sulfates (mg/l)	966.0
Total Iron (mg/l)	30.7	Total Manganese (mg/l)	6.5

The alga Ulothrix was the only aquatic organism observed at the survey site.

Lick Fork does not support a fishery due to the highly acidic nature of its waters. Evenhuis (1973) found minnows and darters in the Left Fork of Middle Creek limited to that section of stream above the confluence with Lick Fork and its associated acid water.

01018914

Johns Creek

Drainage System:	Levisa Fork - Big Sandy River
County:	Pike
7.5 Min. Quadrangle Name:	Belfry
Latitude:	37° 31' 34" N
Longitude:	82° 21' 58" W
Location:	on KY 194 61 m below confluence with Stinking Branch; 4.1 km north of Kimper, Kentucky
Survey Date:	26/Jun/80

Johns Creek heads in eastcentral Pike County against the Tug Fork divide at an elevation of 500 m. Flowing in a northwesterly direction for 64.4 km, Johns Creek reaches its confluence with the Levisa Fork opposite the community of Auxier in Floyd County. The third order segment of this stream is 15.6 km in length. Aerial surveys reveal the presence of several active deep mines above the site. Extensive surface mining has occurred on the south slope of Johns Creek west of its confluence with Long Fork. Scattered surface mines are located on Hurricane Creek and Gabriel Branch. The Varney AP coal preparation plant is located 2.5 km upstream from the site.

The stream at the survey site was in a comparatively constricted section of the floodplain. Slopes to the east and west are steep and forested. Approximately 60% of the watershed is in forest above the site. Riparian vegetation afforded 0-5% shade at the site. A railroad track parallels the stream along the base of the west slope while KY 194 follows the base of the east slope. Discharge from Stinking Creek is acidic (pH 2.4) and is having a detrimental affect on water quality in Johns Creek. Acid carried by Stinking Creek is being leached from a gob pile to the west of the railroad track.

Table BS21

Survey Site Physical Morphology and Percentage Substrate Composition in Johns Creek, Pike County, Kentucky, 26/Jun/80.

Stream:	Width	5.79 m	Depth	.12 m
Bottom Type (%):	Bedrock	50	Boulder	0
	Cobble	0	Rubble	0
	Gravel	0	Sand	20
	Silt	30	Clay	0

Physicochemical analyses indicate that Johns Creek is seriously impacted by acid mine drainage. Elevated values for specific conductance, sulfates, iron, and manganese were observed, while pH was depressed.

Generally streams in the Big Sandy River basin that are impacted by mining exhibit alkaline conditions and are not characterized by high acidity concentrations. Alkalinity and acidity in Johns Creek were nearly equal. Alkaline conditions which are undoubtedly present above the survey site, are being utilized in the neutralization of acid discharging from Stinking Creek.

Table BS22

Analytical Results for Certain Physicochemical Parameters Surveyed in Johns Creek, Pike County, Kentucky, 26/Jun/80.

Temp °C	22	Specific Conductance (μmhos/cm)	1291
Turbidity (NTU)	8.6	pH	5.9 (Field) 6.3 (Lab)
Dissolved Oxygen (mg/l)	8.9	Total Alkalinity (mg/l)	23.2
Total Acidity (mg/l)	18.2	Sulfates (mg/l)	620.0
Total Iron (mg/l)	6.32	Total Manganese (mg/l)	2.29

A cursory biotic survey revealed that the biotic component of the Johns Creek site was depauperate. The orders Trichoptera and Diptera were represented by a single caddisfly and chironomid. Minnows were absent at the site and in the acid plume discharging from Stinking Creek. Above the survey site, minnows, caddisflies, mayflies, and chironomids were present.

Johns Creek formerly supported a high quality warmwater fishery. Today its fishery is listed as poor due to silt pollution from mining. Acid drainage further limits the fishery for about 1.6 km below the confluence of Stinking Creek. Primary species sought are catfish and suckers (William Deskins - Pike County Conservation Officer, pers. comm.).

01018912

Sycamore Creek

Drainage System:	Levisa Fork - Big Sandy River
County:	Pike
7.5 Min. Quadrangle Name:	Thomas
Latitude:	37° 37' 44" N
Longitude:	82° 32' 19" W
Location:	at Sycamore Creek Road bridge 1.1 km east of junction with KY 194 near Gulnare, Kentucky
Survey Date:	25/Jun/80

Sycamore Creek heads in northwest Pike County at an elevation of 313.9 m. This stream flows in a general westerly direction to its confluence with Johns Creek at Gulnare, Kentucky. The third order segment of this stream is 4.5 km in length. Topographic maps do not indicate the presence of underground mining. Surface mining has occurred on the north slope divide .5 km above the survey site and in the extreme headwaters. Active surface mining began just prior to the survey sampling. Approximately 5% of the surface has been disturbed by mining. Several gas wells are scattered along the stream.

The stream sampling site was between steep, forested slopes to the north and south in a floodplain of moderate width. Approximately 65% of the watershed is in forest, with light agriculture and other human activities accounting for 35% of the land usage. A cultivated field is located to the south of the stream directly above the Sycamore Creek Road bridge. Riparian vegetation afforded 5-25% shade at the site.

Sycamore Creek is a stream of low to moderate gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream stage was low with slow flow. Substrate was largely gravel with rubble, silt, and sand. Silt sedimentation was moderate.

Table BS23

Survey Site Physical Morphology and Percentage Substrate Composition in Sycamore Creek, Pike County, 25/Jun/80.

Stream:	Width	1.83 m	Depth	.11 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	30
	Gravel	40	Sand	10
	Silt	20	Clay	0

Physicochemical analyses reveal elevated levels of iron and manganese. Specific conductance and sulfates are within acceptable limits for unimpacted waters. Dyer and Curtis (1977) noted that iron and manganese concentrations increase with initiation of mining activity and return to normal levels within a year following cessation of mining. Elevated iron and manganese concentrations in this stream possibly are a reflection of surface mining recently begun in the watershed. Increases in sulfate levels may lag for several months (Curtis 1972). Further surveys are necessary to verify whether Sycamore Creek is being impacted by mining activities.

Table BS24

Analytical Results for Certain Physicochemical Parameters Surveyed in Sycamore Creek, Pike County, 25/Jun/80.

Temp °C	22	Specific Conductance (μmhos/cm)	244
Turbidity (NTU)	6.3	pH	6.6 (Field)
Dissolved Oxygen (mg/l)	5.6	Total Alkalinity (mg/l)	86.4
Total Acidity (mg/l)	3.2	Sulfates (mg/l)	15.4
Total Iron (mg/l)	3.05	Total Manganese (mg/l)	.63

A cursory biotic survey revealed the presence of minnows, caddisflies, mayflies, and crayfish.

Pike County conservation officer Don Bevins (pers. comm.) considered Sycamore Creek to be a fair fishery primarily for minnows. The fishery is being impacted by silt.

01018913

Brushy Fork of Johns Creek

Drainage System:	Levisa Fork - Big Sandy River
County:	Pike
7.5 Min. Quadrangle Name:	Varney
Latitude:	37° 38' 40" N
Longitude:	82° 28' 04" W
Location:	3.1 km south off KY 881 on Brushy Fork Road near Piso, Kentucky
Survey Date:	25/Jun/80

Brushy Fork heads in northcentral Pike County at an elevation of 381 m. Flowing in a general northwesterly direction, Brushy Fork reaches its confluence with Johns Creek at Thomas, Kentucky. The third order section of this stream is 7.81 km in length. Topographic maps reveal the presence of scattered deep mines along the stream course. Aerial surveys indicate extensive surface mining in headwater areas and along the west slope. Approximately 25% of the surface has been disturbed by mining.

The stream sampling site was in a floodplain of moderate width. Steep, forested slopes rise to the east and west. Approximately 50% of the watershed is in forest. Brush Fork Road parallels the stream to the east. A gravel ford is located directly above the site. Riparian vegetation affords 25-50% shade.

Brushy Fork is a stream of low-moderate gradient with a pool-riffle ratio of 80% pool to 20% riffle. At the time of sampling, the stream stage was low with moderate flow. Substrate was predominately sand with rubble and gravel. Some coal was present. Silt sedimentation was slight with yellowboy scattered along the shore.

Table BS25

Survey Site Physical Morphology and Percentage Substrate Composition in Brushy Fork of Johns Creek, Pike County, Kentucky, 25/Jun/80.

Stream:	Width	3.35 m	Depth	.17 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	30
	Gravel	10	Sand	60
	Silt	0	Clay	0

Physicochemical analyses indicate Brushy Fork to be impacted by mining. Elevated specific conductance and sulfate levels were observed. Values for iron and manganese were not elevated. Iron and manganese levels have been observed to return to normal levels about one (1) year after cessation of mining (Dyer and Curtis 1977).

Table BS26

Analytical Results for Certain Physicochemical Parameters Surveyed in Brushy Fork of Johns Creek, Pike County, 25/Jun/80.

Temp °C	23	Specific Conductance (μmhos/cm)	364
Turbidity (NTU)	2.0	pH	7.4 (Field) 7.6 (Lab)
Dissolved Oxygen (mg/l)	8.0	Total Alkalinity (mg/l)	92.2
Total Acidity (mg/l)	9.4	Sulfates (mg/l)	213.0
Total Iron (mg/l)	.45	Total Manganese (mg/l)	.14

A cursory biotic survey revealed the presence of minnows, caddisflies, stoneflies, mayflies and crayfish.

Pike County conservation officer William Deskins (pers. comm.) reported that a high quality fishery formerly existed in Brushy Fork. Today this fishery is considered poor due to extreme silt pollution. The primary species sought are suckers.

01015913

Little Paint Creek

Drainage System:	Levisa Fork - Big Sandy River
County:	Johnson
7.5 Min. Quadrangle Name:	Oil Springs
Latitude:	37° 50' 49" N
Longitude:	82° 56' 14" W
Location:	6.4 km northeast of Oil Springs, Kentucky, at Davis Branch Road bridge off KY 580
Survey Date:	5/Jun/80

Little Paint Creek heads in western Johnson County against the Licking River divide at an elevation of 329.3 m. Flowing northward, Little Paint Creek joins Open Fork to form Paint Creek. The third order segment of this stream is 11.9 km in length. Western tributaries originating in eastern Magoffin County drain an area underlain by the Oil Springs pool. Numerous oil wells and storage tanks are located in this area. Topographic maps reveal a few deep mines scattered in headwater areas above Oil Springs. Several small surface mines are located above the stream site, the closest being 8.1 km upstream. Less than 5% of the surface has been disturbed by mining.

The stream sampling site was situated in a relatively wide floodplain with forested slopes rising to the east and west. Approximately 60% of the watershed is in forest. A concrete ford is located directly below the site. KY 580 parallels the stream along the west slope base. The adjoining west floodplain above the site is in cultivation. Riparian vegetation afforded 50-75% shade.

Little Paint Creek is a stream of moderate gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate was largely sand with gravel, coal, and silt. Silt sedimentation was slight.

Table BS27

Survey Site Physical Morphology and Percentage Substrate Composition in Little Paint Creek, Johnson County, Kentucky, 5/Jun/80.

Stream:	Width	2.59 m	Depth	.16 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	30	Sand	60
	Silt	10	Clay	0

Physicochemical analyses do not indicate Little Paint Creek to be impacted by mine drainage. Values for specific conductance, sulfates, iron, and manganese were not elevated.

Table BS28

Analytical Results for Certain Physicochemical Parameters Surveyed in Little Paint Creek, Johnson County, Kentucky, 5/Jun/80.

Temp °C	17	Specific Conductance (μmhos/cm)	208
Turbidity (NTU)	2.2	pH	7.4 (Field) 7.7 (Lab)
Dissolved Oxygen (mg/l)	7.4	Total Alkalinity (mg/l)	62.4
Total Acidity (mg/l)	4.0	Sulfates (mg/l)	25.0
Total Iron (mg/l)	.40	Total Manganese (mg/l)	.065

A cursory biotic survey revealed the presence of caddisflies, mayflies, chironomids, damselflies, dragonfly nymphs, cranefly larvae, riffle beetles, and minnows.

Johnson County conservation officer Larry Short (pers. comm.) reported the fishery of Little Paint Creek to be fair and largely limited to sucker fishing in spring. Mining has not had a significant effect on the fishery in this stream. Evenhuis (1973) stated that nearby Paint Creek was virtually free of pollution and supported a good black bass fishery.

01015912

Mudlick Creek

Drainage System:	Levisa Fork - Big Sandy River
County:	Johnson
7.5 Min. Quadrangle Name:	Paintsville
Latitude:	37° 50' 22" N
Longitude:	82° 51' 28" W
Location:	1.6 km northwest of Staffordsville, Kentucky at the KY 172 bridge
Survey Date:	5/Jun/80

Mudlick Creek heads at an elevation of 262.1 m in northcentral Johnson County. The stream flows southeastward to its confluence with Paint Creek west of Staffordsville. The third order segment of this stream is 12.2 km in length. Deep mines are indicated by topographic maps to be 3.0 km upstream along State Branch. Several small surface mines are scattered along the stream course. Approximately 10% of the surface has been disturbed by mining.

The stream sampling site was in a floodplain of moderate width with forested slopes rising to the north and south. Approximately 60% of the watershed is in forest. KY 172 crosses Mudlick Creek just above the site. The stream parallels the highway for some distance above the bridge through a narrow valley. Riparian vegetation afforded 0-5% shade at the site.

Mudlick Creek is a stream of moderate gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted of gravel and rubble with boulders and silt. Silt sedimentation was moderate. A small amount of iron flocculent was present.

Table BS29

Survey Site Physical Morphology and Percentage Substrate Composition in Mudlick Creek, Johnson County, Kentucky, 5/Jun/80.

Stream:	Width	5.79 m	Depth	.22 m
Bottom Type (%):	Bedrock	10	Boulder	30
	Cobble	0	Rubble	0
	Gravel	40	Sand	0
	Silt	20	Clay	0

Physicochemical analyses indicate that Mudlick Creek is impacted by mine drainage. Elevated values for specific conductance, sulfates, iron, and manganese were observed.

Table BS30

Analytical Results for Certain Physicochemical Parameters Surveyed in Mudlick Creek, Johnson County, Kentucky, 5/Jun/80.

Temp °C	18		Specific Conductance (μmhos/cm)	431
Turbidity (NTU)	50 15.0	(Field) (Lab)	pH	7.2 (Field) 7.6 (Lab)
Dissolved Oxygen (mg/l)	7.6		Total Alkalinity (mg/l)	51.6
Total Acidity (mg/l)	3.8		Sulfates (mg/l)	166.0
Total Iron (mg/l)	.77		Total Manganese (mg/l)	.60

A cursory biotic survey revealed the presence of caddisflies, mayflies, chironomids, stoneflies, water striders, crayfish, and minnows.

Johnson County conservation officer Larry Short (pers. comm.) considered the fishery of Mudlick Creek to be poor. The primary species sought are suckers during their spring run. Evenhuis (1973) stated that although some deep pools supporting fishable populations were present, Mudlick Creek could only be classified as a minnow stream.

01014912

Toms Creek

Drainage System:	Levisa Fork - Big Sandy River
County:	Johnson
7.5 Min. Quadrangle Name:	Sitka
Latitude:	37° 53' 22" N
Longitude:	83° 48' 47" W
Location:	.48 km above confluence with Frogonery Branch off KY 1559 W of Stambaugh, Kentucky
Survey Date:	4/Jun/80

Toms Creek is formed by the confluence of Jim Stambaugh and Browns Forks in northcentral Johnson County at an elevation of 213.4 m. The stream flows in a general southeastward direction to its confluence with the Levisa Fork opposite Offutt, Kentucky. The total stream length is 16.9 km with a third order segment of 3.69 km. Numerous deep mines are scattered throughout the headwaters of Toms Creek above the survey site.

The stream sampling site was situated in a floodplain of moderate width with forested slopes rising to the north and south. Forests cover approximately 60% of the watershed. Contour surface mining is being conducted on the south slope. Coal piles are located on the south floodplain. A gravel road to the mining operations crosses the stream about 1000 m above the site. KY 1559 parallels the stream along the north slope base. Riparian vegeation at the stream site consisted of brush along the south bank and afforded 0-5% shade.

Toms Creek is a stream of moderate gradient with a pool-riffle ratio of 50% pool to 50% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted largely of gravel with sand and silt. Silt sedimentation was moderate.

Table BS31

Survey Site Physical Morphology and Percentage Substrate Composition in Toms Creek, Johnson County, Kentucky, 4/Jun/80.

Stream:	Width	1.92 m	Depth	.23 m
Bottom Type (%):	Bedrock	-	Boulder	-
	Cobble	-	Rubble	-
	Gravel	80	Sand	10
	Silt	10	Clay	-

Physicochemical analyses indicate the water quality of Toms Creek to be impacted by mine drainage. Specific conductance, sulfates, iron, and manganese were observed to be at elevated levels.

Table BS32

Analytical Results for Certain Physicochemical Parameters Surveyed in Toms Creek, Johnson County, Kentucky, 4/Jun/80.

Temp °C	22.8	Specific Conductance (µmhos/cm)	411
Turbidity (NTU)	5.3	pH	7.4 (Field) 7.6 (Lab)
Dissolved Oxygen (mg/l)	-	Total Alkalinity (mg/l)	54.2
Total Acidity (mg/l)	4.6	Sulfates (mg/l)	147.0
Total Iron (mg/l)	.93	Total Manganese (mg/l)	.63

A cursory biotic survey was not conducted at this site.

Johnson County conservation officer Larry Short (pers. comm.) considered the fishery of Toms Creek to be poor and limited to the taking of suckers in spring.

01013913

Nats Creek

Drainage System:	Levisa Fork - Big Sandy River
County:	Lawrence
7.5 Min. Quadrangle Name:	Richardson
Latitude:	37° 54' 10" N
Longitude:	82° 38' 47" W
Location:	at KY 1690 bridge 2.5 km north of Lawrence-Johnson County line
Survey Date:	25/Jun/80

Nats Creek heads at an elevation of 250 m against the Tug Fork divide in southeastern Lawrence County. Flowing westwardly off the divide, Nats Creek swings northward near KY 1690; afterward, the stream parallels the Levisa Fork; upon joining the Left Fork of Nats Creek, Nats Creek turns westward once again, reaching its confluence with Levisa Fork near Richardson, Kentucky. The third order segment of this stream is 5.41 km in length. Topographic maps do not reveal the presence of underground mines above the stream site. Extensive surface mining has been conducted in the headwaters of Nats Creek and along Laurel Fork. Approximately 40% of the watershed surface above the site has been disturbed by mining.

The stream sampling site was in a narrow floodplain with forested slopes rising to the east and west. Approximately 55% of the watershed is in forest. Riparian vegetation provides 5-25% shade at the site. The headwaters are relatively uninhabited.

Nats Creek is a stream of moderate to high gradient with a pool-riffle ratio of 40% pool to 60% riffle. At the time of sampling, the stream was at low stage with fast flow. Substrate was predominately sand with some silt. Sedimentation was slight occurring as silt and coalfines. A small amount of iron flocculent was scattered along the shore.

Table BS33

Survey Site Physical Morphology and Percentage Substrate Composition in Nats Creek, Lawrence County, Kentucky, 25/Jun/80.

Stream:	Width	2.40 m	Depth	.05 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	0	Sand	90
	Silt	10	Clay	0

Physicochemical analyses indicate that Nats Creek is impacted by mine drainage. Elevated levels for specific conductance, sulfates, iron and manganese were observed.

Table BS34

Analytical Results for Certain Physicochemical Parameters Surveyed in Nats Creek, Lawrence County, Kentucky, 25/Jun/80.

Temp °C	24	Specific Conductance (μmhos/cm)	408
Turbidity (NTU)	1.4	pH	8.2
Dissolved Oxygen (mg/l)	8.1	Total Alkalinity (mg/l)	33.4
Total Acidity (mg/l)	3.4	Sulfates (mg/l)	455.0
Total Iron (mg/l)	1.57	Total Manganese (mg/l)	2.45

A cursory biotic survey revealed the presence of damselfly nymphs and minnows.

Conservation officer Arnold Carter (pers. comm.) reported the fishery of Nats Creek to be poor and unimpacted by silt or acid mine drainage. Primary species sought are panfish.

01013912

Left Fork Nats Creek

Drainage System:	Levisa Fork - Big Sandy River
County:	Lawrence
7.5 Min. Quadrangle Name:	Richardson
Latitude:	37° 56' 24" N
Longitude:	82° 37' 42" W
Location:	at KY 1690 bridge 1.8 km east of Richardson, Kentucky
Survey Date:	25/Jun/80

The Left Fork of Nats Creek heads at an elevation of 231.7 m against the Tug Fork divide in the southeast corner of Lawrence County. Flowing in a westerly direction, the creek reaches its confluence with Nats Creek about 1.6 km east of the community of Richardson. The third order segment of this stream is 3.0 km in length. Topographic maps indicate the presence of deep mines 1.6 and 3.2 km upstream from the survey site. Extensive surface mining has been conducted above Peach Orchard, Kentucky, 1.8 km upstream. Approximately 40% of the surface has been disturbed by mining.

The stream sampling site was in a floodplain of moderate width. Forested slopes rise to the north and south. Approximately 40% of the watershed is in forest. KY 2033 parallels the north bank of the stream. Riparian vegetation afforded 25-50% shade at the site.

The Left Fork of Nats Creek is a stream of moderate gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted of sand with silt, coal, and gravel. Silt sedimentation was moderate. Iron flocculent was present along the shore.

Table BS35

Survey Site Physical Morphology and Percentage Substrate Composition in Left Fork of Nats Creek, Lawrence County, Kentucky, 25/Jun/80.

Stream:	Width	2.13 m	Depth	.08 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	10	Sand	60
	Silt	30	Clay	0

Physicochemical analyses indicate that this creek is impacted by mine drainage. Elevated levels for sulfates and iron were observed.

Table BS36

Analytical Results for Certain Physicochemical Parameters Surveyed in Left Fork of Nats Creek, Lawrence County, Kentucky, 25/Jun/80.

Temp °C	23	Specific Conductance (μmhos/cm)	281
Turbidity (NTU)	2.2	pH	8.5
Dissolved Oxygen (mg/l)	9.5	Total Alkalinity (mg/l)	62.8
Total Acidity (mg/l)	1.4	Sulfates (mg/l)	430.0
Total Iron (mg/l)	.90	Total Manganese (mg/l)	.25

A cursory biotic survey revealed the presence of creek chubs (Semotilus atromaculatus) and a single johnny darter (Etheostoma nigrum). Benthic macroinvertebrates were conspicuously absent. Branson and Batch (1972) noted that creek chubs are resistant to silt and turbidity resulting from mining. These fishes shift to a diet of terrestrial-type insects as benthic insects are eliminated by siltation. The johnny darter is more tolerant of slow-flowing water than many other darters, reaching greatest abundance in pools with bottoms of mixed sand, silt, and gravel (Smith 1979).

Conservation officer Arnold Carter (pers. comm.) reported the fishery of this creek to be poor due to silt pollution. Primary species sought are panfish.

01008912

Big Creek

Drainage System:	Tug Fork - Big Sandy River
County:	Pike
7.5 Min. Quadrangle Name:	Williamson
Latitude:	37° 39' 20" N
Longitude:	82° 22' 20" W
Location:	on KY 468 1.1 km above confluence with Elkins Fork
Survey Date:	25/Jun/80

Big Creek is one of the major tributaries to Tug Fork in Kentucky. Formed by the confluence of Pigeonroost Branch and Meathouse Fork (elevation 243.8 m) near Canada, Kentucky, in northcentral Pike County, Big Creek flows in a northwesterly direction to the confluence of Elkins Fork, where the stream flows northeasterly to its confluence with the Tug Fork opposite Nolan, West Virginia. Big Creek is 18.8 km in length and has a third order segment of 9.54 km. Topographic maps reveal numerous undergound mines scattered along Big Creek and its tributaries above the survey site. Aerial surveys indicate the presence of a small revegetated surface mine and an active underground mine and tipple 1.61 and 3.45 km above the site, respectively. Recent extensive surface mining has taken place on Road Fork with a few scattered surface mines above Canada, Kentucky. Approximately 10% of the surface above the stream site has been disturbed by mining.

The stream sampling site was near the base of the west slope. Railroad tracks parallel the west bank and are separated from the stream by trees and shrubs growing along the stream. Riparian vegetation afforded 5-25% shade. KY 468 parallels the stream on the east side of the floodplain at the base of the east slope. Approximately 60% of the slopes above the survey site are forested. Light farming and other human related activities in the floodplain account for 30% of the watershed usage.

Big Creek is a stream of low to moderate gradient with a pool-riffle ratio of 70% pool to 30% riffle. At the time of sampling, the stream stage was low with moderate flow. Substrate was predominately sand with gravel and rubble. Silt sedimentation was negligible and a small amount of yellowboy was confined to pools.

Table BS37

Survey Site Physical Morphology and Percentage Substrate Composition in Big Creek, Pike County, Kentucky, 25/Jun/80.

Stream:	Width	3.96 m	Depth	.20 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	20
	Gravel	10	Sand	65
	Silt	5	Clay	0

While physicochemical analyses indicated elevated specific conductivity, as would be expected in a stream receiving mine drainage, sulfates were within acceptable levels. Alkalinity was comparatively high at 338 mg/l with zero acidity. Harker et al. (1979) observed similar results in a second order stream receiving discharge from an inactive deep mine. They suggested that elevated alkalinity and specific conductance reflected high levels of bicarbonate and sodium issuing from deep mine waters. Big Creek is being impacted by alkaline mine drainage with the most probable source being the underground mine located upstream. Eastern Kentucky University (1975) noted that alkaline drainage is dependent on the type of bedrock and content of sulfur in coal seams. When bedrock is rich in carbonate and the coal is low in sulfur, elevated alkalinities often result. This stream is listed as being impacted due to its elevated conductivity and iron values.

Table BS38

Analytical Results for Certain Physicochemical Parameters Surveyed in Big Creek, Pike County, Kentucky, 25/Jun/80.

Temp °C	23	Specific Conductance (μmhos/cm)	832
Turbidity (NTU)	1.8	pH	6.7 (Field) 8.2 (Lab)
Dissolved Oxygen (mg/l)	9.7	Total Alkalinity (mg/l)	338.0
Total Acidity (mg/l)	0	Sulfates (mg/l)	50.0
Total Iron (mg/l)	.72	Total Manganese (mg/l)	.08

A cursory biotic survey revealed the presence of stoneflies, mayflies, chironomids, and minnows.

Pike County conservation officer William Deskins (pers. comm.) reported that Big Creek formerly supported a high quality fishery; however, due to heavy silt pollution from mining, a poor quality fishery has resulted. Primary species sought include catfish and suckers. Evenhuis (1973) noted the presence of a fair sucker fishery in the lower half of Big Creek. The fishery was reported as limited due to siltation and acid originating from mining.

01007913

Pigeonroost Fork of Wolf Creek

Drainage System:	Tug Fork - Big Sandy River
County:	Martin
7.5 Min. Quadrangle Name:	Kermit
Latitude:	37° 46' 02" N
Longitude:	82° 26' 54" W
Location:	on KY 1714 2.3 km south of junction with KY 1439 southwest of Pilgrim, Kentucky
Survey Date:	25/Jun/80

Pigeonroost Fork is formed by the confluence of Maynard Fork and Davis Fork at an elevation of 243.8 m in southcentral Martin County. Flowing in a northerly direction, Pigeonroost Fork reaches its confluence with Wolf Creek 3.0 km southwest of Pilgrim, Kentucky. The third order segment of this stream is 10.5 km in length. A few scattered deep mines are revealed by topographic maps to be located along tributaries above the survey site. Surface mining in this watershed is quite limited. Small surface mines were located 4.8 and 12.0 km above the survey site. Less than 5% of the surface has been disturbed by mining.

The stream sampling site was in a floodplain of moderate width with forested slopes rising to the northeast and southwest. Approximately 70% of the watershed is in forest. Riparian vegetation afforded 25-50% shade at the site.

Pigeonroost Fork is a stream of moderate to high gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream stage was low with moderate flow. Substrate consisted largely of sand with a little silt. Silt sedimentation was negligible.

Table BS39

Survey Site Physical Morphology and Percentage Substrate Composition in Pigeonroost Fork of Wolf Creek, Martin County, Kentucky, 25/Jun/80.

Stream:	Width	2.74 m	Depth	.06 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	0	Sand	95
	Silt	5	Clay	0

Physicochemical analyses indicate that surface mining is not having an impact on water quality in this watershed. Specific conductance, sulfates, and manganese were within acceptable levels for unimpacted streams. Iron was slightly elevated.

Table BS40

Analytical Results for Certain Physicochemical Parameters Surveyed in Pigeonroost Fork of Wolf Creek, Martin County, Kentucky, 25/Jun/80.

Temp °C	23	Specific Conductance (μmhos/cm)	135
Turbidity (NTU)	1.3	pH	7.6 (Field) 7.3 (Lab)
Dissolved Oxygen (mg/l)	7.9	Total Alkalinity (mg/l)	40.0
Total Acidity (mg/l)	1.6	Sulfates (mg/l)	14.1
Total Iron (mg/l)	.74	Total Manganese (mg/l)	.44

A cursory biotic survey revealed the presence of damselflies, minnows, and the blackside darter (Percina maculata).

Conservation officer Hayse McCoy (pers. comm.) reported the fishery of Pigeonroost Fork to be good. Primary species sought are panfish, suckers, catfish, and bass.

01007912

Emily Creek

Drainage System:	Tug Fork - Big Sandy River
County:	Martin
7.5 Min. Quadrangle Name:	Kermit
Latitude:	37° 47' 42" N
Longitude:	82° 25' 12" W
Location:	on Emily Creek Road .5 km south of junction with KY 292 at Pilgrim, Kentucky
Survey Date:	25/Jun/80

Emily Creek heads in eastcentral Martin County at an elevation of 289.6 m. Flowing in a northerly direction, Emily Creek reaches its confluence with Wolf Creek at Pilgrim, Kentucky. The third order segment of this stream is 7.4 km in length. Topographic maps do not reveal the presence of deep mines in the watershed. Extensive surface mining has occurred in the headwaters of Emily Creek and Copper Mine Branch. Surface mining through mountain top removal has been conducted between Pigeonroost Fork and White Oak Fork. Approximately 25% of the surface has been disturbed by mining.

The stream sampling site was in a floodplain of moderate width. Forested slopes rise to the east and west. A small cattle lot is located on the east bank. Emily Creek Road parallels the stream along the east slope. Riparian vegetation afforded 25-50% shade.

Emily Creek is a stream of moderate gradient with a pool-riffle ratio of 80% pool to 20% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate was largely sand with gravel and coal. Sedimentation was heavy due to a large amount of iron floc (yellowboy).

Table BS41

Survey Site Physical Morphology and Percentage Substrate Composition in Emily Creek, Martin County, Kentucky, 25/Jun/80.

Stream:	Width	3.05 m	Depth	.10 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	10	Sand	90
	Silt	0	Clay	0

Physicochemical analyses indicate that Emily Creek is impacted by mine drainage. The highest specific conductance (2288 µmhos/cm) of any stream surveyed in the Big Sandy drainage was recorded in this stream. Sulfates were also elevated. Iron and manganese, although within acceptable concentrations, were slightly elevated. These cations were found by Dyer and Curtis (1977) to return to normal levels about a year following cessation of mining.

Table BS42

Analytical Results for Certain Physicochemical Parameters Surveyed in Emily Creek, Martin County, Kentucky, 25/Jun/80.

Temp °C	23	Specific Conductance (µmhos/cm)	2288
Turbidity (NTU)	2.6	pH	7.6 (Field) 7.5 (Lab)
Dissolved Oxygen (mg/l)	9.4	Total Alkalinity (mg/l)	57.8
Total Acidity (mg/l)	3.4	Sulfates (mg/l)	223.0
Total Iron (mg/l)	.49	Total Manganese (mg/l)	.48

A cursory biotic survey revealed the presence of chironomids, minnows, and darters.

Conservation officer Hayse McCoy (pers. comm.) considered the fishery of Emily Creek to be fair. Primary species sought are bass, suckers, catfish, and panfish.

01005912

Middle Fork of Rockcastle Creek

Drainage System:	Tug Fork - Big Sandy River
County:	Martin
7.5 Min. Quadrangle Name:	Inez
Latitude:	37° 46' 05" N
Longitude:	82° 36' 10" W
Location:	on Middle Fork Rockcastle Creek Road above confluence with Laurel Fork 1.1 km off KY 3
Survey Date:	25/Jun/80

The Middle Fork of Rockcastle Creek is formed in southwestern Martin County by the confluence of Left Fork and Music Fork at an elevation of 277.4 m. Flowing in a northwesterly direction, the creek joins Coldwater Fork at Inez, Kentucky to form Rockcastle Creek. The third order segment of this stream is 6.6 km in length. Topographic maps do not reveal the presence of underground mines above the survey site. Extensive surface mining through mountain top removal has occurred to the south of the confluence of this creek and Laurel Fork. Surface mining has also occurred on the western slopes to within 1.6 km of the stream site. A tipple and coal preparation facility are located 4.6 km above the site. Approximately 60% of the surface has been disturbed by mining.

The stream sampling site was in a narrow floodplain with steep, forested slopes rising to the northwest and southeast. Approximately 30% of the watershed is in forest. Middle Fork Rockcastle Creek Road closely follows the stream along its south bank. Riparian vegetation affords 0-5% shade.

The Middle Fork of Rockcastle Creek is a moderate to high gradient stream with a pool-riffle ratio of 30% pool to 70% riffle. At the time of sampling, the stream stage was low with fast flow. Substrate consisted solely of shifting sand. Sedimentation was negligible. A small amount of coalfines were present.

Table BS43

Survey Site Physical Morphology and Percentage Substrate Composition in Middle Fork of Rockcastle Creek, Kentucky, Martin County, 25/Jun/80.

Stream:	Width	2.47 m	Depth	.05 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	0	Sand	100
	Silt	0	Clay	0

Physicochemical analyses indicate that this stream is impacted by mining. Elevated values for specific conductance, sulfates, iron and manganse were observed.

Table BS44

Analytical Results for Certain Physicochemical Parameters Surveyed in Middle Fork of Rockcastle Creek, Kentucky, Martin County, 25/Jun/80.

Temp °C	28	Specific Conductance (μmhos/cm)	808
Turbidity (NTU)	2.0	pH	7.8 (Field) 7.8 (Lab)
Dissolved Oxygen (mg/l)	8.2	Total Alkalinity (mg/l)	152.0
Total Acidity (mg/l)	8.6	Sulfates (mg/l)	515.0
Total Iron (mg/l)	1.04	Total Manganese (mg/l)	1.03

A cursory biotic survey revealed the presence of crayfish, chironomids, and dragonfly nymphs. Creek chubs (Semotilus atromaculatus) were the only fish taken at the site.

Conservation officer Hayse McCoy (pers. comm.) related that the stream supports a fishery of good status although there is mining impact in the form of silt. Primary species sought are bass, panfish, suckers, and catfish.

Little Sandy River Basin - Water Quality. A summary of physicochemical parameters surveyed in the Little Sandy drainage is presented in Table 25. A total of four third order streams were surveyed of which two were considered to be impacted by mine drainage.

As a whole, the water quality in the Little Sandy Basin does not appear to be seriously impacted by mine drainage. Impacted streams in the drainage are largely confined to the East Fork. Our results indicate that while impacted streams in the Little Sandy Basin are mineralized, acid drainage is not a serious problem.

Little Sandy, Tygarts Creek and Upper Ohio River Basins - Fishery Evaluation. A total of 93 third order streams representing 233.7 stream miles in 6 counties were evaluated for their fishery potential. Evenhuis (1972) stated that many third order streams in the Little Sandy and Tygarts drainages are often dry in summer, rendering them of little importance to sports fisheries. Most third order streams may serve as sources of baitfish and suckers; additionally, third order streams may provide spawning sites for fishes. Of the streams evaluated, conservation officers considered 60 streams (65%) to be poor, 16 streams (17%) to be fair, 5 streams (5%) to be good, and 1 stream (1%) to be excellent fishery streams. No third order stream in the Upper Ohio River drainage was considered to support a good or excellent sport fishery. Six third order streams reported to be supporting good to excellent sport fisheries and streams considered by Evenhuis (1972) to be of high quality are listed in Table 26. Streams of poor to fair quality are listed in Table 27. Trout are stocked in Laurel Creek and Caney Creek (Elliott County) of the Little Sandy River drainage and in Schultz Creek (Greenup County) of the Tygarts Creek drainage (Kentucky Department of Fish and Wildlife, pers. comm.).

The Little Sandy River and Tygarts Creek support significant muskellunge populations. Muskellunge inhabit the Little Sandy River from its mouth to river mile 50 and Tygarts Creek from its mouth to river mile 75 (Brewer 1980).

Approximately 58 miles of third order streams are considered by conservation officers to be impacted by mine drainage. An additional 28 miles are listed as probably impacted. Of the impacted streams, 62% of the mileage is impacted by siltation, 2% by acid, and 36% by acid and silt. Greenup County Conservation Officer Carl Salyers (pers. comm.) reported that several fish kills have occurred in Cane Creek (Little Sandy River) due to mine drainage.

Table 25

Summary of Mean and Range Data for Physicochemical Parameters Surveyed in Third Order Streams in the Little Sandy River Basin

	Impacted (2)		Unimpacted (2)	
Parameter	Mean	Range	Mean	Range
pH	7.3	7.0-7.5	7.8	7.7-7.9
Alkalinity (mg/l $CaCO_3$)	33.0	16.0-50.0	70.2	39.4-101.0
Acidity (mg/l)	3.0	2.6-3.4	4.8	4.0-5.6
Sulfates (mg/l)	141.0	66.0-216.0	21.8	21.4-22.2
Total Iron (mg/l)	0.56	0.49-0.62	0.43	0.29-0.57
Total Manganese (mg/l)	0.68	0.31-1.05	0.19	0.08-0.30
Specific Conductance (μmhos/cm)	422	208-636	214	172-255

( ) Number of streams sampled

Table 26

Sports Fisheries Streams Rated as Good to Excellent in the Little Sandy and Tygarts Creek River Basins

River Basin	County	Stream
Little Sandy	Elliott	Big Caney Ck. Big Gimlet Ck. Rocky Branch, Newcomb Ck. Caney Ck.*
	Carter	Little Sandy River*
	Boyd	Bolts Fork East Fork, Little Sandy River*
	Greenup	Little Sandy River* Clay Lick Creek East Fork, Little Sandy River*
Tygarts Creek	Carter	Tygarts Creek* Unnamed tributary (Box Canyon)
	Greenup	Tygarts Creek*

*Streams higher than third order rated by Evenhuis (1972) as high quality fishing streams.

Table 27

Third Order Streams with Fair to Poor Fisheries in the Little Sandy, Tygarts Creek and Upper Ohio River Basins with an Assessment of Mining Impact

River Basin	County	Stream	Fishery		Mining Impact		
			Fair	Poor	Silt	Acid	None
Little Sandy	Elliott	Arab Fork, Big Sinking Ck.		x			x
		Brier Fork, Middle Fork, Little Sandy River		x	x		
		Clay Fork, Big Sinking Ck.		x			x
		Doctors Branch, Little Sandy R.		x	x		
		Durham Fork of Clay Fork		x		x	x
		Green Branch of Little Fork, Little Sandy River		x			x
		Ison Ck.		x			x
		Left Fork of Middle Fork, Little Sandy R.			x	x	
		Lick Fork of Newcomb Ck.		x	x		
		Little Caney Ck.	x				x
		Little Sandy River		x			x
		Neal Howard Ck.		x	x		
		Right Fork of Newcomb Ck.		x	x		
		South Ruin Ck.		x			x
		Wallow Hole Ck.		x	x		
	Rowan	Bates Br. of Laurel Ck.		x			x
		Big Caney Ck.		x			x
		Laurel Ck.		x			x
	Lawrence	Bells Trace Ck.		x			x
		Dry Fork of Little Fork, Little Sandy River		x			x

Table 27 continued

River Basin	County	Stream	Fishery		Mining Impact		
			Fair	Poor	Silt	Acid	None
	Lawrence (continued)	East Fork of Little Sandy River	x				x
		Equal Fork of Dry Fork	x				x
	Carter	Barnett Ck.		x	x	x	
		Bells Trace Ck.		x	x	x	
		Dry Fork, Little Sinking Ck.		x		x	
		Four Mile Ck.		x	x	x	
		Grahn Fork, Little Sinking Ck.		x		x	
		Lost Ck.		x	x	x	
		Straight Ck.		x	x	x	
		Wilson Ck.		x			x
		Upper Stinson Ck.		x	x	x	
	Boyd	Shope Ck.		x			x
		Williams Ck.		x	x	x	
	Greenup	Brush Ck.		x	x	x	
		Cane Ck.		x	x	x	
		Coopers Fork		x			x
		Crane Ck.	x				x
		Culp Ck.		x			x
		Holbrook Branch, Laurel Ck.		x	x		
		Indian Run		x			x
		Lost Ck.	x		x		
		North Fork, Oldtown Ck.		x			x
		Raccoon Ck.	x				x
		Sandsuck Ck.		x	x		
		Whetstone Ck.	x				x
Tygarts Creek							
	Carter	Bens Run		x			x
		Brushy Ck.		x			x
		Clark Branch, Tygarts Ck.		x			x

Table 27 continued

River Basin	County	Stream	Fishery Fair	Fishery Poor	Mining Impact Silt	Mining Impact Acid	Mining Impact None
Tygarts Creek	Carter continued						
		Cory Branch, Tygarts Ck.		x			x
		Goodin Branch, Jacobs Fork		x			x
		Grassy Ck.	x				x
		Jordan Fork, Buffalo Ck.		x			x
		Leatherwood Branch, Jacobs Fork		x			x
		McClone Fork, Buffalo Ck.	x				x
		Macabee Ck.	x		x	x	
		Perry Branch, Tygarts Ck.		x			x
		Smith Ck.		x			x
		Smith Run		x			x
		Smokey Ck.	x				x
		Soldier Fork, Tygarts Ck.		x		x	
		Upper Tygarts Br.	x				x
	Greenup	Beechy Ck.		x			x
		Brushy Ck.		x			x
		Buzzard Roast Fork		x			x
		Horner Fork, Three Prong Br.		x			x
		Horse Hollow Ck.		x			x
		Little Leatherwood Branch		x			x
		Little White Oak Ck.		x			x
		Schultz Ck.	x				x
		Stockholm Ck.		x			x
		Three Prong Branch, Tygarts Ck.		x			x
Upper Ohio							
	Boyd	Catletts Creek	x		x		
		Hood Ck.		x	x	x	

Table 27 continued

River Basin	County	Stream	Fishery		Mining Impact		
			Fair	Poor	Silt	Acid	None
Upper Ohio							
	Greenup	Coal Branch	x				x
		Grays Branch	x				x
		Pond Run		x			x
		Right Fork, Smith Branch	x				x
		Uhlens Run	x				x

06005912

Righthand Fork of Everman Creek

Drainage System:	Little Sandy River
County:	Carter
7.5 Min. Quadrangle Name:	Grayson
Latitude:	38° 21' 54" N
Longitude:	82° 57' 46" W
Location:	1.6 km west of Pactolus, Kentucky off KY 7 on Floyd Atkins farm
Survey Date:	4/Jun/80

Righthand Fork heads against the Tygarts Creek divide in northcentral Carter County at an elevation of 253.0 m. Flowing southeastwardly, Righthand Fork reaches its confluence with Everman Creek west of the community of Pactolus, Kentucky. The third order segment of this stream is 4.38 km in length. Topographic maps do not indicate the presence of any mining activity in this watershed.

The stream sampling site was situated in a relatively wide floodplain with slopes to the east and west. Forests cover approximately 50% of the watershed. KY 7 parallels the stream along the east slope base. Pasture lies on the west floodplain. Riparian vegetation afforded 0-5% shade.

Righthand Fork is a low to moderate gradient stream with a pool-riffle ratio of 90% pool to 10% riffle. At the time of sampling, stream stage was low with moderate flow. Substrate consisted of sand, silt, and gravel. Silt sedimentation was slight to moderate.

Table LS1

Survey Site Physical Morphology and Percentage Substrate Composition in Righthand Fork of Everman Creek, Carter County, 4/Jun/80.

Stream:	Width	1.58 m	Depth	.35 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	20	Sand	50
	Silt	30	Clay	0

Physicochemical analyses indicate that this stream is not affected by mining activities. Specific conductance, sulfate, iron, and manganese values were not elevated.

Table LS2

Analytical Results for Certain Physicochemical Parameters Surveyed in Righthand Fork of Everman Creek, Carter County, Kentucky, 4/Jun/80.

Temp °C	17	Specific Conductance (μmhos/cm)	148
Turbidity (NTU)	1.9	pH	7.7 (Field) 7.3 (Lab)
Dissolved Oxygen (mg/l)	-	Total Alkalinity (mg/l)	39.4
Total Acidity (mg/l)	5.6	Sulfates (mg/l)	21.4
Total Iron (mg/l)	.285	Total Manganese (mg/l)	.080

A cursory biotic survey revealed the presence of mayflies, caddisflies, stoneflies, chironomids, water pennies, crayfish, and minnows.

The fishery status of Righthand Fork is unknown. In view of its size, this stream probably serves only as a source for baitfish.

06004914

East Fork Little Sandy River

Drainage System:	Little Sandy River
County:	Lawrence
7.5 Min. Quadrangle Name:	Boltsfork
Latitude:	38° 15' 12" N
Longitude:	82° 41' 33" W
Location:	at gravel road bridge off KY 31 .5 km south of Boltsfork, Kentucky
Survey Date:	4/Jun/80

The East Fork of the Little Sandy River heads against the Big Sandy River divide at an elevation of 275.8 m in northcentral Lawrence County. The stream flows 65.7 km in a general northwardly direction to its confluence with Little Sandy River north of Argillite, Kentucky. The third order segment of the stream is 13.3 km in length. The lower section of this stream drains portions of the Princess coal mining district, an area of extensive surface mining. Neither surface or deep mines are located above the survey site.

The stream sampling site was situated in a relatively wide floodplain with partially forested east and west slopes. Approximately 45% of the watershed is in forest. The stream flows against the base of the east slope. The adjoining floodplain to the west is in cultivation. Riparian vegetation afforded 25-50% shade.

The East Fork is a low gradient stream with a pool-riffle ratio of 90% pool to 10% riffle. At the time of sampling, the stream was at low stage with low flow. Substrate consisted of gravel with silt. Silt sedimentation was moderate.

Table LS3

Survey Site Physical Morphology and Percentage Substrate Composition in East Fork Little Sandy River, Lawrence County, Kentucky, 4/Jun/80.

Stream:	Width	3.17 m	Depth	.33 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	70	Sand	0
	Silt	30	Clay	0

Physicochemical analyses indicate that the East Fork is not impacted by mine drainage. Although iron slightly exceeds levels of concern, it may well be representative of background levels. Sulfates were at levels encountered in unimpacted streams.

Table LS4

Analytical Results for Certain Physicochemical Parameters Surveyed in East Fork Little Sandy River, Lawrence County, Kentucky, 4/Jun/80.

Temp °C	23	Specific Conductance (μmhos/cm)	245
Turbidity (NTU)	3.8	pH	7.9 (Field) 7.5 (Lab)
Dissolved Oxygen (mg/l)	-	Total Alkalinity (mg/l)	101
Total Acidity (mg/l)	4	Sulfates (mg/l)	22.2
Total Iron (mg/l)	.54	Total Manganese (mg/l)	.300

A cursory biotic survey revealed the presence of caddisflies, crayfish, chironomids, and minnows.

Kentucky Nature Preserves (1979) found the East Fork of the Little Sandy River to support a rather diverse biotic community. Coleoptera and Ephemeroptera were the most speciose benthic macroinvertebrate groups. Fishes were also somewhat speciose, although the darters were not well represented, possibly due to the lack of well-developed riffle areas or the silty nature of the sample area.

Evenhuis (1972) stated that although the East Fork supported a good population of game and panfish, fishing pressure was limited to catfish and sucker. Lawrence County conservation officer Arnold Carter (pers. comm.) described the fishery of this stream to be fair with panfish the primary species sought.

06004913

Williams Creek

Drainage System:	Little Sandy River
County:	Boyd
7.5 Min. Quadrangle Name:	Argillite
Latitude:	82° 45' 30" N
Longitude:	38° 25' 22" W
Location:	1.1 km above confluence with East Fork Little Sandy River on KY 5 south of Naples, Kentucky
Survey Date:	4/Jun/80

Williams Creek heads in eastcentral Carter County at an elevation of 277.4 m. The stream flows in a general northeasterly direction to its confluence with the East Fork of the Little Sandy River near Naples, Kentucky. The third order segment of this stream is 14.6 km in length. Williams Creek drains a large portion of the Princess coal mining district. A few deep mines are scattered along the stream. Extensive surface mining has been conducted below Rush, Kentucky, with numerous small surface mines scattered in headwater areas. Approximately 50% of the surface has been disturbed by mining.

The stream sampling site was in a rather broad floodplain with slopes rising to the east and west. Forests cover about 25% of the lower watershed with 60% of the upper watershed being forested. The floodplain is intensively farmed. Limestone riprap is positioned along the west bank. Riparian vegetation afforded 25-50% shade at the site.

Williams Creek is a stream of moderate gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted largely of gravel with silt. Silt sedimentation was moderate.

Table LS5

Survey Site Physical Morphology and Percentage Substrate Composition in Williams Creek, Boyd County, Kentucky, 4/Jun/80.

Stream:	Width	4.97 m	Depth	.3 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	70	Sand	0
	Silt	30	Clay	0

Physicochemical analyses indicate that Williams Creek is impacted by mine drainage. Elevated values for specific conductance, sulfates, iron, and manganese were observed.

Table LS6

Analytical Results for Certain Physicochemical Parameters Surveyed in Williams Creek, Boyd County, Kentucky, 4/Jun/80.

Temp °C	22.0	Specific Conductance (μmhos/cm)	600
Turbidity (NTU)	6.1	pH	7.5 (Field)
Dissolved Oxygen (mg/l)	-	Total Alkalinity (mg/l)	50.0
Total Acidity (mg/l)	2.6	Sulfates (mg/l)	216.0
Total Iron (mg/l)	.620	Total Manganese (mg/l)	1.05

A biotic survey was not conducted at this site.

Boyd County conservation officer Bob Gibson (pers. comm.) reported the fishery of Williams Creek to be poor due to mining impacts of silt and acid. Primary species sought are panfish, suckers, and catfish.

06004912

Culp Creek

Drainage System:	Little Sandy River
County:	Greenup
7.5 Min. Quadrangle Name:	Argillite
Latitude:	38° 29' 25" N
Longitude:	82° 49' 14" W
Location:	at Culp Creek Road bridge .8 km east of Argillite, Kentucky
Survey Date:	4/Jun/80

Culp Creek heads in eastcentral Greenup County at an elevation of 224.0 m. The stream flows in a northerly direction to its confluence with the East Fork of the Little Sandy River northeast of Argillite, Kentucky. The third order segment of this stream is 5.87 km in length. Numerous inactive deep mines are located in the headwaters. A small inactive surface mine (operation ceased 5 years ago) is also located in the headwaters. The former site of an iron furnace dating back to 1822 is located at Argillite. Coal used at the furnace may well have been mined along Culp Creek.

The stream sampling site was located in a floodplain of moderate width with steep, forested slopes rising to the east and west. Approximately 60% of the watershed is forested. Culp Creek Road, which follows the stream, breaks through a narrow gap directly west of the site to join KY 1 at Argillite. Light agriculture is conducted to a limited extent in the floodplain. Riparian vegetation afforded 75-100% shade.

Culp Creek is a stream of moderate gradient with a pool-riffle ratio of 70% pool to 30% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted of sand with gravel. Silt sedimentation was slight to moderate. A small amount of iron flocculent was scattered along the shore.

Table LS7

Survey Site Physical Morphology and Percentage Substrate Composition in Culp Creek, Greenup County, Kentucky, 4/Jun/80.

Stream:	Width	2.89 m	Depth	.24 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	20	Sand	80
	Silt	0	Clay	0

Physicochemical analyses indicate that Culp Creek is marginally impacted by mine drainage. Sulfates were the only parameter to exceed concentrations indicative of unimpacted streams. Dyer and Curtis (1977) noted that sulfate levels may remain elevated for some time following cessation of mining. They suggested that if initial oxidation of pyritic material is extremely rapid, gypsum may precipitate from solution in spoil banks, then redissolve when the oxidation of pyrite slows to equilbrium at which point drainage water is no longer saturated with gypsum. Fairly steady concentrations of sulfate are maintained by this process until gypsum is completely dissolved. All other parameters were within levels consistent with unimpacted streams.

Table LS8

Analytical Results for Certain Physicochemical Parameters Surveyed in Culp Creek, Greenup County, Kentucky, 4/Jun/80.

Temp °C	17.5	Specific Conductance (µmhos/cm)	181
Turbidity (NTU)	1.4	pH	7.0 (Field) 6.9 (Lab)
Dissolved Oxygen (mg/l)	-	Total Alkalinity (mg/l)	16
Total Acidity (mg/l)	3.4	Sulfates (mg/l)	66.0
Total Iron (mg/l)	.49	Total Manganese (mg/l)	.310

A cursory biotic survey revealed the presence of chironomids, isopods, dragonfly nymphs, crayfish, minnows, and darters.

Greenup County conservation officer Carl Salyer (pers. comm.) reported the fishery of Culp Creek to be poor. The primary species sought are panfish and suckers.

Licking River Basin - Water Quality. A summary of physico-chemical parameters surveyed in the Licking drainage is presented in Table 28. A total of seven streams were surveyed of which one stream was considered to be impacted.

The results indicate that mining impacted third order streams in the Licking River Basin while mineralized, generally do not experience serious acid pollution. Water quality impacts appear to be largely limited to that section of the Licking River above Salyersville, Magoffin County, Kentucky. Subjective data from Morgan County conservation officer Jeff Preston (pers. comm.) indicates that current mining operations are impacting third order streams in this county also.

Licking River Basin - Fishery Evaluation. A total of 95 third order streams representing 232.3 stream miles in 8 counties were evaluated for their fishery potential. Jones (1970) stated that many third order streams in the Licking River Basin were too small to support significant sport fisheries however, a few did support fisheries in short sections. Most third order streams serve as sources of baitfish and may support angling for suckers and panfish; these streams may also provide sites for spawning. Of the streams evaluated, conservation officers considered 52 streams (55%) to be poor and 19 streams (20%) to be fair fishery streams. No streams were considered to be good or excellent. Streams of poor to fair fisheries quality are listed in Table 29. Trout are stocked in North Fork Triplett Creek (Rowan County). Approximately 16% of Kentucky's muskie waters are in the Licking River drainage (Jones 1970). Streams supporting muskellunge populations include the main stem of the Licking River (LRM 140 to 225), North Fork Creek, North Fork Triplett Creek, and Beaver Creek.

Approximately 37 miles of third order streams are considered by conservation officers to be impacted by mine drainage. Of the impacted streams, 75% of the mileage is impacted by siltation with the remaining 25% impacted by acid.

Table 28

Summary of Mean and Range Data for
Physicochemical Parameters Surveyed in the Third
Order Streams in the Licking River Basin

	Impacted Streams (1)	Unimpacted (6)	
Parameter	Value	Mean	Range
pH	8.2	7.7	7.4-7.9
Alkalinity (mg/l $CaCO_3$)	105.6	64.5	43.4-102.6
Acidity (mg/l)	2.8	4.2	0.8-10.0
Sulfates (mg/l)	183.0	32.9	11.1-63.5
Total Iron (mg/l)	0.53	0.85	0.19-1.89
Total Manganese (mg/l)	0.18	0.26	0.02-0.65
Specific Conductance (μmhos/cm)	525	197.3	103-284

( ) Number of streams sampled

Table 29

Third Order Streams with Fair to Poor Fisheries in the Licking River Basin with an Assessment of Mining Impact

River Basin	County	Stream	Fishery		Mining Impact		
			Fair	Poor	Silt	Acid	None
Licking							
	Magoffin	Broadtree Fork, LF Middle Fk.		x	x		
		Brushy Fork, Licking R.		x	x		
		Burning Fork, Licking R.		x			x
		Cranes Nest Br., LF Middle Fk.		x			x
		Elk Creek		x			x
		Grape Ck.		x			x
		Hammond Fork, Rockhouse Ck.		x			x
		Jake Fork, Runcheon Camp Ck.		x			x
		LF Johnson Ck.		x			x
		Lick Ck.		x			x
		Licking River	x		x		
		Mash Fork, Licking R.		x		x	
		Oakley Ck.		x			x
		Peicy Ck.	x				x
		Puncheon Camp Ck.		x	x		
		Raccoon Ck.		x	x		
		RF - MF Licking R.	x		x		
		Rockhouse Fork, Burning Fork		x			x
		Spruce Pine Fk., LF Middle Fk.		x			x
		State Road Fk., Licking R.		x		x	
		Stinson Ck.		x			x
		Wheeler Run Fork, Johnson Ck.		x			x

Table 29 continued

River Basin	County	Stream	Fishery Fair	Fishery Poor	Mining Impact Silt	Mining Impact Acid	Mining Impact None
Licking							
	Morgan	Baldwin Br., Blackwater Ck.		x			x
		Big Mandy's Ck.		x	x		
		Blackwater Ck.	x				x
		Broke Leg Ck.	x				x
		Caney Ck.		x	x		
		Caskey Fork, Grassy Ck.		x			x
		Coffee Ck.		x	x		
		Devils Fork, NF Licking R.	x				x
		Fannins Fork, Laurel Fork		x			x
		Jones Ck.		x	x		
		LF White Oak Ck.	x				x
		Lick Fork, Elk Fk., Licking R.		x			x
		Little Caney Ck.		x			x
		Long Branch, Licking R.		x			x
		Lower Long Br., Grassy Ck.		x			x
		Middle Fork, Elk Fork		x	x		
		Middle Fork, Lacey Ck.		x			x
		Murphy Fork, Dilfield Fk.		x			x
		Nickell Fork, Grassy Ck.		x			x
		NF Licking R.	x		x		
		Open Fork, Licking R.		x			x
		Payton Fork, Grassy Ck.		x			x
		Pleasant Run	x				x
		RF White Oak Ck.		x			x
		Road Fork, Licking R.		x			x

Table 29 continued

River Basin	County	Stream	Fishery		Mining Impact		
			Fair	Poor	Silt	Acid	None
Licking							
	Morgan (continued)	Sellars Fork, Greasy Ck.		x			x
		Spaws Ck.		x	x		
		Stacey Fork, Caney Ck.		x			x
		Straight Ck.		x	x		
		War Ck.		x	x		
	Rowan	Big Brushy Ck.		x			x
		Bluebank Branch, Licking R.		x			x
		Bull Fork, North Fork, Triplett Ck.		x			x
		Christy Ck.		x			x
		Craney Ck.		x			x
		Dry Ck.		x			x
		Hays Branch, Triplett Ck.		x			x
		Lick Fork, North Fork, Licking R.		x			x
		Little Brushy Ck.		x	x		
		Ramey Ck.		x			x
		Scott Ck.		x			x
		Slabcamp Ck.		x			x
		Three Lick Branch, Licking R.		x			x
		Upper Lick Ck.		x			x
		Wagner Fork, Caney Ck.		x			x
	Elliott	Fulton Fork, Devils Fork, NF Licking R.		x			x
	Menifee	Beaver Ck.	x				x
		Botts Fork, Brushy Ck.		x			x
		Broke Leg Ck.		x			x
		Clifton Ck.		x			x
		Dog Trot Fork, Slate Ck.		x			x

Table 29 continued

River Basin	County	Stream	Fishery Impact: Fair	Fishery Impact: Poor	Mining Impact: Silt	Mining Impact: Acid	Mining Impact: None
Licking							
	Menifee (continued)	EF Slate Ck.	x				x
		Hawkins Br., Slate Ck.		x			x
		Leatherwood Ck.	x				x
		Little Blackwater Creek		x			x
		Meyers Fork, Beaver Ck.	x				x
		Ratliff Ck.		x			x
		Salt Lick Ck.		x			x
		Slate Ck.	x				x
		Stonequarry Ck.		x			x
	Bath	Clear Ck.	x				x
		Mill Ck.	x				x
	Fleming	Flag Branch, Rocklick Ck.	x				x
		Storey Branch, Fox Ck.	x				x
	Montgomery	Brush Ck.	x				x
		Tributary to Brush Ck.		x			x
		Clay Lick Branch, Slate Ck.		x			x
		Long Branch, Slade Ck.		x			x
		Lower Spruce Ck.		x			x
		Sycamore Ck.		x			x
		Upper Spruce Ck.		x			x

05040914

Licking River

Drainage System:	Licking River
County:	Magoffin
7.5 Min. Quadrangle Name:	David
Latitude:	37° 33' 36" N
Longitude:	82° 55' 17" W
Location:	.5 km above confluence with Brushy Fork on KY 7 near Gunlock, Kentucky
Survey Date:	5/Jun/80

The Licking River is formed by the confluence of Straight Fork and Howard Fork (elevation 317.0 m) in southern Magoffin County against the Big Sandy and Kentucky river divides. The stream flows in a northwesterly direction 484.7 km to its confluence with the Ohio River at Covington, Kentucky. The third order stream segment is 6.10 km in length. Topographic maps reveal the presence of deep mines on Shepherd Branch and Crager Branch, 3.1 and 3.4 km above the site. Extensive mountain top removal mining has been conducted in the headwaters of Becky Branch and Licking Rockhouse Branch. A coal haul road parallels Licking Rockhouse Branch, joining KY 7 .8 km above the site. Small surface mines are located on Grassy Creek and on Licking River at Gunlock, Kentucky.

The stream sampling site was situated in a winding floodplain of moderate width with forest covered slopes rising to the north and south. Approximately 50% of the watershed above the site is forested. KY 7 parallels the stream along the west bank. A cornfield lies on both east and west floodplains at the site. Riparian vegetation in the form of shrubs afforded 5-25% shade.

The section of Licking River sampled was of low to moderate gradient with a pool-riffle ratio of 90% pool to 10% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted largely of sand with silt. Silt sedimentation was moderate.

Table L1

Survey Site Physical Morphology and Percentage Substrate Composition in Licking River, Magoffin County, Kentucky, 5/Jun/80.

Stream:	Width	3.26 m	Depth	.22 m
Bottom Type (%):	Bedrock	0	Boulder	5
	Cobble	0	Rubble	0
	Gravel	0	Sand	80
	Silt	15	Clay	0

Physicochemical analyses indicate that the Licking River is perhaps marginally impacted by mine drainage. Iron and manganese exceeded levels for unimpacted streams, while specific conductance and sulfates, although within acceptable levels, were slightly elevated. Dyer and Curtis (1977) found increases in iron and manganese associated with active surface mining. Sulfates may lag in their increase to higher levels. Agricultural activities may have contributed to the excess iron and manganese concentrations.

Table L2

Analytical Results for Certain Physicochemical Parameters Surveyed in Licking River, Magoffin County, Kentucky, 5/Jun/80.

Temp °C	22	Specific Conductance (μmhos/cm)	217
Turbidity (NTU)	31 (Field)	pH	7.6 (Field) 7.5 (Lab)
Dissolved Oxygen (mg/l)	8.9	Total Alkalinity (mg/l)	52.4
Total Acidity (mg/l)	2.4	Sulfates (mg/l)	45.1
Total Iron (mg/l)	1.89	Total Manganese (mg/l)	.65

A cursory biotic survey revealed the presence of dipterans, odonates, trichopterans, ephemeropterans, decapods, and cyprinids.

Magoffin County conservation officer Calvin Prater (pers. comm.) considered the fishery of the Licking River section surveyed to be fair, although impacted by mine silt. Panfish are of prime interest. Jones (1970) reported the Licking River fishery in Magoffin County as fair for redhorse suckers, catfish, blackbass, and panfish. He noted that the river carried an extremely heavy silt load due to poor agricultural practices.

05040913

Big Half Mountain Creek

Drainage System:	Licking River
County:	Magoffin
7.5 Min. Quadrangle Name:	Tiptop
Latitude:	37° 36' 28" N
Longitude:	83° 01' 51" W
Location:	on KY 1471 above confluence with Equal Fork at Duco, Kentucky
Survey Date:	5/Jun/80

Big Half Mountain Creek heads against the Kentucky River divide at an elevation of 378.0 m in southcentral Magoffin County. The stream flows in a northerly direction to its confluence with Licking River near Swampton, Kentucky. The third order stream segment is 1.1 km in length. Headwater areas above Duco, Kentucky, through mountaintop removal, have been extensively surface mined. Approximately 40% of the surface has been disturbed by mining.

The stream sampling site was located in a relatively narrow high mountain floodplain. Forested slopes rise to the east and west. Approximately 40% of the watershed is forested. KY 1471 parallels the stream along the east bank. A pasture is on the west floodplain. This section of Big Half Mountain Creek has been channelized to permit road construction. Riparian vegetation afforded 0-5% shade.

Big Half Mountain Creek is a stream of moderate to high gradient with a pool-riffle ratio of 60% pool to 40% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted of rubble and gravel with silt. Silt sedimentation was slight.

Table L3

Survey Site Physical Morphology and Percentage Substrate Composition in Big Half Mountain Creek, Magoffin County, Kentucky, 5/Jun/80.

Stream:	Width	1.80 m	Depth	.13 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	50
	Gravel	40	Sand	0
	Silt	10	Clay	0

Physicochemical analyses indicate that Big Half Mountain Creek is impacted by mine drainage. Elevated values for specific conductance, sulfates, and iron were observed.

Table L4

Analytical Results for Certain Physicochemical Parameters Surveyed in Big Half Mountain Creek, Magoffin County, Kentucky, 5/Jun/80.

Temp °C	25	Specific Conductance (μmhos/cm)	525
Turbidity (NTU)	7.8 (Field)	pH	8.2 (Field) 8.0 (Lab)
Dissolved Oxygen (mg/l)	8.3	Total Alkalinity (mg/l)	105.6
Total Acidity (mg/l)	2.8	Sulfates (mg/l)	183.0
Total Iron (mg/l)	.53	Total Manganese (mg/l)	.18

A cursory biotic survey revealed the presence of caddisflies, mayflies, stoneflies, chironomids, crayfish, and minnows.

The fishery of Big Half Mountain Creek is restricted to that section near its confluence with the Licking River. The section of the Licking River within Magoffin County supports populations of both commercial and sport fishes. Jones (1970) considered the fishery of the Upper Licking River as fair, although impacted by an extremely heavy silt load.

05040912

Oakley Creek

Drainage System:	Licking River
County:	Magoffin
7.5 Min. Quadrangle Name:	Salyersville S
Latitude:	37° 40' 05" North
Longitude:	83° 02' 33" West
Location:	.2 km above confluence with Right Oakley Creek on KY 1635 2.4 km southwest of Sublett, Kentucky
Survey Date:	5/Jun/80

Oakley Creek heads against the Kentucky River divide at an elevation of 313.9 m in southcentral Magoffin County. Flowing in a general northward direction, Oakley Creek reaches its confluence with the Licking River west of Sublett, Kentucky. The third order segment of this stream is 5.17 km in length. Topographic maps reveal the presence of deep mines .9 - 1.6 km above the stream site. Several surface mines are scattered in headwater areas. Two surface mines are located 3.5 km upstream. Surface mining has disturbed approximately 10% of the watershed.

The stream sampling site was situated at the base of a northeast facing slope in a floodplain of moderate width. KY 1635 and a railroad track parallel the northeast slope. Slopes along the stream are steep and forested. Approximately 60% of the watershed is in forest. Riparian vegetation afforded 25-50% shade.

Oakley Creek is a moderate gradient stream with a pool-riffle ratio of 70% pool to 30% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted of gravel with silt. Silt sedimentation was moderate. Some iron stain was present in gravel.

Table L5

Survey Site Physical Morphology and Percentage Substrate Composition in Oakley Creek, Magoffin County, Kentucky, 5/Jun/80.

Stream:	Width	1.22 m	Depth	.13 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	80	Sand	0
	Silt	20	Clay	0

Physicochemical analyses indicate that Oakley Creek is perhaps marginally impacted by mining. Elevated values for iron were observed. Manganese was slightly elevated although within acceptable levels. Dyer and Curtis (1977) stated that iron and manganese levels return to normal a year following cessation of mining. Sulfates were at levels considered indicative of unimpacted streams.

Table L6

Analytical Results for Certain Physicochemical Parameters Surveyed in Oakley Creek, Magoffin County, Kentucky, 5/Jun/80.

Temp °C	25	Specific Conductance (μmhos/cm)	258
Turbidity (NTU)	24 (Field)	pH	7.9 (Field) 7.8 (Lab)
Dissolved Oxygen (mg/l)	7.65	Total Alkalinity (mg/l)	102.6
Total Acidity (mg/l)	10.0	Sulfates (mg/l)	31.5
Total Iron (mg/l)	1.41	Total Manganese (mg/l)	.44

A cursory biotic survey revealed the presence of caddisflies, chironomids, mayflies, crayfish, and minnows.

Magoffin County conservation officer Calvin Prater (pers. comm.) considered the fishery of Oakley Creek to be poor and unimpacted by mining. This stream probably serves only as a baitfish source.

05036913

Little Caney Creek

Drainage System:	Licking River
County:	Morgan
7.5 Min. Quadrangle Name:	West Liberty
Latitude:	37° 53' 37" N
Longitude:	83° 17' 27" W
Location:	at gravel road bridge off US 460 .6 km southwest of Index, Kentucky
Survey Date:	5/Jun/80

Little Caney Creek heads in westcentral Morgan County at an elevation of 315.5 m. The stream flows in a northeasterly direction to its confluence with Caney Creek west of Index, Kentucky. The third order segment of this stream is 4.25 km in length. A deep mine is located 2.3 km upstream from the survey site. Surface mining has not been conducted in this watershed.

The stream sampling site was situated in a relatively broad floodplain with forested slopes rising to the east and west. The floodplain supports light agriculture. US 460 parallels the stream to the east with broad fields adjoining to the west. Approximately 50% of the watershed is in forest. Riparian vegetation afforded 0-5% shade.

Little Caney Creek is a stream of moderate gradient with a pool-riffle ratio of 80% pool to 20% riffle. At the time of sampling, the stream was at low stage with moderate flow. The substrate consisted of sand with gravel and silt. Silt sedimentation was moderate.

Table L7

Survey Site Physical Morphology and Percentage Substrate Composition in Little Caney Creek, Morgan County, Kentucky, 5/Jun/80.

Stream:	Width	2.77 m	Depth	.30 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	0
	Gravel	30	Sand	50
	Silt	20	Clay	0

Physicochemical analyses do not indicate the stream to be impacted by mining. Specific conductance, sulfates, and manganese levels were consistent with those of unimpacted streams. Iron values although slightly elevated probably reflect background concentrations.

Table L8

Analytical Results for Certain Physicochemical Parameters Surveyed in Little Caney Creek, Morgan County, Kentucky, 5/Jun/80.

Temp °C	29	Specific Conductance (μmhos/cm)	187
Turbidity (NTU)	16 (Field)	pH	7.4 (Field) 7.5 (Lab)
Dissolved Oxygen (mg/l)	7.7	Total Alkalinity (mg/l)	62.4
Total Acidity (mg/l)	5.2	Sulfates (mg/l)	25.3
Total Iron (mg/l)	.71	Total Manganese (mg/l)	.24

A cursory biotic survey of Little Caney Creek revealed the presence of mayflies, chironomids, caddisflies, stoneflies, crayfish and minnows.

Harker et al. (1979) found that nearby Caney Creek supported a benthic community of low diversity and equitability. Ephemeropterans and coleopterans were the most speciose groups. The stream supported a variety of fishes. Jones (1970) stated that Caney Creek supports a good fishery for blackbass, panfishes, and suckers in spring; however, the fishery is poor in summer and fall due to low water.

Morgan County conservation officer Jeff Preston (pers. comm.) reported the fishery of Little Caney Creek to be poor. This stream probably serves mainly as a source of baitfish.

05036912

Pleasant Run

Drainage System:	Licking River
County:	Morgan
7.5 Min. Quadrangle Name:	West Liberty
Latitude:	37° 58' 52" N
Longitude:	83° 20' 08" W
Location:	.9 km west of Yocum, Kentucky, on KY 519 above confluence with Painter Branch
Survey Date:	5/Jun/80

Pleasant Run heads in northcentral Morgan County at an elevation of 297.2 m. Flowing in a generally southwestward direction, Pleasant Run reaches its confluence with Licking River southwest of Yocum, Kentucky. The third order segment of this stream is 7.82 km in length. Topographic maps do not indicate the presence of mining in this watershed.

The stream sampling site was situated in a narrow floodplain with steep, forested slopes rising to the north and south. Rhododendrons and conifers made up a major portion of the north slope canopy. Approximately 50% of the watershed is forested. Riparian vegetation afforded 50-75% shade.

Pleasant Run is a stream of moderate gradient with a pool-riffle ratio of 50% pool to 50% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted of gravel with rubble and boulders. Silt sedimentation was negligible.

Table L9

Survey Site Physical Morphology and Percentage Substrate Composition in Pleasant Run, Morgan County, Kentucky, 5/Jun/80.

Stream:	Width	9.14 m	Depth	.30 m
Bottom Type (%):	Bedrock	0	Boulder	20
	Cobble	0	Rubble	30
	Gravel	50	Sand	0
	Silt	0	Clay	0

Physicochemical analyses indicate that the water of Pleasant Run is of high quality. Specific conductance, sulfates, and manganese were at levels consistent with unimpacted streams. Iron although slightly elevated probably reflected background concentrations.

Table L10

Analytical Results for Certain Physicochemical Parameters Surveyed in Pleasant Run, Morgan County, Kentucky, 5/Jun/80.

Temp °C	23	Specific Conductance (μmhos/cm)	135
Turbidity (NTU)	9.2 (Field)	pH	7.9 (Field) 7.7 (Lab)
Dissolved Oxygen (mg/l)	8.6	Total Alkalinity (mg/l)	55.6
Total Acidity (mg/l)	2.4	Sulfates (mg/l)	20.8
Total Iron (mg/l)	.69	Total Manganese (mg/l)	.035

A cursory biotic survey revealed the presence of mayflies, stoneflies, water pennies, chironomids, crayfish, minnows and darters.

Morgan County conservation officer Jeff Preston (pers. comm.) considered the fishery of Pleasant Run to be fair for largemouth bass, panfish, and sucker.

05037912

Meyers Fork of Beaver Creek

Drainage System:	Licking River
County:	Menifee
7.5 Min. Quadrangle Name:	Scranton
Latitude:	37° 56' 45" N
Longitude:	83° 32' 29" W
Location:	at Meyers Fork Road bridge 4.4 km off KY 460; north of Denniston, Kentucky
Survey Date:	5/Jun/80

Meyers Fork heads against the Kentucky River divide in eastcentral Menifee County at an elevation of 362.7 m. Flowing in a northwesterly direction through the Daniel Boone National Forest, Meyers Fork reaches its confluence with Beaver Creek at the head of Beaver Creek embayment in Cave Run Reservoir. The third order segment of this stream is 7.4 km in length. Topographic maps indicate the presence of four deep mines and a quarry 3.5 and 2.6 km above the stream site, respectively. Surface mining has not been conducted in the watershed.

The stream sampling site was in an entrenched floodplain; steep, forested slopes rise to the east and west. Approximately 60% of the watershed is in forest. Light agriculture is conducted in the floodplain. The former Meyers Fork School structure is located on the east floodplain at the site. A small hog lot is directly upstream. Riparian vegetation afforded 0-5% shade.

Meyers Fork is a stream of moderate gradient with a pool-riffle ratio of 50% pool to 50% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate was predominately gravel and rubble with sand and silt. Silt sedimentation was negligible.

Table L11

Survey Site Physical Morphology and Percentage Substrate Composition in Meyers Fork of Beaver Creek, Menifee County, Kentucky, 5/Jun/80.

Stream:	Width	4.57 m	Depth	.24 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	45
	Gravel	45	Sand	5
	Silt	5	Clay	0

Physicochemical analyses revealed Meyers Fork to be one of the highest quality streams visited during the survey. Parameters were at levels consistent for unimpacted streams.

Table L12

Analytical Results for Certain Physicochemical Parameters Surveyed in Meyers Fork of Beaver Creek, Menifee County, Kentucky, 5/Jun/80.

Temp °C	17	Specific Conductance (μmhos/cm)	103
Turbidity (NTU)	12 (Field)	pH	7.6 (Field) 7.6 (Lab)
Dissolved Oxygen (mg/l)	11.2	Total Alkalinity (mg/l)	43.4
Total Acidity (mg/l)	4.4	Sulfates (mg/l)	11.1
Total Iron (mg/l)	.19	Total Manganese (mg/l)	.02

A cursory biotic survey revealed the presence of caddisflies, dragonflies, mayflies, and minnows.

Menifee County conservation officer Charles Hale (pers. comm.) described the fishery of Meyers Fork to be fair, with primary species sought being panfish, suckers, and catfish.

05035912

Christy Creek

Drainage System:	Licking River
County:	Rowan
7.5 Min. Quadrangle:	Haldeman
Latitude:	38° 11' 27" N
Longitude:	83° 18' 26" W
Location:	at gravel road bridge off KY 32 at junction with Open Fork Road 2.8 km west of Elliottville, Kentucky
Survey Date:	4/Jun/80

Christy Creek heads in eastcentral Rowan County at an elevation of 327.7 m. Flowing in a westerly direction, Christy Creek reaches its confluence with Triplett Creek east of Morehead, Kentucky. The third order segment of this stream is 4.60 km in length. An inactive deep mine is located 1.2 km northeast of the site. Surface mining has not been conducted in the watershed.

The stream sampling site was situated at the base of a north facing slope in a floodplain of moderate width. KY 32 parallels the stream to the north. Approximately 60% of the watershed is forested. Riparian vegetation afforded 75-100% shade.

Christy Creek is a stream of moderate gradient with a pool-riffle ratio of 50% pool to 50% riffle. At the time of sampling, the stream was at low stage with moderate flow. Substrate consisted of rubble with gravel and silt. Silt sedimentation was slight.

Table L13

Survey Site Physical Morphology and Percentage Substrate Composition in Christy Creek, Rowan County, Kentucky, 4/Jun/80.

Stream:	Width	5.43 m	Depth	.12 m
Bottom Type (%):	Bedrock	0	Boulder	0
	Cobble	0	Rubble	70
	Gravel	20	Sand	0
	Silt	10	Clay	0

Physicochemical analyses revealed a slightly elevated level for sulfates. This would appear to indicate active mining had occurred in the watershed. Environmental Specialist Lonnie Castle (pers. comm.) of the Kentucky Division of Water indicated that there has been no surface or deep mining in the Christy Creek watershed. In view of this fact, the observed sulfate concentration probably represents a normal background level. Manganese, iron and specific conductance were at levels consistent for unimpacted streams.

Table L14

Analytical Results for Certain Physicochemical Parameters Surveyed in Christy Creek, Rowan County, Kentucky, 4/Jun/80.

Temp °C	20	Specific Conductance (μmhos/cm)	284
Turbidity (NTU)	12 (Field)	pH	7.8 (Field) 7.8 (Lab)
Dissolved Oxgyen (mg/l)	-	Total Alkalinity (mg/l)	70.4
Total Acidity (mg/l)	0.8	Sulfates (mg/l)	63.5
Total Iron (mg/l)	.22	Total Manganese (mg/l)	.165

A cursory biotic survey revealed the presence of mayflies, stoneflies, caddisflies, and minnows.

Rowan County conservation officer Marland Crawford (pers. comm.) considered the Christy Creek fishery to be poor, with suckers the primary species sought.

References

APHA, AWWA and WPCF. 1975. Standard methods for the examination of water and wastes. American Public Health Association, Washington, D. C. 1193p.

Appalachian Regional Commission. 1969. The incidence and formation of mine drainage pollution in Appalachia. Appendix C. Appalachian Regional Commission, Washington, D. C. 377p.

Babcock, J. V. 1977. Endangered plants and animals of Kentucky. Institute for Mining and Minerals Research, University of Kentucky, Lexington, Kentucky. 90p.

Brewer, D. L. 1980. A study of native muskellunge populations in eastern Kentucky streams. Kentucky Fisheries Bulletin No. 64. Department of Fish and Wildlife Resources, Frankfort, Kentucky. 107p.

Branson, B. A. and D. L. Batch. 1972. Effects of strip mining on small stream fishes in east-central Kentucky. Proc. Biol. Soc. Wash. 84:507-517.

Brant, Russell A. and Norman C. Hester. 1980. Coal in Kentucky. In: 1980 Keystone Coal Industry Manual. Reprint 7, Kentucky Geological Survey, University of Kentucky, Lexington Series XI.

Brent, C. R. and J. Howell, (eds.) 1976. An environmental impact analysis of South Mississippi Electric Power Association's proposed coal preparation facility at Gardner (Clay County) Kentucky. South Mississippi Electric Power Association.

Carter, J. P. 1970. Survey and classification of six Kentucky streams. Project F-35-2. Department of Fish and Wildlife Resources, Division of Fisheries, Frankfort, Kentucky. 51p.

_____ and A. R. Jones. 1969. Inventory and classification of streams in the Upper Cumberland River drainage of Kentucky. Kentucky Fisheries Bulletin No. 52. Department of Fish and Wildlife Resources, Frankfort, Kentucky. 71p.

Charles, James R. 1964. Effects of oil field brines. Proc. Eighteenth Annual Conf., Southeastern Assoc. of Game and Fish Commissioners. pp 1-63.

Clay, William M. 1975. The fishes of Kentucky. Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky. 416p.

Corbett, D. M. 1969. Acid mine-drainage problem of the Patoka River watershed, southwestern Indiana. Water Resources Research Center Report of Investigations No. 4, Indiana University, Bloomington, Indiana. 183p.

Curtis, W. F., R. F. Flint, F. H. George and J. F. Santos. 1978. Fluvial sediment study of Fishtrap and Dewey lakes drainage basins, Kentucky-Virginia. U.S. Geological Survey Water-Resources Investigations 77-123. U.S. Geological Survey, Louisville, Kentucky. 92p.

Curtis, W. R. 1972. Chemical changes in stream flow following surface mining in eastern Kentucky. 4th Symp. Coal Mine Drain. Res., Mellon Inst., Pittsburgh, Pennsylvania. p19-31.

_____ 1977. Sampling for water quality. National Bureau of Standards Special Publication 464. Methods and Standards for Environmental Measurement, Proc. of the 8th IMR Symposium, September 20-24, 1976, Gaithersburg, MD. p237-244. National Bureau of Standards, Washington, D.C.

Dyer, K. and W. R. Curtis. 1977. Effects of strip mining on water quality in small streams in eastern Kentucky 1967-1975. U.S. Dept. of Agriculture Forest Service. Research Paper NE-372. Northeastern Forest Service Experiment Station, Upper Darby, Pennsylvania.

Eastern Kentucky University. 1975. Surface mine pollution abatement and land use impact investigation. Vol. II. Report ARC 71-66-T2. Eastern Kentucky University, Richmond, Kentucky. 279p.

Evenhuis, B. L. 1972. Inventory and classification of streams in the Little Sandy River, Tygart's Creek and Kinniconick Creek drainages. Kentucky Fisheries Bulletin No. 58. Department of Fish and Wildlife Resources, Frankfort, Kentucky. 27p.

_____ 1973. Inventory and classification of streams in the Big Sandy River drainage. Kentucky Fisheries Bulletin No. 57. Department of Fish and Wildlife Resources, Frankfort, Kentucky. 44p.

Environmental Protection Agency. 1974. Methods for chemical analysis of water and wastes. National Environmental Research Center, Cincinnati, Ohio 298p.

Grubb, H. F. and P. D. Ryder. 1972. Effects of coal mining on the water resources of the Tradewater River basin, Kentucky. Geological Survey Water-Supply Paper 1940. U. S. Government Printing Office, Washington, D. C. 83p.

Harker, D. F. Jr., S. M. Call, M. L. Warren, Jr., K. E. Camburn, and P. Wigley. 1979. Aquatic biota and water quality of the Appalachian Province, Eastern Kentucky. Technical Report. Vol. I and II. Kentucky Nature Preserves Commission, Frankfort, Kentucky. 1012p.

_____, M. L. Warren, Jr., K. E. Camburn, S. M. Call, C. J. Fallow, and P. Wigley. 1980. Aquatic biota and water quality survey of the Upper Cumberland River basin. Technical Report. Vol. 1. Kentucky Nature Preserves Commission, Frankfort, Kentucky. 683p.

Henley, J. P. 1970. Stream bottom fauna. In: C. R. Collier, R. J. Pickering and J. J. Musser (eds.), Influences of strip mining on the hydrologic environment of parts of Beaver Creek basin, Kentucky, 1955-66. Pp. C46-53. Geological Survey Professional Ppaer 427-C. U. S. Government Printing Office, Washington, D. C. 80p.

Horton, R. E. 1945. Erosional development of streams and their drainage basins. Bull. Geo. Soc. Am. 56:257-370.

Jones, A. R. 1970. Inventory and classification of streams in the Licking River drainage. Kentucky Fisheries Bulletin No. 53. Department of Fish and Wildlife Resources, Frankfort, Kentucky. 63p.

_____ 1973. Inventory and classification of streams in the Kentucky River drainage. Kentucky Fisheries Bulletin No. 56. Department of Fish and Wildlife Resources, Frankfort, Kentucky. 109p.

Kentucky Division of Water. 1980. Kentucky 305(b) report to congress on water quality. Division of Water, Frankfort, Kentucky. 91p.

Laflin, B. D. 1980. Inventory and classification of streams in the Rough River and Nolin River drainages. Kentucky Fisheries Bulletin No. 65. Department of Fish and Wildlife Resources, Frankfort, Kentucky. 90p.

Lee, D. A., C. R. Gilbert, C. H. Hocutt, R. E. Jenkins, D. E. McAllister and J. E. Stauffer, Jr. 1980. Atlas of North American freshwater fishes. North Carolina State Museum of Natural History, Raleigh, North Carolina. 854p.

Lotrich, V. A. 1973. Growth, production, and community composition of fishes inhabiting a first-, second-, and third-order stream of Eastern Kentucky. Ecol. Monogr. 43(3):377-397.

Kimball, L. Robert, Consulting Engineers. 1974. Water quality in the eastern Kentucky coal fields. L. Robert Kimball Consulting Engineers, Ebensburg, Pennsylvania.

Mayes, Sudderth and Etheredge, Inc. 1975. The river basin water quality management plan for Kentucky, Upper Cumberland River. Division of Water, Frankfort, Kentucky.

McFarlan, Arthur C. 1961. Geology of Kentucky. Waverly Press, Inc. Baltimore, Md. 531p.

Metcalf and Eddy, Inc. 1975. The river basin water quality management plan for Kentucky, Ohio River. Division of Water, Frankfort, Kentucky.

Miller, Wihry and Lee, Inc. 1975. The river basin water quality management plan for Kentucky, Kentucky River. Division of Water, Frankfort, Kentucky.

Minear, R. A. and B. A. Tschantz. 1976. The effect of coal surface mining on the water quality of mountain drainage basin streams. Jour. Water Poll. Control Fed. 48(11): 2549-2569.

Nichols, L. E. Jr., and F. J. Burlow. 1973. Effects of acid mine drainage on the stream ecosystem of the East Fork of the Obey River, Tennessee. Jour. Tenn Acad. Sci. 48(1):30-39.

Ohio River Basin Commission. 1977. Green River basin comprehensive coordinated joint plan. Ohio River Basin Commission, Cincinnati, Ohio. 114p.

Roy F. Weston, Inc. 1975. The river basin water quality management plan for Kentucky, Green River. Division of Water, Frankfort, Kentucky.

Sehlinger, Bob and Winfield C. Underwood. 1980. A fishing guide to the streams of Kentucky. Thomas Press, Ann Arbor, Mich. 378p.

Smith, Phillip W. 1979. The fishes of Illinois. Univ. of Illinois Press, Urbana, Illinois. 314p.

Tarter, D. C. 1970. Food and feeding habits of the western blacknose dace, Rhinichthys atratulus meleagris Agassiz, in Doe Run, Meade County, Kentucky. Amer. Midl. Nat. 83(1):134-159.

U.S. Army Corps of Engineers. 1974. The national strip mine study, Vol. I and II. U.S. Army Corps of Engineers, Washington, D. C. 341p.

U. S. Department of Agriculture. 1975. Green River basin report on water, land and related resources, Kentucky and Tennessee. U.S. Department of Agriculture, Soil Conservation Service, Lexington, Kentucky. 48p.

U. S. Geological Survey. 1980. Water resources data for Kentucky. U.S. Geological Survey water-data report KY-79-1, Water Year 1979. U.S. Geological Survey, Louisville, Kentucky. 582p.