SECTION 1

INTRODUCTION

Location of Study Area

The study area, composed of Licking Creek and its tributary streams, is located in the southwestern portion of Clarion County, in west-central Pennsylvania. (See Exhibit I.)

Description of Study Area

The watershed encompasses 52 square miles and contains approximately 70 miles of stream, of which 25 have been found to be seriously polluted. As indicated by a review of mine permits issued by the Pennsylvania Department of Environmental Resources, approximately 6.88 square miles within the watershed are being actively mined as of March 1975. An additional 3 square miles are accounted for as seriously disturbed by past mining. The population of the study area as of the 1970 census is 3,634, which accounts for 9 percent of the total population of the county.* The primary industry within the watershed is coal extraction.* Coal has been mined extensively in the watershed in the past, and projections indicate at least another 20 years of mining activity in the study area.**

Study Area Needs Related to Water Quality

The prime needs of the study area are as follows: adequate wildlife cover to permit sport hunting; clean, life-supporting streams that would permit sport fishing and water contact sports; and industrial sites which would promote a more diverse economy for the area.

Study Relationship to Area Needs

The purpose of undertaking the Licking Creek Acid Mine Drainage Abatement Study is to answer the following questions:

(a) What is the average daily acid load at the confluence of Licking Creek and the Clarion River?

* Clarion County Master Plan, 1970 Clarion County Planning Commission.
** C & K Coal Company.

(b) Which tributary streams are contributing acid water to Licking Creek?
(c) What are the sources of acid discharges to Licking Creek and its tributaries?
(d) Which of these sources should be abated to provide acceptable water quality in Licking Creek?
(e) What methods would best abate these acid sources?
(f) What will be the cost of abatement from a first cost and a maintenance standpoint?

Stream Numbering System

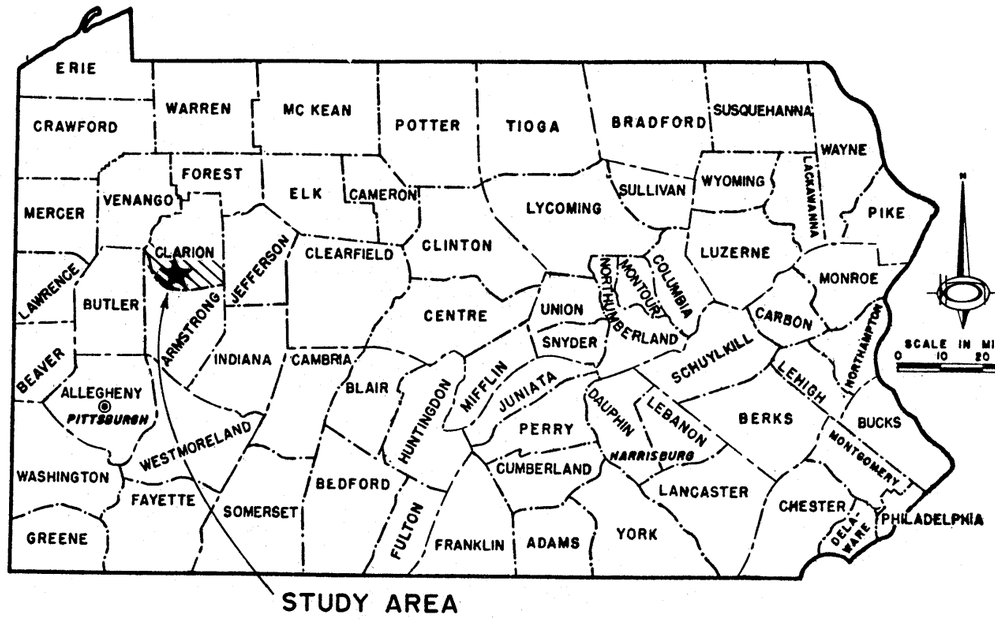
The streams in the Licking Creek Watershed are identified numerically and will be referred to by identification numbers as well as by name in this report. The numbering system used references all streams as tributary to Licking Creek, which is assigned the number "1". All streams directly tributary to the main stream of Licking Creek (first order tributaries) are identified by a two-part number, the first part bearing the number "1" to designate Licking Creek and the second number indicating its position from the mouth of Licking Creek. Proceeding upstream from the mouth of Licking Creek, those streams entering the main stream from the left are assigned even numbers and those entering from the right are assigned odd numbers. Therefore, the first tributary encountered would be Cherry Run, which enters from the right and is assigned the number 1-01. Proceeding upstream on Licking Creek, the next tributary enters from the right and is assigned the number 103. The first tributary entering from the left is upstream from 1-03 and carries the number 1-04. In order to maintain continuity in the numbering system, the number 1-02 is not used since no tributary enters the main stream from the left between 1-01 and 1-03.

Second, third and fourth order tributaries (those tributary to lower order tributaries) are numbered in a similar manner and would carry three, four, or five-digit numbers such as 1-01-14, 1-01-14-02, and 1-01-14-02-01.

All streams in the Licking Creek Watershed and their identification numbers are shown on Exhibit II.

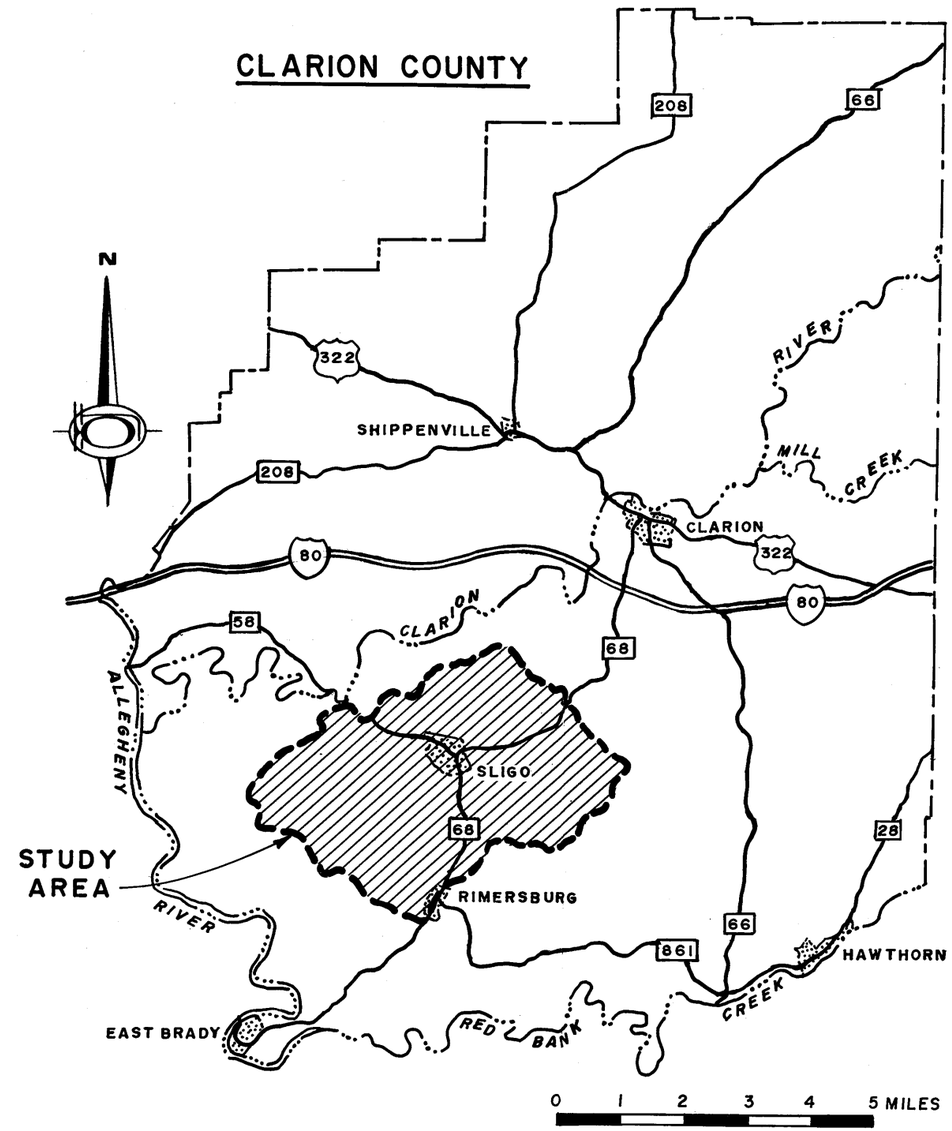
Sample Point Designation Systems

All sample points are identified by a single number such as 1, 2, 3, etc. Further identification is made through the use of the stream numbering system and the distance from the mouth of the stream sampled to the upstream sample point. For example, Sample Point No. 1 would be identified as 1 (0.64), the 1 indicating Licking Creek and the (0.64) indicating the location of the point 0.64 miles upstream from the mouth of Licking Creek.



PENNSYLVANIA

CLARION COUNTY



ACID MINE DRAINAGE STUDY
LICKING CREEK
CLARION COUNTY, PENNSYLVANIA
SL. 194
LOCATION MAP

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

EXHIBIT 1

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ACID MINE DRAINAGE STUDY
LICKING CREEK
CLARION COUNTY, PENNSYLVANIA
SL. 194

STREAM NUMBERING MAP

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

EXHIBIT II

Average Acid Load in Licking Creek

As reflected by available data, the total daily acid load in Licking Creek measured as Sample Point No. 1, 0.64 miles from the confluence with the Clarion River, ranges from 6,566 to 48,090 pounds with an average value of 14,137 pounds. (See Exhibit III.)

Tributary Streams Contributing Acid to Licking Creek

Of the 76 streams in the study area, the four streams listed below contribute 115 percent of the pollution loading found at the mouth of Licking Creek: (See Exhibits IV through VII.) Due to instream neutralization the total acid contributions may total more than the measured acid loading at the mouth of the receiving stream.

Anderson Run	10%	Little Licking Creek	35%
Mineral Run	40%	Unnamed Tributary No. 10114	30%

Sources of Acid Discharges

The sources of acid discharges, rather than being a limited number of major discharges, are in fact an extremely large number of seeps caused by nearby infiltration through strip mine areas. As precipitation infiltrates the pile and moves downward, the production of acid mine drainage takes place through the backing-leaching of acid salts from the pile as well as the inception of the series of chemical reactions necessary to form the acid. Upon reaching the water table or a less permeable layer of soil, the acid mine drainage surfaces as a spring or discharge from the toes of the spoil.

Sources to be Abated

Of the strip mines in the watershed, those of primary importance in an abatement plan would be ones which have seeps flowing into the four primary acid-contributing streams.

Methods of Abatement

Of the methods of abatement considered in this study, the one of primary importance would be that of selected re-mining of the contributing areas. Such re-mining would enable the Commonwealth to realize abatement at no
cost to the taxpayers. Of course, it is not economically feasible to re-mine some of these areas. For those areas not feasible to re-mine, a wide choice of abatement procedures presents itself, dependent upon the end use desired

for the areas. Among these procedures are the following:

(a) Regrading, liming, fertilizing, and planting
(b) Regrading, application of a soil conditioner such as sewage sludge, and planting
(c) Disposal of acid water into a deep polluted aquifer by the use of transfer wells

Cost of Abatement

Areas suitable for reclamation have been investigated in the four major polluted sub-watersheds. Due to the relatively small contribution of the other sub-watersheds, a detailed investigation was not made of these areas. The costs of reclamation have been based on unit prices for excavation, planting, and clay highwall seals effective in the first quarter of 1975. The unit prices include a 2% overhead factor. The cost of abatement for the entire area as outlined in option 2 would total $3,438,112 with an average cost per pound of acid removed of $324, assuming an effectiveness of 75%.