

## SECTION II

### STUDY AREA DESCRIPTION

#### Geography

The study area, Licking Creek Watershed, is located in Clarion County, in the northwestern portion of Pennsylvania known as the Allegheny Plateau. The confluence of Licking Creek with the Clarion River is approximately 71 miles south-southeast of Erie and 52 miles north-northeast of Pittsburgh.

The topography is a moderately to steeply rolling peneplain rising gradually to the east, dissected by numerous creek and stream channels forming narrow valleys. The elevation above sea level varies from 950 feet at the confluence of Licking Creek and the Clarion River to 1,540 feet north of the Village of Currlsville in the western portion of the watershed, or a total difference in elevation of 590 feet. The average elevation of the hilltops (former peneplain) is 1,400 to 1,500 feet above sea level.

The Licking Creek Watershed has been extensively mined. Numerous deep mines have been located throughout the watershed; however, later surface operations have destroyed most of the old deep mine openings. This watershed contains many acres of unreclaimed surface mines, partly attributed to the fact that these operations were performed when only minimal reclamation was required.

The Clarion Master Plan of 1970 by the Clarion County Planning Commission indicates in Clarion County winters are moderately cold and summers are warm and humid. Average temperatures range from 70° in July to the mid-20°'s in January, with seasonal highs of 95° to 100° and lows of -15° to -25° not uncommon. The yearly average temperature is 46.7°. The average precipitation in Clarion County is approximately 45 inches per year, about 9 percent of which falls as snow. The average snowfall is 40 inches per year (this converts to 4 inches of rainfall) and a snow cover of one inch or more can be found during at least 80 days a year. The average depth of frozen ground ranges from 15 to 20 inches. The number of days without frost (growing season) averages 120 to 140 days per year. In an average year, there will be approximately 30 to 40 thunderstorms. In July, the humidity averages 60 to 70 percent, providing a pleasant summer climate.

Licking Creek, Little Licking Creek, Cherry Run, Anderson Run, Mineral Run, and numerous unnamed tributaries are seriously polluted by coal mine drainage. Degraded water quality is evident from the uppermost reaches of the watershed and persists over the entire downstream length with the affected streams being acidic, highly mineralized, and devoid of normal aquatic life.

The headwaters of Licking Creek rise in the south-central portion of Clarion County east of the community of Curllsville. The stream flows generally west approximately 12 miles to its confluence with the Clarion River at Callensburg. The watershed is rhombic in shape and drains 52 square miles of Clarion County.

The Licking Creek drainage area is bounded on the north by the Clarion River, on the west by the Allegheny River and minor Allegheny River tributaries, on the south by Redbank Creek, and on the east by Piney Creek. Major drainage areas are as shown in Table 2-1.

TABLE 2-1  
DRAINAGE AREAS

Name	Area Sq. Mi.	% of Watershed
Cherry Run	21.3	41
Little Licking Creek	5.31	10
Anderson Run	4.07	8
Mineral Run	2.83	5
Craggs Run	1.81	3
Licking Creek	16.68*	33*

### Geology

The terrain of western Pennsylvania is the result of a number of successive geologic "episodes," or cataclysmic changes, followed by long periods of more gradual changes.

In early geologic time, the entire area was covered by a vast inland sea or strait, extending from Hudson's Bay to the Gulf of Mexico. This strait, filled with marine growth and sediment, eventually matured into petroleum and natural gas deposits. As the highlands to the east eroded into this strait, it gradually filled and formed a bog, or swamp condition, supporting lush vegetation. Rising seas covered this vegetation, but as the erosional process continued, these seas were also filled in and the new vegetation took over. This cycle continued, and these alternating beds of vegetation and sedimentation produced the vast coal beds that now underlie the area (See Table 2-2).

\* Area draining directly into Licking Creek not via tributaries.

**TABLE 2-2**  
**COLUMNAR SECTION**

GENERALIZED SECTION OF THE ROCKS EXPOSED IN THE FOXBURG AND CLARION QUADRANGLES.									
SCALE: 1-INCH=100 FEET.									
System	Series	Group	Formation	Strata	Section	Thickness in feet	Minor divisions	Character and distribution of minor divisions	General character of formation
CARBONIFEROUS	PENNSYLVANIAN		Conemaugh formation.	Com		220-  (0-3)	Mahoning sandstone member (upper part). Mahoning coal. Mahoning sandstone member (lower part).	Coal of good quality, but local.  Brown, heavy and conglomeratic to staly; variable in development.	More or less sandy olive to gray shale with thin to thick beds of sandstone, sometimes conglomeratic, thin coal, and clay.
			Allegheny formation.	Ca		240-270	Upper Freeport coal. Upper Freeport clay. Upper Freeport limestone member. Lower Freeport coal. Lower Freeport clay. Lower Freeport limestone member. Freeport sandstone member. Upper Kittanning coal. Upper Kittanning clay. Thin coal. Middle Kittanning coal. Middle Kittanning clay. Lower Kittanning coal. Lower Kittanning clay. Kittanning sandstone member.	Excellent coal, low in sulphur and other impurities. Generally gray, shaly; locally thin clay. Both above and below limestone. Light-gray limestone, generally thin bed in places (thick and of good quality). In western part of area commonly split by a parting of clay or shale. Thin-bedded yellowish to dark-gray clay. Very local. Generally coarse, very resistant sandstone or fine conglomerate. Local, but its horizon usually marked by a trace of coal or sand clay. Dark gray, plastic clay. Possibly a split from Middle Kittanning coal north of Klinesburg. Good coal, but thin; present over most of area. Generally sandy gray clay.	Iron-bearing shale, fine-grained to conglomeratic sandstone, limestone, and valuable beds of coal and clay.
				(C)			Vanport limestone member. Upper Clarion coal. Upper Clarion clay. Lower Clarion coal. Lower Clarion clay. Clarion sandstone member. Crawfordsville coal. Brookville coal.	Gray fossiliferous limestone. Sulphurous; probably a split from the Lower Clarion coal. White plastic clay; local. Generally white to pinkish sandstone; contains pyrite. White, yellow, or gray clay, generally plastic, and over 4 feet thick. Coarse resistant thick-bedded to massive gray or pinkish sandstone. Well developed along Bear Run and locally elsewhere. Locally attains minable thickness but is sulphurous. Generally good coal but thin; at some places it resembles coked coal.	
			Petersville formation.	Cpr		180-180	Homewood sandstone member. Nerac shale member. Connopessing sandstone member.	Resistant sandstone with irregular beds of shale. Equivalent to the uppermost beds of the Petersville in the type locality.  Thin to thick bedded resistant sandstone with lenses of shale.	
					UNCONFORMITY				
MISSISSIPPIAN	POCONO		Burgoon sandstone.	Cbg		200			Fine, more or less friable sandstone with thin to very thick lenses of shale.
			Chazy formation.			20-4	Meadville shale member.		Hard gray shale with pebbles near top.

## Rock Formations: Carboniferous System, Pennsylvania Series General Features

The Pennsylvania series is divided into four formations on a more or less arbitrary basis. The Pottsville formation--the lowest of the four--rests upon the underlying Mississippian and is predominantly sandy or conglomeratic. The Allegheny formation lies upon the Pottsville and because of its workable coal beds is the most valuable economic formation in the area covered by this report. In the early geologic reports on Pennsylvania this formation was called the "Lower Productive Coal Measures." Above the Allegheny is the Conemaugh Formation. There are in places minor unconformities between the two formations, but they appear to be only locally developed. Formerly this formation was known as the "Lower Barren Coal Measures." The highest formation of the Pennsylvania series is the Monongahela, which is above the Conemaugh. It is of great economic value in southwestern Pennsylvania but is not present in the area covered by this report. To the early workers it was known as the "Upper Productive Coal Measures."

### Allegheny Formation

Although the individual members of the Allegheny formation are variable in thickness, thinning of one seems to be accompanied by thickening of another, with the result that the formation as a whole has a rather uniform thickness, which ranges from 345 to 370 feet, the thickening taking place in a northwesterly direction. Coarse sandstone beds are prominent in some places, although in others there appears to be no massive sandstone present. Throughout most of the formation the shales are brown, but in the central and upper portions olive-green shales are not uncommon.

The Upper Freeport coal, the top of which marks the top of the Allegheny formation, is persistent in occurrence and lies about 245 feet above the Vanport limestone. Between the Upper and Lower Freeport coals is an interval of 30 to 50 feet occupied by sandy shales and sandstones, which in places are somewhat conglomeritic. The Lower Freeport coal lies 175 to 220 feet above the Vanport limestone. Below this coal and above the Upper Kittanning coal occurs 40 to 60 feet of the Freeport sandstone. Although this member is predominantly sandy, it may consist entirely of shale in some localities. In other localities it may be conglomeritic with pebbles as large as 1 inch in diameter. At 130 to 180 feet above the Vanport limestone lies the horizon of the Upper Kittanning coal. The middle Kittanning coal is 35 to 65 feet below the Upper Kittanning coal, the interval being occupied by shale and, to a lesser extent, by sandstone. The Lower Kittanning coal lies 20 to 50 feet above the Vanport limestone, the interval usually being about 35 feet. In the northern part of the area, where the Vanport limestone does not occur,

this sandstone occupies the interval between the Lower Kittanning and Clarion coals. In places, however, sandy shale takes the place of the sandstone.

The Vanport limestone is one of the most reliable horizon markers in northwestern Pennsylvania. It is a dark-gray fossiliferous limestone averaging 7 feet in thickness in the eastern part of the area and 10 feet in the western part. In some localities 35 feet of drab shale and iron nodules occur between the Vanport limestone and the Upper Clarion coal. In many places the limestone is immediately underlain by a coarse sandstone about a foot or more in thickness. In still other places the Vanport rests directly on the Upper Clarion coal. In most of western Pennsylvania where the Clarion coal is present it occurs as one bed. However, in Butler, Venango, and Clarion Counties the Clarion coal is split into two benches. In Clarion County the interval between the two coals ranges from a few inches to 25 feet and in most places the interval is occupied by darkgray shale, though locally some sandy layers occur. The lower coal lies 40 to 70 feet above the Brookville coal. The Clarion sandstone, which is well developed in some of the adjoining counties, does not appear to be present as a recognizable unit in Clarion County, the structure between the Clarion and Brookville coals being shale. The Brookville coal is very irregular both in quality and thickness. Four shale partings are rather common and these appear to thicken northward until in the vicinity of Shippenville the top of the coal is about 24 feet from the bottom. The coal is separated from the top of the Pottsville formation by a few feet of clay, shale, or shaly sandstone.

The generalized sections of this formation in the Allegheny Valley contain seven coals which have been named Upper Freeport, Lower Freeport, Upper Kittanning, Middle Kittanning, Lower Kittanning, Clarion, and Brookville. These coals are all found somewhere and the generalized sections are meant to show simply their relative positions. It is an error, however, to assume that all these coals must occur everywhere through the area in which the formation is found.

The Upper Freeport coal marks the top of the Allegheny formation, and, although not everywhere of workable thickness, the coal is generally present where it has not been eroded away. The base of the formation is marked by the top of the Homewood sandstone. In some places the Brookville coal lies directly on the Homewood, but in others several feet of sandy shale intervene. The Brookville coal is not present everywhere nor is the Homewood sandstone massive everywhere; therefore, in some places the base of the Allegheny formation is not easily determined.

## History

Clarion County, Pennsylvania, lies between latitudes 40° 57' and 41° 24" and longitudes 79° 13' and 79 42" and has a total land area of 600 square miles. The county was first visited by white men on August 5, 1758, when missionary Christian Fredrick Post crossed the northern portion of the county while bearing a message from the white government to the Allegheny tribes. The area was purchased from the Indians on January 21, 1785, and the first private land purchase was on May 1, 1785. The first white man to actually settle in the county was Alisalom Travis, who settled there in 1792. This settlement was short lived as Mr. Travis died in 1795. Permanent colonization of the area took place in 1800. In 1805, logging operations were started and the first saw mill was established. By 1885, 15 saw mills were in operation within the county producing \$274.00\* worth of lumber products per year. In 1800, oil was discovered while drilling for water; however, commercial operations for oil were not undertaken until 1866. Coal mining was begun in 1873 with the opening of the Fairmont Coal Company mine. By 1885, the coal industry numbered nine mines employing 611 persons with a payroll of \$185,831\* and a production of 373,504 tons of coal. Other industries during this time were engaged in farming and pig iron production.

The demand for coal as fuel for the railroads and industry made the mining of this resource economically feasible for the county. The last two decades of the 19th century and the first two decades of the 20th century saw the peak of the drift (shaft), or deep mine recovery. As thick coal seams were depleted, and as the demand for coal increased during the First World War, strip mining was utilized to recover the thinner coal seams near the surface. Today, strip mines provide about 96 percent of all coal produced in Clarion County.

Coal has been, and will probably continue to be, the dominant extractive industry in the county. Coal strata of varying thicknesses underlie the area and have been commercially mined for almost a hundred years. Table 2-3 shows coal production figures for Clarion County.

From an original deposit of approximately 2 billion tons of coal it is estimated that 1.8 billion tons remain in the county, and about one half of this, comprising 913 million tons, is deemed recoverable.

\*History of Clarion Pennsylvania Davie, A. J., Editor  
1887, with Historical Supplement of 1969 Record Press  
Rimersburg, Pa.

TABLE 2-3

CLARION COUNTY  
COAL PRODUCTION, 1960 - 1975\*  
(Tons)

<u>Year</u>	<u>Deep Production</u>	<u>Strip Production</u>	<u>Auger Production</u>	<u>Total Production</u>
1960	57,429	2,604,795	NA	2,662,224
1961	41,157	2,906,951	5,370	2,953,478
1962	50,028	3,351,486	29,061	3,430,575
1963	129,252	3,351,618	20,222	3,671,092
1964	85,550	3,473,031	45,464	3,604,045
1965	60,066	3,084,603	23,332	3,168,001
1966	40,946	3,246,035	14,790	3,301,771
1967	34,060	2,776,548	525	2,811,133
1968	2,570	2,871,365	17,241	2,891,176
1969	-----	3,782,727	-----	3,782,727
1970	6,570	4,365,798	2,570	4,374,938
1971	2,785	4,490,715	27,795	4,521,295
1972	-----	4,427,787	-----	4,427,787
1973	-----	5,151,871	16,905	5,168,776
1974	-----	5,062,848	840	5,063,688
1975	-----	5,395,529	11,893	5,407,422

### Strip Mine Spoil

In past strip mining, the overburden of soil and rock was moved to one side. The soil, shale, sandstone, and carbonaceous shales were thoroughly mixed. The last cut where coal had been removed remains as a channel through the coal until it was partly fill by slumping from the high wall and from the last spoil bank. The banks were seldom leveled, leaving a series of depressions between the piles. Revegetation was less than favorable because of the highly mineralized content of the material and the high temperatures produced by radiant energy. Generally, spoil covered the entire area affected by the stripping operation. In this report, the term spoil area and strip mine area are used interchangeably to define the area affected by strip mining operations.

### Mine Refuse

Refuse is the rejected material from a tippie, associated with a deep mine. The coal is mined underground and brought to the surface where the usable coal is extracted, with the unwanted material (refuse) being wasted above ground.

\* Pennsylvania Department of Environmental Resources

The refuse contains shale, sandstone, roof coal, and coal fines. Usually refuse contains sufficient coal to render it combustible.

Population

Of the total Clarion County population, the Licking Creek Watershed accounts for approximately 3,634 or 9.5%. (See Table 2-4). The county population has remained fairly constant since 1900, with a peak of 38,414 in 1970 and a low of 34,283 in 1900. It is assumed that the general population trends for the county hold true for the watershed.

TABLE 2-4

POPULATION IN WATERSHED

<u>Township</u>	<u>Portion in Watershed</u>	<u>1970 County Population</u>	<u>Population in Watershed</u>
Perry	12.5%	1,209	151
Licking	50%	546	273
Toby	75%	1,206	905
Piney	50%	465	233
Monroe	25%	1,129	282
Porter	10%	1,436	144
<u>Borough</u>			
Callensburg	100%	249	249
Sligo	100%	825	825
Rimersburg	50%	1,146	573
TOTAL			3,634

Watershed Population Density

Per Square Mile - 70

Per Acre - 0.1

Recreation

Recreation, as defined for the purposes of this study, includes outdoor swimming, boating and canoeing, fishing, hunting, skiing and other winter sports, hiking, driving for sightseeing and relaxation, nature walks, picnics, camping, and horseback riding.



Suburbanites and country people participate more in outdoor recreation than city people. People in the country tend to favor camping, fishing and hunting, whereas city people emphasize sightseeing and pleasure driving, picnicking and swimming.

It may safely be stated that, although there is no exact way to measure or project the demand or determine the monetary benefits of recreation land in Licking Creek Watershed, it is apparent that the demand for the utilization of these resources will indeed be extensive. Certainly the most valuable means to achieve the maximum benefits of recreation resources is in the reclamation of the lands damaged by past surface mining.

### Summary

As reflected previously, mining is still an important segment of the economic makeup of the area and one which should remain as such due to the large reserves of coal and the increased demand for fossil fuel resulting from the present energy crisis. Contemplation of the cessation of surface mining at this time would be a serious, mistake.

Lands ravaged by previous surface and deep mining are not at this time contributing positively to the economy; in fact, their contribution is a large negative factor in the future growth of the county's economy. For this reason, serious consideration should be given not only to abating acid mine drainage in the watershed but also to the reclamation of these lands so as to be useful in farming, recreation, industry, and residential construction sites. For the purpose of an active abatement program, it would be wise for the Commonwealth to look at the possibility of some form of joint effort between the Department of Environmental Resources and other agencies such as the Fish Commission, the Game Commission, the Clarion County Planning Department, the Pennsylvania Industrial Development Authority and others with the thought in mind that an effective reclamation program can have far-reaching benefits to all concerned.