

## SUMMARY

### INTRODUCTION

Basis for Survey - This report submits the results of an acid mine drainage pollution survey of Hillman State Park. The investigation, a follow-up to a 1967 FWPCA study of mine drainage in the Raccoon Creek Watershed, is an initial step in the formulation of development plans for Hillman State Park.

Purpose - Specific items of purpose of the survey were to review the mining history, identify pollution sources, monitor water quality for a one-year period, evaluate abatement techniques and costs, and submit recommendations for early action Quick Start programs.

### DESCRIPTION OF THE AREA

Location - Hillman State Park, a land area of approximately 5.7 square miles, is located in Hanover Township, Washington County, approximately 20 miles west of the city of Pittsburgh.

Geography - The natural geography of Hillman State Park has been altered significantly by past strip mining activities and partial reclamation practices. At present, large land areas are not adequately drained.

Geology - Hillman State Park is included within the geologic province known as the Appalachian Plateau. The bedrock strata in the area are members of the Conemaugh and Monongahela Formations of Pennsylvanian Age. The soil cover over most of the higher regions of the park is composed principally of strip mine backfill.

Mining History - Coal mining activities on the Hillman State Park property began in 1914 and continued until 1966. It is estimated that the amount of coal removed totals some 15 million tons or approximately 98% of the Pittsburgh Coal reserve initially in place. Approximately 94% of the coal obtained from the property was removed by surface stripping methods. No highwalls exist since most hills were removed in total in the mining process.

### STUDY METHODS

Compilation of Information - Numerous sources were contacted in an effort to compile basic information necessary to the completion of this survey. A listing of principal information sources is provided within the report.

Location and Survey of Sources - The identification phase of acid mine drainage sources began in July 1970. Including sources, a total of 44 sampling stations were ultimately selected. Stream flows and stream quality data were obtained at sampling stations during the 13 month period from July 1970 through July 1971.

## STUDY RESULTS

General Description of Pollution Sources - Acid mine drainage in Hillman State Park is the result of disrupted surface drainage caused by extensive strip mining and partial reclamation practices. Numerous un-drained sub-watersheds are responsible for seepage and runoff of acid mine drainage along most streams.

Individual Sources - Twenty-four acid mine drainage sources have been identified. Eight sources, each discharging more than 350 pounds of net acid per day to receiving streams, are considered major.

Stream Quality - The majority of streams in Hillman State Park are in the variable acid flow category under both high and low flow conditions. Variable acid flow is characterized by a pH of 5.5 or above and net acidity of less than 300 mg/l.

## ABATEMENT

Objective - The objective of an abatement plan in Hillman State Park is to eliminate or minimize acid mine drainage into the area's streams. As a side consideration to the abatement plan, it is desirable to enhance the qualities of the land relative to its intended use.

Method - The feasible method of abatement is surface reclamation, a source control technique. Major earthmoving operations, involving some 1.7 million cubic yards, are required to open isolated sub-watersheds to existing streams.

The Abatement Plan - An abatement plan involving surface reclamation has been developed. The plan is based on a consideration of anticipated effectiveness and expected costs. Three Quick Start programs are defined to perform the abatement plan.

## CONCLUSIONS

Severity of Pollution - All major streams in Hillman State Park are polluted to some degree by acid mine drainage. The overall drainage problem is not severe by normal classifications, but is highly undesirable with respect to the intended use of the area. The average total acid load discharged into the area's streams is estimated at 10,600 lbs/day. This amount includes some 1,500 lbs/day which originates at sources located outside the Hillman Park boundaries. The average net acid load (acidity less alkalinity) into the park's streams is approximately 7,900 lbs/day.

Effectiveness of Abatement - It is estimated that 56% of the total acid load originating in Hillman State Park can be abated through performance of the proposed reclamation program. In terms of net acid load, the reduction is estimated at approximately 75%. The abatement is estimated to be attainable within a period of about two years, even though some deterioration in water quality can initially be expected since fresh reactive surfaces will be exposed in the construction process.

Costs and Benefits - The estimated cost of the abatement plan for Hillman State Park is \$1,144,000. Performance of the abatement plan is expected to reduce the total acid stream loads some 5,100 lbs/day and restore natural drainage to approximately 800 acres of park land.

Priorities - Priorities have been developed for completion of the various segments of the abatement plan. Priorities are based principally on indicators relating cost to abatement and cost to acres restored.

## RECOMMENDATIONS

The following recommendations are made as a result of the survey of acid mine drainage in Hillman State Park:

1. Implement the abatement plan presented in the subsequent sections of this report.
2. Perform the abatement plan in accordance with established priorities.
3. Obtain adequate information during performance of the abatement work to aid in future evaluations of similar areas.
4. Evaluate the effectiveness of abatement with a continuing survey of water quality during and after construction.

## INTRODUCTION

### BASIS FOR SURVEY

Land Gift - Hillman State Park became a reality in 1969 when Mr. James F. Hillman, president of the Harmon Creek Coal Corporation, donated a 3,654 acre tract of land to the Commonwealth of Pennsylvania for use as a state park. The donation is believed to be the largest single land gift for state park purposes in the United States. The property is located approximately 20 miles west of Pittsburgh in Hanover Township, Washington County and is contained wholly within the Raccoon Creek Watershed. Much of the donated land was extensively surface mined by the Harmon Creek Coal Corporation in previous years. Significant land areas were reclaimed or partially reclaimed during the mining operations, principally through the efforts of Mr. Hillman, a noted conservationist and leader in Pittsburgh community development.

Previous Investigation - A preliminary investigation of acid mine drainage in the Raccoon Creek Watershed was performed by the Federal Water Pollution Control Administration and the Washington County Planning Commission in 1967. The study concluded that many principal streams in the watershed were polluted by significant quantities of acid mine drainage. The study recommended an action program aimed at establishing a priority listing of pollution sources and preparing engineering studies to evaluate abatement methods for specific regions of the watershed.

Data Pertinent to Hillman State Park - The FWPCA study of 1967 included some limited data on the area now known as Hillman State Park. Two streams, Brush Run and Dilloe Run, were reported to receive combined net acid loadings

of almost 4 tons/day from reclaimed or partially reclaimed strip mines. Brush Run was reported alkaline in its lower reach, whereas Raccoon Creek received approximately 2 tons/day of acid from Dilloe Run. The study further indicated that the bulk of the acid mine drainage in the area was the result of a convergence of numerous small seepage streams.

Contract SL-130-2 - A decision was reached in 1970 by joint representatives of the Commonwealth's Department of Mines and Mineral Industries and the Department of Forests and Waters to move forward with a detailed pollution survey of the Hillman State Park area. This decision was an outgrowth of initial discussions regarding a development plan for Hillman State Park and the previous knowledge of mine drainage problems in the area. Contract SL-130-2 was subsequently authorized. The survey is wholly funded under Act No. 443, which administers a portion of the \$500 million bond issue approved by Pennsylvania voters in 1967.

#### PURPOSE

The purpose of the survey was to review the problem of acid mine drainage in Hillman State Park and to develop recommendations for abatement. Specific items of purpose were to:

1. Review the available mining history and perform a geologic reconnaissance of the area.
2. Locate and define acid mine drainage pollution sources.
3. Obtain water quality data over a minimum period of one year.

4. Evaluate the feasibility of abatement techniques and develop an abatement plan for the area.
5. Estimate costs of the abatement plan and establish priorities for completion of the work.
6. Submit conclusions and recommendations pertinent to the specific items of purpose, including recommendations for early action Quick Start programs.

## DESCRIPTION OF THE AREA

A description of the Hillman State Park location, geography, climate, geology, mining and oil-producing history is presented under the following headings.

### LOCATION

Washington County-Hillman State Park is located in Hanover Township, Washington County, Pennsylvania. The central portion of the-park is situated approximately 20 miles west of Pittsburgh and about eight miles east of Weirton, West Virginia. See Plate 1, Location Map.

Prominent Boundaries - The park area is located within a region generally bounded by U. S. Route 22, U. S. Route 30 and Pa. Route 18. U. S. Route 22 forms the southern boundary of the park between the towns of Bavington and Florence.

Acreage - The total surface area of Hillman State Park is 3,654 acres or approximately 5.7 square miles. As indicated on the Park Boundary Map, Plate II, an approximate 200 acre tract of land within the central portion of the park is privately owned. A complete listing of adjacent property owners is provided in Table 12, Appendix C. All adjacent property owners are also indicated on the Inventory Maps of Appendix A.

### GEOGRAPHY

Mature Region - Hillman State Park is located in what is known geographically as a maturely dissected region. Such a region is one where the principal streams have eroded their valleys to a fairly uniform grade and the

smaller branches have cut the uplands into numerous narrow ridges. The result is a hilly topography.

Relief- The total relief which persists over the Hillman property is about 400 feet. Elevations of 900 feet are common in the low valley bottoms in the southeast portion of the park, while the highest elevations encountered in the north and northwest regions of the park are just under 1,300 feet. Within the main park area, local reliefs of 100 feet are common between adjacent hills and valleys.

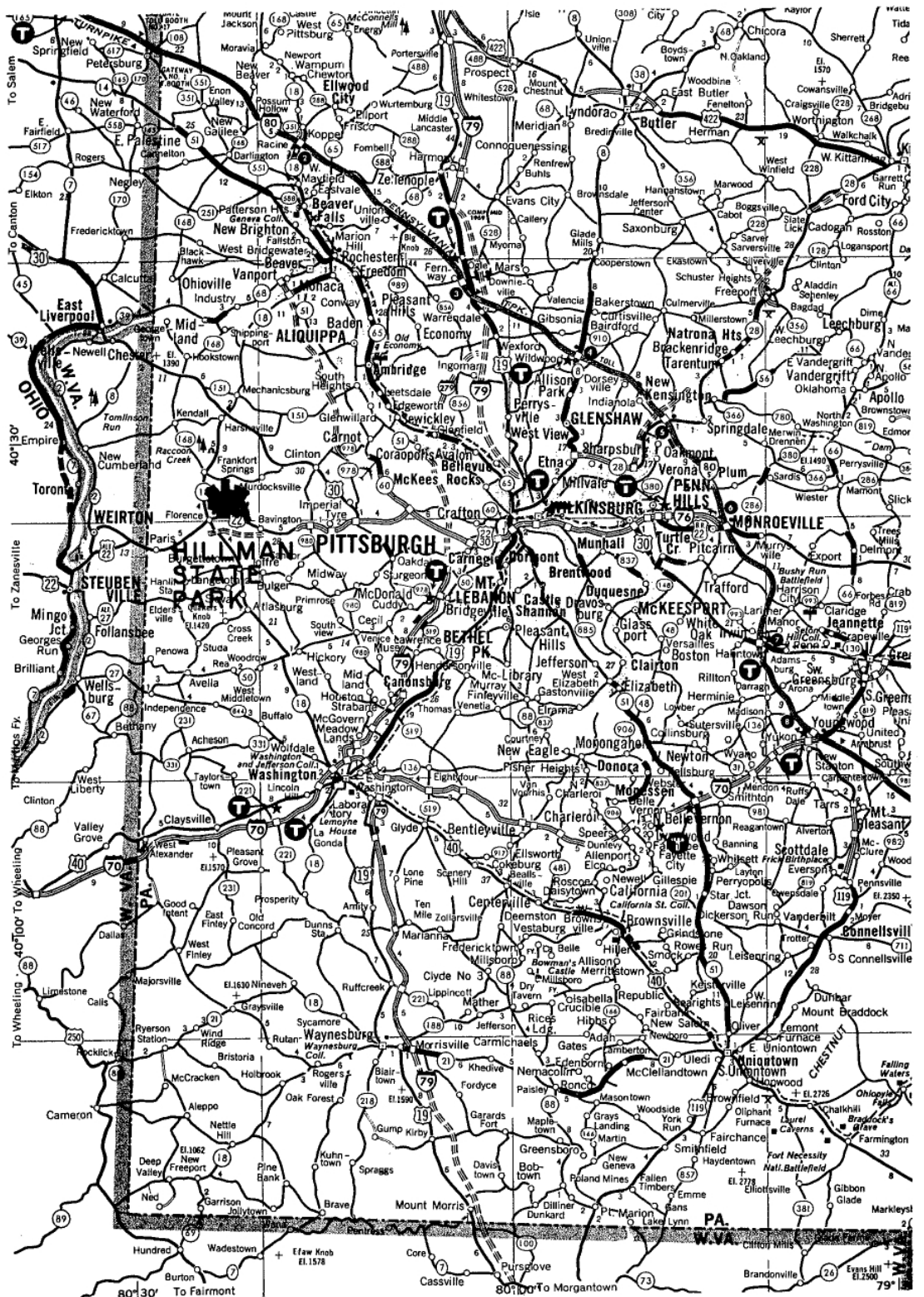
Altered Landform - Extensive strip mining of the Hillman property has in many ways dramatically altered the natural geography of the area. A mature region would normally be well drained; however, as a result of the stripping operations and partial reclamation practices, numerous undrained areas presently exist within the area.

Raccoon Creek Watershed - The entire Hillman State Park property is contained within the Raccoon Creek Watershed, as shown on Plate III. Raccoon Creek, located just east of the Hillman area, flows north and empties into the Ohio River approximately 20 miles north of the park boundary.

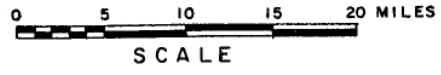
Major Streams - Three major streams flowing east into Raccoon Creek drain the majority of the Hillman Park area. See Plate II. These streams are Dilloe Run, Brush Run and Hogs Run. Two small, unnamed streams drain the extreme southeast corner of the park lands.

Brush Run - Brush Run is the most important stream in Hillman State Park draining approximately 85% of the total area. A unique feature of the Brush Run basin is its unsymmetrical drainage pattern, as indicated





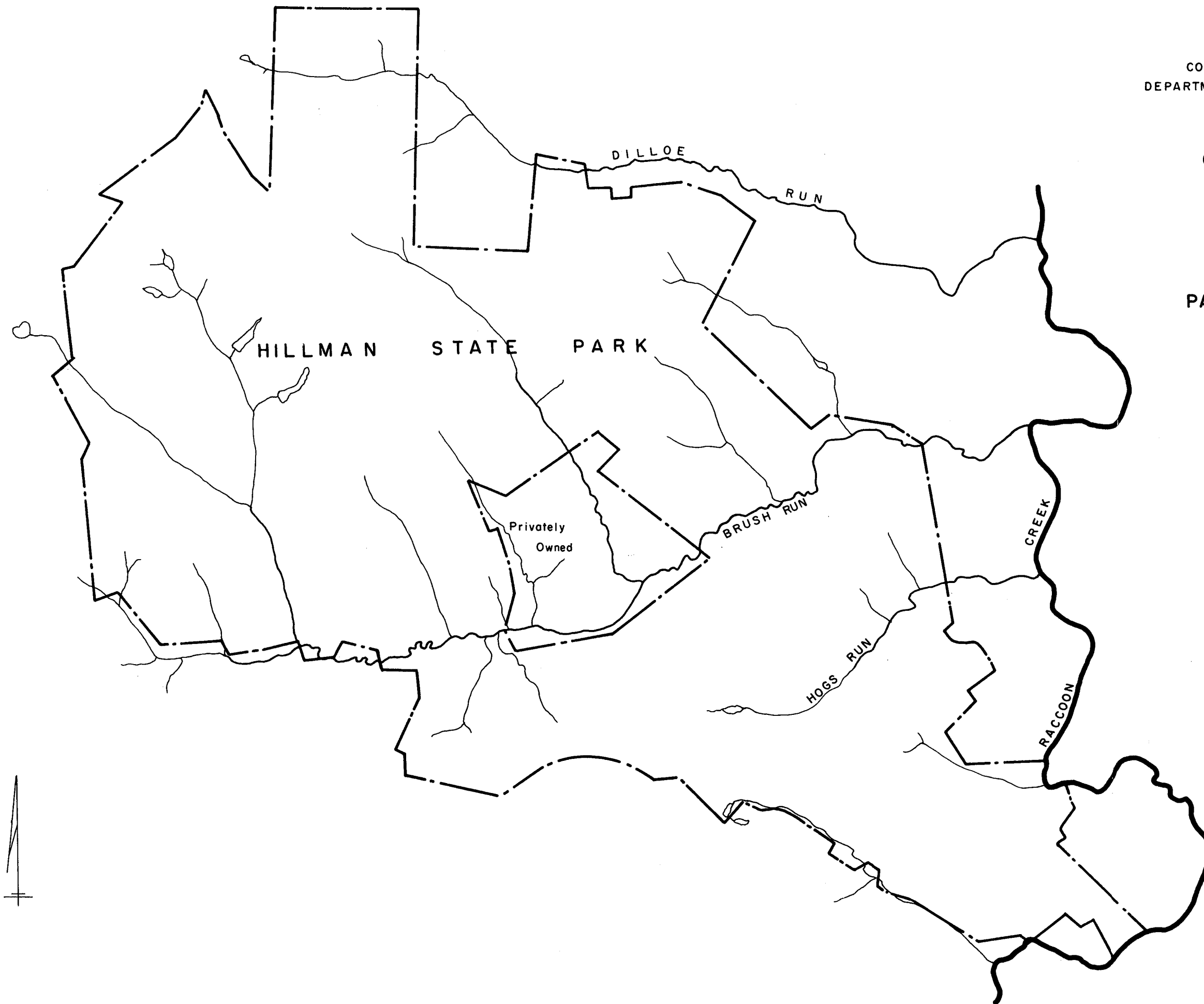
# LOCATION MAP

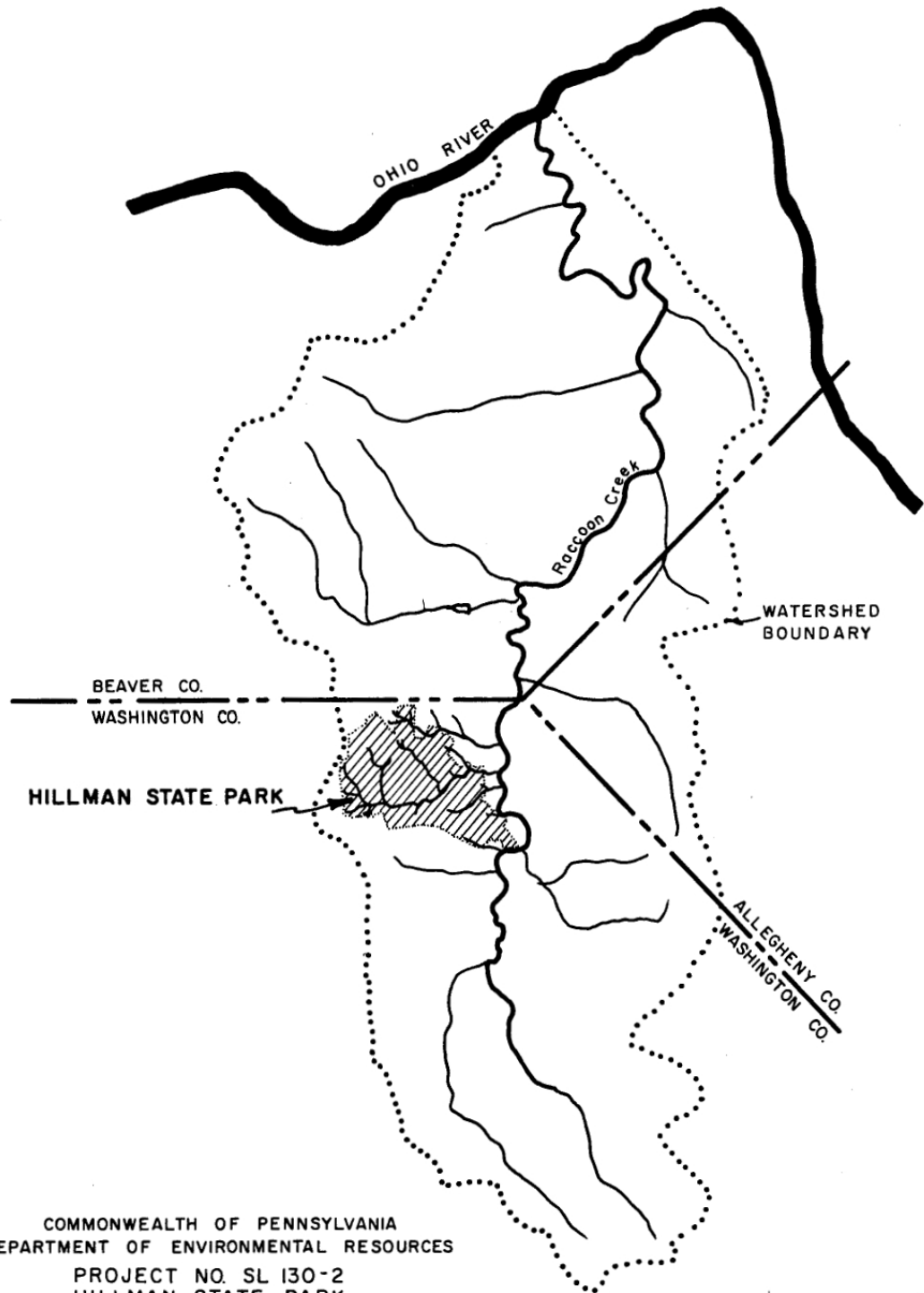


SCALE  
PLATE I

PROJECT NO. SL-130-2  
HILLMAN STATE PARK  
(RACCOON CREEK WATERSHED)

PLATE II  
PARK BOUNDARY MAP





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PLATE III

RACCOON CREEK WATERSHED

on Plate II. Brush Run tributaries which flow south are generally prominent and drain large areas, whereas the few tributaries which flow north are short and drain considerably less area.

## CLIMATE

General - Hillman State Park is situated in a humid continental type of climate modified only slightly by its nearness to the Atlantic Seaboard and the Great Lakes.

Air Masses - Two predominant types of air masses influence the climate of the area. The first has a polar continental source in Canada and moves into the region in tracks varying from almost due north to due west. The second occurs as frequent northeasterly invasions of warm air originating in the Gulf of Mexico.

Precipitation - Precipitation in the area is normally well distributed throughout the year. Approximately 25% of a total annual precipitation of 36 inches occurs as snow during the winter months.

Study Period - The measured precipitation for the Hillman State Park area during the period of study amounted to an annual total of slightly more than 34 inches. This amount is approximately 5% less than the normal annual total. Although the annual total is not greatly different from the normal, Plate IV indicates significant departures from normal on a monthly basis. These monthly departures are reflected in the stream flow data obtained over the study period.

## GEOLOGY

Appalachian Plateau - Hillman State Park is contained within the geologic province known as the Appalachian Plateau. This province is characterized by essentially flat-lying strata whose regularity is broken by low, broad folds.

West Middletown Syncline - The West Middletown Syncline is the fold which most prominently affects the local geology of the Hillman area. The north trending axis of the syncline crosses below the eastern edge of the park near Bavington. The closure of the syncline just to the northeast of the park results in a basin-like structure within the main park area. This condition is evident by noting the circular pattern formed by the Pittsburgh Coal structural contours. See Composite Map, Appendix C.

Stratigraphy - The bedrock strata exposed over various portions of Hillman State Park are members of the Conemaugh and Monongahela Formations of Pennsylvanian Age. The total stratigraphic thickness exposed is on the order of 400 feet. All of the strata are sedimentary in origin.

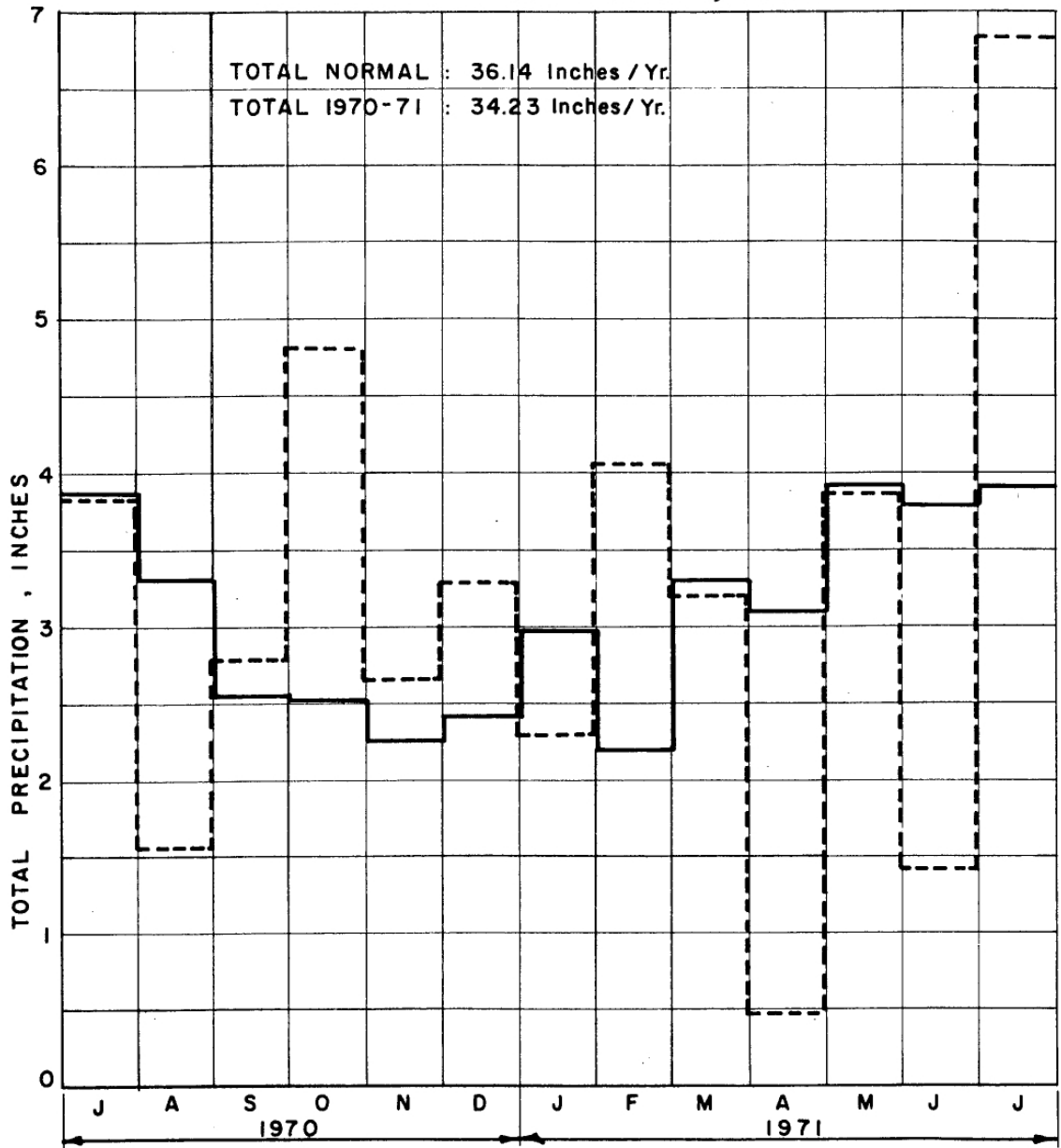
Bedrock Character - The Conemaugh and Monongahela Formations are comprised principally of shales and sandstones, but also contain prominent limestones and coal horizons.

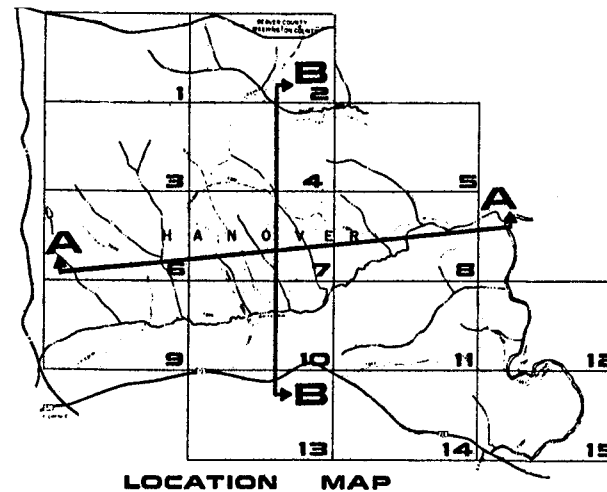
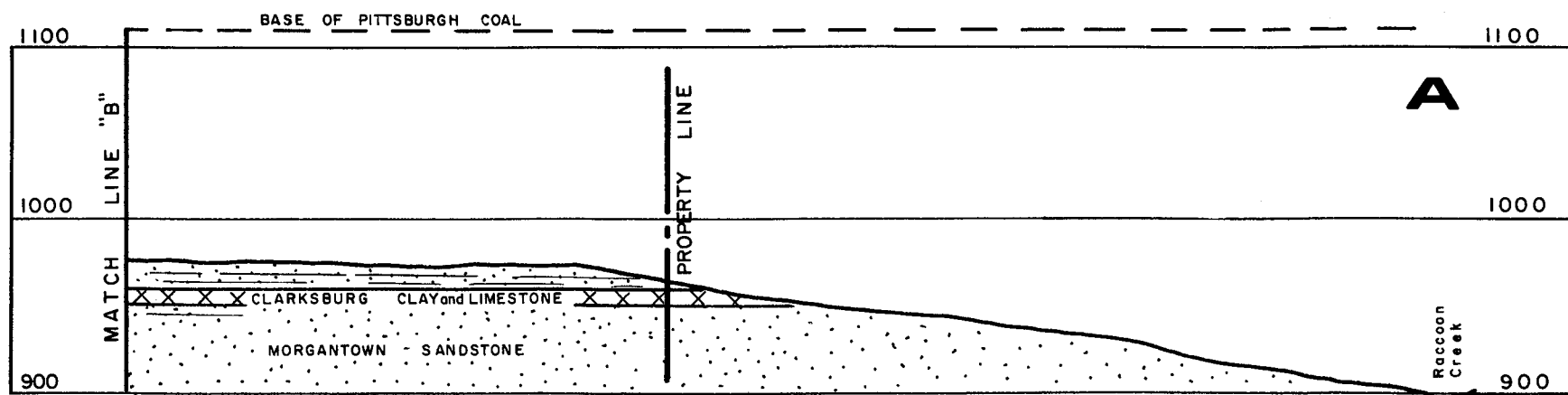
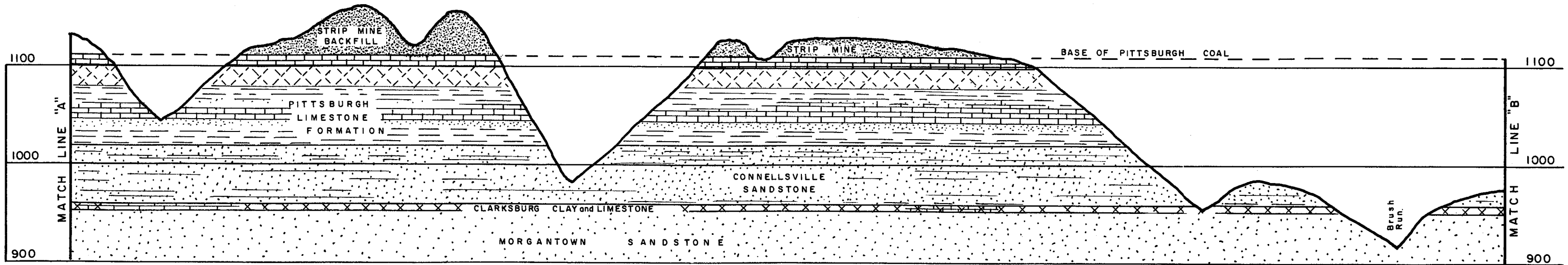
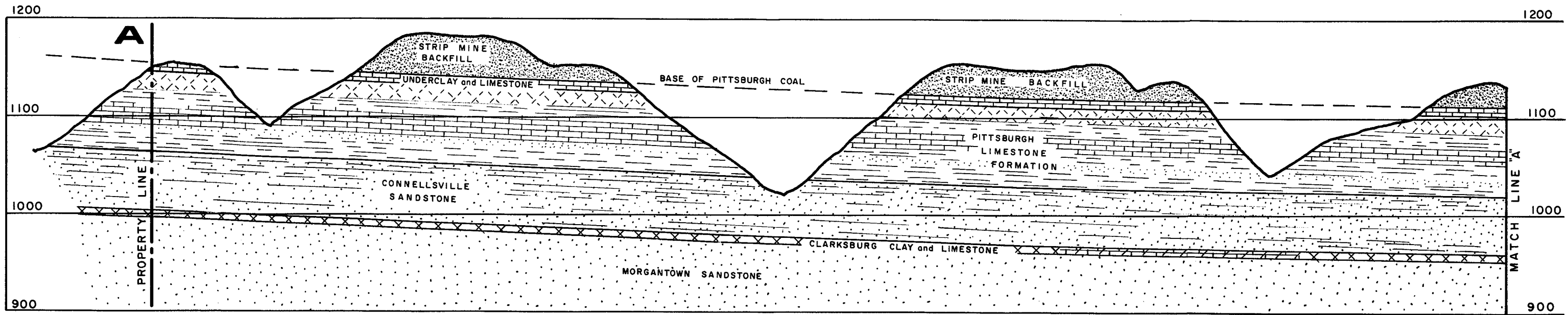
Important Marker Beds - Individual geologic horizons which outcrop in the hills and valleys of Hillman State Park are shown on the Geologic Sections, Plates V and VI. The more important strata are the Pittsburgh Sandstone (actually sequences of shale and sandstone), the Pittsburgh Coal, the Pittsburgh Limestone (actually sequences of limestone and shale), the Connellsville Sandstone and the Morgantown Sandstone.

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MONTHLY RAINFALL DATA  
 (GREATER PITTSBURGH INTERNATIONAL AIRPORT)

———— = 1931-1960 Normal  
 - - - - = 1970-1971 Survey Period

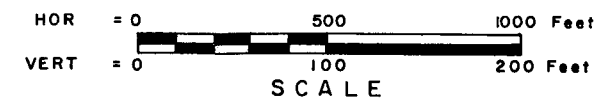


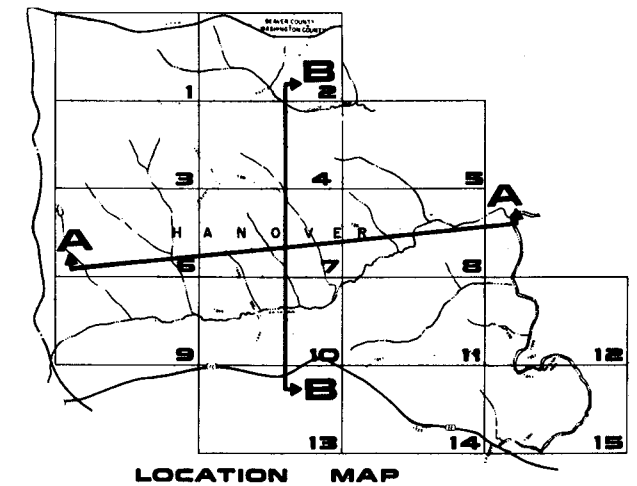
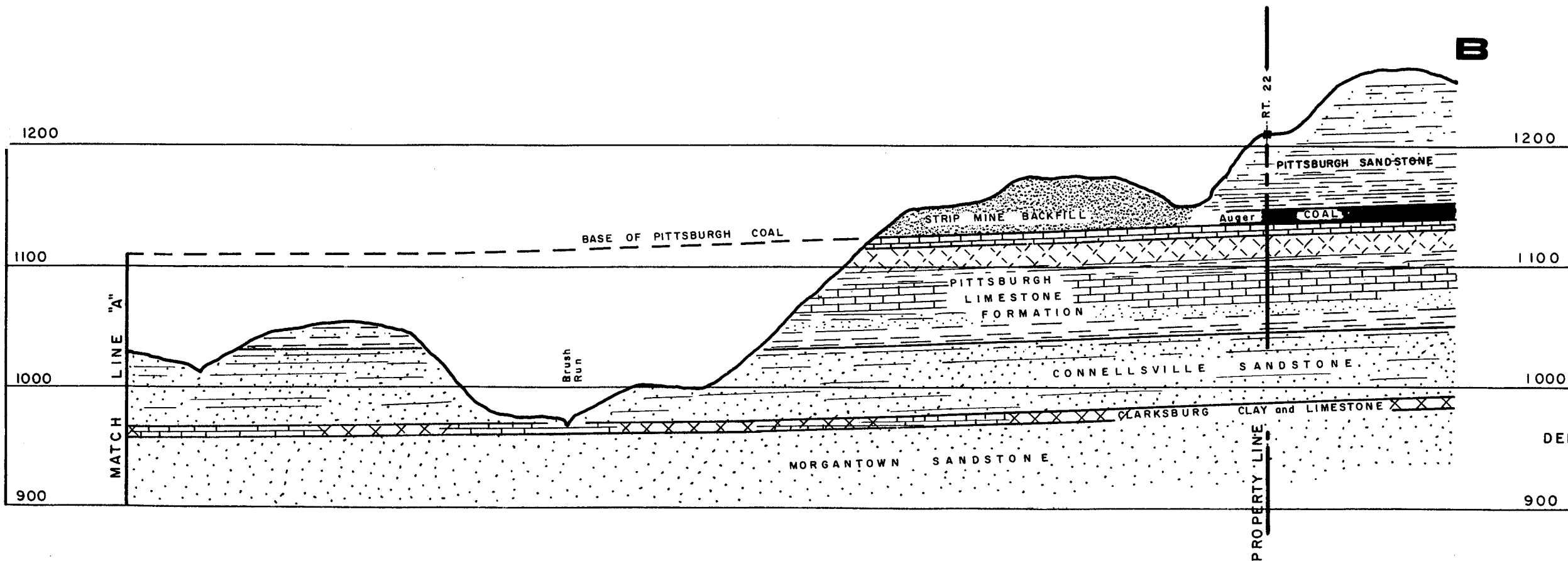
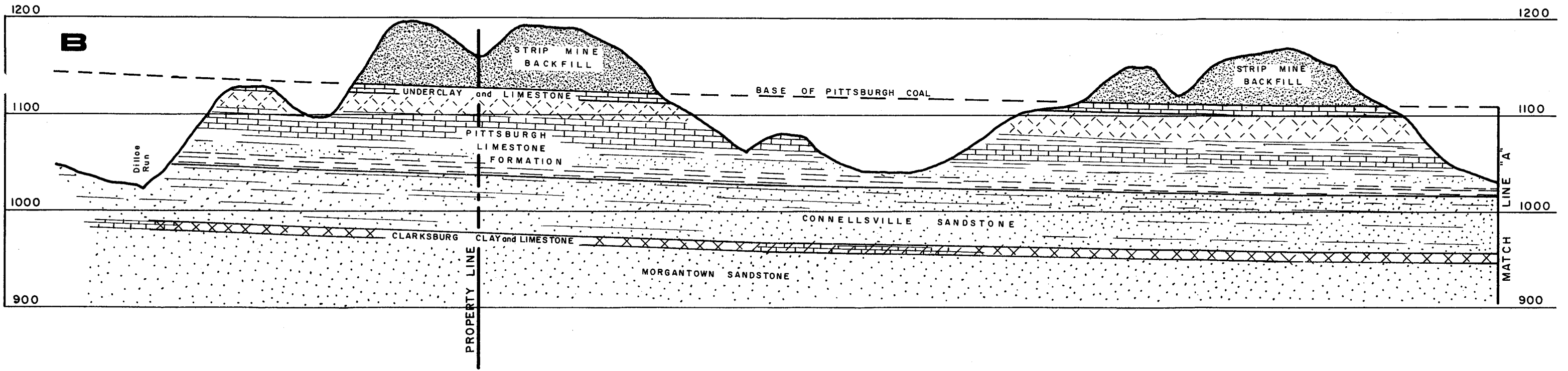


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PLATE V

**GEOLOGIC CROSS SECTION A-A**



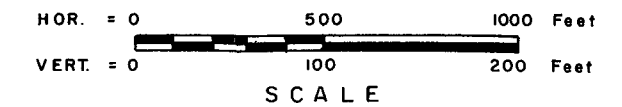


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PLATE VI

**GEOLOGIC CROSS SECTION B-B**





Limestones - The limestone beds which most likely affect the mine acid drainage problem in Hillman State Park are the Redstone, Pittsburgh, and Clarksburg Limestones. The Redstone is located approximately 60 feet above the Pittsburgh Coal Seam and was excavated in many of the mined areas. As a result, remains of this generally thin limestone bed are present in much of the strip mine backfill in the area. Available analyses of the Redstone show it to be high in magnesium content and, even though a recent study has shown that a magnesium limestone is not an effective neutralizer, the presence of the limestone rock fragments in the backfill is believed to have a positive neutralizing action. The Pittsburgh and Clarksburg Limestones are located beneath the Pittsburgh Coal Seam and are cut by the major streams leading to Raccoon Creek. The Pittsburgh Limestone is very erratic and contains numerous interbeds of shale, claystone and sandstone. The Clarksburg is likewise thin and erratic. Both of these limestones aid in the neutralization of acid streams as the water moves toward Raccoon Creek.

Soil Conditions - Strip mine backfill forms the soil cover over most of the higher elevations of Hillman Park. This backfill cover consists principally of shale, claystone and limestone rock fragments and limited amounts of silt and clay. Residual soils - sands, clays, and silts - formed by the weathering of underlying bedrock strata, are the predominant soil types found along most valley slopes below the Pittsburgh Coal elevation. Alluvial, or stream deposited, clays and silts are the principal soil types present along the low, broad stream valley of Brush Run.

## MINING HISTORY

Fifty Years - Mining of the Pittsburgh Coal Seam on the now Hillman State Park property was performed over a period of better than 50 years.

Early Operations - Strip mining over small areas of the Hillman property was first initiated in 1914 by John A. Bell. In the early 1920's, J. R. Elec operated a small country deep mine along the northern edge of U. S. Route 22. This operation, covering an area of about 17 acres, is the only known deep mine located inside the park boundaries.

Harmon Creek Coal Corporation - The Harmon Creek Coal Corporation purchased the majority of the Hillman Park property between the years 1935 and 1940. The Harmon operations began on a large scale in 1937 with the purchase of a 15 cu. yd. shovel.

World War II Operations - Strip mining in the area moved at a significant pace during World War II. To help ease coal shortages during this period, the Harmon Creek Coal Corporation permitted a number of small coal contractors to strip mine in the area on a royalty basis. These smaller operators normally stripped horizontal distances of 25 to 40 ft. into the hillsides. Harmon subsequently stripped the hilltops beyond these points.

Post-War Operations - Mining of the Hillman property continued after World War II when properties within the village of Five Points were purchased and the entire village area was strip mined. A 12 cu. yd. dragline, purchased in 1954, facilitated coal removal during these later years. Auger mining was performed in certain limited areas. Forty-two inch augers were used and auger holes generally ranged from 20 to 180 feet in depth. Mining operations were finally completed in 1966.

Mining Methods - It is estimated that approximately 94% of the coal obtained from the Hillman Park property was removed by the surface stripping method. Augering and the early deep mining operation accounts for the additional 6% of coal removed.

Extent of Mining and Recovery - An estimate of the total amount of coal removed from the Hillman State Park property would range in the neighborhood of 15 million tons or 98% of the estimated coal reserve initially in place.

Remaining Coal - Coal remains in place in only a few isolated areas of Hillman State Park. The estimated remaining reserve, contained for the most part under three unmined hilltops, is 300,000 tons. The amount of vertical overburden above this coal generally varies from 50 to 130 feet. The total volume of overburden covering the 300,000 tons of coal is estimated to be close to 4 million cubic yards.

Early Reclamation - Significant land areas were partially smoothed and reforested by the Harmon Creek Coal Corporation as the stripping operations progressed. Also, auger holes were backfilled as this form of mining was completed. In some of the areas of early reforestation, dense patches of trees with heights of 15 feet or more now exist. The extent of reforestation over much of the Hillman area can be noted by study of the aerial photographs contained in Appendix A.

Locations - The areas of deep, strip, and auger mining, as well as those areas where coal remains in place, are indicated on the Inventory Maps included within Appendix A and on the Composite Map of Appendix C.

## OIL PRODUCING HISTORY

Florence-Five Points Field - A significant portion of the Florence Five Points oil field is included within the Hillman State Park boundaries. This field was once one of the more prolific oil producing pools in the Southwestern Pennsylvania region.

Development - The field was discovered in the late 1800's and was fully developed by 1915. The oil producing territory at one time measured some . seven miles in length and about two and one-half miles wide. The producing horizon is the Hundred-Foot Sand of the Pocono Formation. Well depths generally range from 1,800 feet to 2,000 feet.

Wells - The number of wells originally drilled in what is now Hillman State Park exceeded 170. Although the majority of these wells have since been abandoned, a total of 28 wells are currently classified as active, i.e., producing or potentially productive.

Well Capacities - Initial producing rates of the Florence-Five Point wells ranged from about 100 to 500 barrels daily, but remaining active wells today produce only fractions of barrels per day. There appear to be no reliable records of the cumulative oil produced from the Florence-Five Points field.

Present Ownership - The active wells within Hillman State Park are currently owned and operated by the Cassidy Oil Company of Florence.

Locations - The locations of wells, as could be determined from available records, and their current status, are indicated on the Inventory Maps included in Appendix A.