U.S. Department
of the Interior

Heritage Conservation
and Recreation Service

Lehigh Canal

An HCRS Project Report

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HCRS Publication Number 36

U.S. Department of the Interior
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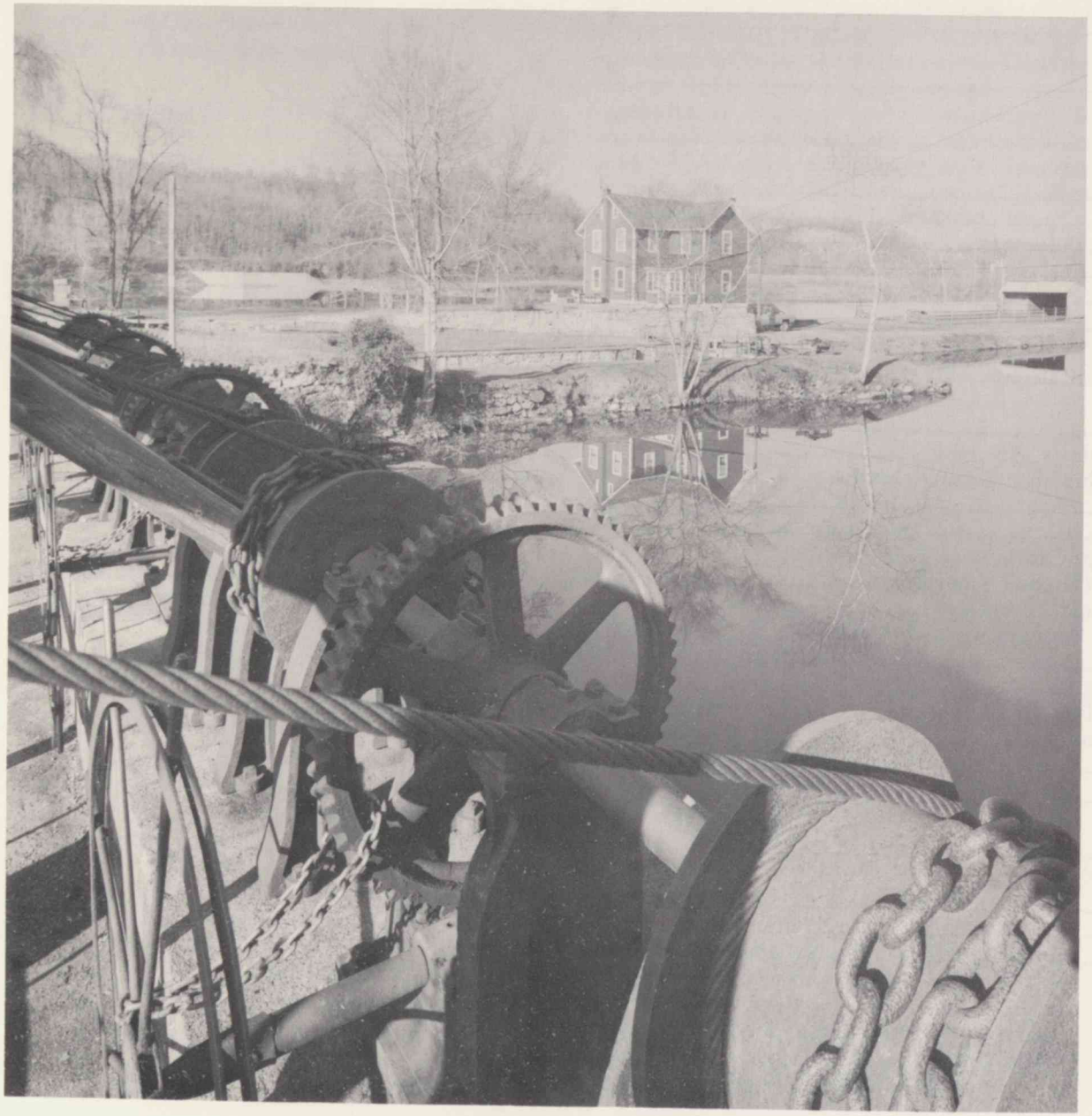

Guard Lock 8 and lockhouse in Hugh Moore Park, the 3-5 mile canal section restored in 1978.

Acknowledgments

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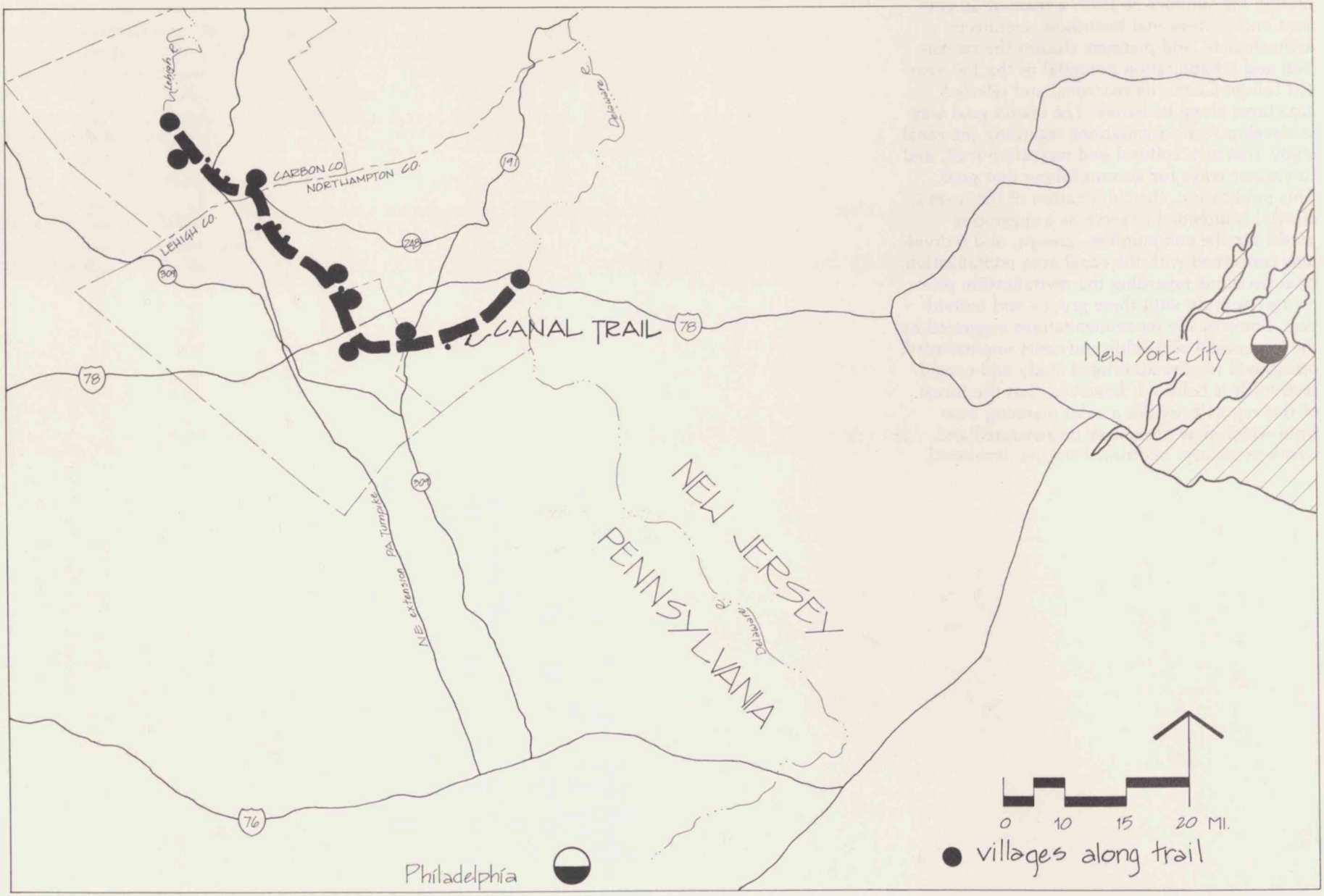
Preface

During the summer of 1979, a team of 10 student and professional historians, architects, archeologists, and planners studied the recreation and rehabilitation potential of the 150-year-old Lehigh Canal, its environs, and selected structures along its banks. The team's goal was to develop recommendations regarding the canal study area as a cultural and recreation trail, and to suggest ways for accomplishing that goal. This publication, the culmination of the team's efforts, is intended to serve as a suggestive model for the communities, groups, and individuals concerned with the canal area revitalization; final decisions regarding the revitalization process rest entirely with these groups and individuals. Some of the recommendations suggested by the team could be quickly and easily implemented, others will require additional study and consideration. It is believed, however, that the thrust of this report provides a solid planning base from which new ideas may be generated and, where necessary, additional studies developed.



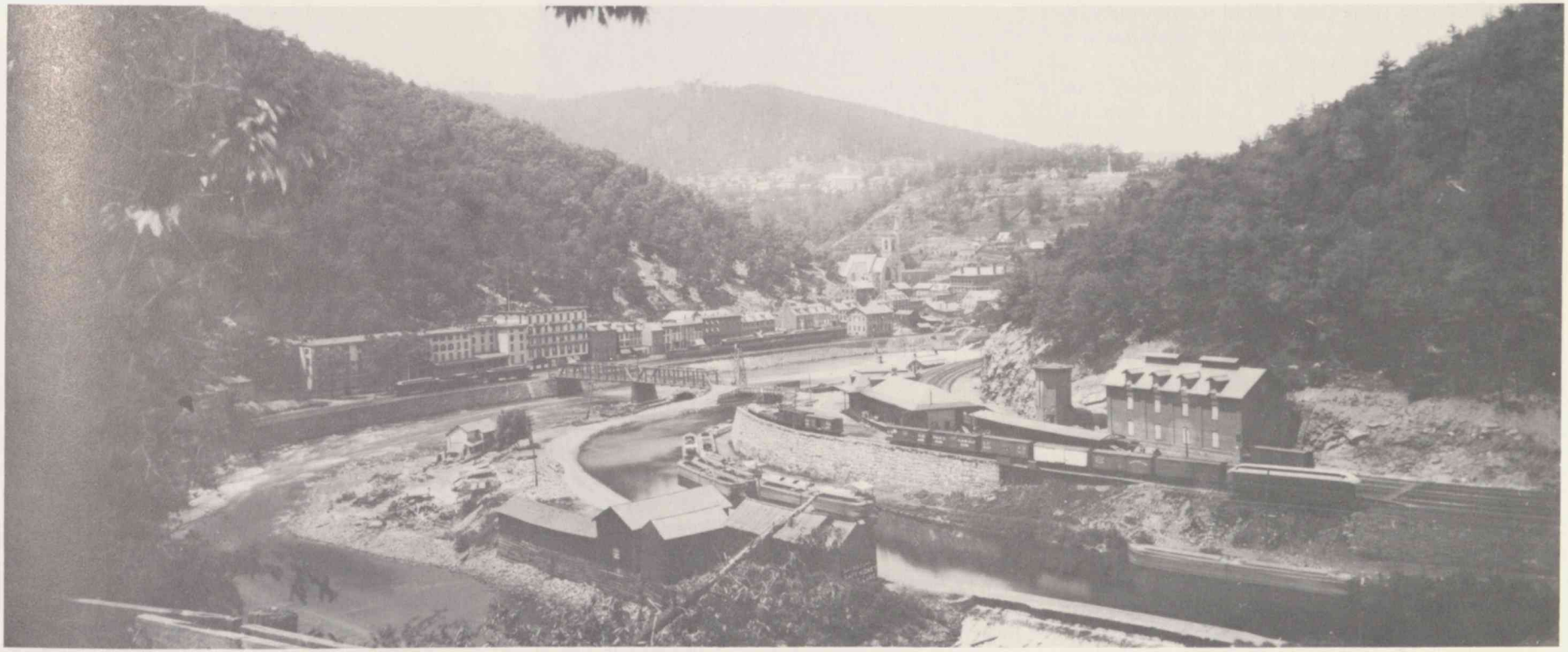
Regional map.

Introduction

The Heritage Conservation and Recreation Service (HCRS) conducted the Lehigh Canal Project during the summer of 1979. A 10-member team examined the 150-year-old engineering work for its potential as a regional recrational/cultural trail. Initiated by an ad hoc committee of federal, state, and local planners, this project is based on a concept originally developed by the Pennsylvania Department of Community Affairs. Composed of representatives from the Carbon County Planning Commission, the Lehigh-Northampton Counties Joint Planning Commission, the Northampton County Park Board, the Pennsylvania Department of Community Affairs, the Pennsylvania Historical and Museum Commission, and the HCRS Northeast Regional Office (NERO), the committee was organized to continue earlier volunteer efforts, initiated more than 25 years ago, to revitalize the canal.

In 1953 the Lehigh River Restoration Association was formed to dredge and to clean portions of the canal and to rebuild the towpath. Sections were rewatered and used for recreation. Although hampered by floods and insufficient funds, the association's efforts were rewarded in the mid-1950s with the restoration of portions of the canal in Weissport, Walnutport, and Freemansburg.

In 1964 the Lehigh Coal and Navigation Company offered the remaining canal properties for sale, and several municipalities bought sections within their jurisdiction. The larger cities of Easton, Bethlehem, and Allentown developed parks along the canal, offering areas



Picturesque Jim Thorpe. Once extending to White Haven, this northern section of the canal was destroyed in a flood in 1862. With the exception of some complete lock chambers, the 46-mile main section originating in Jim Thorpe is all that remains.

for hiking and biking, boating, and picnicking as well as areas at Hugh Moore Park in Easton for a historical interpretation of the canal. These individual efforts were hampered by problems with breaches in the dams, affecting the water supply of the canal, and by poor communication and coordination between communities and interest groups.

The ad hoc committee has taken the lead in uniting canal revitalization efforts and providing direction. Upon the committee's invitation, HCRS implemented a project in 1979 to examine the canal and its resources, to make recommendations to regenerate recreational uses of the canal, to link community efforts, and to act as a catalyst for revitalization of communities along the canal.

The study area is the Lower Division of the Lehigh Coal and Navigation Company Canal, a 46-mile slackwater navigation system paralleling the Lehigh River from Jim Thorpe to Easton in Carbon, Lehigh, and Northampton counties. Two-thirds of the 46-mile trail along the canal is publicly owned and the remaining third is privately held. In June 1979 segments totaling 31.57 miles were designated a National Recreation Trail by HCRS. Approximately 21 miles have been placed on the National Register of Historic Places. The counties included for study are characterized by rich farmland and natural deposits of limestone, slate, zinc, and iron ore. Historically, the rich anthracite coal beds of northeast Pennsylvania provided the economic stimulation for construction of the canal. Today, lying 50 miles from Philadelphia and 90 miles from New York City, the canal is in a key regional location to link with existing recreational resources. The objective of the HCRS study was to assess the cultural and natural resources along the canal, to suggest ways to enhance their use, and to encourage economic stimulation in canal communities.

Inventory

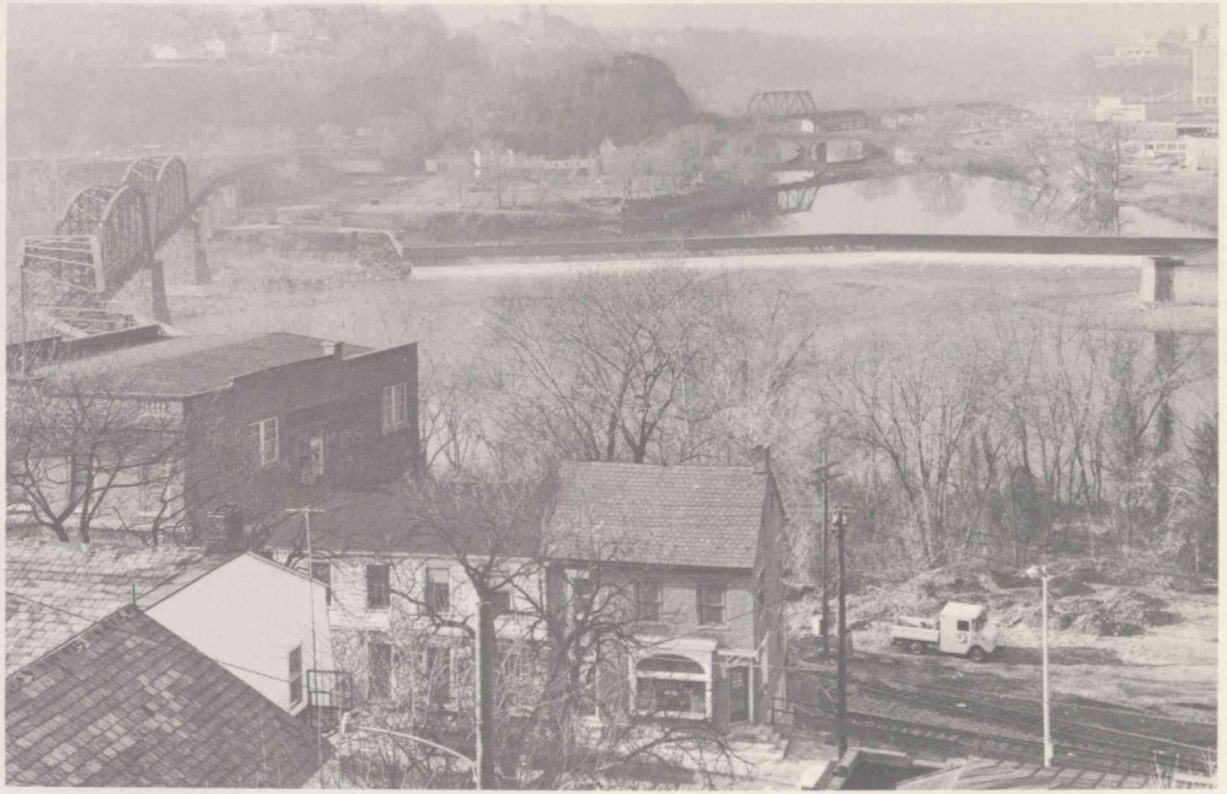
Once a thriving transportation corridor, important to the development and growth of the Lehigh Valley region, the Lehigh canal helped unify the people and places in the Lehigh Valley. Much of the canal is now an underused resource, and has suffered from a half-century of neglect. The recommendations of this study outline actions to reestablish the canal as a resource that could stimulate economic revitalization in the communities through which it runs. The summary of the inventory and analysis of canal resources forms the basis of the recommendations.

History

The Lehigh Valley has been inhabited since the early 1700s. German settlers developed Upper Milford in 1738 as the region's first township. Moravians established Bethlehem and Nazareth, the region's first towns, in the 1740s. Scotch-Irish immigrants settled in the area between Catasauqua and Treichlers and inland to present-day Bath. During the 1700s Bethlehem was the center for economic growth and trade in the valley with trails and roads throughout the region leading to Bethlehem.

Located at the fork of the Delaware and Lehigh rivers, Easton became the seat of Northampton County in 1752 and surpassed Bethlehem in importance and population by the 1790s. Allentown was founded in 1762 at the fork of the Jordan and Lehigh Creeks, and was established as a trade and milling center.

By the time of the American Revolution, small-scale industry and commerce such as weaving, tanning, shoemaking, and gunsmithing flourished. Swift streams powered many grist and sawmills, and the agricultural economy blossomed to meet the valley's growing population.



The Lehigh River meets the Delaware River at Easton, Pennsylvania and Phillipsburg, New Jersey, terminus of the Lehigh Canal. Three canals meet here — the Delaware, the Morris, and the Lehigh.

The introduction of navigation on the Lehigh River in the 1790s and the eventual completion of a slackwater canal system in 1829 changed the history of the Lehigh Valley and brought the region into the forefront of America's Industrial Revolution. Pennsylvania's anthracite coal fields lie north and west of the valley. The Lehigh Coal Mine Company was formed in 1792 to exploit coal fields discovered in the vicinity of Mauch Chunk, now Jim Thorpe. Lying dormant for 25 years, the company lacked capital, a sound market for anthracite, and any means of shipping it, if a market were found.

In 1817, Josiah White, Erskine Hazard, and George F. A. Hauto leased the Lehigh Coal Mine Company holdings and received legislative permission to form the Lehigh Coal Company and the Lehigh Navigation and Coal Company, consolidated the following year as the Lehigh Coal and Navigation Company (LC&N). The company improved the Lehigh for downstream

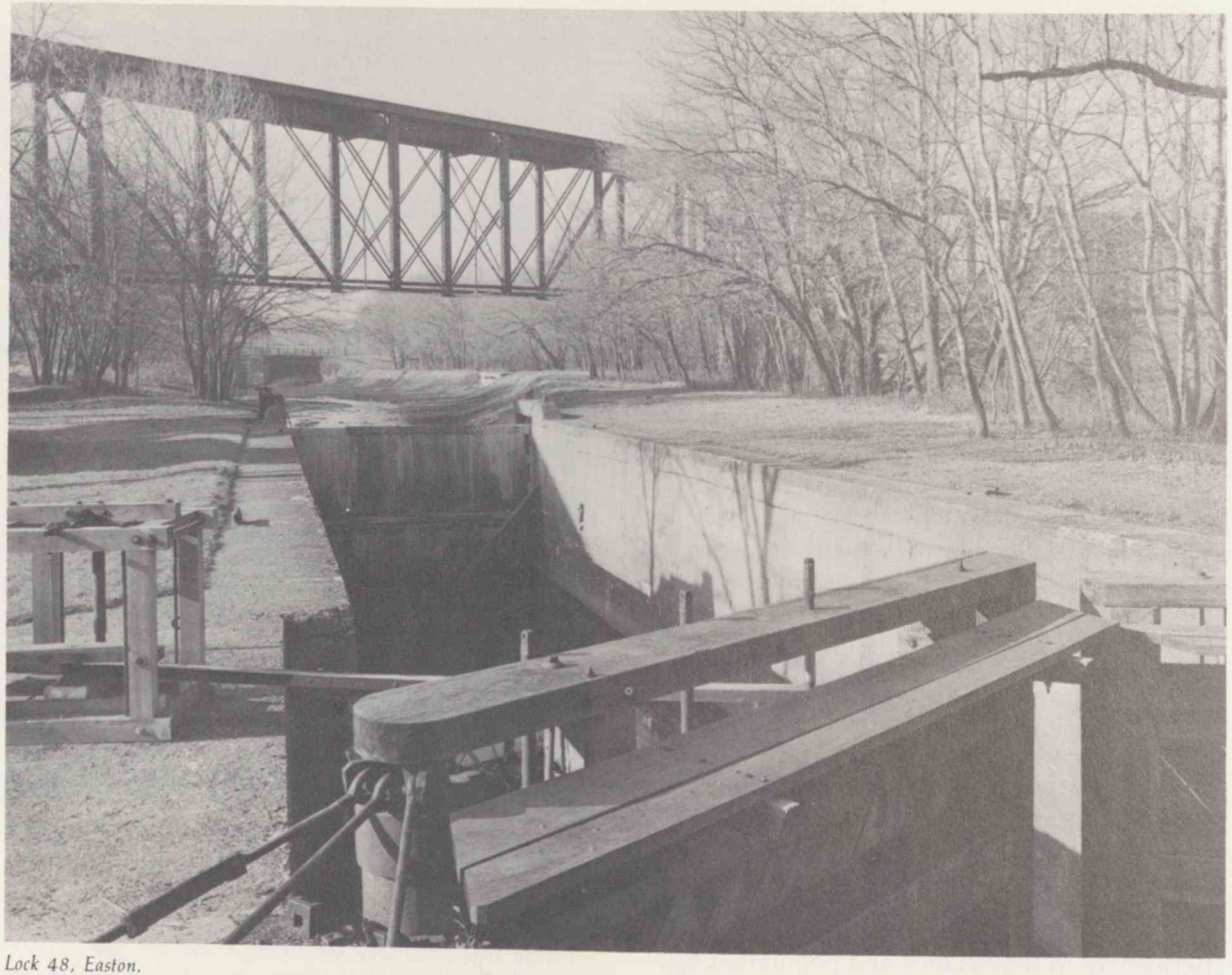
Historic view of the canal at Abbott Street, Easton. This was one of the earliest and largest industrial areas to develop along the canal. Courtesy of Canal Museum, Easton.

navigation by arks (a type of coal barge) with a series of 37 wing dams and 13 timber crib dams with flash gates, locally called "bear trap locks."

Increased demand for coal, competition from the Schuylkill Navigation Company, 25 miles south, and the dubious economics of building arks at Mauch Chunk, only to have them broken up at Philadelphia and sold as low-grade lumber, led the company to petition for further improvement rights.

In 1826 the LC&N received permission to build a series of locks, dams, channels, and slackwater pools to allow upstream and downstream navigation between Easton and Mauch Chunk with the stipulation that navigation be extended an additional 25 miles upstream to White Haven within 5 years.

In 1827 the company employed Canvass White as chief engineer for the Lehigh Canal construction. The 46-mile lower division between Easton and Mauch Chunk was completed in June 1829 with nine timber crib dams (varying in height from 5 to 16 feet), and 52 locks, (100–130 feet long by 22–30 feet wide with lifts of 2–13 feet to overcome the 353-foot change of elevation). The canal prism was 5 feet deep, 60 feet wide at the top, 45 feet wide at the bottom, and could accommodate 100 to 150 ton



Lock 48, Easton.

mule-drawn boats. There was a total of 10 miles of slackwater navigation above the nine dams with towpaths along the river bank. Although the state's Delaware Division canal, opened in 1831, provided the necessary link between the Lehigh at Easton and Bristol near Philadelphia, its conservative 100-foot by 11-foot locks restricted the size of boats on the Lehigh and proved a source of aggravation to company proprietors. The company took an active role in developing the valley by selling and leasing rights to excess canal water to mill operators for power, and by providing incentives for the use of anthracite in iron smelting.

A handful of charcoal-fired blast furnaces operated in the valley during the 18th and early

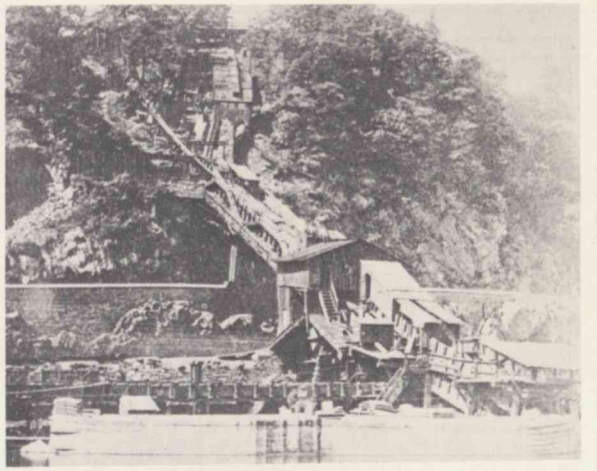
Lehigh Coal and Navigation Company stock certificate picturing Josiah White and Erskine Hazard, organizers of the company.

19th centuries. With hopes of enlarging its coal sales, the LC&N heavily financed anthracite smelting experiments. An experiment at the Mauch Chunk furnace proved to be a technical success but an economic failure. The real boom in Lehigh Valley iron production followed David Thomas' successful introduction of hot-blast anthracite smelting at the Crane Iron Company's Catasauqua Works in 1840.

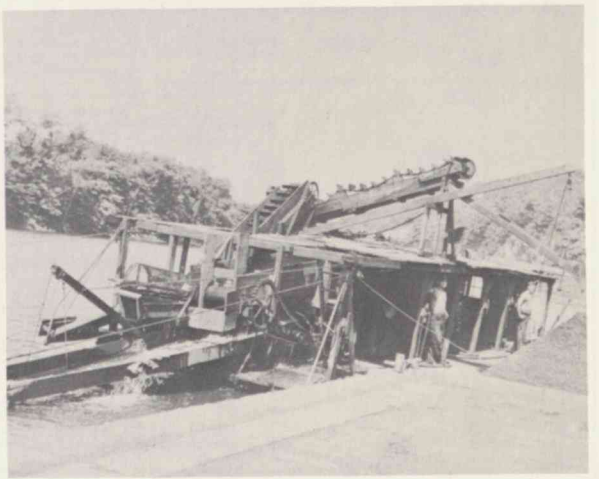
The canal and the coal it transported spurred development of the pigment, slate, cement, and silk industries in the valley. A large part of the zinc ore mined at Friedensville, south of Bethlehem, and processed at zinc plants in Bethlehem and later Palmerton, went into white zinc oxide pigments.

William Roberts and Nelson Labar opened the first commercially successful slate quarry at Slatington in 1844. There were 5 quarries in the area by 1850, 41 by 1884, and more than 60 by 1900. Factories near the quarries and in Slatington trimmed and dressed slate for roofing, school slates, store fixtures, billiard tables, floor tiles, stair treads, mantles, and drainage fixtures.

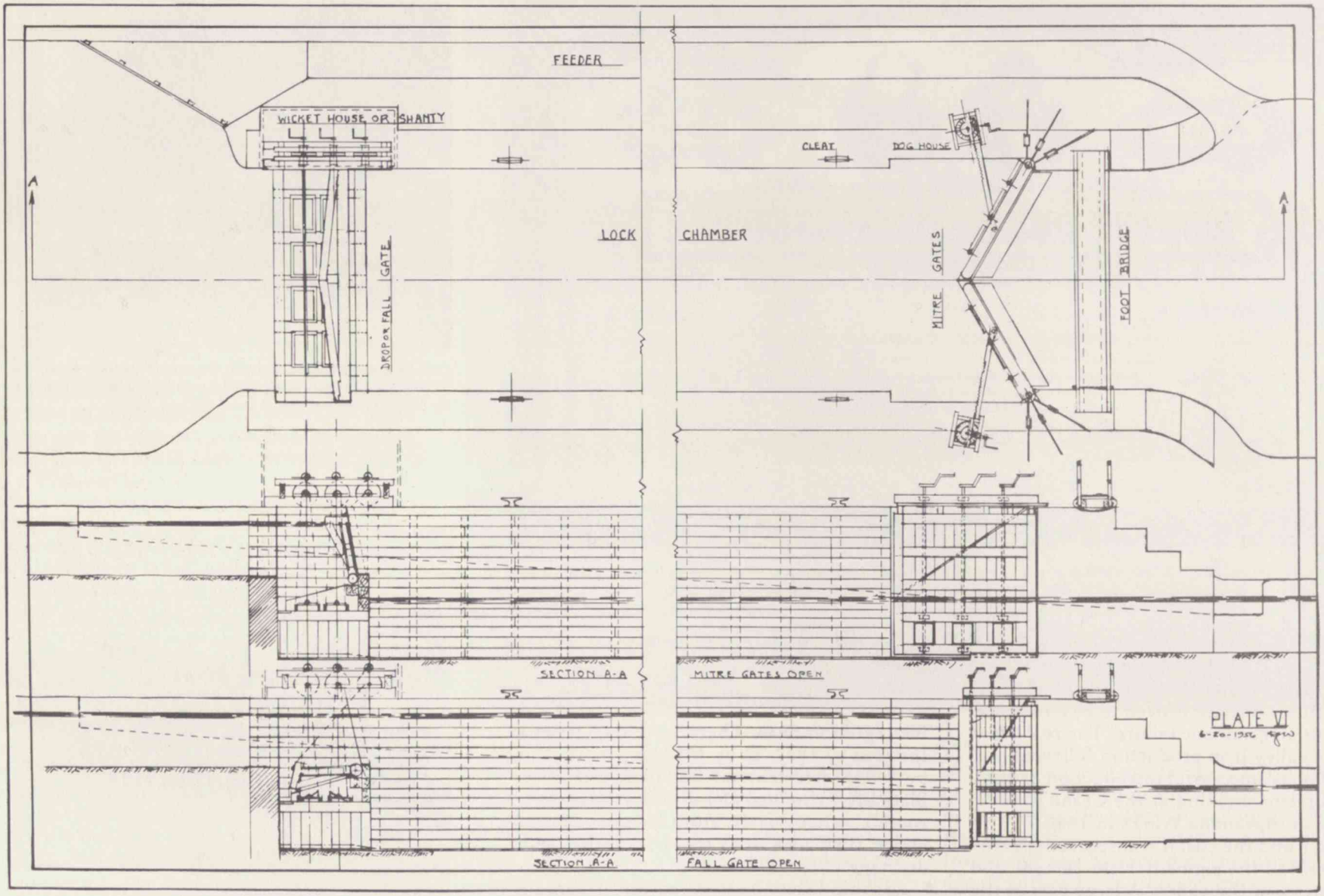
Canvass White located beds of meagre limestone suitable for the manufacture of natural hydraulic cement near Lehigh Gap in 1828.



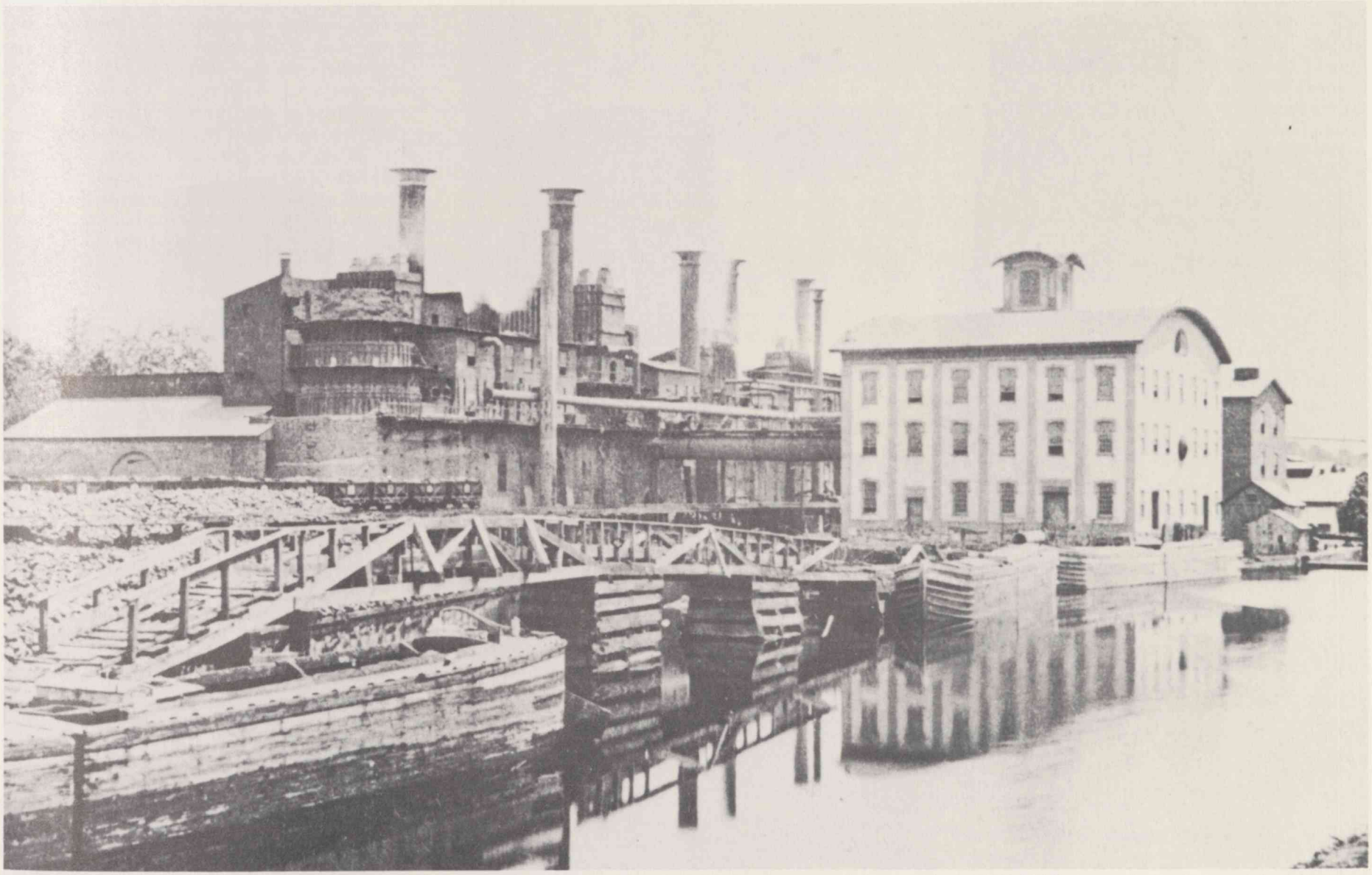
Coal chutes near Mauch Chunk (Jim Thorpe) used to transport coal from the terminus of the Switchback Railroad to the boats at the loading dock on the Lehigh Canal. Courtesy of Canal Museum, Easton.



Canal dredge, which operated on the canal during the 1950s. During the Lehigh Canal's active years this vessel scooped up coal, which had fallen off the canal boats. Courtesy of Canal Museum, Easton.



Typical lock construction along the Lehigh Canal. Locks along the canal were constructed to accommodate 100- to 150-ton boats—a departure from previous English and American canal construction, which limited capacity to 25 tons. Reprint from Proceedings, *1958. Courtesy of the Lehigh County Historical Society.*



Historic photograph of the Crane Iron Company near Catasauqua. The hot blast anthracite smelting method applied here in 1840 was responsible for a great boom in Lehigh Valley iron production. Courtesy of Canal Museum, Easton.

Coplay Cement Kilns, Coplay.

Calcined in upright kilns at relatively low temperatures, natural cement depended on impurities in its parent limestone in order to set. In 1866 David O. Saylor built two natural cement kilns at Coplay. Nine years later, using a new English process of high temperature calcination, he produced this country's first Portland cement. The hard water-resistant Portand cement proved to be popular and plants were built throughout the region's limestone belt. By 1890 about 70 percent of the country's Portland cement was produced in the Lehigh Valley.

The men who came to the Lehigh Valley to work the canal, railroads, ironworks, and slate quarries brought wives and children with them or started families soon after they arrived. In the late 19th century, textile tycoons from Paterson, New Jersey, the silk capital of the United States, recognized and took advantage of the vast untapped pool of female and child labor by building branch mills in the valley. The industry began in 1881 with Phoenix Silk Company's Adelade Mill in Allentown and spread throughout the valley. By 1910 there were silk mills producing threads, broad goods, ribbons, and braid in almost every city, town, and borough in the valley.

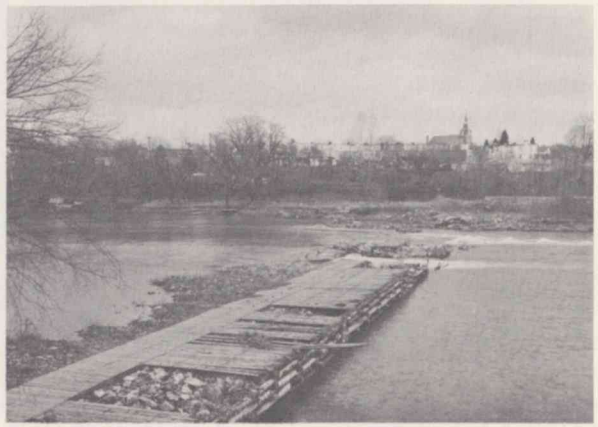
The economic growth in the valley was also stimulated by the railroads. The main reason for the demise of the Lehigh Canal was the railroad which was faster, usable year-round, and easier to build and maintain than a canal. Inability to compete with the railroads, damage from a major flood, and the Depression closed the canal in 1931.

Cultural and Natural

Prior to developing the trail plan, cultural and natural resources were inventoried and assessed. Structures such as dams, locks, lock-

Cutting ice from canal near Island Park. Courtesy of Canal Museum, Easton.

tenders houses, silk mills, ironworks, railroad stations, and repair shops still exist. Many of these lie in ruins, creating a romantic setting, itself a unique resource of the Lehigh Valley. Reminders of the canal era also include main streets where canal and land traffic once met. Each of these reminders is a resource, part of the cultural heritage of the Lehigh Valley.



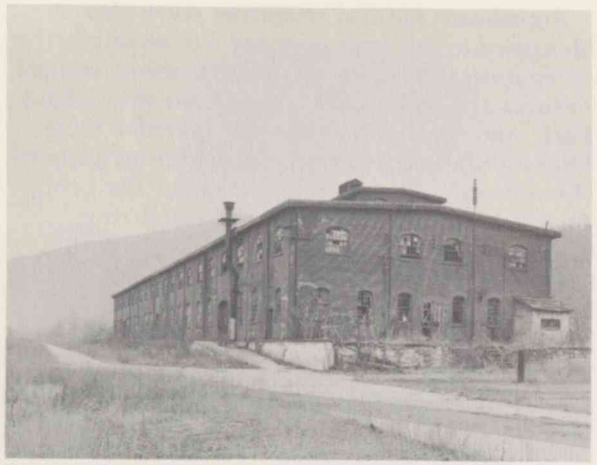
Hokendauqua Dam, with a view to North Catasauqua.

Significant natural resources were also identified in the canal corridor. For example, the steep forested slopes of Carbon County, unique natural areas like Catasauqua Lake and Island Park, and scenic areas like the corridor from Laury's Station to Treichlers also contribute to the natural and cultural heritage of the Lehigh Canal. Identifying, preserving, stabilizing, using, and enhancing these resources is the objective of the recommendations made in the trail plan.

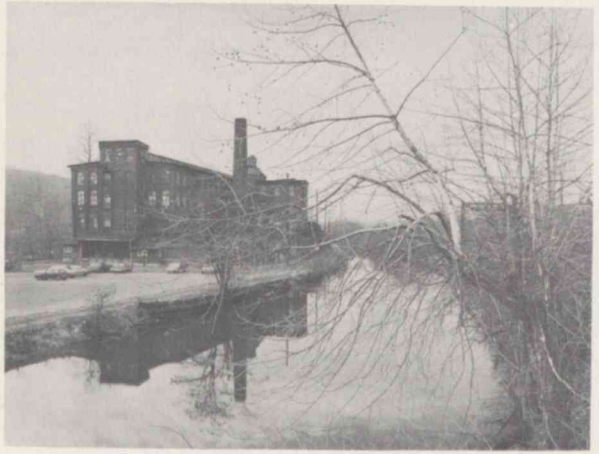
Bethlehem Steel plant, Bethlehem.

Historic and Archeological Resources

The historic and archeological resources inventoried were related to the canal and the history of the Lehigh Valley. Historic features included dams, guard locks, lift locks, aqueducts, and lockhouses; railroads, bridges, and highways; coal, iron, steel, slate, cement and zinc industries; silk cordage and machinery manufactures; grain and sawmills; breweries; and communities along the canal. The archeological reconnaissance survey covered items from the

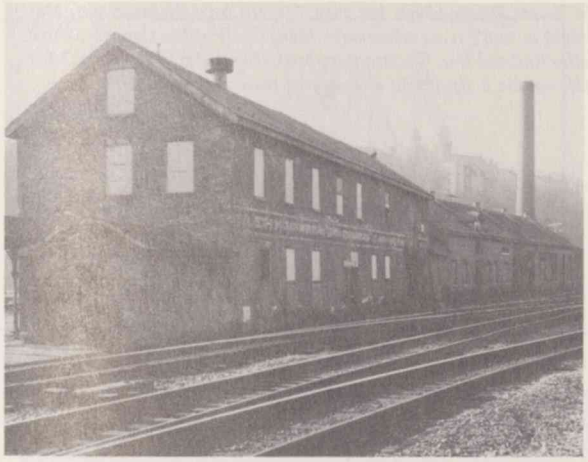


Packerton Shops, Lehighton.



Saquoit Silk Mill, Bethlehem.

Glendon Iron Company ruins in Hugh Moore Park, along the eastern section of the Lehigh Canal. All that appears to remain of this once-successful industry are the deteriorating foundations of three blast furnaces built between 1844 and 1850. Public appreciation of the site's historic significance could be enhanced by making interpretive information available on an adjacent marker.



Lehigh Valley Railroad steam laundry and dining car supply building, Easton.

Paleolithic period to the Industrial Age. Altogether approximately 375 historic and archeological sites were inventoried, providing a data base for planning and historical interpretation.

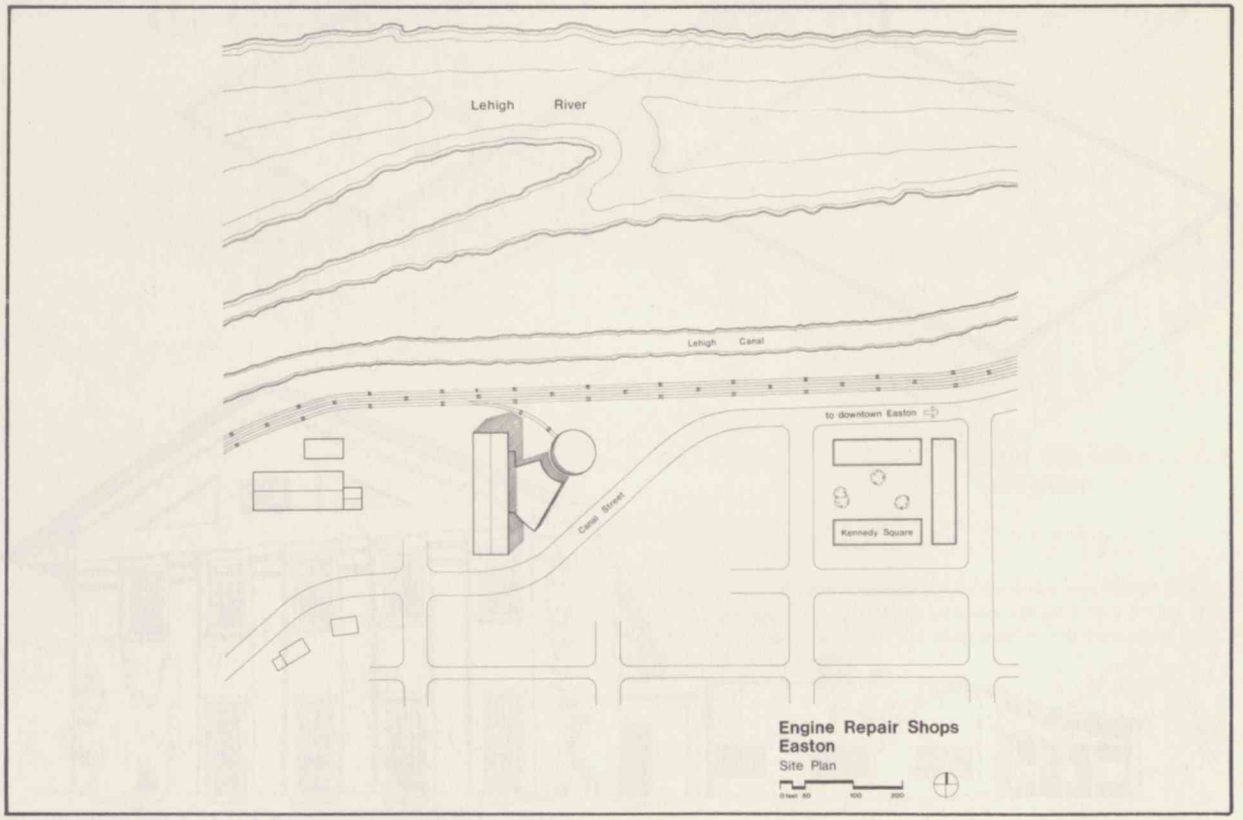
Because they are not always readily visible, potential archeologically sensitive areas along the canal were identified on the trail plan to assist local planners and those implementing the canal plan. Exact locations are not published here, but are on file at the Pennsylvania Historical and Museum Commission. Since only a preliminary reconnaissance survey was possible for locating archeological evidence, more indepth research and concomitant survey should be conducted prior to canal development.

Once archeological sites are identified, the options for protection, are avoidance or mitigation. Avoidance of cultural resources is the most desirable solution and can be easily accomplished if these considerations are included early in the planning process. Excavation of a site may destroy the resource, and prove to be expensive, and time-consuming. It must be the last alternative considered in planning or development endeavors. (See A-3 for federal compliance explanation and requirements.)

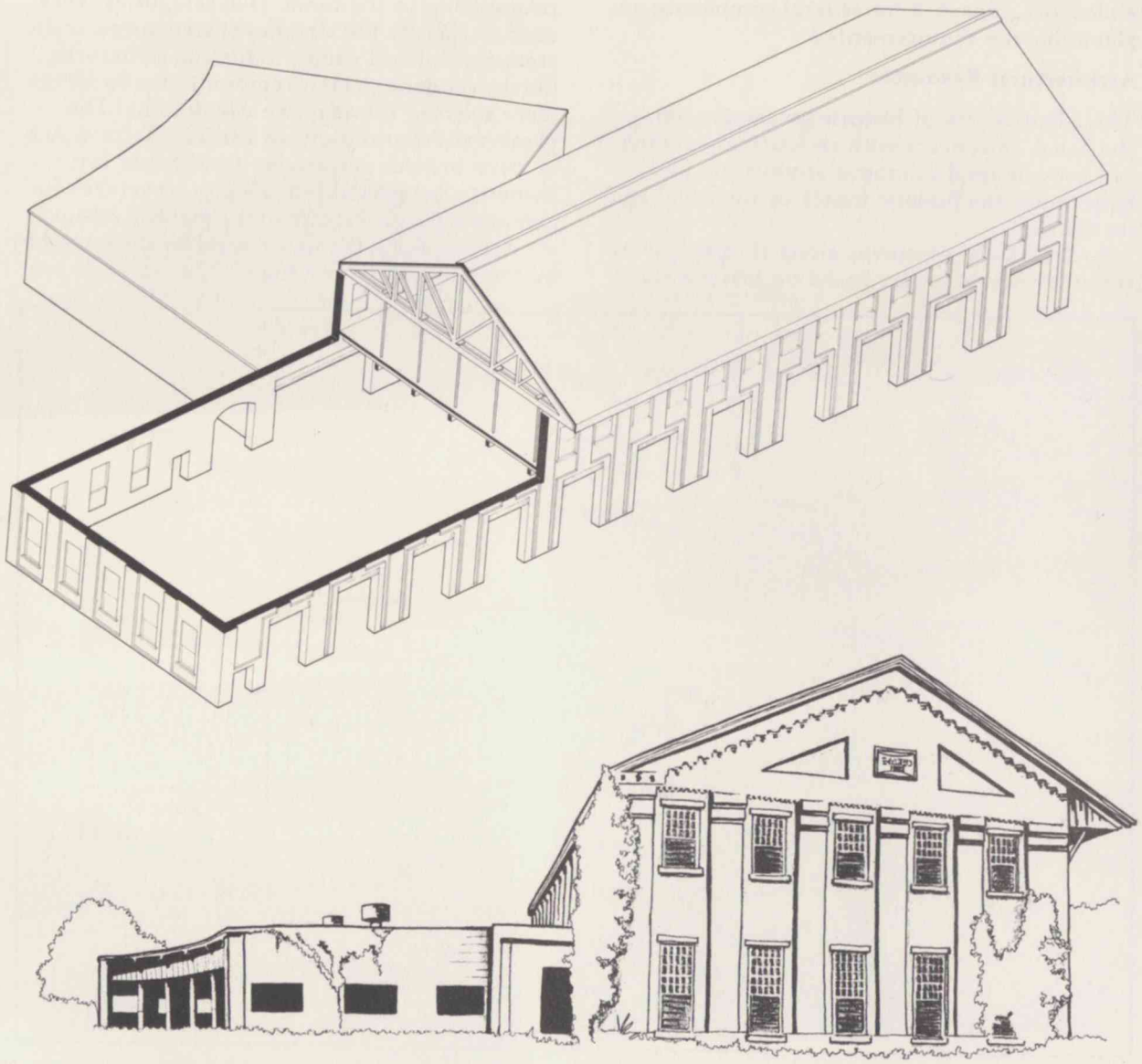
Architectural Resources

The adaptive use of historic structures along the canal, in concert with recreation planning, can provide local economic stimulation and help retain the historic legacy of the canal and its towns.

Architectural resources along the canal were selected from a survey based on historic significance, structural integrity, siting, and relationship to the canal. Five categories were used to classify the significant structures: train stations, railroad shops, industrial structures, hotels, residences. Four representative buildings were selected for adaptive use designs. The preservation provisions of the Tax Reform Act of 1976 provide certain tax treatments for owners who rehabilitate historic structures for commercial use. Private investment in historic structures along the canal could be encouraged by the tax incentives available through this act.

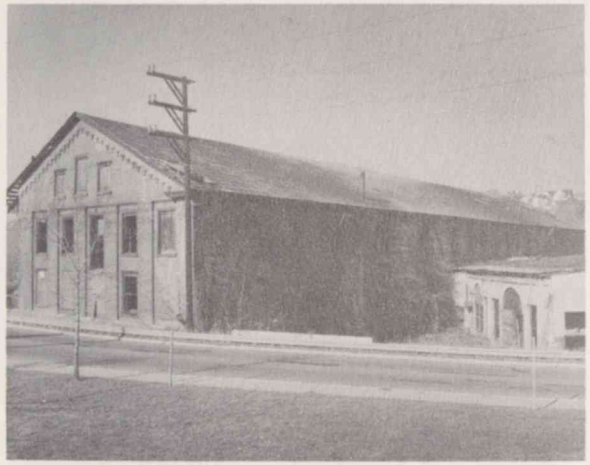


The Easton Repair Shops complex lies 3 miles east of Easton on Canal Street in a middle- and low-income residential area. It is within a 20-acre area owned by the City of Easton Redevelopment Authority, and is zoned for civic, community, and educational use.

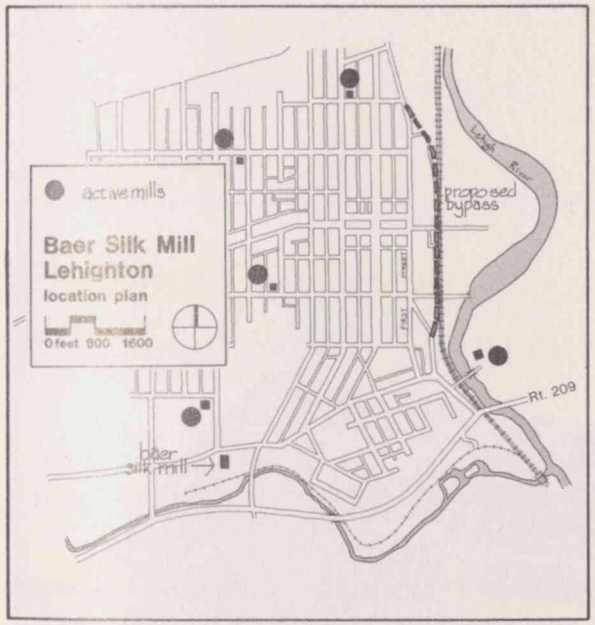


Elevation of Easton Repair Shops.

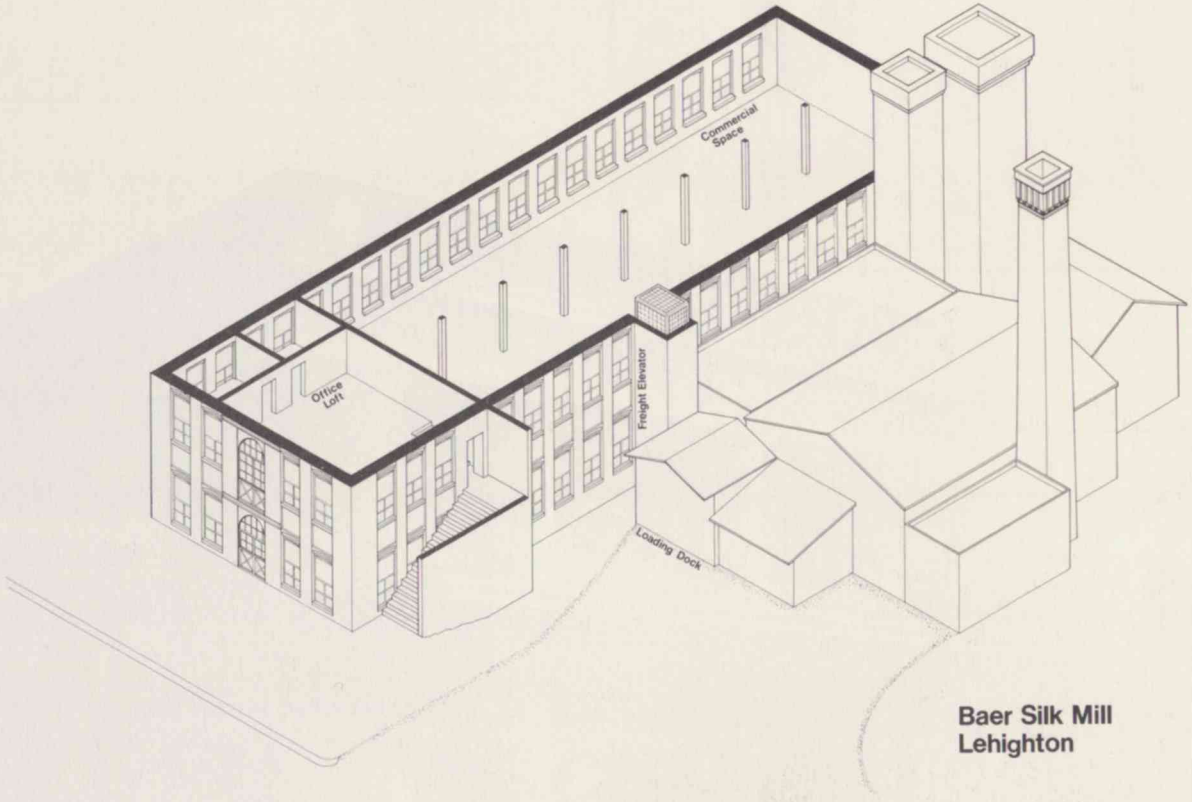
The Easton Repair Shops, less than 250 feet from the canal, were constructed in 1882 as one of two major heavy repair centers along the Lehigh Valley Railroad line. The two-story brick shops, 256 feet long by 65 feet wide, contain a significant second-story truss system.



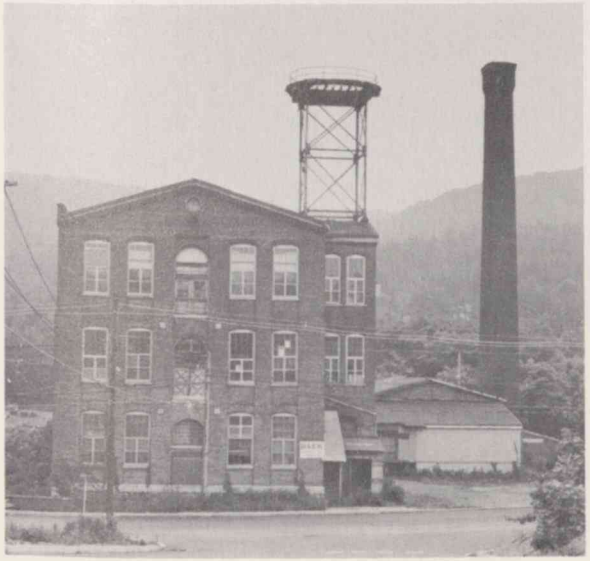
The shops and adjacent roundhouse are vacant and have some deterioration of planking, trusses, and roof asphalt sheathing; however, they are structurally sound. Adaptive use as a restaurant, bike or canoe rental shop, a hikers' shop, or an industrial office or warehouse could benefit community and canal development.



Baer Silk Mill shown in relation to active mills and local access routes.

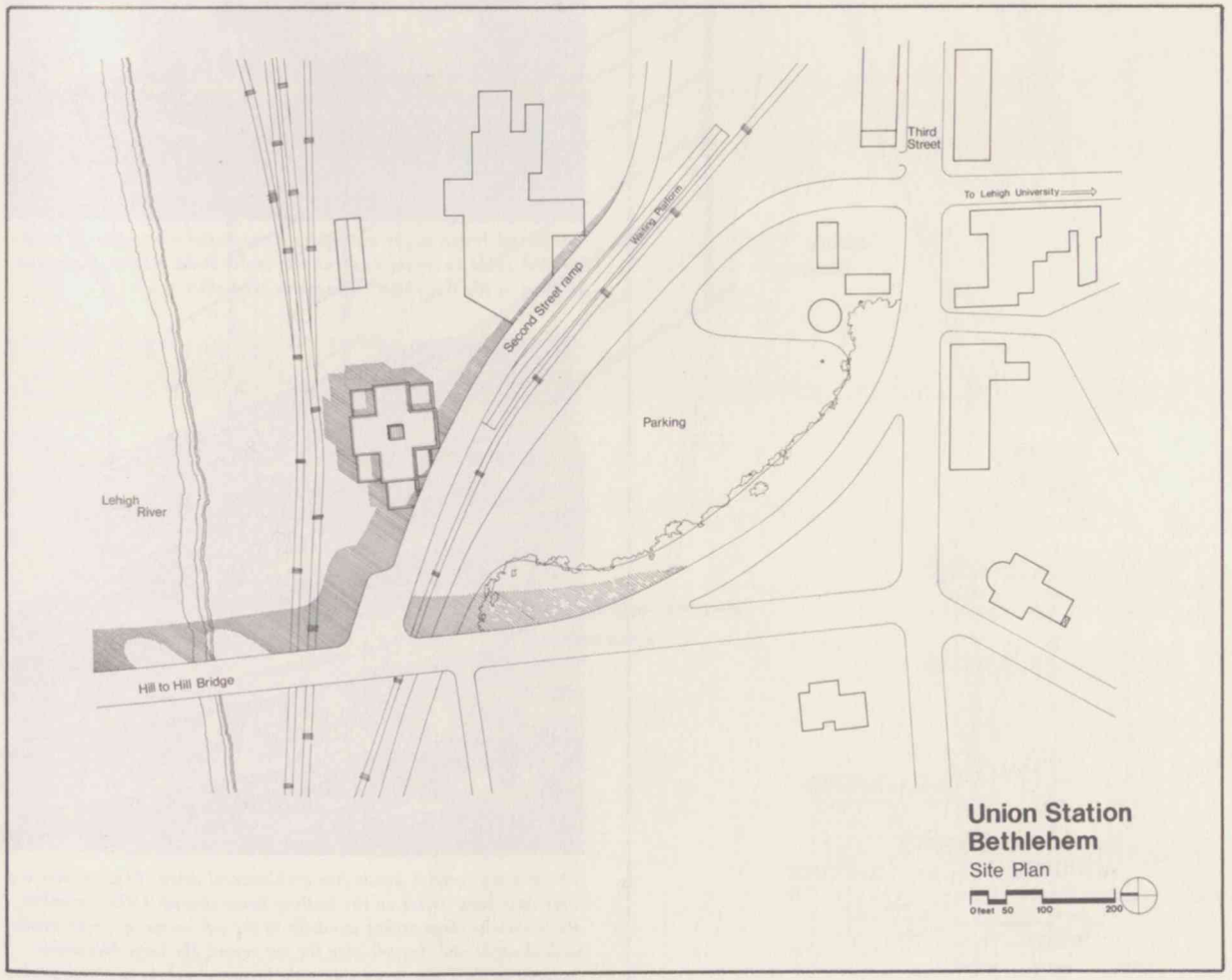


Open floor space, numerous windows, loading docks, and an operable freight elevator make this building an attractive site for a reuse project. It would be particularly well-suited for adaptation as a factory outlet for the area's five active mills.

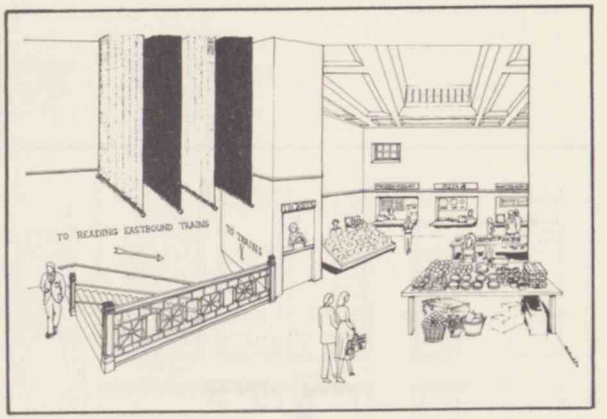


The architectural style of the 1898 Baer Silk Mill in Lehighton is typical of the other mills in the area, and represents the once-prosperous silk industry of the Lehigh Valley.

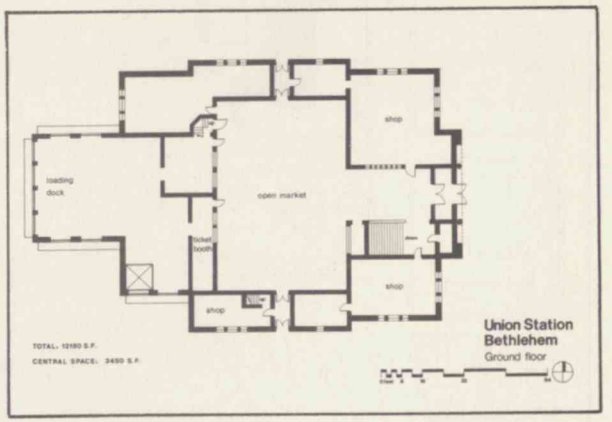
Bethlehem's Union Station was once a fashionable neo-classical railroad station. A shattered stained-glass skylight in the waiting room, tiled walls, remains of waiting benches, and cast-iron fences and railings are reminders of its former elegance. It was constructed in 1924 to serve the Lehigh Valley Railroad and the Reading Railroad. An underground corridor, now blocked, connected the station interior with the tracks outside.



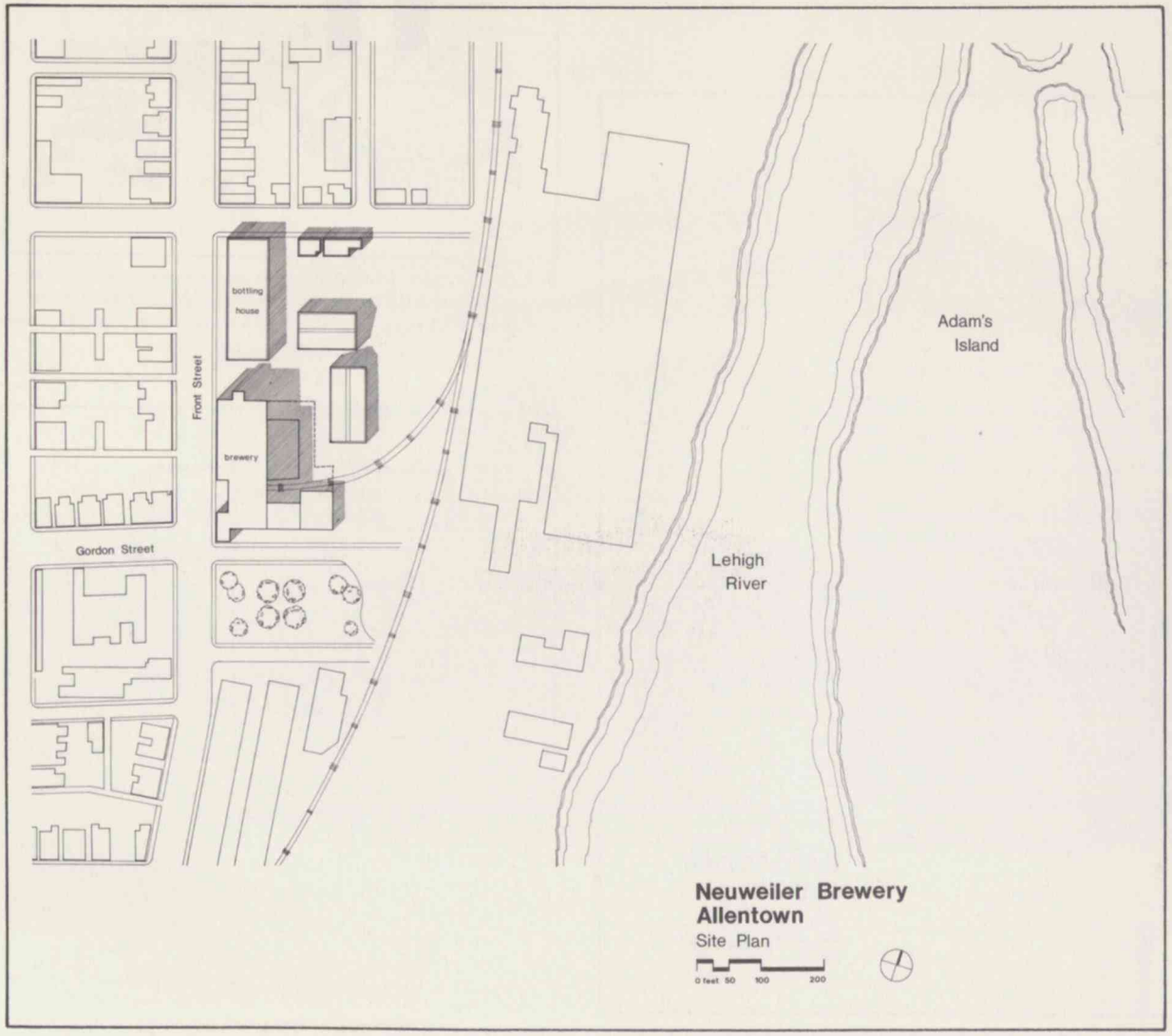
The station is currently used by Amtrak for commuter service to and from Philadelphia. It is located on Third Street in Bethlehem in an industrial area bordering the Bethlehem Steel complex, and is within two blocks of Lehigh University.



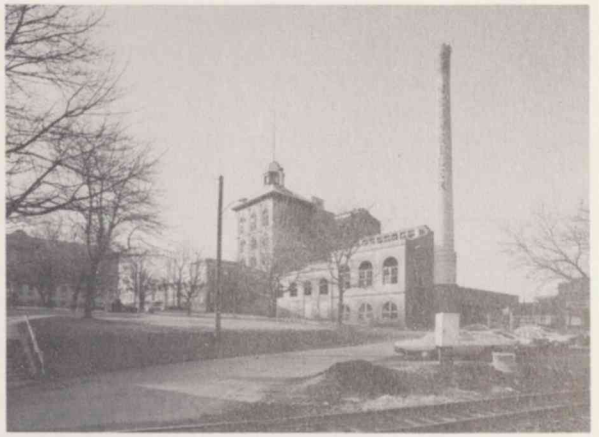
Bethlehem has plans for developing this area as a transportation services district. Business resulting from adaptive use of Union Station for offices, a Amtrak ticket office, specialty shops, a market, and cafes could support the proposed district as well as nearby canal facilities.



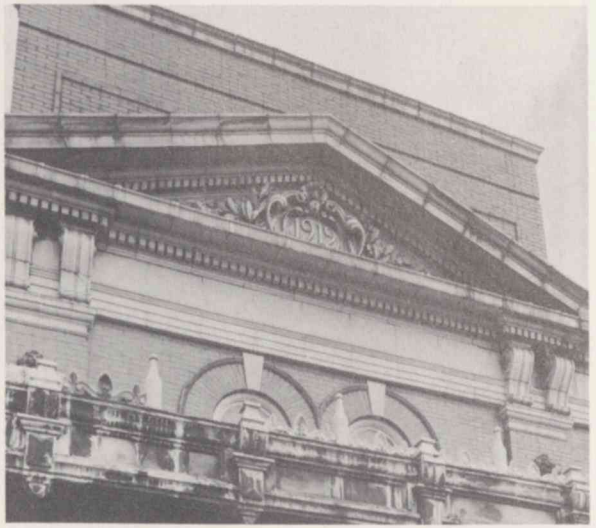
Floor plan of Union Station, Bethlehem.



Site plan of Neuweiler Brewery.

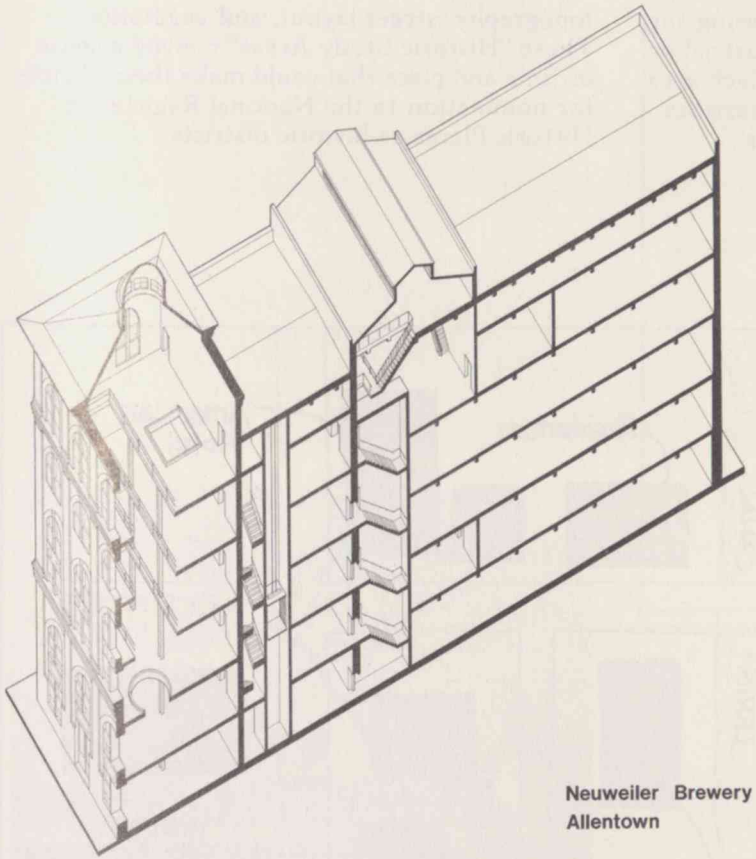


The vacant brewery, surrounded by a residential and industrial neighborhood, could be reused as a cultural center containing museums and galleries, a library, shops, restaurants, and office spaces.

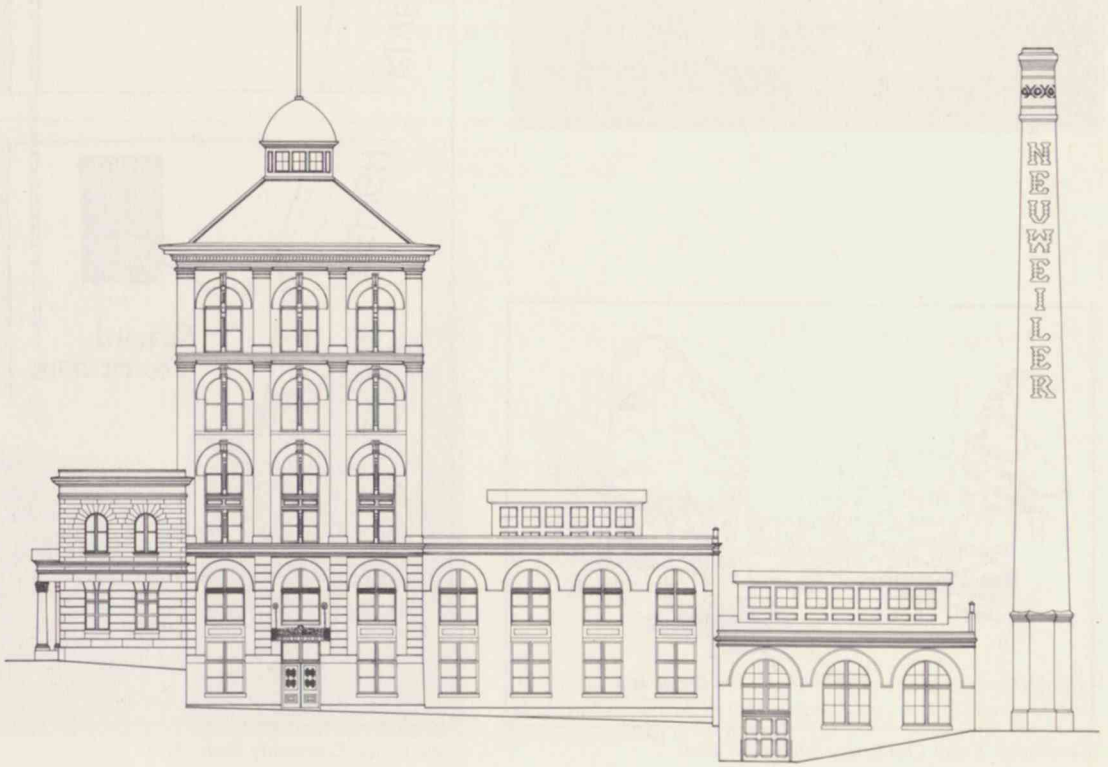


The brewery complex boasts fine architectural detail. Pictured here is a copper beer-bottle frieze on the bottling house canopy. Other embellishments include large arched windows in the vat rooms, a copper cupola with skylight and flagpole atop the vat rooms, the large Neuweiler insignia on the Front Street side of the brewery, and the tan brick smokestack with a corbelled brick top and Neuweiler name set in dark brick down the stack.

The brewery contains 76,500 square feet of floor space. The six floors are a complex mixture of space once used as vat rooms and storage areas. The storage rooms, 117 by 52 feet, have 12 inches of insulation for refrigeration.



Neuweiler Brewery
Allentown

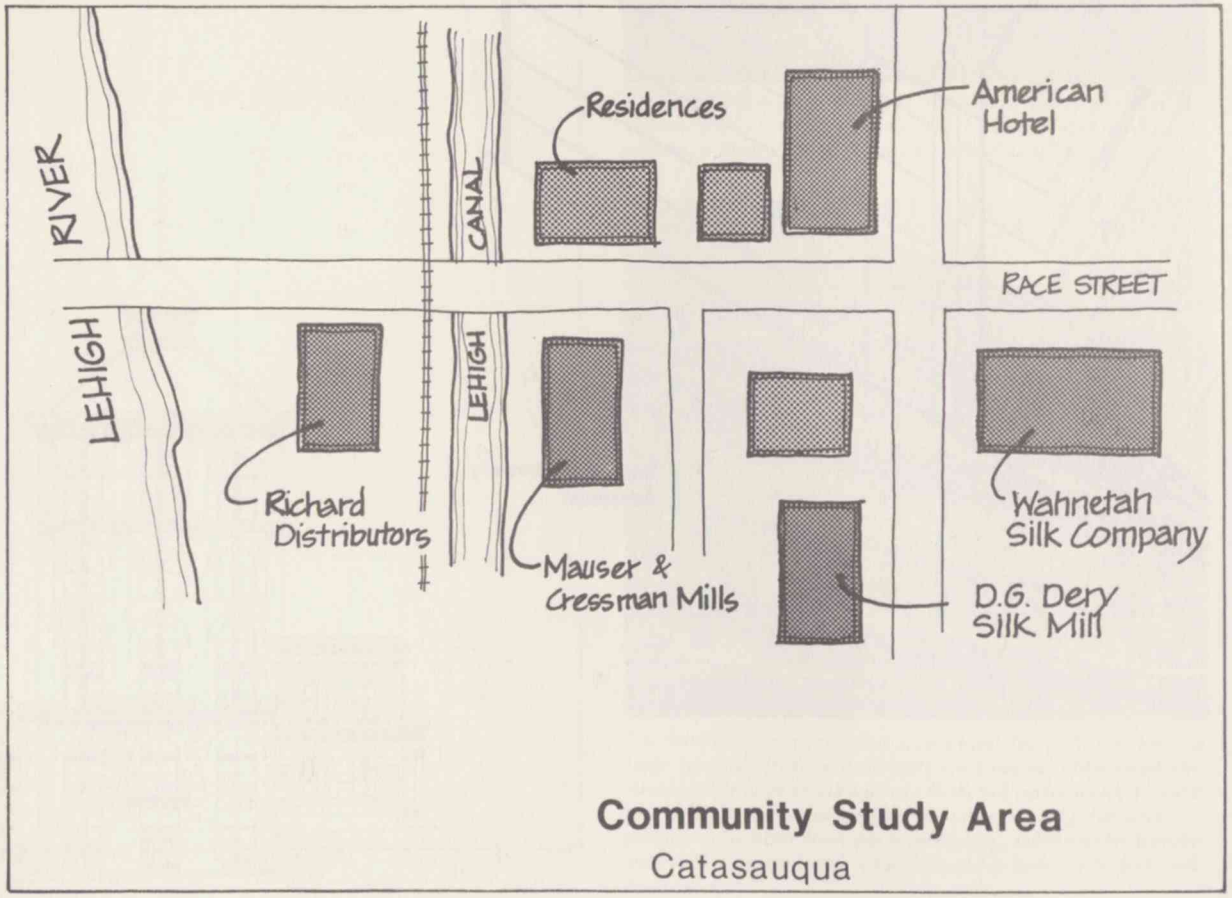


Elevation of Neuweiler Brewery.

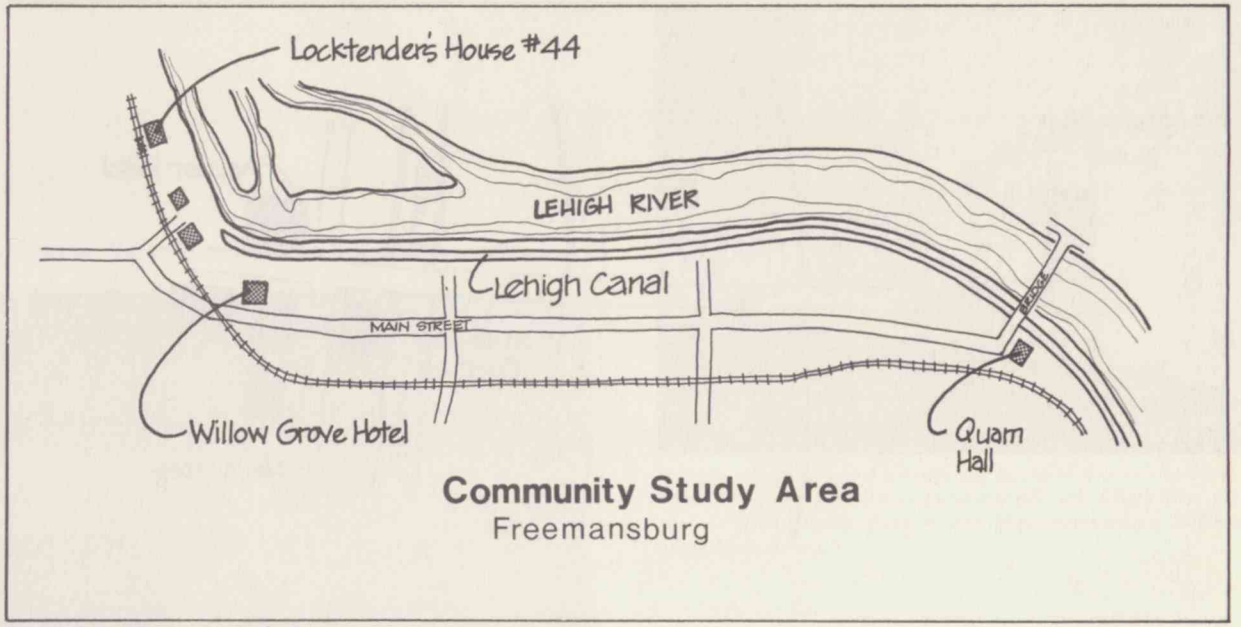
Community Study Areas

In addition to individually significant structures, the Lehigh Valley possesses areas where a number of structures and their setting along the canal are significant, and they share such common characteristics as streets crossing the canal, historic inns or hotels, and industrial or canal related commercial structures. Each area uniquely renders these shared characteristics by its response to local factors such as topography, street layout, and vegetation. These "Historic Study Areas" convey a sense of time and place that could make them eligible for nomination to the National Register of Historic Places as historic districts.

Catasauqua: Canal-Community Intersection detail.



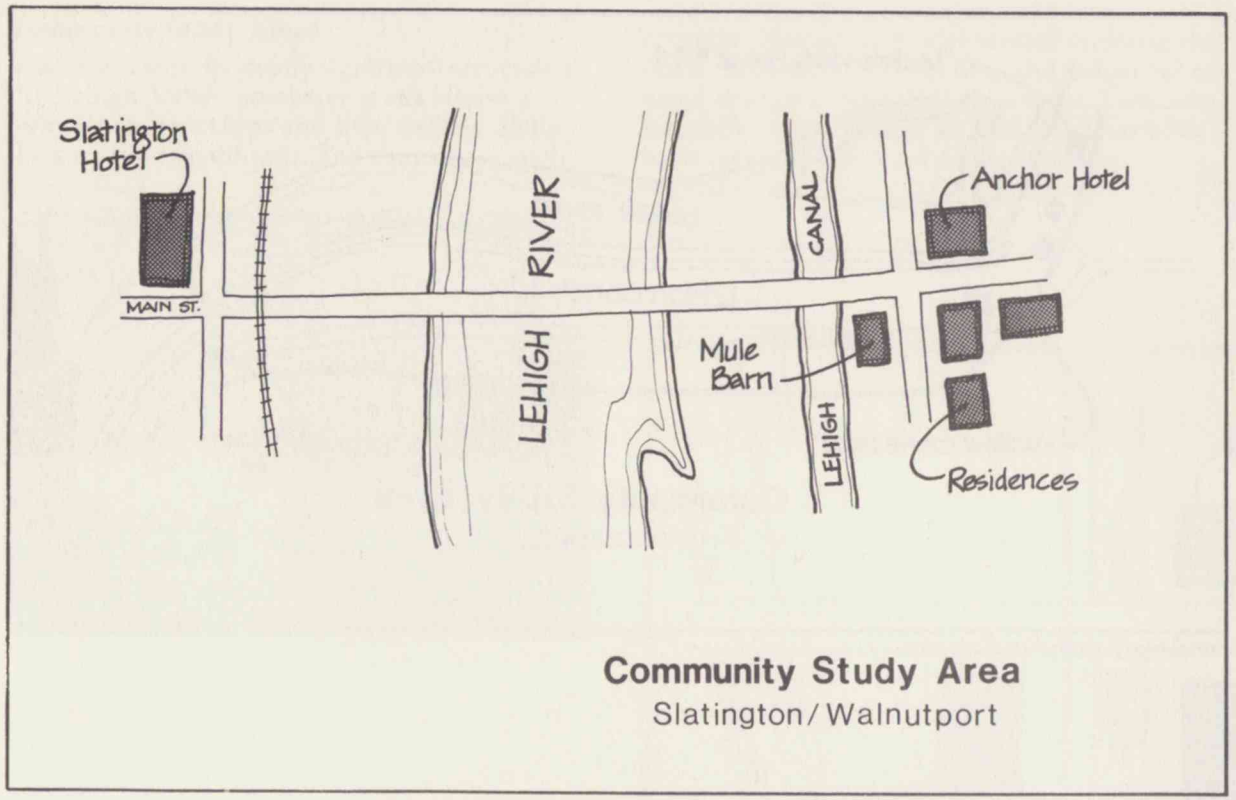
Catasauqua: Community Study Area.



Freemansburg: Community Study Area.

Freemansburg's Main Street runs parallel to the canal. The canal is the backyard for many of the nineteenth century residences along the street.

The Parker steel truss bridge crosses the Lehigh Canal at Freemansburg. Q.U.A.M. Hall (Bridge Company Building) is at the head of Main Street and adjacent to the bridge.

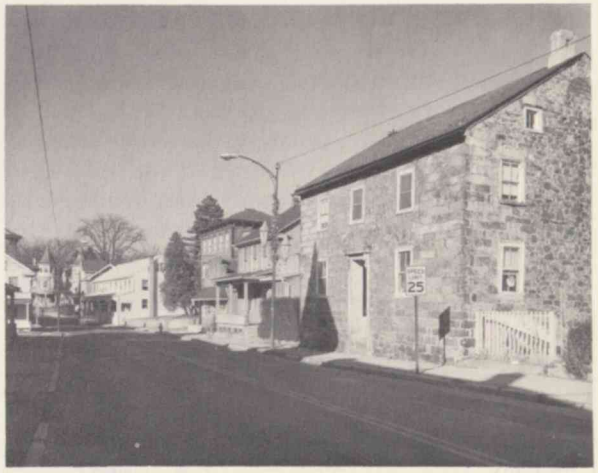


Slatington/Walnutport: Community Study Area.

An old barn and the Anchor Hotel, originally a boatman's tavern constructed in 1834, stand at the Main Street and canal intersection in Walnutport.

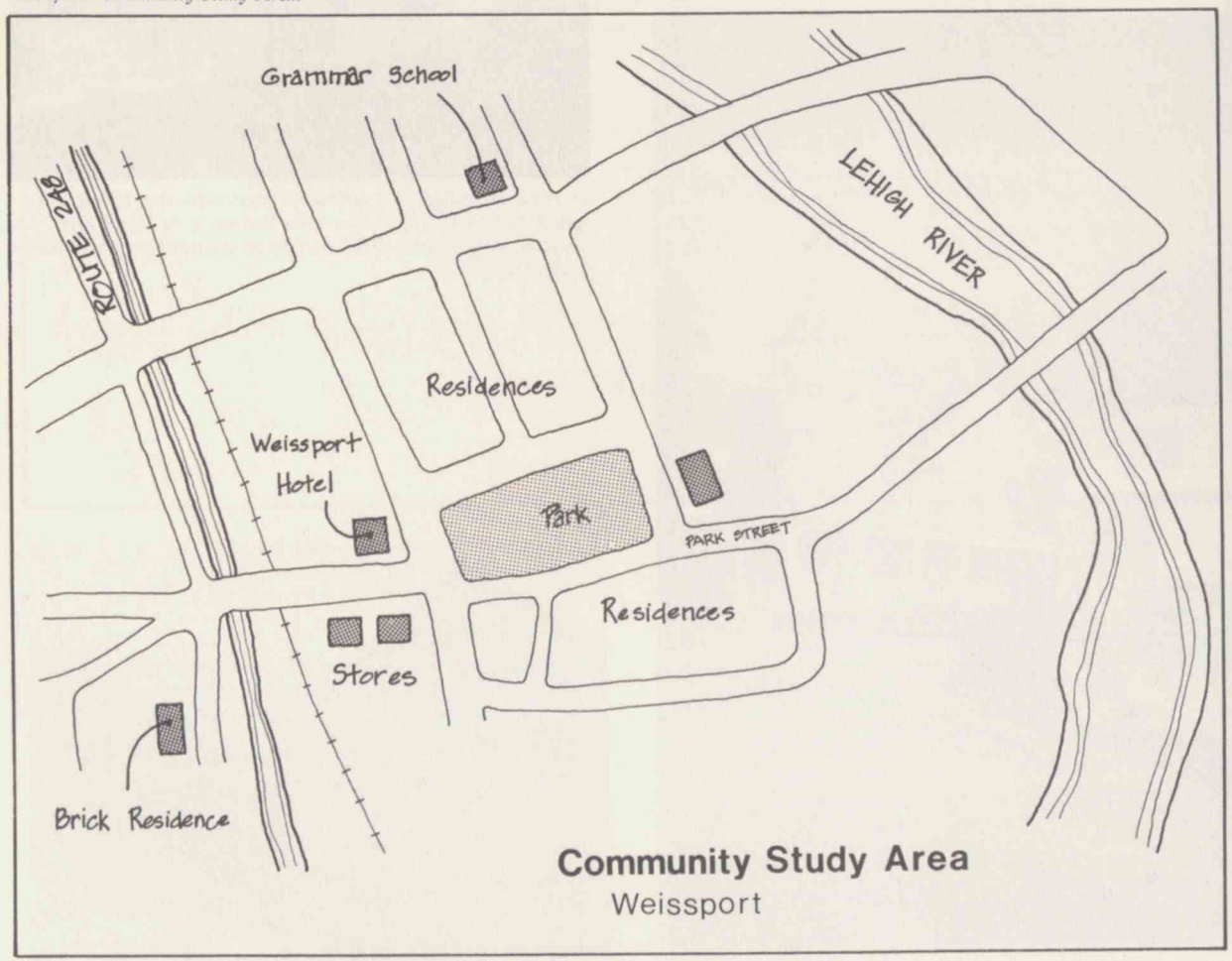
The Lehigh Canal is the front yard for many Walnutport homes, reflecting long-term visual and economic connections between the canal and the town it spawned. Unlike residences on Freemansburg's Main Street, Walnutport's Canal Street residences face the canal.

The Kern Roller Mill, built in 1859, used slate as its primary construction material. Slate structural details may be seen in buidings throughout the town.

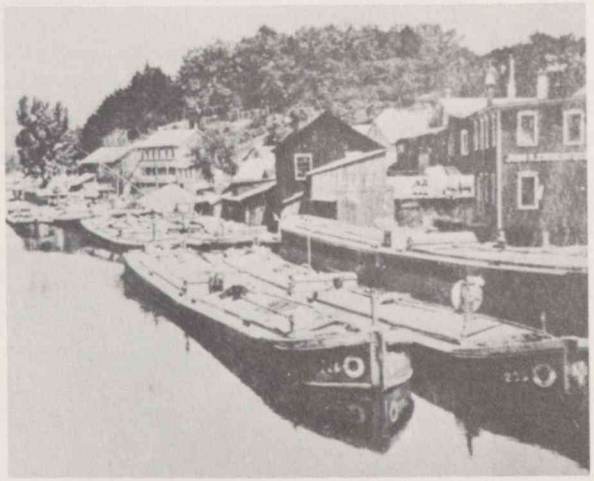


In 1844, the valley's first commercially successful slate quarry was opened. Slatington, a small town on the west side of the Lehigh River, is a reminder of the industry of this era with its nineteenth century buidings lining Main Street.

Weissport: Community Study Area.



Weissport's town green lies close to, but is separated from, the canal by the Lehigh and Susquehanna Railroad tracks. Several historic residences, churches, commercial buildings, and hotels are located on the town green.

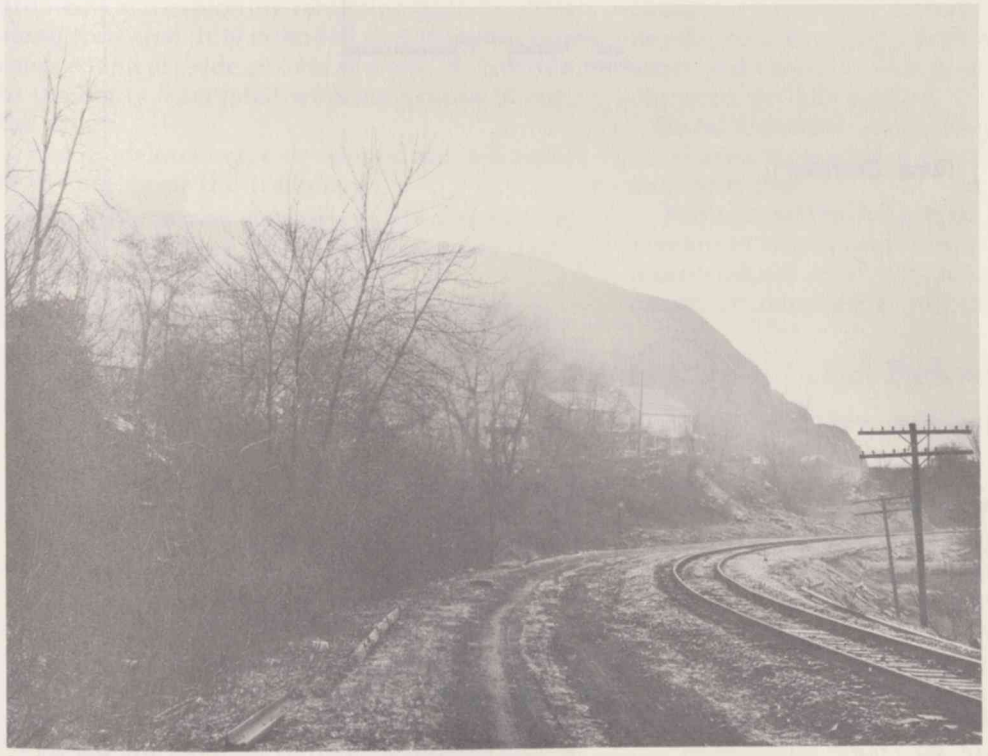


Historic view of Weissport showing the John Ziegenfuss store, a major supply stop on the Lehigh Canal. Courtesy of Canal Museum, Easton.

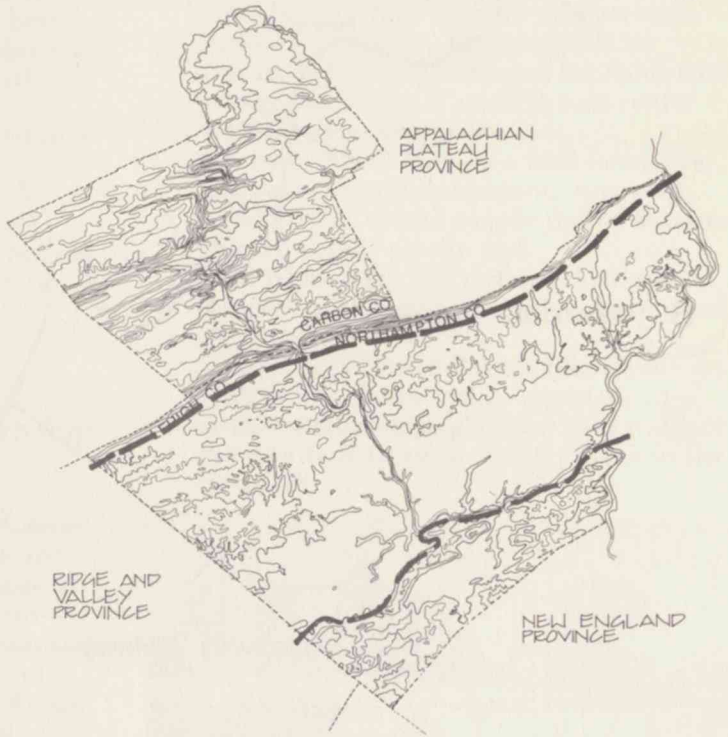
Natural Resources

The study area falls within three physiographic provinces—the Appalachian Plateau, the Lehigh Ridge and Valley, and the New England,—and is characterized by a variety of landforms including mountains (the Poconos), linear ridges and valley, and gentle rolling hills. A glacial overburden contributes to the overall morphology of much of this area. The underlying bedrock included noncarbonate sedimentary rock, igneous rock, and, metamorphic rock. The noncarbonate sedimentary rock of the Ridge and Valley Province is in the portion of Northampton County known as the Slate Belt, and was quarried near Pen Argyl, Bangor, and Slatington. Southward, the gently rolling valley bottoms are underlain with limestone, a carbonate, and are of particular importance for the production of Portland cement. This area is also very fertile, with fairly deep soils and gentle slopes suitable for agricultural use.

The Lehigh corridor is extensively forested with large stands of maple, ash, hickory, and oak. This in combination with stretches of agricultural landscape presents a varied and interesting series of views, especially from the river and along the towpath.

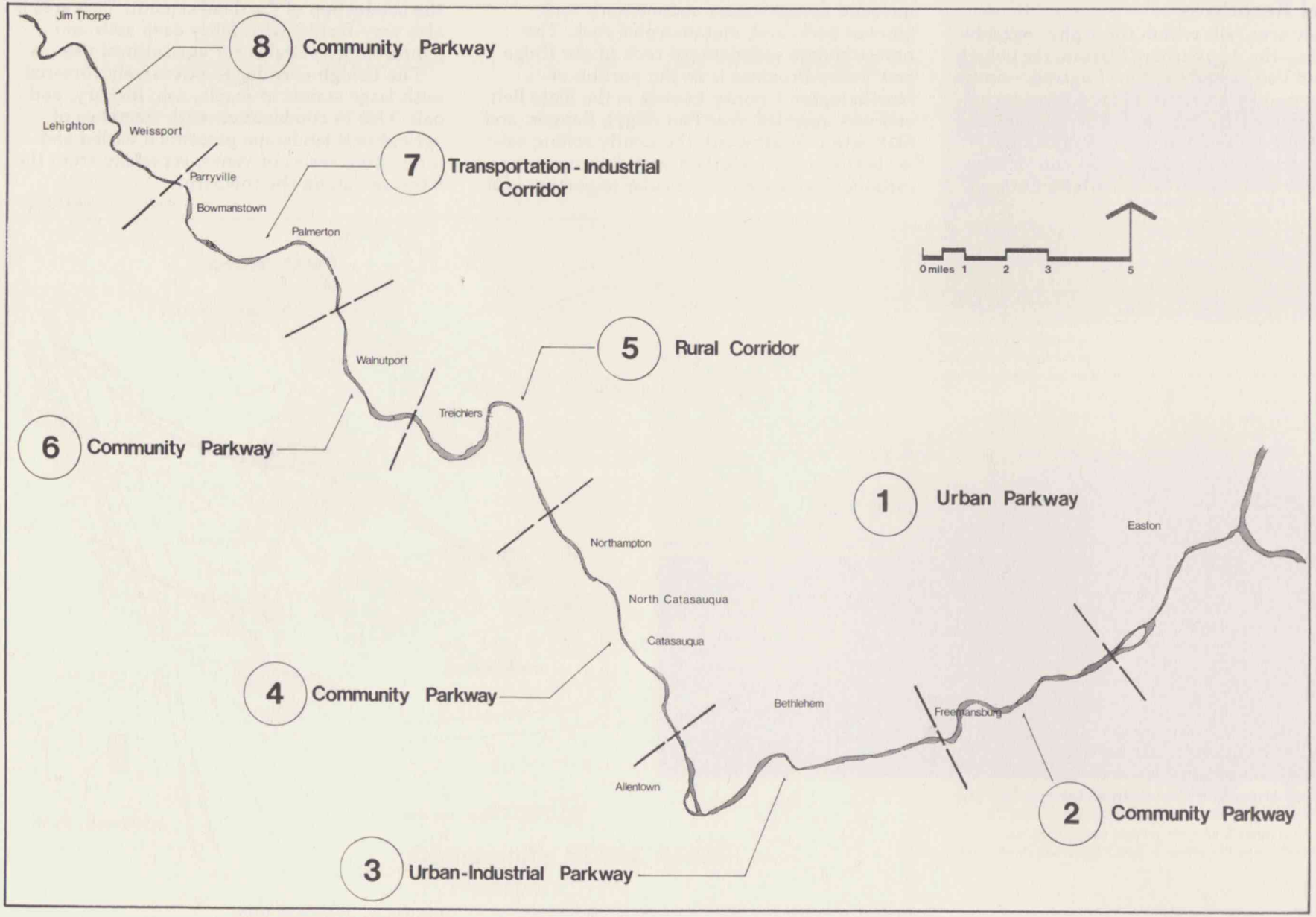


Looking south to Marshall's Hill and the Lehigh Gap from Palmerton.



Source:
Soils of Pennsylvania
Progress Report #365, Nov. 1977

Physiography of the Lehigh Valley.


Jim Thorpe
8 Community Parkway
Lehighton
Weissport
7 Transportation - Industrial Corridor
Parryville
Bowmanstown
Palmerton
0 miles 1 2 3 5
5 Rural Corridor
Walnutport
Treichlers
6 Community Parkway
1 Urban Parkway
Easton
Northampton
North Catasauqua
Catasauqua
4 Community Parkway
Bethlehem
Allentown
2 Community Parkway
3 Urban-Industrial Parkway

Trail Plan

Guidelines and Descriptive Categories

The trail plan marks the culmination of a 30-year effort by various interests in the Lehigh Valley. Without that interest and subsequent consensus that development of the Lehigh Canal should evolve from a conservation viewpoint, this plan would never have been produced. The plan is conceptual. It presents prototypical strategies for solving problems and exploiting recurring opportunities along the canal. It is intended that this plan be a catalyst and provide an overall sense of direction to the many interested working groups along the canal.

Ten guidelines were developed and followed in the design of the trail plan:

- Exploit common elements of site, open space, and architecture to enhance a sense of unity along the canal.
- Use existing roads where possible for access to the trail.
- Direct bicycle and other intensive traffic on the existing roadways when river banks are narrow and unable to carry the increased load.
- Avoid or minimize disturbance to private property.
- Avoid or minimize disturbance to historic, natural, and archeological sites.
- Determine appropriate restoration/rehabilitation treatments according to the needs and maintenance capacities along the canal; complete rewatering of the canal is not recommended.
- Retain the existing natural setting of the canal corridor.
- Build upon existing restoration efforts.
- Build upon and exploit existing recreational uses in the canal corridor.
- Improve links between the canal and nearby communities.

For the purposes of this study the canal was delineated in eight sections. Each section is characterized by one of the five following descriptive categories.

Urban Parkway—A portion of the canal in an urban area that has been developed into a park.

Community Parkway—A portion of the canal that intersects small communities connected by natural areas.

Urban Industrial Parkway—A portion of the canal in an urban area that has already been developed into a park, with adjacent industrial areas and railroads that give an industrial character to that portion.

Rural Corridor—A portion of the canal in a rural area, surrounded by steep forrested hills and farmland.

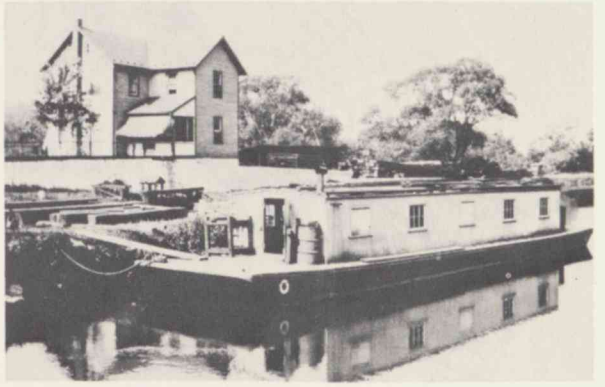
Transportation-Industrial Corridor—A portion of the canal running through a heavily industrialized area with major transportation routes encroaching on the canal.

Section I: Urban Parkway

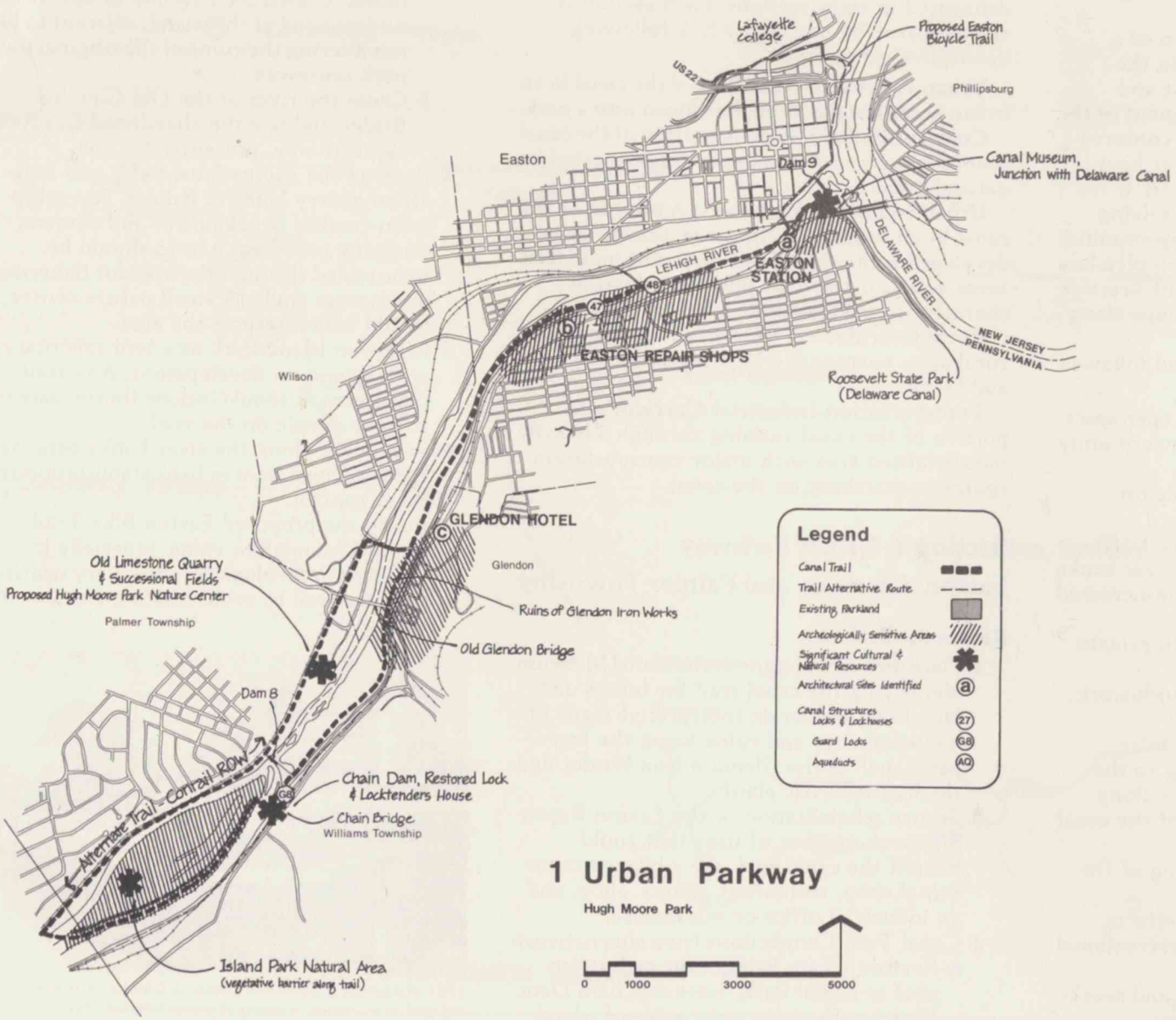
Easton, Glendon, and Palmer Township

Recommendations:

1. Place directional signs at the Canal Museum identifying the canal trail for hikers and bicyclists, and locate interpretive signs of historical sites and ruins along the towpath, such as the Glendon Iron Works, and the hydroelectric plant.
2. Secure rehabilitation of the Easton Repair Shops. A number of uses that could benefit the canal park are a bike or canoe rental shop, restaurant, hikers' shop, and an industrial office or warehouse.
3. Canal Trail Connections (two alternatives):
   a. Restore Chain Bridge (for pedestrian use) to Island Park, west of Chain Dam. Direct path along outer edge of island, restricting access to the rest of the island. Construct a second bridge at the western end of the island, adjacent to but not altering the ruins of the original towpath causeway.
   b. Cross the river at the Old Glendon Bridge and use the abandoned ConRail right-of-way, presently for sale.
4. Restrict the successional fields and limestone quarry lands in Palmer Township from further development and present dumping practices. Access should be maintained through the area for fishermen and nature trails. A small nature center would help interpret the area.
5. Maintain Island Park as a bird sanctuary, with minimum development. Any trail development should include thorny barriers to keep people on the trail.
6. Save trees along the river banks because they are important in bank stabilization and flood control.
7. Route the proposed Easton Bike Trail around foundation ruins, especially in sensitive archeological zones. Vary width of the bike trail to avoid existing trees in the trail path.



1927 photograph of lock-tender's house in Glendon. It is now restored and used as a museum. Courtesy of Canal Museum, Easton.

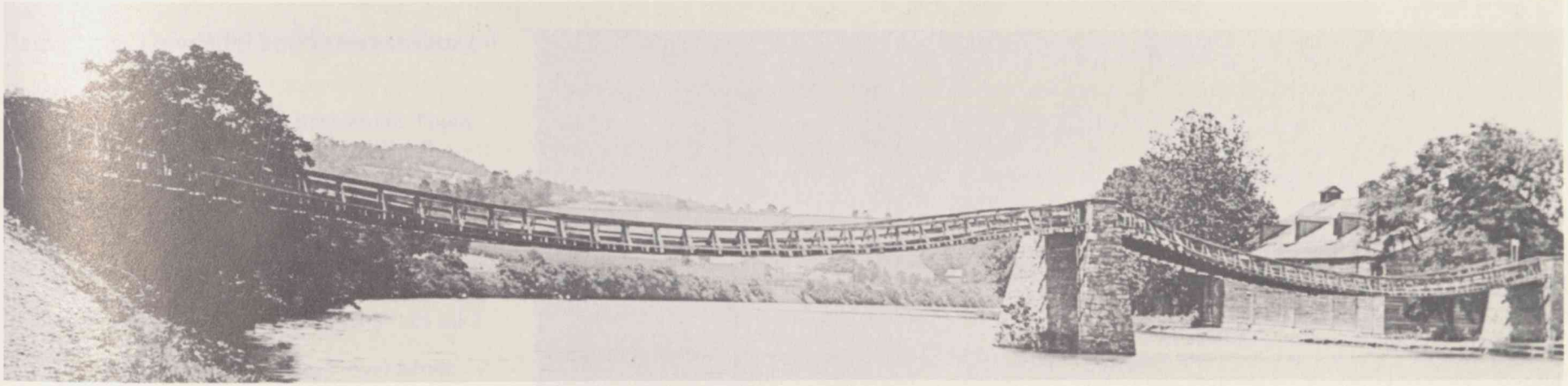

Lafayette College
Proposed Easton Bicycle Trail
US 22
Phillipsburg
Easton
Dam 9
Canal Museum, Junction with Delaware Canal
LEHIGH RIVER
EASTON STATION
DELAWARE RIVER
NEW JERSEY
PENNSYLVANIA
EASTON REPAIR SHOPS
Roosevelt State Park (Delaware Canal)
Wilson
GLENDON HOTEL
Glendon
Old Limestone Quarry & Successional Fields
Proposed Hugh Moore Park Nature Center
Palmer Township
Ruins of Glendon Iron Works
Old Glendon Bridge
Dam 8
Alternate Trail - Conrail ROW
Chain Dam, Restored Lock & Locktenders House
Chain Bridge
Williams Township
Island Park Natural Area
(vegetative barrier along trail)
Legend
Canal Trail
Trail Alternative Route
Existing Parkland
Archeologically Sensitive Areas
Significant Cultural & Natural Resources
Architectural Sites Identified
Canal Structures Locks & Lockhouses
Guard Locks
Aqueducts
1 Urban Parkway
Hugh Moore Park
0
1000
3000
5000

Section 1: Urban Parkway

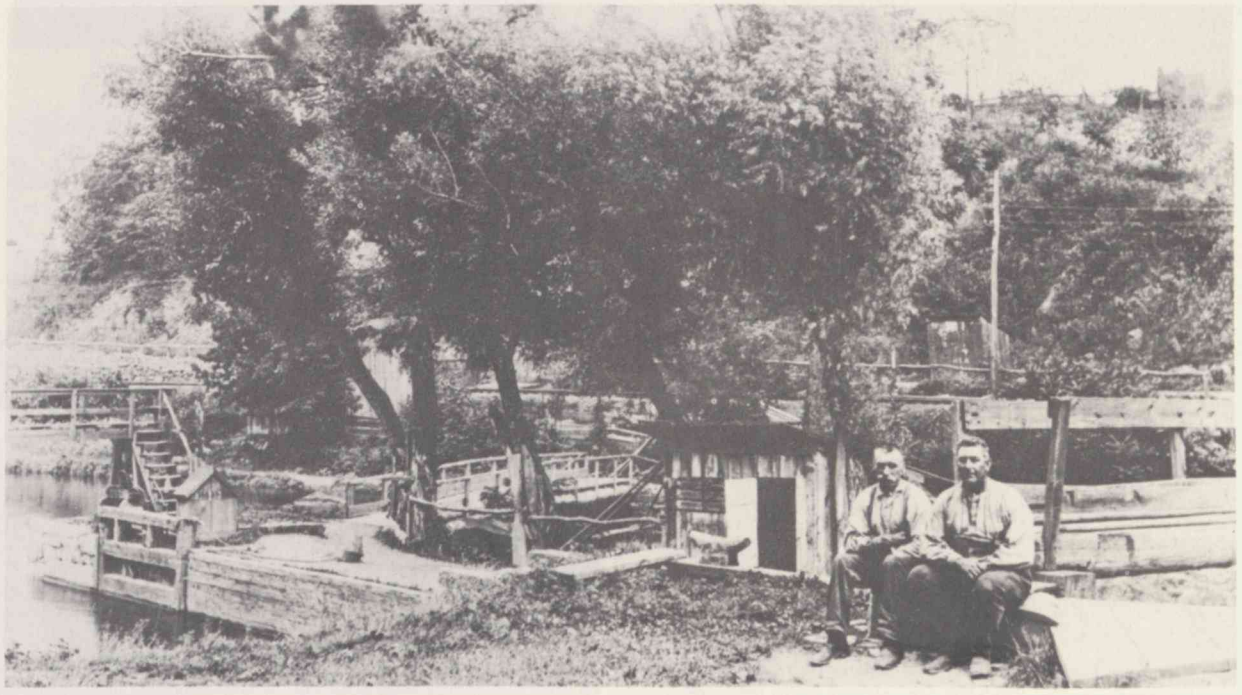
Municipalities	Archeological Zones	Historical Resources	Potential Adaptive Use Structures	Natural Areas	Recreation	Canal Condition	Trail
Easton	Confluence of Delaware and Lehigh rivers to Third St. Bridge Outlet Lock 48 to Chain Dam intermittently	Dam 9 LVRR*: Freight station LVRR: Steam laundry and dining car service LVRR: Repair shops Outlet Lock 48 Ruins of toll collector's office at outlet lock Ruins of hydroelectric plant Lock 47	LVRR: Freight station and steam laundry and dining car service building LVRR: Repair shops		Roosevelt State Park (Delaware Canal) Hugh Moore Park Easton Bike Trail (proposed) Whitewater Canoe Course	Restored as park and watered to Guard Lock 8 Locks 47, 48 and Guard Lock 8, fully restored	Existing towpath through Hugh Moore Park in good condition
Glendon	Outlet Lock 48 to Chain Dam intermittently	Old Stone Inn Glendon Hotel Ruins of the Glendon Ironworks Site of Lucy Furnace, Glendon	Glendon Hotel				Existing towpath good through Hugh Moore Park to Chain Dam
Wilson	Island Park	Ruins of towpath causeway		Old limestone quarry and successional fields (scenic areas) Island Park Natural Area (special wildlife and plant habitat)	Hugh Moore Nature Center (proposed) Island Park Natural Area		Serious break in towpath beyond Chain Dam; there is no crossing at or below the dam to north side of river
Palmer Township							
Williams Township							

*Lehigh Valley Railroad

The former site of an amusement park, Island Park now offers a protective environment for birds and other wildlife.



Chain Bridge at Island Park near Glendon was constructed to carry the towpath of the Lehigh Navigation System across the main channel of the Lehigh River. Courtesy of Canal Museum, Easton.



Lock tenders at Chain Dam, 1888. Courtesy of Canal Museum, Easton.

Lock-tender's house and remains of Lock 44.

View from Pop's Rock looking west towards the river and canal in Freemansburg. The Bethlehem Steel plant is on the left.

Section 2: Community Parkway

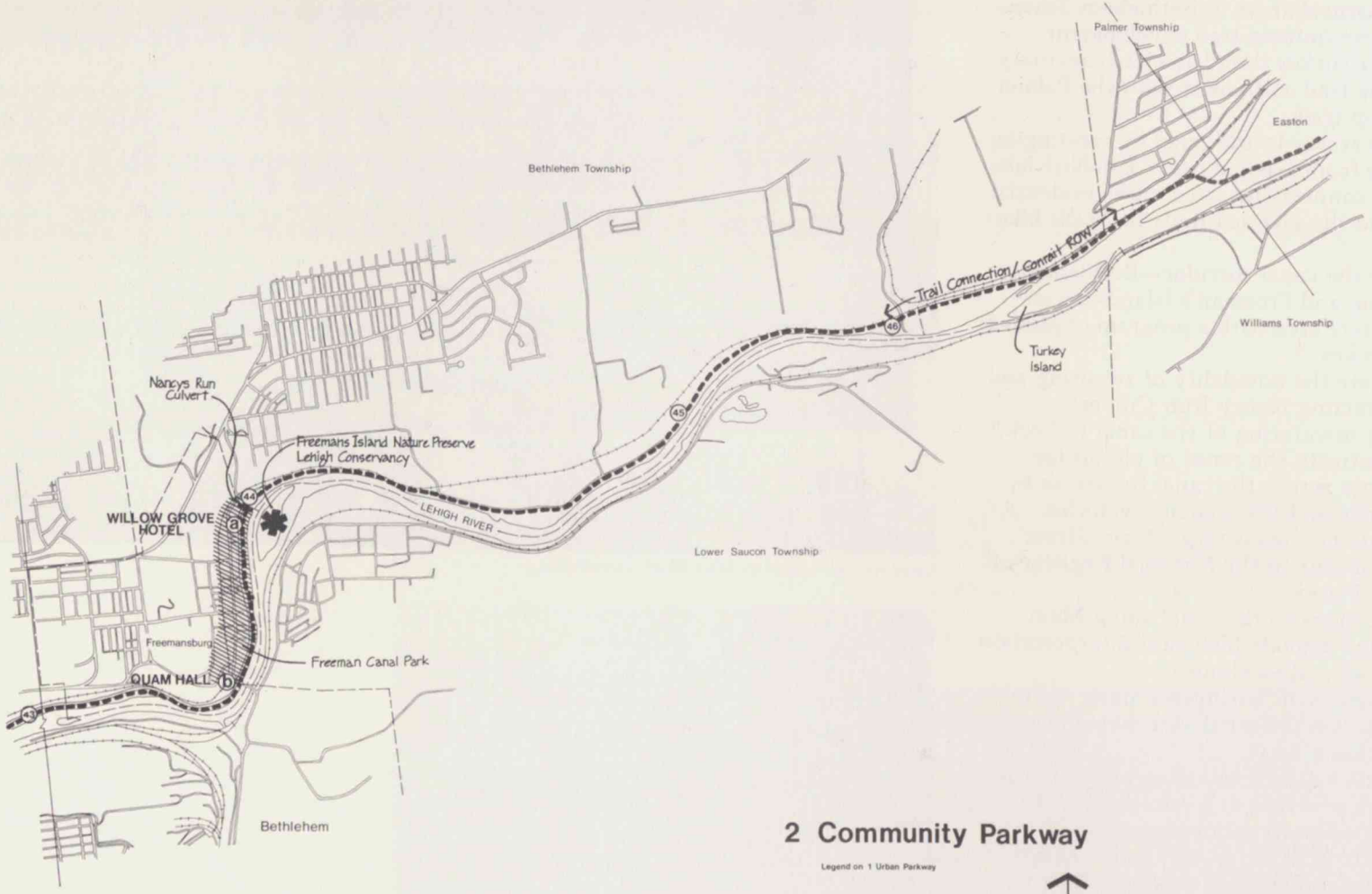
Bethlehem Township and Freemansburg

Recommendations:

1. Retain natural areas in Bethlehem Township by minimizing trail development. Maintain Turkey Island as a bird sanctuary. Clear the trail and link it with the Palmer Township trail.
2. Improve access to the canal by creating an entrance from existing roads. Establish bike trails to connect the canal with residential areas and the planned Rails-to-Trails bike trail.
3. Develop the canal corridor—Bethlehem Township and Freeman's Island—as an interpretive area with a program of guided nature hikes.
4. Investigate the possibility of repairing and reconstructing Nancy Run Culvert, allowing rewatering of the canal to Lock 44. Investigate the reuse of old bridge abutments across the canal for access by emergency and maintenance vehicles.
5. Nominate Freemansburg's Main Street and canal area to the National Register of Historic Places.
6. Improve signs to the canal along Main Street and provide historical interpretation of Lock 44 and lockhouse.
7. Encourage small businesses along Main Street to use the canal as a theme in rehabilitation efforts.
8. Clear title to Lock 44 lock-tender's house and lease property at a minimal rate to a private nonprofit group or individual in return for restoration and maintenance. Occupation of the house would deter vandalism and provide security for the park.

Canal manager's house on Main Street, Freemansburg.

Freemansburg Canal Park.



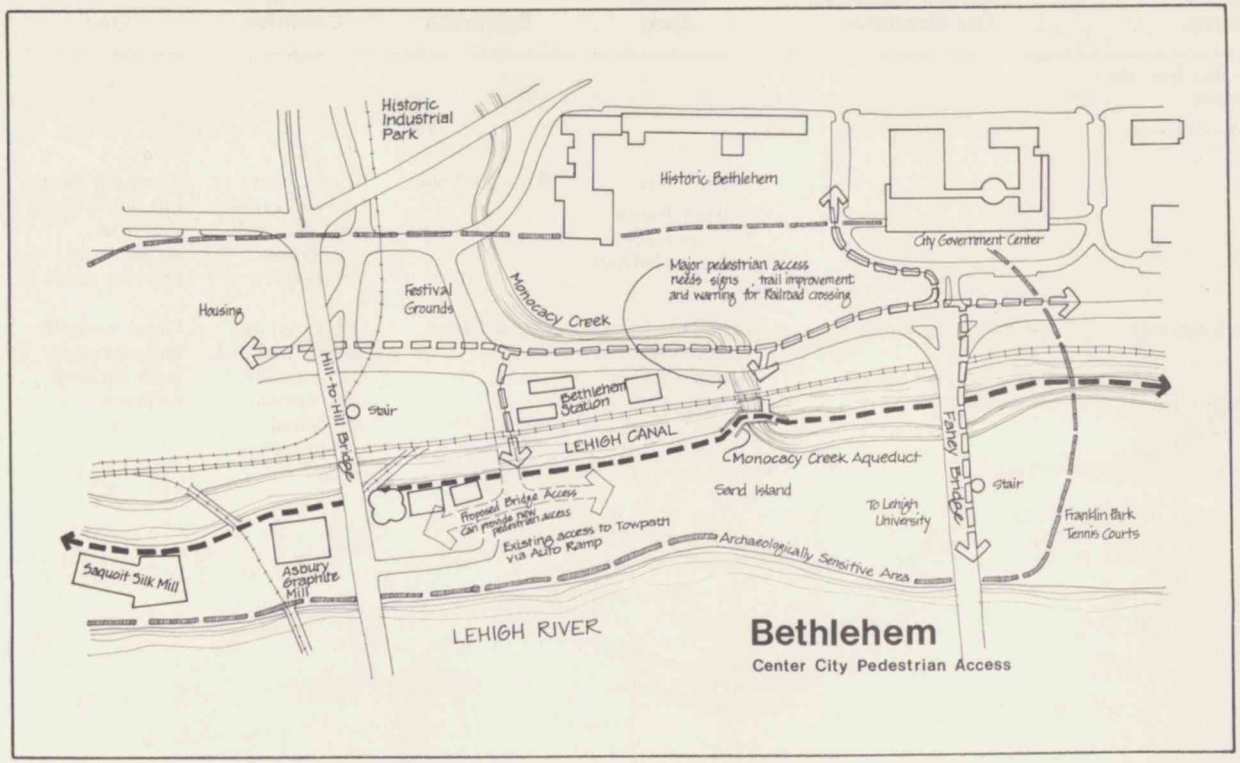
2 Community Parkway

Legend on 1 Urban Parkway

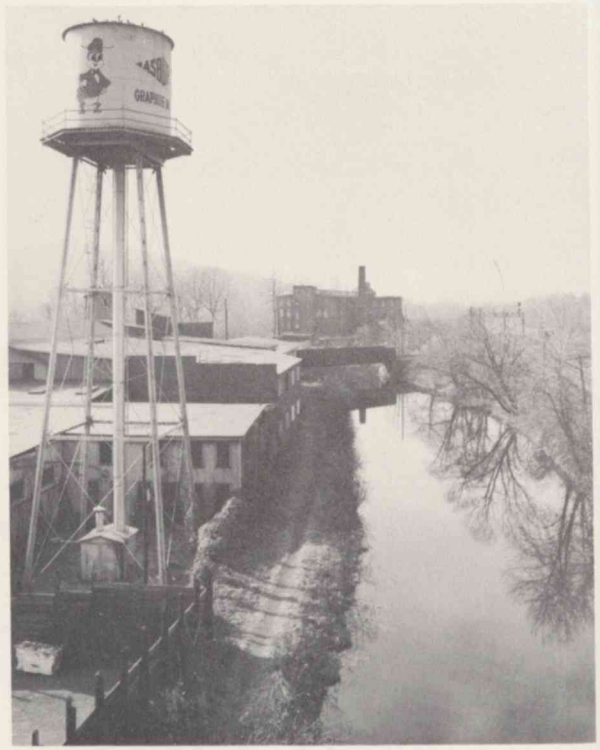
0 feet 1000 3000 5000

Section 2: Community Parkway

Municipalities	Archeological Zones	Historical Resources	Potential Adaptive Use Structures	Natural Areas	Recreation	Canal Condition	Trail
Lower Saucon Township		Ruins of Coleraine Iron Co.: Redington Furnace Davis House (Steel City)					
Bethlehem Township		Lock 46 Lock 45 Carter House		Scenic vistas Turkey Island (special wildlife and plant habitat)	Rails-to-Trails	Canal overgrown, canal bed dry, lock structures overgrown	Towpath exists but overgrown; potential access from existing roads
Freemansburg	From Lock 44 to the bridge	Lock 44 and lock-tender's house Q.U.A.M. Hall (Bridge Co. Building)	Willow Grove Hotel Q.U.A.M. Hall (Bridge Co. Building)	Freemans Is. Nature Preserve (Lehigh Valley Conservancy)	Canal Park	Restored as park canal bed temporarily dry due to breached Allentown Dam	Good towpath and access with parking facilities



Bethlehem: Center City Pedestrian Access detail.



Asbury Graphite Mill and Saquoit Silk Mill, along the canal.

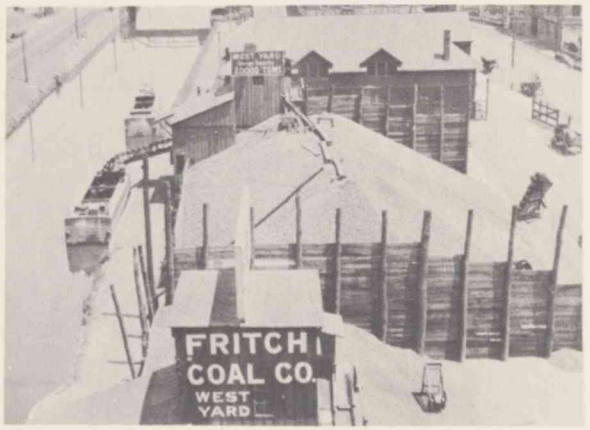
Section 3a: Urban-Industrial Parkway

Bethlehem

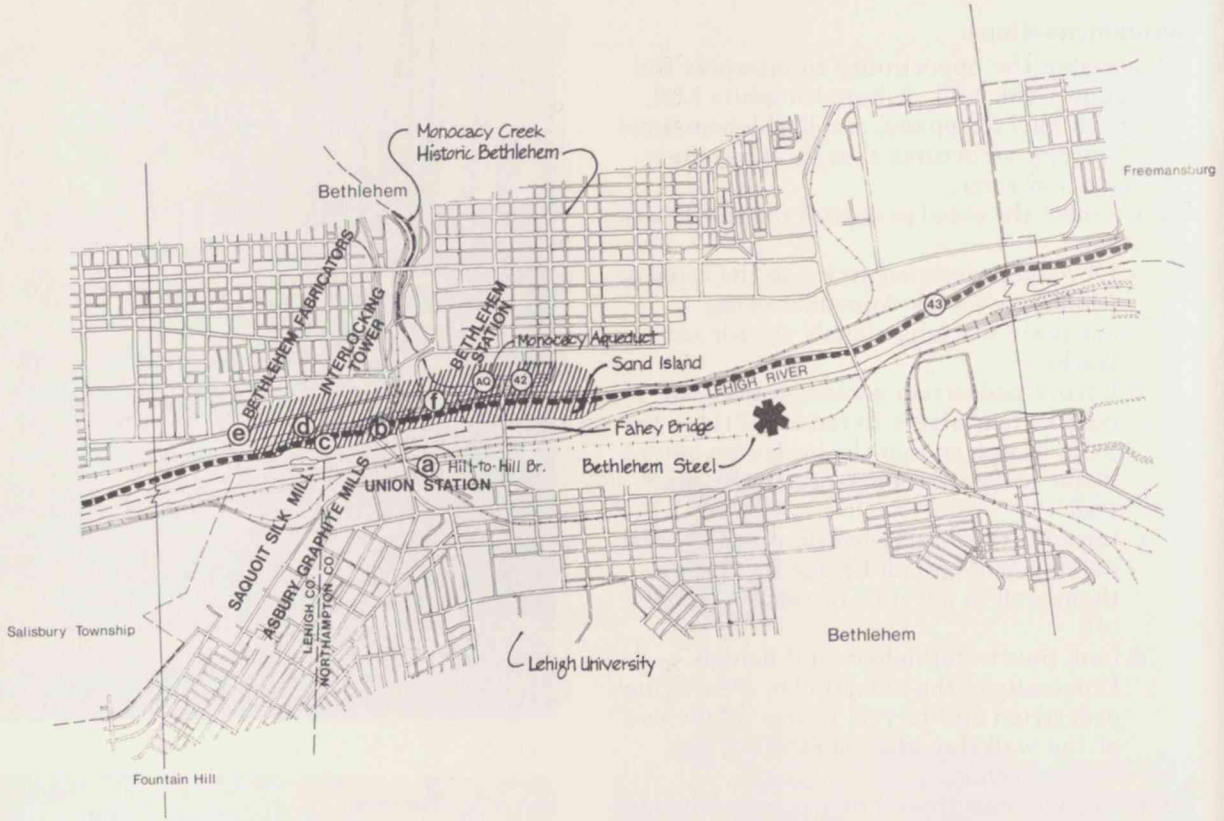
Recommendations:

1. Develop the opportunity to interpret the Saquoit Silk Mill, Asbury Graphite Mill, Fritch Fuel Company, and Bethlehem Steel Company structures that lie along the canal and river.
2. Connect the canal park with the center city area:
   a. Develop pedestrian access to the canal at Monocacy Creek Aqueduct using adequate warning signals at railroad tracks.
   b. Ensure pedestrian access on the proposed Main Street Extension Bridge to Sand Island, so that the bridge becomes a major pedestrian entrance to the canal trail.
   c. Improve the directional signs to the canal park on Hill-to-Hill Bridge by placing them well in advance of the canal turn off.
   d. Link South Bethlehem and Lehigh University to the canal trail by identifying pedestrian and bicycle routes. Make use of the walkway and stairs off of the Fahey Bridge.
3. Create loop bicycle and hiking trails linking the center city and canal park areas with Monocacy Creek and Park.
4. Propose rehabilitation of Bethlehem's Union Station as a mixed use facility, including a Amtrak ticket office, specialty shops, market, and cafes.

Monocacy Creek Aqueduct, looking west toward the canal.

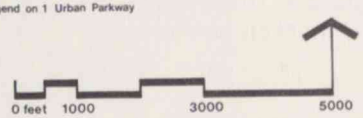


Early twentieth century view of the Fritch Fuel Company. Open since 1850, it is the longest operating coal yard in the Lehigh Valley. Courtesy of Canal Museum, Easton.



3a Urban-Industrial Parkway

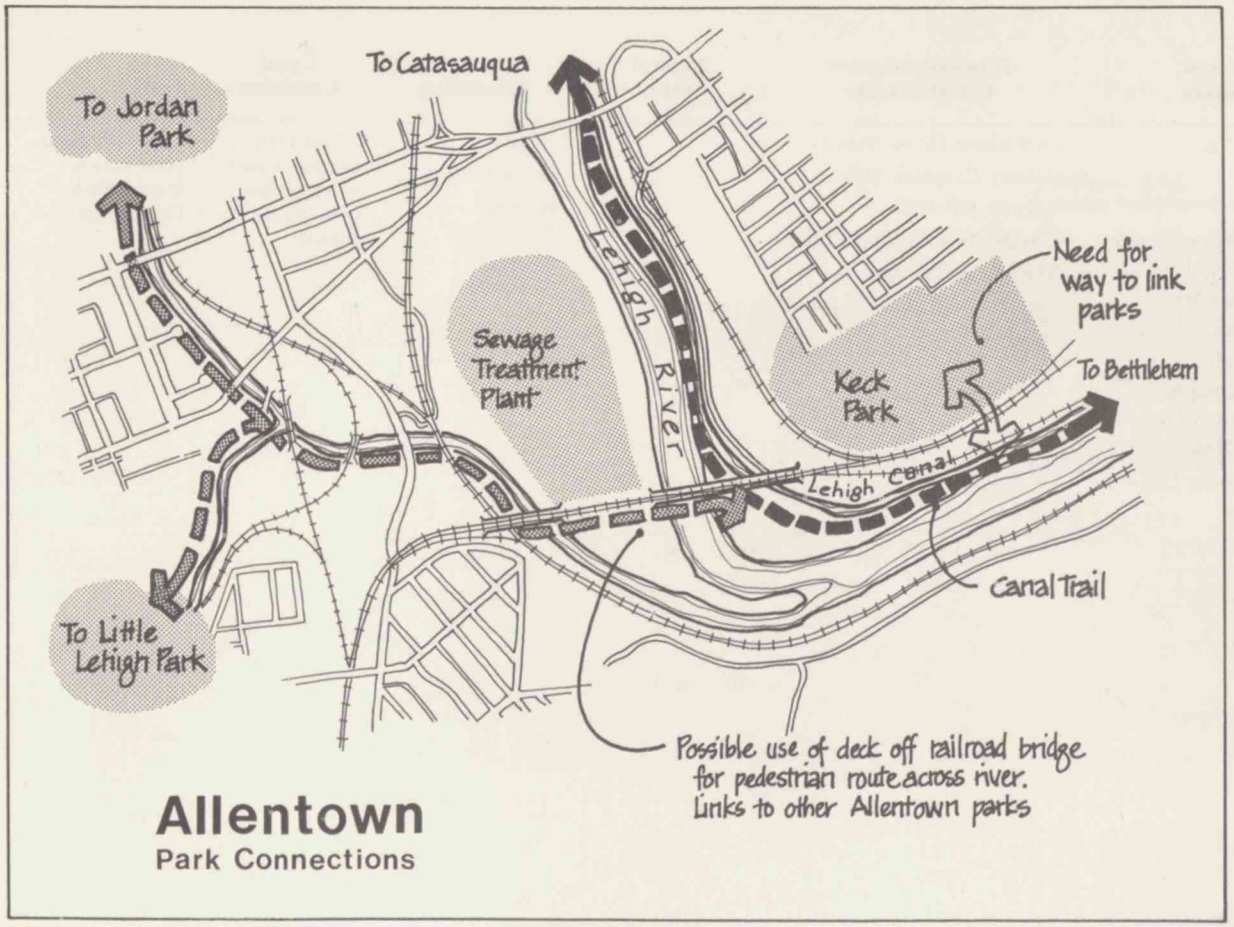
Legend on 1 Urban Parkway



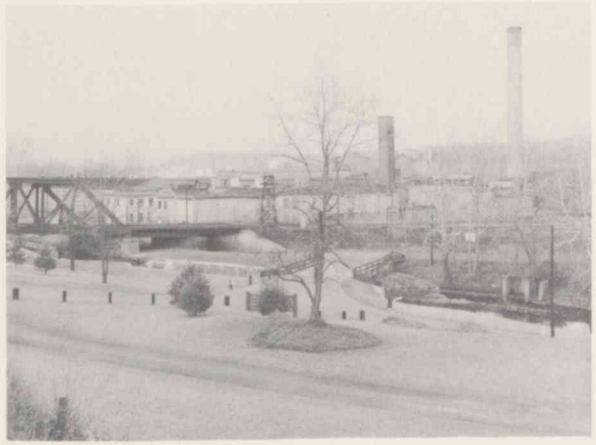
Section 3a: Urban-Industrial Parkway

Municipalities	Archeological Zones	Historical Resources	Potential Adaptive Use Structures	Natural Areas	Recreation	Canal Condition	Trail
Bethlehem	Sand Is. confluence of Monocacy Creek and Lehigh River	Lock 43 Lock 42 Fritch Fuel Co. CRRNJ*: Bethlehem Freight Depot and Station Asbury Graphite Mill Saquoit Silk Mill Bethlehem Steel LVRR and Reading RR: Bethlehem Union Station Lock 41 Bethlehem Historic District	Bethlehem Union Station Asbury Graphite Mill Saquoit Silk Mill CRRNJ: Interlocking Tower Bethlehem Fabricators CRRNJ: Bethlehem Station		Sand Is. Franklin Park Historic Bethlehem Festival Grounds	Canal maintained as park, watered depending on season	Towpath good, poor access from Hill-to-Hill Bridge

*Central Railroad of New Jersey



Allentown: Park Connections plan.



Allentown Canal Park.

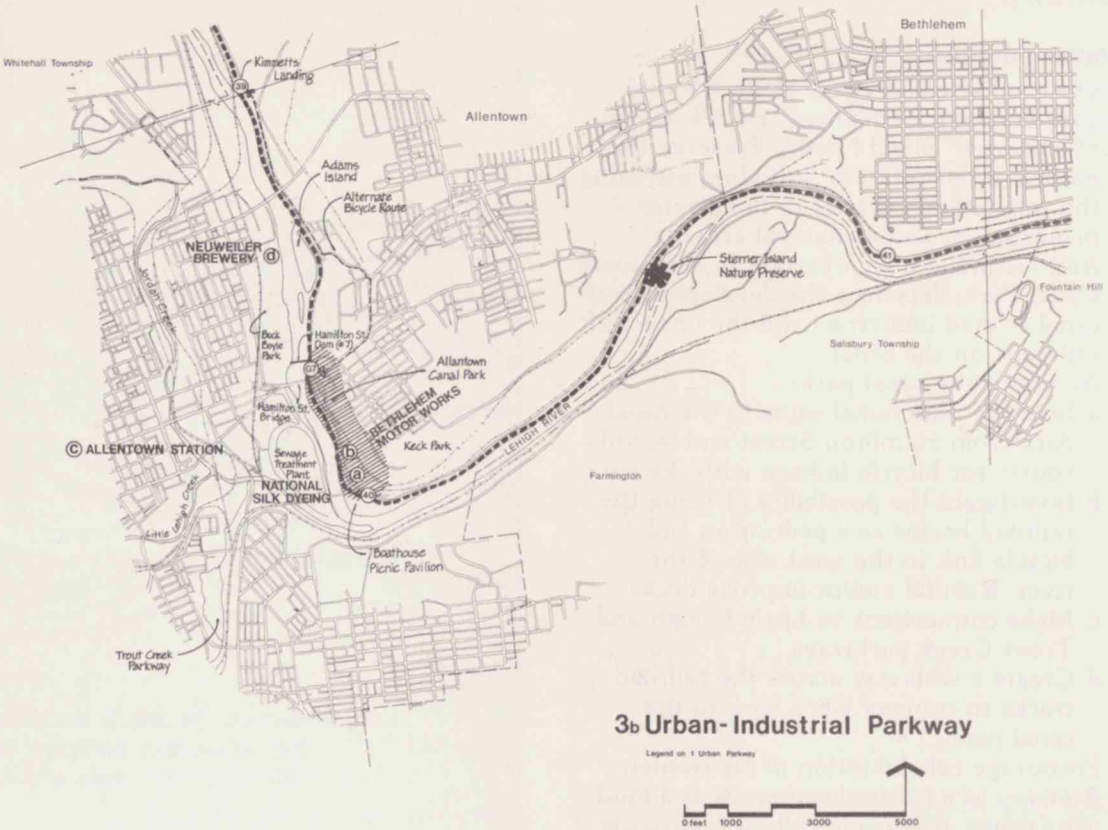
Section 3b: Urban-Industrial Parkway

Allentown

Recommendations:

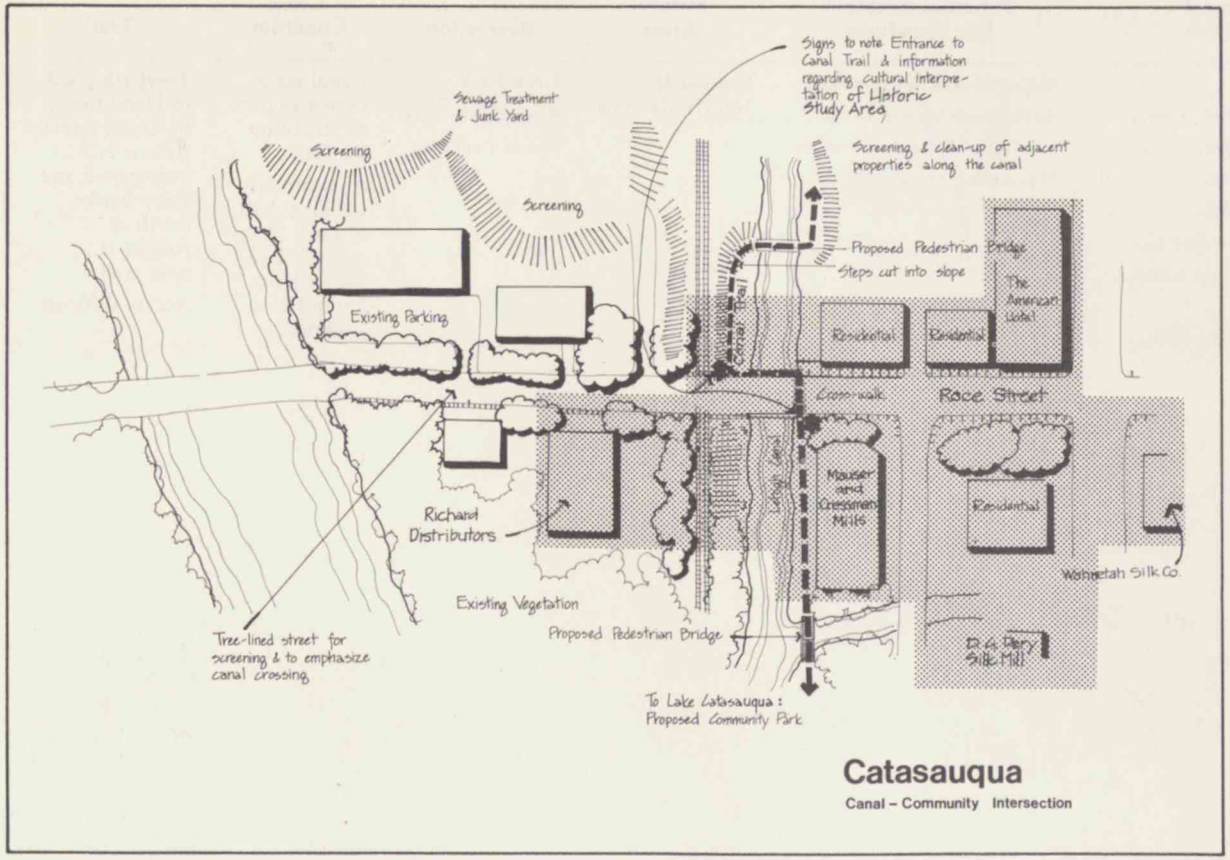
1. Open up selected vistas along the towpath between Bethlehem and Allentown.
2. Use Sterner Island Nature Preserve for natural interpretation, including assessing the role of such islands in floodwater management and as natural areas.
3. Add historical interpretation in Allentown Canal Park, depicting the development of canal related industries and the impact of railroads on the canal.
4. Access to the canal park:
   a. Improve directional signs to the canal park from Hamilton Street and identify routes for bicycle linkage with the park.
   b. Investigate the possibility of using the railroad bridge as a pedestrian and bicycle link to the west side of the river. Rebuild and/or improve decks.
   c. Make connections to Little Lehigh and Trout Creek parkways.
   d. Create a walkway across the railroad tracks to connect Keck Park to the canal park.
5. Encourage rehabilitation of Neuweiler Brewery as a cultural center, or as a multi-use facility, to include galleries, museum space, a library, specialty shops, restaurants, and apartments, or even reuse as a local brewery.
6. Clear the towpath above Hamilton Street to the north end of Adam's Island. The narrow trail requires an alternate bicycle path using existing roads.
7. Use Kimmetts Landing as an important access point for trail users going in both directions.

View of Allentown showing the boat basin and early industrial sites along a slackwater section of the canal. Courtesy of the Lehigh County Historical Society.

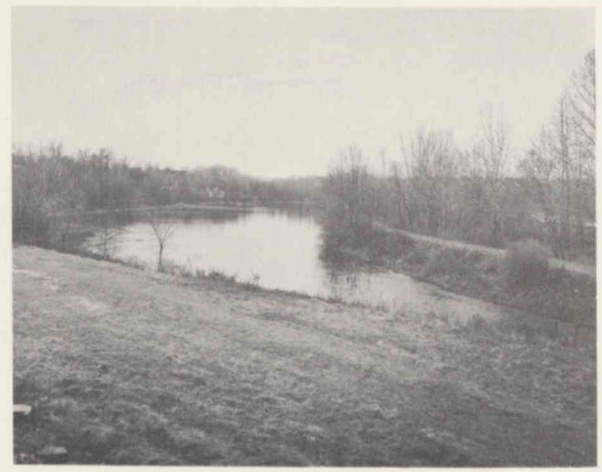

Bethlehem
Whitehall Township
Kimberts Landing
Allentown
Adams Island
Alternate Bicycle Route
NEUWEILER BREWERY
Jordan Creek
Sterner Island Nature Preserve
Fountain Hill
Salisbury Township
Back Boyle Park
Hamilton St. Dam (#7)
Allantown Canal Park
Hamilton St. Bridge
BETHLEHEM MOTOR WORKS
ALLENTOWN STATION
Sewage Treatment Plant
Keck Park
LEHIGH RIVER
NATIONAL SILK DYEING
Farmington
Little Lehigh Creek
Boathouse Picnic Pavilion
Trout Creek Parkway
3b Urban-Industrial Parkway
Legend on 1 Urban Parkway
0 feet 1000 3000 5000

Section 3b: Urban-Industrial Parkway

Municipalities	Archeological Zones	Historical Resources	Potential Adaptive Use Structures	Natural Areas	Recreation	Canal Condition	Trail
Allentown	Lock 40 to Hamilton St. Bridge	Lock 40 Bethlehem Motors Corp. National Silk Dyeing Co. Neuweiler Brewery Adelaide Silk Mills Allentown Gas Light Co. CRRNJ: Allentown Station Hanover Mills Allentown Rolling Mills Guard Lock 7 Dam 7 Lock 39	National Silk Dyeing Co. Bethlehem Motor Corp. CRRNJ: Allentown Station Neuweiler Brewery	Sterner Is. Nature Reserve	Keck Park Buck Boyle Park Trout Parkway	Canal maintained as park to Hamilton St. Dam At Kimmetts Landing, half of Lock 39 remains, filled for parking lot and boat landing	Towpath good to Hamilton St. Dam, dam to Adams Is., overgrown and steep banks, north of Adams Is., easy trail Access difficult



Catasauqua: Canal-Community Intersection plan.



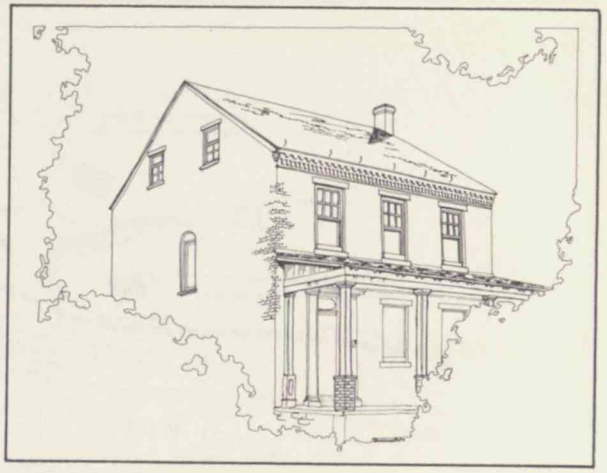
Catasauqua Lake.

Section 4: Community Parkway

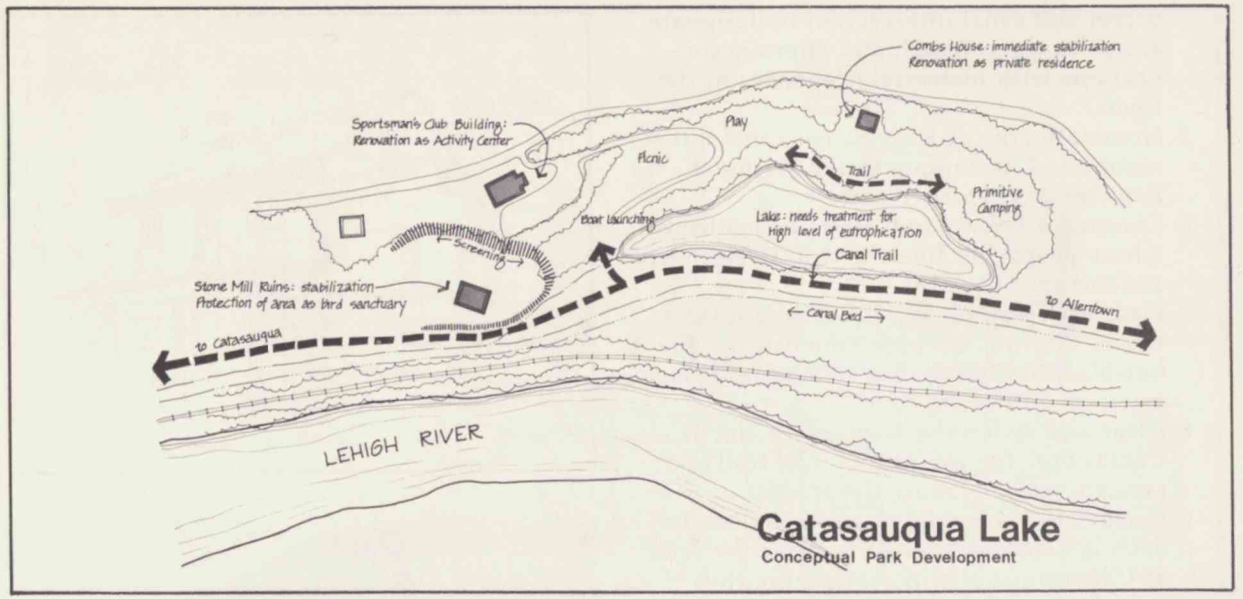
Hanover Township, Catasauqua, North Catasauqua, Coplay, Northampton, Whitehall Township

Recommendations:

1. Clear towpath in Hanover Township to make trail connections.
2. Develop Catasauqua Lake as a historic, natural, and recreational area. Recommendations for development:
   a. Lease Combs House to nonprofit group or private citizen for minimal or no rent in return for restoration and maintenance. (Use as a private residence or hostel would help protect and stabilize lake area.)
   b. Explore renovating the Sportman's Club building as an activity center/ community center for classes, meetings, a hostel, a day camp, or Saturday camp facility accessible with towpath bicycle and hiking trails.
   c. Stabilize and protect the Old Stone Mill ruins and develop as a natural area and bird sanctuary.
   d. Study the lake for solutions to eutrophication problems.
3. Locate trail on the east side of the canal, in Catasauqua along the back of the residences and industries facing the canal. The intersection at Race Street requires a short detour around residences by crossing the canal.
4. Place signs and landscaping, including screening of visible junkyards, at the Race Street and canal intersection to designate access to the towpath and improve connections with historical properties in the town.
5. Nominate area of Race Street canal intersection in Catasauqua to the National Register of Historic Places.
6. Encourage private industries and citizens whose properties line the trail to clean up and enhance the area.
7. Place interpretive sign at Crane Ironworks, site of the first US experiment using the hot-blast technique in the smelting of iron ore with anthracite coal.
8. Clear and widen the towpath in North Catasauqua for use as a bicycle trail and repair washouts along the trail.
9. Explore the potential of restoring Hokendauqua Dam in order to rewater the canal at Catasauqua and of revitalizing the Lehigh River Recreation Center.
10. Develop historical interpretation of Thomas Iron Works, in Hokendauqua (Whitehall Township).
11. Clear existing trail in Northampton and define trail through proposed park property.
12. Improve pedestrian connections from the trail in Northampton to Main Street and residential areas and develop safe bicycle routes through the town.
13. Explore National Register status of Main Street, Northampton.
14. Negotiate with the Tri-Boro Sportman's Club in Northampton regarding trail access.

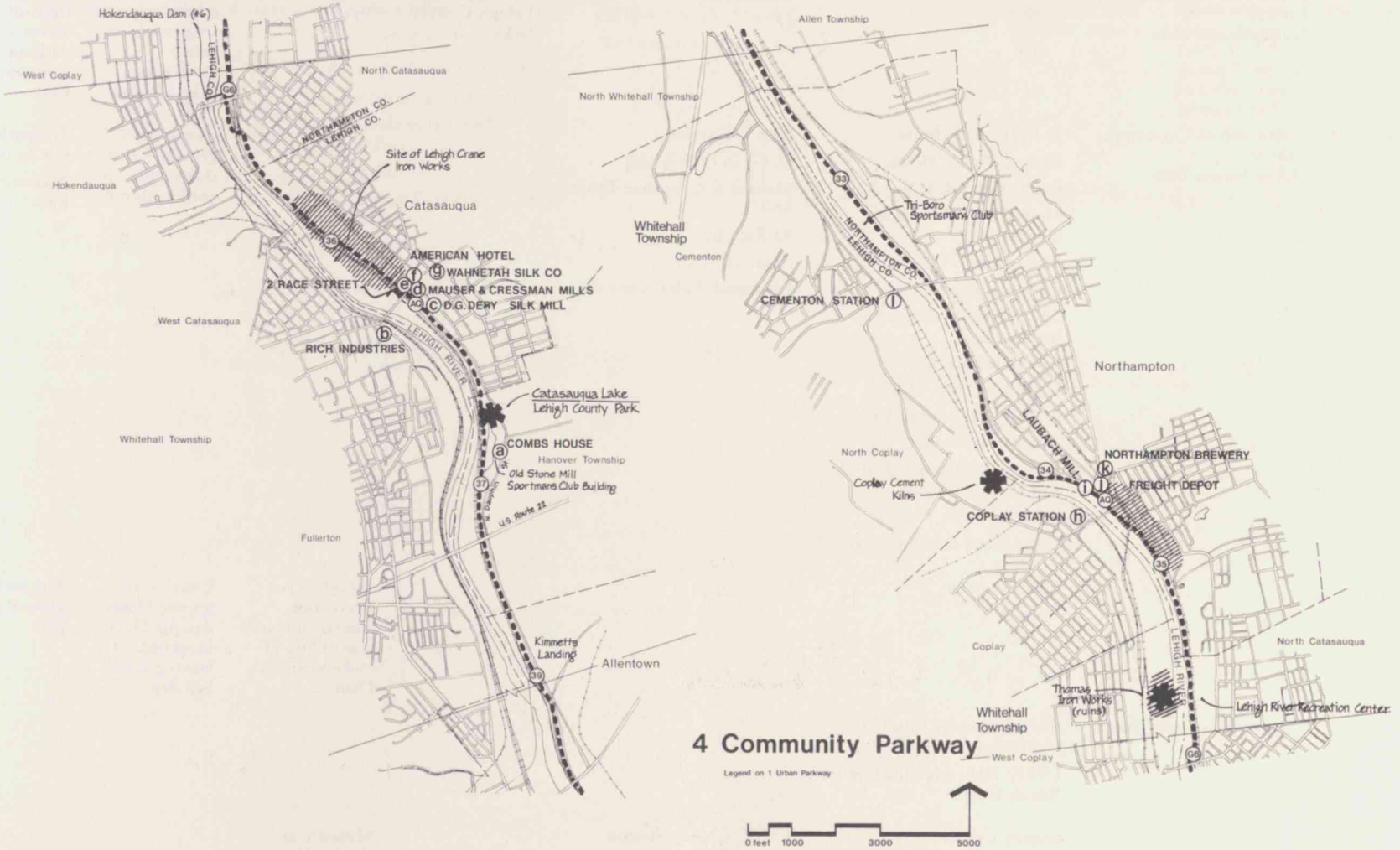


Combs House, Catasauqua.



Catasauqua Lake conceptual park development plan.

Ruins of Thomas Iron Works: Hokendauqua Plant.


Hokendauqua Dam (#6)
LEHIGH CO.
West Coplay
North Catasauqua
NORTHAMPTON CO.
LEHIGH CO.
Site of Lehigh Crane Iron Works
Hokendauqua
Catasauqua
AMERICAN HOTEL
WAHNETAH SILK CO
MAUSER & CRESSMAN MILLS
D.G. DERY SILK MILL
2 RACE STREET
West Catasauqua
RICH INDUSTRIES
LEHIGH RIVER
Catasauqua Lake
Lehigh County Park
COMBS HOUSE
Hanover Township
Old Stone Mill
Sportmans Club Building
Whitehall Township
U.S. Route 22
Fullerton
Kimmetts Landing
Allentown
Allen Township
North Whitehall Township
Tri-Boro Sportsmans Club
Whitehall Township
Cementon
CEMENTON STATION
Northampton
LAUBACH MILL
North Coplay
NORTHAMPTON BREWERY
Coplay Cement Kilns
FREIGHT DEPOT
COPLAY STATION
Coplay
North Catasauqua
Thomas Iron Works (ruins)
Lehigh River Recreation Center
Whitehall Township
West Coplay
4 Community Parkway
Legend on 1 Urban Parkway
0 feet 1000 3000 5000

Section 4: Community Parkway

Municipalities	Archeological Zones	Historical Resources	Potential Adaptive Use Structures	Natural Areas	Recreation	Canal Condition	Trail
Hanover Township	South end of Catasauqua Lake to Hokendauqua Dam	Combs House Lock 37	Combs House	Catasauqua Lake (Lehigh County Park)	Lehigh County Park	Canal overgrown, water stagnated; below Catasauqua Lake filled in	Trail follows right-of-way; access and parking at Catasauqua Lake
Catasauqua	South end of Catasauqua Lake to Hokendauqua Dam	E. A. Jackson House George Taylor House Wahnetah Silk Mill Mauser and Cressman Flour Mill #2 Race Street Catasauqua Silk Mill Site of Lehigh Crane Ironworks T. Tassie Coal Co. D. G. Dery Silk Mill F. W. Wint Lumber Yard Bryden Horse Shoe Co. Davies and Thomas Foundry and Machine Shop Lock 36 Catasauqua Creek Culvert	Rich Industries D. G. Dery Silk Mill Mauser & Cressman Flour Mill #2 Race Street American Hotel Wahnetah Silk			Canal overgrown, water stagnated, used as dump	Towpath in fair condition. Access at Race Street
N. Catasauqua		Guard Lock 6 Dam 6			Lehigh River Recreation Center, unused due to loss of Hokendauqua Dam	Canal overgrown; Hokendauqua Dam breached, leaving canal bed dry	Towpath overgrown, access poor
Whitehall Township	Thomas Ironworks Ruins	Site of Thomas Iron Co.: Hokendauqua Plant LVRR: Hokendauqua Engine Repair Shops					
Coplay		Coplay Cement Kilns LVRR: Coplay Station	LVRR: Coplay Station		Museum at Coplay Cement Kilns		

Section 4: Community Parkway

Municipalities	Archeological Zones	Historical Resources	Potential Adaptive Use Structures	Natural Areas	Recreation	Canal Condition	Trail
Northampton	Confluence of Lehigh River and Hokendauqua Creek	General Cigar Co. (Laubach Mill) Northampton Brewery John H. Meyer Silk Mill CRRNJ: Siegfried Station Hokendauqua Creek Aqueduct Lock 34 Lawrence Portland Cement Co. Lock 33	Laubach Mill CRRNJ: Freight Depot Northampton Brewery		Proposed park with ball fields in filled canal area	Open to Hockendauqua Creek Aqueduct, used as dump; Lock 34 to Cementon Bridge filled in	Trail clear, good access
Whitehall Township		LVRR: Cementon Station	Cementon Station				

Rural landscape in North Whitehall Township.

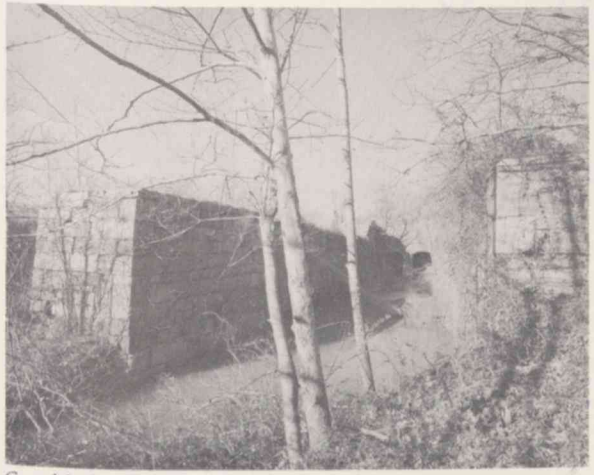
Section 5: Rural Corridor

Allen Township and Lehigh Township

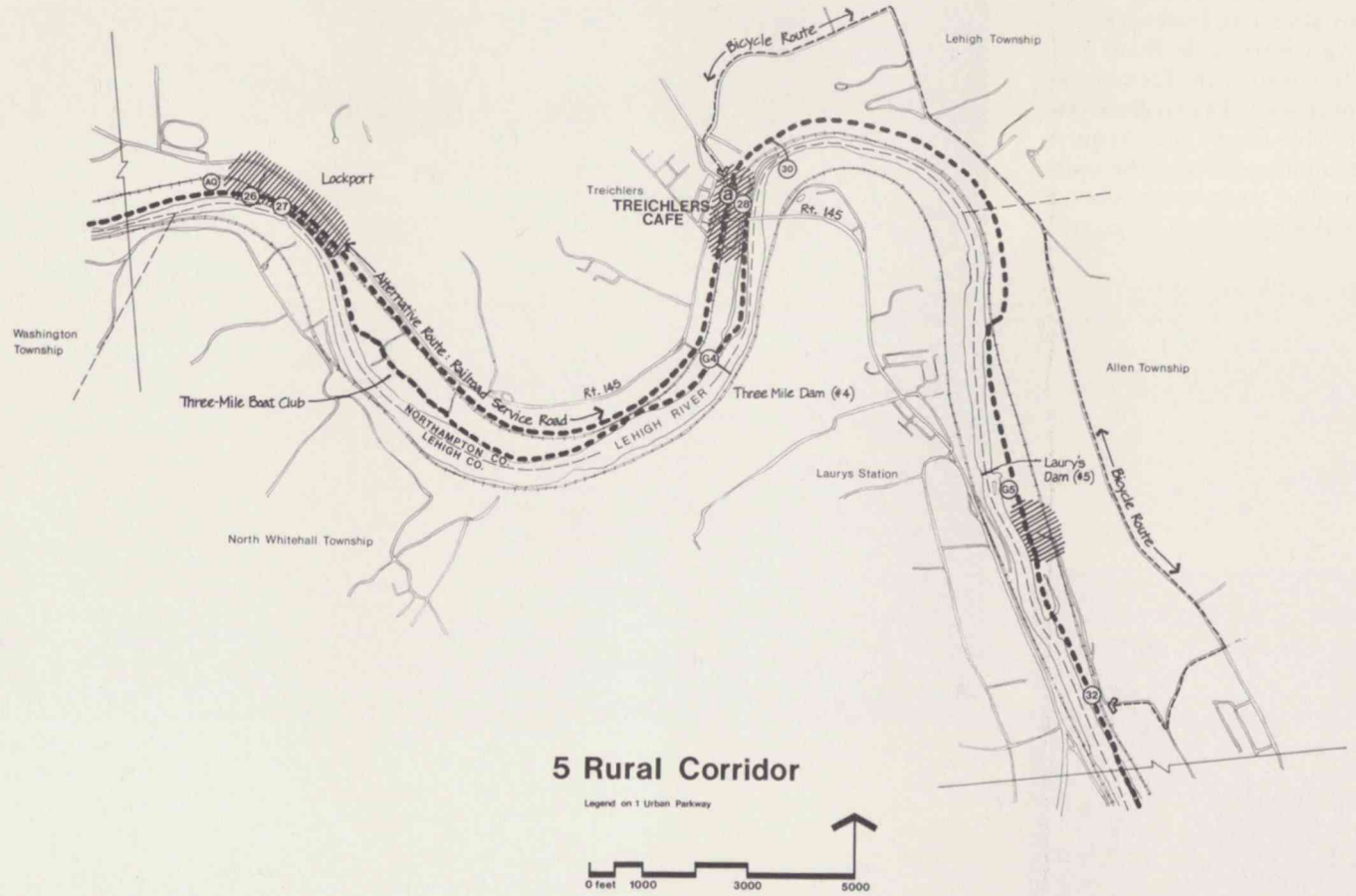
Recommendations:

1. Clear a trail from Northampton to Treichlers, cutting into the slope where necessary. To avoid steep slopes for bicyclists, create an alternate trail from Northampton along Cherryville Road and other back roads to connect in Treichlers.
2. Use the railroad service road as an alternate trail around Three-Mile Boat Club. Acquire an easement for trail access from the club.
3. Develop an interpretive program at Guard Lock 5, explaining the operation of guard locks and dams.
4. Open scenic vistas in this section.

Treichlers Cafe, Lehigh Township.

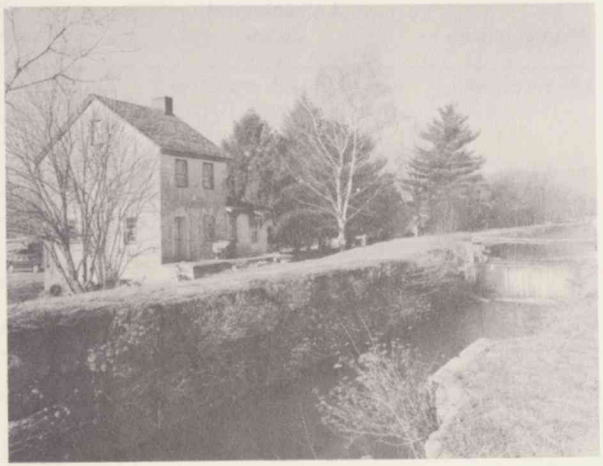


Guard Lock, Allen Township.

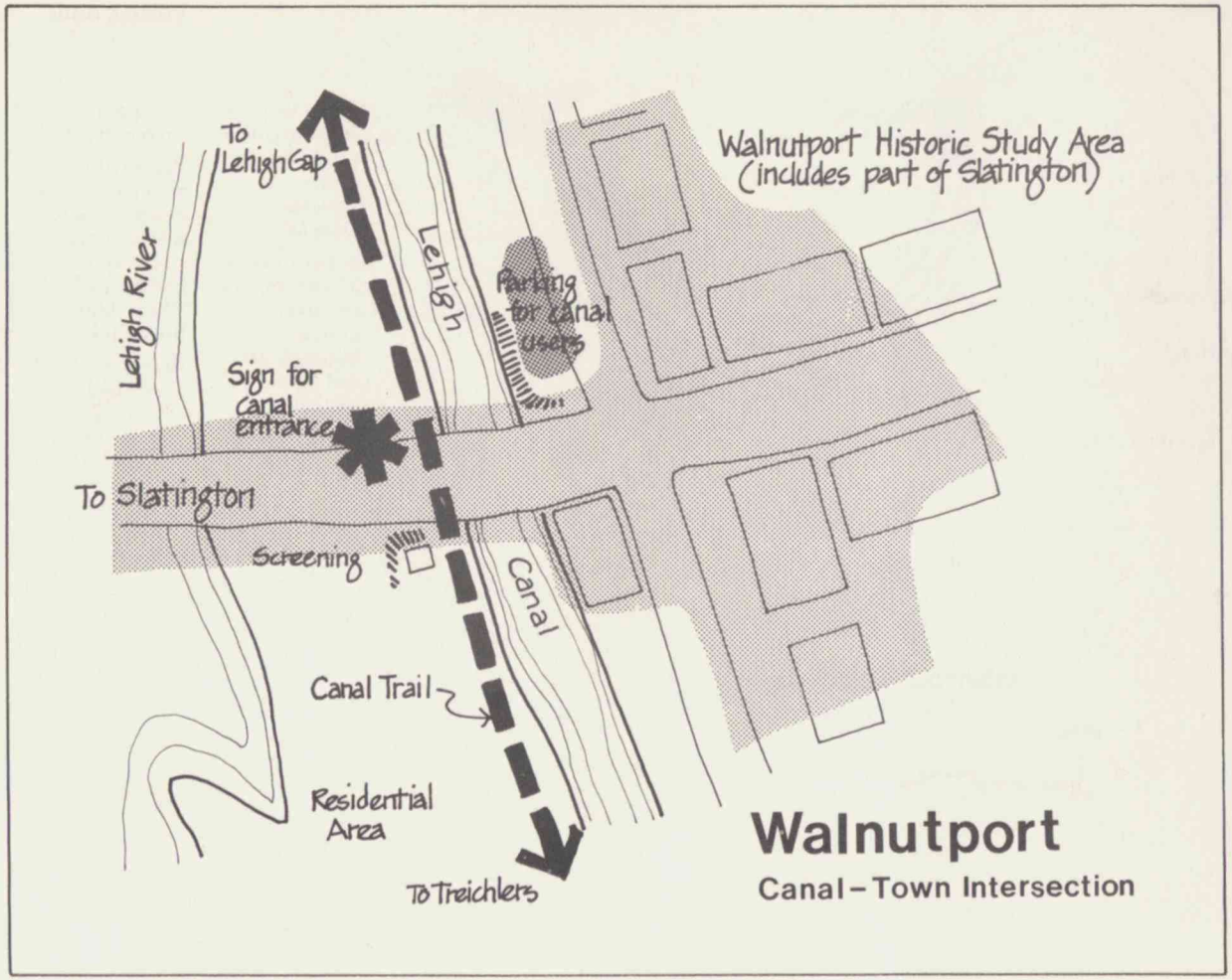

Bicycle Route
Lehigh Township
Lockport
Treichlers
TREICHLERS CAFE
Rt. 145
Alternative Route: Railroad Service Road
Washington Township
Three-Mile Boat Club
Rt. 145
Three Mile Dam (#4)
NORTHAMPTON CO.
LEHIGH CO.
LEHIGH RIVER
Allen Township
Laurys Station
Laury's Dam (#5)
Bicycle Route
North Whitehall Township
5 Rural Corridor
Legend on 1 Urban Parkway
0 feet 1000 3000 5000

Section 5: Rural Corridor

Municipalities	Archeological Zones	Historical Resources	Potential Adaptive Use Structures	Natural Areas	Recreation	Canal Condition	Trail
Allen Township	Guard Lock 5 and Dam 5	Lock 32 Guard Lock 5 Dam 5		Scenic vistas		Canal overgrown, water stagnated	Towpath overgrown, access difficult Alternate bicycle route from Lock 32 to Treichlers following existing roads
Lehigh Township	Outlet Lock (30) to bridge in Treichlers	Lock 30 Lock 28 Mauser Mill Co.: White Star Mills Guard Lock 4 Dam 4 Lock 27 and lock-tender's house Ruins of Stone Hotel (Lockport) Lock 26 Bertsch Creek Aqueduct	Treichlers Cafe			Canal bed dry and overgrown, wash out below Treichlers Dam (4) Between Lock 27 and 26, dry and overgrown Between 26 and 25 dry or partially silted in	Towpath intermittent Potential for alternate route along railroad service road to Lockport and around Three-Mile Boat Club Access at Treichlers



Lock 23 and lock-tender's house, Walnutport.



Walnutport: Canal-Town Intersection plan.

Section 6: Community Parkway

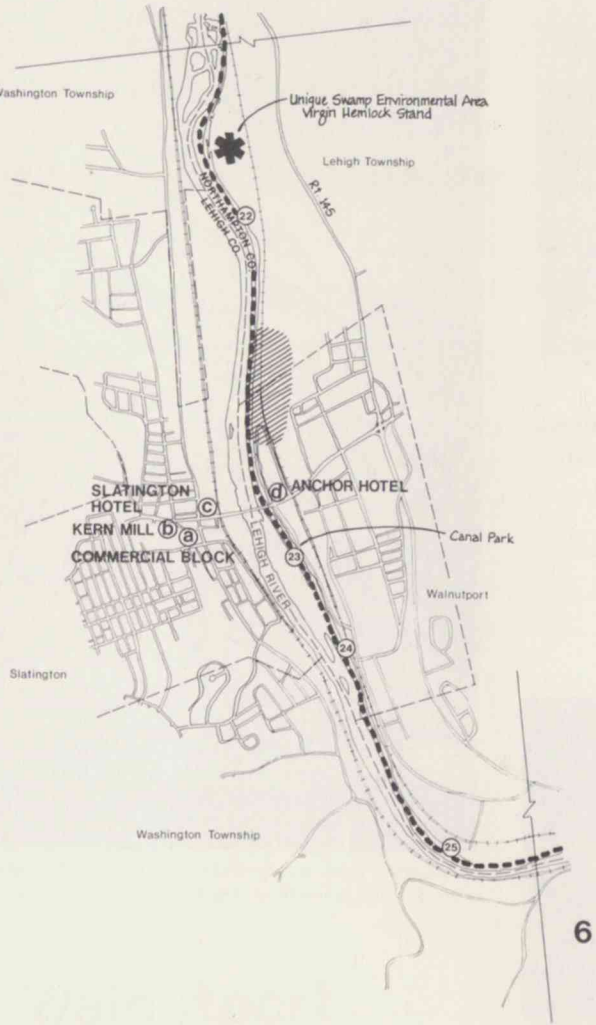
Lehigh Township, Walnutport, and Slatington

Recommendations:

1. Ensure continued water supply for the Walnutport section of the canal.
2. Screen the pumping station at the Main Street and canal intersection in Walnutport.
3. Landscape the accessway to the towpath in Walnutport, incorporating directional signs.
4. Nominate the Walnutport Main Street and Canal Street area and the commercial area in Slatington to the National Register of Historic Places.
5. Emphasize scenic vistas in this section, especially at Lock 22.
6. Study the unique bog swamp and hemlock stand for potential interpretive program.
7. Provide camping areas.

Part of Kern Mill complex, Slatington.

Architectural detail is a significant resource in towns along the canal. These facades in Slatington are particularly interesting for their adaptations of nineteenth and twentieth century design styles.



6 Community Parkway

Legend on 1 Urban Parkway

0 feet 1000 3000 5000

Section 6: Community Parkway

Municipalities	Archeological Zones	Historical Resources	Potential Adaptive Use Structures	Natural Areas	Recreation	Canal Condition	Trail
Lehigh Township		Lock 25					
Slatington		Kern Roller Mill News Publishing Co. Old Lehigh State Co.: Mantle factory John D. Emack Slate factory A. J. Kern Saw Mill National School Slate Co.	Commercial block Kern Roller Mill Slatington Hotel				
Walnutport	Residences facing the canal	Anchor Hotel Pennsylvania House Egypt Silk Mills Lock 24 Lock 23	Anchor Hotel		Canal park	North of Lock 25 canal watered and maintained as park. Water supply not assured due to lack of proper dam construction at Lehigh Gap	Towpath good, access good
Lehigh Township		Lock 22		Unique swamp environmental area Virgin hemlock stand		Clear, but dry	Good trail

View to Lehigh Gap. Highways have obliterated the old towpath along this and other sections of the canal. Trails can be adapted to the terrain and existing highways, roads, and abandoned railroad grades.

Section 7: Transportation-Industrial Corridor

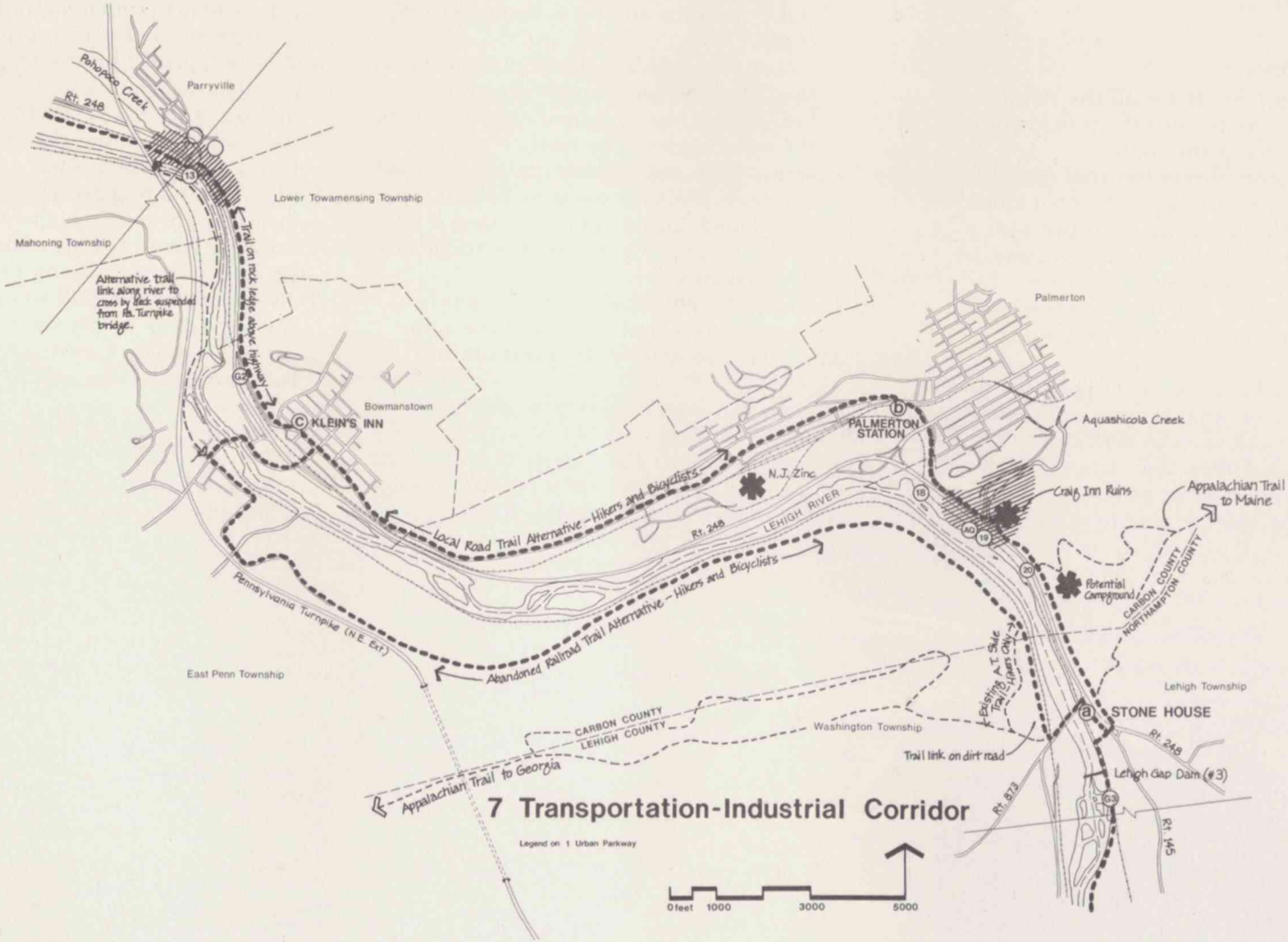
Lehigh and Lower Towamensing Townships, Palmerton, and Bowmanstown

Recommendations:

1. Develop loop potential with the Appalachian Trail, combining efforts in historical and recreational planning.
2. Trail Placement: Direct the trail from the river edge, over the railroad embankment adjacent to the canal, up to Route 248. (Construct steps, or preferably a ramp, at the railroad embankment and place adequate warning signals at the tracks.) At Route 248, two alternative routes are suggested.
   a. Follow the Appalachian Trail on the east side of the river and then use an abandoned railroad line above the highway to the Aquashicola Creek area. Construct a series of switchbacks or ramps from the edge of the railroad line to the creek. Direct the trail across the existing (old Route 248) bridge, into Palmerton, behind the New Jersey Zinc Company plant, and into Bowmanstown, using existing roads.
   b. Follow the Appalachian Trail west across the Lehigh River. Use an abandoned Lehigh and New England railroad line to the west bank of the river. Negotiate access from the highway to the railroad line with property owners. Follow the abandoned railroad grade, linking it with an existing road and cross the bridge into Bowmanstown.
3. Develop the potential for positive interaction between trail users and the communities, and among the communities as well.
4. Develop an interpretation of the impact of zinc technology.
5. Develop the area from Lock 18 to Lock 20 as a park, tying it in with a potential campground near Lock 20 on the banks of Aquashicola Creek. A row of poplar trees, the locks, and aqueduct ruins offer a scenic contrast with the impact of the New Jersey Zinc Company building in Palmerton and an opportunity for an interpretive program.
6. Where separate bicycle trails are not possible, designate a bicycle lane on existing highways with a painted line or curb, and erect signs denoting the area as an official bicycle and hiker route.
7. Stabilize and prepare a ledge for hiking and bicycling above the highway from Bowmanstown to Parryville, or investigate an alternate route along the river's edge.
8. As an alternative trail to Parryville, follow the west bank of the river to the Pennsylvania Turnpike. Construct a platform on the turnpike bridge and continue the trail into Parryville.
9. Construct a deck or ledge under the Route 248 bridge at Pohopoco Creek in Parryville to connect the trail to Lock 13 where the restored canal begins.

New Jersey Zinc Company plant.

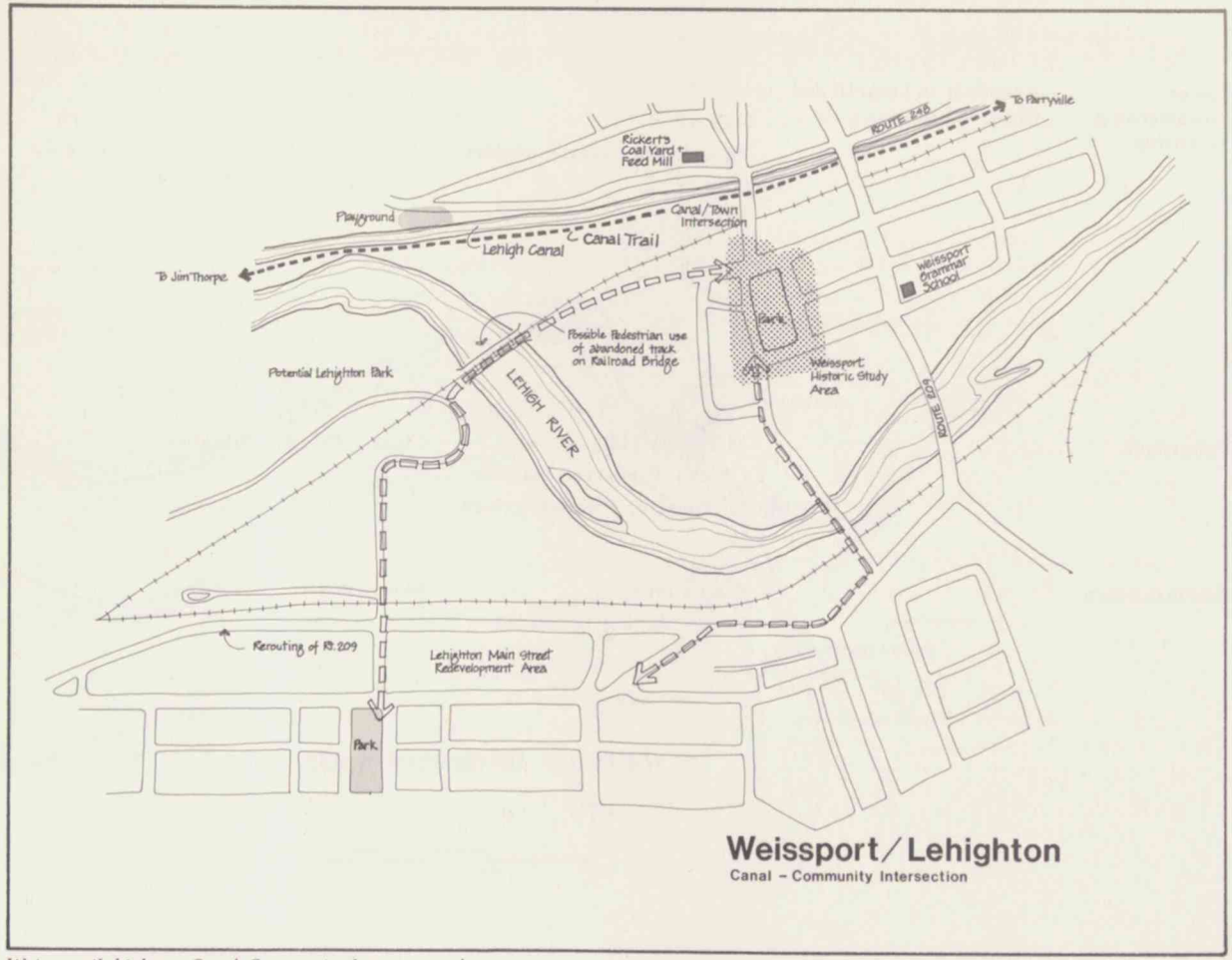
Ruins of aqueduct at Aquashicola Creek, Palmerton.


Pohopoco Creek
Rt. 248
Parryville
Lower Towamensing Township
Mahoning Township
Alternative trail link along river to cross by flick suspended from Pa. Turnpike bridge.
Trail on rock ledge above highway
C KLEIN'S INN
Bowmanstown
Palmerton
D PALMERTON STATION
Aquashicola Creek
N.J. Zinc
Craig Inn Ruins
Appalachian Trail to Maine
Local Road Trail Alternative - Hikers and Bicyclists
Rt. 248
LEHIGH RIVER
Potential Campground
CARBON COUNTY
NORTHAMPTON COUNTY
Pennsylvania Turnpike (N.E. Ext)
Abandoned Railroad Trail Alternative - Hikers and Bicyclists
East Penn Township
Existing A.T. Side Trail - Uses Only
Lehigh Township
a STONE HOUSE
CARBON COUNTY
LEHIGH COUNTY
Washington Township
Trail link on dirt road
Rt. 248
Lehigh Gap Dam (#3)
Appalachian Trail to Georgia
Rt. 873
Rt. 145
7 Transportation-Industrial Corridor
Legend on 1 Urban Parkway
0 feet 1000 3000 5000

Section 7: Transportation-Industrial Corridor

Municipalities	Archeological Zones	Historical Resources	Potential Adaptive Use Structures	Natural Areas	Recreation	Canal Condition	Trail
Lehigh Township		Guard Lock 3 Dam 3 Site of Chain Bridge Chain Bridge Toll House Stone House	Stone house (Weider's Crossing)		Appalachian Trail (proposed link) Hiking and biking using abandoned railroad tracks	Clear but dry; dam gone	Trail exists but access difficult due to slope
Lower Towamensing Township	Aqueduct to Lock 18 and Craig Inn ruins	Lock 20 Lock 19 Aquashicola Creek Aqueduct Lock 18			Campground (potential at Appalachian Trail crossing) Appalachian Trail (proposed link) Potential for park and interpretive center at Aquashicola Creek Aqueduct	Canal bed partially silted; locks in fair to good shape	Trail access difficult
Palmerton		Marshall's Hill CRRNJ: Palmerton Station NJ Zinc Co.: Palmerton plant	CRRNJ: Palmerton Station			Obliterated by highway	Break in trail due to highway; alternative using existing roads
Bowmanstown		Klein's Inn Prince Manufacturing Co.	Klein's Inn			Obliterated by highway	Break in trail

Near Weissport, Lock 10 is stabilized and maintained by the Lehigh River Restoration Association.



Weissport/Lehighton: Canal-Community Intersection plan.

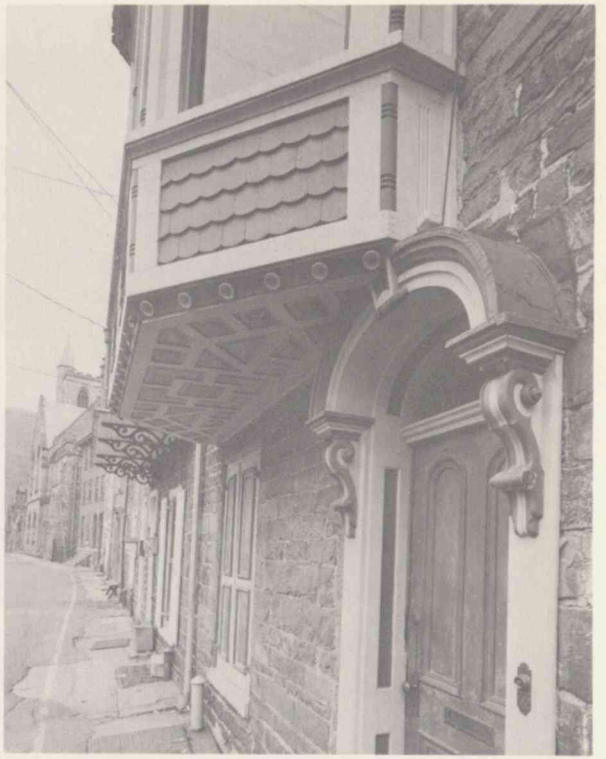
Section 8: Community Parkway

Parryville, Weissport, Lehighton, Mahoning Township, and Jim Thorpe

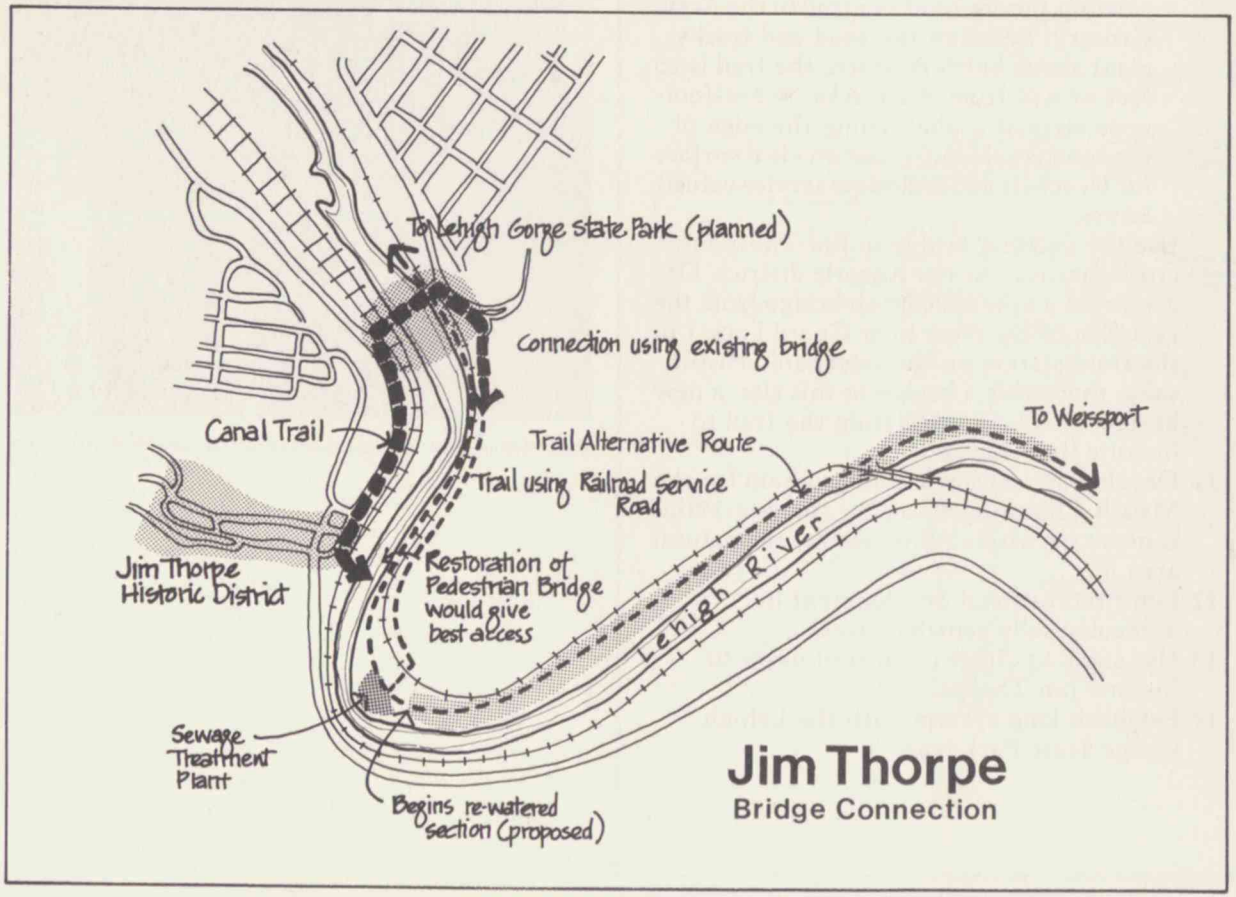
Recommendations:

1. Continue canal restoration from Lock 13 in Parryville to Guard Lock 1 in Jim Thorpe.
2. Define access to canal and parking with directional signs in Weissport.
3. Landscape the canal area in Weissport to link with the town green.
4. Investigate possible National Register status for a historic district or individual structures in Weissport.
5. Discourage the use of trail bikes by constructing trail barriers at several points along the towpath, or develop a trail bike park elsewhere, confining the use to one area, such as an abandoned strip mine or an environmentally disturbed area unattractive to most other recreational uses.
6. Establish access from Lehighton to the canal park in Weissport using unused track on the railroad bridge.
7. Coordinate existing efforts to revitalize First Street in Lehighton with the canal trail development.
8. Explore the feasibility of adaptive use of the Baer Silk Mill as a textile outlet, and link it with the canal trail.
9. Clear and stabilize the locks in Jim Thorpe. Explore the possibility of rewatering the canal by constructing a dam across the upper end of the canal, just below the sewage treatment plant overflow area.
10. Implement two trail alternatives in Jim Thorpe:
    a. Direct the trail around the sewage treatment plant and clear a path along the river. There are sections where the land is narrow, rocky, and steep and at best the trail would have to be on a narrow ledge of rocks, unsuitable for bicyclists. Route the trail around major trees, for variety and bank stabilization.
    b. Cross the railroad tracks at the sewage treatment plant. Ensure proper warning signals at the railroad crossing. Use the existing service road as a trail to the Acme Grocery. Between the road and tracks, plant shrub barriers where the trail is 25 feet or less from the tracks. A 3–4-foot-wide strip of asphalt along the edge of the road would make this an ideal surface for bicyclists and still allow service vehicle access.

    Use the existing bridge in Jim Thorpe to cross the river to the historic district. Or, construct a new pedestrian bridge from the east side of the river near Guard Lock 1 to the train station on the west bank. Historically, there was a bridge to this site; a new bridge would aid in relating the trail to historic Jim Thorpe.
11. Develop an interpretation program for the Mauch Chunk Furnace, for the late-19th-century gasworks ruins, and for the natural area.
12. Limit recreational development in archeologically sensitive areas.
13. Use signs to direct canal trail users to historic Jim Thorpe.
14. Establish loop system with the Lehigh Gorge State Park trail.



Detail of stone house window bay and entrance on Race Street, Jim Thorpe.

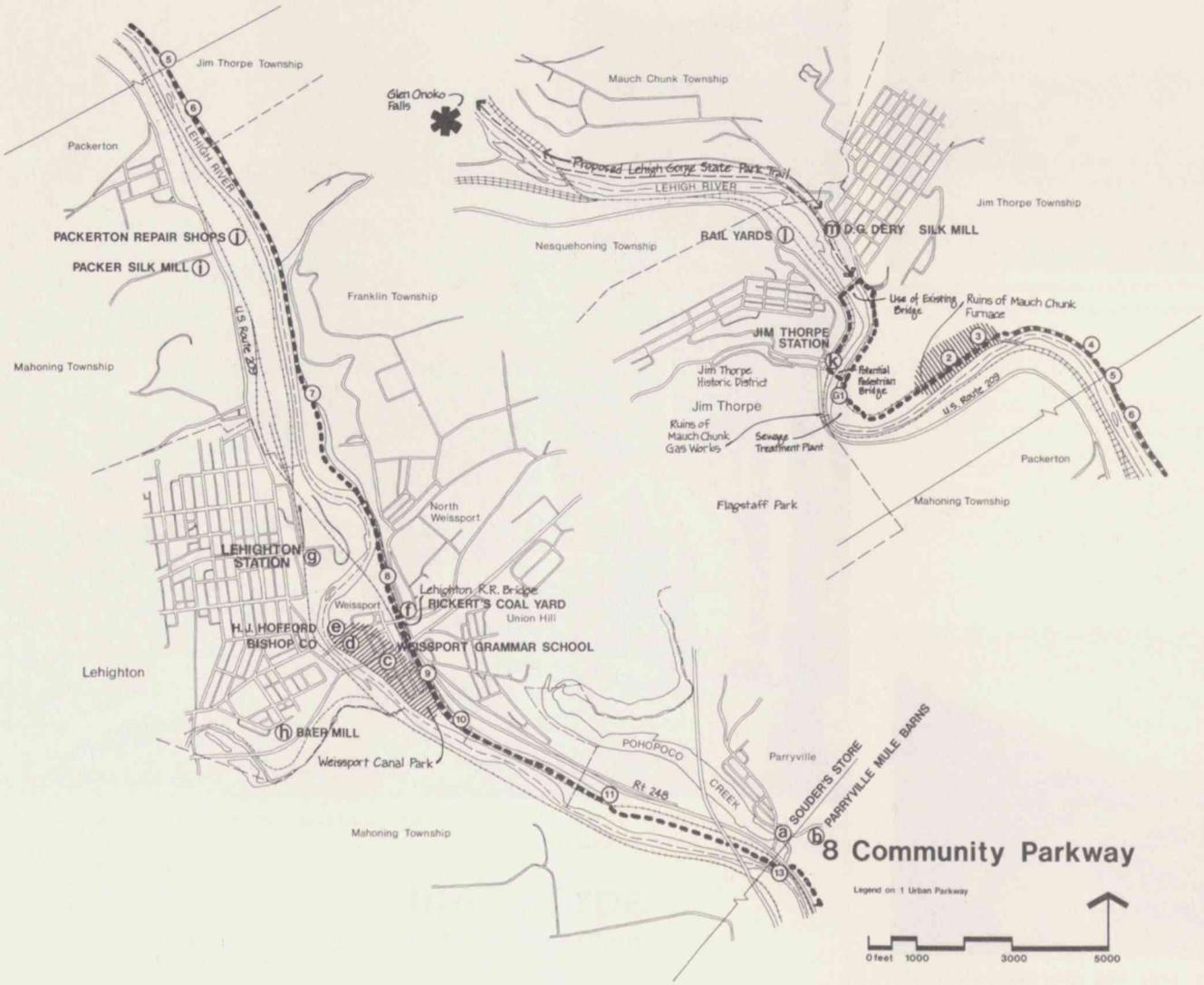


Jim Thorpe: Bridge Connection plan.

Current efforts to revitalize Lehighton's First Street can be aided by connecting it with the canal trail on the opposite side of the river.

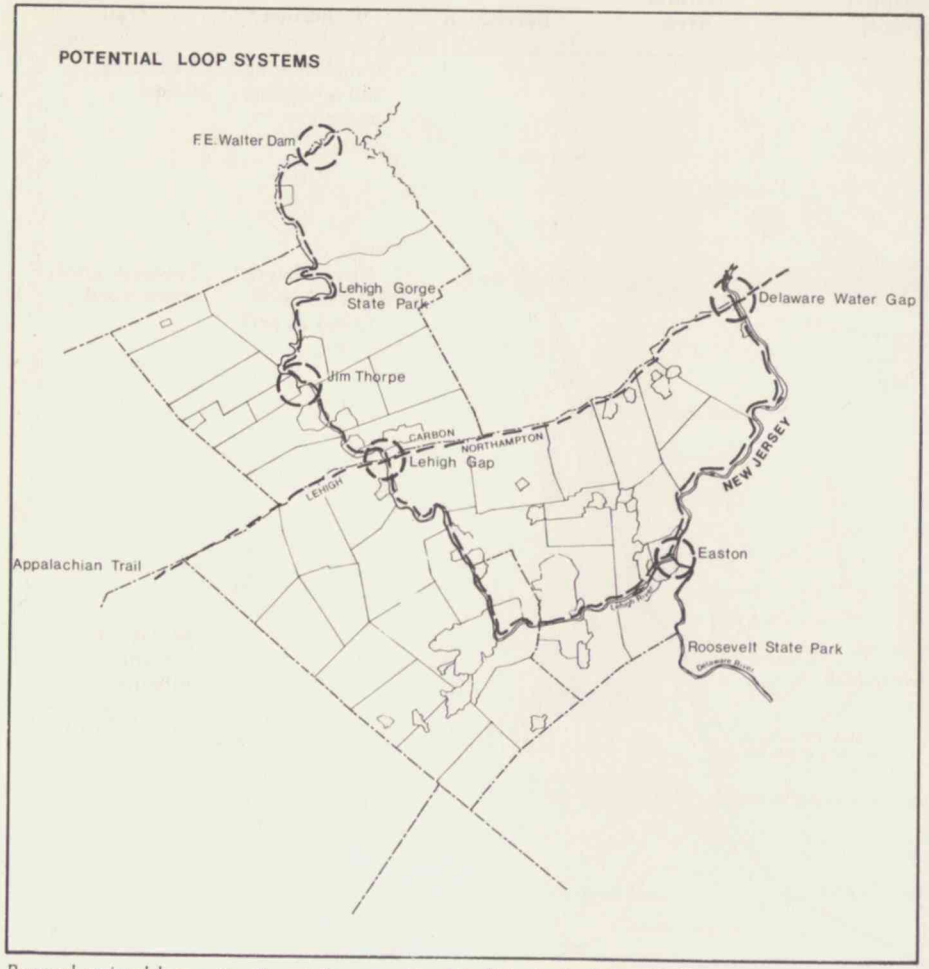
Mauch Chunk (Jim Thorpe), c. 1891. View along bend on the Lehigh River showing the Lehigh Valley Railroad Station and gasworks (opposite side of river). Courtesy of Eleutherian Mills Historical Library, Greenville, Delaware.

Mauch Chunk (Jim Thorpe), c. 1890. Looking south down Susquehanna Street toward the Mansion House Hotel. Courtesy of Eleutherian Mills Historical Library, Greenville, Delaware.

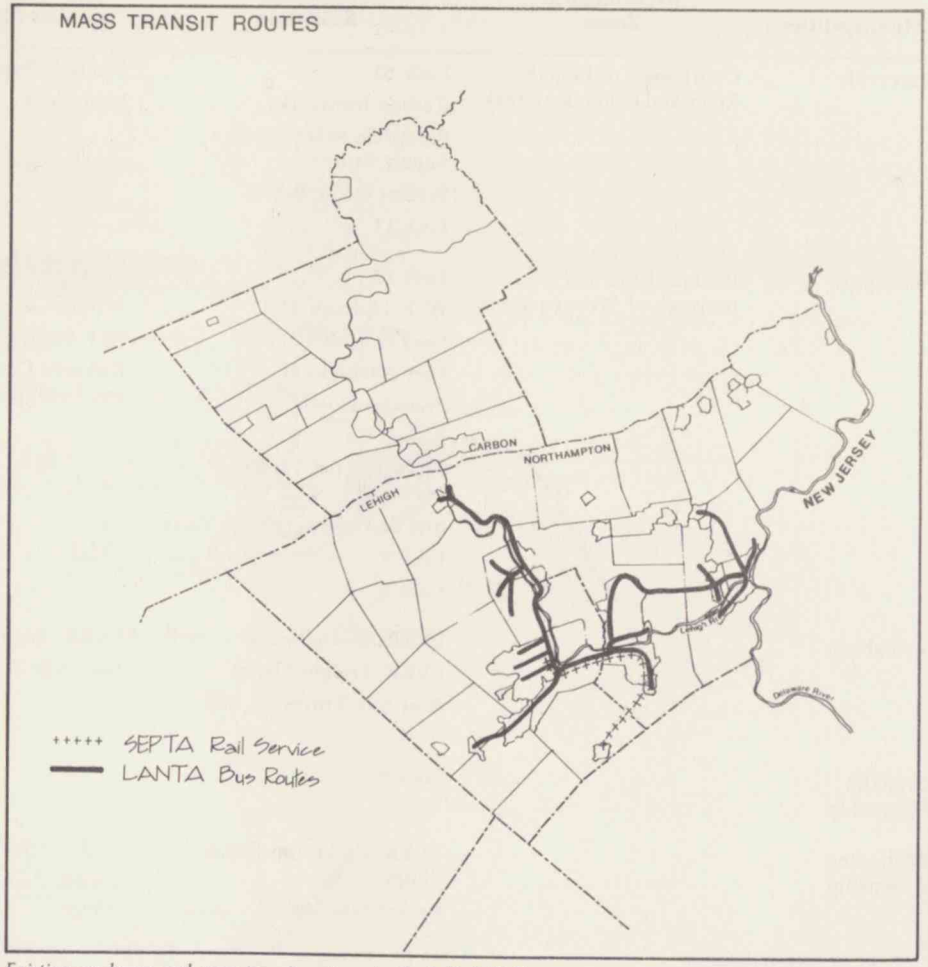

Jim Thorpe Township
Packerton
LEHIGH RIVER
PACKERTON REPAIR SHOPS
PACKER SILK MILL
U.S. Route 209
Mahoning Township
Franklin Township
Glen Onoko Falls
Mauch Chunk Township
Proposed Lehigh Gorge State Park Trail
LEHIGH RIVER
Nesquehoning Township
RAIL YARDS
D.G. DERY SILK MILL
Jim Thorpe Township
Use of Existing Bridge
Ruins of Mauch Chunk Furnace
JIM THORPE STATION
Potential Pedestrian Bridge
Jim Thorpe Historic District
Jim Thorpe
Ruins of Mauch Chunk Gas Works
Sewage Treatment Plant
U.S. Route 209
Packerton
Flagstaff Park
Mahoning Township
North Weissport
LEHIGHTON STATION
Lehighton R.R. Bridge
RICKERT'S COAL YARD
Union Hill
Weissport
H.J. HOFFORD BISHOP CO
WEISSPORT GRAMMAR SCHOOL
Lehighton
BAER MILL
Weissport Canal Park
POHOPOCO CREEK
Rt 248
Parryville
SOUDER'S STORE
PARRYVILLE MULE BARNS
Mahoning Township
8 Community Parkway
Legend on 1 Urban Parkway
0 feet 1000 3000 5000

Section 8: Community Parkway

Municipalities	Archeological Zones	Historical Resources	Potential Adaptive Use Structures	Natural Areas	Recreation	Canal Condition	Trail
Parryville	Confluence of Lehigh River and Pohopoco Creek	Lock 13 Carbon Ironworks Parryville Mill (Souder's Supply Store) Stables (Mule Barn) Lock 11	Souder's Supply Store Mule Barn			Canal clearing and rewatering underway Lock 11	Trail being cleared
Weissport	Boatyard site and borough of Weissport	Lock 10 W. F. Hofford Mill Feed mill, elevator Fort Allen Hotel Franklin Hotel Bishop Co. Rickerts Coal Yard and Feed Mill Site of Weissport Boat Yard Lock 9 Lock 8	Weissport Grammar School Bishop Co. H. J. Hofford Mill Rickert's Coal Yard and Feed Mill		Town park	Canal watered and maintained as park	Towpath good, access good
Lehighton		LVRR: Roundhouse LVRR: Freight Depot Baer Silk Throwing Mill	LVRR: Freight Depot Baer Silk Throwing Mill				Access into Lehighton difficult
Franklin Township		Lock 7				Canal maintained as park	
Mahoning Township		LVRR: Packerton Repair Shops Packer Silk Mill	Packer Silk Mill LVRR: Packerton Repair Shops				
Jim Thorpe	Packerton Junction to Guard Lock 1	Jim Thorpe Historic District Flagstaff Pavilion Mauch Chunk Furnace Mauch Chunk Gasworks	CRRNJ: Jim Thorpe Station CRRNJ: railyards and shops D. G. Dery Silk Mill	Glen Onoko Falls	Lehigh Gorge State Park Glen Onoko Falls Jim Thorpe Historic District Flagstaff Park	Canal overgrown; filled in at sewage treatment plant	Trail overgrown with poor access



Proposed regional loop system ties existing recreational facilities in the Lehigh Valley to areas of potential development along the canal.



Existing roadways and mass transit systems in the Lehigh Valley.

Implementation of the Trail Plan

The trail plan is an outline that, when followed, can coordinate various individual efforts along the canal. Public efforts include stabilizing locks and developing trails; and private efforts include reusing historic structures along the canal. The following steps are recommendations for implementation, additional analyses, and specific design tasks.

Assemble all tools available for implementation of the trail plan and set strategies:

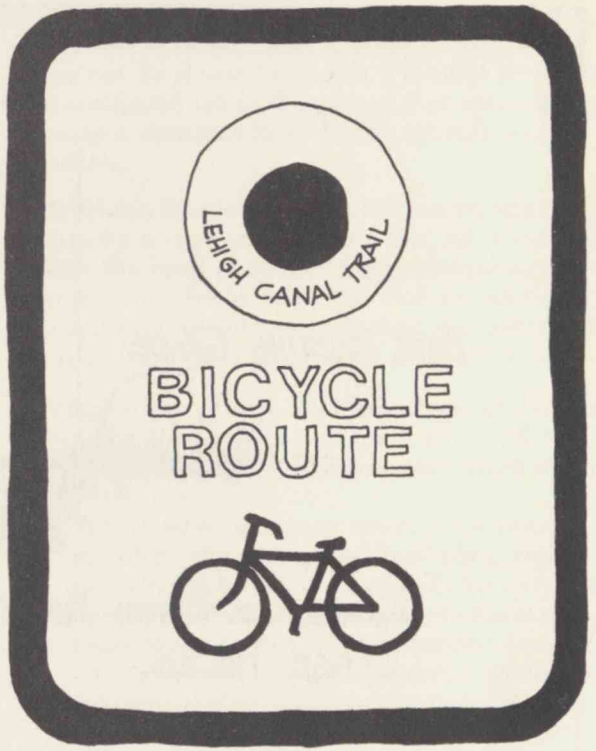
- Survey potential funding sources for more detailed planning and design projects.
- Start a promotional campaign to generate public awareness of the area's heritage.
- Look for opportunities that coincide with current development efforts, such as the Army Corps' low-head hydropower generating study.
- Use the support of local interest groups.
- Add issues such as growth management and tax sharing to the agenda of the ad hoc committee.

Perform additional assessment and analyses:

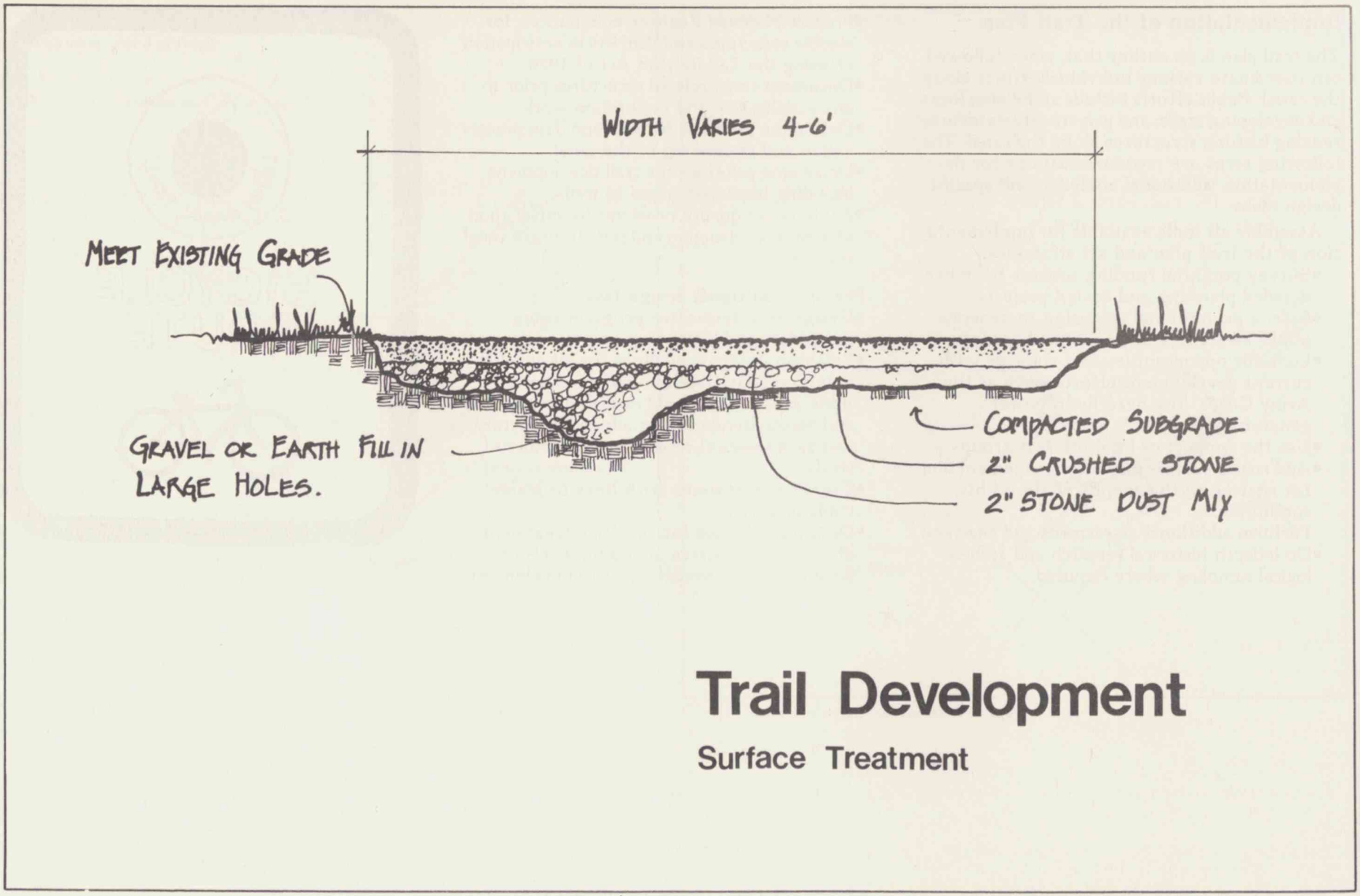
- Do indepth historical research and archeological sampling where required.
- Prepare National Register nominations for eligible structures and districts in anticipation of using the Tax Reform Act of 1976.
- Document canal related structures prior to any stabilization and restoration work.
- Determine priorities for lock and dam preservation and rewatering of the canal.
- Determine priorities for trail development including improved access to trail.
- Study water quality problems in anticipation of dam reconstruction and rewatering of canal segments.

Perform additional design tasks:

- Design an interpretive program using pamphlets and signs.
- Establish design guidelines for all development, emphasizing low-maintenance solutions; guidelines should include all standards and recommendations made in the historic and archeological resource management study.
- Create loop systems with links to major trails or parks.
- Design guidelines for sensitive treatment of historic resources including levels of documentation needed prior to develoment.



Proposed logo for bicycle route.



Proposed treatment of surfaces along the trail.

Appendixes

A-1 Guidelines for Trail Development

Trail Surfacing—The surface treatment of the trail can vary with community resources and needs, but should be suitable for bicycles as well as hikers. Hard surfaces, such as concrete and asphalt are durable, but expensive and incompatible with most natural settings. Their use, therefore, is not recommended. Several surface treatments that are relatively inexpensive and more compatible to the area and nature of the canal tract are suggested, to be used according to community needs.

Before surfacing, roots, tree stumps, and earth buildup should be scraped or removed from the trail and gravel or earth used to fill large holes. In some cases, compacted earth or grass could be a suitable trail surface, but will be subject to wear and erosion. Suggested surfacing:

1. Stabilized earth gravel—a mixture of compacted graduated stone aggregate, earth and moisture.
2. Limestone dust—rolled.
3. Stone dust—a 2-inch layer over gravel, cinder, crushed stone, or an existing suitable base.
4. Compacted cinder.

Bank Stabilization for Trail — In areas where there is little room for a trail along a steep embankment, boulders could be placed along the shore and gravel or earth fill could be used to create an area wide enough for a trail.

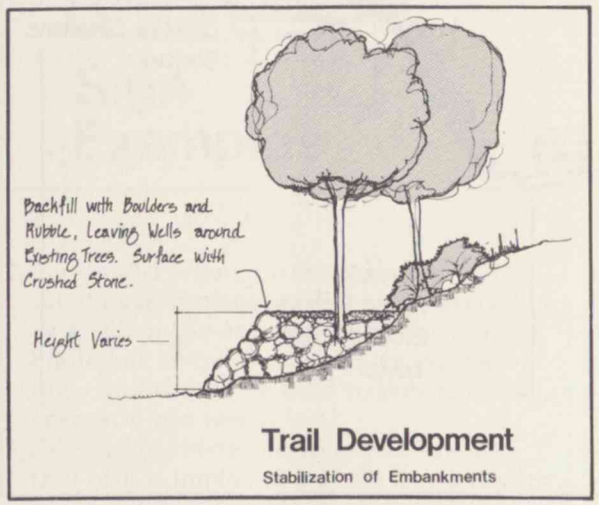
Stepped Ramps—In some places, stepped ramps may be the logical way of handling slopes and preventing erosion.

Ramps—At entry points in developed areas of the park, ramps should be used instead of steps, to provide access for the handicapped. The level towpath is ideal for use by the handicapped, but crossing the canal and railroad lines is presently difficult. Specifications for design guidelines for the handicapped are available from both state and federal recreation departments.

Footbridges—In certain communities the trail crosses the canal. Construction of simple, low-maintenance footbridges is suggested. Sophisticated structures are generally unnecessary and volunteer groups easily construct a suitable structure as a service project. Bridge maintenance requirements should be a major consideration as funding will be limited.

Control Points—Control points are suggested only where there is a problem with vehicular use, and in those cases, should be designed **not** to discourage pedestrian use. Communities should select materials and a design compatible with, or reflective of, the area.

Railroad Crossings—Where the trail crosses active railroad lines, adequate warning should be given by bells, lights, or signs, as required by the railroad. Where the trail must be developed adjacent to the rail lines, the minimum distance of 20 feet is required by ConRail. Shrubs and trees can be planted to act as a barrier between the track and rail as illustrated. For specific site concerns, communities should consult with ConRail.

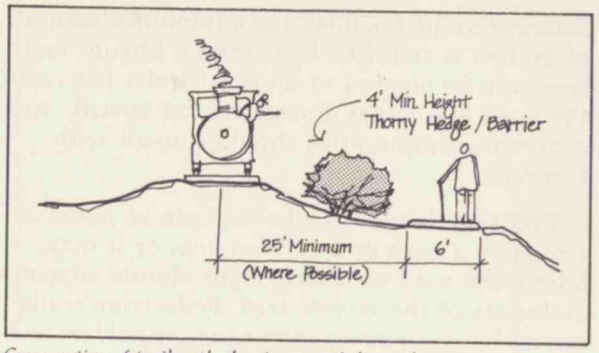


Proposed method of embankment stabilization.

Trails on Roads—A bike path can be noted on a road by a curb or a painted line, or it may follow the road shoulder. Signs should advise motorists of the bicycle trail. Pedestrian trails can make use of sidewalks or road shoulders and should also have signs noting pedestrian use.

Vegetation—Trees, shrubs, and ground cover should be used to enhance the trail. Landscaping is an efficient means of site improvement at many problem areas.

1. Where ruins or scenic areas have been noted on the conceptual trail plan, vegetation should be cleared along the towpath to open up views. In areas where character is monotonous, breaks in vegetation to the river view will help add variety and interest.
2. Additional planting along the trail can effectively screen adjacent land where unsightly. Fast growing vines and ground covers can be successful screens.
3. Dense growing shrubs with low branches or thorns can be planted as thickets to act as barriers in areas environmentally or archeologically sensitive, or where use must be restricted.
4. Exposed areas should be covered with grasses or fast growing ground cover to limit erosion, as well as to improve the general character of the site.
5. Shrubs with fruit, such as berries or nuts, and edible bark should be used along the towpath for wildlife.
6. When selecting plants, consideration should be given to autumn foliage and spring flowers, using a variety of plants that



Cross-section of trail path showing use of thorny barriers.

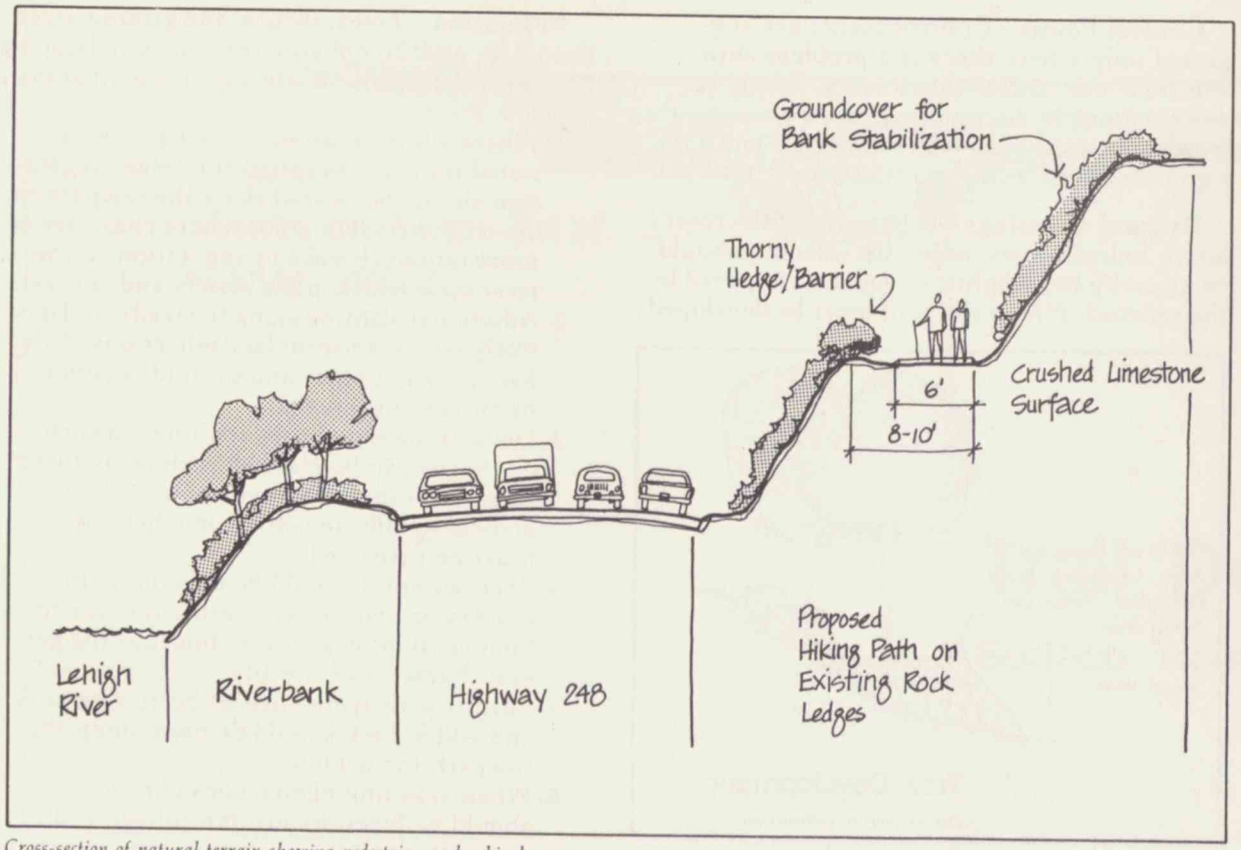
will provide enjoyment year-round. Evergreen trees or ground covers should be included to provide color during winter months.

7. Care should be given to using plant material indigenous to a region, and suitable for a particular area. Flood plain species will be suitable for most of the canal corridor. Hardier species should be selected for use at canal-community intersections because they will be exposed to compaction, salt damage, and auto pollution.
8. Trees and shrub compositions can effectively strengthen the link between the canal trail and the community. Plants can create a focal point at the intersection and, then, link with the landscaping along streets leading from the canal. A repetition of species or of design within the district or different communities can reinforce the canal theme.

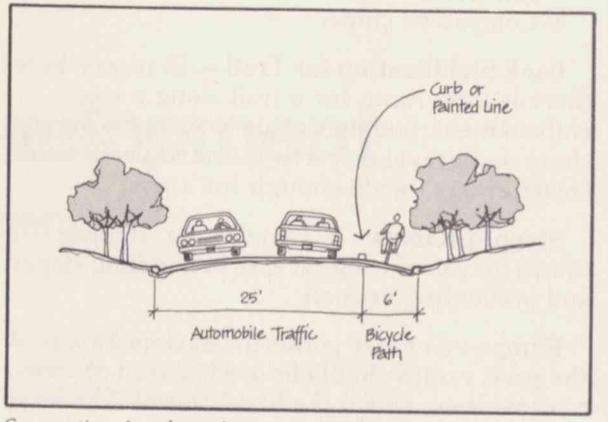
Signs—Two different categories of signs should be used along the canal and within communities: directional signs that lead users to facilities, and interpretive signs that explain the significance of an area.

The "Bull's Eye" logo shown is only an example. Many catchy logos could symbolize the Lehigh Canal. We encourage the local artists to formulate a design; perhaps a logo contest would be appropriate. A logo is an excellent means of establishing identity and continuity, within a flexible sign program. Different scales, shapes of signs, and means of mounting them convey continuity if there is some repetition of color, logo, etc.

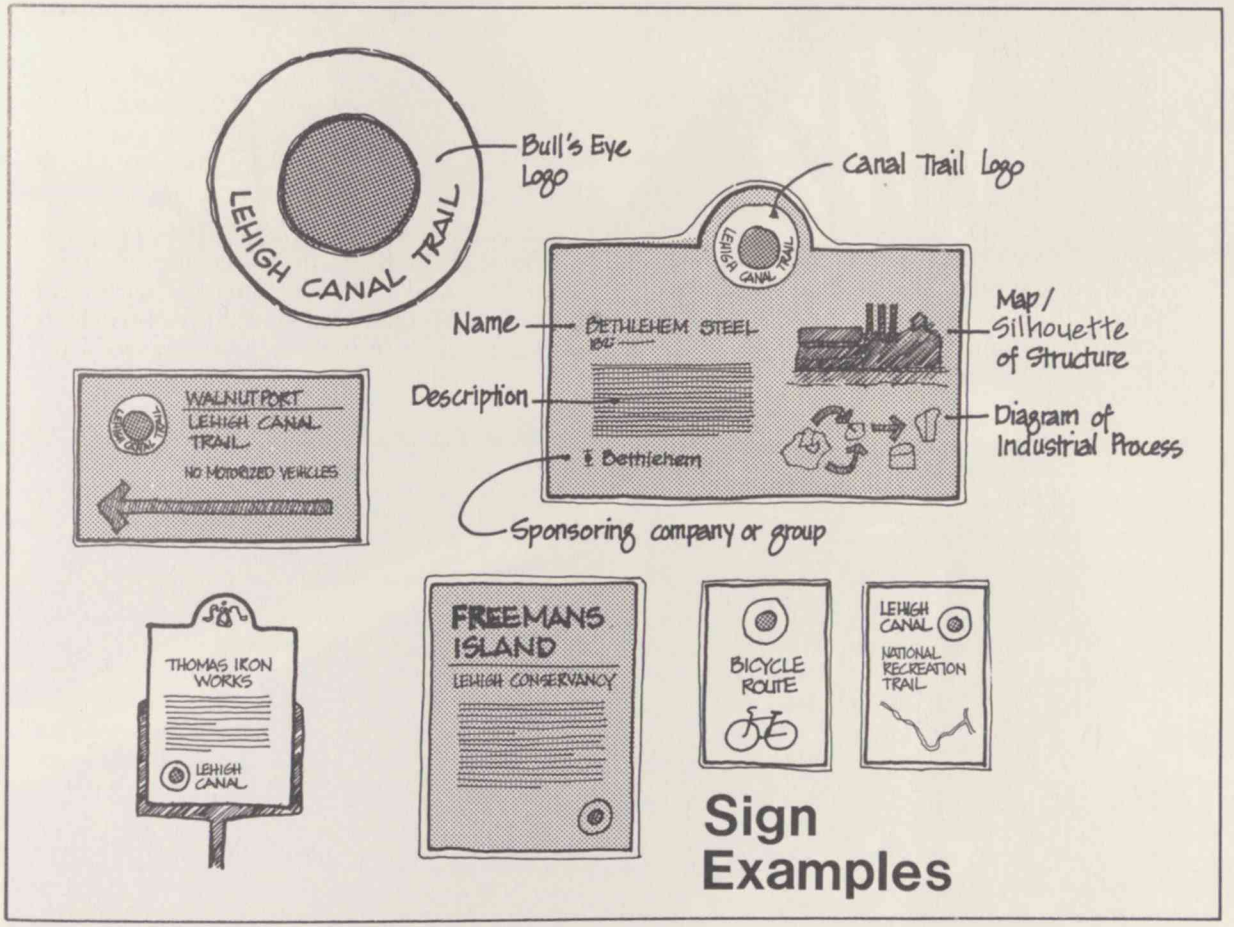
Where the trail has been developed through areas of private ownership, signs could note restricted use and ask for consideration and respect of property.



Cross-section of natural terrain showing pedestrian and vehicular use.



Cross-section of roadway showing combined use for cars and bicycles.



Examples of appropriate signs for canal use.

SIGNS	
	Historical Interpretation
	Natural Interpretation
	Industrial Interpretation
	Trail / Town Identification
GENERAL GUIDELINES	① Use canal logo to create sense of continuity
	② Encourage local participation / talents (i.e. use company logos, local group sponsors, etc.)
	③ Simplify graphics / construction to be easily replaceable
	④ Minimize number of signs

Types of signs, and guidelines for their use.

Support Facilities—

1. Shelters, picnic areas, restrooms, and concession stands—where the canal trail parallels existing or proposed recreation areas, communities may develop these facilities to benefit and encourage area use. The need for such facilities should be determined by each community based on needs, resources, and projected growth of the area.
2. Parking—Parking facilities should be located near the canal park for trail users' but away from the entrance area. Space is limited at all canal-community intersections and should be used to enhance the entrance into town.
3. Recreation-related concessions—As the trail plan is implemented, the feasibility for bicycle, canoe, and other rentals should be studied. Concessions could be located in a number of towns for drop-off and pick-up.
4. Camping—Primitive camping facilities will be needed as trail use develops and can be provided in some of the more remote stretches of the trail. Campgrounds should be no closer than 5 miles apart, and their construction should be dictated by trail use.
5. Hostels—Until an accurate user-study can be completed, we can only suggest the establishment of hostels at the intersection of the canal trail with other established recreation facilities, such as the Appalachian Trail at the Lehigh Gap, the Delaware Canal Trail at Easton, and the proposed Lehigh Gorge Trail in Jim Thorpe. Currently a bill is before Congress to provide matching funds for the adaptive use of buildings on the National Register of Historic Places as hostels. Communities interested in establishing hostels should contact American Youth Hostels, Inc.

A—2. Photo 1. Lock 40, Allentown.

A-2 Lock Stabilization Report

Introduction

Despite a half century of decay following the Lehigh Canal's 1931 closing, traces of almost all engineering structures—dams, locks, aqueducts, and culverts—are visible today. Their condition varies from ruins, washed out dams, and piles of rubble that once formed locks, to completely restored locks in Easton's Hugh Moore Park.

With renewed interest, and increasing recreational use of the canal, many structures require stabilizing treatments to prevent their further deterioration and to protect canal users from injury. This does not mean the entire canal should be restored as at Hugh Moore Park or Delaware Canal/Roosevelt State Park. There is a very real difference between stabilization and restoration. Restoration seeks to recreate an image of the past.

Stabilization aims to preserve as much of the historic fabric as possible in a way that will arrest further deterioration and collapse. Obviously, stabilization is a prerequisite for restoration or reuse. Stabilized structures are attractive—park and trail-side amenities. Four locks on the C&O Canal in Maryland, and the Black River, Delaware and Hudson, and Erie canals in New York State are good examples of "dry" lock stabilization.

Stabilization and restoration work on historic structures must be well-documented, reversible, and carefully supervised. Documentation consists of generating photographs, written descriptions, and measured drawings (where practical) of existing conditions *before work begins.* Materials and evidence obliterated during even the most benign stabilization may be important to restorers and historians. As work progresses, descriptions and photos of what was done should be maintained.

Reversible work does not seriously disrupt historic fabric and can be removed without damaging or destroying the original structure. The effects of using loose fill and timber structures are reversible; they can be put in and taken out without too much damage. However, the application of poured concrete, cast into historic masonry and anchored with reinforcing bars, is not reversible. (See photo 1.)

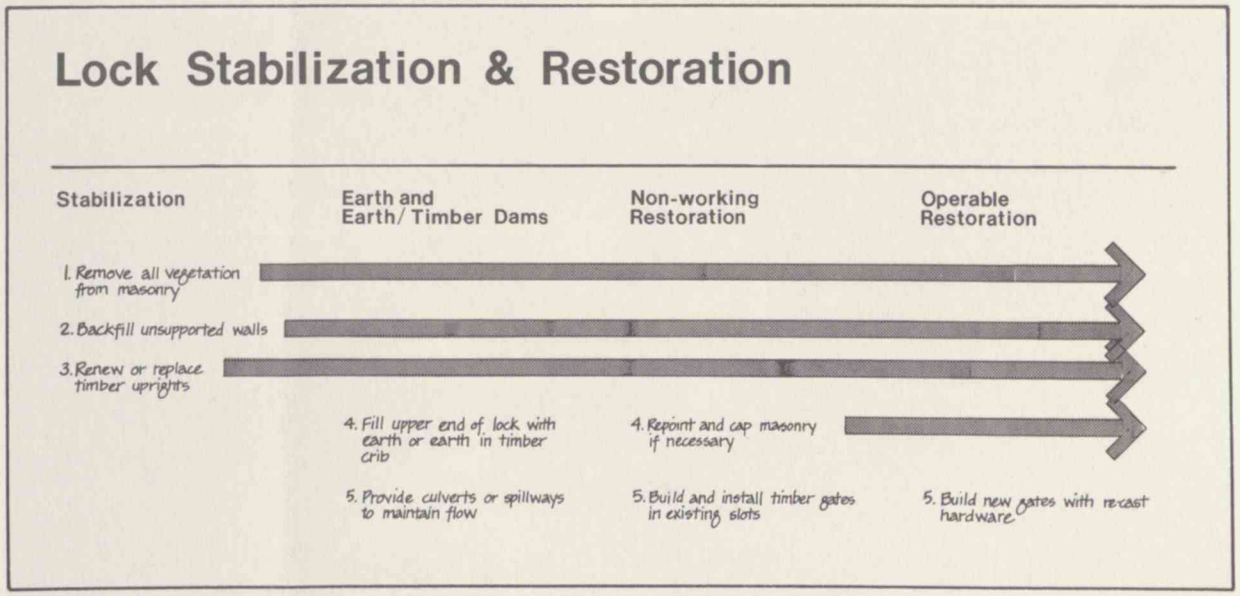
Those who would restore lock structures must resist the temptation to over-engineer their treatments. Monocacy Creek aqueduct in Bethlehem is a good engineering solution to the problem of carrying canal water across the creek and providing adequate flood spillways. Unfortunately, it is an over-engineered solution that destroyed most of the structure's original fabric and precluded future restoration. (See photo 2.)

Usually, local labor using timber, earth-fill, rock, and a judicious amount of mortar can perform stabilization and restoration work that is relatively inexpensive, historically accurate, and aesthetically pleasing. The work of Lehigh Canal Recreation Commission in Carbon County is a prime example of good local restoration.

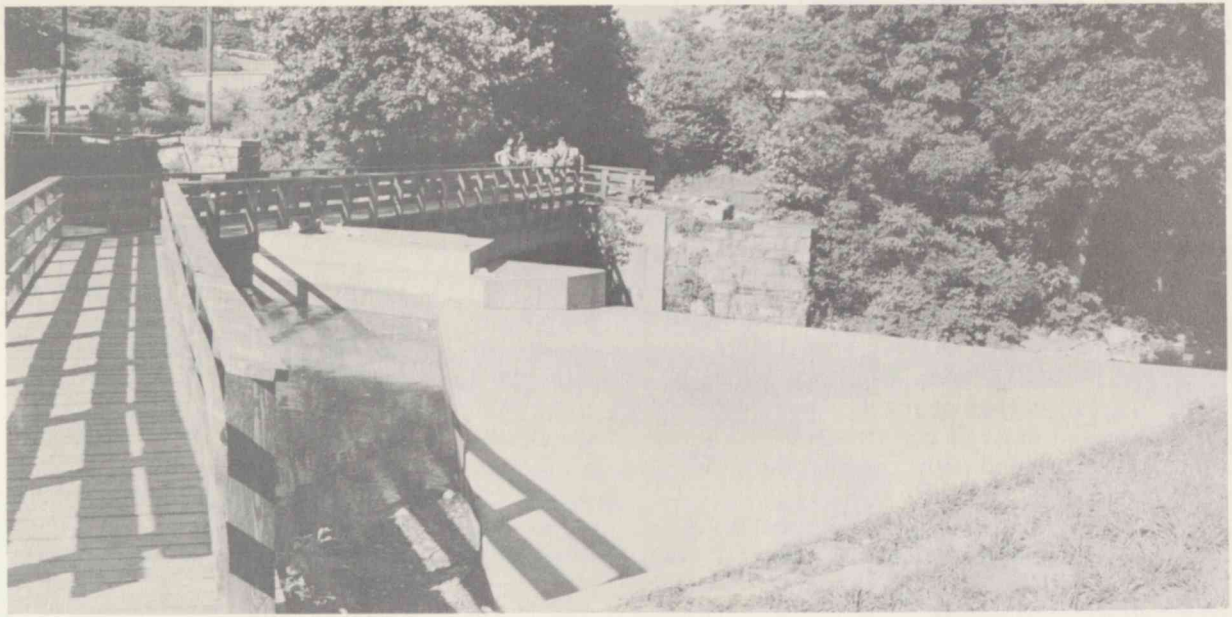
Stabilization

Locks:

Most locks on the Lehigh Canal are 100 feet long, 22 feet wide, and had lifts ranging from 4 to 12 feet. While all have masonry chambers, they display a variety of materials (depending on location): rough fieldstone, rubble, slate slabs and blocks, dressed limestone, and sandstone. Most were originally lined with wood to prevent damage to boats and lock walls. After

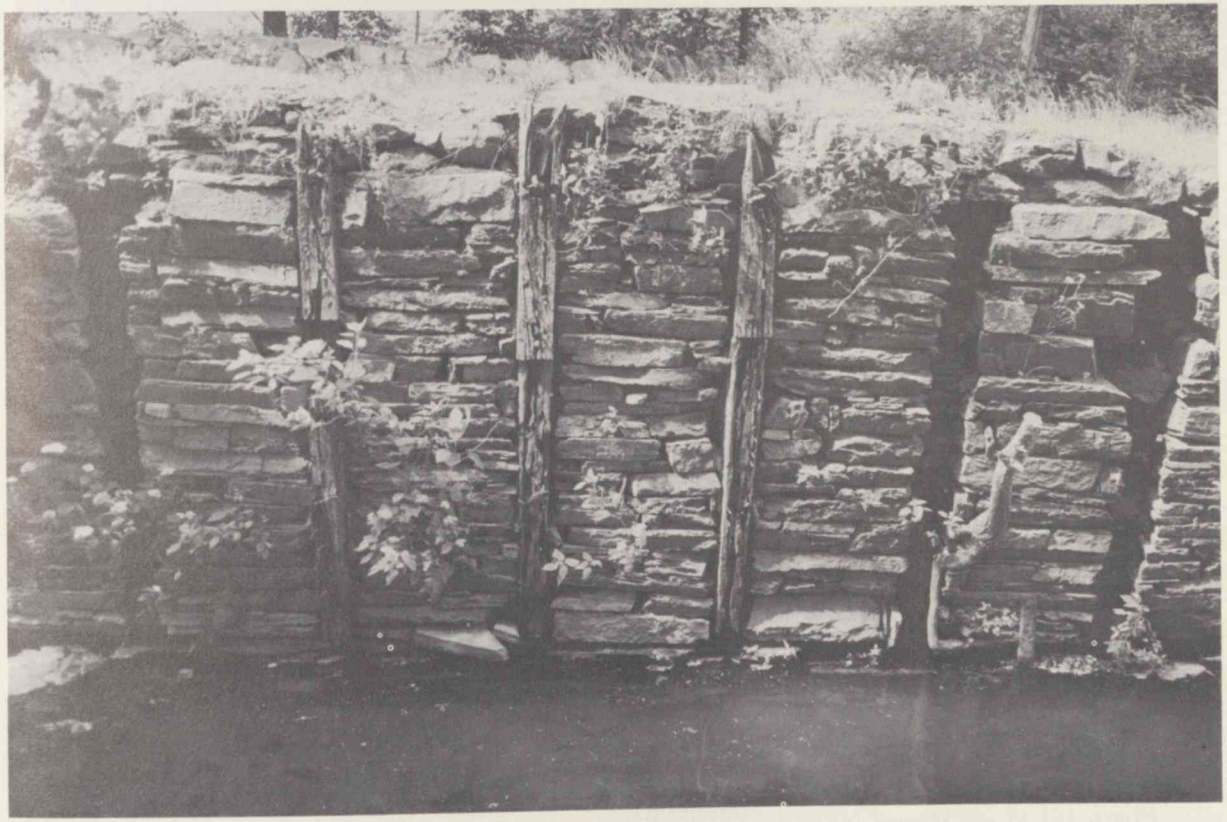


Guidelines for lock stabilization and restoration procedures.

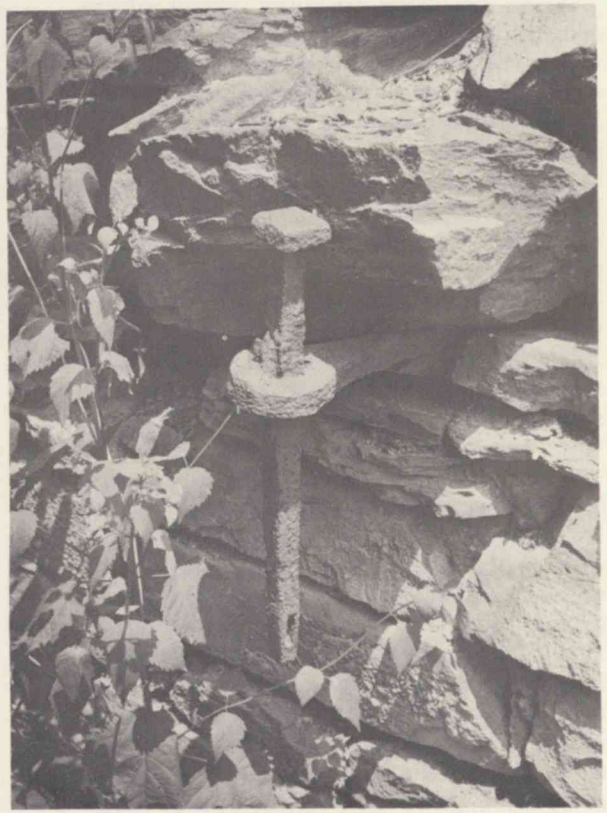


A—2. Photo 2. Monocacy Creek Aqueduct, Bethlehem.

A—2. Photo 3. Lock 27, Lockport.



A—2. Photo 4. Lock 11, near Weissport.



A—2. Photo 5. Lock 11, near Weissport.

1895, some locks were capped with concrete copings. The variety of material, modifications made through the years, and present conditions preclude a standardized approach to lock stabilization or restoration, but the following general guidelines are applicable to many locks along the canal.

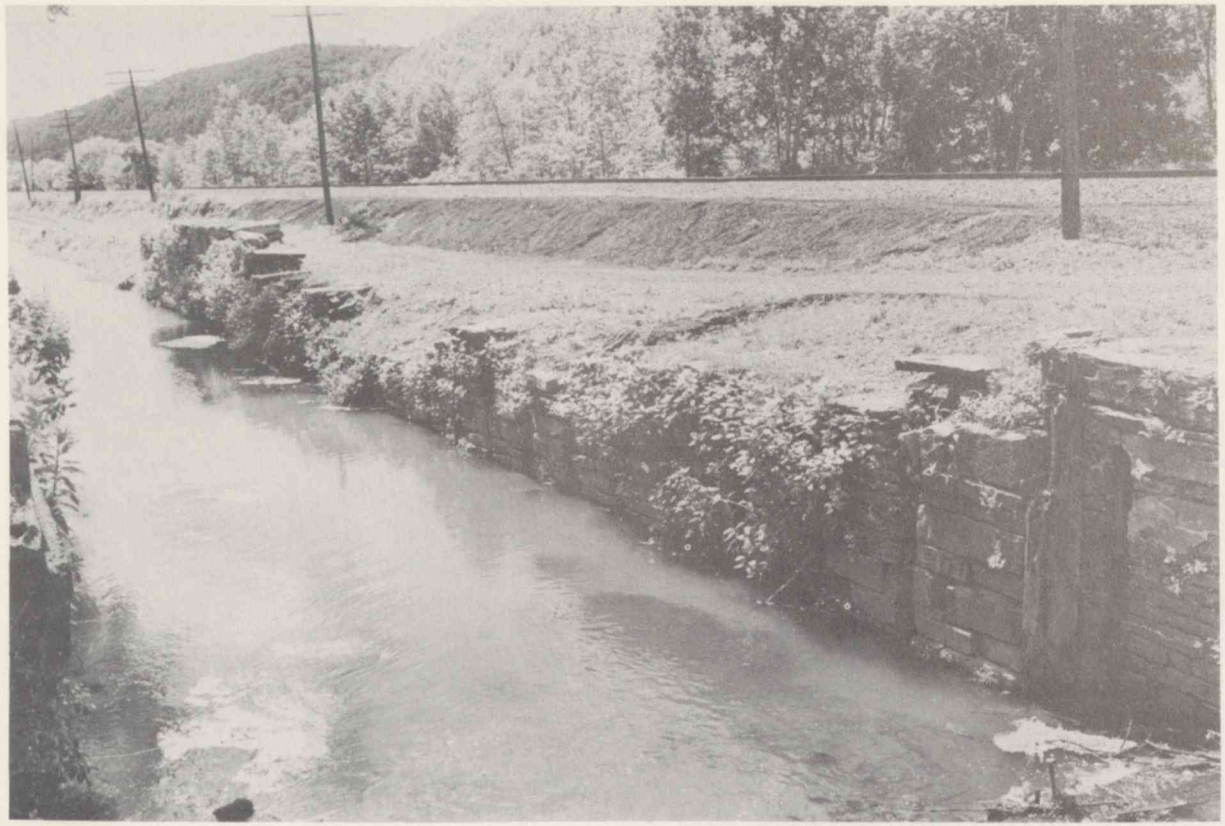
Vegetation can severely damage masonry structures. Weeds, grasses, and trees, once started in a stone wall, send their roots deep into joints and disrupt and crack rocks, opening the way for water. (See photo 3.) Root spreading combined with freezing and thawing will turn the finest stone wall (or lock chamber), into a pile of rubble. Even moss crumbles stone through chemical action and provides a place for moisture to collect and plants to grow. Thus, the first and most important step in stabilization is to clear away all vegetation.

Plants should be uprooted by hand. Workers have to be careful not to pull out large chunks of masonry with particularly deep-rooted specimens. Trees should be felled and their stumps trimmed close to the wall. Roots of shade trees growing near, but not in, lock masonry, can be trimmed with a planting bar or sharpened ditching spade to prevent further damage. Herbicides, to hinder reintroduction of plants, should **not** be used in canal structures because of the risk of downstream contamination. Once masonry is thoroughly grubbed out, subsequent clearing at 3-or 4-year intervals will be far less difficult.

After the initial grubbing, places where erosion has exposed the outside of the lock walls, for example Lock 19 at Aquashicola Creek near Palmerton, should be backfilled for support. Earth-moving machinery should be used carefully to avoid pushing walls into the chamber. Locks 4 and 5 below Jim Thorpe, and Lock 13 at Parryville were built with exposed stone on their upstream faces, but most locks require fill to stabilize their walls. Locks such as 2, 3, 4, 5, 6, 13, and several others downstream will be adequately stabilized with nothing more than thorough grubbing and backfilling where needed. As with engineering solutions, restorers should strongly resist the temptation to do too much.

A good way to stabilize unsound lock walls is to replace the upright 4 inch by 4 inch timbers that are set into pockets along each lock wall. (See photo 4.) Originally these timbers braced the wall and served as nailers for the locks' plank lining. They are held by wrought iron rods that run through the stonework to pin-in-eye toggles. (See photo 5.) Timbers are secured with thin iron wedges and square washers. The whole assembly provides a considerable brace—especially in small stone masonry. Replacing rotten and missing uprights with pressure treated oak 4 inches by 4 inches, will alleviate many problems. the bar spacing is somewhat irregular, so posts have to be drilled individually on site. Replacement wedges must be wrought iron. Mild steel, the most available modern structural material, is not acceptable. Contact between mild steel and wrought iron sets up a galvanic action that will corrode and destroy both pieces.(See photo 1.)

Repointing is a costly and potentially damaging process that is justified only when lock walls show signs of imminent collapse, have loose small stones, or present an unavoidable hazard to the public.



A—2. Photo 6. Lock 10, near Weissport.

Sometimes gate pockets, wing walls, or other unsound areas can be secured with mortar without repointing the entire wall. This is cheaper, but it risks solidifying one section of a fairly elastic structure and creating differential forces that will eventually shatter the repointed segment. There are no set rules regarding where to spot point and where not to, but the problem of shifting stonework is something to keep in mind before masons try patching and filling.

The first step in repointing is clearing the joints of all old mortar, dirt, and plant material. Most mortar in the canal structures has crumbled and can be raked out with a poker, while the rest will have to be chipped out to a depth of 1 inch with a hammer and chisel. Hand-held air chisels remove more stone than mortar and must not be used. After chipping and brushing, joints are finally cleared with streams of high-pressure air or water.

Undiluted Portland cement should not be used because when cured, it is harder than the surrounding rock and does not flex with seasonal temperature changes. (The result is visible in

brick buildings that have been mistakenly repointed with Portland cement. Within a few seasons the bricks have shattered, leaving a grey honeycombed mortar with red powder in each cavity.)

Portland can be tamed by mixing it with sand and hydrated lime. A mixture of one part white Portland cement, two parts lime, and seven parts sand provides a mortar strong enough to resist weathering without damaging the stone it is meant to protect. After joints are dampened and packed with mortar, they should be finished with recessed mortar lines—strong yet unobtrusive and protected from the weather.

Locks in high visitation areas may require top grouting or coping to secure their upper surfaces against collapse. The LC&N cast concrete copings on some locks in the early years of this century—Lock 45 in Freemansburg is a good example. It looks deteriorated today because the plank linings are gone, revealing rough battered edges.

Repointing will secure locks with stone copings in place. Where the coping is gone and sections of the unsupported walls have fallen, as in Lock 10 near Weissport (See photo 6), the top edge can be buttered by a soft layer of mortar mixture (one part Portland, four parts lime, and six to seven parts sand, capped by a weather resistant layer (one part Portland, one part lime, five parts) sand.

The final word on repointing or any major stabilization/restoration work is: if the money is not available to do it right, do not do it. Ill-advised "restoration" does far more damage that gradual deterioration.

Culverts:

There are about a dozen culverts carrying small streams under the canal. Some are in good shape; others, like the one at Catasauqua Creek, have been washed out.

First and most important, silt and debris must be cleared out of the culvert tubes. Plugged culverts that cause streams to back up above the canal are one of the principal causes of bank damage. For instance, problems at Nancy's Run in Freemansburg were caused in large part by a plugged culvert. The silting problem at Nancy's Run results in part from design problems. The tubes do not have enough cross section to carry flood waters and they do not have enough slope for their length and are too close to river level. Culverts should be inspected each summer, and cleaned if necessary. Culvert facings that support the embankment at each end of the tubes tend to be pushed over their supports by the earth they are designed to contain. When they do, the entire embankment soon follows—especially if the canal is filled with water. (Results of this process can be seen at Catasauqua. Eventually, flood conditions on Catasauqua Creek will necessitate the reconstruction or removal of the culverts.) There is no simple way to prevent this unfortunate occurrence short of pulling down the embankment and rebuilding the stone wall. Present positions of culvert faces should be noted and their movements monitored at least once a year.

Aqueducts:

Of the four aqueducts built on the Lehigh Canal only the one over Monocacy Creek still carries water. The one at Bertsch Creek still has some bed timbers in place, but only abutments and vestiges of the piers remain at Hokendauqua and Aquashicola Creeks. These sites need only occasional brush clearing and grubbing.

Rewatering

Background and Guidelines:

Rewatering dry canal sections raises a series of problems. Most planners and engineers are principally concerned with how to raise enough water to provide sufficient pool levels and flow to prevent stagnation. They tend to concentrate on the dry season, when low-flow conditions are acute.

Unfortunately, washouts at Freemansburg and erosion near Weissport (now corrected) indicate that insufficient attention has been to paid to high flow and flood conditions. Water supplies from the Lehigh and intersecting streams and springs have to be considered individually, section by section. However, there are some general guidelines for high water control.

1. Provide ample spillways. It is better for high water to spill back into the Lehigh River at reinforced low spots in the towpath, than for it to break its own path in an unplanned spot. Depressed sections of the towpath, lined with cobblestone, Belgian block, or timber with an erosion-proof stream face provide simple effective means of dealing with flood waters. A particularly good original section can be seen between Lock 40 and Lock 41, near Allentown. There are two new examples with timber reinforcement near Weissport.

   Culverts or closed top bar spillways are not as effective as reinforced low-bank sections. They become clogged and will constrain flows if the water level goes higher than the midpoint of the tube.
2. Provide some way to shut off the water supply. There should be a sturdy guillotine gate (rack and pinion or screw driven) in a high barrier wall at the upstream end of each section.

   Most of the necessary hardware survives at guard locks and dams, but it needs to be refurbished and made operable. Guard lock and dam abutment faces should be inspected and reinforced if necessary. An extremely strong (timber with strap steel reinforcement) water and ice proof barrier

should be installed in upstream gate pockets. Buffer bars may be needed to protect that gate from ice damage.

3. Reinforce banks at erosion points (especially outside bends and lock forebays). Most of these areas received stone rip-rap or timber reinforcement during the years of canal operation. (See photo 7.) Many are in fine condition or need only minor repair. In areas where reinforcement is damaged or nonexistent, stone-filled gabions provide an ugly but quick, cheap, and effective solution. The use of palisades of treated timber pilings are also an effective, but expensive solution. Triangular reinforced concrete posts, used to support highway guard rails, are good as erosion stoppers if provided with "dead men" or long rods driven into the bank to prevent them from shifting. Cast in place, concrete erosion walls are not satisfactory along this canal. They shift, crack, and eventually collapse as the banks move; any retaining walls in this canal have to be flexible.

   Stone rip-rap is an attractive, historically accurate, but labor intensive and costly means of bank protection. As with all other reinforcements, particularly in flood plain areas, rip-rap should be built up above the normal water line, to towpath level.

4. Do not constrict the channel with reinforcements. Any constrictions will increase the water's velocity, height, and erosive power.

   In addition to spillways, head gates, and bank reinforcement, rewatered canal sections require dump gates, to drain the canal for cleaning.

Locks:

After stabilization, there are at least three ways to prepare lock chambers for rewatering. Earth-filled timber crib dams are simple and effective.

A—2. Photo 7. Near Lock 41, Bethlehem.

Fixed upstream "gates" are more attractive but require a finer grade of materials and workmanship. Fully operable restorations, such as the Hugh Moore Park locks, are handsome, historically accurate, and tremendously expensive.

Each treatment has to raise the upper pool level with a dam or barrier at the lock's upstream end and provide a spillway to maintain flow. Earth-filled timber cribs, like the ones at Locks 8, 10, 11, and 23, are a simple effective way to maintain pool level and ensure adequate flow. (See photo 8.) Built of railroad ties and treated timber of similar cross section, the cribs stabilize their earth fill and provide firm spillway platforms. They are adaptable and can fill irregularities in locks with bowed or damaged walls. Two-inch-screen crushed stone, packed into wicket cavities, provides a firm base for the crib and fill.

Cribs have two rows of main timbers set at right angles to the flow, and three rows of parallel sleepers, one at each side of the lock opening and one at the center, spiked together with dummy timbers filling spaces in the downstream face caused by the sleepers. The up-

A—2. Photo 8. Lock 10 spillway, near Weissport.

stream face is sheathed with 1-1/2-inch treated planking and the whole crib is filled with clean dirt and gravel.

Most of the existing crib-fill arrangements on the Lehigh have cast-in-place concrete spillways. Treated timbers would work just as well. When concrete is used, it should not be poured directly into a lock's stonework; if it is, any future work would cause severe damage to the stonework. The Carbon County crews have done well by tying the spillway into the crib and filling the spaces on each side between spillway and lock walls with timber and stones.

There must be some sort of back surface immediately under the spillway to break the impact of falling water and to prevent the dam from washing out its own footings. An apron of large cobbles and crushed stone will do in most places. If these are washed out, a row of vertical pilings will hold the next batch in place.

Spillways and a rough apron below can give considerable aeration to the canal's water. Baffle boards can be installed in the spillway to create more turbulence and aeration.

Many locks can be restored to hold water by installing a fixed wood plate in the pockets that once held upstream drop gates. While not a full and accurate restoration, a nonworking upper gate maintains much of the original character and appearance of an operating lock.

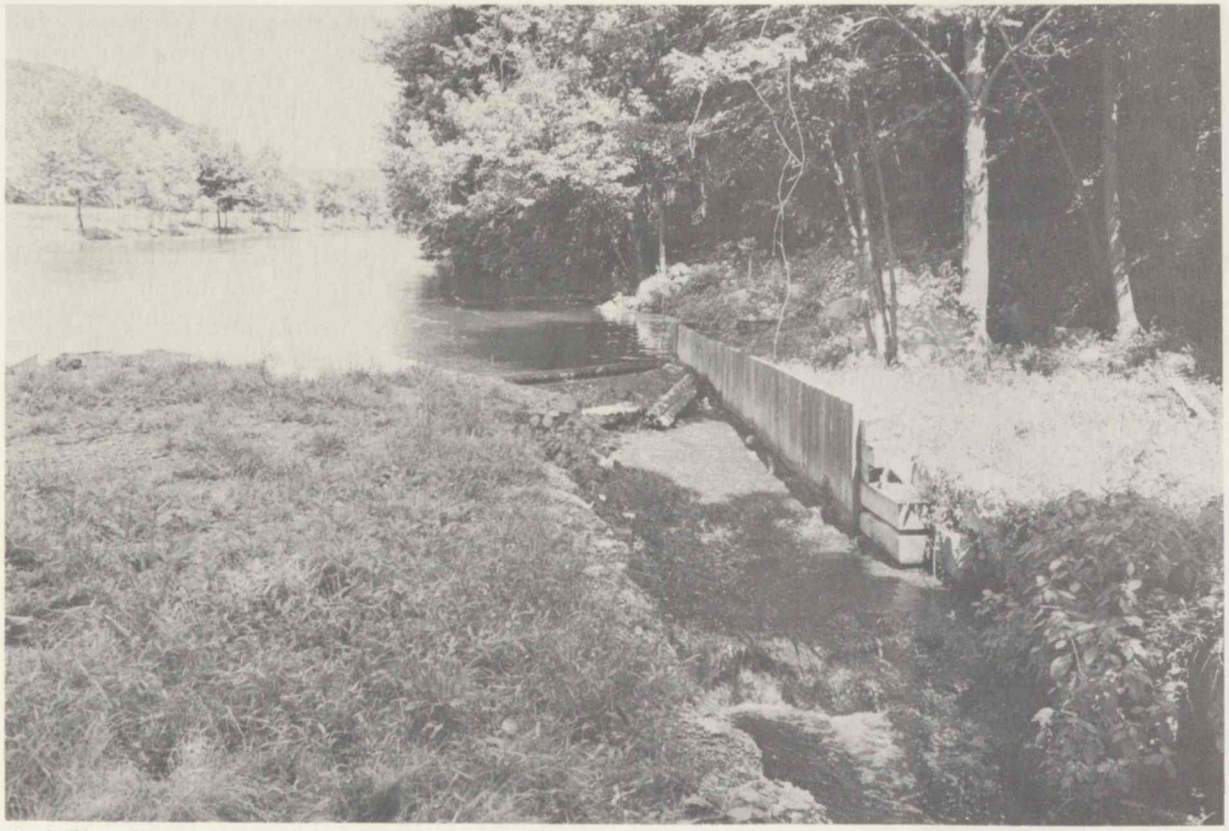
Given sound masonry and undamaged gate pockets, this restoration can be done with no modification or damage to historic fabric.

The timber gate is built off-site, preferably using pressure treated planks and timbers. Oak 8-inch by 8-inch framing and double 2-inch by 10-inch planking will be strong enough to withstand floods, ice, and rot. Since most locks were built 22 feet wide with an allowance for 5 feet of water to flow over their upstream sills, gates for this standard size lock can be built at a central shop and trucked to their respective locks. An optional, and highly desirable feature would be a sliding valve built into the base of each gate that would facilitate draining upstream sections for cleaning and repair.

The lock chamber is prepared by replacing sill timbers to provide a firm water-tight base for the new gate, repointing upstream gate pockets for reinforcement, and planking over the upper wicket openings to prevent leakage and erosion under the gate.

Any hardware, such as wickets or gate lifting gear, discovered in this process, should either be removed or buried in place if determined that its removal would cause irreversible damage. If removed, the materials must be thoroughly washed of all soil, salts, and corrosive agents, dried in the sun, and stored under cover with complete identification and labels stating the place they were found and the date they were removed. Subsequent restorers may need these parts, either in their own right or as patterns for replacement iron.

The gate can be lowered into place with a back hoe or light crane. Drop gate pockets are inclined upstream at a 10 degree angle from the vertical. The gate must be secured with 6-inch



A—2. Photo 9. Bypass at Lock 11, near Weissport.

by 6-inch timbers tied into the pocket wall with long rods on both sides of the upstream face. These timbers hold the gate in place when the canal is dry. Water pressure, and silt will hold it in place when the canal is full. Concrete braces poured into the lock wall like those at Lock 41 between Allentown and Bethlehem should not be used in future projects. The area immediately below the gate in the lock chamber where the wickets once opened should be banked with a stone and cobble apron to prevent erosion.

Bypass spillways that ran beside all locks must be opened, cleaned, and restored. (See photo 9.) A spillway with removable flash boards should be restored or built at the upper end of each one so that excess flows can be directed around the lock chamber.

Fixed timber gates provide a simple, attractive, and fairly inexpensive means for maintaining pool level in the canal section. Although they require careful fitting, including modifications of the basic plan to fit specific locks, and more complex carpentry than earth-filled timber cribs, they will not cost much more given the amount of fill, machine time, labor, and heavy timbers that go into cribs.

Full Restoration

Locks:

Considering high price of materials and labor, and current economic conditions, future restorations on the order of Hugh Moore Park are unlikely. (See photo 10.) Readers interested in specifications, and 1978 prices for gates, hardware, and extensive masonry work are referred to the files of Hugh Moore Park in Easton, PA.

Restoration is a slow, meticulous, expensive process, and is not amenable to fast work or high technology. An official who advocates full restoration should be fully aware of the costs and ethical responsibilities, including archeological survey, design review (for historical as

A—2. Photo 10. Lock 47, Easton.

well as structural considerations), and the constant skilled supervision required on the job site.

Culverts:

The canal bed over culverts is prone to leakage. Before the channel is rewatered, the clay puddling that lines the canal bed should be inspected and reinforced with a few loads of tamped clay, if necessary.

Rewatering the channel increases outward pressure on the banks, pushing culvert facings off their supports even faster. Facings should be checked and preferably serviced before the bed takes on its additional load. Displaced stones should be marked and their movement monitored every 6 months.

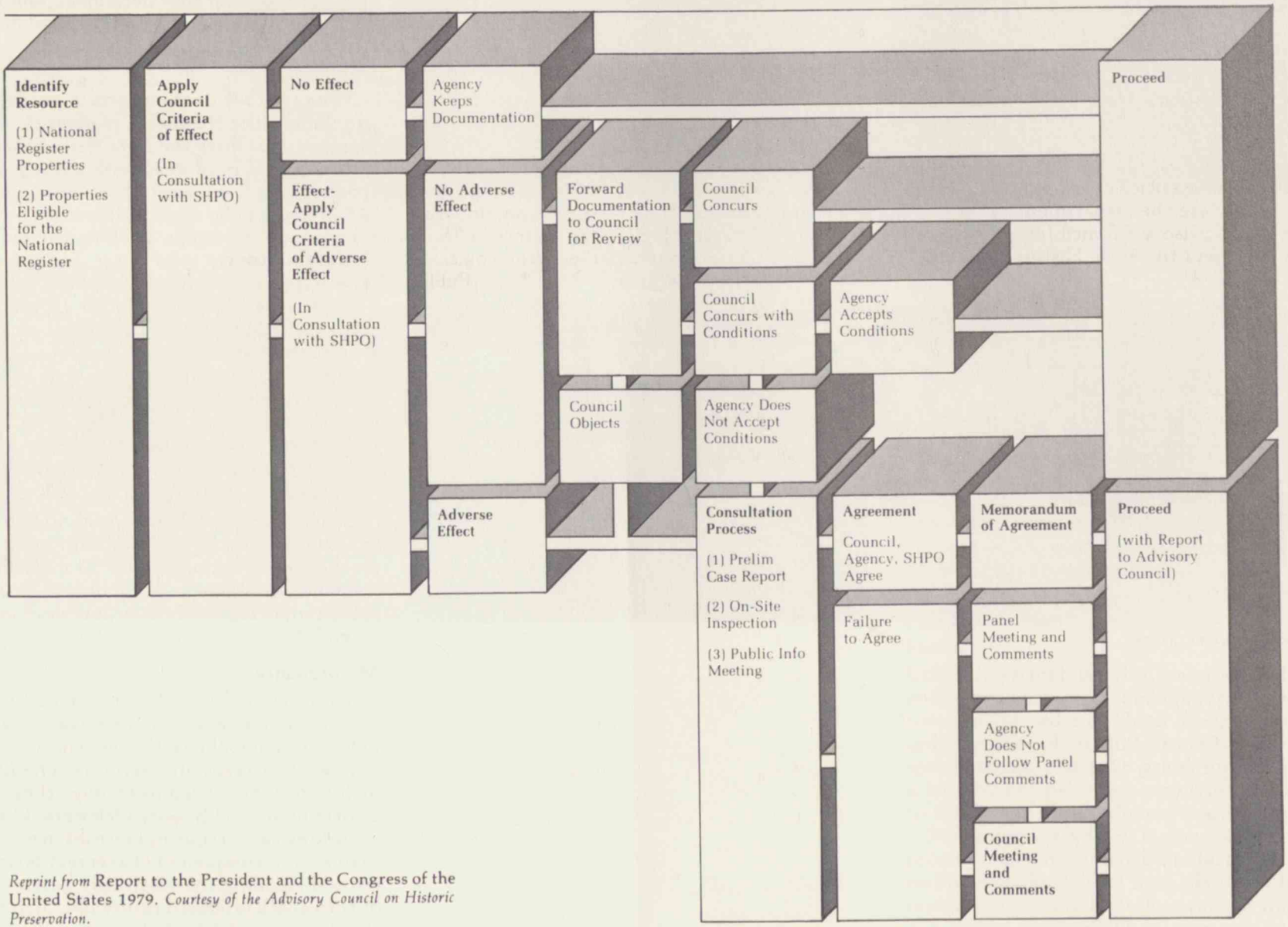
The culvert at Catasauqua Creek would have to be completely rebuilt before the canal above it could be rewatered. If not, backwater behind the present jerry constricted culvert would wash out the canal's upstream bank.

Aqueducts:

Other than Monocacy Creek, none of the aqueducts stand in sections that have any prospect of being rewatered. Bertsch Creek aqueduct would make a fine terminal spillway if Walnutport's watered section were ever extended.

Maintenance

The interest groups who undertake the stabilization, restoration, or rewatering of the Lehigh Canal will face the regular task of maintaining their respective sections. The LC&N maintained the canal only through the continual efforts of several hundred laborers. Obviously a working canal requires more intensive upkeep than a static component of a recreation trail. But notwithstanding the essentially passive nature of the canal's proposed future use, maintenance should be a significant element in the overall rehabilitation plan for the canal.



Reprint from Report to the President and the Congress of the United States 1979. *Courtesy of the Advisory Council on Historic Preservation.*

A-3 Compliance

The protection of historic resources is mandated under provisions of the National Historic Preservation Act of 1966 (amended 1976) and Executive Order 11593. Compliance with these protective provisions is mandatory if a project under consideration is to be supported by federal funds and might adversely affect a cultural resource listed on the National Register of Historic Places, or one that might be eligible for listing. The agencies concerned with compliance review are the Department of the Interior, the Advisory Council for Historic Preservation, and the State Historic Preservation Offices. Before a project may proceed, its potential impact on historic cultural resources in the area must be reviewed. If the impact will be significant, provisions must be made for mitigating the adverse effects or for altering the original plan to avoid the site.

A prudent and early acknowledgment of compliance requirements can be a cost-effective project planning tool. The project budget can be developed to include archeological and historical research that would be used to evaluate areas of potential impact. Mitigation expenses incurred at this stage would be far less than those resulting from a delay once construction was begun. Results from a research and planning approach that fully considers compliance may also yield a significant body of environmental and cultural data, useful for parties concerned with the project, as well as in the planning of future projects.

Interagency Archeological Services—Washington

One of the programs of HCRS, Interagency Archeological Services (IAS) directs and coordinates a nationwide effort to protect significant archeological and historic remains threatened by federal construction projects, programs, or activities. IAS:

- Assists federal agencies in the fulfillment of their Executive Order 11593 responsibilities by helping them to locate, identify, and evaluate historic properties under their jurisdiction or control, or to conduct data recovery, if necessary, under Public Law 93-291.
- Develops for the Secretary of the Interior national goals and objectives, policies, standards, guidelines, and procedures for all federal agencies to follow in the administration of the archeological and historic data recovery program under the Archeological and Historic Preservation Act of 1974 (Public Law 93-291).
- Manages the permit system instituted under the Antiquities Act of 1906 (Public Law 59-209) to regulate data recovery projects on most federally-owned or controlled lands.
- Consults with the Advisory Council on Historic Preservation on archeological issues.
- Reports annually to Congress on the scope and effectiveness of the program.

IAS Field Offices

The Interagency Archeological Services program is administered at the field level by the three regional offices, IAS-Atlanta, IAS-Denver, and IAS-San Francisco. Each field office:

- Maintains a day-to-day liaison with other Federal agencies at the regional level in order to identify and plan for needed data recovery projects.
- Identifies firms or institutions capable of performing data recovery.
- Establishes the scope of archeological services required for projects, negotiates contracts, and reviews data recovery proposals.
- Monitors field and laboratory work.
- Reviews and approves final reports submitted following the completion of data recovery.

Because many federal agencies whose actions may affect significant sites do not have sufficient archeological staff expertise, IAS is able to provide invaluable technical assistance nationwide. With its staff of professional archeologists in Washington and in the field, IAS is in a unique position to coordinate federally-sponsored archeological activities and to help other Federal agencies meet their responsibilites under Executive Order 11593 and Public Law 93-291.

Program Scope

Legislation

Historic preservation in the United States has been shaped by a body of more than two dozen laws that deal with archeological, architectural, cultural, and historic resources. Their intent is to make the Federal Government accountable for any potential impact its actions may have on the cultural environment. Laws that are particularly pertinent to archeology include: the Antiquities Act of 1906 (Public Law 59-209). The Historic Sites Act of 1935 (Public Law 74-292), the National Historic Preservation Act of 1966 (NHPA) (Public Law 89-665 as amended), the National Environmental Policy Act of 1969 (NEPA) (Public Law 91-190), and the Archeological and Historic Preservation Act of 1974 (Public Law 93-291). As mentioned earlier, Executive Order 11593 assigns certain responsibilities to Federal agencies with regard to historic preservation.

Often poorly understood by agency planners, archeological resources frequently receive inadequate consideration during project planning. It cannot be emphasized too strongly in this report that the timely application of the legal requirements cited above are intended to integrate historic preservation goals with the successful completion of agency construction projects without undue costs. The

harmful effects of proposed construction projects, if recognized and dealt with during the planning phase, could be avoided or, at least minimized. IAS believes the failure of agencies to follow the historic preservation compliance process is the main cause of the needless destruction of archeological resources as well as costly construction delays. Unfortunately, archeologists have long been accused of obstructing public works projects when just the opposite seems more accurate: a construction project in full compliance with the intent of Federal law is seldom delayed by the recovery of significant archeological information.

Complying with the Requirements of the Law

In order to deal responsibly with the cultural environment and to avoid delays caused by the failure to take the "preventive measures" required by law, Federal agencies should begin the compliance process in the early stages of planning for a construction project. This process consists of three major steps.

1. *Identification of Cultural Resources within the Project Area.* Executive Order 11593 requires all federal agencies to locate, identify, and evaluate all historic and archeological resources under their jurisdiction or control that will be affected by their actions. The agency must consult with the State Historic Preservation Officer and ask the Secretary of the Interior to resolve questions of whether properties are eligible for inclusion in the National Register of Historic Places. Where properties eligible for the National Register are involved, the agency should reevaluate the proposed undertaking to consider its impact.

   Archeological sites are often the most numerous cultural entities identified during inventory and evaluation. Current knowledge about the distribution of sites geographically makes detailed site predictions difficult; therefore, systematic field surveys should be undertaken for many projects, even when state plans for the protection of cultural resources called for by the National Historic Preservation Act of 1966 have been completed.

2. *Consultation with the Advisory Council on Historic Preservation.* The National Historic Preservation Act of 1966 created the Advisory Council on Historic Preservation to counsel the President and the Congress and established the National Register of Historic Places. The Federal agency must consult with the State Historic Preservation Officer to determine whether (1) its undertaking will affect a significant cultural resource in or eligible to be entered in the National Register, and (2) if the resource will be affected, whether the effect will be adverse. The Council must be given an opportunity to comment on the proposed project.

   If the Council deems there will be an adverse effect, the agency must submit a preliminary case report to the Council, outlining the project and its impact on the property. The Council staff, the State Historic Preservation Officer and the agency will then explore methods by which the adverse effects can be avoided or minimized. The final plan to avoid the property or mitigate the adverse effect must be acceptable to all three parties and must be incorporated into a legally binding Memorandum of Agreement. If no agreement can be reached, the full Council must formally comment on the matter. The federal agency is responsible for deciding the ultimate disposition of the property. It may elect to carry out, modify or ignore the Council's recommendations. Current policy of the Council is to view its comments as not legally binding. However, if the federal agency chose to ignore the Council's comments and subsequently had to defend its action in the courts, a position of noncompliance would severely weaken the case.

3. *Data Recovery* is defined as the scientific retrieval and preservation of archeological and historic materials and information that would otherwise be lost and the study of these resources in their original context. Because cultural resources that have been destroyed by construction or by archeological excavation cannot be replaced, their protection and conservation for long-term scientific study is always preferable to immediate excavation. In addition, techniques for recovery are continually improving. Accordingly, data recovery through archeological salvage is undertaken only as a last resort to save important information, while allowing a construction project to proceed.

   If the consultation process reveals no way to avoid damaging or destroying the cultural resources and finds that recovery of specimens and scientific information is in the public interest, the agency may use its authority under the Archeological and Historic Preservation Act to undertake archeological excavations. The agency may contract for this work directly, using up to one percent of the authorized project appropriation, or may request the Secretary of the Interior to assume responsibility for the archeological investigations on a cost reimbursable basis or through the use of discretionary funds appropriated to him for this purpose. When significant archeological sites are threatened by issuance of a federal permit or license or in other federally-

assisted projects where the one percent proviso cannot be applied, the Secretary of the Interior may elect to fund data recovery as the only prudent recourse to destruction of the resource without prior study. Data recovery, therefore, is the last step taken under preservation law and should only be conducted after a federal agency has fully discharged its responsibilities for identifying, evaluating, and considering cultural resources in the planning process.

Photograph of c. 1900 painting of the canal at Sagers Milling Company, Canal Street, Allentown. Courtesy of the Lehigh County Historical Society.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities to protect and conserve our land and water, energy and minerals, fish and wildlife, parks and recreation areas, and to insure the wise use of all these resources. The Department also has major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The Heritage Conservation and Recreation Service, a non-land managing agency within the Department, is responsible for assuring the identification, protection, and beneficial use of our important cultural, natural, and recreational rsources. The Service offers grant assistance, technical information, and guidance to those in the public and private sectors involved in conservation or recreation projects.

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