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OHIO AND ERIE CANAL

DRAFT

HISTORIC STRUCTURE REPORT



OHIO AND ERIE CANAL

MASONRY AND CONCRETE STRUCTURES

HISTORIC STRUCTURE REPORT

CUYAHOGA VALLEY NATIONAL RECREATION AREA

NATIONAL PARK SERVICE

ADMINISTRATIVE DATA SECTION

ARCHITECTURAL DATA SECTION

PREPARED BY

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SEPTEMBER 1993

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PREFACE

The initial research for this report, compiled by Unrau and Scrattish, was published in August of 1984 under the title Historic Structure Report, Ohio and Erie Canal. A product of extensive historical research, the above mentioned report provides an in- depth discussion regarding the evolution and impact of the canal. The intent of the following document is to augment the 1984 report, hereinafter referred to as the Historical Data Section, through the presentation of administrative and architectural data.

This Historic Structure Report is an integral part of a comprehensive planning process that is hierarchical and dynamic. The purpose is to provide both a record of and a reference for administrative decisions. While the content is limited by the level of information available, preparation of the report during this stage of the planning process underscores the importance of decisionmaking at a conceptual level.

Due to the complex nature of the numerous structures which comprise the Ohio and Erie Canal, further research, investigation and documentation will be required. Analysis, commensurate with the level of proposed treatment and the significance of each structure, will be completed on a project-by-project basis as funds are made available. Only after the subsequent recommendations have been reviewed and approved, in accordance with cultural resource compliance requirements of the National Historic Preservation Act, will work commence on the individual structures.

INTRODUCTION

The Ohio and Erie Canal, a 308-mile inland waterway, linked Lake Erie at Cleveland with the Ohio River at Portsmouth. The canal provided the first viable means of transportation to develop the interior of the state of Ohio and the then western frontier of the nation[1]. The advent of the canal, beginning with the opening of the northern division in 1827, provided the catalyst for development of the Cuyahoga Valley. Assuming a primary role in northeast Ohio's transportation network, the canal served as the major route in the valley for several decades.

The Cuyahoga Valley reached the apex of its importance as a transportation conduit between 1827 - 1840[2]. Interregional competition from the proliferation of new canal routes during the 1840s and the construction of Ohio's railroad system in the 1850s precipitated the demise of the canal. By 1860, it was clear that canals could not compete against the greater flexibility and speed of the railroads. The unprecedented devastation wrought by the March 1913 flood, therefore, only accelerated the demise of Ohio's unpopular canal system[3]. The canal was literally destroyed from Akron north to Brecksville. The segment from Brecksville north to Cleveland was considered salvageable and, although abandoned as a transportation route, was retained as an industrial water supply.

Approximately twenty-two miles of the Ohio and Erie Canal right of way passes through the Cuyahoga Valley National Recreation Area. Generally following the path of the Cuyahoga River between Akron and Cleveland, the canal bisects the recreation area along its north-south axis. Extant components of the canal include the remains of numerous historic structures, such as locks and aqueducts, linked by the canal prism and towpath.

The northern six miles of the canal within the recreation area, from Route 82 north to Rockside Road, remain in a watered condition. A large mid-twentieth-century feeder dam near Route 82 maintains a constant supply of water in the canal. A steel company utilizes this segment of the canal, under a hydraulic lease, for cooling purposes at a mill located to the north of the recreation area.

To the south, the balance of the canal within the recreation area is no longer water-charged. The prism and towpath of the canal, however, are discernible and retain their original configuration for most of the length; obliteration by modern construction has occurred in only three areas. The relatively narrow valley, with its steep walls, has successfully retarded commercial and residential growth and this segment of the canal, abandoned in 1913, lies practically undisturbed[4].

ADMINISTRATIVE DATA SECTION

ADMINISTRATIVE DATA

Cuyahoga Valley National Recreation Area was established for the purposes of preserving and interpreting the natural, historic, scenic and recreational values of the Cuyahoga River Valley[5]. The single most important historical development in the Cuyahoga Valley was the construction of the Ohio & Erie Canal[6]. The significant era of westward expansion and settlement in the United States history is well represented by the remaining canal structures and associated farms and settlements along the length of the valley[7]. Once part of a statewide system of canals, this portion of the canal reflects a now vanished era.

Prior to 1989, virtually all the canal lands and associated structures within the recreation area were owned by the State of Ohio. The absence of fee ownership prevented Federal intervention to protect, stabilize or preserve the resource. Considerable obstacles, however, impeded the acquisition of the canal. Complicating the matter was a state regulation preventing the donation of the canal to the Federal Government (O.RC. 123.681) and a stipulation in the recreation area's enabling legislation prohibiting the acquisition of public lands except through donation (PL. 93-555). Legislation, introduced in the Ohio Legislature, was enacted to allow for transfer of the canal within the recreation area to the United States (Amendment to the 1959 Canal Lands Authority Act). In December of 1989, canal lands encompassing 129.71 acres were acquired in fee by donation from the State of Ohio and assigned tract number 105-075.

NATIONAL REGISTER OF HISTORIC PLACES

In 1966, a 1.5 mile section of the watered portion of the canal and associated structures were listed as a National Historic Landmark (NHL) in the National Register of Historic Places (NRHP). The listing, amended in 1983, was expanded to encompass a 4 mile section. The landmark includes Locks 39, 38 and 37, Tinkers Creek Aqueduct and two buildings dating from the canal era. Designation as an NHL recognizes a property as being nationally significant; this listing is the only NHL within the recreation area.

Three additional canal structures were listed in the National Register of Historic Places in 1974. Lock 29 and the remains of the Peninsula Aqueduct were included in the Peninsula Village Historic District listing, and Lock 28 was designated as an individual listing.

In 1979, the Ohio and Erie Canal was entered in the National Register of Historic Places as a thematic resource. This listing designated the majority of the canal and numerous structures within the recreation area. The listing includes three segments of the canal encompassing a combined distance of 16 miles; three areas where the canal has been obliterated by modern construction were excluded from the nomination. The following structures are identified as contributing to the NRHP thematic resource listing: Locks 39 through 37, Locks 35 through 26, Tinkers Creek Aqueduct, Peninsula Feeder, Peninsula Aqueduct and Furnace Run Aqueduct. Locks 36, 25 and 24 are not included in the listing.

PLANNING DOCUMENTS

Beyond the apparent significance of National Register status, the importance of the canal to the recreation area is demonstrated by its pervasiveness in the park's planning documents. The preservation and use of the Ohio & Erie Canal are the greatest cultural resource management priority in the recreation area[8]. Development of the canal is central to the mission of Cuyahoga Valley.

The General Management Plan (GMP), approved February 1977, calls for developing the northern, watered portion of the canal into a major interpretive area. The plan recommends further study to determine the appropriate long-range level of treatment, and that this level is to be consistent for the section as a whole. The immediate level of treatment proposed for features are ongoing maintenance and stabilization as necessary to ensure resource preservation until more intense levels of treatment are undertaken. The canal structures in the southern, unwatered portion are identified in the GMP as structures which merit protection and interpretation; the proposed level of treatment is stabilization to stop or slow deterioration[9].

The Statement for Management, an integral component of the GMP, was revised in 1991. Included within this document was a revision to properties classified as a historic zone. The classification was expanded and the revised historic zone includes the entire length of the Ohio and Erie Canal from Rockside Road to Ira Road.

The Resources Management Plan (RMP), approved September 1986, proposes specific use and treatments for individual structures. The plan includes two projects specifically related to the research, development and maintenance of the Ohio & Erie Canal. Project C-33 addresses the northern, watered portion of the canal. The recommended course of action is restoration of the canal from Rockside Road to Route 82 to evoke the canal era. The intent, as presented in the RMP, is not full-scale restoration. The plan instead recommends that evocation of the canal in this segment is the most appropriate and cost-effective way to preserve it and present it to the visiting public. Project C-34 addresses the southern two-thirds of the canal, from Route 82 to Bath Road. The recommended course of action is low-level stabilization of the deteriorated canal structures. While the RMP addresses the treatment of certain canal components, recommendations presented are not comprehensive in nature[10]. The RMP has recently been updated and the revised document is currently under review. Project 313.00 addresses both the watered and unwatered portions of the canal and contains recommendations similar to that presented above.

The Cultural Landscape Report (CLR), approved in 1987, not only lists the canal structures as primary cultural features which contribute to Cuyahoga Valley, but identifies them as the single most significant feature[11].

The Interpretive Prospectus (IP), approved in 1989, also identifies interpretation of the Ohio and Erie Canal as a high priority. The proposed level of treatment is consistent with that presented in the above discussed plans. The prospectus calls for wayside exhibits to be located at the majority of the canal structures[12].

EXISTING DOCUMENTATION

Four canal structures have been documented by the Historic American Building Survey / Historic American Engineering Record office. Measure drawings and photographs are on file for Locks 39, 38, 37 and 29.

RESOURCE IDENTIFICATION

A complete listing of all canal structures located within the recreation area and the recommended treatments is contained on the following pages. Structures are presented geographically from north to south.

Structures presently included on the NPS List of Classified Structures (LCS) are referenced both by park-specific historic structure number and LCS identification number; all are classified as Management Category A. For structures not presently included on the LCS, reference is to the canal station number, as documented in a c.1912 survey performed by G. Silliman.

The following list includes slight modifications to information as it appears on the LCS. In two instances, one number has been assigned in the LCS to two distinct canal features and these components are listed as separate entries. Minor adjustments to structure names have been included when appropriate.

JUSTIFICATION OF TREATMENT

Due to the number of structures and the diversity of recommendations, justifications of recommended treatments are presented within the Architectural Data Section. With the exception of Tinkers Creek Aqueduct, recommended treatments are consistent with that proposed in the LCS.

LISTING OF OHIO & ERIE CANAL STRUCTURES

STRUCTURE NAME	HS # / LCS # or Station #	RECOMMENDED TREATMENT
Lock 39 & Spillway	HS-128/11175	Restoration
Waste Weir	Sta. 460+75	Preservation
Culvert	Sta. 478+90	Rehabilitation
Culvert	Sta. 504+80	Rehabilitation
Lock 38 & Spillway	HS-126/11173	Restoration
Tinkers Creek Aqueduct	HS-123/11170	Rehabilitation
Lock 37 & Spillway	HS-121/11168	Restoration
Flood Gate	Sta. 613+00	Preservation
Culvert	Sta. 636+00	Rehabilitation
Waste Weir	Sta. 636+10	Preservation
Flood Gate & Waste Weir	Sta. 638+20	Preservation
Lock 36	HS-118/11165	Preservation
Lock 35	HS-117/11164	Preservation
Flood Gate	Sta. 838+34	Preservation
Waste Weir & Flood Gate	Sta. 863+00	Preservation
Lock 34	HS-116/11163	Preservation
Brandywine Culvert	Sta. 921+39	Preservation
Lock 33	HS-115/11162	Preservation
Stanford Culverts	Sta. 961+94	Preservation
Lock 32	HS-114/11161	Preservation
Lock 31	HS-112/11159	Preservation
Feeder Dam Complex	HS-111/11158	Preservation
Lock 30	HS-111/11158	Preservation

LISTING OF OHIO & ERIE CANAL STRUCTURES (cont.)

STRUCTURE NAME	HS # / LCS # or Station #	RECOMMENDED TREATMENT
Lock 29	HS-110/11157	Preservation
Peninsula Aqueduct	HS-110/11157	Preservation
Lock 28	HS-107/11154	Preservation
Lock 27	HS-106/11153	Preservation
Furnace Run Aqueduct	HS-105/11152	Preservation
Flood Gate	Sta. 1305+46	Preservation
Lock 26	HS-104/11151	Preservation
Lock 25	HS-103/11150	Preservation
Lock 24	HS-102/11149	Preservation
Yellow Creek Culvert	HS-101/11148	Preservation

ARCHITECTURAL DATA SECTION

ARCHITECTURAL DATA

Stabilization of the canal towpath, as outlined in Cuyahoga Valley's General Management Plan[13] and Trail Plan[14], is virtually complete. The corridor, along the entire length of the canal within the recreation area, has been developed to serve as a continuous, multi-purpose spine trail. This project was begun after the staffs of the NPS Midwest Regional Office and the Ohio Historic Preservation Office entered into a Programmatic Memorandum of Agreement which outlined the basic intent of the project. As construction documents were completed for each section, the details were reviewed and approved prior to the commencement of physical work. Structures improved in conjunction with the development of the towpath include Lock 29, Peninsula Aqueduct abutments and three waste structures. Improvements ranged from repointing to comprehensive stabilization, and are discussed in the respective sections. As a separate project, Lock 38 has been restored to its 1907 appearance.

METHODOLOGY

Reflecting the dichotomy of the resource, the Architectural Data Section is divided into two parts: the Watered Portion of the Canal and the Unwatered Portion of the Canal. Each part is divided into categories which represent structure-types. Information is presented under four headings: Physical History, Physical Description, Existing Conditions and Recommended Treatment. Where dictated by similarities of information under these headings, the text is organized to comprehensively address more than one structure or structure-type.

The section entitled Physical History contains information presented in the Historical Data Section, published in 1984, which should be consulted for citations of source material. Pertinent historical information was extruded and summarized to provide a chronology of events associated with a specific structure or structure-type.

To eliminate repetition, information presented for structures along the watered portion is later referenced in that for the unwatered portion, as appropriate.

Visual on-site inspections were conducted between the fall of 1991 and the summer of 1993. The level of investigation was commensurate with the significance of each structure. Locks 39, 38 and 37, and Tinkers Creek Aqueduct received the highest priority as they are identified as structures which contribute to the National Historic landmark. The waste structures along the watered portion, while not listed as contributing features, clearly impact the overall historic character of the NHL and were prioritized accordingly. The majority of photographs were taken by the author; exceptions are noted.

PART I:
WATERED PORTION
OF THE CANAL

1. LOCKS

Along the entire length of the Ohio and Erie Canal, 146 locks provided a total rise and fall of approximately 1,207 feet. The northern division of the canal, from the north end of Portage Summit at Akron to Lake Erie at Cleveland, descends rapidly; this significant change in elevation, 395 feet in 38 miles, required the construction of 44 locks to raise and lower canal boats through the Cuyanoga Valley. Locks 39 through 24, inclusive, are located within what is now the recreation area.

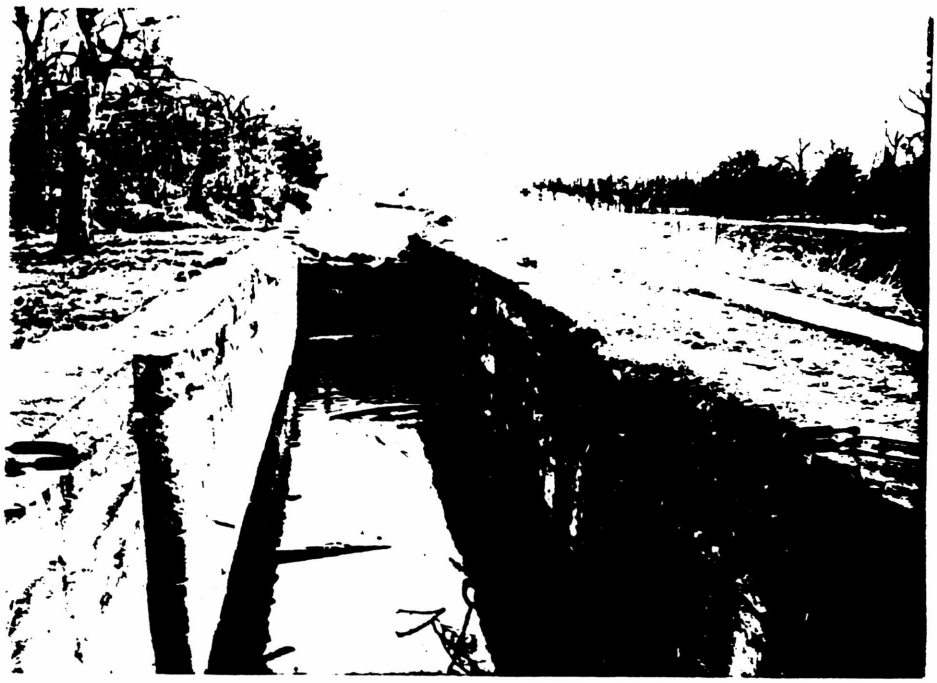
Locks 39, 38 and 37, located within the presently watered section, are typical of those built along the Ohio and Erie Canal. Situated in line with the canal prism, each lock provides a lift ranging from 8 feet to 9.5 feet. To the east of each lock is a spillway, a man-made channel which permits canal water to flow around the lock. The towpath extends both north and south along the west side of the canal prism, as always between the canal and the Cuyahoga River. Canal Road roughly parallels the waterway to the east.

The similarities of Locks 39, 38 and 37 dictate that all information presented under the headings of Physical History, Physical Description, Existing Conditions and Recommended Treatment address the structures as a group.

LOCK 39

11 Mile Lock

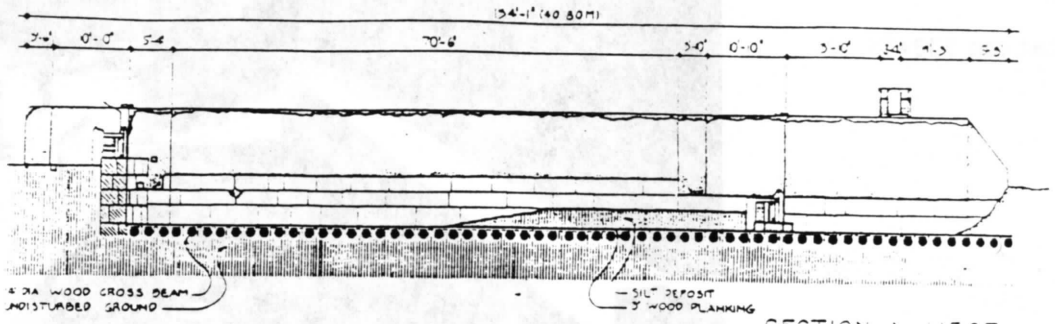
Station 533+75



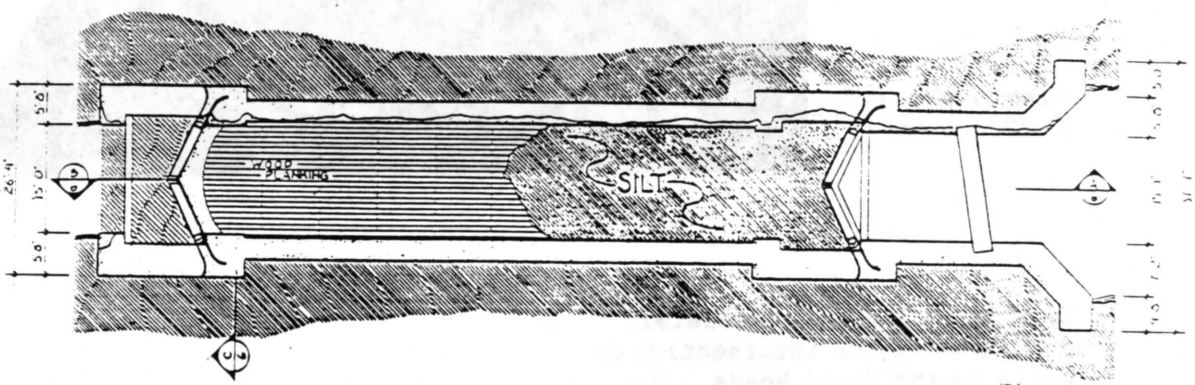
View from north.

Lock 39 is located approximately 1/4 mile south of Rockside Road. Access and, in general, visibility are limited to that from the towpath. A wooded area to the east screens the view of the lock from Canal Road and immediately to the west of the towpath are cultivated fields. Improvements at this location, other than the development of the towpath, include the installation of a bridge across the lock chamber above the lower gate chamber.

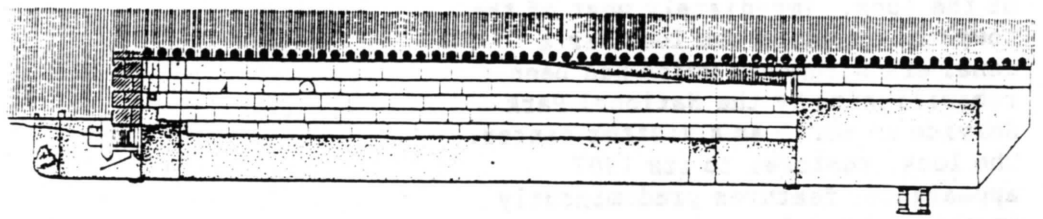
Site Plan. Silliman Survey c.1912.



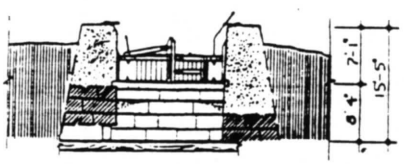
SECTION A WEST



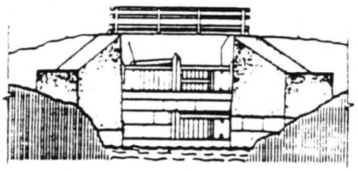
PLAN



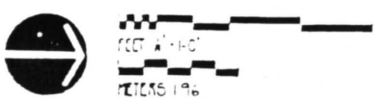
SECTION B EAST



SECTION C SOUTH



NORTH ELEVATION



DELINEATED BY: KAREN T. CLINE

OHIO AND ERIE CANAL
HISTORIC AMERICAN ENGINEERING RECORD
NATIONAL PARK SERVICE
UNITED STATES DEPARTMENT OF THE INTERIOR

OHIO AND ERIE CANAL: LOCK NO 39 - 1826; RECONSTRUCTED 1905-1906
WEST SIDE OF CANAL ROAD, 3400 FEET NORTH OF STONE ROAD
CUYAHOGA COUNTY
OHIO

ALLEY VIEW

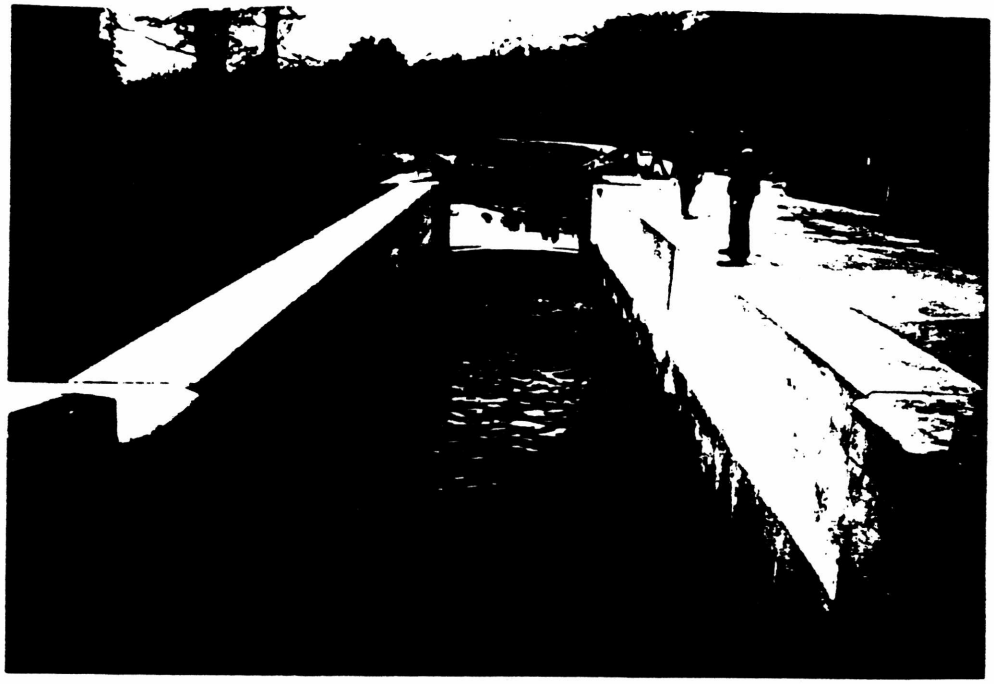
SHEET 3 OF 3

HISTORIC AMERICAN ENGINEERING RECORD
OH-59

LOCK 38

12 Mile Lock

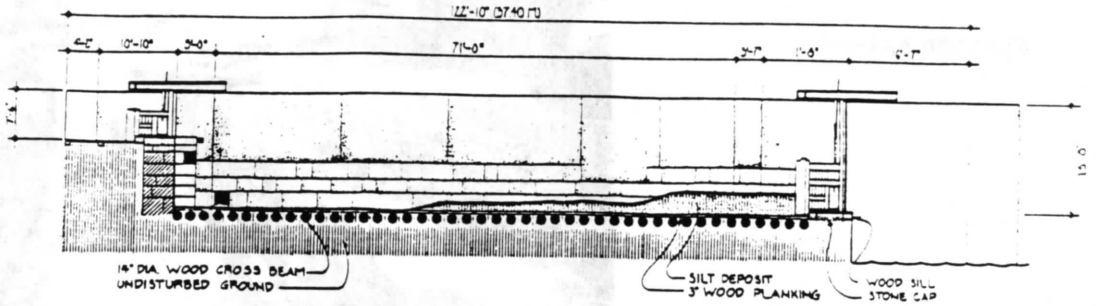
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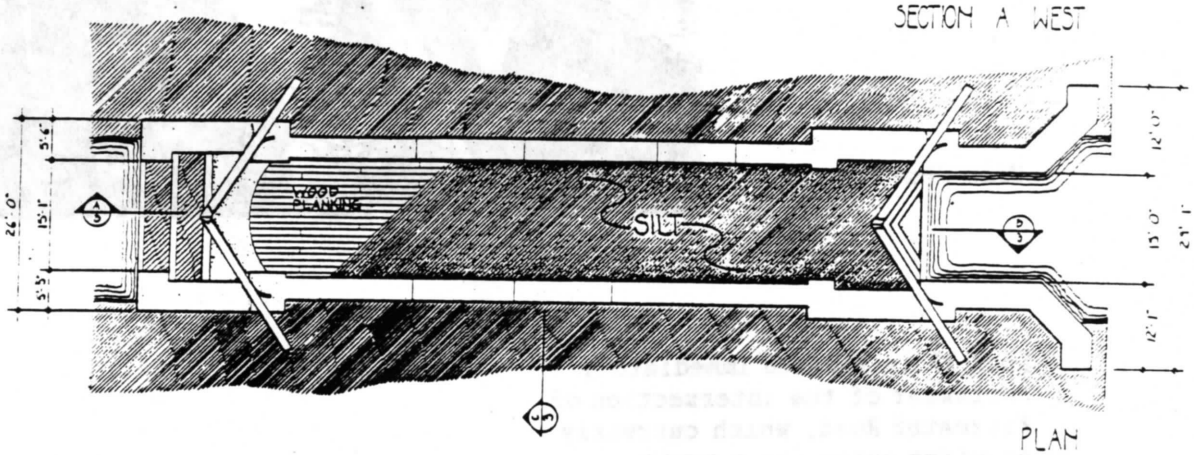
View from north.
[WPTC, 9/92]

Lock 38 is located immediately southwest of the intersection of Hillside and Canal Roads. The Hillside Road Bridge passes over both the canal and the spillway just north of the lock. Immediately west of the towpath, opposite the lock, is a canal era structure which has been rehabilitated by the National Park Service to serve as a visitor center. The lock, restored to its 1907 appearance, features predominantly in this cultural setting.

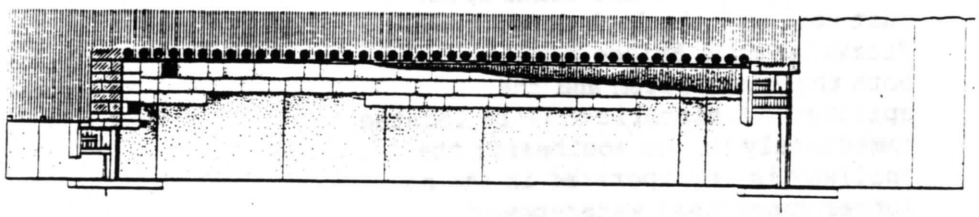
Site Plan. Silliman Survey c.1912.



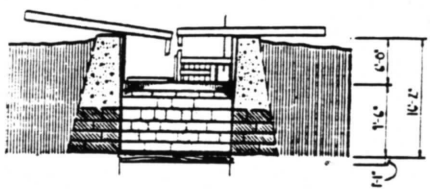
SECTION A WEST



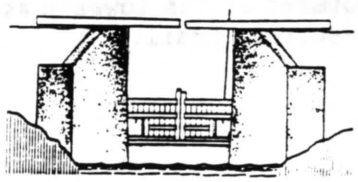
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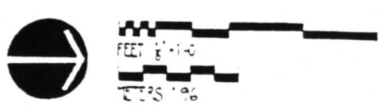
SECTION B EAST



SECTION C SOUTH



NORTH ELEVATION



DELINEATED BY: MARCY SCHULTE 1986

OHIO AND ERIE CANAL HISTORIC AMERICAN ENGINEERING RECORD NATIONAL PARK SERVICE DEPARTMENT OF THE INTERIOR	OHIO AND ERIE CANAL : LOCK NO. 38 - 1826-27; RECONSTRUCTED 1905-06 CANAL AND HILLSIDE ROADS CUYAHOGA COUNTY VALLEY VIEW OHIO	SHEET 3 OF 5	HISTORIC AMERICAN ENGINEERING RECORD OH-59

LOCK 37

14 Mile Lock

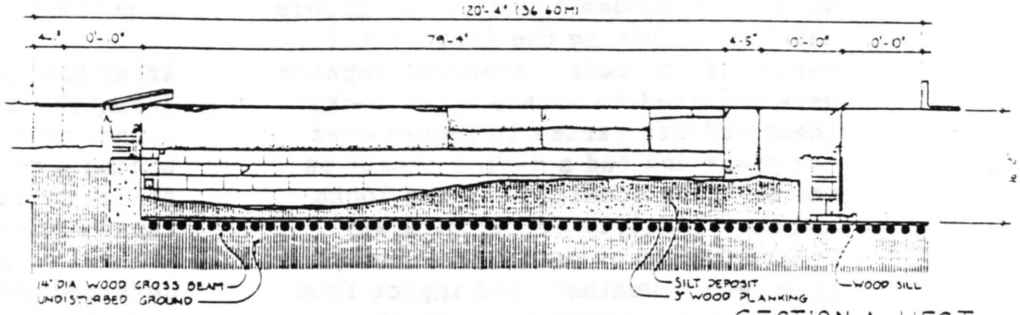
Station 611+46



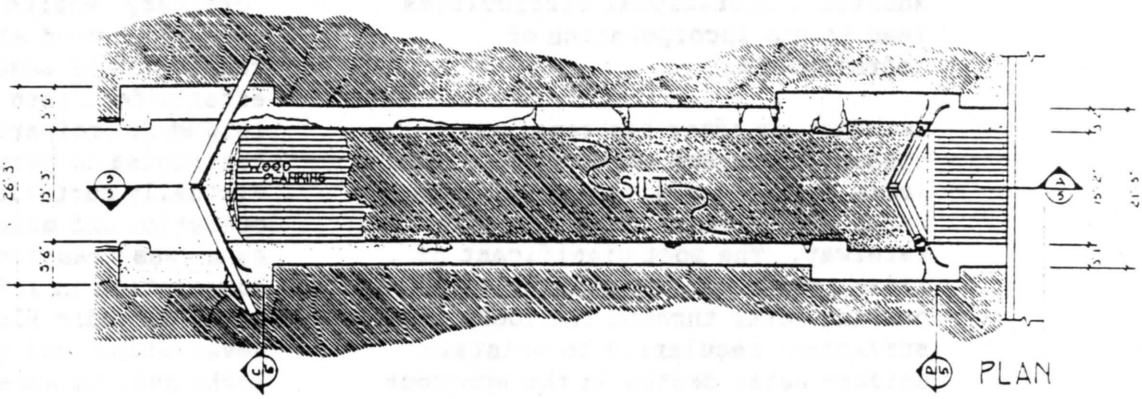
View from north.

Lock 37 is located immediately southwest of the intersection of Fitzwater Road, which currently provides access to a county maintenance yard, and Canal Road. Just north of the lock structure, Fitzwater Road Bridge passes over both the canal prism and the spillway. A historic mill is located immediately to the southeast; the spillway is incorporated in the no longer functional water-power system. While the lock is quite visible, public access is presently limited to that from the towpath. There have been no improvements at this location other then the development of the towpath as a multi-purpose trail.

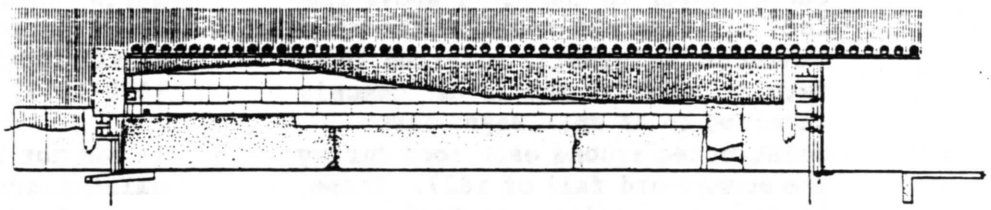
Site Plan. Silliman Survey c.1912.



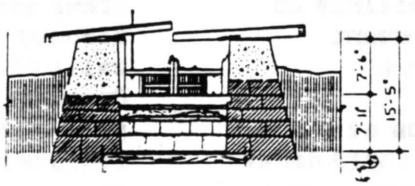
SECTION A WEST



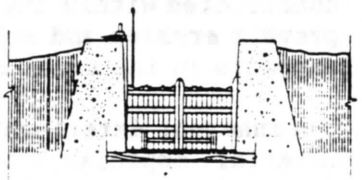
PLAN



SECTION B EAST



SECTION C SOUTH



SECTION D NORTH



FEET 1/8"=1'-0"
METERS 1:96

DELINEATED BY KAREN T. CLINE 1984

OHIO AND ERIE CANAL

OHIO AND ERIE CANAL LOCK NO 37 - 1825-26; RECONSTRUCTED 1905-06
CANAL AND TOWPATH ROADS
CUYAHOGA COUNTY
VALLEY VIEW
OHIO

SHEET 4 OF 5

HISTORIC AMERICAN ENGINEERING RECORD
OH-59

PHYSICAL HISTORY

The locks, built between 1825 and 1827, were constructed of sandstone walls with wooden foundations, floors and gates. During the operational period of the canal, numerous repairs were required to maintain the locks; these efforts varied in degree over the years and had a direct impact on the both the condition of the locks and the viability of the waterway. Deterioration of materials, damage from severe weather, and impact from heavy use all contributed to the necessity of frequent repairs. In addition, operational difficulties lead to the incorporation of improvements.

Immediately after the canal was opened, it became apparent that the locks required modifications if the canal was to function as a viable waterway. The most significant of these issues was the difficulty of passing water through the locks with sufficient regularity to maintain uniform water depths in the numerous short levels on the Cleveland to Akron sector. The inadequate flow caused water in the level above the lock to raise and overflow the prism. Channels, originally referred to as regulating weirs and later commonly referred to as spillways, were constructed around each lock during the summer and fall of 1827. These spillways provided a control mechanism which allowed an equitable flow of water to by-pass the locks and remedied the loss of water. A tumble of wood or stone was typically constructed within the spillway to prevent erosion and subsequent deposits in the canal below.

The inherent deterioration of material, especially the rapid decay of wood, soon became apparent. By 1834, wood elements of the locks, most notably the lock gates, were extremely deteriorated and required replacement. It was clear that wood elements not continuously submerged in water would require entire renewal or extensive repairs every six to nine years.

After the late 1830s, the decentralization of responsibilities along the canal began what was to become a continual decline in the condition of the locks. As with all canal structures, the locks received minimal maintenance; repairs were deferred until they became critical, threatening suspension of navigation. This included even 'ordinary repairs' such as the renewal of wood elements and the regrouting of masonry. Maintenance efforts fell into serious decline in 1856 when ordinary repairs were contracted to private firms and were virtually curtailed when the entire operation and maintenance of the canal was transferred to a private corporation in 1861. During this time, periodic flooding took a devastating toll on the deteriorated locks and, in some instances, undermined foundations. The only notable improvement which occurred during this period was the installation of new, modified gates at all locks in the valley during 1858-1859.

It was not until 1876 that maintenance activities on the locks resumed. As early as 1864 it had been reported that the masonry in many of the locks was deteriorating and the walls were inclining inward. During spring repairs in 1876 and 1877, crews set back the two top courses of masonry in the chambers and wing walls of all the locks in the Cuyahoga Valley. Lock 29 was in such poor condition that complete replacement with all new material was necessitated during 1880-1882.

In 1884, following a devastating flood, virtually all the lock chambers were again contracted in the width and the relaying of the top courses was necessitated to maintain navigation. During 1887, as part of a major effort to increase the efficiency of the northern division, the upper courses in the lock walls were again set back and new gates installed. For the first time brick, cement and concrete were used for repairs, prior to this only grout and wood had been used.

Despite these repairs, the chief engineer reported that further work was necessary on the locks. A number of the lock walls were so out of plumb that boats were chafed in passing. Some chamber walls needed repairing where the stone was crumbling. Insufficient appropriations necessitated patching of structures rather than their substantial reconstruction. Continual efforts were made to repair the locks; chambers surfaces were adjusted and aligned, wing walls rebuilt, miter sills repaired, and new flooring installed at various locks. While these repairs resulted in an improvement of the physical condition of the locks, steady gradual decline continued. This slow, continuing deterioration was leading to irreparable ruin of the locks.

In November of 1904, the state legislature was pressured to appropriate funds for improvement of the northern division of the canal and from 1905-1909 a major rehabilitation of the northern division ensued. Work was performed both under contracts and by state crews. In general, contract work was limited to that above the low level water line and the state worked on foundations and lower parts of the lock walls. All the locks in valley were 'rebuilt' with the exception of the recently replaced Lock 29. The rebuilding consisted of removing defective masonry and replacing it with concrete. A 15 horsepower traction engine with hoister attached, a pulsometer pump and 2 small concrete force-pumps for grouting lock walls were used; this equipment allowed the crews to grout a considerable portion of the old walls which otherwise would have had to been removed and rebuilt. New flooring and miters were placed and new gates were installed in every lock. Tumbles, generally, were either faced with concrete or replaced with new concrete structures. Most tumbles featured a curved front so as to discharge water with less undermining tendency.

The canal was abandoned as a waterway in 1913. Under the subsequent hydraulic lease, maintenance of these structures has been the responsibility of the steel company who utilizes the canal as a source of cooling water. While documentation of work performed during this period is rather limited, it appears that the locks have received virtually no maintenance. The tumbles, however, have been maintained and improved as they are required to ensure the flow of water being used for industrial purposes. Drawings, dating from the 1950s, suggest that a face of reinforced concrete was applied to the side walls, new slabs of reinforced concrete were installed, and in some cases, an extension to the discharge apron was constructed.

Since the identification of the canal as a significant historic resource and the establishment of the recreation area, the locks now figure predominantly among cultural resource management priorities. Those within the watered portion afford an excellent opportunity for interpretation of the historic canal era and its significance in the development of Cuyahoga Valley.

PHYSICAL DESCRIPTION

The primary structure of the lock consists of two parallel walls. While there are slight dimensional variations, the lock proper is approximately 90 feet in length, measured from gate to gate in the closed position, with inner faces of the walls set 15 feet apart. The main chamber is flanked at both the downstream and upstream ends by smaller chambers with recessed walls. These recessed areas form pockets to accommodate the wooden gates in their open position. The ends of the lock are typically protected by wingwalls; in some instances however, the lock walls terminate abruptly at the ends of the gate recesses. The drawings on preceding pages, prepared by a HABS/HAER team in the summer of 1986, provide documentation of subtle variations between the lock structures.

The visible face of the lock walls is comprised of masonry and poured concrete. The lower portion of the wall consists of hammer-dressed sandstone laid in courses of uniform height; the stones are set in a mortared bed and joints are tooled. Stonework in the upper portion has been removed and replaced with a face of concrete. The poured in place concrete, segmented by control joints, has chamfered edges; the surface features evidence of the rough sawn planks used to form the concrete, most notably at the outer corners of the recessed areas. The face of the concrete and stone are flush. Although the line of transition varies, the concrete generally extends just below the low level water line.

While historic data provides inconsistent information regarding specific construction details of the walls, the documentation does support some basic assumptions. The lock walls are battered; typical of gravity retaining walls, the width increases towards the bottom of the lock. While the significant increase occurs on the back face, there is also a slight battering on the inner face of the chamber. The face stones contain intermittent headers which extend back through the inner wall of backing stone. The concrete applied to the upper portion of the wall is a minimum of eight inches in depth. The actual cross section of the lock walls, however, can only be determined by physical investigation which includes core boring and extensive excavations.

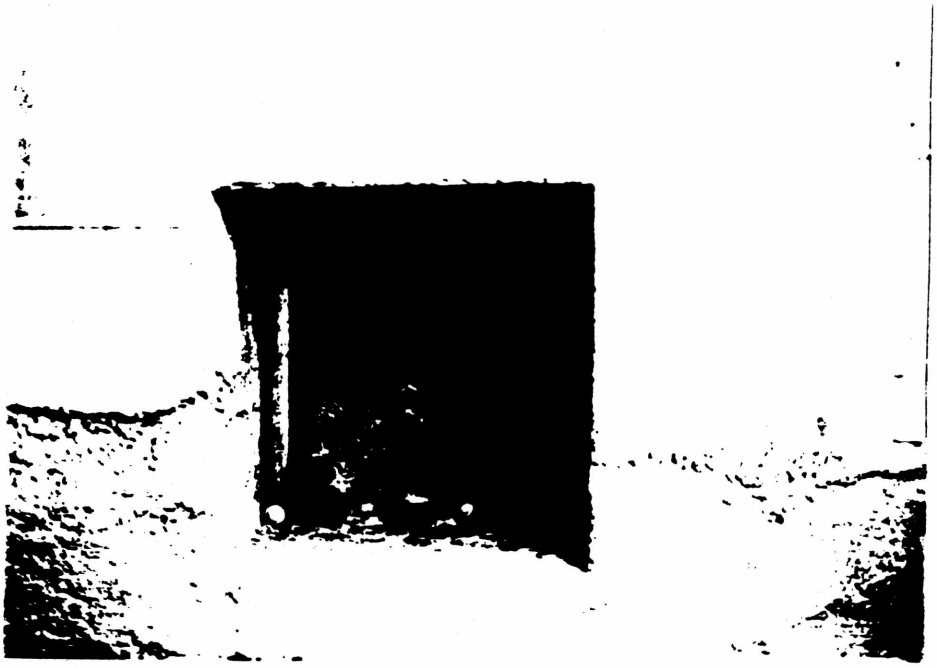


Lock 37. Intersection of chamber wall and breast wall.

The upper recess is terminated at the downstream edge by a breast wall which extends transversely across the chamber and ties into the main walls. The breast wall is constructed of masonry and is semi-circular in design. With a top elevation set approximately equivalent to the floor of the upstream canal prism, this wall forms the vertical step, or lift, between the levels of water. One course of masonry is recessed to accommodate a heavy timber, one of two bumping beams which protect the breast wall; the main lock walls feature indentations which receive the ends of a second bumping beam. A lock culvert, a provision for controlling the flow of water from the upper canal into the lock chamber, is often constructed within the masonry of the berm wall. The inlet, located in the upstream gate pocket, features a wicket gate controlled by a stem or reach rod which penetrates the top of the lock wall. The discharge, a rectangular opening, is located within the upstream portion of the chamber at the bottom of the lock wall.

The three locks along this watered portion of the canal all terminate abruptly at the ends of the upstream gate recess. Wingwalls, limited to the downstream ends, are constructed of either masonry or concrete. The majority angle outward and step downward conforming with the topography of the earthen banks.

A set of gates are hung within each recessed chamber. The gates are constructed of white oak timbers secured with iron hardware. Portions of gates which remain conform to drawings prepared in 1905 which provides a complete picture of construction details. The structural system of the lock gates is comprised of a half-cylindrical heel post and mitered toe post joined by horizontal rails; the connections are mortise and tenon secured with metal straps. Vertical planking is applied to the upstream face. Sluice gates, located at the bottom of the lock gate adjacent to the heel post, control the flow of water into and out of the lock. The design, similar to a butterfly-type value, consists of a



Lock 38. Lock culvert inlet after restoration.

flat metal plate which rotates around a central stem attached to the face of the gate with iron straps. The sluice gate is operated by a detachable wrench, a long handle which attaches to the reach rod above the balance beam.

The rounded portion of the heel post is received by a hollow quoin, a wood member with a quarter-round arc located at the downstream interior corner of each recess. The gate pivots on a gugdeon at the base of the heel post. A ring bolted to anchor straps, referred to as a 'goose neck' or 'goon neck,' secures the heel post to the top of the lock wall and acts as a first-class fulcrum. Gate movement is controlled by a balance beam which, to provide leverage, extends well past the heel post. Existing balance beams vary in composition from solid timbers to built-up dimensional lumber.

In the closed position when viewed from above, the gates form an angle pointing upstream; the mitered toe post provides a seal and water



Lock 39. Lower gate 'goose necks.'



Lock 38. Upper lock gates after restoration.

pressure ensures that the gates remain closed. The angle also facilitates gate operations by reducing the arc of the gate between the open and closed position. A miter sill, located at the downstream edge of both the upper and lower recesses, provides a stop against which the bottom of lock gates rest in a closed position, preventing leakage of water under the gate. The sills are constructed of wood members with concrete infill or poured concrete with a steel channel face.

Given that the most observable features of the lock conform to the early specifications, it is reasonable to assume that the substructure of the lock is also consistent in its similarities. The masonry lock walls are constructed on timber foundations. Where necessary, rows of sheet piling composed of planks are set into the ground across the foundation or piles are driven to form a secure foundation. Square hewn timbers, not less than 1 foot in thickness, lay horizontally across the lock pit extending beyond the line of the lock walls. These timbers are 'well puddled' with a tempered mixture of clay or similar material used as a watertight lining.

Early specifications call for two layers of flooring. Three inch thick oak planks were to be 'trunneled' - fastened with cylindrical pins of hardware - or spiked to the timbers; this first layer was to be placed longitudinally across the entire foundation extending beneath the lock walls. A second layer of 2 inch thick planks secured with spikes was specified to run lengthwise between the lock walls. Physical investigation of existing fabric at Lock 38, however, reveals only one layer of flooring; 3 inch thick planks are placed lengthwise between the lock walls, trunneled and spiked to the timbers. Flooring upstream of the breast wall consists of timbers with concrete infill. Composition of flooring at other locks is not known and will require similar investigations as that performed at Lock 38.

Spillways are located to the east, the by-pass channel running approximately parallel to the lock. Tumbles consist of a low wall which extends transversely across the channel and ties into sidewalls. This low wall forms the vertical fall between the levels of the channel. The sidewalls are protected on the upstream end by wingwalls.



Lock 39. Tumble.

EXISTING CONDITIONS

The three locks within the watered portion of the canal were in similar condition at the time of Federal acquisition. During 1991 and 1992, Lock 38 was restored to its 1907 appearance. The following description of the locks reflects conditions prior to this restoration.

The lock walls appear to be structurally stable. There is no indication that the walls are pitching inward as occurred so frequently during the operational period of the canal. It is likely, therefore, that the historic movement was a result of deteriorated mortar and the subsequent lack of bonding between stones; these conditions permitted external forces including soil and frost pressures to slide the upper courses inward. The application of concrete along the upper portion of the wall appears to have resolved this problem.

The condition of the concrete varies significantly within each individual structure. Visual indications of deterioration and damage are limited to surface-related concerns. While horizontal cracking exists, the location and pattern indicates that the cracking is the result of inadequate bonding between pours of concrete forming a cold joint. The surface of the concrete and edges of control joints are spalling; this freeze-thaw damage ranges from slight demarcations to significant loss of concrete. Erosion and disintegration of the surface of the concrete caused by physical abrasion is most apparent at the natural water line. Even in areas where deep deterioration of concrete has occurred no reinforcing is apparent at Locks 38 and 39; reinforcing bars, however, are exposed at Lock 37. Efflorescence is occurring on all of the lock walls; since deterioration indicative of excessive infiltration of ground water is not apparent, the salts are likely originating within the concrete wall. Brown staining is limited to an isolated area on Lock 37; the configuration of the stain suggests the presence of ferrous aggregate, but may be the result of corrosion of reinforcing. In general, the condition of the concrete appears to be more deteriorated toward the top of the lock walls.

To ascertain subsurface conditions of the concrete, a program of core boring was conducted at Lock 38 during the fall of 1991[15]. A total



Lock 37. Lock chamber wall.

of twelve cores were taken; locations included the upper and lower portions of both the east and west walls and the top of each wall. When possible the cores were tested for compressive strength; extensive core delaminations prohibited such testing of five cores.

While the condition of the concrete varied, the cores taken from the lower portions of the concrete were generally in better condition. Samples from the upper portion and top of the lock walls exhibited extensive crumbling, numerous delaminations and lower compressive strengths. No reinforcing was present in any of the cores. Sandstone was encountered beneath the concrete of the upper and lower portions of both the east and west walls at a depth ranging from 8 to 13 inches below the surface. Cores taken from the top of the walls encounter gravel at 10 to 12 5/8 inches below the surface of the concrete.

One core, taken from the lower portion of the east wall, was selected for a complete petrographic analysis. The concrete was found to be non-air-entrained and to contain aggregate that is freeze-thaw unstable. The exposed surface of the cementitous matrix was highly carbonated and contained microfractures typical of freeze-thaw distress. The absence of microfractures at greater depths indicates that the concrete has not been critically saturated with water during periods of freezing and thawing. The coarse aggregate exhibited physical weakness, high porosity and a potential to react with cement alkalis.

The information revealed by core boring is keeping with that obtained from visual inspection. In summary, the surface concrete toward the top of the lock walls is deteriorated and requires replacement, while the lower portion of concrete is in relatively sound condition. In conjunction with archeological investigations performed during the summer of 1992, the back of the east wall was inspected for moisture content. Despite a wet spring, the ground was relatively dry and well drained.

Masonry which comprises the lower portion of the lock walls and the breast walls is in generally good condition. Many of the joints, however, are open with mortar deeply eroded. In isolated instances, the edges of stones are broken or chipped, but no spalling is evident. Areas of stonework at Lock 39 have been repointed; the mortar extends far beyond the limits of the joints. The timber bumping beams which protected the breast walls are all missing, with the exception of one at Lock 37 which is severely deteriorated.

Wingwalls constructed of concrete appear to be sound and are in generally good condition; deterioration is limited to minor spalling of the surface. Masonry wingwalls are exhibiting signs of failure, most notably the northeastern wingwall of Lock 39. Individual stones have rotated out of alignment. The resulting separation between stones has allowed a considerable amount of vegetation to take hold and water to penetrate the structure.

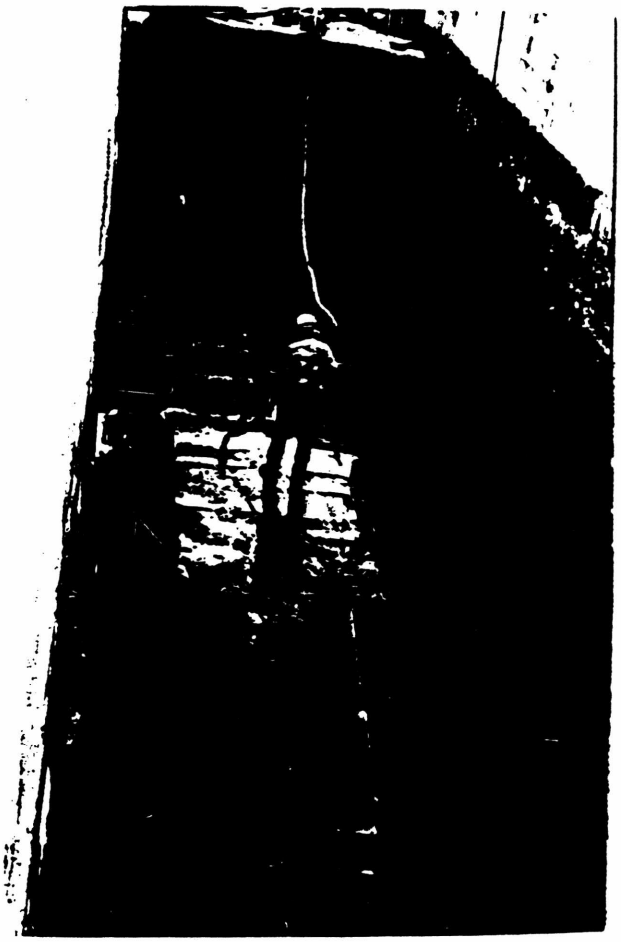
Lock culverts are apparent at Locks 39 and 38; the accumulation of debris and silt at Lock 37 prevents observation of the appropriate area even when the canal is dewatered. At Lock 38 the culvert gate and frame are intact but are deteriorated; a metal sleeve penetrating the top of the lock wall is the only remaining evidence of the control mechanism.

This culvert is almost completely blocked by fine debris; stonework inside the culvert is in excellent condition and exhibits a master level skill.

While some gates are missing in their entirety, a portion of most gates are extant. Elements which remain include heel and toe posts, bottom and intermediate rails, areas of sheathing, sluice gates, balance beams and hollow quoins; all are severely deteriorated. A fair amount of hardware remains, some of which is in good condition. As a safety measure at Lock 38, a stop dam comprised of vertical steel 'I' beams and horizontal wood timbers was installed in the downstream end of the upper gate chamber.

Only limited areas of the lock floors are visible when the canal is dewatered due to presence of silting and debris; observable areas are severely deteriorated. At the exposed southern portion of Lock 38, only a few random planks remain, approximately 90 percent of the flooring material is missing. After the debris and silt were removed, it was discovered that while the flooring in the northern portion of the main chamber is in good condition, that in the downstream gate recess is severely deteriorated or missing and requires total replacement. All visible transverse foundation timbers appear sound. Concrete has been placed between these timbers in lower gate recess and in the southern portion of the lock chamber. This concrete is in generally good condition as is the concrete floor of the upper gate recess. While the concrete miter sill at the upstream end appears to be sound, the concrete infill of the downstream wooden miter sill is displaced and requires replacement. The condition of the flooring and foundation at Locks 39 and 37 is not known and will require similar investigations as that performed at Lock 38.

The tumbles of the spillways appear to be structurally stable and are in good condition. Deterioration is limited to surface-related concerns such as isolated areas of minor spalling.



Lock 38. Flooring and foundation. [WPTC, 9/92]

RECOMMENDED TREATMENT

The recommended level of treatment for Locks 37, 38 and 39 is restoration; this is consistent with that proposed in the List of Classified Structures. As defined by the Secretary of the Interior, restoration is the process of accurately recovering the form and details of a property and its setting as it appeared at a particular period of time by the means of removal of later work or the replacement of missing earlier work[16].

Restoration to the 1907 appearance is recommended as it will allow for the integrity of the locks to be preserved while returning the structures to an operational condition. Restoring to this period will permit the preservation or stabilization of concrete wall surfaces, an alteration of historical value which conveys a desirable sense of evolution, and minimize removal of existing fabric. Sufficient historic documentation and fabric exists to accurately reconstruct missing or severely deteriorated elements, such as lock gates, enabling the locks to be functional. The results will not only increase the life of the structures and their value as a cultural resource, but will also provide a beneficial contribution to the historic scene thereby enhancing the historic integrity of the Ohio and Erie Canal National Historic Landmark.

In accordance with NPS policy and guidelines, the criteria established for restoration projects have been rigorously applied. While consideration was given to preservation, this level of treatment was found to be inadequate. Restoration is essential for public understanding and appreciation of the park's historical and cultural associations; adequate interpretation cannot be imparted through other means[17].

Lock 38 has been restored to its 1907 appearance. Restoration was performed by crews from the NPS Williamsport Preservation Training Center between October of 1991 and October of 1992. Impairment of the original fabric was minimized. Replacement of missing fabric was based on historical, architectural and archeological data of sufficient adequacy to permit accurate restoration with a minimum of conjecture. Any changes made during restoration were recorded and important elements removed during research or restoration and important to a technical understanding of the structure were accessioned and preserved. This successful project should be used to guide work at Locks 39 and 37. The drawings which follow illustrate the scope of work performed. The Project Record which provides a comprehensive description of the restoration process should be consulted.

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FROM WPTS

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2. AQUEDUCTS

Aqueducts are structures that carry the canal waterway and towpath over obstacles such as large streams and creeks. During the operational period of the canal, several aqueducts were constructed within what is now the recreation area. Of these structures, Tinkers Creek Aqueduct, located along the watered portion of the canal, is the only one which remains.

The uniqueness of Tinkers Creek Aqueduct dictates that information presented under the heading Physical History, Physical Description, Existing Conditions and Recommended Treatment address only this structure.

TINKERS CREEK AQUEDUCT

Station 566+00



View from west.

Tinkers Creek Aqueduct is located between Locks 38 and 37. The structure carries the canal waterway and towpath over Tinkers Creek, and is situated just upstream (east) of the confluence of the creek and the Cuyahoga River. Access is limited to that from the towpath. Portions of the structure are from the towpath and from Canal Road located to the east. There have been no improvements at this location other than the development of the towpath as a multi-purpose trail.

Site Plan. Silliman Survey c.1912.

PHYSICAL HISTORY

The original aqueduct, constructed between 1825 and 1827, featured a wooden trunk with timber framing supported by uncut masonry abutments and central pier. The timber and uncut stone were extremely susceptible to deterioration necessitating replacement of the framing and trunk in 1836 and of the pier in 1841-1842. While the Canal Commissioners had considered substituting a stone structure, economic considerations lead to rebuilding with timber. The wood framing, although constructed in a more durable manner, and the uncut stone supports had severely deteriorated by 1844. In addition, it had become apparent that the location of the aqueduct along Tinkers Creek was undesirable during flood conditions. A contract was let to construct a new aqueduct 'located several chains to the north.' No evidence of an aqueduct remains at the original location.

The new aqueduct was completed in the spring of 1845. Also a two-span structure, the aqueduct was supported by abutments and a central pier of cut ashlar masonry. The superstructure, however, was similar to that of the previous aqueduct and its rapid deterioration necessitated frequent extensive repairs and total replacement in 1870 and in 1896.

In 1905 a contract was let to the King Bridge Company of Cleveland to construct a steel superstructure. Removal of the existing structure and repair of the abutments and pier was performed by state crews; the supports were modified to allow for a four foot increase in trunk width. General plans and performance specifications were prepared by the state; the actual design was at the discretion of the contractor, subject to approval by the State Engineer.

Since the abandonment of the canal as a water way in 1913, maintenance of the aqueduct has been the responsibility of the steel company who utilizes the canal as a source of cooling water under a hydraulic lease. Documentation of improvements/repairs performed is rather limited. While the trunk has received periodic repairs, it appears that the last improvements to the steel superstructure were performed during c.1960 major renovations.

Since the identification of the canal as a significant historic and cultural resource and the establishment of the recreation area, the aqueduct now figures predominantly among cultural resource management priorities. The aqueduct, located within the watered portion of the canal, is a critical element in maintaining the continuity of the waterway and the towpath trail.

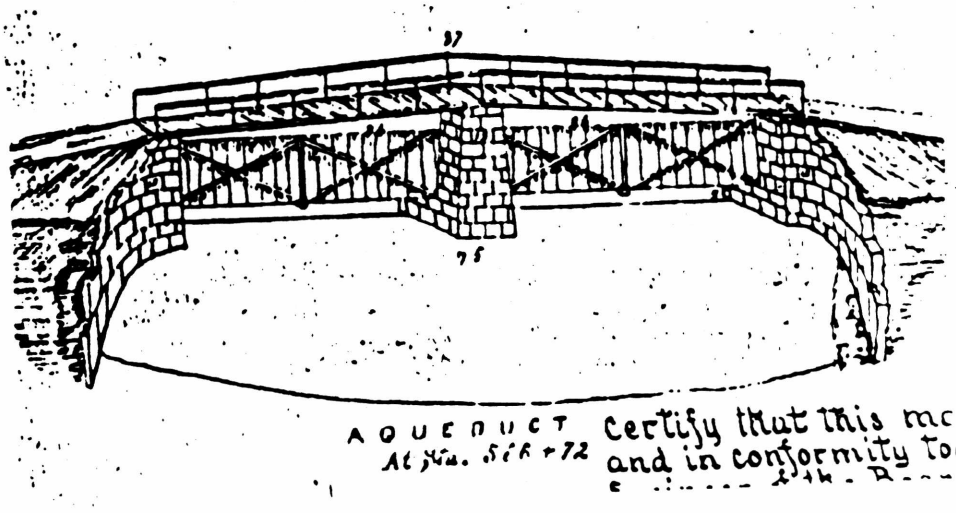


Illustration from 1892 survey maps.

PHYSICAL DESCRIPTION

The present Tinkers Creek Aqueduct consists of a steel superstructure and wooden trunk supported by masonry abutments and central pier. The length of the aqueduct, measured between abutments, is approximately 76 feet; the overall width is approximately 37 feet 9 inches. A wooden bridge is incorporated at the west, extending the full length of the aqueduct to provide continuity of the towpath.

The abutments and central pier of the aqueduct are composed of ashlar, dressed sandstone with tooled margins. The coursed masonry is laid in mortar. Areas of the stone abutments which support the steel superstructure were removed and replaced with reinforced concrete during c.1960 renovations. The abutments are protected by curved wingwalls which splay out to contain the canal prism, towpath and berm. Three of the masonry wingwalls are stepped to generally conform with the topography of the earthen bank. The southeastern wingwall terminates at the concrete abutment of an adjacent vehicular bridge. The pier is tapered and corners on the upstream elevation are rounded creating a shearwater. The portion of the pier which supports the towpath bridge features a capstone that is corbeled on the west but is flush on the north and south.

The steel superstructure of the aqueduct is in the form of a pony truss; there is no lateral bracing between the top chords and the load is carried level with the bottom chords of the truss. The type of truss employed is that of a Warren truss with verticals; diagonal members carry both compressive and tensile forces, and vertical members serve as bracing for the triangular web system. The steel superstructure consists of two spans, each 39 feet in length at the bottom chord and comprised of 4 panels. The webs are 8 feet in height and are set 24 feet apart.



View from east.



West web, south span.

Truss members are built-up sections consisting of channels, 'I' bars and plates. Repairs performed to the steel superstructure during c.1960 renovations include the addition of bars, plates and angles welded onto various truss members, most notably at the diagonal members and the bottom chords. While this work was presumably performed in an attempt to supplement deteriorated members and to prevent further deterioration, the additions extend only within the panels and do not provide reinforcement at the connections where it is most required.

The bottom chords of the east and west trusses are connected by plate girders installed during c.1960 renovations. A portion of the old hanger plate still remains above the pin connection. New hanger plates were welded onto this remaining fabric, and riveted and welded to the new plate girders.

The wooden trunk, supported by the steel superstructure, has a clear width of approximately 21 feet 9 inches and the sidewalls are approximately 5 feet 8 inches in height. The floor system consists of wood joists and two layers of 2 inch tongue and groove fir planking. The sidewalls consists of wood posts and planking identical to that of the floor. Due to its inherent susceptibility to deterioration, the trunk has been repaired and replaced at periodic intervals. The most recent replacement was performed in November of 1975 when the deteriorated trunk, reportedly constructed in 1945, was leaking severely. A layer of treated plywood has recently been installed over the sidewalls; tar has been applied to the joints above the water line. The trunk of the aqueduct is introduced into the canal prism at both ends by poured concrete walls with chamfered corners; defining the towpath and the berm, the walls divert water into the aqueduct.



Trunk, prior to application of plywood. [HABS, 7/86]

Two wood gates are located in the towpath (west) sidewall of the trunk to aid in the periodic drainage of the canal to perform repairs. The mechanism is secured to the south western top chord. The gates were installed sometime after 1959 as they do not appear on drawings of existing conditions from that date. Drawings indicate that an area of removable boards and later a gate of unknown details functioned as a drainage mechanism prior to the installation of the existing gates.

A hold-down system spans the width of the aqueduct above the central pier. Comprised of 'I' beams, the system was installed to prevent floatation of the wooden trunk during flood conditions of Tinkers Creek. While the date of this modification is unknown, installation occurred between 1913 and 1959 when it appears in a drawing of existing conditions.

The wooden towpath bridge is approximately 8 feet 10 inches in width. Girders of the steel superstructure extend to the east beyond the truss to provide support for the bridge. Wood decking is supported by I beams, which in turn are supported by posts comprised of angle sections that rest on the girders. Along the western edge, a metal handrail with lattice infill provides protection from the steep drop to the creek below.

A battering wall protects the structure at the upstream (west) elevation from the forces of the creek during high water conditions. The wall, which extends from each abutment to the central pier, is comprised of wooden posts secured by plates and rods to an H beam. The entire system is attached to the superstructure by plates which extend from vertical truss members.

EXISTING CONDITIONS

The abutments, wingwalls and pier are showing signs of decay. Joint deterioration is prevalent. Missing mortar and subsequent lack of bonding between stones has resulted in individual stones rotating out of alignment, most notably at the southeastern wingwall. The resulting separation between stones has permited a considerable amount of vegetation to take hold. These separations and general joint deterioration have allowed water to penetrate the structure. In a few areas, excessive amounts of water infiltration has resulted in damage to the masonry.

The trunk of the aqueduct is functional in that water seepage is somewhat minimized; the ability to hold water, however, is a direct result of the recent application of plywood sheathing. In general, wood elements, such as the bridge decking and battering wall slats, are deteriorated. The concrete walls which introduce the trunk into the canal prism appear to be structurally stable; spalling is occurring, most notably at the southwestern wall, but the resultant damage is relatively limited in depth.

In 1991, the National Park Service entered into a contract with Environmental Design Group (EDG), a multi-discipline architectural/engineering firm, to perform an inspection and analysis of various structures along the watered portion of the canal owned by the Federal Government; Tinkers Creek Aqueduct was among the structures investigated. The purpose of this study was to provide an evaluation of the structural integrity of the aqueduct based on available drawings and documents, supplemented with physical data obtained by visual inspection and physical measurements. Their report concludes that the steel superstructure is in an advanced state of deterioration and is approaching the point of failure.

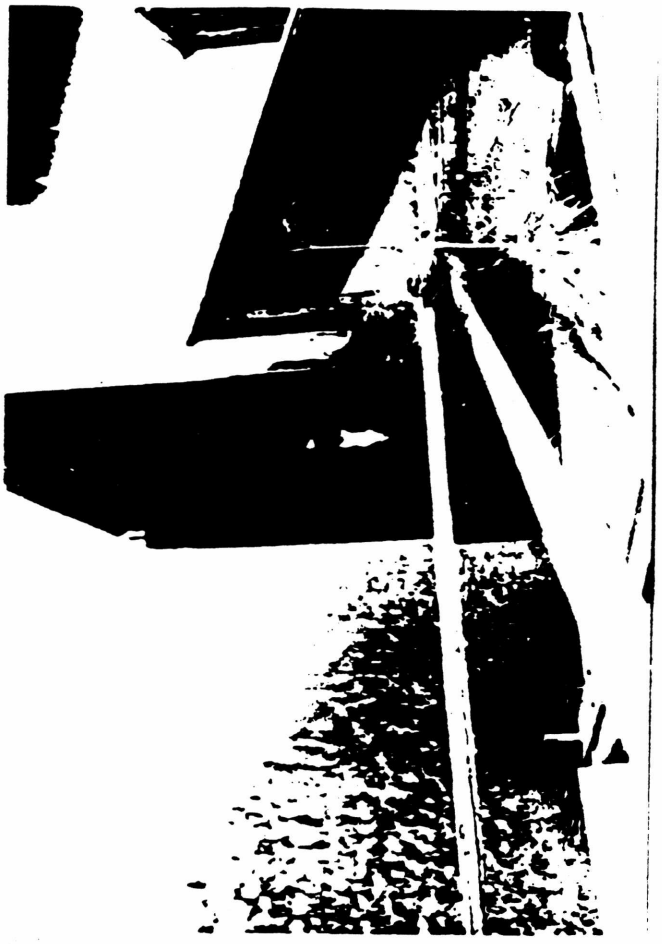


Southwest wingwall.

The lower two feet of all the trusses are severely deteriorated. A number of the lower chord members have total section loss and the remainder are greatly reduced at the joints. The bearings at the abutments were encased in concrete during c.1960 renovations; this modification has altered the original design of the structural system, transforming the bearings from pinned to fixed. The remainder of lower pin joints are severely rusted or have been welded resulting in fixed rather than pinned joints. In some instances, the shaft of the pin is visible due to complete section loss of truss members. The girders beneath the lower chords are also severely corroded; the webs, upper flanges and lower flanges have all lost in excess of 50 percent of their cross section.

The upper portion of the trusses are also exhibiting signs of failure. At the pier, the southwest upper cord has buckled approximately 2 inches and has total section loss in the web of one channel. Most members of the southeast truss at the pier have total section loss, exposing the shaft of the main pin which has lost approximately 25 percent of its cross section. At this bearing point, the southeast truss has settled 3/8 inch, while the pier has an apparent settlement of an estimated 2 inches. Deflection is occurring at all truss top chord members, most notably the southwest top cord which has deflected 1 inch at the center.

The Summary of Findings contained within EDG's report rates the structural condition of the aqueduct as poor. The aqueduct has suffered significant section loss of main load carrying members; deterioration of connections; and settlement, buckling and deflection of structural steel. Due to the severe state of deterioration, EDG recommends total replacement before 1996. While this information is based on recent inspections, it is clear that the deteriorated condition has existed for an extensive period of time.



Girder, section loss.

RECOMMENDED TREATMENT

The level of treatment proposed in the List of Classified Structures is preservation. This recommendation, prepared in 1981, was part of a park-wide survey to identify cultural resources and did not involve a comprehensive analysis of condition. As the vast majority of the aqueduct's structural members are not easily observable, it is likely that the true extent of deterioration was not apparent and, therefore, not taken into consideration. Due to the present condition, preservation of Tinkers Creek Aqueduct is not achievable. As outlined in the Existing Conditions, total replacement of the steel superstructure is required to attain a safe and functional aqueduct. The scope of work falls outside the realm of a preservation project.

Through the existing fabric and available drawings, reconstruction of the superstructure faithful to 1905 technology is possible; the project would involve virtually no conjecture but, would require modifications to eliminate deficiencies of design and materials. In accordance with NPS policy and guidelines, however, all prudent and feasible alternatives to reconstruction must be considered; reconstruction also must be demonstrated to be the only alternative permitting appreciation of the historical or cultural association for which the park was established.[18] While continuity of the canal waterway and towpath over Tinkers Creek is critical to the mission of the park, replication of the deteriorated aqueduct is not crucial. The installation of a new superstructure would not impair an appreciation of the significance of the canal. A wayside, to be located adjacent to the aqueduct, provides the opportunity to present the 1907 aqueduct through pictorial documentation. Reconstruction of the existing superstructure, therefore, is not recommended due to the limited associated benefits and the ability to relay the information through an interpretive wayside.

Rehabilitation of Tinkers Creek Aqueduct is, therefore, recommended as the appropriate level of treatment. Severely deteriorated fabric should be replaced using contemporary construction methods and materials. Features which contribute to the value of the structure's appearance and scale should be carefully analyzed and reviewed for their appropriateness. While contemporary in both appearance and feel, the new structure must make reference to the historic aqueduct. Massing, scale and materials are issues which must be thoroughly considered to ensure that the new aqueduct is architecturally compatible with other canal structures and the overall character of the corridor. This includes the design of such components as the superstructure, trunk, bridge and battering wall.

In addition to appearance, all construction materials and methods should be evaluated for strength and life-expectancy to ensure an extended life span for the structure and to reduce future maintenance costs. Care should be taken to respect technological advancements and to eliminate deficiencies of design. Thin members joined by a pin connection, typical in older forms of trusses, are inherently susceptible to deterioration; unless frequent maintenance is performed, corrosion will transform the joint to a fixed connection and erode the associated members. The girders applied to the underside extend into the path of water and large floating debris during high water conditions and are

vulnerable to the added side pressure. While evaluating new methods for appropriateness, incorporation of similar features into the final design should be avoided.

The abutments and central pier will require repair; the level of stabilization efforts will varying in accordance with the condition. To protect against water infiltration and subsequent structural problems, all surfaces should be cleaned of vegetation and any loose or friable material. Joints should be cleaned and repointed where necessary. Any stones not within the proper alignment should be removed and reset flush with the face of the wall.

The outward movement of the wingwalls must be corrected and the walls returned to a monolithic state. Specific sections exhibiting signs of significant deterioration may require dismantling. In these ares, the stonework should be taken down to stable stone, and all loose rubble or other undesirable material removed from behind the walls. To accomplish this, the areas should be photographed and recorded in sufficient detail to permit accurate reconstruction. The stones should be dismantled by hand and the areas reconstructed using the original stone with mortar matching the original materials in constituent composition, color and texture. Damaged stones, inappropriate for reuse, will require replacement with new stones that match the original without any deviations. Voids in the back face of the walls should be filled with grout, proper attention being given to ensure that face stones are not pushed out of alignment. Depending on the condition of the soil behind the walls, installation of a drainage system may be required. Grading and seeding of the areas adjacent to the walls will prevent further erosion.

While the concrete areas on which the superstructure bears will likely require replacement, the concrete walls which diverts the canal into the aqueduct will only require repair.

All information regarding the construction of the existing aqueduct, including available drawings supplemented with data obtained from physical investigations, should be compiled and a complete set of existing drawings prepared. As the abutments and central pier which support the aqueduct are the only historic fabric to remain, both the National Historic Landmark and National Register of Historic Places listing must be revisited. The criteria must be applied to the new structure and a determination made if the Tinkers Creek Aqueduct is still a contributing feature, and the nominations should then be appropriately modified.

3. WASTE STRUCTURES

Waste structures are control components which regulate the level of the water within the canal and provide protection to the balance of the waterway during conditions of high water. Such structures include flood gates and waste weirs. A flood gate is a sluice - a man-made channel for conducting water - with valves or gates that regulate the flow of water. A waste weir is a dam that is located in line with the canal berm. Waste structures along the presently watered portion of the canal, within what is now the recreation area, include one flood gate, two waste weirs and one combination flood gate and waste weir.

Similarities dictate that information presented under the headings of Physical History and Recommended Treatment address the waste structures as a group. Physical Description and Existing Conditions, however, are presented for each individual structure.

PHYSICAL HISTORY

While the original contract specifications for the canal addressed in detail primary canal components such as locks, no data was provided on the construction of waste structures. The contracts indicate that these structures were handled on a case-by-case basis and were generally handwritten into contracts by an acting commissioner or state engineer. Based on the original contracts, it appears the only one waste structure was constructed between 1825-1827 within what is now the recreation area -- a waste weir located between Locks 27 and 26.

This omission of waste structures during the initial planning and construction reflects the difficulty of determining the height of various streams during flood conditions upon completion of the canal. Adjacent land was cleared, low grounds drained and obstructions removed which had previously prevented the flow of surface water. As early as January of 1828, a major flood caused damage to the canal. The river and streams rose more rapidly and to a greater height than anticipated. To prevent similar occurrences in the future, extensive waste ways were formed by simply reducing the height of the towpath banks at certain areas. While these waste ways were relatively primitive, they provided areas for excess water to escape without damage to the canal.

Based on available documentation, there is no indication as to when permanent structures were built to regulate excess water introduced into the canal by floods. Even the detailed specifications prepared in 1833, which was the first document to discuss component structures on the canal in a comprehensive manner, did not address waste structures. A report filed in 1834, however, makes reference to waste structures indicating that such structures were constructed prior to that date.

Extremely limited information is available regarding waste structures throughout the operational period of the canal. 'Waste gates' are mentioned under the renewal of wooden structures in 1834 and 1841 indicating that the gates were constructed of wood. Measures taken after a succession of floods in June of 1843, which caused considerable damage to the canal, included the construction of several waste gates and the renewal of waste weirs. Work performed in 1893 included repairs to the stone structure of a waste gate and the replacement of oak planks within a waste weir; while these entries refer to specific structures, they provide an indication of construction materials.

The first known document which records the location of waste structures is a set of survey maps prepared in 1892; these maps contain a brief note regarding the character of each structure. A later set of maps which documents a survey performed by G. Silliman, c.1912, reflect conditions after the 1905-1909 improvement of the northern division of the canal.

In addition to the Silliman Survey, documentation of waste structures during this period of improvements includes construction drawings and reports which briefly outline the work performed. While the majority of this information is structure specific, there are certain common factors which support some basic conclusions. Wooden waste weirs were replaced with concrete structures. Additional flood gates were installed and the existing ones were generally replaced. Butterfly-type valves, previously installed within all flood gates, were no longer used. While

reports indicate that flood gates were to be constructed with masonry bottom and sides, drawings and existing fabric indicate that they were actually constructed of concrete.

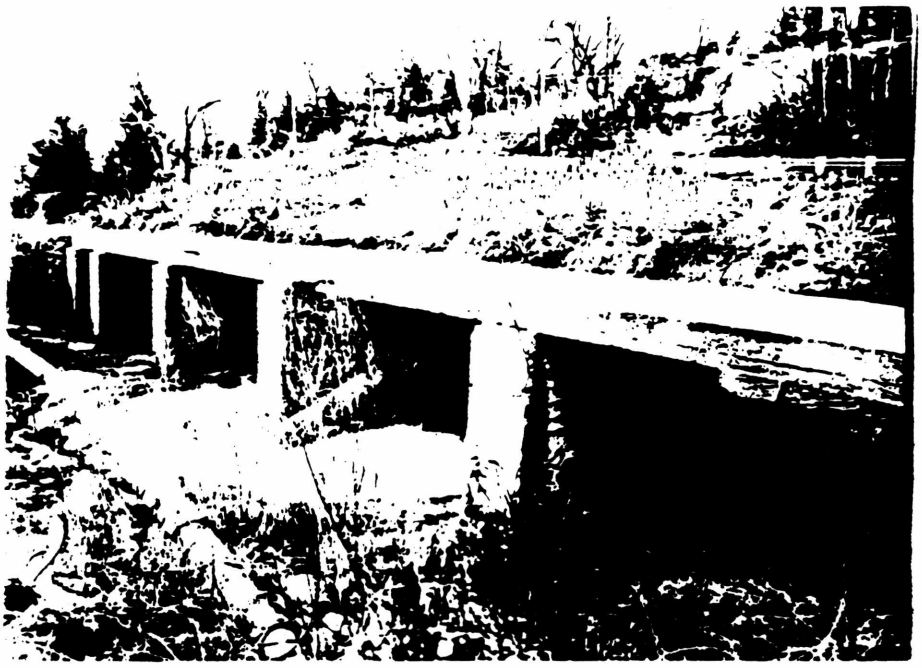
Along the presently watered portion of the canal within what is now the recreation area, the Silliman Survey identifies one waste weir, two flood gates and one combined waste weir and flood gate. Of these structures, all but one flood gate remain today. After the abandonment of the canal as a waterway in 1913, these structures continued to be maintained as they were required to ensure the flow of water being used for industrial purposes.

Since identification of the canal as a significant historic and cultural resource and the establishment of the recreation area, these waste structures now play an important role in ensuring the continuity of the waterway and the towpath, and contribute to the overall historic character of the corridor.

In 1991, the National Park Service entered into a contract with Environmental Design Group (EDG), a multi-discipline architectural/ engineering firm, to perform an inspection and analysis of various structures along the watered portion of the canal owned by the Federal Government; the waste structures were among those investigated. The purpose of this study was to provide an evaluation of the structural integrity based on available drawings and documents, supplemented with physical data obtained by visual inspection and physical measurements. Their report concludes that the conditions range from fair to poor.

WASTE WEIR

Station 460+44



View from west.

The existing concrete waste weir, located south of Lock 39, was construction in 1906 during the improvement of the northern division. This concrete structure replaced an earlier waste weir, shown in the 1892 Survey as a wooden bridge supported by stone abutments. At an unknown date the associated waste way, which carried excess water to the Cuyahoga River, has been replaced by a culvert. The towpath has been redirected from its original alignment and is presently located to the west of this structure.

PHYSICAL DESCRIPTION

The waste weir, constructed of concrete, is comprised of a wall segmented by six piers which rise above the wall to support a deck. The wall, located in line with the west berm and equal in height to the natural water line of the canal, regulates the level of water within the prism. The piers are rectangular

Site Plan. Silliman Survey c.1912.

in shape with chamfered vertical edges and evidence of formwork used during construction is apparent. Placed perpendicular to the canal, the piers support a reinforced concrete deck which served as a towpath bridge.

When the canal rises, water overflows into a basin located immediately to the west. The water is directed into a 42 inch corrugated metal culvert which was at one time tar coated. This pipe extends westward where it connects to a 72 inch reinforced concrete pipe that discharges into the Cuyahoga River. Approximately 50 feet of the pipe is exposed in an oxbow of the river and there is approximately 3 feet of standing water above the invert. A smoke test was performed to confirm the path of the water.

EXISTING CONDITIONS

The structure appears to be relatively sound and no indications of movement are evident. The concrete, however, is exhibiting signs of deterioration. Most significant is horizontal cracking which exists at the mid point of the deck; the location and pattern indicate that the cracks are the result of inadequate bonding between pours of concrete forming a cold joint. While the surface of the concrete is spalling in isolated areas, there has not been a significant loss of material.

Physical evidence to the west of the waste weir, including a shifted manhole cover and an accumulation of leaves and debris, suggests that the culvert is underdesigned. The towpath directly above the culvert shows signs of settlement and ponding, indicating that the crown may be damaged and material is being washed into the pipe. An exposed 6 inch gas line which crosses the basin



View from north.

is no longer utilized, but is maintained as an emergency supply line.

The Summary of Findings contained within EDG's report rate the structural condition of the culvert as fair. The waste weir was not investigated. Based on existing conditions, the structure does not require replacement and can be return to a state of full utility through repair.

FLOOD GATE

Station 613+00



View from northwest.

This flood gate, located immediately south of Lock 37, is among the many waste structures constructed during the 1905-1909 improvement of the northern division. There is no documentation which indicates that a waste structure existed at this location prior to that time. Documented improvements, subsequent to the abandonment of the canal as a waterway, include an extension of the discharge apron, drawing prepared in November of 1949, and replacement of the four wooden gates, drawing prepared in October of 1960.

PHYSICAL DESCRIPTION

The flood gate consists of a concrete sluice with four wooden gates each individually controlled by a rack and pinion operator. The sluice serves as abutments for a wooden bridge which provides continuity of the towpath over the channel.

Site Plan. Silliman Survey c.1912.

The upper portion of the sluice is comprised of a concrete flat slab and parallel side walls which decrease in height towards the discharge. The lower extension of the discharge apron, constructed of reinforced poured concrete, slopes downward generally conforming with the topography of the adjacent earthen hillside; the side walls splay outward and terminate in wing walls which are parallel to the flood gates. Excess water is directed by a waste way into the Cuyahoga River.

The gates are constructed of horizontal boards secured by vertical wood slats. The centrally located vertical member extends upward forming a stem on which a stationary gear rack is mounted. Rotating gear pinions, mounted approximately level with the towpath bridge, move the gates up or down within the associated wood framework. Horizontal boards, placed above the gates in their closed position, act as stop logs to prevent the flow of water through the sluice. The towpath bridge is supported by steel stringers laid unattached on the concrete abutments. The deck is comprised of treated random width boards.

EXISTING CONDITIONS

The concrete sluice is exhibiting signs of deterioration. Significant cracking exists within the portions that serve as abutments for the bridge. This cracking is most severe on the south abutment which is currently braced by a wood board attached to the framework of the south gate. The location and pattern indicate that these crack are the result of inadequate bonding between pours of concrete forming a cold joint. The remainder of the sluice appears structurally stable. Visual indications of deterioration are limited to surface-related concerns such as isolated areas of spalling and superficial cracking. Erosion and disintegration of surface concrete caused by physical abrasion is limited to those areas subjected to flowing canal water and is most apparent at the natural water line.

The gates and associated framework, as with all wood elements, are prone to deterioration and are exhibiting signs of decay. The towpath bridge, although in relatively good condition, is restricted in its load rating due to the lack of lateral bracing on the stringer.

The Summary of Findings contained within EDG's report rate the structural condition of the flood gate as fair. Based on existing conditions, the structure does not require replacement and can be return to a state of full utility through repair.

WASTE WEIR

Station 636+10



View from south.

This waste weir is located to the south Lock 37. The structure is situated immediately south of the Sagamore Creek Culvert and it appears that the weir is integral to the function of the culvert. During flood conditions, the flow of Sagamore Creek exceeds the capacity of the culvert and water flows over Canal Road into the canal prism. This weir provides an area where this excess water can escape the canal without causing damage to the canal berm.

There is no documentation which suggests that a weir existed at this location prior to the construction of the existing culvert in 1913. It is presumed that the weir was constructed sometime shortly after 1913, likely following a devastating flood.

PHYSICAL DESCRIPTION

The waste weir is consists of a section of the towpath berm which is reduced in height and protected by a covering of concrete. For approximately 85 feet, the towpath is

Site Plan. Silliman Survey c.1912.

set at a lower elevation and is surfaced with a concrete slab. This lower area of the towpath is introduced at both ends by a concrete ramp flanked by low concrete walls with chamfered edges. The slab slopes down to the west generally conforming to the topography of the berm forming a discharge apron. Excess water is directed into a basin at the foot of the weir which is contiguous with the downstream channel of Sagamore Creek.

EXISTING CONDITIONS

The concrete of the weir is generally in good condition. There are several cracks which extend the full length of the sloped portion. The entire structure, however, has been lifted; this displacement is the result of freeze-thaw cycles. When water in the canal approaches the crest of the weir, water flows through the cracks. During periods when water in the canal is lower, water flows beneath the bottom edge of the sloped weir slab. These conditions indicate that the west bank of the canal is breached in this area.

The basin at the foot of the weir has been significantly reduced in area by sediment. Sizeable trees are present in what used to be the basin, indicating that the condition have existed for considerable time. In addition, the alignment of Sagamore Creek has also been altered and now flows along the foot of the weir undercutting the base of the structure.

The Summary of Findings contained within EDG's report did not rate the structural condition of the waste weir. Based on existing conditions, the structure is in fair condition and does not require replacement, but can be return to a state of full utility through repair.



View from southwest.

FLOOD GATE AND WASTE WEIR

Station 638+20



View from southwest.

This combination flood gate and waste weir is located between Locks 37 and 36. The existing waste structure was constructed in 1905 during the improvement of the northern division. This concrete structure replaced an earlier 'waste way with flat bridge' shown in the 1892 Survey. There is no documentation which indicates that a flood gate existed at this location prior to 1905.

PHYSICAL DESCRIPTION

The structure is comprised of two integrated components, a flood gate to the south and a waste weir to the north. A wooden bridge extends across both components providing continuity of the towpath.

The flood gate consists of a concrete sluice with four wooden gates each individually controlled by a rack and pinion operator. This structure is virtually identical to the flood gate at Station 613+00. The waste weir

Site Plan. Silliman Survey c.1912.

consists of a concrete wall which extends from the north sidewall of the flood gate terminating at a concrete wingwall approximately 20 feet to the north and is segmented by a centrally located pier. This wall, located in line with west berm and equal in height to the natural water line of the canal, regulates the level of water within the prism. Excess water is directed by a waste way into Sagamore Creek just upstream of the confluence of the creek and the Cuyahoga River.

The towpath bridge consists of steel stringers and beams supported by the side walls of the sluice and the pier and wingwall of the waste weir. The deck is comprised of treated random width boards.

EXISTING CONDITIONS

The over all condition of the concrete is poor. Erosion and disintegration of concrete caused by physical abrasion and weathering is prevalent. In severely affected areas, the damage ranges from 4 to 9 inches in depth and has resulted in a significant loss of concrete.

Adjacent to the wooden gates, the concrete has completely eroded. Horizontal cracking exists on both sidewalls of the sluice; while the cracks vary in severity, the location and pattern indicates that the cracks are the result of inadequate bonding between pours of concrete forming a cold joint. The most severe crack extends completely through the cross section of the northern sidewall, which is currently held in place by gravity.

The gates and associated framework, as with all wood elements, are prone to deterioration and are exhibiting signs of decay. The towpath bridge, although in relatively good condition, is restricted in its load rating due to the lack of lateral bracing on the stringers and the bearing capacity of the concrete supports.

The Summary of Findings contained within EDG's report rate the structural condition as poor. Based on existing conditions, however, the structure does not require replacement and can be return to a state of full utility through repair.



View from west.

RECOMMENDED TREATMENT

The level of treatment recommended for all of the waste structures is preservation; as these structures are not identified on the current List of Classified Structures, this recommendation is not in conflict with any previously proposed treatment. The historical significance and integrity, as well as the existing conditions, dictate that these waste structures be preserved.

There have been no major alterations to any of these structure since their construction during the early 20th Century. While limited changes have occurred, such as the extension of the discharge apron on the flood gate at station 613+00, the alterations are minor and do not have an adverse impact on the qualities for which the canal is significant. Preservation will permit the retention of such features, which not only convey a desirable sense of evolution but are typically required for efficient operations, and minimize the removal of existing fabric.

As outlined in the Existing Conditions, the waste weirs and flood gates are deteriorated but can be returned to a state of utility through repair. The overall character and form of the structures is to be preserved, however, discrete rehabilitation of specific elements is required to improve the utility and function of these structures. The results will not only extend the life of the structures, but will enhance their presently limited ability to function as control structures which provide protection to the balance of the waterway and their currently restricted capacity to provide continuity of the towpath.

The remainder of this section briefly discusses preservation concepts as they apply to the waste structures.

Concrete

Concrete stabilization is required to reestablish the structural integrity and to arrest further deterioration of these structures. This work is generally limited to the repair of cracks and spalls, however, in isolated cases complete replacement of specific elements may be required. All deteriorated or damaged concrete should be removed back to relatively sound material and the affected areas patched. If reinforcing is exposed during concrete removal, the steel should be cleaned or replaced if necessary. In general, all repairs should match the form, texture and color of the original fabric. Routine maintenance should include removal of vegetation which may be deleterious to the concrete.

In addition to concrete repairs, the waste weir at station 636+10 will require stabilization of the adjacent canal bank to curtail water flow beneath and through the structure. The source of the water can be determined by performing additional investigation, such as successive dye-testing, thereby reducing the extent of bank stabilization required.

Gates and Mechanisms

The wooden gates and associated control mechanisms, at each of the flood gates, require repair or replacement. The existing fabric is not original. No information is available regarding that installed during the initial construction of these specific flood gates. Study of detailed drawings available for similar structures built during the same period, however, reveals that the existing gates resemble historic

gates. The existing control mechanisms, which are evidence of the period when the canal was used solely for industrial purposes, are consistent with the utilitarian nature of these waste structures. In general, the existing elements are compatible in both design and material with the structures' overall appearance and do not detract from the historic character of the corridor. As with all unprotected operable elements, these features will require aggressive routine maintenance. The gates, like all wood elements, will require periodic replacement. New material should match the form, texture and color of the existing fabric, however, care should be taken to eliminate deficiencies of design and material.

Provisions for Water Flow

Improvements are required to ensure that the structures will function at their full capacity during flood conditions. The waste ways should be cleared of vegetation, including brush and second growth timber, and debris. Stone protection should be installed at areas of high scour such as at the point of discharge and at abutments within the canal prism. Additional erosion control measures may be required in areas adjacent to the structures.

The waste weir at station 636+10 requires more extensive intervention. The basin at the foot of the weir should be reestablished and lined with stone protection. To eliminate the present undermining of the base, the downstream channel of Sagamore Creek must be excavated to direct water away from the waste weir.

The culvert which has replaced the waste way of the weir at station 460+75 requires additional improvements. The metal segment, at the inlet, is apparently underdesigned. The capacity of the concrete segment, at the outlet, should be calculated to determine the appropriate size of the inlet pipe. Installation of a new inlet should include the construction of a headwall to eliminate the potential erosion of adjacent land. At the outlet, a headwall should be constructed and stone protection or gabions installed to stabilize the culvert and prevent scour. In the interim, precautions should be taken to restrict individuals from exploring the culvert.

Codes and Regulations

To provide for use of the towpath as a multi-purpose trail, modifications are required to comply with applicable codes and regulations. Components which provide continuity of the towpath, such as bridges, must be carefully reviewed; use requirements of both visitors and service vehicles must be taken into consideration.

Bridges should be supplemented or replaced to provide systems that are capable of supporting the desired loading. The existing decking, however, should be reinstalled or replaced with similar fabric, thereby virtually eliminating the visual impact of such modifications.

Improvements to specific features are also required to achieve compliance with regulations such as handicapped accessibility guidelines including edge protection and maximum slope requirements. The most extensive intervention, in this regard, is likely to occur at the waste weir at station 636+10 where the approach ramps exceed the allowable maximum slope. New elements, where necessary, should be compatible with the structures' appearance and the overall character of the corridor, yet distinguishable from historic fabric upon close inspection. Design

precedence for these type of improvements can be found by examining details of the existing structures. Where practical, similar situations should be treated in a consistent manner.

Further Study

Recommendations for further study include an thorough inspection and structural analysis of the waste weir at station 460+75. The assessment should address the structure's capacity to function as a waste structure and as a towpath bridge. This information should be used in determining the feasibility of redirecting the towpath to its original alignment over the concrete deck. In the interim, precautions should be taken to prevent public access of the bridge.

4. CULVERTS

Culverts were constructed to carry small streams beneath the canal waterway and towpath. The watered portion of the canal, within what is now the recreation area, features three culverts.

Similarities dictate that information presented under the headings Physical History and Recommended Treatment address the culverts as a group. Physical Description and Existing Conditions, however, are presented for each individual structure.

PHYSICAL HISTORY

While the original contract specifications for the canal addressed in detail primary canal components such as locks, no data was provided on the construction of secondary structures such as culverts. These structures were handled on a case-by-case basis and were generally handwritten into contracts by an acting commissioner or state engineer. Based on the original contracts, a list has been compiled of all component structures built between 1825-1827 within what is now the recreation area; while this list includes numerous culverts, the specific location of these structures are not identified nor are construction methods and materials.

A report filed in 1833 was the first document to discuss component structures on the canal in a comprehensive manner. Detailed specifications provide a record of the methods and materials used in the construction of culverts between 1825-1833. Arch culverts were formed of stone, cut in regular segments and laid in range work, with wingwalls and parapet walls of cut stone; the masonry was erected on a floor of hewn timbers secured by sheet piling at both the head and the foot. Box culverts, constructed of broad pieces of timber, served as land drains or carried small springs under the canal; in general, apertures ranged from 8 to 16 inches square and placement was restricted to where the culvert would always be under water so as to reduce the possibility of premature decay.

Throughout the operational period of the canal, extremely limited information was recorded regarding culverts. While periodic repairs to culverts were noted, in general there was no indication as to the extent of the repairs or the location of the structures. One exception being in 1846 when cast iron arches were installed in culverts whose stone arches had deteriorated.

The first known document which records the location of culverts is a set of survey maps prepared in 1892; these maps contain a brief note regarding the character of each culvert. A later set of maps which documents a survey performed by G. Silliman, c.1912, reflect conditions after the 1905-1909 improvement of the northern division of the canal. During these improvements, it appears that the majority of culverts within the northern division were replaced. Documentation suggests that the new structures were box culverts constructed of concrete reinforced with steel rods.

Along the presently watered portion of the canal within what is now the recreation area, the Silliman Survey identifies three culverts; there is currently a culvert at each of these locations. After the abandonment of the canal as a waterway in 1913, these culverts continued to be maintained since they also carried the streams beneath Canal Road located immediately east of the canal prism. These culverts are presently included on the Cuyahoga County Bridge and Culvert Inventory and, each being over 10 feet in width, receive periodic inspections. Since the identification of the canal as a significant historic and cultural resource and the establishment of the recreation area, these culverts now play an important role in ensuring the continuity of the waterway and the towpath.

In 1991, the National Park Service entered into a contract with Environmental Design Group (EDG), a multi-discipline architectural/engineering firm, to perform an inspection and analysis of

various structures along the watered portion of the canal within the recreation area; the three culverts were among the structures investigated. The purpose of this study was to provide an evaluation of the structural integrity based on available drawings and documents, supplemented with physical data obtained by visual inspection and physical measurements. In summary, their report concludes that the condition of the culverts range from fair to poor.

CULVERT

Station 504+88

This double box concrete culvert is also located between Locks 39 and 38, and carries a small stream beneath Canal Road and the canal prism. The north box was constructed in 1908 during the improvement of the northern division and is shown as 'Box Culvert 2X6' on the Silliman Survey. There is no documentation that a structure existed at this location prior to that date. The structure was modified in 1929 with the addition of second box immediately to the south. At an unknown date, the north box was closed with concrete.

PHYSICAL DESCRIPTION

The culvert is built of reinforced poured concrete. An interior wall, which begins about 14 feet from the inlet and extends to the outlet, divides the culvert into two boxes. A concrete headwall with a single wing, located at the inlet just east of Canal Road, is protected by a guardrail. The outlet consists of a

Site Plan. Silliman Survey c.1912.

concrete headwall with two wingwalls, which forms a discharge apron. Water discharged from the culvert flows directly into the Cuyahoga River.

EXISTING CONDITIONS

The north box of the culvert has been closed with concrete beneath the canal prism and the portion under the road is filled with earth. Water is forced to flow into the inlet of the south box. While the floor has a build-up of silt, the flow through the south box is steady and appears to equal the flow of the stream. At the discharge, the Cuyahoga River is approximately 6 to 7 feet in depth and is undermining the apron by about 4 feet.

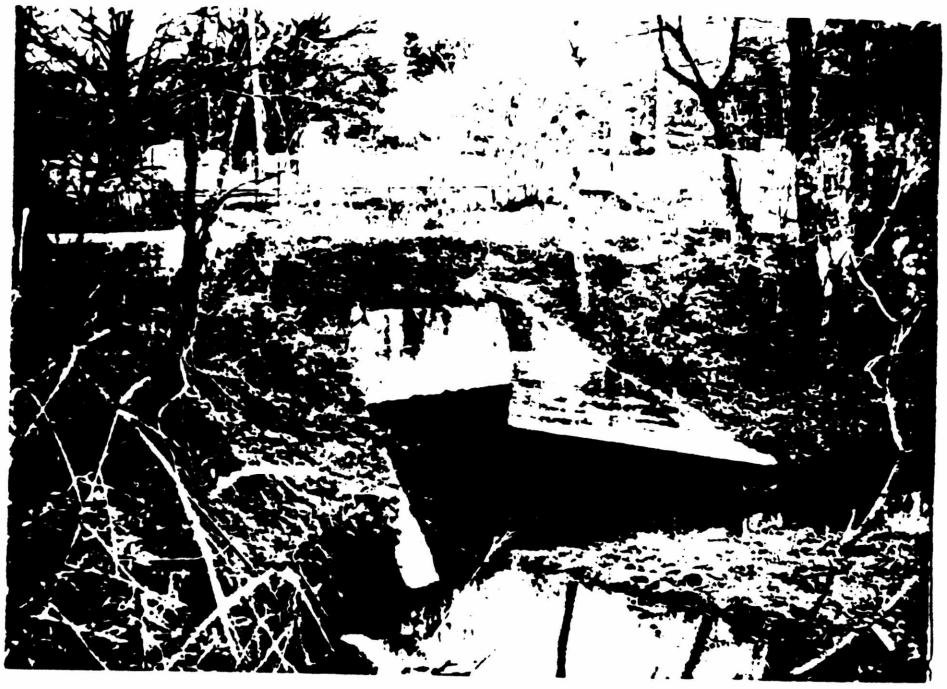
The condition of the concrete varies within the structure. The ceiling of the north box, near the outlet, features a spalled area through which water is leaking. The south box is in fair condition; in general, there are a few cracks through which water is leaking and some minor honeycomb spalling. At the floor, erosion of surface concrete is apparent and there are a few spalled holes which extend 3 to 4 inches below the level of the floor. The east headwall has some minor spalling which has exposed the reinforcing bars.

The Summary of Findings contained within EDG's report rates the structural condition of the culvert as fair. Based on existing conditions, the north box requires replacement, while the south box may only require repair.

CULVERT

Sagamore Creek Culvert

Station 636+00



View of headwall at outlet.

This concrete box culvert, located between Locks 37 and 36, carries Sagamore Creek beneath Canal Road and the canal prism. According to Cuyahoga County records, the existing structure was constructed in December of 1913, after the abandonment of the canal as a navigable waterway. A '5X9 stone arch culvert,' likely built during the original construction of the canal between 1825-1827, is shown at this location on both the 1892 Survey and the later Silliman Survey. This confirms that, unlike the majority of culverts, this arch culvert was not replaced during the 1905-1909 improvement of the northern division. An associated waste weir, located immediately to the south, is discussed in the section entitled Waste Structures.

Site Plan. Silliman Survey c.1912.

PHYSICAL DESCRIPTION

This box culvert, constructed of reinforced poured concrete, was designed with a single 12 foot by 7 1/2 foot opening. The structure follows the natural southwest flow of the creek beneath Canal Road and then turns to the west running perpendicular to the canal prism above. A large concrete head wall is located at the inlet to the east side of Canal Road. On the west bank of the canal towpath, the culvert terminates in wing walls which splay outward. The downstream channel of the creek flows into the Cuyahoga River.

It appears that the culvert was originally underdesigned and the headwall and Canal Road were to act as a broad-crested weir. During flood conditions, the flow of Sagamore Creek exceeds the capacity of the culvert; the creek flows over the roadway and enters the canal. The waste weir, located immediately to the south, was constructed to provide an area where this water could escape the canal without damaging sections of the berm.

EXISTING CONDITIONS

The current alignment of Sagamore Creek upstream of the culvert is poor. Rock and sediment build-up, approximately 2 to 3 feet in height, has forced the channel to the north. The creek now flows into the northern portion of the headwall and runs along the headwall until it enters the culvert. This alignment has resulted in undermining of the inlet structure. Flow through the culvert is severely restricted by sediment; the opening at the outlet has been reduced to 18 inches in height. As with the creek upstream, the discharge channel has also been realigned. The creek, which once flowed westward away from canal, now flows along the berm for a distance undercutting the outlet structure as well as the waste weir to the south. Sizable trees are present in what used to be the discharge channel, indicating that the current alignment has existed for a considerable amount of time.

The condition of the concrete culvert is poor; visual indications of deterioration include significant areas of spalling and substantial leaking. Most notable is a large spall in the ceiling, approximately 130 square feet and up to 6 inches in depth, which extends across the entire width from sidewall to sidewall. A leak in the ceiling, located at the north wall west of the turn in the culvert, appears to be from the canal due to its location and steady flow.

The Summary of Findings contained within EDG's report rates the structural condition of the culvert as poor. Based on existing conditions, replacement of the box culvert is required.

RECOMMENDED TREATMENT

The level of treatment recommended for all of the culverts is rehabilitation; as these structures are not currently identified on the List of Classified Structures, this recommendation is not in conflict with any previously proposed treatment. As outlined in the Existing Conditions, the culvert boxes are severely deteriorated and require replacement. The only possible exception is the south box of the culvert at Station 504+88 which may only require repair; this, however, may be problematic in that the structure is integral with that of the severely deteriorated north box.

Due to the present condition of the culverts, preservation of the existing fabric is not feasible. The extent and depth of spalled areas have resulted in a significant loss of concrete within the ceiling systems, creating unstable structures. Preservation activities, such as cleaning and repair, are not recommended even as an interim measure; the ultimate failure and collapse of the culverts, as well as breaching of the canal, are primary concerns.

While continuity of the canal waterway and towpath is critical to the mission of the park, the culverts do not play a primary role in the park's interpretive program. The installation of new structures would not impair an appreciation of the significance of the canal. The culverts should, therefore, be replaced using contemporary construction methods and materials.

During the almost 100 years since these culverts were originally designed, significant development has occurred in drainage areas and various water courses have changed. A hydraulic analysis of each water shed should be performed to ensure that the new structures are appropriately sized. All construction methods and materials should be evaluated for strength and life-expectancy to ensure an extended life span for the structures and to reduce future maintenance costs. Since these structures are under the jurisdiction of local governments, careful coordination with these agencies will be required.

Features which contribute to the value of the culverts' appearance and scale are limited to visible inlet and outlet structures. While these elements should be contemporary in both appearance and feel, architectural compatibility with other canal structures and the overall character of the corridor should be given consideration. Materials and massing of these elements should be reviewed for their appropriateness.

In the interim, certain steps should be taken to utilize the full capacity of the existing culverts. Both upstream and downstream channels should be cleared of vegetation and debris; stone protection or gabions should be installed at areas of high scour. More extensive intervention is required at the Sagamore Creek Culvert, at Station 636+00, where the channels should be excavated to allow a straight and uniform inflow and outflow. As the effected portions of these streams flow through land not under Federal ownership, coordination with adjacent landowners will be required.

PART II:
UNWATERED PORTION OF THE CANAL

1. LOCKS

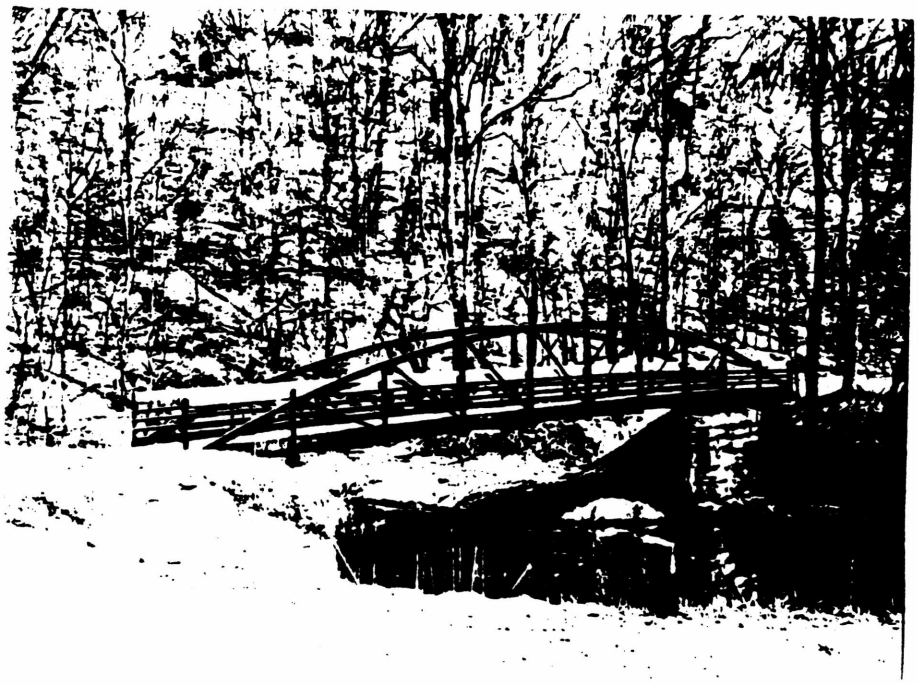
Locks 36 through 24, inclusive, are located along the presently unwatered section of the canal within what is now the recreation area. As with the locks located along the watered portion, these structures are typical of locks built along the Ohio and Erie Canal. Situated in line with the canal prism, each lock provides a lift ranging from 8 feet to 12 feet. North of Peninsula, the towpath extended along the west side of the waterway and spillways were located to the east. At Peninsula, the canal crossed the Cuyahoga River and from there south, the towpath extended along the east side and spillways were located to the west.

With the exception of Lock 29, information under the headings of Physical History and Physical Description parallels that presented for the locks in Part I. Since the abandonment of the canal, modern development has impacted only a few of the locks; the majority remain unaltered, affected only by the inherent process of deterioration. Information regarding Existing Conditions is presented for each individual structure. Recommended Treatment, located at the end of Part II, addresses all structures along the unwatered portion of the canal.

LOCK 36

Pinery Lock
17 Mile Lock

Station 763+43



View from southwest.

Lock 36, located less than 1/4 north of Station Road, is situated immediately south of where the watered portion of the canal begins. The feeder, which passes water from the Cuyahoga River to the canal, is situated to the east and runs approximately parallel with the lock.

The lock chamber has been filled, reportedly during the 1930s construction of the High Level State Route 82 Bridge which is located to the south. Exposed areas are limited to the northwest wingwall and a portion of the top surface of the west lock wall. Presumably, the balance of the structure, as well as the tumble, remains intact below grade. Access is limited to that from the towpath and visibility is extremely restricted due to the amount of exposed material. The towpath has been significantly realigned in this area. Recent improvements at this location include the installation of a bridge by the Park Service to provide for

Site Plan. Silliman Survey c.1912.

continuity of the towpath over the feeder. The east abutment was constructed within the chamber, however, the lock structure was not disturbed.

Immediately west of the feeder, opposite Lock 36, the remains of a concrete wall are visible. While not confirmed by available documentation, this wall is likely a component of the historic towpath bridge once located across the discharge of the feeder. The west abutment of the new bridge was constructed immediately adjacent to this area, however, the concrete wall was not disturbed.

EXISTING CONDITIONS

The northwest wingwall is entirely exposed. The concrete surface of the north face is in relatively good condition. Visual indications of deterioration are limited to surface-related concerns such as horizontal cracking, spalling and efflorescence.

The back south face of the wingwall, however, is also exposed. This face consists of sandstone rubble with weak mortar and was not designed to resist weathering. Joint deterioration is prevalent and the encroachment of vegetation is relatively severe.

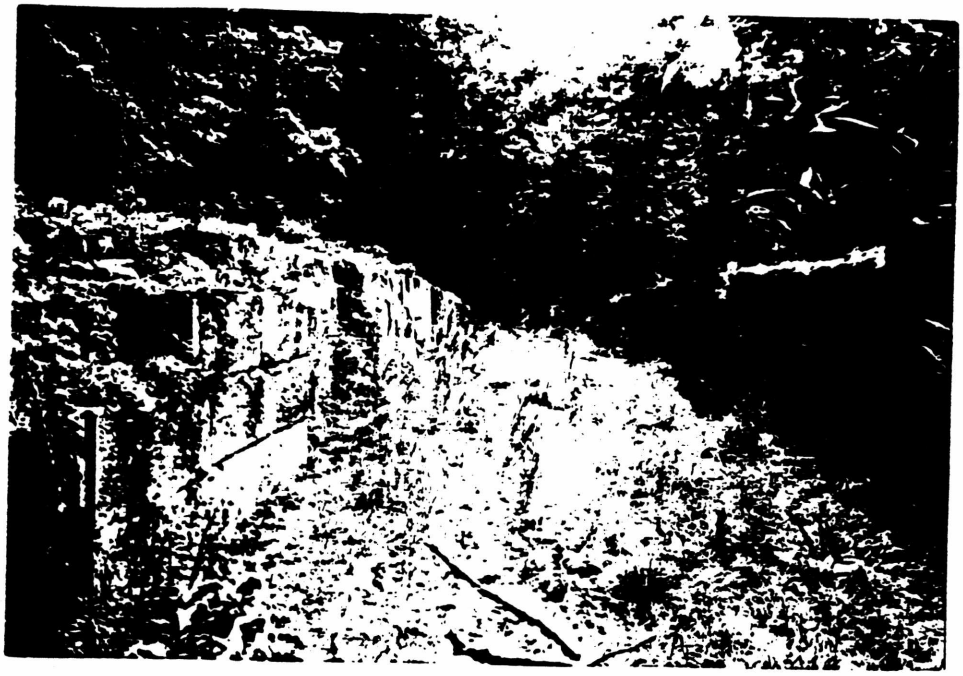


View from southeast. Concrete wall in background.

LOCK 35

Kettlewell Lock
Kitlewell Lock
Whiskey Lock

Station 812+30



View from north.

Lock 35 is located approximately 3/4 mile south of Station Road. Access and visibility are limited to that from the towpath. There have been no improvements at this location other than the development of the towpath as a multi-purpose trail.

EXISTING CONDITIONS

The concrete face is in poor condition. Although random areas of the finish surface remain, the majority of this fabric has delaminated from the inner concrete. The balance of the surface is spalled; vertical cracks and subsequent erosion are apparent. Complete deterioration of the concrete has resulted in exposure of the rough sandstone back-up at the northwest wingwall and the east wall of the lower gate chamber. The exposed back-up at the east is undermined. Due to the build-up of organic material within the lock chamber, the breast wall is not visible.

Site Plan. Silliman Survey c.1912.

The southwest wingwall has a severe vertical crack indicative of movement. The northeast wingwall is constructed of masonry and the joints are open with mortar deeply eroded.

A portion of the lock culvert inlet is discernable and a metal sleeve protrudes above the top surface of the lock wall. With the exception of the northeast, metal pins are visible at locations where a gate was secured to the lock wall. An indentation of the goose neck is apparent at both south locations; a portion of the goose neck anchor strap remains at the southeast.

Erosion of adjacent soil has resulted in exposure of the back face of both south wingwalls and a small portion of the west chamber wall. The majority of exposed material is concrete. The encroachment of vegetation is generally limited to areas where deterioration has created a ledge and the top surface of the lock walls. Trees adjacent to the walls outside of the chamber have been removed.



Vertical crack - movement.



Southeast wingwall. Back face exposed.

LOCK 34

Red Lock

Station 906+16



View from north.

Lock 34 is located immediately to the north of Highland Road and is visible from this roadway. Access is readily obtained from a trailhead to the east. Improvements at this location are limited to the development of the towpath trail as a multi-purpose trail.

EXISTING CONDITIONS

The concrete face is in poor condition. While isolated areas of the finish surface remain, without exception this fabric has delaminated from the inner concrete. The balance of the surface is spalled. Vertical and horizontal cracking are apparent. Complete deterioration of the concrete face has resulted in numerous areas of exposed rough sandstone back-up, but is most severe at the south wingwalls. The masonry breast wall is visible and joints are open with mortar deeply eroded. Although severely deteriorated, the steel channel remains on the concrete miter sill.

Site Plan. Silliman Survey c.1912.

There are no wingwalls to the north; these were likely removed during improvements to Highland Road which once ran immediately north of the lock. While concrete wingwalls remain to the south, significant vertical cracks indicative of movement have developed.

The lock culvert inlet is visible and a metal sleeve protrudes from the top surface of the lock wall. Indentations which received the ends of bumping beams are apparent. Metal pins protrude above the top surface of the lock walls where the upper gate was secured to the lock.

Erosion of adjacent soil has resulted in a significant exposure of the back face of the east wall. Large areas of sandstone back-up are exposed along the northern portion. The encroachment of vegetation is most severe at the southern portion of the lock. The vertical crack in the wingwalls and areas of exposed sandstone back-up are supporting the growth of vines and other vegetation with invasive root systems. Stumps remain, both within the chamber and immediately adjacent to the lock walls, where trees have recently been removed.

The tumble, located to the south of Highland Road, is in extremely poor condition. The concrete sections which remain standing are severely deteriorated.



Miter sill with steel channel.

LOCK 33

Wallace Lock
Lost Lock

Station 958+28



View from north.

Lock 33 is located between Highland and Boston Mills Roads, situated almost midway between these roadways. Access and visibility are limited to that from the towpath. There have been no improvements at this location other than the development of the towpath as a multi-purpose trail.

EXISTING CONDITIONS

The concrete face is in extremely poor condition. Deterioration has resulted in a significant loss of historic fabric. While small isolated patches of the finish surface remain, generally along the top of the walls, without exception this fabric is delaminated from the inner concrete. The balance of the surface is spalled, and large areas of the rough sandstone back-up have been exposed by the complete degradation of the concrete face.

Site Plan. Silliman Survey c.1912.

There are areas of severe deterioration where virtually all fabric is missing and only a limited amount of rubble remains. Missing elements include the following: the entire wingwall and a portion of the gate chamber at the northeast, and a section of the west wall which encompasses portions of the wingwall and the lower gate chamber. The entire wingwall, a portion of the gate chamber, and the tumble at the southeast are also likely missing, although some remaining fabric may be obscured by dense vegetation. In all instances, the adjacent walls are undermined by the loss of lower fabric. There is a significant build-up of earth and organic material within the chamber, the breast wall is not visible.

The segment of the northwest wingwall which remains is in poor condition; virtually all of the concrete face is missing, erosion of adjacent soil has exposed the back face of the rubble back-up, and the remaining fabric is undermined. Erosion of adjacent soil has also exposed the concrete back face of the southwest wingwall.

The encroachment of vegetation is severe. The deteriorated top surface of walls are supporting the growth of grass. Vines and other vegetation with invasive root systems are prevalent, especially where the rubble back-up is exposed. A tree and numerous large shrubs are growing within the lock chamber.



Exposed sandstone back-up.

LOCK 32

Boston Lock

Station 997+60



View from south.

Lock 32 is located just north of Boston Mills Road, within the once thriving community of Boston. Access and visibility are limited to that from the towpath. Improvements at this location, other than the development of the towpath, include the installation of a wooden bridge across the lock above the lower gate chamber.

EXISTING CONDITIONS

The concrete face is in poor condition. Large areas have spalled and, in some cases, a limited portion of the rough sandstone back-up is exposed. While areas of the finish surface remain, generally at the wingwalls, some of this fabric is delaminated from the inner concrete. The masonry breast wall and one to two courses of the lower masonry are visible. Joints are open with mortar deeply eroded. Areas of the stonework have been improperly repointed; mortar extends far beyond the limits of the joints.

Site Plan. Silliman Survey c.1912.

There are significant vertical cracks indicative of movement at the southern wingwalls and erosion of adjacent soil has exposed the concrete back face of the southwest wingwall. A small area of the northeast wingwall is undermined.

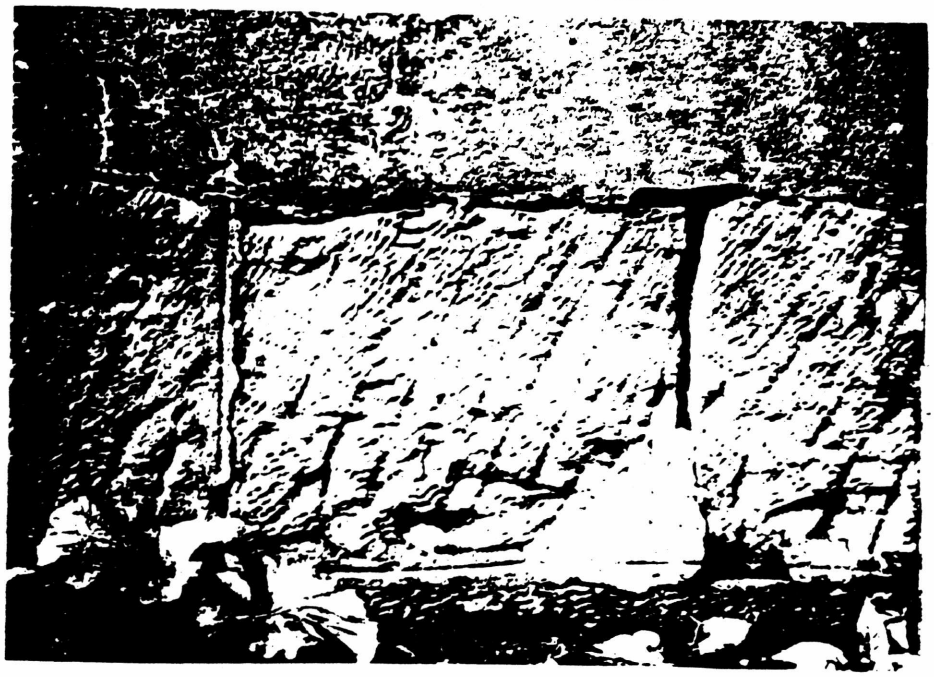
The lock culvert inlet is discernable and a metal sleeve penetrates the top of the lock wall. On the southeast wall, an indentation which received the end of a bumping beam is visible. Metal pins protrude above the top surface of the lock wall where the upstream east gate was secured to the lock.

The encroachment of vegetation is most severe at the masonry breast wall and the deteriorated top surface of the walls. Random clusters of plants have taken hold in areas where deterioration has created a ledge.

A tumble of standard construction is located to the east. The concrete is in fair condition. Deterioration is limited to surface-related concerns.



Vertical crack - movement.



Chamber wall - concrete/masonry transition line.

LOCK 31

Lonesome Lock

Station 1069+76



View from north.

Lock 31 is located between Boston Mills Road and State Route 303, situated almost midway between these roadways. Access and visibility are limited to that from the towpath. There have been no improvements at this location other than the development of the towpath as a multi-purpose trail.

EXISTING CONDITIONS

The concrete is in fair condition. While horizontal cracking, spalling and efflorescence exists, deterioration of the concrete face is has not resulted in exposure of the rough sandstone back-up. There is, however, a significant vertical crack at the west wall within the lower gate chamber. Erosion of adjacent soil has exposed a small area of the rubble back-up along the west lock wall. The masonry breast wall and one course of the lower masonry are visible. Joints are open with mortar deeply eroded.

Site Plan. Silliman Survey c.1912.

The most significant loss of concrete is on the southwest wingwall. The concrete back face of the southeast wingwall is exposed. Both north wingwalls are constructed of masonry and, while joint deterioration is prevalent, these walls appear to be relatively stable.

The lock culvert inlet is discernable and a metal sleeve penetrates the top of the lock wall. A portion of the culvert discharge is also visible. Indentations which received the ends of the bumping beam are apparent. Metal pins protrude from the top surface of the lock wall and an indentation of the goose neck is visible at all four locations where a gate was secured. A segment of the goose neck anchor strap remains at the southeast.

The encroachment of vegetation is rather limited. Moss is prevalent along the deteriorated top surface of the lock walls and a tree is growing within the upper gate chamber immediately adjacent to the breast wall.

Historic data suggests that a tumble was not constructed within the regulating weir of this structure. There is, however, a large pile of sandstone blocks covered with dense vegetation located to the east of the lower portion of the lock chamber.



Lock culvert inlet.

LOCK 30

Feeder Lock

Station 1109+48



View from south.

Lock 30 is located less than 1/2 mile north of State Route 303. The structural components of a feeder are located immediately to the west and the lock figures predominantly in this complex of cultural resources. Access and visibility are limited to that from the towpath. There have been no improvements at this location other than the development of the towpath as a multi-purpose trail.

EXISTING CONDITIONS

The condition of the concrete varies within this structure. In general, the west lock wall is more deteriorated than the east wall. Visual indications of deterioration on the east wall are generally limited to surface-related concerns such as horizontal cracking, vertical cracking, spalling and effloresence; the significant loss of concrete and exposure of the rough sandstone back-up are limited to the wingwalls, both of which are slightly undermined. Virtually all of the

Site Plan. Silliman Survey c.1912.

surface of the concrete face, however, is missing on the west wall and there are numerous large areas where the rough sandstone back-up is exposed. The southwest wingwall has a significant vertical crack indicative of movement and the remaining fabric is severely deteriorated.

While the masonry breast wall is exposed, apparently a thin concrete coating was applied to the courses of masonry at the lower portion of the walls. Joints are open with mortar deeply eroded. The lock culvert inlet is visible and a metal sleeve is flush with the top surface of the wall. Metal pins protrude from the top surface of the lock wall at all four locations where a gate was secured. To the north of the lower gate chamber, the wall features a rectangular indentation perhaps indicative of a bridge across the chamber.

The encroachment of vegetation is not severe and is generally limited to the masonry breast wall and areas where deterioration has created a ledge. A large stump remains on the top surface of the east wall where a mature tree was recently removed.

To the east of the southeast wingwall, remains of the tumble are evident. The tumble, constructed of masonry, is obscured by moss and dense vegetation.



Masonry with concrete coating.

LOCK 29

Peninsula Lock

Station 1125+91

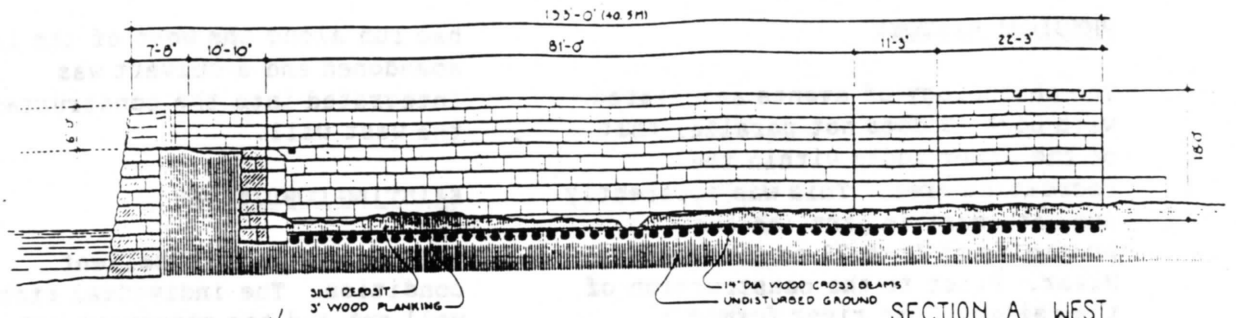


View from north. Prior to improvements.

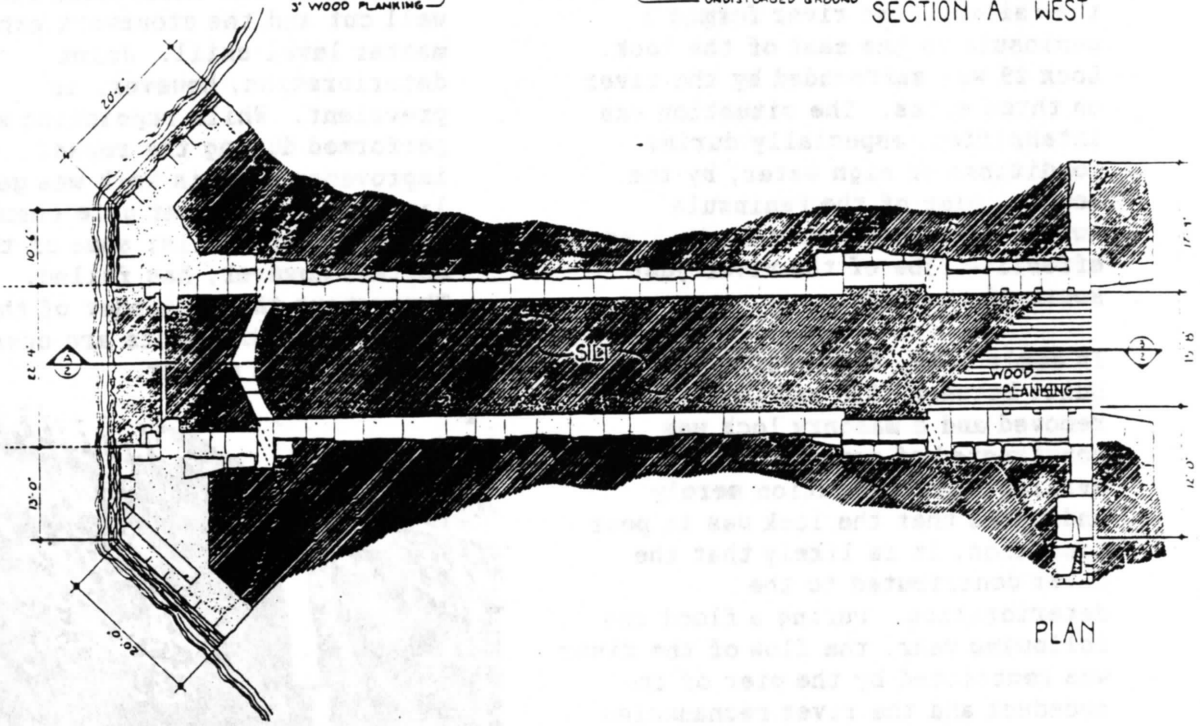
Lock 29 is the only lock within the recreation area constructed entirely of masonry. The lock is located just north of State Route 303 within the community of Peninsula. Situated on the northern bank of the Cuyahoga River, the lock is structurally integral with the northern abutment of the Peninsula Aqueduct which once carried the canal over the river. While visibility is limited to that from towpath, accesses is readily obtained from the adjacent trailhead recently constructed by the Park Service.

Recent improvements at this location, associated with the development of the towpath, are numerous. The towpath extended along the west side of the waterway to the north and along the east to the south, necessitating the installation of a bridge across the lock chamber. Continuity of the towpath also required the installation of a bridge over the Cuyahoga River where the Peninsula Aqueduct once stood. During these improvements, Lock 29 received preservation treatment.

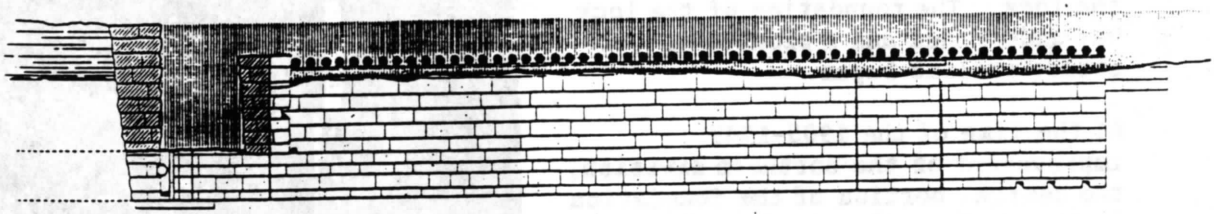
Site Plan. Silliman Survey c.1913.



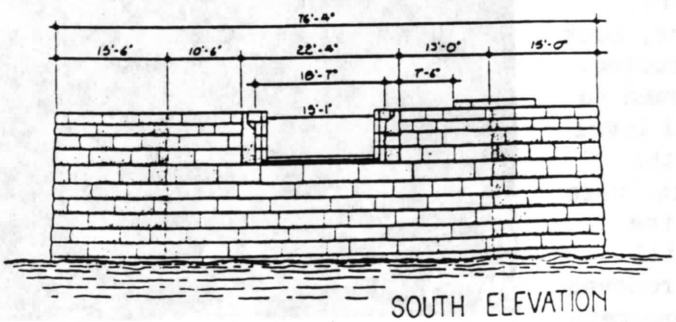
SECTION A WEST



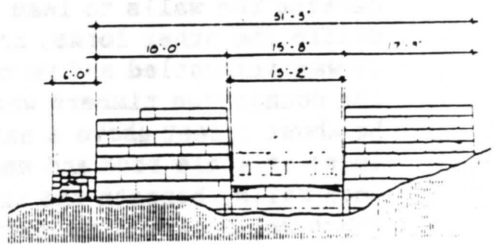
PLAN



SECTION B EAST



SOUTH ELEVATION



NORTH ELEVATION

FEET 1/8"-1'-0"

METERS 1:

DELINEATED BY WILLIAM F. CONWAY 1980

OHIO AND ERIE CANAL

OHIO AND ERIE CANAL LOCK NO. 29 1825-27; RECONSTRUCTED 1905-06

CUYAHOGA RIVER, 400 FEET NORTH OF MAIN STREET (AT 30')

SHEET 2 OF 3

HISTORIC AMERICAN ENGINEERING RECORD

PHYSICAL HISTORY

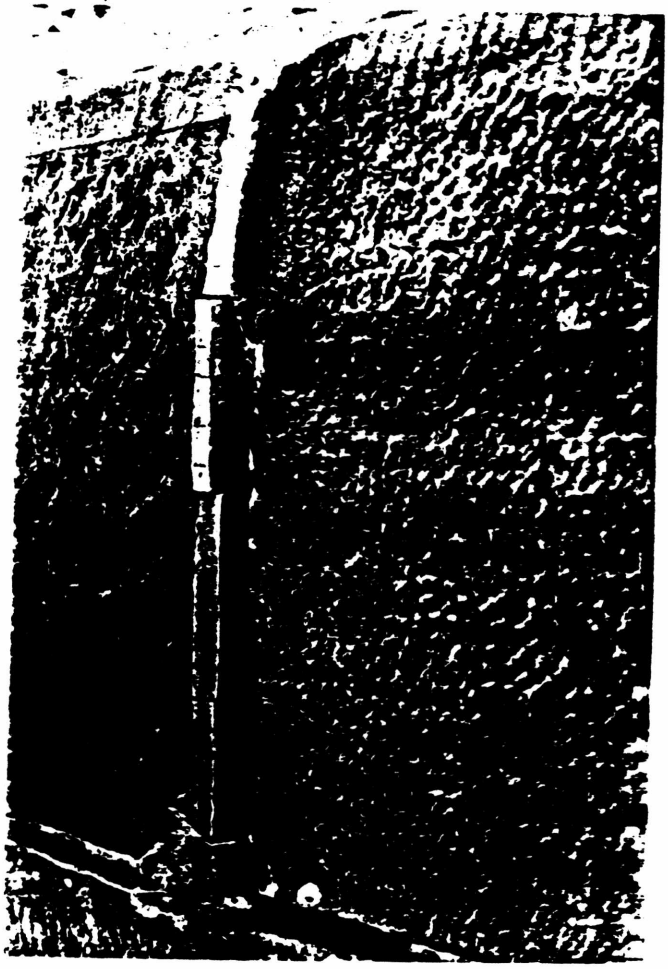
The chronology of events associated with Lock 29 does not parallel that of the other locks within the recreation area. This was apparently due, at least in part, to the proximity of Lock 29 to the Cuyahoga River. Prior to the construction of the railway, the river formed a peninsula to the east of the lock. Lock 29 was surrounded by the river on three sides. The situation was intensified, especially during conditions of high water, by the central pier of the Peninsula Aqueduct which greatly diminished the effective flow of the river just south of the lock.

In early 1882, the original lock, built between 1825 and 1827, was removed and a masonry lock was constructed of new material. While available documentation merely indicates that the lock was in poor condition, it is likely that the river contributed to the deterioration. During a flood the following year, the flow of the river was restricted by the pier of the aqueduct and the river rechanneled itself across the canal just north of the lock. The foundation of the lock was undermined and a process of steady decline began.

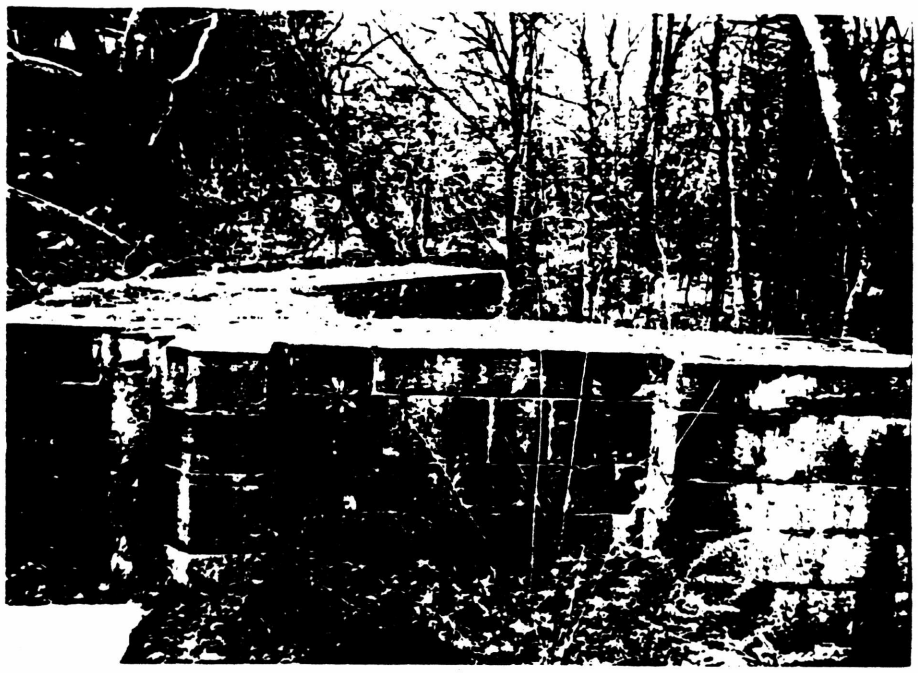
At the time of the 1905-1909 improvement of the northern division, the central portion of the foundation timbers had completely failed, causing the walls to lean inward. Unlike the other locks, however, Lock 29 was dismantled and reconstructed. The foundation timbers were found to be about 5 feet above a natural level sheet of shale rock and under the lock walls, beneath the timbers, were rough walls extending down to the shale. The gravel and earth fill between these lower walls was removed and the area was filled with concrete up to the timbers. A channel which had run along the west of the lock was abandoned and a culvert was integrated into the constructed of the west wall.

EXISTING CONDITIONS

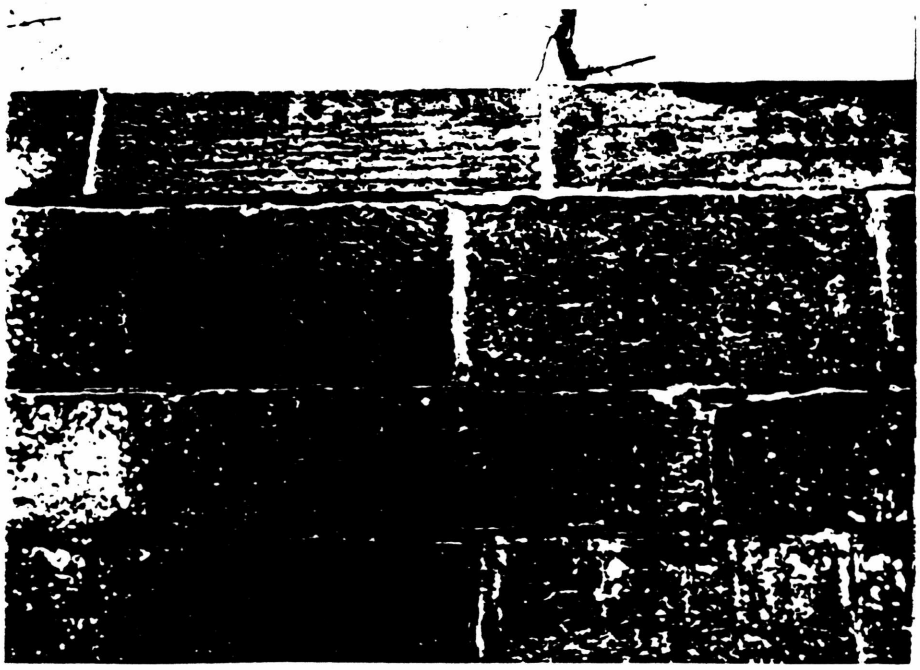
The masonry is in excellent condition. The individual stones are well cut and the stonework exhibits a master level skill. Joint deterioration, however, is prevalent. While repointing was performed during the recent improvements, this work was generally limited to the lower gate chamber and the north wingwalls; some of the new mortar, however, has failed. Throughout the remainder of the lock, a number of the joints are open with deeply eroded mortar.



Failure of recently applied mortar.



Upper gate chamber. Stonework.



Joint deterioration.

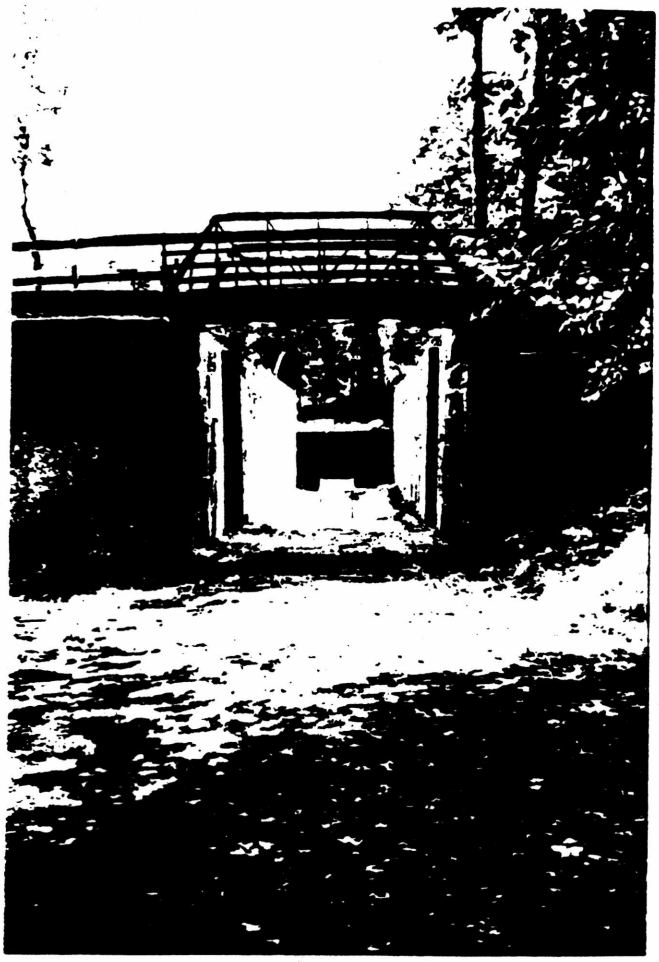


Southwest wingwall. Exposed back face.

The entire structure appears to be stable and there are no indications of movement. The erosion of adjacent soil, however, has resulted in exposure of the back face of the walls. While the earthen embankments were reestablished at certain locations during recent improvements, the rough sandstone back-up is exposed along the west lock wall and the southwest wingwall.

The lock culvert inlet, a circular steel channel, is apparent just above the upper gate recess on the east wall. The masonry housing of the discharge is located adjacent to the northeast wingwall. Just below the lower gate recess, there are notches in the coping stones were the towpath bridge was supported. Indentations which received the ends of bumping beams are apparent. Metal pins protrude above the top of the lock wall and an indentation of the goose neck are visible at all four locations where a gate was secured; the indentation has been filled with concrete at the northeast and northwest. At the lower corners of the gate chambers, there is evidence of the thin coat of grout used to seal behind the hollow quoins; a piece of metal fastener remains at the northeast.

The encroachment of vegetation is limited. Random clusters of plants have taken hold in joints. There is a build-up of organic material and vegetation within the upper gate chamber and on the masonry miter sill. The most severe encroachment is at the lock culvert discharge and the exposed rubble back-up along the west lock wall and the southwest wingwall. A tree within the lock chamber immediately north of the breast wall and several tree outside the chamber adjacent to the lock walls were removed during the recent improvements.



View from north. Recent improvements.



View from south. Recent improvements.

LOCK 28

Deep Lock

Station 1164+04



View from south.

Lock 28, located approximately 1/2 mile south of State Route 303, is situated within a unit of the Metro Parks, Serving Summit County. The lock is visible and accessible not only from the towpath, but also from a system of trails within the Metro Park. Improvements at this location are limited to the development of the towpath as a multi-purpose trail. Maintenance of the lock is presently the responsibility of the Metro Park.

According to documentation regarding the improvement of the northern division, the concrete face applied at Lock 28 was reinforced with horizontal and vertical half-inch iron rods. The upper wingwalls were underpinned with concrete. The northeast wingwall was dismantled and rebuilt, and the top courses and coping of the northwest wingwall were relaid.

Site Plan. Silliman Survey c.1912.

EXISTING CONDITIONS

The concrete face is in fair condition. The finish surface is generally intact within the lock chamber and deterioration is restricted to surface-related concerns. While efflorescence is prevalent, horizontal cracking and crazing are relatively limited. Spalling is most severe at the upper gate chamber and the south wingwalls; although a great deal of the surface has been effected, virtually no rough sandstone back-up has been exposed. The masonry breast wall is visible and the joints are deteriorated. The concrete miter sill with steel channel is in good condition.

There is a significant vertical crack indicative of movement at both south concrete wingwalls. The north wingwalls are constructed of masonry and cylindrical holes, the result of the 1909 reconstruction, are apparent; joint deterioration is most severe at the lower courses. There is limited exposure of the back face at each wingwall due to the erosion of adjacent soil.

The lock culvert inlet has been infilled with wood boards. Metal pins protrude above the top of the lock wall and an indentation of the goose neck is visible at all four locations where a gate was secured. Notches in the coping stones just north of the lower gate chamber are indicative of a bridge across the lock chamber.

The encroachment of vegetation is most severe with joints of the breast wall and the northeast wingwall. Moss is prevalent along the top surface of the walls of the lock chamber and the lower gate chamber.



Breast wall and lock culvert inlet.

The concrete tumble, located to the southwest, is in fair condition. Deterioration is limited to surface-related concerns.

LOCK 27

Johnny Cake Lock

Station 1282+16



View from south.

Lock 27 is located approximately 1/4 mile north of Bolanz Road, situated in the once thriving hamlet of Everett. Visibility and access are limited to that from the towpath. Residential property screens the view from Riverview Road located to the west. Immediately to the east of the towpath are cultivated fields. There have been no improvements at this location other than the development of the towpath as a multi-purpose trail.

According to historic documentation, concrete was installed under the lock in 1901.

EXISTING CONDITIONS

The concrete face is in poor condition. While a significant portion of the finish surface is intact, some of this fabric has delaminated from the inner concrete. Spalling is most severe at the southwest wingwall and random areas on the east lock wall. There has,

Site Plan. Silliman Survey c.1912.

however, been no exposure of the rough sandstone back-up. Efflorescence is prevalent. Horizontal and vertical cracking are apparent. Physical abrasion is limited to areas along the existing water line and is most severe at the northeast wingwall. The masonry breast wall is visible, as is the deteriorated concrete miter sill with steel channel.

The northwest wingwall is constructed of masonry and the joints are open with mortar deeply eroded.

The lock culvert inlet is visible. Metal pins protrude from the top surface of the lock wall where the upper gate was secured to the east wall. The goose neck remains at the northwest and the southwest. Indentations which received the ends of bumping beams are apparent.

Erosion of adjacent soil has exposed limited portions of the back face of the southwest wingwall and the west lock wall. The encroachment of vegetation is most severe at the northwest wingwall. Moss and vines are prevalent along the top surface of all walls. Several trees are growing immediately adjacent to the lock walls outside of the chamber.

The concrete tumble, located to the southwest, is in fair condition. While there is some surface deterioration, marks left by the formwork are still visible. The encroachment of moss and vines is relatively limited.

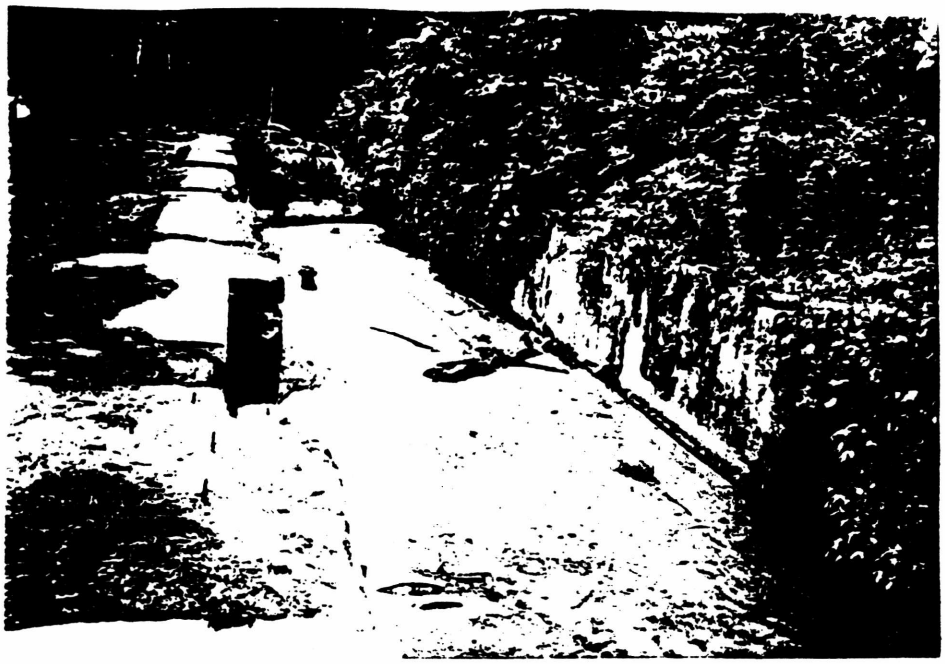


Chamber wall. Vertical & horizontal cracking.

LOCK 26

Pancake Lock

Station 1365+40



View from north.

Lock 26 is located approximately 1/4 mile north of Ira Road. Visibility and access are limited to that from the towpath. A wooden area screens the view from Riverview Road located to the west. There have been no improvements at this location other than the development of the towpath as a multi-purpose trail.

EXISTING CONDITIONS

The condition of the concrete face varies within this structure. In general, the east lock wall is more deteriorated than the west wall. A significant portion of the west wall's finish surface is intact, however, some of this fabric is delaminated from the inner concrete. Visual indications of deterioration on the west wall are generally limited to surface-related concerns such as horizontal cracking, vertical cracking, spalling and efflorescence. Although there has been a significant loss of fabric on

Site Plan. Silliman Survey c.1912

the east wall, no areas of rough sandstone back-up have been exposed. The finish surface which remains at the top of the east wall is delaminated and, in general, undermined by the loss of lower fabric. Due to the presence water within the lock chamber, the breast wall is not visible.

The only remains of the south wingwalls consist of a limited amount of rubble. The north wingwalls are concrete. The lock culvert inlet is visible and metal pins protrude above the top surface of the east wall where a gate was secured.

The encroachment of vegetation is severe along the top surface of the west wall and the lower gate chamber of the east wall. Vines and other vegetation with invasive root systems are prevalent.



Top surface of chamber wall.

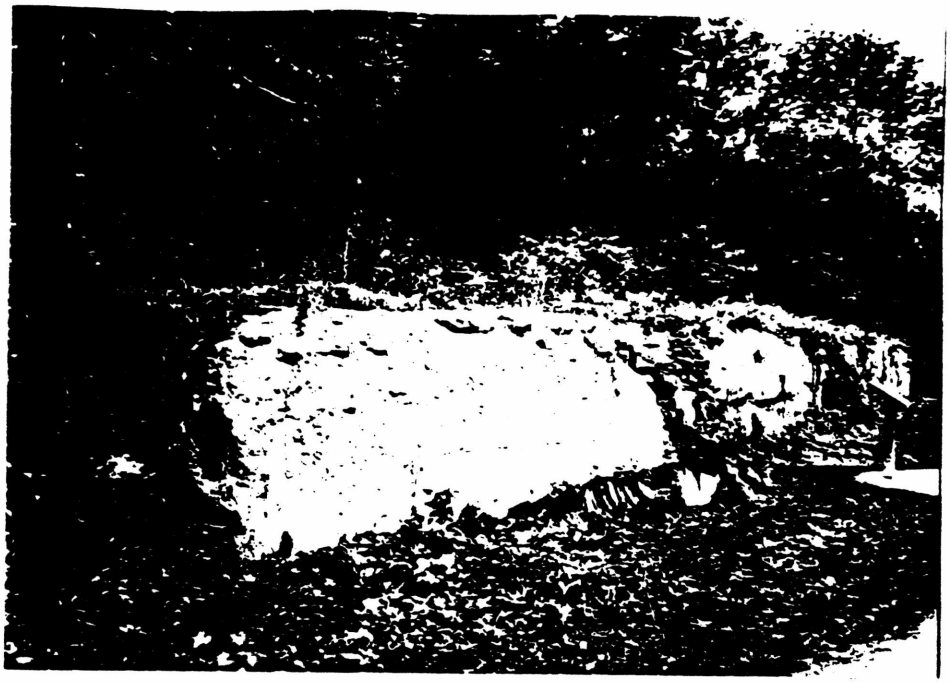


Upper gate chamber, west wall. Severe encroachment of vegetation.

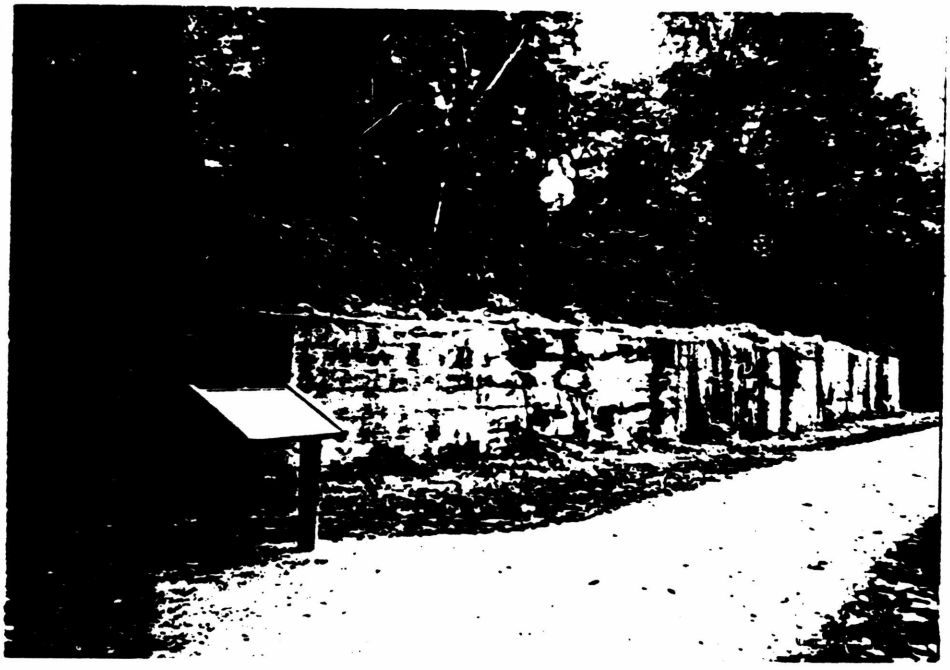
LOCKS 25 and 24

Yellow Creek Locks

Station 1406+42
Station 1419+54



Lock 25.
View from south.



Lock 24.
View from south.

Locks 25 and Lock 24 are located between Bath and Ira Roads. This segment of the canal was obliterated by the construction of Riverview Road in the 1930s under the Works Progress Administration. In both instances, the east wall of the lock was removed and the remaining west wall is situated adjacent to the east berm of the roadway. While the locks are visible from the Riverview Road, access is limited to that from the towpath. There have been no other improvements at these locations other than the development of the towpath as a multi-purpose trail. By necessity, this portion of the towpath was redirected from its original alignment.

EXISTING CONDITIONS

The concrete face of Lock 25 is in extremely poor condition. Deterioration has resulted in a significant loss of historic fabric. While isolated patches of the finish surface remain, without exception this fabric is delaminated from the inner concrete. The balance of the surface is spalled, and large areas of the rough sandstone back-up have been exposed by the complete degradation of the concrete face. Horizontal and vertical cracking are apparent. The lock culvert inlet is visible.

The concrete face of Lock 24 is far less deteriorated. A significant portion of finish surface remains and evidence of the formwork is apparent. Severe spalling, resulting in exposure of the rough sandstone back-up, is limited to an area of the upper gate chamber and the southeast wingwall. Horizontal cracking is prevalent and there are three significant vertical cracks indicative of movement. The lock culvert inlet is visible. The back

Site Plan. Silliman Survey c.1912.

face of the southeast wingwall has been exposed by the erosion of adjacent soil.

At both locks, the encroachment of vegetation is generally limited to areas of deterioration. The deteriorated top surface of the walls are supporting the growth of grass. Vines and other vegetation with invasive root systems have taken hold at vertical cracks, areas of exposed sandstone back-up and behind delaminated finish surfaces.

There is evidence of two tumbles associated with these locks; one is situated approximately midway between the structures and the other is located to the south of Lock 24. The concrete surface of both tumbles are in extremely poor condition and a significant amount of rough sandstone back-up is exposed. Portions have been undermined by the loss of lower fabric, the back face of the walls are exposed and there is vertical cracking indicative of movement. The encroachment of vegetation is severe.



Lock 25. Delaminated concrete surface.



Lock 25.
Exposed sandstone back-up.

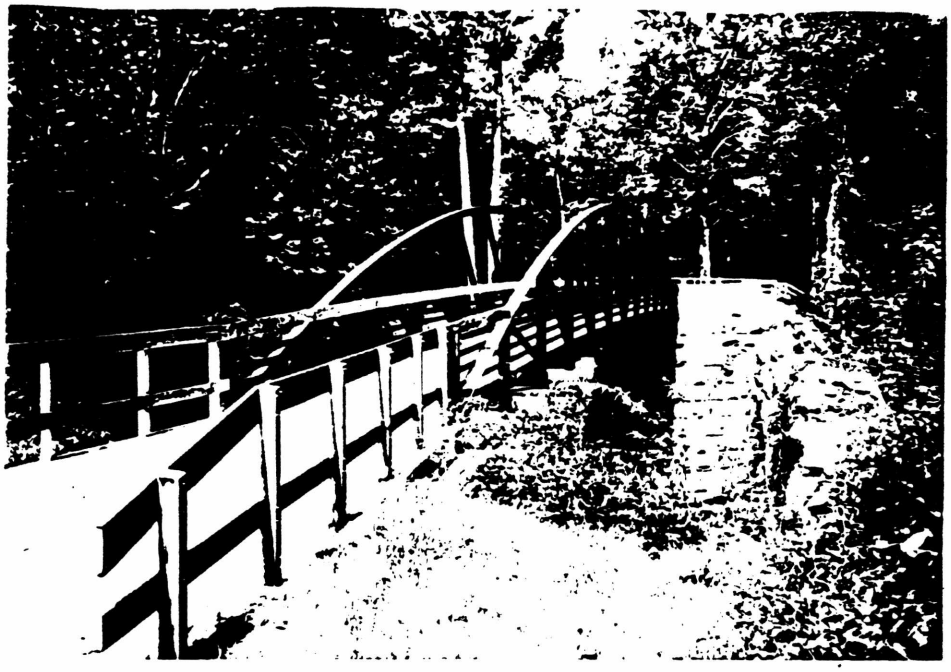
2. AQUEDUCTS

Aqueducts are structures that carry the canal waterway and towpath over obstacles such as large streams and creeks. According to the Silliman Survey, c.1912, two aqueducts were located along the presently unwatered portion of the canal within what is now the recreation area. The abutments of both these aqueducts remain.

The uniqueness of the aqueducts dictates that information under the headings of Physical History, Physical Description and Existing Conditions be presented for each structure individually. Recommended Treatment, located at the end of Part II, addresses all structures along the unwatered portion of the canal.

PENINSULA AQUEDUCT

Station 1126+84



North abutment.
View from south.

The abutments of the Peninsula Aqueduct are located just north of State Route 303 within the community of Peninsula. The structures are not only visible from the towpath, but can be seen from areas within the northeastern portion of the community. Access is readily obtained from the adjacent trailhead recently constructed by the Park Service.

Recent improvements, associated with the development of the towpath, include the installation of a bridge across the abutments. The bridge spans the Cuyahoga River providing continuity of the towpath.

PHYSICAL HISTORY

During the original construction of the canal between 1825-1827, an aqueduct was built to carry the canal waterway and towpath over the Cuyahoga River in Peninsula. The original aqueduct consisted of a wooden truck with timber framing.

Site Plan. Silliman Survey c.1912.

supported by masonry abutments and central pier. The wood aqueduct was extremely susceptible to premature decay and required replacement in 1844. As early as 1857, the north abutment wall had begun to crumble, reportedly due to defective quality of stone and poor workmanship; by 1864, the south abutment required repairs. New abutments were constructed in 1872. Frequent extensive repairs were required to maintain the wooden trunk and timber framing.

In 1905, a contract was let to the King Bridge Company of Cleveland to construct a new aqueduct. The abutments were completely reconstructed by State crews and the central pier, which had reduced the effective flow of the Cuyahoga River, was removed. The new superstructure was to be a single span of 85 feet and to consist of steel trusses supporting a wooden trunk; the actual design was at the discretion of the contractor, subject to approval by the State Engineer. The 1905 aqueduct was destroyed during the flood in 1913.

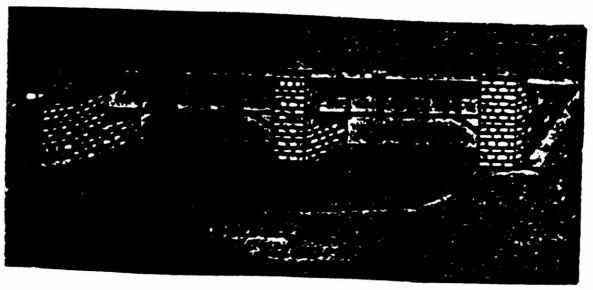


Illustration from 1892 Map.

PHYSICAL DESCRIPTION

The north and south abutments are composed of ashlar, dressed sandstone with tooled margins. The north abutment is protected by wingwalls which splay outward to contain the canal prism, towpath and berm. The south abutment terminates abruptly at the west and to the east is integral with a masonry retaining wall which runs along the river embankment.



South abutment. View from north. Prior to improvements.

EXISTING CONDITIONS

The masonry is generally in good condition. Signs of decay are restricted to the cracking and chipping of individual stones at random locations. Cylindrical holes, the result of the 1905 reconstruction, are apparent. Joint deterioration is relatively limited. Missing mortar and the subsequent lack of bonding between stones, however, has resulted in individual stones rotating out of alignment at the west portion of the south abutment. Along the east edge of the south abutment, there is a vertical crack indicative of movement.

The encroachment of vegetation is most severe at the southwest wingwall. Vines and other vegetation with invasive root systems are prevalent at the top surface of walls and areas of joint deterioration.



South abutment. Vertical crack.



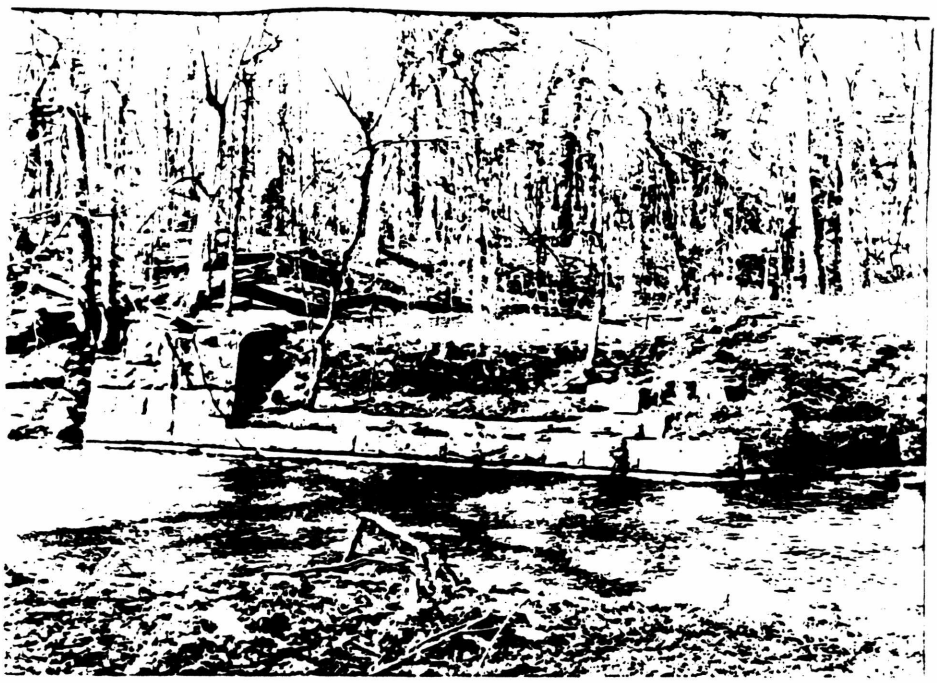
North abutment. View from south.



South abutment. Encroachment of vegetation.

FURNACE RUN AQUEDUCT

Station 1294+00



North abutment. View from south. [Bobel, 3/92]

The abutments of Furnace Run Aqueduct are located just north of Bolanz Road. Access and visibility are limited to that from the towpath. The towpath has been realigned to the east and a new bridge installed to provide for continuity of the towpath over Furnace Run.

PHYSICAL HISTORY

During the original construction of the canal, a stone arch culvert was installed to carry Furnace Run under the canal. Frequently obstructed by deposits of gravel and sandy soil, the culvert was inadequate to pass the required volume of water. The stream recurrently raised over the embankment of the canal, submerging acres of cultivated land. In 1858, a section of the culvert collapsed. Temporary repairs provided for continued navigation until 1860 when the culvert was removed and an aqueduct installed.

Site Plan. Silliman Survey c.1912.

A contract was entered into with Mosley and Co. of Cincinnati to install a patent wrought iron aqueduct of 40 foot span. Stone abutments were constructed by State crews. The project was completed in April of 1860.

The aqueduct was frequently damaged during flood conditions. The abutments had been constructed on mud sills and were extremely susceptible to the hydraulics of Furnace Run. In 1866, the north abutment was razed and a new abutment was constructed on a pile foundation. Similarly, a new south abutment was constructed in 1833. While the aqueduct was again displaced by a flood in 1899, the abutments were not damaged. In 1912, the aqueduct was devastated when the north abutment was undermined; a new north abutment was constructed, the south abutment repaired and the truss replaced. This new aqueduct was destroyed a year later during the flood of 1913.

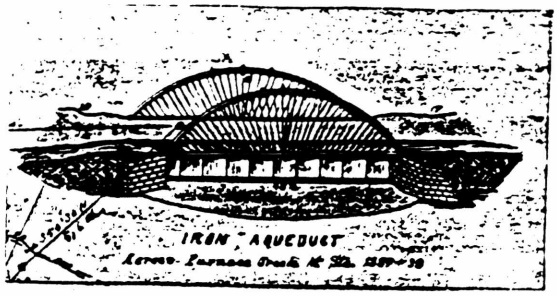


Illustration from 1892 Map.

PHYSICAL DESCRIPTION

The north and south abutments are composed of ashlar, dressed sandstone with tooled margins. The abutments are protected by wingwalls which splay outward to contain the canal prism, towpath and berm.

Much of the fabric above the level of the aqueduct bed is missing. A pile of sandstone blocks, located to the south, likely contains a portion of the dislodged fabric.



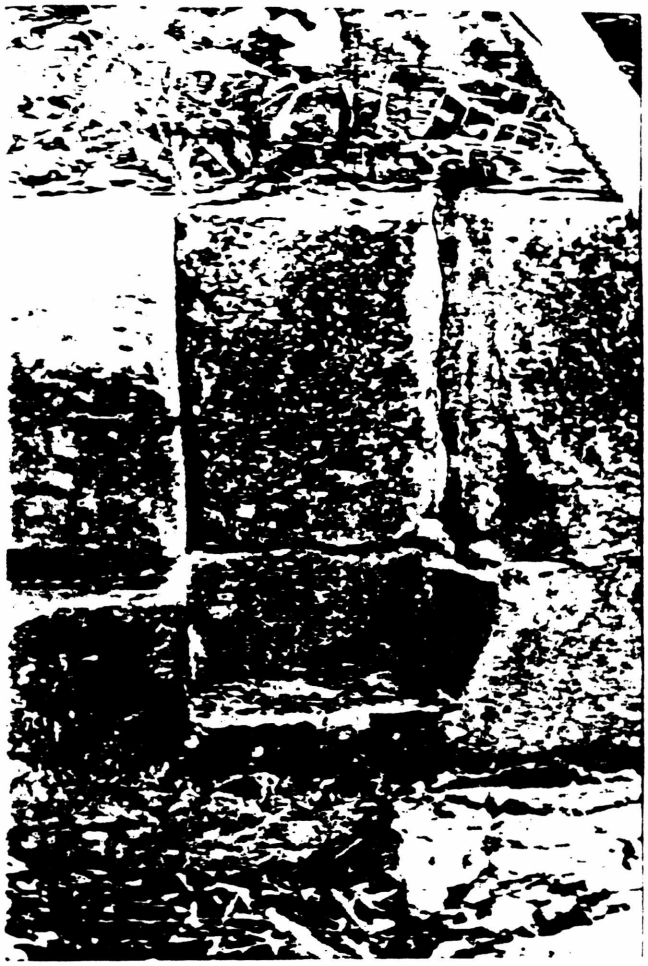
South abutment. West wingwall.

EXISTING CONDITIONS

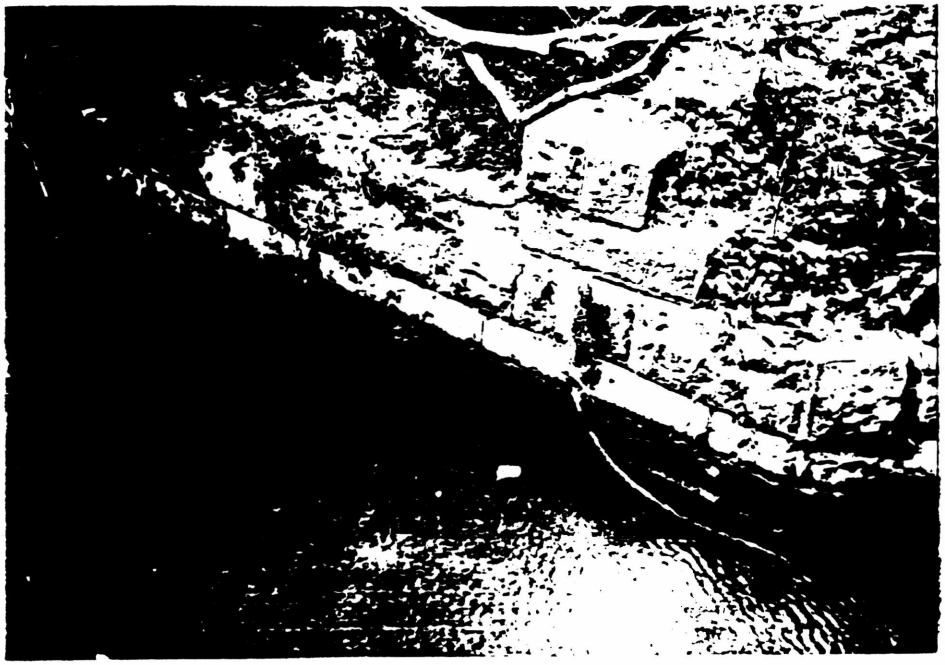
The remaining masonry is generally in fair condition. Although joint deterioration is prevalent, severe movement of the remaining fabric is limited to the southwest wingwall, where individual stones have rotated out of alignment. The bed of the stream has eroded and the foundation of the north abutment, consisting of wood planks and timbers, is visible beneath the water line of the stream.

Metal tabs protrude from joints at locations where the aqueduct was secured to the abutments; a length of metal rod remains at the southeast and the northeast. Profiled stonework at the north abutment, forming indentations to either side of the aqueduct bed, is apparent.

The encroachment of vegetation is most severe at the north abutment. Vines and other vegetation with invasive root systems are prevalent at the top surface of the remaining fabric. Two large trees have fallen on the masonry, and trees are growing within the bed of the aqueduct and on the northwest wingwall.



Profiled stonework.



North abutment. Exposed foundation.

3. FEEDER DAM COMPLEXES

The construction of feeder dam complexes was required to ensure an adequate supply of water for the Cleveland-Akron sector of the canal. Two such complexes were constructed along the presently unwatered portion of the canal within what is now the recreation area: the Yellow Creek Feeder Dam, abandoned in 1858, and the Peninsula Feeder Dam.

The uniqueness of the Peninsula Feeder Dam dictates that information under the headings of Physical History, Physical Description and Existing Conditions be presented for this complex. Recommended Treatment, located at the end of Part II, addresses all structures along the unwatered portion of the canal.

PENINSULA FEEDER DAM COMPLEX

Station 1109+75



Feeder Sluice.
View from north.

The remains of the Peninsula Feeder Dam Complex are situated to the west of Lock 30, approximately 1/2 mile north of State Route 303. Access and visibility are limited to that from the towpath. There have been no improvements at this location other than the development of the towpath as a multi-purpose trail. The towpath has been slightly redirected from the original alignment to by-pass the remains of the towpath bridge.

PHYSICAL HISTORY

The Peninsula Complex was constructed in 1830 when it was determined that an additional feeder was required to insure an adequate water supply for the Cleveland-Akron sector of the canal. The complex consisted of a low brush and stone dam across the Cuyahoga River which diverted water into the canal through a man-made channel approximately 135 feet in length. Head gates regulated the

Site Plan. Silliman Survey c.1912.

flow of water into the canal and flood gates protected this short waterway from high water; the gates were supported by sluices constructed of cut stone. A bridge provided for continuity of the towpath across the feeder.

While the dam required periodic renewal, it appears that no work was performed on the feeder structures until 1906 during the improvement of the northern division. A new concrete feeder sluice was constructed and the masonry flood gate sluice was dismantled and relaid. The masonry abutments of the towpath bridge were also dismantled and relaid, and a new concrete deck installed.

PHYSICAL DESCRIPTION

Structural components of the complex which remain include the feeder sluice, the flood gate sluice and the towpath bridge. Any remaining fabric of the dam is obscured by dense vegetation.

The feeder sluice, which supported the head gates and directed water into the feeder channel, consists of parallel concrete walls. These walls decrease in height within the feeder and are extended by low masonry walls constructed of rubble. At the mouth of the feeder, the east wall of the sluice is protected by a concrete wingwall; the west wall is integral with the flood gate sluice composed of ashlar, dressed sandstone with tooled margins.

The towpath bridge consists of masonry abutments and a concrete deck reinforced with steel rails and wire netting.

EXISTING CONDITIONS

The concrete feeder is in poor condition. While areas of the finish surface remain, spalling and horizontal cracking have resulted in a relatively significant loss of fabric. Indentations which held the head gate, however, are still apparent. The back face of the walls



Towpath Bridge.
View from north.

have been exposed by the erosion of adjacent soil. The encroachment of vegetation is limited to a mature tree within the northern end of the feeder sluice.

The masonry sluice appears to stable and is in fair condition. Profiled stonework, which received the flood gate, is apparent. The encroachment of vegetation is most prevalent at the top surface of the walls and at the back faces which have been exposed.

The deck of the towpath bridge is in poor condition. Horizontal cracking and subsequent erosion have resulted in exposure of the steel rails. Although the masonry abutments appear to be relatively stable, the mortar has failed and individual stones are deteriorated. The back face of each abutment, exposed by the erosion of adjacent soil, are undermined. The encroachment of vegetation is severe.



Flood gate sluice. South wall.

4. WASTE STRUCTURES

Waste structures are control components which regulate the level of the water within the canal and provide protection to the balance of the waterway during conditions of high water. Such structures include flood gates and waste weirs. A flood gate is a sluice - a man-made channel for conducting water - with valves or gates that regulate the flow of water. A waste weir is a dam that is located in line with the canal berm. Numerous waste structures are identified on the Silliman Survey, c.1912, along the presently unwatered portion of the canal within what is now the recreation area. Of these structures, the remains of three are visible today.

Information under the heading of Physical History parallels that presented for the waste structures in Part I until the abandonment of the canal in 1913. After this portion of the waterway was drained, these structures were left unaltered, affected only by the inherent process of deterioration. Physical Description and Existing Conditions, presented for each individual structure, include information regarding recent improvements performed in conjunction with the development of the towpath. Recommended Treatment, located at the end of Part II, addresses all structures along the unwatered portion of the canal.

FLOOD GATE

Hookers Run

Station 838+34



View from west.

This flood gate, located south of Lock 35, is among the many waste structures constructed during the improvement of the northern division between 1905-1909. There is no documentation which indicates that a waste structure existed at this location prior to that time.

PHYSICAL DESCRIPTION

This waste structure consists of a concrete sluice which presumably once supported wood flood gates and served as abutments for a towpath bridge. The sluice is comprised of parallel walls which decrease in height towards the discharge. Wingwalls, placed perpendicular to the side walls, are located along the canal berm.

A towpath bridge, recently installed by the Park Service, spans the channel of the concrete sluice.

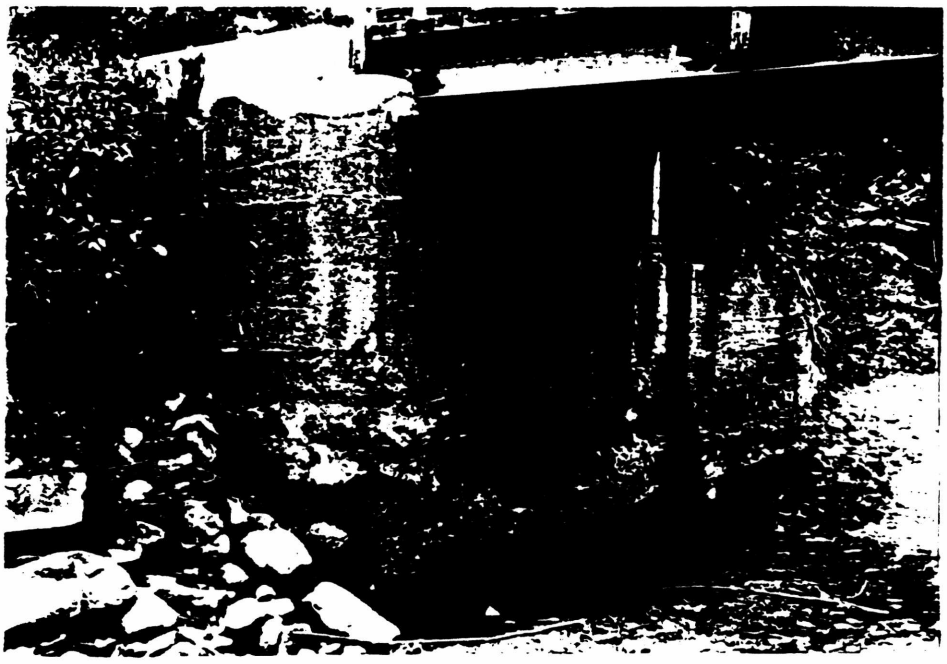
Site Plan. Silliman Survey c.1912.

EXISTING CONDITIONS

The historic fabric is in relatively good condition. The finish surface of the poured concrete is generally intact and evidence of the formwork is apparent. Indentations which received the gate are visible and a steel rod protrudes from the indent on the south wall.

Deterioration is limited to surface-related concerns. Spalling is most serve at the lower portion of the southeast wingwall and the south sidewall. An area of the north sidewall was previously underpinned with an apron of concrete; the creek bed is now lower and the apron is undermined. The encroachment of vegetation is limited to moss and vines along the top surface of the discharge walls.

Visible improvements to the historic structure are limited to the installation of supplemental concrete at the deteriorated top surface of the walls.



South sidewall.

WASTE WEIR & FLOOD GATE

Goose Pond Waste Weir

Station 863+00



View from north Prior to improvements. [Stefanik, 3/87]

The existing structure, located to the south of Lock 35, was constructed during the 1905-1909 improvements of the northern division. This concrete structure replaced an earlier waste weir, shown in the 1892 Survey as a wooden bridge supported by stone abutments.

PHYSICAL DESCRIPTION

The structure is comprised of two integrated components, a waste weir to the north and a flood gate to the south. The waste weir consists of a low concrete wall segmented by five piers which rise above the wall to support a deck. The southern most pier serves as a side wall of the flood gate, a concrete sluice which once supported wood gates.

A wood deck, installed by the Park Service, spans the piers, providing continuity of the towpath.

Site Plan. Silliman Survey c.1912.

EXISTING CONDITIONS

The historic structure appears to be relatively sound and no indications of movement are evident. While the concrete is exhibiting signs of deterioration, there has not been a significant loss of fabric. The finish surface remains virtually intact and evidence of the formwork is visible. Indentations which received the flood gate are apparent and a steel rod protrudes from the indent on the north sidewall. Although efflorescence is prevalent, horizontal cracking and spalling are limited. The encroachment of vegetation is generally restricted to the presence of moss, which is most severe on the west face of each pier.



Pier and weir wall.



North abutment and pier.

FLOOD GATE

Station 1305+46



View from east.

This masonry structure, located south of Bolanz Road, was likely constructed between 1825-1827. Documentation indicates that this was the only waste structure built during the original construction of the canal within what is now the recreation area. Cylindrical holes in the masonry indicate that the structure was dismantled and relaid, presumably during the 1905-1909 improvement of the northern division.

PHYSICAL DESCRIPTION

This waste structure consists of a masonry sluice comprised of parallel walls which decrease in height towards the discharge. Wingwalls, placed perpendicular to the side walls, are located along the canal berm.

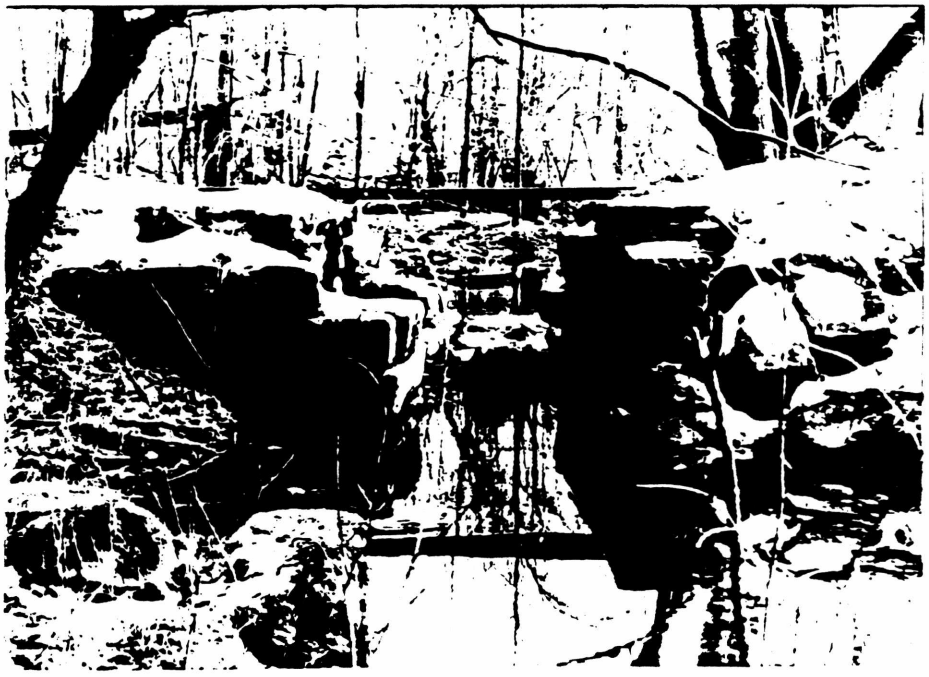
Recent improvements, associated with the development of the towpath, include stabilization of the historic fabric and the installation of a bridge across the channel of the masonry sluice.

Site Plan. Silliman Survey c.1912.

EXISTING CONDITIONS

Prior to recent improvements, the historic structure was in extremely poor condition. Missing mortar and the subsequent lack of bonding between stones had resulted in individual stones rotating out of alignment. Numerous stones had been dislodged and were located within the stream bed. The masonry had deteriorated and cracked corners were rounded by physical abrasion. No evidence of profiled stonework that may have received a flood gate was apparent.

The structure was dismantled and relaid; dislodged stones were incorporated. A drainage system was installed behind the walls. While deterioration of the stones resulted in joints wider than that historically appropriate, the structure has been returned to a stable condition and contributes to the overall historic character of the corridor.



View from east. Prior to improvements. (Bobel, 3/92)

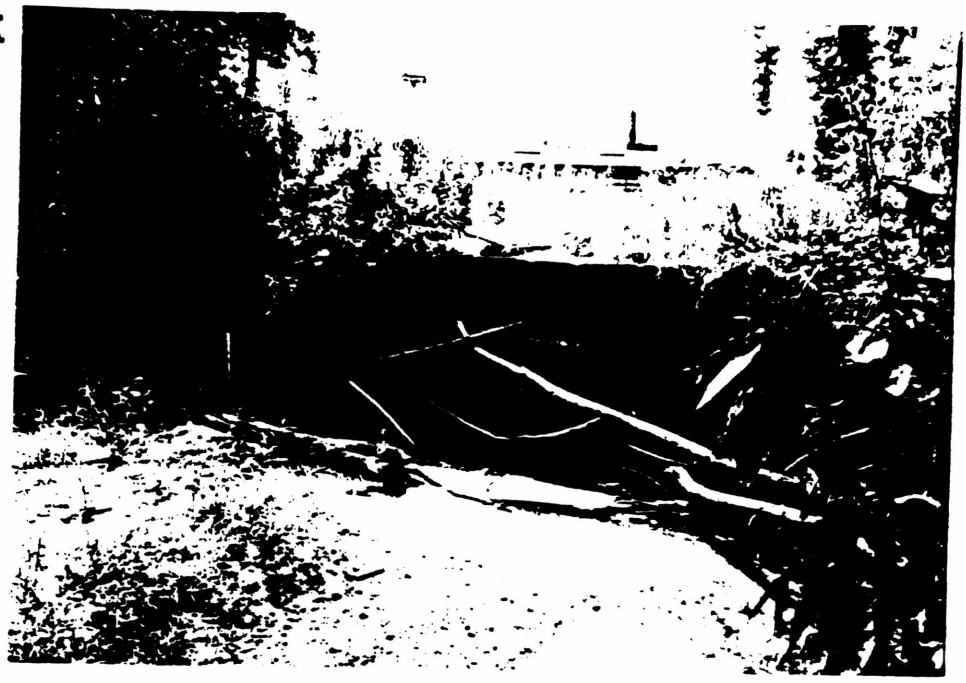
5. CULVERTS

Culverts were constructed to carry small streams beneath the canal waterway and towpath. Numerous culverts are identified on the Silliman Survey, c.1912, along the presently unwatered portion of the canal within what is now the recreation area. Since the abandonment of the canal, the water courses and the associated watersheds have changed dramatically, necessitating the construction of modern culverts of appropriate capacity at different locations. Of the structures identified by Silliman, only two are functional and the remains of two others are visible.

Information under the heading of Physical History parallels that presented for the culverts in Part I until the abandonment of the canal in 1913. After this portion of the waterway was drained, the majority of these structures were left unaltered, affected only by the inherent process of deterioration. Physical Description and Existing Conditions are presented for each individual structure. Recommended Treatment, located at the end of Part II, addresses all structures along the unwatered portion of the canal.Physical Description and Existing Conditions, presented for each individual structure, include information regarding recent improvements performed in conjunction with the development of the towpath.

BRANDYWINE CREEK CULVERT

Station 921+39



East Headwall.

This masonry arch culvert, located south of Lock 34, carries Brandywine Creek beneath the access road to Jaite Paper Mill. The canal prism within this area was obliterated by the construction of the roadway. The culvert is neither accessible nor visible from the towpath.

Available documentation does not provide information regarding the construction of this culvert. The 1892 Survey, however, does identify a stone arch culvert at this location; the illustration contained on the map closely resembles the existing structure. Cylindrical holes in the masonry indicate that this structure has been dismantled and relaid.

PHYSICAL DESCRIPTION

The Brandywine Creek Culvert is semi-circular in form. The east headwall is constructed of ashlar, dressed sandstone and features curved wingwalls. The opening is well-

Site Plan. Silliman Survey c.1912.

formed by voussoirs, wedge-shaped units whose converging sides are cut as radii of the center of the arch, which protrude from the headwall. The keystone, while not embellished, extends slightly beyond the voussoirs.

The central portion of the west headwall has been either replaced or faced with concrete. The surface is smooth, no evidence of formwork is apparent. Curved masonry wingwalls remain to either side.

EXISTING CONDITIONS

Masonry of the east headwall is in good condition. Joint deterioration is limited to isolated areas. Missing mortar and the subsequent lack of bonding between stones, however, has resulted in individual stones rotating out of alignment at the lower portion of the southeast wingwall.

The masonry wingwalls of the west headwall are in poor condition. Joint deterioration is prevalent and numerous stone have rotated out of alignment. Significant cracks, indicative of movement, exist in the concrete portion of the west wall.

The encroachment of vegetation is limited to the top surface of the walls and the ledge created by the protruding voussoirs on the east headwall.



West Headwall.

STANFORD CREEK CULVERTS

Station 961+94
Station 973+02



Concrete Culvert. East Headwall.

These culverts are located south of Lock 33. Apparently both were built to carry Stanford Creek beneath the canal prism. The culverts are neither visible nor accessible from the towpath. Available documentation does not provide information regarding the construction of these culverts. The 1892 Survey, however, does identify a stone arch culvert at the appropriate location; the illustration closely resembles the existing structure.

PHYSICAL DESCRIPTION

The structure at Station 961+94 is a stone arch culvert semi-circular in form. The headwalls are constructed of ashlar, dressed sandstone. The opening is well-formed by voussoirs, wedge-shaped units whose converging sides are cut as radii of the center of the arch.

Site Plan. Silliman Survey c.1912.

The culvert at Station 973+02 is a circular pipe culvert. The headwalls are constructed of concrete. While the west headwall is rectangular in shape, the east headwall slopes downward to either side of the opening and features a protruding lip at the top surface of the wall.

EXISTING CONDITIONS

The stone arch culvert is in poor condition. Joint deterioration is prevalent and numerous stones have rotated out of alignment. The encroachment of vegetation is severe.

The majority of the concrete of the east headwall is in fair condition. There is a loss of finish surface, however, below a line extending from the top of the culvert opening. The concrete of the west headwall is in poor condition. There is a loss of finish surface immediately surrounding the culvert opening and the balance of the fabric is spalled. The encroachment of vegetation is limited to moss along the top surface of the east headwall.

Presently, these culvert do not carry Stanford Creek which has rechanneled itself to the south. They apparently currently function as land drains.

PH[illegible] EE INSE[illegible]

Stone Culvert.
West headwall.

YELLOW CREEK CULVERT

Station 1452+87



East Headwall.

This masonry arch culvert, located south of Lock 24, carries Yellow Creek beneath Riverview Road. The canal prism within this area was obliterated by the construction of the roadway during the 1930s. The culvert is neither accessible nor visible from the towpath.

The stone arch culvert was constructed in 1844. The canal had originally crossed Yellow Creek 'by means of an embankment extending across the valley. Flood water was passed around the embankment by a dam and waste weir.' By the early 1840s, the bed of the creek had become filled with deposits and navigation on the canal was frequently interrupted, necessitating the construction of a culvert. At this location, an 'arch culvert and bridge' is identified in the 1892 Survey; the illustration contained on the map closely resembles the existing structure.

Site Plan. Silliman Survey c.1912.

This structure is incorrectly identified in the List of Classified Structures as Yellow Creek Aqueduct. Although data from the operational period of the canal contains a reference to Yellow Creek Aqueduct, the location of this structure is not known. Documented repairs, performed during 1883, include work on the abutments, superstructure and trunk.

PHYSICAL DESCRIPTION

The masonry arch culvert is semi-circular in form. Both the inlet and outlet headwalls are constructed of ashlar, dressed sandstone and feature curved wingwalls. The opening, on either side, is well-formed by voussoirs, wedge-shaped units whose converging sides are cut as radii of the center of the arch. The keystones, while not embellished, protrude slightly from the surrounding stones.

The west headwall has been extended in height, presumably during the construction of Riverview Road. Stones of the upper portion of the wall are significantly larger than those below and the profile of the wall changes, creating a ledge at the top surface of the original wingwalls.



West Headwall.
South Wingwall.

EXISTING CONDITIONS

The masonry is in fair condition. Joint deterioration is prevalent. Missing mortar and the subsequent lack of bonding between stones has resulted in individual stones rotating out of alignment. Movement is most severe at the southwest wingwall; numerous stones are missing and much of the remaining fabric is displaced. Signs of masonry decay, including cracking and spalling, are apparent at both walls.

The encroachment of vegetation is generally limited to the top surface of the walls. A tree is growing on the ledge formed by the extension of the west headwall.

RECOMMENDED TREATMENT FOR ALL STRUCTURES ALONG THE UNWATERED PORTION OF THE CANAL

The recommended level of treatment for abandoned structures located in the unwatered portion of the canal is preservation; this is consistent with that proposed for the structures which are presently included in the List of Classified Structures. Although no longer water-charged, this portion of the canal is, for the most part, still discernable as a formerly navigatable waterway. Taken as a group, these deteriorated structures retain sufficient form and material to convey their original use and function. The historic significance and integrity dictates that these structures be preserved.

Although historic documentation and existing fabric is sufficient to permit accurate restoration, such treatment would not be in accordance with established criteria for restoration projects included in NPS policies and guidelines. Restoration of these structures is not essential for public understanding and appreciation of the park's historical and cultural associations. The public is provided the opportunity to view restored, operational canal structures within the watered portion of the canal. The existing conditions of the structures along the unwatered portion of the canal convey a desirable sense of evolution reflecting the abandonment of the canal and the subsequent decline of structural components. Restoration, therefore, is not recommended. Adequate interpretation of these abandoned structures can be imparted through preservation.

Deterioration, as outlined in the Existing Conditions, generally precludes comprehensive stabilization. The majority of the structures, in their present condition, are not inherently durable or weather-resistant. Extensive intervention would be required to arrest deterioration and to reestablish the structural integrity and weather-resistant conditions. Such treatment would significantly alter the appearance of these structures.

The recommendation for preservation, therefore, includes low-level stabilization intended to retard deterioration without adversely impacting the historic character. The structures, in their present condition, are visible to the public and satisfy the requirements of the established interpretive program. Without intervention, however, continued deterioration will result in a limited life span. The intent is to extend the life expectancy of these structures while disturbing the existing form and the site to the least extent possible.

Treatment is divided into two categories: immediate preservation and long-term preservation. Work recommended in immediate preservation is aimed at reducing the rate of deterioration by limiting deleterious factors. Long-term preservation addresses a methodology to establish a program which will manage, passively or actively, the inherent decline of these abandoned structures.

IMMEDIATE PRESERVATION

Measures should be implemented to diminish primary threats to these structures. While extensive intervention would be required to arrest deterioration, several factors which are accelerating deterioration can be addressed with a minimum of intervention. Immediate preservation treatments should include the following:

1. **Remove vegetation.**

These abandoned canal structures are extremely susceptible to the encroachment of vegetation. Management of the vegetation is essential to diminish the accelerating deterioration and to extend the life expectancy of these structures. Existing vegetation should be removed and a program of periodic plant removal should be established and implemented.

In general, all vegetation should be removed by hand. Where possible, vines and other vegetation with invasive root systems should be cut at the base and allowed to dry before removal. In some instances, where roots continue to grow, the use of herbicides may be required. All organic debris should be cleared from the structures; while removing vegetation will discourage further growth, the elimination of a conducive environment is necessary to preclude all growth.

Tree removal must be evaluated on a case-by-case basis. In some instances, mature trees which provide support for unstable structural components or which prevent significant erosion should not be removed during this initial phase of stabilization. The program for vegetation management, however, should permit for the retention of trees only when removal would be more damaging. In all cases of tree removal, the subsequent decay of extensive root systems will result in ground settlement and periodic inspections should be performed to determine if remedial work is required.

2. **Grade adjacent ground surfaces.**

While exposure to moisture in the form of precipitation, runoff and ground water is inherent, adverse effects can be diminished by limiting the amount of infiltration. Measures designed to reduce, although not completely eliminate, moisture infiltration will significantly slow the rate of deterioration and extend the life expectancy of these structures.

Ground surfaces should be graded, where necessary, to slope away from the structures. Positive drainage of storm water will decrease the amount of water directed towards the structures and will minimize the saturation of soil adjacent to the structures, reducing moisture infiltration. Seeding of these areas, in most instances, will prevent erosion. Additional soil erosion control, however, may be required at certain locations.

3. **Protect components highly susceptible to resist weathering.**

Site conditions, under which these structures were intended to function, have changed dramatically since the abandonment of the canal. The erosion of adjacent embankments and the lack of water within the canal prism pose serious threats which can be eliminated through proper management of the site. Structural components, not designed to resist weathering, are extremely susceptible to rapid deterioration if exposed to the elements.

The rubble backup of structural walls was intended to provide mass to prevent overturning from lateral pressure of the earth and was not designed to resist weathering. The stones were often loosely laid with weak or no mortar and, if exposed, provide areas for water infiltration which will rapidly deteriorate the rubble back up and accelerate deterioration of the associated face wall. The rubble back up will loose its capacity to act as a homogenous structural component resulting in ultimate failure of the entire wall. Areas where earthen embankments have eroded, revealing the rubble backup, should be reestablished when subsequent damage to the wall will not occur. Significant cracks and voids in the back face of these walls should be filled with grout prior to backfilling. The eroded embankments should be filled first with a layer of granular material. This layer will act as a french drain and reduce hydrostatic pressures against the back of the wall.

Wood elements are inherently prone to decay if subjected to conditions of differing moisture content. Timber foundations and flooring were intended to function with a watered lock chamber or below grade. If exposed, the wood will deteriorate rapidly, leading to instability and ultimately failure of the entire structure. Adequate protection, such as a sufficient layer of soil, should be provided to ensure against deterioration associated with prolonged exposure.

LONG-TERM PRESERVATION

The treatments recommended for immediate preservation will retard, not arrest, deterioration. Further degradation of the material as a result of moisture infiltration and surface weathering will continue and there will be additional loss of historic fabric. The following measures are recommended to develop a program to manage, actively or passively, the decline of these abandoned structures:

1. Determine rate of deterioration.

While deterioration is apparent, the rate at which the structures are deteriorating has not been established. Empirically, it can be expected that deterioration will accelerate. Each structures should be documented, noting the location and extent of deterioration. A long-term monitoring program should be established and implemented. The program should include a yearly condition survey and documentation of deterioration. The comparison of observations to previous years will ascertain the rate of deterioration.

2. Establish acceptable amount of deterioration.

In general, the primary function of the abandoned structures is to enhance the public understanding and appreciation of the canal. Taken as a group, the structures are critical to the park's resource management program and interpretive program. The role of each individual structure, however, varies significantly. Accordingly, the acceptable amount of deterioration will vary with each structure.

Numerous factors should be taken into consideration when establishing the acceptable amount of deterioration

for each structure. Issues include the uniqueness of the structure, the integrity of form and the condition of the materials. The one extreme, where continued deterioration may be acceptable, is represented by Locks 25 and 24; the locks are of standard construction, a significant portion of the historic fabric has been removed, and the remaining material is in poor condition. The other extreme, where any deterioration may be unacceptable, is represented by Lock 29 in Peninsula; this structure is the only example of masonry lock construction, the overall form has not been modified and the materials are in good condition.

In addition to the above, special consideration must be given to structures or components which serve as bridge abutments or as retaining walls for the towpath. Those which serve as bridge abutments were stabilized during the development of the towpath and should not be permitted to deteriorate. These structures should receive routine periodic maintenance to insure their continued capacity to function as load bearing elements.

Components which serve as retaining walls for the towpath, however, have not been comprehensively addressed. While the existing conditions of these elements, which include numerous lock walls, are adequate to retain the earthen embankment of the towpath, the situation should be closely monitored. The lack of water pressure in the canal prism to equal the pressure of the earthen embankments has contributed to the decline of these structures and may ultimately lead to instability. As deterioration continues, these walls may not have the integrity to be self-sustaining, jeopardizing continuity of the towpath. Extensive intervention may be required to stabilize these walls in order to insure the continued safe operation of the towpath.

3. Develop preservation alternatives

The selection of long-term preservation treatment for each structure must take several factors into consideration. Issues include the park's intended use of the specific structure, the acceptable amount and rate of deterioration, and the acceptable level of intervention. In general, further intervention is not recommended for structures that appear to be relatively stable with a slow rate of deterioration. Where the progression of deterioration is found to be unacceptable, additional preservation treatment should be implemented.

Additional preservation treatment can be expected to impact the historic fabric and the overall appearance of the structure. In each instance, several alternatives having different degrees of intervention should be explored. The intent is to extend the life expectancy and/or enhance the capacity of the structure with the minimum of intervention.

The remainder of this section briefly discusses preservation concepts, outlining a general approach for dealing with these abandoned structures.

Concrete Surfaces

Stabilization of concrete surfaces will be required where the rate of deterioration is determined to be unacceptable. Areas where the concrete finish surface is missing are extremely suspectable to further degradation resulting from moisture infiltration. Effective preservation treatments, however, are extremely limited.

Stabilization requires repairing cracks and spalls. In most cases, the associated erosion and weakening of adjacent material is severe. Treatment with minimum intervention, therefore, will typically result in a short-term solution. Cracks could be epoxy injected, but the continued erosion of surrounding concrete will eventually expose the epoxy. Surfaces could be treated with a protective coating such as a water repellent, but such coatings are generally not durable unless applied to sound material.

Treatments with maximum intervention will be required for effective long-term stabilization. All deteriorated or damaged concrete should be removed back to sufficiently sound material and the affected areas patched. Repairs should match the form, texture and color of the original fabric. The corrosion of embedded steel is a serious threat to concrete. If reinforcing is exposed during concrete removal, the steel should be cleaned or replace if necessary.

The selection of treatment should be carefully analyzed for each affected area. Maximum intervention may not be warranted on vertical surfaces of concrete where exposure to water is generally limited to wind-driven rain. Horizontal surfaces, however, are extremely susceptible to water infiltration introduced by rain, snow and ice. Special consideration should be given to areas where the top surface of a wall is extremely deteriorated and water is permitted to gravitate throughout the wall interior. Based on existing conditions, this is likely to be a common problem shared by virtually all structures whose rate of deterioration is determined to be unacceptable.

While extensive intervention may be required to stabilize the top surface of a wall, treatment will be limited to a specific area of historic fabric, yet significantly extend the life-expectancy of the entire structure. A sensitive design applied consistently to all structures requiring such repair will reduce the impact on the historic character of the corridor.

Masonry

The life-expectancy of masonry components, where the rate of deterioration is determined to be unacceptable, can generally be extended by treatment with a minimum of intervention. In most cases, the stones are in good condition and deterioration is characterized by missing or weakened mortar and the subsequent disalignment of individual stones or wall sections.

Cleaning and repointing of joints will reduce moisture infiltration and protect against further structural failure. Mortar should match the original material in constituent composition, color and texture. Other work may involve securing of loose stones and the filling of cavities or voids. Where the intent is to arrest further movement and correction of prior movement is not required, individual stones or entire sections which have rotated out of alignment should be stabilized at their existing location.

More extensive intervention may be required where elements or areas are significantly deteriorated and it is necessary to return them to a monolithic state. In these cases, stonework should be taken down to stable stone, and all loose mortar, rubble or other undesirable material removed. The stones should be carefully dismantled and the areas

reconstructed using original stone with mortar to match the original material. Damaged stones, inappropriate for reuse, should be replaced with new stone that match the original. Voids in the back face of the walls should be filled with grout. Depending on the conditions, it may be necessary to supplement the masonry with a concrete substructure and/or to install a drainage system.

Missing Structural Fabric

Reinforcement of areas undermined by the complete decay of supporting fabric may be required where the rate of deterioration is found to be unacceptable. The extent of missing structural fabric includes a range of conditions. In some instances, the concrete surface has completely eroded resulting in the exposure of rubble back up stones which form protruding ledges. In extreme cases, structural fabric is missing for the entire width of the wall, including both the concrete surface and rubble back up. This latter condition is most prevalent at lock wingwalls. The remaining unsupported fabric is unstable and threatens the structural integrity of the structure.

Here again, effective preservation treatments are extremely limited. Support of these undermined areas will require underpinning. The level of intervention will be directly related to the amount of missing fabric and the condition of the adjacent historic fabric. All deteriorated or damaged fabric should be removed back to sound material and the remaining fabric underpinned. When repair occurs at the base of a wall, the associated foundation should be inspected for load bearing capacity and, if necessary, supplemented. Repairs should consist of poured concrete compatible in color and texture with the original surface fabric. The form, however, should clearly distinguish the repair from remaining historic fabric. Where practical, these areas should be stabilized in their existing location and not returned to their original alignment.

Reinforcement of these areas will affect the adjacent historic fabric and the appearance of the structure. Repair, however, will significantly increase the stability and life expectancy of the entire structure. While the level of intervention can be reduced by limiting the affected areas to a absolute minimum, restricting treatment will directly impact the effectiveness of repair. Underpinning will not arrest deterioration of the remaining historic fabric. The intent is, by stabilizing the component so that it does not collapse, to retain the existing form for the longest period of time possible. A sensitive design applied consistently to all structures requiring such repair will reduce the impact on the historic character of the corridor.

Improvements

To provide for use of the towpath as a multipurpose trail, improvements may be required at these structures to eliminate or reduce inherent safety hazards. As necessary, precautions should be taken to protect the public from hazards associated with significant changes in elevation, such as at lock chambers, or extremely deteriorated conditions.

Items likely to be given consideration include the installation of railings, barriers or warning signage along the towpath. The selection of treatment should be that which has the least level of intervention on both the appearance of the structure and the public's ability to appreciate the resource, but adequately addresses the

hazardous condition. New elements should be compatible with the overall appearance of the corridor, yet distinguishable from historic fabric. Existing contemporary elements along the towpath should be examined as a design precedence for these type of improvements. A standardized approach should be developed for similar situations and applied in a consistent manner.

General

The maximum feasible amount of historic fabric should be retained and stabilization work should detract as little as possible from the structure's appearance. In general, new material should match the existing fabric in color, texture and other visual qualities. All repairs should be documented, including both the extent of work and the process undertaken. The planning process must respect that, while preservation treatment will achieve greater durability, the structures will continue to deteriorate.

ENDNOTES

1. Cuyahoga Valley National Recreation Area, "Briefing Book," 1986.

2. Nick Scrattish, Historic Resource Study - Cuyahoga Valley National Recreation Area (Denver, CO: National Park Service, 1985), p. 175.

3. Ibid., p. 155.

4. Carol Poh Miller, "Ohio and Erie Canal" in National Register of Historic Places Inventory Nomination Form, (Columbus, OH: Ohio Historical Society, 4 June 1979.

5. Public Law 93-555, to provide for the establishment of Cuyahoga Valley National Recreation Area, December 27,1974 (88 Stat. 1784; 16 USC 460 ff).

6. Harry Phanz, "The Cuyahoga Valley between Akron and Cleveland," p. 11.

7. Ibid., p. 1.

8. Cuyahoga Valley National Recreation Area, "Briefing Book," 1986.

9. Cuyahoga Valley National Recreation Area, "General Management Plan," July 1977, pp. 38-39.

10. Cuyahoga Valley National Recreation Area, "Resources Management Plan," September 1986, pp. 151-156.

11. Cuyahoga Valley National Recreation Area, "Cultural Landscape Report," December 1987, pp. 20-21.

12. Cuyahoga Valley National Recreation Area, "Interpretive Prospectus," December 1988, p. 9.

13. Cuyahoga Valley National Recreation Area, "General Management Plan," July 1977, p. 7.

14. Cuyahoga Valley National Recreation Area, "Trail Plan," 1985, pp. 18-23.

15. Solar Testing Laboratories, Inc., "Ohio and Erie Canal Lock 38," STL File No. A91874X2, 7 November 1991.

16. U.S. Department of the Interior, Secretary of the Interior's Standards for Historic Preservation Projects (Washington, D.C.:National Park Service, 1985), p. 3.

17. National Park Service, Cultural Resources Management Guideline (NPS-28, Release No. 3, August 1985), Chapter 3, p. 8.

18. Ibid., p. 9.