

GAO

Report to the Honorable Frank R. Wolf,  
House of Representatives

April 1987

# PARKS AND RECREATION

## Patowmack Canal Preservation Responsibilities Being Met by Park Service



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**Resources, Community, and  
Economic Development Division****B-225945****April 23, 1987****The Honorable Frank R. Wolf  
House of Representatives****Dear Mr. Wolf:**

In your July 25, 1986, letter, you requested that we address a constituent's concerns that the National Park Service has been indifferent to the mandate of the Congress "to preserve the historic Patowmack Canal" and therefore is not carrying out the intent of the act of May 29, 1930, that authorized the George Washington Memorial Parkway which includes the canal. The Patowmack Canal, at Great Falls Park, Virginia, was built during the late eighteenth century to provide a navigable bypass to the Great Falls of the Potomac River. As agreed with your office, we looked at what the Congress envisioned when it provided for the preservation of the canal, the actions taken by the Park Service with respect to the canal, since its acquisition in 1966, and the Park Service's future plans for preserving the canal.

In summary, we found no legal basis in either the May 29, 1930, act or the basic authorities of the Park Service (16 U.S.C. 1) to conclude that the Park Service, by preserving the canal in its present state rather than rebuilding, is not meeting its statutory responsibilities. The Park Service's position is based on its longstanding policy of not rebuilding any structure unless it can be rebuilt to exact original specifications. In the case of the canal, not only are original specifications not available, but according to the Park Service, any attempt to rebuild the canal would result in the destruction of what remains of the original canal.

A preservation plan was prepared for the canal in 1985. Some preservation work was done by park crafts employees and maintenance staff in 1986, but most of the work in the preservation plan must be funded through the Park Service's construction budget account. As of March 13, 1987, the preservation work planned for the canal was ranked 5th among 11 construction projects in the George Washington Memorial Parkway for funding. Parkway officials estimated that it may be fiscal year 1989 before the canal work is started.

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**Background**

The George Washington Memorial Parkway was made a part of the National Capital Parks by the act of May 29, 1930 (46 Stat. 483). The parkway includes land on the shores of the Potomac River, and adjacent

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lands, from Mount Vernon to a point above Great Falls on the Virginia side, except the city of Alexandria, and from Fort Washington to a similar point above Great Falls on the Maryland side, except within the District of Columbia. The parkway also includes the Mather Gorge (the narrow portion of the river below the falls) and the Great Falls Park on the Potomac River. The Patowmack Canal is located in the Great Falls Park on the Virginia side of the river.

The construction of the Patowmack Canal started under the leadership of George Washington in 1786. It was one of the earliest waterways using canal locks<sup>1</sup> in the nation and was opened to river traffic in 1802. The canal was about 1-mile long and was used by small, shallow-draft boats.

The company that built the canal did not prosper mainly because the canal operated for only a few months each year. This condition was due to high and low water levels that frequently occur in the river. When the company went out of business in 1828, the canal property was sold to the Chesapeake and Ohio Canal Company. The property later became known for its recreational value.

In 1952 the Fairfax County Park Authority acquired the land nearest the Great Falls while the majority of the land now included in the park was owned by the Potomac Electric Power Company. Although the Park Service was authorized in the May 29, 1930, act to acquire the lands in and around the canal, acquisition did not take place until 1966 because funds to acquire these lands were not made available until then.

The Congress enacted Public Law 89-255 (79 Stat. 981) in 1965, authorizing the Park Service to exchange a tract of land it owned in Maryland for the tract containing the canal. The act also authorized appropriations of up to \$1 million to equalize the values of the tracts. The Park Service paid out \$975,000 to complete the land exchange with the Potomac Electric Power Company in September 1966.

The land owned by Fairfax County was purchased for about \$640,000. The county received its payment through an arrangement whereby parking fee collections at Great Falls Park were collected and retained in the amount of the purchase price.

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<sup>1</sup>The canal had five locks that provided a stairway approach to the river's gorge.

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Appendix I presents additional information on the history of the canal and appendix II presents information on the canal's construction features.

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## Scope and Methodology

In conducting our review, we reviewed the legislative histories of the various acts discussed in this report, including the legislative histories of the Park Service's basic authorities. We reviewed the Park Service's policies and guidelines governing historic structures and a Park Service study that identified various funding alternatives for the canal. To obtain information for our review, we contacted officials at the Park Service's George Washington Memorial Parkway (Parkway), the National Capital Region, and the Williamsport, Maryland, Preservation Training Center.

At the Parkway, we interviewed the Deputy Park Superintendent and various park officials and reviewed records and reports pertaining to the preservation of the canal. At the National Capital Region, we interviewed the Associate Regional Director for Operations and the Chief of the Historical Resource Division. We also obtained information on the preservation activities funded by the Park Service since 1966 and on the construction priorities within the region and the Park Service. At the Training Center, we interviewed one of the Historical Architects who developed cost estimates for the three funding alternatives for the canal. (See apps. III, IV, and V.) The architects submitted a preservation plan to Park Service management based on their work. We were not able to completely review their work because the records supporting these estimates were previously destroyed in the Training Center's records management process.

As you requested, we interviewed officials from the Virginia Canals and Navigations Society, which was founded in 1977 to preserve and enhance Virginia's rich inland waterways heritage. We also visited the canal site with them to obtain technical information on structural features and the Society's opinions on preserving the canal. Also, we interviewed an official of the Fairfax County Park Authority to obtain information on the authority's involvement with the canal. We conducted our review between August 1986 and February 1987 in accordance with generally accepted government auditing standards.

## Statutory Responsibilities of Preserving the Canal Being Met by the Park Service

The act of May 29, 1930, requires the Park Service to preserve the Patowmack Canal. To preserve the canal would mean, according to the act, to take those measures necessary to keep the canal in its present state by preventing further deterioration. Although the 1930 act requires that the Park Service preserve the canal, its responsibility to preserve the canal does not necessarily include reconstruction. The Senate Committee on the District of Columbia's report on the act neither states nor suggests that the Committee intended that the phrase "the preservation of the historic Patowmack Canal" meant that the canal be reconstructed.

The legislative history of the 1965 act authorizing the Park Service to acquire the land at Great Falls also does not refer to reconstruction of the canal, but only to the presence on the land of the remains of the canal and associated buildings.

## Park Service Plan for Funding Preservation Work for the Canal

The Park Service has taken the position that the canal is a historic structure that should not be rebuilt as an operating canal. This is in keeping with its longstanding policy of not restoring or rebuilding any structure to less than original specifications, which in the case of the canal are not available. In addition, according to the Park Service, what remains of the original canal would be destroyed by any rebuilding attempt.

The Park Service has studied various funding alternatives, including reconstruction, but limited preservation work through 1986 has consisted of emergency stabilization of lock structures, removal of destructive vegetation, and archeological investigation and salvage.

## Past Efforts to Preserve the Canal

According to Park Service officials, the first recorded work at the canal was structural work done in the 1930's. The first known Park Service initiative occurred in 1972 when all the structures at the canal were surveyed and recorded. A preservation and flood control study was done at the site in 1977. Also, about \$40,000 was designated in 1977 for archeological excavations at three structures in Matildaville.<sup>2</sup> The most significant expenditure occurred during 1979-80 when about \$165,000 was used to stabilize and to provide metal braces for locks 1 and 2.

<sup>2</sup>The town of Matildaville, settled at the head of the canal locks, started out as a construction camp and eventually included the company superintendent's house, a market, gristmill, sawmill, foundry, inn, and some small homes

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Funds were donated in 1975 by the American Society of Civil Engineers to construct the interpretive model of the canal that is displayed in the Great Falls Visitor Center.

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## Funding Alternatives Reviewed

In 1982, the Secretary of the Interior's Advisory Committee recommended that the Patowmack Canal be designated a National Historic Landmark. The committee did not recommend that the canal be reconstructed. Rather, it recommended that the Park Service preserve it and increase the public's awareness of the canal so that the requirements of the National Historic Preservation Act Amendments of 1980 (Public Law 96-515, Dec. 12, 1980) regarding historic structures are met. The canal was officially designated a National Historic Landmark on January 4, 1983. In January 1984 a historical architectural team from the Park Service's Williamsport, Maryland, Preservation Training Center was requested by the National Capital Region to prepare a preservation plan for the canal. The team concluded that there was only conjectural evidence on what the canal was like when it was operational and, since most of the canal was covered with silt and vegetation, it could only speculate as to where these parts of the canal are located. The head gates of locks 1 and 2 were the only original operating parts from the canal's structure that remained. The team concluded that the canal was nothing more than a collection of archeological remains.

The team issued its preservation plan in February 1985 and presented three funding alternatives. The Park Service released these alternatives publicly in May 1985. The team's detailed cost estimates were \$5.6 million for a fully reconstructed and operating canal; \$2.3 million for a dry (earth-filled) canal; and \$2.0 million for a partly reconstructed and earth-filled canal. These alternatives are discussed in more detail in appendixes III, IV, and V.

On December 30, 1985, the Superintendent, George Washington Memorial Parkway, after considering the three funding alternatives, approved a multiphase preservation program for the canal. This program was intended to serve as a compromise by combining work elements from all three funding alternatives. The initial phase of work was to stabilize those canal and canal-related structures that were in danger of being lost due to collapse, specifically locks 1 and 2. Lock 1 would be provided with stairs and a walkway so that visitors could enter the lock. The Superintendent's plan pointed out that lock 2 may have to be earth-filled because of major structural failures in the lock. The Parkway

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would be required in the remaining phases to give priority to the protection of historic resources that are subjected to slow deterioration and erosion from natural forces and visitor use. Masonry structures would be reset, drainage systems installed, and interpretive trails built.

The Deputy Park Superintendent said that the cost to complete the multiphase program was estimated at about \$2.8 million. A detailed breakdown of the work and what each work category would cost was not available in Parkway or National Capital Region records.

National Capital Region officials told us that because the costs to do the work are substantial, the Park Service would need to request a construction line-item in the budget specifically for this work. In the Park Service's construction project priority system, as of March 13, 1987, the Patowmack Canal project was ranked 199th among 595 projects nationwide, 15th among 57 projects in the National Capital Region, and 5th among 11 projects in the Parkway. Parkway officials estimated that it may be fiscal year 1989 before the canal work is started.

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### Some Work Started in 1986

Although the overall preservation work at the canal had to compete with other projects in the park system, the Parkway Superintendent worked with Region officials to start some preservation work on the canal in 1986. By using other Parkway funds, a program was started in the summer of 1986 that utilized Parkway crafts employees and maintenance staff to remove trees and vegetation in order to stabilize lock walls.

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## Conclusions

The Park Service has a longstanding policy against rebuilding any structure unless it can be rebuilt in accordance with the exact original specifications. In the case of the canal, not only are such specifications not available, but, according to the Park Service, any attempt to rebuild the canal would result in the destruction of what remains of the original canal. Accordingly, the Park Service has taken the position that it should preserve the remaining structures of the canal rather than rebuild them. We found no legal basis to conclude that the Park Service, by not rebuilding the canal, is not meeting its statutory responsibilities.

As directed by your office, we did not obtain official comments from the Park Service on this report. We did, however, discuss its factual accuracy with the Chief of the Historical Resource Division, National Capital



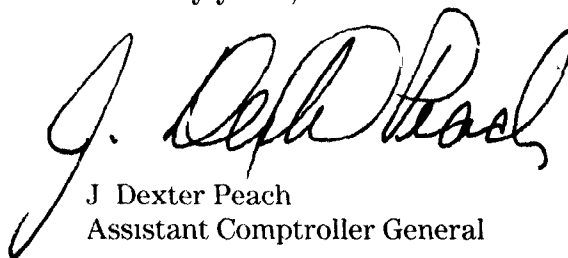
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Region, and incorporated the Region's views into the report where appropriate

As you requested, unless you publicly announce its contents earlier, we plan no further distribution of this report until 10 days from the date of this letter. At that time, we will send copies to interested parties, including the Park Service, and make copies available to others on request.

This work was performed under the direction of James Duffus III, Associate Director. Other major contributors are listed in appendix VI.

Sincerely yours,



J Dexter Peach  
Assistant Comptroller General

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**Abbreviations**

GAO      General Accounting Office

# Historical Background on the Patowmack Canal<sup>1</sup>

The George Washington Memorial Parkway was created to preserve the natural scenery along the Potomac River. It connects the historic sites from the Mount Vernon Estate past the nation's capital to the Great Falls of the Potomac. According to the Park Service, one of George Washington's major goals after the Revolutionary War was his plan to encourage internal commerce in the new nation by making the Potomac River navigable as far as the Ohio River Valley.

Park Service records indicated that, by far, the most demanding and complex task in making the Potomac River navigable was the building of a canal to skirt the Great Falls on the river. Roaring over the rocks, the river drops nearly 80 feet in less than a mile. The Patowmack Company, organized May 17, 1785, started construction of the Patowmack Canal in 1786. Construction was slow and engineers faced constant challenges. The section above the Mather Gorge was solid rock, and a channel was cut by using black-powder blasting techniques. Deep stair-step locks were devised for boats to reach the waters in the gorge. Stone masons, some of whom are known to have worked on the construction of the White House, shaped and set stones in the locks. Carpenters built miter gates with valves that permitted upstream and downstream use, and holding basins were dug to regulate the water supply. One of the earliest canals with locks in the nation, the Patowmack Canal was opened to river traffic in 1802.

Engineers designed the Patowmack Canal for the small, shallow-draft vessels of the late 1700's. These boats ranged from rafts, gondolas, and dugout canoes to the long narrow "sharper," a keelboat that carried up to 20 tons of cargo. The trip downstream from Cumberland, Maryland, to Georgetown took 3 to 5 days while the round trip required 12 to 18 days since a boat had to be poled upstream against the current. Only sharpeners made the return trip; rafts and gondolas were broken up and sold for lumber in Georgetown. Between 1799 and 1822, nearly 14,000 vessels carried 163,798 tons of cargo along the Potomac.

At the head of the canal locks at Great Falls was the town of Matildaville. A construction camp at first, the community grew and included the company superintendent's house, a market, gristmill, saw-mill, foundry, inn, and some small homes. Canal workers were sheltered in huts and barracks. The community's plan for becoming an industrial center did not occur. The company failed to prosper because high and low water levels in the river allowed the canal to operate efficiently

<sup>1</sup>This background was developed from records of the Park Service

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**Appendix I  
Historical Background on the  
Patowmack Canal**

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only a few months a year. When the company went out of business in 1828 and sold its rights to the Chesapeake and Ohio Canal Company, the community in Matildaville began to decline. Like the canal, Matildaville is a collection of archeological remains.

# Canal Construction Features

The Patowmack Canal was about 1,820 yards in length and about 25 feet at the water level and 20 feet at the bottom in width. (See fig. II.1.) It had an operating depth of 2 to 4 feet. Some of the prominent features of the canal are discussed below.

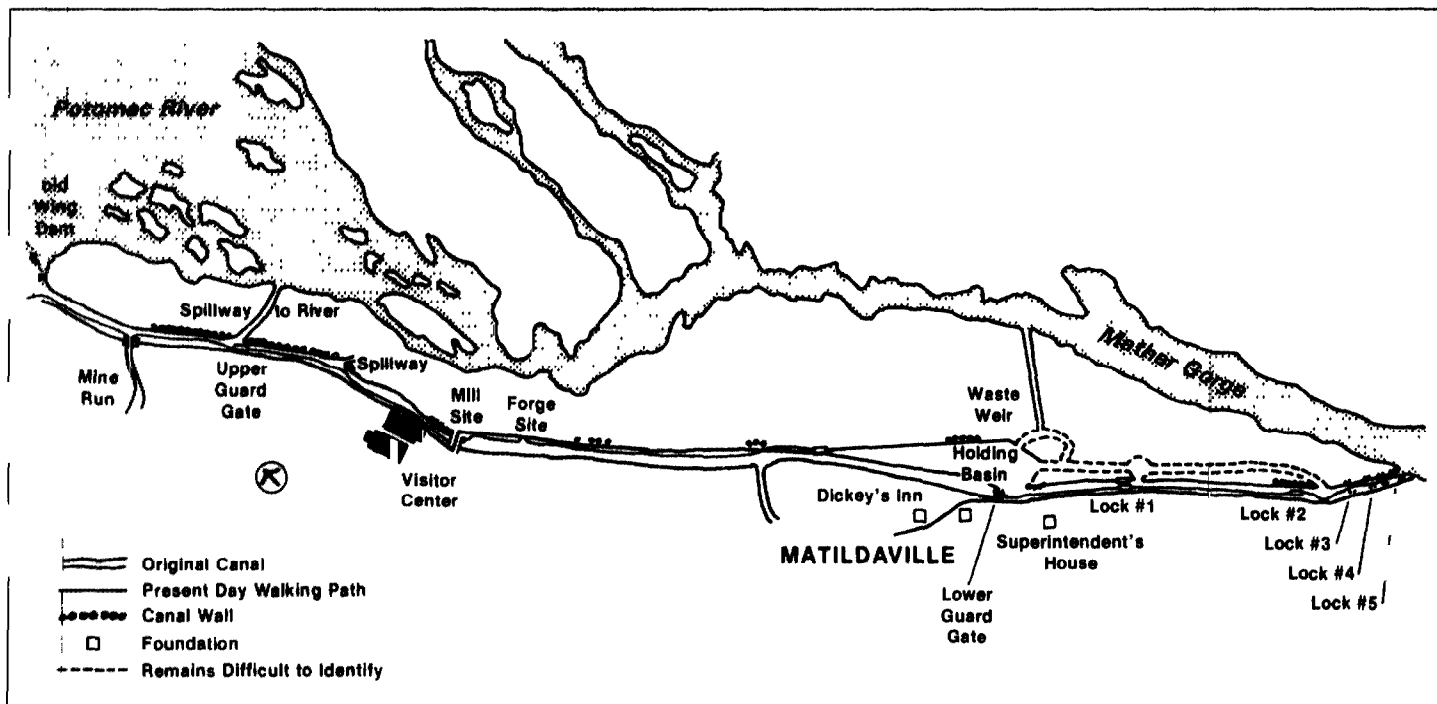
## Wing Wall

The wing wall functioned historically to divert additional water from the river into the canal, particularly during low water periods. The wall has been almost completely destroyed by flooding, although its basic configuration can be seen during low water periods. Canal company records indicate that in 1821 the wing wall was raised and extended considerably to provide more water for the operations.

## Canal Prism

The canal prism is the navigable channel affording level stretches of water between the canal entrance, locks, and discharge points. The canal prism is a significant archeological feature, but for much of its length, siltation and/or erosion have obliterated surface traces of its course.

Figure II.1: Map of the Patowmack Canal in Great Falls Park, George Washington Memorial Parkway



Source: National Park Service

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**First Spillway and  
Upper Guard Gate**

The first spillway and upper guard gate served to divert flood waters from the canal back into the Potomac River. The canal company's records do not indicate whether these features were part of the original canal.

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**Lower Spillway**

The lower spillway served as a leveling device by discharging excess water into the Potomac River.

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**Grist Mill and Foundry  
Waste Weirs**

The waste weirs at the Grist Mill and foundry sites were dam devices with a water outlet that were used to provide the water needed to power the mill wheels.

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**Holding Basin**

The holding basin functioned as a reservoir to impound sufficient water to operate the locks. Basically triangular in form, it was 1,175 feet in length, 210 feet at its widest point, and a maximum of 13 feet deep.

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**Guard Gate**

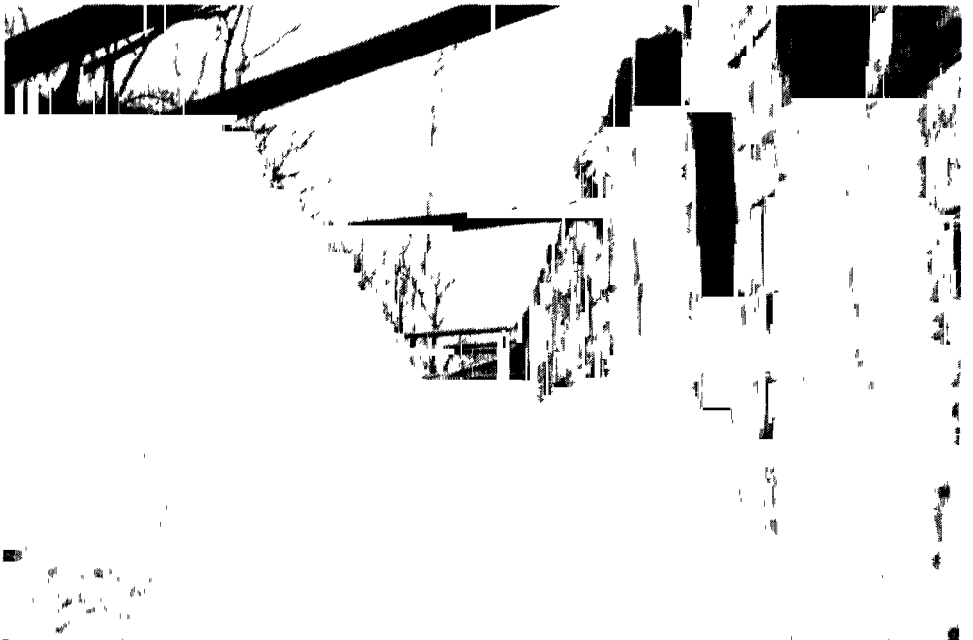
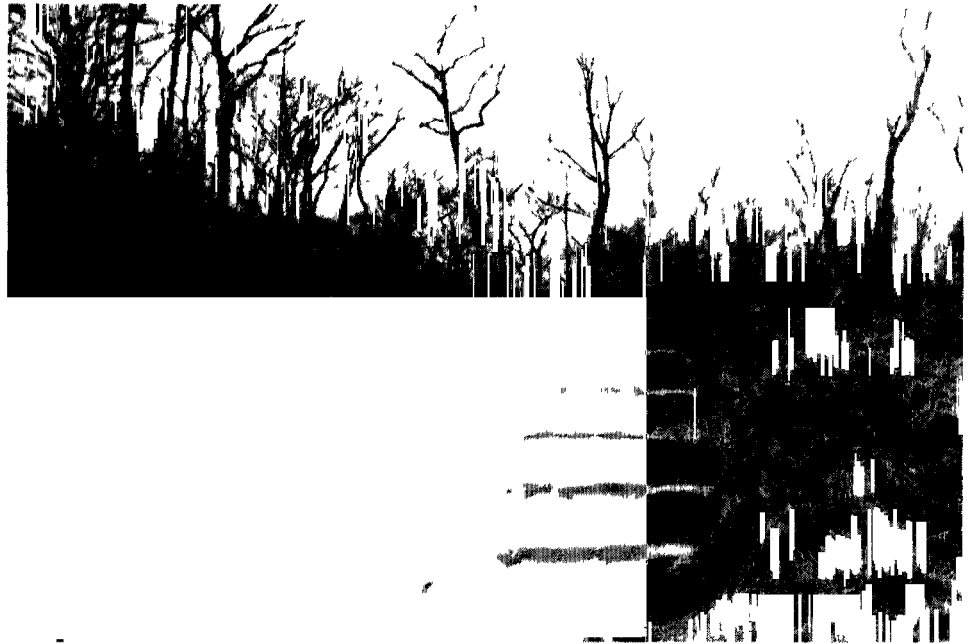
The guard gate was located above the locks at the lower end of the holding basin. The gate controlled the flow of water to the locks. If flooding occurred, the gate was locked and the excess water discharged through the holding basin waste weir. The gate also controlled the flow of water when repairs to the locks were necessary.

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**Lock 1**

Lock 1, the best preserved of the locks, is 100 feet in length and 14 feet in width. It was designed for a lift of 10 feet and a capacity of 18,200 cubic feet. (See fig. II.2.)

Figure II.2: Locks 1 and 2



Source: National Park Service



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**Lock 2**

After lock 1 was completed, the canal company encountered financial difficulties and construction delays. The width of lock 2 was reduced to 12 feet but the length remained at 100 feet. The lock was designed for a lift of 16 feet and a capacity of 22,800 cubic feet.

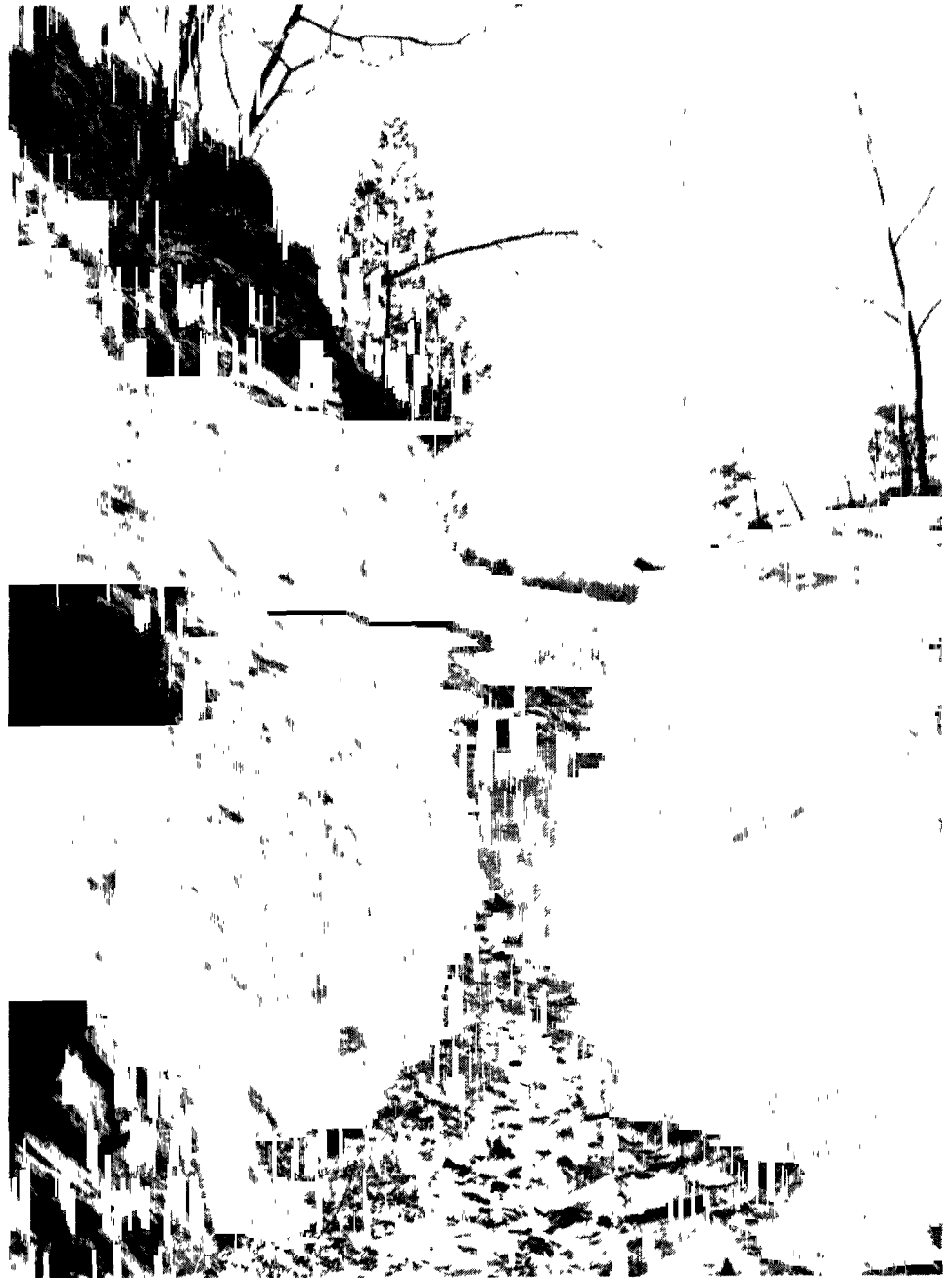
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**Locks 3, 4, and 5**

These locks were joined, forming a riser of three steps having a combined lift of 50 feet. Their capacities were 20,400, 25,200, and 25,200 cubic feet, respectively.

Locks 4 and 5 were cut through bedrock. Except for an isolated masonry structure on the south west wall and remnants of wrought iron anchors, nothing remains of the gates and operating features. (See fig. II.3.)

Figure II.3: Bedrock Cuts for Locks 4 and 5



Source: National Park Service

# National Park Service's Cost Estimates to Perform Funding Alternative I—Reconstruct the Canal

Alternative I would fully reconstruct and make the canal operational. All operating structures would be reconstructed to a functional condition to maintain and regulate water flow in the canal prism. The Historical Architects, Williamsport Preservation Training Center, estimated that reconstruction would cost about \$5.6 million because such features as the wing dam, spillways, guard gates, and locks would have to be rebuilt. According to a historical architect at the Center, this alternative would not meet the Park Service's policy concerning historic structures but was prepared so that a reconstruction alternative would be presented in the preservation plan.

**Table III.1: Cost Estimates for Alternative I, February 1985**

Description of work	Cost estimates
Restore wing dam.	<b>\$1,200,000</b>
Entrance to canal	
Remove silt build-up	\$30,000
Clear and thin vegetation	25,000
Excavate canal prism	25,000
	<b>80,000</b>
Restore first spillway.	
Demolition	2,500
Restoration	26,000
	<b>28,500</b>
Upper guard gate	
Masonry repair and restoration	110,000
Reconstruct gates	75,000
	<b>185,000</b>
Canal to lower spillway	
Excavation	12,000
Clear and thin vegetation	12,500
Repair canal walls	65,000
	<b>89,500</b>
Lower spillway:	
Restore to operating level of canal	<b>45,000</b>
Excavate canal from lower spillway to Grist Mill	<b>8,500</b>
Grist Mill site	
Restoration of mill outlet to retain water at operating level of canal	<b>26,000</b>
Canal from Grist Mill site to holding basin.	
Excavation	128,000
Stabilization of canal walls	275,000
Removal of existing walkway	8,500
	<b>411,500</b>

**Appendix III  
National Park Service's Cost Estimates to  
Perform Funding Alternative I—Reconstruct  
the Canal**

Description of work	Cost estimates
Holding basin.	
Clear cut vegetation within berm	14,000
Selective cutting of mature trees	8,500
Excavation	90,000
Restoration of berm	35,000
	<b>147,500</b>
Reconstruct waste weir	<b>46,000</b>
Reconstruct lower basin feeder gate	<b>16,000</b>
Lower guard gate	
Restoration and stabilization of masonry	75,000
Reconstruct gates	65,000
	<b>140,000</b>
Lock 1	
Excavation	7,000
Restoration and stabilization of masonry	150,000
Reconstruct floors, sills, gates, and hardware	450,000
	<b>607,000</b>
Lock 2:	
Excavation	7,500
Restoration and stabilization of masonry	300,000
Reconstruct floors, sills, gates, and hardware	450,000
	<b>757,500</b>
Lower holding basin	
Excavation	8,000
Clear cut vegetation	12,000
Reconstruction of walls	40,000
	<b>60,000</b>
Lock 3.	
Excavation	7,000
Restore west (land side) wall	150,000
Reconstruct east wall	250,000
Reconstruct timber framing, gates, and hardware	220,000
	<b>627,000</b>
Locks 4 and 5	
Clear debris	5,000
Reconstruct timber framing	400,000
Reconstruct masonry	150,000
Reconstruct gates	450,000
Reconstruct operating hardware	100,000
	<b>1,105,000</b>
Selective clearing of vegetation at locks	<b>12,000</b>
Reconstruct visitor walkway from Grist Mill site to locks 3, 4, and 5	<b>38,000</b>
<b>Total estimated costs to complete alternative I</b>	<b>\$5,630,000</b>

# National Park Service's Cost Estimates to Perform Funding Alternative II—Dry Canal

Alternative II would provide for a dry canal. The major feature is that the canal prism, from the upstream entrance to lock 3, would be re-established and filled with earth to the original water operating level. From lock 3, the earth would be graded down gradually into the existing level of the Mather Gorge and a subsurface drainage system would be placed the length of the prism. The cost for the dry canal option was estimated at about \$2.3 million.

**Table IV.1: Cost Estimates to Complete Alternative II, February 1985**

Description of work	Cost estimates	
<b>Canal Prism:</b>		
Construct earth berm at upstream entrance	\$33,000	
Backfill canal prism to operating level	345,000	
Install subsurface drainage	165,000	
Construct pedestrian walkway	185,000	
Clear and thin vegetation, reseeding	29,000	
Construct culvert at mine run	140,000	
Stabilize and restore masonry structures	145,000	\$1,042,000
<b>Holding basin</b>		
Stabilize stone retaining wall	45,000	
Selective restoration of masonry features	46,000	
Clear and thin vegetation, reseeding	8,000	
Provide earth fill to operating level	9,000	
Construct pedestrian walkway and bridge	26,000	
Paving to delineate land side of canal	235,000	369,000
<b>Head gate:</b>		
Selective restoration and stabilization of masonry	31,000	
Earth fill to operating level	26,000	
Clear and thin vegetation, reseeding	8,000	65,000
<b>Lock 1</b>		
Selective restoration and stabilization of masonry	45,000	
Excavate lock to historic elevation	7,000	
Reconstruct two pairs of lock gates	435,000	
Provide subsurface drainage	6,000	
Backfill at lock ends	15,000	
Construct stair and walkway	15,000	
Clear and thin vegetation, reseeding	35,000	558,000

**Appendix IV  
National Park Service's Cost Estimates to  
Perform Funding Alternative II—Dry Canal**

<b>Description of work</b>	<b>Cost estimates</b>	
Lock 2		
Selective restoration and stabilization of masonry	90,000	
Install subsurface drainage	20,000	
Construct retaining wall	15,000	
Earth fill to operating level	31,000	
Clear and thin vegetation, reseeding	9,000	165,000
Locks 3, 4, and 5:		
Stabilize masonry	44,500	
Clear and thin vegetation, reseeding	27,000	
Earth fill to operating level	18,500	
Construct pedestrian walkway in gorge with barrier river end	26,500	
Clear debris in gorge	5,000	121,500
<b>Total costs estimated to complete alternative II</b>		<b>\$2,320,500</b>

# National Park Service's Cost Estimates to Perform Funding Alternative III— Impoundment

Alternative III contained parts of alternatives I and II. It would impound water between the upper canal entrance and the Grist Mill site. From the mill site, a dry canal would be constructed. Lock 1 would be constructed so that visitors would be allowed to enter the lock. The construction work was estimated at a cost of about \$2.0 million.

**Table V.1: Cost Estimates to Complete Alternative III, February 1985**

Description of work	Cost estimates	
<b>Impound water to grist mill site</b>		
Canal entrance:		
Clear and thin vegetation	\$8,000	
Earth berm dam with riprap on river side and overflow structure for excess water from mine run	33,000	<b>\$41,000</b>
First spillway:		
New riprapped earth berm over existing stone remains		<b>9,500</b>
Canal to lower spillway:		
Clear and thin vegetation	12,500	
Selective repairs to stone walls	87,000	<b>99,500</b>
Regrade canal bed		<b>145,000</b>
Lower spillway		<b>37,000</b>
Canal from lower spillway to Grist Mill site:		
Excavation and dewatering operations, cutback and riprap at existing drainage entering canal		<b>137,000</b>
Grist Mill site:		
Construction of outlet point, waste weir, and spillway	26,000	
Riprapped earth berm at limit of impounded area	8,000	<b>34,000</b>
<b>Total costs estimated to impound water to Grist Mill site</b>		<b>503,000</b>
<b>Dry canal from grist mill site to outlet at downstream end</b>		
Lower spillway to holding basin:		
Construct pedestrian walkway	185,000	
Clear and thin vegetation, reseeding	12,500	
Stabilize and restore masonry structures	58,000	<b>255,000</b>
Holding basin:		
Stabilize stone retaining wall	45,000	
Selective restoration of masonry features	46,000	
Clear and thin vegetation, reseeding	8,000	
Provide earth fill to operating level	9,000	
Construct pedestrian walkway and bridge	26,000	
Paving to delineate land side of canal	235,000	<b>369,000</b>

**Appendix V  
National Park Service's Cost Estimates to  
Perform Funding Alternative III—  
Impoundment**

<b>Description of work</b>	<b>Cost estimates</b>	
<b>Head gate</b>		
Selective restoration and stabilization of masonry	31,000	
Earth fill to operating level	26,000	
Clear and thin vegetation, reseeding	8,000	<b>65,000</b>
<b>Lock 1:</b>		
Selective restoration and stabilization of masonry	45,000	
Excavate lock to historic elevation	7,000	
Reconstruct two pairs of lock gates	435,000	
Provide subsurface drainage	6,000	
Backfill at lock ends	15,000	
Construct stair and walkway	15,000	
Clear and thin vegetation, reseeding	35,000	<b>558,000</b>
<b>Lock 2.</b>		
Selective stabilization and restoration of masonry	90,000	
Install subsurface drainage	20,000	
Construct retaining wall	15,000	
Earth fill to operating level	31,000	
Clear and thin vegetation, reseeding	9,000	<b>165,000</b>
<b>Locks 3, 4, and 5</b>		
Stabilize masonry	44,500	
Clear and thin vegetation, reseeding	27,000	
Earth fill to operating level	18,500	
Construct pedestrian walkway in gorge with barrier at river end	26,500	
Clear debris in gorge	5,000	<b>121,500</b>
<b>Total costs estimated for dry canal from Grist Mill site to outlet at downstream end</b>		<b>1,533,500</b>
<b>Total costs estimated to complete alternative III</b>		<b>\$2,037,000</b>



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# Major Contributors to This Report

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Resources, Community,  
and Economic  
Development Division,  
Washington, D.C.

James Duffus III, Associate Director, (202) 275-7756  
Robert E. Allen, Jr., Group Director  
Joseph A. Maranto, Evaluator-in-Charge  
Sharon Keesee, Typist

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