

"WE ARE AGAIN IN THE MIDST OF TROUBLE":
FLOODING ON THE POTOMAC RIVER
AND THE STRUGGLE FOR THE SUSTAINABILITY
OF THE CHESAPEAKE AND OHIO CANAL, 1828-1996

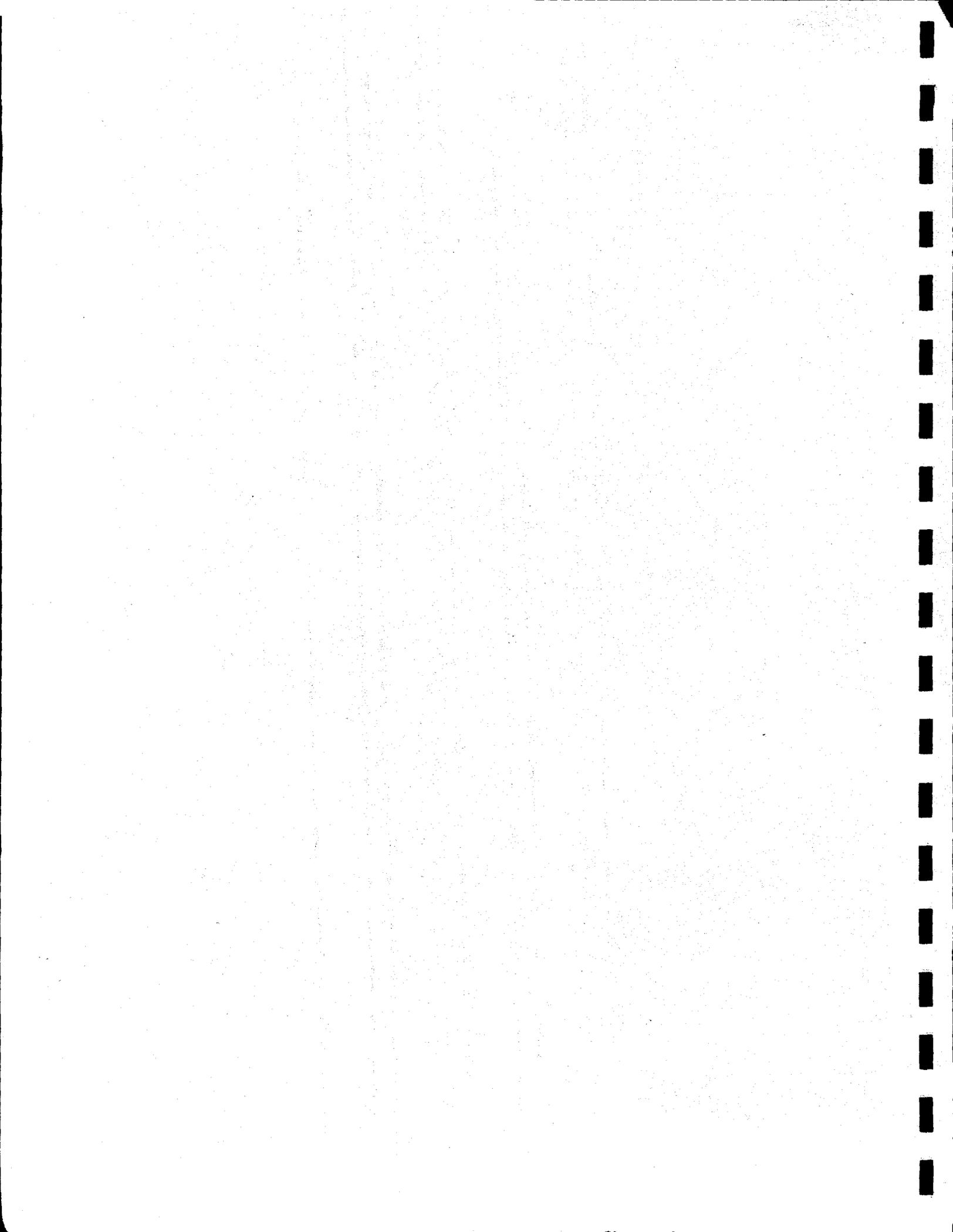


By

Donald R. Shaffer

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AND THE STRUGGLE FOR THE SUSTAINABILITY
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Prepared By

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We are again in the midst of Trouble, Everything we have been doing the Last 6 weeks have been swept a way; and we may as well & Better have burn [sic], the money we have expended on this portion of the Canal; The whole canal is now under water; This is discouraging; I am discouraged after night & day for the Last 6 weeks to restore the navigation; and Just as it was Ready for the Trade, to entirely be swept away.

W. S. Elgin, maintenance superintendent, to James M. Coale, president of the C&O Canal Company. 25 November 1847.

This letter, written shortly after renewed flooding destroyed just-completed repairs of an earlier flood in October 1847, captures the devastating effect flooding had on the morale of people working on the Chesapeake and Ohio Canal.

Cover Photo: a crowd on the banks of the Potomac River at Williamsport, Md., watches the water rising around the Cushwa Coal Warehouse on March 18, 1936. The warehouse and its adjacent basin served canal traffic until the canal closed in 1924. The building is now the C&O Canal NHP's visitors' center in Williamsport. Note the inundated railroad cars to the left of the warehouse. The canal runs parallel to the trees behind the railroad cars. The March 1936 flood was the greatest ever recorded on the Potomac.

Photo Credit: New American Photo Archives, Marylandia, McKeldin Library, University of Maryland, College Park.

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ABSTRACT

Recurrent flooding has plagued the Chesapeake and Ohio Canal throughout its history. During its operational era, major floods repeatedly put the waterway out of business, sometimes for months, and were a key factor behind the failure of the C&O Canal Company in 1890 and the final closure of the canal in 1924. Since the purchase of the canal by the federal government in 1938 and its transformation into a park, flooding has continued to be a major problem. Flood damage has made the towpath inaccessible to the public for long periods and required the expenditure of tens of millions of dollars for repairs and the stabilization of canal structures.

The response to flood damage on the C&O Canal changed over time. The shifts reflected the differing priorities of the organizations controlling the canal. For instance, the C&O Canal Company, which built the waterway, wanted to operate it as a profitable business. Consequently, the company promptly repaired flood damage. Every day the canal was closed meant a loss of revenue. As the threat posed by the river to reliable navigation became apparent in the 1840s, the company started trying to protect to the canal and make it sustainable. However, it experienced only limited success in this endeavor and the considerable expense of flood repairs and damage prevention activities contributed to the failure of the canal company in 1890.

The canal fell into the hands of trustees representing the Baltimore and Ohio Railroad. Their main concern was not the canal's sustainability, but preventing its right-of-way from falling into the hands of competitors. To control the C&O Canal's right-of-way, the B&O found it necessary to keep the canal in operation to prevent its sale by the courts. Consequently, they spent only the bare minimum required to maintain the canal and undertook few projects aimed at preventing flood damage. Under the B&O trustees, the condition of the canal declined. The waterway managed to stay in operation for thirty-five more years, however, because the period from 1889 to 1924 was unusually free of major floods on the Potomac River. After the flood of May 1924 finally gave the railroad the justification to close the canal, maintenance on the waterway largely ceased and its rate of deterioration increased markedly.

With the acquisition of the C&O Canal by the federal government in 1938, the National Park Service adapted it to serve the recreational needs of the national capital region and the goal of historic preservation. Both aims gave the federal government an incentive to repair and maintain the C&O Canal, especially after major floods. However, since the canal had to

compete with the rest of the government for federal dollars, maintenance funds were often scarce and money for flood restoration slow in coming. Repairs that would have taken weeks or months under the C&O Canal Company, stretched into years under federal control. Given these circumstances, the canal continued to deteriorate until the 1972 flood finally prompted the federal government to spend millions restoring and stabilizing the waterway. This expenditure improved the flood worthiness of the canal, but failed to make it invulnerable to damage from high water as the floods of 1985 and 1996 have shown.

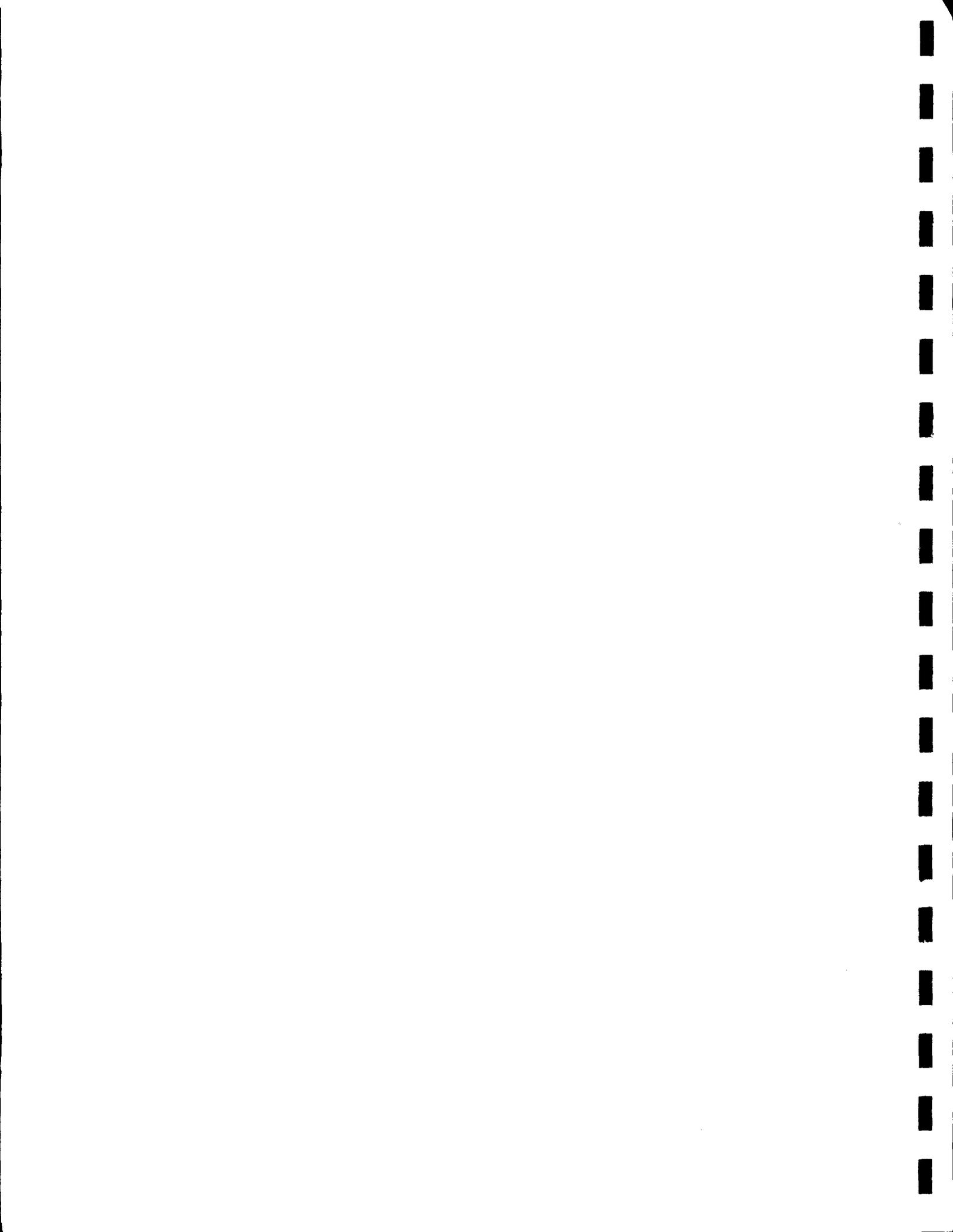
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INTRODUCTION

This report is a historical analysis of responses to flooding on the Chesapeake and Ohio (C&O) Canal from the time construction began on the waterway in 1828 up until (but not including) the flood of January 1996. The January 1996 flood on the Potomac River devastated the Chesapeake and Ohio Canal National Historical Park (hereafter C&O Canal NHP), which follows the Potomac for nearly 185 miles along its northern shore from Washington, D.C., to Cumberland, Md. The flood cut many breaks in the towpath, damaged other canal structures, and scattered garbage and debris over the park. A second flood in September 1996 compounded the devastation left from January. The floods of 1996 were the latest in a long series of ravaging episodes of high water to affect the C&O Canal since 1828. During the years it was a functional waterway, major floods time and again put the canal out of commission, seriously inconveniencing shippers and undermining confidence in the canal company.

However, the greatest problem resulting from flooding was the extraordinary repair expense. In fact, the cost of fixing the canal after floods contributed significantly to the failure of the C&O Canal Company. Each episode of high water increased its already ponderous debts until by the late 1880s the canal company's credit was completely exhausted, allowing the great flood of 1889 to deal the company a fatal blow. The Baltimore and Ohio Railroad, which controlled the canal between 1890 and 1938, largely managed to avoid such catastrophic expenditures because of an unusually flood-free period on the Potomac between 1890 and 1924, but the federal government was not as fortunate. Three major floods on the Potomac River since 1938 (in October 1942, June 1972, and November 1985) and many other smaller floods have cost the National Park Service (NPS) tens of millions of dollars.

The floods of January and September 1996 necessitated another round of costly repairs. Congress and the Department of the Interior have thus far proved generous in funding this work, and the C&O Canal NHP also has benefitted from an unprecedented outpouring of volunteer labor and gifts from private sources. However, the Superintendent of the C&O Canal NHP, Douglas Faris, and his staff have recognized the impracticality in an increasingly austere fiscal climate of obtaining tens of millions of dollars to restore the canal after each major flood. Therefore, they decided after the 1996 floods to rebuild the canal in as sustainable a manner as possible in order to minimize the expense of future flood repairs.

In keeping with the goal of making the canal sustainable, the C&O Canal NHP launched the Flood History Study during the summer of 1996. The project was organized as Cooperative Agreement CA-3040-4-9001 between the C&O Canal NHP and the University of Maryland, College Park. The Flood History Study had two goals: 1) to provide a thorough and detailed description and analysis of the effects of flooding upon the canal throughout its history and; 2) to determine what measures had been made in the past to protect the canal, in the hope it could provide ideas for future flood protection.

Previous scholarship by NPS historian Harlan D. Unrau already has addressed the first question. As a member of the restoration team from the Denver Service Center after the 1972 flood, Unrau wrote a flood history of the C&O Canal in 1976. He provided a detailed discussion of floods affecting the C&O Canal from 1828 to 1936, based primarily on the C&O Canal Company papers at the National Archives in Washington, D.C., the published annual reports of the canal company, and newspaper accounts. His study moved chronologically, describing the causes of each episode of high water (if known), the extent and patterns of damage, repair activity--and in a few cases--flood damage prevention efforts. Unrau's study was intended for publication as part of a series of studies he wrote on the history of the C&O Canal, but funding never materialized and the flood history stayed in manuscript form.

The Flood History Study builds on Harlan Unrau's work. Research began in late August 1996 in the C&O Canal Company papers, which are now located at the new National Archives facility in College Park, Maryland (known as Archives II). These papers are part of Record Group 79, Records of the National Park Service. At Archives II researchers examined sixty-five bound volumes and loose documents, that if piled on top of each other would rise nearly thirty-nine feet in the air. Of these records, the correspondence of the executive and field officers of the C&O Canal Company, the minutes of the directors and stockholders meetings, and the correspondence of B&O Railroad trustees, who managed the canal during the entire period it was controlled by that corporation, proved most useful.

It had been thought prior to the beginning of the project that the records of the Civilian Conservation Corps (CCC), whose personnel did repair work on the C&O Canal in the late 1930s, would prove valuable. However, consultation with archivists revealed that the CCC papers merely documented the operation of their camps, and that the planning and management of the repairs on the canal were the responsibility of the National Park Service. Archives II personnel located four boxes containing NPS correspondence, research reports, plans, and blueprints for the pre-World War II restoration of the canal. These materials were

examined after the investigation of the C&O Canal Company papers was completed.

Work at the National Archives was finished by mid-January 1997. From then until the end of March research continued simultaneously in documentary materials gathered from several sources. Perhaps were the most important were NPS records on the C&O Canal held at the Washington National Records Center in Suitland, Md. As Suitland is merely a storage facility, it was necessary to have the records there shipped out to the headquarters of the C&O Canal NHP in Sharpsburg, Md. Since the Suitland records were not catalogued the author ordered their entire holdings on the C&O Canal (filling over forty standard government storage boxes) to cull them for useful material. The most valuable documents from Suitland consisted of the correspondence on the maintenance of the canal from the 1940s until it became a national monument in 1961. Time also was spent gathering relevant newspaper clippings off microfilm at the University of Maryland, College Park, and examining documents from the library at headquarters of the C&O Canal NHP. The library contained a nearly complete collection of the annual reports of the C&O Canal Company and a file of correspondence dealing with the repair of the canal after the 1972 and 1985 floods, and other miscellaneous materials. However, the disorganized condition of the library meant its resources probably were not fully utilized.

Research notes from the documentary sources were compiled in electronic form as word processing files. They consist primarily of verbatim extracts of original documents from the National Archives, the Washington National Records Center, and other sources. The electronic notes are a chronological, documentary history of flooding and flood damage prevention activities on the C&O Canal from 1828 to 1996. The newspaper clippings and more recent park documents on flooding also were collected in a "C&O Canal Flood File." The clippings and documents in the flood file are referenced and described, although not transcribed, in the electronic notes. The electronic notes and the C&O Canal Flood File are available at the headquarters of the C&O Canal NHP.

Starting in late March, a mini-oral history project began, consisting of interviews with seven men who had played a role in flood repairs in the C&O Canal NHP after the 1972 and 1985 floods. The subjects interviewed were (in alphabetical order): 1) William Failor, superintendent from 1972 to 1981; 2) John Frye, a former member of the C&O Canal Commission (the citizens' advisory panel for the park), a seasonal ranger and canal enthusiast; 3) Gordon Gay, current chief of interpretation for the park; 4) George Hicks, a former maintenance foreman and preservation officer; 5) Richard Huber, who headed the restoration team after the 1972 flood; 6) Dale Sipes, maintenance

chief from 1971 to 1985; and 7) J. D. Young, assistant superintendent from 1977 to 1991. The number of interviews was constrained by time limitations, and the difficulty of locating former park personnel.

A typical interview consisted of questions regarding specific floods that occurred during the subjects' association with the C&O Canal NHP, and their participation in post-flood repairs. For administrative personnel questions related more to administrative and financial issues associated with repairing the canal, while the questions directed to former maintenance personnel concentrated on the actual repair work. All of the interviewees were asked for specific suggestions about how to increase the sustainability of the canal, and most gave many practical suggestions. The interviews were recorded and transcribed, and the tapes and transcripts are available at the headquarters of the C&O Canal NHP.

The following report is an interpretive study of the response of canal authorities to floods. It contains only general descriptions of the floods and flood damage on the C&O Canal, sufficient for readers to understand the actions taken to prevent future flood damage. Persons seeking the most detailed information on flood damage patterns should consult the electronic notes, the C&O Canal Flood File, and Harlan Unrau's flood history.

Users of these sources, however, should understand their limits. The papers of the C&O Canal Company, particularly the correspondence files, get sketchy after 1880. Likewise, the papers of B&O trustees are sparse prior to the 1910s. Hence, the historical record has gaps, and even where records do exist they might not contain the information intelligible or useful to modern readers. Personnel on the canal wrote for their own time. For instance, early in the history of the canal, they often described place locations in terms of canal construction sections, a description for which is not available. They also wrote of place names which have fallen out of use; made statements based on unstated facts known to the recipient of the letter but unknown to modern readers; or were inadvertently or deliberately vague. Certainly the most useful documents in the electronic notes are the letters of the maintenance superintendents. They provide the most detailed information of flood damage patterns. The stockholders and directors proceedings can also be useful, but the data they contain tends to be more summary in nature.

Likewise, the value of the oral histories are limited by the memories of the men interviewed. After many years, most of the subjects do not remember details in any systematic way. Consequently, the interviews are valuable more in terms of the

theory and practice of flood protection, than they are in documenting specific flood damage. Documentary sources are a better source of flood damage information, particularly during the era of the C&O Canal Company. Harlan D. Unrau's study is a fine recapitulation of the information in the electronic notes (prior to 1938) and the C&O Canal Flood File, but it is essentially derivative in nature.

Hence, rather than repeat yet again the information on flood damage patterns available in the aforementioned resources, this report mainly analyzes how canal managers reacted to floods, and how such responses changed over time, particularly as different organizations gained control of the canal. This question has received only minimal attention in the past--an unfortunate oversight. For just as floods were recurring, so were the efforts to protect the canal from the Potomac River. Nineteenth-century engineers described such work as making the canal more "durable" or "permanent," instead of "sustainable," but they clearly aspired after same goal pursued by the C&O Canal NHP today. Hence, their experience is of considerable relevance to the present campaign to protect the park from floods.

The report contains four chapters. The first three chapters consist of a general history of the reaction to flooding on the C&O Canal by the managers that controlled it. The first chapter considers this question during the life of the C&O Canal Company (1828-90). The second chapter examines the response of the B&O Railroad to flooding on the canal (1890-1938). The third chapter looks at the problem of floods under federal control (1938-present). The fourth chapter presents two case studies. These case studies examine, over the entire history of the canal, how authorities coped with floods in two of its most vulnerable areas: the Widewater section between Great Falls and Old Angler's Inn, and the general area of canal opposite of Harpers Ferry, W.Va.--particularly at the junction of the Potomac and Shenandoah Rivers. The report also is illustrated with historic photographs, and contains maps to help readers understand where events being described actually took place.

Donald R. Shaffer, a recent Ph.D. in the History Department at the University of Maryland, College Park, was the principle researcher for the Flood History Study, and the author of this report. Many other people, however, made contributions to the project. Rebecca Stevens organized the cooperative agreement between the C&O Canal NHP and the University of Maryland. Doug Stover and Jill Halchin supervised the project for the park. Judy Collins assisted in the research at the National Archives for short periods. Dwight Stinson, historian for the C&O Canal NHP, also provided occasional research assistance.

CHAPTER 1

THE C&O CANAL COMPANY

The Early Years: 1828-36

The C&O Canal Company labored futilely for sixty years to cope with flooding from the Potomac River. The company failed because it had what ultimately proved a horrendous task: to maintain a functional and profitable canal within the flood plain of an especially flood-prone river.¹ The frequency and severity of high water ultimately proved beyond the resources of the company to pay for repairs.

Promoters of the C&O Canal were aware before its construction that flooding posed a potential threat, but they thought the danger manageable. The Joint Virginia-Maryland Commission that studied the feasibility of a canal along the Potomac in the early 1820s recommended the canal "be generally elevated above the highest floods, except when it is found necessary to take in a supply of water from the river or to pass expensive ground along a rocky shore."²

Likewise, the C&O Canal Company also knew early on of the waterway's vulnerability to the Potomac River. Yet they also believed they could cope with the problem. During the early years of construction, Charles Mercer, the first president of the canal, gave orders that engineers ensure that the height of the canal embankments were above the highest known floods in the

¹A report by the Army Corps of Engineers to Congress after World War II, indicated that the potential for flooding on the Potomac was greater than on other rivers. The Corps stated:

The capacity of streams in the Potomac River to translate run-off rapidly downstream results (a) from the mountainous terrain of the larger portion of the basin and (b) from the pattern of the streams in the watershed in which tributaries of nearly equal length converge at several points to synchronize flood crests. Studies indicate that the same amount of flood run-off will produce larger flood flows in the Potomac River Basin than in adjacent Middle Atlantic coastal rivers to the south.

See Congress, House, Committee on Flood Control, Potomac River and Tributaries, Maryland, Virginia, West Virginia, and Pennsylvania, 79th Cong., 2d sess., 1946, House Document No. 622, p. 24.

²Message of the Governor of Maryland, Communicating the Report of the Commissioners Appointed to Survey the Potomac River (Annapolis: J. Hughes, 1822), 47.

river.³ In addition, the construction guidelines for the C&O Canal gave instructions for making the embankments of the canal flood resistant. The company directed:

In all cases when the outside walls of the canal is liable to be covered by river freshets, the embankments behind the same shall be carried up with spall of the quarries or excavated rock of the Section, one foot in thickness, and if there be no spalls, the contractor may be required to pound or reduce part of the excavated rock of the Section to a size to pass through a three-inch ring.⁴

Therefore, during the earliest years of the C&O Canal, canal officials believed they could successfully deal with high water. They established a dual strategy of minimizing flood damage: 1) to place the canal out of harm's way by constructing it beyond the flood plain whenever possible; 2) to build structures sufficiently strong, elevated, and well drained to withstand freshets within the flood plain. Because of the narrowness of the Potomac Valley, it often was not possible to place the canal outside the flood plain, and the company more often was forced to adopt the second preventive approach.

During the 1830s, contractors, and company engineers and division superintendents proposed various improvements they believed would make the canal safer against freshets. The projects included strengthening weak walls and embankments with masonry or riprap, adding additional culverts, waste weirs, spillways and stop locks. The President and Board of Directors approved many of these proposals. Perhaps the most significant flood damage prevention project, completed by 1835, was "protection walls, embracing fully thirty miles in extent . . . on the line of the canal, varying from ten to twenty feet in height, and, in some places from forty to sixty feet."⁵

³Minutes, 30 August 1828, C&O Directors Proceedings, 1828-90.

⁴Quoted in Harlan D. Unrau, Chesapeake and Ohio Canal National Historic Park Resource Study, Chapter 4, Canal Engineering Technology Employed in the Construction of the Chesapeake and Ohio Canal: 1828 (Seneca, Md.: Chesapeake and Ohio Canal Restoration Team, 1976), 83.

⁵Seventh Annual Report, 1 June 1835, Proceedings of the Stockholders, 1828-90, Chesapeake and Ohio Canal Company, Entry 180, Record Group 79, Records of the National Park Service, National Archives, College Park, Md. [Hereafter C&O Stockholders Proceedings, 1828-90]. G. C. Washington, who made the annual report in 1835, unfortunately did not specify where these walls had been built.

The First Major Flood: 1836

The June 1836 freshet was the first major flood to affect the canal after the beginning of construction. The spring of 1836 was very wet and six days of continuous rain in June raised the water level in the Potomac's tributaries, particularly the Shenandoah. The resulting flood was the greatest on the river since 1810. Company officials initially feared the flood had done considerable damage to the canal. However, the devastation turned out to be less than initially thought and the canal company fully restored navigation within three weeks. "On the completed portion of the canal," wrote NPS historian Harlan Unrau, "the most extensive damage occurred at Dam No. 4 and Harpers Ferry and from Seneca to Little Falls. The flood inflicted considerable damage upon the canal embankments still under construction below Cacapon River."⁶ There were six notable breaches from Little Falls to Seneca. There were also some breaks in the canal between Edwards Ferry and Seneca, and a sizable breach and erosion of the guard bank at Dam 4. On the unfinished portion of the canal, the canal company lost 5,800 cubic yards of embankment to the high water. The flood also left sand bars in many places along the prism of the canal, particularly at Harpers Ferry where breaks above the town led to the obstruction of the feeder at Dam 3.

During the flood of 1836, J. Y. Young, superintendent of the Georgetown division, took several steps to reduce damage from the flood once he learned the water in the river was rising. He had the canal emptied between Lock 14 and 15, in the Widewater area, to reduce the pressure on an embankment where a slippage had developed. Young also instructed a foreman to cut a controlled break in an embankment on the Georgetown level to save a high embankment farther downstream, because he found a waste weir there could not sufficiently vent the excess water from the canal.⁷

⁶Harlan D. Unrau, The Major Floods of the Potomac River and Their Effect on the Chesapeake and Ohio Canal: 1828-1936, Chapter 10, Chesapeake and Ohio National Historical Park Historic Resource Study (Seneca, Md.: Chesapeake and Ohio Canal Restoration Team, 1976), 3.

⁷Ibid., 3-4; J. Y. Young, Superintendent, Canal Line to J. P. Ingle, Clerk, Washington, D.C., 2 June 1836, [6 a.m.]; J. Y. Young, Superintendent, Canal Line [near Lock 21], to J. P. Ingle, Clerk, Washington, D.C., 2 June 1836, [4 p.m.]; J. Y. Young, Superintendent, Canal Line, to "Dear Sir," 3 June 1836, C&O Incoming Correspondence, 1828-90.

Young's letters are a good example of the use of construction sections, in the early decades, to describe locations along the canal. A construction section was a unit of the canal assigned to a particular contractor to build. In his 4:00 p.m. letter on June 2, Young writes, "The only plan I could adopt with the Geo Town level was to cut away through on Sec E to save the high

The success with which the canal withstood the flood of June 1836, made canal officials, particularly the C&O President, G. C. Washington, confident about the canal's sustainability. At the annual company meeting, he asserted that the damage to the waterway had occurred primarily where the canal was too close to the river, and he assured stockholders that the company was trying to move the unfinished portions of the canal farther away from the Potomac's shore. Furthermore, the masonry structures "were fully tested . . . and notwithstanding the immense pressure on the aqueduct and other masonry, none have been injured."⁸

Still, in the wake of the flood, the C&O Canal Company initiated some additional flood control projects. These included a waste weir near Muddy Branch culvert and Lock 28; a stop lock at the abutment of Dam 4; riprapping the embankment above Dam 4; and coping the Rock Creek basin with stone.⁹ These improvements made G. C. Washington very confident the canal could withstand future high water. A year after the flood he reported to the C&O stockholders:

The high freshets of this spring have passed by without injury to the canal, and we have every reason to believe that the great strength of the dams, superior masonry of the aqueducts, locks, culverts, and wastes, with the increasing

embankment of Sec B." Where exactly these locations were on the canal can only be guessed at, as the author has never come across location descriptions for construction sections on the C&O Canal. Harlan Unrau experienced the same frustration in his study of flooding on the C&O Canal. See Unrau, The Major Floods, 1.

⁸Eight Annual Report, 15 June 1836, C&O Stockholders Proceedings, 1828-90.

⁹Minutes, 12 November 1834, C&O Directors Proceedings, 1828-90; J. Y. Young, Superintendent, Canal Line, to the President and Directors, 12 April 1836, C&O Incoming Correspondence, 1828-90; John P. Ingle, Clerk, Washington, D.C., to G. W. Rodgers, Superintendent, 29 July 1836; John P. Ingle, Clerk, Washington, D.C., to W. S. Elgin, Superintendent, 6 January 1837; John P. Ingle, Clerk, Washington, D.C., to Charles B. Fisk, Chief Engineer, 30 November 1837, Letters Sent by the Office of the President & Directors, 1828-70, Chesapeake and Ohio Canal Company, Entry 194, Record Group 79, Records of the National Park Service [Hereafter C&O Outgoing Correspondence, 1828-70]; W. S. Elgin, Superintendent, Harpers Ferry, to Charles B. Fisk, Resident Engineer, 9 February 1837, Letters Received By The Chief Engineer, 1834-52, Chesapeake and Ohio Canal Company, Entry 207, Record Group 79, Records of the National Park Service, National Archives, College Park, Md. [Hereafter Chief Engineer's Incoming Correspondence, 1834-52].

solidity of the embankments, afford an ample guarantee against future damage.¹⁰

By June 1838, the flood of 1836 was becoming a distant memory, and Washington felt confident enough to tell stockholders:

As no breaches of any consequence have occurred on the line, and as the embankments are becoming more solid every day, we have reason to believe such accidents will be of rare occurrence, and that the cost of repairs will consequently decrease every year. Indeed, it is one of the highest recommendations of canals, that, unlike most works of art, their strength increases with their age. The materials of which this canal is constructed are imperishable, with the exception of the lockgates and a few pivot-bridges; and when it is completed, the annual expense of repairs will be inconsiderable, compared with its magnitude and cost, and will abduct but a small amount from its vast receipts.¹¹

The Devastating 1840s

The unprecedented floods of the 1840s show Washington's comments were naive. During three years of the decade, major freshets hit the finished portions of the canal (which by 1842 was completed as far as Dam 6, about 134 miles upstream from Georgetown), straining the resources of the company and leaving the canal in need of renovation.

However, even before the 1840s floods, the completed parts of the canal had started to deteriorate, the result of inadequate maintenance. The cost of building the canal greatly overran the initial estimates during the 1830s and the company had trouble raising sufficient capital to continue construction. By the early 1840s, the C&O Canal Company was virtually bankrupt, and had to suspend construction on the canal in the spring of 1842. As the company's position grew ever more tenuous, maintenance suffered. The company could not afford the \$40,000 per year the chief engineer estimated was needed to keep up the canal.¹² Division superintendents ran up debts because the company could

¹⁰Ninth Annual Report, 12 June 1837, C&O Stockholders Proceedings, 1828-90.

¹¹Tenth Annual Report, 4 June 1838, Ibid.

¹²Fourteenth Annual Report, 6 June 1842, Ibid.

not supply them with sufficient funds to pay their expenses.¹³ As the financial condition of the C&O Canal grew increasingly desperate, company officials became worried about the possibility of unplanned repair expenses they could not pay for and took extreme steps to avoid them. In the spring of 1841, they ordered superintendents to lower the water level in the canal to three feet, nine inches (less than two-thirds of the canal's designed six-foot depth) as a preventive measure against costly breaches in the canal; although lowering the water to such a low level seriously impeded navigation on the canal.¹⁴

Such was the condition of the canal when the freshet of April 1843 struck. The flood started from a rapid snow melt in the mountains of western Maryland. The most severe damage was between Edwards Ferry and Georgetown, with a lesser amount between Dam 4 and Dam 6 (then the terminus of the canal). The chief engineer estimated that it would cost \$10,000 to restore navigation and \$20,000 to repair damage fully. The company turned to banks in the District of Columbia to finance the repairs, pledging future tolls and water rents as security. Under strong financial pressures to resume navigation, repairs progressed quickly. Although, the flood struck on April 15, by May 6, canal boats could again traverse the entire canal.¹⁵

As in 1836, the division superintendents on the canal worked to minimize damage during the flood. As the water rose, W. S. Elgin, based in Harpers Ferry, had the waste weirs on his section of the canal raised to vent excess water from the canal back into the river.¹⁶ J. Y. Young repeated his tactics of 1836, cutting the embankments of the eastern-most portion of canal where he

¹³Charles B. Fisk, Chief Engineer, Frederick, to the President and Directors, 1 December 1842, C&O Incoming Correspondence, 1828-90.

¹⁴Thomas Turner, Clerk, Frederick, to J. Y. Young, Superintendent, 9 April 1841, Letters Received, by President and Directors, 1873-80, Chesapeake and Ohio Canal Company, Entry 191, Record Group 79, Records of the National Park Service, National Archives, College Park, Md. [Hereafter C&O Outgoing Correspondence, 1828-70].

¹⁵Unrau, The Major Floods, 5-6.

¹⁶W. S. Elgin, Superintendent, Harpers Ferry, to Charles B. Fisk, Chief Engineer, 15 April 1843, 7:30 a.m., Chief Engineer's Incoming Correspondence, 1834-52.

thought it would relieve pressure on more important embankments and prevent costly uncontrolled breaks.¹⁷

Before the canal company could fully restore the injuries from the April freshet, an even more serious flood struck the C&O Canal in September 1843. Several days of heavy rain across the Potomac basin resulted in high water from Dam 6 all the way down to Georgetown. Damage was heaviest below Edwards Ferry, but particularly downstream of Seneca, where numerous breaks occurred and one-third of Lockhouse 6 washed away. It took a full month to repair the canal and the September deluge cost an additional \$30,000 on top of the injuries still left from April.

As before, the division superintendents worked to minimize damage. J. Y. Young cut the canal embankment at strategic points to allow water to exit the canal before it damaged expensive canal structures. This tactic, however, proved unable to save the Beaver Dam culvert because the flood waters were too high there.¹⁸

The company again had to borrow money to pay for repairs. This time it tapped the banks in Frederick, Maryland, soliciting loans of \$10,500. Milling interests in Georgetown, who were dependent on the canal for water power, also advanced the canal company \$3,000 on their water rents to speed the repair of the Georgetown level.¹⁹

The September 1843 flood convinced the C&O Canal Company that further preventive measures were necessary to protect the canal from flooding. Chief Engineer Charles B. Fisk wrote the president, "with a like rise of the river, we should again suffer the same damages, unless certain precautionary work . . . can be done, that shall keep the river out at points of greatest damage."²⁰ Top company officers agreed with Fisk's

¹⁷J. Y. Young, Superintendent, to Thomas Turner, Frederick, 19 April 1843, C&O Incoming Correspondence, 1828-90.

¹⁸J. Y. Young, Superintendent, Canal Line, to James M. Coale, President, Frederick, 16 September 1843; J. Y. Young, Superintendent, Lock 26, to James M. Coale, President, 19 September 1843, Ibid.

¹⁹Minutes, 21 September 1843, C&O Directors Proceedings, 1828-90

²⁰Charles B. Fisk, Chief Engineer, Canal Line opposite Harpers Ferry, to James M. Coale, President, Frederick, 17 September 1843, C&O Incoming Correspondence, 1828-90.

recommendation. President James Coale, who had taken over the canal shortly before the September flood, recommended to the stockholders a \$60,000 program of repair and preventive activity on the canal, particularly the installation of new waste weirs at strategic points.²¹

The greatest focus of the company's improvement efforts after the 1843 freshets was the Georgetown level, which had flooded in both the April and September freshets, particularly the three-fifths of a mile below Dam 1 at the Little Falls. The flooding had caused breaches as the waters in the canal ran down to the river from the canal. To combat this problem, President Coale recommended:

. . . to raise the part of the towpath liable to overflow, and also the feeder bank below the guard gates [at Dam 1], at least one foot above the highest water mark hitherto known in the Potomac; or, in other words, about one foot higher than the rise of the last September freshet. This, with a tumbling waste 500 feet long on the tow-path side of the canal, near the fourth mile stone, and some few other repairs of minor importance, it is thought would oppose an effectual barrier against the inroads of the river at all times hereafter.²²

The tenuous financial condition of the canal company made financing such improvements a tricky proposition. The Georgetown level was the focus of repairs not only because it had suffered two large breaks during the September 1843 flood, but also because the commercial interests in the town were willing in principle to lend the canal company \$10,000 for the improvements there. Negotiations for the loan, however, delayed the implementation of the Georgetown project. To make the loan, Georgetown demanded a mortgage, which the canal company refused.²³ In the end, negotiations broke off and the C&O Canal Company paid for a more limited program of improvements in Georgetown from funds originally earmarked to finish construction

²¹Special Report of James M. Coale, President, 16 November 1843, C&O Stockholders Proceedings, 1828-90.

²²Appendix to the Sixteenth Annual Report, 3 June 1844, Ibid.

²³Minutes, 5 September 1844, C&O Directors Proceedings, 1828-90.

of the canal to Cumberland.²⁴ In November 1844, it contracted for the construction of a 250-foot spillway at Falls Branch. The company completed the tumbling waste by April 1845 at a cost of nearly \$2,000. The company also raised the "guard banks of the canal at such points as are most exposed to the overflow of the river."²⁵

In addition to the work at Georgetown, the C&O Canal Company engaged in flood damage prevention projects elsewhere on the canal. At the Little Monocacy culvert, the company constructed a new foundation and abutment walls to give the structure additional strength to better withstand floods. It also raised the Shenandoah River lock to prevent overflows that had damaged this area in the past and strengthened weak embankments elsewhere along the canal.²⁶ While the improvements proved helpful, they were not as extensive as the original \$10,000 plan for Georgetown, and nowhere near the \$60,000 recommended by Coale to the stockholders.

Despite the disastrous 1843 season, the canal company remained confident of its ability to meet the challenge of the Potomac River. A committee of stockholders that responded to the 1845 Annual Report articulated this attitude. They wrote:

The excellent condition of the canal in reference to repairs affords the best proof of the gratifying fact that in progress of time and in consequence of the necessary repairs the work has become more perfect and substantial and less liable to accident or injury; and proves conclusively, that in future there will be a diminution of expenses for repairs instead of an increase as in the case of works of a different character.²⁷

The floods of 1846 seemed to bear out the belief of the stockholder's committee. Two major freshets occurred that year,

²⁴Eighteenth Annual Report, 2 June 1846, C&O Stockholders Proceedings, 1828-90.

²⁵Unrau, The Major Floods, 10.

²⁶Ibid., 9.

²⁷Report of the Committee on the Seventeenth Annual Report, 3 June 1845, C&O Stockholders Proceedings, 1828-90.

and the damage from them was much less than in 1843, a fact which the canal company attributed to the precautions built since then.

The first flood of 1846 struck in March, as winter snow in the mountains rapidly melted off. The heaviest damage was between Dams 4 and 5. The flood opened an eighty-foot breach in Dam 4, broke the gates of Locks 41 through 44, and washed away about fifty or sixty feet of sheathing on Dam 5. The canal company restored navigation in just over a week. Damage elsewhere on the canal was relatively light, in part because the flood waters at their peak were four feet less than the flood of September 1843. However, the Chief Engineer Fisk also attributed the small amount of damage to the preventive work done since 1843, particularly raising the canal embankments.²⁸

Still, the light damage in March 1846 did not discourage the Chief Engineer from looking for additional ways to make the canal more flood proof. Fisk had new gates with cast-iron frames installed on the locks damaged in March. The towpath below Dam 5 was raised and protected with stone.²⁹ John G. Stone, the superintendent on the western section of the canal reported that he had constructed waste weirs at "Lock No. 43, below lock No. 44 and below Dam No. 5."³⁰

The repairs and improvements from the March flood were not completed when a second flood hit the canal in July 1846, the result of heavy rains. The level of this flood was comparable to the September 1843 freshet, although it was slightly lower below Williamsport and somewhat higher above. The amount of damage, however, was much less the 1843 flood. William S. Elgin reported, "this freshet above Harpers Ferry was within 14 inches of the Freshet of Sept 1843. But did not do any thing like the damages of that freshet not 1/4."³¹ Elgin and other canal

²⁸Unrau, The Major Floods, 9-10; Charles B. Fisk, Chief Engineer, Washington, D.C., to James M. Coale, President, 19 March 1846, Drafts of Letters Sent By the Chief Engineer, 1836-38, 1846-52, Chesapeake and Ohio Canal Company, Entry 210, Record Group 79, Records of the National Park Service, National Archives, College Park, Md. [Hereafter Drafts of Chief Engineer's Outgoing Correspondence, 1836-38, 1846-52].

²⁹Unrau, The Major Floods, 11.

³⁰John G. Stone, Superintendent, to Charles B. Fisk, Chief Engineer, Frederick, 25 May 1846, Chief Engineer's Incoming Correspondence, 1834-52.

³¹W. S. Elgin, Superintendent, Point of Rocks, to James M. Coale, President, Frederick, 8 July 1846, C&O Incoming Correspondence, 1828-90.

managers again claimed the reduction in damage was due to improvements they had made on the canal since 1843. Charles Fisk wrote to James Coale that, with exception of the collapse of the Broad Run culvert and a significant breach at the Rock Creek basin, the damage between Georgetown and the Rock Creek basin was not heavy. Fisk attributed the light injuries to the installation of new waste weirs and the raising of the canal embankment above the level of the 1843 floods.³² Damages west of Harpers Ferry also were less than expected. W. S. Elgin gave higher embankments the credit. He admitted that Dam 4 had suffered \$1,000 in damage, but blamed the foreman at that location for failing to install the planks in the stop lock there in time prevent significant erosion in the guard bank and to a widening of the breach in the dam left from the March freshet.³³ Indeed, the stockholders' committee that reviewed the annual report of the president and directors congratulated the company on the success with which it had weathered the 1846 floods compared to canals of Pennsylvania.³⁴

Despite the self-congratulations, it was not until a month after the July 1846 flood before the C&O Canal Company managed to restore navigation on the canal, and repairs at Dam 4 were not finished until the autumn of 1847. The company also could not afford \$10,000 in preventive work recommended by the chief engineer, or to permanently replace the Broad Run culvert. All told, the floods of 1846 cost the canal company over \$21,000 and a significant amount of lost revenue while the canal was closed.³⁵ In fact, by the end of the year, depression replaced the mood of celebration, as a smaller flood came down the canal in November exacerbating the breach at Dam 4. This damage led the chief engineer to recommend that the canal company raise "the Guard bank, Guard and Stop locks, and abutment of the dam,

³²Charles B. Fisk, Chief Engineer, Harpers Ferry, to James M. Coale, President, Frederick, 6 July 1846, Ibid.

³³W. S. Elgin, Superintendent, Point of Rocks, to James M. Coale, President, Frederick, 8 July 1846, Ibid.

³⁴Report of the Committee on the Eighteenth Annual Report, 16 July 1846, C&O Stockholders Proceedings, 1828-90.

³⁵Unrau, The Major Floods, 11-12. Note: damage from more minor freshets on the canal in May and November of 1846 are part of the tally of \$21,327.76, in addition to major floods of March and July.

entirely above the highest freshets."³⁶ The board approved this project and authorized the president to borrow money to finance its completion.³⁷

Barely had the company completed its improvements at Dam 4 when an unprecedented flood hit the canal in October 1847. Flooding was not limited to the Potomac, but also occurred on other rivers in Maryland, Virginia, Ohio, and Pennsylvania. While there was significant damage on all portions of the finished canal, according to Harlan Unrau, "The most critical damage to the waterway was concentrated in the following area: Lock No. 7 to Widewater; the level above Great Falls; Point of Rocks to Dam No. 4 and the vicinity of Dam No. 5."³⁸ Despite the preventive work on Dam 4, \$5,000 worth of damage occurred there. W. S. Elgin reported, "the whole of the Cross Guard Bank between the Stop Lock & the abutment of the Dam have been carried a way. The river is runing [sic] around the abutment of the Dam also considerable damage done the Guard Bank."³⁹ As soon as the waters started receding, the chief engineer and division superintendents began repair efforts. The initial damage estimate to repair the canal was \$20,000. James Coale quickly wrote letters to banks in major towns near the canal, soliciting loans to mend the waterway.⁴⁰

Repairs proceeded rapidly after the flood of October 1847 and by the middle of November were on the verge of completion. On November 25, however, the Potomac rose again, wiping out much of the completed repairs. The November flood had a depressing

³⁶Charles B. Fisk, Chief Engineer, Cumberland, to the President and Directors, 29 March 1847, C&O Incoming Correspondence, 1828-90.

³⁷Minutes, 8 April 1847 and 26 May 1847, C&O Directors Proceedings, 1828-90.

³⁸Unrau, The Major Floods, 13.

³⁹W. S. Elgin, Superintendent, Dam 4, to James M. Coale, President, Frederick, 10 October 1847, C&O Incoming Correspondence, 1828-90.

⁴⁰James M. Coale, President, Frederick, to the President and Directors of the Farmers and Merchants Bank of Georgetown, 14 October 1847; James M. Coale, President, Frederick, to W. Maury, President of the Bank of the Metropolis, 14 October 1847; James M. Coale, President, Frederick, to John Van Lear, [Cashier, Washington County Bank, Williamsport], 14 October 1847, C&O Outgoing Correspondence, 1828-70.

effect on the morale of company employees out on the line of the canal. W. S. Elgin wrote James Coale from Dam 4:

We are again in the midst of Trouble, Everything we have been doing the Last 6 weeks have been swept a way; and we may as well & Better have burn [sic], the money we have expended on this portion of the Canal; The whole canal is now under water; This is discouraging; I am discouraged after night & day for the Last 6 weeks to restore the navigation; and Just as it was Ready for the Trade, to entirely be swept away.⁴¹

The damage from the November 25 flood appears to have affected the middle and upper sections of the canal greatest, although it did significant damage below as well. The November 1847 flood, in combination with a smaller freshet sometime in December, essentially ended navigation on the canal that season above Harpers Ferry. It was not until the middle of February 1848 that boats could travel as far as Dam 6. The total cost of repairs for the October, November, and December floods came to over \$48,000.⁴²

Canal Renovations: 1849-52

The freshets of 1847 destroyed confidence that the improvements made after the 1843 and 1846 floods were sufficient to protect the canal from the Potomac. Opinion had long existed within the canal company that only a thorough renovation of the canal would properly safeguard it. Charles Fisk, the chief engineer, had advocated a systematic program of flood repair and preventive activity on the finished portion of the canal since 1842.⁴³ During the mid-1840s, the company had determined which parts of the canal needed refurbishment and improvement, but did not start a restoration program.

The devastating floods of 1847 finally pushed the president and directors to carry out a plan to renovate the entire waterway below Dam 6. The imminent completion of the last section of the

⁴¹W. S. Elgin, Superintendent, Dam 4, to James M. Coale, President, Frederick, 25 November 1847, C&O Incoming Correspondence, 1828-90.

⁴²Unrau, The Major Floods, 14.

⁴³Charles B. Fisk, Chief Engineer, Frederick, to the President and Directors, 1 December 1842, C&O Incoming Correspondence, 1828-90.

canal between Dam 6 and Cumberland provided a further motivation. To run fully loaded coal boats down from Cumberland would require the canal to carry the six feet of water for which it had been designed. Since its opening, however, the waterway often had carried less than six feet because the embankments, weakened by flooding and neglect, had proven incapable of carrying a full load. Outside pressure also played a role in prompting a campaign to repair the canal and safeguard it against future floods. The citizens of Washington, Georgetown, and Alexandria sent a memorial to the canal company in June 1848, requesting that a committee of stockholders be appointed to investigate the condition of the canal below Dam 6 and see that "proper measures are adopted without delay, the necessary means, may be raised among ourselves & other interested parties to forthwith place the Canal between Georgetown & Dam No 6, in a permanently substantial & profitable condition."⁴⁴

The biggest obstacle to the renovation program that began after the 1847 floods was financial. Burdened by staggering debts incurred in completing the canal, it was impossible for the C&O Canal Company to finance restoration efforts internally. Likewise, the amount of money required for the repair and improvement program--\$200,000--was beyond the lending capacity of the banks which regularly did business with the canal. Even if they had had sufficient resources, the banks were not eager to make loans to the canal company. Many of these institutions still were owed substantial repayments for previous flood repairs. The company had discovered as much in the spring of 1848 when the banks refused to lend it money to pay for further preventive activities at Dam 4.⁴⁵

To get the money to finance the renovation program required government assistance, and the C&O Canal Company turned to the State of Virginia.⁴⁶ Virginia had assisted the canal much less

⁴⁴Memorial of Citizens of Washington, Georgetown, and Alexandria, 17 June 1848, in the Appendix to the Report of the Committee on the Twentieth Annual Report, 2 August 1848, C&O Stockholders Proceedings, 1828-90.

⁴⁵James M. Coale, President, Frederick, to George Schley, Hagerstown Bank, Hagerstown, 28 March 1848; James M. Coale, President, Frederick, to John Van Lear, Cashier, Washington County Bank, Williamsport, 11 July 1848, C&O Outgoing Correspondence, 1828-70. In fact, it was necessary for the canal company to refinance the loans made to repair the 1847 damage. See Minutes, 18 April 1849, C&O Directors Proceedings, 1828-90.

⁴⁶The federal government had been at best indifferent to the canal since the accession of Andrew Jackson to the presidency in 1829. Jackson and his Democratic party successors did not believe the federal government should support internal improvements that were not national in character. Although

than Maryland, even though by the 1840s much of the trade on the canal ended in Alexandria rather than Georgetown (because of a serious silting problem in the Rock Creek basin). Consequently, in the fall of 1848, the C&O Canal Company sent a memorial to the State of Virginia asking for a loan of \$200,000 to finance the renovation of the canal from Georgetown to Dam 6. The Virginia legislature declined to lend the money outright, but it did pass a bill on March 15, 1849, that guaranteed an issue of \$200,000 in repair bonds to be offered by the canal company.⁴⁷

After the passage of the bond guarantee, preparations for the renovation campaign proceeded quickly. By August 1849, Charles Fisk had submitted his plan for the consideration of the C&O's president and directors and the Virginia Board of Public Works. Fisk foresaw eight separate projects. The company would spend the largest share stemming from the sale of the repair bonds--\$80,000--to raise the towpath where it had worn down from erosion or use. With a portion of the aforementioned sum, Fisk also planned to desilt the Rock Creek basin and protect the canal from leakage in the limestone country.⁴⁸ The next largest project--\$50,000--was the dams. Fisk wanted to repair all the existing dams and protect Dams 4, 5, and 6 from future floods by raising their guard banks. The third largest project--\$20,000--was to raise the level of the canal at vulnerable locations to exclude flood waters, and, where this was not possible, to improve drainage from the canal prism by means of new overflow wastes and waste weirs. The remainder of the projects consisted of repairing or, when necessary, rebuilding culverts, building

the C&O Canal served two states at that time and the District of Columbia, the Democrats were content to leave support for the canal to Maryland, Virginia and the District of Columbia. Maryland had already supplied most of the money to construct the canal, and pledged its credit in the mid-1840s to allow the company to sell construction bonds to finish the waterway.

⁴⁷Minutes, 3 August 1848 and 18 April 1849, C&O Directors Proceedings, 1828-90.

⁴⁸The author was unable to determine precisely where the limestone country was located. However, parts of the canal in Frederick, Washington, and Allegany counties passed through areas dominated by this porous rock. See William E. Davies, Highlights of the Geology and Engineering of the Chesapeake and Ohio Canal (Washington, D.C.: American Geophysical Union, 1989), 11-24.

new bypass flumes around some locks and repairing others, and tightening the aqueducts against leakage.⁴⁹

The company moved quickly to implement Fisk's plan. Within the month, the C&O Canal Company had borrowed \$10,000 based on the coming issue of repair bonds and started renovating the dams.⁵⁰ The work was carried out by crews under the supervision of the division superintendents, themselves directed by the chief engineer. By April 1850, Fisk submitted a detailed progress report of the work to date, showing that he had spent \$60,274.67 of the \$200,000 bond issue.⁵¹ The sale of the repair bonds itself proved successful, selling at face value or even slightly above. By June 1851, Samuel Sprigg, James Coale's successor as president, reported to the stockholders:

The repairs of the canal have been continued with as little interruption to the navigation as practicable; and are now so far advanced, as to give assurance of comparative security against encroachments by high water in the river, at several points, which have heretofore been most exposed; and we trust, by the close of the present year, they will have been so far completed, as to leave but little apprehension for the future safety of the works, and the maintenance of uninterrupted navigation.⁵²

While the renovation proceeded smoothly, the C&O Canal Company experienced problems with conditions the State of Virginia had added to the legislation guaranteeing the repair bond issue. The Virginia legislature forced the canal company to promise to build a new outlet lock opposite Berkeley County, Virginia--despite the fact that boats already could exit the canal to Berkeley County in the slackwater above both Dams 4 and 5, and that the added expense of the new outlet lock would divert

⁴⁹Charles B. Fisk, Chief Engineer, Cumberland, to President and Directors, 2 August 1849, C&O Incoming Correspondence, 1828-90. For a list of specific projects completed with the funds from the repair bonds, see Charles B. Fisk, Chief Engineer, Cumberland, to the President and Directors, 25 April 1850 and 6 May 1850, C&O Incoming Correspondence, 1828-90.

⁵⁰Minutes, 24 August 1849, C&O Directors Proceedings, 1828-90.

⁵¹Charles B. Fisk, Chief Engineer, Cumberland, to the President and Directors, 25 April 1850, C&O Incoming Correspondence, 1828-90.

⁵²Twenty-Third Annual Report, 2 June 1851, C&O Stockholders Proceedings, 1828-90.

at least \$30,000 from the restoration of the canal. The canal company later managed to convince the Virginia Board of Public Works to waive building the Berkeley outlet lock.⁵³ However, it was less successful in deflecting business interests in Alexandria. The Virginia Board of Public Works, responding to pressure from Alexandria merchants, retroactively prohibited the canal company from spending repair bond money east of the C&O Canal's junction with the Alexandria aqueduct. The Alexandria business community feared that if the Rock Creek basin was dredged and navigation on the easternmost section of the canal improved, it would draw traffic away from their city in favor of Georgetown.⁵⁴ While the canal company managed to avoid a blanket prohibition against repairs east of the Alexandria aqueduct, it was forced to pledge to use its own funds, and not money from the repair bonds, to desilt the Rock Creek basin (a \$15,000 project).⁵⁵ Later the canal company got a further exemption from the prohibition, permitting repair bond funds to be used "to the first lock below the aqueduct." However, the company could not afford to dredge the basin from its own resources, and the project was delayed.⁵⁶ Still, despite the obstacles to the renovation of the canal imposed by the State of Virginia, by the spring of 1852 the restoration of the canal above the intersection with the Alexandria aqueduct was essentially complete.

The test of the renovation came immediately, when the largest flood on the Potomac to that date hit the canal in April 1852. It also was the first major freshet on the river since the completion of the canal to Cumberland two years earlier. The flood started on April 18 after six days of heavy rain raised the river to levels six feet over October 1847, with the river cresting at sixty-four feet in Great Falls.⁵⁷ By April 29, Charles Fisk reported on damage from the flood, which he

⁵³Twenty-Second Annual Report, 3 June 1850, Ibid.

⁵⁴James M. Coale, President, Frederick, to J. Brown Jr., 2nd Auditor and Secretary, Board of Public Works, Richmond, Va., 22 April 1850, C&O Outgoing Correspondence, 1828-70.

⁵⁵Twenty-First Annual Report, 13 June 1849; Twenty-Second Annual Report, 3 June 1850, C&O Stockholders Proceedings, 1828-90.

⁵⁶Twenty-Third Annual Report, 2 June 1851, Ibid.

⁵⁷Twenty-Fourth Annual Report, 7 June 1852, Ibid.

estimated would cost \$80,000 to repair. Only the uppermost twenty-one miles of the waterway escaped significant damage. From Town Creek to Seneca there were many small breaches, but the dams suffered the most extensive damage. At Dam 6, a breach of 200 feet had opened in the Virginia abutment of the dam. Fisk wrote of Dam 4, "the river broke over the Guard bank and around the Maryland abutment. The damage, however, at this point . . . does not exceed that of 1847." At Dam 3, according to Fisk, "the river has broken around the Maryland Abutment, and in returning to the river over and through the towpath of the level above Lock No. 34, has done damage exceeding that done in 1847."⁵⁸ Below Seneca, the canal was a shambles, especially at Widewater. Outside Widewater, four major breaks occurred on the Georgetown level, and two large blowouts in the towpath between Little Falls and the entrance to Widewater.⁵⁹

The flood of April 1852 dramatically proved that the costly restoration of the canal had utterly failed, in the words of its architect, Charles Fisk, "to guard and protect the canal in all time to come against the floods of the Potomac."⁶⁰ Fisk and other C&O Company officials attributed the calamity to the decision to protect the canal against floods of the proportions of October 1847--then the highest on record--but not a larger flood. Fisk claimed that an investigation of crests in the Potomac had revealed no evidence of previous floods greater than 1847 height. "If there are marks of higher water along the river as high as the late fresh, within the last 100 years," he wrote, "I have not met with them."⁶¹

Later, other officers would suggest the 1852 renovation failed because \$200,000 was not enough money to properly protect the canal against high water. William Grason, Samuel Sprigg's successor as president of the canal company, told the stockholders in June 1854:

⁵⁸Charles B. Fisk, Chief Engineer, Washington, D.C., to President and Directors, 29 April 1852, C&O Incoming Correspondence, 1828-90.

⁵⁹Unrau, The Major Floods, 15.

⁶⁰Charles B. Fisk, Chief Engineer, Cumberland, to C. J. Faulkner, 18 January 1849, C&O Incoming Correspondence, 1828-90.

⁶¹Charles B. Fisk, Chief Engineer, Washington, D.C., to President and Directors, 29 April 1852, *Ibid.*

Indeed, it could hardly have been expected, that one hundred and thirty-four miles of canal . . . requiring the removal of obstructions, and the reconstruction of dams, culverts, and embankments, could have been placed in [adequate] condition . . . without the expenditure of a much larger sum than two hundred thousand dollars.⁶²

Even as the top officials from the canal offered excuses for the failure of their costly efforts to protect the canal from the river, they still had the difficult task of rebuilding the waterway yet again. Charles Fisk estimated it would take ten weeks to put the canal back in navigable condition. However, even more challenging than the task of filling in breaks in the canal embankments and rebuilding the guard walls and abutments at the dams, was finding \$80,000 to pay for this work. The company was responsible for interest payments on millions of dollars of loans stemming from the construction and renovation of the canal, as well as debts left over from earlier floods, at a time when virtually no revenue was coming in. Fortunately for the C&O Canal Company, the communities and banks near the national capital came to the rescue. Most of the money for the repairs after the 1852 flood came from the cities of Washington, Alexandria, and Georgetown, with banks in these places supplying the remainder, in tandem with advances on water rents from the Georgetown millers and subscriptions from Cumberland. W. W. Corcoran, a leading merchant and financier in Washington, D.C., also pledged a personal loan of \$5,000 to the company, should the first \$75,000 prove insufficient to make the repairs. As it turned out, the canal company needed Corcoran's money. It was not until the middle of July that navigation was possible along the entire line of the canal, and the final cost of repairing the canal was nearly \$100,000.⁶³

The overrun in the repair costs resulted from new flood prevention improvements ordered by the C&O directors on the suggestion of Charles Fisk. At Dam 6, the company replaced the embankment washed away with a heavy masonry wall. It built a new guard bank from Dam 3 to Lock 36 at Harpers Ferry, elevated several feet higher than the 1852 flood. The guard banks above Widewater, and the guard banks at Dams 2 and 4 also were raised above the level of the 1852 flood, as well as paved and riprapped

⁶²Twenty-Sixth Annual Report, 5 June 1854, C&O Stockholders Proceedings, 1828-90.

⁶³William Grason, President, Washington, D.C., to W. W. Corcoran, Washington, D.C., 19 July 1852, C&O Outgoing Correspondence, 1828-70; Unrau, The Major Floods, 17.

to make them more flood resistant. The company built new waste weirs, and enlarged some of the existing waste weirs to drain more water. Part of the cross-section at Dam 5 was modified to "free it from the effects of reaction during freshets, by which it has heretofore been very much injured." The modifications made it more like Dam 6, which had less steep cascade, helping to preserve the structure from the churning action of the water as it struck the channel below the dam.⁶⁴

The improvements made after the flood of April 1852 show the C&O Canal Company continued to believe it was worth spending large sums to protect the canal from the river. They did not question their ability to make the canal sustainable. In their opinion, the renovation of 1849-51 had failed because the structures the company had built were not high enough, or sufficiently substantial and capacious to be effective against a flood of the level of 1852. With the points most heavily damaged protected against another such flood, they asserted, the canal was safe for some time to come. Thomas L. Patterson, Charles Fisk's successor (with the title of engineer and general superintendent), even went as far to argue that the canal had held up well to the 1852 flood, considering it was only designed to withstand an 1847-level flood. Now that the waterway had gained protection against another flood of the proportions of 1852, he considered the canal safer still.⁶⁵

Rebuilding Dams 4 and 5: 1852-60

Yet continued flooding in the 1850s and 1860s, although not as destructive as the flood of April 1852, further called into question the effectiveness of the company's protective measures, especially at the dams. Weakened by the 1852 flood and earlier water action, the dams increasingly were the canal's weakest points. In his study of canal engineering, Harlan Unrau attributed the vulnerability of the dams on the C&O Canal to their poor design. Dams 1 and 2 (1828-31) were the most flimsy, constructed of "timber cribs, loose rubble stone, and brush." They had to be rebuilt almost each year because high water in the spring regularly washed large portions of them out. Dams 4, 5, and 6 (1833-39) were "heavily reinforced wooden structures firmly

⁶⁴Quoted in *Ibid.*; Thomas L. Patterson, Engineer and General Superintendent, Washington, D.C., to the President and Directors, 1 June 1853, in Appendix A, Twenty-Fifth Annual Report, 6 June 1853, C&O Stockholders Proceedings, 1828-90; Unrau, Canal Engineering Technology, 144-45.

⁶⁵*Ibid.*

secured to the sub-riparian rock and resting at either end against natural rock or rubble masonry abutments."⁶⁶ However, this design easily developed leaks and, when subjected to flood waters, breaches occurred. Only Dam 8 (1837-50), constructed of masonry and upstream of the more flood-prone stretches of the Potomac, held up well against the river.⁶⁷ Indeed, dam construction for the C&O Canal Company had been a "learning exercise" which taught that although the dams farther downstream had been cheaper to build, they were ruinously expensive to maintain. As construction moved farther up the Potomac, the company proved increasingly willing to build expensive but more substantial dams in the hope they would hold up better against the river and prove cheaper in the long run.⁶⁸

The company struggled during the 1850s and 1860s about what to do with its troublesome dams. The issue became one of paramount importance. The dams were perhaps the most critical structures on the C&O Canal because they supplied the water used in the canal. If the dams leaked or breached, however, the supply of water to the canal often was insufficient to maintain operations, particularly during times of low water on the river. In the wake of the flood of 1852, the problem of leaks and breaches became acute and the company, despite its tenuous financial state, had to deal with the problem.

Of all the dams on the canal, Nos. 4 and 5 proved the most vexing to the C&O Canal Company. The canal's president, William Grason, in a report to a special meeting of the stockholders,

⁶⁶Unrau, Canal Engineering Technology, 140-41. "Dam No. 6," according to Unrau, "was built with a less steep slope on its downstream side and additional timber facing on its upstream side to give it further stability against the action of the river."

⁶⁷What is truly remarkable about Dam 8 is how little it appears in the records of the C&O Canal Company. While volumes of correspondence passed between officers of the company about Dams 1-6 (no "Dam 7" was ever built), virtually nothing appears about Dam 8, a testament to its sturdiness. Further evidence of its strength was the failure of the Army Corps of Engineers in its attempt to demolish the structure in 1954 to make way for modern flood control improvements to protect Cumberland. Despite the use of the 300 sticks of dynamite, the 100-year-old masonry structure held together. See C. W. Heine, Park Historian, to Chief, Public Use Branch, National Park Service, 13 April 1954, Administration, Protection and Maintenance File 1460/C&O-5, National Capital Parks, National Park Service, Washington National Records Center, Suitland, Md. [Hereafter Administration, Protection and Maintenance File 1460/C&O-5].

⁶⁸Unrau, Canal Engineering Technology, 140-41.

admitted that the structures being "badly constructed at first, and injured by repeated floods, have not been in a proper condition for many years past to supply the levels below with sufficient depth of water in very dry seasons."⁶⁹ Dams 4 and 5 had required \$40,000 in repairs even before the 1852 flood struck. After the waters receded there had been little money to fix these dams because the company had to devote its limited resources to rebuild Dam 6, which had been more seriously damaged.

It was not until the spring of 1853 that the canal company had sufficient resources to contemplate repairs at Dams 4 and 5. Grason informed the stockholders he had directed the general superintendent, Thomas L. Patterson, to make plans to repair Dams 4 and 5.⁷⁰ Patterson first turned his attention to Dam 5. However, the repairs planned for the structure did not take place because, as Grason informed the stockholders the following June, "the difficulty of procuring and delivering [sic] timber at the proper time, and the probability of a falling off in the revenue, in consequence of the detention of boats, prevented the commencement of the work."⁷¹ That is, the damages at Dam 5 themselves delayed the repairs, by preventing the canal company from earning enough revenue to start them. The company was reduced to dumping gravel and other materials to plug the breaches temporarily in order to open the canal for navigation and obtain funds for more permanent repairs.

Although the condition of Dam 5 was more pressing because of its failure to supply the canal below with enough water to allow laden boats to pass, William Grason was actually more concerned about Dam 4. As of the summer of 1854, Dam 4 could still divert enough water to maintain navigation to Harpers Ferry, but it was closer than Dam 5 to total collapse. The C&O president was so worried about Dam 4 that he told the stockholders he had ordered the company to investigate how much money it would cost to replace the old structure with a masonry dam. As he and the board were coming to the end of their terms as officers of the company, he felt unable to order the replacement dam built. However, Grason was confident that a masonry dam would be durable

⁶⁹Report of William Grason, President, to Adjourned Stockholders Meeting, 3 August 1853, C&O Stockholders Proceedings, 1828-90.

⁷⁰Minutes, 28 September 1853, C&O Directors Proceedings, 1828-90.

⁷¹Twenty-Sixth Annual Report, 5 June 1854, C&O Stockholders Proceedings, 1828-90.

enough to withstand freshets and provide a reliable water supply to the canal. No doubt trying to build support for the considerable expense that a masonry dam at No. 4 and other locations would entail, he told the stockholders, "When the contemplated improvements are made in the dams, nothing will be required except ordinary repairs to keep the canal in navigable order."⁷²

Yet the C&O Canal Company did not have the resources to finance immediate construction of masonry dams in the summer of 1854. In fact, the company had reached yet another financial crisis. The financial state of the waterway was such that it suspended interest payments on the Virginia repair bonds in June 1854.⁷³ A committee of directors that inspected the canal in 1854 recommended the company take no specific action at either dam, merely that Patterson and his subordinates keep a close eye on the structures, and take whatever action was needed to keep them sufficiently tight to supply the canal with water. Based on this advice, the full board dropped plans for replacement of the dams, or their systematic repair, instead opting to do nothing until the issue had received further study.⁷⁴

The canal company gave responsibility for examining its options concerning the dams to A. K. Stake, Patterson's successor as general superintendent. In October 1854, Stake reported that the company had three choices for dealing with Dam 4. As suggested earlier by William Grason, Stake thought the most effective solution would be to replace the wooden dam with a masonry structure. However, a masonry dam would cost \$65,000 and take two or three years to build. The cheapest plan would be to reinforce the existing dam with "cribs of timber thrown across immediately below the present Dam, and Secured to it." Stake quickly dismissed this option stating:

. . . there are objections to it which would make it preferable to adopt the third plan, which is to thoroughly overhaul the old dam, replacing the decayed timber, renewing the filling, and remedying the defects known to exist in its original construction, this could be done by means such are now being used at Dam No 5, and at cost which would not exceed 25000\$ and might fall short of that amount, the

⁷²Twenty-Sixth Annual Report, 5 June 1854, Ibid.

⁷³Ibid.

⁷⁴Minutes, 6 July 1854, C&O Directors Proceedings, 1828-90.

expense would be regulated by the amount of timber and materials necessary to be removed and replaced.⁷⁵

While Stake recommended the replacement of the old structure with a masonry dam, he admitted the complete refurbishment of the old dam was the next best option. The company initially chose refurbishment for both Dams 4 and 5, and spent over \$10,000 on such work at Dam 5 in the autumn of 1854.⁷⁶ The directors ordered Stake in December 1854 to implement a similar plan at Dam 4, but Stake did not start work until early in the summer of 1855.⁷⁷ High water in the river delayed the completion of the repairs at Dam 4.⁷⁸

In the summer of 1856, the C&O Canal Company suddenly and without explanation ended its efforts at refurbishing Dams 4 and 5, and decided to replace them with masonry structures. In late August 1856, the directors ordered the solicitation of bids for a masonry dam at No. 4, using a plan drawn up by Thomas L. Patterson. They also hired Patterson to execute a design for another masonry dam at No. 5, and to supervise the construction of both dams. The firm of John Humbird and Company received the contract to build the new dam to replace the old Dam 4 in October 1856. By November, Patterson had finished his plan for the new Dam 5, and the company solicited bids to build it.⁷⁹

Replacing the dams was a bold move for a company in such dire financial condition. In January 1857, the C&O Canal Company filed a certificate with the State of Virginia stating its inability to pay interest on the 1849 repair bonds. The certificate was essentially an admission that the canal company could not make interest payments on the loan for the foreseeable future. Desperate necessity, however, pushed the company to

⁷⁵A. K. Stake, General Superintendent, to [President and Directors], 19 October 1854, C&O Incoming Correspondence, 1828-90.

⁷⁶B. F. Hollman, Superintendent, Williamsport, to the President and Directors, 3, 25 November and 11 December 1854, Ibid.

⁷⁷Minutes, 16 December 1854, C&O Directors Proceedings, 1828-90.

⁷⁸Twenty-Eighth Annual Report, 2 June 1856, C&O Stockholders Proceedings, 1828-90.

⁷⁹Minutes, 27 August, 3 October, 7 November 1856, and 7 January 1857, C&O Directors Proceedings, 1828-90.

replace the old dams. Only expensive masonry structures seemed to promise they could withstand the Potomac and provide a sufficient supply of water to the canal in all seasons. Though the company did not have the money to build the dams, it had no choice but to start construction. Without reliable navigation, the company could not hope to attract sufficient traffic to remain in operation and eventually pay off its debts.

High water on the Potomac struck as construction of the masonry dams started. About the same time the canal company signed a contract for the new Dam 5 in February 1857, an ice freshet occurred--the first of a series of four destructive floods in four months. In his report to the stockholders, C&O President William P. Maulsby recounted the disastrous spring of 1857:

In February the severity of the weather relaxed, and there occurred an Ice Freshet such as had not for very many years, if ever, occurred before. The decaying structures at Dams 4 and 5 gave way, the former being much injured, the latter totally swept off from the Virginia abutment to the repaired portion of the Maryland side--over Five Hundred Feet. Measures were immediately taken to repair the damages thus occasioned, and about the 25th of February a large and efficient force of workmen were engaged in making the repairs. It was proposed to complete them, and reestablish navigation by the 1st of April, if possible, or as soon thereafter as practicable, and the plan of repairs was adopted with that view. Those at No. 4 were completed. Those at No. 5 being much more extensive, and embracing the stoppage of the entire waters of the River for a distance of over Five Hundred feet, were pressed forward with the utmost energy, and on the 12th of April the breach was closed, leaving but a few days to be occupied in completing the filling of the cribs with stone, and sheeting them. On that day a freshet occurred, which aided a few boats, in waiting at that point, to pass but which also carried away a portion of the work, which had been entirely filled, and was deemed most secure of all, but of which foundation proved to be defective. Again was the work entered upon and on the 4th of May had so far progressed as to require but a few days for final completion. On that day another Freshet occurred, which assisted in passing a large number of boats in waiting, but which finally succeeded in sweeping off about one halt [sic] of all the work that had been done, after a struggle between the structure and the flood extending from Saturday until Tuesday, and also in injuring and weakening all that was left. The Work was resumed, in the hope that on this day navigation would be restored. A fourth Freshet occurred during the week before last, which had the effect of putting back operations for some days, but caused no other

material injury at No. 5, and at this time it is the expectation of the Board that navigation will be resumed the 16th instant, at latest. This last freshet carried away a small portion of Dam No. 4, but that too will be repaired by the day named.⁸⁰

In actuality, because of further high water on the Potomac in June and July of 1857, the canal company did not restore navigation on the waterway until August.⁸¹

The damages of the floods of the spring of 1857 added further to the staggering debt of the C&O Canal Company. To pay for the repairs to Dam 4 and 5, the company negotiated loans from coal companies, who after the completion of the canal to Cumberland in 1850 had become the main users of the waterway. To fix the damages resulting from the February ice freshet, they made loans of \$15,750 to the canal.⁸² After the second major flood in May, several banks in Washington, D.C., Alexandria, and the Corporation of Georgetown loaned the canal company a further \$25,000.⁸³

President William P. Maulsby's faith in the sustainability of the canal was unshaken by the floods of 1857. Despite the disaster at Dams 4 and 5, Maulsby stated that the rest of the canal had come through the high water well. He bragged to the Governor of Maryland that the C&O Canal, except for the dams, had fared much better than other canals across the country. Indeed, Maulsby asserted that the dams were the only significant obstacle to the company's prosperity. "The Canal has been nominally, but never really finished," he wrote. "The Chief points of difficulty have been the Dams mentioned. They have never been perfect structures, and so indispensable are perfect Dams at those points that without them the Canal never could have in the past and never can in the future present an inviting aspect to transportation." In short, Maulsby promised that once the

⁸⁰Twenty-Ninth Annual Report of the President and Directors of the Chesapeake & Ohio Canal Company to the Stockholders, June 1st, 1857 (Frederick, Md.: Johnson, Koontz, & Cole Printers, 1857), 12.

⁸¹William P. Maulsby, President, to the Governor of Maryland, 7 November 1857, C&O Outgoing Correspondence, 1828-70.

⁸²Minutes, 1 May 1857, C&O Directors Proceedings, 1828-90.

⁸³Minutes, 29 May 1857, Ibid.

masonry dams were completed, the canal would be sustainable and could finally look forward to a profitable future.⁸⁴

The floods of the spring of 1857, however, hindered the completion of the masonry dams. The canal company had originally contracted for the completion of the new Dam 4 by January 1, 1858. After the floods subsided, the contractors building the dam still claimed this was possible but demanded extra money to hire more men to speed the work. The company agreed to pay, but only if the contractors dropped their compensation claims for damages incurred during the spring floods. The contractors agreed to forego their flood damage claims, but only if the canal company extended the completion deadline, which it refused to do.⁸⁵ Stung by the refusal and fearful the canal company could not make payments for work already completed, the contractors slowed progress on Dam 4. The delay in the completion of the dams brought a response from Thomas L. Patterson, the engineer supervising construction of the dams, who recognized the vulnerability of the uncompleted structures, particularly Dam 4, to the river. In November 1857, he recommended preventive action at Dam 4 to safeguard the unfinished masonry dam against high water. Patterson recommended:

I propose to construct a crib enclosing the end of the masonry and connecting it with the old dam. This crib will be filled with stone and planked so as to be tolerably tight in order that, in case of high water, the space between the old and new dams shall be full of water and the new work not exposed to the shock of a mass of water falling against it.⁸⁶

Patterson believed Dam 5 was more secure than Dam 4. Still, he thought it too could be safeguarded. "It would add to its security," he wrote, "if about five hundred cubic yards of gravelling were put in so as to fill up the space between the old dam and new."⁸⁷

⁸⁴Maulsby to Governor, 7 November 1857, C&O Outgoing Correspondence, 1828-70.

⁸⁵Minutes, 1 July and 13 September 1857, C&O Directors Proceedings, 1828-90.

⁸⁶T. L. Patterson, Engineer, to the President and Directors, 1 and 6 November 1857, C&O Incoming Correspondence, 1828-90.

⁸⁷Ibid.

The canal company also sought to speed completion of Dam 5, by offering its contractor more money. Unlike at Dam 4, an agreement was reached, but despite the incentives offered, the new Dam 5 was not completed by its deadline date, June 1858. In fact, by that date both dams were only about one-fifth complete. The poverty of the C&O Canal Company and high water in the Potomac continued to delay their completion.⁸⁸

Although it was unable to repay its outstanding loans, the C&O Canal Company managed to find financing for the new dams. The coal companies, which had a great interest in reliable navigation on the canal, offered in August 1858 to lend the canal company up to \$100,000 to complete the masonry dams. The loan was to be in the form of toll certificates, which the canal company would give to the contractors in payment for their work, and which the contractors in turn would sell for cash, principally to the coal companies. Then the coal companies would pay its tolls with certificates. In essence, the toll certificates allowed the canal to finance the masonry dams out of future revenue.⁸⁹ Unfortunately, too many toll certificates were already in circulation, and the new issue cut into the cash receipts of the company to an excessive degree. Not enough canal tolls came as cash. As a result, the canal company did not take in enough revenue to pay its current expenses. It was forced to institute a policy where only half of tolls could be paid in the certificates and the remainder had to be paid in cash.⁹⁰ By the summer of 1859, the company could no longer afford to redeem toll certificates at all, and appealed to the coal companies for a suspension of their use.⁹¹

Even more troubling to the canal company than its finances was the fact that as long as the masonry dams remained uncompleted, they had to continue--at ruinous expense--to repair the old Dams 4 and 5. After the floods of 1857, William P. Maulsby had ordered that temporary crib dams be built across the

⁸⁸Thirtieth Annual Report, 7 June 1858, C&O Stockholders Proceedings, 1828-90.

⁸⁹Minutes, 9 August 1858, C&O Directors Proceedings, 1828-90.

⁹⁰Minutes, 3 and 4 March 1859, Ibid. It is worth noting at the same time it was demanding that canal users pay at least half their tolls in cash, however, the company tried to pay off the contractors at the dams entirely in toll certificates.

⁹¹Minutes, 14 July 1859, Ibid.

breached portions of the dams in order to restore navigation quickly. The canal company hoped these crib dams would soon be replaced by the masonry dams. However, the slow progress on the masonry dams meant extensive work was necessary to keep what was left of the old dams and the temporary cribs in place. This work diverted men and resources from the new dams. L. J. Brengle, Maulsby's successor as C&O president, estimated in his 1859 report to the stockholders that it had cost \$100,000 to maintain the old dams in the past two years, leaving only \$58,000 to spend on building the new masonry dams.⁹² Inflating repair costs were new freshets in the river. The April 1859 flood damaged Dam 4. John G. Stone, the general superintendent, informed the stockholders, "About 100 feet of the guard bank was washed away by the water getting over the bank just above the abutment where the crib of the old Dam connected with the bank, part also of the crib work put in last Spring was carried away. " The flood also weakened the existing Dam 5, but Stone did not specify how.⁹³

In addition, flooding plagued the construction of the masonry dams. High water in the autumn of 1858 prevented the completion of the nearly finished Dam 4 that year. It also ignited great fears that floods would wash away the new dams before they were sufficiently finished to withstand the river. As a stopgap measure, the company built temporary crib dams at the new Dam 4 to provide it some protection. Still, a freshet near Williamsport in April 1859 damaged the uncompleted masonry structure. The new dam was just downstream from the old Dam 4, and timber and other debris coming over the old dam hit the new dam with such force that it dislodged masonry, causing \$10,000 in damage.⁹⁴ Another flood struck in September 1859, this time washing away 175 feet of masonry at No. 4. The company responded by "building a temporary crib in front of the damaged portion of the dam, and a contract was let to Lewis Stanhope to construct a permanent crib at that point and fill the space between the old

⁹²Thirty-First Annual Report of the President and Directors of the Chesapeake and Ohio Canal Company to the Stockholders, June 6th, 1859 (Frederick, Md.: Schley, Haller & Co., 1859), 3-6; Thirty-Second Annual Report of the President and Directors of the Chesapeake and Ohio Canal Company to the Stockholders, June 4th, 1860 (Frederick, Md.: Schley, Haller & Co., 1860), 6-13.

⁹³Minutes, 1 September 1859, C&O Directors Proceedings, 1828-90.

⁹⁴Thirty-First Annual Report, 10-11.

and new dams with stone."⁹⁵ To finance these repairs, the canal again appealed to the coal companies. An agreement was reached that the coal companies would pay their tolls in cash for two months to finance repairs from the flood and continued work on the masonry dams.⁹⁶

Further damage occurred to the old dams as a result of an ice freshet in January 1860. Having no other source of assistance, the C&O Canal Company turned once more to the coal companies. The coal companies, however, proved more reluctant to assist the canal than before. In order to finance the repair of the old dams, the coal companies demanded that the canal company surrender to them control of the issuance of toll certificates. This would have essentially allowed the coal companies to cut off the canal company's principle means of obtaining credit if they wished, and the canal company found this condition unacceptable. Instead, the C&O directors authorized the issue of toll certificates to pay for a crib dam to bridge the breach at Dam 4 and to secure the Virginia abutment at Dam 5. The coal companies refused to buy these toll certificates, however, so the company gave them to a director to sell to other parties, but found few buyers. The canal company also explored the possibility of suspending acceptance of toll certificates to increase the cash receipts temporarily, but its attorney advised against this step. Finally, in June 1860, the canal company reached an agreement with the coal companies in which the latter advanced the canal an additional \$10,000 in anticipation of future tolls. The money was to be used to repair the old Dam 4 and continue work on the new masonry dam. In October the coal companies agreed until further notice to pay half their tolls in cash.⁹⁷ Although the canal and the coal companies came to terms, the president and board decided to stop work on the masonry dam at No. 5, believing the limited resources of the company were better applied at Dam 4, where the old dam was more vulnerable and the masonry dam, begun in early 1857, was closer to completion.⁹⁸

⁹⁵Unrau, The Major Floods, 19.

⁹⁶Minutes, 6 December 1859, C&O Directors Proceedings, 1828-90.

⁹⁷Minutes, 28 January, 2 March, 5 and 26 April, 15 May, 1 and 9 June, and 5 October 1860, Ibid.

⁹⁸Thirty-Second Annual Report of the President and Directors of the Chesapeake and Ohio Canal Company to the Stockholders, June 4th, 1860 (Frederick, Md.: Schley, Haller & Co., 1860), 6-13.

The Civil War Era: the 1860s

Through the early 1860s, the C&O Canal Company limped along, struggling with its limited resources to preserve the canal, especially Dams 4 and 5, against the river. Rather than being confronted with a big flood, the canal during this period suffered through a long series of smaller freshets. The first of these minor floods struck in the summer of 1860. James Fitzpatrick, then President of the canal company, later remembered:

The summer of 1860 . . . was indeed remarkable for heavy rains and high waters. Scarcely a month passed without a rise of water, causing serious interference with the progress of the work under contract, and affecting the crib dams so much so, that they needed constant attention to replace the metal carried away by the high waters. It being a matter of necessity to maintain the navigation, in order to be put in receipt of revenue, we were compelled to expend from 4 to 5 thousand dollars at Dam No 4 and about 2800 dollars at 5.⁹⁹

The next flood came in November 1860, causing damage mainly at Dam 5, where the masonry abutment on the Virginia side of the river was swept away (lesser damage also occurred at Dams 4 and 6). The freshet of April 1861 was the highest flood on the upper portion of the river since April 1852. Washes and breaches occurred there, while the canal below Harpers Ferry sustained less damage. The outbreak of the Civil War brought a new impediment to repairs. With the secession of Virginia in April 1861, the Virginia-Maryland border, which the canal followed, became the most important battleground of the war. Both armies, but particularly the Confederate, damaged the canal, and hindered commerce and the activities of C&O maintenance personnel. For instance, after the July 1861 freshet caused further injury to the canal, repairs crews were reluctant to travel to damaged locations for fear of confronting hostile southern troops. It was not until Union army dispatched forces to protect the workers that the pace of repairs quickened and the canal finally reopened in late August 1861.¹⁰⁰

⁹⁹James Fitzpatrick, Former President, Cumberland, to W. S. Ringgold, Clerk, 28 January 1862, C&O Incoming Correspondence, 1828-90.

¹⁰⁰Unrau, The Major Floods, 19-21.

If 1860 and 1861 were difficult years for the C&O Canal Company, 1862 proved even more trying. High water returned in late April 1862, causing heavy damage at Dam 4. A shipper in Williamsport lamented to a C&O Director that the freshet was the "7th high water within the last 18 months." The damage at Dam 4 might have been less, but "the Plank at the Stop Lock Dam No 4 had either not been put in or if put in had gone out."¹⁰¹ The shipper insisted that this was not the first time negligence had worsened the injury to the canal during a flood. Company records bear his complaint out. Such had been the case during the November 1860 flood as well.¹⁰² The canal was back in operation on May 8, but high water on May 14 damaged the uncompleted repairs made to Dam 5 after Confederate troops had tried to destroy the structure in December 1861. Navigation again resumed at the beginning of June, just in time for heavy rain to cause a significant breach in the canal near the Antietam Ironworks.¹⁰³

The series of small floods between the summers of 1860 and 1862, combined with the obstruction of commerce along the canal by the war, led to renewed financial problems for the C&O Canal Company. Floods and war significantly reduced the company's income at the same time it was forced to increase its expenditures to repair the damage wrought by high water and marauding armies. Making the situation even worse was that many tolls were still being paid in the form of certificates instead of cash. In October 1861, the company took a step it had contemplated for some time and suspended the use of toll certificates, stating "the means of the Company are inadequate to the proper repairs and maintenance of the navigation of the canal."¹⁰⁴ While the company attorney quickly pushed the president and directors to rescind their action (which was illegal), the declaration of suspension demonstrates the company's desperate position. Unable to suspend the use of toll certificates unilaterally, the company raised its transportation

¹⁰¹Charles Embry and Son, Williamsport, to H. W. Dellinger, Director, 26 April 1862, C&O Incoming Correspondence, 1828-90.

¹⁰²Unrau, The Major Floods, 19. Both episodes point out the importance of quick action on the part of canal personnel in minimizing damage along the waterway from floods (although it was not unusual for canal users to unfairly blame maintenance workers for flood damage that was beyond human control).

¹⁰³Ibid., 22-23.

¹⁰⁴Minutes, 1 October 1861, C&O Directors Proceedings, 1828-90.

rates in an attempt to bring in more revenue.¹⁰⁵ Raising tolls proved only of limited value in increasing revenue, at least initially. Alfred Spates, president of the canal company, confessed to the stockholders in 1863, "The Company have again been greatly restricted in making repairs on the Canal by their limited revenues, and have been obliged to confine them to such as were indispensably requisite to maintain the navigation, leaving others of greater magnitude, where it could be safely done, to be effected when their means or credit will be more ample."¹⁰⁶

While the company was able to pick up the pace of repair activities early in 1864, by the end of the Civil War the canal was in poor shape. With the end of the conflict in 1865, the president and board of directors determined to refurbish the canal. They ordered Charles P. Manning, the engineer and general superintendent, to examine the entire line of the canal and suggest any repairs and flood improvements that would make the canal "permanent and efficient."¹⁰⁷ Manning, like his predecessors in the 1850s, found the dams of great concern. He recommended that the masonry dam at No. 5, where construction had stopped during the war with the structure only two-thirds complete, be resumed. The gradual accumulation of sediment in the canal from flooding and normal water flow bothered Manning. He recommended a systematic program of dredging, and hinted that the company should end the sale of water for powering manufacturing, which would enable them to run less water down the canal and minimize silting.¹⁰⁸ While the sale of water power continued, the C&O Canal Company resumed work on Dam 5 in July 1866. As before, high water plagued construction of the dam, although not to the extent it had in the 1850s. A freshet in October 1866 carried away a coffer dam and damaged a

¹⁰⁵Minutes, 10 April 1863, Ibid.

¹⁰⁶Thirty-Fifth Annual Report of the President and Directors of the Chesapeake & Ohio Canal Company to the Stockholders, June 1st, 1863 (Washington, D.C.: R. A. Waters, 1863), 4.

¹⁰⁷Minutes, 14 September 1865, C&O Directors Proceedings, 1828-90.

¹⁰⁸Charles P. Manning, Engineer and General Superintendent, Cumberland, to the President and Directors, 12 April 1866 and 31 May 1866, C&O Incoming Correspondence, 1828-90.

just-completed sixty-foot section of the masonry dam.¹⁰⁹ The structure was injured one more time by high water in 1867, before it was finally completed in 1869.¹¹⁰

Prosperity, More Renovations, and More Flooding: The 1870s

With the end of the Civil War, the Chesapeake and Ohio Canal entered the most prosperous period in its existence. The canal company suffered through a brief depression after the Civil War, but in the late 1860s traffic and revenue for the waterway began to increase, and for five years starting in 1870 the canal even made a profit. Finally in the black, the company resumed interest payments on the Virginia repair bonds and retired this debt in 1871. It also began paying interest on the preferred construction bonds.¹¹¹

The prosperity of the waterway meant the C&O Canal Company finally had money for a new repair and improvement program. In December 1868, President Alfred Spates and the board of directors appropriated \$100,000 for that purpose.¹¹² The repair and improvement program continued under Spates' successors, James C. Clarke and Arthur P. Gorman. The architect behind the repairs was William R. Hutton, the company engineer during this period and designer of the Georgetown incline plane. In the 1870 Annual Report to the stockholders, Hutton outlined his vision for repairing the canal. Of particular concern to Hutton was the vulnerability of the canal embankments to the river at certain locations. While he believed the weakest locations had already been protected, he identified areas that still needed work. They were the guard bank of Dam 4, which needed "rip rap or slope wall" to provide protection from erosion and a sagging fifty-two

¹⁰⁹Unrau, The Major Floods, 24.

¹¹⁰Fortieth Annual Report of the President and Directors of the Chesapeake & Ohio Canal Company to the Stockholders, June 1st, 1868 (Washington, D.C.: Samuel Polkinhorn, 1868), 4-5; Minutes, 5 and 6 May 1870, C&O Directors Proceedings, 1828-90.

¹¹¹Walter S. Sanderlin, The Great National Project: A History of the Chesapeake and Ohio Canal (Baltimore, Md.: The Johns Hopkins Press, 1946), 228-29; Minutes, 27 July 1870, C&O Directors Proceedings, 1828-90.

¹¹²Forty-First Annual Report of the President and Directors of the Chesapeake & Ohio Canal Company to the Stockholders, June 7th, 1869 (Georgetown, D.C.: Courier Print, 1869), 4-5.

foot sustaining wall near Great Falls, which he recommended "be protected by an exterior revetment at its foot, and for at least one-third of its height." Hutton also suggested that the Rock Creek basin and the Georgetown level required extensive desilting.¹¹³

In July 1870, William R. Hutton submitted a comprehensive repair and improvement plan to the president and board of directors. Hutton's \$77,620 program consisted of general restoration, rather than building or improving water control structures. Most of the money would go toward desilting the canal and repairing locks and other structures. However, Hutton did plan to riprap embankments, raise the towpath, repair culverts, and work on other flood control projects. Hutton's proposal contemplated spending most of the funds in three of the seven divisions of the canal: Georgetown, Monocacy, and Williamsport. The bulk of the proposed expenditure at Williamsport was for the Conococheague aqueduct, which had been damaged during the Civil War. The board of directors approved Hutton's plan and he started restoration work after the end of the 1870 boating season. Over the winter of 1870-71, Hutton spent about half the \$77,620 repairing the Conococheague aqueduct, building a flume at the guard bank at Dam 5, and desilting the canal in and around Georgetown. The repairs continued over the winter of 1871-72, with over \$24,000 programmed.¹¹⁴

Despite all the restorative and preventive work conducted between 1870 and 1872, William R. Hutton was still not satisfied he had put the canal in first-class condition. In August 1872, he submitted a report to the company describing the progress of the work to date and what still needed to be done. Hutton discussed the desilting of the canal prism, which had just been completed; the need to repair and raise an unspecified twenty miles of the canal towpath; the state of each dam (he recommended that Dam 6 be replaced with a masonry dam, but thought a masonry dam not worth the cost at Dam 1); the condition of the locks, culverts, waste weirs, aqueducts, bridges, and other structures (specifying those that needed work). He also recommended raising, building up, or riprapping canal embankments and reinforcing walls to protect certain structures from the river

¹¹³Forty-Second Annual Report of the President and Directors of the Chesapeake & Ohio Canal Company to the Stockholders, June 6th, 1870 (Annapolis, Md.: George Colton & Sons, Printer, 1870) 24-25.

¹¹⁴Minutes, 3 and 27 July 1870, and 7 December 1871, C&O Directors Proceedings, 1828-90.

better.¹¹⁵ The work Hutton suggested started in the autumn of 1872. It included among other projects riprapping the guard banks of Dams 4 and 5, and rebuilding a retaining wall below Lock 15 in Widewater that had been weakened seriously over time.¹¹⁶

Restoration work on the canal continued under Hutton's successor, Thomas L. Patterson. Besides keeping up the pace of repairs on the locks, culverts, and aqueducts, and dredging material out of the canal, Patterson recommended replacing Dams 1 and 2 with masonry structures. Patterson's goal in suggesting masonry dams was to insure a reliable supply of water to the lowest part of the canal, particularly in Georgetown where the canal company had water power leases. The company, however, did not pursue Patterson's proposal and opted, as it had in the past, to rebuild the existing stone and brush dams.¹¹⁷

Starting in the winter of 1873-74, restoration activity shifted to the aqueducts. Both the Seneca and Big Tonoloway aqueducts received extensive repairs. Crews took down the berm walls of both structures and reconstructed them. The company also continued its dredging activities near Georgetown.¹¹⁸ By 1876, James C. Clarke's successor as president, Arthur P. Gorman, pronounced the condition of the canal as "excellent," although

¹¹⁵William R. Hutton, Report of W. R. Hutton, Chief Engineer as to the Condition of the Chesapeake and Ohio Canal, With Estimate of Cost of Extraordinary Repairs Required During the Current Year, August 14, 1872 (Annapolis, Md.: Luther F. Colton and Company, Printers, 1872), 1-30.

¹¹⁶Minutes, 16 September 1872, C&O Directors Proceedings, 1828-90; Forty-Fifth Annual Report of the President and Directors of the Chesapeake & Ohio Canal Company to the Stockholders, June 2nd, 1873 (Annapolis, Md.: L. F. Colton & Co., Steam Printers, 1873), 29.

¹¹⁷I. R. Mans, Superintendent, Georgetown, to the President and Directors, 27 December 1873, C&O Incoming Correspondence, 1828-90.

¹¹⁸Forty-Sixth Annual Report of the President and Directors of the Chesapeake & Ohio Canal Company to the Stockholders, June 2nd, 1874 (Annapolis, Md.: L. F. Colton & Co., Steam Printers, 1874), 11-12; Annual Report of the President and Directors, 7 June 1875, Printed Materials, 1816-1907, Chesapeake and Ohio Canal Company, Entry 320, Record Group 79, Records of the National Park Service, National Archives, College Park, Md.

dredging of the canal prism and the rebuilding of retaining walls on the Georgetown level continued into 1877.¹¹⁹

During the period of renovation and improvement of the canal in the 1870s, flooding continued to plague the waterway. Two notable floods struck the canal in the early 1870s, as well as a host of smaller, more localized freshets. In September 1870, a record flood on the Shenandoah River slammed into the Potomac, causing an 850-foot breach in the canal embankment at Lock 33 opposite Harpers Ferry and weakening the "sea wall" supporting the towpath there. The 1870 flood severely injured the canal from Harpers Ferry to Sandy Hook, with notable damage below Seneca as well. The flood forced company crews to breach an embankment near Georgetown to safeguard the high banks and walls of the canal. While they succeeded, the force of the water exiting the hastily cut channel caused a 360-foot hole in the waterway. The flood put the canal out of commission from September 30 until mid-October, and cost the company over \$22,000 by the end of 1870. The repairs might have cost less had not the canal company been in haste to resume navigation on the canal before the end of 1870 boating season.¹²⁰

An even more expensive flood occurred in August 1873. This freshet showed the vulnerability of the culverts passing mountain streams under the canal and into the Potomac River. A flash flood that followed fourteen days of rain overwhelmed many culverts, particularly in the Antietam and Monocacy divisions of the canal. In the Antietam Division, the limestone formations of the region compounded the damage: flood waters working their way through fissures in the rock caused two breaches in the canal. It cost \$25,000 and almost a month to put the canal back into operation.¹²¹

Still, canal officials believed all the repair and preventive work done on the canal in the 1870s had left the waterway in the best shape it had been in years, and was more resistant to floods. Arthur P. Gorman admitted the damage to the canal from the August 1873 flood was the worst since 1852. However, he asserted, "but for the substantial manner in which

¹¹⁹Forty-Ninth Annual Report of the President and Directors of the Chesapeake and Ohio Canal Company to the Stockholders, June 4th, 1877 (Annapolis, Md.: Maryland Republican Steam Press, 1877), 9.

¹²⁰Unrau, The Major Floods, 25-26; Minutes, 11 January 1871, C&O Directors Proceedings, 1828-90.

¹²¹Unrau, The Major Floods, 26-27.

[the canal] was constructed possibly its navigation would not be resumed."¹²² After the canal came through a flood in April 1874 relatively unscathed, Gorman grew even more optimistic about the sustainability of the canal. "During the greater portion of the past month the Potomac River was so swollen from the heavy rains as to overflow some portions of the Canal," Gorman wrote, "but so solid have become the banks, and so permanent are the repairs, that but little damage has been done the works."¹²³

While Gorman was no doubt correct that the canal was more resistant to floods than it had been in years, it could not withstand the flood of November 1877. This flood was the worst ever recorded on the Potomac to that date, easily exceeding the flood of April 1852. The crest of the flood generally exceeded that of April 1852 by two feet, and at the confluence of the North and South branches of the Potomac the river was six feet higher than in 1852. Damage was heavy all along the entire line of the canal, but it was worst in the waterway's middle section because the exceptionally high level of the Antietam and Conococheague during the flood.¹²⁴ In the words of the Arthur P. Gorman, the flood of November 1877 "was the greatest ever known in the Potomac river. It damaged . . . every mile of the canal from Cumberland to Georgetown. Large portions of it were swept completely away, and others filled up as completely, as if the canal had never been excavated."¹²⁵

The most notable loss to the canal was at Dam 4. Despite the dam's sturdy masonry construction, 200 feet in the center of the 720-foot span washed away during the 1877 flood, even before the river had reached its crest. The calamity stunned the officers of the C&O Canal Company. The company had spent hundreds of thousands of dollars replacing the old wooden dams

¹²²Minutes, 10 September 1873, C&O Directors Proceedings, 1828-90.

¹²³A. P. Gorman, President, Annapolis, to the Directors, 11 May 1874, C&O Incoming Correspondence, 1828-90.

¹²⁴Unrau, The Major Floods, 27-28.

¹²⁵Testimony of A. P. Gorman, President, C&O Canal Company, 31 May 1880, in Testimony for the Respondents, Cumberland, Md., Daniel K. Stewart v. The Chesapeake and Ohio Canal Company, The Chesapeake and Ohio Canal Company Collection, Archives and Manuscripts Department, McKeldin Library, University of Maryland, College Park.

with masonry structures.¹²⁶ The 1877 flood showed the masonry dams, while more sustainable than their predecessors, were themselves susceptible to the worst the river could offer. The company temporarily sealed the breach at Dam 4 with crib dams until more permanent repairs could be initiated.

Despite the onset of winter, the C&O Canal Company did not wait until spring to repair the canal. While starting work on the entire line, the initial priority was the canal below the Dam 1. The canal company wanted to resume water supplies to Georgetown. The flood struck the canal on November 24, 1877, and by December 20 water was again on the Georgetown level. A mild winter helped push along the pace of repairs elsewhere and the company restored navigation along the entire line of the canal by April 1878. However, the condition of the canal was abysmal. Isaac R. Mans, superintendent of the canal in Georgetown, wrote that his division, particularly the towpath and culverts, was "in very bad condition."¹²⁷ Indeed, restoration work continued through 1878, and it was not until June 1879 that President Gorman declared the repairs essentially complete (except Dam 4, where the company did not finish work until October 1879).¹²⁸

After the 1877 deluge, the canal company engaged in further flood control work. Most of this labor included elevating the towpath and building high retaining walls to protect the canal at vulnerable locations such as opposite Harpers Ferry.¹²⁹ However, another improvement was quite novel. In 1879, the canal company installed a telephone system along the line. At the time, it was the longest operating telephone circuit in the world.¹³⁰ The telephone constituted a significant advance in

¹²⁶Minutes, 12 December 1877, C&O Directors Proceedings, 1828-90.

¹²⁷I. R. Mans, Superintendent, to A. P. Gorman, President, Annapolis, 20 May 1878, C&O Incoming Correspondence, 1873-80.

¹²⁸John Humbird, B. B. Crawford, P. Hamill, Directors, Annapolis, to President, A. P. Gorman, 27 September 1879, Ibid.; Fifty-First Annual Report of the President and Directors of the Chesapeake and Ohio Canal Company to the Stockholders, June 2nd, 1879 (Annapolis, Md.: Maryland Republican Steam Press, 1879), 8-9.

¹²⁹Ibid.

¹³⁰In installing a telephone system, the C&O Canal Company was on the cutting edge of technology. Alexander Graham Bell made the first successful test of the telephone in March 1876. He spent the remainder of the year perfecting the device, and by early 1877 commercialization began. Long

flood damage prevention, giving superintendents along the canal much more time to prepare the canal for high water than in the past. Before, notification had come by a horse back rider reporting from the nearest telegraph office. The telephone also allowed the superintendents to better regulate the water flow in the canal during floods, preventing inadvertent overflows. As Edward Mulvaney, a longtime superintendent, explained:

By the use of the telephone, the water can be regulated on the levels by the feeder at the upper end of the division. At Cumberland, there is a feeder which feeds 50 miles of the canal, and there are telephone stations at regular distances along the canal, and they regulate the supply by sending word through this telephone as to the amount of water to be let in from this feeder, and therefore, they need not let more on than is necessary. If the water is let on too much after a rain, it is likely to overflow some of the levels and thereby cause a breach in the canal. But if the levels are overflowed now they can be notified immediately by telephone and the water let off, and it will recede immediately.¹³¹

The Decline of the C&O Canal Company: the 1880s

While the canal recovered physically from the flood of November 1877, it weakened the C&O Canal Company financially. The initial estimate placed the cost of repairs on the canal at just over \$200,000. A decline in the coal trade due to the Panic of 1873 and labor unrest along the waterway during the summer of

distance telephone communications still was in its infancy when the C&O Canal network was built in 1879, as inventors were still looking for the best medium to transmit signals over long distances. It was not until the early 1880s that copper wire became the standard material for transmitting long-distance telephone signals and long-distance lines began to be laid between major cities in the Northeast. The author did not come across any information describing the technology used in the C&O Canal telephone system. See The New Encyclopedia Britannica: Macropedia, 1995 ed., s. v., "Telecommunications Systems."

¹³¹Testimony of Isaac R. Mans, Former Division Superintendent of the Canal in Georgetown, 16 March 1880, in Report of the Joint Standing Committee Appointed Under Article 3, Section 24, of the Maryland Constitution, in the Chesapeake and Ohio Canal Investigation (Annapolis, Md.: W. T. Iglehalt and Company, State Printers, 1880), 187; Testimony of Edward Mulvaney, Canal Shipping Agent in Cumberland, and a former (and future) Division Superintendent, 18 March 1880, in Ibid., 212-17; Sanderlin, The Great National Project, 246; Fifty-Second Annual Report of the President and Directors of the Chesapeake and Ohio Canal Company to the Stockholders, June 7th, 1880 (Annapolis, Md.: Maryland Republican Steam Press, 1880), 10-11.

1877 had already hurt the canal company even before the flood. Consequently, the company had no alternative but to borrow money to repair the canal. The initial loans to start the repairs came from the coal companies and banks in Maryland and Washington, D.C. The company managed to raise over \$110,000 from these sources, and President Gorman even contributed \$5,000 of his own money. However, the unprecedented cost of the repairs pushed the canal to seek government assistance. Gorman, who was influential in Maryland politics, convinced the state legislature to guarantee the issuance of up to \$500,000 in repair bonds in February 1878. The bonds proved indispensable, because the repair estimate had increased by April 1878 to between \$225,000 and \$250,000. The flood of 1877 left the canal company with an extra debt of nearly \$200,000 on top of already ponderous obligations.¹³²

The ill fortune that beset the C&O Canal Company in the mid-1870s continued into the 1880s. Labor troubles plagued the company and the Baltimore and Ohio Railroad forced the canal into a price war for control of the Allegheny coal trade. The canal company repeatedly had to reduce tolls on the waterway to retain its share of the coal traffic, which by the 1880s was almost the only commodity shipped on the canal. As toll rates fell, so did revenue, which not only ended the flood improvement program of the 1870s, but also forced the company to slash expenditures for basic repairs. The only maintenance program it continued from before the 1877 flood was the dredging of the Rock Creek basin, which became critical after 1887 when the federal government purchased the Alexandria aqueduct for conversion into a bridge. Consequently, the condition of the C&O Canal deteriorated during the 1880s, leaving it increasingly vulnerable to flooding.¹³³

Subsequent flooding took a terrible toll on the canal. A freshet in June 1884 struck the Washington County portion of the waterway, causing a one week closure.¹³⁴ A much more destructive series of freshets hit the canal during April and May of 1886. The first flood on April 1 breached Dam 6, the remaining wooden dam on the canal, and resulted in damage elsewhere on the line as well. The gap in Dam 6 was widened by another flood in the river on April 4, and again on May 9. Rather than replace Dam 6 with a masonry dam, the company opted

¹³²Fifty-First Annual Report, 8-9; Unrau, The Major Floods, 27-30.

¹³³Sanderlin, The Great National Project, 248-52.

¹³⁴Unrau, The Major Floods, 30.

to rebuild it again as a wooden dam. However, G. W. Smith, the company engineer recommended, "If rebuilt it should be of sawed white oak (and not hewn as in old dam) and filled with broken stone instead of field stone or stone from the river bottom which have been run smooth by the action of the water, which latter fact was the cause of so much leakage in the dam."¹³⁵

The C&O Company financed repairs after the 1886 flood by using its authority to sell repair bonds under the 1878 Maryland legislation. Before 1885, the company had sold only \$125,000 of the \$500,000 in bonds authorized. The board of directors sold \$189,000 in bonds (at a 14 percent discount) in 1886 before the flood to pay off its short-term indebtedness, principally the back wages and salaries of its employees. After the 1886 flood, the company sold the remainder of the 1878 bonds to pay for the repairs and to put off the day of reckoning in its futile price war with the railroad. Investors were willing to buy the bonds because they carried a preferred mortgage on the physical property of the canal company. The majority bondholder would probably take over the canal's assets if it went bankrupt. However, the weak position of the company meant the bonds sold at a deep discount: bonds sold in August 1887 carried a 22 percent discount, and by the end of 1887 the discount had increased to 24 percent.¹³⁶ With the sale of the last bonds, the officers of the canal company realized they had no further resources should another calamity befall the canal. Victor Baughman, the president of the canal company, warned the stockholders:

The situation becomes more embarrassing when it is remembered that all of the assets of the Company have been used--that there are no more repair bonds to fall back upon in the event of another flood. A recurrence of these floods is inevitable. The extent of the destruction they may entail cannot be conjectured. With a steady and gradually increasing indebtedness, and without a dollar of means to repair in the event of a disaster--a destruction of any considerable portion of the works (though not so disastrous as that of the past season) will amount to--for it will

¹³⁵Report of G. W. Smith, Engineer, to L. Victor Baughman, President, 17 April 1886 in Minutes, 22 April 1886, C&O Directors Proceedings, 1828-90.

¹³⁶Sanderlin, The Great National Project, 254.

essentially produce--a total abandonment of the canal as a water-way carrier.¹³⁷

The Failure of the C&O Canal Company: 1889-90

The scenario Baughman feared was closer at hand than he probably imagined. In late May 1889, the largest flood in the history of the Potomac to that date, eclipsing those of 1852 and 1887 hit the canal. It devastated the entire canal from Cumberland to the Rock Creek basin, causing the greatest injury below Harpers Ferry (see Figures 2 and 3). Initial damage estimates ranged between \$500,000 and \$1,000,000, although the figure quickly fell to \$300,000. Company officials indicated it would take \$180,000 alone to restore the canal from Georgetown to Great Falls, while \$60,000 would be necessary to rebuild the waterway from Great Falls to Harpers Ferry, and another \$60,000 to reconstruct the waterway from there to Cumberland.¹³⁸

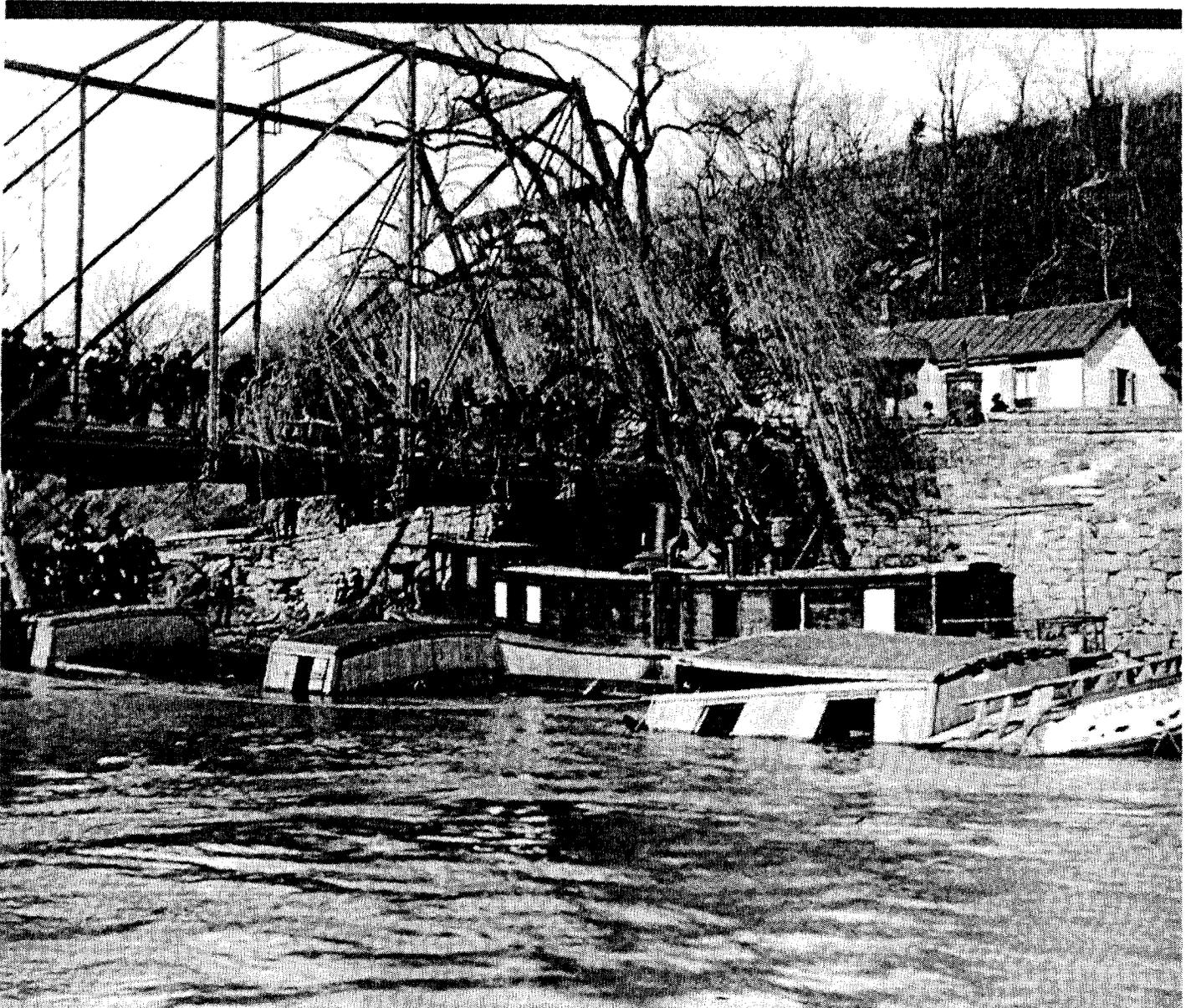
Even before the flood waters drained from the C&O Canal, the debate about its future began. The 1889 flood raised the distinct possibility that the waterway would close. It was apparent to all concerned that the canal company could not raise the \$300,000 needed for the repairs because in the years leading up to the flood it had trouble meeting operating expenses from its current revenues, let alone making debt payments.¹³⁹ Since it was obvious that the canal company probably could not repair the waterway, the debate shifted to whether it was worth restoring the canal at all, and what should be done with the canal if it was not restored. In Georgetown, the millers, dependent on the water power supplied by the canal, pushed for the quick repair of at least the Georgetown level of the C&O Canal, while other business interests, which had transportation needs, believed that a railroad should replace the canal. Railroads, however, were feared greatly in the nineteenth century as monopolistic price gougers, and the majority public opinion

¹³⁷Fifty-Ninth Annual Report of the President and Directors of the Chesapeake and Ohio Canal Co. to the Stockholders, January 5th, 1887 (n.p., [1887]), 8.

¹³⁸Baltimore Sun, 11 June 1889, 1.

¹³⁹Evening Star (Washington, D.C.), 3 June 1889, 5.

FIGURE 2



Chain bridge, above Georgetown, with packet steamboat
John C. Poor partially submerged. Flood of 1889

FIGURE 3



Lockhouse 16, below Great Falls, after the flood of May 1889

avored saving the C&O Canal as a competitor that would keep transportation rates lower.¹⁴⁰

Despite the widespread belief that it was without means to repair the waterway itself, the C&O Canal Company attempted to find money. Stephen Gambrill, president of the canal company, called a meeting of parties interested in saving the waterway on June 19, 1889. The meeting produced an agreement between the company and Georgetown millers to restore the Georgetown level. The millers would advance \$16,000 from future water rents for the repairs.¹⁴¹ Mending the Georgetown level proceeded rapidly, and by the end of the summer water was again flowing from Dam 1 to the Rock Creek basin. However, the June 19 meeting did not determine the means to repair the rest of the canal. The C&O stockholders pushed the Maryland legislature for the authority to issue new repair bonds. Although the State of Maryland granted this authority, the company could find no market for the bonds, because earlier issues already carried a lien on the companies assets, and the company could only pledge future revenues as collateral, which had proved inadequate for even the current expenses of the company. Having failed at selling bonds, the company attempted to find contractors who would take toll certificates in payment for their work but, like the bond issue, this tactic was unsuccessful. The company also appealed to its patrons along the line for assistance but, as elsewhere their efforts met with complete failure.¹⁴²

With the failure of the C&O Canal Company to find money for repairs, its future fell into the hands of the company's old rival, the Baltimore and Ohio Railroad. The B&O was the majority holder of the canal's biggest debt issues, the 1844 construction bonds and 1878 repair bonds. In its capacity as the canal's principal creditor, the B&O petitioned to place the canal in receivership in December 1889. The Washington County Circuit Court approved the receivership petition early in 1890. It must have appeared to most observers that the canal was doomed.

¹⁴⁰Ibid., 4 June 1889, 5.

¹⁴¹Minutes, 19 June 1889, C&O Directors Proceedings, 1828-90.

¹⁴²President and Directors to the Stockholders of the Chesapeake and Ohio Canal, 2 June 1890, Brown et al. Trustees v. Chesapeake and Ohio Canal Company, Nos. 4191 and 4198 Equity, Circuit Court of Washington County, Hagerstown, Md.

The Potomac River had played a large role in the death of the C&O Canal Company. Competition with the B&O Railroad was the long-term disease that killed the canal company, but the insustainability of the waterway hurried its demise. Despite large and repeated expenditures for restoration and flood control, the river had overwhelmed the C&O Canal time after time, exhausting the financial resources of the canal company. After sixty years, high water had defeated all efforts to operate a profitable canal within the flood plain of the Potomac River.

CHAPTER 2

THE B&O RAILROAD

A New Philosophy: 1890-1924

Rather than shut down the C&O Canal, however, the B&O Railroad chose to repair it. The prime reason behind the decision was that if the B&O closed the canal, the Washington County Circuit Court would have required its sale to insure that the C&O's bondholders would receive at least a partial repayment. With a sale, a bidding war would have broken out with other railroads interested in acquiring the canal's right-of-way. A competitor running a railway line along the path formerly followed by the canal would have forced the B&O to keep its transportation rates low, reducing revenue. Therefore, the Baltimore and Ohio Railroad decided to rebuild the C&O Canal and operate it as a canal, even if it lost money, rather than closing the waterway and risk losing its right-of-way. Under the supervision of the court, the B&O could control the canal through a group of trustees, ostensibly to generate revenue to pay off the canal's bondholders, but in reality setting the waterway's toll structure in its own interest and preventing the canal from falling into the hands of an effective competitor.¹

Under the receivership, the C&O Canal entered a new era. The C&O Canal Company had operated the canal with the goal of it being a reliable, profitable waterway. To that end, the canal company expended vast sums of money to protect the canal from the Potomac River. The B&O Railroad, however, had a different priority--the success of its rail operation. The B&O repaired the canal after the 1889 flood, and kept it functioning for decades afterwards because the alternative was risking a takeover of the canal's right-of-way by a competitor. Hence, the B&O took the measures needed to keep the canal running, but it did not have the incentive of the C&O Canal Company to prevent flood damage. Sustainability was a much less important issue for the B&O receivers than it had been for the C&O Canal Company.

The repair of the canal after the 1889 flood set the tone for the B&O Railroad's tenure over the canal. The B&O initially estimated the cost of fixing the canal at \$200,000. When it appeared that the expense might exceed this figure, the railroad lost enthusiasm for the project. Only a threat by the Washington County Circuit Court to sell the canal prompted the B&O finally to start the repairs. The indecision of the B&O Railroad

¹Sanderlin, The Great National Project, 263-66.

actually increased the expense, because the damage to the canal worsened while it sat abandoned. The railroad finished the repairs in September 1891 at a cost of over \$430,000. Back in operation, the C&O Canal continued a fitful existence. Almost its entire traffic consisted of hauling coal for the Consolidation Coal Company, also owned by the railroad.²

Under the B&O Railroad, maintenance of the canal lagged. Indeed, an examination of the correspondence of George L. Nicolson, the general manager of the C&O Canal during the entire period of its receivership (1890-1938), indicates that he spent much more time considering easements and fending off encroachments to the canal than he did on maintenance or preventive work for the waterway.³

While preventing damage from intrusions, the B&O Railroad expended as little money as possible to maintain the waterway. The C&O Canal Company had spent beyond its resources on maintaining and improving the waterway. The B&O, through its trustees, was much more stingy. To minimize costs, the trustees tried to get other parties to repair damage from flooding whenever possible. When the ice guards on Dam 5 were damaged by a freshet early in the spring of 1913, George L. Nicolson suggested the canal shift two-thirds of the estimated \$10,000 repair cost off on the owners of the Martinsburg Power Company, which had a generating station at the dam.⁴ Even when other parties agreed to share costs, however, the representatives of the B&O were reluctant to spend money on the canal if they felt the expense could be put off. In 1921, it became apparent that leaks had developed in Dam 4. Representatives of the Hagerstown and Frederick Railway, which had bought the Martinsburg Power

²Ibid., 266, 271.

³Still, defending the integrity of the canal against interlopers was important. The volume of economic activity and development increased in the Potomac Valley during the early twentieth century--much of it potentially harmful to the waterway. Nicolson battled businesses and municipalities that allowed their wastes to flow into the canal or whose activities made it more vulnerable to flooding. The efforts of George Nicolson at fending off destructive encroachments went far toward preserving the canal.

⁴G. L. Nicolson, General Manager, to H. R. Preston, Trustee, Baltimore, 2 July 1913, Correspondence of Office of Trustees, 1913-38, Chesapeake and Ohio Canal Company, Entry 202, Record Group 79, Records of the National Park Service, National Archives, College Park, Md. [Hereafter Trustees' Correspondence, 1913-38].

Company, proposed splitting the cost of the repairs. Nicolson and the trustees, however, declined because they felt the leaks did not immediately endanger the dam.⁵

Despite the neglect of the Chesapeake and Ohio Canal by the B&O Railroad, some preventive work occurred on the canal during its tenure that aimed to minimize flood damage. After three breaks on the canal in the 1914 season caused a loss of twenty-nine boating days, the Evening Star, in Washington, D.C., reported that before the opening of the 1915 season "at many points the banks have been made heavier to prevent possible washouts if heavy rains come."⁶

Still, as in the case of repairs, the trustees tried to shift the cost of flood improvements to other parties whenever possible. An ice freshet damaged the wooden top of Dam 5 in February 1918. George L. Nicolson suggested to the trustees that it would be a good idea to replace the wooden top with one made of concrete. The trustees did not prove receptive to the idea because they saw the improvement as having greater benefits to the power company that rented the dam, than to the B&O Railroad. But they agreed to go along with the improvement after the Hagerstown and Frederick Railway Company agreed to share the cost of the concrete cap.⁷

The C&O Canal survived three decades of parsimony from the Baltimore and Ohio Railroad because the period from 1889 to 1924 was remarkably free of major freshets on the Potomac River. George L. Nicolson recalled that four "serious" floods affected the canal in 1897, 1902, 1907, and 1914.⁸ Evidence from the papers of the trustees and newspapers indicates at least sixteen notable episodes of high water occurred between 1889 and 1924.

⁵G. L. Nicolson, General Manager, to Hugh L. Bond, Jr., Trustee, Baltimore, 19 November 1921, Trustees' Correspondence, 1913-38. Nicolson might have been reluctant to spend the money repairing the leaks because the B&O had done considerable repair work to the dam twenty years earlier.

⁶Evening Star (Washington, D.C.), 9 March 1915, 20; Office of Trustees, to Hugh L. Bond, Jr, Baltimore, 18 January 1915, Trustees' Correspondence, 1913-38.

⁷G. L. Nicolson, General Manager, to Hugh L. Bond, Jr., Trustee, 29 April 1918; G. L. Nicolson, General Manager, to A. C. Polk, Construction Manager, Sanderson and Porter, 24 May 1918; President, Hagerstown & Frederick Railway Company, Frederick, to G. L. Nicolson, General Manager, 26 June 1918, Ibid.

⁸Sanderlin, The Great National Project, 276.

However, damage from these floods was quite small compared to the major floods of the nineteenth century. The river that had behaved so unfavorably for the Chesapeake and Ohio Canal Company, smiled upon the Baltimore and Ohio Railroad.⁹

The Railroad Faces Floods: 1924

The good fortune of the C&O Canal under the B&O Railroad came to abrupt end in 1924. In late March 1924, the first major flood in thirty-five years struck the canal. The damage from this flood occurred mostly on the upper portion of the canal, especially near Cumberland, Hancock, and Williamsport, although there were some significant breaks around Dam 1. Initial press reports were pessimistic. The Evening Star told its readers on March 31, "the entire Williamsport division of the Chesapeake and Ohio Canal has been destroyed and may never be rebuilt . . . when the waters receded today it was found that its banks had been obliterated." The Star indicated that canal officials doubted the waterway would ever be reconstructed.¹⁰ However, as the water receded from the canal, optimism replaced fear as it became apparent that the damage was much lighter than expected. The Star reported on April 1 that George L. Nicolson was inspecting the canal with a view toward repairing it.¹¹ Likewise, the Morning Herald in Hagerstown informed the public the same day that the Williamsport division would be fixed in ten days.¹² Nicolson denied on April 2 that any plans existed to close the

⁹A number of factors may explain the B&O Railroad's good fortune. First, it may simply have been a matter of probability. Floods do not occur at even intervals. The chance of a twenty-year flood is once every twenty-years, but such a deluge is possible at any time. In 1996, for instance, the C&O Canal experienced two twenty-year floods. Second, the clearing of the watershed stabilized or even dropped off by the end of the nineteenth century, meaning water did not run off as fast and cause bigger floods on the Potomac River. It is certainly no coincidence that the floods on the river got progressively worse over the course of the nineteenth century, while sustained deforestation was taking place in the Potomac basin. Third, the calm period on the river between 1890 and 1924 also may have been a product of long-term weather cycles.

¹⁰Evening Star (Washington, D.C.), 31 March 1924, 4.

¹¹Ibid., 1 April 1924, 2.

¹²Morning Herald (Hagerstown), 1 April 1924, 1.

canal permanently because of the freshet, and announced that the Vang Construction Company had been hired to repair the damage.¹³

Two factors were behind the B&O's quick change of heart. First, when it became apparent that the repairs would not be too costly, the most major objection by the trustees to repairing the canal--the expense--disappeared. Indeed, the damage estimate for the flood came to only \$30,000.¹⁴ Second, there probably was still a lingering fear that if the railroad abandoned the canal, the courts would revoke the receivership and the B&O might lose control of the C&O Canal's right-of-way.

As repairs from the late March freshet drew to a close, another much more serious flood hit the canal in May 1924. The tributaries of the Potomac, particularly the Shenandoah, flooded and the high waters coursed down the river, mortally damaging the C&O Canal from Cumberland to the Tidewater. On May 13, Evening Star reported that, "in many places the waters of the Potomac and Chesapeake and Ohio Canal have merged and for miles the canal cannot be seen."¹⁵

A comprehensive damage estimate for the canal from the May 1924 flood was never drawn up, but it is evident that the waterway suffered along most of its 184.5 miles. Nicolson did submit a damage report from Cumberland down to Big Slackwater. From Cumberland to South Branch there was no additional damage to that from the March flood. From South Branch down to Dam 6, the towpath that had been replaced was washed out and further erosion had taken place. More scouring of the towpath occurred from Dam 6 to Hancock. The bridge over the feeder at Dam 6 had washed away. Near Williamsport, there were three breaks in the towpath (two below the town and one three and half miles above), sand bars in the canal prism, and general erosion.¹⁶ A replacement parapet on the Conococheague aqueduct, built after a canal boat broke through the original stone parapet in April 1920, was torn

¹³Evening Star (Washington, D.C.), 2 April 1924, 1; Morning Herald (Hagerstown), 2 April 1924, 1.

¹⁴H. R. Preston, Law Department, Baltimore and Ohio Railroad Company, to George M. Shriver, 11 April 1924, Trustees' Correspondence, 1913-38.

¹⁵Evening Star (Washington, D.C.), 13 May 1924, 1.

¹⁶G. L. Nicolson, General Manager, to H. R. Preston, Trustee, Baltimore, 15 May 1924, Trustees' Correspondence, 1913-38.

off (see Figure 4).¹⁷ The damage to the lower portion of the canal was worse than above (although the precise damage points are undetermined). The Evening Star informed its readers that the "flood . . . has swept down the Potomac miles of the canal walls, from Harpers Ferry to Washington."¹⁸ In many places the waters of the river and the canal became one (see Figures 5 and 6).

In any case, the damage from the May flood was devastating, and the Star did not hesitate to tell the public that the canal "was likely doomed."¹⁹ Because damage was less on the upper portion of the canal, the B&O Railroad briefly considered keeping the canal open from Cumberland to Williamsport (where coal bound for Baltimore was usually transferred to the railroad), but by early August 1924 the B&O dropped this idea in favor of closing the entire waterway.²⁰ Only the canal below Dam 1, and at Dams 4, 5, and 8 continued to operate, honoring existing agreements to provide water power and for electric power generation. To that end, the company quickly repaired two breaks in the canal embankment near Chain Bridge.²¹ Nicolson conducted limited repairs on the rest of the canal. He had the "main and largest breaches" refilled to minimize damage to the canal from future freshets.²² After these repairs were finished in January 1926, maintenance on the canal, outside the revenue generating areas, largely ceased.²³

¹⁷Evening Star (Washington, D.C.), 30 April 1920, 20; 12 May 1920, 7.

¹⁸Evening Star (Washington, D.C.), 14 May 1924, 1.

¹⁹Ibid.

²⁰H. R. Preston, Law Department, Baltimore and Ohio Railroad, to G. L. Nicolson, General Manager, 22 May 1924, Trustees' Correspondence, 1913-38.

²¹Evening Star (Washington, D.C.), 15 May 1924, 4.

²²H.R. Preston, Law Department, Baltimore and Ohio Railroad, to J. C. Shriver, Cumberland, 24 June 1924; G. L. Nicolson, General Manager, to H. R. Preston, Trustee, 26 June 1924, Trustees' Correspondence, 1913-38.

²³Evening Star (Washington, D.C.), 31 January 1926, 6; 10 August 1924, 22.

FIGURE 4



Conococheague aqueduct, at Williamsport,
after the flood of May 1924

FIGURE 5



Lock 17, at Great Falls, during the flood of May 1924

FIGURE 6



Lock 52, below Hancock, during the flood of May 1924

Therefore, the flood of May 1924 proved a boon to the B&O Railroad. It allowed them to forego the considerable expense of maintaining the canal as an operating waterway, while still controlling of its right-of-way. To please the Washington County Circuit Court, the B&O maintained the fiction that the canal could quickly be put back into operation should the coal trade revive sufficiently to justify it. However, for all intents and purposes, the railroad largely left the remains of the canal to the mercy of the river.²⁴

Abandonment and Disintegration: 1924-38

With the closing of the waterway, the B&O Railroad became reluctant even to repair genuine flood damage outside those areas that continued to generate revenue. In September 1926, runoff from heavy rain blew out two culverts, the first one mile below Dam 4 and the other below Williamsport. Despite the serious harm to the canal, Nicolson wrote the trustees, "I will do nothing unless you instruct me to make repairs."²⁵ Nicolson and trustees also hesitated to restore Dam 6 meaningfully, after the 1924 flood damaged it seriously and minor freshets that followed added to the deterioration. To the railroad, repairing Dam 6 would have wasted money because there was no power generation at that wooden structure. They allowed the dam to continue slowly falling apart until a fire finally destroyed it in 1934.²⁶

However, it was impossible for the B&O Railroad to neglect utterly upkeep on the abandoned sections of the canal. Repairs the B&O did make to the canal fell into four categories. They made some repairs to satisfy government mandates. For instance, after a freshet in late April 1929, Nicolson fixed a break in the towpath near Round Top Mountain so the B&O could run water down the canal to flush mosquitoes out of the stagnant pools in the empty prism as required by the Maryland State Board of Health.²⁷

²⁴Sanderlin, The Great National Project, 277-78.

²⁵G. L. Nicolson, General Manager, to H. R. Preston, Trustee, 27 September 1926, Trustees' Correspondence, 1913-38.

²⁶H. R. Preston, Trustee, to G. L. Nicolson, General Manager, 28 July 1932, Trustees' Correspondence, 1913-38; G. L. Nicolson, General Manager, to H. R. Preston, Trustee, 1 September 1934, Ibid.

²⁷G. L. Nicolson, General Manager, to H. R. Preston, Trustee, 2 May 1929, Ibid.

The B&O also repaired major structures whose loss would be noticeable and undermine the notion that the canal could be quickly returned to service. Such was the case of a road culvert at Sir John's Run, which it repaired after the October 1929 flood. The public used the culvert and would have complained.²⁸ Still other repairs were made simply because they were inexpensive. For example, Nicolson recommended repairing a damaged culvert after an April 1929 flood near Sandy Hook because it would cost only \$238.²⁹ When repairs were not cheap, the trustees sometimes justified them to the B&O Railroad by reasoning they would avoid a greater expense in the future. The trustees themselves stated in their 1932 report to the Washington County Circuit Court that they had "made only such expenditures as were necessary to prevent serious depreciation in the Canal, and have repaired several small breaks . . . which if not repaired might later lead to much more serious breaks."³⁰

After 1924, if the trustees were reluctant to fund repairs, they proved even more hesitant to fund improvements to minimize flood damage. The trustees entertained preventive work where they thought they might lessen their expenses, but rarely followed through on such projects. For instance, George L. Nicolson suggested in 1927 that replacement of the loose stone dam at Little Falls (Dam 1) that supplied the Georgetown level with a more permanent structure. Such a dam would save the \$1,000 to \$2,000 spent annually renewing the existing structure, which deteriorated rapidly from freshets and normal river flow. Still, while they considered this idea, they never actually built a more substantial dam at the Little Falls, instead finding the yearly expense of rebuilding the loose stone structure more economical.³¹ The tenants at Dam 4, the Potomac Edison Company,

²⁸G. L. Nicolson, General Manager, to H. R. Preston, Trustee, 22 July 1929, *Ibid.* It is worth noting that the trustees apparently only authorized cheap, temporary repairs at Dam 6 that were washed away by a freshet the following October. See G. L. Nicolson, General Manager, to H. R. Preston, Trustee, 19 October 1929, *Ibid.*

²⁹G. L. Nicolson, General Manager, to H. R. Preston, Trustee, 6 May 1929 and 12 June 1929, *Ibid.*

³⁰Report of the Surviving Trustees, Herbert R. Preston and George A. Colston, 27 June 1932, *Brown et al. Trustees v. Chesapeake and Ohio Canal Company.*

³¹G. L. Nicolson, General Manager, to H. R. Preston, Trustee, 25 February 1927; H. R. Preston, Trustee and General Solicitor, to George M. Shriver, Senior Vice-President, 6 February 1928, *Trustees' Correspondence, 1913-38.*

pushed the trustees to spend \$25,000 to plug leaks at Dam 4, but the B&O Railroad apparently never initiated the project because of the expense.³² The trustees did build a stone wall to protect a canal bank at Dam 3 after a freshet damaged it.³³

When the canal closed in 1924, the condition of the waterway rapidly deteriorated in those areas not generating revenue for the railroad company. Nicolson was warned repeatedly by Maryland authorities that the canal was becoming a public nuisance: a dumping ground, with smelly, stagnant pools ideal for breeding mosquitoes.³⁴ This situation was not entirely the fault of the B&O Railroad since some communities along the canal used the waterway for waste disposal. The town of Glen Echo, in Montgomery County, and the City of Cumberland both dumped waste from sewer lines into the canal (the problem in both places predated the closing of the canal).³⁵ While Nicolson was willing to run water down the canal prism from time to time to deal with the mosquitoes, he did not feel that cleaning up dumped waste was the B&O's responsibility because it had not dirtied up the canal in the first place. True to form, however, Nicolson and the trustees did accede to the Civil Works Administration cleaning up the prism of the canal at Williamsport in 1933.³⁶ However, Nicolson had so given up on preserving the canal that he

³²Superintendent of Power, Potomac Edison Company, Hagerstown, to G. L. Nicolson, General Manager, 10 September 1930; American Asphalt Grouting Company, Chattanooga, Tenn., to G. L. Nicolson, General Manager, 13 September 1930, Ibid.

³³G. L. Nicolson, General Manager, to H. R. Preston, Trustee, 31 October 1930, Ibid.

³⁴Abel Wolman, Chief Engineer, State of Maryland, Department of Health, to G. L. Nicolson, General Manager, 14 June 1929, 5 September 1929, and 5 October 1931, Ibid.

³⁵G. L. Nicolson, General Manager, to W. T. Pratt, Health Officer, Montgomery County, Rockville, 20 February 1923; to George W. Offutt, Jr., 20 February 1923; Robert B. Morse, Chief Engineer, to Abel Wolman, Chief Engineer, State Department of Health, 12 April 1923; George A. Pearre, Company Counsel, Baltimore and Ohio Railroad Company, to G. L. Nicolson, General Manager, 25 April 1923; Mayor and Council of Glen Echo, to C&O Canal Company, 6 May 1930; Charles S. Moore, to G. L. Nicolson, General Manager, 19 March 1931, Ibid.

³⁶G. L. Nicolson, General Manager, to Messrs. Lane, Ballentine & Mish, Hagerstown, 20 December 1933, Ibid.

approved a request by farmers near Williamsport to dam off a portion of the canal bed as a watering hole for their stock.³⁷

Hence, by the early 1930s the canal was in dilapidated condition, and was more so after the flood of March 1936, the largest ever recorded on the Potomac. The flood also was notable because of the high degree to which it affected the upper reaches of the Potomac River. Consequently, severe damage occurred along the entire line of the canal from Cumberland to Georgetown (see Figures 7, 8, 9, and 10). Dam 4, which had failed in the 1877 flood, did so again. An ice drift had already taken out part of the dam near its Maryland abutment in February 1936. The March flood widened the break.³⁸

The B&O railroad limited its repairs of the C&O Canal after the flood of 1936 to the areas still generating revenue. These included the rubble dam at Little Falls (Dam 1) and the Georgetown level, which were necessary to provide water power. These repairs cost \$25,460. Dam 4, which the trustees rented for power generation, was repaired by the tenant, the Potomac Edison Company. To help prevent future flood damage, Potomac Edison also installed a concrete cap-piece in place of the old ice guards.³⁹ The trustees admitted there was damage elsewhere, but unlike 1924 they were confident enough not to fix these injuries, merely to promise they would be put right at some future date before the canal went back into operation.⁴⁰

Hence, under the B&O Railroad, the C&O Canal experienced a period of malign neglect. The B&O did as little as possible for the canal. Only the calm of the Potomac River from 1889 to 1924 prolonged its operation. Once the flood of May 1924 gave the railroad an excuse to close the canal--while maintaining control of its right-of-way--it did so. The B&O Railroad's inattention and the rivers flooding transformed the canal into a magnificent wreck.

³⁷G. L. Nicolson, General Manager, to F. Wine, Williamsport, 5 September 1934, *Ibid.*

³⁸Unrau, The Major Floods, 41-44.

³⁹*Ibid.*, 44.

⁴⁰Report of the Surviving Trustee, Herbert R. Preston, 8 June 1936, Brown et al. Trustees v. Chesapeake and Ohio Canal Company.

FIGURE 7



Lockhouse 6, below Dam 1, during the flood of March 1936

FIGURE 8



Lock 6, below Dam 1, after the flood of March 1936

FIGURE 9



Lock 15, upstream end of Widewater, after the flood of March 1936

FIGURE 10



Eroded towpath near Lock 18, at Great Falls,
after the flood of March 1936

CHAPTER 3

THE NATIONAL PARK SERVICE

The Canal Revived: 1938-42

By 1938, the Baltimore and Ohio Railroad was in financial trouble, and it sold the C&O Canal to the federal government to repay money borrowed from the Reconstruction Finance Corporation. The federal government was willing to buy the canal because it had long recognized its historic value and recreational potential. Repairing the canal also was viewed as a worthwhile project that could provide employment to workers made jobless during the Great Depression.¹

In acquiring the C&O Canal, however, federal officials paid little thought to its vulnerability to the Potomac--despite the fact that the most devastating flood ever recorded on the river had occurred a scant two years before.² Instead, they gave their attention to restoring the canal between Georgetown and Seneca. Congress appropriated \$500,000 for the project, which included repairing and rebuilding canal structures, as well as clearing the prism of debris and rewatering it.

The Civilian Conservation Corps (CCC) established two camps to participate in the repairs. The young men in these camps initially cleared trash from around the canal, and then graded the prism and towpath. The Public Works Administration (PWA) oversaw more complex projects such as rebuilding locks, bridges, and repairing large breaks, with actual work done by private contractors, most notably the D.C. construction firm, Corson and Gruman. According to NPS historian Barry Mackintosh:

¹Barry Mackintosh, C&O Canal: The Making of a Park (Washington, D.C.: National Park Service, 1991), 5-11.

²The National Park Service was certainly aware that flooding was a potential problem. A citizen of Cumberland, Harry J. Athey, had written Franklin Roosevelt in 1941, suggesting the C&O Canal could be transformed into either an underground highway or a bomb shelter with its roof also serving as an emergency landing strip for planes. The White House forwarded the letter to NPS, which in turn passed the letter to Frank T. Gartside, assistant superintendent of National Capital Parks. Gartside wrote Athey, politely suggesting his ideas were impractical because, "the canal property, in many places, is subject to complete inundation during periods when the river is in flood stage." See Frank T. Gartside, Assistant Superintendent, National Capital Parks, to Harry J. Athey, Cumberland, 24 July 1941, Administration, Protection and Maintenance File 1460/C&O-5.

The work on the canal proceeded expeditiously. By February 1940 the 23 locks from Georgetown to the inlet at Violettes Lock had been returned to operating condition. The stonework of some had required only minor resetting and repointing; others had been completely reconstructed. All had received new wooden gates, with ironwork salvaged from the old ones and from locks further up the canal. At Widewater a large break from 1936 flood (requiring some 30,000 cubic yards of fill), two small dams, and some rubble wall had been repaired by Corson & Gruman Company under a \$101,000 contract. In addition to clearing the channel, the CCC had repaired lesser breaks and surface wash elsewhere along the towpath and would proceed to develop picnic areas at Carderock and Great Falls. . . . The lockhouses at Locks 5, 7, and 10 were upgraded during 1939 with modern plumbing, heating, and electrical systems.³

The NPS repair plan included some provisions for flood control. Contractors reconstructed a historic spillway at the Foundry Branch, and repaired and improved flood structures at Widewater, historically a vulnerable location on the canal (see p. 108). Certainly the renovation of the canal made it better able to resist flood damage. However, except at the Foundry Branch and Widewater, the repairs proceeded with little consideration of how well they would protect the canal against the river.⁴

In some instances compliance with federal regulations and changing responses by other agencies apparently slowed the pace of the repairs of the C&O Canal. While Maryland politicians had scrutinized the waterway during the era of the canal company, and the Washington County Circuit Court watched during the receivership period, as a unit of the federal government the canal became subject to a much more oversight, regulation, and control, which could hinder repairs. Activities on the canal were sometimes under the regulatory jurisdiction of another federal agency other than the National Park Service. An early example of this problem was the repairs at Widewater in 1939. The work there was delayed by the Department of Labor, which set wage rates for federal contracts. The Labor Department initially informed NPS that rubble masons and cut stone masons should be paid different wages, and the Park Service wrote its contract for Widewater on that basis. Shortly before bids for the project were opened, however, the Labor Department told NPS that all

³Mackintosh, The C&O Canal, 35-36.

⁴Ibid., 31.

masons should be paid the same. The change made it necessary to restart the bidding process and the beginning of work on the Widewater project was delayed.⁵

A much bigger problem for the C&O Canal under NPS control was that it was totally dependent on Congress for funding. While Congress initially appropriated \$500,000 to restore the canal, it neglected to fund regular maintenance. The nature of politics made it easier to appropriate large sums of money to repair a damaged canal than to fund a maintenance staff that would prevent damage. The Park Service could not even spend revenue the canal generated from water rents and power generation directly on the canal. Such money went to the federal treasury.⁶

World War II and the Flood of 1942

The entry of the United States in World War II, in December 1941, brought an end to the repairs of the canal, which were drawing to a close in any case because the National Park Service had exhausted the \$500,000 appropriation for that purpose. The war also resulted in the disbandment of the CCC, which had been maintaining the canal in lieu of direct congressional funding.

The war could not have occurred at a worse time for the C&O Canal. Less than a year after Pearl Harbor, it was hit by a major freshet in October 1942. The flood largely stemmed from the Shenandoah River, where water levels actually exceeded the great flood of 1870 on its lower stretches. Consequently, the October 1942 flood affected the Potomac mostly below Harpers Ferry. At several points the river crested even higher than it had in 1936.⁷

The flood devastated the newly-repaired section of the canal from Seneca to Georgetown. The Park Service did what it could to prevent damage. The Evening Star reported "workmen were opening the canal locks to permit the rising waters to empty into the Potomac River."⁸ Despite these efforts the canal overflowed near Fletcher's Boat House, damaging nearby railroad tracks and

⁵Evening Star (Washington, D.C.), 24 August 1939, B4.

⁶Ibid., 18 September 1940, B5.

⁷Potomac River and Tributaries, House Document No. 622, 18-20.

⁸Evening Star (Washington, D.C.), 16 October 1942, A2.

washing three freight cars into the river. A break in the canal developed there, and another above Chain Bridge, in addition to a large break at Widewater (see **Figures 11 and 12**).⁹ There also was damage to the canal upstream, with some breaks in the canal embankment, and trees and other debris were scattered on the towpath.¹⁰ Arthur E. Demaray, associate director of the National Park Service, estimated it would cost \$250,000 to repair the canal upstream as far as Great Falls.¹¹

Just as World War II brought an end to the repair of the C&O Canal, the conflict hindered fixing it after the 1942 flood. The War Production Board, which regulated industrial production to further the war effort, prohibited federal civilian construction projects over \$10,000 during the war. The B&O Railroad patched the breach in the canal at Fletcher's Boathouse bordering its tracks, but repairing the remainder of the canal required more creativity.¹² Arthur E. Demaray suggested restoring the canal from Georgetown to Dam 1, because the C&O Canal could provide an alternate means of supplying water to the Dalecarlia Reservoir in the event that both of the normal conduits from Great Falls were bombed or sabotaged.¹³ Demaray's idea transformed the repair of the canal from a prohibited recreation project into a national security concern, which gained the approval of the War Production Board in November 1942. While the repair of the remainder of the canal would have to wait until after the war, its proximity to the national capital and the National Park Service's security argument enabled at least a partial repair of the canal during the war.

⁹Ibid., 17 October 1942, A1; 19 October 1942, B1; Chris Baumann, Widewater: An Assessment for Historic Preservation ([Sharpsburg, Md.]: C&O Canal National Historical Park, National Park Service, Department of the Interior, 1984), 60.

¹⁰For a description of damage in the canal from Swain's Lock to Seneca see William G. Haywood, Associate Civil Engineer, to F. F. Gillen, Acting Superintendent, National Capital Parks, 22 October 1942, Flood and Droughts File 1570-35, National Capital Parks, National Park Service, Washington National Records Center, Suitland, Md.

¹¹Arthur E. Demaray, Associate Director, National Park Service, to the Secretary of the Interior, 23 October 1942, Administration, Protection and Maintenance File 1460/C&O-5.

¹²Washington Post, 14 November 1942, 5B

¹³Demaray to the Secretary of the Interior, 23 October 1942, Administration, Protection and Maintenance File 1460/C&O-5.

FIGURE 11



Break in the towpath embankment at Fletcher's Boathouse,
above Georgetown. Flood of October 1942

FIGURE 12



Widewater, looking upstream, after the flood of October 1942

While the acquiescence of the War Production Board removed an obstacle, it did not lead to the immediate repair of the C&O Canal. Work on the canal between Georgetown and Dam 1 required a congressional appropriation. Preoccupied with the legislative problems created by the war, Congress did not immediately act. The Army Corps of Engineers, which managed the water supply for the District of Columbia, volunteered to repair the feeder canal from the Dam 1 to the main canal, and make the alterations in the waterway that would allow it to supply water to the Dalecarlia Reservoir.¹⁴ However, the cost for the remainder of the repairs fell on the shoulders of the National Park Service. Congress finally appropriated money in April 1943 to repair the canal as far as Dam 1. The Park Service made the announcement of the contract for the repair project in May 1943 and the contract was awarded the following month to Corson and Gruman, the same firm that had repaired Widewater before the war.¹⁵ Corson and Gruman completed the work by early autumn, and the Park Service resumed the popular canal boat trips in early October 1943.¹⁶

The Park Service tried to make the section of the canal it restored during World War II more flood resistant. Parts of the towpath were rebuilt with a clay and cement mixture to make them more durable. The Public Roads Administration conducted tests to determine the optimal mix of clay and cement. After the towpath was rebuilt, the contractor riprapped the towpath embankment in places to prevent erosion. Besides the towpath, the Park Service also experimented with making the Dam 1 more sustainable. Since the earliest days of the canal, the dam had been composed of rubble stone and had to be rebuilt almost every year. The contract with Corson and Gruman called for 200 feet of the dam, the portion that had been most badly washed in 1942, to be replaced by a dam with a concrete core wall.¹⁷ Finally, the

¹⁴E. A. Schmitt, Head Engineer, United States Engineer Office, Washington, D.C., to F. F. Gillen, Acting Superintendent, National Capital Parks, Washington, D.C., 21 November 1942, Ibid.

¹⁵Irving C. Root, Superintendent, National Capital Parks, to Major D. M. Radcliffe, U.S. Engineers Office, Washington, D.C., 17 May 1943, Ibid.

¹⁶Evening Star (Washington, D.C.), 4 October 1943, A2.

¹⁷F. F. Gillen, Acting Superintendent, National Capital Parks, Washington, D.C., to Arthur D. Hill, Jr., Acting Assistant Solicitor, Department of Labor, Washington, D.C., 16 April 1943; and Thomas H. MacDonald, Public Roads Administration, Washington, D.C., 14 May 1943; P. E. Smith, Engineer, to Robert C. Horne, Chief, Engineering Division, National Capital Parks, 17 October 1946, Administration, Protection and Maintenance File 1460/C&O-5.

Park Service helped develop a contingency plan for the canal in event of flooding. It drew up the plan as part of a larger flood emergency plan for Washington, D.C. The plan was to go into effect for the canal when the gauge of the Potomac at Wisconsin Avenue in Georgetown reached 12.6 feet or higher. Under those conditions, NPS would install the planks in the stop lock above Widewater and warn residents living along the canal.¹⁸

The Postwar Years: 1945-1972

After the end of World War II, the Park Service repaired the rest of the restored portion of the canal from Georgetown to Seneca. The Park Service resurfaced the towpath from Georgetown to Seneca, repaired washouts at Locks 7 and 8, and constructed a spillway at Lock 7. Only Widewater, from the stop lock on Level 16 to Old Angler's Inn, remained unrepaired. This project was deemed too expensive at that time.¹⁹ The Park Service arranged with the Corps of Engineers to water the canal from Old Angler's Inn to Lock 5, by a diversion of surplus water from the Washington Aqueduct. It also constructed a temporary earth dam at the entrance to Widewater near Old Angler's Inn to prevent the aqueduct water from flowing back into that area. However, the supply of water from the aqueduct was erratic and the canal between Locks 5 and 14 was often only partially full.²⁰

While repairs proceeded on the restored portion of the C&O Canal, great uncertainty existed in the National Park Service during the late 1940s and 1950s about the canal west of Seneca. The canal's prospects there were part of a larger struggle about

¹⁸F. F. Gillen, Acting Superintendent, National Capital Parks, Washington, D.C., to Lt. Col. Byron Bird, Chief, Engineering Division, U.S. Engineer Office, Washington, D.C., c. Autumn 1843, Flood and Droughts File 1570-35.

¹⁹The estimated cost of the repairs from Lock 5 to Seneca after the October 1942 flood was \$140,000. Of that figure, about 75 percent or \$105,000 was needed to repair Widewater. By 1953, because of inflation, the price to repair Widewater had jumped to \$150,000. See Robert C. Horne, Chief, Engineering Division, to Harry T. Thompson, Associate Superintendent, National Capital Parks, 1 December 1953, Administration, Protection and Maintenance File 1460/C&O-5.

²⁰H. E. Van Gelder, Landscape Architect to Harry T. Thompson, 12 June 1945; National Capital Parks Press Release, 1 February 1946, Ibid.; Mackintosh, C&O Canal, 48.

development in the Potomac flood plain. Responding to the devastating floods of the 1920s, 30s, and 40s, the Army Corps of Engineers proposed a series of fourteen dams in the Potomac basin, that would have permanently inundated seventy-eight miles of towpath, and the Monocacy and Antietam aqueducts. The Park Service opposed the dams as did the vast majority of the public. Instead, NPS adopted an existing proposal to build a parkway along the route of the Chesapeake and Ohio Canal above Great Falls. Others, most notably Supreme Court Justice William O. Douglas, opposed both the dams and the parkway, insisting on the preservation of the canal in its existing state from Georgetown to Cumberland. Douglas and his supporters feared vehicular traffic on the parkway would mar the peacefulness and natural beauty along the towpath.

Despite the atmosphere of uncertainty, efforts continued to make the C&O Canal more sustainable. After the Corps of Engineers' plan for dams was defeated in spring of 1945, the Park Service sought to use the Corps' expertise to make the canal more sustainable. John Nolen Jr., Director of Planning for the National Capital Park and Planning Commission, wrote:

I am convinced that properly designed revetments, spillways, diversion levees and other facilities could mitigate if not entirely eliminate the bad wash-outs that occurred in the 1924, 1936 and 1942 floods. It is probably not feasible to attempt protections from what might be called minor erosion or wash-outs, but such major damage as occurred at Widewater and the upper part of the Feeder Canal could be eliminated.²¹

The Corps of Engineers, declined to help, stating that it lacked congressional authority to assist the National Park Service in protecting the C&O Canal from the Potomac.²²

While the Park Service opposed the dams proposed by the Corps of Engineers in the Potomac Basin, they decided to cooperate with the Corps' flood control plans for Cumberland, Maryland, the western terminus of the canal. The Corps wanted to

²¹John Nolen Jr., Director Planning, to General Grant, 9 April 1945, National Park Service, Central Classified File, 1933-49, National Capital Parks, 650-03, Record Group 79, Records of the National Park Service, National Archives, College Park, Md. [Hereafter Central Classified File, 1933-49, 650-03].

²²Minutes, 205th Meeting of the National Capital Park and Planning Commission, 19-20 April 1945, Administration, Protection and Maintenance File 1460/C&O-5.

remove Dam 8 (which NPS owned), an action that would make it difficult for the Park Service ever to rewater the canal above Dam 5. The Corps also wanted to build a levee that would cover the last mile of the canal and towpath and raise the grade of the old canal basin in Cumberland.²³

The Park Service fell in with the Corps of Engineers plans for Cumberland because by late 1945 managers doubted the wisdom of restoring the canal west of Seneca. The cost of maintaining a rewatered canal from Cumberland to Georgetown was too high. Arthur E. Demaray, associate director of the Park Service summed up the developing position in a letter to the Secretary of the Interior, Harold Ickes. He told Ickes that the canal maintained between Georgetown and Seneca "should be ample to disclose to the visiting public the historical aspects of the canal, and also should be ample to actively maintain as a recreational area."²⁴

Another reason NPS cooperated with the Corps of Engineers flood control project in Cumberland was because it would protect the remainder of the canal property in the area. After World War II, the National Park Service began planning to build a parkway along the canal right-of-way, and the Corps of Engineers improvements would provide flood protection for the upper part of the road and the visitor's center planned for the terminus of the parkway at Cumberland.

In fact, supporters of the C&O Canal Parkway within the National Park Service promoted the parkway project, in part because they thought a road would hold up better against the Potomac than a canal. As part of the planning for the parkway, the Park Service commissioned a study of the possible effects of flooding on the proposed road. Henry G. Weeden, a civil engineer and author of the study, admitted that while "occasional interruptions" would occur to traffic because of flooding, the road would be more sustainable than the canal. Weeden wrote:

While the records show that the past floods were very costly to the Chesapeake and Ohio Canal Company it must be borne in mind that the maintenance and operation of a canal located

²³William G. Hayward, Civil Engineer, P. E. Smith, Chief, Engineering Division, and Merel S. Sager, Planning Division, to Irving C. Root, Superintendent, National Capital Parks, Washington, D.C., 24 October 1945; Minutes, NCP Staff Meeting, 24 October 1945, *Ibid.*; Mackintosh, The C&O Canal, 53.

²⁴A. E. Demaray, Associate Director, National Park Service, to the Secretary of the Interior, 11 December 1945, Administration, Protection and Maintenance File 1460/C&O-5.

in the flood plain of a river and subjected to periodic inundation offers a peculiar problem. Floods of short duration that might prove disastrous to a canal embankment do not constitute a serious problem in highway maintenance and traffic control.²⁵

For those levels that were subject to flooding, he pointed out that many federal roads existed in Washington, D.C., that were subject to high water. "The majority of the roads in East and West Potomac Park, the lower sections of Rock Creek and Potomac Parkway and Anacostia Park are especially subject to inundation," he wrote, "and traffic on the Mt. Vernon Memorial Highway is interrupted occasionally." However, Weeden said nothing about how well these roads had come through floods. He merely recommended masonry revetments to protect the embankments of the C&O Canal Parkway against the river.²⁶

As the debate over the western portion of the canal heated up in the early 1950s, the Park Service tried to make the restored canal between Georgetown and Seneca more flood proof. By 1946, it had pronounced the concrete cap, laid on a portion of Dam 1 during World War II, a success. While the unprotected stones laid at Little Falls Dam in 1943 and again 1944, had largely washed away, the 200 feet of the structure with the concrete cap was still intact. P. E. Smith, a NPS engineer, recommended capping the entire dam at a cost of \$119,000. He figured the money would be quickly recouped by saving the government from having to relay stones regularly at the dam.²⁷ The project gained added urgency the summer of 1948, when the river fell low enough that the leaky rubble dam could not divert enough water to supply water power in Georgetown. However, nothing was done immediately because of a lack of funds.²⁸ It

²⁵Henry G. Weeden, Civil Engineer, "A Study of the Potomac River Related to the Construction of a Parkway Along the Route of the Chesapeake and Ohio Canal," National Capitol Parks, U.S. Department of the Interior, Washington, [1950], 11. Note this report was included verbatim in Congress, House, Committee on Public Lands, Chesapeake and Ohio Canal Report, 81st Cong., 2d sess., 1950, House Document No. 687.

²⁶Ibid, 9-12.

²⁷P. E. Smith, Engineer, to Robert C. Horne, Chief, Engineering Division, National Capital Parks, 17 October 1946, Administration, Protection and Maintenance File 1460/C&O-5.

²⁸Robert C. Horne, Chief, Engineering Division, National Capital Parks, to Harry T. Thompson, Assistant Superintendent, National Capital Parks, 28 July 1948, Ibid.

was not until September 1949 that capping of Dam 1 started. Park Service work crews completed the project in late November.²⁹ A report written in 1954 indicated the concrete cap on the rest of the dam was working, and "no dislodgement of stones or breaching of the dam has since occurred," with exception of a minor "wash-through on Snake Island, which became apparent in the fall of 1950, at a point where the Island was largely cobble and gravel."³⁰

Existing commitments made it impossible for the National Park Service to ignore the condition of the canal above Seneca. The Park Service had taken over the leases of Dams 4 and 5 when it bought the canal in 1938. However, the condition of these dams had deteriorated so much by the late 1940s, there was a real danger that they would fail. Of particular concern was the guard bank at Dam 4. The Potomac Edison Company, the tenant at Dam 4, wanted to rebuild the guard bank and place a concrete cap at the feeder inlet of the dam to prevent water leaking through the lock gates there. They proposed doing the work themselves for costs plus 15 percent to cover the administrative expenses, but the Park Service was unable to accept the offer because federal rules prohibited non-bid repair contracts over \$500.³¹ Dam 5 also was a source of trouble. Potomac Edison notified NPS in October 1951 that the gates of the feeder lock at Dam 5 were deteriorating and could collapse at any time. The power company complained they had given the Park Service notice of this problem in 1947, but nothing had been done. NPS apologized for its inaction, citing the scarcity of maintenance funds for the canal above Seneca, and proceeded to make emergency repairs on the lock gate.³² By

²⁹George E. Clark, Construction and Repair Division, to Robert C. Horne, Chief, Engineering Division, National Capital Parks, 3 January 1950, Ibid.

³⁰Robert C. Horne, Chief Engineer, National Capital Parks, "Construction and Maintenance of the C&O Canal Dam No. 1, Little Falls, Brookmont, Maryland," 27 July 1954, Ibid.

³¹Harry T. Thompson, Assistant Superintendent, to George S. Humphrey, Vice President, Operation and Engineering, Potomac Edison Company, 14 October 1949, Ibid.

³²George S. Humphrey, Vice President, Operation and Engineering, Potomac Edison Company, to Irving C. Root, Superintendent, National Capital Parks, 12 October 1951; Harry T. Thompson, Associate Superintendent, National Capital Parks, to George S. Humphrey, Vice President, Operation and Engineering, Potomac Edison Company, 19 November 1951; Lorin A. Davis, Chief, Administrative Division, National Capital Parks, to Director, National Park Service, 20 March 1952, Ibid.

early 1953, however, Potomac Edison was again lamenting the condition of Dams 4 and 5. Nothing had been done about the guard bank at Dam 4, and a sink hole had developed at Dam 5. The Park Service engineers who examined these problems recommended grouting and filling the sinkhole at Dam 5 and replacing the missing guard bank at Dam 4, as well as solving the drainage problem at that dam. They warned "the situation is critical and it is impossible to judge the extent of the hidden damage that might cause a collapse in several years or even the next freshet."³³ As with Dam 1 in the late 1940s, funds were not available to start the repairs immediately. Potomac Edison suggested it pay for the work and deduct future rental payments against the cost. However, federal law prohibited the Park Service from accepting the power company's offer. The finance officer for the Park Service suggested that a solution to the problem would be to negotiate a new rental agreement for Dams 4 and 5, passing maintenance responsibility for the dams to Potomac Edison, in exchange for lower rent. The only alternative would be to divert rehabilitation funds from the budget of National Capital Parks for 1954 to pay the \$30,000 needed for the project.³⁴ It appears from correspondence after the flood of October 1954, that the Potomac Edison Company did the work at Dams 4 and 5 based on a renegotiated rental agreement. What Potomac Edison did at Dam 5 is not known, but at Dam 4, according to a Park Service naturalist, they:

. . . razed the superstructure of the old canal stop lock and have left only the deck and stringers spanning the canal at the top of the stone abutments . . . they have poured a concrete wall forming a dam across the canal between the stone abutments and have provided therein a vertical slit into which a piece of metal may be dropped to block the water. They have also built a concrete wall between the south abutment of the stop lock and their dam.³⁵

³³Robert C. Horne, Chief, Engineering Division, to Harry T. Thompson, Associate Superintendent, National Capital Parks, 19 June 1953, Ibid.

³⁴Keith Neilson, Finance Officer, to Director, National Park Service, 30 July 1953, Ibid.

³⁵W. Drew Chick, Jr., Chief Park Naturalist, to Superintendent, National Capital Parks, 9 November 1954, Ibid.

Potomac Edison also repaired Dam 4 after the October 1954 flood caused by Hurricane Hazel.³⁶

As the 1950s progressed, the Park Service paid more attention to western portion of the C&O Canal. The parkway plan was dead by the mid-1950s, primarily because of the effective advocacy of William O. Douglas. In place of the parkway, the NPS decided it would restore towpath continuity from Georgetown to Cumberland, with a view to gaining national park status for the canal. In 1957, crews were hired to clear the canal and towpath west of Seneca of accumulated growth and fix the many breaks that had developed there over the years. In addition, the repair of Widewater finally began in 1953 and was completed by 1957. By September 1958, a hiker could finally walk the entire 184.5 miles of the canal without detouring around flood damage.³⁷

Achieving towpath continuity was easier, however, than maintaining it. Even without major floods, localized freshets and other hazards such as city sewer run-off and muskrats, could cause significant trouble.³⁸ Some first-time canal users, particularly bicyclists, found it harder to travel the towpath than they had imagined because of breaks and erosion caused by minor floods. Likewise, the accumulation of weather and flood damage had left many aqueducts and culverts along the canal in a severely deteriorated state. Some culverts had collapsed already, the victim of cavities created by tree roots growing down from the abandoned canal prism. The cavities allowed water seepage to gradually break down the mortar in the culverts. Accumulation of debris in their interiors obstructed water flow so that flash floods overwhelmed them and washed out the berm of the towpath. The dams also continued to cause problems. In 1964, it was necessary to make major repairs to Dam 4 after a

³⁶Harry T. Thompson, Associate Superintendent, National Capital Parks, to C. G. McVay, Manager of Power Production, Potomac Edison Company, Hagerstown, Ibid.

³⁷Evening Star (Washington, D.C.), 6 September 1958, A24.

³⁸Harry T. Thompson, Superintendent, National Capital Parks, to Director, National Park Service, 23 July 1958, Administration, Protection and Maintenance File 1460/C&O-5. For a general description of the maintenance problems of the C&O Canal during a non-flood period see Cornelius W. Heine, Assistant Regional Director, Conservation, Interpretation, and Use, National Park Service, to Robert L. Wiggins, Old Museum Village of Smith's Clove, Montroe, N.Y., 18 August 1964, Administrative Correspondence, 68A-3048, National Capital Region, National Park Service, Washington National Records Center, Suitland, Md. [Hereafter Administrative Correspondence, National Capital Region, 68A-3048].

major leak was discovered in the Maryland abutment. The lime cement used by the C&O Canal Company to construct the dam had dissolved over time creating fissures in the structure of the dam. The fissures necessitated pumping in cement under pressure to plug them and rebuilding the earthen portion of the abutment. Without the repairs of Dam 4 in 1964, it is likely the fissures would have grown bigger and that the dam would have eventually failed.³⁹

Still, the National Park Service enjoyed a period of relatively few floods on the Potomac through the late 1940s, 1950s and 1960s. Of course, minor floods affected the canal. High water, significant enough to cause appreciable damage to the C&O Canal occurred in May 1947, October 1954, August 1955, July 1956, January 1958, May 1958, April 1960, February 1961, and March 1967. In May 1947, a culvert in the District of Columbia near Canal Road and Weaver Terrace blew out during a rain storm, unable to handle runoff from a modern storm drain.⁴⁰ The remains of Hurricane Hazel passed through the Potomac basin in October 1954, flooding the canal from Big Slackwater to Harpers Ferry, around Point of Rocks, and in other areas. Breaks to the canal occurred near Harpers Ferry and new fill at Dam 4 was washed away.⁴¹ Hurricane Diane caused flooding in August 1955 leading to some minor breaks in the towpath (**see Figures 13, 14, and 15**).⁴² A flash flood in the Washington metro area in July 1956 caused a 100-foot break in the towpath just above Pennyfield Lock (No. 22). Heavy rains the same month contributed to a rock slide 150 feet below the Paw Paw Tunnel.⁴³ Flooding in January 1958 scoured the embankment and eroded the towpath near a pumping

³⁹Edwin M. Dale, Superintendent, C&O Canal National Monument, Hagerstown, to Mason Gigeous, Potomac Fish and Game Club, Williamsport, 4 March 1964, Administrative Correspondence, National Capital Region, 68A-3048; Daily Mail (Hagerstown), 15 April 1964, 32; 8 August 1964, 18.

⁴⁰Evening Star (Washington, D.C.), 29 May 1947, A14; 30 May 1947, B1.

⁴¹Private R. A. Fallin, to Chief, U.S. Park Police, 2 November 1954, Administration, Protection and Maintenance File 1460/C&O-5.

⁴²Evening Star (Washington, D.C.), 19 August 1955, A1; 20 August 1955, A1, A24.

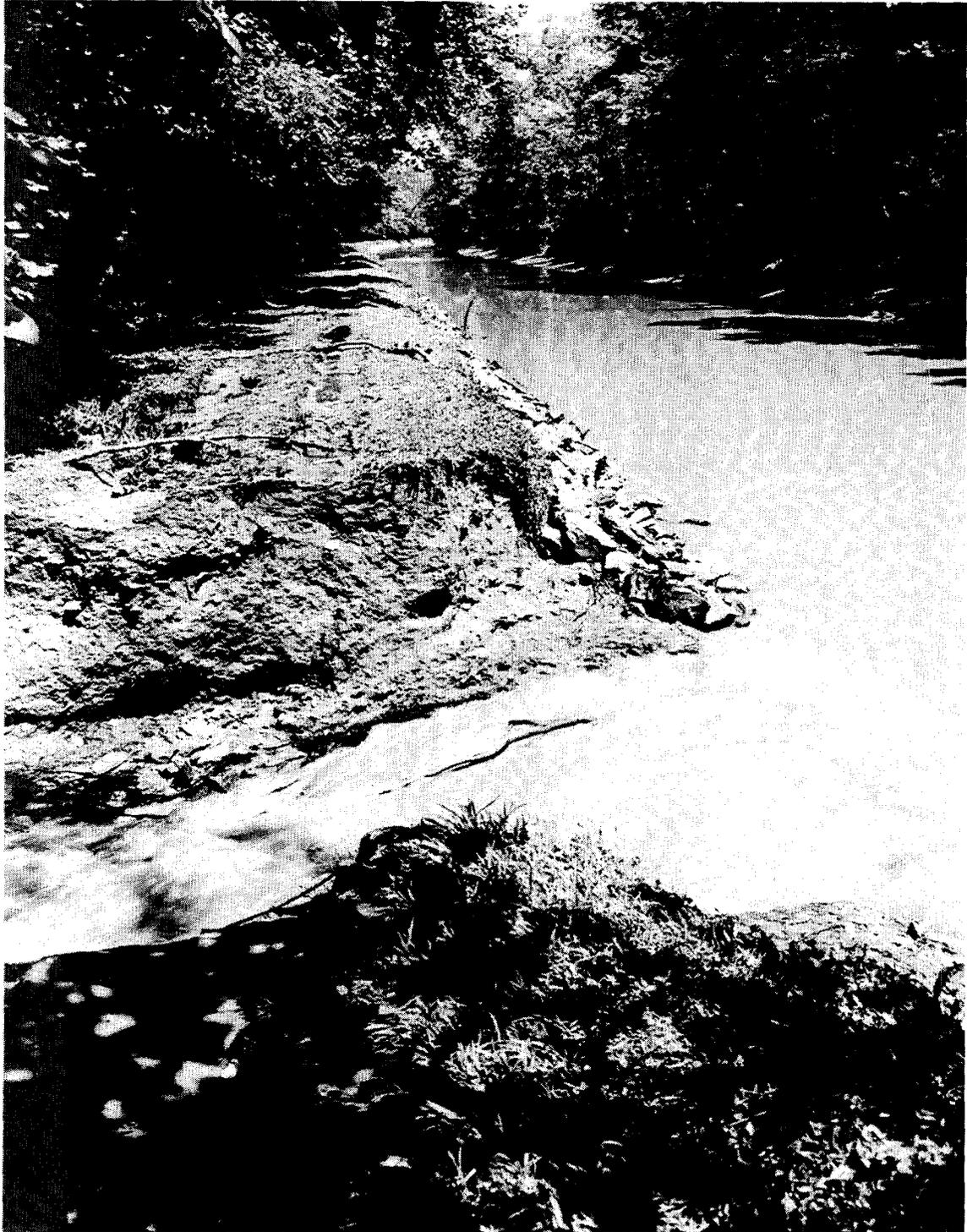
⁴³Robert C. Horne, Acting Associate Superintendent, National Capital Parks, to the Director, National Park Service, 25 July 1956, Administration, Protection and Maintenance File 1460/C&O-5.

FIGURE 13



Spectators observe flood waters from the Virginia side
of Great Falls. Flood of August 1955

FIGURE 14



Break in towpath, 1/4 a mile above Lock 20
at Great Falls. Flood of August 1955

FIGURE 15



Break in the towpath at Lock 7,
near Glen Echo. Flood of August 1955

station being constructed to supply water to Rockville, Maryland.⁴⁴ High water in May 1958, caused a break in the feeder canal running water to the main channel from Dam 1.⁴⁵ Flooding in April 1960 led to the loss of 1,000 yards of fill material used to build ramps across the towpath for Park Service vehicles.⁴⁶ Several breaks in the towpath between Cumberland and Seneca resulted from flooding during February 1961.⁴⁷ A flood in March 1967, the worst since the flood of Hurricane Hazel, damaged the canal between Oldtown and Seneca. A second flood later the same month compounded the injury, requiring \$72,000 in repairs.⁴⁸

In the decades following World War II, the National Park Service continued to refine its flood contingency plans for the C&O Canal. The main preventive step in the earlier plan had been to install planks in the stop lock above Widewater when the level of the river rose above 12.6 feet at Wisconsin Avenue in Georgetown. In 1958, the Park Service added new steps. In addition to installing the planks at Widewater, the canal barges were to be docked in a safe location. When the river reached sixteen feet, workers would empty the Georgetown level of the canal and open the gates on Locks 1, 2, 3, and 4 to allow flood waters to pass through unimpeded. They also would close the paddles on the feeder lock at Lock 5 and open the spillways at Fletcher's Boathouse and Foundry Branch. This plan was composed

⁴⁴Robert C. Horne, Chief, Division of Design and Construction, to Chief, Engineering Branch, 2 January 1958, Ibid.

⁴⁵Harry T. Thompson, Superintendent, National Capital Parks, to Director, National Park Service, 23 July 1958, Ibid.

⁴⁶Morning Herald (Hagerstown), 18 April 1960, 1.

⁴⁷George A. Palmer, Assistant Regional Director, Region Five, National Park Service, Philadelphia, Pa., to Majorie A. James, Washington, D.C., 21 April 1961, Administrative Correspondence, National Capital Region, 68A-3048; Evening Star (Washington, D.C.), 20 February 1961, B1; 21 February 1961, D1.

⁴⁸W. Dean McClanahan, Superintendent, C&O Canal National Monument, Hagerstown, to the Director, 28 April 1967, National Capital Parks Regional Office, General Records, 72A-6215, National Park Service, Washington National Records Center, Suitland, Md [Hereafter General Records, 72A-6215].

under the auspices of National Capital Parks, and did not include provisions for the canal west of Seneca.⁴⁹

The 1972 Flood

After thirty years of relative peace, the largest flood since 1936 struck the C&O Canal in June 1972. The cause of the flood was Hurricane Agnes, whose remnants passed through the Potomac watershed. The flood was most destructive to the canal below Hancock, with the damage getting progressively worse closer to Washington, D.C. Sixty-six miles of towpath eroded and were left impassable, and twenty-six breaks occurred, seventeen downstream of Seneca (see Figure 16). The worst break on the canal occurred at Widewater, where the flood tore a 300-foot gash thirty feet deep in the towpath. Eighty-six culverts suffered damage, twenty-two extensively; even more were clogged with silt and debris. All the aqueducts suffered, particularly on the Monocacy River where the downstream wing wall collapsed in the face of a tremendous flow coming into the Potomac from this tributary. The flood also washed away bridges, damaged locks and lockhouses, and left trees and debris scattered over the towpath and canal prism. The initial damage estimate was \$7 million, but that figure quickly rose as the full accounting of the injury to the canal, by then a national historical park, became clearer.⁵⁰ An estimate prepared by A. W. Franzen, architect for the Harpers Ferry National Historical Park, dated July 14, 1972, put the damage at \$9,926,000. Franzen also indicated it would take nearly \$60,000,000 to restore properly the canal downstream of Hancock.⁵¹ The latter figure included the accumulated deterioration to structures on the canal, which was intermixed and sometimes impossible to differentiate from 1972 flood damage. In September 1972, a NPS fact sheet estimated it would take \$34 million to repair the C&O Canal NHP.⁵²

⁴⁹National Capital Parks Organization Manual For Emergency Flood Control For Predicted Stages of 9.0 to 26.0 Low Water Datum At Wisconsin Avenue Gauge, February 1958, Flood and Droughts File 1570-35.

⁵⁰Washington Post, 1 July 1972, A1.

⁵¹A. W. Franzen, Architect, Harpers Ferry National Historical Park, to Joseph R. Prentice, Engineering Technician, National Capital Parks, 14 July 1972, Flood File, Chesapeake and Ohio Canal National Park, Sharpsburg, Md. [Hereafter C&O Canal Flood File].

⁵²Fact Sheet: Storm Damage at the C&O Canal NHP, 20 September 1972, Ibid.; Mackintosh, The C&O Canal, 161.

FIGURE 16



Break in the towpath near Glen Echo
caused by the flood of June 1972

Like thirty years earlier, the C&O Canal was slow to recover from the flood. While World War II had hindered the repair of the canal in the 1940s, the delay after the 1972 flood was caused by the White House. The \$34 million supplemental appropriation request by the Interior Department became stalled in the Office of Management and Budget (OMB), which wanted to restrain federal spending.⁵³ All the repairs to the canal in 1972 were stopgap measures funded out of C&O Canal NHP's fiscal 1973 maintenance budget and \$400,000 diverted to the park by the Secretary of the Interior, Rogers C. B. Morton. Because of OMB resistance, it was not until 1973 that the repair of the canal began in earnest. Even then the funding for repairs was inadequate. The C&O Canal NHP received an additional \$1.8 million for repairs as part of its 1974 budget.⁵⁴ It was not until September 1973 that NPS awarded the first contract, in the amount of \$353,800, for repairs between Georgetown and Lock 5 (see Figure 17).⁵⁵

Considerably more money than \$1.8 million was required to restore the remainder of the canal. The urgent need for funds was accentuated when the Catoctin aqueduct, sagging after decades of neglect and flooding, finally collapsed during heavy rains in late October 1973.⁵⁶ Additional money came in the form of funds for the 1976 Bicentennial of the United States. The C&O Canal NHP was designated to receive \$3 million for repairs in fiscal 1975 from bicentennial money. Secretary Morton pushed the OMB for an additional \$10 million appropriation. However, the OMB rejected the Secretary's request because officials were afraid that if it acquiesced, every congressional representative would be pushing for reconsideration of proposed NPS construction projects in their district.⁵⁷

The National Park Service used the bicentennial funds to form the C&O Canal Restoration Team in September 1973, under the leadership of Richard G. Huber, a Washington, D.C.-based

⁵³Washington Post, 1 October 1972, E1; 8 October 1972, D6.

⁵⁴Ibid., 25 November 1973, D1.

⁵⁵Ibid., 15 September 1973, B3.

⁵⁶Ibid., 1 October 1972, E1; 8 October 1972, D6.

⁵⁷Francis M. Wiles, Director of Budget, Office of Budget and Management, to the Files, 21 June 1974, C&O Canal Flood File.

FIGURE 17



Dump trucks carry clay dirt in November 1973
to repair the canal after the flood of June 1972

landscape engineer working for NPS' Denver Service Center. The first task of the restoration team, in consultation with the superintendent of the C&O Canal NHP, William R. Failor, was to establish repair priorities. With only \$3 million committed, funding was nowhere near the \$34 million originally requested for flood repair and stabilization. It was necessary to decide what parts of the canal most urgently needed work, and what parts could be left until later. With the collapse of the Catoctin aqueduct no doubt still in mind, Huber and his team decided in January 1974 to concentrate on the canal's masonry structures instead of the towpath, which the public was already clamoring to see reopened. Huber justified the decision on flood control and historic preservation grounds, stating:

We are cognizant of the facts that the towpath is used extensively by bikers and hikers, and that towpath continuity has been and probably still is a major concern. However, if the overall significance of this historic resource is to be maintained we believe there is an urgent need now to stabilize, repair, or restore the many masonry structures which are in such a bad state of disrepair. Most of these structures are water control devices, designed to handle or provide for the control of water, and unless they are re-established as such, damage from high water and floods will continue to occur. We believe that damage from restoration of the towpath to its historic grade is a very important factor in the overall canal picture as it relates to water control. However, it is our opinion it should not take precedence [sic] over repair and stabilization of the structures which handle or provide for the control of water.⁵⁸

The list of seventeen structures designated in the spring of 1974 to be completed by 1976 reflected the water control and historic preservation priorities set by the restoration team. At the top of the list was the stop lock above Widewater. This device had been inoperative during the 1972 flood, contributing to the massive towpath breaks there.⁵⁹ The remaining sixteen projects involved repair and stabilization work on five aqueducts, five culverts, three locks and the guard locks at Dam

⁵⁸Richard H. Huber, Restoration Team Leader, C&O Canal, to Director, National Capital Parks, 30 January 1974, Ibid.

⁵⁹Dales Sipes. Interview by Donald R. Shaffer, 14 April 1997.

4, 5, and 6, the Mule Barn at Four Locks, and the Busey Cabin.⁶⁰ The team also compiled a list of twenty additional projects if more funds became available.⁶¹ By the time Huber and his group disbanded, they had actually completed twenty-seven separate projects, costing \$4.2 million. These included aqueducts, culverts, locks, and other masonry structures in the original plan, and towpath restoration from Foundry Branch to Great Falls, as well as the repairs at Widewater.⁶² Indeed, the bicentennial work emphasized towpath continuity to an extent not originally foreseen by Richard Huber and his group.

The organization of labor for the restoration of the C&O was a complex affair. Besides the work overseen by the restoration team, additional projects fell under the supervision of the chief of maintenance for the C&O Canal NHP, Dale Sipes. It was necessary for Huber and Sipes to divide the work. Huber and his team generally oversaw the expensive, complex, and high-profile projects.⁶³ They brought in architectural and engineering firms to design seven of them, two were planned by the Federal Highway Administration (the stabilization of the Monocacy and Tonoloway aqueducts), and the remainder by the restoration team itself. Even then, park maintenance personnel did the actual field work for thirteen of the twenty-seven bicentennial projects (contractors did the remainder).⁶⁴ Therefore, park maintenance crews worked at times under the supervision of the restoration team and other times under their own division chief. While the restoration team and park maintenance worked amicably, Dale Sipes

⁶⁰John A. Townsley, Deputy Director, National Capital Parks, to Restoration Team Leader, 11 April 1974, C&O Canal Flood File. The seventeen projects approved included for fiscal 1974: 1) Stop Lock 16; 2) Monocacy aqueduct; 3) Lock 43; 4) Little Monocacy culvert; 5) Tonoloway aqueduct; 6) Little Catoctin aqueduct; for fiscal 1975: 7) Culvert at Milepost 135.17; 8) Fifteenmile Creek aqueduct; 9) Mule Barn at Four Locks; 10) Busey Cabin; 11) Guard Locks at Dams 4, 5, and 6; 12) Muddy Branch culvert; 13) Evitts Creek aqueduct; 14) Culvert-Waste Weir at Milepost 119.78; 15) Lock 23; 16) Lock 54; 17) Sideling Hill Creek aqueduct.

⁶¹Richard G. Huber, Restoration Team Leader, to Director, National Capital Park, 6 May 1974, Ibid.

⁶²Merrill J. Mattes, Landmarks of Liberty: A Report on the American Revolution Bicentennial Development Program of the National Park Service (Washington, D.C.: History Division, National Park Service, 1989), 18-29.

⁶³Richard G. Huber. Interview by Donald R. Shaffer, 1 April 1997.

⁶⁴Mattes, Landmarks of Liberty, 17.

thought the presence of Huber's group was unnecessary. Sipes believed his men had developed an expertise with canal structures that the restoration team did not have and that they could have completed the repairs on their own with much greater speed.⁶⁵

With the bicentennial funding in place, the restoration team and park personnel made considerable progress on the repairing the canal in 1974. The greatest priority that year was restoring the continuity of the towpath. The park managed to repair the towpath from Georgetown to Seneca in 1974, with the exception of Widewater. A bridge across Lock 34 near Harpers Ferry restored towpath continuity in the Piedmont section of the canal, and a foot bridge allowed traffic to cross Catoctin Creek (in place of the collapsed aqueduct). Water control structures also received attention. Culverts with the highest priority received extensive work. An effort also was made to clean the debris out of as many culverts as possible to ensure the unimpeded flow of water underneath the canal. Contractors stabilized the foundation of the Monocacy aqueduct and the remains of the collapsed aqueduct at Catoctin Creek.⁶⁶ The park gave the most attention in 1974 to the heavily used sections of the canal near Washington, where more of the damage from the 1972 flood had occurred. By August 1974, the first five miles of the canal from Georgetown to Brookmont, Maryland had been rewatered.⁶⁷

Repairs on the canal continued in 1975. Park maintenance employees finished the repairs of Widewater in October, restoring towpath continuity in the canal below Seneca. It also raised the level of the towpath between Locks 5 and 10 to historic grade and worked on the repairs of several culverts, locks, and other projects. Contractors finished repairs of the stop lock above Widewater in August 1975, completed the stabilization of three aqueducts and started two more, and placed concrete bulkheads in the guard locks of dams 4, 5, and 6. The bulkheads proved quite worthwhile, preventing the uncontrolled flow of water down the canal from the dams in times of floods.⁶⁸

⁶⁵Sipes interview.

⁶⁶Annual Report, 1974, Chesapeake and Ohio Canal National Historical Park, 20-21.

⁶⁷Washington Post, 20 August 1974, C1.

⁶⁸Annual Report, 1975, Chesapeake and Ohio Canal National Historical Park, 29-33. George Hicks, a former maintenance foreman on the canal believes the bulkheads were one of the most effective flood control measures taken after the 1972 deluge. "We found that putting those bulkheads . . . really

The stop lock and bulkheads were just some of the steps the park took after the 1972 flood to prevent future damage from high water to the C&O Canal. The official policy was to accomplish this task through existing flood control structures. The Park Service attributed much of the flood damage on the canal to the fact that many of the existing water control devices were not functional in June 1972. "We have found that the floodproofing features included in the original design and construction of the canal are adequate today," a report on the subjected stated. "The problem is that these features have been allowed to deteriorate over the past 100 years where they do not function as their intended purpose." The C&O Canal NHP indicated that a purpose of its restoration of the canal was to make these structures function properly. "Good judgment," according to one report, "has dictated that the floodproofing features must be put back in those areas where repairs are made. These include stop locks, waste weirs, restoring towpath to historic grade to permit even overflow rather than concentrated overflow in low areas and the rebuilding of culverts."⁶⁹

Flood proofing features consisted of modern features at some locations on the canal, such as the concrete bulkheads at the guard locks of Dams 4, 5, and 6. Huber's restoration team also utilized modern technology at Widewater. They tried to increase the stability of the tall and vulnerable towpath embankment there by reinforcing it with gabions (see p. ?). Park maintenance forces also stabilized culverts using concrete bands.⁷⁰

Using modern flood control structures or repairs was counter to NPS policy for preservation of historic structures and landscapes where they were noticeable or obtrusive. Consequently, at least one dramatic idea to protect the canal was not adopted. It called for protecting the canal with a levee between towpath and the river. To provide adequate protection, however, the levee would have had to have been at least thirty feet tall in places. Such a levee would not only have been prohibitively expensive to build, but upsetting to park visitors by blocking the view of the river from the towpath and clashing

eliminated a lot of our damage," he told the author. See George Hicks. Interview by Donald R. Shaffer, 14 April 1997.

⁶⁹Report of the C&O Canal National Historical Park to Harry C. McKittrick, Office of Management of Budget, 29 October 1974, C&O Canal Flood File.

⁷⁰Ibid. Hicks and Huber interviews.

with the nineteenth-century charm of the canal.⁷¹ It also proved impossible to install more modest modern flood control devices to the canal in high-use areas. NPS wanted to add a modern culvert at Widewater, but dropped the idea when a member of the C&O Canal Commission, the nineteen-member citizen's advisory group to the park on policy matters, threatened to sue to block the installation of the structure.⁷²

By the end of 1976, Richard Huber and his team had finished their work on the C&O Canal. The date that repairs of damage from the 1972 flood ended is hard to determine because damage from floods and neglect were often indistinguishable. The C&O Canal NHP achieved towpath continuity by the end of 1975, but it took many years' more effort to bring the towpath back to historic grade along the length of the canal. Except for the massive infusion of money that had come from the Bicentennial, work on major structures proceeded slowly, particularly the expensive repairs of the culverts. Lack of funds limited the park to stabilizing no more than three culverts a year. Park maintenance forces continued restoration and stabilization during the remainder of the 1970s and into the 1980s.⁷³ A statement prepared for the formulation of the 1979 budget summarized the extent of the work on the canal since 1972. "We have stabilized 5 locks, 3 guard locks, 7 aqueducts, 10 culverts, a mule barn, 6 lockhouses, the Paw Paw Tunnel ravine, 2 major breaks in the towpath at Wide Water and rebuilt and resurfaced approximately 17

⁷¹Huber interview. The park did install dikes in 1976 to protect the Sideling Hill Creek, Town Creek and Evitts Creek aqueducts from storm runoff, but this measure was nowhere near as ambitious as trying to protect the canal from the Potomac with massive levees. See Annual Report, 1976, Chesapeake and Ohio Canal National Historical Park, 20.

⁷²John Frye. Interview by Donald R. Shaffer, 5 May 1997. In all fairness, the National Park Service could not please everyone when it came to the issue of historical authenticity and the C&O Canal. Carrie Johnson, a Washington Post journalist criticized the Park Service for the non-historical way it had stabilized the canal's aqueducts. "The agency," she wrote, "lacks the millions of dollars, the craftsmen and the engineering lore to rebuild all the aqueducts precisely as they were. So it has settled for propping up the most rickety ones without trying the preserve or echo the canal's 19th-century style." Yet other people complained when the park did aim for historical authenticity. Bicyclists griped about the use of shale, a historically authentic towpath material, because it caused flat tires and was hazardous to fall on. See Washington Post, 1 May 1979; 22 September 1983, MD3.

⁷³Hicks interview. Hicks indicated that the informal policy was to stabilize one culvert a year in each of the three districts of the park.

miles of towpath," it stated.⁷⁴ In 1978, the Park Service ordered a \$2.7 million project for the canal in Georgetown, principally aimed at stabilizing the retaining walls and dealing with the persistent leakage of water from the canal.⁷⁵ It also financed restoration work for one lift lock, six lockhouses, and six culverts the same year through the State of Maryland's Land Heritage Program. Land Heritage represented the first major infusion of Maryland money into the canal in over a century.⁷⁶

As repair of old injuries continued, smaller floods inflicted new damage on the C&O Canal in the years following 1972. The canal was hit by a flood in October 1976, which cost \$70,000 to repair. Although damage was spread across the park, the most significant expense from this flood came when the foot bridge over Catoctin Creek washed away. The bridge collapse meant an interruption in the continuity of the towpath, so recently reestablished.⁷⁷ George Hicks, a maintenance foreman with the canal at the time, attributed the loss of the bridge to poor design. According to Hicks:

[The bridge] was a steel I-beam fabricated with a concrete deck with metal railing up the sides, and we had to drop this railing every time Catoctin Creek was coming up. If we didn't, it was going to collect a lot of brush. Well, that I-beam washed up out of its seat--we had them set on gabion baskets--and that I-beam is still laying in the creek bed of Catoctin Creek; it washed out.⁷⁸

The 1976 flood was followed by another flood in February 1979. This deluge occurred after the rapid melt-off of snow from a major blizzard. However, the damage from the canal was minor. Water from the river flowed into the canal at Locks 6 and 7, but did so little harm it did not even merit attention in the annual report of the C&O Canal for 1979. The Washington Post, however,

⁷⁴FY 79 Briefing Statement, C&O Canal National Historical Park, 31 January 1978, C&O Canal Flood File.

⁷⁵Washington Post, 26 October 1978, DC1, DC5.

⁷⁶Annual Report, 1976, Chesapeake and Ohio Canal National Historical Park, 34.

⁷⁷1976 Annual Park Report, 22-23.

⁷⁸Hicks interview.

carried a photograph of the flood waters running around the lockhouse at Lock 7--a favorite television image in future floods.⁷⁹

The largest flood on the Potomac to that date after the 1972 flood occurred in February 1984. It was caused by six inches of rain in twelve hours in the Blue Ridge, aggravated by the frozen ground in the mountains that meant the water ran off immediately rather than seep into the ground. Consequently, flooding was most acute in Frederick and Washington counties, where tributaries run out of the Blue Ridge. Seventy miles of towpath there went completely underwater. Portions of the canal flooded from Cumberland all the way to Georgetown and damage occurred along the entire line. The condition of the canal, which was in much better shape than when Agnes had struck in 1972, helped limit the damage. Most structures of the canal came through the flood well. The main injury was to the towpath, with breaks and erosion in some areas, and silt and debris covering it in others. The cost to repair the canal was put at \$580,000. The National Park Service funded \$300,000 of that figure from its emergency fund, and another \$280,000 was reallocated from other portions of the C&O Canal's budget.⁸⁰

The 1985 Flood

The damage from 1984 was not entirely repaired when a larger flood hit the canal in November 1985. High water affected the C&O Canal NHP from the Oldtown to Georgetown, but the deluge was most memorable at the confluence of the North and South branches of the Potomac River. The South branch flooded so severely that water backed up at its confluence with the North branch and trees and other debris actually floated upstream on the North branch for a time. Unlike most other floods, much of the worst damage was on the upper portion of the canal. The Paw Paw Tunnel flooded for the first time since 1936 and the park visitor's center in the town of Hancock also went under water. While the 1985 flood was notable for the large amount of damage on the upper portion of the canal, there also was significant injury downstream. Opposite Harpers Ferry, a perennial trouble spot, the towpath at Lock 33 completely washed away under the pressure of the Shenandoah River and there was a massive blowout in the

⁷⁹Washington Post, 27 February 1979, C1, C6.

⁸⁰Ibid., 16 February 1984, C1, C5; 17 February 1984, B1, B6; 18 February 1984, B1-B2; 19 February 1984, C4; 3 March 1984, B2; National Parks (May/June 1984): 34; C&O Canal National Historical Park Flood Damage, 2/14-2/17/84, c. 1984, C&O Canal Flood File.

canal below Fletcher's Boathouse above Georgetown. The post-Agnes work continued to pay off, as most damage was to the towpath rather than to masonry structures. Towpath eroded for miles, and more than thirty breaks occurring in its embankment. The damage estimate for entire park was \$9.3 million.⁸¹

Repairs proceeded more promptly after the 1985 flood, than it had in 1972. The C&O Canal NHP got funding much quicker. Superintendent Richard Stanton closed 70 percent of the park, more than was strictly necessary, according to Barry Mackintosh, to reinforce his appeal for repair money.⁸² Exaggerating the damage worked, encouraging Congress to make an emergency appropriation of \$2 million for immediate repair needs, in the midst of a period of austerity for the National Park Service as a whole.⁸³

The repairs after the 1985 flood were done by mostly park maintenance crews, who were much better equipped than they had been in June 1972. Repair work started sooner than in 1972, because the bidding process for contractors was eliminated and planning simplified. Indeed, some repairs began almost immediately. Gordon Gay, chief of interpretation for the C&O Canal NHP during the 1985 flood, remembered that maintenance crews started pulling debris off the Monocacy aqueduct "just practically days after the water went down."⁸⁴

The experience after the 1985 flood also showed park personnel exhibited greater expertise in repairing the canal and more sensitivity to working in a national park than contractors.

⁸¹Washington Post, 15 November 1985, C7; Richard Stanton, "The Flood of '85," Superintendent, C&O Canal Historical Park, 29 November 1985, C&O Canal Flood File; Gordon Gay. Interview by Donald R. Shaffer, 30 April 1997; Hicks interview; Edwin M. Dale, Superintendent, C&O Canal National Monument, Hagerstown, to George A. Palmer, Acting Regional Director, Northeast Region, National Park Service, Philadelphia, Pa., 23 November 1962, Administrative Correspondence, National Capital Region, 68A-3048.

⁸²Mackintosh, The C&O Canal, 168.

⁸³Baltimore Sun, 7 May 1986, 14. While budgetary times were tough, Stanton engaged in a bit of historical revisionism when he claimed that money had been much quicker in coming after the 1972 flood than after 1985. He told Baltimore Sun columnist Matt Seiden, "We got the money just like that." Stanton, who had overseen the repairs of the canal after 1972 for National Capital Parks, certainly knew better.

⁸⁴Gordon Gay. Interview by Donald R. Shaffer, 30 April 1997.

J. D. Young, assistant superintendent of the C&O Canal NHP at the time, stated in this regard:

. . . most private sector organizations unless they have done extensive work with the Park Service, are not that sensitive to the values of the historic fabric of a historic structure like the C&O Canal, and therefore you need to have someone in charge of that kind of an operation who knows what to do and what not to do. For instance, if you were just to turn a private contracting company loose on the towpath and give them specifications and say, "Go down and fix this break in the towpath," and they had trouble getting their dump trucks to the towpath, they're just as apt to cut the trees down to get by. Park Service personnel would evaluate that first. And primary in their minds is always the protection of the resource, and that's not true in the private sector because they're not working with historic resources and historic structures that need to be protected.⁸⁵

Still, for all the values and expertise the park maintenance department brought to the post-1985 repairs, they needed help. One of the biggest tasks created by the 1985 flood was trash removal. High water had left large amounts debris covering the towpath and canal prism, and removing it was a monumental task, particularly at a time when the C&O Canal NHP faced the prospect of no additional funds forthcoming from Congress. A solution, however, came from Superintendent Richard Stanton. Stanton proposed inviting boy and girl scout troops, among the biggest users of the towpath, to a "Cleanup Camporee." The scouts would camp along the canal and spend their mornings as volunteers picking up trash, and then have the remainder of the day for scouting activities.⁸⁶ The plan called for about 10,000 scouts to pick up trash over the summer of 1986, although about 8,700 actually participated. The Camporee was deemed a major success. Secretary of the Interior, Donald P. Hodel, visited Williamsport for the kickoff on June 1. By mid-July the project was half complete. The scouts finished the bulk of trash pickup by the

⁸⁵J. D. Young. Interview by Donald R. Shaffer, 16 April 1997.

⁸⁶The use of volunteers on the canal was not entirely without precedent. The park had informally used volunteers to rebuild stone walls near Great Falls after the Agnes flood, and "level walkers" of the C&O Canal Association had reported conditions along the towpath for years. However, volunteers never had been used in the C&O Canal National Historical Park on such a massive scale before 1986. See Montgomery County Sentinel, 31 August 1972, A1.

end of August, prompting Stanton to reopen the towpath ahead of schedule.⁸⁷

The completion of the Camporee did not end the repair of the canal. Much of the towpath was still in poor condition. Repairs resumed on the canal in the spring of 1987. With the towpath clear, park maintenance could get heavy vehicles near the canal and work on filling in the breaks and restoring damaged towpath. It was also necessary to clean out the culverts that had filled with silt and debris during the flood. The park contracted out the culvert work and the repair of towpath in the Palisades District, while park maintenance crews did the remainder of the work. Repair work on the canal continued into 1988.⁸⁸

After the 1985 flood, there was talk of installing non-historic flood prevention structures on the canal. Soon after the flood waters receded, Richard Stanton wrote to the park staff:

A few modifications to the canal seem essential. For example, a flood control structure below Fletcher's will be designed. As in Agnes, a blowout between Foundry Branch and Fletcher's saved the Lock 3 complex in Georgetown. Some kind of large hand-controlled weir must be installed. Other non-historic strengthening [sic] will also be considered.⁸⁹

While the C&O Canal NHP considered non-historic water control structures after the 1985 flood none appears to have been built, other than collapsible handrails on the Olmsted Island bridges at Great Falls. It was hoped the handrails, which could be removed during a flood, would prevent the accumulation of

⁸⁷Washington Post, 28 August 1986, MD9. Although the scouts were the largest component of the volunteers, other people gave their time as well. Some of these volunteers came from local civic and interest groups. National Guard and Army personnel participated in the cleanup and the Defense Department lent equipment to the park. Volunteers contributed a total of 43,925 hours to the restoration of the canal after the 1985 flood. See Young interview; C&O Canal National Historical Park, Fiscal 1989 Budget Briefing Statement, 9 January 1988, C&O Canal Flood File.

⁸⁸Washington Post, 6 April 1987, D8; Richard L. Stanton, Superintendent, C&O Canal, to Regional Director, National Capital Region, 13 April 1987; Manus J. Fish, Regional Director, National Capital Region, to Carrie Johnson, Chairman, C&O Canal National Historical Park Commission, 13 April 1987 (draft); C&O Canal National Historical Park, Fiscal 1989 Budget Briefing Statement, 9 January 1988, C&O Canal Flood File.

⁸⁹Stanton, "The Flood of '85," Ibid..

debris on the structure--the main cause of its failure during the 1972 flood. The park also repaired a historic waste weir near Chain Bridge and rebuilt a high wall at the Dam 4 winch house, but otherwise it settled for putting the canal the way it had been before the flood.⁹⁰

Like the C&O Canal Company, the National Park Service, during its first forty-seven years' management of the canal displayed an active interest in making the historic resource more sustainable. In the pre-World War II restoration, after the floods of 1942, 1972, and 1985, and at other times it took specific actions to strengthen the canal against the force of the Potomac River. Some of these preventive efforts succeeded, such as the bulkheads on Dams 4 and 5. Yet inadequate funding and certain federal regulations hindered the effectiveness of the National Park Service in flood damage prevention. The post-1972 rehabilitation of the C&O Canal NHP increased its ability to withstand floods, but still could not save the canal from significant damage during a major flood.

⁹⁰Ibid.; Young interview. According to J. D. Young, Dick Stanton opposed rebuilding the Olmsted Island bridge, until public pressure forced him to embrace the project.

CHAPTER 4

SUSTAINABILITY: CASE STUDIES

Particular locations along the C&O Canal have demonstrated a pronounced vulnerability to floods during its history. This vulnerability was a consequence of design choices made by the canal company, and the geography of certain locations along the Potomac. Two of the most notorious trouble spots are Widewater (between Great Falls and Old Angler's Inn), and a section of canal opposite Harpers Ferry, W.Va., at the confluence of the Shenandoah and Potomac Rivers. Historically, high water plagued the canal in these locations, and despite determined preventive action by the C&O Canal Company, the B&O Railroad, and the National Park Service, there only has been limited success in minimizing flood damage at both these places. They represent two of the greatest challenges in making the canal sustainable--locations where engineering has repeatedly failed to protect the canal from the river.

Widewater

Below Great Falls, Bear Island splits the Potomac River into two channels. Engineers designing the C&O Canal decided to avoid digging and blasting a path along the river by damming off the inactive northern channel, constructing a wall and towpath along the island and incorporating the channel into the canal. This solution saved money for the C&O Canal Company in the 1830s when it was plagued by overruns, lawsuits, and other problems. However, it cost the company and its successors dearly in the years that followed. Although the southern channel of the Potomac has the capacity to handle the entire flow from upstream in low or normal periods, during a flood the northern channel becomes an overflow path.

The vulnerability at Widewater first became apparent in the 1840s. During the flood of October 1847, William H. Bryan, the collector of tolls in Georgetown reported, "Mr Lambie was down today & I am told, & reports that there is already 150 or 200

feet of the high embankment below the log wall gone."¹ It was the largest breach ever seen of the C&O Canal to that date.²

Such breaks at Widewater occurred repeatedly because the embankment there was much taller and narrower than anywhere else on the canal, yet it had to hold in a large body of water. When flood waters suddenly increased the pressure on the embankment, particularly after years of neglect, it easily broke.³

The flood of 1847 convinced the C&O Canal Company that preventive measures were necessary at Widewater. Rather than reinforce the embankment, the solution of Chief Engineer Charles B. Fisk was to build a stop lock and guard bank above Lock 16 to divert the water rushing down to Widewater area back to the southern channel of the Potomac.⁴

The stop lock and guard bank at Widewater built in the late 1840s were a dismal failure. Two major breaches occurred at Widewater during the flood of April 1852, the first in the same location as the large break in 1847, except that it was 500 feet in length, rather than only 200 feet. The water rushing through this break washed the embankment all the way down to its bottom. The second break occurred 100 yards upstream from the first and was seventy-five feet long. After a flood where the total repair estimate came to \$80,000, Charles Fisk indicated it would cost \$10,000 to fix Widewater alone. With no better way to protect the canal near Bear Island, the canal company rebuilt the guard

¹William H. Bryan, Collector, Washington, D.C., to Charles B. Fisk, Chief Engineer, Georgetown, 9 October 1847, Chief Engineer's Incoming Correspondence, 1834-52. During the nineteenth century, Widewater was referred to as "log walls" or the "log wall level." According to Thomas L. Patterson, a former engineer and general superintendent of the canal, and his partner T. P. Kinsley, the area took its name from the construction of the towpath there. "The towpath lies along the rocky points of the island [Bear Island], " they wrote, "and was probably, originally formed on a wharf or wall of logs bolted to the surface or face of the cliff. All trace of these logs has disappeared [by 1890] except the occasional bolt showing where they had been secured." See Report of T. L. Patterson and T. P. Kinsley, Civil Engineers, Exhibit "A," to the Maryland Receivers, 9 June 1890, Brown et al. Trustees v. Chesapeake and Ohio Canal Company.

²John Lambie, Superintendent, Georgetown, to James M. Coale, President, Frederick, 8 November 1847, C&O Incoming Correspondence, 1828-90.

³Sipes interview.

⁴Charles B. Fisk, Chief Engineer, Cumberland, to President and Directors, 25 April 1850 and 2 August 1849, C&O Incoming Correspondence, 1828-90.

bank and stop lock. However, they raised the stop lock above the level of the 1852 flood, and secured it to higher ground on the north and to the guard bank on the south.⁵

These structures did their job until November 1877. The great flood of that month exceeded the levels of 1852 and caused considerable harm at Widewater. Three hundred yards above the bottom of Widewater there was a break 192 feet long and twelve feet deep. Not only that, but the embankment from the break to the downstream end of Widewater appeared to be slipping slowly into the water. The flood damaged Lock 15, its flume, and the towpath below it. Lock 16 also suffered injury as well as the towpath between it and Lock 15. Still, the cost of damage in this area was less than in 1852, only \$4,500.⁶

It is not known if any improvements were made to the stop lock and guard bank after the 1877 flood. In any case, the guard bank failed in 1889, when high water not only devastated Widewater yet again, but put the canal company out of business. The B&O trustees hired two engineers to survey the damage on the canal. Thomas L. Patterson, a former engineer and general superintendent of the canal, and his partner, T. P. Kinsley, reported that the failure of the guard bank had sent water rushing below Lock 15 into the widewater, causing two breaches. They wrote:

The Canal here occupies a deep rocky gorge, formerly the inside channel of the river. This was cut off from the river by an embankment to the head of an island and another forty feet high from the foot of the Island to the mainland. It is through this latter bank that a breach has been made, not however to its full depth. . . . There is a second breach below the junction of the high embankment with the mainland, where the towpath is very high above the ordinary water level of the river opposite it.⁷

⁵John Page, Georgetown, to "Dr Sir," 22 April 1852; Charles B. Fisk, Chief Engineer, Washington, D.C., to President and Directors, 29 April 1852, C&O Incoming Correspondence, 1828-90; Patterson and Kinsley, Exhibit "A," to the Maryland Receivers, 9 June 1890, Brown et al. Trustees v. Chesapeake and Ohio Canal Company.

⁶Benjamin Fawcett, Secretary, to President and Directors, c. December 1877, C&O Incoming Correspondence, 1828-90.

⁷Patterson and Kinsley, Exhibit "A," to the Maryland Receivers, 9 June 1890, Brown et al. Trustees v. Chesapeake and Ohio Canal Company.

Patterson's and Kinsley's account of the damage at Widewater in 1889 is supplemented by an earlier report of the officers of the C&O Canal Company to its stockholders. This account describes the break at the downstream end of Widewater as 150 feet long and thirty feet deep. In the second break, 920 feet of towpath was washed away. On the way to causing the two breaks the flood waters also "nearly destroyed" Lock 15.⁸ The damage estimate submitted by the receivers of the C&O Canal Company put the cost of the repairs to the entire canal at \$268,698. Of that figure, \$37,057 was needed just to fix Widewater and the rest of the level below Lock 15.⁹

After the 1889 flood, a calm period on the Potomac spared Widewater significant damage until the flood of 1924. The trustees of the B&O Railroad did not submit damage reports for Widewater during May 1924 and March 1936, but the area certainly suffered during these floods because of the extensive repair work that was necessary there in the late 1930s.

The National Park Service rebuilt Widewater as part of its pre-World War II restoration of the canal between Georgetown and Seneca. NPS devoted a considerable portion of its resources to this area during the project. Of the \$500,000 appropriated by Congress, one-fifth was spent at Widewater. In repairing Widewater, the Park Service designed the work specifically with sustainability in mind. Besides rebuilding the stop lock above Lock 16, the National Park Service, according to the Evening Star, had the contractor for Widewater "construct the retaining walls, dikes, cribbing, earth fill and riprap so that it will be easy for flood water to flow over the top of the embankment over a wide front, carrying away a few feet of easily replaced topping."¹⁰ At points where flood waters had broken through in 1936, workers installed concrete capping to provide further reinforcement.¹¹

Despite the improvements at Widewater, the flood of October 1942 devastated the area. After spending a large sum to renovate and improve this area, Congress refused to appropriate money for

⁸The President and Directors to the Stockholders of the Chesapeake and Ohio Canal, 13 June 1889, Ibid.

⁹Report of the Maryland Receivers, 9 June 1890, Ibid.

¹⁰Evening Star (Washington, D.C.), 15 September 1939, B1.

¹¹Washington Post, 14 November 1942, 5B.

its maintenance. There was no one around to install the boards in the stop lock and flood waters proceeded without impediment into Widewater, where they overwhelmed the concrete capping.¹² According to the Washington Post, "water washed under and around the capping, then crumbled it, as it did at another natural outlet point farther down."¹³

The considerable expense of repairing Widewater meant it was last area of the canal downstream from Seneca repaired after the 1942 flood. The estimated expense of restoring the canal from Lock 5 to Seneca after the 1942 flood was \$140,000. About 75 percent of that amount, or \$105,000 would have been needed just to repair Widewater.¹⁴ Hence, instead of restoring Widewater after World War II, the Park Service opted instead to repair the rest of the canal above and below. They used the stop lock to divert canal water from Dam 2 back to the river, and built a dike at the bottom of Widewater to prevent water on the Lock 14 level from flowing back into the area. The Corps of Engineers supplied surplus water from the Washington aqueduct to fill the canal from the bottom of Widewater to Lock 5.¹⁵ Not until 1954 did the Park Service finally start to rebuild Widewater, and job was not finished until 1957. Even then, a section of towpath remained unrepaired below Lock 15, leaving a rocky, barely passable trail for hikers.¹⁶

After the repairs were finished, NPS management was not optimistic the work would survive. The new towpath embankment showed signs of slippage soon after its completion. Harry T. Thompson, associate superintendent of National Capital Parks, did not think the slippage was a problem unless a flood appeared.

¹²Baumann, Widewater, 60.

¹³Washington Post, 14 November 1942, 5B.

¹⁴Horne to Thompson, 1 December 1953, Administration, Protection and Maintenance File 1460/C&O-5.

¹⁵P. E. Smith, Chief, Engineering Division, to H. T. Thompson, 29 August 1945; E. A. Schmitt, Chief Water Supply Division, U.S. Engineers Office, Irving C. Root, Superintendent, National Capital Parks, Washington, D.C., 2 October 1945; National Capital Parks Press Release, 1 February 1946, Ibid.

¹⁶Baumann, Widewater, 12.

"In which case," he added, "I doubt if anything would save the Widewater fill in the future any more than it has in the past."¹⁷

NPS launched a more ambitious restoration of Widewater in 1970. The aim was to repair the towpath and eliminate the rocky section impassible to bicycles. However, to make the area accessible to heavy trucks workers cut down trees and turned the towpath into a road, complete with turnabouts. This approach angered the environmental community, and public pressure forced the abandonment of the towpath restoration project before its completion. Environmentalists, objecting to damage to geological resources and to inadequate compliance with preservation laws, also stopped construction of a temporary foot bridge over the rocky gap below Lock 15 in 1976.¹⁸

The flood Thompson had feared finally came in 1972, when flood waters again devastated Widewater. With the stop lock inoperative (from wear and neglect), there was nothing to divert the flood away from this area and it tore two holes in the embankment, the first eighty feet long and seventeen feet deep and the second 195 feet long and twenty-one feet deep.¹⁹

The C&O Canal Restoration Team, led by Richard G. Huber, planned and supervised the repairs at Widewater after the 1972 flood. Contractors working under the restoration team made the stop lock functional and rebuilt the 900-foot guard wall that funnelled the diverted water down to the southern channel of the Potomac River. According to NPS historian Merrill J. Mattes, work on the guard wall consisted of:

. . . a complete reconstruction of 450 feet . . . and patch repairs of the remaining 450 feet using hand placed riprap. Both wing walls on the berm side as well as the guard wall were restored. Mortared and dry-laid walls adjacent to the stop lock parapet wall that carried the towpath were also restored, and the towpath was regraded for 200 feet downstream. The earth ramp built under the previous contract would now impede the diversion of flood waters, so

¹⁷Harry T. Thompson, Associate Superintendent, National Capital Parks, to Chief, Maintenance Branch, 1 February 1954; Harry T. Thompson, Assistant to the Director, to Irving Brant, Washington, D.C., 7 November 1957, Administration, Protection and Maintenance File 1460/C&O-5.

¹⁸Baumann, Widewater, 13-20.

¹⁹Mattes, Landmarks of Liberty, 19.

it was removed and replaced by a wooden stairway that would be washed clear in a flood.²⁰

As previously indicated, the restoration team gave the embankments in Widewater extra stability by placing gabion baskets in them as reinforcement, much as steel bars give greater strength to concrete. As Mattes described the work:

. . . gabion baskets were wired together to form a core of rock nine feet wide at its base, three feet wide at its top, and 18 feet high. As the gabion core was constructed, the towpath embankment was laid down in 6-inch layers and compacted. Eight-inch filter pipes were laid parallel to the rock core and relieved to the river side of the fill. Because the largest break occurred at a curve, a core of gabions 80 feet long by 12 feet wide was placed on the embankment at the waterline to reduce erosion of the fill from wave action.²¹

The restoration team also had an inoperative waste weir, that could drain excess water from Widewater, stabilized and restored to functional use. Reconstructing the stop lock and guard bank, restoring Widewater proper, and repairing Locks 15 and 16 cost the Park Service \$789,000 of the \$14 million it expended in post-1972 restoration of the canal.²²

The costly repairs after the 1972 flood of Widewater, however, did yield some positive results. In October 1976, about a year after the work at Widewater had ended, the Potomac River experienced a moderate flood. When news of the impending high water reached the chief of maintenance, Dale Sipes, he ordered the foreman in the Palisades District, Don Foster, to have his crew install the planks in the stop lock above Lock 16. The stop lock worked. While the flood washed out the Catoctin Creek foot bridge, Widewater was spared appreciable damage.²³ Likewise,

²⁰Ibid., 20-21.

²¹Ibid., 19. Dale Sipes, the chief of maintenance during the 1972 was critical of using gabions to reinforce the embankment at Widewater, believing they were ineffective for that purpose. "Gabions don't stabilize a structure or a foundation," he told the author. "What they're intended for is to eliminate or reduce the erosion effects on a stream bed." See Sipes interview.

²²Ibid., 19-21; 1975 Annual Park Report, vii.

²³Sipes interview.

the stop gate functioned in 1985, during a much higher flood than in 1976. There was some damage at Widewater, but no gaping breaches as in 1972.²⁴

Whether the preventive measures at Widewater would work in a flood of truly massive proportions, however, is still at best uncertain. The ruin of Widewater after the floods of 1847, 1852, 1877, 1889, 1924, 1936, 1942, and 1972 does not engender optimism in the ability of human ingenuity to prevent flood damage there. However, as the experience of 1976 and 1985 shows, flood prevention at Widewater is not an entirely hopeless task. The measures taken there after 1972 minimized damage in 1976 and 1985, the latter flood being of sizable proportions. Likewise, in 1942 and 1972, when the stop lock was not operative, major damage occurred at Widewater.

The Harpers Ferry Area

Like Widewater, the C&O Canal experienced severe flooding problems at the confluence of the Shenandoah and Potomac Rivers, across from Harpers Ferry, W.Va. However, the flood danger resulted not from taking away a river channel for the canal, but from geography and hydrology. A report to Congress on the flood danger to the proposed C&O Canal Parkway, aptly summarized the threat. "The gradient of the river at this point," the report stated, "is relatively steep and immediately below the confluence with the Shenandoah River the valley is reduced to a narrow gorge where it passes through the Blue Ridge Mountains. Excessive discharge from either the Shenandoah or the Potomac Rivers is impeded at this point causing local floods in this area." Hence, not only severe floods hurt the canal around confluence, but smaller floods did damage as well. The parkway report stated, "Records kept since 1889 show that on an average of every two years the elevation of this high water has equaled that of the towpath and has exceeded the towpath level by five feet on an average of every five years."²⁵

The C&O Canal Company realized the flood problem in the vicinity of Harpers Ferry early. In March 1834, Charles Fisk recommended the construction of waste weirs "above the head of

²⁴Young interview.

²⁵Chesapeake and Ohio Canal Report, House Document No. 687., 8.

Harpers Ferry Falls."²⁶ At some later point, probably in the 1830s, the canal company also built a protection wall of masonry and riprap, five feet in height, along the route of the canal in the Harpers Ferry area to protect it from the river.²⁷

Like the rest of the canal, however, little if any damage occurred in this area during the 1830s. While the Shenandoah River made a significant contribution to the flood of 1836, there was only minor damage to the C&O Canal there, although water covered the area.²⁸

The luck of Harpers Ferry changed for the worse in the 1840s. The flood of February 1840, which affected the unfinished portion of the canal most greatly, caused four breaches between Lock 31 and Dam 3. One of the breaks at the head of Lock 36 was fifty-five feet long and went down to the bottom of the embankment.²⁹ Waters overran the canal at Lock 33 in April 1843.³⁰ The river rose even higher in the Harpers Ferry area in September 1843. A resident wrote the canal company, "The Shanandoah [sic] Locks are gone the river higher than ever known, the bank of the Canal here under water."³¹ The flood caused

²⁶Charles B. Fisk, Engineer, Washington, D.C., to the President and Directors, 18 March 1834, C&O Incoming Correspondence, 1828-90.

²⁷Chesapeake and Ohio Canal Report, House Document No. 687., 8.

²⁸J. Y. Young, Superintendent, Georgetown, to J. P. Ingle, Clerk,, Washington, D.C., 1 June 1836; James O'Reilly, Georgetown, to John P. Ingle, Clerk; W. S. Elgin, Superintendent, to President and Directors, 6 June 1836; W. S. Elgin, Superintendent, Harpers Ferry, to G. C. Washington, President, Washington, D.C., 13 June 1836, C&O Incoming Correspondence, 1828-90.

²⁹W. S. Elgin, Superintendent, Harpers Ferry, to Francis Thomas, President, 11 February 1840; G. W. Rodgers, Superintendent, Canal Line, to John P. Ingle, Clerk, 13 February 1840, Ibid.

³⁰W. S. Elgin, Superintendent, Harpers Ferry, to Charles B. Fisk, Chief Engineer, 15 April 1843, 12 noon, Chief Engineer's Incoming Correspondence, 1834-52.

³¹J. G. Cobb, Harpers Ferry, to James M. Coale, President, 16 September 1843, C&O Incoming Correspondence, 1828-90.

severe erosion in the embankments around the Shenandoah River Lock, and tore one of the lock gates out.³²

It appears that the canal company raised the level of the embankments at Harpers Ferry, as at other vulnerable locations on the canal, because of the September 1843 flood. After the July 1846 freshet, which came within fourteen inches of the September 1843 height, Superintendent W. S. Elgin wrote, "the improvement done at the Shenandoah inlet Lock has saved the canal at this point and there is no damage for 20 miles Below this point." According to Elgin, the damage was not even one-fourth as much of that of the previous flood.³³

The Harpers Ferry area appears to have escaped serious damage in the flood of October 1847, but it was not so lucky in April 1852. The Shenandoah River inundated both the town of Harpers Ferry and the C&O Canal. There was a breach eighty feet long in the Maryland abutment of Dam 3. While the damage estimate for the entire canal was \$80,000, between Lock 32 and Dam 3 it was \$5,000 alone. After the flood, W. S. Elgin proposed running a guard bank from Dam 3 to Lock 36.³⁴

The worst flood to that date in the Harpers Ferry area, the "Great Freshet in the Shenandoah," started September 30, 1870. According to Harlan Unrau, "The most significant damage to the waterway occurred between Sandy Hook and Lock No. 33 at Harpers Ferry. Here a breach 850 feet in length was opened in the canal embankment, and the protective wall which supported the towpath was greatly undermined."³⁵

³²Unrau, The Major Floods, 7.

³³W. S. Elgin, Superintendent, Point of Rocks, to James M. Coale, President, Frederick, 8 July 1846, C&O Incoming Correspondence, 1828-90.

³⁴W. S. Elgin, Superintendent, Harpers Ferry, to Charles B. Fisk, Chief Engineer, 25 April 1852, Chief Engineer's Incoming Correspondence, 1834-52.; Charles B. Fisk, Chief Engineer, Washington, D.C., to President and Directors, 29 April 1852, C&O Incoming Correspondence, 1828-90; Charles Fisk, Chief Engineer, Washington, D.C., to W. S. Elgin, Superintendent, 5 May 1852, Drafts of Chief Engineer's Outgoing Correspondence, 1836-38, 1846-52.

³⁵Unrau, The Major Floods, 25; Forty-Third Annual Report of the President and Directors of the Chesapeake & Ohio Canal Company to the Stockholders, June 5th, 1871 (Hagerstown, Md.: A. G. & M. W. Boyd, Printers, 1871), 8.

However, the injury to the canal in 1870 palled in comparison to the flood of November 1877. "It looked to me as if the canal was gone forever at Harpers Ferry," a coal company officer later testified.³⁶ A C&O Canal Company committee was more descriptive about the disaster. It stated, "at Harpers Ferry . . . for a distance of more than two thousand feet the Entire guard wall at the inlet lock at the Shenendoah [sic] was swept away and the canal filled with the wash from the Potomac . . ." ³⁷ After the 1877 flood, crews excavated the debris and rebuilt the guard wall higher than before.³⁸

The area around Harpers Ferry also suffered in the flood of 1886, but detailed records describing the damage were not found. It was necessary, however, to add stone to Dam 3 afterward and to clean out its feeder, suggesting a relatively mild freshet.³⁹

The 1889 flood devastated Harpers Ferry to a greater extent than the horrendous flood of 1877. The canal company reported to its stockholders soon after the waters receded that from Lock 32 to the Harpers Ferry bridge, "the Towpath, and heavy river walls for the distance of a Mile are nearly destroyed, the river and Canal being one for nearly all the distance." The flood also badly damaged Locks 34, 35, and 36. The B&O trustees, who took over the canal company in 1890, believed it would cost \$22,503 to restore the canal from Lock 32 to 36--over 8 percent of the repair estimate for the entire canal.⁴⁰

³⁶A. P. Gorman, President, Annapolis, to the Directors, 12 December 1877, C&O Incoming Correspondence, 1828-90.

³⁷P. Harriell and John Humbird, Baltimore, to the President and Directors, 12 December 1878, Ibid.

³⁸Ibid.; Testimony of Frederick Mertens, Boat Builder in Cumberland, 4 March 1880, in Report of the Joint Standing Committee, 93-94.

³⁹Fifty-Ninth Annual Report, 15-18.

⁴⁰The President and Directors to the Stockholders of the Chesapeake and Ohio Canal, 13 June 1889; Report of the Maryland Receivers, 9 June 1890, Brown et al. Trustees v. Chesapeake and Ohio Canal Company. Patterson and Kinsley, the engineers left a more explicit description of the damage to the canal around Harpers Ferry. See Report of T. L. Patterson and T. P. Kinsley, Civil Engineers, Exhibit "A," to the Maryland Receivers, 9 June 1890, Ibid.

As might be expected, the C&O Canal at Harpers Ferry suffered greatly during the great floods of 1924, but no detailed records of that damage were found in the course of research. In 1936, the canal in Harpers Ferry suffered extensive damage from Lock 32 all the way up to Dam 3.⁴¹ The greatest flood in the history of the lower Shenandoah River occurred in October 1942. Water levels for that flood exceeded the great flood of 1870 on the Shenandoah and approached those of March 1936 flood on the Potomac. Like 1936, no documents have been found describing the damage to the canal around Harpers Ferry as a result of the 1942 flood.⁴² The lack of records for the area beginning in 1924 reflects the neglect of the B&O Railroad afforded the canal after that year.

Unlike Widewater, the C&O Canal opposite Harpers Ferry was not restored before World War II. Indeed, the canal in this area received little maintenance after navigation ended in 1924 either by the B&O Trustees or by the National Park Service, and by the early 1950s the canal there was in ruins. The lack of maintenance and repeated floods took their toll. Henry G. Weeden, the Park Service engineer who surveyed the location around 1950 for the proposed C&O Canal Parkway, remarked in his report that the old protective wall had been "practically obliterated in many places."⁴³

The poor state of the canal in the Harpers Ferry area impressed Weeden. While apparently downplaying the flood threat at other locations on the canal to advance the cause of the parkway, Weeden was frank about the vicinity of Harpers Ferry. He warned:

The terrain at Harper's Ferry, the confluence of the Potomac and the Shenandoah Rivers, is such that the parkway would be exposed to the full force of all future floods. Because of the steep cliffs [sic] along the Maryland side of the river it will be impossible to change the alignment to any extent and some study should be made as to the advisability of a by-pass of this difficult condition. Interruption in the use of the parkway in this area may be expected every year or so if the present alignment and grade of the canal is followed unless substantial erosion control and flood

⁴¹Unrau, The Major Floods, 42.

⁴²Potomac River and Tributaries, House Document No. 622, 23, 26.

⁴³Weeden, "A Study of the Potomac River," 9.

protection walls are constructed similar to the original canal protection.⁴⁴

The flood of June 1972, as many floods before it, caused great damage at Harpers Ferry. Although damage on the canal extended all the way up to Hancock in 1972, it was greater below Harpers Ferry where the swollen Shenandoah River added its waters to the Potomac.⁴⁵ The flood rendered the towpath impassible, caused a sixty-foot washout at Lock 34 and a 100-foot washout of the guard bank of Dam 3, as well as causing more general damage in the mile of the canal downstream of the dam.⁴⁶ Rather than repair the break at Lock 34, the Park Service built a foot bridge to span the gap, restoring towpath continuity, while leaving the hole as an escape valve for future flood waters.⁴⁷ Richard G. Huber's restoration team after 1972 also repaired many of the culverts in the Harpers Ferry area and restored the towpath.⁴⁸ Still, Harpers Ferry suffered in the November 1985 flood. A large washout occurred between Lock 33 and the Shenandoah River Lock, "exposing the Canal prism to the river."⁴⁹

Despite extensive and repeated damage to the canal in the Harpers Ferry area, it did not become an expensive problem like Widewater. The high visitation at Widewater and its location in the rewatered section of the canal between Georgetown and Seneca made it important to repair that location completely after each major flood, despite the great expense. At Harpers Ferry, however, it was possible to leave some damage where it did not make sense financially to repair in the face of future floods.

⁴⁴Ibid., 9.

⁴⁵Sipes interview.

⁴⁶Jack Hobbs, Safety Officer, to Chief, Division of Safety Management, 3 July 1972, National Capital Region Records, 79-770003, National Park Service, Washington National Records Center, Suitland, Md.; Office of Cooperative Activities, National Capital Parks, National Park Service, General Plan: Chesapeake an Ohio Canal National Historical Park, (Washington, D.C.: National Park Service, 1975), 48.

⁴⁷Mattes, Landmarks of Liberty, 23.

⁴⁸Huber interview.

⁴⁹Stanton, "The Flood of '85," C&O Canal Flood File.

CONCLUSION

The Flood History Study reveals the organizations who controlled the C&O Canal, at best, experienced only limited success in protecting it from the flooding of the Potomac River. In the case of both the C&O Canal Company and the National Park Service, their failure to build a sustainable canal was not from lack of effort. The C&O Canal Company's expenditures on flood repairs, renovations, and preventive activity helped financially ruin the organization. Likewise, since 1938, NPS has spent tens of millions of dollars repairing and protecting the canal. It has had some success with these expenditures, such as the bulkheads on Dams 4 and 5. However, the devastation of the C&O Canal NHP after the 1985 and 1996 floods show the river is still winning the battle. Yet the neglect of the canal by the B&O Railroad demonstrates the consequences of too little maintenance or flood damage prevention. As a result of the B&O's inaction between 1924 and 1938, flooding reduced the C&O Canal during those years from a functional waterway to an unsightly wreck. Hence, while history does not provide much encouragement because of the lack of success in building a sustainable canal, the past also demonstrates the folly of abandoning this effort if this valuable historic resource is to be preserved.

It must be admitted that the Flood History Study is not, nor should be, the last word on the history of flooding on the C&O Canal. The study was unable to utilize all the documentation existing on the canal, particularly outside of the Washington, D.C. metropolitan area. These sources include the personal papers of two presidents of the C&O Canal Company: those of Alfred Spates (1861-65, 1867-69) at the University of Virginia in Charlotte and Arthur P. Gorman (1872-82) in the Southern Historical Collection at the University of North Carolina at Chapel Hill. It might also be worthwhile to examine the papers of Daniel Van Slyke, an engineer who worked on the canal during the 1830s (at the New York Public Library) and Alexander B. McFarlan, an inspector of masonry during the construction of the waterway (at the Western Reserve Historical Society in Cleveland, Ohio). For floods in more recent decades, a large collection of records of the C&O Canal Association, a private organization devoted to preserving the canal, have recently opened at George Washington University in Washington, D.C. The association's canal walkers regularly reported on conditions throughout the park, and a systematic examination these reports could yield valuable information not only on major floods, but on the many minor episodes of flooding. The C&O Canal NHP also should systematically gather together its flood related records. There was a disappointing lack of records on flooding available from the park, particularly for the 1985. In any case, the C&O Canal NHP must continue oral interviews of former park personnel

involved in flood repairs. Such individuals interviewed for this report had many practical suggestions, based on years of experience, in minimizing flood damage. However, the Flood History Study was only able to make a start in tapping the wisdom of former and current employees in flood damage prevention.

History has much to tell that can help preserve the C&O Canal NHP. However, it is imperative that those persons who read this report do not stop with it, but go back and examine the primary sources available on flooding, especially the electronic notes and C&O Canal Flood File. They provide the most direct, detailed, and unfiltered information on flooding. This report can only provide an interpretation and analysis of the aforementioned resources. It is meant to provide insight and perspective. Intensive study of original documents, combined with a sense of how they fit into the larger picture hopefully will help readers avoid repeating the mistakes of the past, while recapturing old wisdom and assisting them in thinking of new approaches to the problem of the sustainability of the C&O Canal NHP.

BIBLIOGRAPHY

Primary Sources

Books and Pamphlets

Annual Report, Chesapeake and Ohio Canal National Historical Park. Sharpsburg, Md.: 1974-79.

Annual Report of the President and Directors of the Chesapeake & Ohio Canal Company to the Stockholders. Various locations and publishers, 1828-89.

Hutton, William R. Report of W. R. Hutton, Chief Engineer as to the Condition of the Chesapeake and Ohio Canal, With Estimate of Cost of Extraordinary Repairs Required During the Current Year, August 14, 1872. Annapolis, Md.: Luther F. Colton and Company, Printers, 1872.

Message of the Governor of Maryland, Communicating the Report of the Commissioners Appointed to Survey the Potomac River. Annapolis, 1822.

Office of Cooperative Activities, National Capital Parks, National Park Service. General Plan: Chesapeake an Ohio Canal National Historical Park. Washington, D.C.: National Park Service, 1975.

Report of the Joint Standing Committee Appointed Under Article 3, Section 24, of the Maryland Constitution, in the Chesapeake and Ohio Canal Investigation. Annapolis, Md.: W. T. Iglehalt and Company, State Printers, 1880.

Manuscripts

Archives and Manuscripts Department, McKeldin Library, University of Maryland, College Park, Maryland

The Chesapeake and Ohio Canal Company Collection.

Chesapeake and Ohio Canal National Historical Park, Sharpsburg, Maryland

C&O Canal Flood File.

Circuit Court of Washington County, Hagerstown, Maryland

Brown et al. Trustees v. Chesapeake and Ohio Canal Company, Nos. 4191 and 4198 Equity.

National Archives, College Park, Maryland

Proceedings of the Stockholders, 1828-90, Chesapeake and Ohio Canal Company, Entry 180, Record Group 79, Records of the National Park Service.

Proceedings of the President and Directors, 1828-90, Chesapeake and Ohio Canal Company, Entry 182, Record Group 79, Records of the National Park Service.

Letters Received by the Office of the President and Directors, Chesapeake and Ohio Canal Company, Entry 190, Record Group 79, Records of the National Park Service.

Letters Received by President and Directors, 1873-80, Chesapeake and Ohio Canal Company, Entry 191, Record Group 79, Records of the National Park Service.

Letters Sent by the Office of the President & Directors, 1828-70, Chesapeake and Ohio Canal Company, Entry 194, Record Group 79, Records of the National Park Service.

Letters Sent by President & Directors, 1879-81, Chesapeake and Ohio Canal Company, Entry 196, Record Group 79, Records of the National Park Service.

Correspondence of Office of Trustees, 1913-38, Chesapeake and Ohio Canal Company, Entry 202, Record Group 79, Records of the National Park Service.

Letters Received By The Chief Engineer, 1834-52, Chesapeake and Ohio Canal Company, Entry 207, Record Group 79, Records of the National Park Service.

Drafts of Letters Sent By the Chief Engineer, 1836-38, 1846-52, Chesapeake and Ohio Canal Company, Entry 210, Record Group 79, Records of the National Park Service.

Letter Book of the Resident Engineer of the 1st Residency of the 1st Division, 1828-31, Chesapeake and Ohio Canal Company, Entry 211, Record Group 79, Records of the National Park Service.

Records of Ellwood Morris, Principal Assistant Engineer, 1838-40, Chesapeake and Ohio Canal Company, Entry 214, Record Group 79, Records of the National Park Service.

Printed Materials, 1816-1907, Chesapeake and Ohio Canal Company, Entry 320, Record Group 79, Records of the National Park Service.

National Park Service, Central Classified File, 1933-49, National Capital Parks, 650-03, Record Group 79, Records of the National Park Service.

Washington National Records Center, Suitland, Maryland

Administration, Protection and Maintenance File 1460/C&O-5, National Capital Parks, National Park Service.

Flood and Droughts File 1570-35, National Capital Parks, National Park Service.

Administrative Correspondence, 68A-3048, National Capital Region, National Park Service.

National Capital Parks Regional Office, General Records, 72A-6215, National Park Service.

National Capital Region Records, 79-770003, National Park Service.

Oral History Interviews

Failor, William R., 25 March 1997.

Frye, John, 5 May 1997.

Gay, Gordon, 30 April 1997.

Hicks, George, 14 April 1997.

Huber, Richard G., 1 April 1997.

Sipes, Dale, 14 April 1997.

Young, J. D., 16 April 1997.

Periodicals

Baltimore Sun.

Daily Mail (Hagerstown).

Evening Star (Washington, D.C.).

Montgomery County Sentinel.

Morning Herald (Hagerstown).

National Parks.

Washington Post.

Secondary Sources

Books and Pamphlets

- Baumann, Chris. Widewater: An Assessment for Historic Preservation. [Sharpsburg, Md.]: C&O Canal National Historical Park, National Park Service, Department of the Interior, 1984.
- Mackintosh, Barry. C&O Canal: The Making of a Park. Washington, D.C.: History Division, National Park Service, 1991.
- Mattes, Merrill J. Landmarks of Liberty: A Report on the American Revolution Bicentennial Development Program of the National Park Service. Washington, D.C.: History Division, National Park Service, 1989
- Sanderlin, Walter S. The Great National Project: A History of the Chesapeake and Ohio Canal. Baltimore, Md.: The Johns Hopkins Press, 1946.

Government Publications

- Congress, House, Committee on Flood Control. Potomac River and Tributaries, Maryland, Virginia, West Virginia, and Pennsylvania. 79th Cong., 2d sess., 1946, House Document No. 622.
- Congress, House, Committee on Public Lands, Chesapeake and Ohio Canal Report. 81st Cong., 2d sess., 1950, House Document No. 687.

Unpublished Materials

- Unrau, Harlan D. Chesapeake and Ohio Canal National Historic Park Resource Study, Chapter 4, Canal Engineering Technology Employed in the Construction of the Chesapeake and Ohio Canal: 1828. Seneca, Md.: Chesapeake and Ohio Canal Restoration Team, 1976.
- _____. The Major Floods of the Potomac River and Their Effect on the Chesapeake and Ohio Canal: 1828-1936, Chapter 10, Chesapeake and Ohio National Historical Park Historic Resource Study. Seneca, Md.: Chesapeake and Ohio Canal Restoration Team, 1976.

Henry G. Weeden, Civil Engineer, "A Study of the Potomac River
Related to the Construction of a Parkway Along the Route of
the Chesapeake and Ohio Canal," National Capitol Parks, U.S.
Department of the Interior, Washington, [1950].

APPENDIX A

DAMAGE TO THE C&O CANAL FROM MAJOR FLOODS

<u>Flood or Flood Sequence</u>	<u>Areas With Major Damage</u>	<u>Damage Estimate (\$)</u>
June 1836	Little Falls to Seneca, Harper Ferry, Dam 4, below the Cacapon River	Unknown
April 1843	Georgetown to Edwards Ferry, with lesser damage between Dam 4 and Dam 6	\$20,000
September 1843	Georgetown to Dam	\$30,000
March 1846	Dam 4 to Dam 5	\$21,327.76 ¹
July 1846	Georgetown to Dam 6, water highest from Williamsport to Dam 6	\$21,327.76 ¹
October 1847	Georgetown to Dam 6, heavier in certain areas below Dam 5.	\$48,201.56 ²
April 1852	Town Creek to Georgetown, with the greatest damage below Seneca	\$100,000 ³
February to June 1857	Dam 4 and 5	\$90,000
Summer 1860 to Summer 1862	Various locations, but principally at Dams 4 and 5	\$50,000
September 1870	Sandy Hook to Harpers Ferry, Seneca to Georgetown	\$22,520.42

DAMAGE TO THE C&O CANAL FROM MAJOR FLOODS

¹Combined damages from the March and July 1846 freshets.

²Damage estimate includes the follow-up flood of November 1847.

³Figure includes the cost of post-flood improvements.

(Continued)

<u>Flood or Flood Sequence</u>	<u>Areas With Major Damage</u>	<u>Damage Estimate (\$)</u>
August 1873	Antietam and Monocacy Divisions	\$25,000
November 1877	The entire canal, with the worst damage in the in the middle section.	\$238,500.21
April-May 1886 at Dam 6.	The entire canal, with worst damage at Dam 6	\$82,000
May-June 1889	The entire canal, with worst damage below Harpers Ferry	\$430,764.43
March-April 1924	Williamsport, Hancock, and Cumberland and some damage at Dam 1	\$30,000
May 1924	The entire canal, with worst damage below Harpers Ferry	Unknown
March 1936	The entire canal.	\$25,406.05 ⁴
October 1942	Worst damage below Harpers Ferry	\$250,000 ⁵
June 1972	Georgetown to Hancock, with the worst damage below Harpers Ferry	\$14,000,000
February 1984	The entire canal.	\$580,000
November 1985	South Branch to Georgetown	Unknown

⁴Figure reflects only the repair of the canal at and below Little Falls.

⁵Figure reflects only the repair estimate from Georgetown to Great Falls.

APPENDIX B

DOCUMENTED FLOODS ON THE POTOMAC RIVER, 1828-1996

July/August 1829
February 1831
January 1832
February 1832
April 1832
November 1832
January 1834
April 1834
June 1834
August 1834
June 1836
November 1836
March 1838
January 1840
February 1840
May 1840
January 1841
August 1842
April 1843
August 1843
September 1843
March 1845
March 1846
May 1846
July 1846
November 1846
March 1847
October 1847
November 1847
December 1847
January 1849
April 1852
September 1852
June 1855
August 1855
February 1857
May 1857
June 1857
May/June 1858
April 1859
September 1859
January 1860
Summer 1860
November 1860
April 1861

DOCUMENTED FLOODS ON THE POTOMAC RIVER, 1828-1996
(continued)

July 1861
November 1861
April 1862
June 1862
April 1863
July 1863
December 1863
April/May 1864
March 1865
May 1865
October 1866
February 1867
October/November 1867
Winter 1868
May 1868
October 1868
September 1870
August 1872
February 1873
May 1873
June/July 1873
July 1873
August 1873
August 1874
January 1874
April 1874
March 1875
July/August 1875
September 1876
January 1877
November 1877
January 1879
June 1884
March/April 1886
May 1887
July 1887
May/June 1889
April 1891
October 1896
February 1897
April 1901
February 1902
June 1910
July 1912
Spring 1913
June 1915

DOCUMENTED FLOODS ON THE POTOMAC RIVER, 1828-1996
(continued)

August 1915
June 1916
March 1917
February 1918
December 1918
January 1919
May 1921
March/April 1924
May 1924
February 1925
November 1925
August 1926
September 1926
September 1927
April/May 1928
June 1928
April/May 1929
October 1929
July 1931
May 1932
April 1933
August 1933
December 1934
March 1936
January 1937
April 1937
May 1942
October 1942
September 1945
May 1947
April 1948
December 1948
June 1949
November 1952
October 1954
July 1955
August 1955
July 1956
January 1958
May 1958
April 1960
February 1961
March 1963
March 1967
June 1971
June 1972

DOCUMENTED FLOODS ON THE POTOMAC RIVER, 1828-1996
(continued)

October 1976
February 1979
February 1984
February 1985
November 1985
January 1996
September 1996

